

# **GO-4 Interceptor II**



## **Service Manual V1.2**

**Westward Industries Ltd.**

**July 2003**



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# 1 General Information

## 1.1 General Information

### HOW TO USE THIS MANUAL

This manual is divided into 13 sections.

Each section includes the essential removal, installation, adjustment and maintenance procedures for servicing your Interceptor II. This information is correct at the time of publication.

**TROUBLESHOOTING** tables are included for systems to help you diagnose the system problem and find the cause. The repair for each possible cause is referred to in the remedy column to lead you to the solution quickly.

### DEFINITION OF TERMS

#### Standard Value (Service standard)

Indicates the value used when a part or assembled item should be inspected, or the value to which a part or assembled item should be adjusted after reinstallation. It is given by a tolerance.

#### Service Limit

Indicates the maximum or minimum value that a part or assembled item must meet when inspected. It is a value established beyond the standard value.

### NOTE, WARNING , CAUTION, ABBREVIATION

#### NOTE

Information needed in reference to a repair service.

#### CAUTION

Information about an activity that could cause damage to the vehicle.

#### WARNING

Information about an activity that could cause injury or damage to the driver, occupants or repairman.

### ABBREVIATIONS

SOHC: Single Over Head Camshaft

### VEHICLE IDENTIFICATION NUMBER LOCATION

The vehicle identification number (VIN) is located on the top of the firewall.

## 1.2 VIN

Sample VIN:            2W9   M   P   H   55   7   2   P   044   XXX  
                                  (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)   (10)

- 1- "2W9" - as assigned by the Motor Vehicle Manufacturer's Association
- 2- "M" - Type of cycle: (M) for motorcycle
- 3- "P" - Type of GO-4: (P) for police
- 4- "H" - Type of engine: (H) for Hyundai
- 5- "55" - Net brake horse power: 55hp
- 6- "7" - Check digit

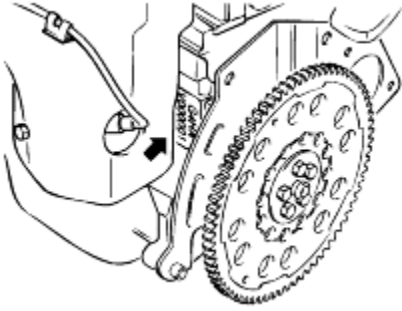
- 7- "2" - Vehicle model year: (2) for 2002 as per tables
- 8- "P" - Plant of manufacture: (P) for Portage la Prairie
- 9- "044" - (044) as assigned by the Motor Vehicle Manufacturers Association
- 10- "XXX" - The numbers sequentially assigned by the manufacturer in the production process

1.2.1 Table – Vehicle Model Year

<b>Year</b>	<b>Code</b>	<b>Year</b>	<b>Code</b>
1991	M	1998	W
1992	N	1999	X
1993	P	2000	Y
1994	R	2001	1
1995	S	2002	2
1996	T	2003	3
1997	V	2004	4

## ENGINE IDENTIFICATION NUMBER LOCATION

The engine identification number is stamped on the right front side of the top edge of the cylinder block.



## DESCRIPTION OF ENGINE IDENTIFICATION NUMBER

The engine identification number consists of 11 digits.

G	4	H	C	Y	0	0	0	0	0	1
1	2	3	4	5	6					

1. Engine fuel  
G - Gasoline
2. Engine range  
4 - In line 4 cycle 4 cylinder
3. Engine development order  
H : Epsilon engine
4. Engine capacity  
C : 999cc
5. Production year  
X - 1999  
Y - 2000  
1 - 2001  
2 - 2002
6. Engine production sequence number  
000001 - 999999

## **PROTECTION OF THE VEHICLE**

Always be sure to cover fenders, seats, and floor areas before starting work.

### **CAUTION**

**The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury. Make sure that the support rod has been released prior to closing the hood. Always check to be sure that the hood is firmly latched before driving the vehicle.**

### **A WORD ABOUT SAFETY**

The following precautions must be followed when jacking up the vehicle.

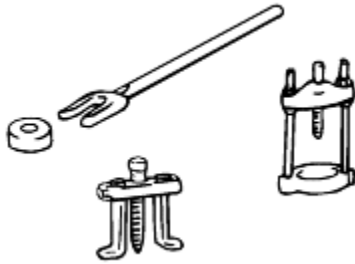
1. Block the wheels.
2. Place a jack under the specified jacking point.
3. Support the vehicle with safety stands (jack stands) Refer to the page 16.
4. Start the engine when engine compartment is clear.

### **PREPARATION OF TOOLS AND MEASURING EQUIPMENT**

Be sure that all necessary tools and measuring equipment are available before starting work.

### **SPECIAL TOOLS**

Use special tools when they are required.





## REMOVAL OF PARTS

First find the cause of the problem and then determine whether removal or disassembly is required before starting the job.

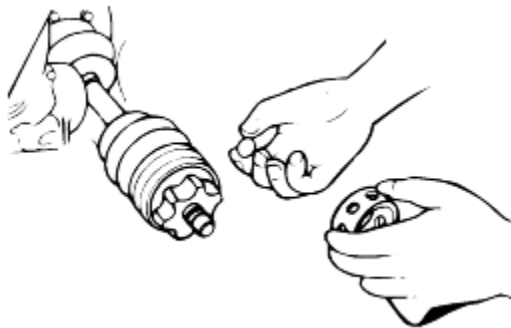


## DISASSEMBLY

If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

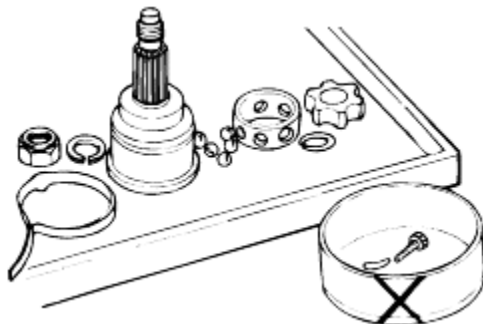
### 1. Inspection of parts

Each part, when removed, should be carefully inspected for malfunction, deformation, damage, and other problems.



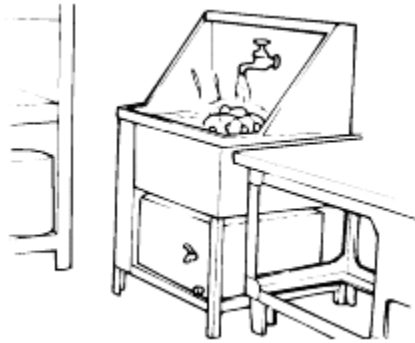
### 2. Arrangement of parts

All disassembled parts should be carefully arranged to be assembled effectively. Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



### 3. Cleaning parts for reuse

All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.



## **PARTS**

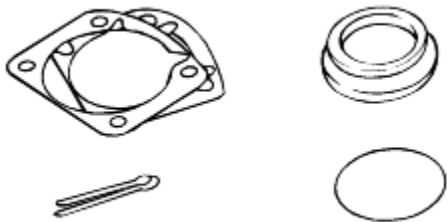
When replacing parts, use Westward Industries genuine parts.

## **REPLACEMENT**

Standard values, such as torque's and certain adjustments, must be strictly observed in the re-assembly of all parts.

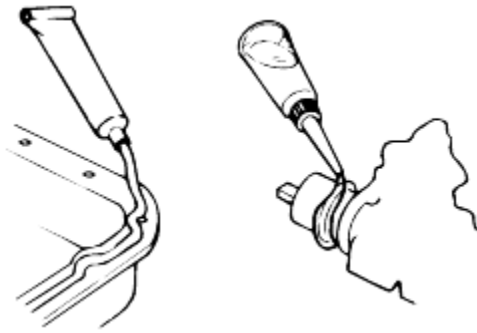
If removed, the following parts should always be replaced with new ones.

1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

1. Sealant should be applied to gaskets.
2. Oil should be applied to the moving components of parts.
3. Specified oil or grease should be applied to the prescribed locations (oil seals, etc.) before assembly.

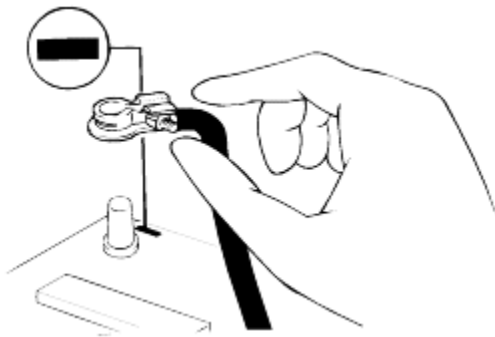


### **ADJUSTMENT**

Use gauges and testers to adjust correctly the parts to standard values correctly.

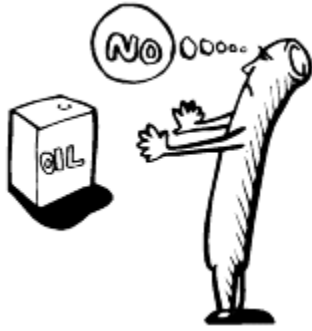
### **ELECTRICAL SYSTEM**

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them or hit them against other parts.



## RUBBER PARTS AND TUBES

Always prevent gasoline or oil from touching rubber parts or tubing.

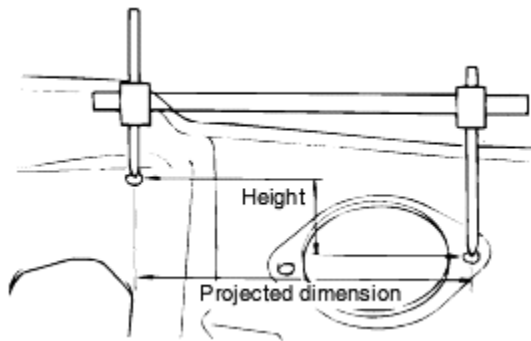


## MEASURING BODY DIMENSIONS

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending
3. For measuring dimensions, both projected dimensions and actual-measurement dimensions are used in this manual.

## DIMENSIONS PROJECTED

1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surfaces.

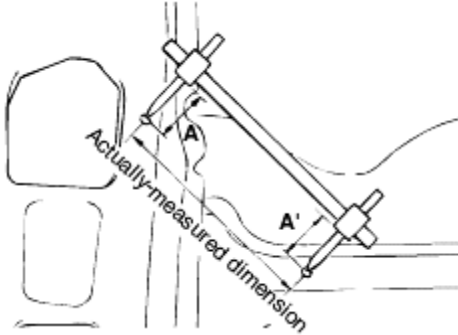


## MEASURING ACTUAL DIMENSIONS

1. These dimensions indicate the actual linear distance between measurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length ( $A=A'$ ) before measurement.

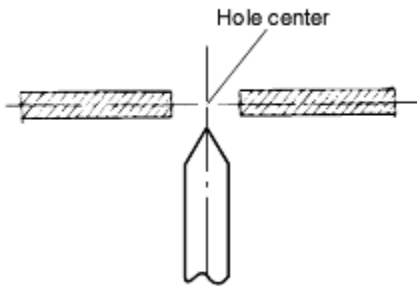
### NOTE

Check the probes and gauge to make sure there is no free play.



## MEASUREMENT POINT

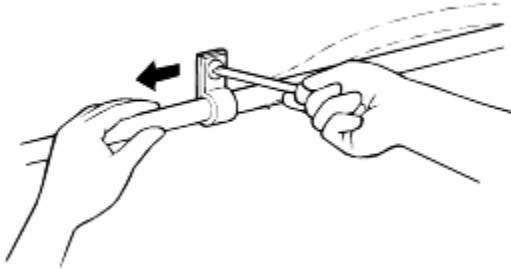
Measurements should be taken at the centre of the hole.



## CHECKING CABLES AND WIRES

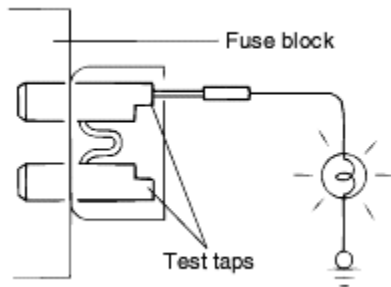
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between their attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)

9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



### CHECKING FUSES

A blade type fuse has test taps provided to allow checking the fuse itself without removing it from the fuse block. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative.)



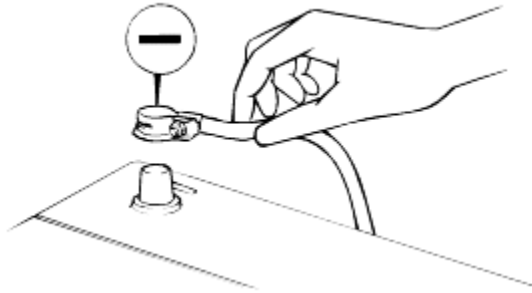
## SERVICING THE ELECTRICAL SYSTEM

1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

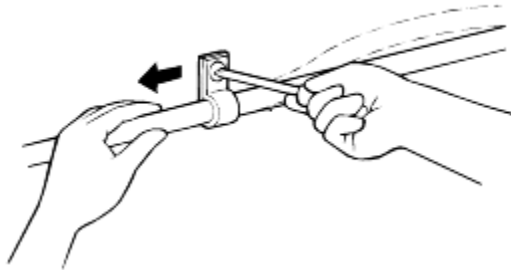
### NOTE

In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. Therefore, if necessary, read the diagnostic codes before removing the battery cable.

- 2.



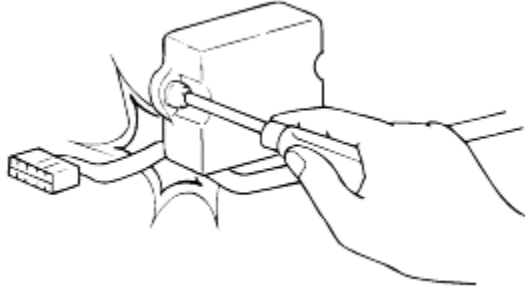
3. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts. Then secure the harness by using a clamp.



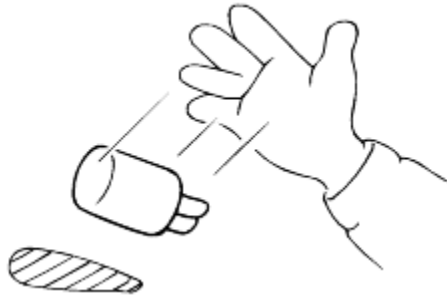
4. If any section of a wiring harness interferes with the edge of a part, or a corner, wrap the section of the harness with tape or something similar in order to protect it from damage.



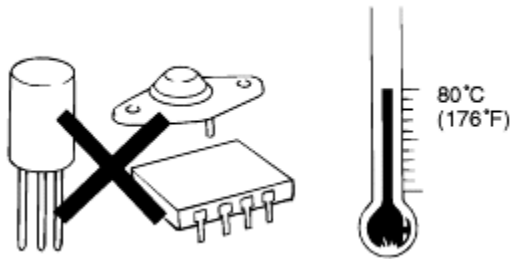
5. When installing any parts, be careful not to pinch or damage any of the wiring harnesses.



6. Never throw relays, sensors or electrical parts, or expose them to strong shock.



7. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts beforehand.

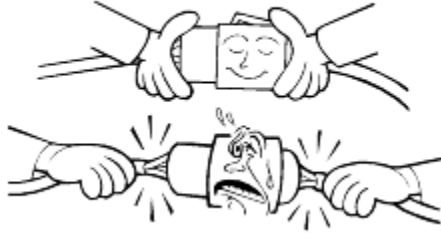


8. Loose connectors cause problems. Make sure that the connectors are always securely fastened.

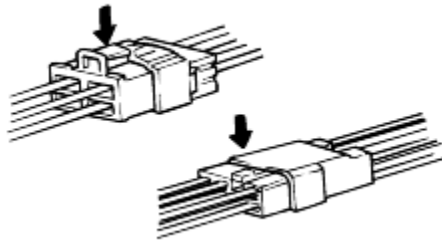




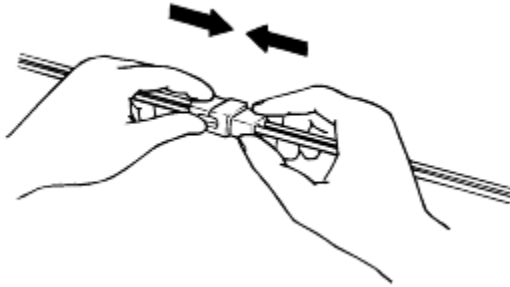
9. When disconnecting a connector, be sure to grip only the connector, not the wires.



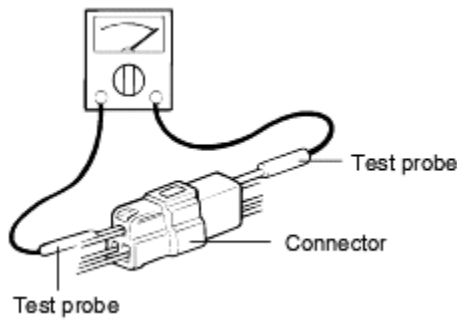
10. Disconnect connectors that have catches by pressing in the direction of the arrows shown in the illustration.



11. Connect connectors that have catches by inserting the connectors until they make a clicking sound.



12. When using a circuit tester to check continuity or voltage on connector terminals, insert the test probe into the harness side. If the connector is a sealed connector, insert the test probe through the hole in the rubber cap until it contacts the terminal, being careful not to damage the insulation of the wires.



13. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropriate wire size.

Nominal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3 mm <sup>2</sup>	AWG 22	-	5A
0.5 mm <sup>2</sup>	AWG20	7A	13A
0.85 mm <sup>2</sup>	AWG18	9A	17A
1.25 mm <sup>2</sup>	AWG16	12A	22A
2.0 mm <sup>2</sup>	AWG14	16A	30A
3.0 mm <sup>2</sup>	AWG12	21A	40A
5.0 mm <sup>2</sup>	AWG10	31A	54A

## PRECAUTIONS FOR CATALYTIC CONVERTER

### CAUTION

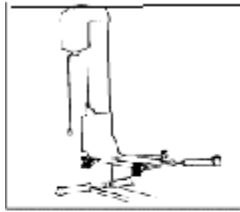
**If a large amount of unburned gasoline flows into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.**

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10 minutes and at idle speed for more than 20 minutes.
3. Avoid spark-jump tests. Do spark-jumps only when absolutely necessary. Perform this test as rapidly as possible and, while testing, never race the engine.
4. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible.
5. Do not run the engine when the fuel tank is nearly empty. This may cause the engine to misfire and create an extra load on the converter.
6. Avoid coasting with the ignition turned off and during prolonged braking.
7. Do not dispose of a used catalytic converter together with parts contaminated with gasoline or oil.

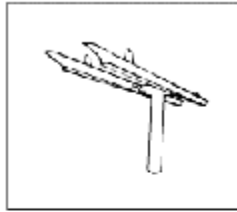
## SRS SYSTEM COMPONENTS INFORMATION CUSTOMER CAUTIONS

Failure to carry out service operations in the correct sequence could cause the airbag system to be deployed unexpectedly during servicing, and a serious accident to occur. Further, if there is a mistake in servicing the airbag system, it is possible that the airbag may fail to operate when required. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following items carefully, then follow the correct procedures described in the repair manual.

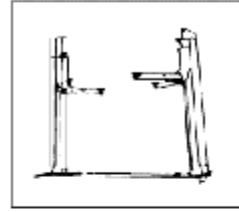
1. Work must be started approx. 30 seconds or longer after the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected. (The airbag system is equipped with a back-up power source. If work is started within 30 seconds when disconnecting the negative (-) battery cable of the battery, the airbag may be operative.) When the negative (-) terminal cable is disconnected from the battery, the clock and audio systems memories will be erased. Before starting work, record the setting of the audio memory system. When work is finished, reset the audio system as before and adjust the clock.
2. Malfunction symptoms of the airbag system are difficult to confirm, so diagnostic codes become the most important source of information when troubleshooting. When troubleshooting the airbag system, always read the diagnostic trouble codes before disconnecting the battery.
3. Never use airbag parts from another vehicle. When replacing parts, replace them with new parts.
4. Never attempt to disassemble and repair the airbag modules, SRSCM, clock spring and Air-bag wiring harness in order to reuse it.
5. If the SRSCM or air bag module have been dropped, or if there are cracks, dents or other defects in the case, bracket or connector, replace them with new ones.
6. After work on the airbag system is completed, reset the SRS SRI.



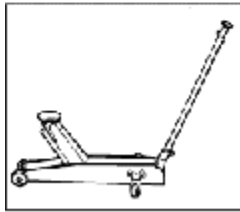
Single post lift



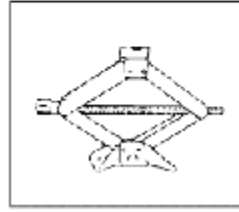
H bar lift



Double post lift



Floor jack



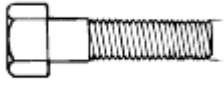

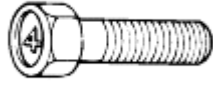
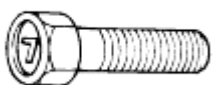
The jack provided with the vehicle



### CAUTION

1. Never use a jack beneath the lateral rod or rear suspension assembly.
2. In order to prevent scarring the sub frame; place a piece of cloth on the jack's contact surface (to prevent corrosion caused by damage to the coating).
3. Never support a vehicle with only a jack. Always use safety stands.
4. Do not attempt to raise one entire side of the vehicle by placing a jack midway between the front and rear wheels. To do so could result in permanent damage to the body.

**TIGHTENING TORQUE TABLE OF STANDARD PARTS**

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3-4 (30-40, 2.2-2.9)	5-6 (50-60, 3.6-4.3)
M6	1.0	5-6 (50-60, 3.6-4.3)	9-11 (90-110, 6.5-8.0)
M8	1.25	12-15 (120-150, 9-11)	20-25 (200-250, 14.5-18.0)
M10	1.25	25-30 (250-300, 18-22)	30-50 (300-500, 22-36)
M12	1.25	35-45 (350-450, 25-33)	60-80 (600-800, 43-58)
M14	1.5	75-85(750-850,54-61)	120-140(1,200-1,400,85-100)
M16	1.5	110-130(1,100-1,300,80-94)	180-210(1,800-2,100, 130-150)
M18	1.5	160-180(1,600-1,800, 116-130)	260-300(2,600-3,000, 190-215)
M20	1.5	220-250 (2,200-2,500, 160-180)	360-420 (3,600-4,200,260-300)
M22	1.5	290-330 (2,900-3,300, 210-240)	480-550 (4,800-5,500,350-400)
M24	1.5	360-420 (3,600-4,200, 260-300)	610-700 (6,100-7,000, 440-505)

**NOTE**

1. The torques shown in the table are standard values under the following conditions:
  - Nuts and bolts are made of galvanized steel bar.
  - Galvanized plain steel washers are inserted.
  - All nuts, bolts, and plain washers are dry.
2. The torques shown in the table are not applicable:
  - When spring washers, toothed washers and the like are inserted.
  - If plastic parts are fastened.
  - If self-tapping screws or self-locking nuts are used.
  - If threads and surfaces are coated with oil.
3. If you reduce the torques in the table to the percentage indicated below, under the following conditions, it will be the standard value.
  - If spring washers are used. : 85%
  - If threads and bearing surfaces are stained with oil. : 85%

## Recommended Lubricants

Parts	Specifications	Remarks
Engine oil	API Classification SE Above	For further details, refer to SAE viscosity number
Automatic transaxle	GENUINE DIAMOND ATF SP-II M	
Brake	DOT 3 or DOT 4	
Cooling system	High quality ethylene glycol	Concentration level 40% (tropical) Concentration level 50% (normal)
Power steering	PSF-3	
Transaxle linkage, parking brake cable mechanism, hood lock and hook, door latch, seat adjuster, trunk latch, door hinges, trunk hinges	Multipurpose grease NLGI grade #2	

M/EAST: Middle East, GEN.: General Areas  
AUST: Australia, EC: European Communities

## LUBRICANTS CAPACITIES

litre (U.S. qts., Imp.qts.)

Description		Capacities
		1.0 I4
Engine oil	Oil pan	2.5 (2.64, 2.20)
	Oil filter	0.3 (0.32, 0.26)
	Total	2.8 (2.96, 2.46)
Cooling system		6.0 (6.34, 5.28)
Automatic transaxle		4.0 (4.23, 2.52)
Power steering		0.9 (0.95, 0.79)

### 1.3 Maintenance Information

#### CHANGING ENGINE OIL

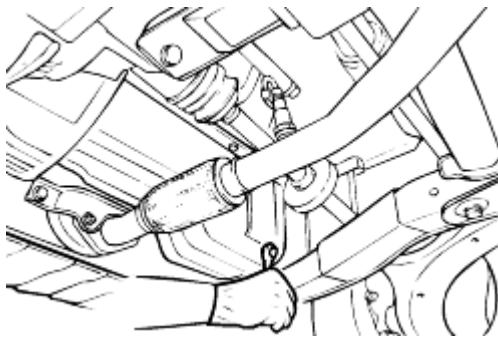
1. If the engine is cold, run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and drain plug. Drain the engine oil.
4. Tighten the drain plug to the specified torque.

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**Tightening torque**

Oil pan drain plug :  
35-45 N.m (350-450 kg.cm, 25-33 lb.ft)

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**NOTE**

**Whenever tightening the oil drain plug; use a new drain plug gasket.**

5. Fill new engine oil through the oil filler cap opening.

**NOTE**

**Do not overfill, this will cause oil aeration and loss of oil pressure.**

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

## REPLACING THE ENGINE OIL FILTER

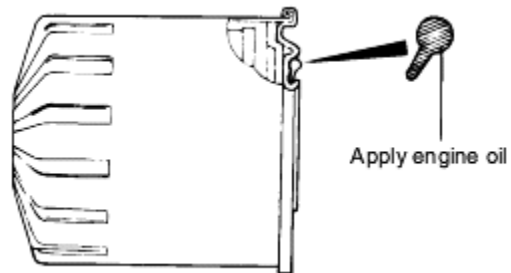
1. Use a filter wrench to remove the oil filter.
  2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.
  3. Tighten the oil filter to the specified torque.
- 

### **Tightening torque**

Oil filter : 12 -16 N.m (120-160 kg.cm, 9-12 lb.ft)

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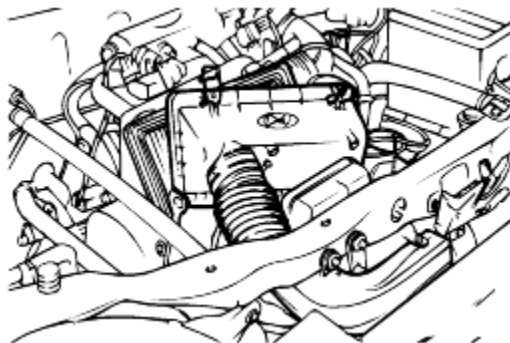
4. Start and run the engine and check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.



## REPLACING THE AIR CLEANER FILTER

The air cleaner filter will become dirty during use and the filtering efficiency will be substantially reduced. Replace with a new one as needed.

1. Disconnect the clip holding air cleaner filter cover.
2. Remove the air filter cover.

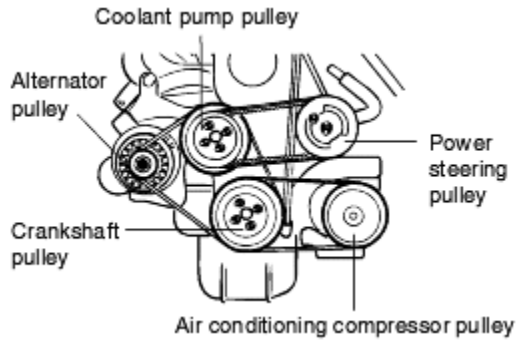


3. Remove the air cleaner filter.
4. Install a new air cleaner filter and replace the air cleaner filter cover.



## ADJUSTING BELT TENSION

Refer to EM Sections.



## COOLING SYSTEM

Check the cooling system for damaged hoses, loose or leaking connections, or other possible causes of coolant leaks.

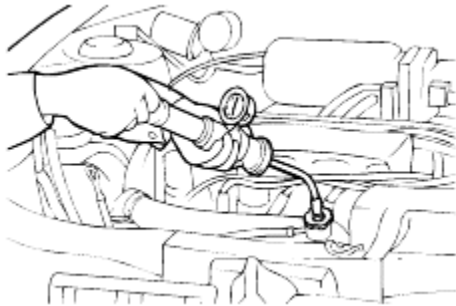
### Antifreeze

The engine cooling system is provided with a mixture of 50% ethylene glycol anti-freeze and 50% water (For the vehicles of tropical area, the engine cooling system is provided with a mixture of 40% ethylene glycol anti-freeze and 60% water at the time of manufacture.)

Since the cylinder head and water pump body, are made of aluminium alloy casting, be sure to use a 30 to 60% ethylene glycol antifreeze coolant to assure corrosion protection and freezing prevention.

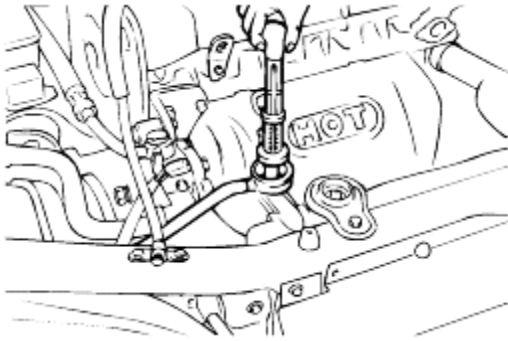
### CAUTION

**If the concentration of the antifreeze is below 30%, the anticorrosion property will be adversely affected. In addition, if the concentration is above 60%, both the antifreeze and engine-cooling properties will decrease, adversely affecting the engine. For these reasons, be sure to maintain the concentration level within the specified range.**



## Measuring of Antifreeze Concentration

Run the engine until the coolant is fully mixed. Drain some coolant (antifreeze), and then measure the temperature and specific gravity of the coolant. Determine its concentration and safe working temperature. If the coolant is short of antifreeze, add antifreeze to a concentration of 50%. (Tropical Areas: 40%)



## Replacing the Coolant

1. Set the temperature control lever to the hot position.
2. Remove the radiator cap.

### **CAUTION**

**Remove the cap slowly. The system is pressurised and the coolant may be hot. Do not open the cap when the engine is hot.**

3. Loosen the drain plug to drain the coolant.
4. Drain the coolant from the reserve tank.
5. After draining the coolant, tighten the drain plug securely.
6. Fill the radiator with the coolant up to its filler neck.
7. Fill the reserve tank with coolant to the MAX. line.
8. Warm up the engine until the thermostat opens, remove the radiator cap and check the coolant level.
9. When the radiator is filled up to its filler neck, install the radiator cap securely.
10. Fill the reserve tank with coolant up to the "FULL" line.

## REPLACING IGNITION CABLES

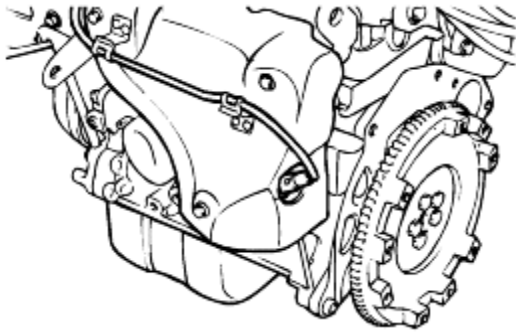
Ignition cables should be replaced periodically with new ones. After replacing, make sure that the ignition cables and terminals are properly connected and fully seated.

### **NOTE**

**When disconnecting an ignition cable; be sure to hold the cable cap. If the cable is disconnected by pulling on it, an open circuit might result.**

## REPLACING OXYGEN SENSOR

The oxygen sensor is a device, which helps control the fuel mixture. If the oxygen sensor is damaged, the exhaust-gas cleaning efficiency as well as drive-ability deteriorates. Therefore, it should be replaced periodically with a new one.



## BALL JOINT AND DRIVESHAFT BOOTS

1. These components, which are permanently lubricated at the factory, do not require lubrication. Damaged seals and boots should be replaced to prevent leakage or contamination of the grease.
2. Inspect the dust covers and boots for proper sealing, leakage and damage. Replace them if defective.

## INSPECTING BRAKE LINES

1. Check all brake lines and hoses for damage, wear, cracks, corrosion, leaks, bends, twists.
2. Check all clamps for tightness.
3. Check that the lines are clear of sharp edges, moving parts and the exhaust system.



## FRONT DISC BRAKE PADS

Check for fluid contamination and wear. Always replace brake pads in complete sets.

### NOTE

If a squealing or scraping noise occurs from the brake during driving, check if the pad wear indicator is contacting the disc, if it is, the brake pad should be replaced.

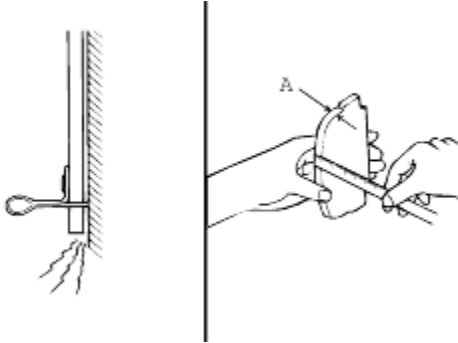
### CAUTION

The pads for the right and left wheels should be replaced at the same time. Never split or intermix brake pad sets. All pads must be replaced as a complete set.

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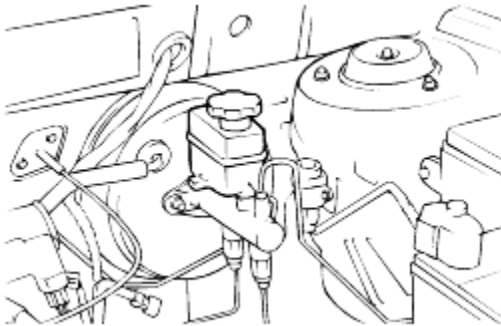
Thickness of pad lining [Limit]: 2.0 mm (0.079 in.)

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## CHECKING THE BRAKE FLUID LEVEL

1. Check the level of the brake fluid in the reserve tank of the master cylinder.
2. The level should be between the "MAX" and "MIN" mark.
3. If the level is lower than the "MIN" mark, add fresh brake fluid up to the "MAX" mark.



## CHANGING BRAKE FLUID

1. Refer to BR-Section for air-bleeding procedures.
2. Connect a vinyl tube to the bleeder screw of each wheel cylinder. Put the other end of the vinyl tube in a vessel for receiving the brake fluid.
3. With a vehicle equipped with ABS (Anti-lock Brake System), refer to the BR-section.

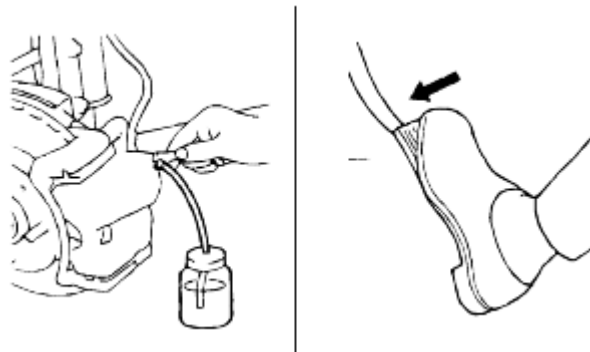


4. Depress the brake pedal a few times. Then loosen the bleeder screw (with the brake pedal still depressed), and tighten it after the brake fluid stops flowing.
5. Repeat the above operation until air bubbles are not in the brake fluid.
6. Repeat these steps for the other cylinders.
7. Add fresh brake fluid up to the "MAX" level in the reserve tank.

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Brake fluid : DOT 3 or DOT4

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## **CHECKING TIRE INFLATION PRESSURE**

Check the tire inflation pressures as follows.

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### **Tire inflation pressure (Check with Tires Cool)**

Tire size :P155 80 R 13

Tire pressure : 32 PSI

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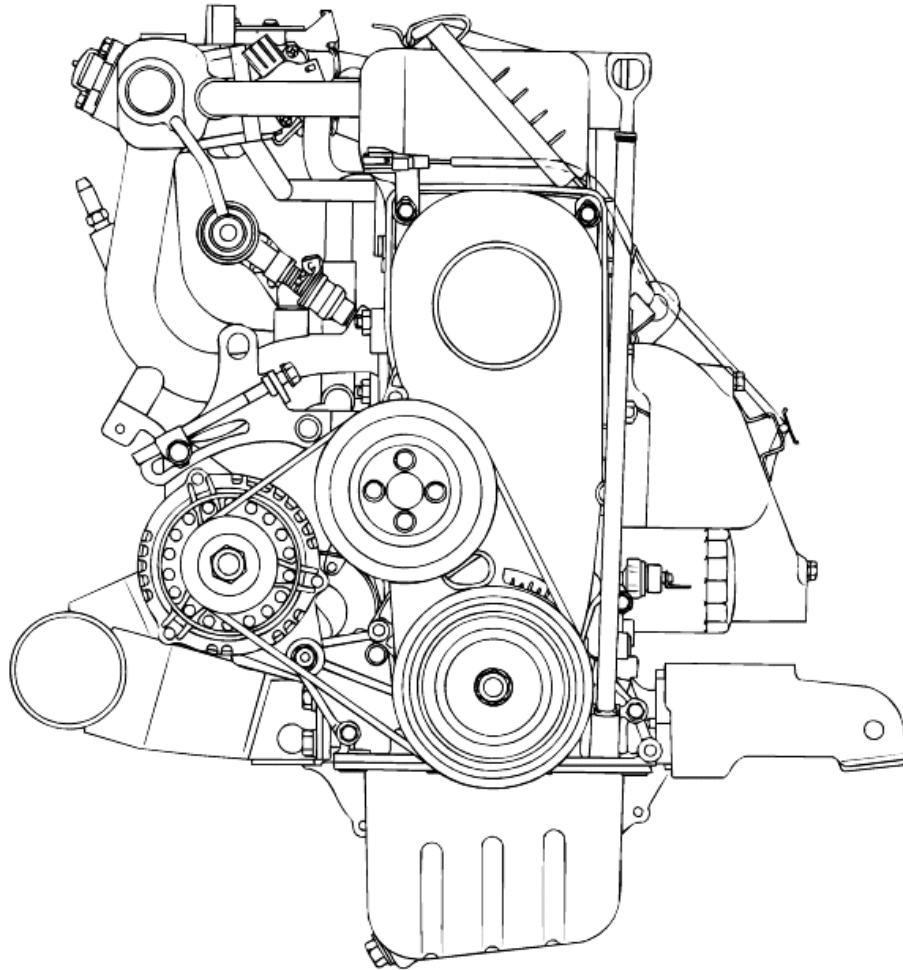
## **ROAD TEST**

Drive the vehicle and check for abnormal conditions.

1. Check oil, fluid, fuel, water and exhaust gas leaks.
2. Check the free play of clutch pedal and brake pedal.
3. Check the operation of brake booster.
4. Check the operation of service brake and parking brake systems.
5. Check the stroke of parking brake lever.
6. Check the drive-ability of engine.
7. Check the condition of instruments, gauges, indicators, exterior lamps, heater and ventilators.
8. Check for abnormal noises from each part.

## 2 Engine Mechanical

### 2.1 General



### EPSILON ENGINE APPEARANCE

**SPECIFICATIONS ECTC0020**

Description	Specification	Limit
<b>General</b> Type Number of cylinders Bore Stroke Total displacement Compression ratio Firing order Idle R.P.M Ignition timing at idling speed	In-line 12 valve SOHC 4 1.0L Eng. 66.0 mm (2.60 in.) 73.0 mm (2.87 in.) 999C 9.7 1-3-4-2 900±100 BTDC 5°±2°/900 rpm	
<b>Valve timing</b> Intake valve Opens (BTDC) Closes (ABDC) Exhaust valve Opens (BTDC) Closes (ABDC)	 5° 35°  43° 5°	
<b>Cylinder head</b> Flatness of gasket surface Flatness of manifold mounting surface Oversize rework dimension of valve seat hole Intake 0.3 mm (0.012 in.) O.S. 0.6 mm (0.024 in.) O.S. Exhaust 0.3 mm (0.012 in.) O.S. 0.6 mm (0.024 in.) O.S. Oversize re-work dimensions of valve guide hole (both intake and exhaust) 0.05 mm (0.002 in.) O.S. 0.25 mm (0.010 in.) O.S. 0.50 mm (0.020 in.) O.S.	Max. 0.05 mm (0.002 in.) Max. 0.15 mm (0.0059 in.)  24.3 - 24.321 mm (0.956 - 0.957 in.) 24.6 - 24.621 mm (0.968 - 0.969 in.)  29.3 - 29.321 mm (1.154 - 1.154 in.) 29.6 - 29.621 mm (1.165 - 1.166 in.)  10.05 - 10.068 mm (0.395-0.396 in.) 10.25 - 10.268 mm (0.403-0.404 in.) 10.50 - 10.518 mm (0.413-0.414 in.)	0.1 mm (0.0039 in.) 0.3 mm (0.0118 in.)
<b>Camshaft</b> Cam height Intake  Exhaust  Journal O.D Bearing oil clearance End play	34.8729 mm (1.3729 in.)  35.1258 mm (1.3842 in.)  Ø41 (-0.045, -0.060) mm (1.181 in.) 0.045 - 0.085 mm (0.0018 - 0.1016 in.) 0.070 - 0.190 mm (0.003 - 0.0075 in.)	34.7729mm (1.3690in.) 35.0258mm (1.3790in.)
<b>Valve</b> Stem O.D. Intake Exhaust Face angle Thickness of valve head (Margin) Intake Exhaust	5.48 - 5.465 mm (0.216 - 0.215 in.) 5.45 - 5.43 mm (0.2146 - 0.2150 in.) 45° - 45.5°  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)	   0.5 mm (0.078 in.) 0.9 mm (0.035 in.)



<b>Description</b>	<b>Specification</b>	<b>Limit</b>
Valve stem to valve guide clearance Intake Exhaust	0.020 - 0.047 mm (0.0007 - 0.0019 in.) 0.050 - 0.082 mm (0.0020 - 0.0032 in.)	0.1 mm (0.004 in.) 0.15 mm (0.006 in.)
<b>Valve guide</b> Installed dimension O.D. Intake Exhaust Service size	10.05 - 10.06 mm (0.3957-0.3961 in.) 10.05 - 10.06 mm (0.3957-0.3961 in.) 0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.) oversize	
<b>Valve seat insert</b> Width of seat contact Intake Exhaust Seat angle Oversize	0.9 - 1.3 mm (0.035 - 0.051 in.) 0.9 - 1.3 mm (0.035 - 0.051 in.) 44° (+0/-30) 0.3 mm, 0.6 mm (0.012 in., 0.024 in.)	
<b>Valve spring</b> Free length Load Installed height Squareness	40.50 mm (1.594 in.) 15.6±0.9 kg/32.0 mm at height 33.3±1.8 kg/24.5 mm at height 22.1 mm (0.870 in.) 1.5° or less	
<b>Cylinder block</b> Cylinder bore Out-of-roundness and taper of cylinder bore Clearance with piston	66.0 - 66.03 mm (2.599 - 2.600 in.) Less than 0.01 mm (0.0004 in.) 0.02 - 0.04 mm (0.0008 - 0.0016 in.)	
<b>Piston</b> O.D. Service size	65.97 - 66.0 mm (2.5976 - 2.5988 in.) 0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize	
<b>Piston ring</b> Side clearance No. 1. No. 2. End gap No. 1. No. 2. Oil ring side rail Service size	0.03 - 0.07 mm (0.001 - 0.003 in.) 0.02 - 0.06 mm (0.0007 - 0.0024 in.) 0.15 - 0.30 mm (0.006 - 0.012 in.) 25 - 0.40 mm (0.010 - 0.016 in.) 0.20 - 0.70 mm (0.008 - 0.028 in.) 0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.)	0.1 mm (0.004 in.) 0.1 mm (0.004 in.) 1 mm (0.039 in.) 1 mm (0.039 in.) 1 mm (0.039 in.)
<b>Connecting rod</b> Bend Twist Connecting rod big end to crankshaft side clearance	0.05 mm (0.002 in.) or less 0.1 mm (0.004 in.) or less 0.10 - 0.25 mm (0.004 - 0.010 in.)	0.4 mm (0.016 in.)
<b>Connecting rod bearing</b> Oil clearance Undersize	0.012 - 0.041 mm (0.0004 - 0.0016 in.) 0.25 - 0.50 mm (10.01 - 0.02 in.)	
<b>Crankshaft</b> Pin O.D. Journal O.D. Bend End play	38 mm (1.496 in.) 42 mm (1.654 in.) 0.03 mm or less 0.25 mm (0.002 - 0.0098 in.)	

Description	Specification	Limit
<b>Crankshaft bearing</b> Oil clearance No. 1,2,3,4,5 Undersize rework dimension of pin 0.25-mm (0.010-in.) 0.50 mm (0.020 in.) Undersized rework dimension of journal 0.25 mm (0.010 in.) 0.50 mm (0.020 in.)	0.020-0.038 mm (0.0008-0.0015 in.)  37.735-37.75 mm (1.4856 - 1.4862 in.) 37.485-37.50 mm (1.4758 - 1.4764 in.)  41.735-41.75 mm (1.643 - 1.6437 in.) 41.485-41.50 mm (1.6333 - 1.6229 in.)	
<b>Flywheel</b> Run-out	0.1 mm (0.004 in.)	0.13 mm (0.005 in.)
<b>Oil pump</b> Clearance between outer circumference and front case Clearance between roter axial side and front case Tip clearance between outer and inner roter Engine oil pressure At engine idle speed Relief spring Free height Load	0.10 - 0.18 mm (0.0039 - 0.0071 in.)  0.04 - 0.095 mm (0.0016 - 0.0037 in.)  0.060 - 0.018 mm (0.0024 - 0.0007 in.)  147 KPa (1.5 kg/cm <sup>2</sup> , 21.33 psi)  38.6 mm (1.5197 in.) 3.65 ± 0.4 kg at 33.0 mm (8.05 ± 0.88 lb. at 1.2992 in.)	
<b>Cooling method</b>	Water-cooled, Pressurised, Forced circulation with electrical fan	
<b>Coolant</b> Quantity	6 lit (7 U.S.qts., 6.9 Imp.qts.)	
<b>Radiator</b> Type Performance	Pressurised corrugated fin type 27,000 Kcal/h	
<b>Radiator cap</b> Main valve opening pressure Vacuum valve opening pressure	73.6-1.3 kPa (10.65-14.91 psi, 0.75-1.05 kg.cm <sup>2</sup> ) 4.90 kPa (0.71 psi, 0.05 kg/cm <sup>2</sup> ) or less	
<b>Coolant pump</b>	Centrifugal type impeller	
<b>Thermostat</b> Type Valve opening temperature Full-opening temperature	Wax pellet type with jiggle valve 82° (180°F) 95°C (203°F)	
<b>Drive belt</b> Type	V-ribbed belt	
<b>Engine coolant temperature sender</b> Type Resistance	Thermistor type 123.8-168.8Ω at 60°C (140°F) 23.5-29.5Ω at 115°C (239°F)	
<b>Thermo switch (on radiator)</b> Operating temperature OFF→ON ON→OFF	85±3°C (185±5.4°F) 78°C (172°F) or more	
<b>Engine coolant temperature sensor</b>		

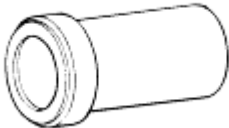
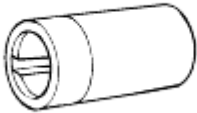
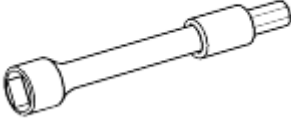
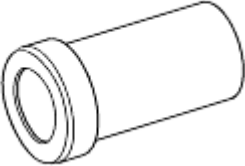

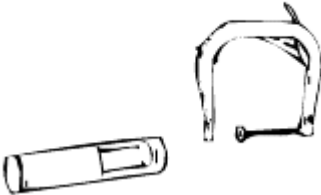
Description	Specification	Limit
Type Resistance	Heat-sensitive thermistor type 2.13-1.61 k $\Omega$ at 20°C (68°F) 258-322 $\Omega$ at 80°C (122°F) or more	
<b>Switching temperature</b>	Switches “ON” at 50°C (122°F) or more	
<b>Automatic transaxle oil cooler</b> Performance	1,000 Kcal/h	
<b>Standard value</b> Coolant concentration	40%	
<b>Air cleaner</b> Type Element	Dry type Panellet type	
<b>Exhaust pipe</b> Muffler Suspension system	Expansion resonance type Rubber hangers	

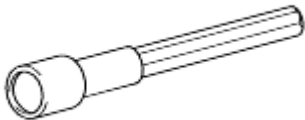
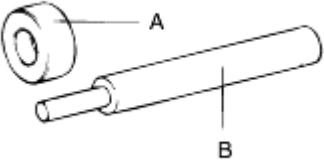
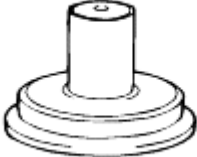
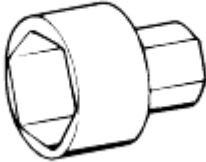

## TIGHTENING TORQUE ECTC0030

Item	Nm	kg.cm	lb.ft
<b>Cylinder Block</b>			
Front roll stopper bracket bolt (M10)	45-55	450-550	33-41
Front roll stopper bracket bolt (M8)	33-50	330-500	24-37
Rear roll stopper bracket bolt	45-55	450-550	33-41
Oil pressure switch	15-22	150-220	11-16
<b>Cylinder head</b>			
Cylinder head bolt			
[cold engine]	60-70	600-700	44-52
[hot engine]	70-75	700-750	52-56
Intake/manifold stay and bracket bolt	18-25	180-250	13-19
Exhaust manifold nut	15-20	150-200	11-15
Rocker cover bolt	8-10	80-100	6-7
Rocker arm shaft bolt	27-32	270-320	20-24
<b>Main Moving</b>			
Connecting rod cap nut	20-23	200-230	15-17
Crankshaft bearing cap bolt	50-55	500-550	37-41
Drive plate A/T bolt	70-80	700-800	52-59
<b>Timing Belt</b>			
Crankshaft pulley bolt	140-150	1400-1500	103-111
Camshaft sprocket bolt	80-100	800-1000	59-74
Timing belt tension bolt	22-30	220-300	16-22
Timing belt cover bolt	10-12	100-120	7-9
Front case bolt	8-10	80-100	6-7
<b>Engine Mounting</b>			
Transaxle mount insulator nut	45-55	450-550	33-41
Transaxle insulator bracket to side member bolts	30-40	300-400	22-30
Rear roll stopper insulator nut	90-100	900-1000	66-74
Rear roll stopper bracket to centre member bolts	45-60	450-600	33-44
Front roll stopper insulator nut	90-100	900-1000	66-74
Front roll stopper bracket to centre member bolts	30-40	300-400	22-30
Oil filter	12-16	120-160	9-12
Oil pan bolts	6-8	60-80	4-6
Oil pan drain plug	35-45	350-450	26-37
Oil screen bolts	15-22	150-220	11-16
Timing belt cover bolts	10-12	100-120	7-9
Surge tank to inlet manifold nuts and bolts	15-20	150-200	11-15
Generator support bolt and nut	20-25	200-250	15-18
Generator brace bolt	12-15	120-150	9-11
Generator brace mounting bolt	20-28	200-280	15-21
Coolant pump pulley	8-10	80-100	6-7
Coolant pump bolt	12-15	120-150	9-11
Coolant temperature sender	10-12	100-120	7-9
Coolant temperature sensor	15-20	150-200	11-15
Coolant outlet fitting bolt	15-20	150-200	11-15
Thermostat housing bolt	8-10	80-200	6-7
Air cleaner body mounting bolts	8-10	80-100	6-7
Air intake hose clamp	3-5	30-50	2-4
Air duct assembly mounting bolt	8-10	80-100	6-7
Intake manifold to cylinder head nuts and bolts	15-20	150-200	11-15
Surge tank stay to cylinder block bolts	18-25	180-250	13-18
Throttle body to surge tank bolts	15-20	150-200	11-15
Exhaust manifold to cylinder head nuts	15-20	150-200	11-15
Exhaust manifold cover to exhaust manifold bolts	8-10	80-100	6-7

<b>Item</b>	<b>Nm</b>	<b>kg.cm</b>	<b>lb.ft</b>
Oxygen sensor to exhaust manifold			
Front exhaust pipe to exhaust manifold nuts	40-50	400-500	32-37
Front exhaust pipe bracket bolts	30-40	300-400	22-30
Front exhaust pipe to catalytic converter bolts	30-40	300-400	22-30
Catalytic converter to main muffler ass'y nuts	40-60	400-600	30-44
Main muffler hanger support bracket bolts	30-40	300-400	22-30
	10-15	100-150	7-11

**SPECIAL TOOLS** ECTC0040

Tool(Number and name)	Illustration	Use
Crankshaft front oil seal installer 09231-22100		Installation of the crankshaft front oil seal (use with 09231 - 11001)
Crankshaft front oil seal guide 09231-11001		Installation of the crankshaft front oil seal (use with 09214-22100)
Cylinder head bolt wrench 09221-21000		Removal and tightening of the cylinder head bolt
Camshaft oil seal installer 09221-21000		Installation of the camshaft oil seal (use with 09221-21100)
Camshaft oil seal guide 09221-21100		Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
Valve spring remover and installer 09222-22100		Removal and installation of the inlet or exhaust valve

Tool(Number and name)	Illustration	Use
Valve stem oil seal installer 09222-22001		Installation of the vale stem oil seal
Valve guide installer 09221-22000 A/B		Removal and installation of the valve guide
Crankshaft rear oil seal installer 09231-21000		1) Installation of the engine rear oil seal 2) Installation of the crankshaft rear oil seal
Oil pressure switch wrench 09260-32000		Removal and installation of the oil pressure switch
Oil filter wrench 09915-47341		Removal and installation of the oil filter.

## TROUBLESHOOTING ECTC0050

Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket Worn or damaged piston rings Worn piston or cylinder  Worn or damaged valve seat	Replace gasket Replace rings Repair or replace the piston and/or cylinder block Repair or replace the valve and/or seat ring
Low oil pressure	Low engine oil level Faulty oil pressure switch Clogged oil filter Worn oil pump gears or cover Thin or diluted engine oil Oil relief valve stuck (open) Excessive bearing clearance	Check engine oil level Replace Replace Replace Change and find out cause Repair Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine vibration	Loose engine roll stopper (front, rear) Loose transaxle mount bracket Loose engine mount bracket Loose centre member Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Retighten Retighten Retighten Retighten Replace Replace Replace
Noisy valves	Thin or diluted engine oil (Low oil pressure) Worn or damaged valve stem or valve guide	Change Replace
Connecting rod and main bearing noise	Insufficient oil supply Thin or diluted engine oil Excessive bearing clearance	Check engine oil level Change and find out cause Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low coolant level	Leakage of coolant 1. Heater or radiator hose 2. Faulty radiator cap 3. Thermostat housing 4. Radiator 5. Engine coolant pump	Repair or replace parts Tighten or replace clamps Replace the gasket or housing Repair or replace Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant
Abnormally high coolant temperature	Faulty thermostat Faulty radiator cap Restricted flow in cooling system Loose or missing drive belt Faulty water pump Faulty temperature sensor or wiring Faulty electric fan Insufficient coolant	Replace parts Replace parts Clear restriction or replace parts Adjust or replace Replace Repair or replace Repair or replace Refill coolant
Abnormally low coolant temperature	Faulty thermostat Faulty temperature sensor or wiring	Replace Repair or replace
Leakage from oil cooling system	Loose connections Cracked or damaged ; hoses, pipes or oil cooler	Replace Replace or repair
Inoperative electrical cooling fan	Damaged : Thermo sensor, Electrical motor, Radiator fan relay, Wiring	Replace or repair



<b>Symptom</b>	<b>Probable cause</b>	<b>Remedy</b>
Exhaust gas leakage	Loose connections Broken pipe or muffler	Retighten Repair or replace
Abnormal noise	Detached baffle plate in muffler Broken rubber hanger Pipe or muffler contacting vehicle body Broken pipe or muffler	Replace Replace Correct Repair or replace

## MAINTENANCE ECTC0060

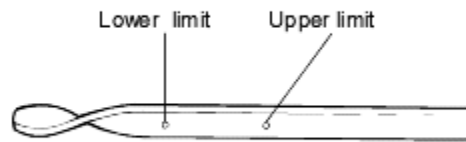
### CHECKING ENGINE OIL

1. Position the vehicle on a level surface.
2. Warm up the engine.

#### **NOTE**

**If a vehicle has been out of service for a prolonged period of time, warm up the engine for approximately 20 minutes.**

3. Turn off the engine, and wait 2 or 3 minutes, then check the oil level.
4. Check that the engine oil level is within the level range indicated on the oil dipstick if the oil level is found to have fallen to the lower limit (the L mark), refill to the "F" mark.



#### **NOTE**

**When refilling, use the same type of engine oil.**

5. Check that the oil is not dirty or contaminated with coolant or gasoline, and that it has the proper viscosity.

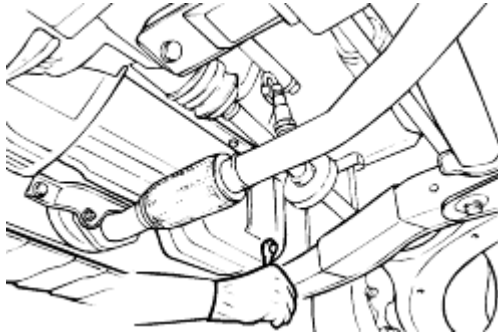
### CHANGING ENGINE OIL

#### **CAUTION**

**Be careful not to burn yourself, as the engine oil is hot.**

6. Run the engine until it reaches normal operating temperature.
7. Turn off the engine

- Remove the oil filler cap and the drain plug (on the oil pan). Drain the engine oil.



- Install and tighten the drain plug to the specified torque.

**Tightening torque**

Drain plug : 35-45Nm (350-450kg.cm, 24-33lb.ft)

**NOTE**

**Whenever tightening the oil drain plug; use a new drain plug gasket.**

- Fill the crankcase with fresh engine oil through the oil filler cap opening.

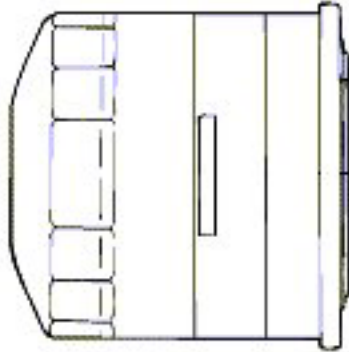
Drain and Refill Without oil filter:  
2.8 liter (2.96U.S.qts, 2.46 Imp.qts.)

Drain and Refill With oil filter:  
3.1 liter (3.28U.S.qts., 2.73 Imp.qts.)

- Install the oil filler cap.
- Start and run the engine.
- Turn off the engine and then check the oil level. Add oil if necessary.

## FILTER SELECTION ECTC0070

All Hyundai engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing the new filter.

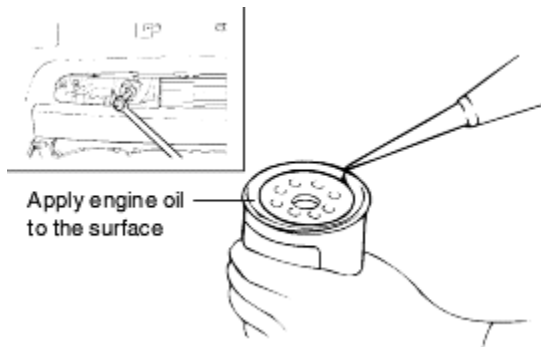


### PROCEDURE FOR REPLACING THE OIL FILTER

#### **CAUTION**

**Be careful not to burn yourself, as the engine and engine oil are hot.**

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.



3. Tighten the oil filter to the specified torque.

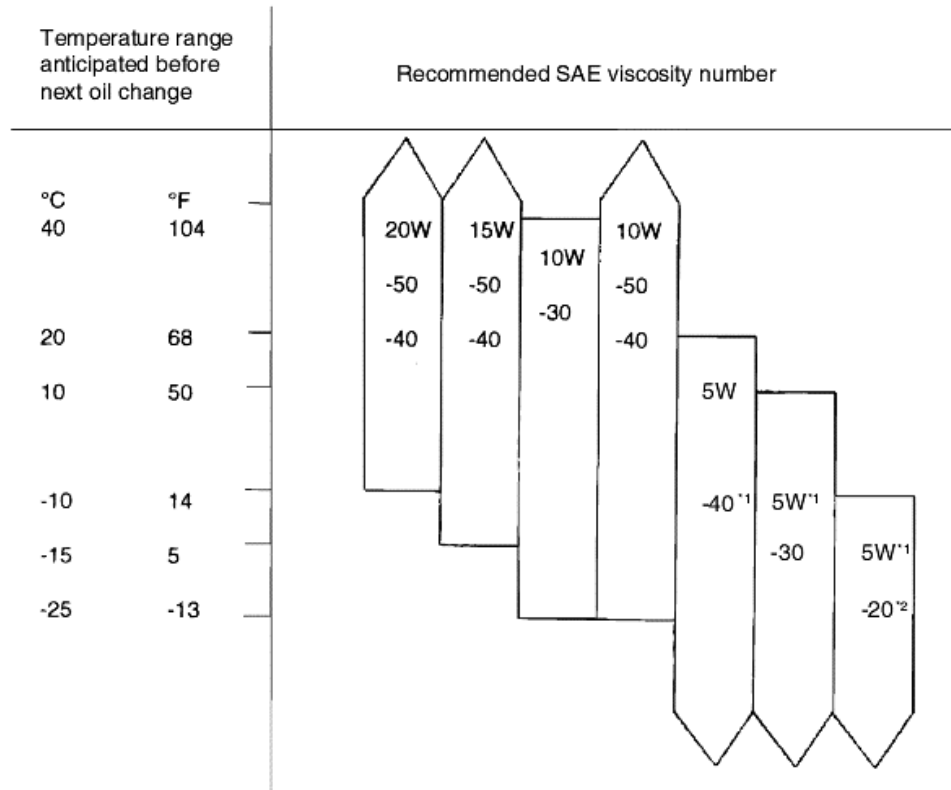
#### **Tightening torque**

Oil filter : 12 - 16 Nm (120 - 160 kg.cm, 9 - 12 lb.ft)

4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

## SELECTION OF ENGINE OIL ECTC0080

### Recommended SAE viscosity grades:



\*1 Restricted by driving condition and environment.

\*2 SAE5W-20 Not recommended for sustained high speed vehicle operation

### NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which:

1. Satisfy the requirements of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.

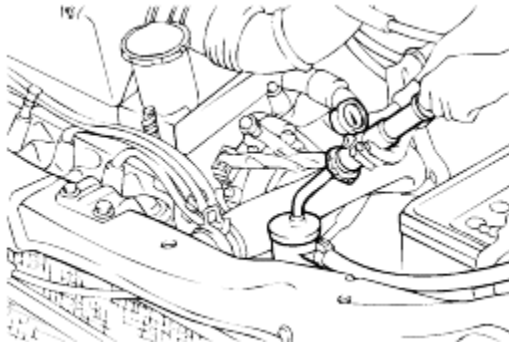
Lubricant that does not have both an SAE grade number and an API service classification on the container should not be used.

## CHECKING COOLANT LEAK ECTC0090

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 KPa (1.4 kg/cm<sup>2</sup>, 20 psi) pressure. Hold it for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.

### NOTE

- a. **Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.**
  - b. **Be sure to clean away any moisture from the places checked completely.**
  - c. **When the tester is removed, be careful not to spill any coolant from it.**
  - d. **Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.**
4. If there is leakage, repair or replace with the appropriate part.



### RADIATOR CAP PRESSURE TEST

1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the gauge stops moving.  
Main valve opening pressure :  
78-108 kPa (0.8-1.1 kg/cm<sup>2</sup>, 11.3-15.6 psi)  
Limit : 65 kPa (0.66 kg/cm<sup>2</sup>, 9.2 psi)
3. Check that the pressure level is maintained at or above the limit.

4. Replace the radiator cap if the reading does not remain at or above the limit.

**NOTE**

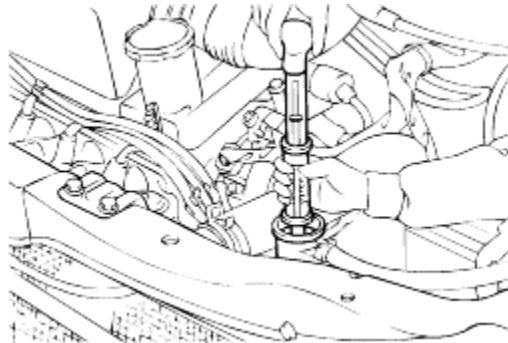
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.

- 5.



## SPECIFIC GRAVITY TEST ECTC0100

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature, using the following table for reference.



RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
Coolant temperature °C (°F) and specific gravity							
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

**Example:** The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F)

### CAUTION

- If the concentration of the coolant is below 30%, its anti-corrosion properties will be adversely affected.
- If the concentration is above 60%, both the anti-freeze and engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
- Do not use together with another brand's product.

### RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]



## CHECKING COMPRESSION PRESSURE ECTC0110

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until engine coolant temperature reaches 80-95°C (176-205°F).
3. Turn off engine and disconnect the spark plug cables.
4. Remove the spark plugs.
5. Crank the engine to remove any foreign material in the cylinders.
6. Insert the compression gauge into the spark plug hole.
7. Depress the accelerator pedal to open the throttle fully.
8. Crank the engine and read the gauge.

---

Standard value : 1500kpa (15.5Kg/cm<sup>2</sup>, 220 psi)

Limit : 1200kpa (12.5Kg/cm<sup>2</sup>, 178 psi)

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9. Repeat steps 6 to 8 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

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Limit : Max. 150 kPa (1.5 kg/cm<sup>2</sup>, 21 psi)  
between cylinders

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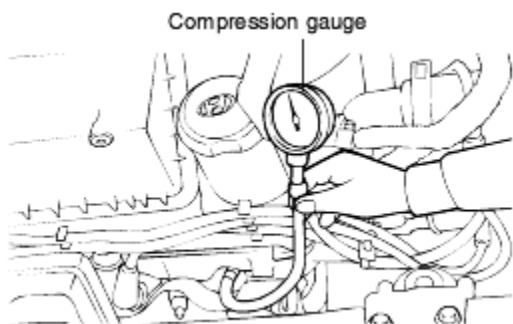
10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 6 to 9.
  - If the addition of oil makes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall
  - If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket, are all possible causes.

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### **Tightening torque**

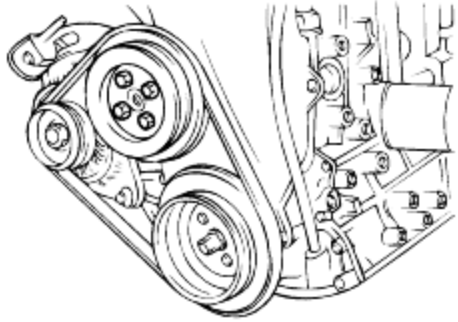
Spark plug : 20-30 Nm (200-300 kg.cm, 14-22 lb.ft)

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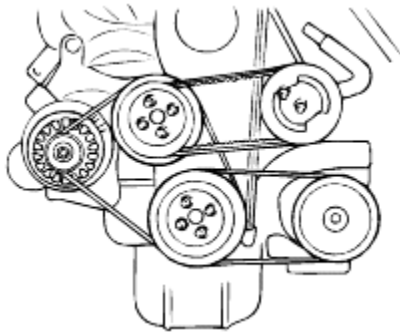


## ADJUSTING TIMING BELT TENSION ECTC0120

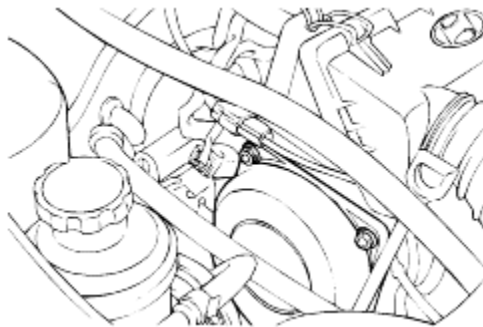
1. Loosen the coolant pump pulley mounting bolt and loosen the generator belt tension adjustment bolt.



2. Remove the coolant pump pulley, generator belt.

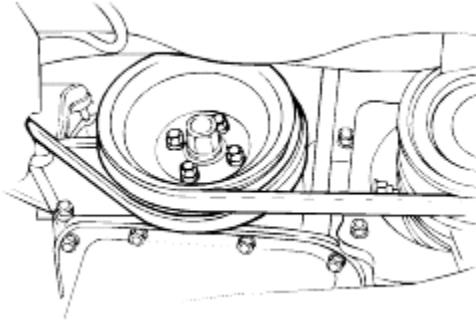


3. Remove the oil level gauge and loosen the timing cover upper side mounting bolt (4EA).

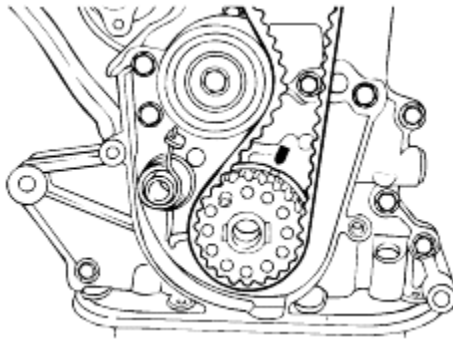


4. Jack up the vehicle.
5. Remove the right wheel and tire.

6. Remove the crankshaft pulley.



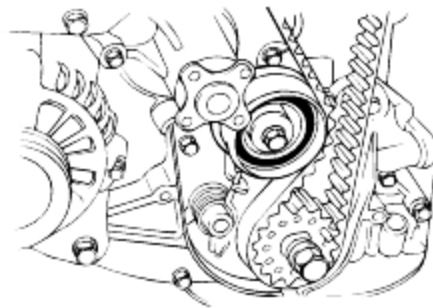
7. Loosen the tension mounting bolts; remove the timing belt cover.
8. Turn crankshaft to place clockwise in No.1 cylinder at top head centre on compression stroke.



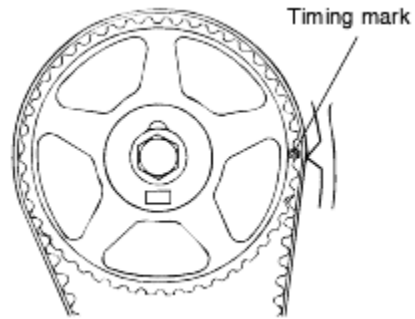
**NOTE**

**Turn the crankshaft clock wise. If counter clock wise, tension is not available.**

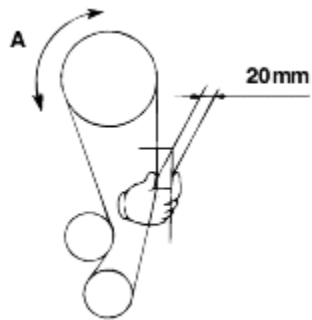
9. Loosen the tensioner bolt 1-2 turn and tension the belt by tensioner spring.



10. Turn crankshaft clockwise as much as two camshaft sprocket teeth.



11. Push the arrow direction on tensioner, measure the engagement between camshaft sprocket 'A' part belt and sprocket.

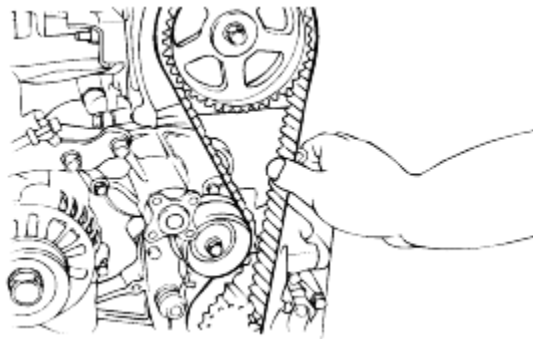


12. Check the tension of timing belt.  
Check the clearance between extension belt side and the centre of the timing belt installation hole.

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Standard valve : 20 mm

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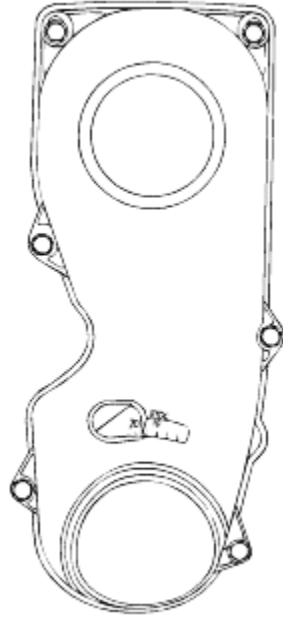
13. Install the timing belt cover.

---

**Tightening torque :**

10-12 Nm (100-200 kg.cm, 7.2-8.7 lb.ft)

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14. Install the crankshaft pulley.

15. Loosen the air condition belt adjust bolt.

16. Install the air condition belt and adjust belt tension.

17. Install the coolant pump pulley.

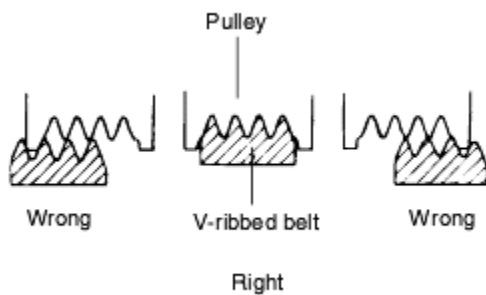
18. Install V-belt and adjust the belt tension.

## ADJUSTING DRIVE BELT TENSION ECTC0130

1. Check that the belts are not damaged and are properly fit for the pulley grooves.
2. Apply 100 N (22-lbs.) force to the back and midway portion of the belt between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge.

### CAUTION

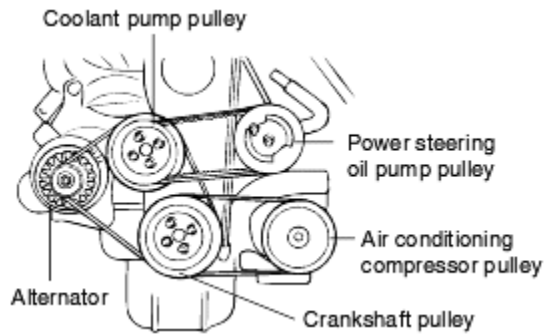
- a. **When installing the V-ribbed belt, check that the V-ribs are properly aligned.**
- b. **If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.**



Standard value: Items		Inspection	Adjustment	
			New	Used
For alternator	Deflection mm (in.)	9.5-11 (0.200-0.236)	8.5-9.5 (0.33-0.37)	10 (0.39)
	Tension N (lb)	350-500 (79-112)	500-600 (110-132)	400 (88)
For air conditioner	Deflection mm (in.)	8 (0.31)	5.0-5.5 (0.20-0.22)	6.0-7.0 (0.24-0.28)
For power steering	Deflection mm (in.)	6.0-9.0 (0.24-0.35)	7.0-10.0 (0.28-0.4)	-

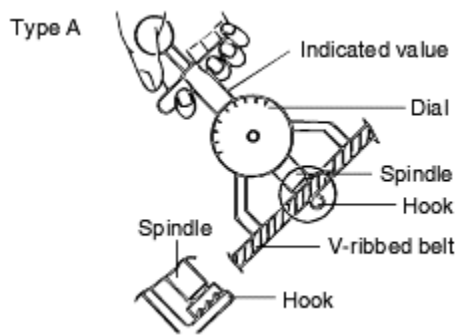
### NOTE

- a. **The belt tension must be measured half - way between the specified pulleys.**
- b. **When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in the above table. Let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection."**
- c. **When adjusting a belt, which has been used, or newly installed, after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table.**
- d. **Refer to the standard value indicated under "Inspection" for periodic inspections.**



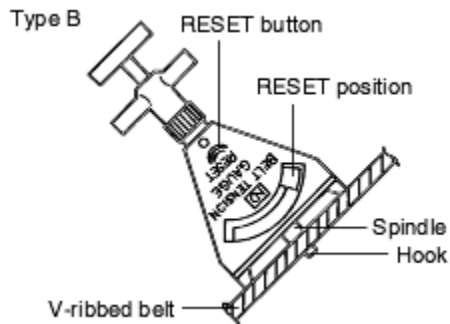
### TYPE A TENSION GAUGE

Do not let the dial section of the tension gauge contact other objects during measurement.



### TYPE B TENSION GAUGE

1. When measuring, turn the reset button in the direction of the arrow and set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.



## ADJUSTING THE ALTERNATOR BELT

### CAUTION

If the belt is too loose, it will cause noise or sudden wear.

If the belt is too tight, the engine coolant pump bearing or the alternator may become damaged.

1. Loosen the alternator nut "A" and the tension adjuster lock bolt "B".
2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the alternator nut "A".
5. Check the tension or the deflection of belt, readjust if necessary.

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### Tightening torque

Alternator support bolt and nut :

20-25 Nm (200-250 kg.cm, 14-18 lb.ft)

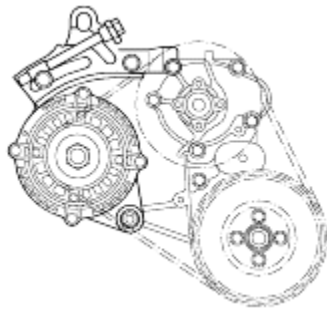
Alternator lock bolt B :

12-15 Nm (120-150 kg.cm, 9-11 lb.ft)

Alternator brace mounting bolt :

20-27 Nm (200-270 kg.cm, 15-20 lb.ft)

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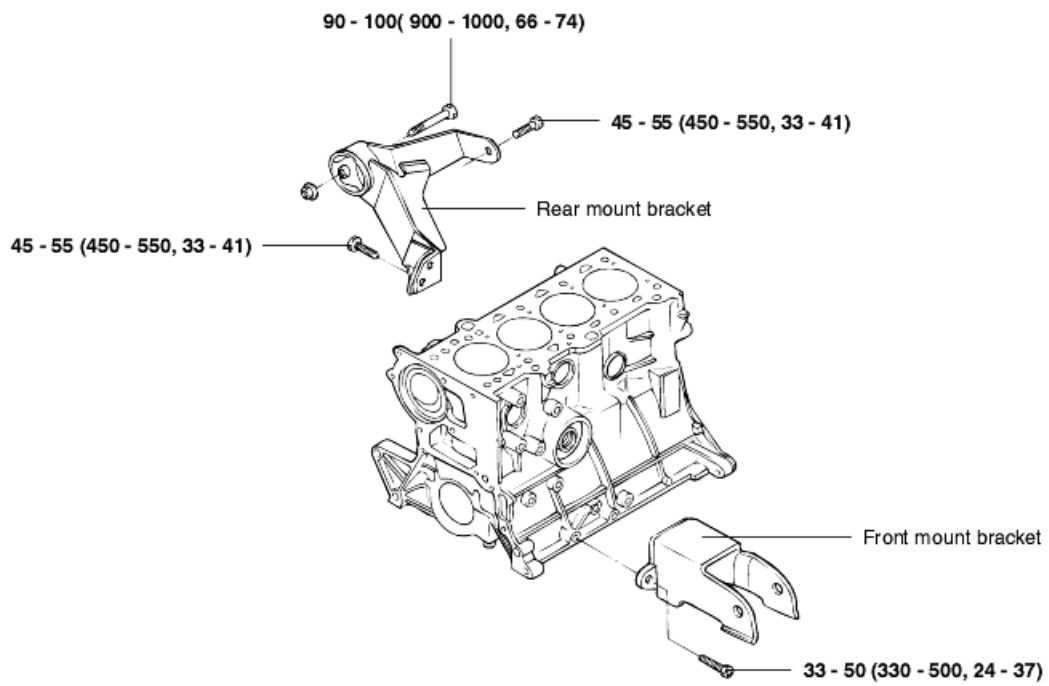




## 2.2 Engine Block

CYLINDER BLOCK ECTC0150

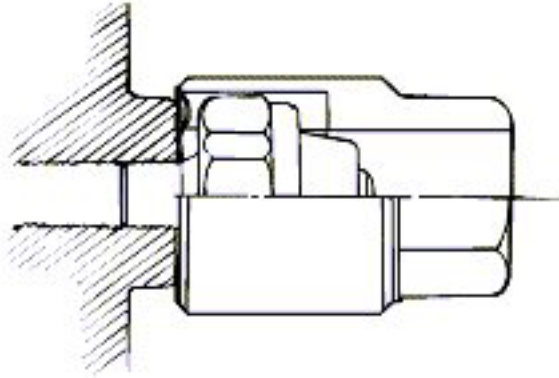
### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

## DISASSEMBLY ECDA0090

1. Remove the cylinder head, timing belt, front case, flywheel, piston and crankshaft.
2. Using the special tool (09260-32000), remove the oil pressure switch



## INSPECTION ECTC0200

### CYLINDER BLOCK

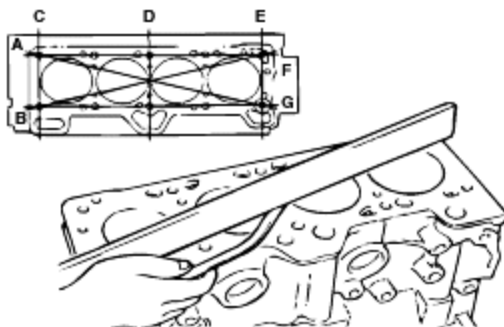
1. Visually check the engine block for scores, rust and corrosion. Also check for cracks or any other defects. Repair or replace the block if defective.
2. Using a straight edge and feeler gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

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Standard : 0.05mm (0.0020 in.) or less

Limit : 0.1mm (0.0039 in.)

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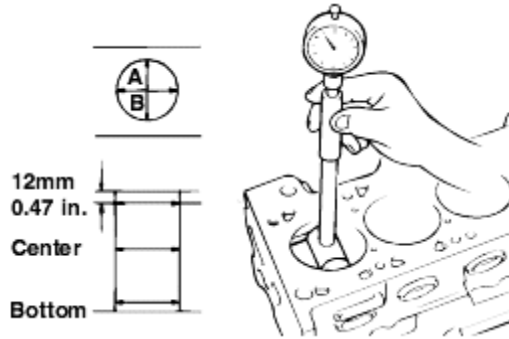
3. Measure the cylinder bore with a cylinder gauge at three levels in the directions A and B. If the cylinder bores show more than the specified out-of roundness or taper or if the cylinder walls are badly scuffed or scored, the cylinder block should be re-bored and honed. New oversize pistons and rings must be fitted. Measuring points are as shown.

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Cylinder I.D : 66mm (2.598 in.)

Cylinder I.D. taper : 0.05mm (0.0019 in.) or less

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4. If a cylinder ridge exists, cut away with a ridge reamer.
5. Oversize pistons are available in four sizes

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**Piston service size and mark mm (in.)**

0.25 (0.010) O.S.....	25
0.50 (0.020) O.S.....	50
0.75 (0.030) O.S.....	75
1.00 (0.039) O.S. ....	100

---

6. When boring the cylinder bore to oversize, keep the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize.

The standard measurement of the piston outside diameter is taken at a level 12-mm (0.47-in.) above the bottom of the piston skirt and across the thrust faces.

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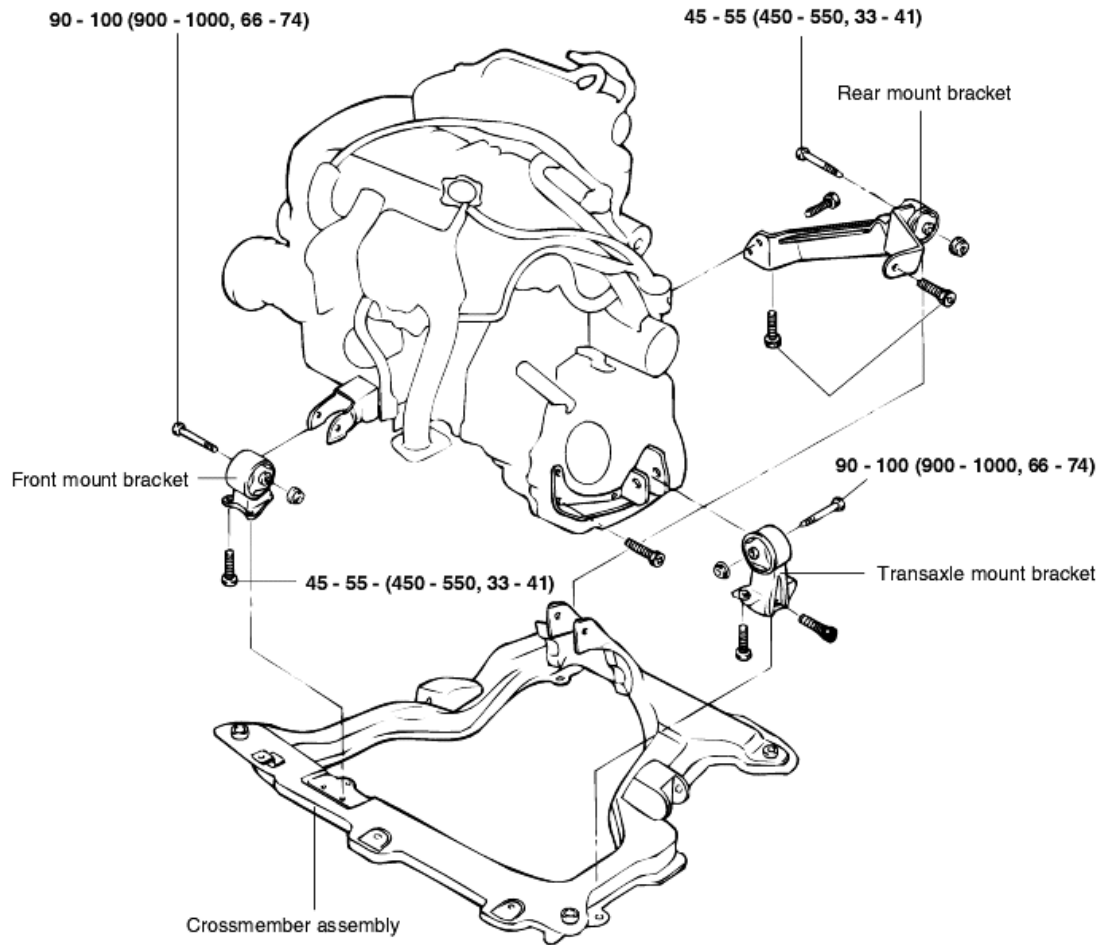
Piston-to-cylinder wall clearance :

0.02-0.04 (0.0008-0.0016 in.)

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# ENGINE MOUNTS

COMPONENTS ECTC0250



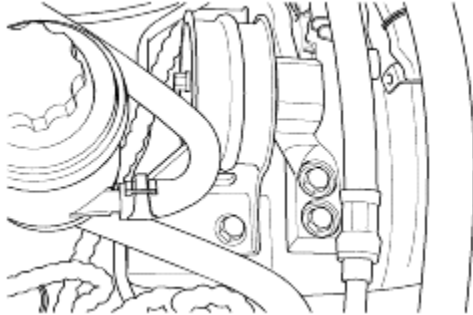
**TORQUE : Nm (kg.cm, lb.ft)**

## REMOVAL ECTC0300

Attach an engine hoist to the engine hooks, and raise the engine just enough so that there is no pressure on the insulators.

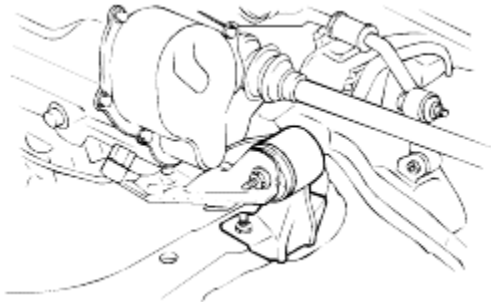
### ENGINE MOUNTING

1. Remove the engine mount insulator bolts.
2. Remove the engine mount bracket from the engine.



### TRANSAXLE

1. Remove the transaxle mount bolt.

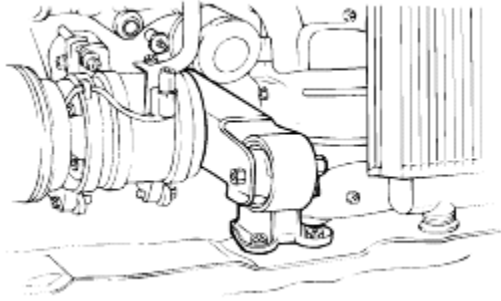


2. Detach the cap from inside the right fender shield. Remove the transaxle mounting bolts.
3. Remove the trans-axle-mounting bracket.

### FRONT ROLL STOPPER

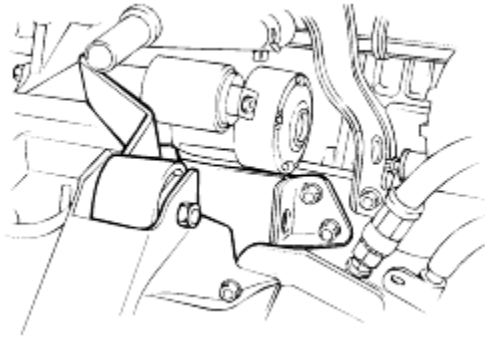
1. Remove the upper and lower bolts of the front roll stopper.

2. Remove the front roll stopper assembly.



### REAR ROLL STOPPER

1. Remove the bolt of the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.



### INSTALLATION ECTC0350

1. While checking the connections of the harnesses, pipes, hoses, etc., and making sure that none of them are caught, damaged, etc., install the engine and transaxle assembly.
2. When the engine and transaxle assembly is installed temporarily tighten the front roll stopper.
3. After the weight of the engine and transaxle assembly has been applied to each insulator, tighten to the specified torque.
4. Reassemble all of the components removed during disassembly. Be especially careful to properly secure all components, including fuel, electrical and fluid pipe connections.
5. Refill the coolant and check for leaks.
6. Refill the transaxle fluid, test its operation, and check for leaks.
7. Check the operation of the transaxle control cable and accelerator cable. Adjust as necessary.
8. Check for proper operation of each of the various gauges.

**REMOVAL**

1. Remove the battery.
2. Detach the air cleaner.
3. Disconnect the backup lamp and engine harness connectors.



4. Disconnect the connectors for the generator harness and the oil pressure gauge wiring.
5. Drain the engine coolant from the radiator.
6. For vehicles with automatic trans-axles, disconnect transaxle oil cooler hoses.

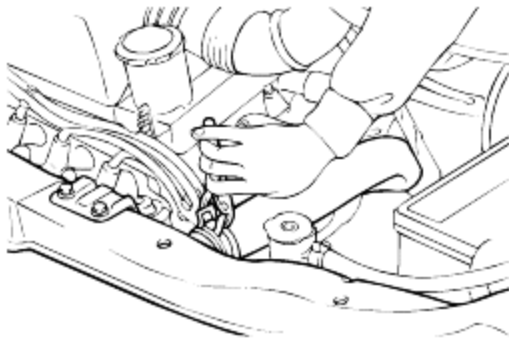
**NOTE**

**When disconnecting the hoses, make identification marks to avoid making mistakes when reconnecting them.**

**CAUTION**

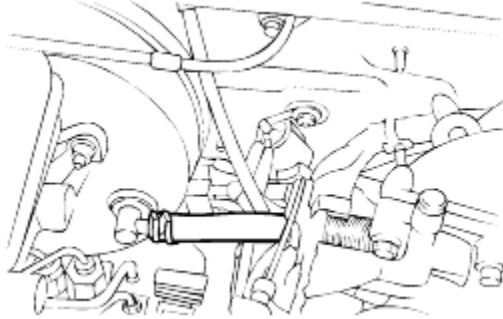
**Be careful not to spill oil or fluid from hoses. Plug the openings to prevent foreign material from entering.**

7. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.



8. Disconnect the engine ground.

9. Disconnect the brake booster vacuum hose.

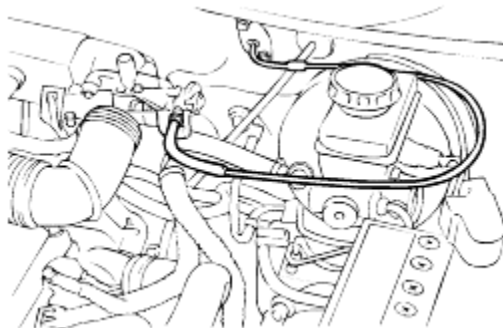


10. Remove the main fuel line and the return and vapour hoses from the engine side.

**CAUTION**

**To reduce the residual pressure in the hoses, refer to Group Fuel System "Fuel filter replacement."**

11. Disconnect the heater hoses (inlet and outlet) on the engine side.
12. Disconnect the accelerator cable at the engine side.

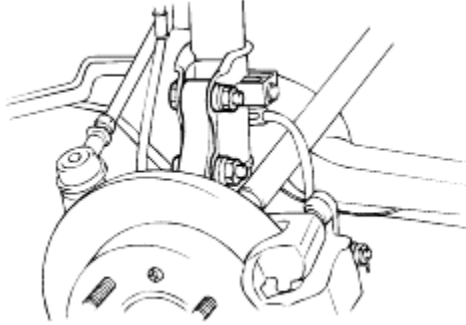


13. For vehicles with automatic trans-axles, remove the control cable from the transaxle.
14. Disconnect the speedometer cable from the transaxle.
15. Disconnect the air conditioning compressor from the mounting bracket.
16. Jack up the vehicle and remove the rear tire.
17. Remove the calliper assembly from knuckle and hold the upper side.





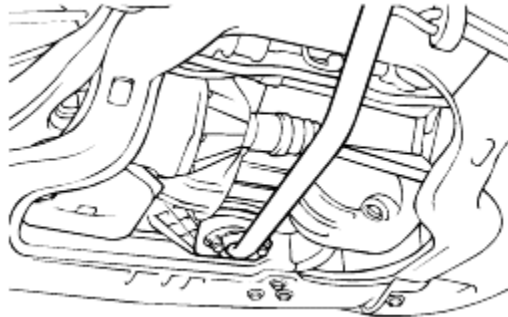
18. Loosen the strut lower bolt and separate from the knuckle.



19. Drain the transaxle oil (or fluid).



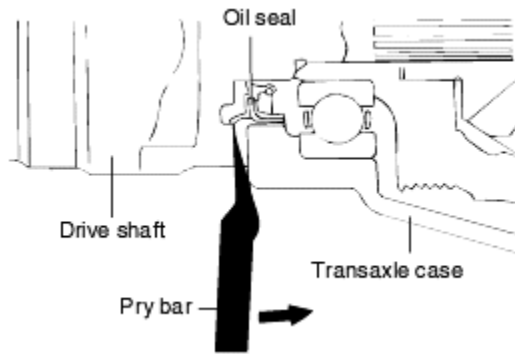
20. Disconnect the front exhaust pipe from the manifold.



**NOTE**

Use wire to suspend the exhaust pipe from the bottom of the vehicle.

21. Remove the drive shafts from the transaxle case.



- Plug the holes of the transaxle case to prevent entry of foreign material.
- Install new circlips on the drive shafts when reassembling.

22. Hang the lower arm and drive shaft from the body with a string.

23. Attach a cable to the engine, and use a chain hoist to lift the engine just enough so that the cable becomes tight.

24. Remove the front roll stopper.

25. Separate the rear roll stopper.

26. Remove the engine mounting insulator bolts.

27. Remove the engine-mounting bracket from the engine.

28. Slowly raise the engine (to the extent that the weight of the engine and transaxle assembly is not applied to the mounting portions) and temporarily hold it in the raised position.

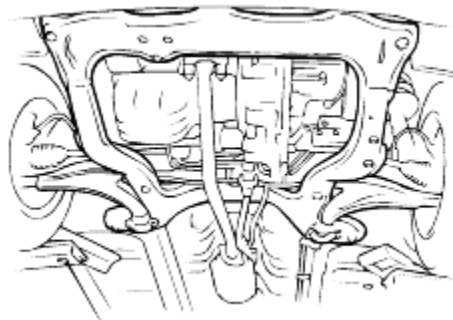
### **CAUTION**

**Check that all cables, hoses, harnesses, connectors, etc. are disconnected from the engine.**

29. Remove the transaxle mount bracket bolts.

30. Remove the left mount insulator bolt.

31. Loosen the sub-frame mounting bolt (4ea) and remove the sub-frame, engine, T/M, steering gear box and drive shaft at a time beneath the vehicle.



32. After removing drive shaft assembly, hang the engine and transaxle assembly on the hanger using the special tool.  
And loosen the mounting bolt and remove the engine and the transaxle assembly from the sub-frame.



## INSTALLATION

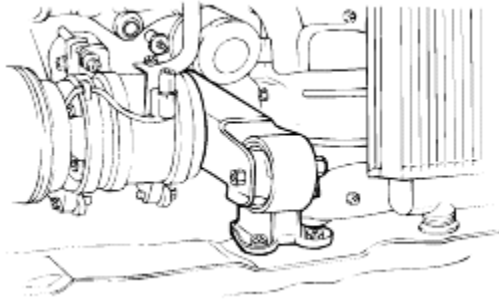
1. While checking the connections of the harnesses, pipes, hoses, etc., and making sure that none of them are being caught, damaged, etc., install the engine and transaxle assembly.
2. Install the front engine mount insulator.

---

**Tightening torque :**

90-100 Nm (900-1000 kg.cm, 66-74 lb.ft)

---



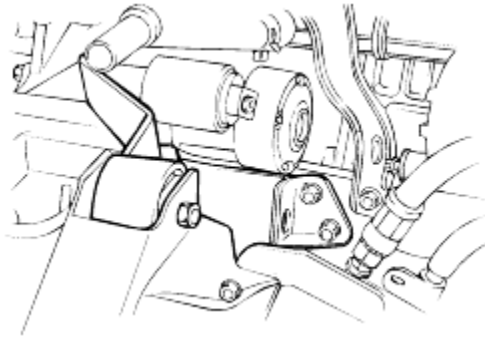
3. Install the rear engine mount insulator.

---

**Tightening torque :**

90-100 Nm (900-1000 kg.cm, 66-74 lb.ft)

---



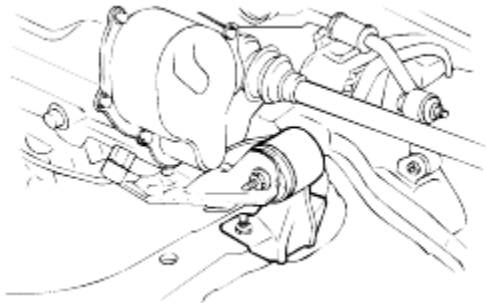
4. Install the transaxle mount insulator.

---

**Tightening torque :**

45-55 Nm (450-550 kg.cm, 33-41 lb.ft)

---

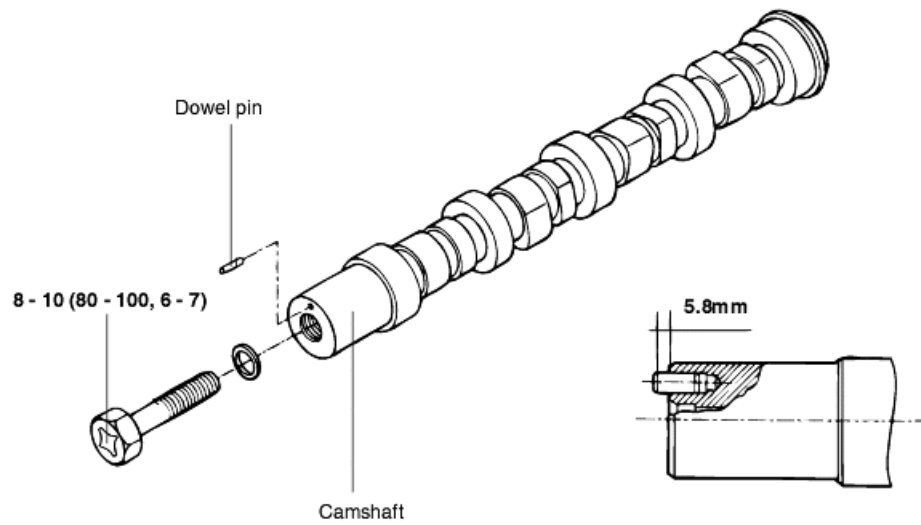


5. After the weight of the engine and transaxle assembly has been put on each insulator, tighten to specified torque.
6. Reassemble all of the components removed during disassembly.  
Be especially careful to properly secure all components, including fuel, electrical and fluid pipe connections.
7. Refill the coolant and check for leaks.
8. Refill the transaxle fluid, test its operation, and check for leaks.
9. Check the operation of the transaxle control cable and accelerator cable.  
Adjust as necessary.
10. Check for proper operation of each of the various gauges.

## 2.3 Main Moving System

### CAM SHAFT

COMPONENTS ECTC0500



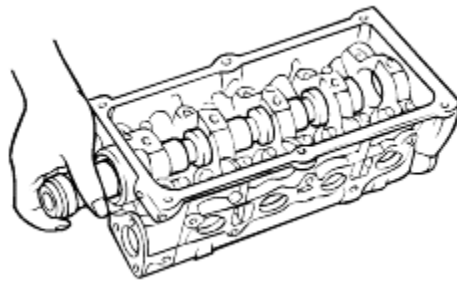
**TORQUE : Nm (kg.cm, lb.ft)**

## DISASSEMBLY ECTC0550

1. Disconnect the breather hose and the PCV hose.
2. Remove the coolant pump pulley and crankshaft pulley.
3. Remove the timing belt cover.
4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Remove the timing belt from the camshaft sprocket.
6. Remove the camshaft sprocket.
7. Remove the ignition coil assembly
8. Remove the rocker cover.
9. Remove the rocker arm shaft assembly; refer to "Rocker Arms and Rocker Arm Shafts" section.



10. Remove the camshaft from front side to rear.
11. Remove the camshaft.



### CAMSHAFT

1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

---

#### Cam height

##### Standard value

Intake : 34.8729mm (1.3729 in.)

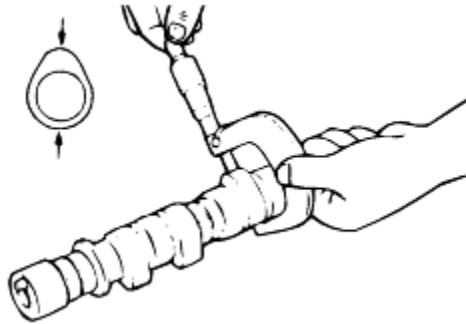
Exhaust : 35.1258mm (1.3829 in.)

##### Limit

Intake : 34.7729mm (1.3690 in.)

Exhaust : 35.0258mm (1.3789 in.)

---



3. Check the cam surface for abnormal wear or damage, and replace if necessary.
4. Check each bearing for damage. If the bearing surface is excessively damaged, replace the cylinder head assembly or camshaft-bearing cap, as necessary.

### OIL SEAL (Camshaft Front)

1. Check the lips for wear. If lip threads are worn, replace.
2. Check the oil seal lip-contacting surface of the camshaft. If it is worn in stages, replace the camshaft.

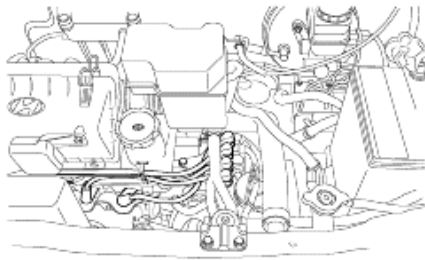
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Camshaft end play : 0.07-0.19mm (0.0003-0.0007 in.)

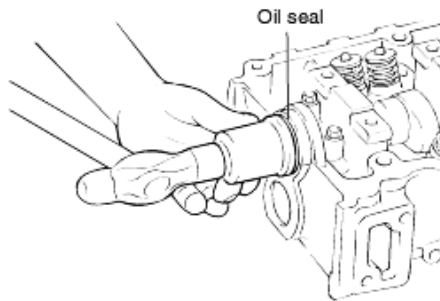
---

## REASSEMBLY ECTC0650

1. Install the camshaft after lubricating the journal of the camshaft with engine oil.
2. Install the ignition coil.



3. Install the rocker arm and rocker arm shaft.  
Refer to the "Rocker Arms and Rocker Arm Shafts" section.
4. Using the Special Tools, Camshaft Oil Seal Installer (09221-21000), press and fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.



5. Install the camshaft sprocket and tighten the bolts to the specified torque.

---

### **Tightening torque**

Camshaft sprocket bolt :

80-100Nm (800-1000kg.cm, 59-74lb.ft)

6. Align the camshaft sprocket and crankshaft sprocket timing marks. The piston in the No. 1 cylinder will then be at top dead centre on the compression stroke.
7. Install a gasket in the rocker cover groove.
8. Temporarily install the rocker cover.
9. Start the engine and run at idle.
10. Install the rocker cover and tighten the bolts to the specified torque.

---

### **Tightening torque**

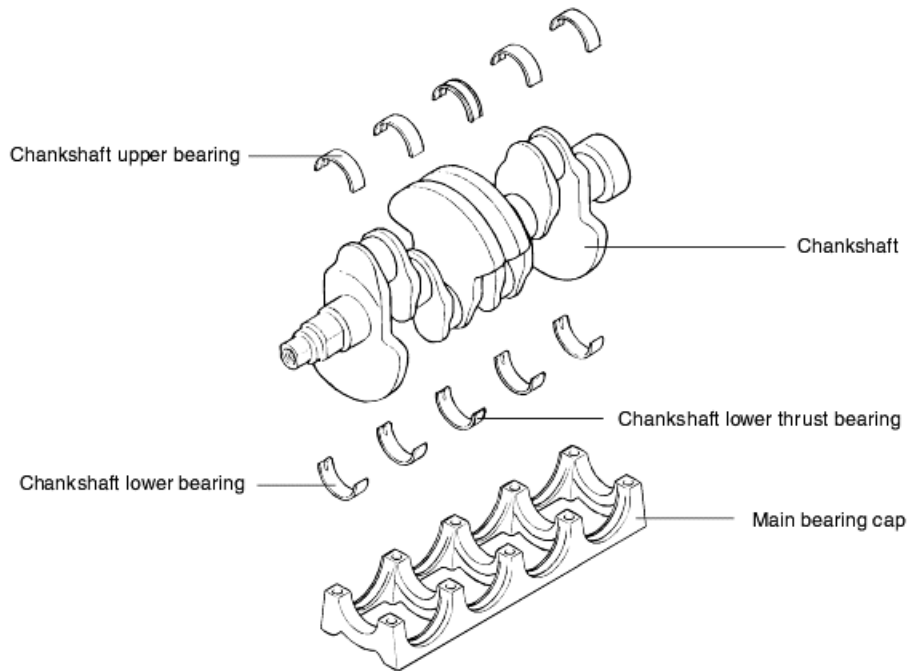
Rocker cover bolt : 8-10Nm (80-100kg.cm, 6-7lb.ft)

11. Install the timing belt cover.
12. Install the coolant pump pulley and crankshaft pulley.



# CRANKSHAFT

## COMPONENTS ECTC0700



## DISASSEMBLY ECDA0320

1. Remove the timing belt train, front case, flywheel cylinder head assembly and oil pan. For details, refer to respective chapters.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.
4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.
5. Remove the crankshaft position sensor wheel.

---

### **CAUTION**

**Mark the main bearing caps to permit re-assembly in the original position and direction.**

---

## CRANKSHAFT

1. Check the crankshaft journals and pins for damage, uneven wear, and cracks. Also check oil holes for clogging. Correct or replace any defective part.
2. Inspect out-of-roundness and taper of crankshaft journal and pin.

---

### Standard value

Crankshaft journal O.D : 42mm (1.654 in.)

Crankshaft pin O.D : 38mm (1.496 in.)

Crankshaft journal, pin out-of-roundness and taper :

0.01mm (0.0004 in.) or less

---

## MAIN BEARINGS AND CONNECTING ROD BEARINGS

Visually inspect each bearing for peeling, melting, seizure and improper contact. Replace the defective bearings.

## OIL CLEARANCE MEASUREMENT

To check the oil clearance, measure outside diameter of the crankshaft journal and the crank pin and inside diameter of the bearing. The clearance measurement is the difference between the measured outside and inside diameters.

---

### Standard value:

Journal oil clearance NO. 1,2,3,4,5 :

0.020-0.038mm (0.0007-0.0014 in.)

Pin oil clearance :

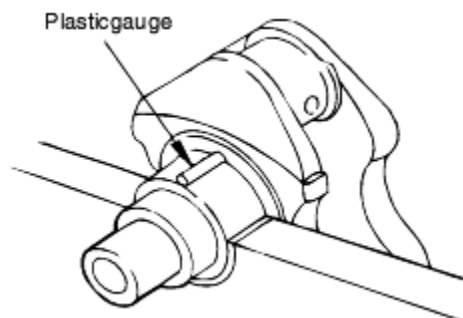
0.012-0.041mm (0.0005-0.0016 in.)

---

## PLASTIC GAUGE METHOD

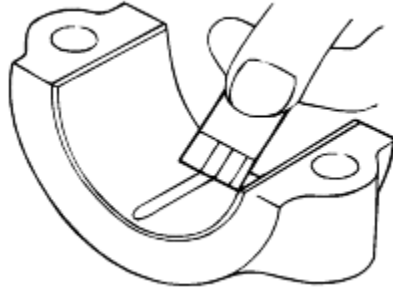
A plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from bearings and journals.
2. Cut plastic gauge to the same length as the width of the bearing and place it parallel with the journal, off from the oil holes.



3. Install the crankshaft, bearings, and caps. Tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastic gauge at the widest point using the scale printed on the gauge package. If the clearance exceeds the repair limit, replace the bearing.  
Should the standard clearance not be obtained even after bearing replacement, the journal should

be ground to a recommended undersize, and a bearing of the same size should be installed.



### **OIL SEAL**

Check front and rear oil seals for damage or worn lips. Replace any seal that is defective.

### **CRANKSHAFT POSITION SENSOR WHEEL**

1. Remove the crankshaft position sensor wheel
2. Check the crankshaft position sensor wheel for damage, cracks and wear, and replace if necessary.
3. Check the clearance between the crankshaft position sensor wheel and the crankshaft position sensor with a depth gage.

---

#### **Standard value**

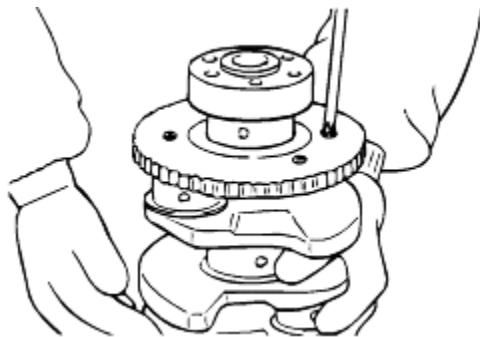
Clearance between the crankshaft position sensor wheel and crankshaft position sensor :

0.5-1.5mm (0.020-0.059 in.)

---

#### **NOTE**

- a. Measure the depth of the top of the crankshaft position sensor wheel teeth and the outside of transaxle housing.
- b. Measure the difference between the crankshaft position sensor length and depth.
- c. The crankshaft position sensor length is the distance between the end of crankshaft position sensor and inner point of contacting face.



1. Install the upper main bearing inserts in the cylinder block.

**When reusing the main bearings, remember to install them by referring to the location marks made at the time of disassembly.**

2. Install the crankshaft. Apply engine oil to the journals.
3. Install bearing caps and tighten cap bolts to the specified torque in the sequence of the centre, No.2, No.4, front and rear caps.  
Cap bolts should be tightened evenly in 2 to 3 stages before they are tightened to the specified torque.  
The caps should be installed with the arrow mark directed toward the crank pulley side of engine.  
Cap numbers must be correct.

---

**Tightening torque**

Main bearing cap bolt :

50-55Nm (500-550kg.cm, 37-41lb.ft)

Connecting rod cap bolt :

20-23Nm (200-230kg.cm, 15-17 lb.ft)

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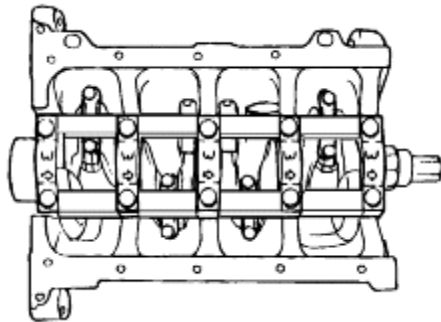
4. Make certain that the crankshaft turns freely and has the proper clearance between the centre main bearing thrust flange and the connecting rod big end bearing.

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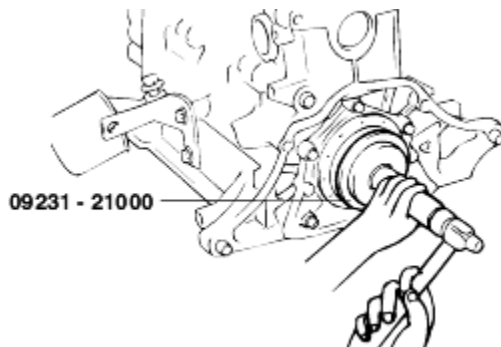
**Standard value**

Crankshaft end play : 0.05-0.25mm (0.002-0.010 in.)

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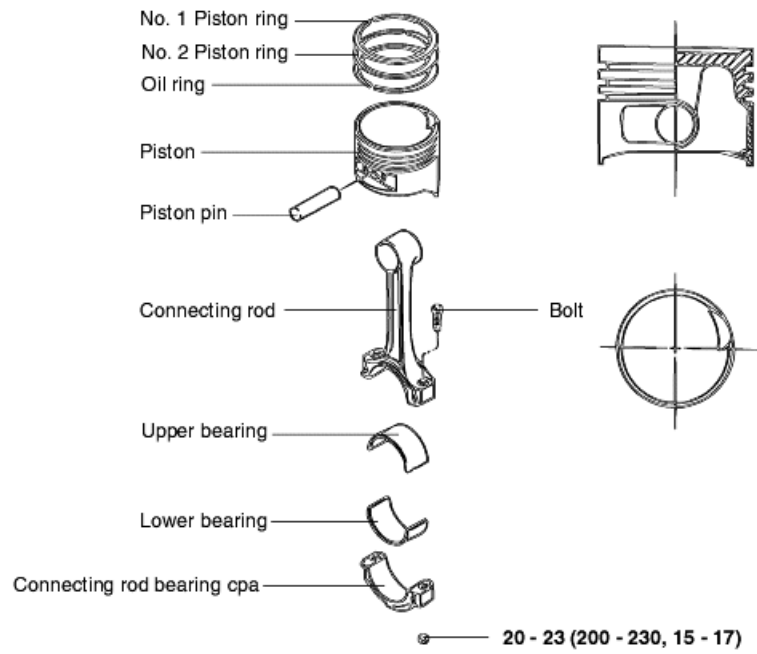
5. Install the oil seal in the crankshaft rear oil seal case. Use the Special Tool, Crankshaft Rear Oil Seal Installer (09231-21000) as shown. Press and fit the oil seal in all the way, being careful not to misalign it.



6. Install the rear oil seal case and gasket. Tighten the five bolts.  
Apply engine oil to the oil seal lips and crankshaft at the time of installation.
7. Install the rear plate and tighten the bolts.
8. Install the connecting rod caps. Refer to the "Piston and Connecting Rods" section.
9. Install the flywheel, front case, oil pan, and timing belt. For further details, refer to the respective chapters.

# PISTON

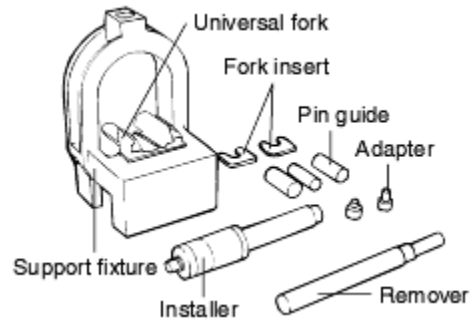
## COMPONENTS ECTC0950



**TORQUE : Nm (kg.cm, lb.ft)**

**DISASSEMBLY**

1. Use the Special Tools (09234-33001) to disassemble and reassemble the piston and connecting rod.

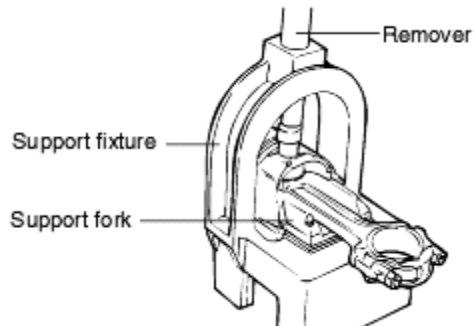


2. Place the proper fork inserts in the fork of the tool. Between the connecting rod and the piston.
3. Insert the proper removal tool through the hole in the arch of the tool.

**NOTE**

**Centre the piston, rod and pin assembly with the removal arbour.**

4. Press the piston pin out of the connecting rod.

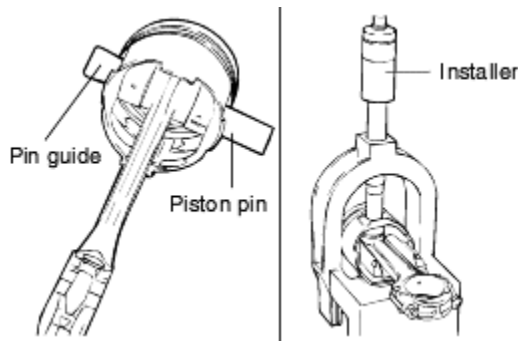


## INSTALLATION ECTC1000

1. Install proper pin guide through piston and into connecting rod. Hand tap pin guide into piston for proper retention. Drop piston pin into the other side of the piston.

### NOTE

The pin guide centres the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also centre this assembly in the tool. If too small a pin guide is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or insert of the tool.



2. Install piston assembly onto fork assembly of tool. Tool will support connecting rod at the piston pin. Be sure to slide the piston assembly onto the fork until the pin guide contacts the fork insert.
3. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alphanumeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.
4. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

### CAUTION

**Do not exceed 5000 pounds of force when stopping the installing arbor sleeve against the arch.**

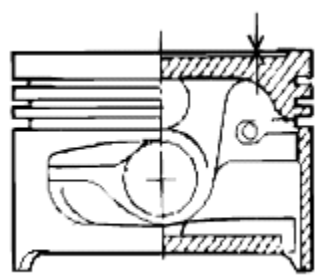
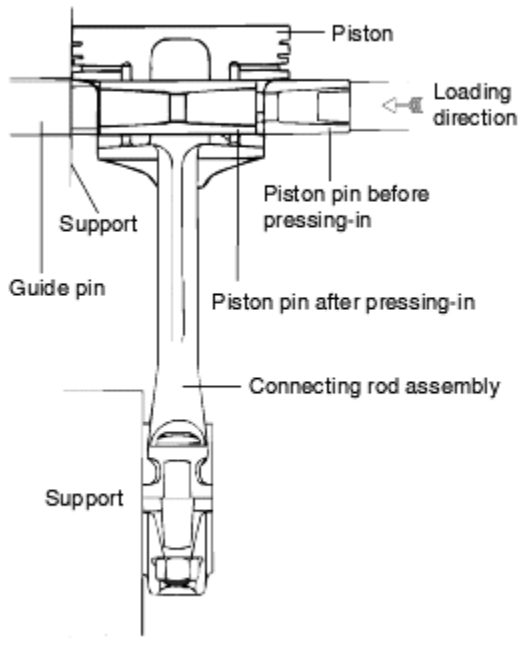
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#### Standard value:

Bowl depth : 3.15mm (1.24 in.)

---





PISTON AND PISTON PINS

1. Check each piston for scuffing, scoring wear, and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, also replace the rings
3. Check the piston pin fit in the piston pinhole. Replace any defective piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pinhole (at room temperature).

PISTON RINGS

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in a ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace only the piston rings.

---

**Piston ring side clearance**

**Standard value**

- No. 1 : 0.03-0.07mm (0.001-0.003 in.)
- No.2 : 0.02-0.06mm (0.0007-0.0024 in.)

**Limit**

- No.1 : 0.1mm (0.004 in.)
  - No.2 : 0.1mm (0.004 in.)
- 

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring.

Item	Standard - mm (in.)	Limit - mm (in.)
Piston ring end gap No. 1	0.15-0.30 (0.0059-0.0118)	1 (0.039)
Piston ring end gap No. 2	0.25-0.40 (0.008-0.014)	1 (0.039)
Oil ring side rail end gap	0.20-0.70 (0.078-0.0275)	1 (0.039)

3. When replacing the ring without correcting the cylinder bore, check the gap with the ring positioned at the bottom of the ring travel.  
When replacing a ring, use a ring of the same size.

---

**Piston ring service size and mark**

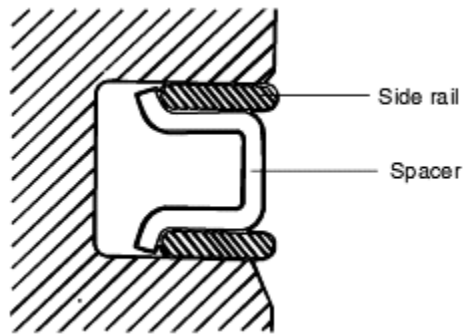
- STD .....None
  - 0.25mm (0.010 in.) O.S .....25
  - 0.50mm (0.020 in.) O.S .....50
  - 0.75mm (0.030 in.) O.S.....75
  - 1.00mm (0.039 in.) O.S .....100
- 

**NOTE**

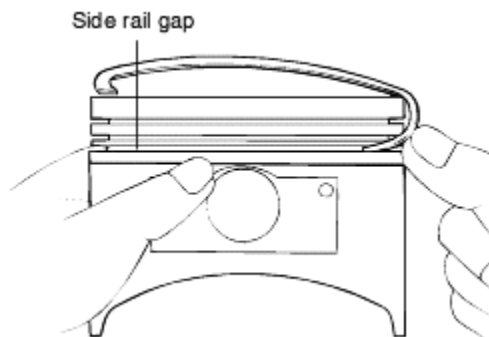
**The mark can be found on the upper side of the ring.**

## REASSEMBLY ECTC1100

1. Install the spacer.



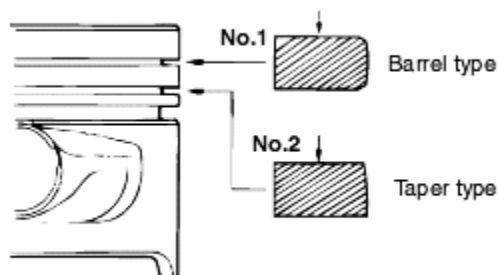
2. Install upper side rail. To install side rail, first put one end of side rail between piston ring groove and spacer, hold it down firmly, then press down the portion to be inserted with your finger into groove as illustrated.



### **NOTE**

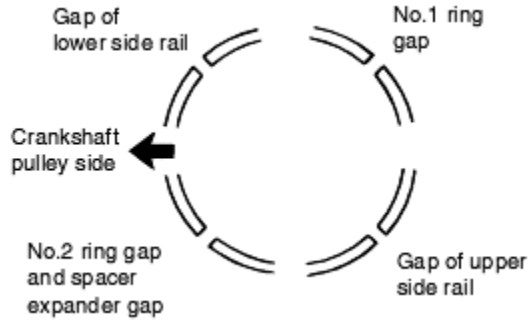
**Do not use piston ring expander when installing side rail.**

3. Install lower side rail using same procedure as Step 2.
4. Using piston ring expander, install No.2 piston ring.
5. Install No. 1 piston ring.



6. Apply engine oil around piston and piston rings.
7. Position each piston ring end gap as far apart from neighbouring gaps as possible. Make sure that gaps are not positioned in side rail thrust and pin directions.

- Hold piston rings firmly in a piston ring compressor as you insert them into cylinder.



- Make sure that the front mark of piston and the front mark (identification mark) of connecting rod are directed toward front of engine.
- When connecting rod cap is installed, make sure that cylinder numbers put on rod and cap at disassembly match each other.
- When new connecting rod is installed, make sure that notches for holding bearing in place are on same side.
- Tighten the connecting rod cap nuts.

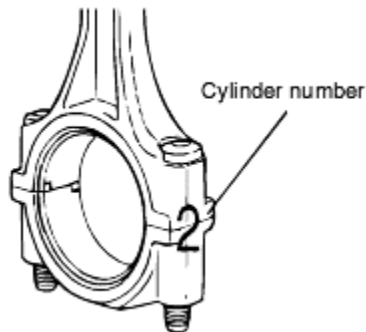
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**Tightening torque**

Connecting rod cap nuts :

20-23Nm (200-230kg.cm, 15-17lb.ft)

---



- Check connecting rod side clearance.

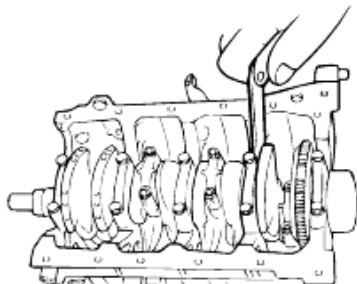
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**Connecting rod side clearance**

Standard value : 0.10-0.25mm (0.004-0.0098 in.)

Limit : 0.4mm (0.0157 in.)

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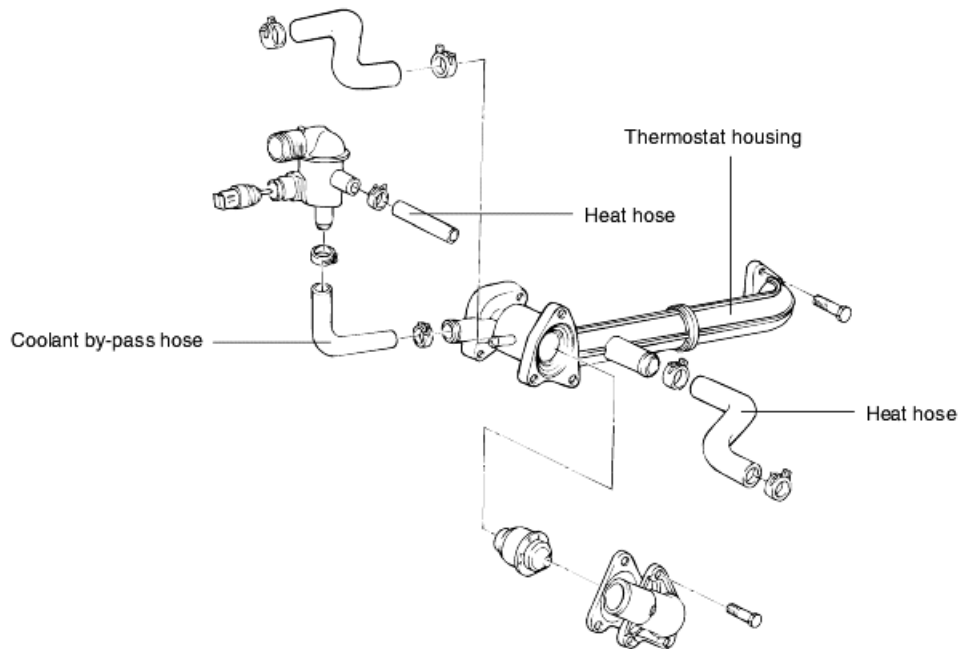


## 2.4 Cooling System

### ENGINE COOLANT HOSE/PIPES

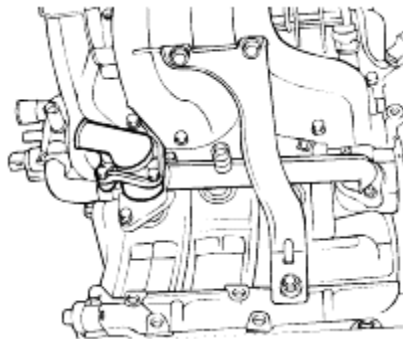
COMPONENTS ECTC1150

INSPECTION ECTC1200



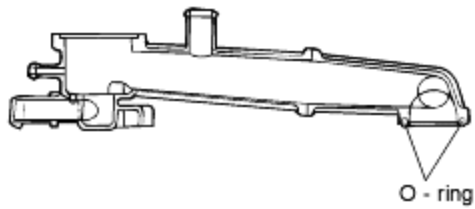
#### TORQUE : Nm (kg.cm, lb.ft)

1. Check the coolant pipes and hoses for cracks, damage, or restrictions.
2. Replace if necessary.



## REASSEMBLY ECTC1250

1. Fit the O-ring in the groove provided at the coolant inlet pipe ends, wet the O-ring with coolant and insert into the coolant inlet pipe.

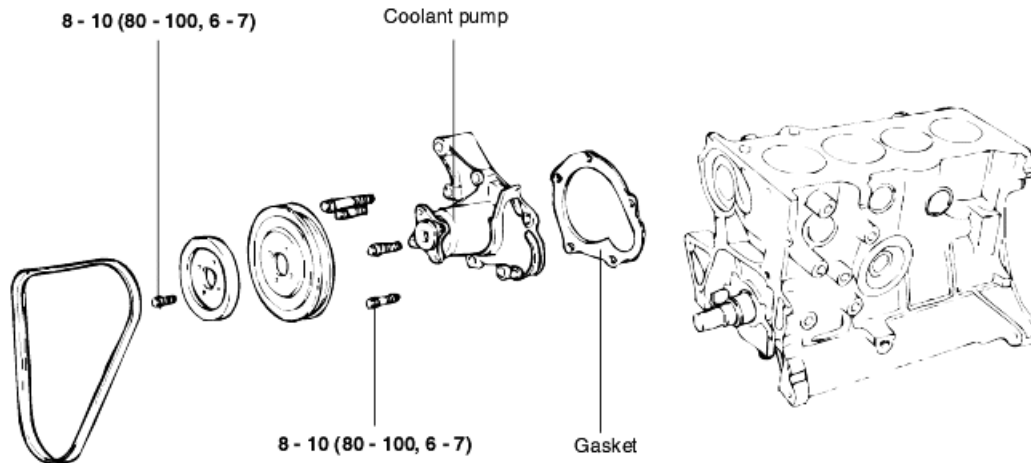


2. Make sure that there is a yellow mark on the inlet coolant hose and while keeping the yellow mark toward of the coolant inlet pipe, fit the hose to the pipe to the end of the yellow mark.

### **NOTE**

- a. **Do not apply oil or grease to the coolant pipe O-ring.**
- b. **Keep the coolant pipe connections free of sand, dust, etc.**
- c. **Insert the coolant pipe fully into the coolant pump.**
- d. **Do not reuse the o-ring but replace it with a new one.**

## ENGINE COOLANT PUMP COMPONENTS ECTC1300



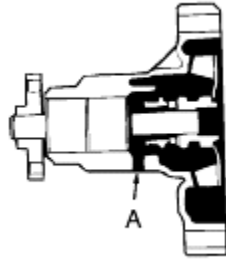
**TORQUE : Nm (kg.cm, lb.ft)**

### DISASSEMBLY ECDA0590

1. Drain the coolant and disconnect the coolant outlet pipe connection hose from the coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt idler.
4. Remove the coolant pump mounting bolts, then remove the generator brace.
5. Remove the coolant pump assembly from the cylinder block.

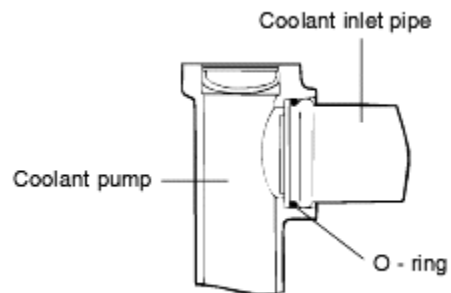
## INSPECTION ECDA0600

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole "A", the seal is defective. Replace the coolant pump assembly.



## REASSEMBLY ECTC1350

1. Clean the gasket surfaces of the coolant pump body and the cylinder block.



2. Install a new coolant pump gasket to the coolant pump and tighten the bolts to the specified torque.

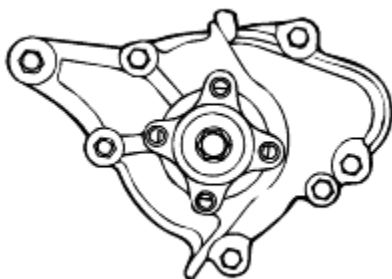
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### **Tightening torque**

Coolant pump bolt to cylinder block :

8-10Nm (80-100kg.cm, 6-7lb.ft)

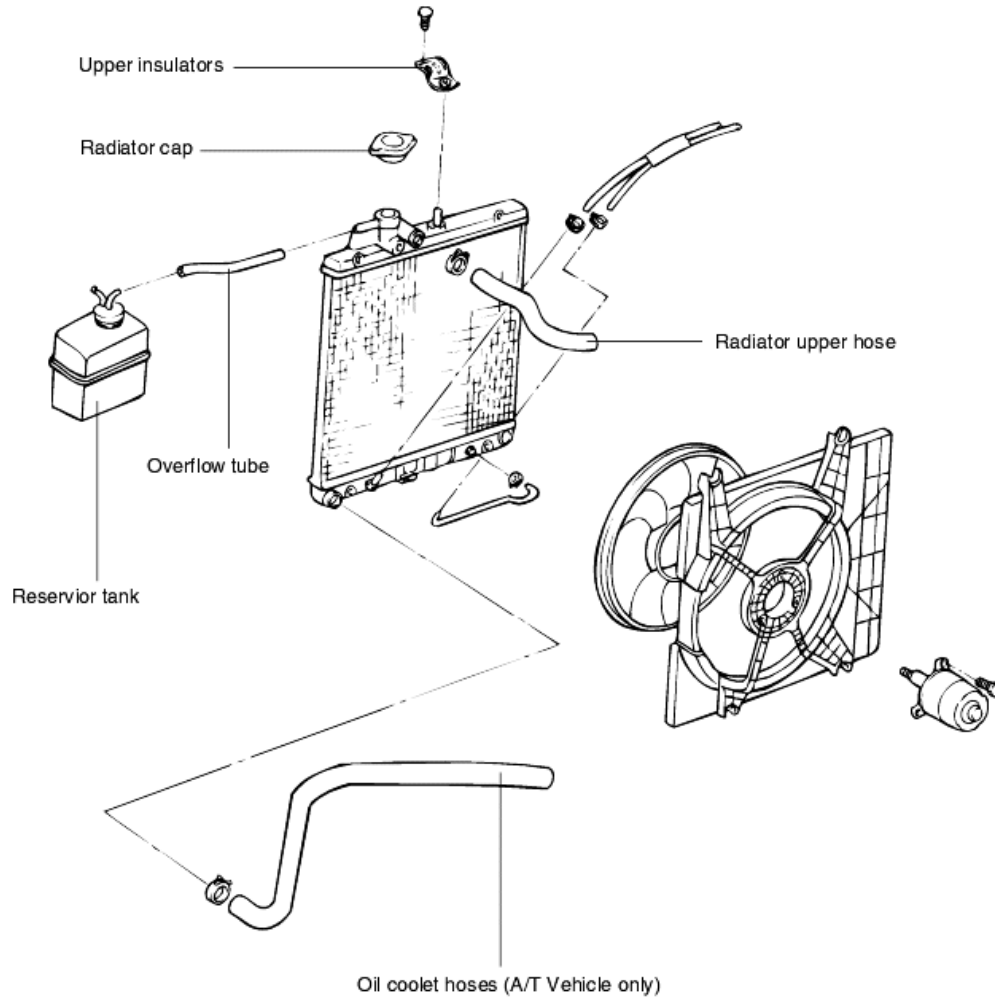
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3. Install the timing belt idler and timing belt. Adjust the timing belt tension. Refer to the “Timing System” section.
4. Install the timing belt covers.
5. Install the coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the system with clean coolant.
7. Run the engine and check for leaks.

## RADIATOR COMPONENTS ECTC1400



### DISASSEMBLY ECDA0630

1. Disconnect the radiator fan motor connector.
2. Loosen the radiator drain plug to drain coolant.
3. Disconnect the upper and lower hose and overflow tube.
4. Remove the radiator mounting bolts.
5. Remove the radiator together with the fan motor.

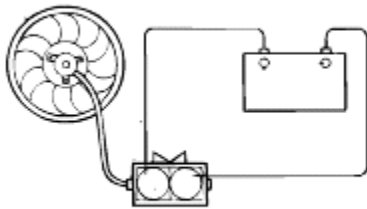
- Remove the fan motor from the radiator.

#### INSPECTION ECDA0640

- Check the radiator for bent, broken or plugged fins.
- Check the radiator for corrosion, damage, rust or scale.
- Check the radiator hoses for cracks, damage or deterioration.
- Check the reservoir tank for damage.
- Check the radiator cap spring for damage.
- Test the pressure of the cap using a cooling system checker
- Check the radiator cap seal for cracks or damage.

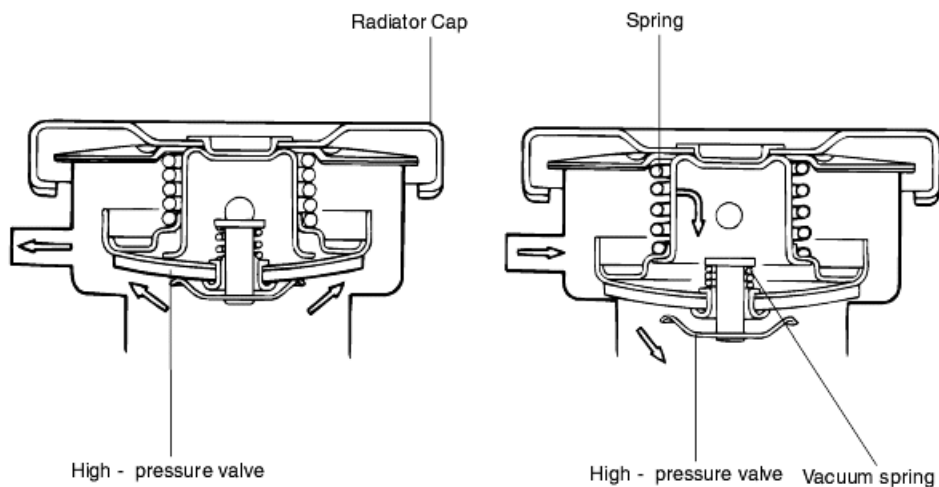
#### Radiator Fan Motor

- Check that the radiator fan rotates when battery voltage is applied to the terminals (as shown in figure).



- Check that abnormal noises are not produced while the motor is turning.

#### REASSEMBLY ECDA0650



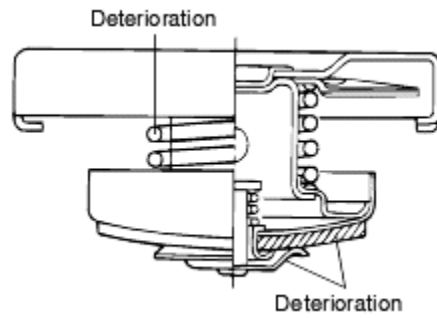
When the pressure is reduced to the specified level  
[81.4 - 108 Kpa (0.83 - 1.1 kg/cm, 11.8 - 15.6 psi)]

When the pressure is reduced to the specified level  
[-6.86 Kpa (-0.07 kg/cm, -1.00 psi)]

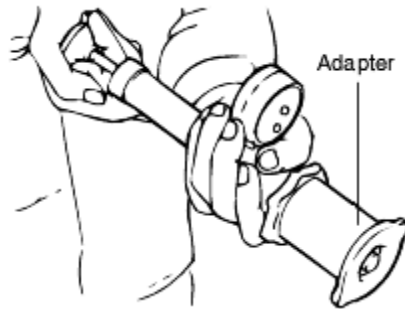


RADIATOR CAP

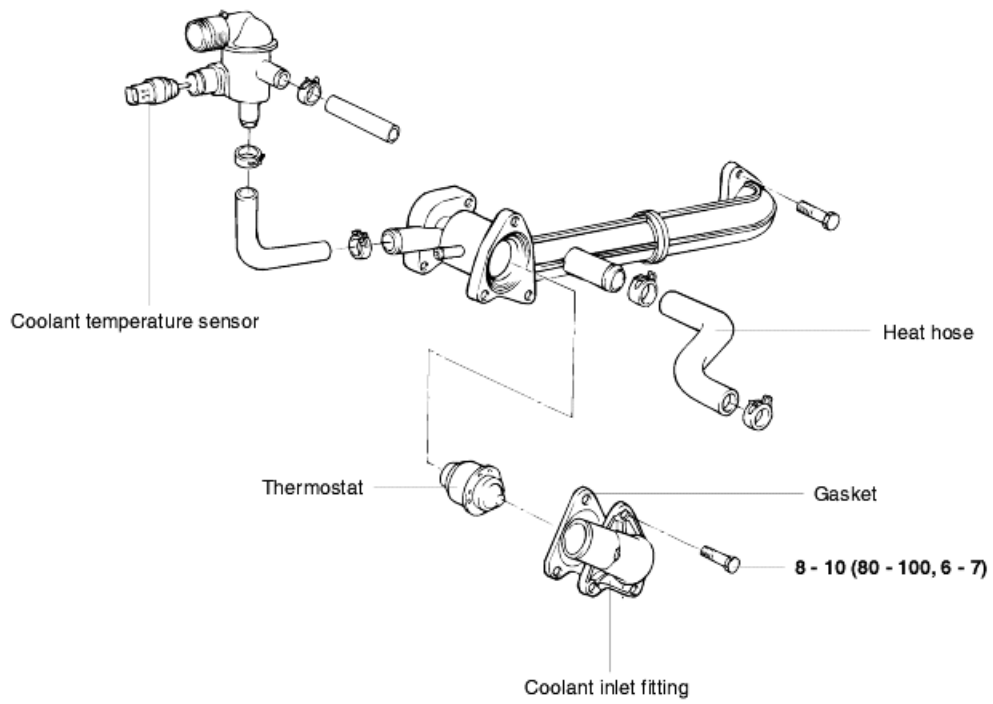
1. Check the radiator cap for damage, cracks and deterioration.



2. Attach a radiator cap tester to the radiator.
3. Pump the tester until the pointer stabilizes.
4. If the pointer stays constant for 10 sec. at a point exceeding the service limit, the radiator cap is good.



COMPONENTS ECTC1500



**TORQUE : Nm (kg.cm, lb.ft)**

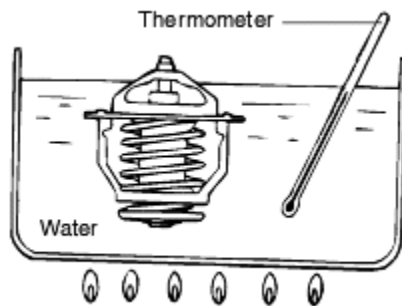
## DISASSEMBLY AND INSPECTION ECTC1550

1. Drain the coolant down to thermostat level or below.
2. Remove the coolant outlet fitting and gasket.
3. Remove the thermostat.
4. Immerse the thermostat in hot coolant to check proper valve opening temperature. Replace if necessary.

Valve opening temperature : 82°C (177°F)

Full opening temperature : 95°C (205°F)

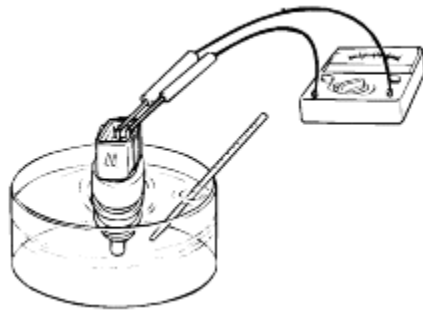
Valve lift (at full open) : 8.5mm (0.33 in.) or more



## COOLANT TEMPERATURE SENDER

1. Heat the engine coolant temperature sender by submerging it in hot water.
2. Check that the resistance is within the specified range.

Resistance : 123.8-172.8  $\Omega$  at 60°C (140°F)  
23.5-29.5  $\Omega$  at 115°C (239°F)



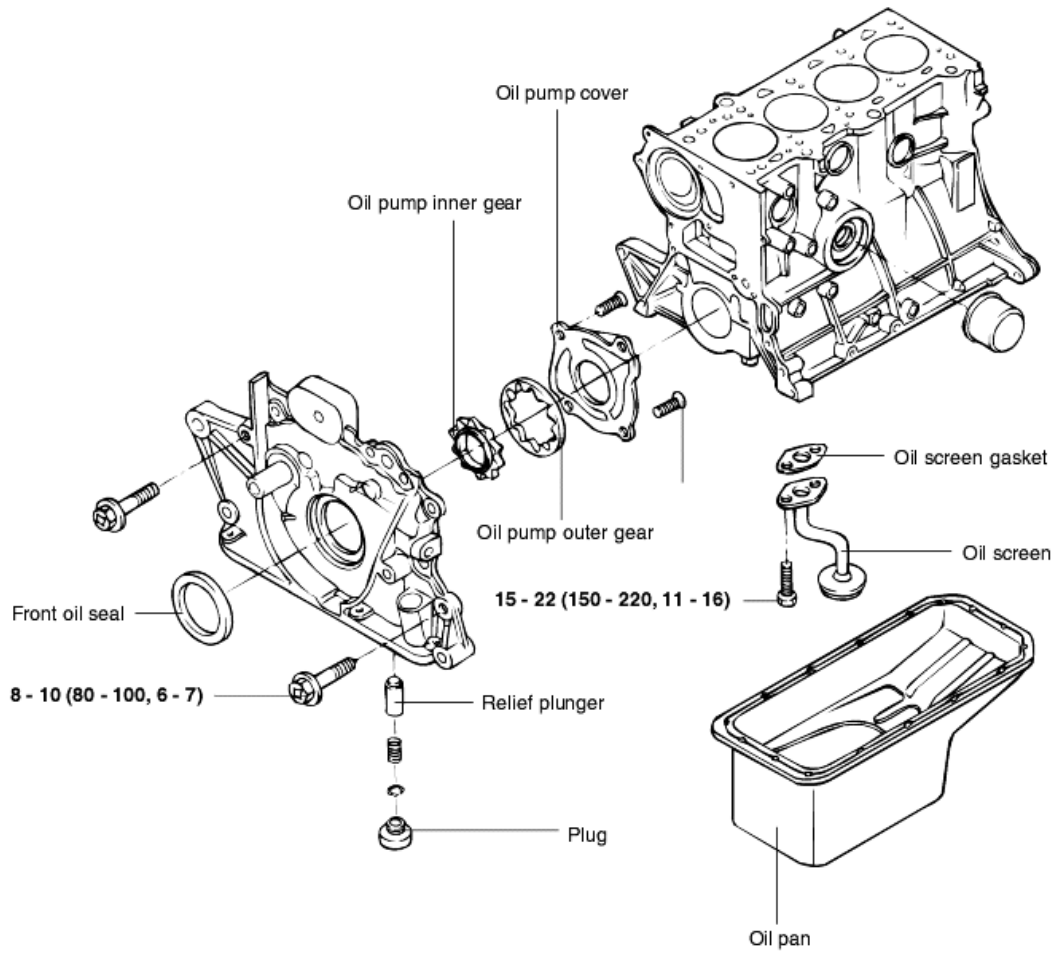
## REASSEMBLY ECDA0710

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible for the thermostat to operate properly.
2. Install a new gasket and the coolant outlet fitting.
3. Refill the system with clean coolant.



## 2.5 Lubrication System

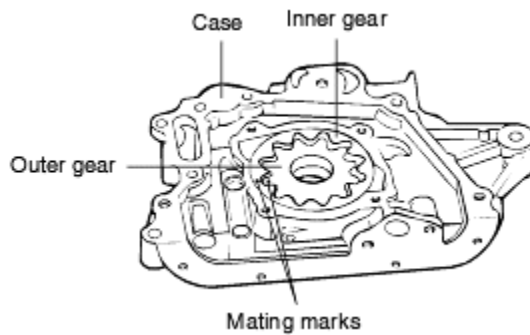
COMPONENTS ECTC1600



**TORQUE : Nm (kg.cm, lb.ft)**

## DISASSEMBLY ECTC1650

1. Remove the timing belt. Refer to the "Timing Belt" section.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen.
5. Remove the front case assembly.
6. Remove the oil pump cover.
7. Remove the inner and outer gears from the front case. The mating marks on the inner and outer gears indicate the direction of installation. Make sure that the inner and outer gears are installed as shown.



8. Remove the plug and remove the relief spring and relief plunger.

## INSPECTION ECTC1700

### Oil Pan and Oil Screen

1. Check the oil pan for failure, damage or cracks. Replace if defective.
2. Check the oil screen for failure, damage and cracks and replace if defective.

### Front Case and Oil Pump Cover

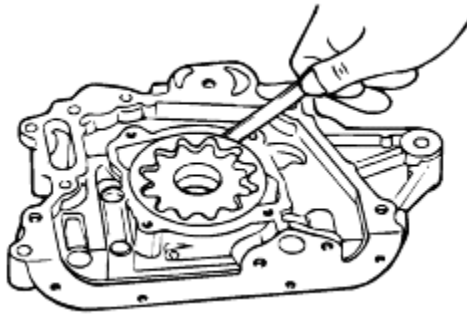
Check for worn (especially stepped) or damaged surfaces contacting gears.

### Oil Pump Gears

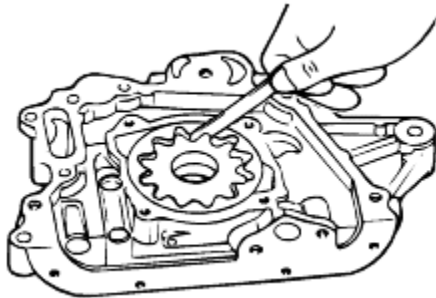
1. Check for worn or damaged gear teeth surfaces.
2. Check for clearance between outer gear and front case.

#### **Outer gear**

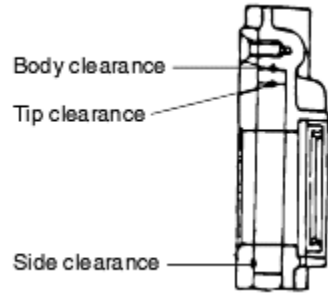
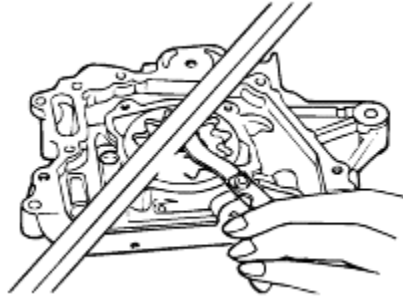
Clearance between outer circumference and front case :  
0.10-0.18mm (0.004-0.007 in.)



3. Check the tip clearance on the pump rotor.  
**Standard value : 0.06-0.18mm (0.002-0.007 in.)**

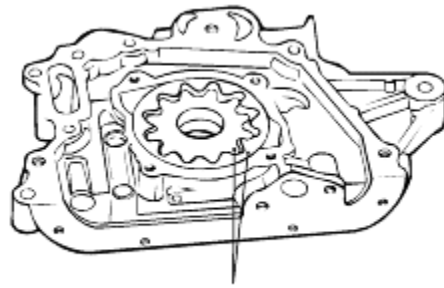


4. Check the axial clearance on the outer pump rotor  
**Standard value : 0.04-0.095mm (0.0016-0.0037 in.)**



### Oil Pump

1. Install the outer and inner gears into the front case. Make sure that the inner and outer gears are installed in the same direction as shown.



Mating mark

2. Install the oil pump cover and tighten the bolts to the specified torque. After the bolts have been tightened, check to ensure that the gear turns smoothly.

#### **Tightening torque**

Oil pump cover bolt :  
8-12Nm (80-120kg.cm, 6-8.8lb.ft)

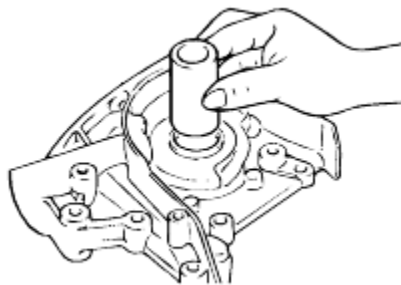
3. Install the relief valve and spring. Tighten the plug to the specified torque. Apply engine oil to the relief valve.

#### **Tightening torque**

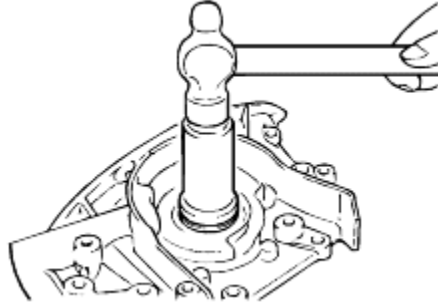
Relief valve plug :  
20-30Nm (200-300kg.cm, 15-22lb.ft)

### Oil Seal

1. Inspect for worn, distorted or damaged lips.
2. Check for elongated spring ring.
3. Install the Special Tool, Crankshaft Front Oil Seal Guide (09231-22100), to the front end of the crankshaft. Apply engine oil to the outer surface of the oil seal guide, and install the new oil seal along the guide by hand, until it touches front case. Always use a new oil seal when reassembling.



4. Use the Special Tool, Crankshaft Front Oil Seal Installer (09231-22000), to install the oil seal.



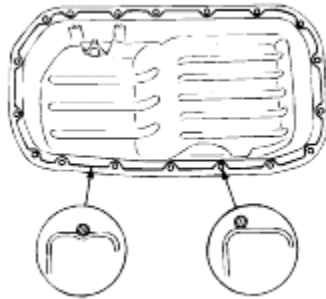
5. Install the crankshaft sprocket, timing belt and crankshaft pulley. Refer to the "Timing Belt" section.
6. Install the oil screen.
7. Clean both gasket surfaces of the oil pan and the cylinder block.
8. Apply sealant into the groove of the oil pan flange as shown.

**CAUTION**

- a. **Apply sealant approx. 4 mm (0.16 in.) in thickness.**
  - b. **After application of sealant, do not exceed 15 minutes before installing the oil pan.**
9. Install the oil pan and tighten the bolts to the specified torque.

**Tightening torque**

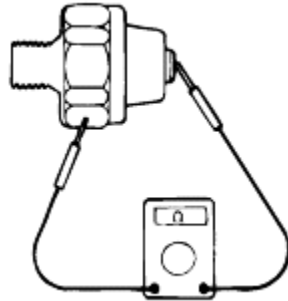
Oil pan bolt : 6-8Nm (60-80kg.cm, 4-6lb.ft)



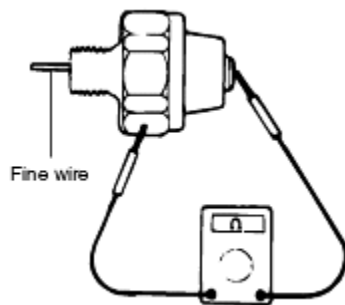
## OIL PRESSURE SWITCH ECFB0220

1. Check the continuity between the terminal and the body with an ohmmeter.

If there is non-continuity, replace the oil pressure switch.

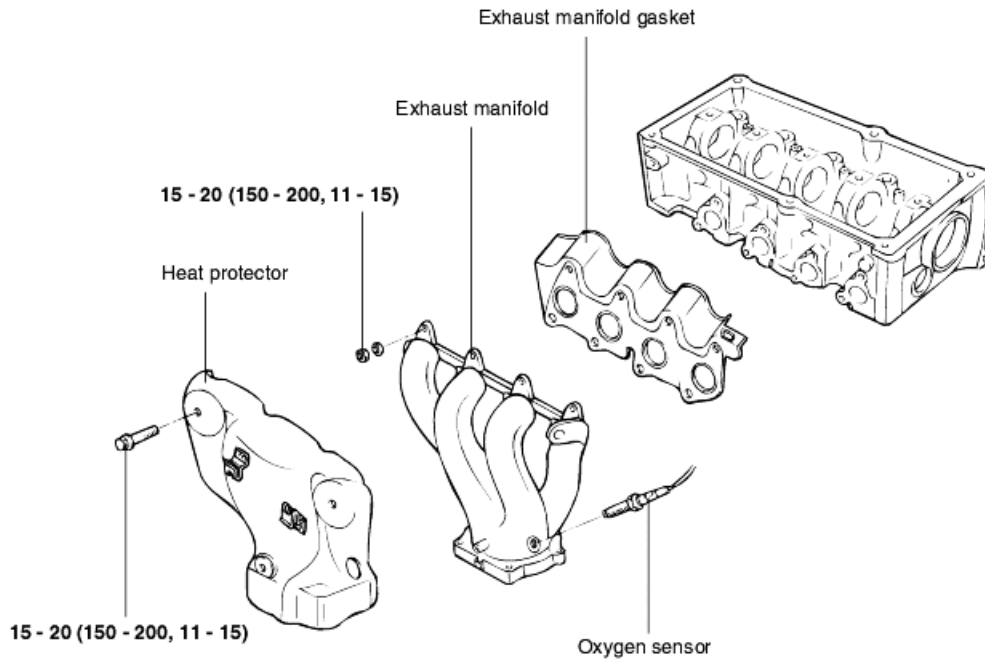


2. Check the continuity between the terminal and the body when the fine wedge is pushed. If there is continuity even when the fine wedge is pushed, replace it.
3. However, if there is non-continuity when a 50 KPa (70 psi) vacuum is applied through the oil hole, the switch is operating properly. Check to see that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.



## 2.6 Intake and Exhaust System

COMPONENTS ECTC1800



**TORQUE : Nm (kg.cm, lb.ft)**



INSPECTION ECTC1850

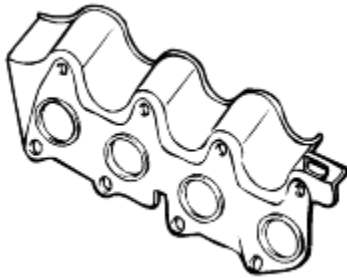
EXHAUST MANIFOLD

Check for damage or cracking.

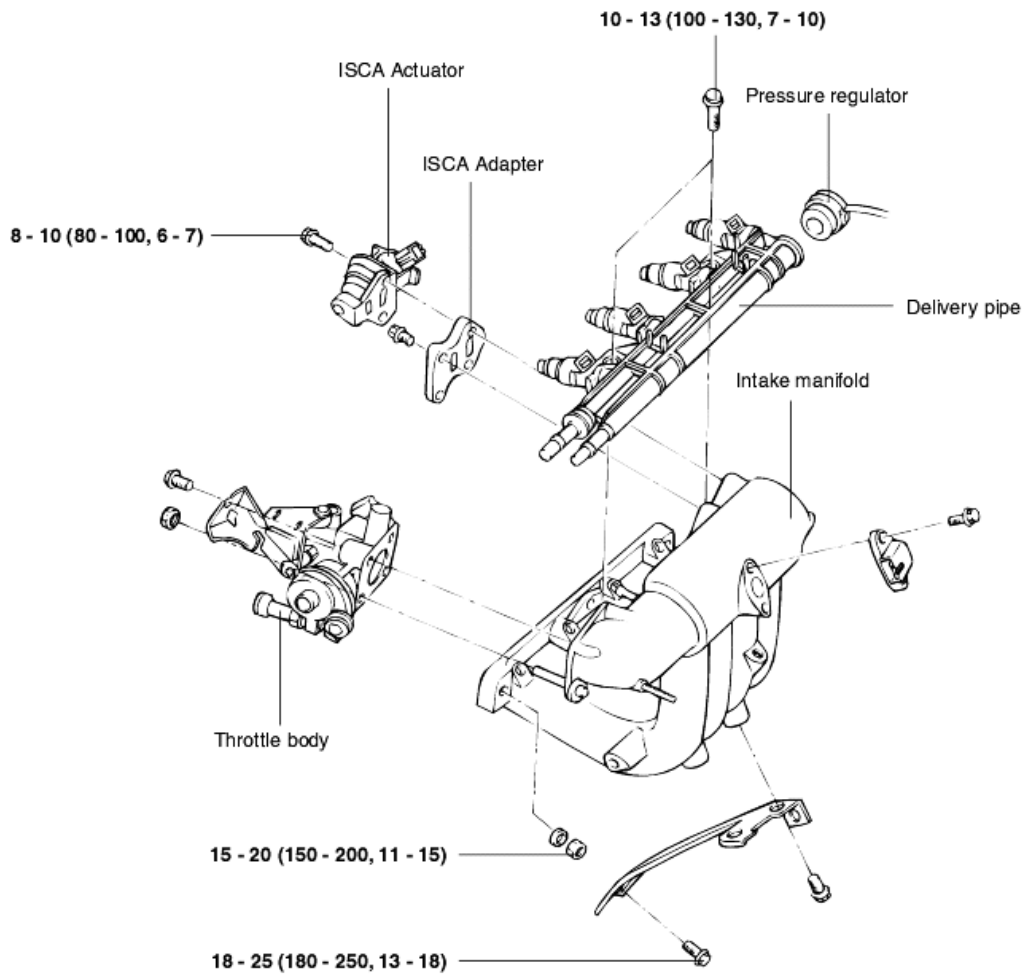


EXHAUST MANIFOLD GASKET

Check for flaking or damage of the gasket.



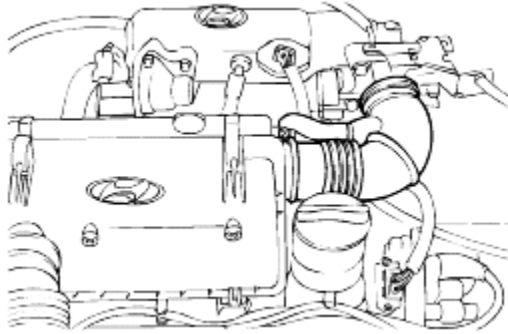
# COMPONENTS ECTC1900



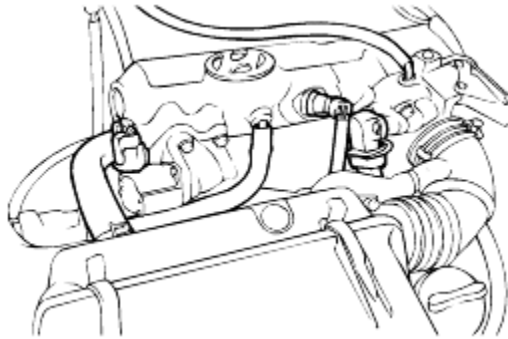
**TORQUE : Nm (kg.cm, lb.ft)**

## REMOVAL ECTC1950

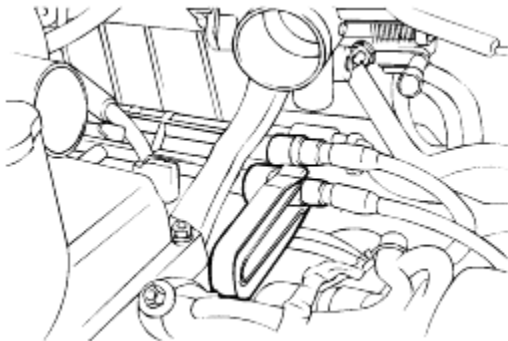
1. Remove the accelerator cable.
2. Remove the intake air hose connected to the throttle body.



3. Disconnect the fuel injector harness connector.
4. Remove the ignition coil connector and high-tension cable.
5. Remove the P.C.V. hose and brake booster vacuum hoses.
6. Remove the ISCA hose, connector and MAP sensor.

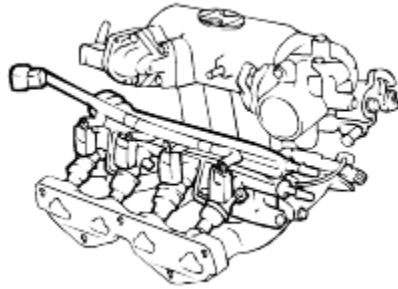


7. Remove the fuel pressure regulator hose.
8. Disconnect the high-pressure fuel hose connection after relieving pressure in the fuel pipeline to prevent fuel overflow.

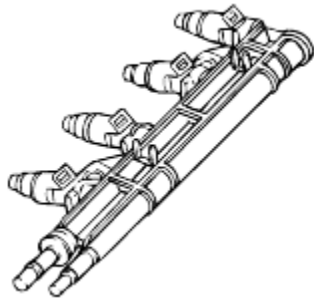


9. Remove the surge tank stay.

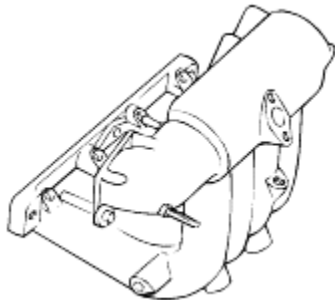
10. Remove the intake manifold with the delivery pipe and fuel injector together.



11. Remove the delivery pipe and fuel injectors from the intake manifold.

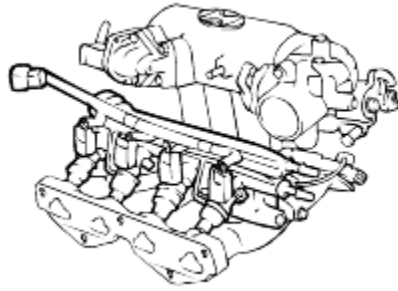


12. Remove the intake manifold.



## INSTALLATION ECTC2000

1. Install the delivery pipe with the fuel injectors attached.



### **CAUTION**

**Be careful not to drop the injectors when removing the delivery pipe.**

2. Ensure that insulators are correctly inserted into the delivery pipe hole.

## INSPECTION ECDA0890

### SURGE TANK

Check the surge tank for defects or cracks. Replace if necessary.

### INTAKE MANIFOLD

Check for damage or cracking of any part.

### AIR HOSE

Check for damage or cracking or any part.

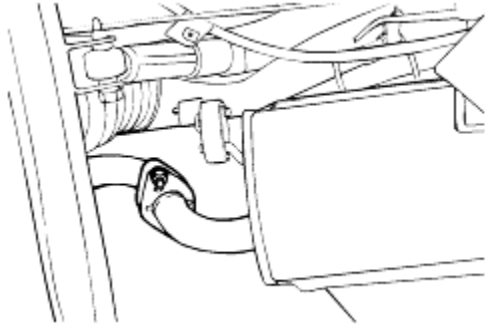
## REMOVAL ECTC2100

### TAIL PIPE

#### **CAUTION**

**Before removing or inspecting the exhaust system, ensure that it has cooled sufficiently.**

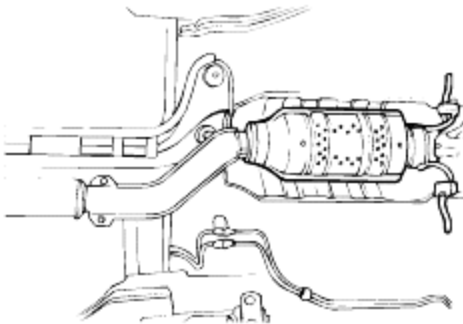
1. Disconnect the tail pipe muffler from the centre muffler.



2. Remove the rubber hangers and take out the tail pipe.

### CATALYTIC CONVERTER

Remove the catalytic converter from the front exhaust.



### FRONT EXHAUST PIPE

1. Remove the front exhaust pipe from the catalytic converter (unleaded vehicle) or exhaust manifold (leaded vehicle).
2. Remove the front exhaust pipe clamp bolt and remove the centre muffler-mounting nut.

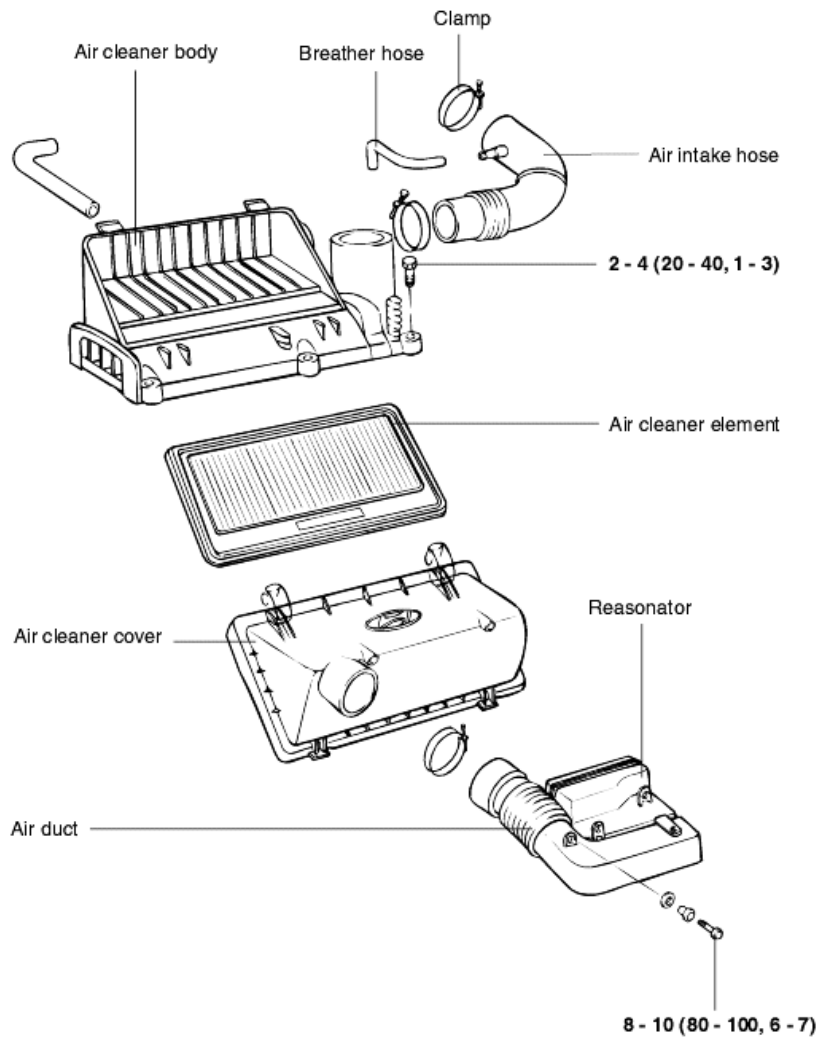
### INSPECTION ECDA0930

1. Check the mufflers and pipes for corrosion and damage.
2. Check the rubber hanger and bands for deterioration and cracks.

### INSTALLATION ECTC2150

1. Temporarily install the catalytic converter assembly the front exhaust pipe, the centre exhaust pipe, and the tail pipe, in that order.
2. Tighten the parts securely. Make sure there is no interference with any body components.

COMPONENTS ECTC2200

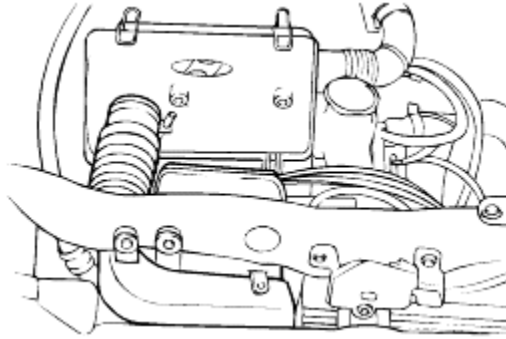


**TORQUE : Nm (kg.cm, lb.ft)**



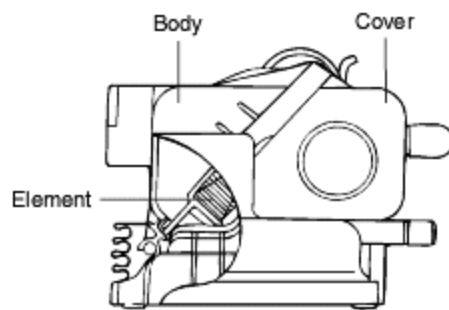
## REMOVAL ECTC2250

1. Remove the air duct connected to the air cleaner.
2. Remove the air intake hose from the air cleaner side.
3. Remove the air cleaner cover and filter.
4. Remove the air cleaner mounting bolts and remove the air cleaner.



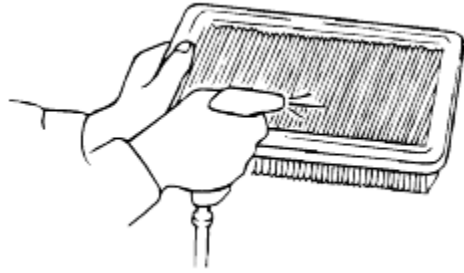
## INSPECTION ECTC2300

1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.



2. Check the air duct for damage.
3. Check the resonator for distortion or damage.
4. Check the air cleaner filter for restrictions, contamination or damage.  
If the filter is slightly restricted, remove dust and other contaminants by blowing air from the upper side through the filter.

5. Check the air cleaner housing for restrictions, contamination or damage.

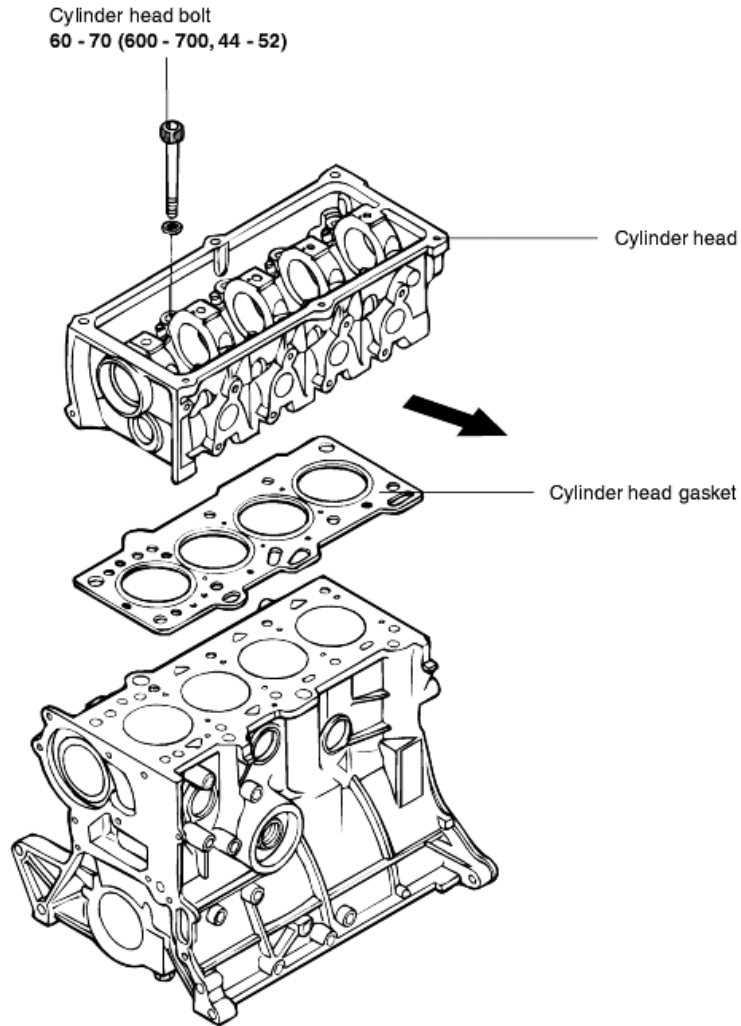


#### INSTALLATION ECFB0320

Installation is the reverse order of removal.

## 2.7 Cylinder Head Assembly

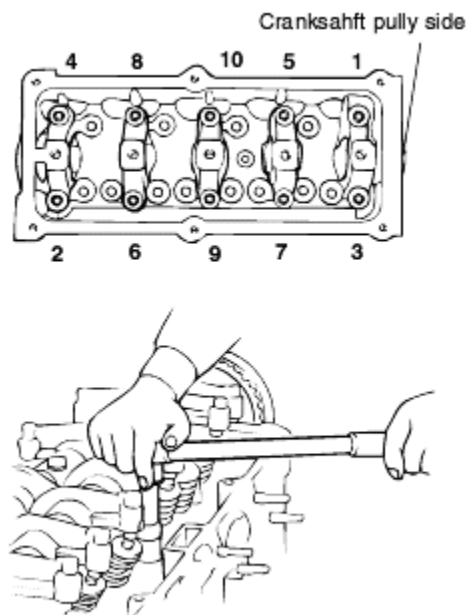
COMPONENTS ECTC2350



**TORQUE : Nm (kg.cm, lb.ft)**

DISASSEMBLY ECTC2400

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose (between the air cleaner and the rocker cover).
3. Remove the air-intake hose.
4. Remove the vacuum hose, fuel hose and coolant hose.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.
7. Remove the surge tank.
8. Remove the intake manifold.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and the crankshaft pulley.
11. Remove the timing belt cover.
12. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
13. Remove the timing belt.
14. Remove the rocker cover.
15. Remove the cylinder head assembly. The cylinder head bolts should be removed using Special Tool, Cylinder Head Bolt Wrench, in the sequence as shown in the illustration.



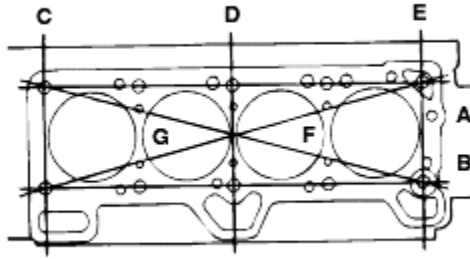
16. Remove the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

**NOTE**

**Make sure that the gasket pieces do not fall in to the engine.**

## INSPECTION ECTC2450

1. Check the cylinder head for cracks, damage and coolant leakage.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
3. Check the cylinder head surface for flatness using a straight edge in the direction of A, B, ...as shown.



If flatness exceeds service limit in any direction, replace the cylinder head, or lightly machine the cylinder head surface.

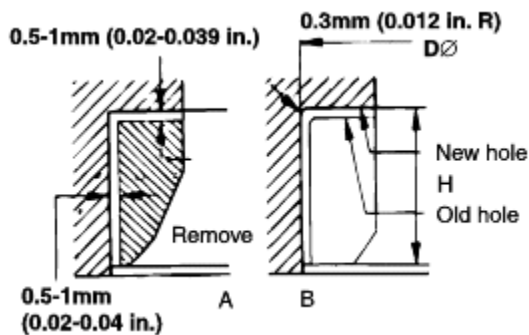
### Cylinder head flatness

Standard value : Less than 0.05 mm (0.002 in.)

Limit : 0.1mm (0.004 in.)

## VALVE SEAT INSERT REPLACEMENT PROCEDURE.

1. Any valve seat insert that has been worn over the service limit should be removed at normal temperature after cutting away most of the insert wall, using valve seat cutters, as shown in Fig A.
2. After removing the seat insert, machine the seat insert bore using a reamer or a cutter. Cut to the size shown in the table.
3. Heat the cylinder head to about 250°C (480°F) and press in the oversize seat insert. The oversize seat insert should be at normal room temperature for installation. After installing a new valve seat insert, resurface the valve seat using the same procedure described in the first paragraph of "Valve Seat Insert" (above).



<b>Valve Seat Insert Oversize Description</b>	<b>Size mm (in.)</b>	<b>Size mark</b>	<b>Seat insert height H mm (in.)</b>	<b>Cylinder head I.D. mm (in.)</b>
Intake valve seat insert	0.3 (0.012) O.S.	30	6.2-6.4 (0.244-0.252)	24.30-24.321(0.957- 0.958)
	0.6 (0.024) O.S.	60	6.5-6.7 (0.256-0.264)	24.60-24.621(0.968- 0.969)
Exhaust valve seat	0.3 (0.012) O.S.	30	6.2-6.4 (0.244-0.252)	29.30-29.321(1.153- 1.154)
	0.6 (0.024) O.S.	60	6.5-6.7 (0.256-0.264)	29.60-29.621(1.165- 1.166)

## REASSEMBLY ECTC2500

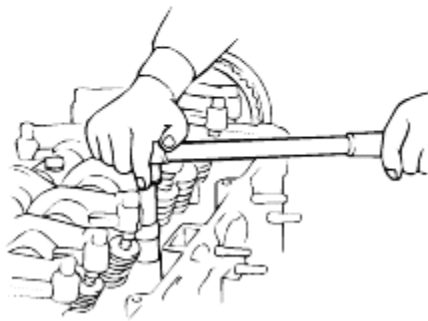
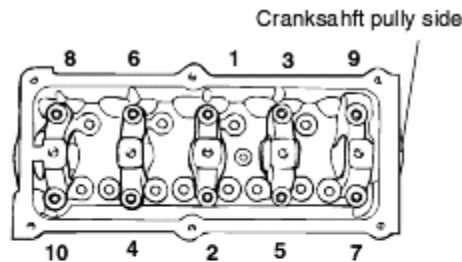
1. Clean all gasket surfaces of the cylinder block and the cylinder head.
2. Install a new cylinder head gasket onto the cylinder head assembly. Do not apply sealant to the gasket and do not reuse the old cylinder head gasket.
3. Install the cylinder head bolts. Starting at top centre, tighten all cylinder head bolts in sequence as shown in illustration, using the Cylinder Head Bolt Wrench. Repeat the procedure; re-tighten all cylinder head bolt to the specified torque.

### Cylinder head flatness

#### Tightening torque

When cold : 60-70 Nm (600-700 kg.cm, 43-51 lb.ft)

When hot : 70-75 Nm (700-750 kg.cm, 51-54 lb.ft)



4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Install the timing belt on the camshaft sprocket, making sure that the tension side is tightened, by turning the camshaft sprocket in reverse. Make sure all timing marks are in alignment.
6. Adjust the timing according to the "Timing Belt" section.
7. Install the rocker cover and tighten the bolts to the specified torque.

#### Tightening torque

Rocker cover bolt : 8-10Nm (80-100kg.cm, 6-7 lb.ft)

8. Install the timing belt cover.
9. Install the new intake manifold gasket and the intake manifold. Tighten the nuts and bolts to the specified torque.

#### Tightening torque

Manifold nuts and bolts (both intake and exhaust) :

15-20Nm (150-200kg.cm, 11-15 lb.ft)

10. Install the new exhaust manifold gasket and the exhaust manifold. Tighten the exhaust manifold attaching nuts to the specified torque.
11. Install the surge tank and tighten the nuts and bolts to the specified torque.

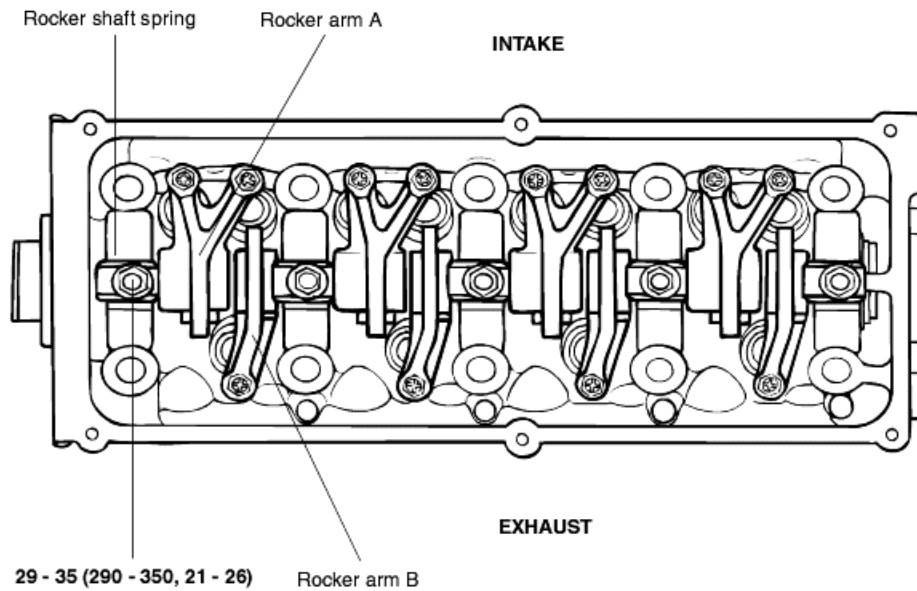
**Tightening torque**

Surge tank to inlet manifold nuts and bolts :  
15-20Nm (150-200kg.cm, 11-15 lb.ft)

12. Install the ignition coil.
13. Install the air intake hose.
14. Connect the vacuum hose, fuel hose and coolant hose.
15. Install breather hose.



## COMPONENTS ECTC2550



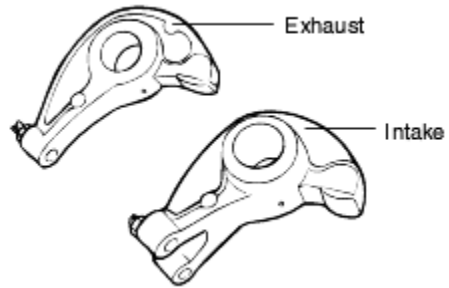
**TORQUE : Nm (kg.cm, lb.ft)**

## DISASSEMBLY ECTC2600

1. Remove the breather hose and PCV valve.
2. Remove the timing belt cover.
3. Remove the rocker cover.
4. Loosen the flange bolts and remove the rocker arm shaft, rocker arms and rocker arm shaft springs as an assembly.
5. Remove the bolts, the rocker arms and arm shaft springs from the rocker arm shaft.

ROCKER ARM

1. Check the rocker face.  
Replace it if damaged or pressed.
2. Check the contact surface on the cam and valve stem.  
If badly worn or damaged, replace it.



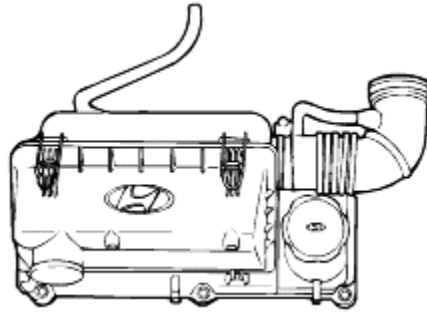
ROCKER ARM SHAFT

1. Check the rocker arm shafts for damage. Replace as necessary.
2. Check the oil hole whether clogged or not.



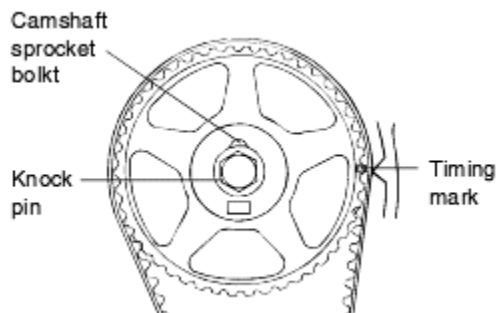
## VALVE CLEARANCE ADJUSTABLE PROCEDURE ECTC2700

1. Warm up engine.
2. Remove air cleaner and breather air cleaner body assembly.



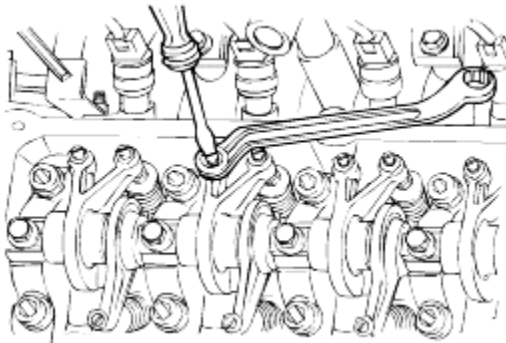
3. Turn crankshaft to normal direction (right turn at engine front view) stop it at No.1 compression top dead centre, shown in fig. Valve clearance adjustable at No.1 compression top dead centre.

	1	2	3	4
CYLINDER NO.	1	2	3	4
INTAKE			0	0
EXHAUST		0		0



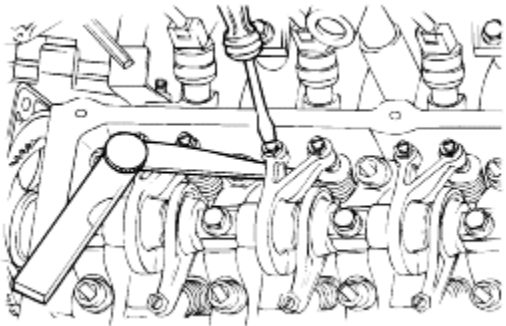
4. Insert clearance gauge between rocker arm adjusting screw and valve stem end. Then fix screw with lock nut after adjusting valve clearance.

	INTAKE	EXHAUST
Standard Clearance (Warm)	0.2mm	0.25mm
Reference Clearance (Cold)	0.1mm	0.17mm



5. Turn crankshaft just one revolution to normal direction (right turn at engine front view) stop it at No.4 compression top dead centre.  
 Insert clearance gauge between rocker arm adjusting screw and valve stem end.  
 Then fix screw with lock nut after adjusting valve clearance.  
 Valve clearance adjustable at No.4 compression top dead centre.

CYLINDER NO.	1	2	3	4
INTAKE			0	0
EXHAUST		0		0

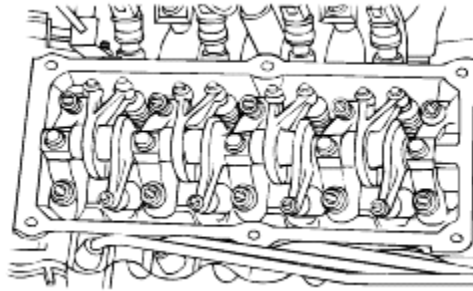


## REASSEMBLY ECTC2750

1. Install the rocker arms and rocker arm shaft springs to the rocker arm shafts, Install the rocker arm shaft to the cylinder head.  
Tighten the rocker arm shaft mounting bolts to the specified torque.

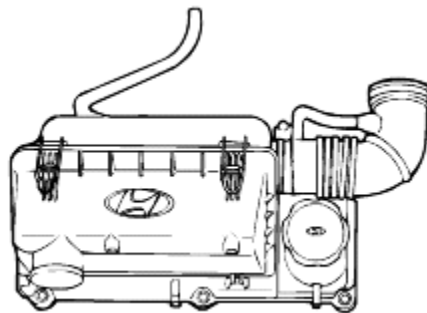
### **Tightening torque**

Rocker arm shaft mounting bolt :  
27-32Nm (270-320kg.cm, 20-24 lb.ft)



2. When installing the rocker arm, shaft and spring, mark the difference of left and right part.  
Use the spring without distinction of intake and exhaust valve.  
Must set the part that is small chamfer side between two parts of rocker arm shaft to the timing belt.
3. Install the air cleaner and the air cleaner body assembly and tighten bolt by specified torque.

Air cleaner and air cleaner body assembly :  
30-40 Nm (300-400 kg.cm, 22-30 lb.ft)



### **CAUTION**

- **Must tighten the air cleaner and air cleaner body assembly at specified torque with bolts.  
If tightening these parts at over torque, there might be change of shape and oil leakage, broken bolts for these parts.**
- **After removing of air cleaner and air cleaner body assembly, you should apply the sealing for these parts when installation.**
- **Because the material of air cleaner and air cleaner body assembly is plastic, be careful tools are not dropped on these parts when removing and installation of engine parts.**
- **When removal and installation of air cleaner and air cleaner body assembly, check**

**the damage of these parts and reuse when there are no problems.**

- **When filling or draining of engine oil, be careful oil not to be dropped on air cleaner and air cleaner body assembly.  
If dropped, clean the spot with oil suction paper, towel completely.**

4. Install the timing belt cover.

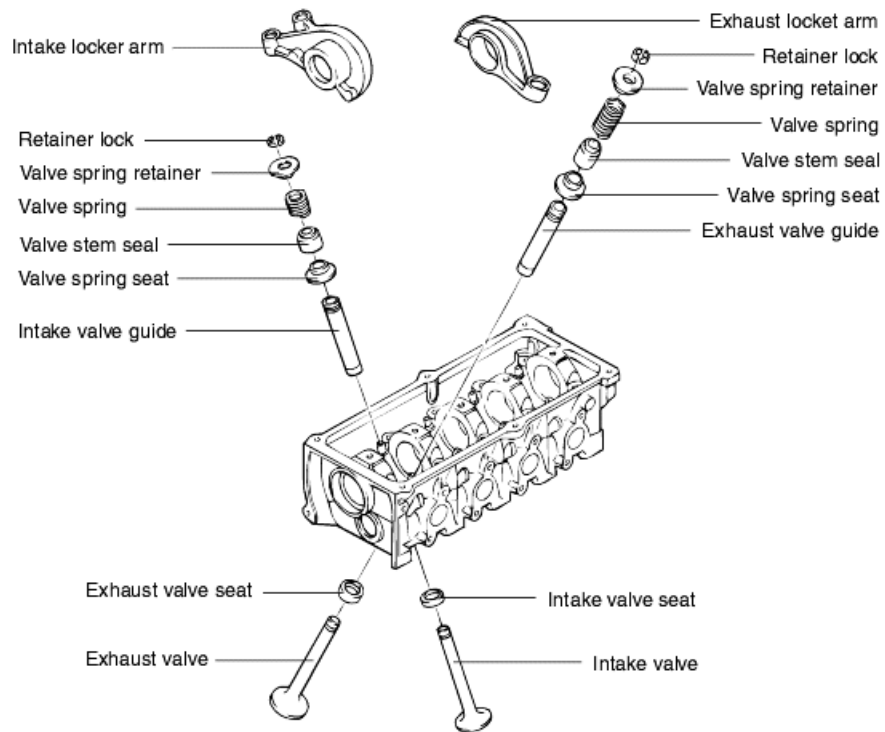
**Tightening torque**

Timing belt cover bolt :

10-12 Nm (100-120 kg.cm, 7-9 lb.ft)

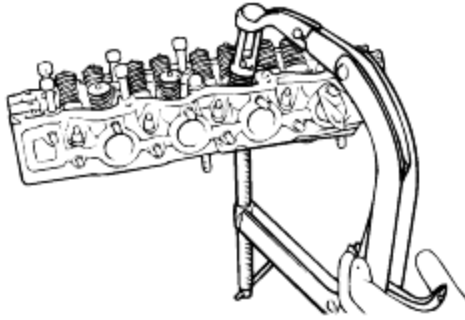
5. Install the breather hose, PCV hose, blow-by hose and spark plug cable.
6. Install the air intake hose and air duct.

# COMPONENTS ECTC2800



## DISASSEMBLY ECDA1130

1. Using the special tool, Valve Spring Remover and Installer, remove the retainer lock. Next, remove the spring retainer, valve spring, spring seat and valve.



### **NOTE**

**Keep these parts in order so that they can be reinstalled in their original positions.**

2. Remove the valve stem seals with pliers, and discard them.

### **NOTE**

**Do not reuse the valve stem seals.**



**VALVE SPRING**

1. Check the valve spring free length and tension. If they exceed the service limit, replace the spring.
2. Using a square, test the squareness of each spring. If a spring is excessively out of square, replace it.

**Valve Spring  
Standard value**

Free height : 40.50mm (1.594 in.)  
 Load : 15.60±0.9kg/32.0mm  
 Out of square : 1.5° or less

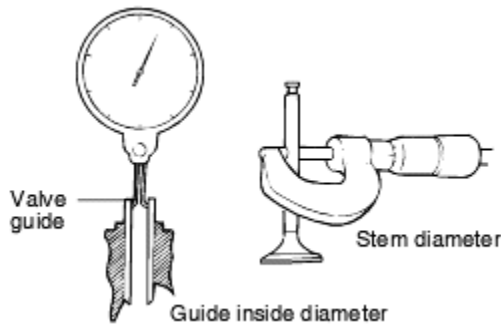
**VALVE GUIDES**

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with the next oversize part.

**Valve stem-to-guide clearance**

**Standard value**

Intake : 0.020-0.047mm (0.0008-0.0018 in.)  
 Exhaust : 0.050-0.082mm (0.0019-0.0032 in.)

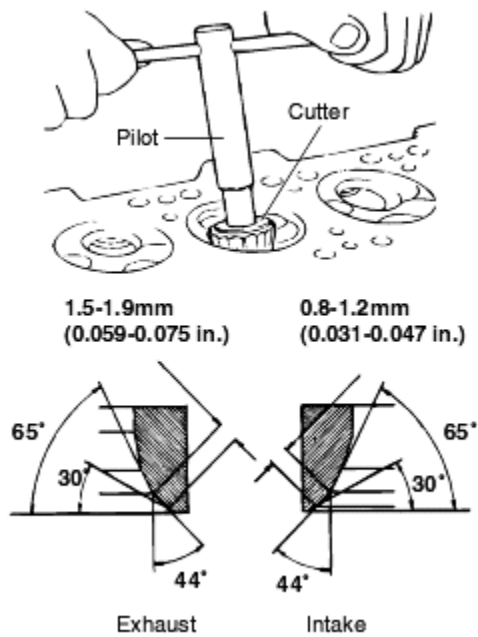


VALVE GUIDE OVERSIZES Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002) O.S.	5	10.05-10.068 (0.395-0.396)
0.25 (0.010) O.S.	25	10.25-10.268 (0.403-0.404)
0.50 (0.020) O.S.	50	10.50-10.518 (0.413-0.414)

**VALVE SEAT INSERT**

Check the valve seat for evidence of overheating and improper contact with the valve face. Recondition or replace the seat, if necessary.

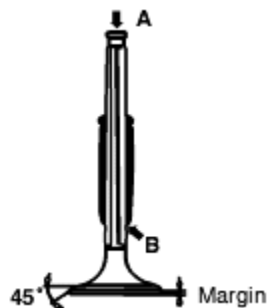
Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centred on the valve face.



## VALVES

Check each valve for wear, damage and distortion of head and stem at B. Repair or correct, if necessary. If stem end A is pitted or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.

Replace the valve if the margin has decreased to less than the service limit.



## MARGIN

### Standard value

Intake : 0.8mm (0.031 in.)

Exhaust : 1.2mm (0.047 in.)

### Limit

Intake : 0.5mm (0.019 in.)

Exhaust : 0.9mm (0.035 in.)

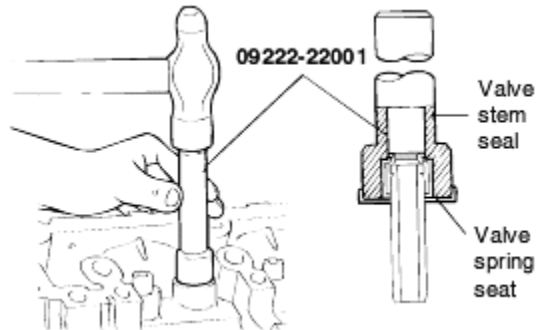
## REASSEMBLY ECFA1150

### NOTE

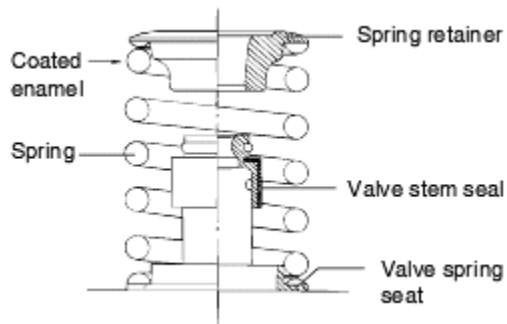
1. Thoroughly clean each part before assembly.
2. Apply engine oil to sliding and rotating parts.

1. After installing the spring seat, fit the stem seal onto the valve guide.  
To install, fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal Installer (09222-22001).

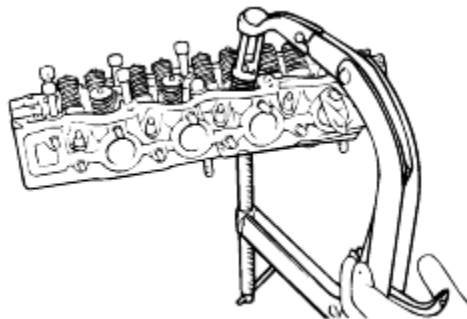
The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leakage down the valve guides. Therefore, when installing, be careful not to twist the seal. Do not reuse old stem seals.



2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid using force when inserting the valve into the seal. After insertion, check to see if the valve moves smoothly.
3. Install springs and spring retainers. Valve springs should be installed with the enamel-coated side toward the valve spring retainer.  
Valve springs should be installed with the enamel-coated side toward the valve spring retainer.



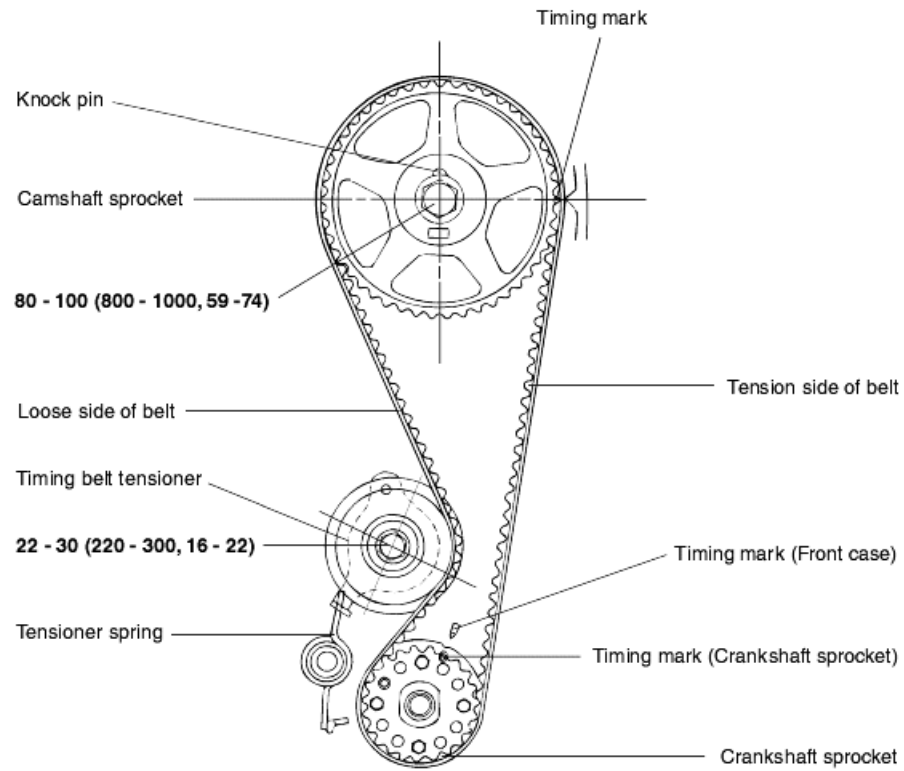
4. Using special tool, Valve Spring Remover and Installer, compress the spring. Be careful that the bottom of the retainer does not distort the valve stem seal. Then install the retainer locks. After installation of the valves, make certain that the retainer locks are properly installed.



5. Install the cylinder head. Refer to "Cylinder Head"

## 2.8 Timing System

COMPONENTS ECTC2900



**TORQUE : Nm (kg.cm, lb.ft)**

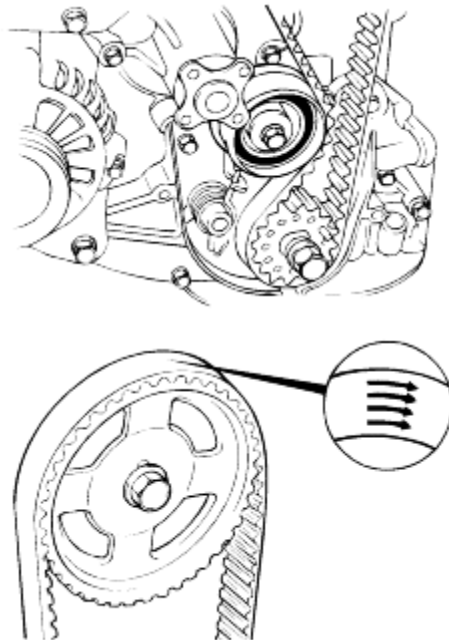
## DISASSEMBLY ECTC2950

1. Loosen the coolant pump pulley bolt.
2. Loosen the generator bolt.
3. Remove the coolant pump pulley and belt.
4. Remove the crankshaft pulley.
5. Remove the timing belt cover.
6. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
7. Remove the camshaft from the camshaft sprocket.
8. Remove the camshaft sprocket.
9. Remove the timing belt.

### **NOTE**

**If the timing belt is reused, mark with an arrow to indicate direction of rotation (or the front of the engine) to make sure that the belt is reinstalled in the same direction as before.**

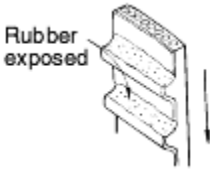
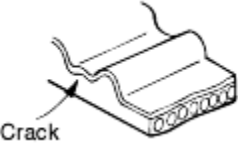

10. Remove the crankshaft sprocket bolts. Remove the crankshaft sprocket and flange.
11. Remove the timing belt tensioner.



TIMING BELT

1. Check the belt for oil or dust deposits. Replace, if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, carefully check the belt. If any of the following flaws are evident, replace the belt.

Description	Flaw conditions
1. Hardened back surface Back surface glossy. Non-elastic and so hard that when your fingernail is pressed into it, no mark is produced.	
2. Cracked back surface rubber	
3. Cracked or separating canvas	
4. Badly worn teeth (initial stage) Canvas on load side tooth flank worn (Fluffy canvas fibres, rubber gone and color changed to white, and unclear canvas texture)	

Description	Flaw conditions
5. Badly worn teeth (last stage) Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced)	 <p>Rubber exposed</p>
6. Cracked tooth bottom	 <p>Crack</p>
7. Missing tooth	 <p>Tooth missing and canvas fiber exposed</p>
8. Side of belt badly worn	
<b>NOTE : A normal belt should have precisely cut sides as if cut by a sharp knife.</b>	
9. Side of belt cracked	

#### SPROCKETS AND TENSIONER

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth pulley rotation and check for play or noise. Replace as necessary.



## REASSEMBLY ECTC3050

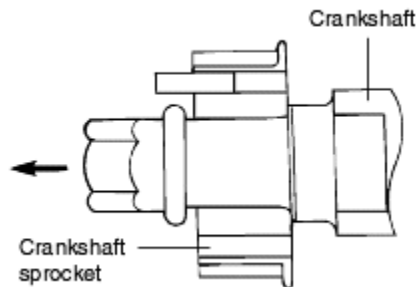
1. Install the flange and crankshaft sprocket as shown. Pay close attention to the mounting directions.

### Tightening torque

Crankshaft sprocket bolt :

70-100Nm (700-1000 kg.cm, 52-74 lb.ft)

2. Install the camshaft sprocket and tighten the bolt to the specified torque.

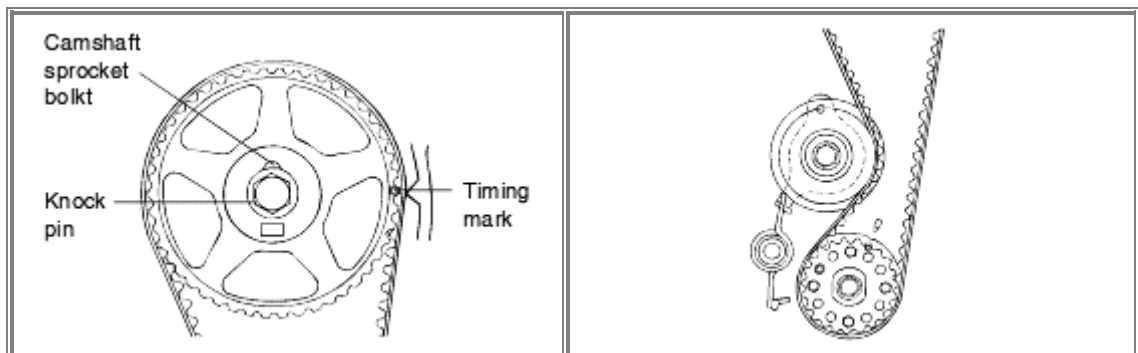


### Tightening torque

Camshaft sprocket bolt :

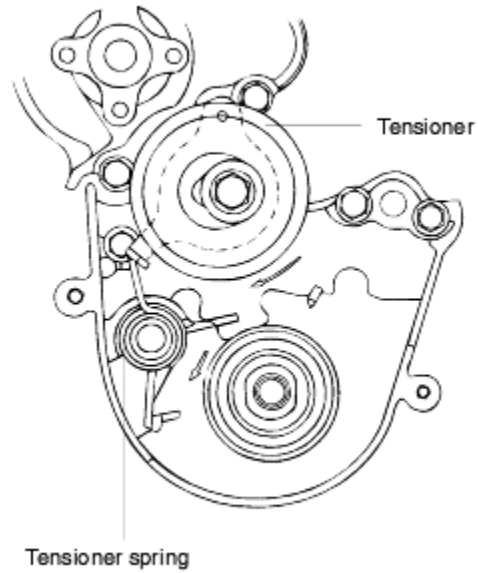
80-100Nm (800-1000 kg.cm, 59-74 lb.ft)

3. Align the timing makers of the camshaft sprocket and crank shaft sprocket, with the No.1 piston placed at top dead centre on its compression stroke.

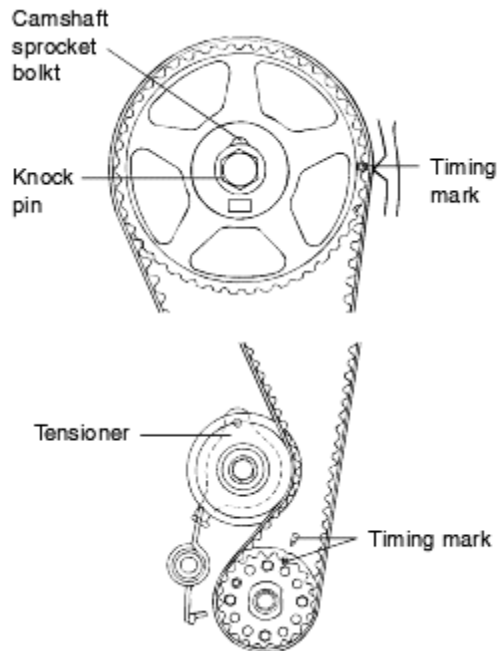


4. Tentatively fasten timing belt tensioner as such position as to place its pulley nearest to water pump body.
5. Hang the tensioner spring on the tensioner bracket and insert the other spring side in the front case using the screwdriver.





6. After installing crankshaft sprocket and camshaft sprocket. Match timing mark of each sprocket as shown.



**NOTE**

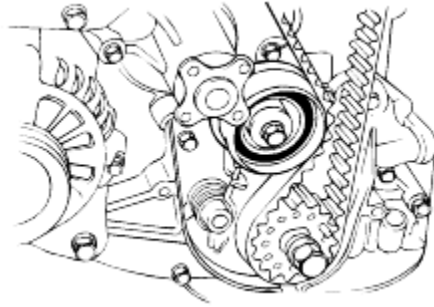
When installing camshaft sprocket. Make sure that camshaft sprocket knock pin fits small hole in pulley as shown.

7. Install timing belt so as not to give slack to tension side.

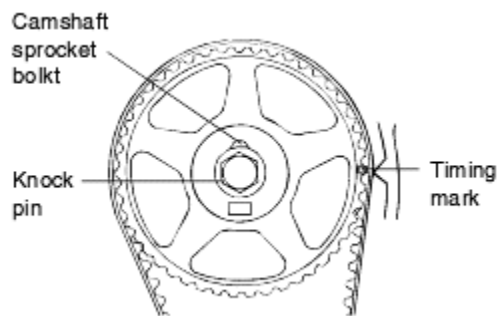
**NOTE**

Then make sure ass timing marks are at correct position respectively with tension side in strained state by applying force to camshaft sprocket in reversing direction.

- Loosen the tensioner mounting bolt in the order as shown to give the timing belt spring tension.

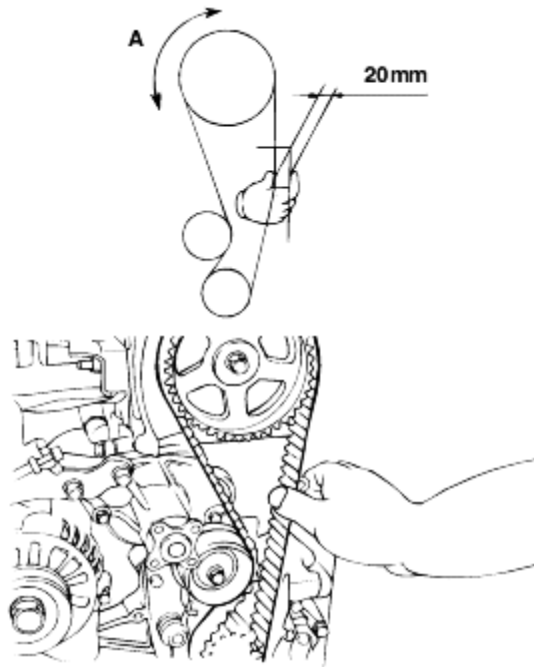


- Rotate crankshaft in regular direction (clockwise view from 8 font) through angle equivalent to two teeth (15°) of camshaft sprocket.

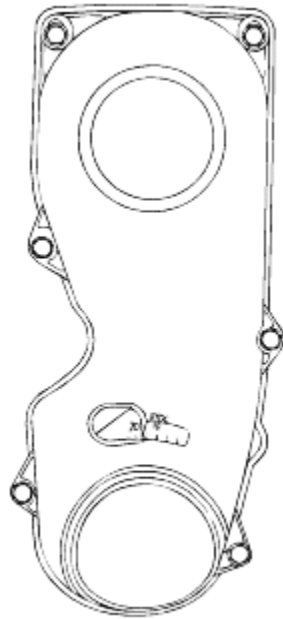


- Add force to tensioner in direction of regular rotation (→direction) so as to bring belt teeth in perfect contact with sprocket teeth without gap.
- After marking sure of this state.  
Fix tensioner in state that only tensioner spring is movable.

12. Make sure that gap between back side of belt and timing belt cover mounting hole centre of cylinder block is about 20mm, when holding the centre of tension side with a thumb and a forefinger.



13. Install the timing belt cover.  
Make sure that gap between back side of belt and timing belt cover mounting hole centre of cylinder block is about 20mm, when holding the centre of tension side with a thumb and a forefinger.



14. Install the crankshaft pulley.

15. Loosen the air condition belt adjust belt tension.
16. Install the air condition belt and adjust belt tension.
17. Install the coolant pump pulley.
18. Install V-belt and adjust the belt tension.

### 3 Engine Electrical System

#### 3.1 General

SPECIFICATIONS EBTC0010

<b>IGNITION COIL</b>	
Type	Mould single coil
Primary coil resistance	$0.8 \pm 0.08\Omega$
Secondary coil resistance	$12.1 \pm 1.8k\Omega$

<b>SPARK PLUG</b>	
Type	UNLEADED
NGK	BKR5ES-11
Champion	RC9YC4, RC10YC4
Plug gap mm (in.)	1.0-1.1 (0.039-0.043)

<b>STARTER MOTOR</b>	
Type	Direct drive type
Rated output	12V 0.7 kW, 0.8 kW (with power steering, A/T)
Rated time	30 sec.
No-load characteristics	
Terminal voltage	11.5V
Amperage	53A or less
Maximum speed	6,600 rpm or more
No. of pinion teeth	8
Pinion gap mm (in.)	0.5-2 (0.0197-0.079)

<b>GENERATOR</b>	
Type	Battery voltage sensing
Rated output	12V 60A
Voltage regulator type	Electronic built-in type
Regulator setting voltage	14.4 ± 0.3V/20°C
Temperature compensation	-10 ± 3mV/°C

<b>BATTERY</b>	
Type	MF 40Ah
Ampere hours (5HR)	30 Ah or more
Ampere hours (20HR)	40 Ah or more
Cold cranking [at -17.8°C (0°F)]	354A or more
Reserve capacity	52 min.
Specific gravity [at 25°C (77°F)]	1.280 ± 0.01

**NOTE**

**COLD CRANKING AMPERAGE** is the amperage that the battery can delivery for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at a specified temperature.

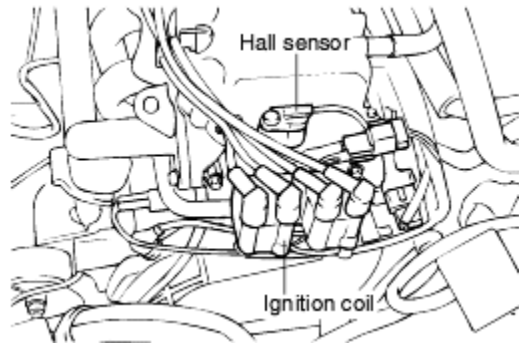
**RESERVE CAPACITY RATING** is the amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5 volts at 26.7°C (80°F).

### 3.2 Ignition System

#### GENERAL INFORMATION EBDA0030

Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data, for the engine operation conditions are pre-programmed in the memory of the engine control module (ECM).

The engine condition (speed, load, warm-up condition, etc.) is detected by various sensors. Based upon these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.



<b>TROUBLESHOOTING</b> Trouble condition	Probable cause	Remedy
Engine will not start or is hard to start. (but turns over)	Ignition coil faulty	Replace ignition coil
	High tension cable faulty	Replace high tension cable
	Spark plugs faulty	Replace plugs
	Incorrect immobilizer system	Adjust
	Ignition wiring disconnected or broken	Replace wiring
Rough idle or stalling	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
	Ignition coil faulty	Replace ignition coil
	High tension cord faulty	Replace high tension cord
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
Poor fuel economy	Spark plugs faulty	Replace plugs

# IGNITION SWITCH EBDA0050

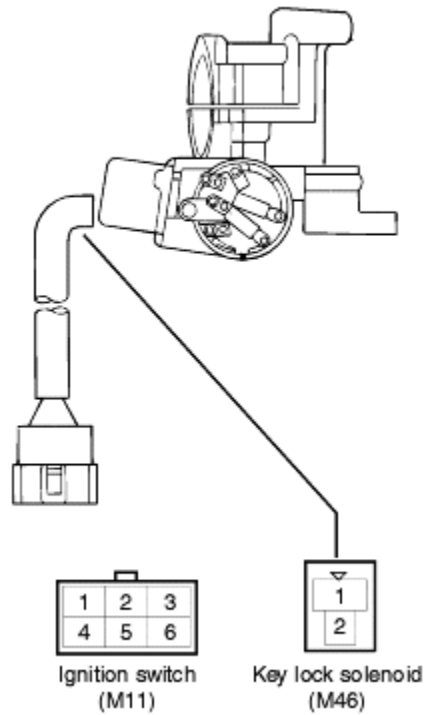
## INSPECTION EBDA0050

1. Remove the connector located under the steering column.
2. Check for continuity between terminals.

Terminal		Ignition switch						Key lock solenoid		
		1	2	3	4	5	6	1	2	
Position	Key									
	Removed									
	LOCK	Inserted								
			○	—		○			○	—
ACC	Inserted		○		○					
ON1			○	○	○	○				
START					○	○	○			

**NOTE**

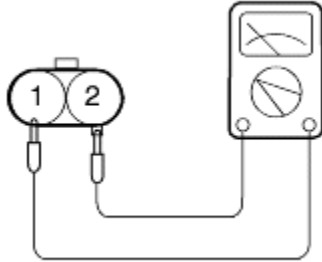
○—○ indicates that there is continuity between the terminals.





## CHECKING IGNITION COILS EBTC0070

1. Measure the primary coil resistance between connector C11-2 terminals 1 and 2 (the coils at the No.1 and No.4 cylinder sides) of the ignition coil, and between connector C11-1 terminals 1 and 2 (the coils at the No.2 and No.3 cylinder sides).  
**Standard value :  $0.8 \pm 0.08 \text{ k}\Omega$**

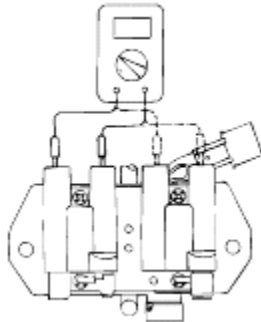


2. Measure the secondary coil resistance between the high-voltage terminal for the No.1 and No.4 cylinders, and between the high-voltage terminals for the No.2 and No.3 cylinders.  
**Standard value :  $12.1 \pm 1.8 \text{ k}\Omega$**

### **CAUTION**

**Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.**

- 3.



## INSPECTION AND CLEANING OF SPARK PLUGS EBTC0090

1. Disconnect the spark plug cable from the spark plug.

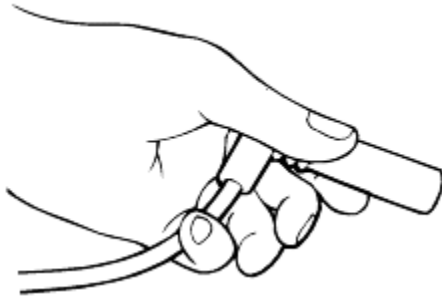
### **NOTE**

**Pull on the spark plug cable boot when removing the spark plug cable, not the cable, as it may be damaged.**

2. Using a spark plug socket, remove all spark plugs from the cylinder head.

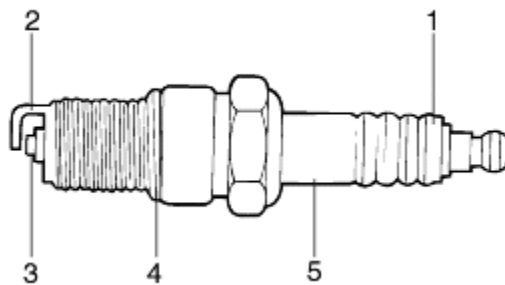
### **CAUTION**

**Take care not to allow contaminants to enter through the spark plug holes.**



3. Check the spark plugs for the following :

- Broken insulator
- Worn electrode
- Carbon deposits
- Damaged or broken gasket
- Condition of the porcelain insulator at the tip of the spark plug

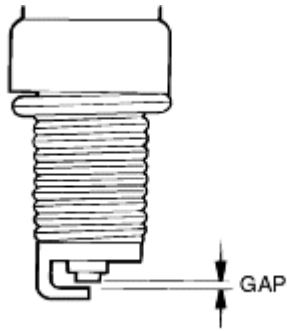


4. Check the spark plug gap using a wire gap gauge, and adjust if necessary.

**Standard value :**

Unleaded : 1.0-1.1 mm (0.039-0.043 in.)

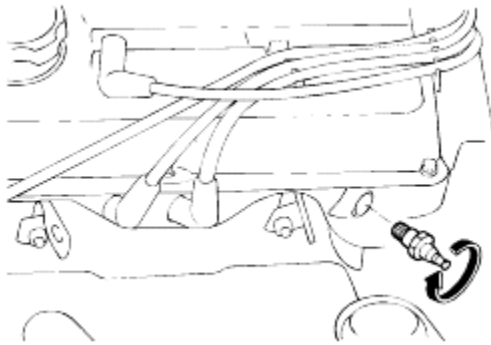
Leaded : 0.7-0.8 mm (0.028-0.031 in.)



5. Re-insert the spark plug and tighten to the specified torque.  
If it is over torqued, damage to the thread portion of cylinder head might result.

**Tightening torque :**

20-30 Nm (204-306 kg.cm, 15-21 lb.ft)



**ANALYZING SPARK PLUGS**

Engine conditions can be determined by examining the tip deposits near the electrode.

Condition	Dark deposits	White deposits
Description	<ul style="list-style-type: none"> <li>o Too rich a fuel mixture</li> <li>o Low air intake</li> </ul>	<ul style="list-style-type: none"> <li>o Too lean a fuel mixture</li> <li>o Advanced ignition timing</li> <li>o Insufficient plug tightening</li> </ul>

**SPARK PLUG TEST (WHEN ENGINE CAN BE CRANKED)**

Connect the spark plug cable. Ground the outer electrode (main body), and crank the engine. In the atmosphere, only short sparks are produced because of the small discharge gap. If the spark plug is good, however, sparks will occur in the discharge gap (between the electrodes). In a defective spark plug, no sparks will occur because of a leak through the insulation.

**CHECKING SPARK PLUG CABLES**

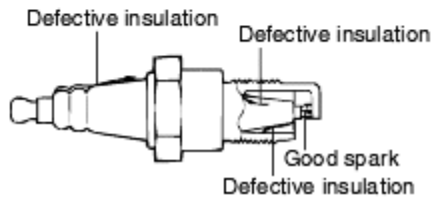
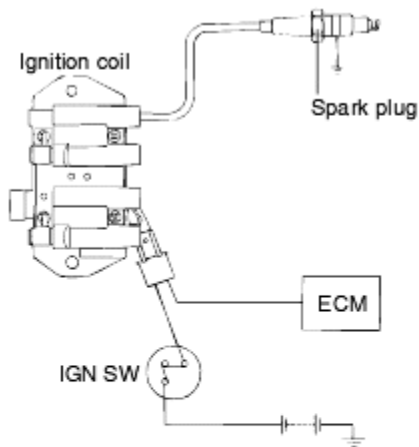
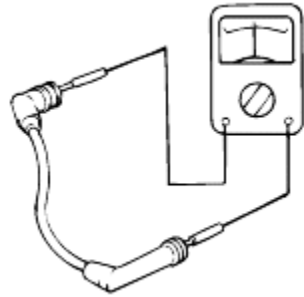
1. Check the cap and outer shell for cracks.
2. Measure the resistance

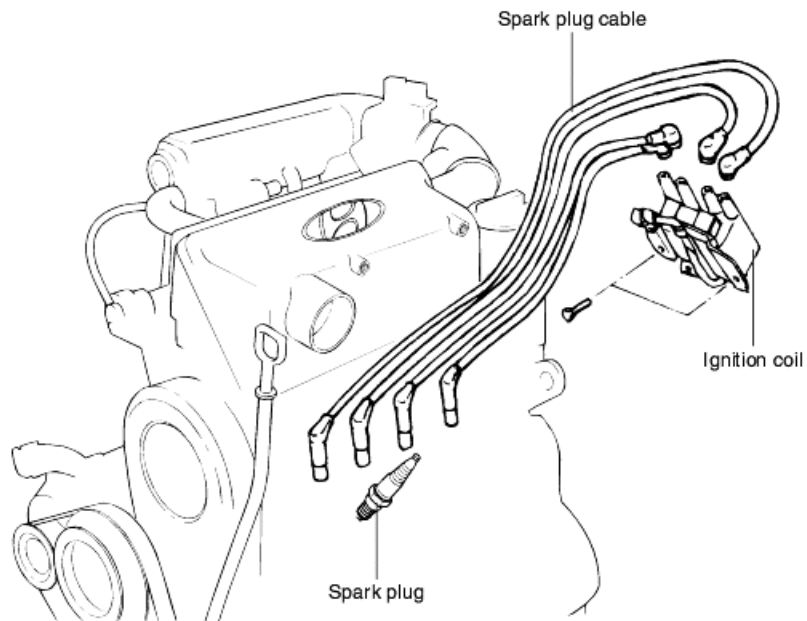
Unit : k $\Omega$ ;

Spark plug cable			
No.1	No.2	No.3	No.4
11.2	9.5	6.9	5.5

**NOTE**

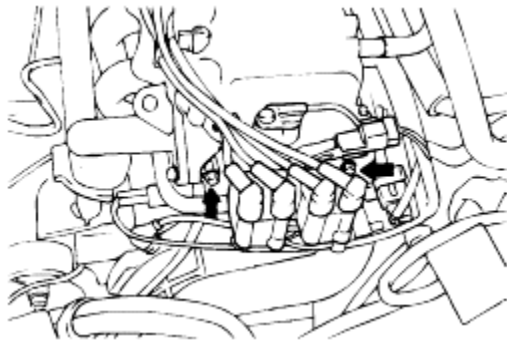
Resistance should not be higher than 10,000 $\Omega$  per foot of cable. If resistance is higher, replace the cable.





#### IGNITION COILS

1. Remove the ignition fuse (Fusible link-F).
2. Disconnect the lead wire.
3. Remove the ignition coil mounting bolt and remove the ignition coil assembly.
4. Installation is the reverse order of removal.

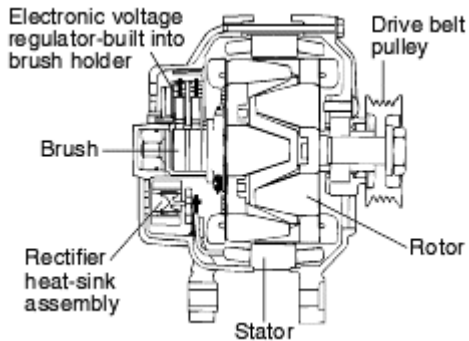


### 3.3 Charging System

#### GENERAL INFORMATION EBD A0240

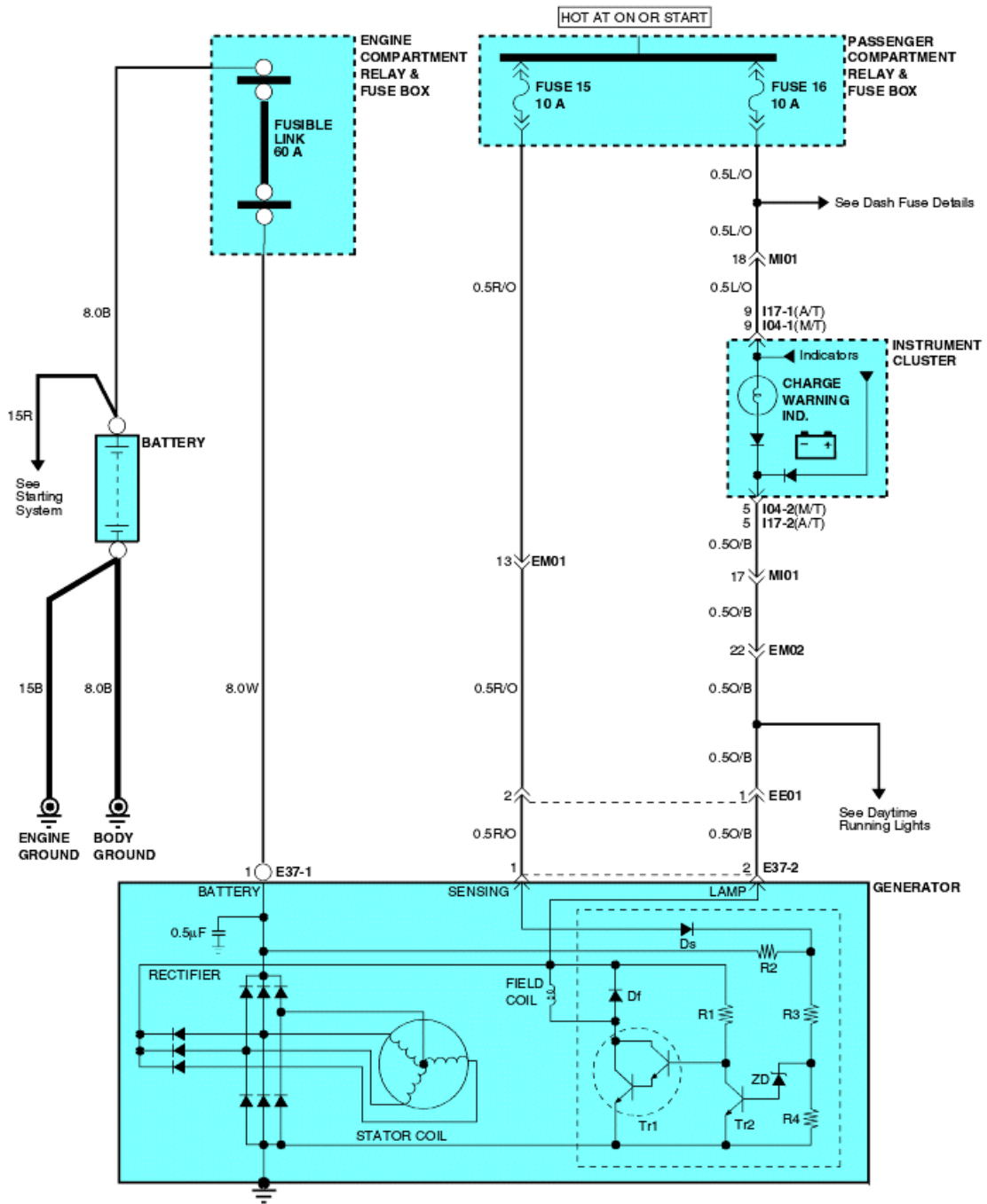
The charging system includes a battery, a generator with a built-in regulator, and the charging indicator light and wire. The generator has six built-in diodes (three positives and three negatives), each rectifying an AC current to DC current. Therefore, the DC current appears at generator "B" terminal.

In addition, the charging voltage of the generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor-brushes, bearings, and drive belt pulley. The brush holder contains a built-in electronic voltage regulator.



<b>TROUBLESHOOTING</b> Trouble condition	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connections
	Electronic voltage regulator faulty	Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn	Adjust tension or replace cables
	Battery cables loose, corroded or worn	Repair or replace cables
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link
	Electronic voltage regulator or generator faulty	Test generator
	Wiring faulty	Repair wiring.
Discharged battery	Drive belt loose or worn	Adjust tension or replace drive belt
	Wiring connection loose or open circuit	Tighten loose connection or repair wiring
	Fusible link blown	Replace fusible link
	Warning indicator and pre-excitation resistor faulty	Replace components
	Poor grounding	Repair
	Electronic voltage regulator or generator faulty	Test generator
	Battery life	Replace battery
Overcharging	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

CIRCUIT DIAGRAM EBTC0250



## INSPECTION OF CHARGING SYSTEM EBDA0270

### CHECKING POWER SOURCE CIRCUIT

The field coil excites the stator coil, which generates charging current.

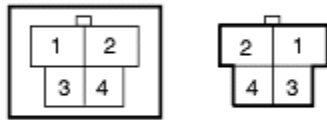
#### TEST

1. Turn the ignition switch "ON".
2. With ignition switch "ON" (but engine off), ensure the charging indicator lamp is illuminated.
3. Disconnect the pre-excitation resistor connector.  
Connect an ohmmeter between terminals 1 and 3 (component side). Connect the (+) lead wire of the ohmmeter to terminal 3 and the (-) lead wire to terminal 1.

#### CAUTION

**If the leads of the ohmmeter are not connected properly, there will be no reading on the ohmmeter. Be sure to connect the leads correctly.**

- 4.



COMPONENTS SIDE HARNESS SIDE

#### RESULT

1. If there is continuity throughout steps 2 and 3, then the circuit is OK.  
If there is continuity throughout steps 2 and 3, then the circuit, not the battery, is faulty.
2. If continuity is absent in step 2 only, then the charging indicator circuit should be checked and repaired. If continuity is absent during step 3 only then the pre-excitation register should be checked and replaced. (Refer to the circuit diagram).

#### NOTE

**If continuity is absent in only one of steps 2 and 3, then the system is working normally. However, the individual circuit should be repaired for more reliable system operation.**



## VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE EBDA0290

This test determines if the wiring between the generator "B" terminal and the battery (+) terminal is good by the voltage drop method.

### PREPARATION

1. Turn the ignition switch to "OFF."

#### **NOTE**

**To identify connection problems, be sure not to disturb either of the two terminals or their connections during this test.**

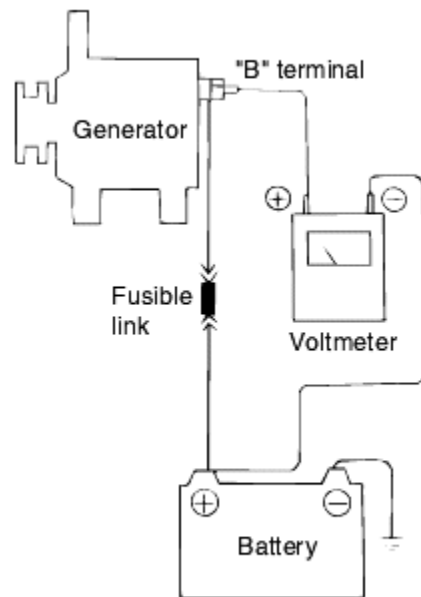
2. Connect a digital voltmeter between the generator "B" terminal and battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.

### CONDITIONS FOR TESTING

With the engine running and headlamps, blower motor etc., check the reading on the voltmeter.

### RESULT

1. The voltmeter should read a standard 0.3V.
2. If the reading is above 0.3V, poor wiring should be suspected. Check wiring from generator 'B' terminal through the fusible link to the battery (+) terminal. Check for loose wiring or color change from an overheated harness. Correct and check again.
3. On completion of the test, set the engine at idle. Then turn off the headlamps, blower motor etc., and ignition.



## OUTPUT CURRENT TEST EBDA0310

This test determines if the generator gives an output current that is equivalent to the nominal output.

### PREPARATION

1. Prior to the test, check the following items and correct as necessary.
  - Check if that the battery installed in the vehicle is in good condition. For details, see "BATTERY".

#### **NOTE**

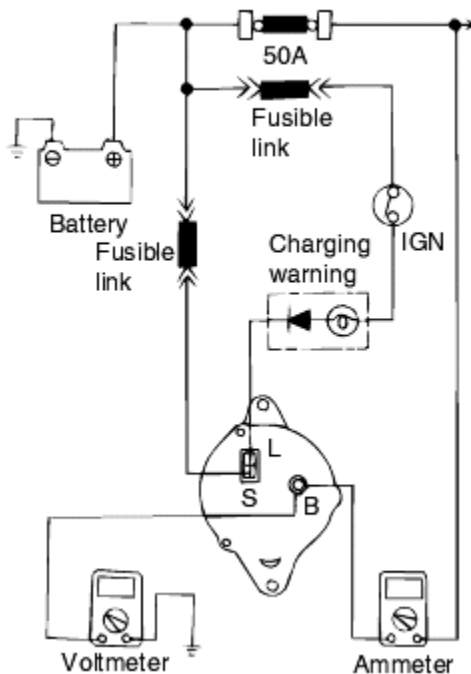
**The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.**

- Check the tension of the generator drive belt. See "COOLING".
2. Turn the ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Disconnect the generator output wire from the generator "B" terminal.
5. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

#### **NOTE**

**Tighten each connection securely, as a heavy current will flow. Do not rely on clips.**

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the generator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



## TEST

1. Check to see that the voltmeter reads the same value as the battery voltage. If the voltmeter reads 0V, an open circuit in the wire between the generator "B" terminal and battery (-) terminal, a blown fusible link or poor ground is suspected.
2. Start the engine and turn the headlights on.
3. Set the headlights to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

### **NOTE**

**After the engine starts, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.**

## RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the generator output wire is in good condition, remove the generator from the vehicle and test it.

### **Limit value**

52.5 A min. : 75A generator

63.0 A min. : 90A generator

### **NOTE**

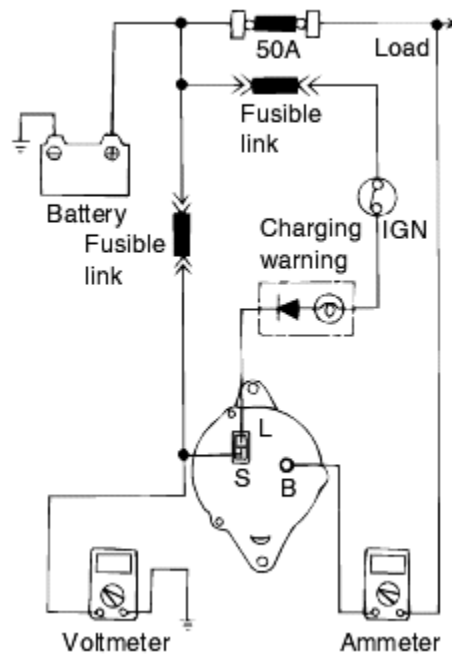
- a. **The nominal output current value is shown on the nameplate affixed to the generator body.**
  - b. **The output current value changes with the electrical load and the temperature of the generator itself. Therefore, the nominal output current may not be obtained. In such case, keep the headlights on to discharge the battery, or use the lights of another vehicle to increase the electrical load.**  
**The nominal output current may not be obtained if the temperature of the generator itself or ambient temperature is too high.**  
**In such a case, reduce the temperature before testing again.**
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
  3. Disconnect the battery ground cable.
  4. Remove the ammeter and voltmeter and the engine tachometer.
  5. Connect the generator output wire to the generator "B" terminal.
  6. Connect the battery ground cable.

## REGULATED VOLTAGE TEST EBDA0330

The purpose of this test is to check that the electronic voltage regulator controls the voltage correctly.

### PREPARATION

1. Prior to the test, check the following items and correct if necessary.
  - Check that the battery installed in the vehicle is fully charged. For battery checking method, see the "BATTERY" section.
  - Check the generator drive belt tension. For belt tension check, see section, "COOLING."
2. Turn ignition switch to "OFF."
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "S(L)" terminal of the generator and ground. Connect the (+) lead of the voltmeter to the "S(L)" terminal of the generator. Connect the (-) lead to a good ground or the battery (-) terminal.
5. Disconnect the generator output wire from the generator "B" terminal.
6. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



### TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.  
Voltage : Battery voltage  
If it reads 0V, there is an open circuit in the wire between the generator "S(L)" terminal and the battery and the battery (+), or the fusible link is blown.
2. Start the engine. Keep all lights and accessories off.

3. Run the engine at a speed of about 2,500-rpm and read the voltmeter when the generator output current drops to 10A or less.

#### RESULT

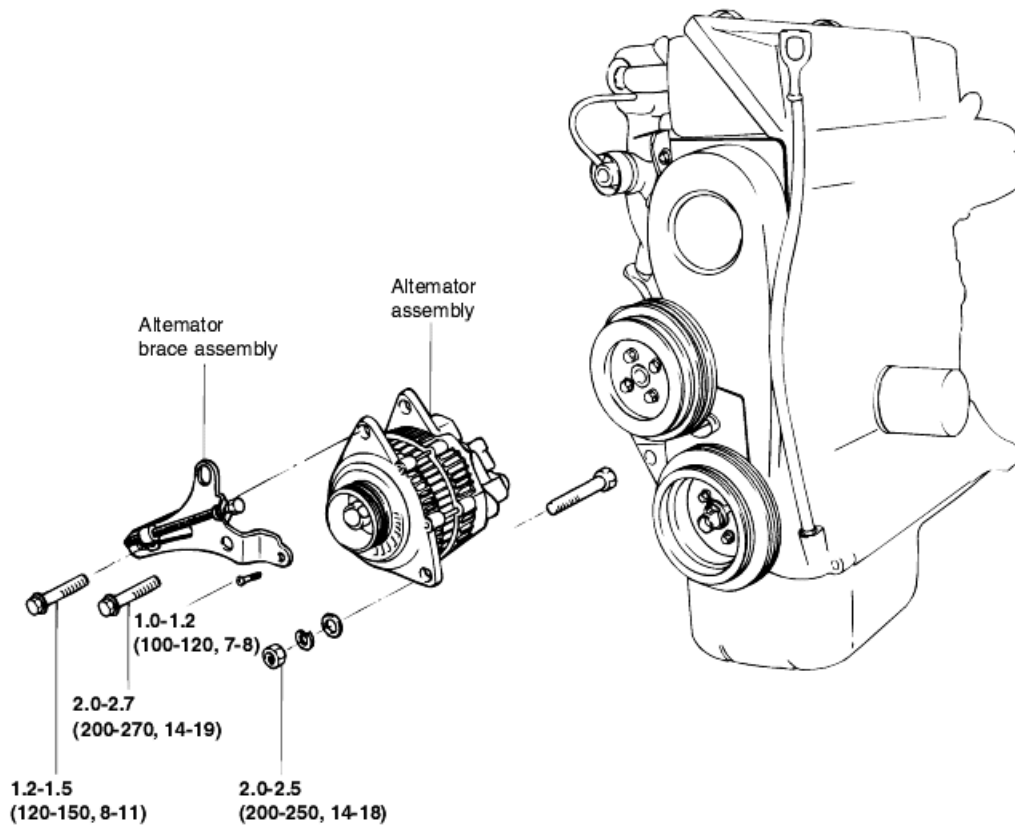
1. If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the generator is faulty.

<b>Regulating Voltage Table</b> Voltage regulator ambient temperature °C(°F)	Regulating voltage V	
	75A generator	90A generator
-20 (-4)	14.2-15.4	14.3-15.2
20 (68)	13.9-14.9	14.1-14.7
60 (140)	13.4-14.6	13.5-14.4
80 (176)	13.1-14.5	13.3-14.3

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter, ammeter, and the engine tachometer.
5. Connect the generator output wire to the generator "B" terminal.
6. Reconnect the battery ground cable.

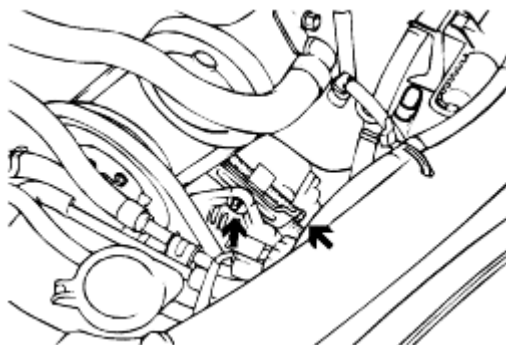
## GENERATOR EBTC0350

### COMPONENTS

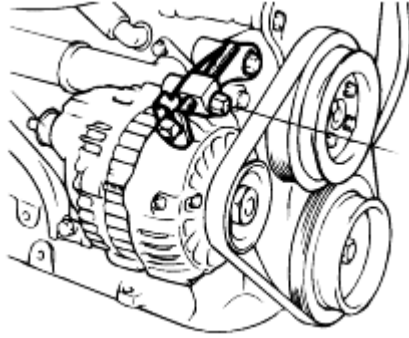


### REMOVAL

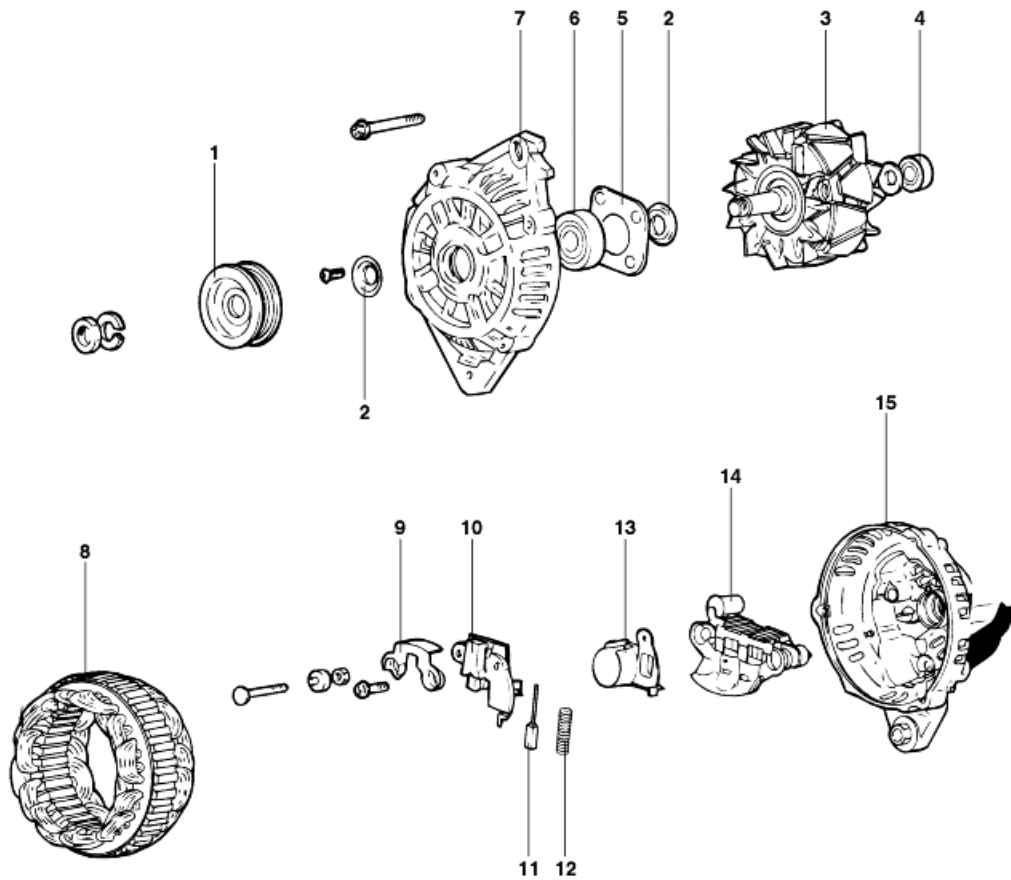
1. Disconnect the negative terminal from the battery and disconnect the radiator fan connector and condenser fan connector.
2. Loosen the belt tension adjusting bolt and remove the mounting bolt. Then, raise the vehicle.



3. Disconnect the generator connector and remove the B+ terminal cable.



4. Remove the belt and detach the generator mounting bolt and nut. Then, remove the generator assembly while raising the radiator.



- |                     |  |
|---------------------|--|
| 1. Pulley           | 8. Stator                              |
| 2. Seal             | 9. Plate                               |
| 3. Rotor assembly   | 10. Voltage regulator and brush holder |
| 4. Rear bearing     | 11. Brush                              |
| 5. Bearing retainer | 12. Brush spring                       |
| 6. Front bearing    | 13. Slinger                            |
| 7. Front bracket    | 14. Rectifier                          |
|                     | 15. Rear bracket                       |

#### DISASSEMBLY

1. Remove the three through bolts.
2. Insert a flat screwdriver between the front bracket and stator core, and pry downward.

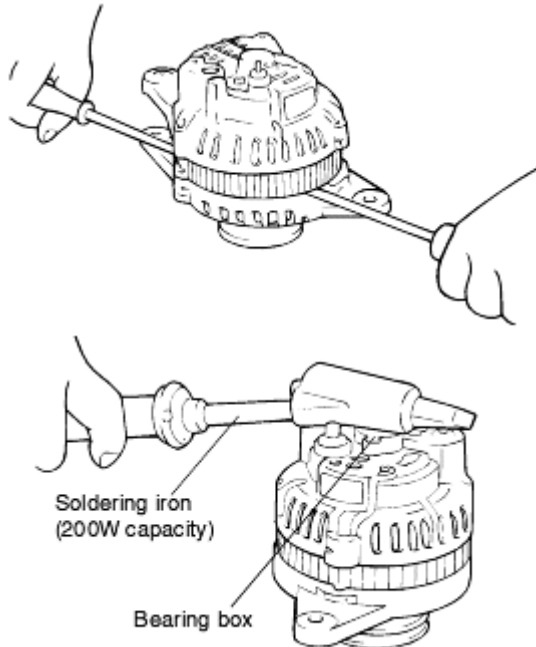
#### **CAUTION**

- a. **Do not insert the screwdriver too deeply, as there is a danger of damaging the**



stator coil.

- b. The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of the rear cover, heat the bearing box section with a 200-watt soldering iron. Do not use a heat gun, as it may damage the diode assembly.



3. Secure the rotor in a vice with the pulley side up.

**CAUTION**

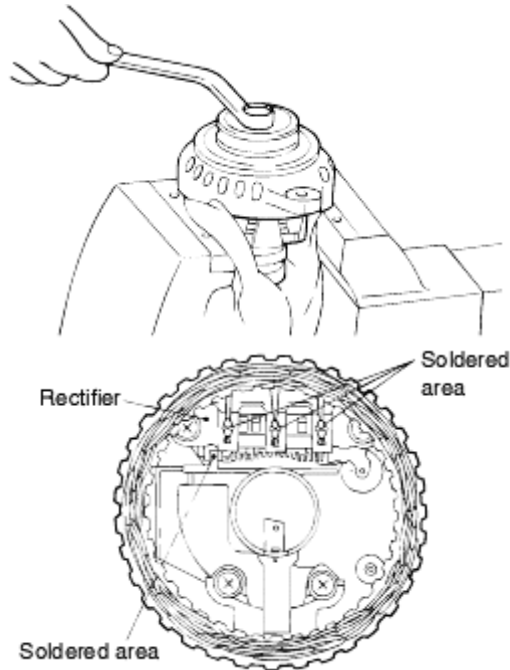
**Be careful that the vice jaws do not damage the rotor.**

4. Remove the pulley nut, then remove the spring washer, then the pulley, and then the spacer.
5. Remove the front bracket and two seals.
6. Remove the rotor from the vice.
7. Remove the brush holder screws, rectifier screws, and nut from the B terminal.
8. Remove the stator assembly from the rear bracket.
9. Detach the slinger from the brush holder.
10. When the stator is to be removed, unsolder the three stator leads to the main diodes on the rectifier.

**CAUTION**

- a. When soldering or unsoldering, be careful not to heat the diodes for too long.
- b. Be careful that excessive force is not exerted on the leads of the diodes.

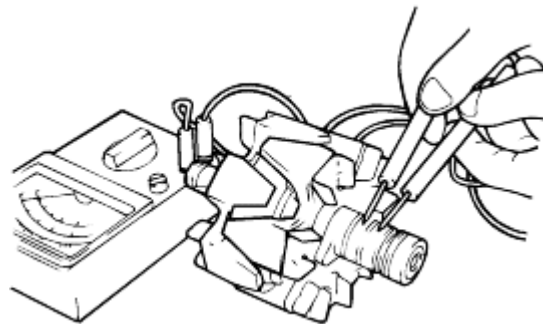
11. When separating the rectifier from the brush holder, unsolder the two plates that are soldered to the rectifier



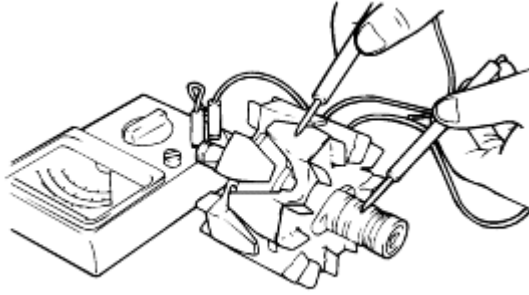
## INSPECTION EBTC0390

### ROTOR

1. Check the rotor coil for continuity. Check to make sure that there is continuity between the slip rings. If resistance is extremely low, it means that there is a short. If there is a short-circuit, or no continuity, replace the rotor assembly.

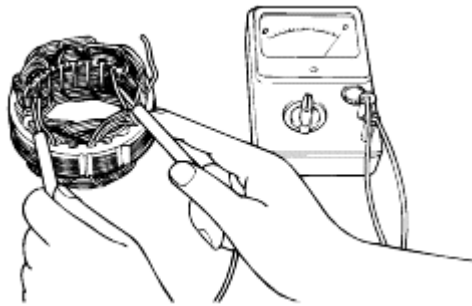


2. Check the rotor coil for ground. Check to make sure that there is no continuity between the slip ring and the core.  
If there is continuity, replace the rotor assembly.

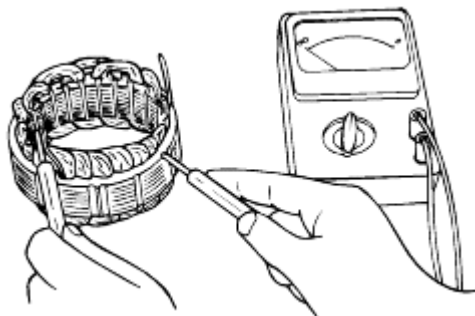


## STATOR

1. Make a continuity check on the stator coil. Check to make sure that there is continuity between the coil leads.  
If there is no continuity, replace the stator assembly.

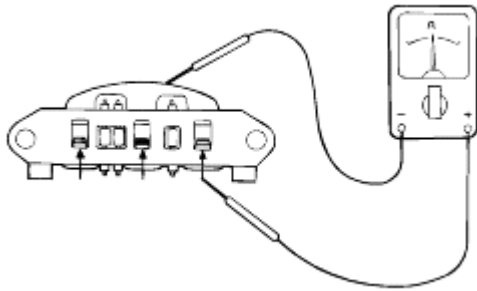


2. Check the coil for grounding. Check to make sure that there is no continuity between the coil and the core.  
If there is continuity, replace the stator assembly.



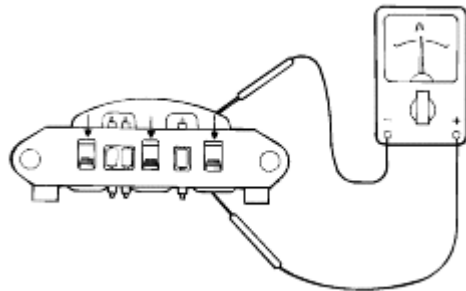
## RECTIFIERS POSITIVE RECTIFIER TEST

Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted. Replace the rectifier assembly.



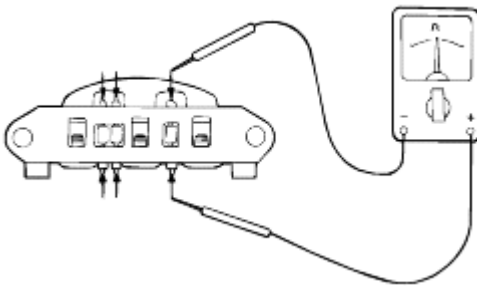
### NEGATIVE RECTIFIER TEST

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted, and the rectifier assembly must be replaced.



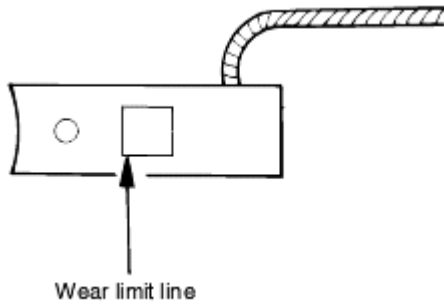
### DIODE TRIO TEST

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction. If continuity is present in both directions, a diode is defective and the heat-sink assembly must be replaced.

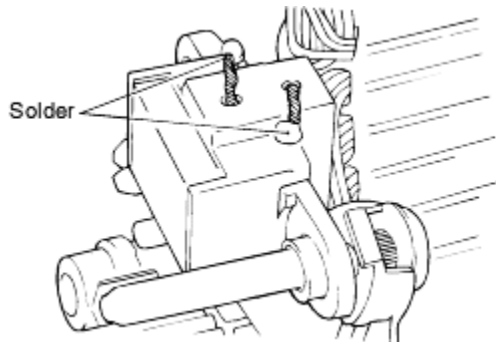


## BRUSH REPLACEMENT

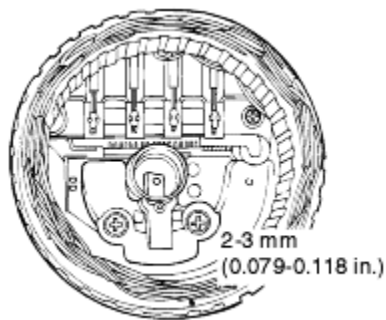
Replace the brushes if they are worn to the limit line.



1. Unsolder the pigtail and remove the old brush and spring.



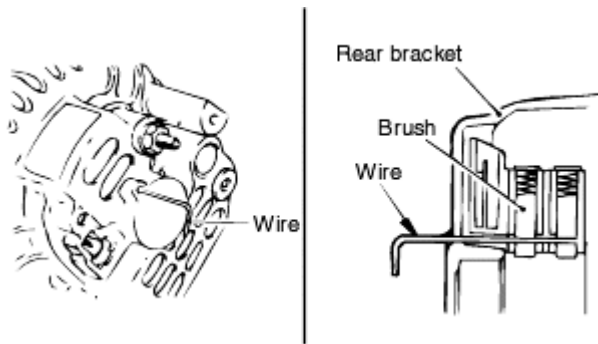
2. Install the brush spring and a new brush in the brush holder.
3. Insert the brush so that there is a space of 2 to 3 mm (0.079 to 0.118 in.) between the limit line and the end of the brush holder.
4. Solder the pigtail to the brush holder.



## REASSEMBLY EBTC0450

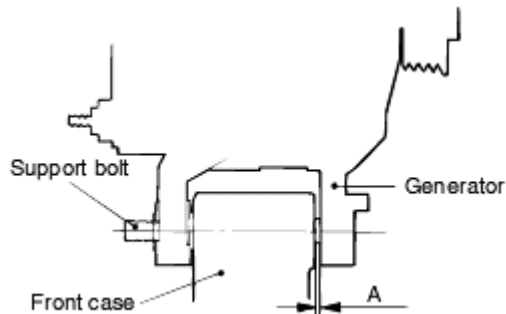
Perform re-assembly as the reverse procedure of disassembly. Pay attention to the following:

Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.



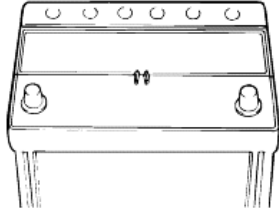
## INSTALLATION EBDA0470

1. Position the generator and insert the support bolt. (Do not attach the nut.)
2. Push the generator forward and determine how many spacers (thickness : 0.198mm) should be inserted between the front leg of the generator and the front case (space "A" in the illustration). (There should be enough spacers so that they do not fall out when you let go of them.)
3. Insert the spacers (space "A" in the illustration), attach the nut, and complete the installation.

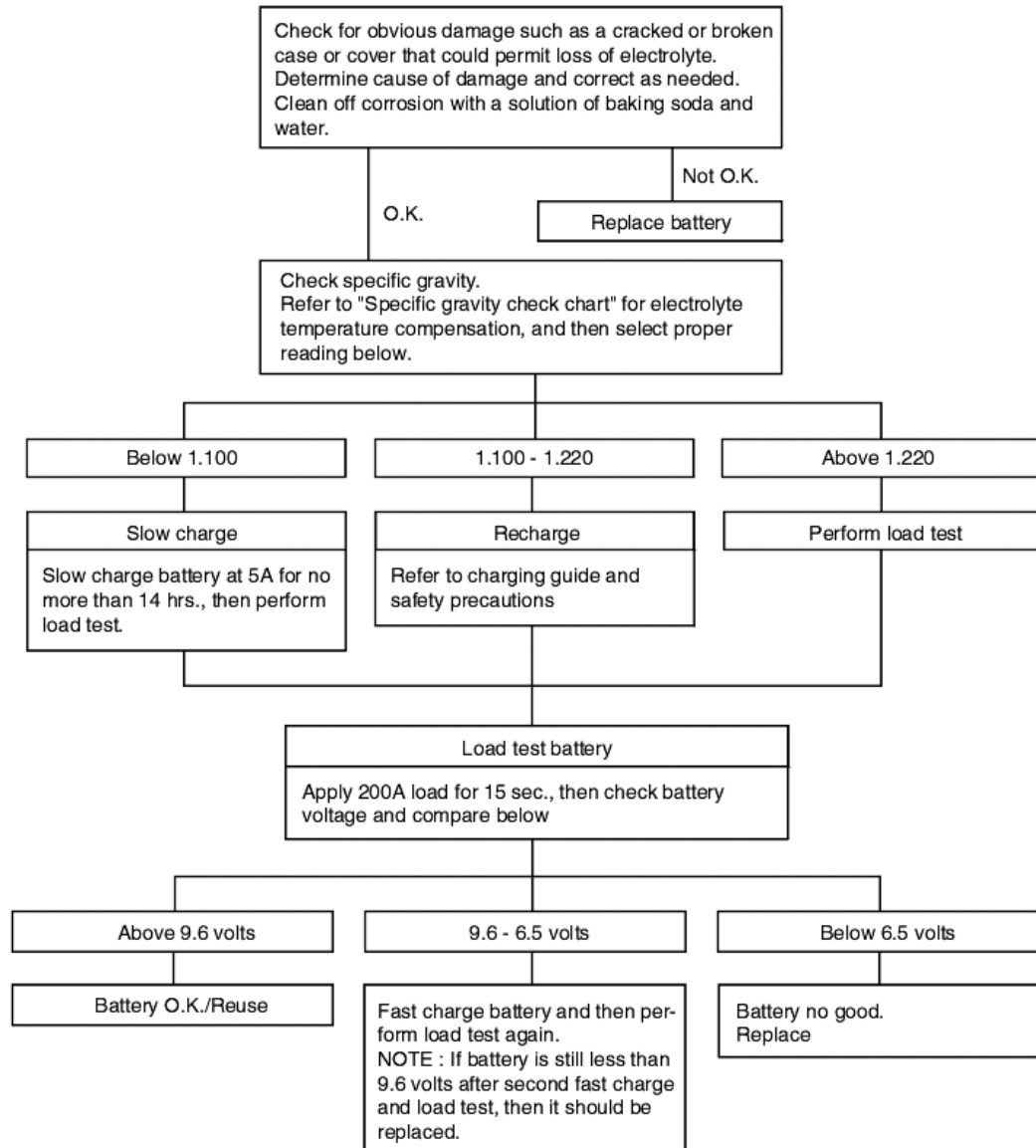


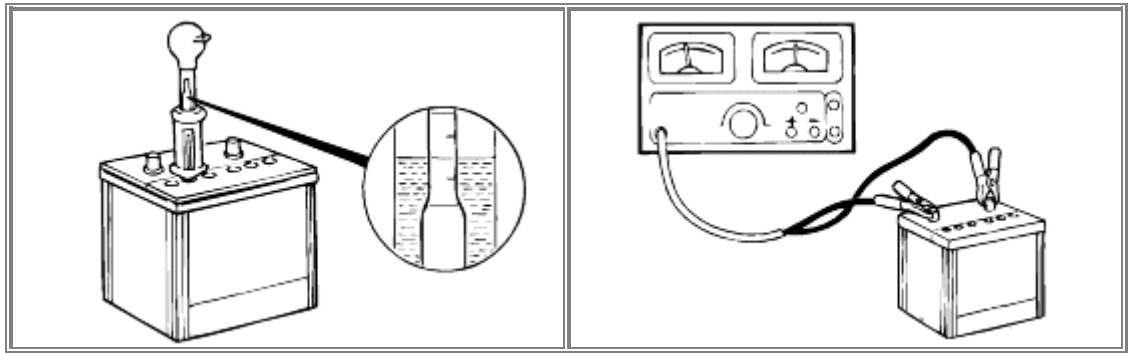
## BATTERY EBDA0490

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



### BATTERY VISUAL INSPECTION (1)







## SPECIFIC GRAVITY CHECK CHART EBDA0510

The specific gravity of battery electrolyte changes with temperature. Heat thins the solution and lowers the specific gravity. Cold thickens the solution and raises the specific gravity.

A fully charged battery should have a specific gravity between 1.260 and 1.280, with the electrolyte temperature at 26.7°C. The specific gravity reading must be corrected by adding 4 points (.004) for each 5.56°C above 26.7°C or subtracting 4 points for every 5.56°C below 26.7°C.

For example : The hydrometer reading is 1.280, and the electrolyte temperature reading is 5.56°C .

According to the chart below, the specific gravity must be lowered by 0.028 points. The true corrected reading is 1.252.

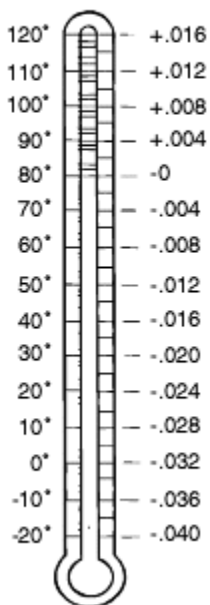
$$1.280 - 0.028 = 1.252$$

You should never take a hydrometer reading immediately after water has been added. The water and electrolyte must be mixed by either charging for a few minutes at a low rate or by allowing the battery to sit for an hour.

### CAUTION

**A difference of 50 points (0.050) or more between one or more cells indicates a defective battery. It should be replaced.**

ELECTROLYTE TEMPERATURE	SPECIFIC GRAVITY CORRECTION
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BATTERY CHARGE RATE EBDA0530

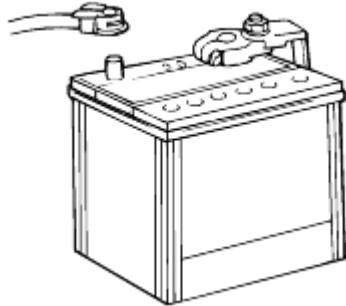
Specific gravity	Charge method	
	Slow charge (5A)	Fast charge (20A)
Below 1.100	14 hours	4 hours
100 - 1.130	12 hours	3 hours
130 - 1.160	10 hours	2.5 hours
160 - 1.190	8 hours	2.0 hours
190 - 1.220	6 hours	1.5 hours
Above 1.220	4 hours	1.0 hour

## BATTERY VISUAL INSPECTION (2) EBDA0550

1. Make sure ignition switch is in the OFF position and all accessories are OFF.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

### **CAUTION**

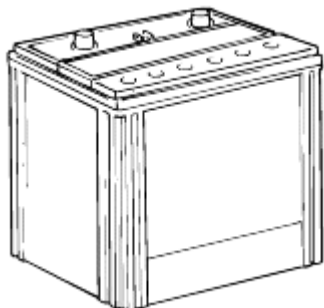
**Care should be taken in the event that the battery case is cracked or leaking, to protect your skin from the electrolyte. A suitable pair of rubber gloves (not household type) should be worn when removing the battery.**



4. Inspect the battery carrier for damage caused by the loss of acid from the battery. If acid damage is present, it will be necessary to clean the area with a solution of clean, warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described in step 4.
6. Inspect the battery case, and cover, for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post cleaner.
8. Clean the inside surface of the terminal clamps with a suitable battery terminal-cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure the top of the terminals are flush with the top of the post.
11. Tighten the terminal nut securely.
12. Coat all connections with light mineral grease after tightening.

**CAUTION**

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of the batteries being charged. A spark will occur where the circuit is broken. Keep all flames away from an open battery.



### 3.4 Starting System

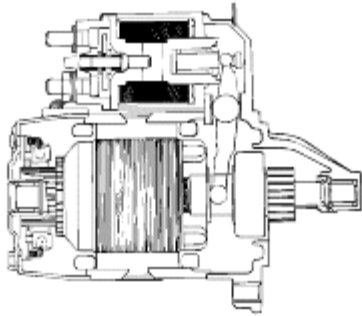
#### GENERAL INFORMATION EBD A0570

The starting system includes the battery, starter motor, solenoid switch, ignition switch, and inhibitor switch (A/T only), connection wires and the battery cables.

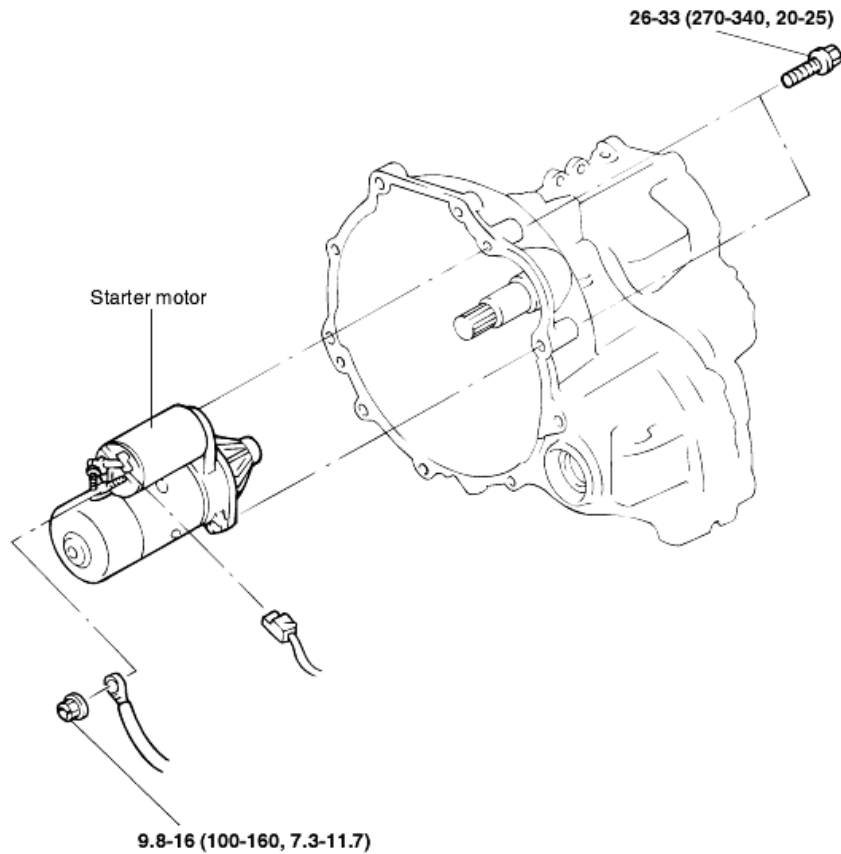
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks.

In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



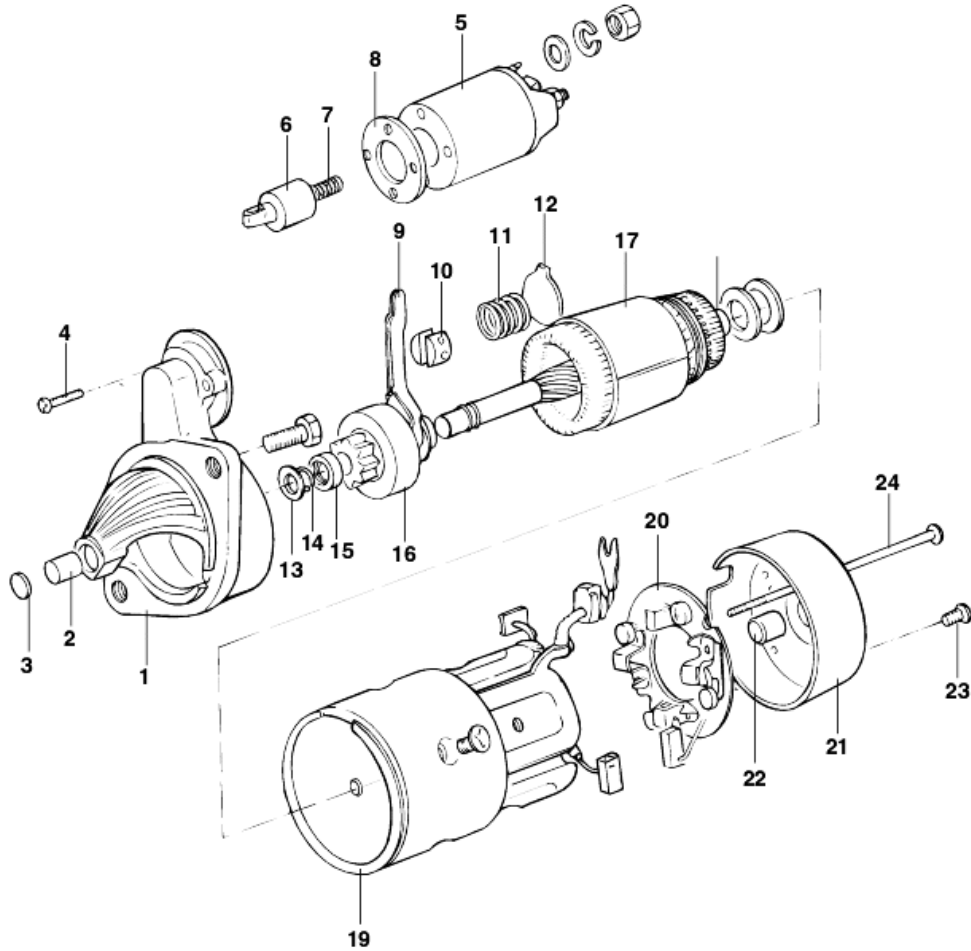
<b>TROUBLESHOOTING</b> Trouble condition	Probable cause	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Inspect wiring and fix
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Ignition wiring faulty	Repair or replace
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter &ebda057a;



**TORQUE : Nm (kg-cm, lb-ft)**

Disconnect the battery ground cable.

1. Remove the speedometer cable and the shift cable.
2. Disconnect the starter motor connector and terminal.
3. Remove the starter motor assembly.
4. Installation is the reverse order of removal.



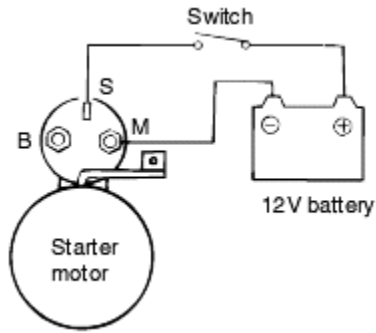
- |                  |                                 |                  |
|------------------|---------------------------------|------------------|
| 1. Front bracket | 9. Lever                        | 17. Armature     |
| 2. Front bushing | 10. Holder                      | 18. Washer       |
| 3. Cap           | 11. Spring                      | 19. Yoke ass'y   |
| 4. Screw         | 12. Packing                     | 20. Plate ass'y  |
| 5. Solenoid      | 13. Washer                      | 21. Rear cover   |
| 6. Plunger       | 14. Stop ring                   | 22. Rear bushing |
| 7. Spring        | 15. Stopper                     | 23. Screw        |
| 8. Packing       | 16. ORC<br>(Overrunning clutch) | 24. Bolt         |

PINION GAP ADJUSTMENT

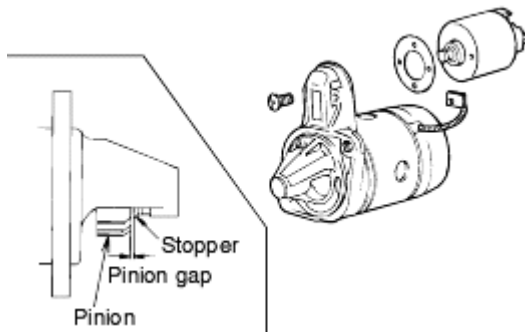
1. Disconnect the wire from the M-terminal.
2. Connect a 12V battery between the S-terminal and the M-terminal.
3. Set the switch to "ON", and the pinion will move out.

**CAUTION**

**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**



4. Check the pinion to stopper clearance (pinion gap) with a feeler gauge. If the pinion gap is out of specification, adjust by adding or removing washers between the solenoid and the front bracket.  
**PINION GAP : 0.5–2.0 mm (0.0197–0.079 in.)**



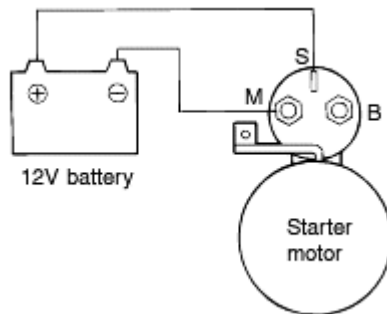
#### SOLENOID PULL-IN TEST

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal and M-terminal.

#### **CAUTION**

**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

3. If the pinion moves out, the pull-in coil is good. If it doesn't, replace the solenoid.



#### SOLENOID HOLD-IN TEST

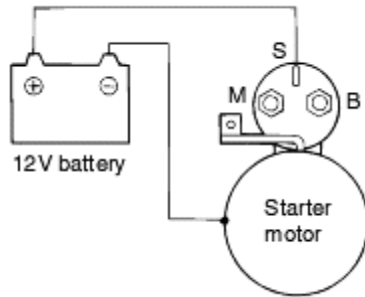
1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal and the body.

#### **CAUTION**



**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

3. If the pinion remains out, everything is in order. If the pinion moves in, the hold-in circuit is open. Replace the magnetic switch.



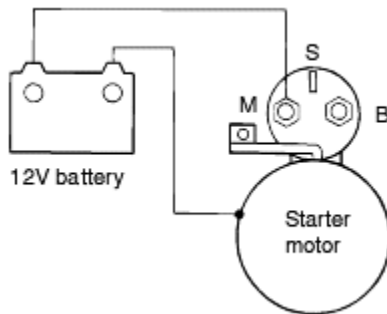
#### SOLENOID RETURN TEST

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the M-terminal and the body.

#### **CAUTION**

**This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.**

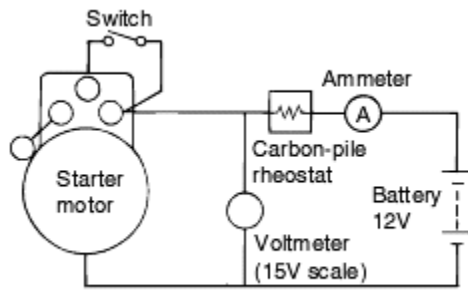
3. Pull out the pinion and then release it. If the pinion returns quickly to its original position, everything is in order. If it doesn't, replace the solenoid



#### PERFORMANCE TEST (NO-LOAD)

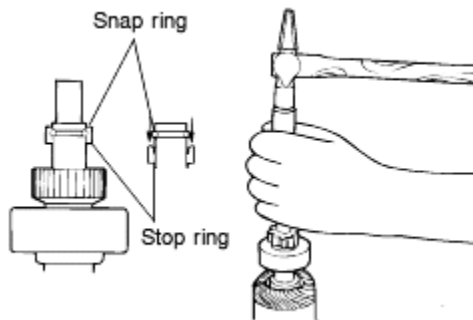
1. Make the no-load circuit test as shown.
2. After adjusting the rheostat until the battery voltage shown on the voltmeter reads 11.5 volts, confirm that the maximum amperage draw is within the specifications and that the starter motor turns smoothly and freely.

**CURRENT : 60A or less**



## DISASSEMBLY EBDA0630

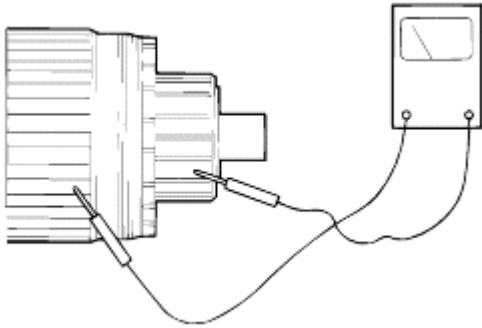
To remove the overrunning clutch from the armature shaft, the stop ring must be removed. Move the stop ring toward the pinion and remove the snap ring. Now the stop ring can be removed from the shaft.



## INSPECTION (After disassembly) EBDA0650

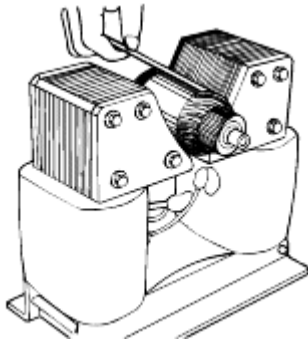
### ARMATURE COIL GROUND TEST

Using an ohmmeter, check to make sure that there is no continuity between the commutator and the armature coil core. If there is continuity, replace the armature assembly.



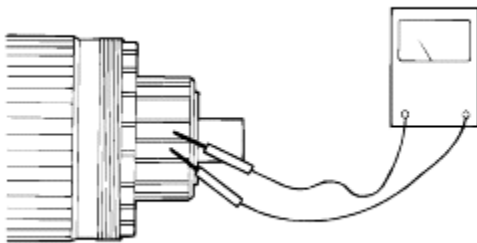
### ARMATURE COIL SHORT-CIRCUIT TEST

Test the armature coil in a growler. Replace the coil if there are signs of a short. If the blade attached to the core vibrates while the core is turned, the armature is shorted.



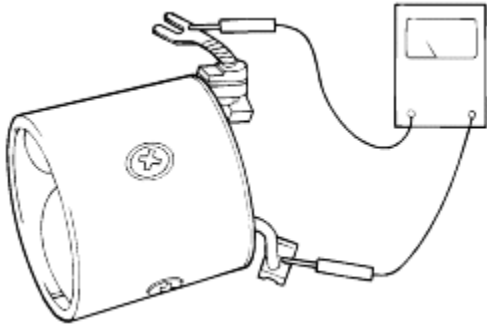
### ARMATURE COIL OPEN-CIRCUIT TEST

Using an ohmmeter, check for continuity between the commutator segments. If there is no continuity, the commutator segments are open. Replace the armature assembly.



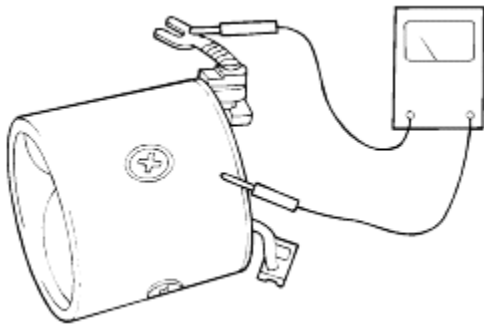
### FIELD COIL OPEN-CIRCUIT TEST

Using an ohmmeter, check the field coil for continuity. If there is no continuity, the field coil is open. Replace the field coil assembly.



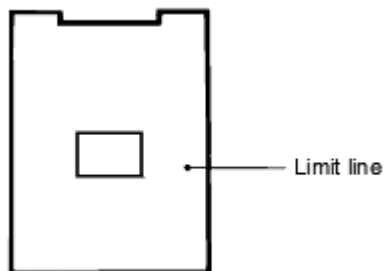
### FIELD COIL GROUND TEST

With the field coil mounted to the yoke, check for continuity between the field coil and the yoke using an ohmmeter. If there is continuity, replace the field coil.



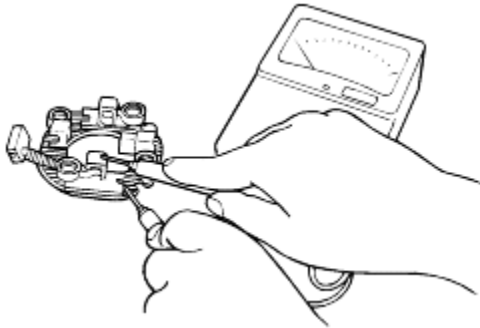
### BRUSH

A brush worn down to the wear limit line should be replaced.



### BRUSH HOLDER

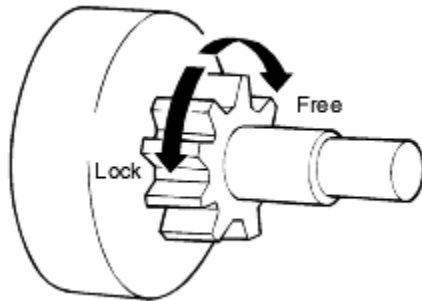
Check for continuity between the (+) side brush holder and brush holder base. If there is continuity, replace the holder assembly.



### OVERRUNNING CLUTCH

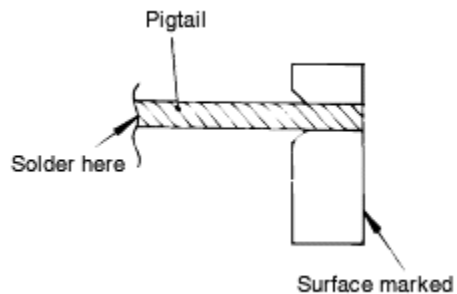
Inspect the pinion and spline teeth for wear or damage. Replace if damaged. Also inspect the flywheel ring gear for damage.

Rotate the pinion. It should turn freely in a clockwise direction, and lock when turned counter-clockwise.



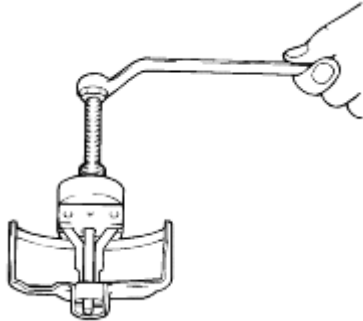
### BRUSH REPLACEMENT

1. Remove the worn brush while taking care not to damage the pigtail.
2. Sand the pigtail end with sandpaper to ensure a good soldering joint.
3. Solder the end of the pigtail.



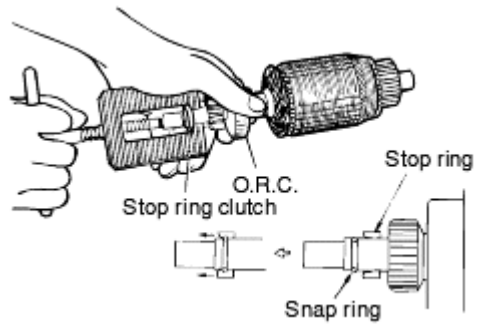
## REAR BRACKET BUSHING REPLACEMENT

1. Before the bushing is removed, measure and record the pressed-in position (depth) of the bushing.
2. The bushing can be removed by the use of a puller as shown in the illustration.
3. Press a new bushing in, up to the position recorded under Step. 1.



## REASSEMBLY EBDA0670

1. Install the overrunning clutch to the front end of the armature shaft.
2. Install the stop ring and the snap ring from the front end of the armature shaft. Push the stop ring all the way toward the snap ring.



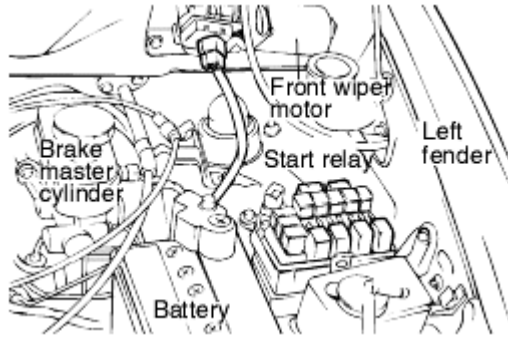
3. When the lever is mounted on the front bracket, pay attention to its direction. If it is mounted in a reverse direction, the pinion will remain in an outward position and fail to operate properly.



## CHECK STARTER RELAY EBTC0710

Remove the starter relay and check continuity between the terminals. If the continuity is not as specified, replace the relay.

Terminal	1	2	3	4	5
Condition					
When de-energized			○ ——— ○		
When energized	○ ——— ○		○ ——— ○		





## 4 Emission Control System

### 4.1 General

#### SPECIFICATIONS EETC0010

Components	Function	Remarks
Crankcase Emission System Positive crankcase ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System Evaporative emission canister EVAP Canister Purge Solenoid Valve	HC reduction	Duty controlsolenoid valve
Exhaust Emission System MFI system (air-fuel mixture control device) Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

MFI : Multi-port Fuel Injection

EVAP : Evaporative Emission

#### SERVICE STANDARD

Evaporative emission canister purge solenoid valve	
Coil resistance	36-44 $\Omega$ [at 20°C (68°F)]

#### TIGHTENING TORQUE

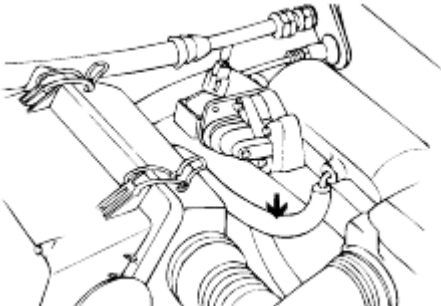
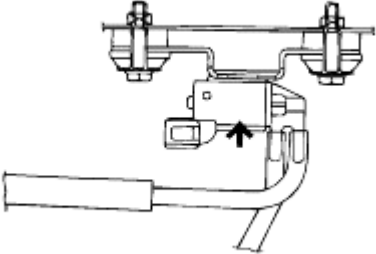
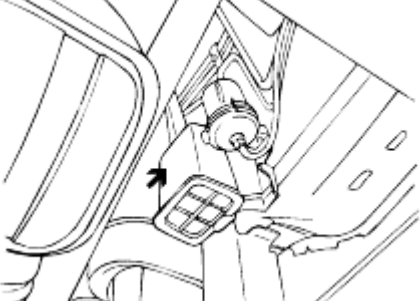
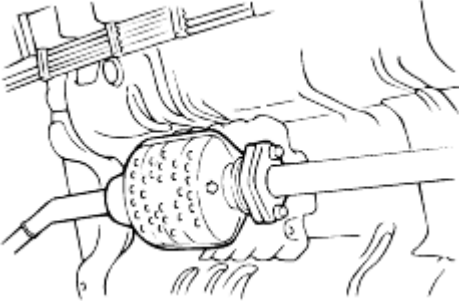
	Nm	kg.cm	lb.ft
Positive crankcase ventilation valve	8-12	80-120	6-8

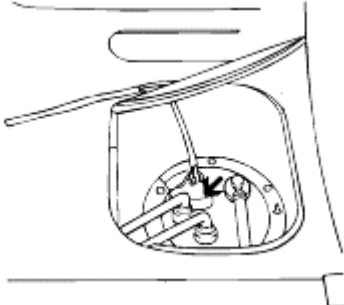
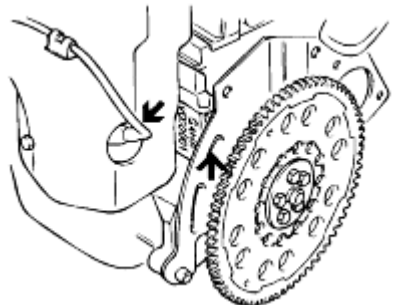
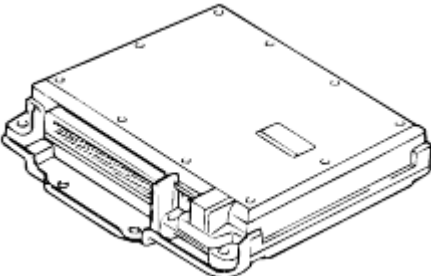
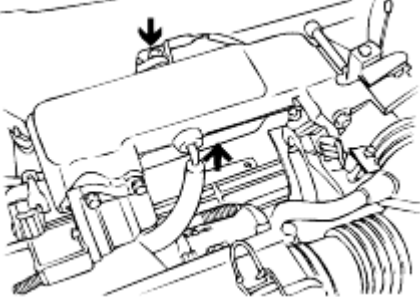
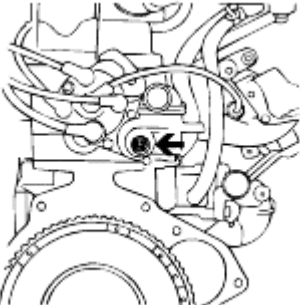
#### TROUBLESHOOTING

Symptom	Probable cause	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged Malfunction of the EVAP Canister Purge Solenoid Valve	Repair or replace Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged Malfunction of the PCV valve. Malfunction of the evaporative emission canister purge system	Repair or replace Replace Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

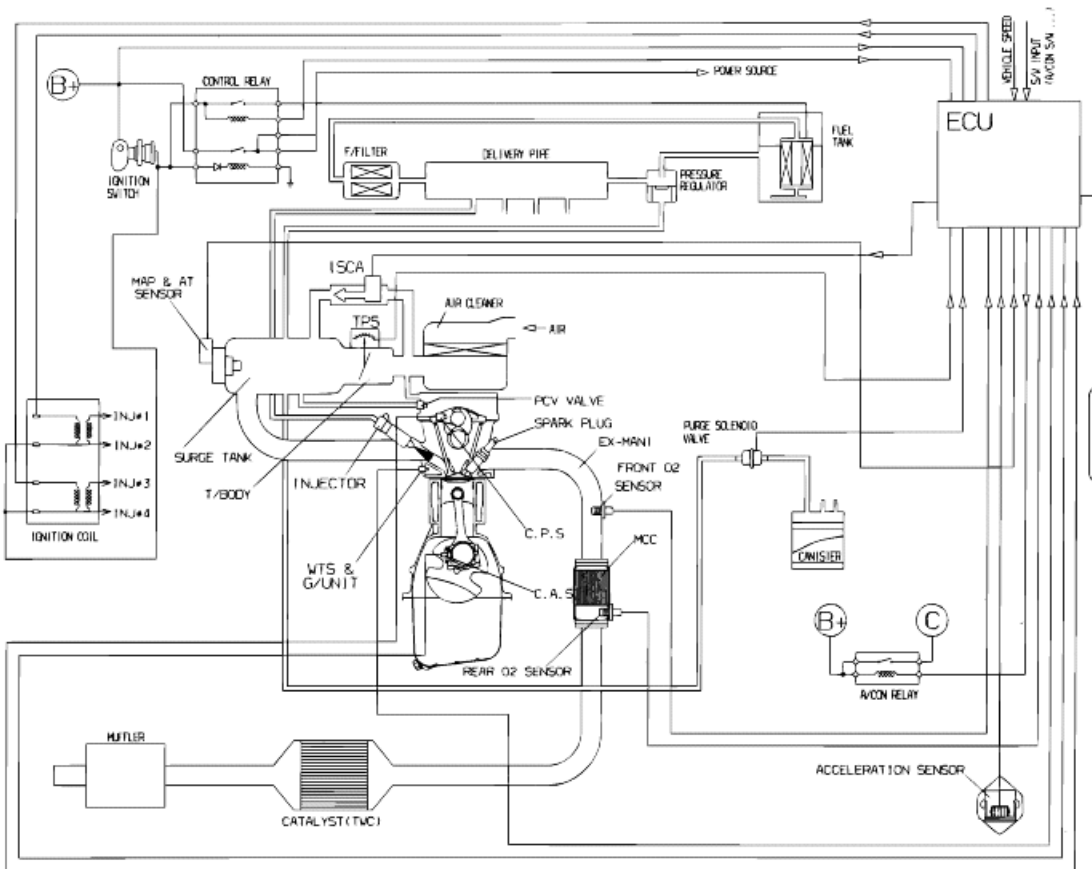
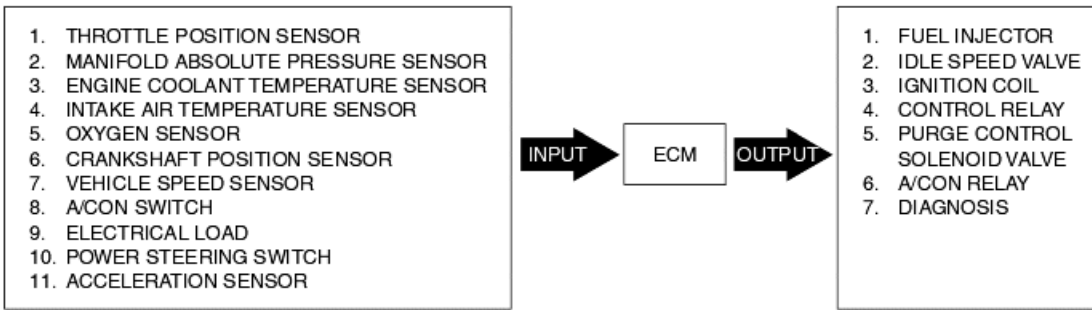
*NEEDS NEW PICTURE*

EMISSION CONTROLS LOCATION EETC0050

A. PCV valve	B. EVAP Canister Purge Solenoid Valve
 A line drawing of an engine compartment showing the PCV valve. The valve is a small cylindrical component mounted on the engine block. An arrow points to the valve's location.	 A line drawing of the EVAP Canister Purge Solenoid Valve. It is a rectangular component with two electrical terminals on top and a hose connection on the side. An arrow points to the valve's location.
C. Evaporative emission canister	D. Three way catalytic converter
 A line drawing of the evaporative emission canister. It is a rectangular, box-like component with a filter on top. An arrow points to the canister's location in the engine compartment.	 A line drawing of a three-way catalytic converter. It is a cylindrical component with a textured surface. An arrow points to the converter's location in the exhaust system.

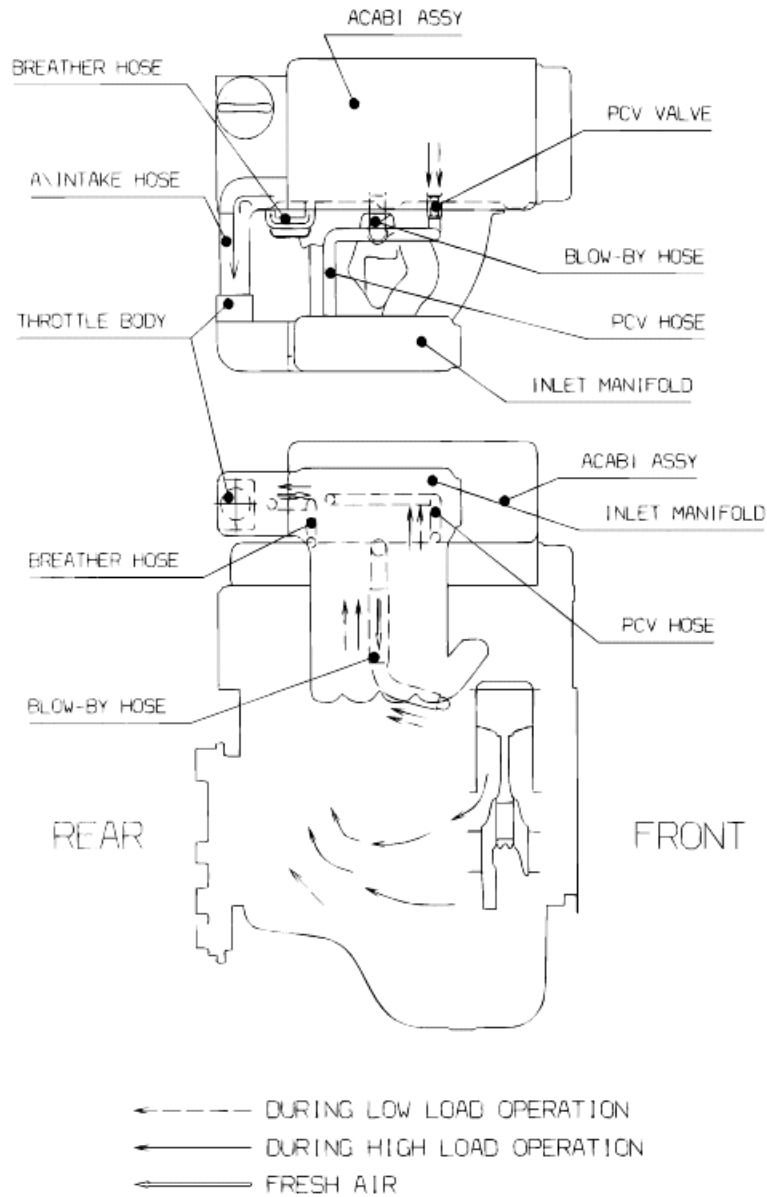
E. Two-way valve	F. Oxygen sensor
	
G. ECM	H. MAP sensor & IAT sensor
	
I. ECT sensor	
	

SCHEMATIC DRAWING [EOBD, BOSCH EMS] EETC0060

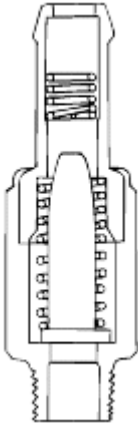
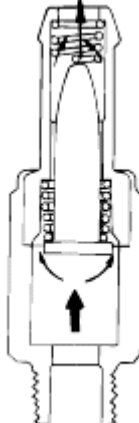
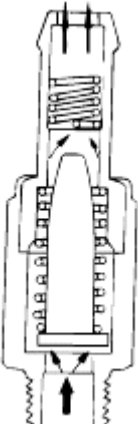
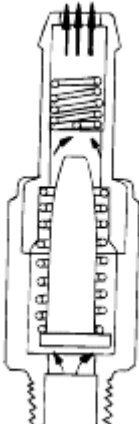


## 4.2 Crankcase Emission Control System

CRANKCASE EMISSION SYSTEM EETC0090



PCV VALVE OPERATING EEA90140

Intake manifold side (No vacuum)		Intake manifold side (High vacuum)	
			
Rocker cover side		Rocker cover side	
Engine condition	Not running	Engine condition	Idling or decelerating
PCV valve	Not operating	PCV valve	Fully operating
Vacuum passage	Restricted	Vacuum passage	Small
Intake manifold side (Moderate vacuum)		Intake manifold side (Low vacuum)	
			
Rocker cover side		Rocker cover side	
Engine condition	Normal operation	Engine condition	Accelerating and high load
PCV valve	Properly operating	PCV valve	Slightly operating
Vacuum passage	Large	Vacuum passage	Much large

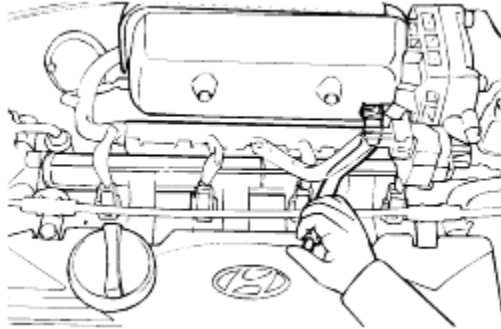
## REMOVAL EEDA0100

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that the intake manifold vacuum can be felt.

### NOTE

The plunger inside the PCV valve will move back and forth.

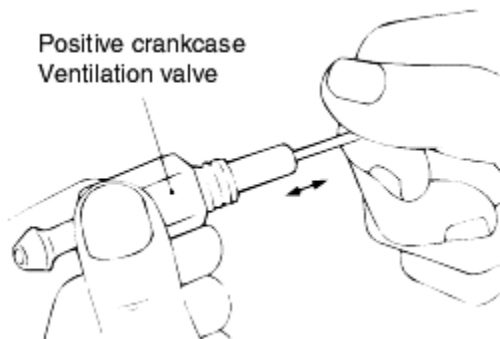
3.



4. If the vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent or replace if necessary.

## INSPECTION

1. Remove the PCV valve.
2. Insert a thin stick into the PCV valve from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



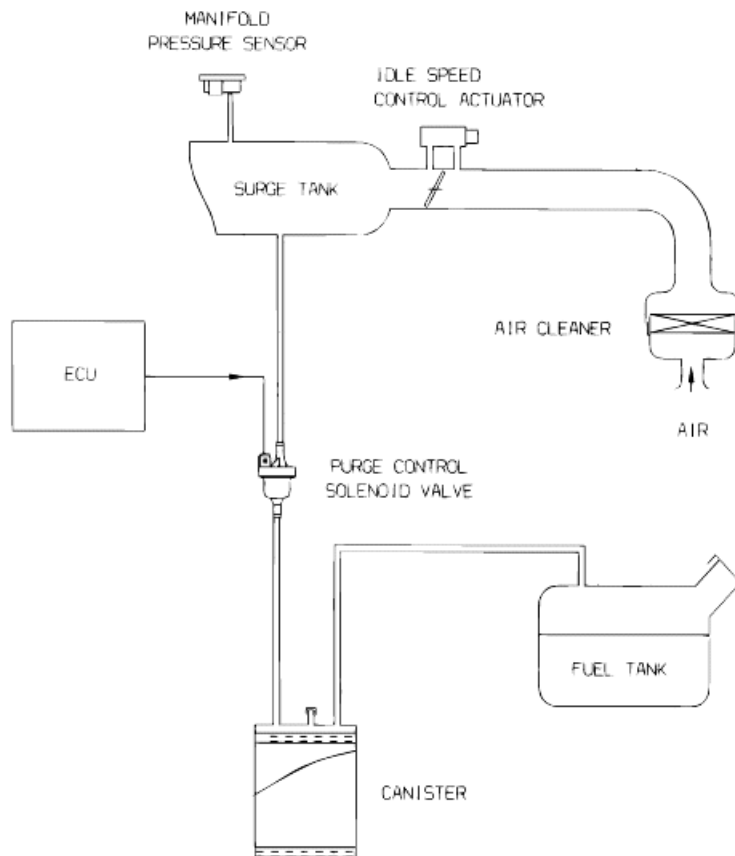
## INSTALLATION

Install the PCV valve and tighten to specified torque.

PCV valve tightening torque: 8-12 Nm (80-120 kg.cm, 5.8-8.7 lb.ft)

### 4.3 Evaporative Emission Control System

#### EVAPORATIVE EMISSION SYSTEM EETC0110





## CHECKING EETC0170

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60° C(140° F) or below] and when it is warm [engine coolant temperature 80° C(176° F) or higher].

When engine is cold

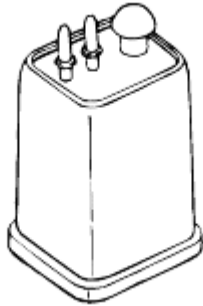
Engine operating condition	Applied vacuum	Result
Idling 3,000 rpm	50 kPa (7.3 psi)	Vacuum is held

When engine is warm

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released.

## INSPECTION EETC0180

1. Look for loose connections, sharp bends or damage to the fuel vapour lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the EVAP canister, inspect for cracks or damage.

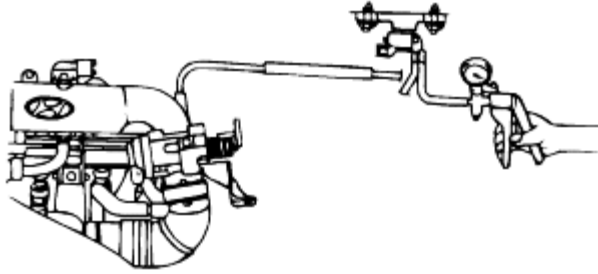


## INSPECTION EETC0190

### NOTE

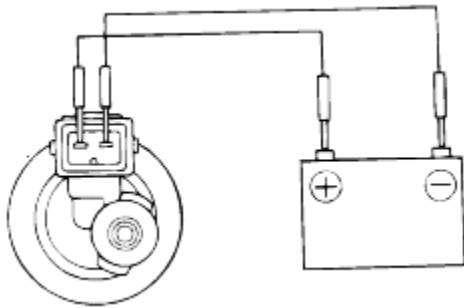
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-stripped vacuum hose was connected.



4. Apply vacuum and check when voltage is applied to the evaporative emission canister purge solenoid valve and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released.
When discontinued	Vacuum is maintained.

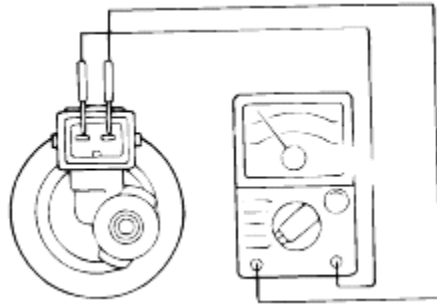


5. Measure the resistance between the terminals of the solenoid valve.

Evaporative emission canister purge solenoid valve

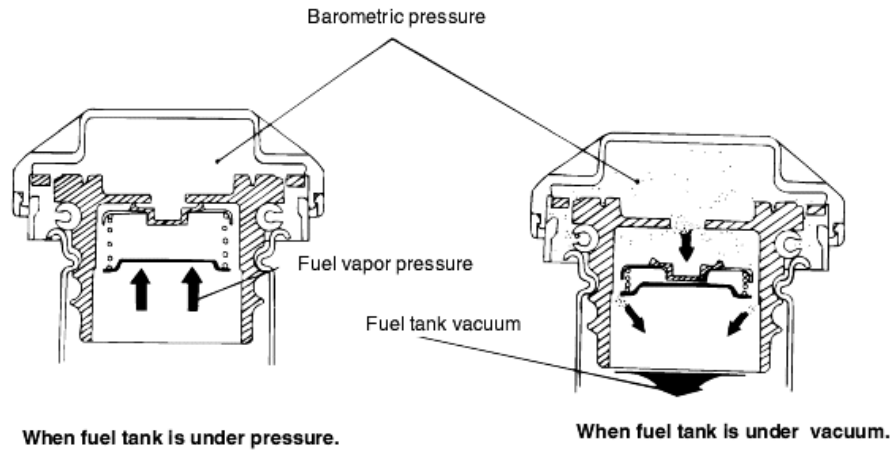
Coil resistance:

36-44  $\Omega$ [at 20° C(68° F)]



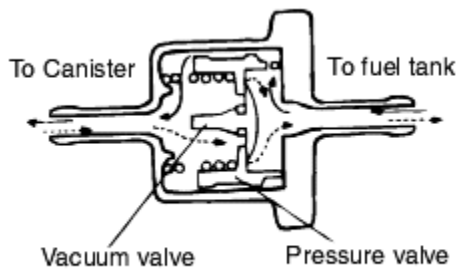
## FUEL FILLER CAP EEDA0150

The fuel filler cap is equipped with a vacuum relief valve to prevent the escape of fuel vapour into the atmosphere.



## TWO-WAY VALVE EETC0240

To inspect the Two-way valve, refer to Group FL-Fuel tank.



## **4.4 Exhaust Emission Control System**

### **EXHAUST EMISSION CONTROL SYSTEM EEDA0180**

Exhaust emissions (CO,HC,and NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.

These items have been integrated into a highly effective system, which controls exhaust emissions while maintaining good drive-ability and fuel economy.

### **AIR/FUEL MIXTURE CONTROL SYSTEM [Multi-port Fuel Injection (MFI) System]**

EEDA0190

The MFI system is a system, which uses the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three-way catalyst. The three-way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

## 5 Fuel System

### 5.1 General

#### SPECIFICATIONS EFTC0010

Items	Specifications
<b>Fuel tank</b> Capacity Fuel filter Fuel pump Throttle body Throttle position sensor (TP Sensor) Resistance Output voltage at curb idle	35 lit. (9.2 U.S. gal., 7.7 Imp.gal.) High pressure type Electrical, in-tank type  Variable resistor type 0.7 - 3.0 k $\Omega$ 0.1 - 0.875V
<b>Input sensors</b> Manifold absolute pressure (MAP) sensor Type Output voltage Knock sensor Intake Air Temperature sensor (IAT Sensor) Resistance EVAP Canister Purge solenoid valve Resistance Engine coolant temperature sensor (ECT Sensor) Resistance  Heated oxygen sensor (HO2S) Output voltage (V) Vehicle speed sensor Camshaft position sensor (CMP Sensor) Output voltage (V) Crankshaft position sensor (CKP Sensor) Output frequency (Hz)	Piezo-Resistivity type 0 - 5V Piezoelectric type Thermistor type 2.0 - 3.0 k $\Omega$ at 20°C (68°F) Duty type 26 $\Omega$ Thermistor type 1.0 - 4.0k $\Omega$ at 20°C (68°F) 0.24 - 0.40k $\Omega$ at 80°C (176°F) Zirconia sensor (Heated) 0 - 1V Reed switch type Hall effect sensor 0 - 5V Magnetic inductive type Idle rpm : 750 - 950Hz 3000 rpm : 2700 - 3300Hz
<b>Output actuators</b> Injector Type Number Coil resistance ( $\Omega$ ) Fuel pressure regulator Regulator pressure Idle speed control actuator (ISC Actuator) Type Control frequency (Hz)	Electromagnetic type 4 15.9 $\pm$ 0.35 $\Omega$ 350 kPa (3.5 kg/cm <sup>2</sup> , 49.8 psi)  Double coil type 100Hz

## SERVICE STANDARD

Items		Standard value
Basic ignition timing		BTDC $8^{\circ} \pm 5^{\circ}$
Curb idle speed (rpm)	Normal	$850 \pm 100$
	Electrical load	$900 \pm 100$
	A/con ON	$900 \pm 100$
	Electrical load & A/con ON	$1000 \pm 100$


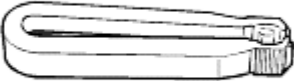

## SEALANT

Engine coolant temperature sensor assembly	LOCTITE 962T or equivalent
Engine coolant temperature sender	Three bond No.2310 or equivalent

## TIGHTENING TORQUE

Items	Nm	Kg·cm	lb·ft
Delivery pipe installation bolts	10 - 15	100 - 150	7 - 11
Heated oxygen sensor	50 - 60	500 - 600	37 - 44
Crankshaft position sensor installation bolts	9 - 11	90 - 110	7 - 8
Knock sensor installation bolt	16 - 25	160 - 250	12 - 18
Engine coolant temperature sensor	15 - 20	150 - 200	11 - 15
Throttle position sensor installation bolts	1.5 - 2.5	15 - 25	1.1 - 1.8
Throttle body to surge tank bolts	15 - 20	150 - 200	11 - 15

SPECIAL TOOLS EFTC0030

Tool (Number and name)	Illustration	Application
09353-24100 Fuel pressure gauge & hose		Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure.
09353-02000 Quick connector remover		Remover of quick connector in delivery pipe and return pipe.
09353-02100 Fuel pressure gauge adapter		Use with fuel pressure gauge when measuring the fuel pressure.



## BASIC TROUBLESHOOTING EFDA0050

When checking for engine trouble, it is important to start with an inspection of the basic systems. If one of the following conditions exists; (A) engine start failure, (B) unstable idling or (C) poor acceleration, begin by checking the following basic systems:

1. Power supply
  - Battery
  - Fusible link
  - Fuse
2. Body ground
3. Fuel supply
  - Fuel line
  - Fuel filter
  - Fuel pump
4. Ignition system
  - Spark plug
  - High-tension cable
  - Ignition coil
5. Emission control system
  - PCV system
  - Vacuum leak
6. Others
  - Ignition timing
  - Idle speed

Trouble with the MFI system is often caused by poor contact of the harness connectors. It is important to check all harness connectors and verify that they are securely connected.

TROUBLESHOOTING GUIDE CHART EFDA0070

Main Symptoms	STARTING							Poor Idling					Poor Driving	
	Unable to start			Difficult to start				Incorrect fast idle	High idle speed	Low idle speed	Rough idling	Engine hesitates or accelerates poorly	Surging	Knocking
Sub-Symptoms	Engine does not turn over	Starter runs but engine does not turn over	Incomplete combustion	Engine turns over	Always	When the engine is cold	When the engine is hot							
Check points														
Starter relay	1													
Starter	2	2		1										
Park/Neutral SW [A/T] or Clutch start SW [M/T]	3													
Flywheel [M/T] or Drive plate [A/T]		4												
Mass air flow sensor circuit			3						3	10	7			
Idle speed control actuator			4	3	3	3	3	3	2	7			2	
Fuel pressure regulator			5	5	5	5				4	11	1		
ECT sensor circuit			6	4	1	1	2	2	1	2	8	6		
Compression			7	8						8	5			
Piston rings			8	9						9				
Ignition timing				10						11	14			
Timing mark			9							12				
Injectors			10	13	8	8		7	4	13	15	4		
PCM			11	14	9	9	4	8	5	14	16	5		
A/C circuit				2				6						
Connecting rod bearing				3										
Crankshaft bearing				4										
Fuel quality				1	2	2				1	3	3		
Spark plugs				2						3	4	2		
Fuel pump				6	6	6				5	12			
Fuel lines				7	7	7				6	13			
Ignition circuit			2	11									3	
Intake air temp. sensor circuit				12	4	4		4			9		1	
Accelerator pedal link							1	1						
TP Sensor circuit								5			6			
Cylinder head										15				
Clutch [M/T]											1			
Brakes not releasing properly											2			
Oxygen sensor circuit											10			
Crankshaft position sensor		3												
Battery voltage		1	1											

Check points	Main Symptoms	Engine Stalls				Others			Refueling
	Sub-Symptoms	Soon after starting	After accelerator pedal is depressed	After accelerator pedal is released	During A/C ON	Excessive fuel consumption	Engine overheats	Engine too cool	Hard to refuel Overflowing spit-Back
Fuel quality		1							
Fuel pressure regulator		2	4			2			
Fuel pump		3							
Fuel lines		4	5						
ISC actuator		5		1	2				
MAF sensor circuit		6	1	2		13			
ECT sensor circuit		7				11			
Injectors		8	6			10			
ECM		9	7	3	3	17			
TP Sensor circuit			2			12			
Spark plug			3			6	8		
A/C circuit					1	14			
Fuel leakage						1			
Accelerator pedal link						3			
Clutch [M/T]						4			
Brakes drag when pedal released						5			
Compression						7			
Piston ring						8			
Ignition timing						9			
Oxygen sensor circuit						15			
Intake air temp. sensor circuit						16			
Coolant leakage							1		
Cooling fan							2	1	
Thermo switch							3		
Radiator and radiator cap							4	2	
Thermostat							5		
Timing belt							6		
Engine coolant pump							7		
Oil pump							9		
Cylinder head							10		
Cylinder block							11		
ECT sender							12	3	
Crankshaft position sensor		11	8	4	4				
Fill vent valve hose-clogging									1
Canister filter-Contamination									2
Fuel shut off valve-operation									3

**NOTE**

The number herein means the check order.

IDLE SPEED

**NOTE**

**Before adjusting, check that the spark plugs, injectors, idle speed control actuator (ISC actuator), compression etc. are normal.**

Check Conditions

- Engine coolant temperature is 80 to 95°C (176 to 205°F).
  - Lights, electric cooling fan and all accessories are off.
  - Transaxle is in neutral ("P" or "N" range for A/T vehicles).
  - Steering wheel is in a straight, forward position (Vehicles with power steering).
1. Install a tachometer to the primary coil side or connect the scan tool to the data link connector.
  2. Start and run the engine at curb idle speed.
  3. Run the engine for more than 5 seconds at an engine speed of 2,000 to 3,000 rpm.  
Then, run the engine at idle for 2 minutes.
  4. Read the idling rpm.  
Idle speed 850 ± 100 rpm

## FUEL PUMP OPERATING CHECK EFTC0110

1. Turn the ignition switch OFF.
2. Apply battery voltage to the fuel pump drive connector to check that the pump operates.

**NOTE**

**The fuel pump is an in-tank type and its operation is hard to hear without removing the fuel tank cap.**

3. Pinch the hose to check that fuel pressure is felt.



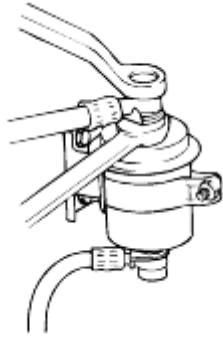
## FUEL PRESSURE TEST EFTC0130

1. Reduce the internal pressure of the fuel pipes and hoses by the following procedures.
  - Disconnect the fuel pump harness connector.
  - Start the engine and after it stops by itself, turn the ignition switch to the OFF position.
  - Disconnect the battery negative (-) terminal.
  - Connect the fuel pump harness connector.
2. Remove the upper eye bolt while holding the fuel filter nut securely.

### **CAUTION**

**Cover the hose connection with a shop towel to prevent splashing of fuel caused by fuel residual pressure in the fuel line.**

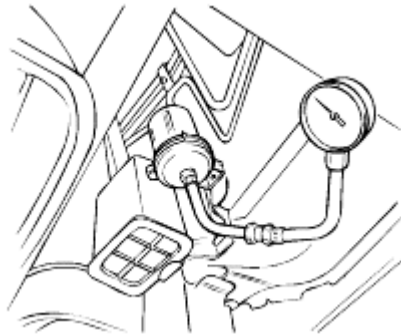
3.



4. Using the fuel pressure gauge adapter (09353-24000, 09353-24100, 09353-24200), install the fuel-pressure gauge to the fuel filter. Tighten the bolt to the specified torque.

### **Tightening Torque**

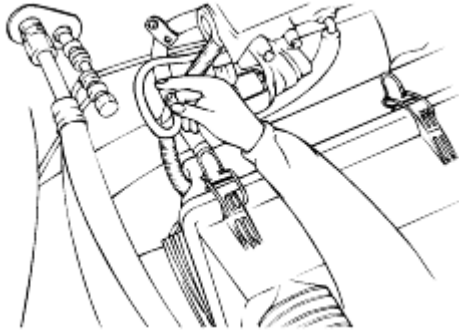
Fuel pressure gauge to fuel filter :  
25 - 35 Nm (250 - 350 kg·cm, 18 - 26 lb·ft)



5. Connect the battery's negative (-) terminal.
6. Apply battery voltage to the terminal for the pump drive and activate the fuel pump: then, with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
7. Start the engine and let it idle.

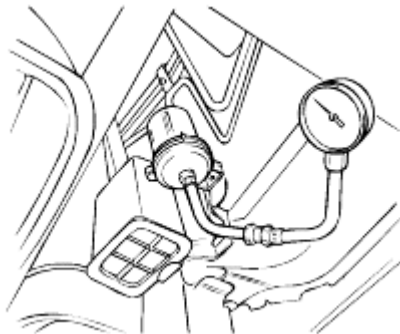
8. Disconnect the vacuum hose from the pressure regulator, and plug the hose end. Measure the fuel pressure.

**Standard valve :** 300 kPa (3.06 kg/cm<sup>2</sup>, 44.37 psi)



9. Measure the fuel pressure when the vacuum hose is connected to the pressure regulator.

**Standard valve :** Approx. 255 kPa (2.57 kg/cm<sup>2</sup>, 37 psi)



10. If the results of the measurements made in steps (6) and (7) are not within the standard valve, use the below table to determine the probable cause, and make the necessary repairs.

Condition	Probable cause	Remedy
Fuel pressure too low	<ul style="list-style-type: none"> <li>a. Clogged fuel filter.</li> <li>b. Fuel leak on the return side, caused by poor seating of the fuel-pressure regulator.</li> <li>c. Low discharge pressure of the fuel pump</li> </ul>	<ul style="list-style-type: none"> <li>d. Replace fuel filter.</li> <li>e. Replace fuel pressure regulator.</li> <li>f. Check the in-tank fuel hose for leakage or replace the fuel pump.</li> </ul>
Fuel pressure too high	<ul style="list-style-type: none"> <li>g. Sticking fuel-pressure regulator.</li> <li>h. Clogged or bent fuel return hose or pipe.</li> </ul>	<ul style="list-style-type: none"> <li>i. Replace fuel pressure regulator.</li> <li>j. Repair or replace hose or pipe.</li> </ul>
There is no difference in fuel pressure when the	<ul style="list-style-type: none"> <li>k. Clogging, or damaged vacuum hose or the</li> </ul>	<ul style="list-style-type: none"> <li>m. Repair or replace the vacuum hose or the</li> </ul>

vacuum hose is connected and when it is not.	nipple.  l. Sticking or poor seating of the fuel pressure regulator.	nipple  n. Repair or replace hose or pipe.
--	--	--

11. Stop the engine and check for a change in the fuel pressure gauge reading, which should hold for approximately 5 minutes. If the gauge indication drops, observe the rate of drop. Determine and remove the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	. Injector leakage	a. Replace injector
Fuel pressure drops immediately after engine is stopped	b. The check valve within the fuel pump is open	c. Replace fuel pump

12. Reduce the pressure in the fuel line.  
13. Disconnect the hose and the gauge.

**CAUTION**

**Cover on the hose connection with a shop towel to prevent splashing of fuel caused by fuel residual pressure in the fuel line.**

14. Replace the O-ring of the end of the hose.  
15. Connect the fuel hose to the delivery pipe and tighten with the specified torque.  
16. Check for fuel leakage.



## MFI SYSTEM INSPECTION EFTC0150

If the MFI system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor drive-ability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the MFI system components with the HI-SCAN.

### NOTE

- **Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.**
- **Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.**
- **The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.**
- **When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.**
- **When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.**

Malfunction Indicator Lamp (MIL)

### [ EOBD ]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turn on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Catalyst
- Fuel system
- Manifold absolute pressure sensor (MAP sensor)
- Intake Air Temperature Sensor
- Engine Coolant Temperature Sensor
- Throttle Position Sensor
- Upstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Upstream Oxygen Sensor Heater

- Injector
- Misfire
- Crankshaft Position Sensor
- Camshaft Position Sensor
- Evaporative Emission Control System
- Vehicle Speed Sensor
- Idle Control Valve
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage



**[ EXCEPT EOBD ]**

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Manifold absolute pressure sensor (MAP sensor)
- Throttle position sensor (TP Sensor)
- Engine coolant temperature sensor (ECT Sensor)
- Idle speed control actuator (ISC Actuator)
- Injectors
- ECM



## INSPECTION

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.
2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

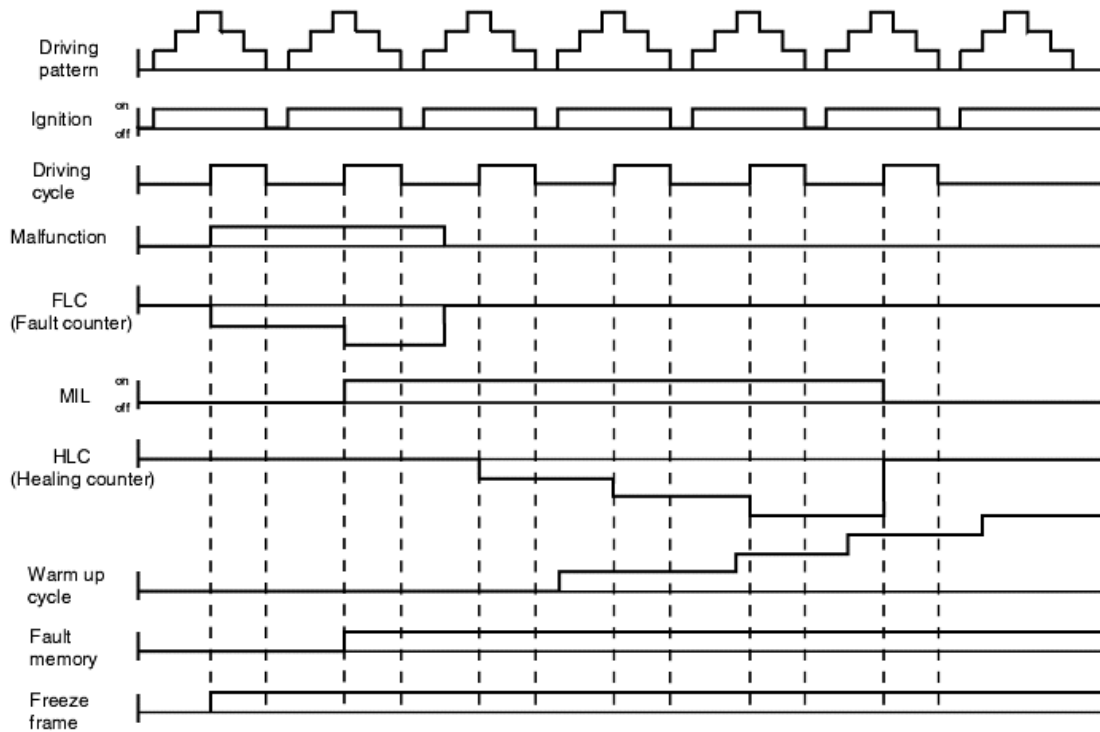
## Self-Diagnosis

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN. Diagnostic trouble codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or the engine control module (ECM) connector is disconnected or by HI-CAN.

## NOTE

**If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.**

## The Relation Between DTC and Driving Pattern in EOBD System EFTC0170



1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.  
If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.
4. A diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

### NOTE

- A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degrees Fahrenheit.
- A "driving cycle" consists of engine start-up, vehicle operation beyond the beginning of closed loop operation.

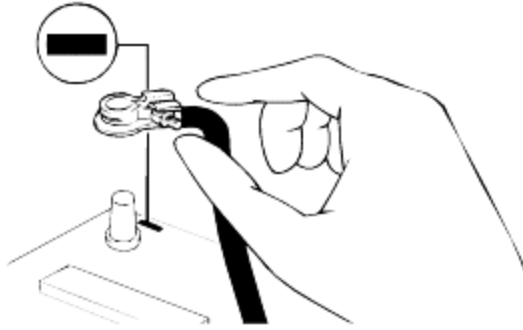
INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES EFTC0190

[ EOBD, BOSCH EMS ] Fault Code No.	Comment	Component	MIL on
P0105	MAP sensor malfunction	MAP Sensor	Yes
P0112	Intake air temp. circuit low input	Intake Air Temperature Sensor	Yes
P0113	Intake air temp. circuit high input		
P0116	Eng.coolant temp.circuit range	Engine Coolant Temperature Sensor	Yes
P0117	Eng.coolant temp.circuit low input		
P0118	Eng.coolant temp.circuit high input		
P0121	TPS circuit range (TPS voltage does not agree with MAF sensor)	Throttle Position Sensor	No
P0122	TPS circuit low input		Yes
P0123	TPS circuit high input		
P0130	O2 sensor circuit malfunction	Upstream Oxygen Sensor	Yes
P0131	O2 sensor circuit low voltage		
P0132	O2 sensor circuit high voltage		
P0133	O2 sensor circuit slow response		
P0134	O2 sensor circuit no activity detected		
P0135	O2 sensor heater circuit malfunction		
P0136	O2 sensor circuit malfunction	Downstream Oxygen Sensor Heater	Yes
P0137	O2 sensor circuit low voltage		
P0138	O2 sensor circuit high voltage		
P0141	O2 sensor heater circuit malfunction	Downstream Oxygen Sensor	Yes
P0201	Injector cyl. 1, circuit malfunction	Injector	Yes
P0202	Injector cyl. 2, circuit malfunction		
P0203	Injector cyl. 3, circuit malfunction		
P0204	Injector cyl. 4, circuit malfunction		
P0230	Fuel pump relay malfunction	Fuel Pump Relay	No
P0300	Random misfire detected	Catalyst damage (you should repair immediately)	Yes and Blinking
P0301	Cylinder 1 misfire detected		
P0302	Cylinder 2 misfire detected		
P0303	Cylinder 3 misfire detected		
P0304	Cylinder 4 misfire detected		
P0326	Knock sensor circuit range	Knock Sensor	No
P0335	Crankshaft position sensor circuit malfunction	Crankshaft Position Sensor	Yes
P0336	Crankshaft position sensor circuit range Random		
P0342	Camshaft position sensor circuit low input	Camshaft Position Sensor	Yes
P0343	Camshaft position sensor circuit high input		
P0422	Manifold catalyst efficiency, below	Catalyst	Yes

	threshold		
P0444	Purge control valve circuit open	Evaporative Emission Control System	Yes
P0445	Purge control valve circuit shorted		
P0501	Vehicle speed sensor range	Vehicle Speed Sensor	Yes
P0506	Idle rpm lower than expected	Idle Control Valve	Yes
P0507	Idle rpm higher than expected		
P0562	System voltage low	Alternator	Yes
P0563	System voltage high		
P0606	Internal control module ROM error	ECM	Yes
P1123	Long term fuel trim additive air, system too rich	Fuel System	Yes
P1124	Long term fuel trim additive, air system too lean		
P1127	Long term fuel trim multiplicative, system too rich		
P1128	Long term fuel trim multiplicative, system too lean		
P1510	Idle control valve opening coil circuit shorted	Idle Control Valve	Yes
P1513	Idle control valve opening coil circuit open		
P1552	Idle control valve closing coil circuit shorted		
P1553	Idle control valve closing coil circuit open		
P1529	Transmission Control Module error code	TCM	Yes
P1586	Encoding signal circuit not rational	MT/AT Encoding	Yes
P1605	Acceleration sensor circuit malfunction	Acceleration Sensor	Yes
P1606	Acceleration sensor not rational		
P1611	MIL request signal circuit low input	MIL-on Request Line	Yes
P1613	MIL request signal circuit high input		
P1610	SMATRA error	Immobilizer	No
P1800	Antenna error		
P1801	Transponder error		
P1803	ECU signal error		
P1805	EEPROM error		
P1624	Radiator Fan low	Radiator Fan	Yes
P1625	Radiator Fan high		
P1765	Torque reduction signal malfunction	-	No

## FUEL FILTER REPLACEMENT EFTC0230

1. Reduce the internal pressure of the fuel lines and hoses by completing the following operations.
  - Disconnect the fuel pump harness.
  - Start the engine. Allow it to stop by itself, then turn the ignition switch OFF.
  - Disconnect the battery negative (-) terminal.
  - Connect the fuel pump harness connector.



2. Remove the eyebolts while holding the fuel filter nuts securely.

### **CAUTION**

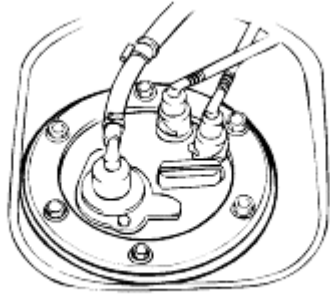
**Cover the fuel filter with a shop towel to avoid residual gasoline from splashing.**

3. Remove the fuel filter mounting bolts, then remove the fuel filter from the fuel filter clamp.
4. After replacing the fuel filter, check for fuel leaks.

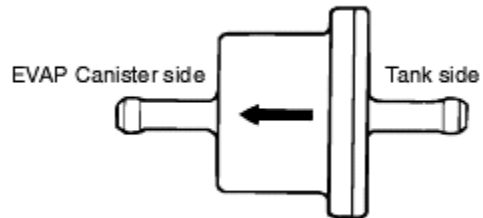


## OVERFILL LIMITER (TWO-WAY VALVE) REPLACEMENT EFTC0250

1. Disconnect the vapour hoses, and then remove the overfill limiter.

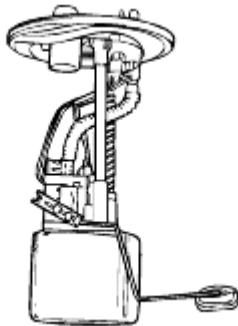


2. Connect the overfill limiter in the correct direction.



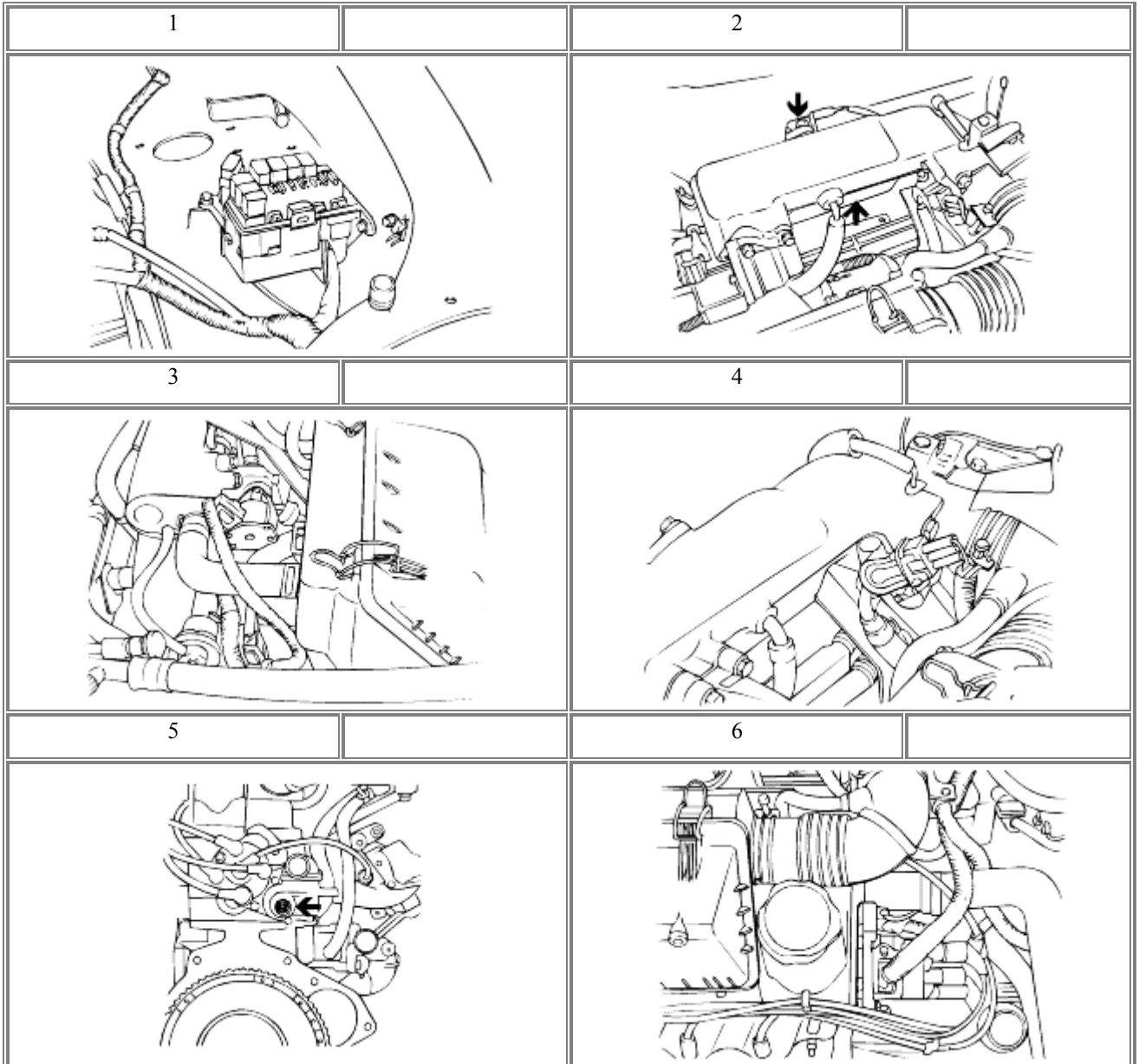
## FUEL SENDER REPLACEMENT EFTC0270

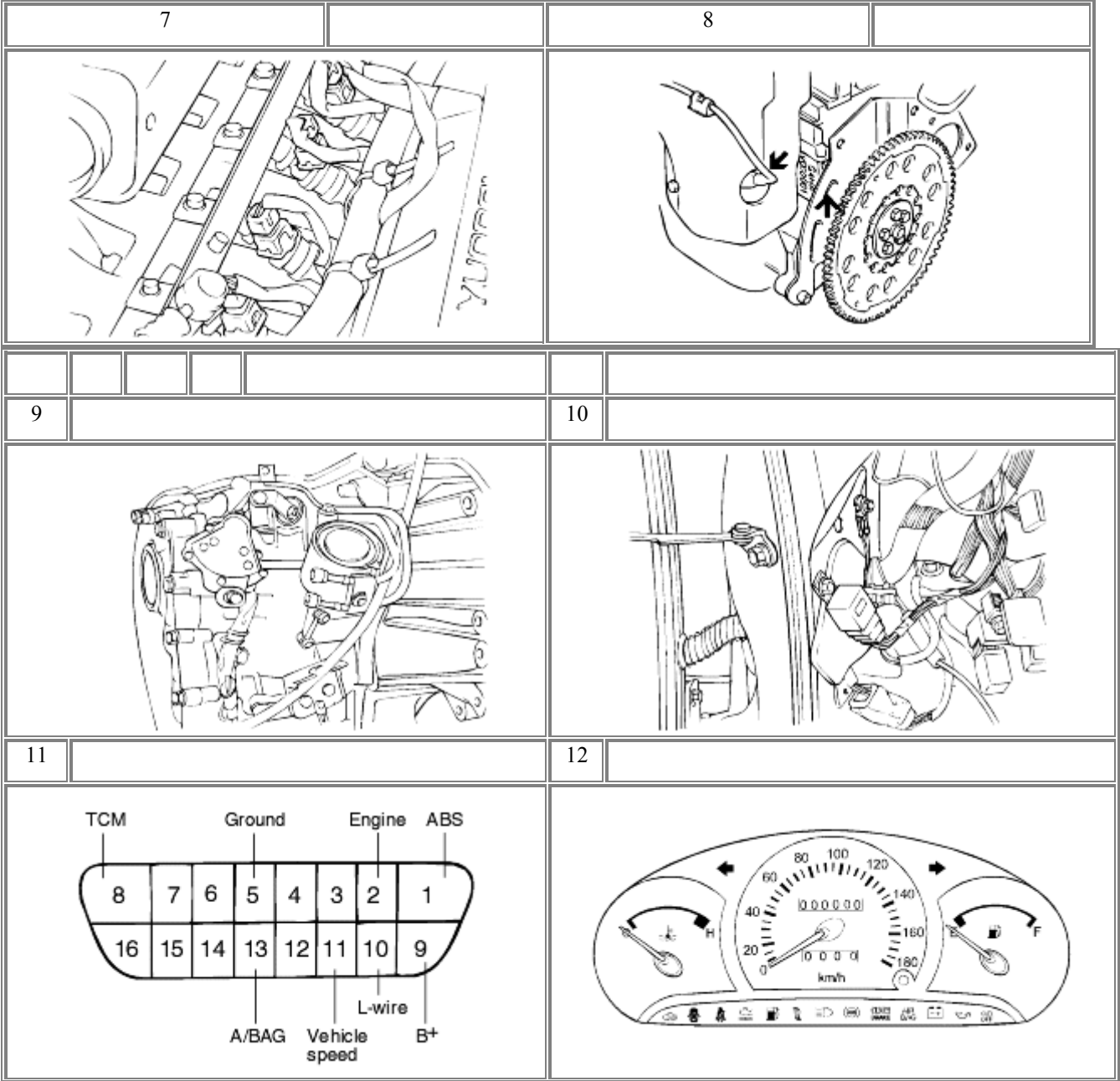
1. Remove the fuel tank cap to lower the fuel tank's internal pressure.
2. Remove the fuel sender installation screws, then remove the fuel sender from the fuel tank.

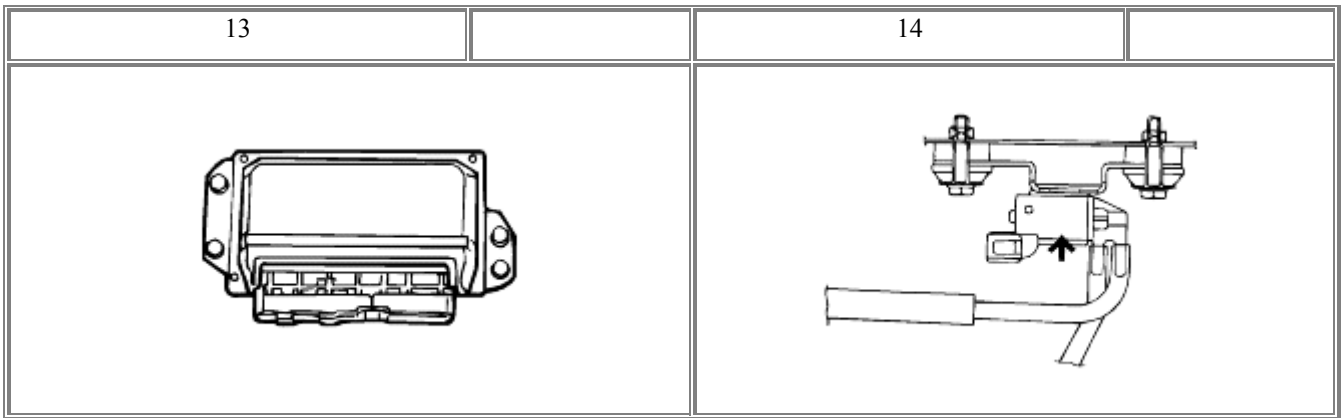




## 5.2 MFI Control System

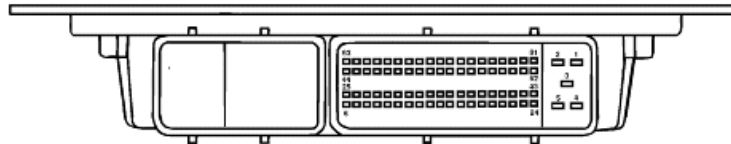






[BOSCH ECU]

**ECM PIN NUMBER CONFIGURATION**



**ECM HARNESS PIN NUMBER CONFIGURATION**

1	2	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63
		82	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
		43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
		4	5	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8

[HEI ECU]

**ECM PIN NUMBER CONFIGURATION**

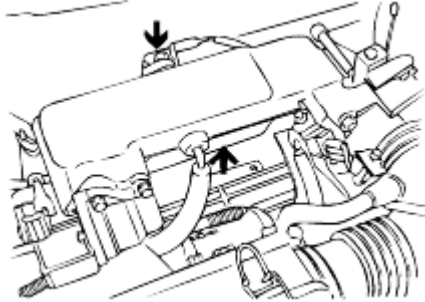
A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D
1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	
A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D
14	15	16	17	18	19	20	21	22	23	24	25	26	9	10	11	12	13	14	15	16	7	8	9	10	11	12	12	13	14	15	16	17	18	19	20	21	22	

**ECM HARNESS PIN NUMBER CONFIGURATION**

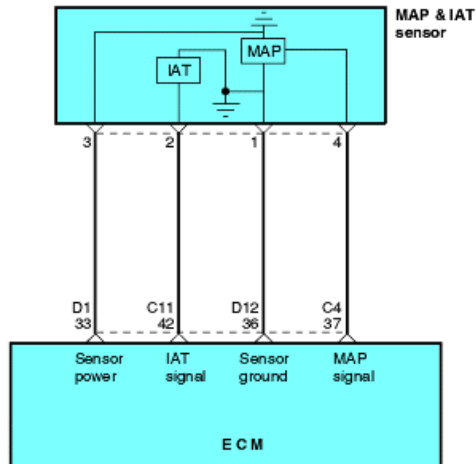
D	D	D	D	D	D	D	D	D	D	C	C	C	C	C	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
11	10	9	8	7	6	5	4	3	2	1	6	5	4	3	2	1	8	7	6	5	4	3	2	1	13	12	11	10	9	8	7	6	5	4	3	2	1	
D	D	D	D	D	D	D	D	D	D	C	C	C	C	C	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
22	21	20	19	18	17	16	15	14	13	12	12	11	10	9	8	7	16	15	14	13	12	11	10	9	26	25	24	23	22	21	20	19	18	17	16	15	14	

## MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR) EFTC7070

The manifold absolute pressure (MAP) sensor is a pressure sensitive variable resistor. It measures changes in the intake manifold pressure which result from engine load and speed changes, and converts this to a voltage output. The MAP sensor is also used to measure barometric pressure at start up, and under certain conditions, allows the ECM to automatically adjust for different altitudes. The ECM supplies 5 volts to the MAP sensor and monitors the voltage on a signal line. The sensor provides a path to ground through its variable resistor. The MAP sensor input affects fuel delivery and ignition timing controls in the ECM.



### CIRCUIT DIAGRAM



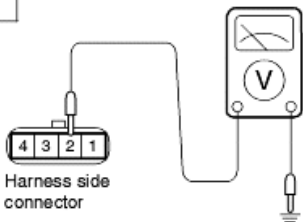
### TROUBLESHOOTING HINTS

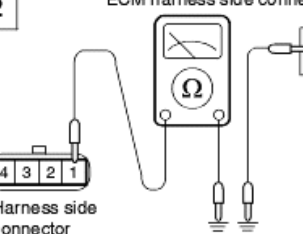
The MIL (Malfunction Indicator Lamp) is ON or the DTC (Diagnostic Trouble Code) is displayed on the HI-SCAN under the following conditions;

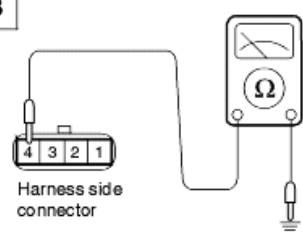
1. When the manifold pressure is 118mb or lower for 0.1 second after turning the ignition key ON.
2. When the manifold pressure is 118mb or lower while the RPM is below 1980rpm.
3. When the manifold pressure is 986mb or higher and the rpm is 2400rpm or more while the accelerator pedal is released (such as when a vehicle is moving down on a sloping road).

USING HI-SCAN Check item	Data display	Check conditions	Engine state	Test specification
MAP sensor	Intake manifold pressure	<ul style="list-style-type: none"> <li>○ Engine coolant temperature: 80 to 95° (176 to 205°F)</li> <li>○ Lamps, electric cooling fan, accessory units: ALL OFF</li> <li>○ Transaxle: Neutral (P range for vehicle with A/T)</li> <li>○ Steering wheel: Neutral</li> </ul>	IG. KEY "ON"	850 - 1024 mb
			Idle	260 - 400 mb

### HARNES INSPECTION PROCEDURES

<b>1</b>	 <p>Harness side connector</p>	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> <li>○ Connector : Disconnected</li> <li>○ Ignition switch : ON</li> <li>○ Voltage (V) : 4.8 - 5.2V</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	 <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the mass air flow sensor.</p> <ul style="list-style-type: none"> <li>○ MAP sensor circuit : Disconnected</li> <li>○ Engine control module connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>3</b>	 <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>○ Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## SENSOR INSPECTION

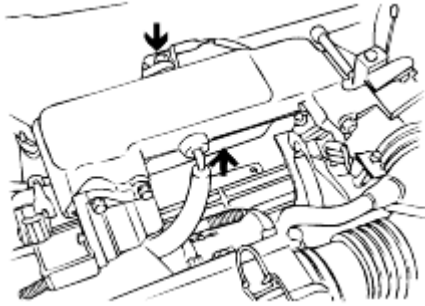
1. Measure the voltage between terminals 1 and 4 of the MAP sensor connectors.  
Terminal 1 : MAP sensor ground  
Terminal 4 : MAP sensor output

<b>Engine state</b>	<b>Test specification</b>
Ignition SW. ON.	4 - 5V
At idle	0.5 - 2.0V

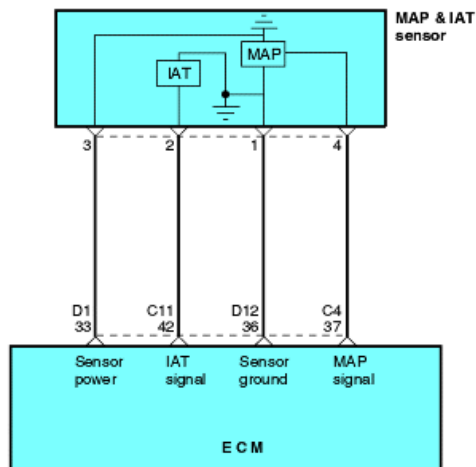
2. If the voltage deviates from the standard value, replace the MAP sensor assembly.

## INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR) EFTC7090

The intake air temperature sensor (IAT Sensor), built in to the MAP sensor, is a resistor-based sensor to detect the intake air temperature. According to the intake air temperature information from the sensor, the ECM will control the necessary amount of fuel injection.



### CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

### TROUBLESHOOTING HINTS

The MIL is ON or the DTC is displayed on the HI-SCAN under the following condition;

- When the intake air temperature is detected below  $-40^{\circ}\text{C}$  or higher than  $120^{\circ}\text{C}$ .

USING HI-SCAN Check item	Data display	Check conditions	Engine state	Test specification
Intake air temperature sensor	Air temperature	Ignition switch : ON or engine running	When -20°C (-40°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C

### HARNESS INSPECTION PROCEDURES

<b>1</b>	<p>Harness side connector</p>	<p>Measure the power supply voltage of the IAT Sensor.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage (V) : 4.8 - 5.2V</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	<p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the IAT sensor.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o IAT sensor connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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### SENSOR INSPECTION

- Using a multi-meter, measure the IAT sensor resistance between terminals 1 and 2.

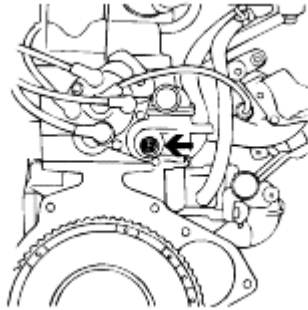
IG.SW.ON	Temperature °C (°F)	Output voltage (Ω)
	0 (32)	4.5 - 7.5Ω
	20 (68)	2.0 - 3.0Ω
	40 (104)	0.7 - 1.6Ω
	80 (176)	0.2 - 0.4Ω

- If the resistance deviates from the standard value, replace the intake air temperature sensor assembly.

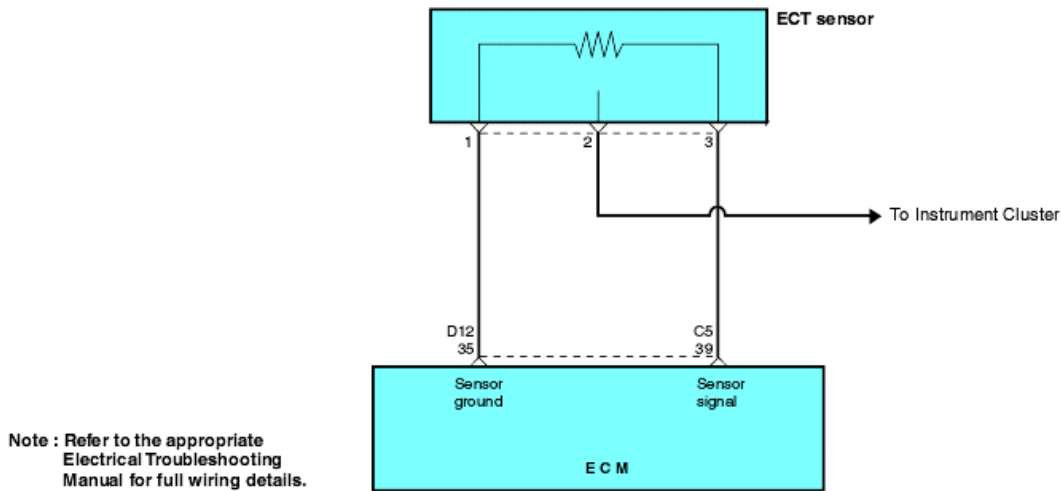


## ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR) EFTC7110

The engine coolant temperature sensor, located in the engine coolant passage of the cylinder head. It detects the engine coolant temperature and relays signals to the ECM. It employs a thermistor, which is sensitive to changes in temperature. The electric resistance of a thermistor decreases in response to temperature rise. The ECM judges engine coolant temperature by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.



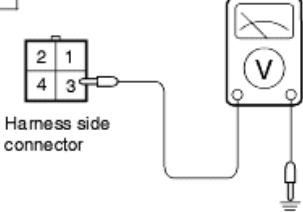
### CIRCUIT DIAGRAM

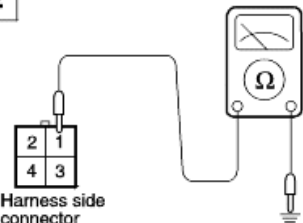


USING HI-SCAN Check item	Data display	Check conditions	Engine state	Test specification
Engine coolant temperature sensor	Sensor temperature	Ignition switch : ON or engine running	When -20°C (-40°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C
USING VOLTMETER Check item		Engine state	Test specification	
Engine coolant temperature sensor output voltage		When 0°C	4.05V	

	When 20°C	3.44V
	When 40°C	2.72V
	When 80°C	1.25V

## HARNESS INSPECTION PROCEDURES

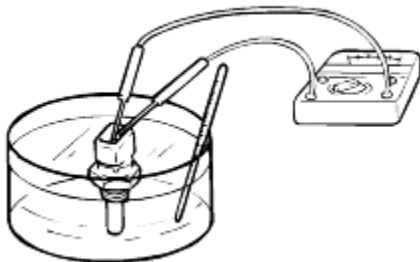
<b>1</b>	 <p>Harness side connector</p>	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage : 4.8 - 5.2V</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	 <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## SENSOR INSPECTION

1. Remove the engine coolant temperature sensor from the intake manifold.
2. With the temperature-sensing portion of the engine coolant temperature sensor immersed in hot water, check resistance.

Temperature °C (°F)	Output voltage (kΩ)
-30 (-22)	22.22 - 31.78
-10 (14)	8.16 - 10.74
0 (32)	5.18 - 6.60
20 (68)	2.27 - 2.73
40 (104)	1.059 - 1.281
60 (140)	0.538 - 0.650
80 (176)	0.298 - 0.322
90 (194)	0.219 - 0.243



3. If the resistance deviates from the standard value greatly, replace the sensor.

#### INSTALLATION

1. Apply sealant LOCTITE 962T or equivalent to threaded portion.
2. Install engine coolant temperature sensor and tighten it to specified torque.

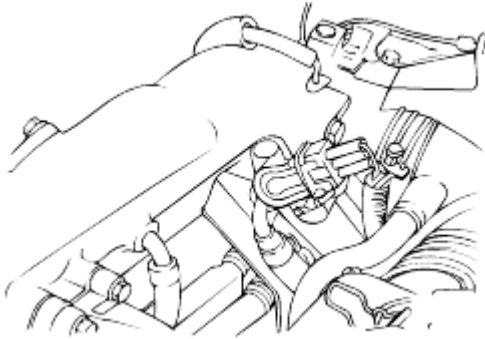
**Tightening torque**

Engine coolant temperature sensor :  
15-20Nm (150-200 kg·cm, 11-15 lb·ft)

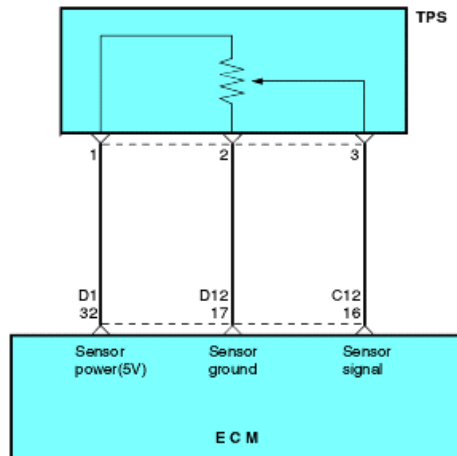
3. Connect the harness connector securely.

## THROTTLE POSITION SENSOR (TPS) EFTC7130

The TP Sensor is a rotating type variable resistor that rotates with the throttle body's throttle shaft to sense the throttle valve angle. As the throttle shaft rotates, the throttle angle of the TP Sensor changes and the ECM detects the throttle valve opening based on the TPS output voltage.



### CIRCUIT DIAGRAM

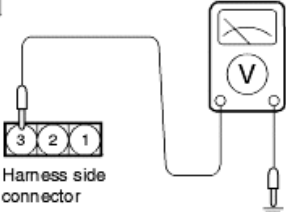


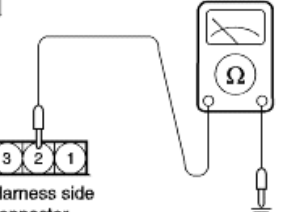
### TROUBLESHOOTING HINTS

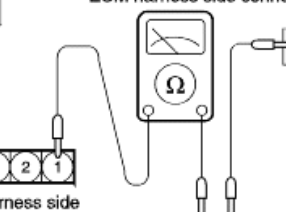
1. The TPS signal is important for the control of automatic trans-axes. Shift shock and other trouble may occur if the sensor is faulty.
2. If the idle condition or acceleration is abnormal, check the TPS connector. (When the TPS connector is not connected properly, the current data on HI-SCAN can show that the idle state remains off, although the accelerator pedal is released. This results in the improper idle or acceleration.)
3. Input voltage from throttle position sensor is below 0.1V or above 4.7V when ignition switch is turned on.

USING HI-SCAN Check item	Data display	Check condition	Test specification
Throttle position sensor	Throttle angle	At idle rpm	8° - 12°
		2000 rpm	9° - 15°
		3000 rpm	12° - 20°
		Wide open throttle	88° - 98°
USING VOLTMETER			
Check item			
Throttle position sensor output voltage	At idle rpm	0.1 - 0.875V	
	Wide open throttle	4.25 - 4.8V	

### HARNES INSPECTION PROCEDURES

<b>1</b>	 <p>Harness side connector</p>	<p>Measure the power supply voltage of the throttle position sensor.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage : 4.8 - 5.2V</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	 <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>3</b>	 <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the throttle position sensor.</p> <ul style="list-style-type: none"> <li>o Throttle position sensor connector: Disconnected</li> <li>o Engine control module connector: Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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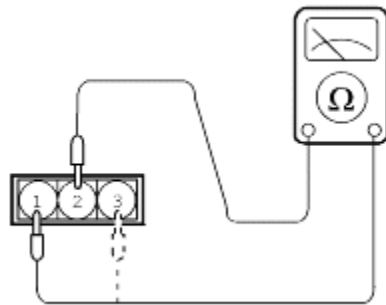
## SENSOR INSPECTION

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between terminals 2 (sensor ground) and terminal 1 (sensor power).  
Standard value : 0.7 - 3.0 k $\Omega$
3. Connect an analog ohmmeter between terminals 2 (sensor ground) and terminal 3 (sensor output).
4. Operate the throttle valve slowly from the idle position to the fuel open position, and check that the resistance changes smoothly in proportion with the throttle valve opening angle.
5. If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

### **Tightening torque**

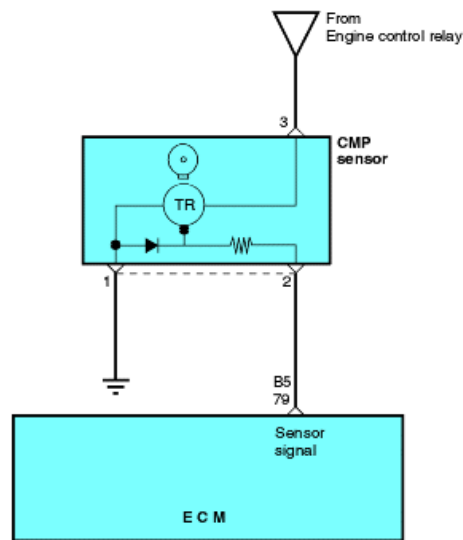
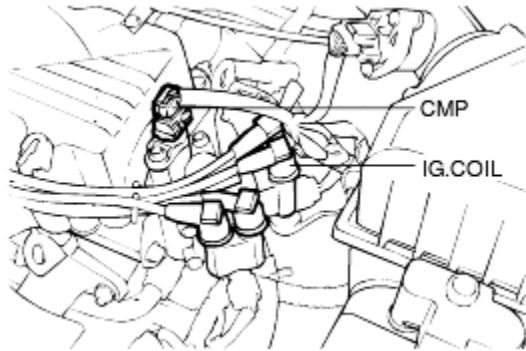
Throttle position sensor :

1.5-2.5Nm (15-25kg·cm, 1.1-1.8 lb·ft)



## CAMSHAFT POSITION SENSOR (CMP SENSOR) EFTC7150

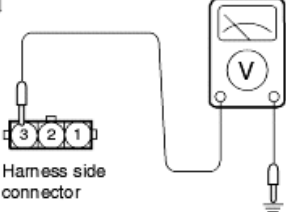
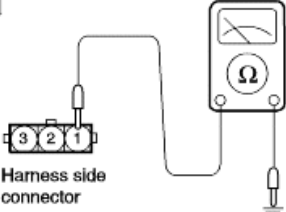
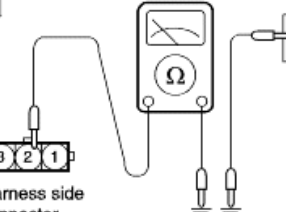
The camshaft position sensor (CMP Sensor) senses the TDC point of No.1 cylinder on its compression stroke. Its signal is fed to the ECM to be used to determine the sequence of fuel injection.



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

USING VOLTMETER Check item	Check condition	Test specification
Camshaft position sensor output voltage	At idle rpm	0 - 5V
	3000 rpm	0 - 5V

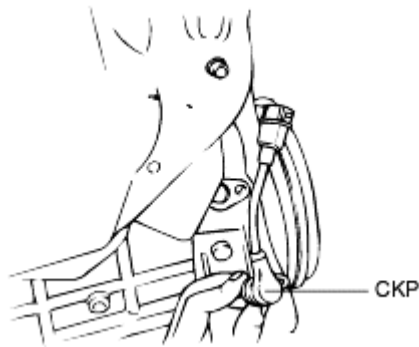
## HARNESS INSPECTION PROCEDURES

<p><b>1</b></p>  <p>Harness side connector</p>	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness</p>
<p><b>2</b></p>  <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness</p>
<p><b>3</b></p>  <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the camshaft position sensor.</p> <ul style="list-style-type: none"> <li>o Camshaft position sensor connector: Disconnected</li> <li>o Engine control module connector: Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>

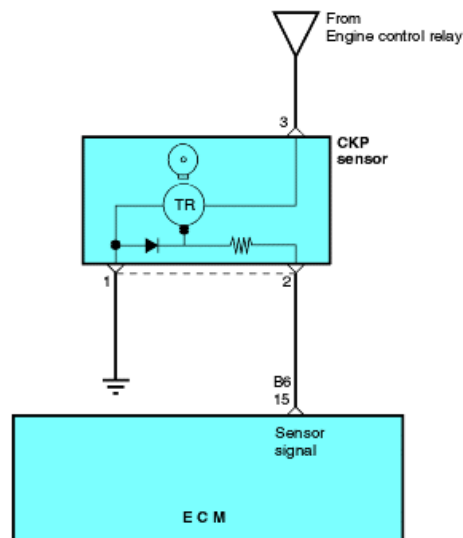


## CRANKSHAFT POSITION SENSOR (CKP SENSOR) EFTC7170

The crankshaft position sensor, consisted of a magnet and coil, is located next to flywheel. The voltage signal from this crankshaft position sensor is relayed to the ECM to indicate engine RPM and the position of the crankshaft.



### CIRCUIT DIAGRAM



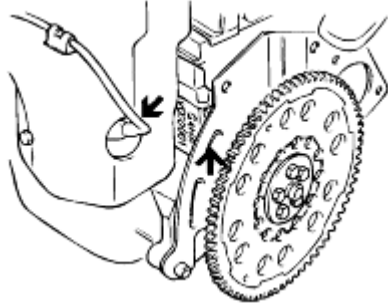
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

<b>2</b>	<p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness</p>
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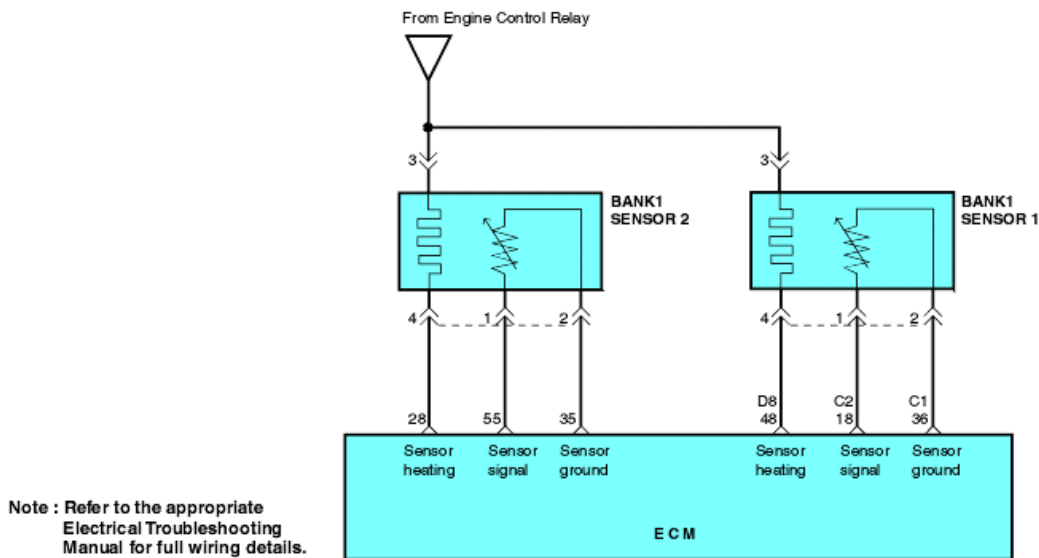
<b>3</b>	<p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the camshaft position sensor.</p> <ul style="list-style-type: none"> <li>o Camshaft position sensor connector: Disconnected</li> <li>o Engine control module connector: Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## HEATED OXYGEN SENSOR (HO2S)- SINGLE HO2S EFTC7190

The heated oxygen sensor senses the oxygen concentration in the exhaust gas, then converts it into a voltage and then sends this to the ECM. The heated oxygen sensor gives an output of about 800mV when the air fuel ratio is richer than the theoretical ratio and output of about 100mV when the ratio is leaner (higher oxygen concentration in exhaust gas.) The ECM controls fuel injection based on this signal so that the air fuel ratio is maintained at the theoretical ratio.



### CIRCUIT DIAGRAM



### TROUBLESHOOTING HINTS

1. If the heated oxygen sensor is defective, abnormally high emissions may occur.
2. If the heated oxygen sensor check is normal but the sensor output voltage is out of specification, check for the following items related to the air fuel ratio control system:
  - Faulty injector.
  - Air leaks in the intake manifold.
  - Faulty mass airflow sensor, purge valve and engine coolant temperature sensor.
  - Wiring connection problem.

USING VOLTMETER/HI-SCAN Check item	Check condition	Engine condition	Test specification
Heated oxygen sensor output voltage	Warm-up	When decelerating suddenly from 4,000 rpm	A. 200mV or lower
		When engine is suddenly raced	B. 600-1,000mV

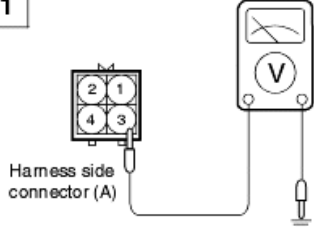
**NOTE**

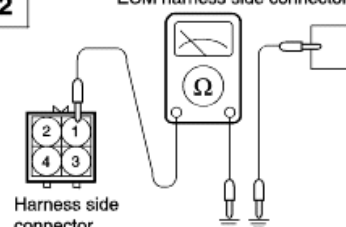
If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O<sub>2</sub> sensor service data in the HI-SCAN will display values in the A range.

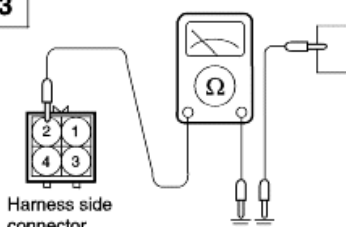
When you suddenly press on the accelerator pedal down, the voltage will reach B range.

When you let the engine idle again, the voltage will fluctuate between ranges A and B. In this case, the O<sub>2</sub> sensor can be determined as good.

**HARNES INSPECTION PROCEDURE**

<b>1</b>	 <p>Harness side connector (A)</p>	<p>Measure the power supply voltage of the heated oxygen sensor.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p>
			<p><b>NG</b> → Repair the harness</p>

<b>2</b>	 <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the heated oxygen sensor.</p> <ul style="list-style-type: none"> <li>o Heated oxygen sensor connector: Disconnected</li> <li>o ECM connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p>
			<p><b>NG</b> → Repair the harness.</p>

<b>3</b>	 <p>Harness side connector</p>	<p>Check for continuity to ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p>
			<p><b>NG</b> → Repair the harness.</p>

## SENSOR INSPECTION

### **NOTE**

- 1. Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 205°F).**
- 2. Use an accurate digital voltmeter.**

Replace the oxygen sensor if there is a malfunction.

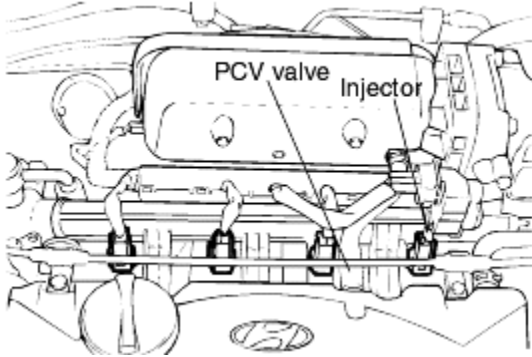
### **Tightening torque**

Heated oxygen sensor :

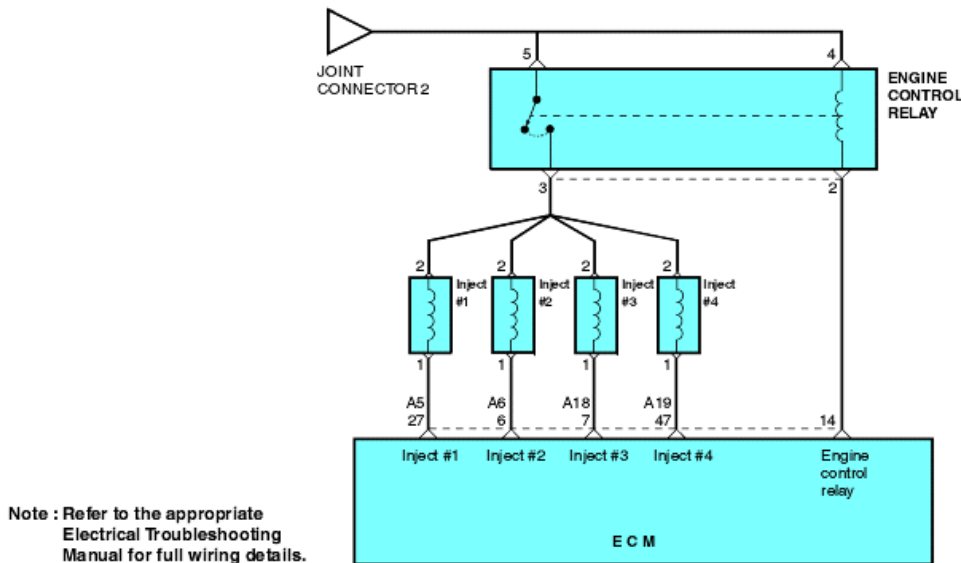
50-60 Nm (500-600 kg·cm, 37-44 lb·ft)

## INJECTORS EFTC7210

The injectors inject fuel according to signals from the ECM. The volume of fuel injected by the injector is determined by the time during which the solenoid valve is energized.



### CIRCUIT DIAGRAM



### TROUBLESHOOTING HINTS

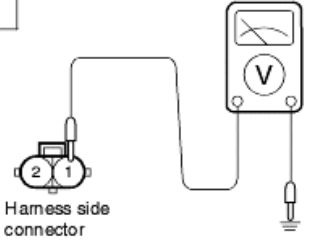
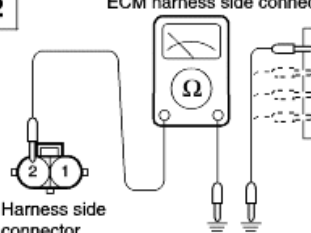
1. If the engine is difficult to start when it is hot, check low for fuel pressure and injector leaks.
2. If the injector does not operate when the engine is cranked, then check the following:
  - Faulty power supply circuit to the ECM or faulty ground circuit.
  - Faulty MFI control relay.
  - Faulty crankshaft position sensor or camshaft position sensor.
3. If engine idle remains unchanged when fuel injection to the cylinders are is cut one after another, check for the following items about such cylinder:
  - Injector and harness.

- Spark plug and high tension cable.
  - Compression pressure.
4. If the injection system is OK but the injector drive time is out of specification, check for the following items:
- Poor combustion in the cylinder (faulty spark plug, ignition coil, compression pressure, etc.)
5. The MIL is on or the DTC is displayed on the HI-SCAN under the following condition.
- When the injector itself is faulty

USING HI-SCAN Check item	Data display	Check conditions	Engine state	Test specification
Throttle position sensor	Throttle angle	<ul style="list-style-type: none"> <li>○ Engine coolant temperature: 80 to 95°C (176 to 205°F)</li> <li>○ Lamps, electric cooling fan, accessory units: ALL OFF</li> <li>○ Transaxle : Neutral (P range for vehicle with A/T)</li> <li>○ Steering wheel : Neutral</li> </ul>	Idle rpm	1.5 - 4.5 ms
			2000 rpm	
			3000 rpm	
			Racing	Increasing

Check item	Check condition	HI-SCAN display	Type
Injector ○ Actuator test	Start the engine	01. No.1 Injector	Activate
		02. No.2 Injector	Activate
		03. No.3 Injector	Activate
		04. No.4 Injector	Activate

## HARNESS INSPECTION PROCEDURES

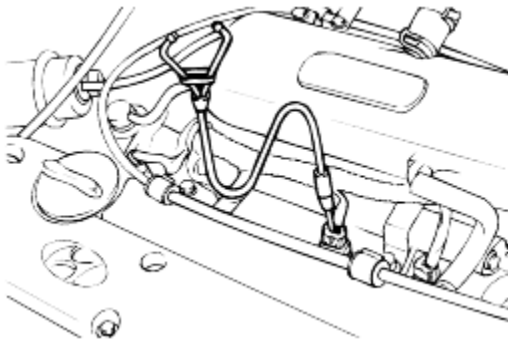
<p><b>1</b></p>  <p>Harness side connector</p>	<p>Measure the power supply voltage of the injector.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> →</p>	<p><b>2</b></p>
<p><b>2</b></p>  <p>Harness side connector</p> <p>ECM harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the injector.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Injector connector : Disconnected</li> </ul>	<p><b>OK</b> →</p> <p><b>NG</b> →</p>	<p><b>END!</b></p> <p>Repair the harness.</p>

## INJECTOR INSPECTION

### Operation Check

Using a HI-SCAN:

- o Activate the fuel injectors in sequence.
- o Check the operating time of the injectors.



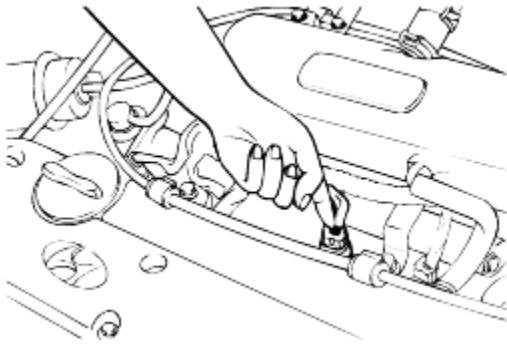
### OPERATION SOUND CHECK

1. Using a stethoscope, check the injectors for a clicking sound at idle. Check that the sound is produced at shorter intervals as the engine speed increases.

#### NOTE

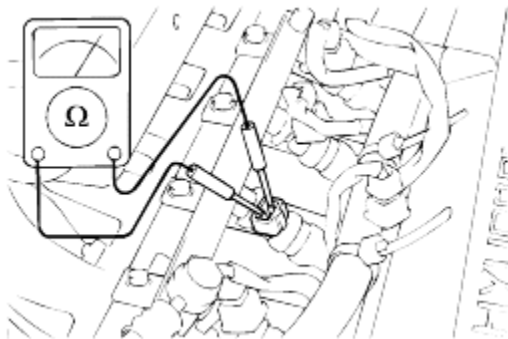
Ensure that the sound from an adjacent injector is not being transmitted along the delivery pipe to an inoperative injector.

2. If a stethoscope is not available, check the injector operation with your finger.  
If no vibrations are felt, check the wiring connector, injector, or injection signal from ECM.



### Resistance Measurement Between Terminals

1. Disconnect the connector at the injector and measure the resistance between the two terminals.



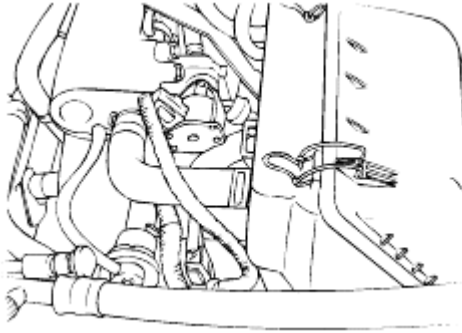
Standard value :  $15.9 \pm 0.35 \Omega$  [at 20°C (68°F)]

2. Re-connect the connector to the injector.

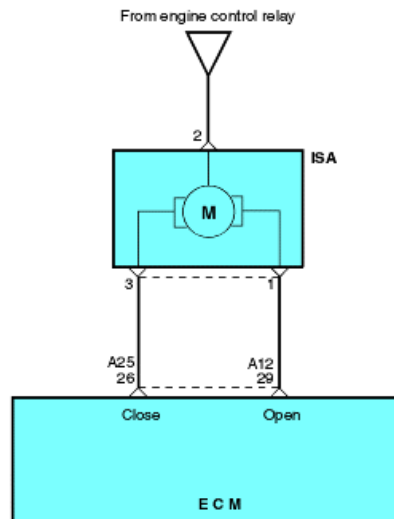


## IDLE SPEED CONTROL ACTUATOR (ISC ACTUATOR) EFTC7230

The idle speed actuator is a double coil type driven by separate driver stages in the ECM. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different angles of the motor. A bypass hose line is positioned, in parallel to the throttle valve where the idle speed actuator is inserted.



### CIRCUIT DIAGRAM



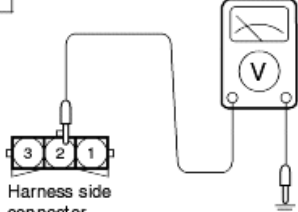
Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

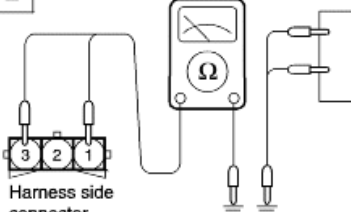
### TROUBLESHOOTING HINTS

Open or short circuit is observed in idle air control system when ignition switch is turned on.

USING HI-SCAN Check item	Check condition	Engine condition	Test specification
Idle speed control actuator	Start the engine	ISCV	Activate
○ Actuator test			

## HARNES INSPECTION PROCEDURE

<b>1</b>	 <p>Harness side connector</p>	<p>Measure the power supply voltage of the injector.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	 <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and the idle speed control actuator.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Idle speed actuator connector: Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## ACTUATOR INSPECTION

### RESISTANCE MEASUREMENT BETWEEN TERMINALS

1. Disconnect the connector at the idle speed control actuator.
2. Measure the resistance between terminals.

#### **Standard value**

Terminal 1 and 2 : 10.5 - 14Ω

Terminal 2 and 3 : 10 - 12.5Ω [at 20°C (68°F)]

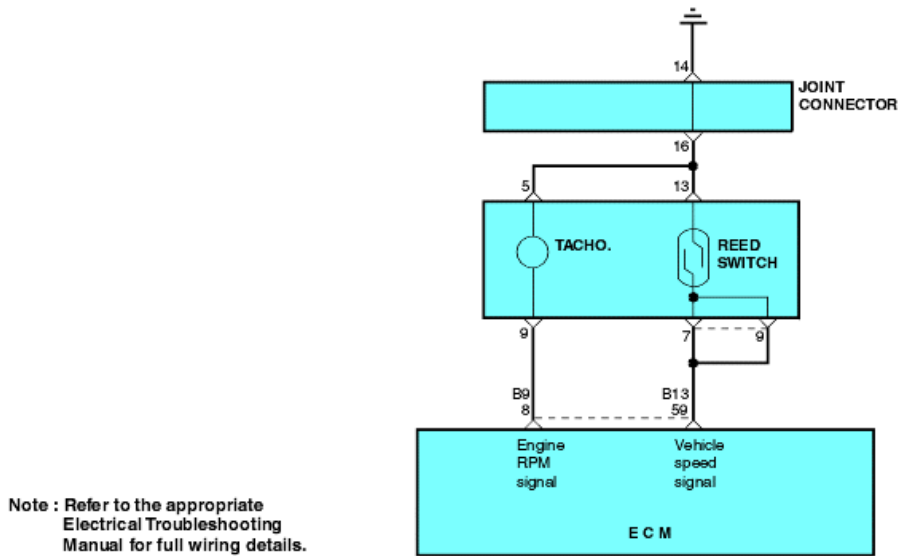
3. Connect the connector to the idle speed control actuator.

## VEHICLE SPEED SENSOR EFTC7250

The vehicle speed sensor is a reed switch that is built into the speedometer. The sensor converts the trans-axle gear revolutions into a pulse signal, which is sent to the ECM.



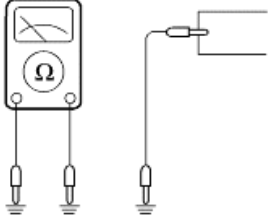
### CIRCUIT DIAGRAM

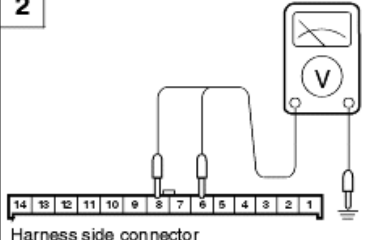


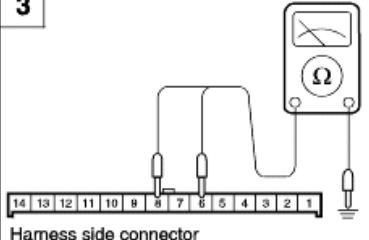
### TROUBLESHOOTING HINTS

If there is an open or short circuit in the vehicle speed sensor signal circuit, the engine may stall when the vehicle decelerates to a stop.

## HARNESS INSPECTION PROCEDURES

<p><b>1</b></p>	<p>ECM harness side connector</p> 	<p>Check the vehicle speed sensor output circuit for continuity</p> <ul style="list-style-type: none"> <li>o Engine control module connector: Disconnected</li> <li>o Move the vehicle or turn the speedometer cable</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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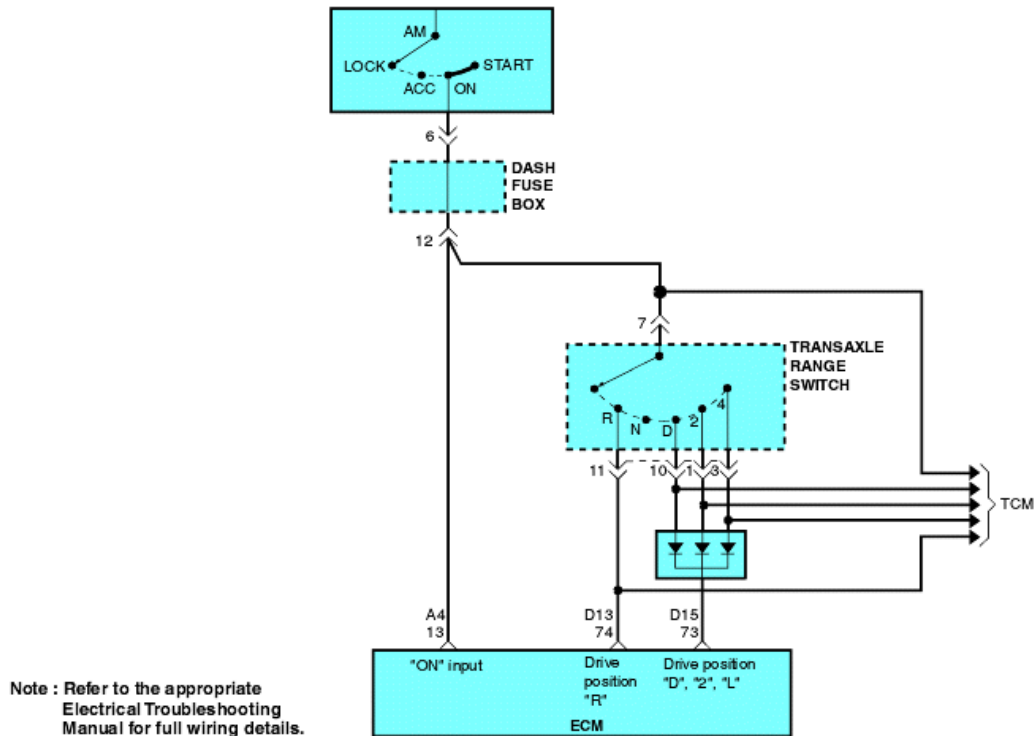
<p><b>2</b></p>	 <p>Harness side connector</p>	<p>Measure the power supply voltage of the vehicle speed sensor.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage : 4.5 - 4.9V</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness.</p>
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<p><b>3</b></p>	 <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## IGNITION SWITCH-ST AND TRANSAXLE RANGE(TR) SWITCH (A/T) EFTC7290

When the ignition switch is set to the ST position, battery voltage is applied through the ignition switch and TR switch to the ECM. If the selector lever is not in P or the N position, battery voltage will not reach the ECM. Based on this signal, the ECM determines the automatic transaxle load and drives the idle speed control actuator to maintain optimum idle speed.

### CIRCUIT DIAGRAM

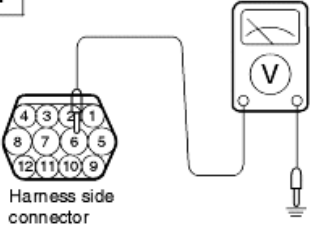
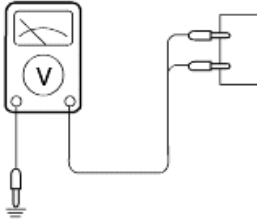
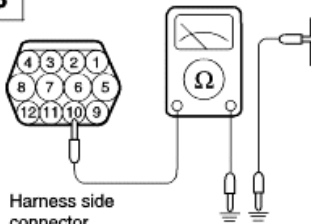
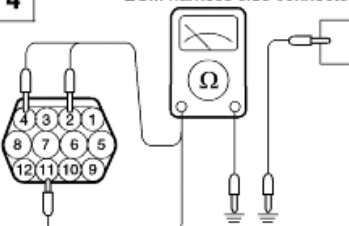


### TROUBLESHOOTING HINTS

If the park/neutral position switch harness check is normal but the switch output is abnormal, check the control cable adjustment.

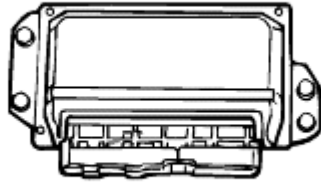
USING HI-SCAN Check item	Data Display	Check condition	Engine state	Test specification
Crank Signal	Switch state (ON/OFF)	Ignition SW : ON	Stop	OFF
			Cranking	ON
TR Switch	Shift lever position	Ignition SW : ON	P or N	P or N
			Others	Others

## HARNESS INSPECTION PROCEDURES

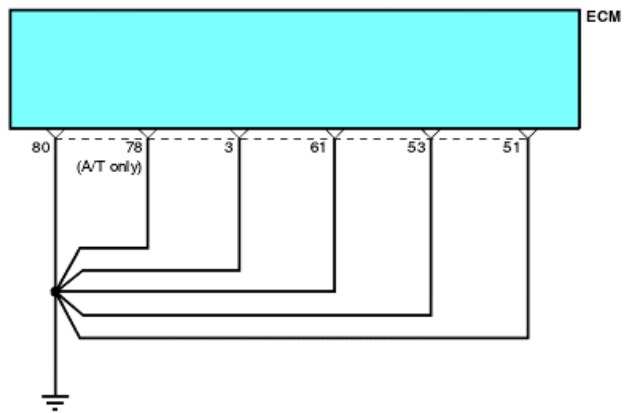
<p><b>1</b></p>  <p>Harness side connector</p>	<p>Measure the power supply voltage of the PNP switch.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o TR switch connector : Disconnected</li> <li>o Ignition switch : START and ON</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Check the power supply circuit.</p>
<p><b>2</b></p> <p>ECM harness side connector</p> 	<p>Measure the input voltage of engine control module.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o TR switch connector : Connected</li> <li>o Ignition switch : START</li> <li>o Voltage : 8V or more</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness.</p>
<p><b>3</b></p>  <p>Harness side connector</p>	<p>Check for continuity of the ground circuit between ECM and Transaxle Range Connector.</p>	<p><b>OK</b> → <b>4</b></p> <p><b>NG</b> → Repair the harness.</p>
<p><b>4</b></p> <p>ECM harness side connector</p> 	<p>Check for continuity of the ground circuit between ECM and Transaxle Range Connector.</p>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>

## ENGINE CONTROL MODULE(ECM) - POWER GROUND EFTC7330

Check the ground condition of the engine control module.

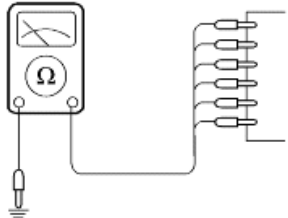


### CIRCUIT DIAGRAM



Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

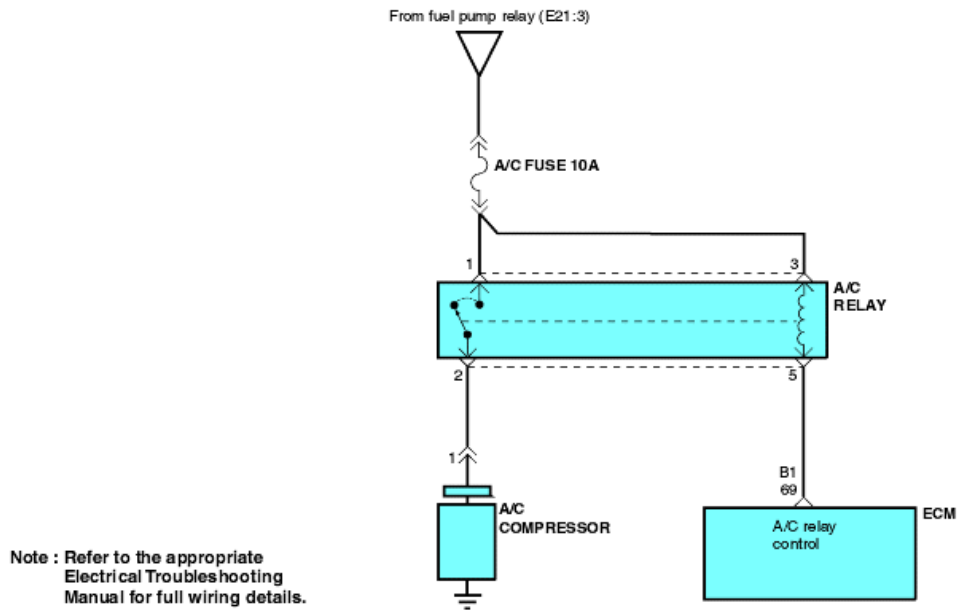
### HARNESS INSPECTION PROCEDURES

<p>ECM harness side connector</p> 	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"><li>o ECM connector : Disconnected</li></ul>	<p><b>OK</b> →</p>    <p><b>NG</b> →</p>	<p><b>END!</b></p>    <p>Repair the harness.</p>
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## AIR CONDITIONING SWITCH AND RELAY EFTC7350

The air conditioning switch relays battery voltage to the ECM when the air conditioning is turned on. When the air conditioning ON signal is input, the ECM drives the ISC Actuator and turns ON the ignition power transistor. Then, the air conditioning power relay coil is energized to turn on the relay switch, which activates the compressor magnetic clutch.

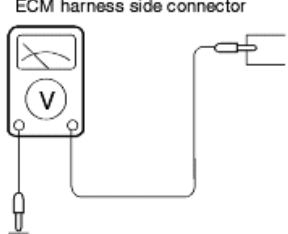
### CIRCUIT DIAGRAM





USING HI-SCAN Check item	Data Display	Check condition	Air conditioning switch	Normal indicator
Air conditioning switch	Switch state (ON/OFF)	Engine: Idling (air compressor is running when air conditioning switch is ON)	OFF	OFF
			ON	ON
Air conditioning compressor	Air conditioning compressor	Engine: Idling after warm-up	OFF	OFF (compressor clutch non-activation)
			ON	ON

### HARNES INSPECTION PROCEDURE

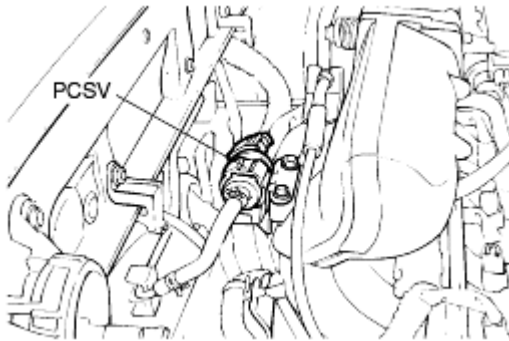
 <p>ECM harness side connector</p>	<p>Measure the power supply voltage of the air condition circuit.</p> <ul style="list-style-type: none"> <li>o Air condition switch : ON</li> <li>o Engine control unit connector: Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage : Battery voltage</li> </ul>	<p><b>OK</b> →</p> <p><b>NG</b> →</p>	<p><b>END!</b></p> <p>Check the air conditioning circuit</p>
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### AIR CONDITIONING INSPECTION

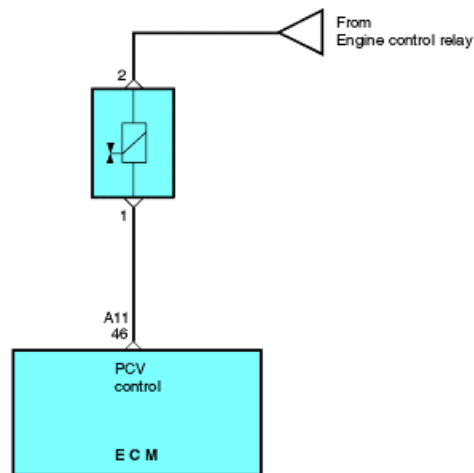
Refer to GROUP-HA service adjustment procedures.

## EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE EFTC7370

The evaporative emission canister purge solenoid valve is a duty control type, which controls the flow of purge air from the evaporative emission canister.



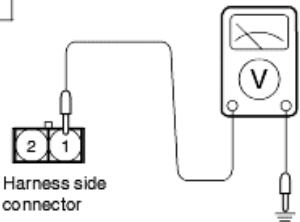
### CIRCUIT DIAGRAM

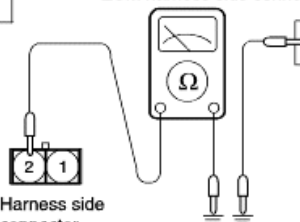


Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

USING HI-SCAN Check item	Check condition	HI-SCAN display	Type
Evaporative emission canister purge solenoid valve <ul style="list-style-type: none"> <li>○ Actuator test</li> </ul>	Start the engine	PURGE VALVE	Activate

## HARNESS INSPECTION PROCEDURE

<p><b>1</b></p>  <p>Harness side connector</p>	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<p><b>2</b></p>  <p>Harness side connector</p> <p>ECM harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the evaporative emission canister purge solenoid valve and the engine control module.</p> <ul style="list-style-type: none"> <li>o Engine control module connector : Disconnected</li> <li>o Evaporative emission canister purge solenoid valve connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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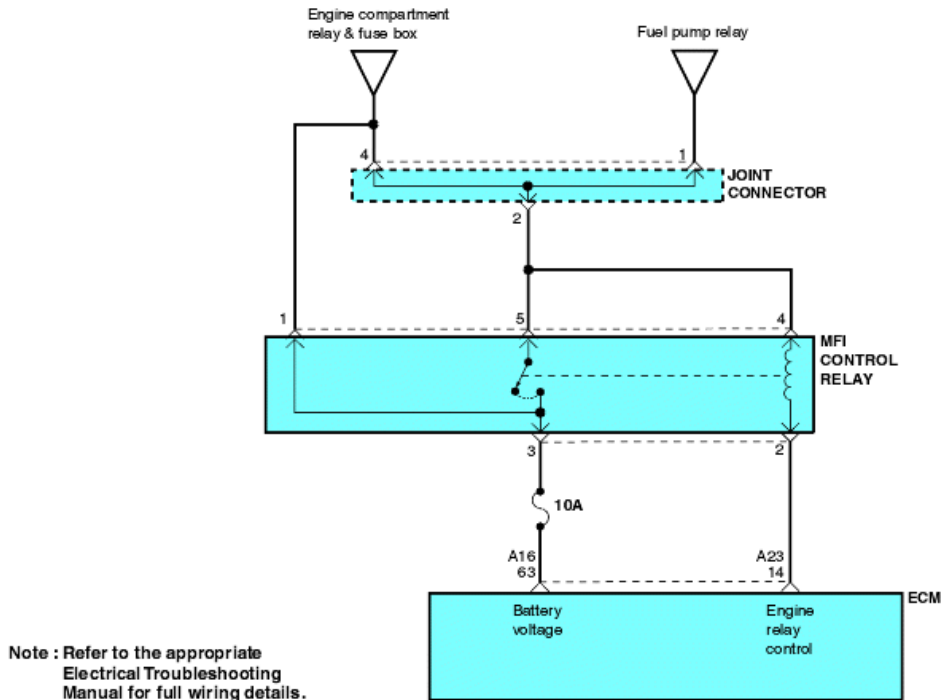
## ACTUATOR INSPECTION

Refer to GROUP EC-Evaporative Emission System.

## MFI CONTROL RELAY EFTC7390

When the ignition switch is on, battery power is supplied to the ECM, the injectors, and the mass air flow sensor, etc. While the ignition switch is turned on, current flows from the ignition switch through the current relay coil to ground.

### CIRCUIT DIAGRAM



### HARNESS INSPECTION PROCEDURES

<b>1</b>	<p>Harness side connector</p>	<p>Measure the power supply voltage of the MFI control relay.</p> <ul style="list-style-type: none"> <li>o MFI control relay connector : Disconnected</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness.</p>
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<b>2</b>	<p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for open-circuit or short-circuit to ground between the engine control module and the MFI control relay.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o MFI control relay : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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## MFI CONTROL RELAY INSPECTION

1. Check continuity of relay contacts between terminals 4 (+) and 2 (-).

Relay coil (between terminal 5 & 1)	Continuity
When de-energized	No
When energized	Yes

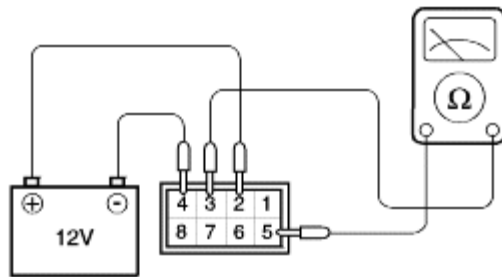
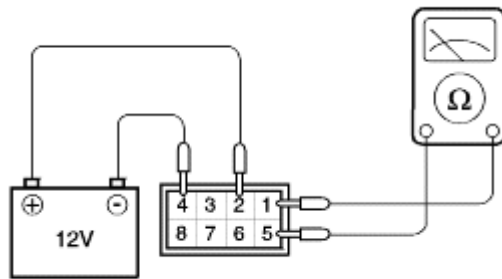
Relay coil (between terminal 5 & 3)	Continuity
When de-energized	No
When energized	Yes

3. If faulty, replace the MFI control relay.

### Tightening torque

MFI control relay :

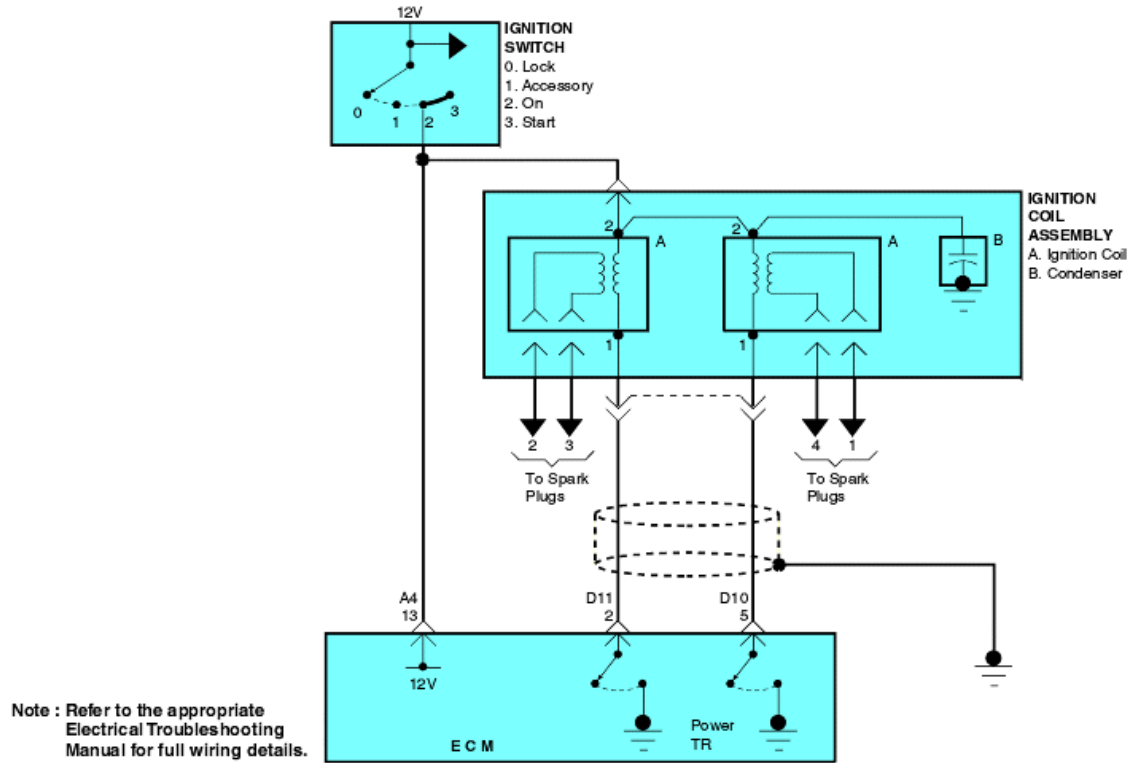
7-11 Nm (70-110 kg·cm, 5.2-8.1 lb·ft)



## IGNITION COIL EFTC7410

When the ignition power transistor is turned ON by a signal from the ECM, the ECM sends a signal to the ignition coil, then the primary current is shut off and a high voltage is induced in the secondary coil.

### CIRCUIT DIAGRAM





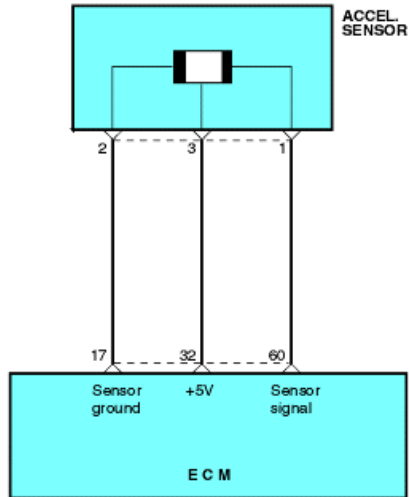
## HARNES INSPECTION PROCEDURE

<p><b>1</b></p> <p>Harness side connector</p>	<p>Measure the power supply voltage of the ignition coil.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> <li>o Ignition switch : ON</li> <li>o Voltage(V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness</p>
<p><b>2</b></p> <p>ECM harness side connector</p> <p>Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ignition coil and the engine control module.</p> <ul style="list-style-type: none"> <li>o Engine control module connector : Disconnected</li> <li>o Power transistor connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>

## ACCELERATION SENSOR EFTC7450

The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.

### CIRCUIT DIAGRAM

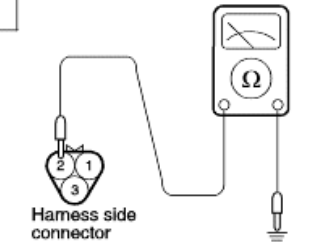


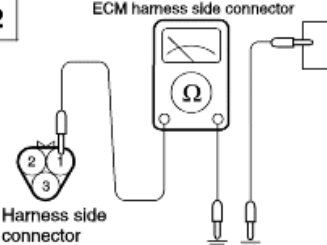
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

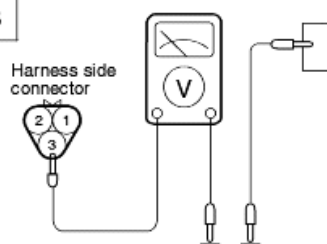
USING VOLTMETER Check item	Check condition	Test specification
Acceleration sensor output voltage (acceleration sensor side connector No.2 or ECM harness side connector No.19)	While idling	2.3 - 2.7V
	While driving	0.5 - 4.5V



## HARNESS INSPECTION PROCEDURE

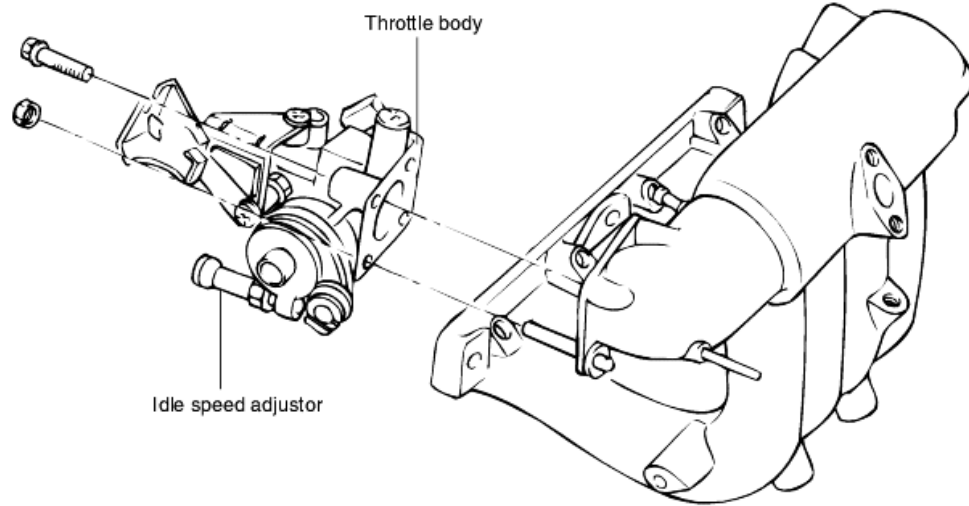
<p><b>1</b></p>  <p>Harness side connector</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o Connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p><b>NG</b> → Repair the harness</p>
---	---	---

<p><b>2</b></p>  <p>Harness side connector</p> <p>ECM harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine module and the acceleration sensor.</p> <ul style="list-style-type: none"> <li>o Acceleration sensor connector : Disconnected</li> <li>o Engine control module connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>3</b></p> <p><b>NG</b> → Repair the harness</p>
---	--	---

<p><b>3</b></p>  <p>Harness side connector</p>	<p>Measure the power supply voltage</p> <ul style="list-style-type: none"> <li>o Acceleration sensor connector : Disconnected</li> <li>o Voltage : 5V</li> </ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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### 5.3 Fuel Delivery System

COMPONENTS EFTC8090



REMOVAL EFTC8110

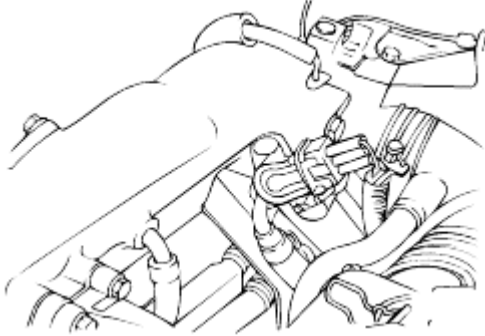
**CAUTION**

**The throttle valve must not be removed.**

Remove the throttle position sensor.

**NOTE**

**Except when necessary for replacement, the throttle position sensor must not be removed.**

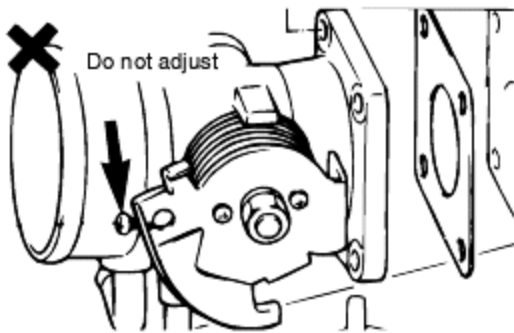


## INSPECTION EFDA8130

1. Check the throttle body for cracks.
2. Check for restriction in the vacuum port or passage.
3. Check for interference when moving the accelerator cable.

### CAUTION

- **Throttle valve set screw was adjusted in the production line with the air volume ( $0.516 \pm 5\%$  g/sec) during idling. So please DO NOT ADJUST IT voluntarily.**
- **When the idle rpm is out of specification, check the relevant sensors and their input or output value first.**
- **The throttle body does not need to be cleaned because carbon in throttle body does not affect the system's operation at all.**

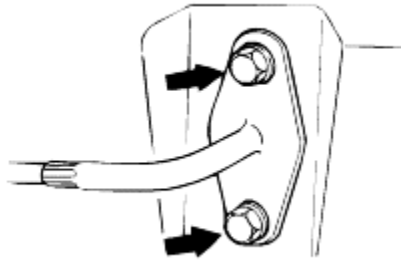


COMPONENTS EFTC8310



## REMOVAL EFTC8330

1. Remove the bushing and inner cable of the accelerator arm side.



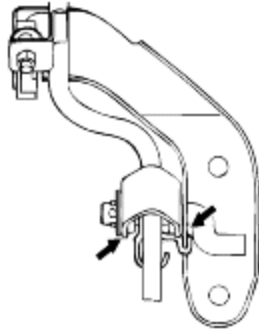
2. After disconnecting the accelerator switch connector, loosen the bolts of the accelerator arm bracket and remove.

## INSPECTION EFDA8350

1. Check the inner and outer cable for damage.
2. Check the cable for smooth movement.
3. Check the accelerator arm for deformation.
4. Check the return spring for deterioration.
5. Check the connection of the bushing to end metal fitting.
6. Check that the accelerator switch operates properly.

## INSTALLATION EFTC8370

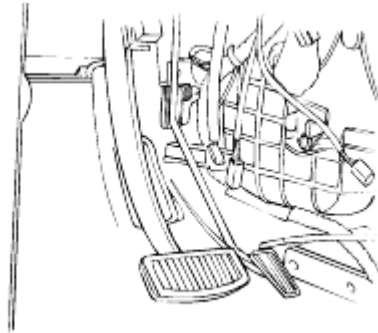
1. When installing the return spring and accelerator arm, apply multi-purpose grease around each moving point of the accelerator arm.



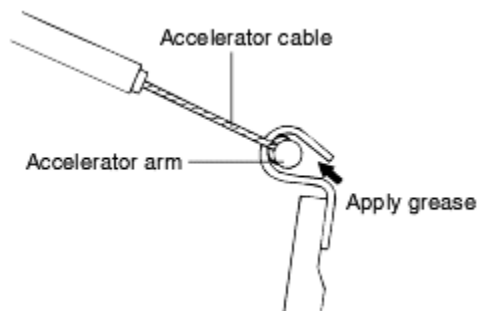
2. Apply sealant to the bolt-mounting hole, and tighten the accelerator arm bracket.

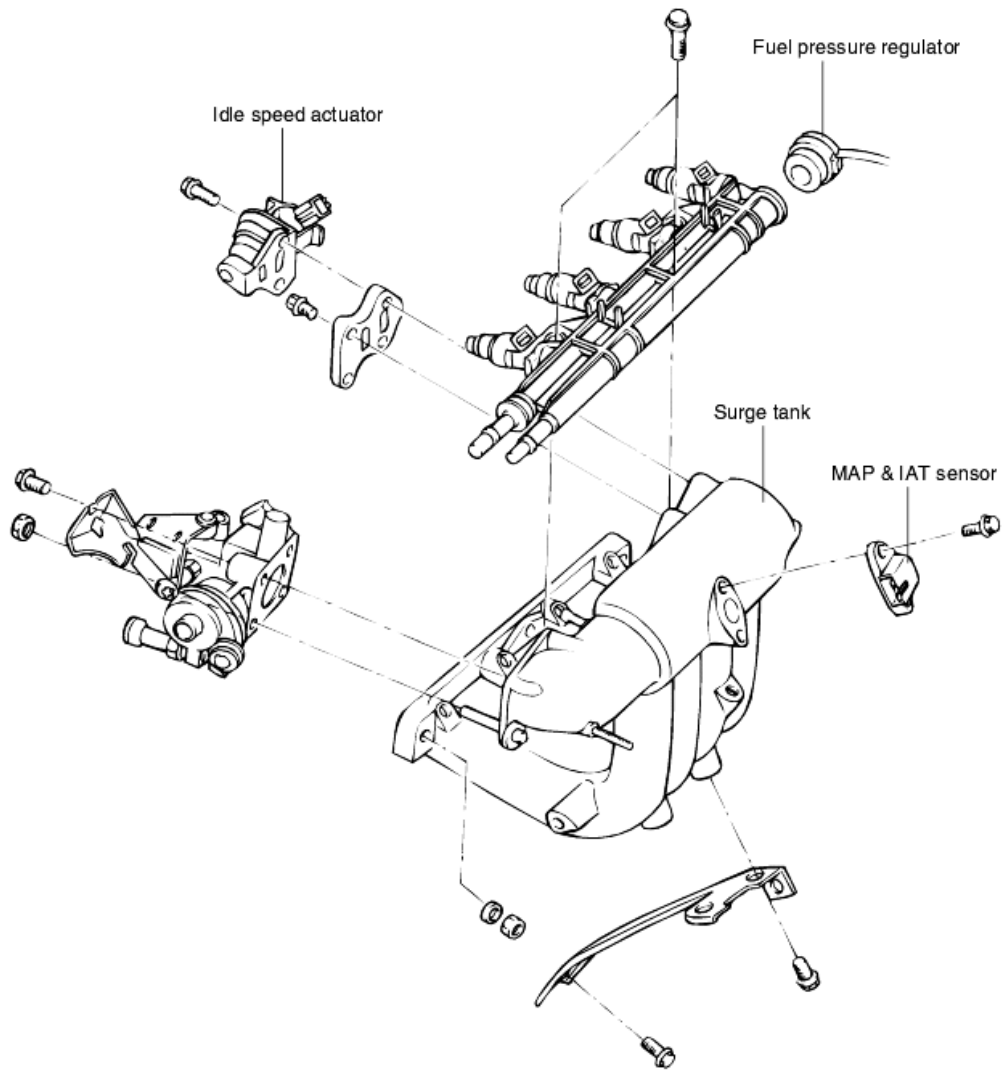
### **Tightening torque**

Accelerator arm bracket bolts :  
8-12Nm (80-120 kg·cm, 5.8-7.2 lb·ft)



3. Securely install the resin bushing of the accelerator cable on the end of the accelerator arm.
4. Apply multipurpose grease around the cable end.







## REMOVAL EFTC8030

1. Release residual pressure from the fuel line to prevent fuel from spilling.

### **CAUTION**

**Cover the hose connection with rags to prevent splashing of fuel that could be caused by residual pressure in the fuel line.**

2. Remove the delivery pipe with the fuel injectors.

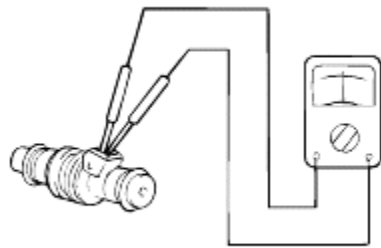
### **CAUTION**

- **Be careful not to drop any injectors when removing the delivery pipe.**
- **Be aware that fuel may flow out when removing the injector.**



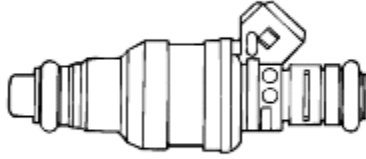
## INSPECTION EFDA8050

1. Measure the resistance of the injectors between the terminals using an ohmmeter.  
Resistance :  $15.9 \pm 0.35\Omega$  [at 20°C (68°F)]
2. If the resistance is not within specifications, replace the injector.



## INSTALLATION EFDA8070

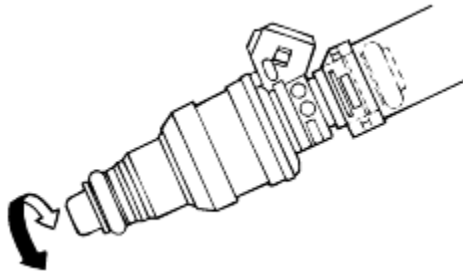
1. Install a new grommet and O-ring to the injector.
2. Apply a coating of solvent, spindle oil or gasoline to the O-ring of the injector.

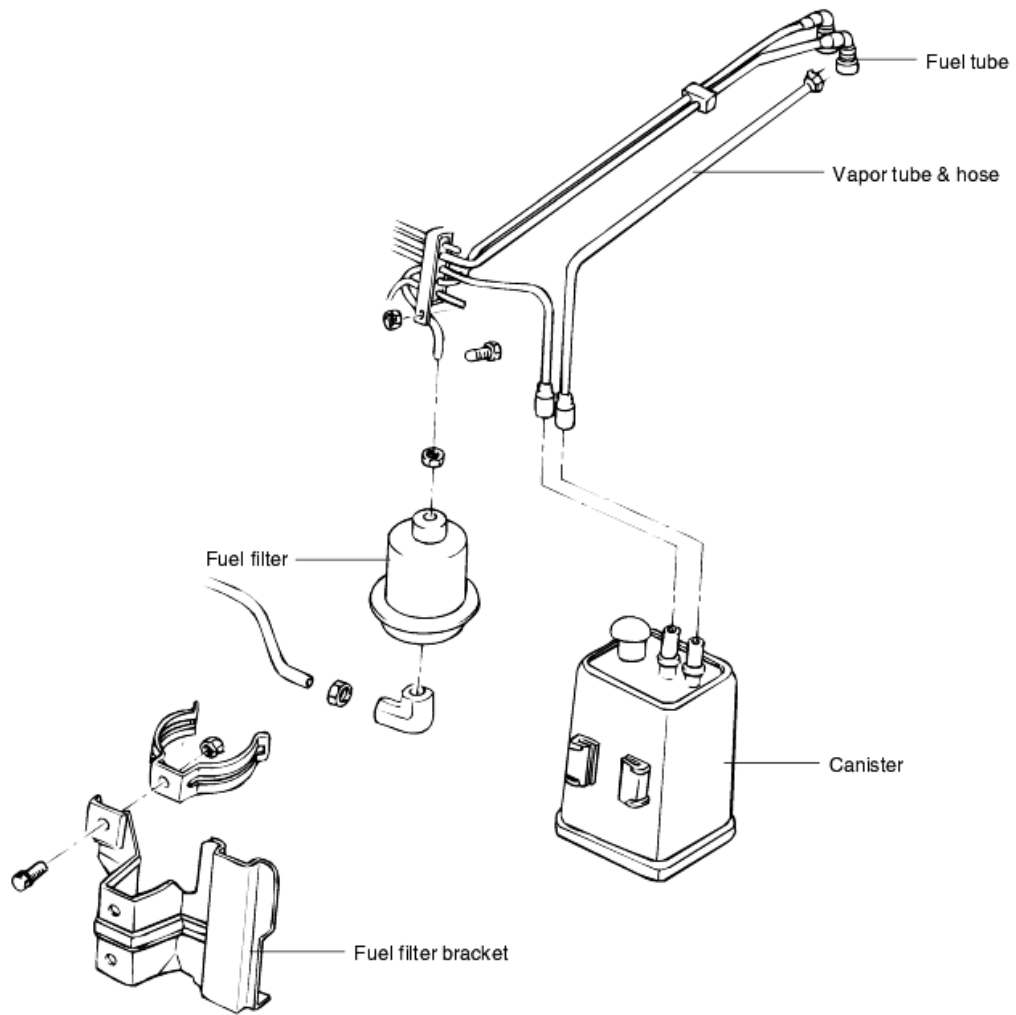


3. While turning the injector to the left and right, fit it on to the delivery pipe.
4. Be sure the injector turns smoothly.

### **NOTE**

**If it does turn smoothly, the O-ring may be jammed: Remove the injector and re-insert it into the delivery pipe and recheck.**





## REMOVAL EFTC8230

1. Remove the upper eye bolt while holding the fuel filter nut securely and remove the high-pressure fuel hose.

### CAUTION

- **Be sure to reduce the fuel pressure before disconnecting the fuel line and hose, otherwise fuel will spill out.**
- **Cover the hose connection with a shop towel to prevent splashing of fuel that could be caused by residual pressure in the fuel line.**



2. Remove the lower eye bolt while holding the fuel filter nut assembly.
3. Remove the fuel filter mounting bolts, then remove the fuel filter from the bracket.
4. Remove the fuel return hose and line.
5. Remove the fuel vapour hose and line.

## COMPONENTS EFTC8150

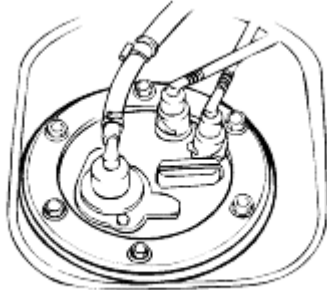


## REMOVAL EFTC8170

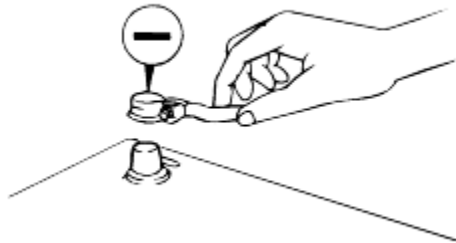
1. To reduce the internal pressure of the fuel lines and hoses, first start the engine with the fuel pump disconnected and wait until it stops by itself.

### **NOTE**

**Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose otherwise fuel will spill out.**



2. Disconnect the battery cable from the negative terminal of the battery.



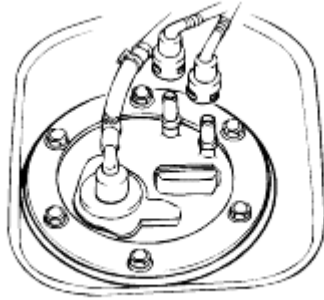
3. Disconnect the high-pressure hose from the fuel filter output side, and disconnect the tap for static electricity.

### **CAUTION**

**Cover the hose connection with a shop towel to prevent splashing of fuel that could be caused by residual pressure in the fuel line.**

4. Lift up the vehicle.
5. Detach the fuel filler hose and levelling hose.

6. Support the fuel tank with a jack.



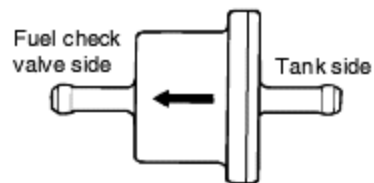
7. Remove the fuel tank bands.

9. Remove the fuel tank.



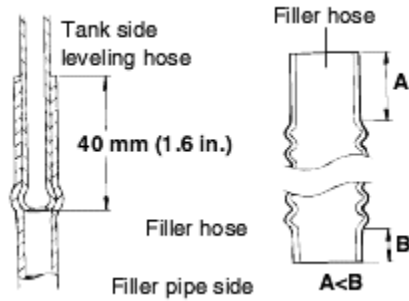
## INSPECTION EFDA8190

1. Check the hoses and the pipes for cracks or damage.
2. Check the fuel tank cap for proper operation.
3. Check the fuel tank for deformation, corrosion or cracking.
4. Check the inside of the fuel tank for dirt or foreign material.
5. Check the in-tank fuel filter for damage or restriction.
6. Test the two-way valve for proper operation.
7. To check the two-way valve, lightly blow into the inlet and outlet. If air passes through after slight resistance, then the valve is good.

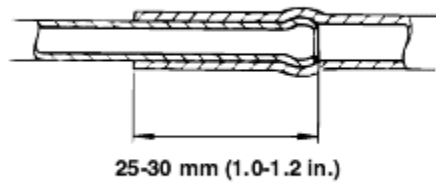


## INSTALLATION EFTC8210

1. Confirm that the pad is fully bonded to the fuel tank, and install the fuel tank by tightening the self-locking nuts.
2. Connect the levelling hose to the tank and at the filler neck by approximately 40mm (1.6 in.).
3. When connecting the filler hose, the end with the shorter straight pipe should be connected to the tank side.



4. Connect the vapour hose. When attaching the vapour hose to the line, be sure that the hose is attached as shown in the illustration.



5. Connect the high-pressure hose to the fuel pump. Be careful that the fuel hose does not twist.
6. Connect the electrical fuel pump connector.





## 5.4 Troubleshooting for DTC

DIAGNOSTIC ITEM EFTC5020

DTC	Diagnostic item
P0105	Manifold Absolute Pressure Sensor Circuit Malfunction

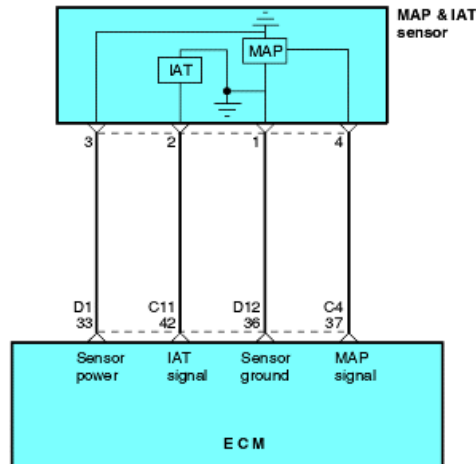
### DESCRIPTION

The MAP sensor is essentially a strain gauge used to measure the pressure in the surge tank. Inside the sensor is a metal diaphragm with a small wire attached. The diaphragm flexes according to changes in pressure. When the diaphragm flexes, the wire attached to it stretches, changing the resistance of the wire. The Engine control Module (ECM) applies five volts to the MAP sensor and measures the voltage drop across the sensor. Sensor output is in volts and as pressure decreases, the voltage drop across the sensor increases. Since the MAP sensor is used as an air flow sensor, the sensor signal is an important input. The ECM uses the information to determine fuel amount and ignition timing.

### FAILURE CONDITIONS

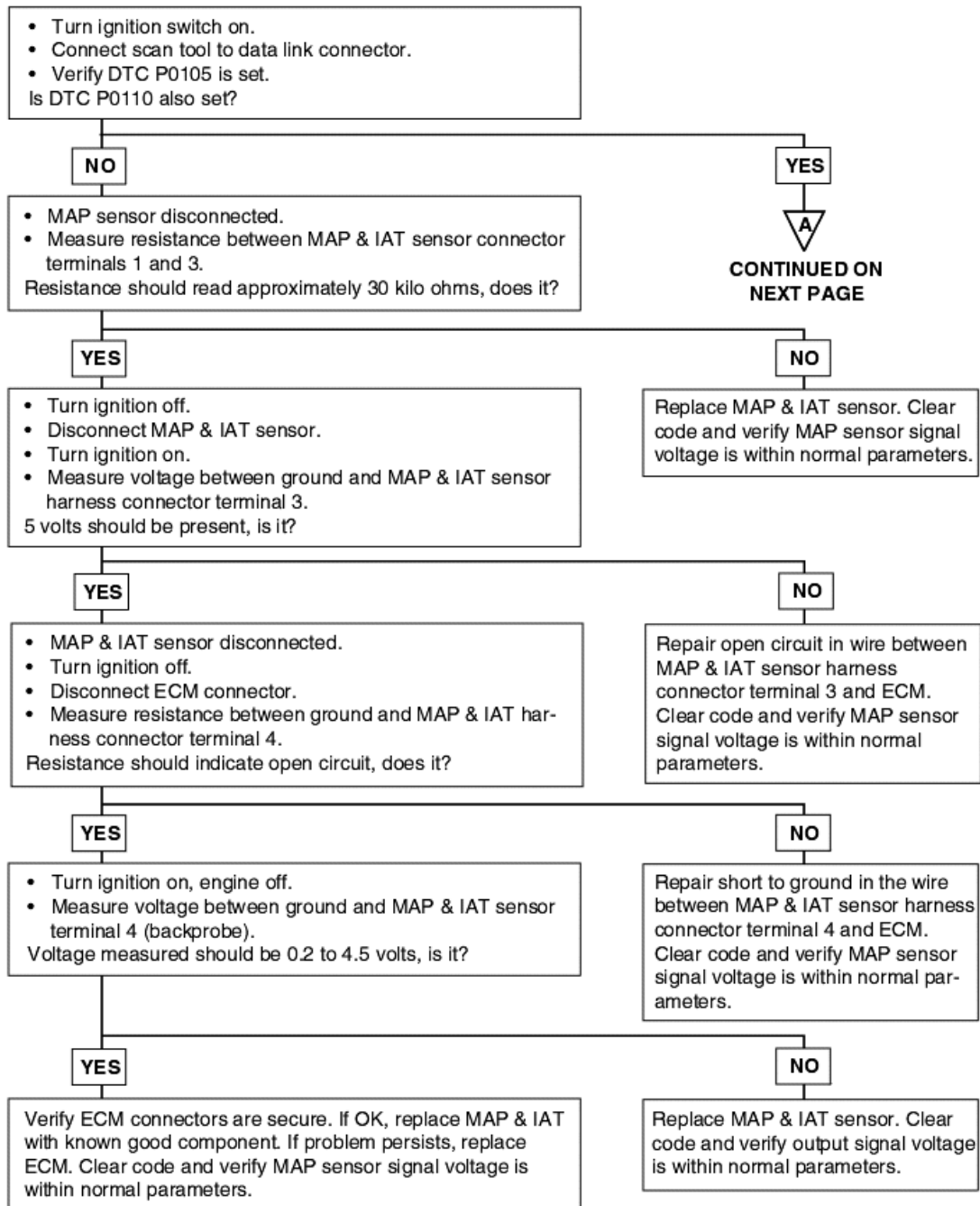
The MAP sensor outputs a voltage, which corresponds to the pressure in the surge tank. The ECM checks whether this voltage is within a specified range. The ECM will set P0105 and the Malfunction Indicator Lamp (MIL) will turn on if the MAP sensor output voltage has continued to be 4.5V or higher — corresponding to a surge tank pressure of 114kPa (17psi) or higher — for 4 sec. or to be 1.95V or lower — corresponding to a surge tank pressure of 50kPa (7.4psi) or lower — for 4 sec.

### CIRCUIT DIAGRAM



**Note :** Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE



CONTINUED FROM  
PREVIOUS PAGE

A

• Turn ignition off.  
• Disconnect MAP & IAT sensor.  
• Measure resistance between ground and MAP & IAT sensor.  
Resistance should be approximately 1 ohm or less, is it?

YES

Replace MAP sensor. Clear code and verify MAP sensor is within normal parameters.

NO

Repair open circuit in wire between MAP sensor harness connector terminal 1 and ECM. Clear code and verify MAP sensor is within normal parameters.

DTC	Diagnostic item
P0112 (P0110)	Intake Air Temperature Low Input
P0113 (P0110)	In take Air Temperature High Input

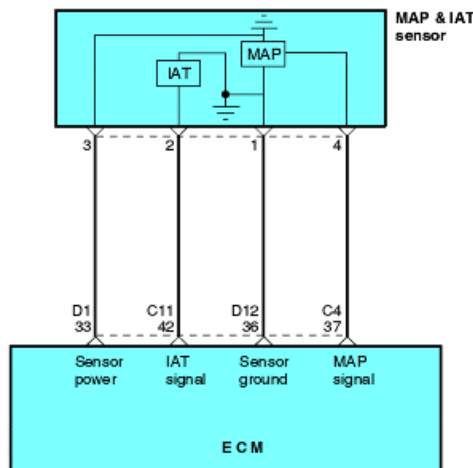
#### DESCRIPTION

The Intake air temperature (IAT) sensor is built in to the MAF sensor. The IAT sensor is a variable resistor whose resistance changes as the temperature of the air flowing through the air intake changes. The Engine Control Module (ECM) uses the IAT sensor input to adjust fuel injector pulse width. When the temperature sensed is cold, the ECM enriches fuel mixture by increasing injector pulse width; as the air warms, the injector pulse width time is shortened.

#### FAILURE CONDITIONS

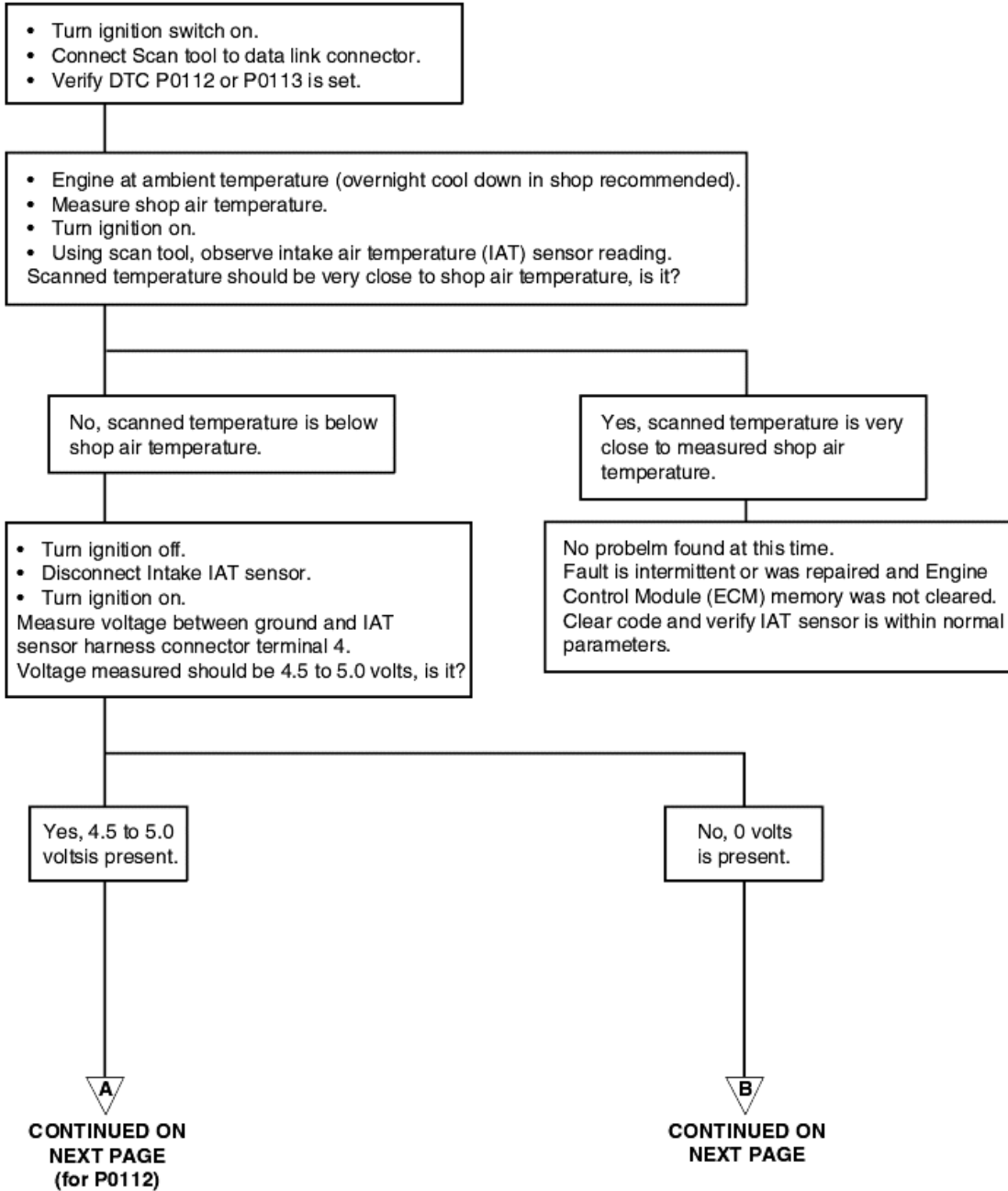
The ECM will set P0112 and the Malfunction Indicator Lamp (MIL) will turn on if the IAT sensor indicates a temperature lower than -49°F (-45°C) for 0.2 seconds during two driving cycles. This check is made after the engine has run for 4 minutes and 10 seconds and then idles for 30 seconds (with no fuel cut-off during a coast-down). This code indicates a lower than expected temperature is being read by the IAT sensor or ECM after the engine has been warmed up.

#### CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE



(for P0112) CONTINUED  
FROM PREVIOUS PAGE

A

(for P0112) CONTINUED  
FROM PREVIOUS PAGE

B

• IAT sensor disconnected.  
• Turn Ignition off.  
• Disconnect ECM connector.  
• Measure resistance between IAT sensor harness connector terminal 4 and ECM harness connector terminal 33.  
Resistance should be approximately 1 ohm or less, is it?

YES

NO

• IAT sensor disconnected.  
• ECM disconnected.  
• Measure resistance between IAT sensor harness connector terminal 1 and ECM harness connector terminal 42.  
Resistance should be approximately 1 ohm or less, is it?

Repair open in wire between IAT sensor harness connector terminal 4 and ECM. Clear code and verify IAT sensor is within normal parameters.

YES

NO

Verify ECM connector is secure.  
If OK, replace IAT sensor with known good component. Clear code and verify IAT sensor is within normal parameters. If problem persists, replace ECM.

Repair open circuit in wire between IAT sensor harness connector terminal 1 and ECM. Clear code and verify IAT sensor is within normal parameters.

DTC	Diagnostic item
P0116	Engine Coolant Temperature Circuit Range
P0117 (P0115)	Engine Coolant Temperature Low Input
P0118 (P0115)	Engine Coolant Temperature High Input

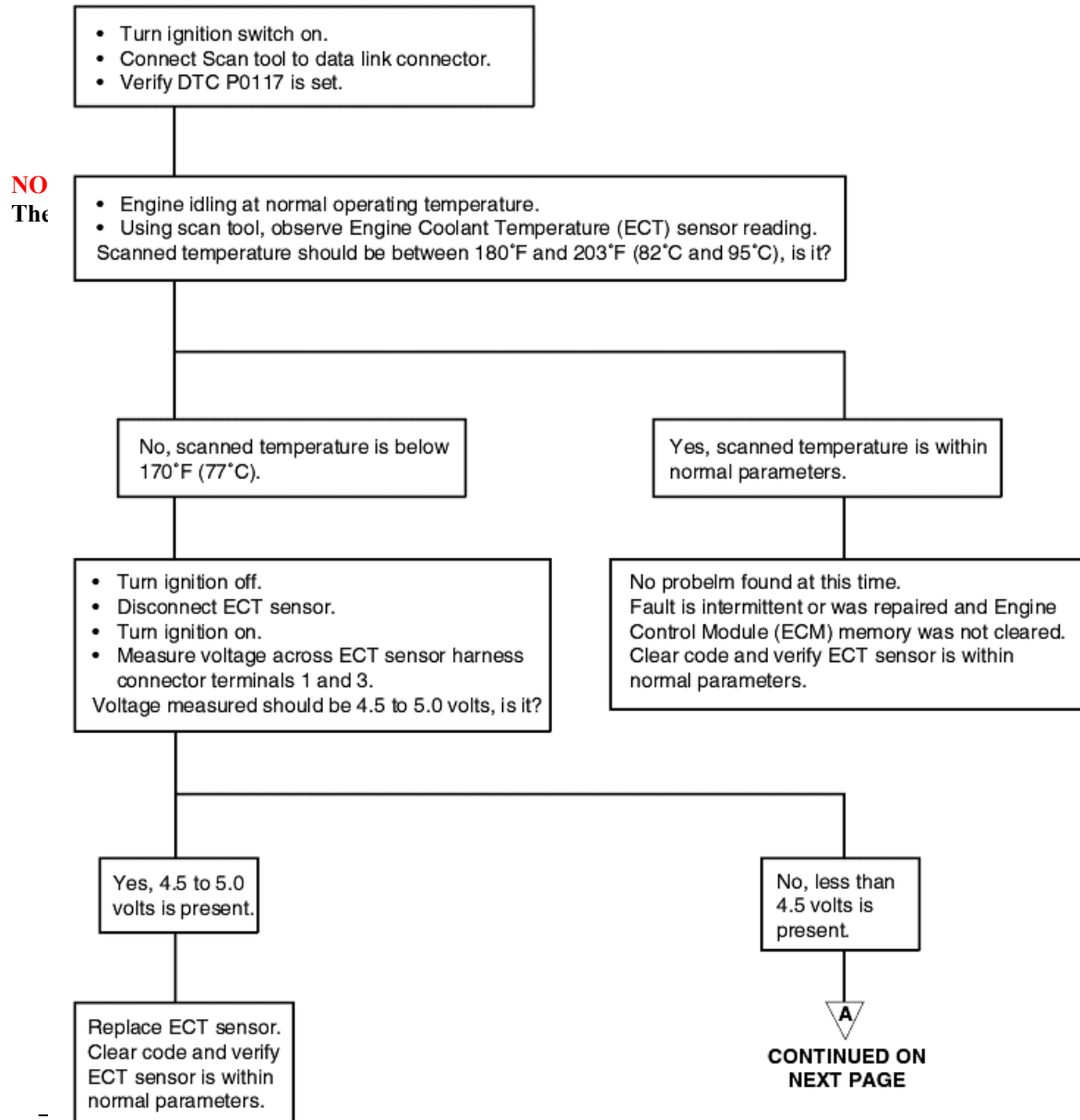
#### DESCRIPTION

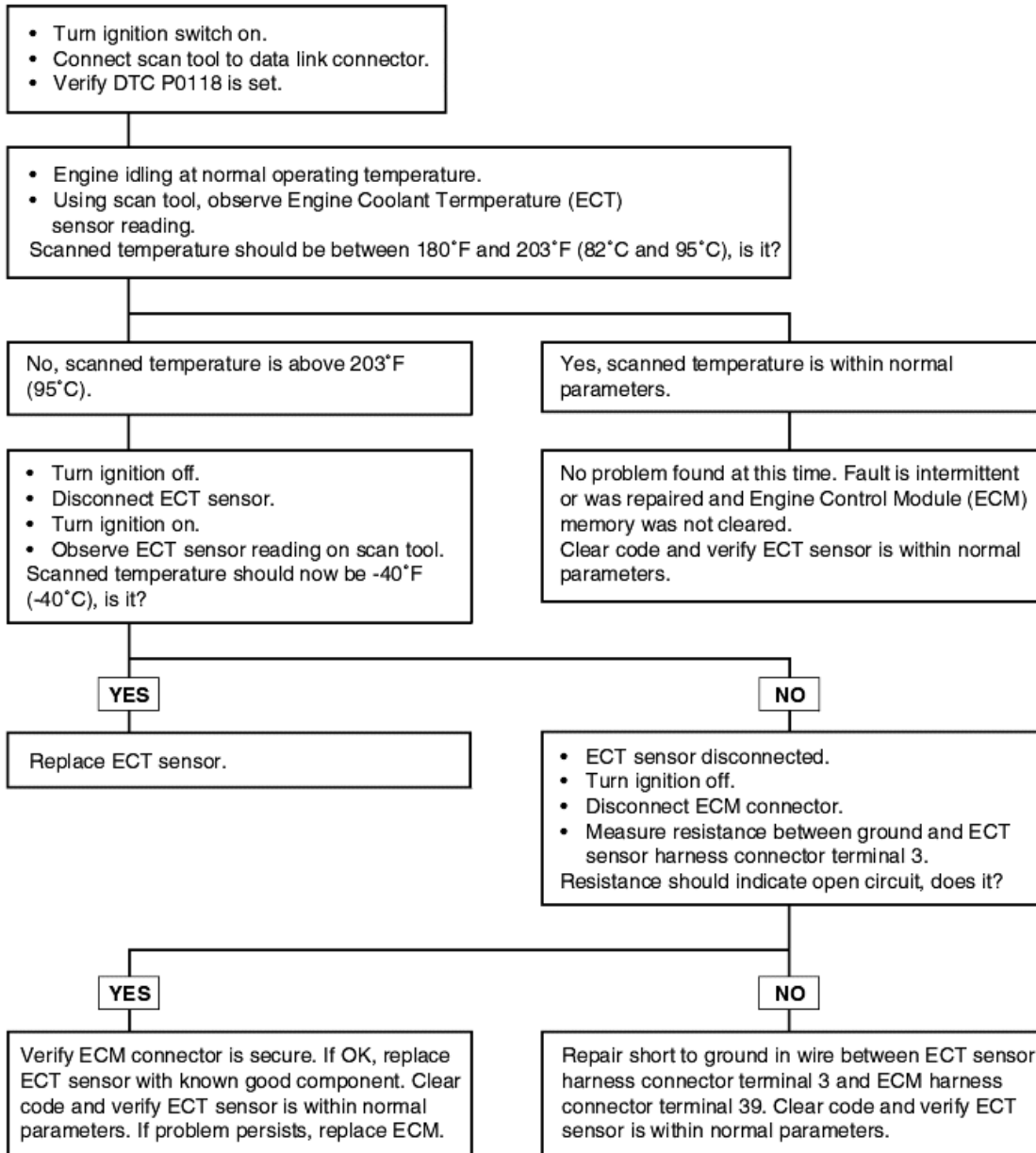
The Engine Coolant Temperature (ECT) sensor is located in the coolant passage of the cylinder head. The ECT sensor is a variable resistor whose resistance changes as the temperature of the engine coolant flowing past the sensor changes. When coolant temperature is low, sensor resistance is high; when coolant temperature is high, sensor resistance is low.

The Engine Control Module (ECM) checks ECT sensor voltage and uses the information to adjust fuel injector pulse width and ignition timing. When the temperature sensed is very cold, the ECM enriches the fuel mixture and advances ignition timing. As coolant temperature rises, the ECM reduces the amount of enrichment and timing advance.

#### FAILURE CONDITIONS

The ECM will set P0116 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor's actual







DTC	Diagnostic item
P0121	TPS Voltage Does Not Agree with MAF Sensor
P0122 (P0120)	TPS Circuit Low Input
P0123 (P0120)	TPS Circuit High Input

#### DESCRIPTION

The Throttle Position sensor mounts on the side of the throttle body and is connected to the throttle valve shaft. The TPS is a variable resistor (potentiometer) whose resistance changes according to throttle valve shaft position. During acceleration, the TPS resistance decreases; during deceleration, the TPS resistance increases.

The Engine Control Module (ECM) applies a reference voltage to the TPS and then measures the voltage that is present on the TPS signal circuit. The ECM uses the TPS signal to adjust timing and injector-pulse width. The TPS signal along with the MAF sensor signal is used by the ECM to calculate engine load.

#### FAILURE CONDITIONS

The ECM will set P0121 and the Malfunction Indicator Lamp (MIL) will turn on if the engine load indicated by the Throttle Position (TP) sensor and the Mass Air Flow (MAF) sensor are different. This code indicates that the throttle position and airflow readings by the TP and MAF sensor, or ECM, do not result in the expected engine load value.

The ECM will set P0122 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as less than 2.1 degrees for more than 0.2 seconds during 2-driving cycles. This code indicates an unusually low throttle position angle being read by the TP sensor or ECM.

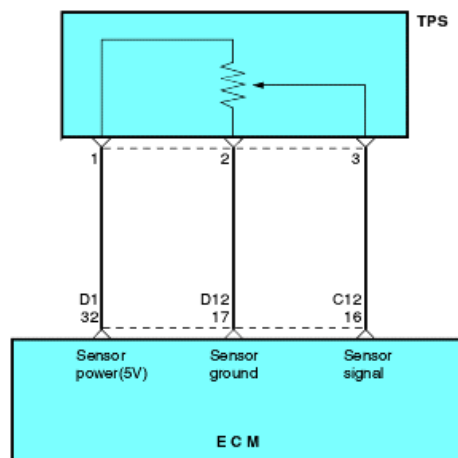
The ECM will set P0123 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as greater than 105.4 degrees for 0.2 seconds during 2-driving cycles. This code indicates an unusually high throttle position angle being read by the TP sensor or ECM.

#### NOTE

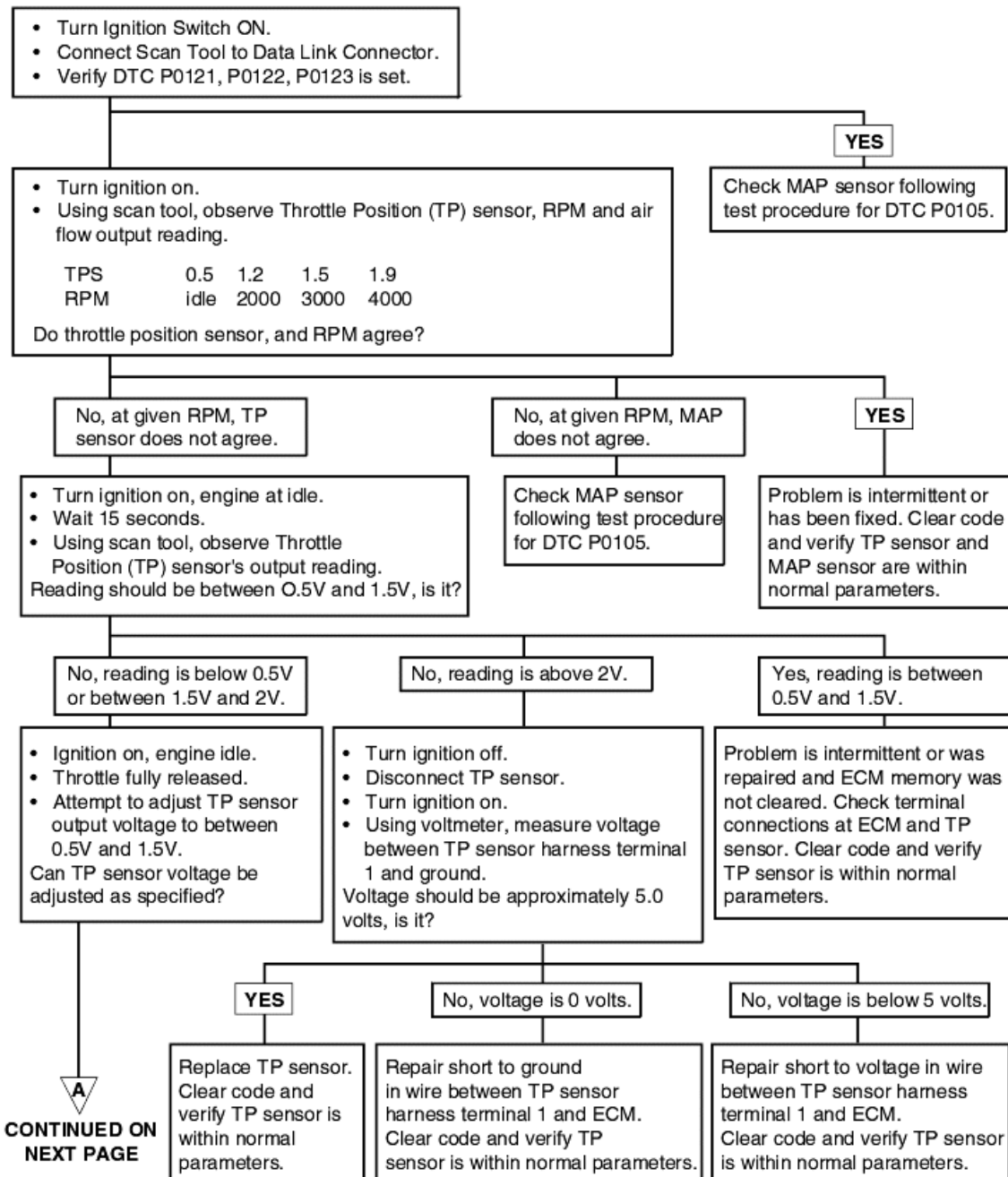
The standard resistance value between terminals 1 and 3 of the throttle position sensor is 1600-2500 ohms.

#### CIRCUIT DIAGRAM

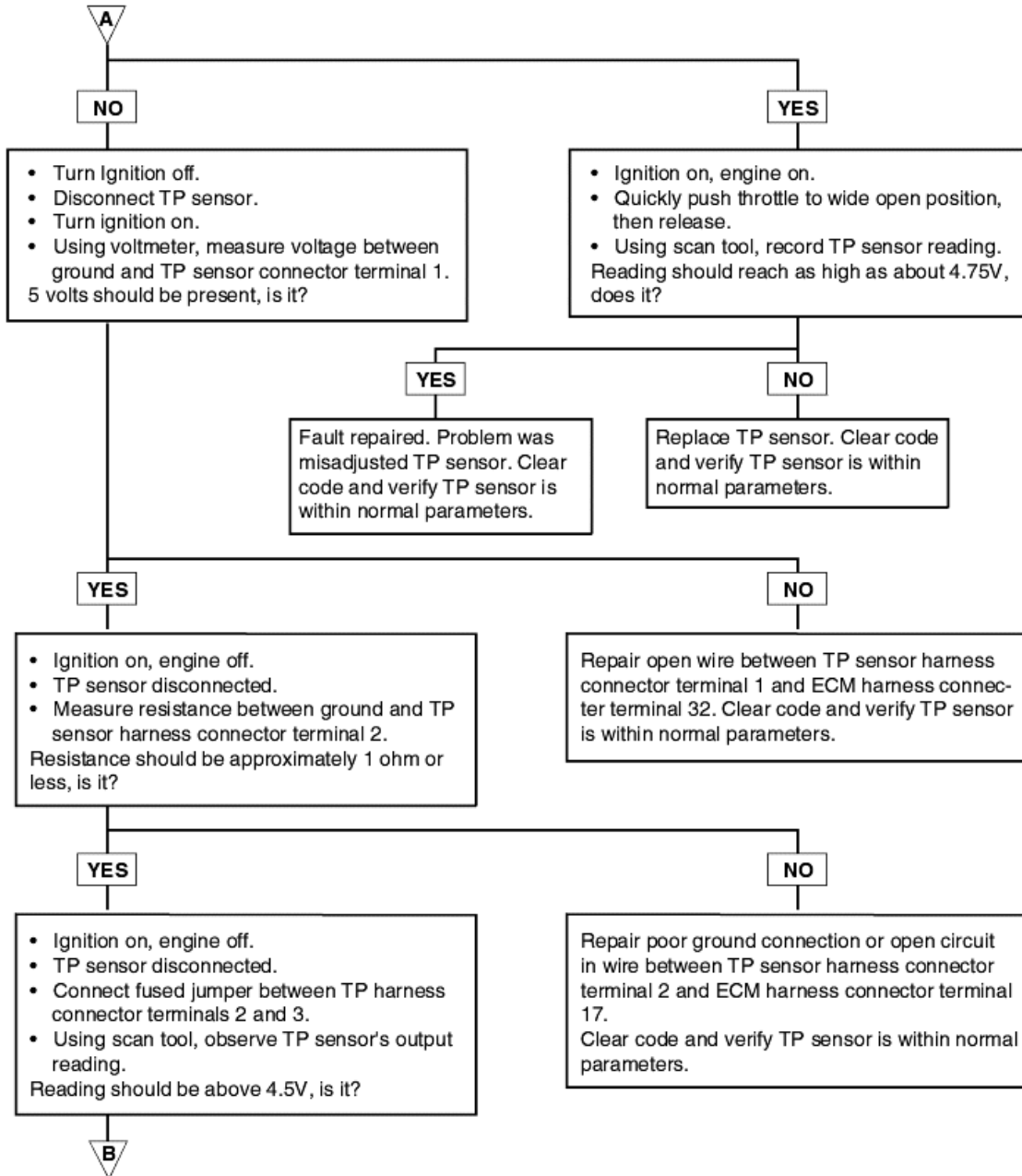
#### TEST PROCEDURE



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

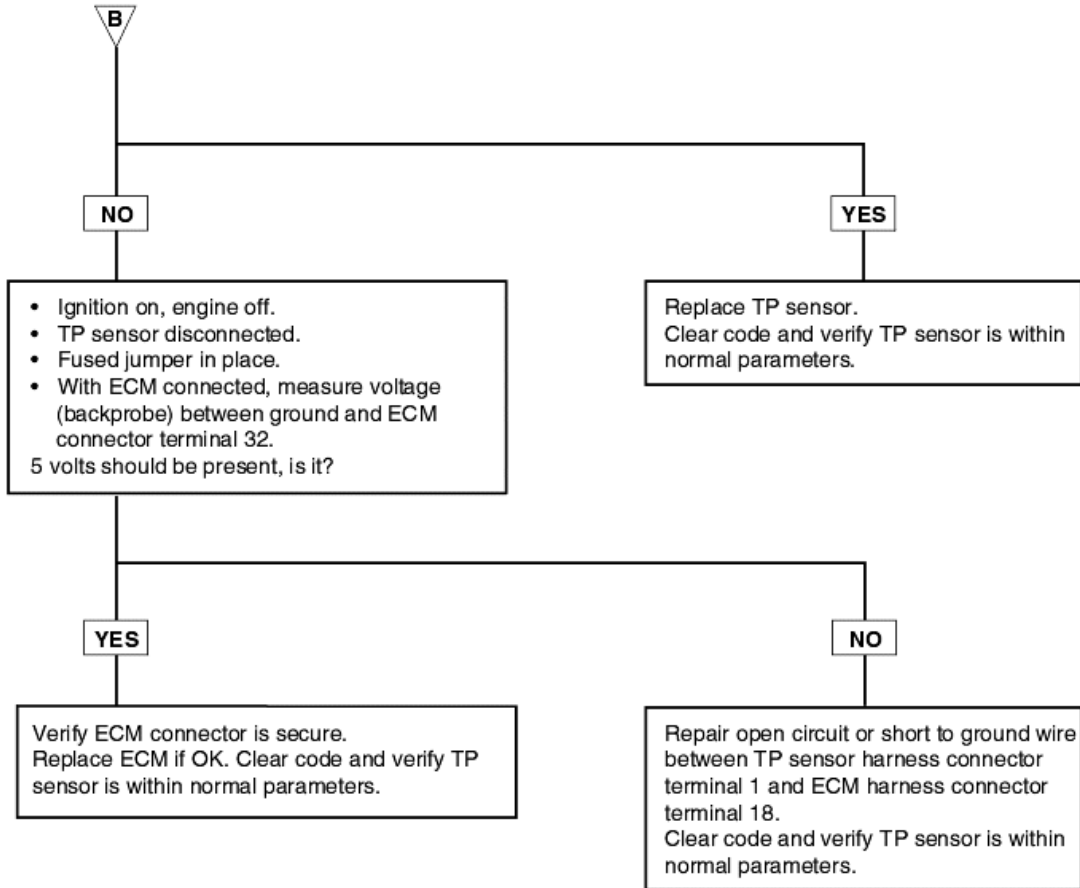


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NEXT PAGE

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PREVIOUS PAGE



DTC	Diagnostic item
P0130	Oxygen Sensor Circuit Malfunction (Bank1, Sensor1)
P0136	Oxygen Sensor Circuit Malfunction (Bank1, Sensor2)

#### DESCRIPTION

The Engine Control Module (ECM) uses oxygen sensor signals to maintain the air fuel mixture at the ratio resulting in optimum fuel economy and reduced emissions. The amount of oxygen in the exhaust gases indicates, to the front oxygen sensor, whether the air fuel mixture being supplied to the engine cylinders is rich or lean. The readings of the rear oxygen sensor are used to indicate the efficiency of the catalytic converter. The ECM calculates catalytic converter efficiency by comparing the rear oxygen sensor signal to the front oxygen sensor signal.

A normal oxygen sensor signal will constantly fluctuate above and below 500 mV, with the front oxygen sensor signal frequency of at least 5Hz at 2500 RPM. Due to the effect of the catalytic converter, the rear oxygen sensor signal frequency will be lower than the front oxygen sensor signal frequency. If the rear oxygen sensor signal coincides with the front oxygen sensor signal a large percentage of the time, this indicates a loss in efficiency of the catalytic converter or a malfunction within the fuel system.

#### FAILURE CONDITIONS

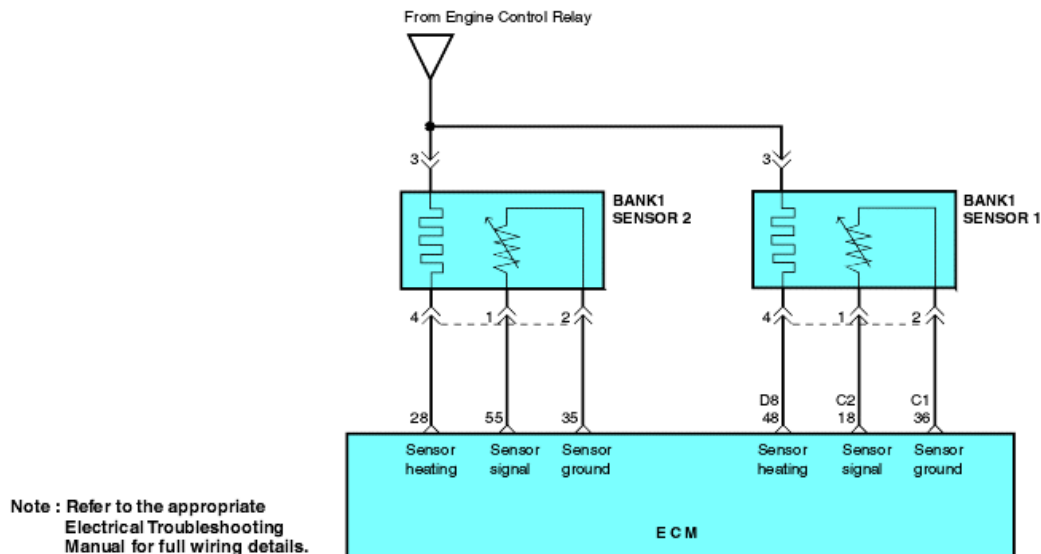
##### (FOR P0130)

After the engine runs, the ECM checks the front oxygen sensor once per driving cycle for 5 sec. If during two driving cycles the front oxygen sensor's output is not between 0 millivolts and +380 millivolts while the rear oxygen sensor's output is greater than 350 millivolts, the ECM will set a code and MIL will turn on. This code indicates uncharacteristic operation of the front oxygen sensor being read by the ECM.

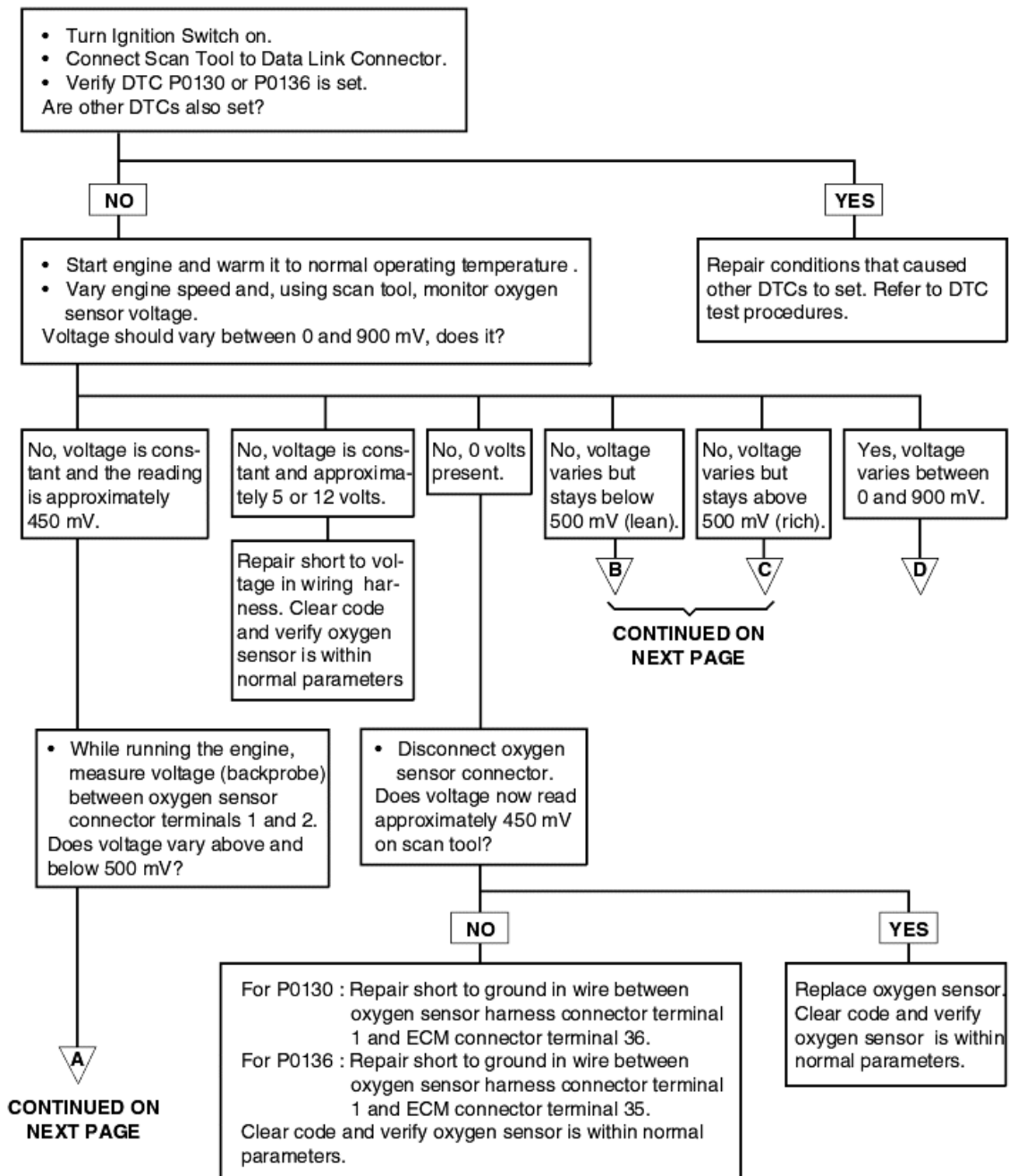
##### (FOR P0136)

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor's output. If during two driving cycles the rear oxygen sensor's output is not between 400 millivolts and 500 millivolts, the ECM will set a code and MIL will turn on. This code indicates an uncharacteristic reading by the rear oxygen sensor or ECM after the engine has been warmed and run for 3 minutes.

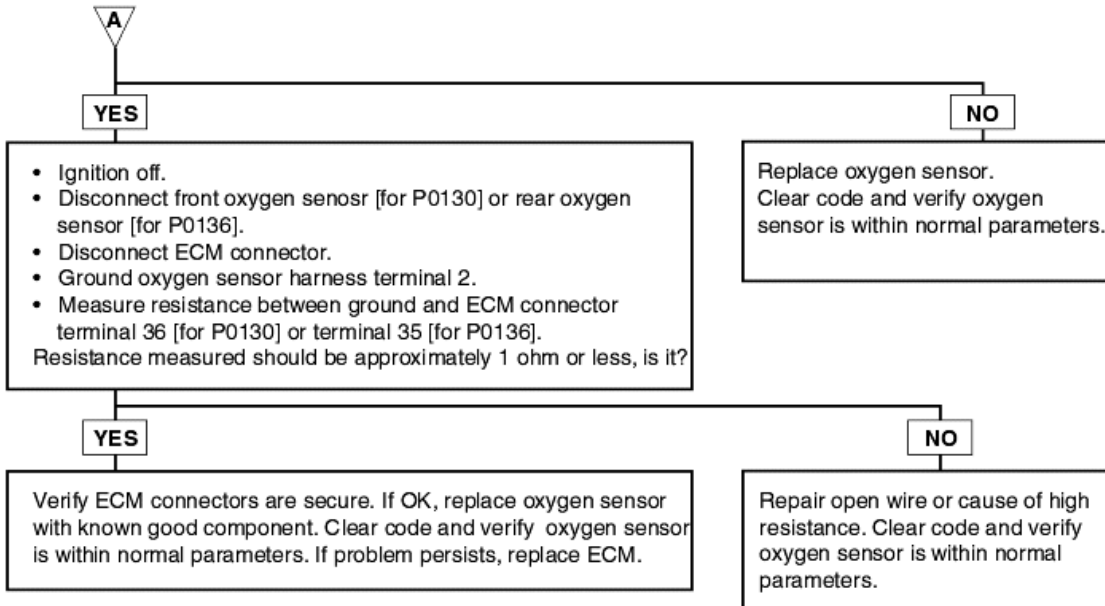
#### CIRCUIT DIAGRAM



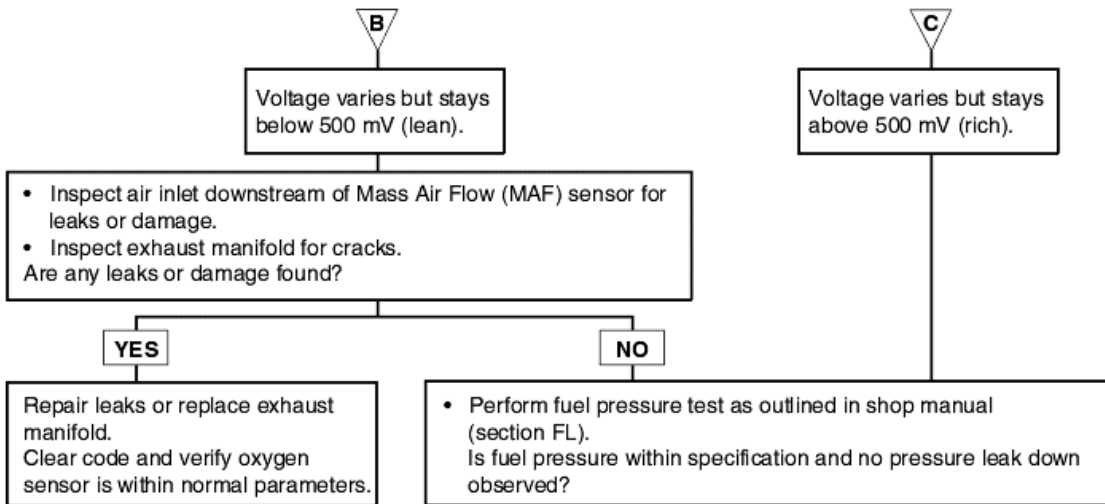
## TEST PROCEDURE



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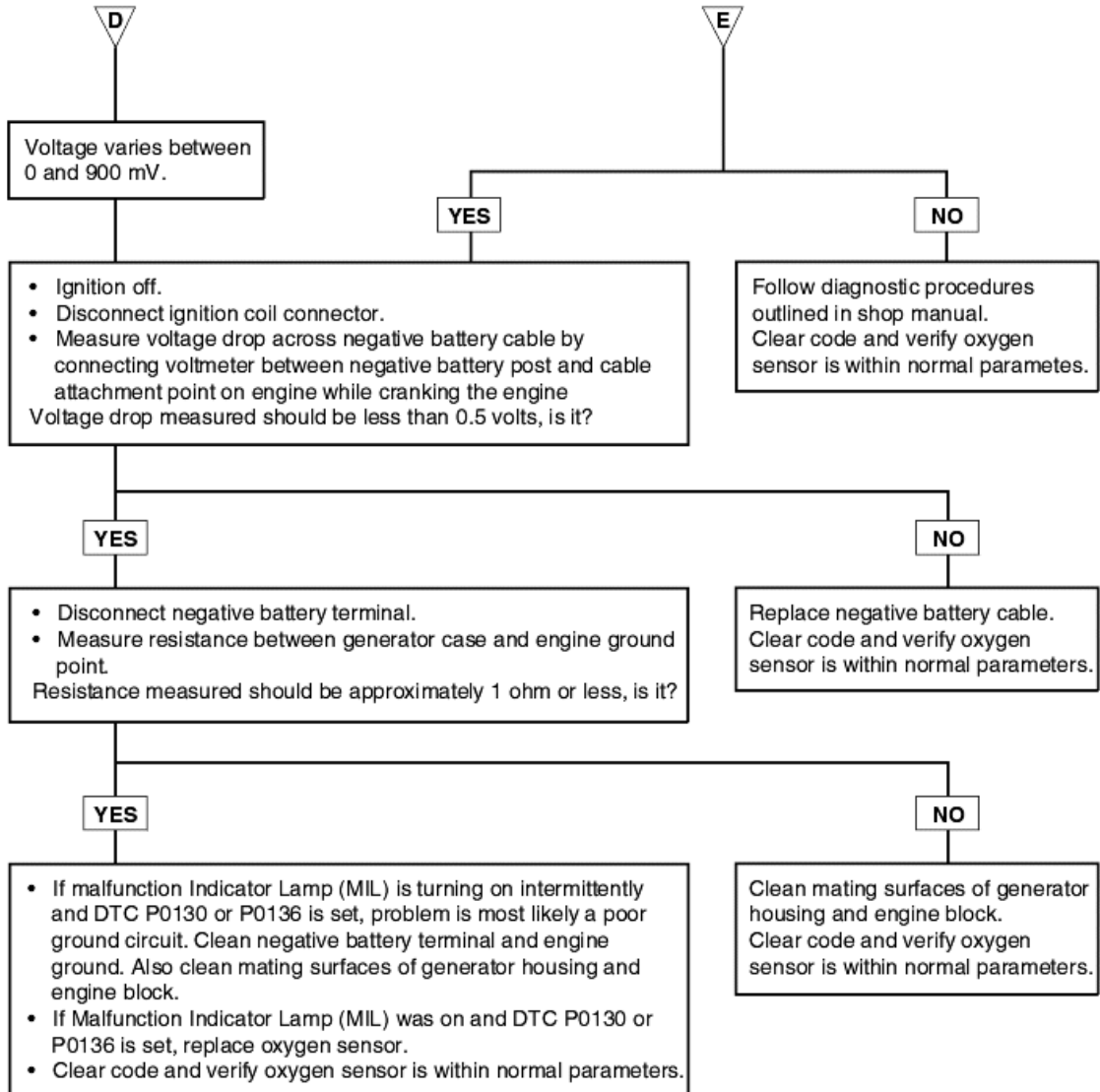


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DTC	Diagnostic item
P0131	Oxygen Sensor circuit Low Voltage (Bank1, Sensor1)
P0137	Oxygen Sensor circuit Low Voltage (Bank1, Sensor2)

## DESCRIPTION

Refer to DTC P0130 & P0136.

## FAILURE CONDITIONS

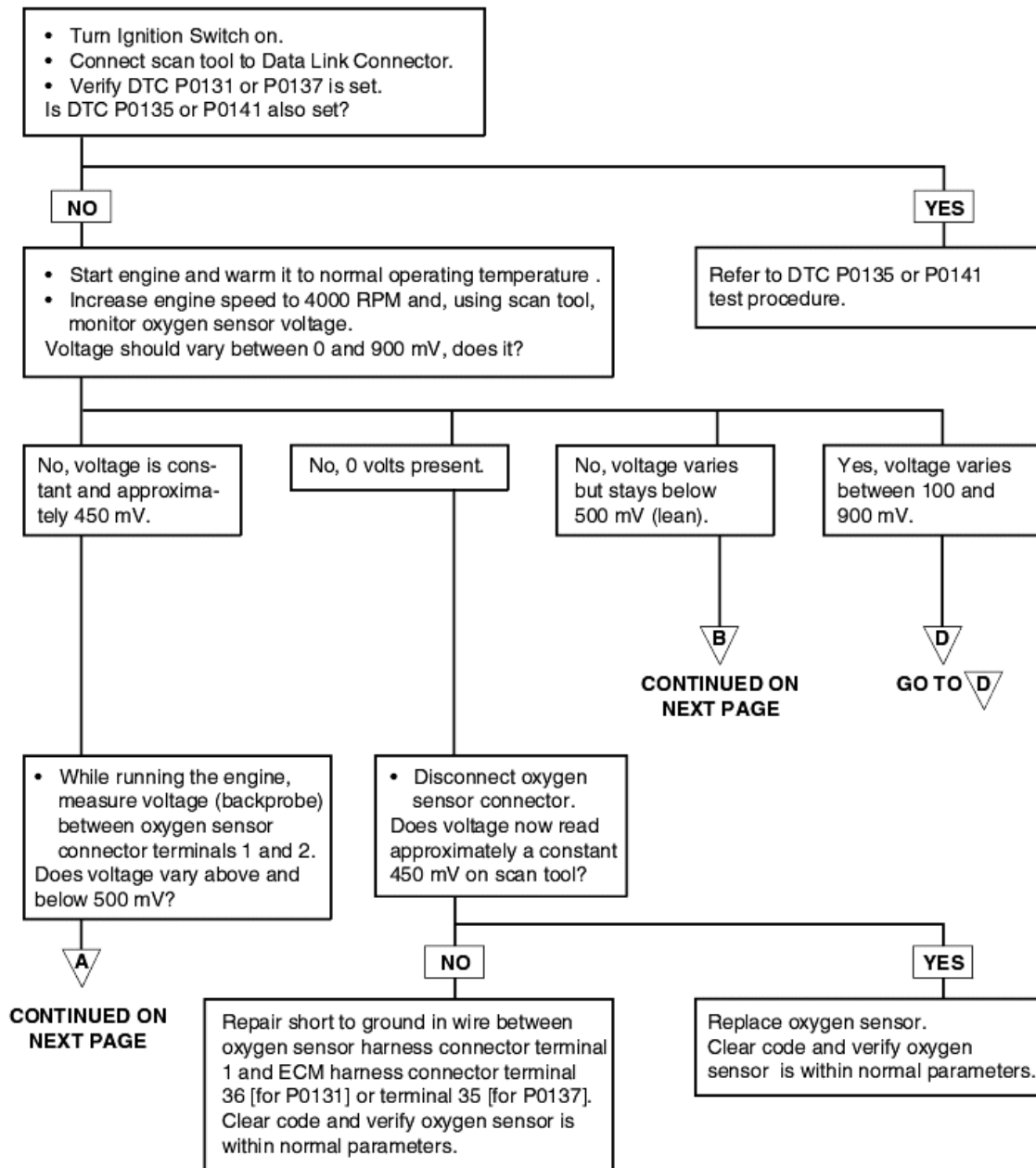
**(FOR P0131)**

After the Front Oxygen Sensor Heater is on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5-second intervals. If during two driving cycles the front oxygen sensor's output falls below 50 millivolts for 0.5 seconds, the ECM will set P0131 and MIL will turn on. This code indicates an unusually lean fuel air mixture being read by the front oxygen sensor or ECM.

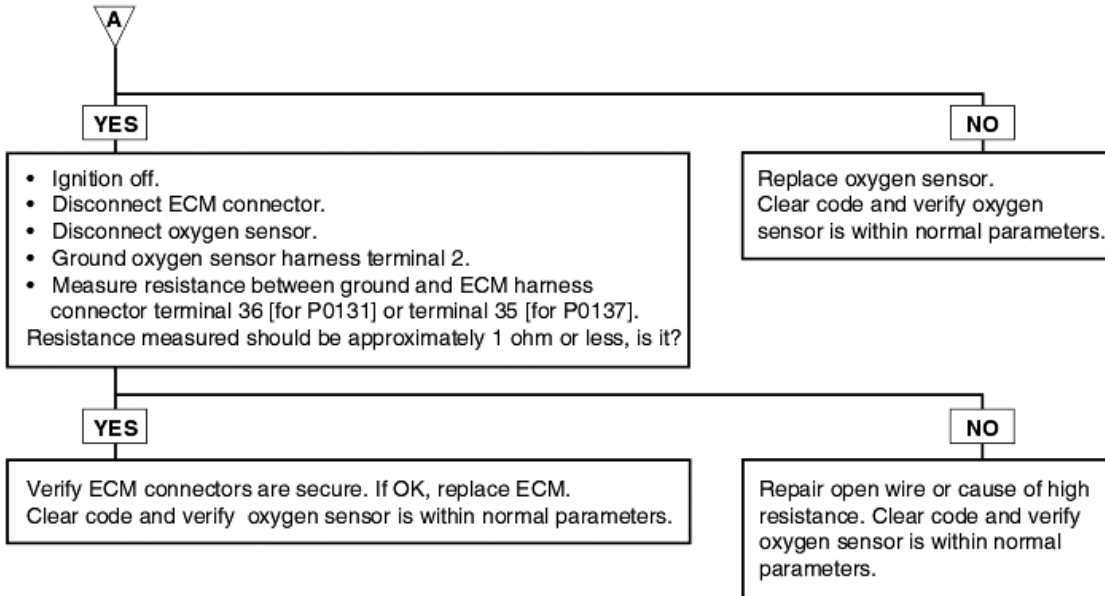
**(FOR P0137)**

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor's output for 0.5 seconds. If during 2 driving cycles the rear oxygen sensor's output falls below 50 millivolts, the ECM will set P0137 and MIL will turn on. This code indicates an extremely low voltage reading by the rear oxygen sensor or ECM.

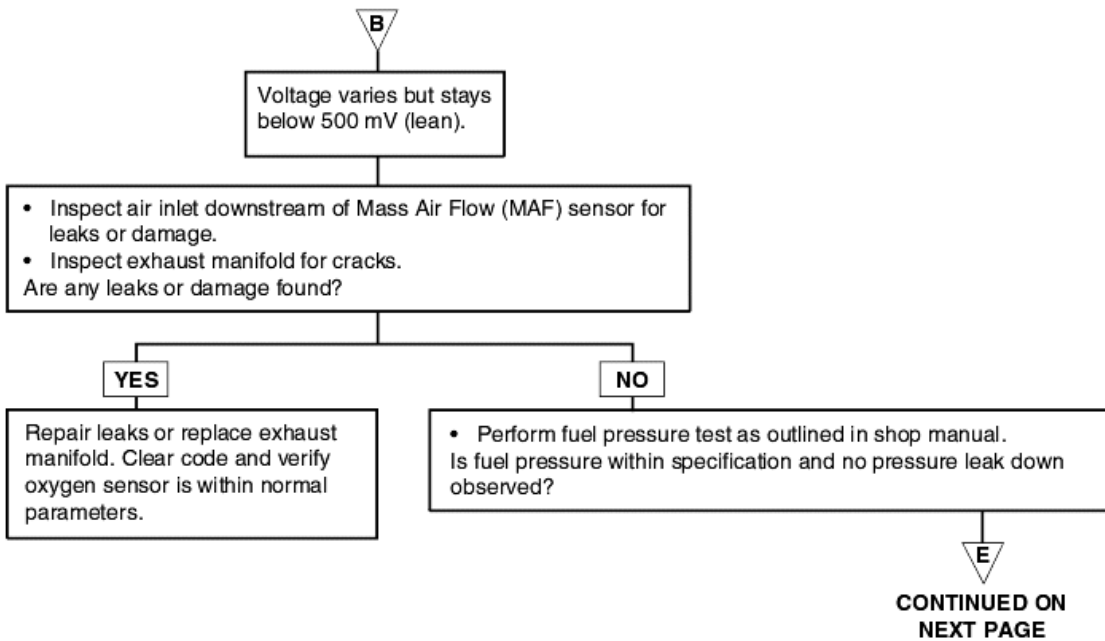
## TEST PROCEDURE



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D

Voltage varies between  
0 and 900 mV.

• Ignition off.  
• Disconnect ignition coil connector.  
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine  
Voltage drop measured should be less than 0.5 volts, is it?

YES

• Disconnect negative battery terminal.  
• Measure resistance between generator case and engine ground point.  
Resistance measured should be approximately 1 ohm or less, is it?

YES

• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0131 or P0137 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.  
• If Malfunction Indicator Lamp (MIL) was on and DTC P0131 or P0137 is set, replace oxygen sensor.  
• Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

E

YES

NO

Follow diagnostic procedures outlined in shop manual.  
Clear code and verify oxygen sensor is within normal parameters.

NO

Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.

NO

Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFTC5310

<b>DTC</b>	<b>Diagnostic item</b>
P0132	Oxygen Sensor Circuit High Voltage (Bank1, Sensor1)
P0138	Oxygen Sensor Circuit High Voltage (Bank1, Sensor2)

**DESCRIPTION**

Refer to DTC P0130 & P0136.

**FAILURE CONDITIONS**

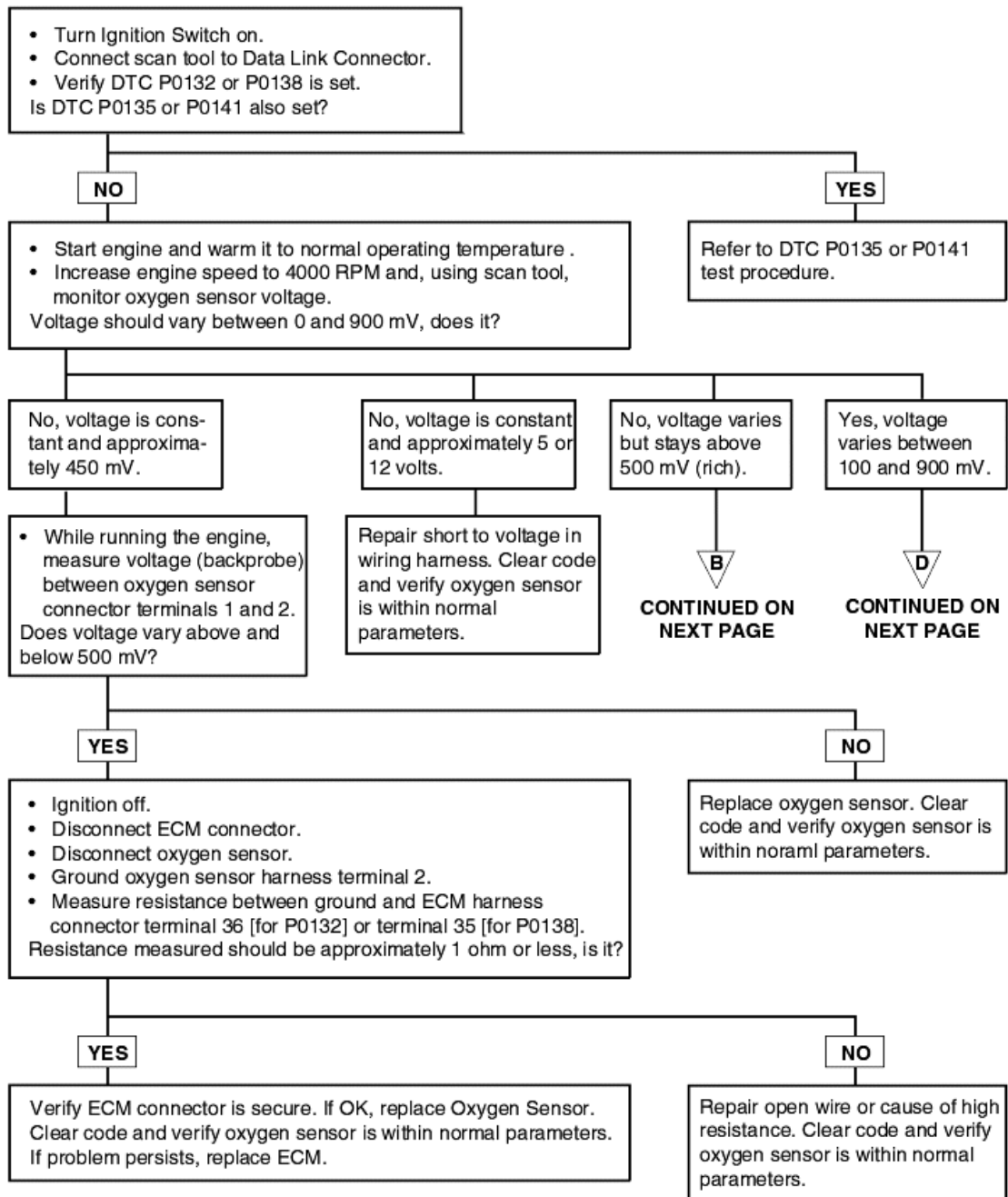
**(FOR P0132)**

After the Front Oxygen Sensor Heater has been on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5-second intervals. If during two driving cycles the front oxygen sensor's output exceeds 1.058 volts for 0.5 seconds, the ECM will set P0132 and MIL will turn on. This code indicates an extremely rich air fuel mixture being read by the front oxygen sensor or ECM.

**(FOR P0138)**

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor for 0.5 seconds. If during two driving cycles the rear oxygen sensor's output is greater than 1.058 volts, the ECM will set P0138 and MIL will turn on. This code indicates an extremely high voltage reading by the rear oxygen sensor or ECM.

## TEST PROCEDURE



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PREVIOUS PAGE

D

Voltage varies between  
0 and 900 mV.

• Ignition off.  
• Disconnect ignition coil connector.  
• Measure voltage drop across negative battery cable by connecting  
voltmeter between negative battery post and cable attachment  
point on engine while cranking the engine  
Voltage drop measured should be less than 0.5 volts, is it?

YES

• Disconnect negative battery terminal.  
• Measure resistance between generator case and engine ground  
point.  
Resistance measured should be approximately 1 ohm or less, is it?

YES

• If malfunction Indicator Lamp (MIL) is turning on intermittently and  
DTC P0132 or P0138 is set, problem is most likely a poor ground  
circuit. Clean negative battery terminal and engine ground. Also  
clean mating surfaces of generator housing and engine block.  
• If Malfunction Indicator Lamp (MIL) was on and DTC P0132 or  
P0138 is set, replace oxygen sensor.  
• Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

B

Voltage varies but stays  
above 500 mV (rich).

• Perform fuel pressure test as outlined in shop manual.  
Is fuel pressure within specification and no pressure leak down  
observed?

YES

NO

Follow diagnostic procedures  
outlined in shop manual.  
Clear code and verify oxygen  
sensor is within normal parameters.

NO

Replace negative battery cable.  
Clear code and verify oxygen  
sensor is within normal parameters.

NO

Clean mating surfaces of generator  
housing and engine block. Clear  
code and verify oxygen sensor  
is within normal parameters.

DTC	Diagnostic item
P0133	Oxygen Sensor Circuit Slow Response (Bank1, Sensor1)
P0134	Oxygen Sensor Circuit Inactive (Bank1, Sensor1)

## DESCRIPTION

Refer to DTC P0130 & P0136.

## FAILURE CONDITIONS[FOR P0133]

**(FOR P0133)**

The ECM will set P0133 and MIL will turn on if the ECM does not sense the following conditions during two driving cycles:

1. Over a period of 2 minutes, the ECM must sense a fuel compensation factor greater 85% or less than 95%:
  - Engine RPM is between 1600 and 3200 RPM.
  - Engine load range is between 1.35 and 3.4 milliseconds.
  - Catalyst temperature is above 372°C (702°F).
  - System is in closed loop.
2. The ECM must make some correction in the air/fuel ratio when:

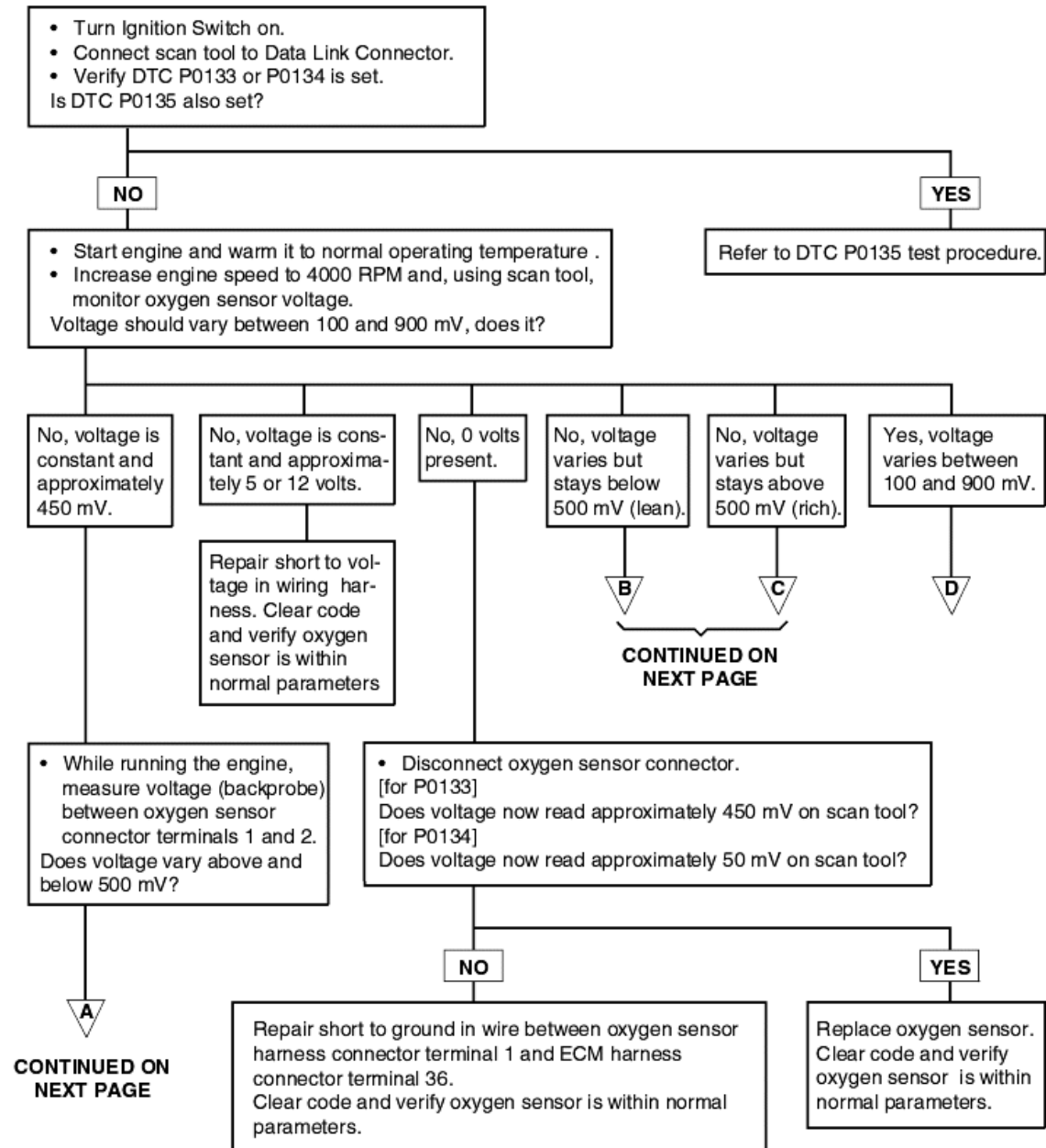
This code indicates the engine air fuel ratio is not being adjusted by the front oxygen sensor signal or the ECM as expected to do so, or not adjusted as often as expected to do so once the engine is warmed or under normal engine use.

**(FOR P0134)**

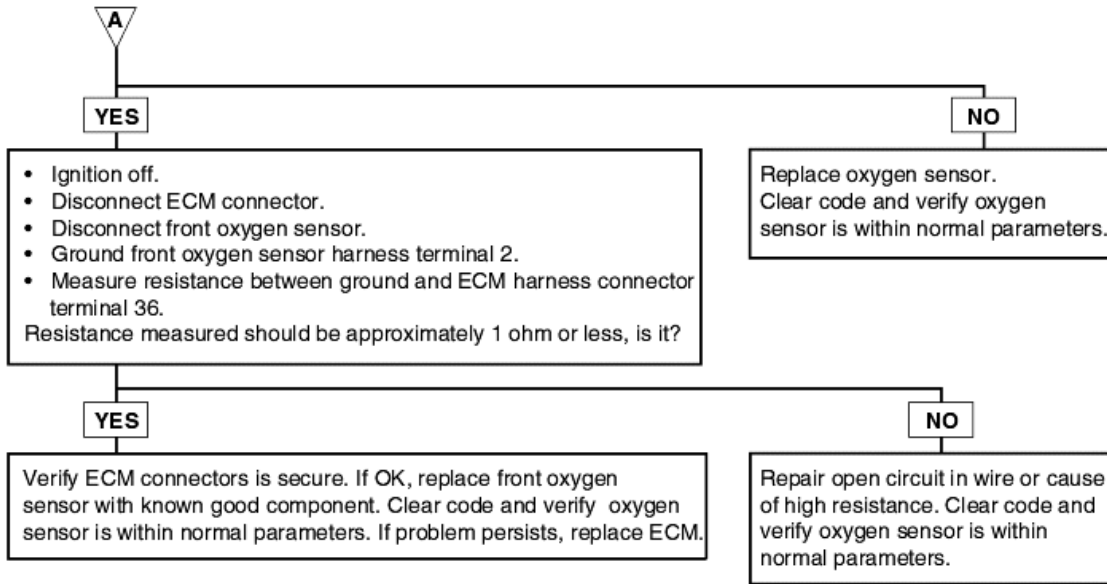
After the engine runs for 3 minutes, the ECM checks the front oxygen sensor. If during 2 driving cycles the front oxygen sensor's output voltage is not between 400 and 600 millivolts for 5 seconds, the ECM will set a code and MIL will turn on. This code indicates the front oxygen sensor is not active within the expected range once the engine has been warmed.



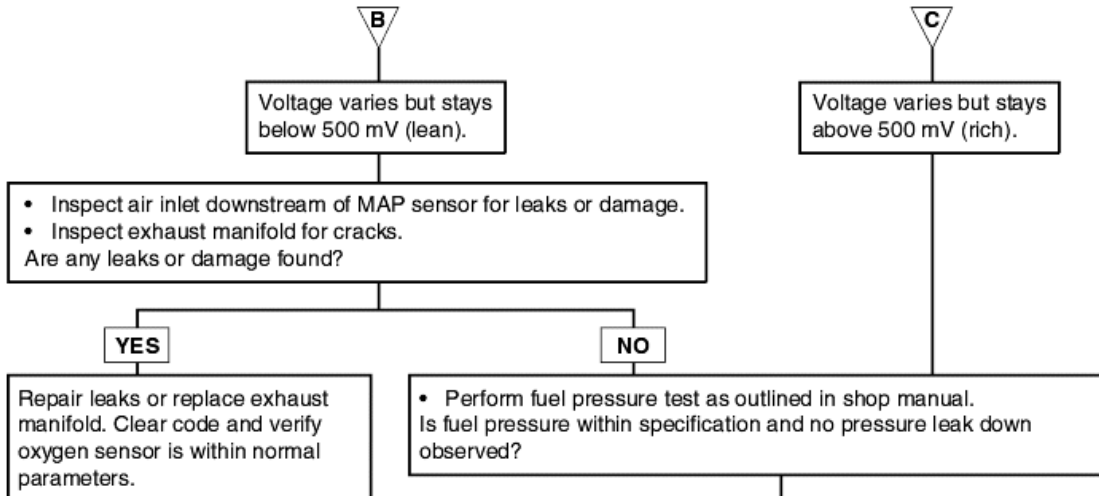
## TEST PROCEDURE



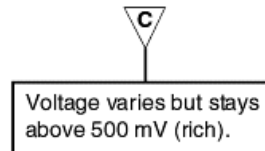
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D

Voltage varies between  
100 and 900 mV.

• Ignition off.  
• Disconnect ignition coil connector.  
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine. Voltage drop measured should be less than 0.5 volts, is it?

YES

• Disconnect negative battery terminal.  
• Measure resistance between generator case and engine ground point. Resistance measured should be approximately 1 ohm or less, is it?

YES

• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0133 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.  
• If Malfunction Indicator Lamp (MIL) was on and DTC P0133 or P0134 is set, replace oxygen sensor.  
• Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

E

YES

NO

Follow diagnostic procedures outlined in shop manual. Clear code and verify oxygen sensor is within normal parameters.

NO

Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.

NO

Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

DTC	Diagnostic item
P0201	Injector Circuit Malfunction-Cylinder 1.
P0202	Injector Circuit Malfunction-Cylinder 2.
P0203	Injector Circuit Malfunction-Cylinder 3.
P0204	Injector Circuit Malfunction-Cylinder 4.

### DESCRIPTION

The fuel injectors are solenoid operated valves. When a fuel injector solenoid is energized (pulsed) the injector needle valve opens, allowing pressurized fuel to pass through the injector and mix with air entering the engine.

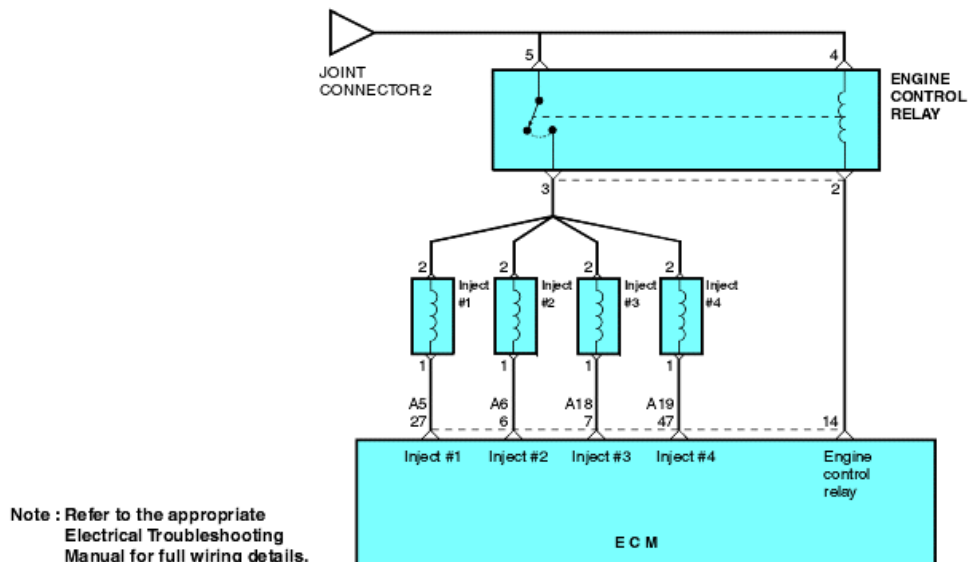
The Engine Control Module (ECM) controls injector timing and pulse width. The ECM, pulses the fuel injectors based on information provided by its network of engine sensors. The ECM uses the crankshaft position sensor to determine when to pulse the injectors. Engine coolant temperature, intake air temperature, airflow, and the ECM to calculate injector pulse width uses all throttle position data.

The ECM also uses its network of sensors to determine whether all injectors should be pulsed at the same time (simultaneous injection) or each injector should be pulsed individually (sequential injection). Sequential injection is almost always used during normal engine operation. Simultaneous injection may be used when the engine is being cranked.

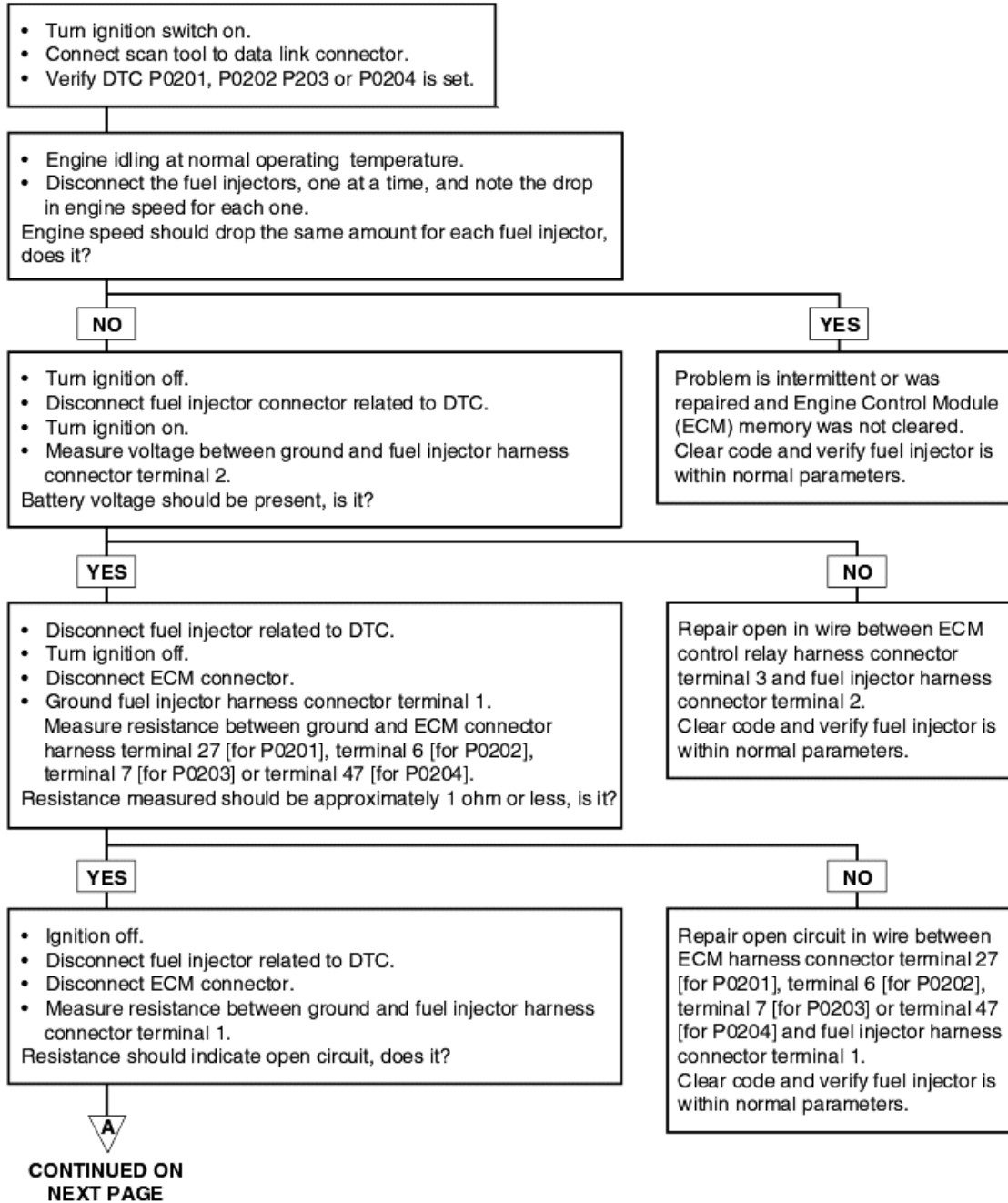
### FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if an open circuit or short to ground is detected in the fuel injector circuit during two driving cycles.

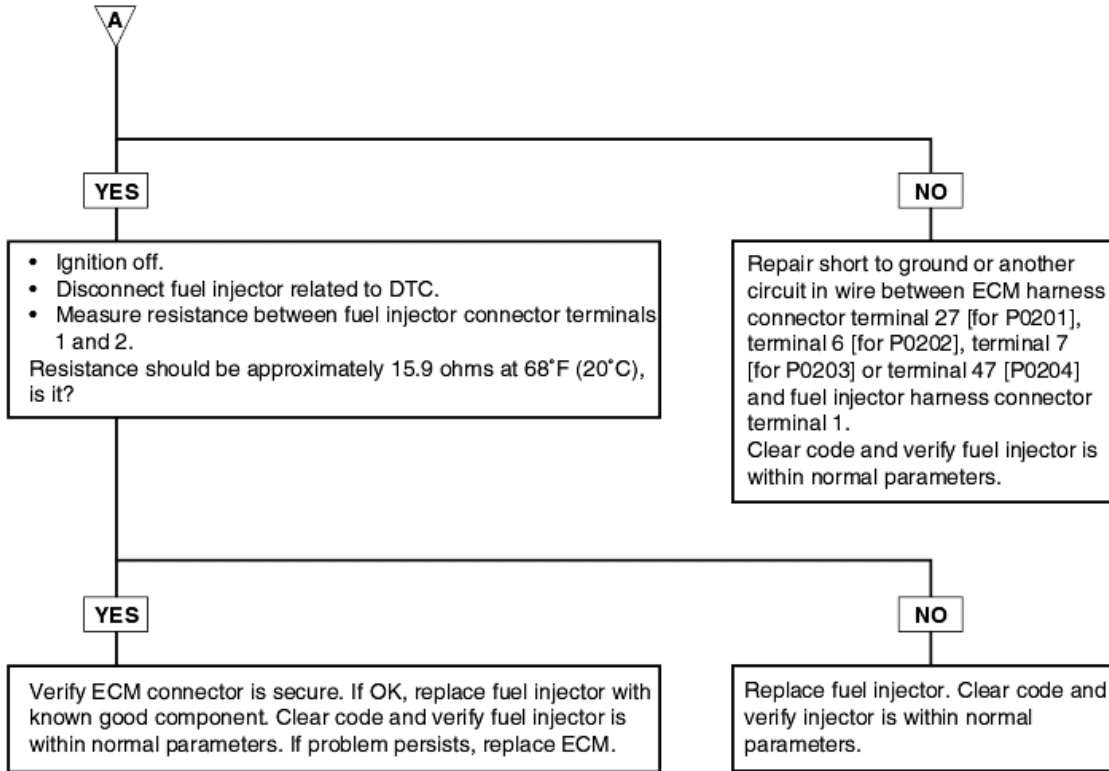
### CIRCUIT DIAGRAM



## TEST PROCEDURE



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<b>DTC</b>	<b>Diagnostic item</b>
P0300	Random Misfire Detected

#### DESCRIPTION

With the ignition switch at ON or START, voltage is applied to the ignition coil. The ignition coil consists of two coils. High-tension leads go to each cylinder from the ignition coil. The ignition coil fires two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3.

The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike across the attached spark plugs.

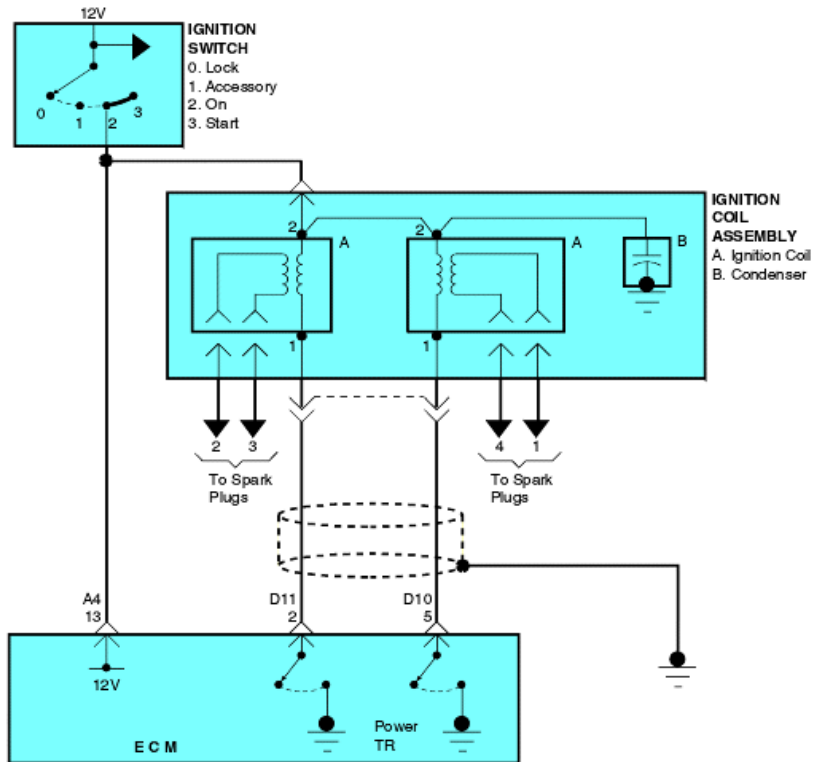
#### FAILURE CONDITIONS

The ECM will set P0300 and the MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditions are met:

- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.
- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

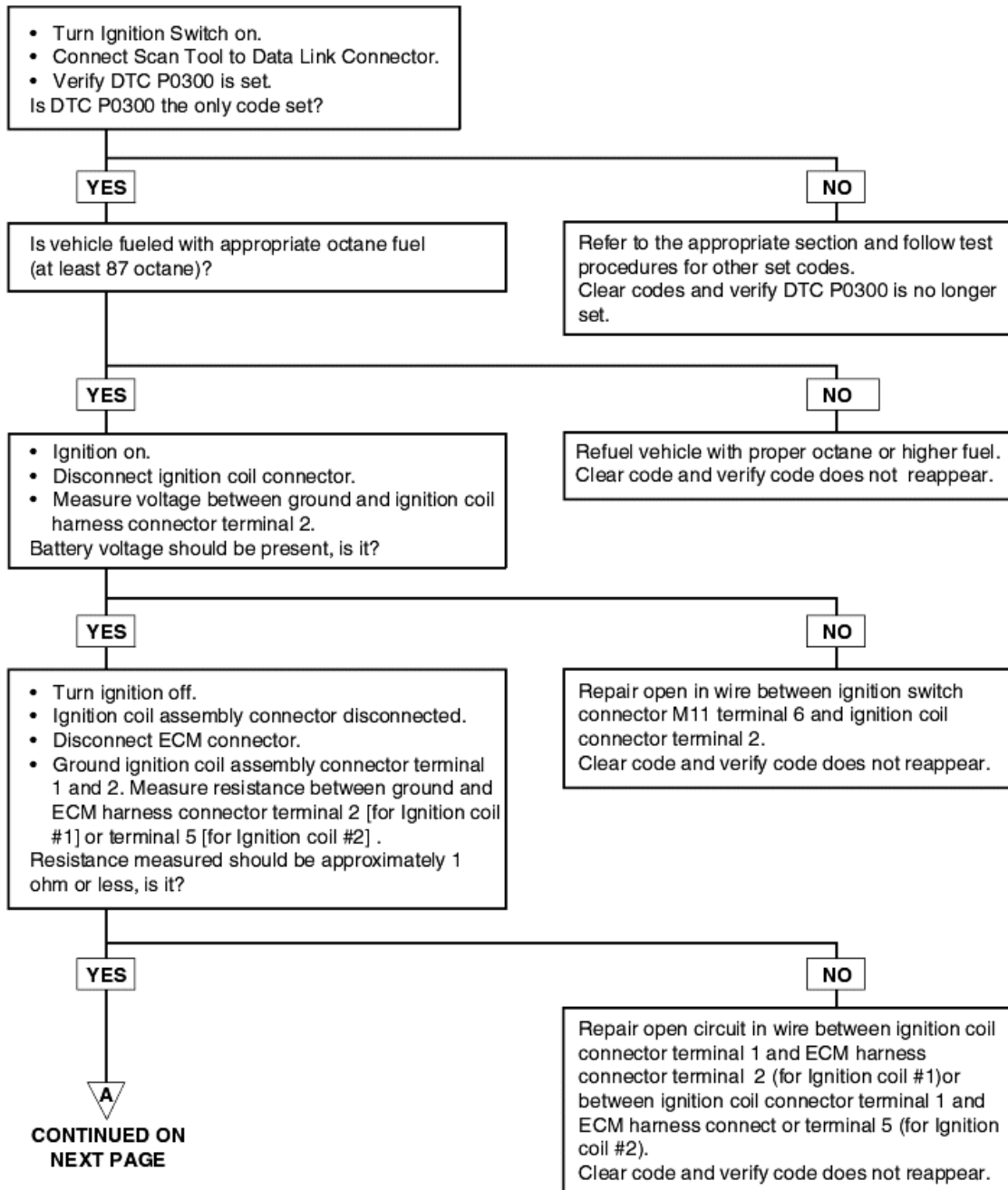
If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

# CIRCUIT DIAGRAM



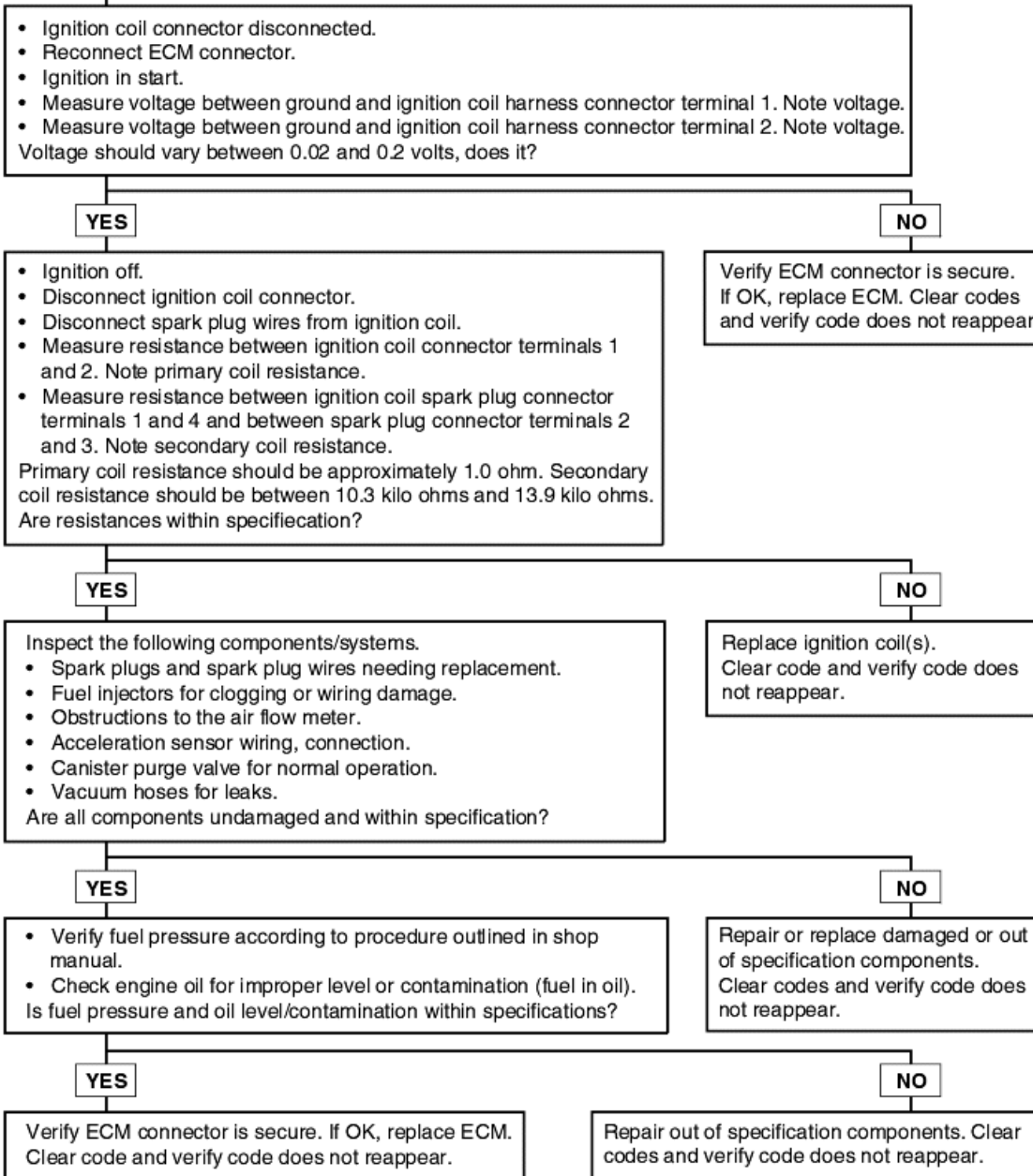


## TEST PROCEDURE



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DTC	Diagnostic item
P0301	Cylinder 1 Misfire Detected
P0302	Cylinder 2 Misfire Detected
P0303	Cylinder 3 Misfire Detected
P0304	Cylinder 4 Misfire Detected

#### DESCRIPTION

Refer to DTC P0300.

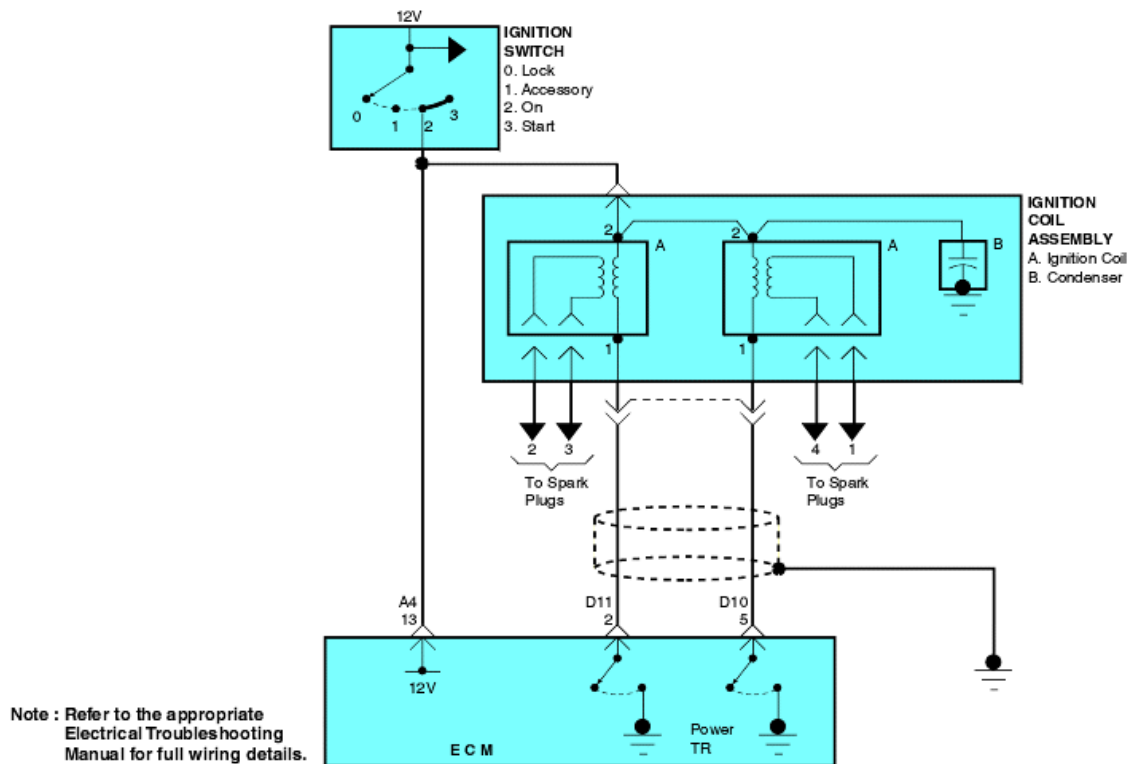
#### FAILURE CONDITIONS

The ECM will set P0301, P0302, P0303 or P0304 and MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditions are met:

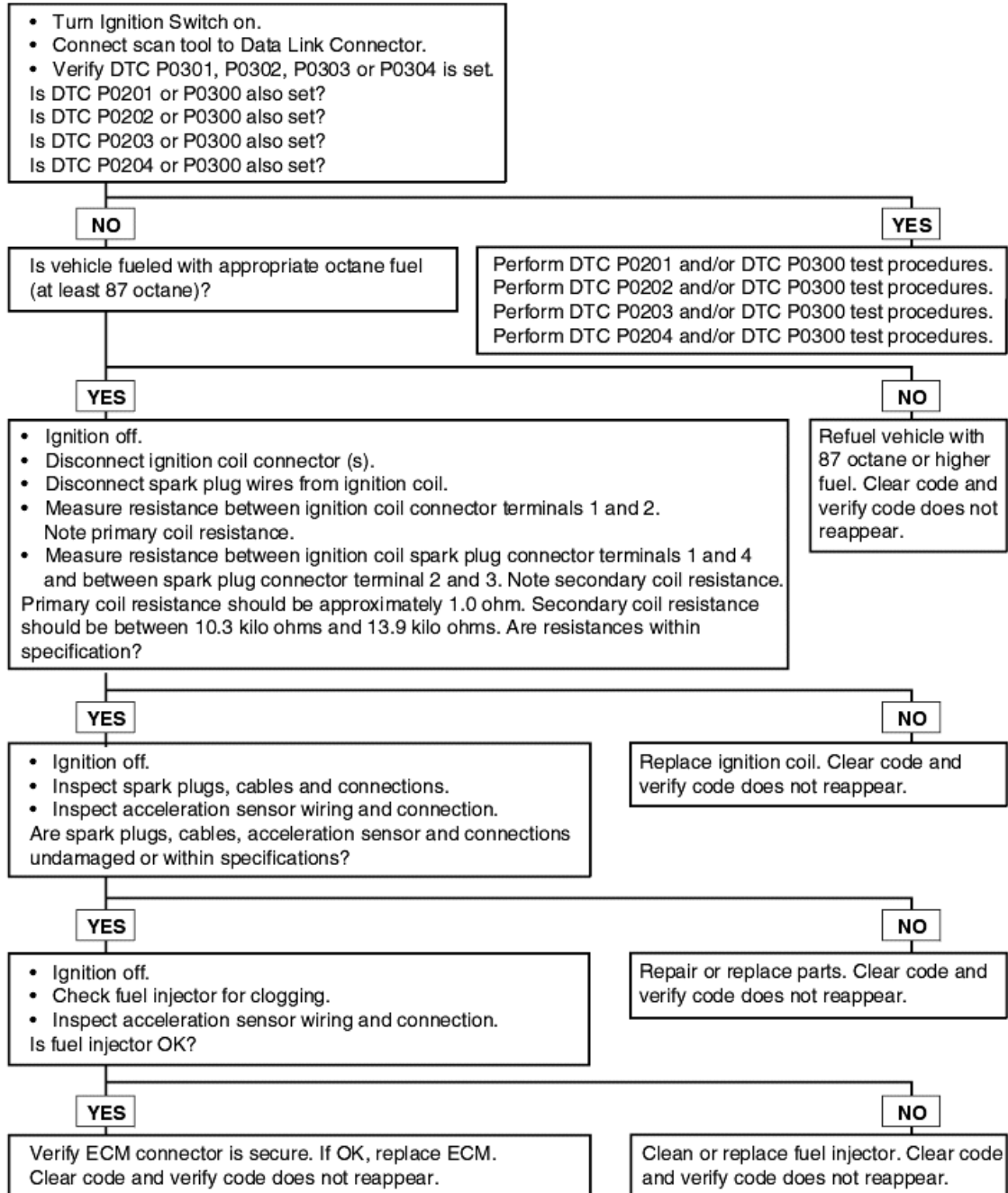
- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.
- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

#### CIRCUIT DIAGRAM



## TEST PROCEDURE



DTC	Diagnostic item
P0335	Crankshaft Position Sensor Circuit Malfunction
P0336	Crankshaft Position Sensor Circuit Out of Range

#### DESCRIPTION

The Crankshaft Position (CKP) sensor consists of a magnet and coil located next to the flywheel. The sensing wheel teeth are used by the CKP sensor to generate a signal. The voltage signal from CKP sensor allows the Engine Control Module (ECM) to determine engine RPM and crankshaft position.

#### FAILURE CONDITIONS

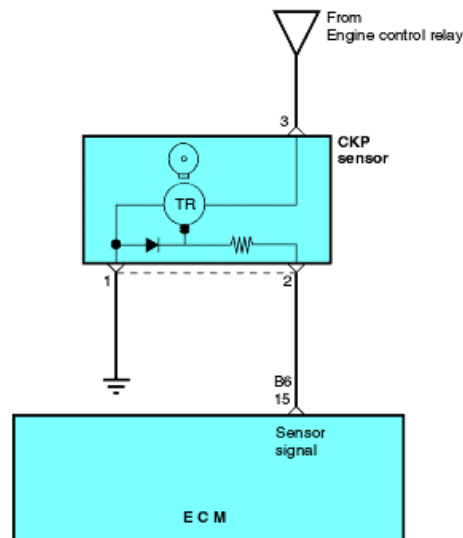
##### (FOR P0335)

The ECM will set P0335 and the MIL will turn on if the CKP signal voltage remains at 0.0 volts with the starter engaged for 4 seconds or 8 revolutions and the Camshaft Position (CMP) sensor signal indicating engine rotation. This check is made every time the engine starts. This code indicates no crankshaft signal is being read by the CKP sensor or the ECM while a CMP sensor signal verifies engine rotation.

##### (FOR P0336)

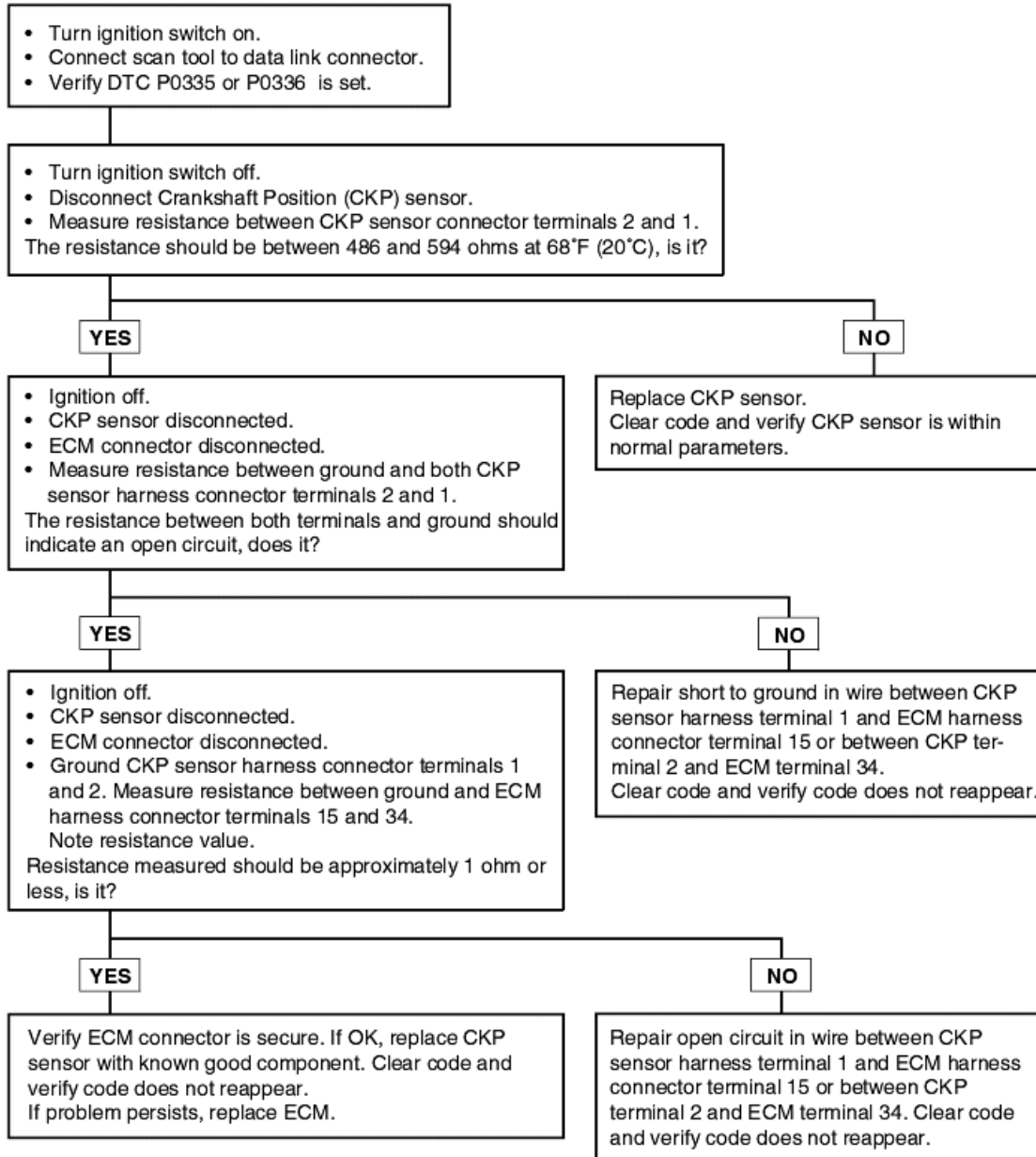
The ECM will set P0336 and the MIL will turn on immediately if the CKP sensor signal does not indicate the two missing teeth in exactly the same position on the tone wheel during two successive engine revolutions. This check is made for 5 seconds when the engine is running above 2000 RPM. This code indicates a problem with the crankshaft being read by the CKP sensor or ECM.

#### CIRCUIT DIAGRAM



Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

## TEST PROCEDURE



DTC	Diagnostic item
P0342 (P0340)	Camshaft Position Sensor Circuit Low
P0343 (P0340)	Camshaft Position Sensor Circuit High

#### DESCRIPTION

The Camshaft Position (CMP) sensor senses the Top Dead Centre (TDC) point of the #1 cylinder in the compression stroke. The CMP sensor signal allows the Engine Control Module (ECM) to determine the fuel injector sequence starting point.

#### FAILURE CONDITIONS

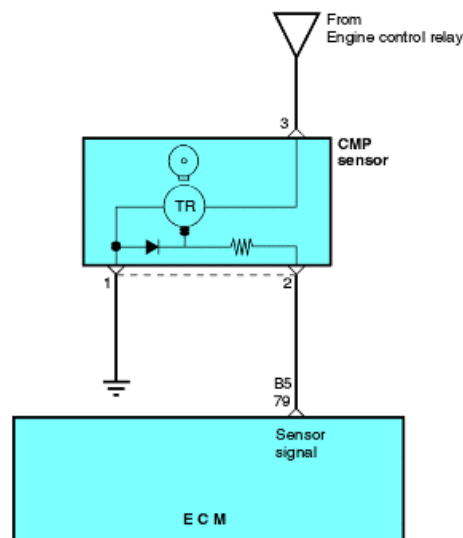
##### (FOR P0342)

The ECM will set P0342 and the Malfunction Indicator Lamp (MIL) will turn on if during two driving cycles there is more than one CMP sensor signal during two engine revolutions when the engine speed is above 600 RPM. This code indicates unexpected camshaft position readings by the CMP sensor or ECM when the engine is rotating.

##### (FOR P0343)

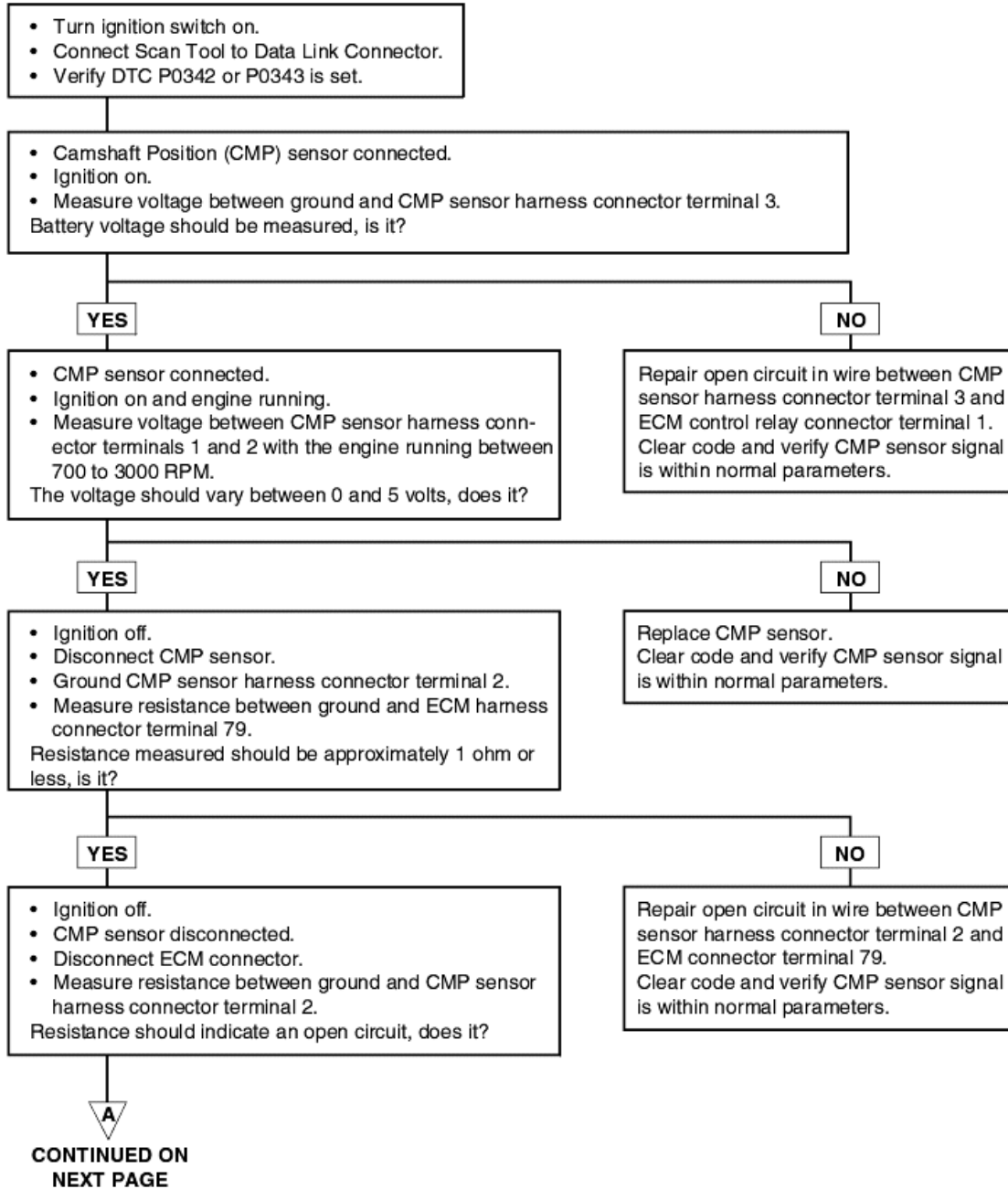
The ECM will set P0343 and the Malfunction Indicator Lamp (MIL) will turn on if during two driving cycles there is no CMP sensor signal within 200 engine revolutions when the engine speed is above 600 RPM. This code indicates unexpected camshaft position readings by the CMP sensor or ECM when the engine is rotating.

#### CIRCUIT DIAGRAM



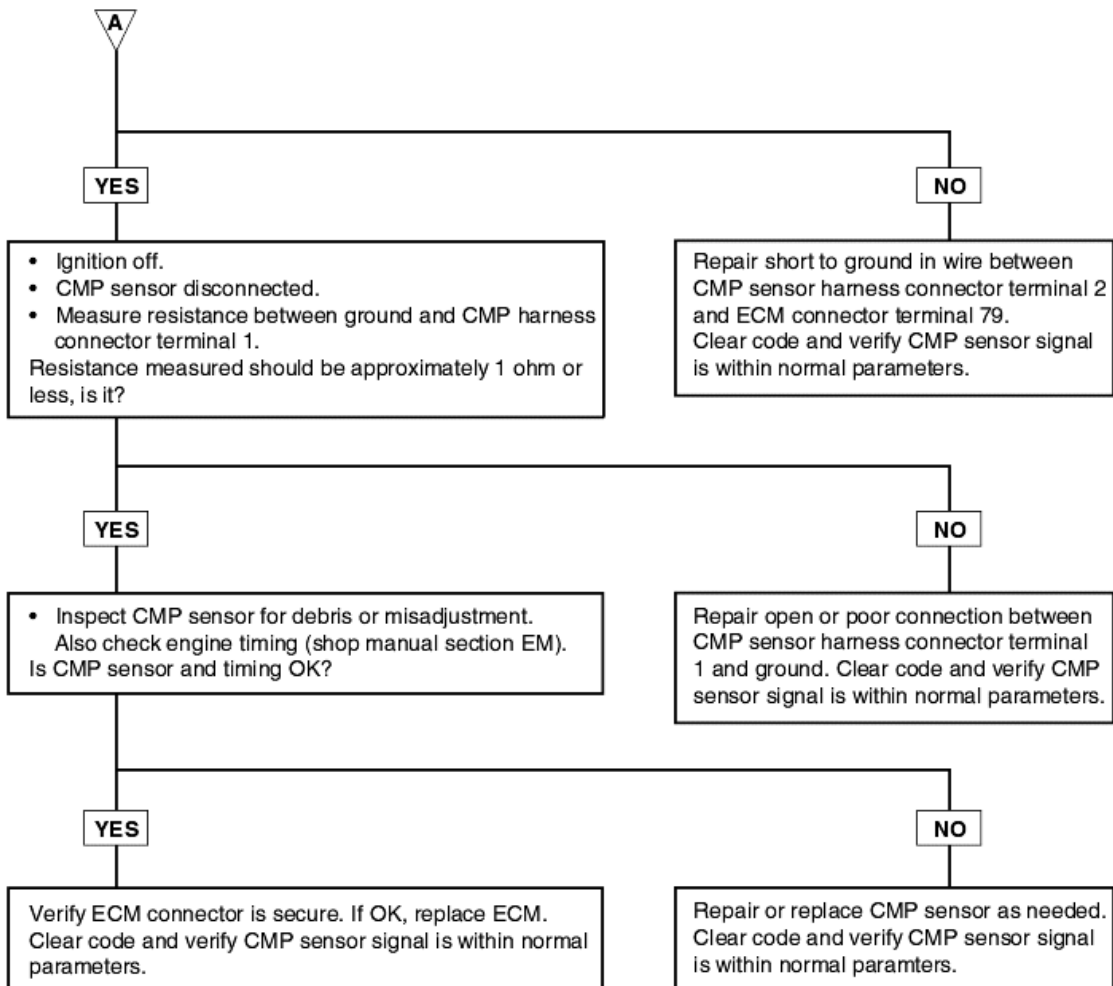
Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

## TEST PROCEDURE





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<b>DTC</b>	<b>Diagnostic item</b>
P0422	Catalyst efficiency Low

#### DESCRIPTION

The catalyst's efficiency is demonstrated in its ability to oxidize CO and HC emissions. The Engine Control Module (ECM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert HC and CO into H<sub>2</sub>O and CO<sub>2</sub> with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between front and rear sensor outputs.

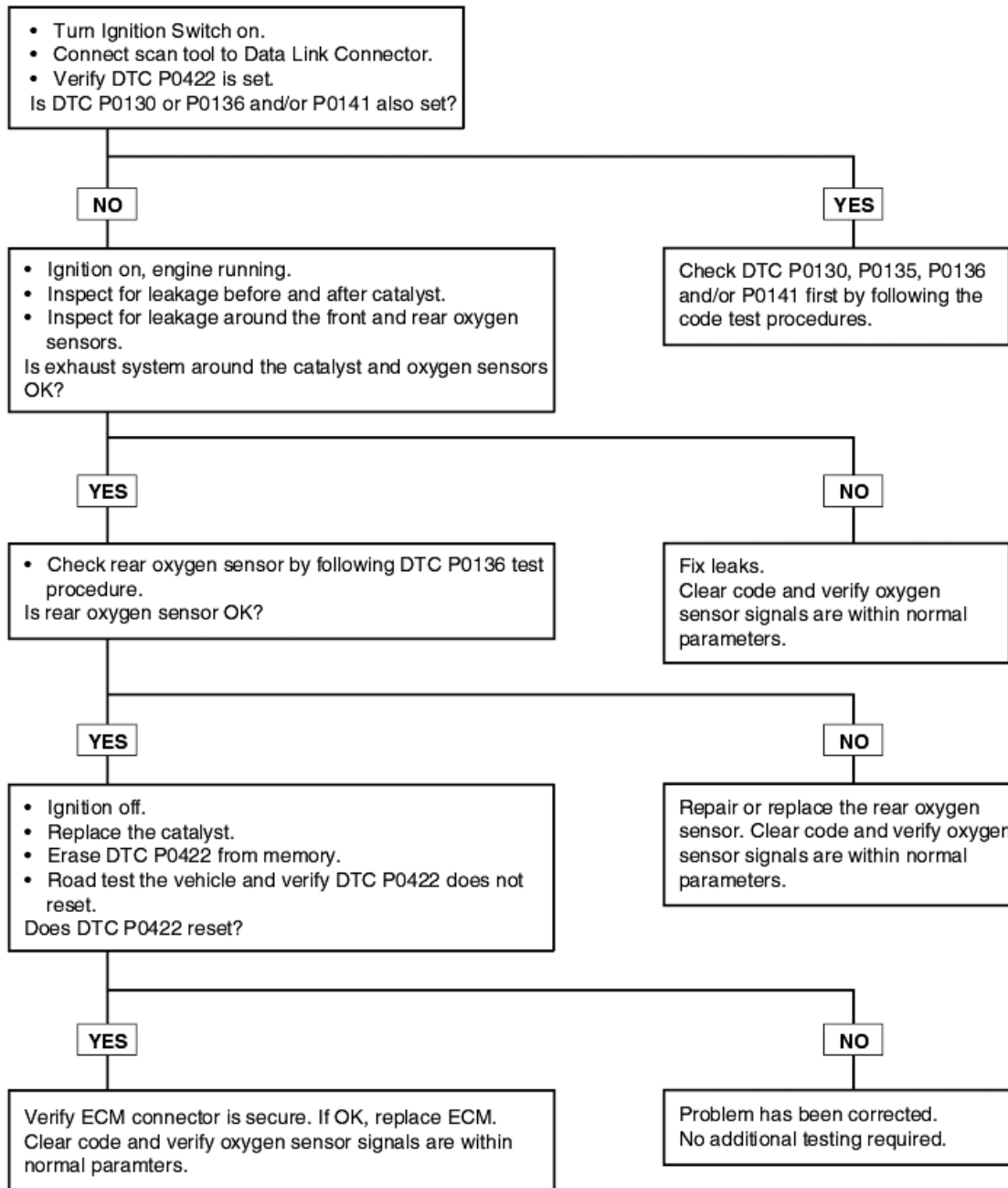
#### FAILURE CONDITION

The efficiency of the catalytic converter is measured by comparing the activity of the front and rear oxygen sensors. The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the front and rear oxygen sensor signals match more than 60% of the time in two of four 170 second monitoring periods during two driving cycles. The measurements are taken when the following conditions are met:

1. The ECM is operating in closed loop.
2. The engine speed is between 1800 and 3200 PRM.
3. The catalyst temperature is above 702°F (372°C).
4. The canister purge function is greater than 0.9.
5. The vehicle is not shifting gears.
6. The engine load is between 1.4 milliseconds and 4.5 milliseconds.

This code indicates that the catalytic converter has been found to have a low efficiency according to the readings of the front and rear oxygen sensors.

## TEST PROCEDURE



<b>DTC</b>	<b>Diagnostic item</b>
P0444	Purge Control Solenoid Valve Circuit Open
P0445	Purge Control Solenoid Valve Circuit Shorted

**DESCRIPTION**

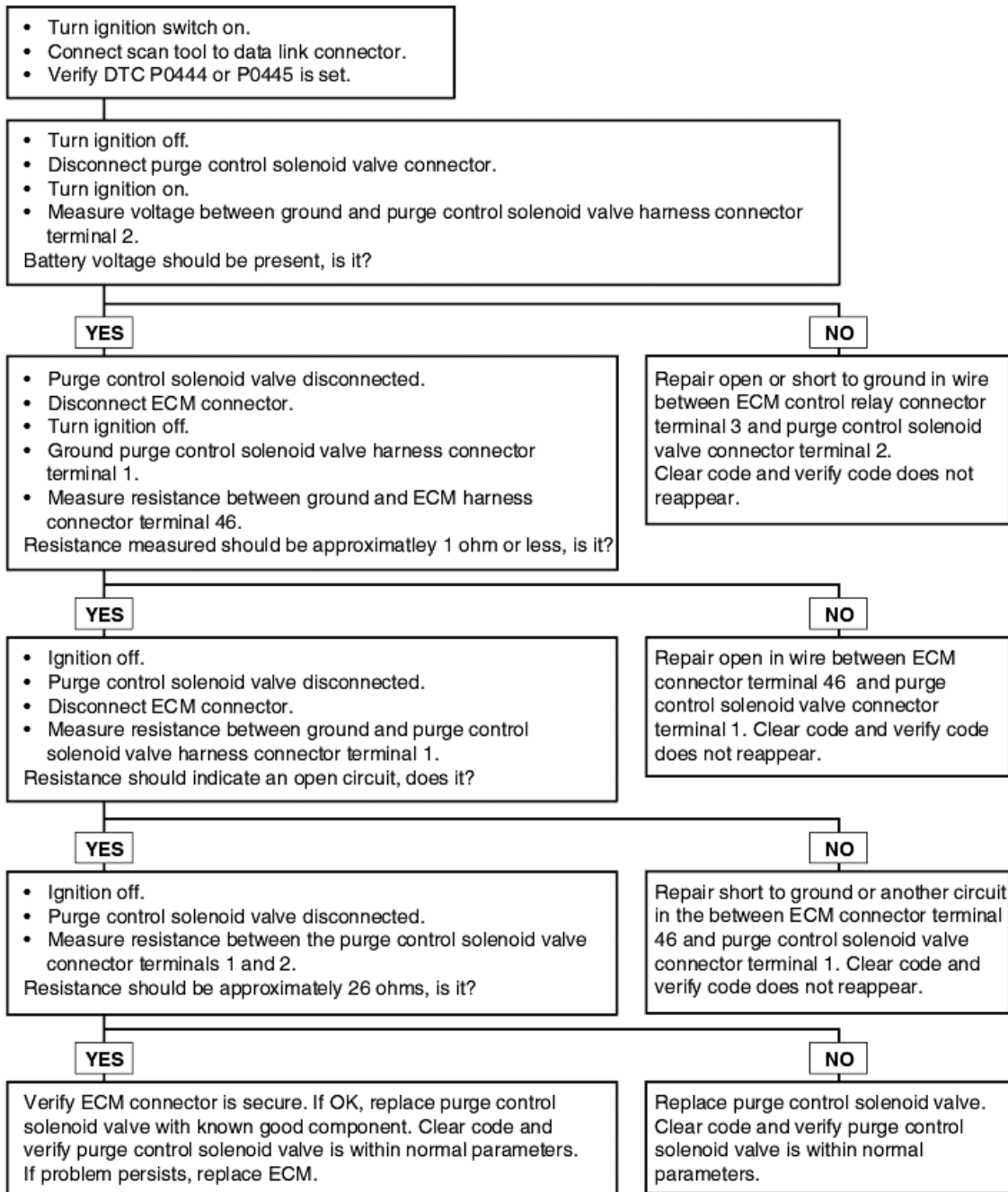
The purge control solenoid valve is part of the evaporative emission control system. The solenoid controls purge air from the evaporative emission canister.

**FAILURE CONDITIONS**

The ECM will set P0444 and the MIL will turn on if an open circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

The ECM will set P0445 and the MIL will turn on if a short circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

## TEST PROCEDURE



DTC	Diagnostic item
P0501 (P0500)	Vehicle Speed Sensor Malfunction

### DESCRIPTION

The vehicle speed sensor is a reed switch that is built into the speedometer. The sensor converts the transaxle gear revolutions into a pulse signal, which is sent to the ECM.

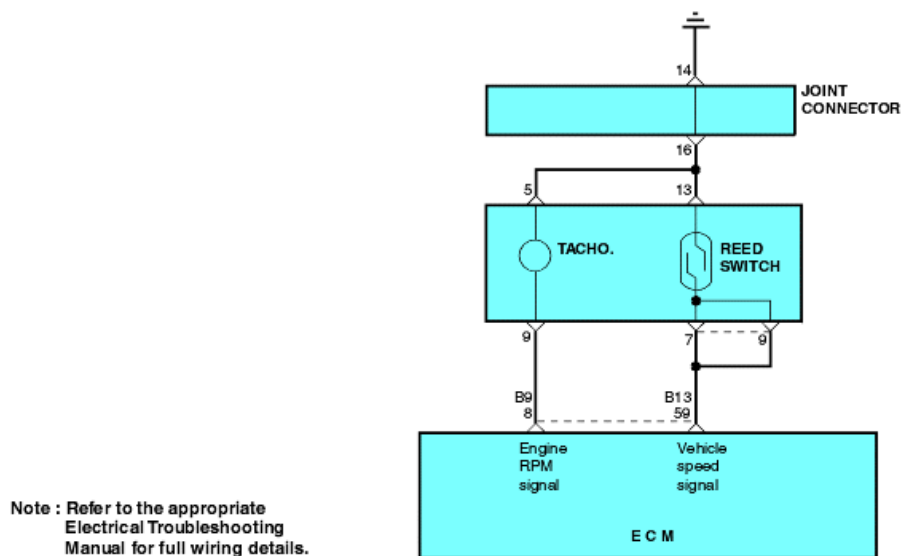
### FAILURE CONDITIONS

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if there is no vehicle speed sensor output signal for 20 seconds during two driving cycles when the following conditions are met:

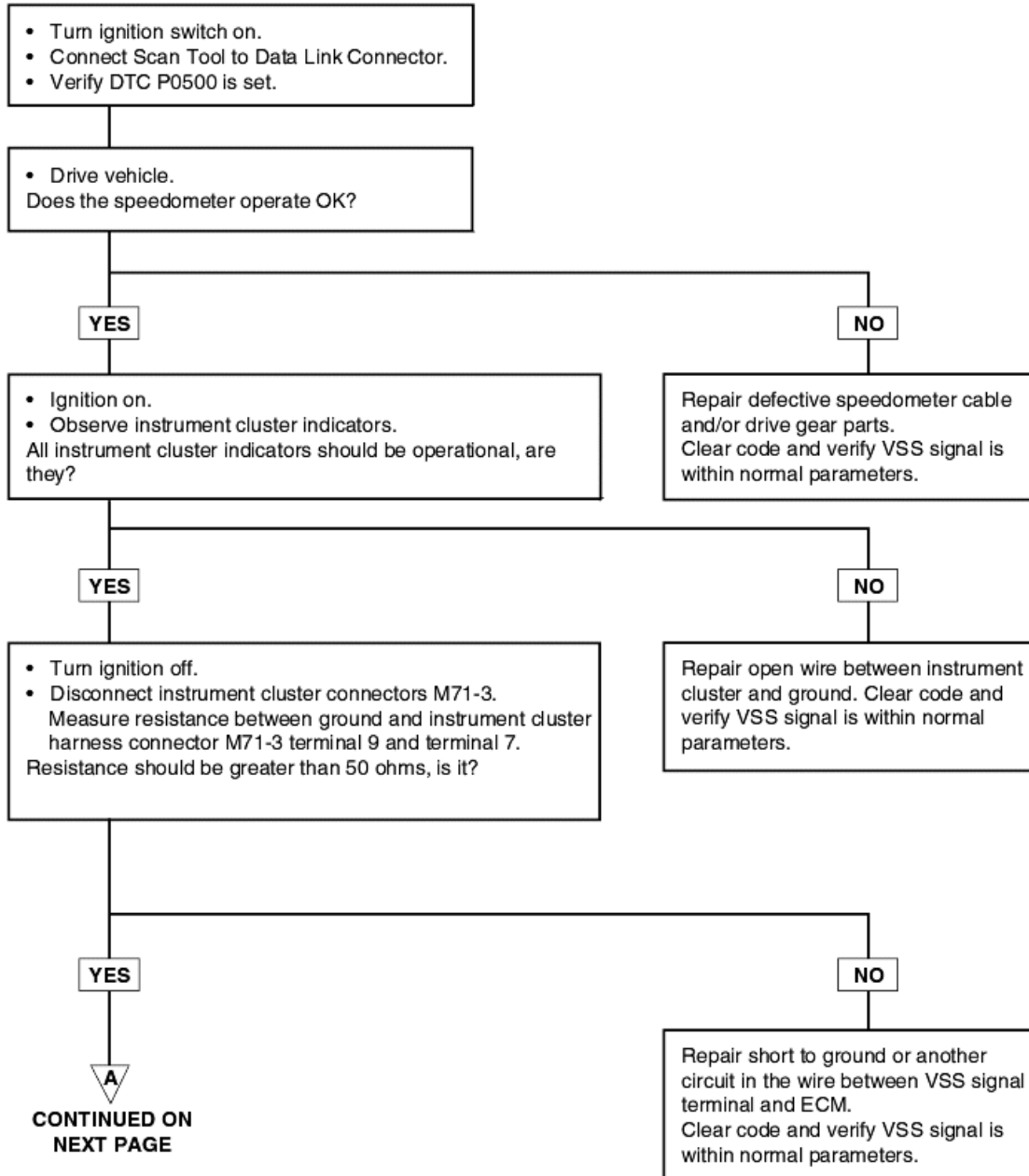
1. Engine speed is greater than 2200 RPM.
2. Engine load is greater than 3.0 millisecond.

This code indicates no speed signal being read by vehicle speed sensor or ECM.

### CIRCUIT DIAGRAM

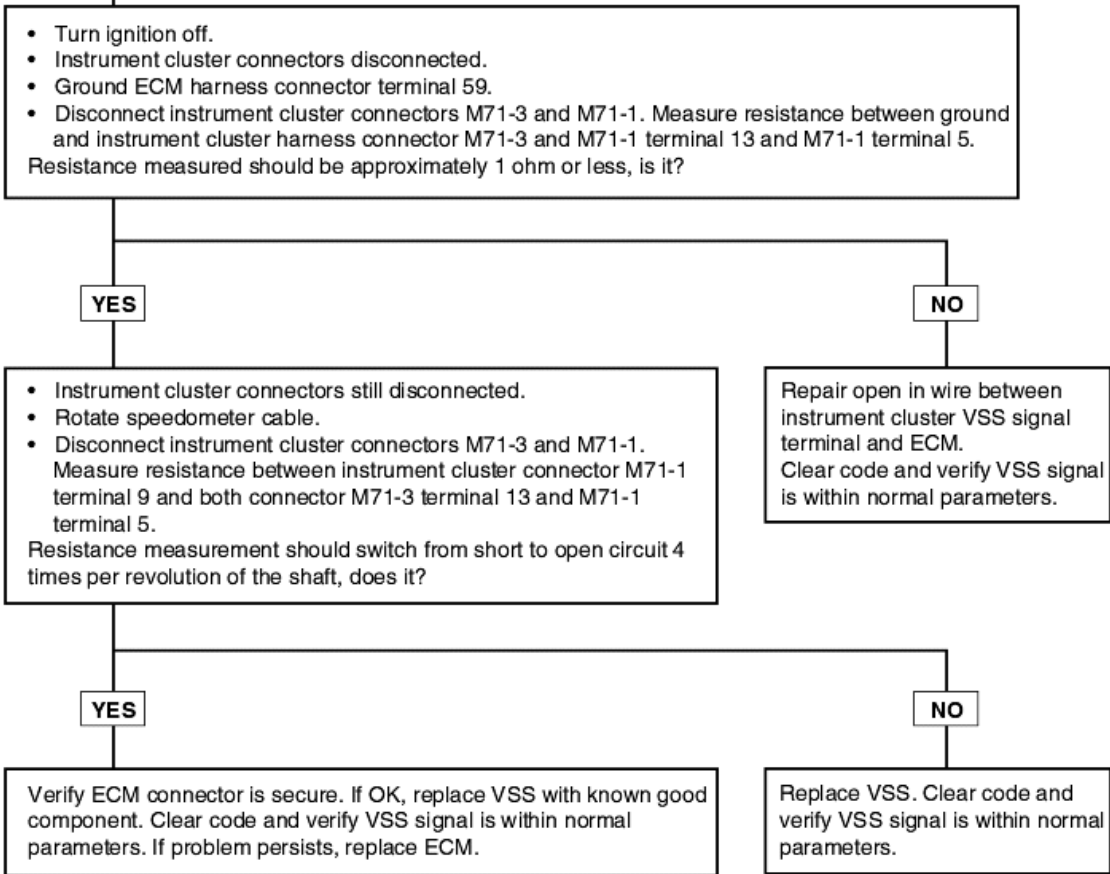


## TEST PROCEDURE



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DTC	Diagnostic item
P0506	Idle RPM Lower Than Expected
P0507	Idle PRM Higher Than Expected

#### DESCRIPTION

Refer to P1510, P1552.

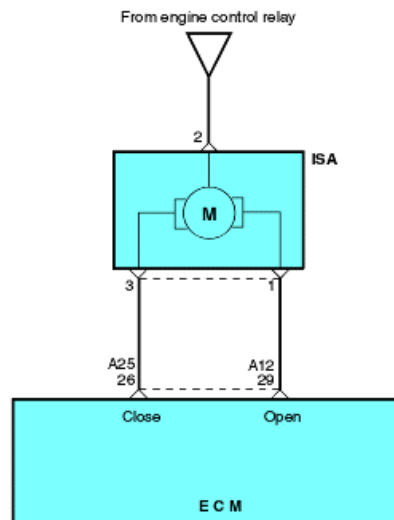
#### FAILURE CONDITIONS

The ECM will set P0506 or P0507 and the MIL will turn on if for 15 seconds the ISC actuator driver circuit values and engine idle speed are not in agreement with values stored in the ECM during two driving cycles when the following conditions are met:

1. The ISC actuator passes idle air at a rate above 4.1 g/s. [for P0506] or 1.7 g/s [for P0507].
2. Engine speed deviation is below 200 RPM.
3. Vehicle speed is zero.
4. Engine coolant temperature is above 167°F (75°C).

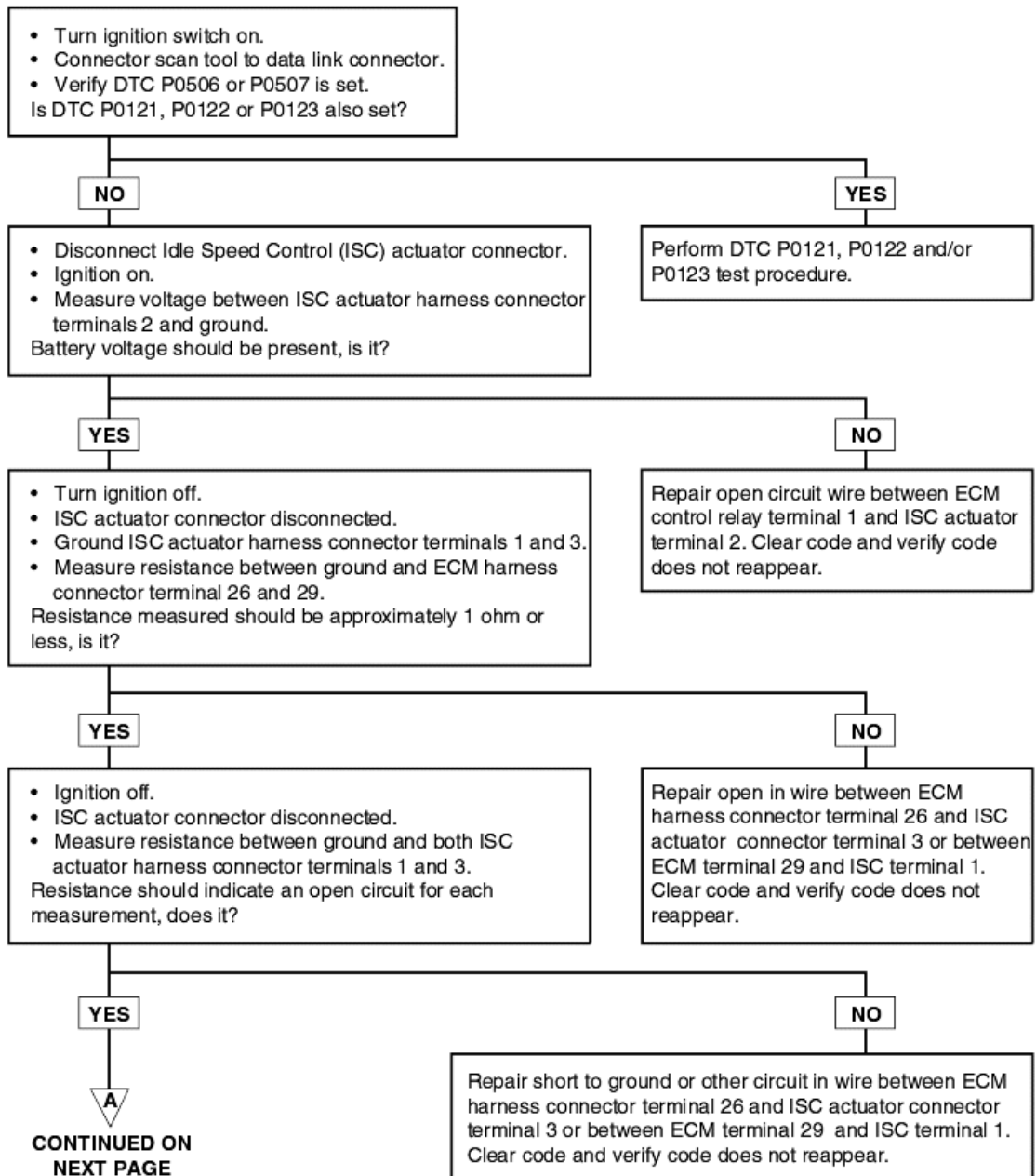
This code indicates the idle speed control actuator and the engine do not agree with the ECM on the idle speed value.

#### CIRCUIT DIAGRAM



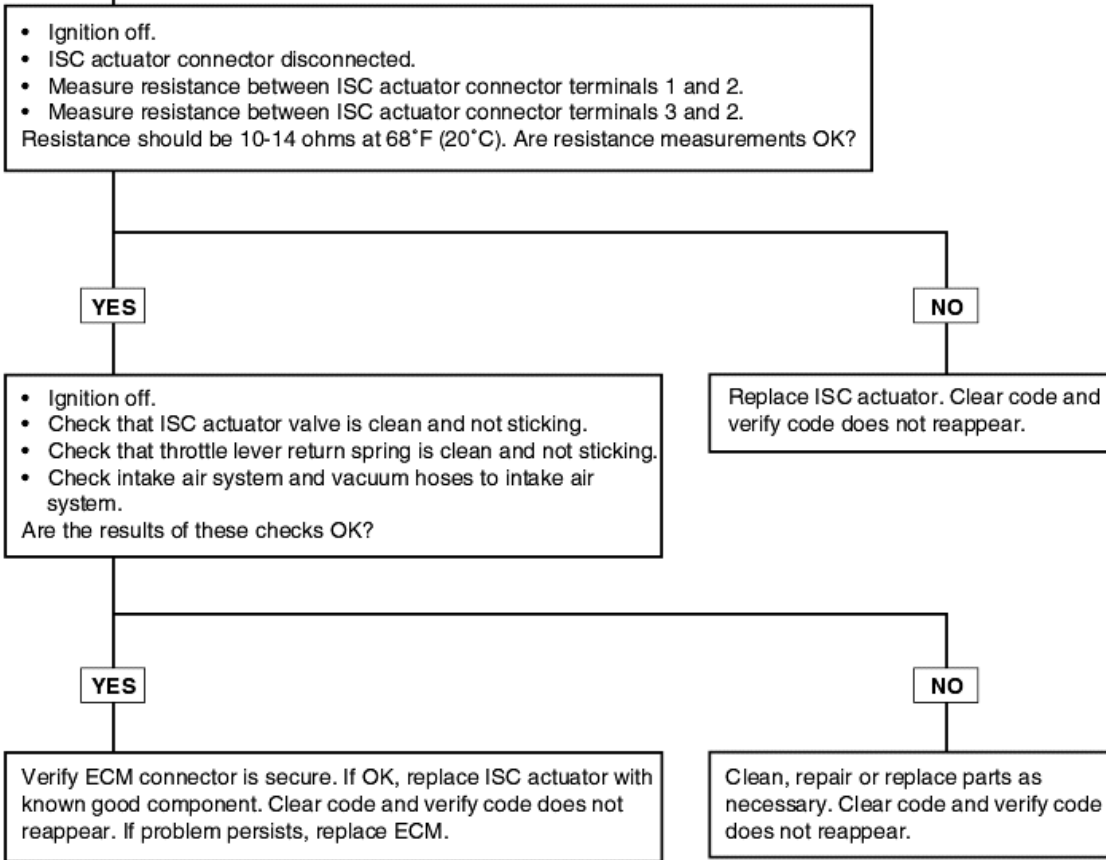
Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

## TEST PROCEDURE



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<b>DTC</b>	<b>Diagnostic item</b>
P1123	Fuel Trim Additive Air System Too Rich
P1124	Fuel Trim Additive Air System Too Lean
P1127	Long Term Fuel Trim Multiplicative System Too Rich
P1128	Long Term Fuel Trim Multiplicative System Too Lean

#### DESCRIPTION

The air/fuel control system, in addition to a number of sensors, includes the following components and systems:

- Intake air system.
- Exhaust system.
- Evaporative emissions control system (includes purge control solenoid valve).
- Fuel injectors.
- Fuel pressure regulator.
- Fuel pump.

For the air/fuel ratio to be within limits, all of the sensors, components and systems associated with the air/fuel control system must function within normal parameters.

#### FAILURE CONDITIONS

##### **(FOR SHORT-TERM FUEL TRIM)**

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the short-term fuel trim value goes 10% to 15% rich [for P1123] or if the short-term fuel trim additive value is less than 0.4 milliseconds, or 10% to 15% lean [for P1124] for 30 seconds during two driving cycles when the following conditions are met:

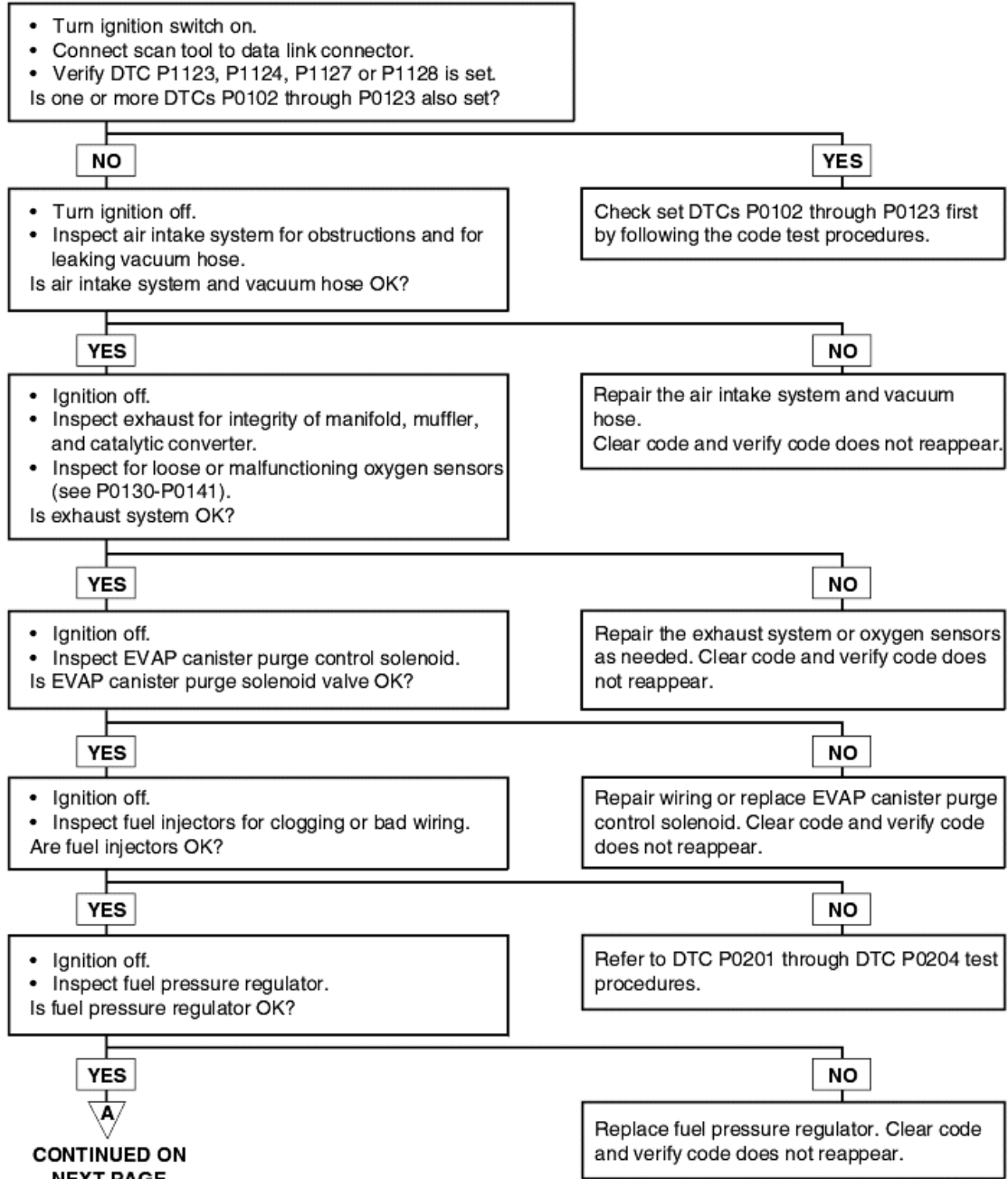
1. ECM is in closed loop operation.
2. Engine speed is below 1000 RPM.
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass airflow is less than 7.5 g/s [for P1123] or 5.5 g/s [for P1124].

##### **(FOR LONG-TERM FUEL TRIM)**

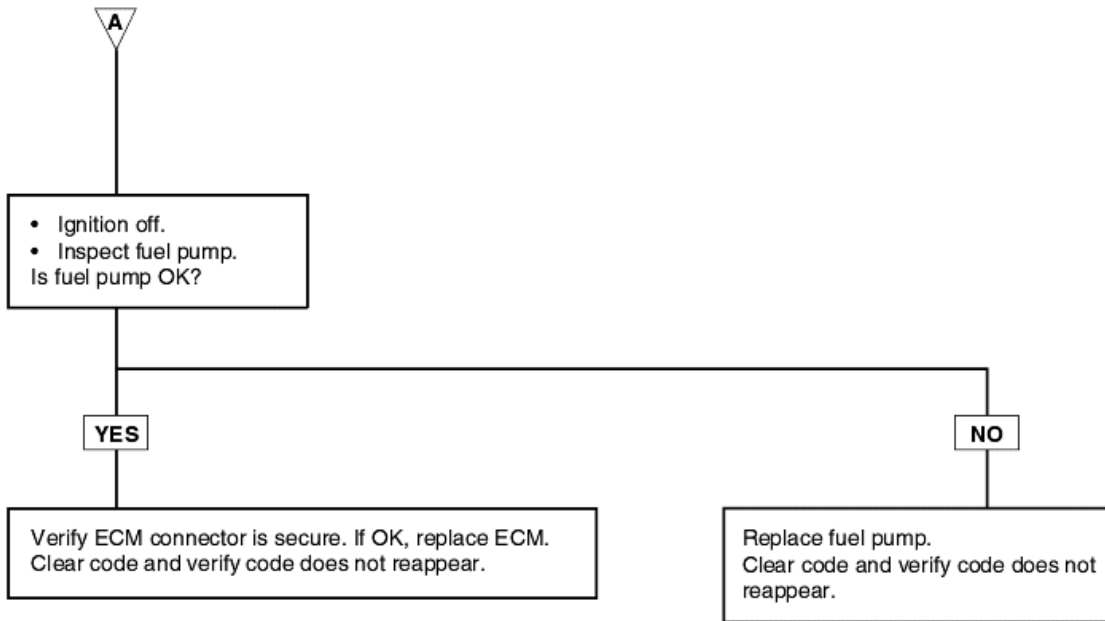
The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the long-term multiplicative value is less than 77% for 30 seconds [for P1127] or if the long-term fuel trim value goes to 10% to 15% lean [for P1128] for 30 seconds during two driving cycles when the following conditions are met:

1. Engine load exceeds 1.8 milliseconds.
2. ECM is in closed loop operation [for P1127].
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass air flow is less than or 5.5 g/s.
6. Engine speed is below 1000 RPM [for P1128].

## TEST PROCEDURE



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PREVIOUS PAGE



DTC	Diagnostic item
P1510	Idle Speed Control Actuator Opening Circuit Shorted
P1552	Idle Speed Control Actuator Closing Circuit Shorted

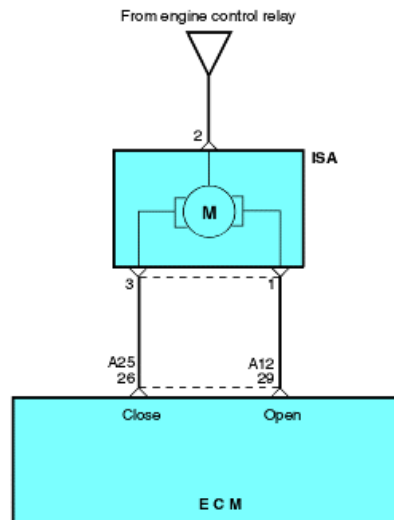
#### DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils, which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

#### FAILURE CONDITION

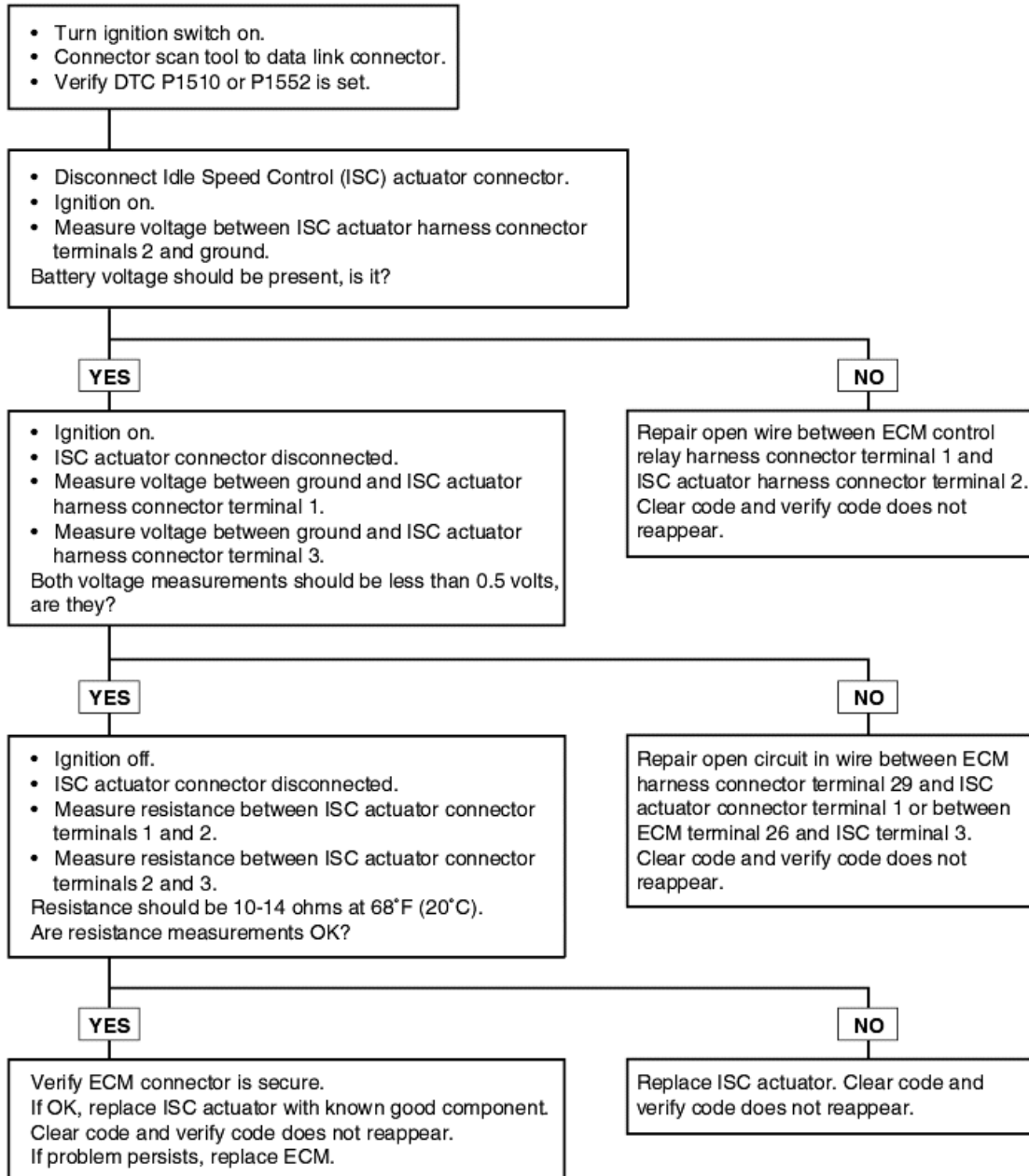
The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1510] or closing coil driver stage [for P1552] is shorted to battery voltage during two driving cycles.

#### CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE





DTC	Diagnostic item
P1513	Idle Speed Control Actuator Opening Circuit Open
P1553	Idle Speed Control Actuator Closing Circuit Open

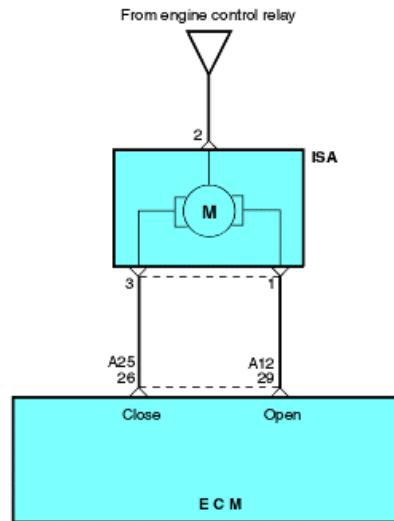
#### DESCRIPTION

Refer to P1510, P1552.

#### FAILURE CONDITIONS

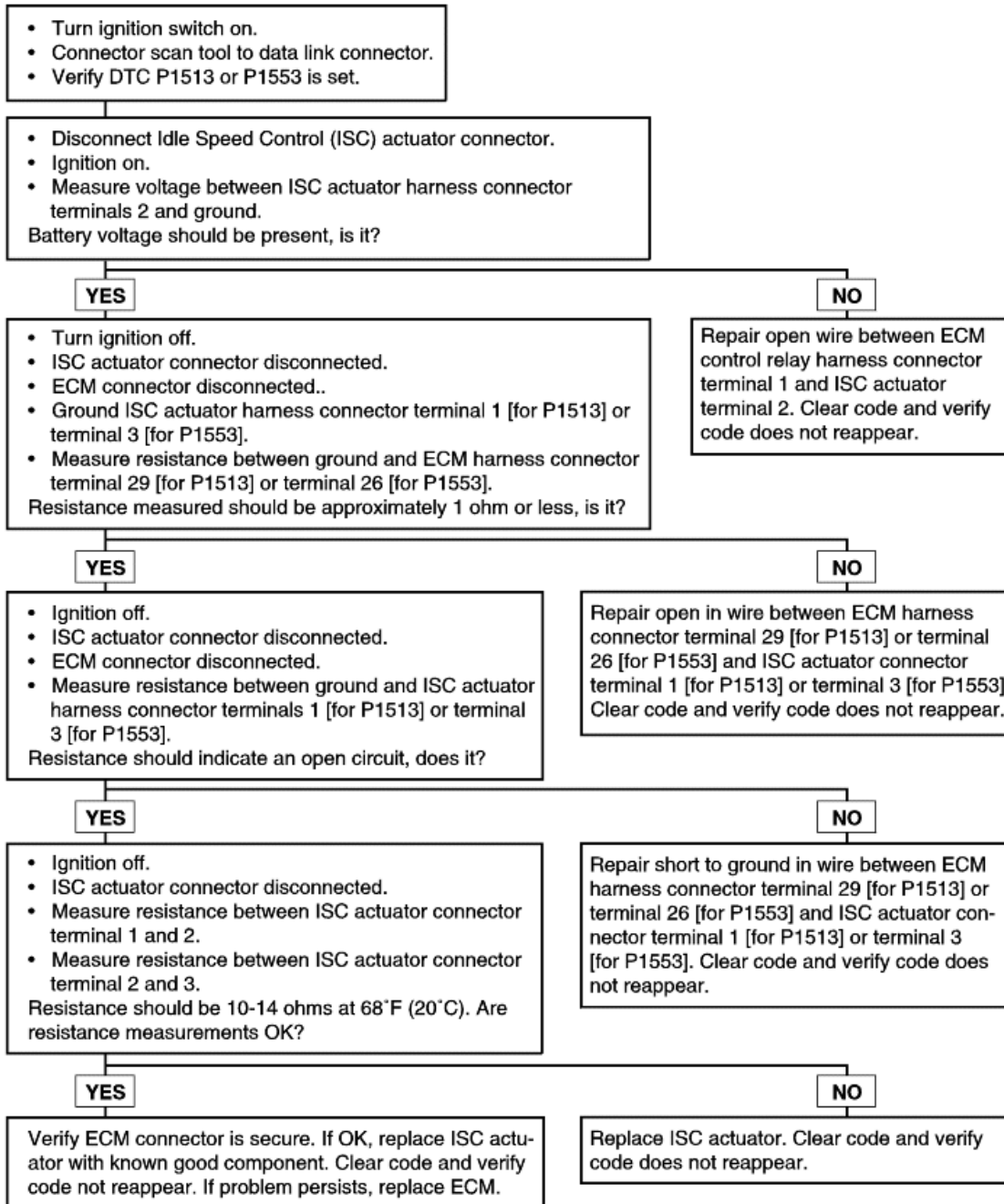
The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1513] or closing coil driver stage [for P1553] is open or shorted to ground during two driving cycles.

#### CIRCUIT DIAGRAM



Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

## TEST PROCEDURE



DTC	Diagnostic item
P1605	Acceleration Sensor Malfunction
P1606	Acceleration Sensor Not Rational

#### DESCRIPTION

The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.

#### FAILURE CONDITIONS

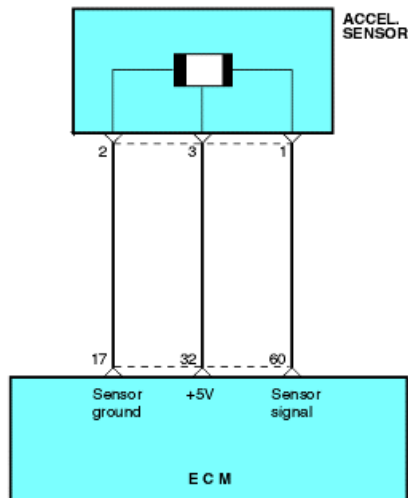
##### (FOR P1605)

The ECM will set a code and the MIL will turn on if the acceleration sensor signal is less than 1.5 or greater than 3.5 volts during two driving cycles. This code indicates an extremely rough or smooth road being sensed by the acceleration sensor or ECM.

##### (FOR P1606)

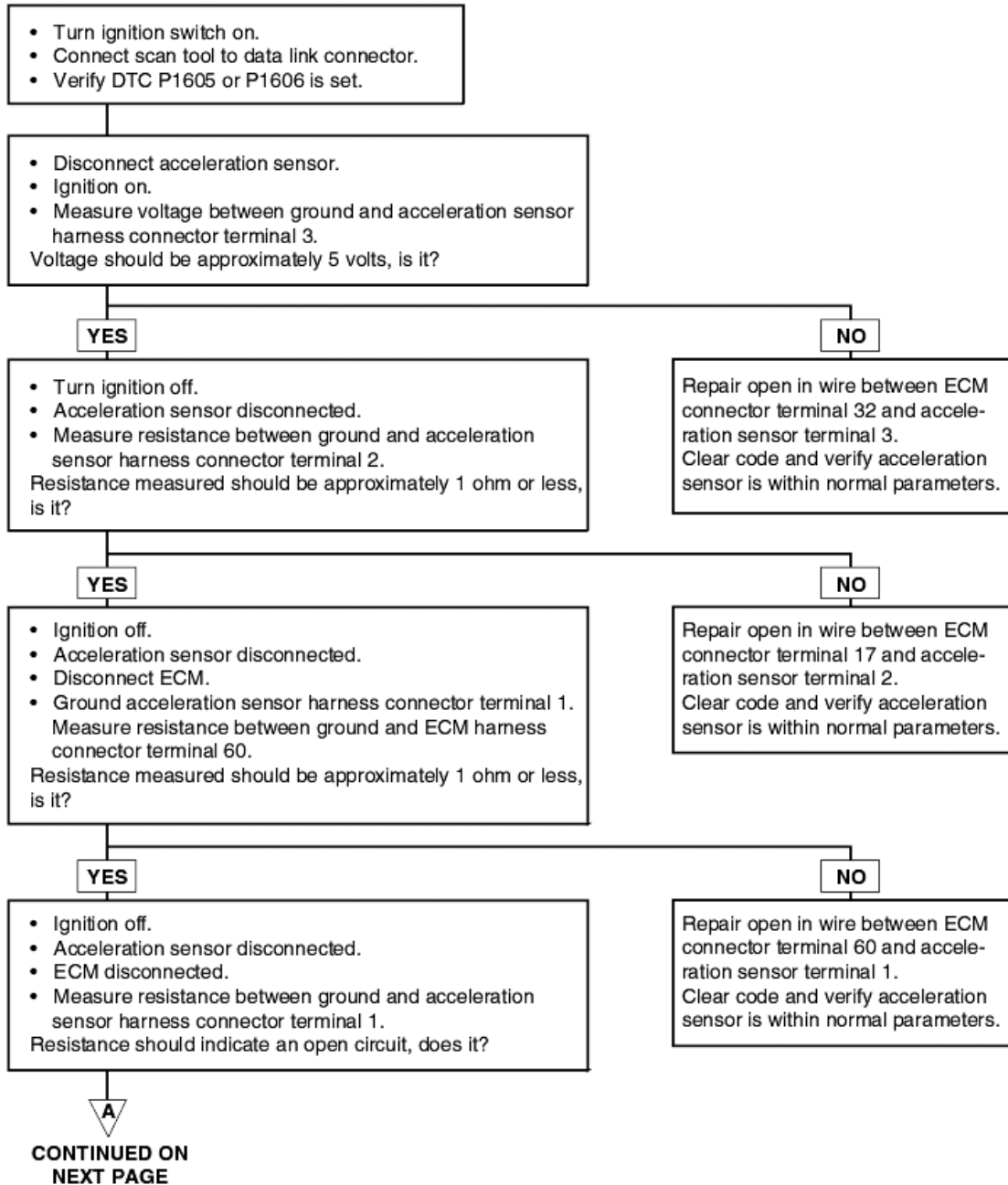
The ECM will set a code and the MIL will turn on if the acceleration sensor signal indicates an acceleration of 0.3g or greater when the vehicle speed is zero during two driving cycles. This code indicates some type of bump being read, with the car speed at zero, by the acceleration sensor or ECM.

#### CIRCUIT DIAGRAM

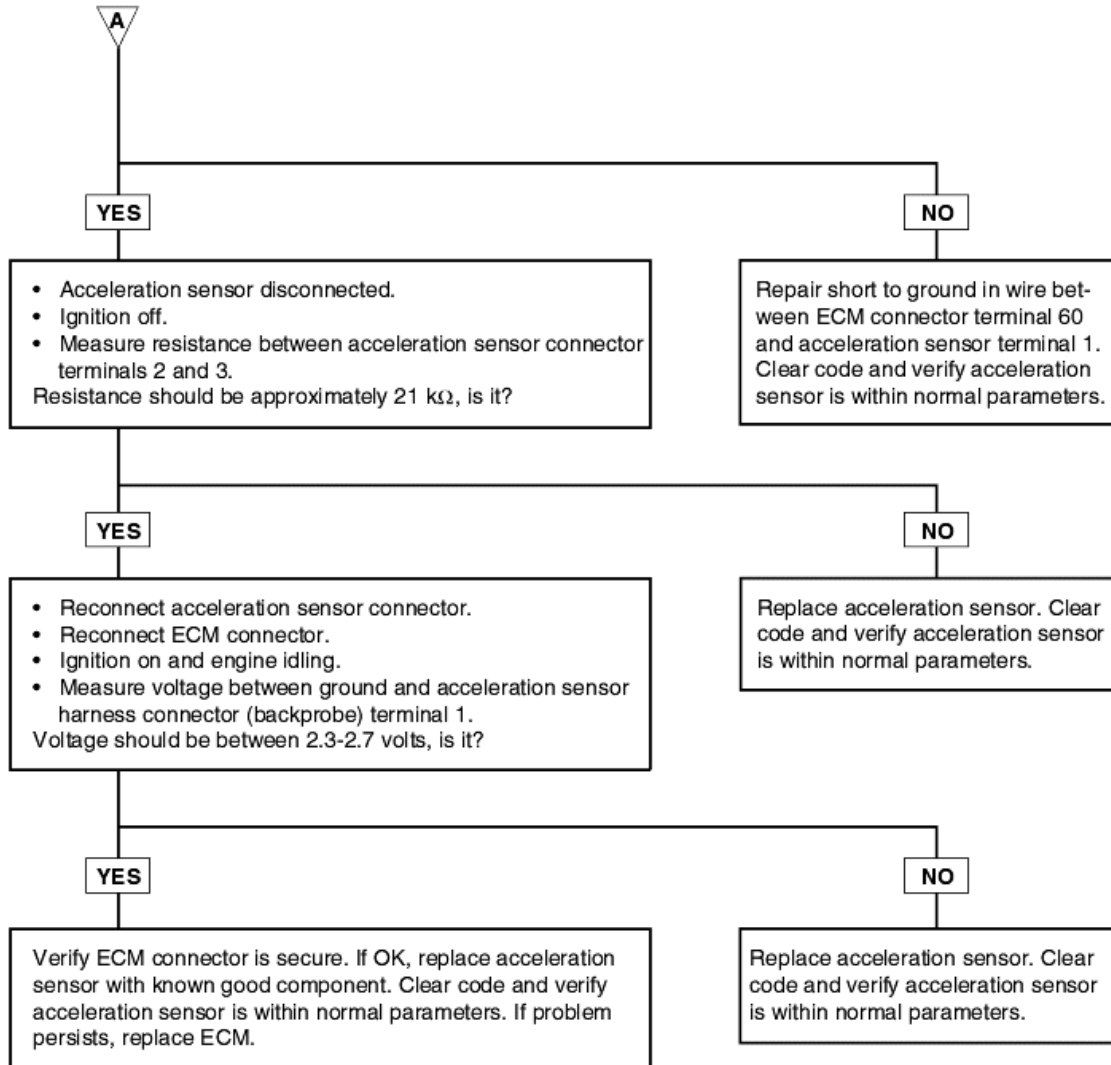


Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE



CONTINUED FROM  
PREVIOUS PAGE



DTC	Diagnostic item
P1611	Malfunction Indicator Lamp (MIL) Request Signal Low
P1613	Malfunction Indicator Lamp (MIL) Request Signal High

#### DESCRIPTION

The Malfunction Indicator Lamp (MIL) request signal wire is used by the Transaxle Control Module (TCM) to signal the ECM to set transaxle related codes.

#### FAILURE CONDITIONS

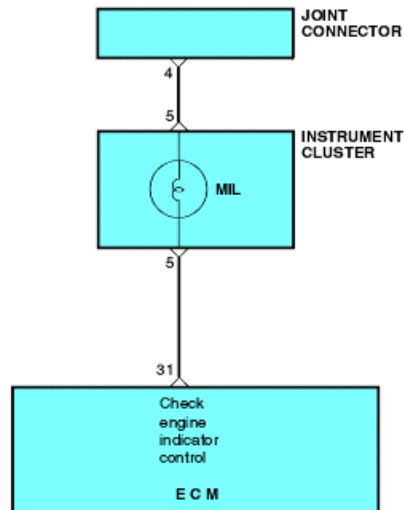
##### (FOR P1611)

The ECM will set a code and the MIL will turn on if the available voltage present is below 80% of battery voltage during two driving cycles. This check is made once per trip for 6 seconds when the engine speed is greater than 240 RPM. This code indicates that lower than expected voltage is being read at the request wire by the ECM.

##### (FOR P1613)

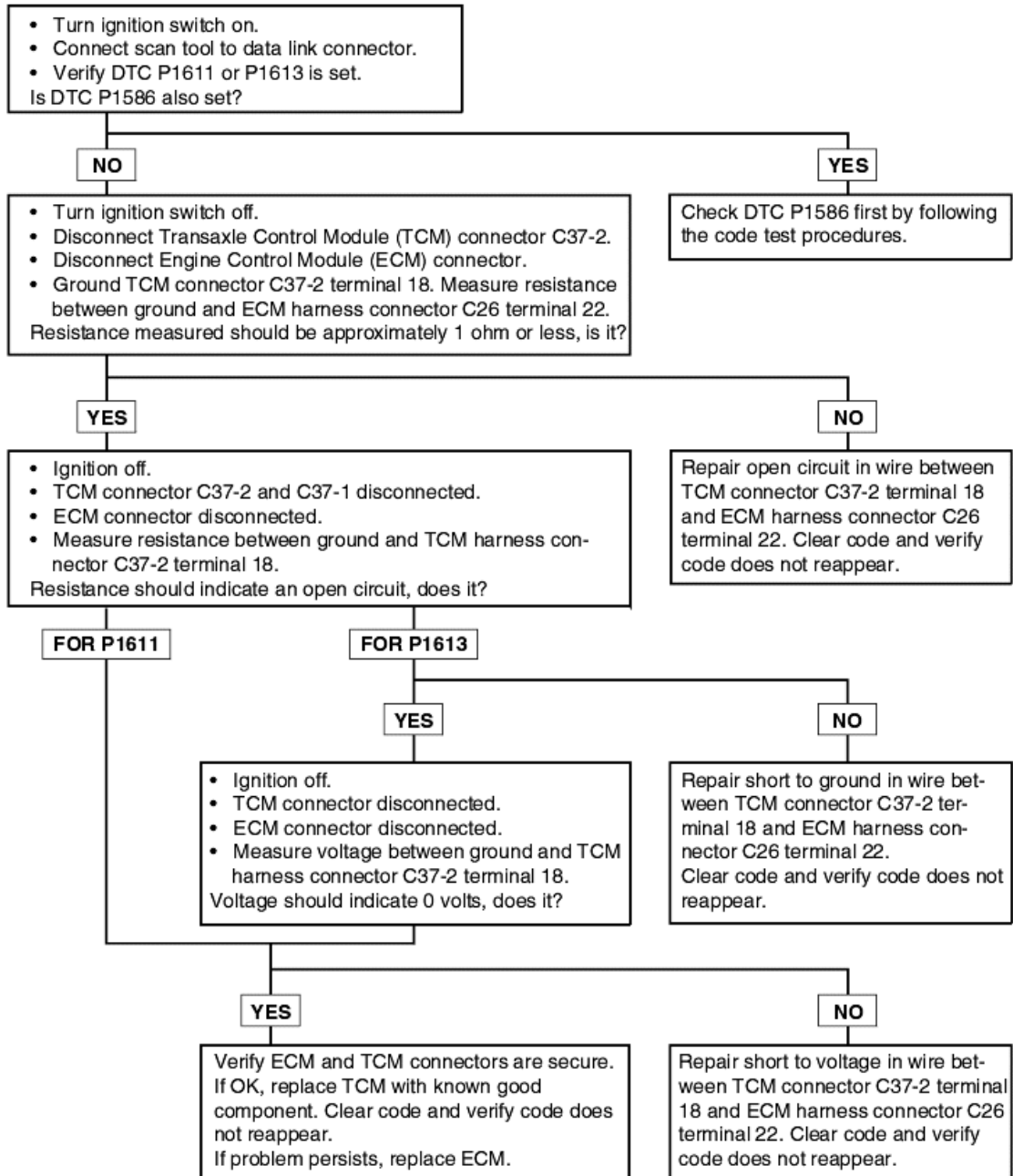
The ECM will set a code and the MIL will turn on if the available voltage present is greater than 120% of battery voltage during two driving cycles. This check is made once per trip when DLC terminal 15 ("L" data line) is "ON" and the engine speed is less than 800 RPM. This code indicates that higher than expected voltage is being read at the request wire by the ECM.

#### CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE



## 6 Trans-axle/Transmission

### 6.1 General

#### SPECIFICATIONS (A/T) EKTC0010

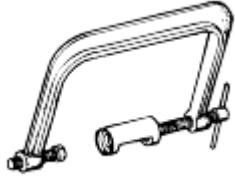

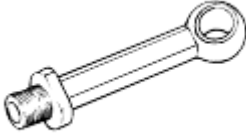




Item		Data
A/T data	A/T type	4-forward speeds and 1 reverse speed, with planetary gears
	Torque converter Type	Ø186 three-point boss, with lock-up control (3-element, 1-step 2 phase)
	Lock-up engagement shift position	4th gear only (3rd gear lock-up is operational only during O/D-OFF)
	Oil pump Type	Trochoid oil pump
	Driving system	Engine drive
	Number of clutches	
	LOW/Clutch	7
	Hi/Clutch	3
	REV/Clutch	2
	L&R Brake	7
	Servo size	56-35
	Four-point gear	
	Output teeth	49
	Idle teeth	55
Reduction teeth	19	
Final teeth	68	
Primary reduction ratio	1.122	
Final reduction ratio	3.579	
Gear ratio		
1st	2.9143	
2nd	1.5255	
3rd	1.000	
4th	0.7255	
Rev	2.6429	
Lubricating system	Forced oil delivery from oil pump	
Cooling system	AT case built-in oil cooler: water cooling	
ATF	ESSO JWS3314	


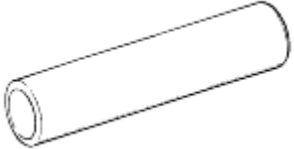


TIGHTENING TORQUE (A/T) EKTC0020

<b>Items</b>	<b>Nm</b>	<b>kg·cm</b>	<b>lb·ft</b>
Drive plate (to torque converter)	19	190	14
Converter housing	30	300	22
Transaxle side cover	20	200	14
Oil pan	13	130	9
Valve body bolt (90mm)	8	80	6
Valve body bolt (20mm)			
Valve body bolt (77mm)			
Valve body bolt (12mm)			
Valve body bolt (87mm)			
Oil pump	9	90	6

## 6.1 SPECIAL TOOLS (A/T) EKTC0030

Tool (Number and name)	Illustration	Use
09222-21001 Valve spring compressor		Removal and installation of snap ring for band servo piston
09452-21500 Oil pressure gauge		Measurement of the oil pressure (use with 09452-21001, 09452-21002)
09452-21001 Oil pressure gauge adapter		Measurement of the oil pressure (use with 09452-21500, 09452-21002)
09452-21002 Oil pressure gauge adapter		Measurement of the oil pressure (use with 09452-21500 and 09452-21001)
09455-02000 Spring compressor		Removal and installation of snap ring for Reverse clutch
09453-21100 Spring compressor		Removal and installation of spring retainer for Low & Reverse brake
09455-02100 Spring compressor		Removal and installation of snap ring for High clutch

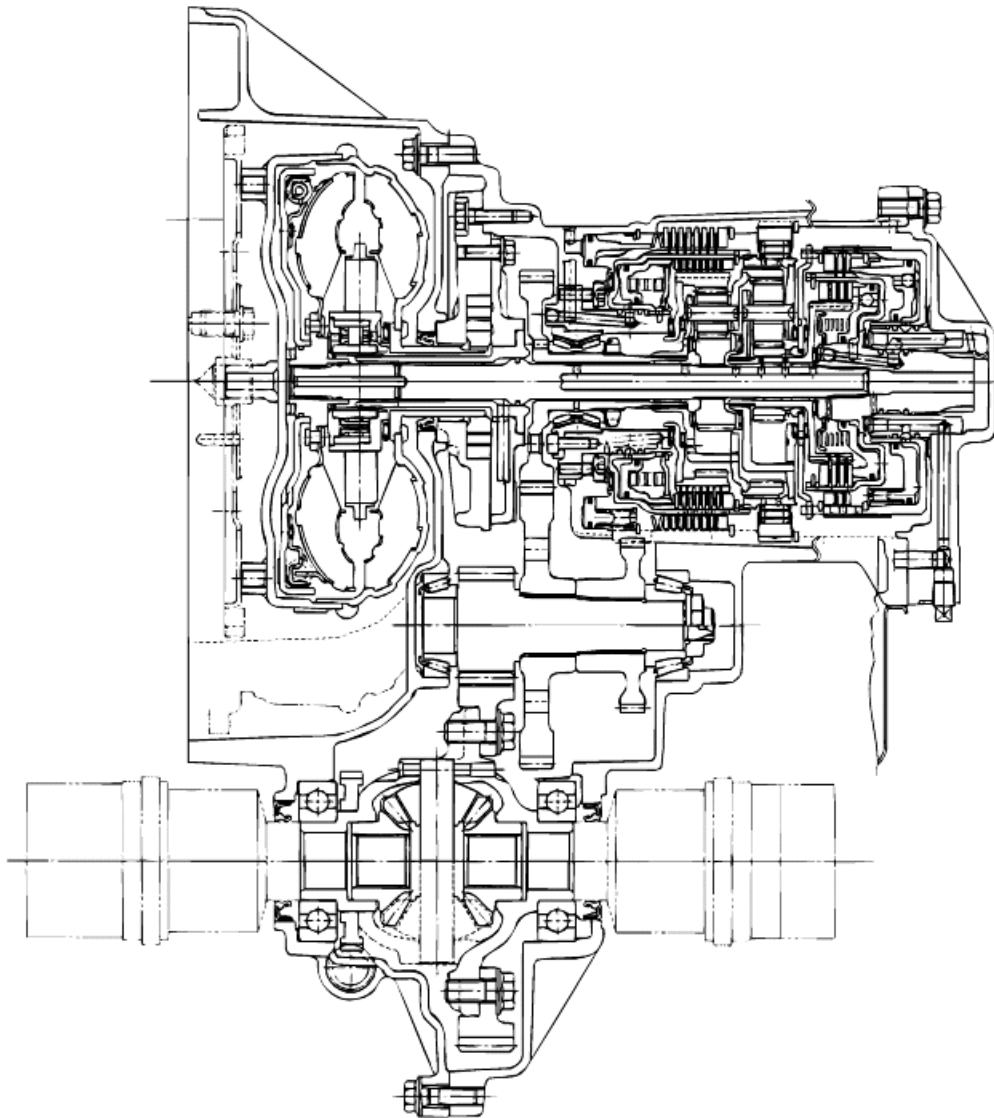
<p>09455-02200 Spring compressor</p>		<p>Removal and installation of snap ring for Low clutch</p>
<p>09455-33200 Bearing installer</p>		<p>Removal of output gear bearing</p>

## 6.2 Automatic Trans-axle System

### GENERAL INFORMATION EKTC0040

This newly developed automatic transaxle is a light and compact transaxle for small vehicles and provides smooth operation, swift driving, and improved fuel consumption. Its electronically controlled shift point, and shift oil pressure have resulted in delicate gear change control for various driving factors such as throttle position and vehicle speed. Thus, smooth driving at all speeds has been realized.

A symmetrical three-element, single-stage, two-phase torque converter is employed. The transaxle consists of 2 single planetary gears, 3 sets of disc clutches, 1 set of disc brakes, 1 set of band brakes, 1 set of one-way clutches, etc.



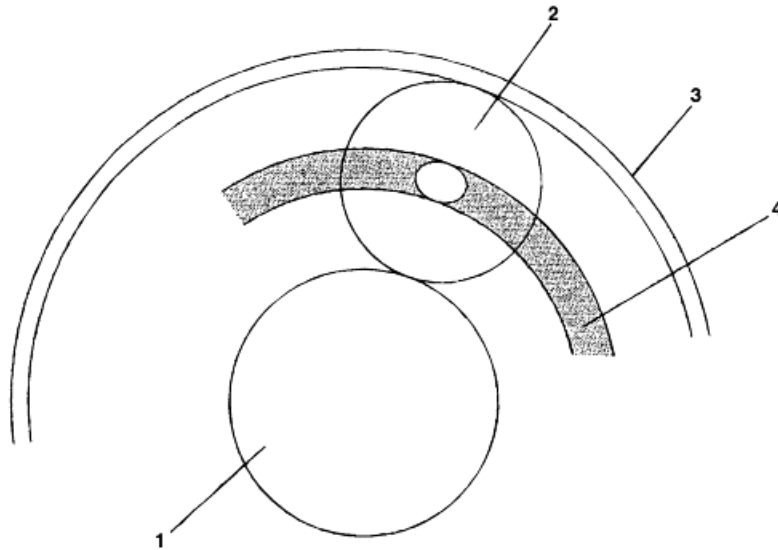
The number of planetary gears, one-way clutches, and disc brakes is 1 set fewer than the conventional transaxle, which improves efficiency.

## POWERFLOW MECHANISM EKT0050

### PLANETARY GEAR UNIT

Planetary gear unit shifts the gear position to forward, reverse, or neutral while driving.

The unit consists of a sun gear, a planetary carrier, and an internal gear. The different engagement patterns of this unit installed in the front and rear operate when driving forward, backward, and shifting.



1. Sun gear
2. Pinion gear
3. Internal gear
4. Planetary carrier

1. When the sun gear is locked, rotation speed of planetary carrier is slower than that of internal gear.
2. When the planetary carrier is locked, rotation speed of sun gear is faster than that of internal gear, and they rotate in the reverse direction.
3. When the internal gear is locked, rotation speed of sun gear is faster than that of planetary carrier.

### CLUTCHES AND BRAKES

To shift gears via the planetary gear unit, clutches and brakes are used to engage and lock the components of the front and the rear. Clutches and brakes, except the one-way clutch, are operated by oil pressure switched by the valve body, the shift valve, and the solenoid valve.

Operating conditions Shift position	Low clutch	Low & reverse brake	High clutch	Reverse clutch	2-4 brake band	Low one-way clutch
P						
R		O		O		
N						
4th gear			O		O	
3rd gear	O		O			
2nd gear	O				O	
1st gear ("D", "2")	O					*O

range)						
1st gear ("L" range)	O	O				* : Operative while accelerating only

**Low clutch**

The low clutch causes an engagement between the rear internal gear and the front planetary carrier.

**Low & reverse brake**

The low & reverse brake locks the front planetary carrier. The brake operates in 1st gear in the "L" range and when the vehicle is moving backward.

It operates to obtain engine brake in the "L" range.

**High clutch**

The high clutch causes an engagement between the front planetary carrier and the input shaft. It operates in 3rd and 4th gears.

**Reverse clutch**

The reverse clutch causes an engagement between the front sun gear and the input shaft. It operates with the low & reverse brake when the vehicle is moving backward.

**Low one-way clutch**

The low one-way clutch prevents reverse rotation of the front carrier. It operates mechanically without being operated by oil pressure.

When the front carrier rotates clockwise, even if engine brake is desirable, engine brake does not occur.

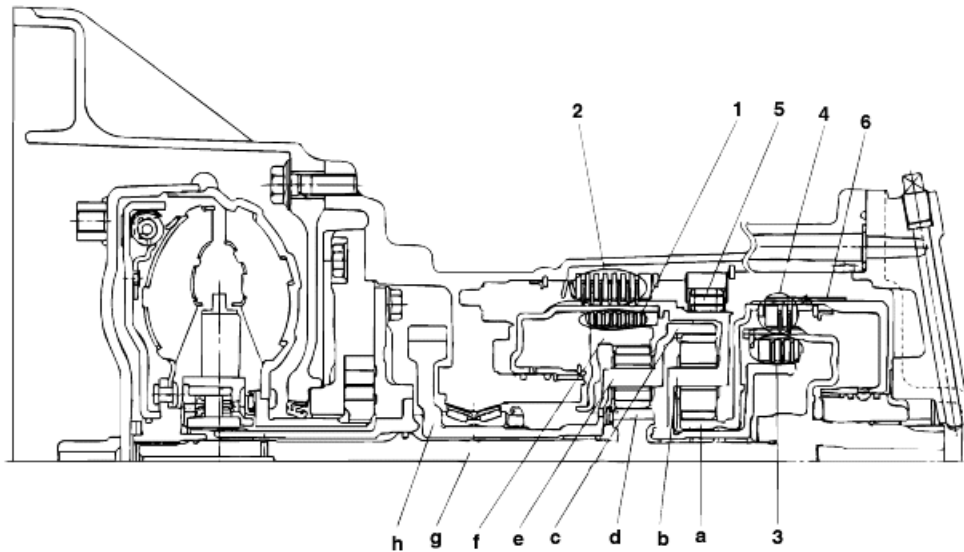
**2-4 brake and brake servo**

The 2-4 brake and brake servo lock the front sun gear. They operate in 2nd and 4th gears. Operation is via the 2-4-brake servo. Line pressure is applied to the engagement and release sides. The brake operates when line pressure is applied to the engagement side only.

The 2-4 brake does not operate when line pressure is applied to both the engagement and release sides.

**Lock-up clutch**

The lock-up clutch is employed inside the torque converter to lock up when creation conditions are met in 3rd and 4th gears.



- |                          |                        |
|--------------------------|------------------------|
| 1. Low clutch            | a. Front sun gear      |
| 2. Low and reverse brake | b. Front carrier       |
| 3. High clutch           | c. Front internal gear |
| 4. Reverse clutch        | d. Rear sun gear       |
| 5. Low one-way clutch    | e. Rear carrier        |
| 6. 2-4 brake             | f. Rear internal gear  |
|                          | g. Input shaft         |
|                          | h. Output gear         |

## POWERFLOW FUNCTIONS

### 1st gear ("L" range)

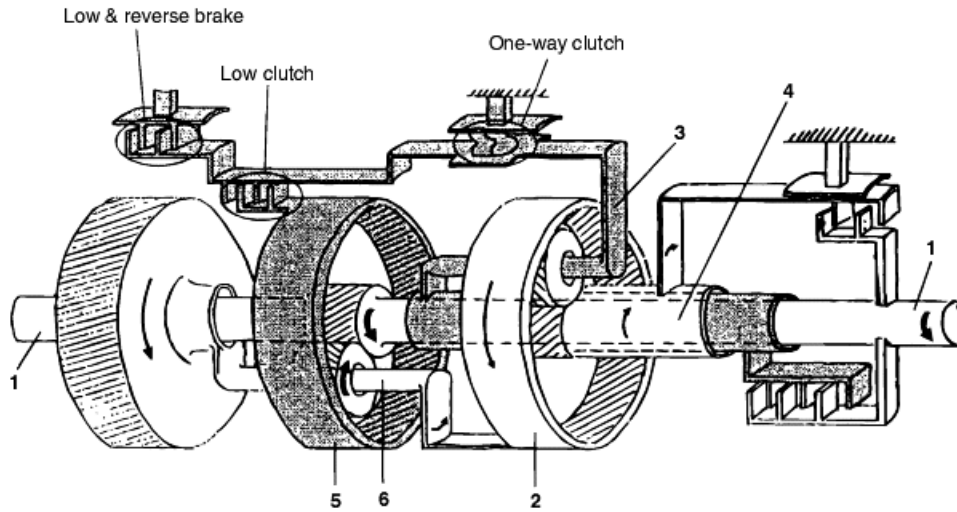
- Operational clutch  
Low clutch : engages the rear internal gear with the front carrier  
Low & reverse brake : locks the front carrier
- Input and output  
Input : Rear sun gear  
Output : Rear carrier
- Rotating conditions of the gear and carrier  
Input rotation :  $n_s$  rpm  
Output rotation :  $n_c$  rpm  
 $n_{sc}$

	<b>Front</b>	<b>Rear</b>
Internal gear	Rotates clockwise ( $N_i$ rpm)	Locked (stationary)
Carrier	Locked (stationary)	Rotates clockwise ( $N_c$ rpm)
Sun gear	Rotates counter-clockwise ( $N_s$ rpm)	Rotates clockwise ( $N_s$ rpm)

$n_{sc}$  indicates that output rotation has been reduced compared to input rotation. Engine brake occurs because clutches and brakes are engaged.

### 1st gear (“D” and ”2” ranges)

The operational clutch, input and output, and rotating conditions of each gear and carrier are almost the same as those in the “L” range. However, since the low & reverse brake is not operating, the rear internal gear is locked only against counter-clockwise rotation by the one-way clutch, and can rotate clockwise. Even if engine brake is desirable, the rear internal gear is allowed to rotate clockwise. Therefore, engine brake does not occur



1. Input shaft (rear sun gear)
2. Front internal gear
3. Front carrier
4. Front sun gear
5. Rear internal gear
6. Rear carrier



## 2nd gear

$n_{sc}$  indicates that output rotation has been reduced compared to input rotation.

In 1st gear operation, the front carrier is locked and the front sun gear rotates counter-clockwise. However, in 2nd gear operation, the front sun gear is locked and the front carrier rotates clockwise. Therefore, the front internal gear rotates faster than in 1st gear, and output rotation in 2nd gear becomes faster than the rotation in 1st gear.

Operational brake and clutch

Low clutch : engages the rear internal gear with the front carrier

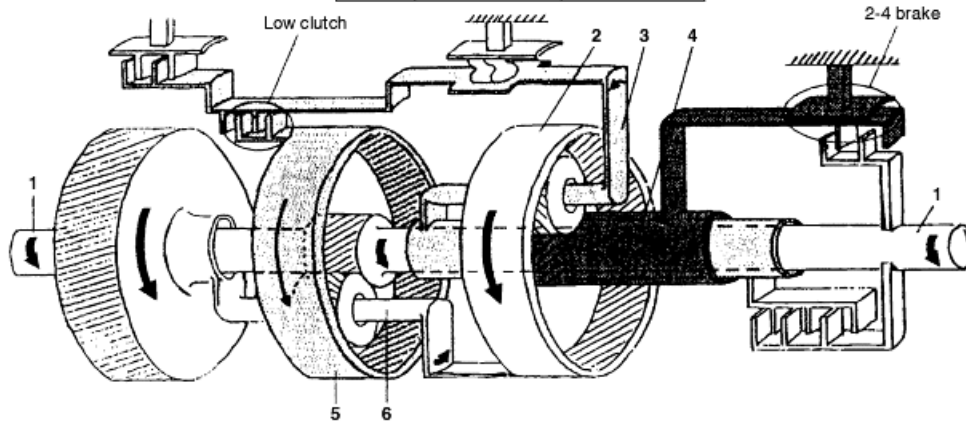
2-4 brake : locks the front sun gear

	Front	Rear
Internal gear	Rotates clockwise ( $N_1rpm$ )	Rotates clockwise ( $N_2rpm$ )
Carrier	Rotates clockwise ( $N_3rpm$ )	Rotates clockwise ( $N_4rpm$ )
Sun gear	Locked (stationary)	Rotates clockwise ( $N_5rpm$ )

Input : Rear sun gear  
Output : Rear carrier

Input revolution :  $n_1rpm$

Output revolution :  $n_2rpm$



1. Input shaft (rear sun gear)

2. Front internal gear

3. Front carrier

4. Front sun gear

5. Rear internal gear

6. Rear carrier

### 3rd gear

In 3rd gear, the rotations of the rear sun gear and the rear internal gear are the same, which means the rear planetary unit rotates as a unit and  $n_s = n_i = n_c$ . Therefore, the input and output axes are linked directly.

Operational brake and clutch

Low clutch : engages the rear internal gear with the front carrier

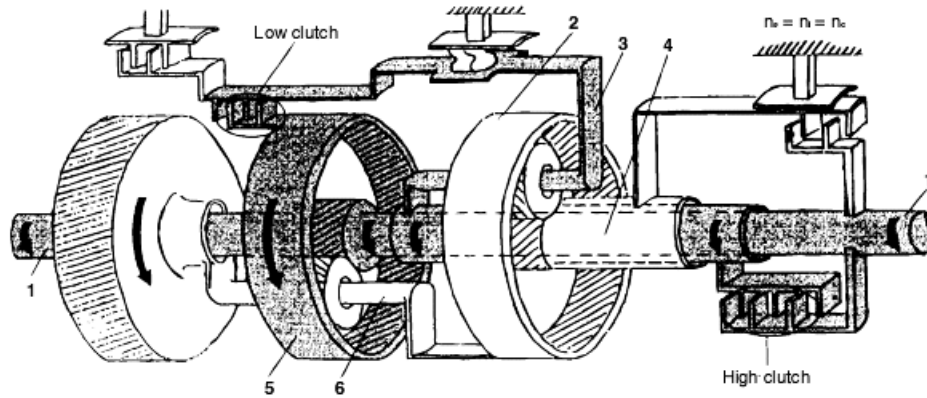
High clutch: engages the front carrier with the input shaft

	Front	Rear
Internal gear	Rotates clockwise ( $N_i$ rpm)	Rotates clockwise ( $N_i$ rpm)
Carrier	Rotates clockwise ( $N_c$ rpm)	Rotates clockwise ( $N_c$ rpm)
Sun gear	Rotates clockwise ( $N_s$ rpm)	

Input : Rear sun gear  
Output : Rear carrier

Input revolution :  $n$ rpm

Output revolution :  $n$ rpm



- |                                |                       |
|--------------------------------|-----------------------|
| 1. Input shaft (rear sun gear) | 4. Front sun gear     |
| 2. Front internal gear         | 5. Rear internal gear |
| 3. Front carrier               | 6. Rear carrier       |

### 4th gear

In 4th gear, the front sun gear is locked and the front carrier rotates. The front internal gear rotates faster than the front carrier. Therefore, output rotation is faster than input rotation.

Operational brake and clutch

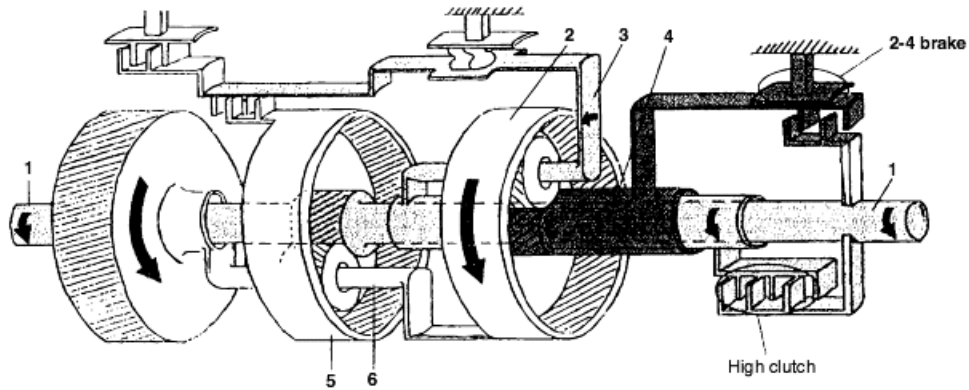
High clutch : engages the front carrier with the input shaft

2-4 brake : locks the front sun gear

	Front	Rear
Internal gear	Rotates clockwise ( $N_1rpm$ )	Rotates clockwise ( $N_2rpm$ )
Carrier	Rotates clockwise ( $N_3rpm$ )	Rotates clockwise ( $N_4rpm$ )
Sun gear	Locked (stationary)	Rotates clockwise ( $N_5rpm$ )

Input : Front carrier  
Output : Front internal gear

Input revolution :  $n_1$   
Output revolution :  $n_2$   
 $n_2 > n_1$

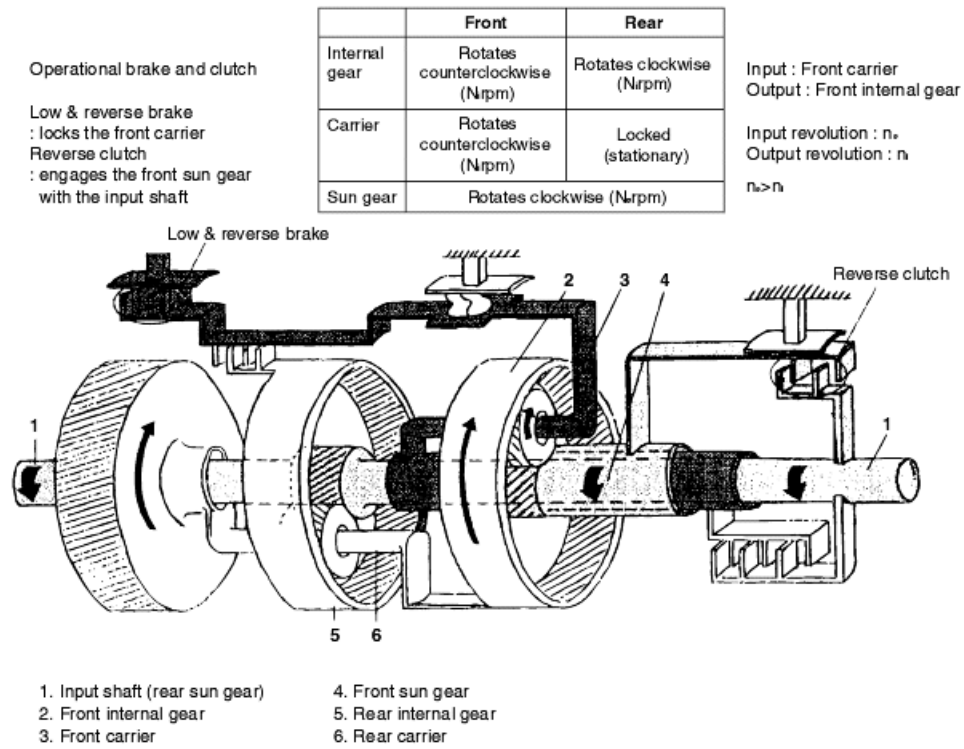


- 1. Input shaft (rear sun gear)
- 2. Front internal gear
- 3. Front carrier

- 4. Front sun gear
- 5. Rear internal gear
- 6. Rear carrier

## Reverse

In the “R” range, the front carrier is locked and the front sun gear rotates clockwise. The front internal gear rotates counter-clockwise. Therefore, the output axis rotates counter-clockwise, and the vehicle moves backward



## OIL PRESSURE MECHANISM EKTC0060

### VALVE BODY

The valve body delivers oil pump discharge pressure to the clutches and brakes.

The valve body consists of a manual valve which delivers basic oil pressure, shift valves which switch the oil pressure circuit to the clutches and brakes, a pressure regulator valve which regulates line pressure, and accumulators which prevent or smooth shift shock.

In the valve body, there are oil circuits. Shift valves are operated by the shift solenoid valves.

Valve name	Function
Pressure regulator valve	Regulates oil pump discharge pressure to the set pressure.
Manual valve	Delivers line pressure directly by select lever.
Pilot valve	Holds oil pressure steady, which fluctuates according to driving conditions.
Pressure modifier valve	Regulates pilot pressure applied to pressure regulator valve.
Line pressure solenoid valve	Regulates pilot pressure applied to pressure modifier valve
Line pressure relief valve	Prevents line pressure applied to manual valve from increasing above the allowable value.
Shift valve A	Switches line pressure applied to shift valve B and the engagement side of 2-4-brake servo.
Shift valve B	Switches line pressure applied to each of the clutch and brake.
Shift solenoid valve A	Operates shift valve A.
Shift solenoid valve B	Operates shift valve B.
Servo release timing valve	Adjusts timing to apply line pressure to the release side of 2-4-brake servo.
Accumulator control valve	Regulates line pressure applied to each accumulator
Lock-up control valve	Regulates oil pressure applied to both engagement and release sides of lock-up clutch.
Lock-up solenoid	Regulates pilot pressure applied to lock-up control valve.

### VALVES AND SOLENOIDS

#### Pressure regulator valve

The pressure regulator valve regulates the oil pump discharge pressure to the set pressure. AT fluid for which oil pressure has been regulated lubricates the torque converter and the inside of the valve.

The oil pressure changes in response to the driving range and throttle position.

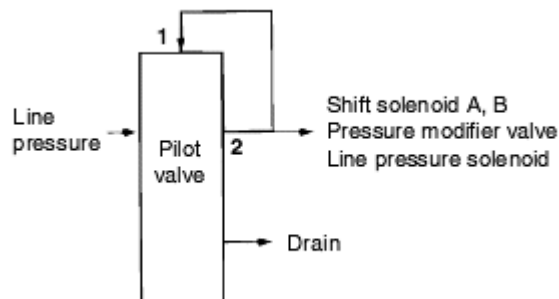
#### Manual valve

The manual valve delivers the line pressure directly via the select lever.

#### Pilot valve

The pilot valve holds the oil pressure steady, which fluctuates according to driving conditions.

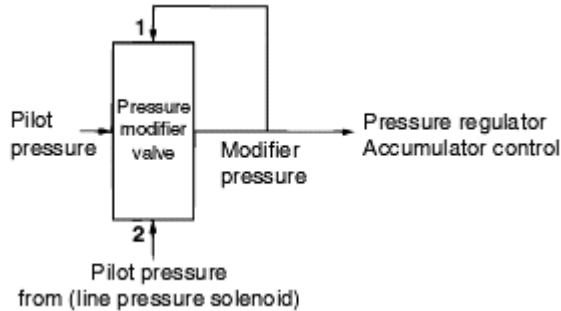
The oil pressure, which has passed through this valve, is called the pilot pressure. It is delivered through each of the solenoid valves to the operation side of the shift valves and the pressure modifier valve.



**Pressure modifier valve**

The pressure modifier valve is operated via pilot pressure, which is regulated, by the line pressure solenoid valve.

The oil pressure, which has passed through this valve, is called the modifier pressure. The modifier pressure operates the pressure regulator valve and the accumulator control valve. Thus, the line pressure changes in response to driving conditions.

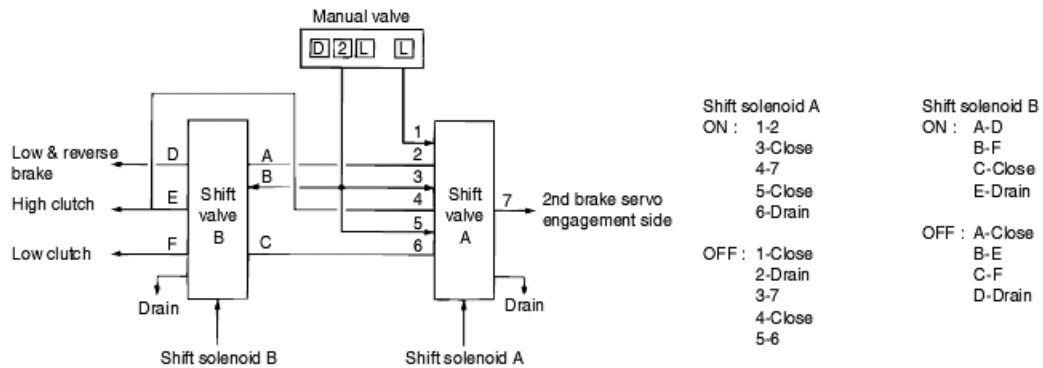


**Shift valve A**

Shift valve A switches the line pressure applied to shift valve B and the line pressure applied to the engagement side of the 2-4-brake servo. This valve is operated by switching the pilot pressure. Switching the pilot pressure is controlled by shift solenoid valve A.

**Shift valve B**

Shift valve B switches the line pressure applied to each clutch and brake, and the pilot pressure applied to the neutral shift valve and the lock-up control valve. This valve is operated by switching the pilot pressure. Switching the pilot pressure is controlled by the shift solenoid valve B.

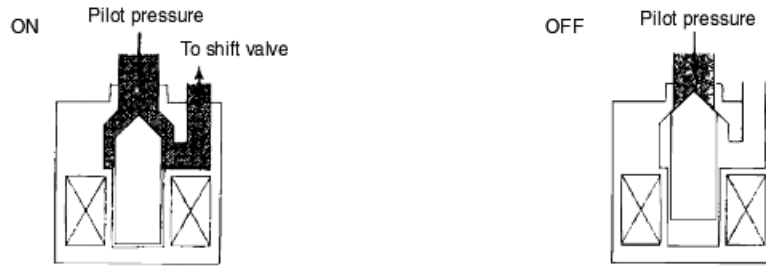


**Shift solenoid valve A**

Shift solenoid valve A controls the pilot pressure which operates shift valve A. ON opens the valve for the pilot pressure : OFF closes it.

**Shift solenoid valve B**

Shift solenoid valve B controls the pilot pressure which operates shift valve B. ON opens the valve for the pilot pressure : OFF closes it.



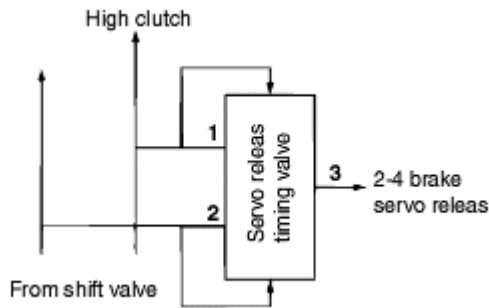
**Servo release timing valve**

The servo release timing valve adjusts the timing for applying the line pressure to the release side of the 2-4 brake servo to the same as that of the timing for applying the line pressure to the low clutch and the high clutch when shifting from 2nd gear to 3rd or from 4th gear to 3rd gear.

When oil pressure is applied to only 1, 2-3 are open and 1 is closed.

When oil pressure is applied to only 2, 1-3 are open and 2 is closed.

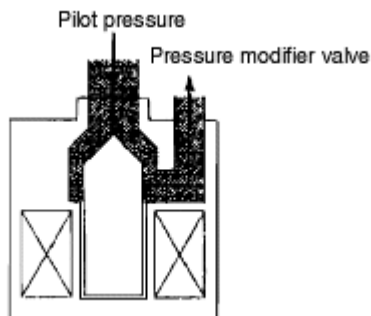
When oil pressure is applied to 1 and 2, 1-3 are open and oil pressure is applied to the release side of the 2-4-brake servo.



**Line pressure solenoid valve**

The line pressure solenoid valve regulates the pilot pressure applied to the pressure modifier valve in response to the throttle position.

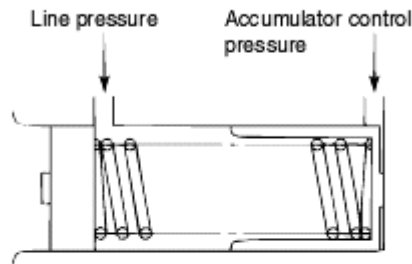
Operation of the valve is duty-controlled.



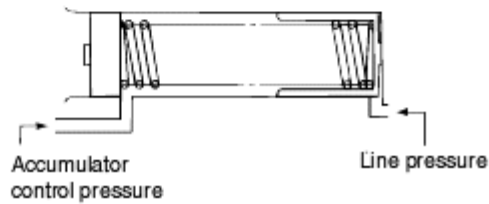
**Accumulator**

This valve prevents an abnormal line pressure rise from being applied to each brake and clutch. The oil pressure rise is controlled by the line pressure (back pressure) applied by the accumulator control valve.

**1-2 accumulator**  
**Servo release accumulator**

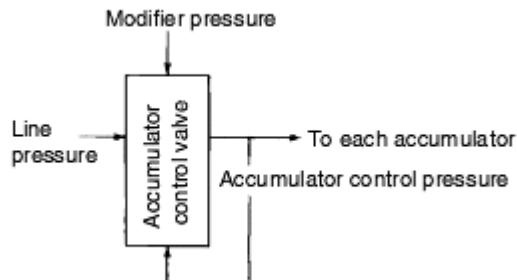


**Low clutch accumulator**



**Accumulator control valve**

The accumulator control valve regulates the line pressure (back pressure) applied to each accumulator. This valve is operated via the pilot pressure regulated by the pressure modifier valve.



**Lock-up solenoid valve**

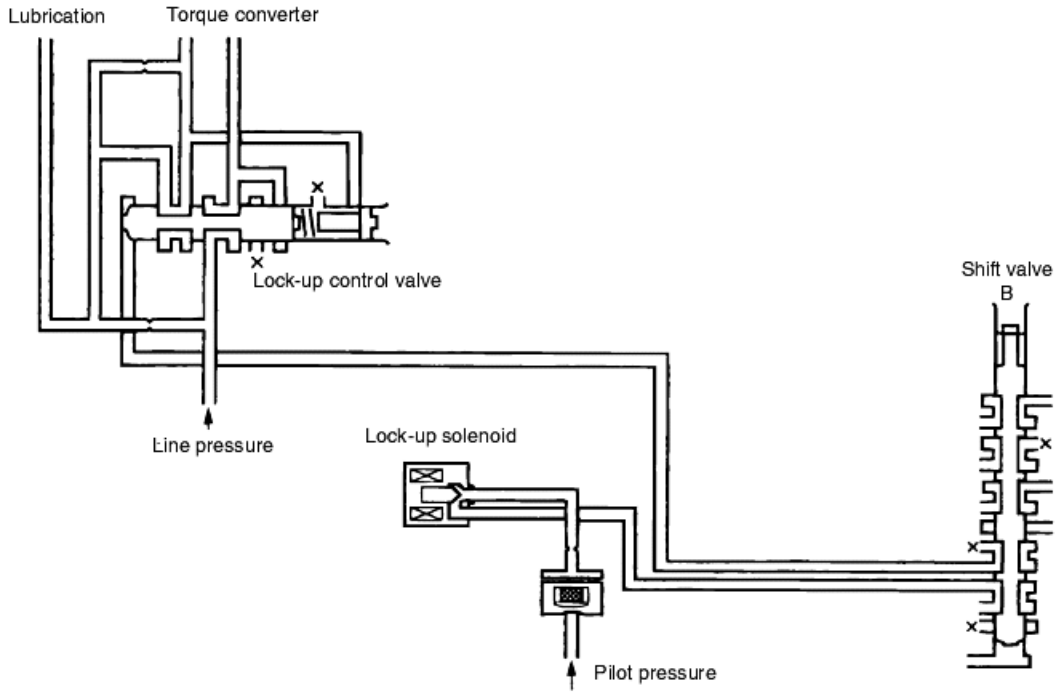
The lock-up solenoid valve regulates the pilot pressure which operates the lock-up control valve during lock-up.

Operation of the valve is duty-controlled.

**Lock-up control valve**

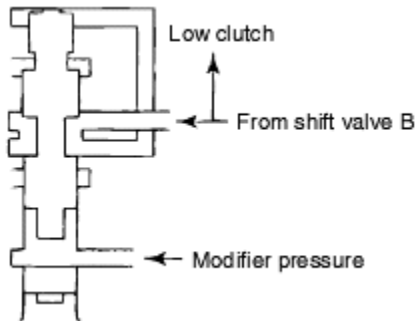
The lock-up control valve controls oil pressure applied to the lock-up clutch in the torque converter by means of pilot pressure regulated by the lock-up solenoid.





**Neutral control valve**

The neutral control valve absorbs fluctuation of line pressure applied to the low clutch.



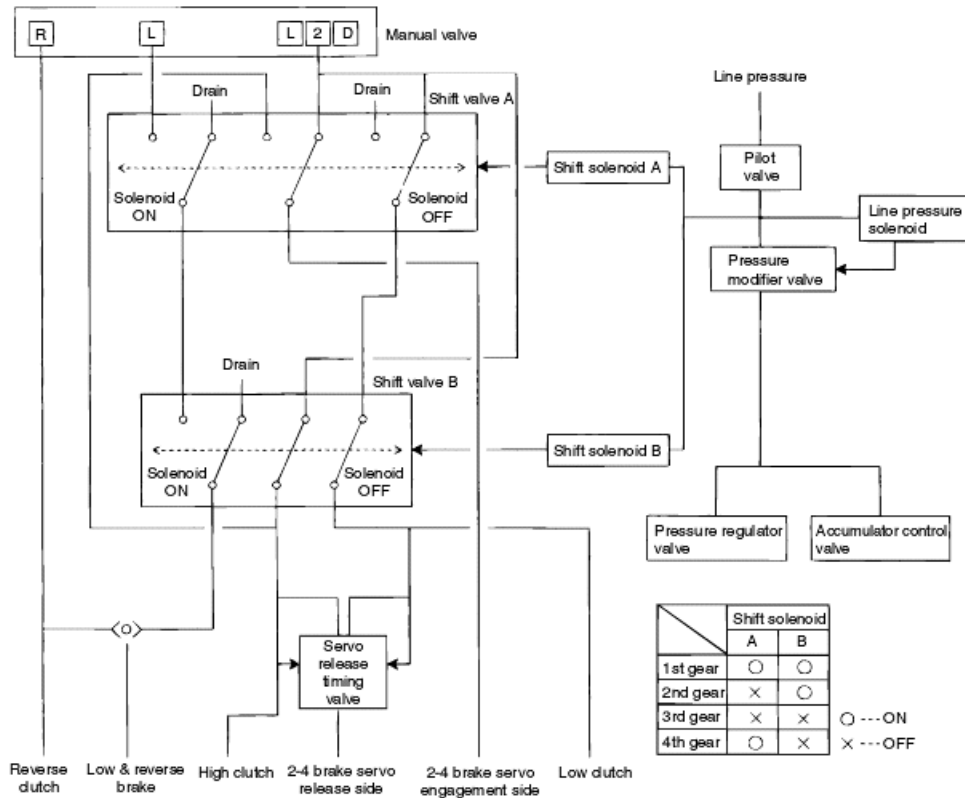
## OIL PRESSURE CIRCUIT EKT0070

To shift gears, two types of oil pressure, line pressure and pilot pressure, are used.

Line pressure which operates clutches and brakes is controlled by the manual valve and shift valves A and B.

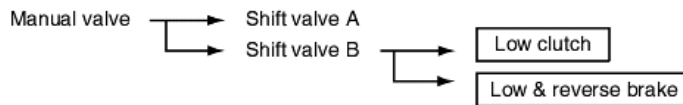
Pilot pressure which is line pressure regulated by the pilot valve operates shift valves A and B and the lock-up control valve. It is controlled by shift solenoid valves A and B and the lock-up solenoid.

Line pressure is regulated by the pressure regulator valve in response to the pressure modifier valve (throttle position) and the manual valve (selector lever position). For control details, refer to the sections on the pressure regulator valve, pressure modifier valve and manual valve in “Valves and solenoids”.

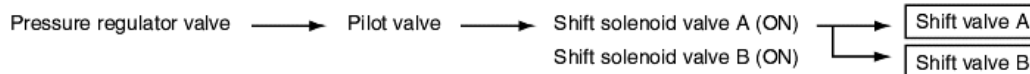


### 1st gear (“L” range)

#### Line pressure



#### Pilot pressure

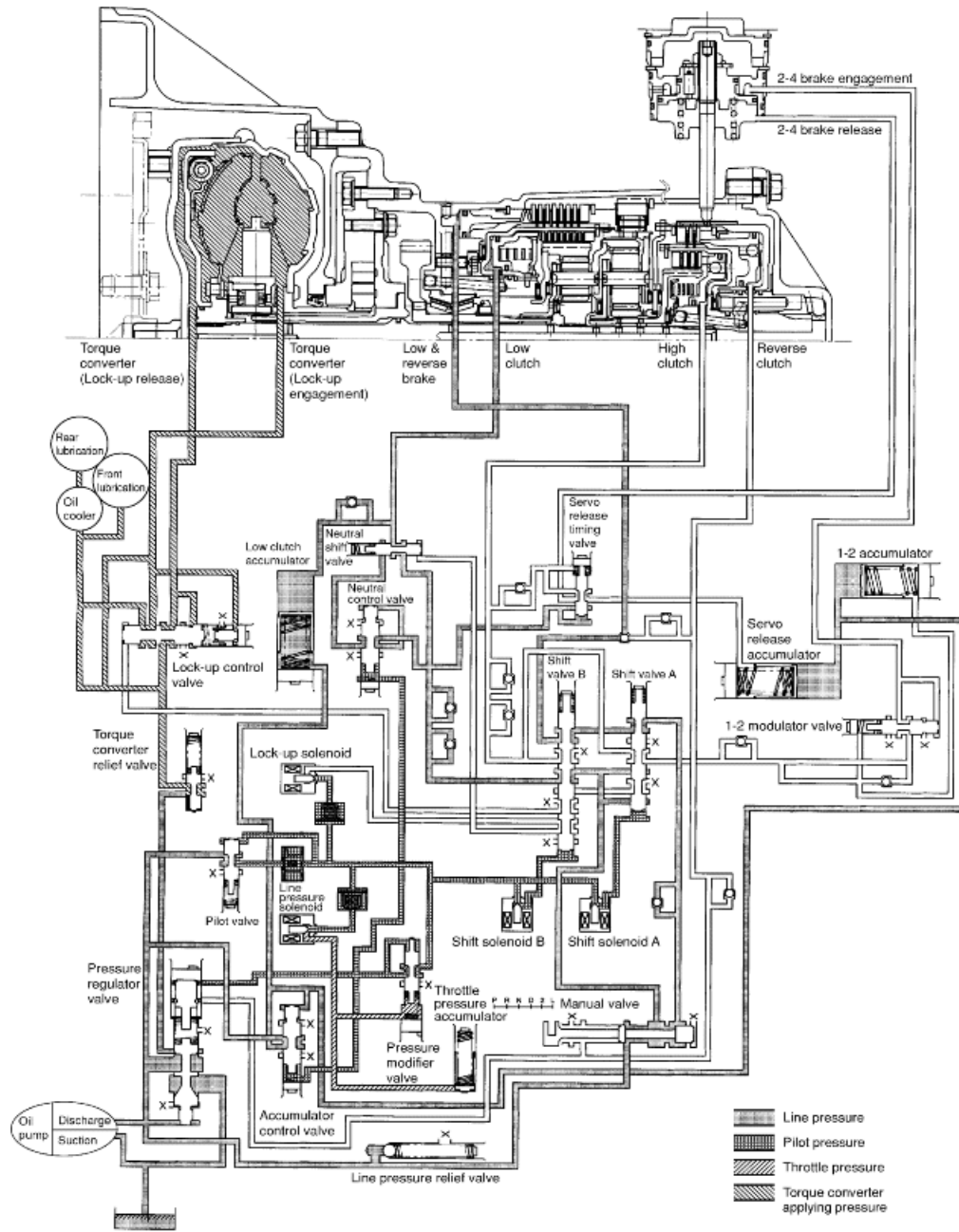


Since shift solenoid valves A and B are ON, pilot pressure operates the shift valves A and B.

Since the manual valve is positioned for the “L” range, oil pressure which has passed through shift valves A and B is applied to the low & reverse brake.

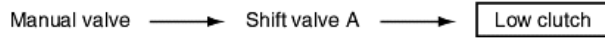
Therefore, line pressure passes through the manual valve and shift valves A and B, and then operates the low clutch and the low & reverse brake. Since the low & reverse brake is operated, engine brake occurs when the accelerator pedal is released.

**1st gear (“L” range)**

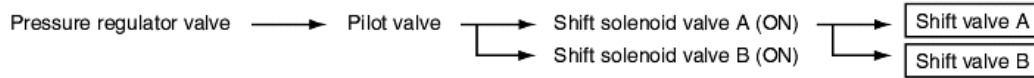


## 1st gear (“D” and “2” ranges)

### Line pressure

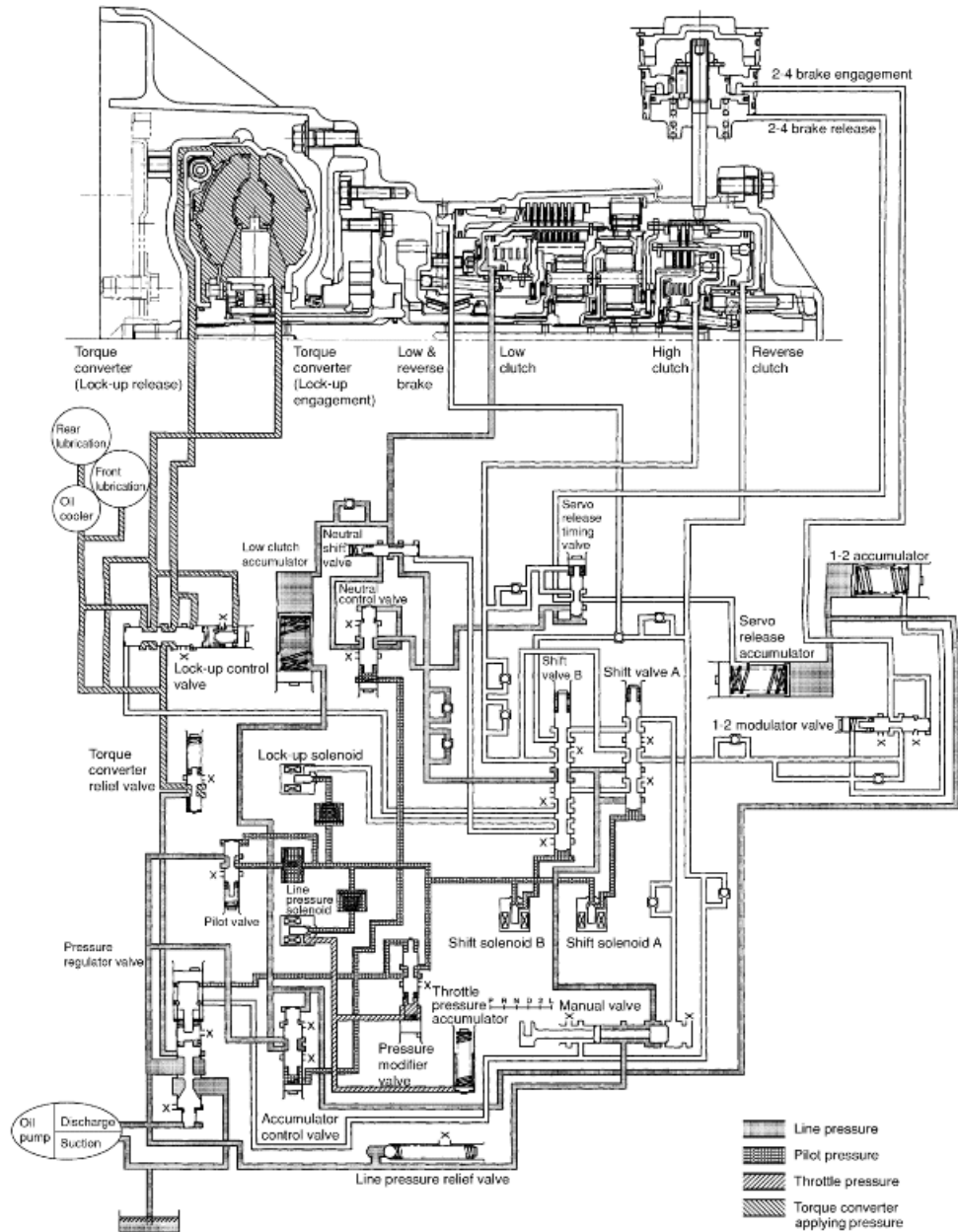


### Pilot pressure



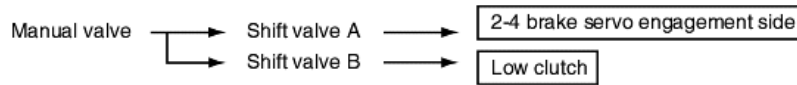
Since shift solenoid valves A and B are ON, pilot pressure operates shift valves A and B. Therefore, line pressure passes through the manual valve and shift valves A and B, and then operates the low clutch. Unlike in the case of “L” range, the low & reverse brake does not operate and the rear internal gear engaged by the low clutch is locked only against counter-clockwise rotation; however, it can rotate clockwise. Therefore, engine brake does not occur when the accelerator pedal is released

1st gear (“D” and “2” ranges)

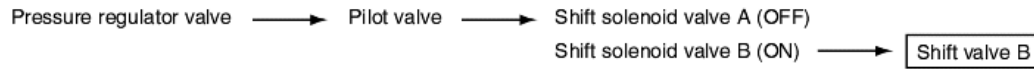


## 2nd gear

### Line pressure



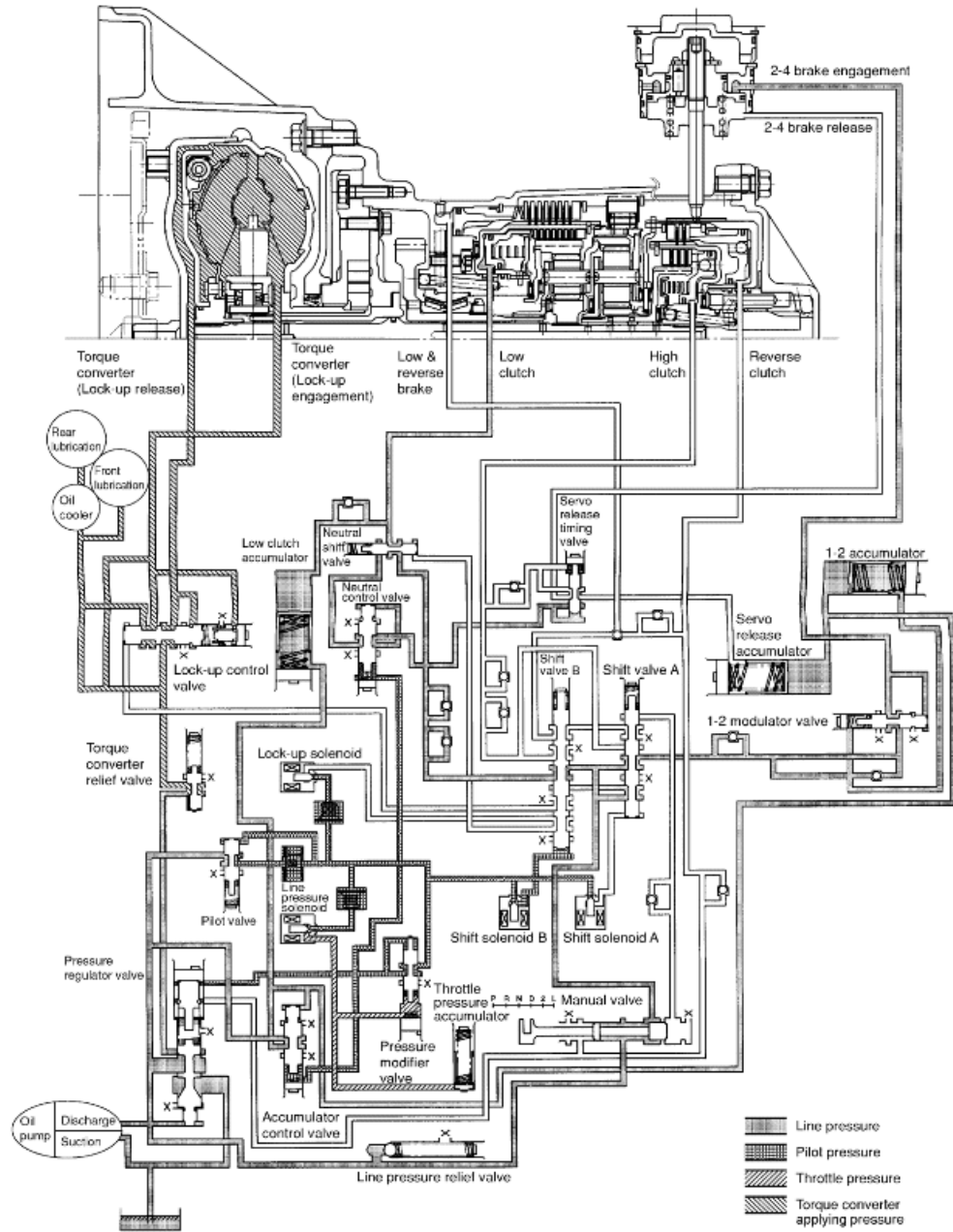
### Pilot pressure



Since shift solenoid valve A is OFF, pilot pressure is blocked and the shift valve A does not operate. Since the shift solenoid valve B is ON, the shift valve B operates.

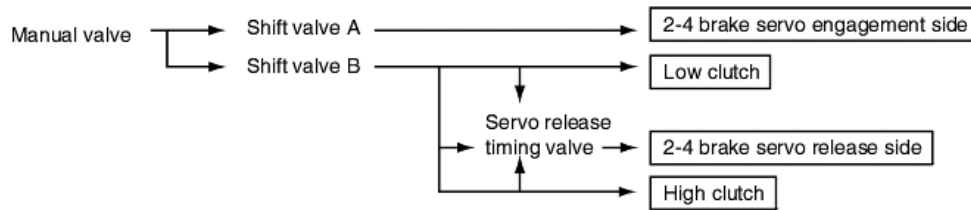
Line pressure passes through the manual valve to shift valves A and B, and operates the 2-4 brake servo engagement side and the low clutch in succession.

## 2nd gear

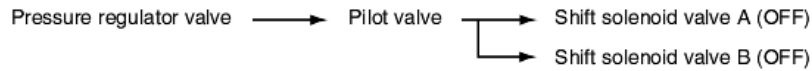


### 3rd gear

#### Line pressure



#### Pilot pressure



Line pressure passes through the manual valve to shift valves A and B.

Line pressure which has passed through shift valve A is applied to the 2-4 brake servo engagement side and shift valve B.

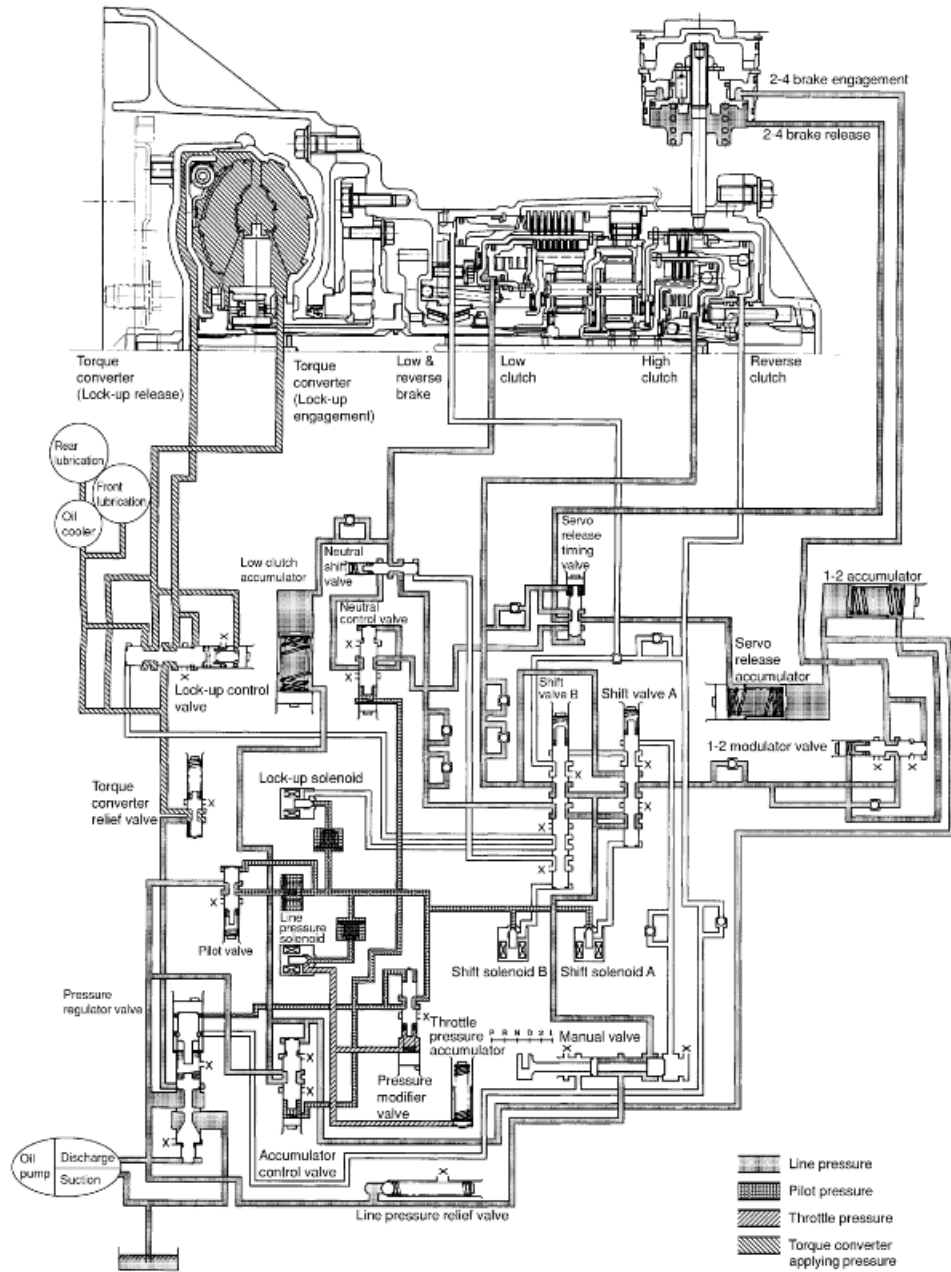
Line pressure which has passed through shift valve B is applied to the low clutch and the servo release timing valve operational side.

Line pressure, which has passed through the manual valve to shift valve B, is applied to the high clutch and the servo release timing valve.

Line pressure, which has passed through the servo release timing valve, is applied to the 2-4 brake servo release side and releases the 2-4 brake. Therefore, the low clutch and the high clutch operate.

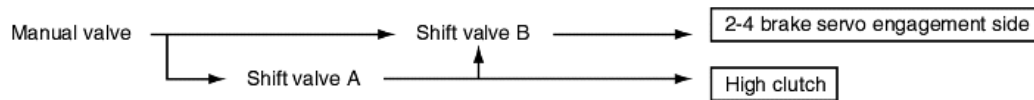


### 3rd gear

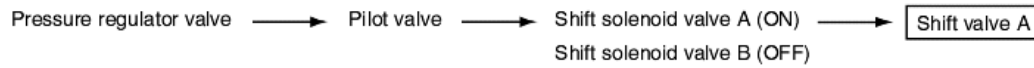


## 4th gear

### Line pressure



### Pilot pressure



Line pressure passes through the manual valve to shift valves A and B.

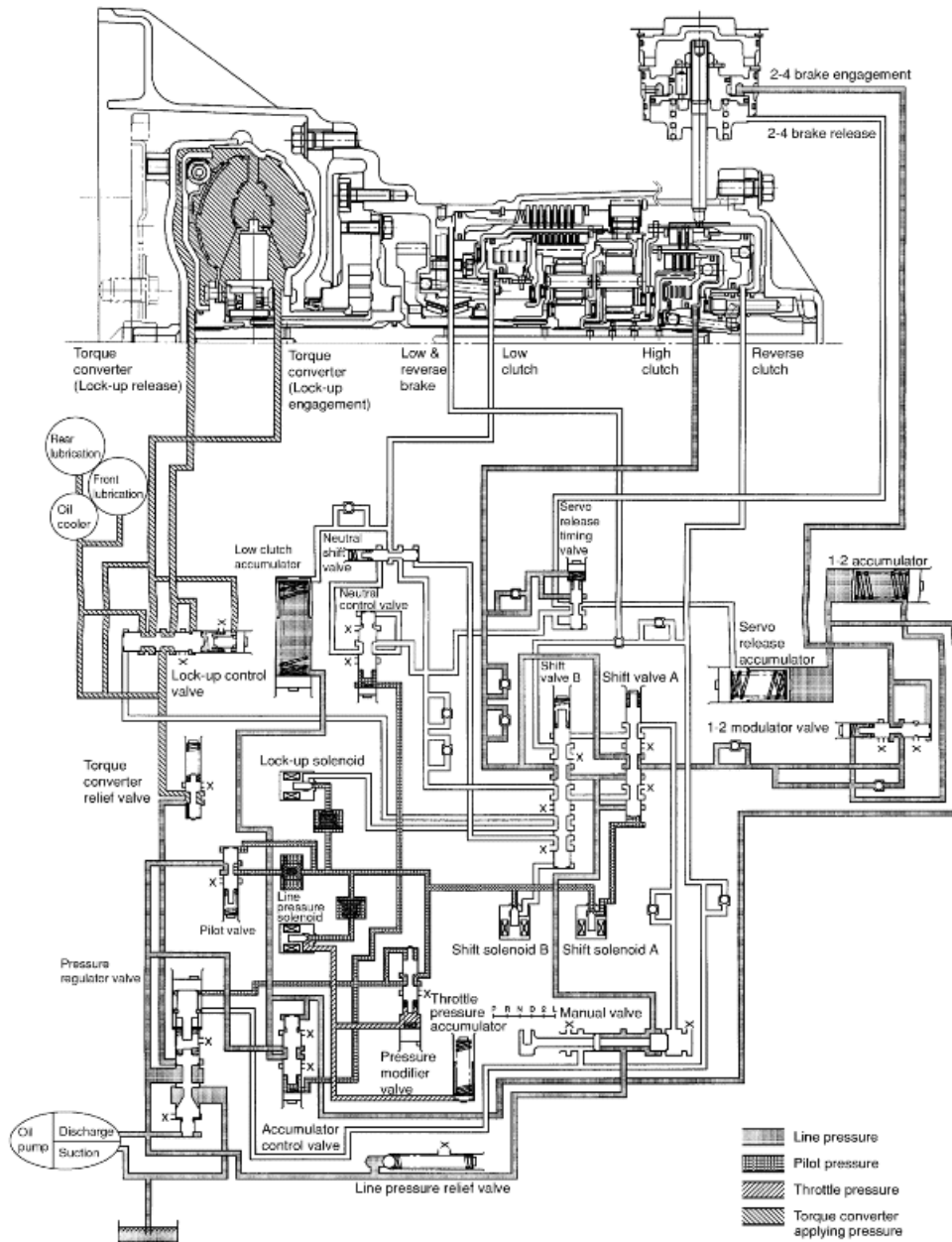
Line pressure, which has sent through the manual valve to the shift, valves stops there.

Line pressure which has passed through shift valve B is sent to the high clutch and shift valve A.

Line pressure which has passed through shift valve A is sent to the 2-4 brake servo engagement side.

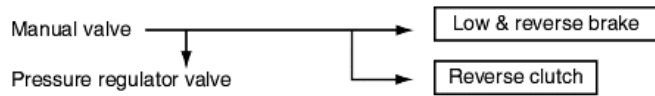
Therefore, the 2-4 brake and the high clutch operate.

# 4th gear



## Reverse

### Line pressure

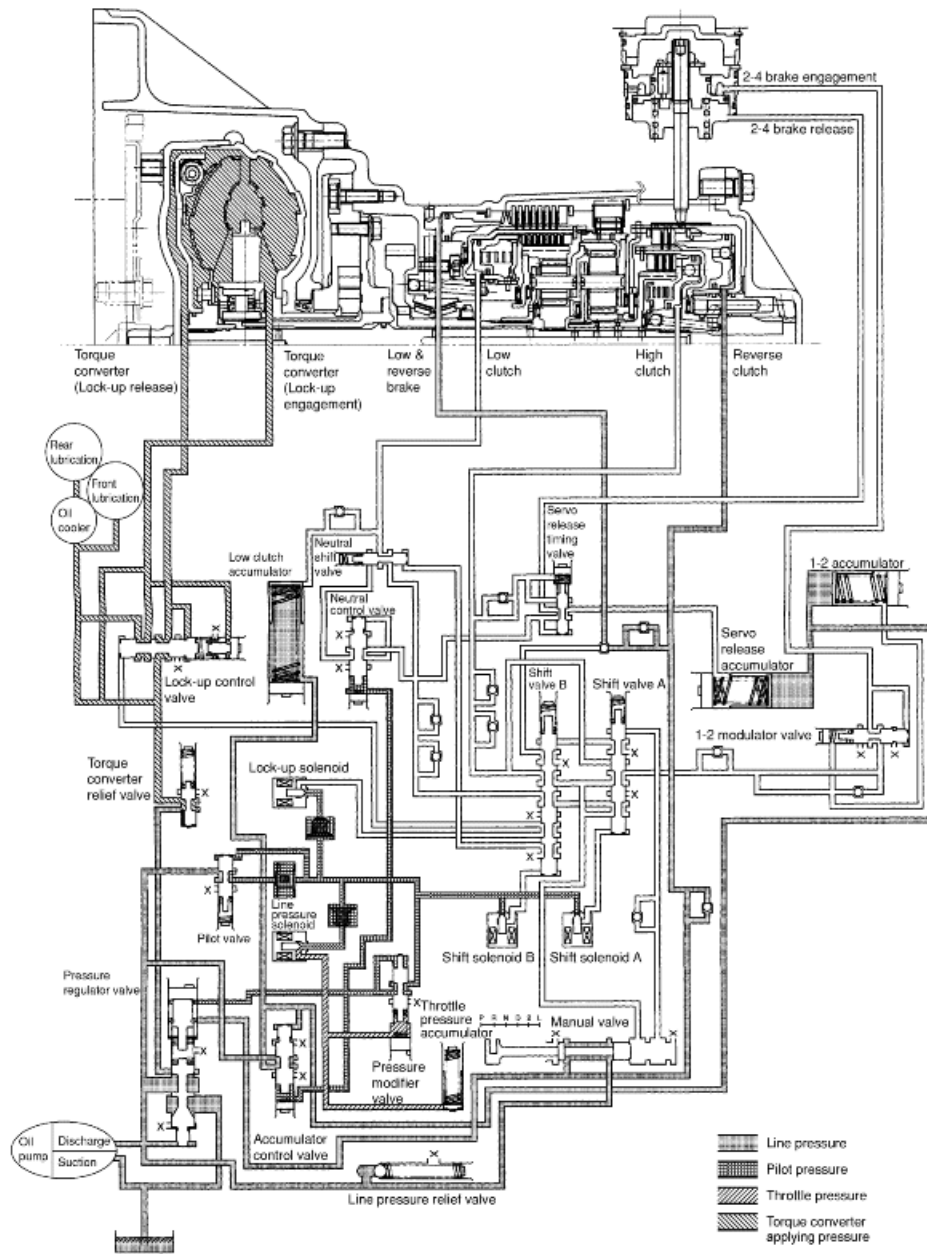


Line pressure which is not applied to the shift valves A and B operates the low & reverse brake and the reverse clutch directly.

Therefore, pilot pressure and shift solenoid valves A and B are not related to gear change.

Line pressure is applied to the pressure regulator valve as well, and line pressure is kept higher than usual.

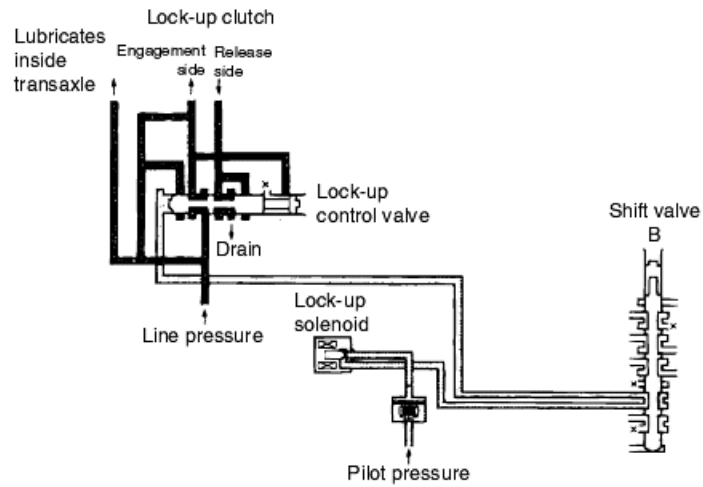
# Reverse



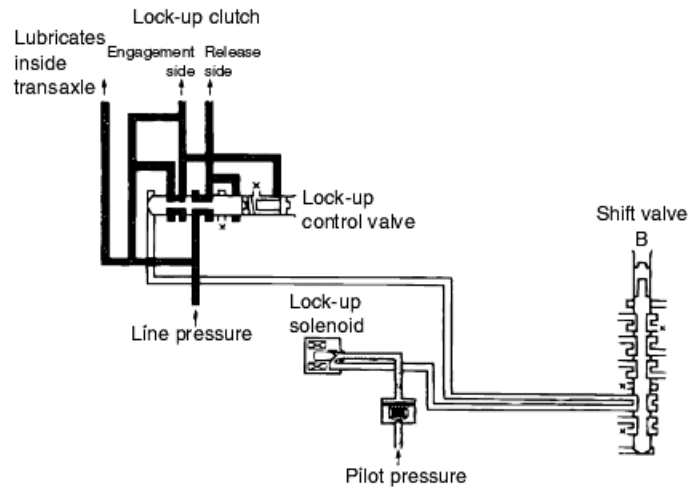
## LOCK-UP CONTROL

When the lock-up control execution conditions are met, the lock-up solenoid applies pilot pressure to shift valve B. Pilot pressure passed through shift valve B operates the lock-up control valve to drain oil pressure from the lock-up clutch release side of the torque converter and to raise oil pressure at the engagement side. The lock-up solenoid is duty-controlled. For control details, refer to the “Control mechanism” section.

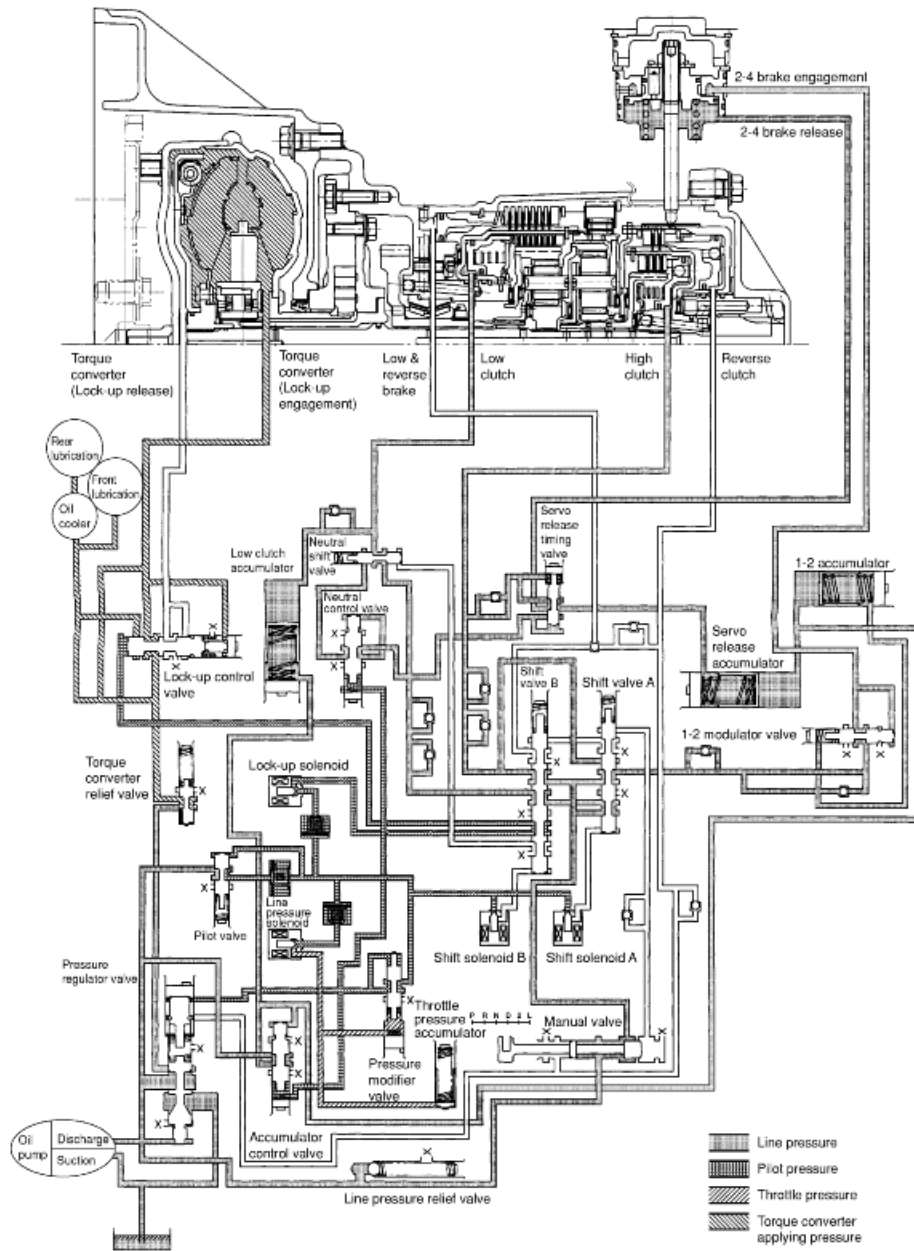
### Lock-up applied



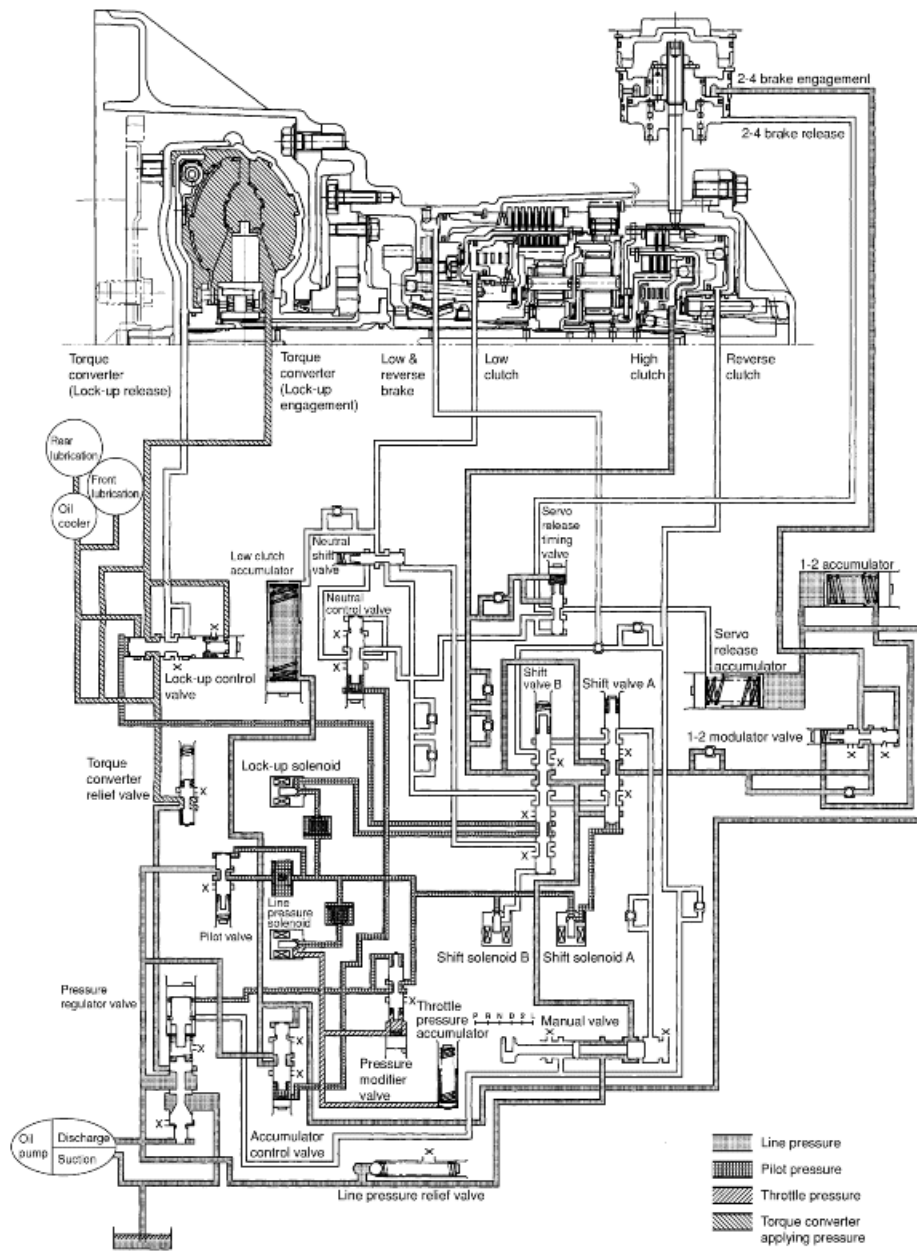
### Lock-up released



### 3rd gear (Lock-up)



## 4th gear (Lock-up)





## CONTROL MECHANISM EKTC0080

### GEAR CHANGE CONTROL

Gears are changed by solenoid valves A and B which are controlled by the TCM, and the manual valve which is operated by the select lever.

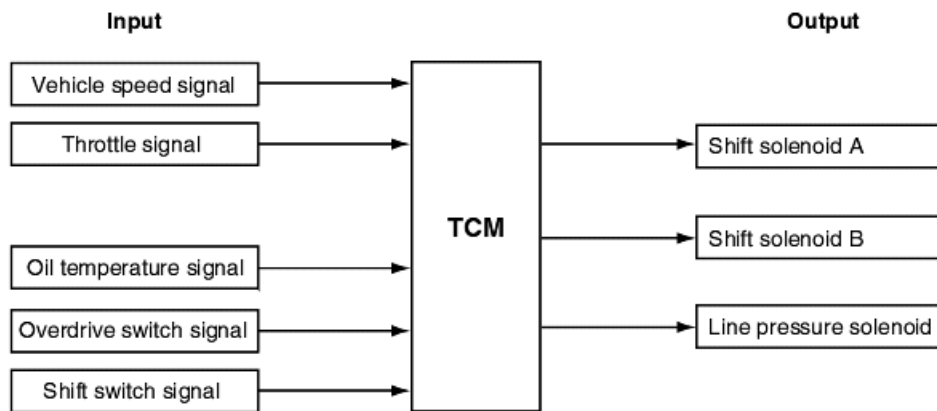
When the select lever is in the “P”, “N” or “R” position, gear change is operated mechanically by the manual valve and line pressure.

In the other positions, shifting up and down to 1st, 2nd, 3rd, and 4th gears is controlled by shift solenoid valves A and B.

#### NOTE

**If the AT fluid temperature is less than 20°C, shifting-up to 4th gear is not possible. This, however, is not a problem.**

Refer to the sections above for the power-low mechanism and the oil pressure circuit for each gear position.



### LOCK-UP CONTROL

When conditions are met when driving at higher than a certain speed in 3rd (overdrive OFF) or 4th (overdrive ON) gears, the TCM outputs a signal to the lock-up solenoid and locks up the lock-up clutch in the torque converter. This is the lock-up control.

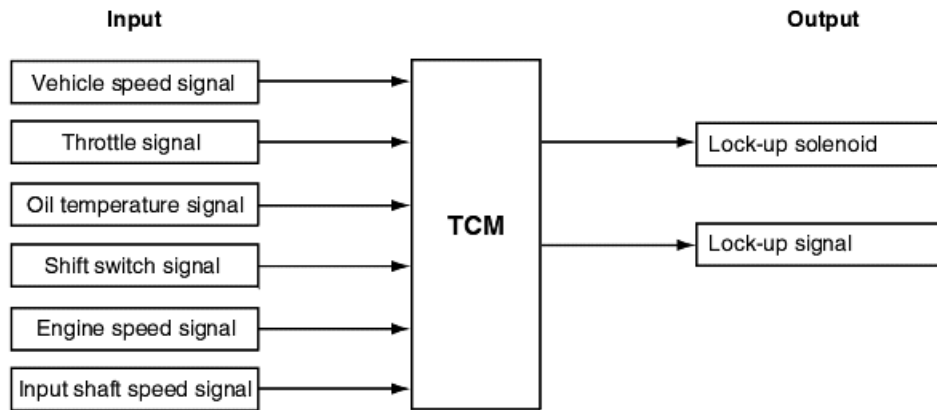
Lock-up control is operated by the lock-up solenoid and the lock-up control valve.

#### LOCK-UP CONTROL EXECUTION CONDITIONS

- The shift position must be 3rd or 4th gear.
- The throttle opening angle and vehicle speed must be within the lock-up control range.
- The AT fluid temperature must be within the control execution range. (20°C or more)
- The shift switch is in the “D” position.

#### CONDITIONS WHEN LOCK-UP CONTROL IS NOT EXECUTED

The execution conditions are not met



### TCM

The TCM is at the right side of the passenger's footing. It sends an output signal to shift solenoids A and B, the line pressure solenoid and the lock-up solenoid in response to the input signal from each sensor to operate shift change in 1st, 2nd, 3rd, and 4th gears and lock-up control.

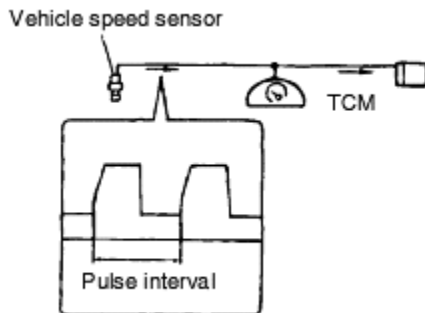
The TCM is equipped with a diagnostic function to detect errors in the controller itself and the input signal. If an error occurs, the fail-safe function works to secure a minimum driving performance.

### INPUT SIGNALS

The signals shown in the diagram specify the input signals for the TCM terminal.

#### Vehicle speed signal

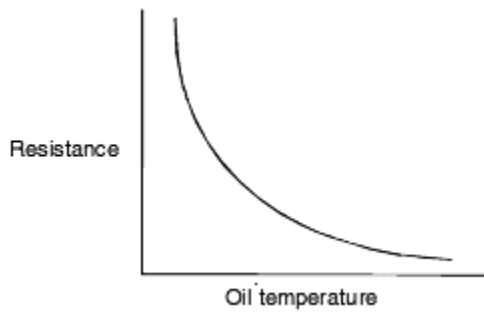
The frequency fluctuation output from the vehicle speed sensor is monitored and is input as vehicle speed. The vehicle speed and throttle signals are used as data for shifting gear.



#### Oil temperature signal

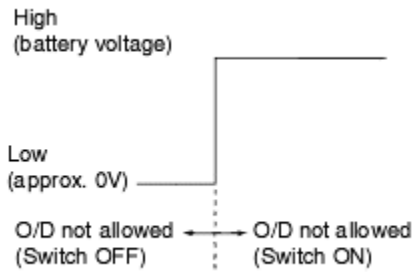
Resistance variation of the oil temperature sensor is monitored via the variation of voltage and is input as AT fluid temperature.

The oil temperature signal is used to determine the shift point.



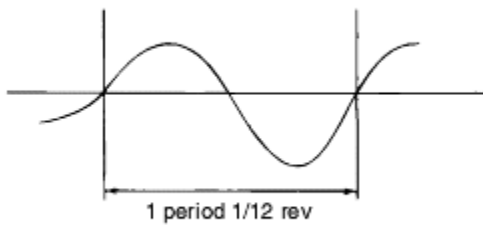
**Overdrive signal**

The overdrive signal is switched by the overdrive switch. Shifting to overdrive is not possible when the switch is ON, and it is possible when the switch is OFF.



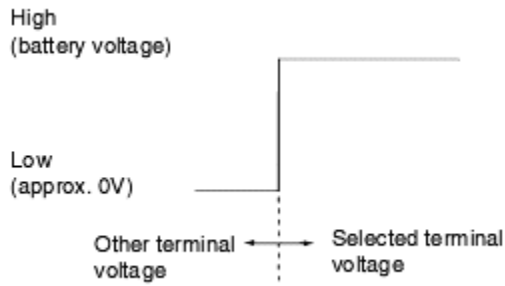
**Input shaft speed signal**

The input shaft speed signal is detected by the turbine sensor. It is input as input shaft rotation. It is used as data for lock-up control.



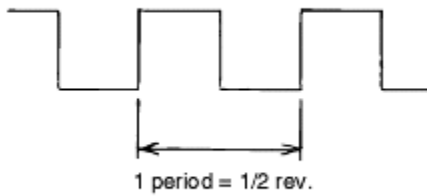
**Shift position signal**

The present positions of the selector lever and the manual valve are detected by the output signal from the shift lever switch. The shift position signal is used to determine the appropriate driving gear for the vehicle speed.



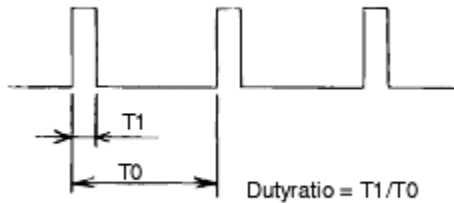
**Engine speed signal**

The engine speed signal is input to the engine controller. It is used as data for lock-up control.



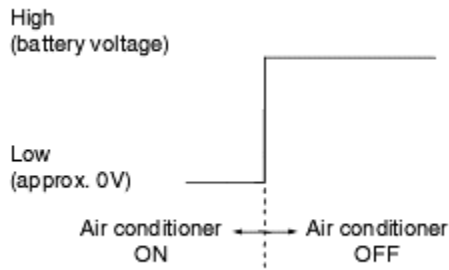
**The throttle position signal**

Throttle position signal input to the engine controller is converted to duty signal and is input to the TCM. As the throttle opening angle increases, the “High” time ratio increases.



**Air conditioner signal**

The control signal from the engine controller to the air conditioner clutch relay is also sent to the TCM. While the air conditioner clutch is operating : that is, the air conditioner signal is “Low (approx. 0V)”, the line pressure solenoid is controlled base on this signal.



**OUTPUT SIGNALS**

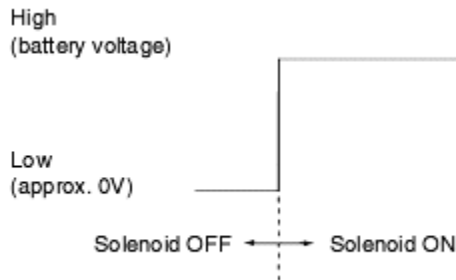
Output signals from the TCM are examined by each input signal and then they are output.

**Shift solenoid a, b signal**

These signals operate shift solenoids A and B respectively.

	1st gear	2nd gear	3rd gear	4th gear
Shift solenoid A	ON	OFF	OFF	ON
Shift solenoid B	ON	ON	OFF	OFF

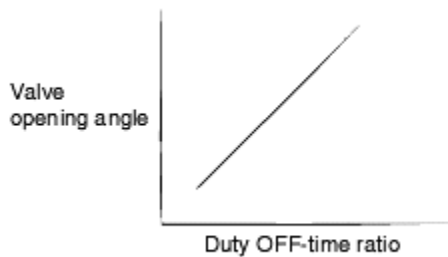
For functions of the shift solenoids, refer to the “Oil pressure mechanism” section.



**Line pressure solenoid signal**

This signal is the duty signal that operates the line pressure solenoid to regulate the line pressure in response to the driving conditions.

It regulates throttle pressure applied to the pressure modifier valve.



**Lock-up solenoid signal**

This signal operates the lock-up solenoid to execute lock-up control.

The duty signal is output when lock-up is applied.

**Lock-up signal**

When gear position, throttle opening angle, and vehicle speed are in the lock-up range and the lock-up control is executed, TCM detect that lock-up control is being executed.

The lock-up signal is output in 1 duty cycle of 10 ms. The ratio of duty ON-time is 80% during lock-up, and 50% unlocked .

#### **MIL lighting request signal**

If the AT controller detects an error, a lighting request of the MIL lamp on the instrument panel is output to the engine controller.

The request signal is 1Hz duty. The ratio of duty ON-time is 85% during request, and 50% during non-request.

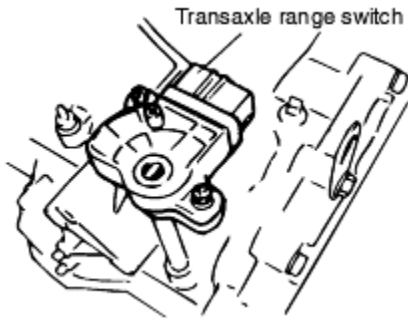
### **SENSORS AND SWITCHES**

#### **Throttle sensor**

A throttle sensor is installed on the throttle shaft. It detects the throttle position. The throttle position is converted to the throttle signal by the engine controller, and is output to the TCM.

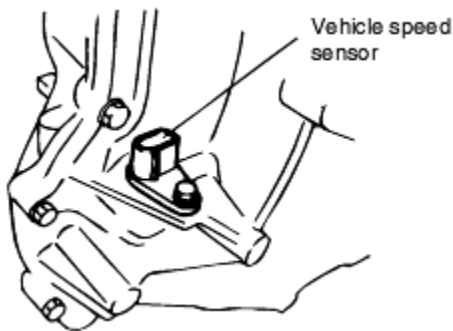
#### **Transaxle Range switch**

A transaxle range switch is installed on the manual shift shaft. The transaxle range switch applies the battery voltage to the TCM in response to the select lever position. The controller detects the positions of the select lever and the manual valve using the output voltage from the shift switch.



#### **Vehicle speed sensor**

A vehicle speed sensor is installed in the transaxle case. It detects the number of signal rotor teeth in the differential gear.



#### **O/D switch**

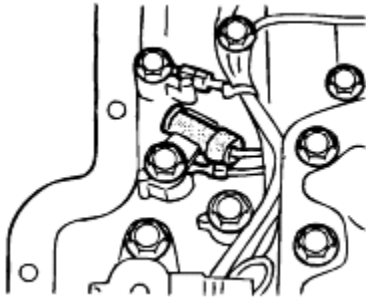
An O/D switch is installed on the select lever. It determines whether shifting to overdrive (4th gear) is possible or not.

Shifting to 4th gear is not possible when the switch is ON. When the vehicle is driving in 4th gear, the gear is shifted down to 3rd gear.

Also, the O/D OFF indicator in the speedometer is lit to indicate that shifting up to 4th gear is not permitted.

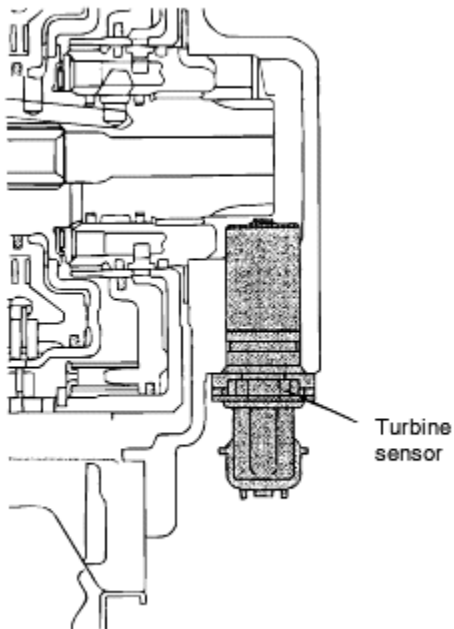
### **Oil temperature sensor**

The oil temperature sensor detects the transaxle fluid temperature. It is installed in the valve body.



### **Turbine sensor (Input shaft speed)**

The turbine sensor detects the input shaft rotation speed. It is installed on the mounting (side cover) at the side of the transaxle case.

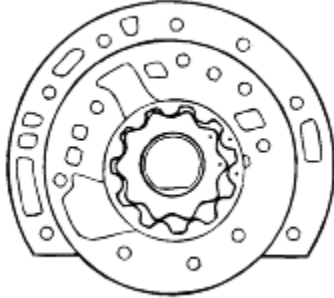


## OTHER MECHANISMS EKTC0090

### OIL PUMP

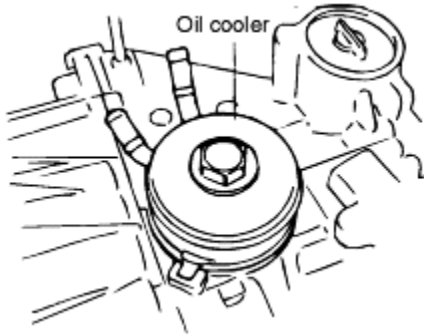
The trochoid oil pump is installed at input shaft side of the transaxle case.

Oil pump is operated by the torque converter sleeve case. Therefore, lubrication inside the transaxle is not carried out when the engine stops.



### OIL COOLER

The built-in (case-combined) water-cooled oil cooler is installed on the transaxle case.



### SELECT LEVER

The select lever is a floor type.

“N” “D” can be selected freely : “P” ;→ “R” , “N” → “R” , and “2”→”L” are selected by pressing the button.



▲ : Shift while pressing the button	
↑ : Shift without pressing the button	
▲▼	<ul style="list-style-type: none"> <li>• Parking position <ul style="list-style-type: none"> <li>- The output shaft of the transaxle is mechanically locked.</li> <li>- Engine can be started.</li> <li>- The key interlock mechanism of the ignition key is released.</li> <li>- When the ignition key is ON, shifting to another range is possible by pressing the button while depressing the brake pedal.</li> </ul> </li> </ul>
▲↓	<ul style="list-style-type: none"> <li>• Reverse position <ul style="list-style-type: none"> <li>- Selected when the vehicle is to be moved backward.</li> </ul> </li> </ul>
↑↓	<ul style="list-style-type: none"> <li>• Neutral position <ul style="list-style-type: none"> <li>- Engine can be started.</li> </ul> </li> </ul>
↑▼	<ul style="list-style-type: none"> <li>• Normal driving position <ul style="list-style-type: none"> <li>- Shifts automatically between 1st and 2nd, 2nd and 3rd, and 3rd and 4th gears in response to the vehicle speed and accelerator opening angle. (Shifting gear is limited to 3rd when O/D is OFF.)</li> </ul> </li> </ul>
↑▼	<ul style="list-style-type: none"> <li>• Position selected when engine braking is desirable or you want to limit the gear to 2nd. <ul style="list-style-type: none"> <li>- Shifts automatically between the 1st and 2nd gear</li> </ul> </li> </ul>
↑▼	<ul style="list-style-type: none"> <li>• 1st gear position <ul style="list-style-type: none"> <li>- Selected when climbing a steep slope or powerful engine braking is desirable when driving down hill.</li> </ul> </li> </ul>

#### NOTE

Be sure to observe the following points when operating the shift lever. Otherwise, it may cause the interior of the automatic transmission to be damaged or the vehicle to start suddenly.

1. "p" should be selected when the vehicle has been brought to a complete stop.
2. Shifting from forward ranges ("D", "2", or "L") to reverse ("R") and vice versa should only happen when the vehicle has been brought to a complete standstill.
3. If the engine is turning over at high speed when "N" or "P" is selected, do not select another range.
4. While driving the vehicle, do not drive continuously with the "N" range is selected or do not repeat the shift operation to the "N" range.

#### TROUBLESHOOTING EKTC0100

When carrying out troubleshooting of the automatic transaxle, check the transaxle in the vehicle first to find the root of the problem, and then determine whether the transmission should be disassembled or not.

Disassembling the transaxle without finding the root of the problem will result in wasted time and may

cause secondary problems.

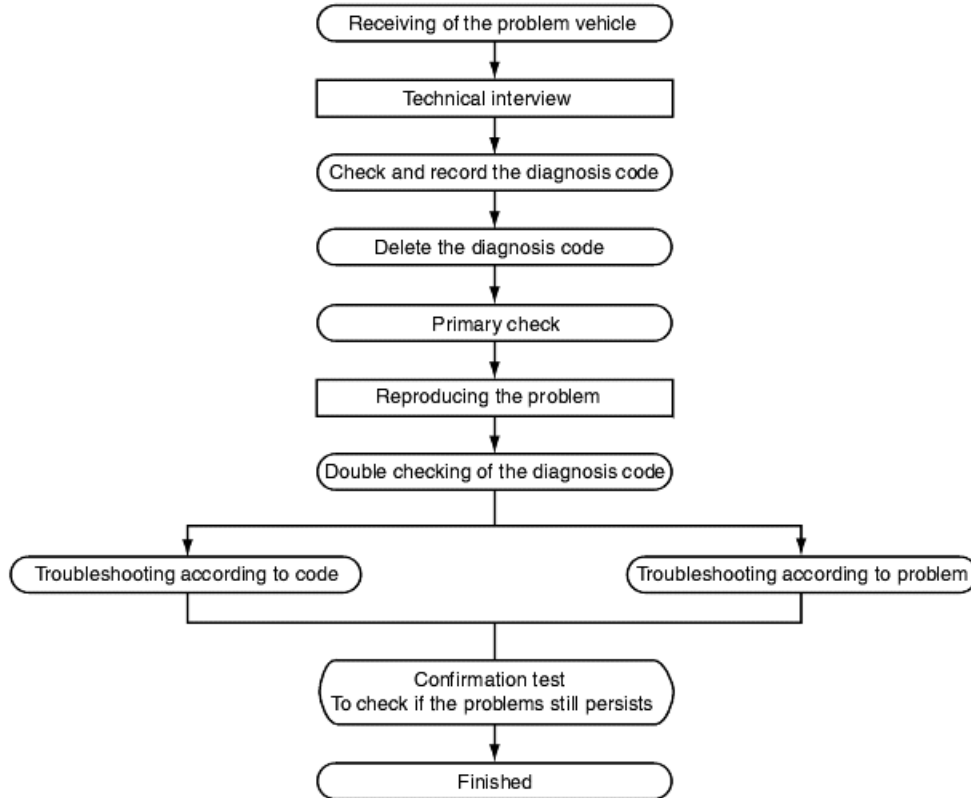
Automatic transmission problems are categorized as follows:

1. Improper inspection or adjustment
2. Poor engine performance
3. Failure of hydraulic control mechanism
4. Failure of electric control unit
5. Mechanical failure in transaxle

In order to properly diagnose the problem in the vehicle, try to determine as accurately as possible from the customer the nature of the problem. Try to reproduce the problem if possible.

#### DIAGNOSTICS TROUBLESHOOTING

The automatic transaxle system is equipped with a diagnostic function, which is an important key in electrical troubleshooting. As for mechanical problems, if no error codes are detected by this function, check and troubleshooting should be carried out referring to the “Troubleshooting according to trouble symptoms”.



#### TECHNICAL INTERVIEW

The first step in the troubleshooting procedure is to assess the conditions, which prevailed at the time the problem occurred, and to decide on a course of action on the basis of these factors. It is easy to assess the conditions when it continues at the acceptance. However, when the problem disappears, it is difficult. If the problem can be reproduced, action can be taken immediately. If not, every effort should be taken to reproduce the problem as closely as possible before proceeding. Even experience service personnel may make errors or come to a standstill if troubleshooting is carried out without first trying to accurately

reproduce the problem. For example, a problem, which occurs only in cold weather or because of vibrations from the road surface, can not be accurately reproduced when the engine is warm or when the vehicle is at a stop. Therefore, to reproduce the problem, it is important that the customer should be asked for detailed circumstances, which lead to the problem: this is the “technical interview”.

As the information gathered in the course of this interview is discussed in troubleshooting, it is necessary not only to ask a series of questions but also to suggest what factors may have had a bearing on the problem. It may be helpful to create a check-list, which could be used in such interviews.

#### PRIMARY CHECK

It is necessary to check whether or not the basic automatic transmission maintenance has been carried out. The maintenance details are outlined in the “Primary check” and “Maintenance”.

1. Power supply and voltage check  
The battery voltage must be 10 - 14V when the engine is stopped.
2. ATF check  
Check level and ATF condition.
3. Stall test  
Check the engine speed at stall in each range, and check the overall performance of the automatic transmission and the engine.
4. Oil pressure test  
Measure the line pressure when idling and when the engine has stalled, and check the functions of each component.
5. Ignition timing and idling engine speed check  
Adjust these if they are not within the specified ranges.  
If a problem occurs such as a “fluctuating engine speed”, troubleshoot the engine first.
6. Select linkage check and adjustment
7. Throttle sensor check and adjustment
8. Road test  
A road test is carried out to assess the problem properly and as a post maintenance check.
9. Electrical wiring check  
Check that the connectors fit securely, that the coupler has neither become rusty nor accumulated grime, that the terminals are secure and have not become distorted and that no parts have come into contact with rotating, shaking or hot parts and have not become loose or damaged.

#### FACTORS RELATING TO THE PROBLEM

When troubleshooting, the service technician must endeavor to reproduce the problem. It is important, therefore, to try, on the basis of the technical interview, to reproduce the set of circumstances, which lead to the problem (road, climate and driving conditions), initially. A patient approach to achieving this end, reproducing factors such as vibration (by manually moving the wire harness or relay), by creating heat (applying hot air) and by using water, is necessary.

Therefore, presuming that the assembly/parts may be the cause of the problem and using a tester to check the various contributory factors will make it possible to determine the behaviour of the assembly/parts at the time the problem occurred.

<b>PRECAUTIONS WHEN DRIVING AND HANDLING THE VEHICLE</b> <b>No.</b>	<b>Precautions</b>
1	If the vehicle breaks down, raise the front wheels off the ground and tow the vehicle. If the vehicle is to be towed using a rope, the towing speed

	should not exceed 35 km/h and the towing should be completed within an hour.
2	If the interior of the automatic transaxle is damaged, it may cause foreign matter to enter the oil cooler and may cause clogging. If necessary, clean and/or replace the oil cooler.
3	Be sure to use only specified ATF, ESSO - JWS3314. Using a different type of ATF may cause problems with the clutch and brake.
4	When the vehicle is stationary with the brake applied and the “D”, “2”, “L” or “R” range is selected, continuing the high-speed rotation of the engine (stall test operation) will cause overheating. Do not allow this to continue for more than 5 seconds.
5	If the ATF temperature is less than 20°C, shifting-up to 4th gear and lock-up operation are not possible. These, however, are not a problem. (It allows the interior of the automatic transaxle to be protected.) When the ATF temperature exceeds 20°C, normal gear shifting is possible.
6	“P” should be selected when the vehicle has been brought to a complete stop.
7	Shifting from forward ranges (“D”, “2”, or “L”) to reverse (“R”) and vice versa should only happen when the vehicle has been brought to a complete standstill.
8	If the engine is turning over at high speed when “N” or “P” is selected, do not select another range. (This may cause the vehicle to start suddenly and may cause damage to the interior of the automatic transaxle.)
9	While driving the vehicle, do not drive continuously with the “N” range is selected or do not repeat the shift operation to “N” range. (The interior of the automatic transaxle may be damaged.)
10	When starting the vehicle in extremely low temperatures (-10°C or less), be sure to warm up the vehicle before driving.

## TROUBLESHOOTING ACCORDING TO DIAGNOSIS CODES EKTC0110

### Display of diagnosis codes

Monitoring of the error codes by operating the Hi-scan pro.

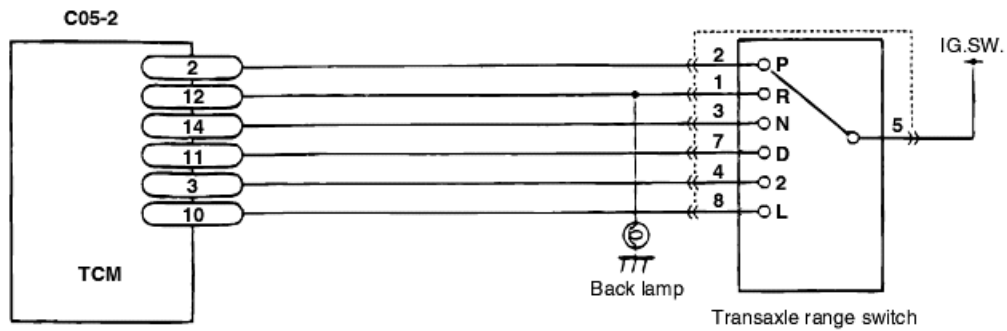
### Deletion of diagnosis codes

Deletion may also be carried out via the Hi-scan pro.

LIST OF DIAGNOSIS CODES DTC	Diagnosed item	Conditions	Fail-safe control
P0705	Shift switch (Transaxle range switch)	No input signal	Considers the previous range as the current one.
		Multiple signals input from the shift switch	Determines shift position according to the following priority:  Prohibits lock-up.
P0710	Oil temperature sensor	Over/under the range	Considers oil temperature as 80°C.
P0715	Turbine(Input) sensor	No input signal	Line pressure control → full throttle
P0720	Vehicle speed sensor) (Output speed	No input signal or signal input problem occurred when driving	“D” range → goes into 3rd gear “2” range → goes into 2nd gear “L” range → goes into 1st gear
P0725	Engine speed signal	No input signal	-
P0731	1st gear ratio	Malfunction of 1st gear engagement elements	-
P0732	2nd gear ratio	Malfunction of 2nd gear engagement elements	-
P0733	3rd gear ratio	Malfunction of 3rd gear engagement elements	-
P0734	4th gear ratio	Malfunction of 4th gear engagement elements	-
P0736	Reverse gear ratio	Malfunction of reverse gear engagement elements	-
P0741	Lock-up clutch (TCC system)	Malfunction of lock-up clutch	Prohibits lock-up.
P0743	Lock-up(TCC) solenoid	Open/short circuit	Sets the lock-up solenoid to OFF.
P0748	Line pressure solenoid (PCSV)	Open/short circuit	Sets the line pressure solenoid to OFF.
P0753	Shift solenoid A (SCSV A)	Open/short circuit	Goes into 3rd gear. Prohibits lock-up.
P0758	Shift solenoid B (SCSV B)	Open/short circuit	Goes into 3rd gear. Prohibits lock-up.
P1791	Throttle position sensor	Over/under the range	Gear change control → Throttle half open
	Throttle signal wire	Abnormal pulse width	Line pressure control → Full throttle Prohibits lock-up.
P1795	GND return wire	Open circuit	Sets the line pressure solenoid to OFF.

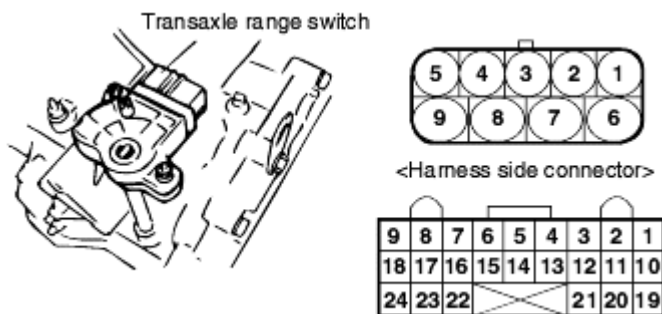
## INSPECTION PROCEDURES FOR DIAGNOSTIC TROUBLE CODES

**Code P0705: No input signal or multiple signals input from the Transaxle range switch**

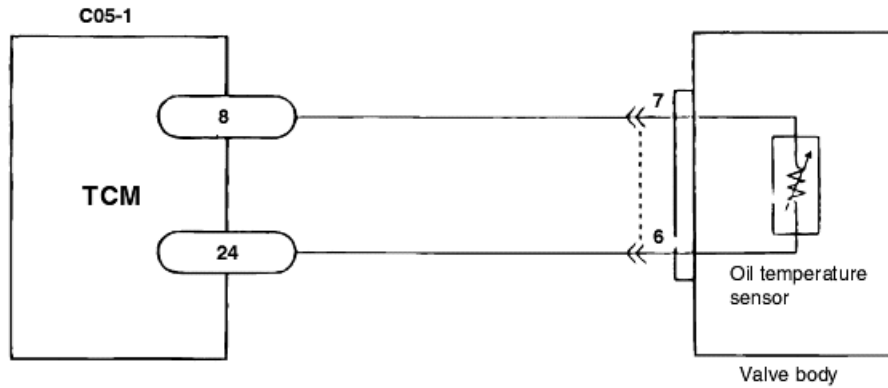


1. Remove the coupler of the parts concerned and of the TCM. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.
3. Perform a continuity check of the harness.
  - Between the shift switch and the controller
  - Continuity positive : normal
  - Continuity negative : open circuit
4. Perform a short circuit check between each of the terminals and the earth point with the coupler removed.
  - Continuity positive : short circuit
  - Continuity negative : normal

When checking the harness, check that the resistance value does not fluctuate by shaking the harness.
5. Install the coupler only to the shift switch and turn the ignition switch to the ON position. Then check the terminal voltage at the controller side.
  - If any terminal has a voltage, other than the terminal at which the shift position is currently selected, its harness is short-circuiting to another harness.
6. If both the unit and the harness operate normally, a contact failure in the coupler or error in the transaxle controller itself is the most likely problem.



## Code P0710: Oil temperature sensor over/under the range



1. Remove the coupler of the parts concerned and of the TCM. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.

Oil temperature sensor resistance standard :

20°C approx. 2.5 k $\Omega$

50°C approx. 0.33 k $\Omega$

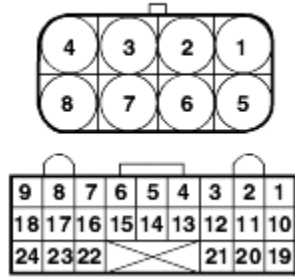
80°C approx. 0.17 k $\Omega$

3. Perform a continuity check of the harness.  
Between the oil temperature sensor and the controller  
Continuity positive : normal  
Continuity negative : open circuit
4. Perform a short circuit check between each terminal of the harness and the earth point with the coupler removed.  
Continuity positive : short circuit  
Continuity negative : normal  
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.
5. Install the coupler only to the controller and turn the ignition switch to the ON position. Then check the terminal voltage at the oil temperature sensor. If the terminal voltage exceeds the specified level, a short circuit between harnesses is the most likely problem.

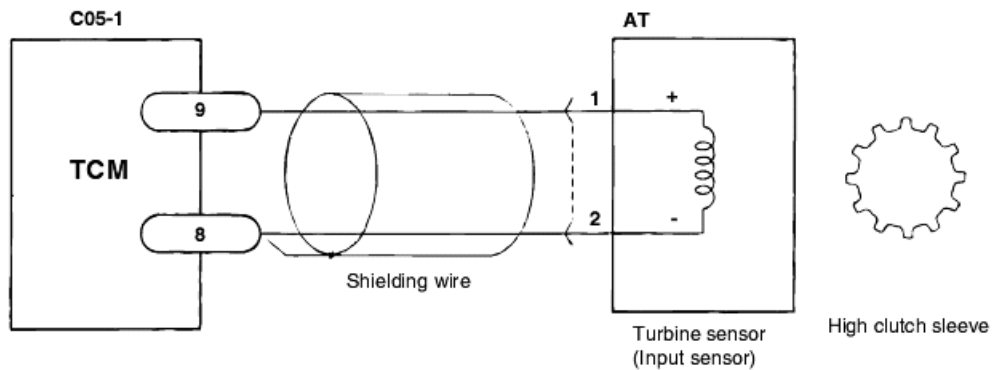
Standard voltage : approx. 2.5V

If both the unit and the harness operate normally, a contact failure in the coupler or error in the TCM itself is the most likely problem.

**A/T Solenoid valve connector**



**Code P0715: No turbine sensor input signal**



1. Check that the voltage of the plus wire from the turbine sensor is approximately 0V when the ignition switch is ON.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.

Turbine sensor resistance standard between plus and minus  
: 540Ω (20°C)

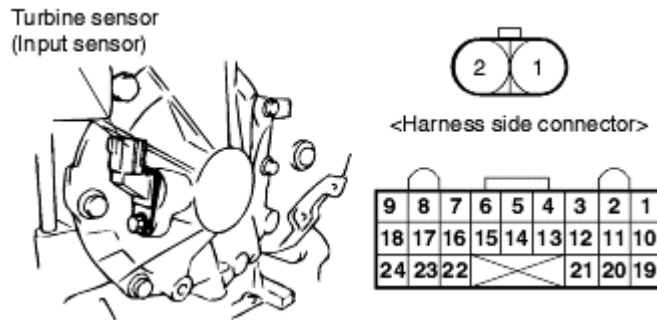
3. Perform a continuity check of the harness.  
Continuity positive : normal  
Continuity negative : open circuit
4. Perform a short circuit check between each of the terminals and the earth point with the connector removed.

Continuity positive : short circuit  
Continuity negative : normal

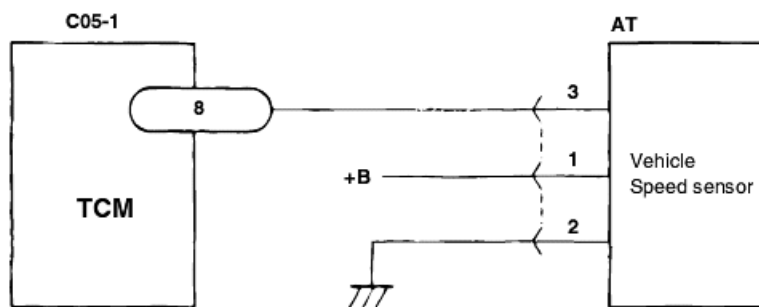
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.

5. If both the unit and the harness operate normally, a contact failure in the connector, or error in the TCM itself or the turbine sensor rotor in the transaxle is the most likely problem.

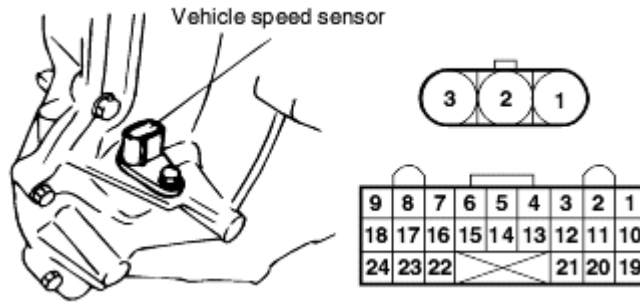




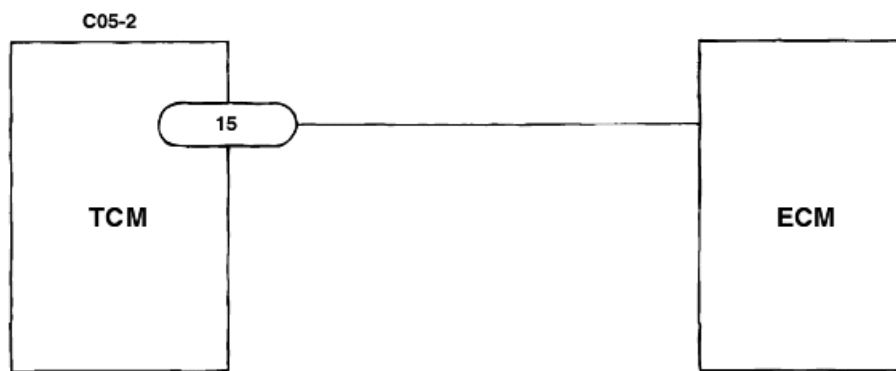
**Code P0720: No vehicle speed sensor input signal or signal input problem occurred when driving**



1. Check if battery voltage is applied to the wire between the battery and the vehicle speed sensor when the ignition switch is ON.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.
3. Perform a continuity check of the harness.  
Continuity positive : normal  
Continuity negative : open circuit
4. Perform a short circuit check between each of the terminals and the earth point with the coupler removed.  
Continuity positive : short circuit  
Continuity negative : normal  
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.
5. If both the unit and the harness operate normally, a contact failure in the connector, or error in the TCM itself or the vehicle speed sensor rotor in the transmission is the most likely problem.



### Code P0725: No engine speed input signal



1. Check if battery voltage is applied to the engine speed sensor wire when the ignition switch is ON.
2. Check the ECM and perform a road test to check that the problem does not recur.
3. Perform a continuity check of the harness.  
Continuity positive : normal  
Continuity negative : open circuit
4. Perform a short circuit check between each of the terminals and the earth point with the coupler removed.  
Continuity positive : short circuit  
Continuity negative : normal  
When checking the harness, check that the resistance value does not fluctuate by shaking it.
5. If both the unit and the harness operate normally, a contact failure in the coupler or error in the TCM itself is the most likely problem.

### Code P0731: Malfunction of 1st gear engagement elements

These problems occur when the predetermined gear ratio cannot be obtained while all the electronic signals concerned with gear change control (the shift solenoids A and B, the vehicle speed sensor, the turbine sensor, etc.) are normal. Therefore, it is necessary to check each of the gear engagement elements in the control valve and inside the transaxle.

**Code P0732: Malfunction of 2nd gear engagement elements**

These problems occur when the predetermined gear ratio cannot be obtained while all the electronic signals concerned with gear change control (the shift solenoids A and B, the vehicle speed sensor, the turbine sensor, etc.) are normal. Therefore, it is necessary to check each of the gear engagement elements in the control valve and inside the transaxle.

**Code P0733: Malfunction of 3rd gear engagement elements**

These problems occur when the predetermined gear ratio cannot be obtained while all the electronic signals concerned with gear change control (the shift solenoids A and B, the vehicle speed sensor, the turbine sensor, etc.) are normal. Therefore, it is necessary to check each of the gear engagement elements in the control valve and inside the transaxle.

**Code P0734: Malfunction of 4th gear engagement elements**

These problems occur when the predetermined gear ratio cannot be obtained while all the electronic signals concerned with gear change control (the shift solenoids A and B, the vehicle speed sensor, the turbine sensor, etc.) are normal. Therefore, it is necessary to check each of the gear engagement elements in the control valve and inside the transaxle.

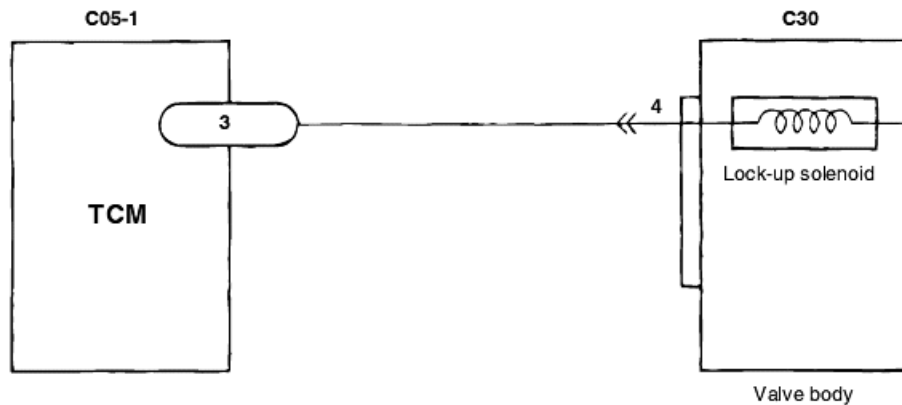
**Code P0736: Malfunction of reverse gear engagement elements**

These problems occur when the predetermined gear ratio cannot be obtained while all the electronic signals concerned with gear change control (the shift solenoids A and B, the vehicle speed sensor, the turbine sensor, etc.) are normal. Therefore, it is necessary to check each of the gear engagement elements in the control valve and inside the transaxle.

**Code P0741: Lock-up clutch malfunction**

This problem occurs when the lock-up clutch will not engage while all the electronic signals concerned with lock-up control (the turbine sensor, engine speed, and the lock-up solenoid) are normal. Therefore, it is necessary to check the lock-up clutch in the torque converter and check inside the control valve.

**Code P0743: Lock-up solenoid open or short circuit (Torque converter control)**



1. Remove the coupler of the parts concerned and of the controller. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.

Lock-up solenoid resistance standard: 13Ω (20°C)

3. Perform a continuity check of the harness.

Continuity positive : normal  
 Continuity negative : open circuit

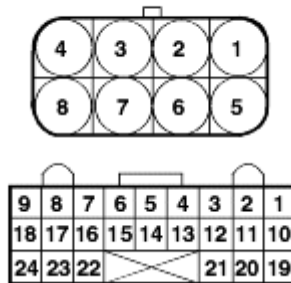
4. Perform a short circuit check between each of the terminals and the earth point with the coupler removed.

Continuity positive : short circuit  
 Continuity negative : normal

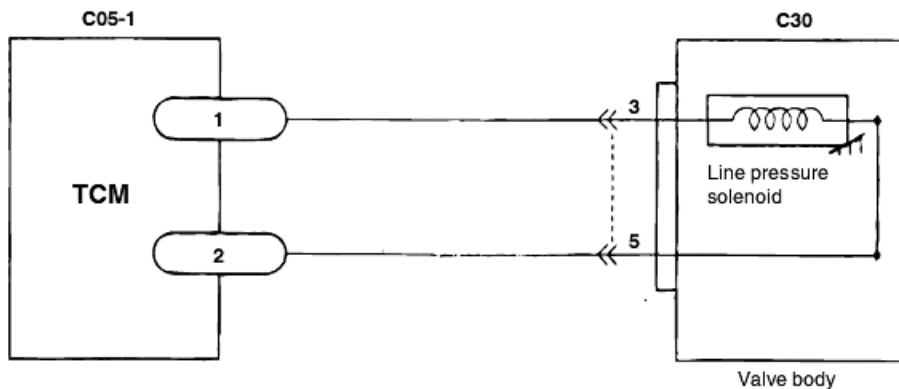
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.

5. If both the unit and the harness operate normally, a contact failure in the connector or error in the TCM itself is the most likely problem.

**A/T solenoid valve connector**



**Code P0748: Line pressure solenoid open or short circuit (PCSV), Code P1795: GND return open circuit**



1. Remove the connector of the parts concerned and of the TCM. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check that the problem does not recur.

**Line pressure solenoid resistance standard (between the solenoid signal line and the body, and between the solenoid signal line and the Ground return line) 2.9Ω (20°C)**

3. Perform a continuity check of the harness.

Continuity positive : normal

Continuity negative : open circuit

4. Perform a short circuit check between each of the terminals and the earth point with the connector removed.

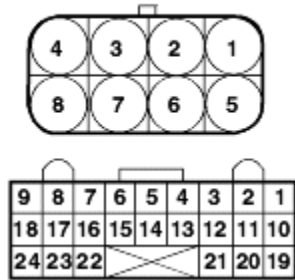
Continuity positive : short circuit

Continuity negative : normal

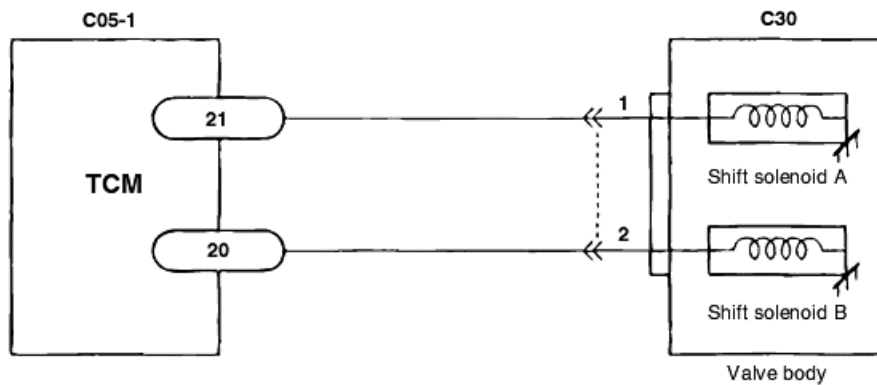
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.

5. If both the unit and the harness operate normally, a contact failure in the connector or error in the TCM itself is the most likely problem.

**A/T solenoid valve connector**



**Code P0753: Shift solenoid A open or short circuit (SCSV A), Code P0758: Shift solenoid B open or short circuit (SCSV B)**



1. Remove the coupler of the parts concerned and of the TCM. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check if the trouble occurs again.

Shift solenoid resistance standard  
: approx. 25Ω (20°C)

3. Perform a continuity check of the harness.

Continuity positive : normal

Continuity negative : open circuit

4. Perform a short circuit check between each of the terminals and the earth point with the connector removed.

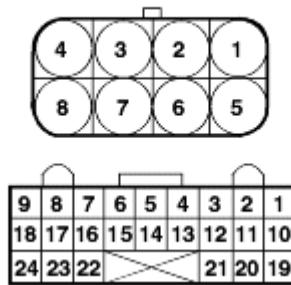
Continuity positive : short circuit

Continuity negative : normal

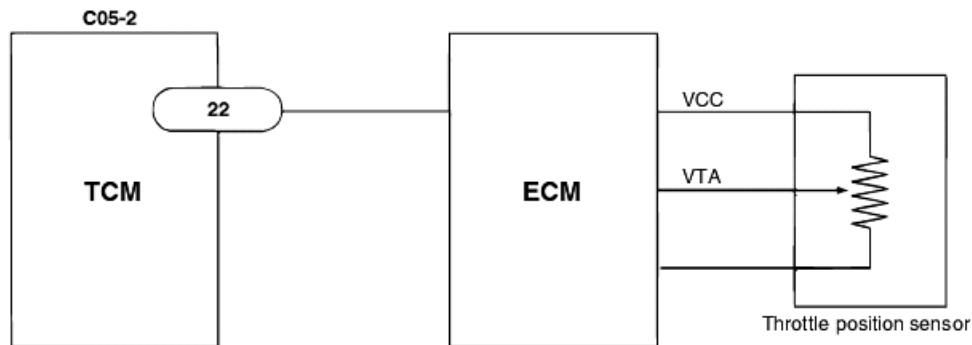
When checking the harness, check that the resistance value does not fluctuate by shaking the harness.

5. If both the unit and the harness operate normally, a contact failure in the connector or error in the TCM itself is the most likely problem.

**A/T solenoid valve connector**



**Code P1791: Throttle position sensor over/under the range and throttle signal abnormal pulse width**



1. Remove the coupler of the parts concerned and of the ECM. At this point the ignition switch must be in the OFF position.
2. Perform a unit check of the parts. If anything is wrong with the unit, replace it and perform a road test to check if the trouble occurs again.

Throttle position sensor voltage standard (between the VTA terminal and the earth):

Throttle closed : 0.5V

Full throttle : 4.5V

3. Perform a continuity check of the harness.

Between the throttle position sensor and the ECM, and between the ECM and the TCM

Continuity positive : normal

Continuity negative : open circuit

4. Perform a short circuit check between each of the terminals and the earth point with the coupler removed.

Continuity positive : short circuit

Continuity negative : normal

When checking the harness, check that the resistance value does not fluctuate by shaking the harness.

5. Install the connector only to the ECM and turn the ignition switch to the ON position. Then check the terminal voltage of the controller.

If the VTA terminal voltage exceeds the specified value, a short circuit between harnesses is the most likely problem.

VCC terminal : approx. 5V

VTA terminal : approx. 0V

6. If both the unit and the harness operate normally, a contact failure in the connector or error in the TCM itself is the most likely problem.





INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

<b>1-1</b>	<b>Vehicle will not move in any range</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect ATF level adjustment</li> <li>• Incorrect select linkage adjustment</li> <li>• Broken or damaged oil pump</li> <li>• Malfunction of torque converter</li> <li>• Error in control valve spool sliding</li> <li>• Damage to gear(s)</li> <li>• Faulty parking release</li> <li>• Faulty engine system</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the automatic transaxle check.</b>		
1	Is the ATF level correct when checked during the primary check?	YES	Go to the next step.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
2	Is there any slippage in the select linkage when checked during the primary check?	YES	Go to the next step.
		NO	Adjust the select linkage.
3	Is the measured line pressure within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to each of the gears (Output gear, idle gear, and differential gear)</li> <li>• Torque converter</li> <li>• Operation of the parking mechanism</li> </ul>
		NO	Check the following: (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>

1-2	<b>Vehicle will not move in “D” or “2”</b>	
<b>Probable cause</b> <ul style="list-style-type: none"> <li>• Low clutch slip</li> <li>• Low one-way clutch slip</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
	In the case where the ATF level and the line pressure measured in the primary check are correct :	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Burn or wear of the low clutch</li> <li>• Operation of the low one-way clutch</li> </ul>

<b>1-3</b>	<b>Vehicle will not move in “D”, “2” or “L”</b>	
<b>Probable cause</b>		
<ul style="list-style-type: none"> <li>• Low clutch slip</li> <li>• Low &amp; reverse clutch slip</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
	In the case where the ATF level and the line pressure measured in the primary check are correct :	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Burn or wear of the low clutch</li> <li>• Burn or wear of the low &amp; reverse clutch</li> </ul>

<b>1-4</b>	<b>Vehicle will not move in “R”</b>	
<b>Probable cause</b>		
<ul style="list-style-type: none"> <li>• Reverse clutch slip</li> <li>• Low &amp; reverse clutch slip</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
	In the case where the ATF level and the line pressure measured in the primary check are correct :	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Burn or wear of the reverse clutch</li> <li>• Burn or wear of the low &amp; reverse clutch</li> </ul>

<b>1-5</b>	<b>Vehicle moves in “N”</b>	
<b>Probable cause</b>		
<ul style="list-style-type: none"> <li>• Sticking of the low clutch resulting form burning or malfunction</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
	In the case where the select linkage adjustment checked in the primary check is correct:	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> </ul>

<b>1-6 Lower than normal maximum speed and/or poor acceleration</b>			
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Faulty TCM</li> <li>• Faulty O/D switch</li> <li>• Faulty ATF temperature sensor</li> <li>• Faulty line pressure solenoid</li> <li>• Faulty shift solenoid</li> <li>• Damage to or wear of oil pump</li> <li>• Malfunction of torque converter</li> <li>• Error in control valve spool sliding</li> <li>• Slip or malfunction of high clutch</li> <li>• Slip or malfunction of 2-4 brake band</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• O/D switch (No service code)</li> <li>• ATF temperature sensor</li> <li>• Line pressure solenoid</li> <li>• Shift solenoid</li> </ul>
		NO	Go to step 2.
2	Is the problem rectified by replacing the TCM with that of the same vehicle type?	YES	Replace the TCM.
		NO	Go to step 3.
3	Disassemble the A/T and check the interior.		Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Disassemble the oil pump assembly and check it for damage or wear.</li> <li>• Check the sliding of the control valve spool.</li> <li>• Check operation of the high clutch and check the plates for burning.</li> <li>• Check operation of the 2-4 brake band and check the band for burning.</li> </ul>
4	If no faults are detected in step 3.		<ul style="list-style-type: none"> <li>• Replace the torque converter.</li> </ul>

2-1, 2-2	<b>No shift in any range. No 1-2 shift-up</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Improper positioning of transaxle range switch</li> <li>• Fault in transaxle range switch itself</li> <li>• Malfunction of shift solenoid A</li> <li>• Malfunction of shift solenoid B</li> <li>• Faulty vehicle speed sensor</li> <li>• Faulty TCM</li> <li>• Malfunction of 2-4 brake band</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>		<b>Action</b>
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Shift solenoid A</li> <li>• Shift solenoid B</li> <li>• Vehicle Speed sensor</li> <li>• Positioning of transaxle range switch and short or open circuit inside the switch.</li> </ul>
		NO	Go to step 2.
2	Is the problem rectified by replacing the TCM with that of the same vehicle type?	YES	Replace the TCM.
		NO	Go to step 3.
3	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the 2-4 brake band</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>2-3</b>	<b>No 2-3 shift-up</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Improper positioning of transaxle range switch</li> <li>• Fault in transaxle range switch itself</li> <li>• Malfunction of shift solenoid B</li> <li>• Malfunction of high clutch</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Shift solenoid B</li> <li>• Positioning of transaxle range switch and short or open circuit inside the switch.</li> </ul>
		NO	Go to step 2.
2	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the high clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>



<b>2-4</b>	<b>No 3-4 shift-up</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Fault in transaxle range switch itself</li> <li>• Malfunction of shift solenoid A</li> <li>• Malfunction of shift solenoid B</li> <li>• Faulty O/D switch</li> <li>• Faulty ATF temperature sensor</li> <li>• Faulty TCM</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Shift solenoid A</li> <li>• Shift solenoid B</li> <li>• ATF temperature sensor</li> <li>• O/D switch (No service code)</li> <li>• Short or open circuit inside transaxle range switch</li> </ul>
		NO	Go to step 2.
2	Is the problem rectified by replacing the TCM with that of the same vehicle type?	YES	Replace the TCM.
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>2-5</b>	<b>Shift point is high or low</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Error in throttle position sensor</li> <li>• Faulty vehicle speed sensor</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Vehicle speed sensor</li> </ul>
		NO	Go to step 2.
2	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>
		NO	Adjust the mounting angle of the throttle position sensor.

**2-6 Lock-up does not operate**

**Probable cause**

- Faulty TCM
- Fault in transaxle range switch itself
- Engine speed sensor
- Faulty turbine sensor
- Malfunction of lock-up solenoid
- Faulty speed sensor
- Faulty ATF temperature sensor
- Malfunction of control valve spool
- Malfunction of torque converter

Step	Check	Action
1	Has the diagnostic code been output during the primary check?	YES According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Lock-up solenoid</li> <li>• Engine speed sensor</li> <li>• ATF temperature sensor</li> <li>• Vehicle speed sensor</li> <li>• Turbine sensor</li> <li>• Short or open circuit inside inhibitor switch</li> </ul>
		NO Go to step 2.
2	Is the problem rectified by replacing the TCM with that of the same vehicle type?	YES Replace the TCM.
		NO Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>
3	In the case where no faults are detected in steps 1 and 2.	<ul style="list-style-type: none"> <li>• Replace the torque converter</li> </ul>

<b>3-1</b>	<b>Clutch slips when vehicle starts (in forward ranges)</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect ATF level adjustment</li> <li>• Error in throttle position sensor</li> <li>• ATF level out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of low clutch</li> <li>• Malfunction of low one-way clutch</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Adjust the mounting angle of the throttle position sensor.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Operation of the low one-way clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

3-2	<b>Clutch slips when vehicle starts (in the reverse range)</b>		
<b>Probable cause</b> <ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect adjustment of select linkage</li> <li>• Error in throttle position sensor</li> <li>• ATF level out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of low clutch</li> <li>• Malfunction of low one-way clutch</li> <li>• Malfunction of control valve spool</li> </ul>			
Step	Check	Action	
<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>			
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Adjust the mounting angle of the throttle position sensor.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Operation of the low one-way clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>3-3</b>	<b>Clutch slips in 1-2 shift-up</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect adjustment of select linkage</li> <li>• Error in throttle position sensor</li> <li>• ATF level out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of low clutch</li> <li>• Malfunction of 2-4 brake band</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Adjust the mounting angle of the throttle position sensor.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Operation of the 2-4 brake band</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>3-4</b>	<b>Clutch slips in 2-3 shift-up</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect adjustment of select linkage</li> <li>• Error in throttle position sensor</li> <li>• ATF level out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of low clutch</li> <li>• Malfunction of high clutch</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Adjust the mounting angle of the throttle position sensor.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Malfunction of high clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>3-5</b>	<b>Clutch slips in 3-4 shift</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• Incorrect adjustment of select linkage</li> <li>• Error in throttle position sensor</li> <li>• ATF level out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of high clutch</li> <li>• Malfunction of 2-4 brake band</li> <li>• Malfunction of control valve spool</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace it.
3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Adjust the mounting angle of the throttle position sensor.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the high clutch</li> <li>• Operation of the 2-4 brake band</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>



3-6	<b>No engine braking in “L”</b>					
<b>Probable cause</b> <ul style="list-style-type: none"> <li>• Low line pressure</li> <li>• ATF level out of specification</li> <li>• Incorrect adjustment of select linkage</li> <li>• Incorrect positioning of transaxle range switch</li> <li>• Faulty TCM</li> <li>• Malfunction of shift solenoid A</li> <li>• Malfunction of shift solenoid B</li> <li>• Malfunction of low clutch</li> <li>• Malfunction of low &amp; reverse clutch</li> <li>• Malfunction of control valve spool</li> </ul>						
<b>Step</b>	<b>Check</b>	<b>Action</b>				
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>					
1	Has the diagnostic code been output during the primary check?	<table border="1"> <tr> <td>YES</td> <td>           According to the diagnostic code check, verify the following parts :           <ul style="list-style-type: none"> <li>• Shift solenoid A</li> <li>• Shift solenoid B</li> <li>• Positioning of the transaxle range switch</li> </ul> </td> </tr> <tr> <td>NO</td> <td>Go to step 2.</td> </tr> </table>	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Shift solenoid A</li> <li>• Shift solenoid B</li> <li>• Positioning of the transaxle range switch</li> </ul>	NO	Go to step 2.
YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Shift solenoid A</li> <li>• Shift solenoid B</li> <li>• Positioning of the transaxle range switch</li> </ul>					
NO	Go to step 2.					
2	Is the ATF level correct when checked during the primary check?	<table border="1"> <tr> <td>YES</td> <td>Go to step 3.</td> </tr> <tr> <td>NO</td> <td>           Adjust the ATF level as specified.            *If the ATF is burnt or dirty, replace the A/T.         </td> </tr> </table>	YES	Go to step 3.	NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
YES	Go to step 3.					
NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.					

3	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 4.
4	Is the problem rectified by replacing the TCM with that of the same vehicle type?	YES	Replace the TCM.
		NO	Go to step 5.
5	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Operation of the low &amp; reverse clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the control valve spool</li> </ul>

<b>4-1</b>	<b>Harsh shock in 1-2 shift-up</b>	
<b>Probable cause</b>		
<ul style="list-style-type: none"> <li>• Low or high line pressure (shifting out of specification)</li> <li>• Error in throttle position sensor</li> <li>• Incorrect adjustment of 2-4 brake band</li> <li>• Breakage of or damage to oil pump</li> <li>• Faulty ATF temperature sensor</li> <li>• Malfunction of line pressure solenoid</li> <li>• Error in control valve spool sliding</li> <li>• Malfunction of 1-2 accumulator</li> <li>• Faulty TCM</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
1	Has the diagnostic code been output during the primary check?	YES According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"><li>• ATF temperature sensor</li><li>• Line pressure solenoid</li><li>• Throttle position sensor</li></ul>
		NO Go to step 2.
2	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES Go to step 3.
		NO Adjust the mounting angle of the throttle position sensor.
3	Check the TCM itself.	Check whether the problem is rectified by replacing the TCM with that of the same vehicle type. <ul style="list-style-type: none"><li>• If the problem is rectified, replace the TCM.</li><li>• If not, go to step 4.</li></ul>
4	Is the line pressure measured during the primary check within the specified range?	YES Check the following : (A/T disassembly) <ul style="list-style-type: none"><li>• Return at the 2-4 brake band adjustment</li><li>• Operation of the 1-2 accumulator</li></ul>
		NO Check the following : (A/T disassembly) <ul style="list-style-type: none"><li>• Damage to or wear of the oil pump</li><li>• Operation of the control valve spool</li></ul>

**4-2 Harsh shock in 2-3 shift-up**

**Probable cause**

- Low or high line pressure (shifting out of specification)
- Error in throttle position sensor
- Malfunction of high clutch
- Breakage of or damage to oil pump
- Faulty ATF temperature sensor
- Malfunction of line pressure solenoid
- Error in control valve spool sliding
- Malfunction of servo release accumulator
- Faulty TCM
- No steel ball in control valve

Step	Check		Action
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• ATF temperature sensor</li> <li>• Line pressure solenoid</li> <li>• Throttle position sensor</li> </ul>
		NO	Go to step 2.
2	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Go to step 3.
		NO	Adjust the mounting angle of the throttle position sensor.
3	Check the TCM itself.		Check whether the problem is rectified by replacing the TCM with that of the same vehicle type. <ul style="list-style-type: none"> <li>• If the problem is rectified, replace the TCM.</li> <li>• If not, go to step 4.</li> </ul>

4	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the high clutch</li> <li>• Operation of the servo release accumulator</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage or wear of the oil pump</li> <li>• Operation of the control valve spool</li> <li>• No steel ball in the control valve</li> </ul>

**4-3 Harsh shock in 3-4 shift-up**

**Probable cause**

- Low or high line pressure (shifting out of specification)
- Error in throttle position sensor
- Malfunction of 2-4 brake band
- Breakage of or damage to oil pump
- Faulty ATF temperature sensor
- Malfunction of line pressure solenoid
- Error in control valve spool sliding
- Malfunction of servo release accumulator
- Faulty TCM

Step	Check		Action
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• ATF temperature sensor</li> <li>• Line pressure solenoid</li> <li>• Throttle position sensor</li> </ul>
		NO	Go to step 2.
2	In response to the throttle opening angle is the throttle voltage of the throttle position sensor within the specified range in the primary check?	YES	Go to step 3.
		NO	Adjust the mounting angle of the throttle position sensor.
3	Check the TCM itself.		Check whether the problem is rectified by replacing the TCM with that of the same vehicle type. <ul style="list-style-type: none"> <li>• If the problem is rectified, replace the TCM.</li> <li>• If not, go to step 4.</li> </ul>

4	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Return of the 2-4 brake band after adjustment</li> <li>• Operation of the servo release accumulator</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>

4-4	<b>Harsh shock during driving when selector is moved from “N” to “D” range</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Low or high line pressure (shifting out of specification)</li> <li>• Improper positioning of transaxle range switch</li> <li>• Malfunction of low clutch</li> <li>• Breakage of or damage to oil pump</li> <li>• Faulty ATF temperature sensor</li> <li>• Malfunction of line pressure solenoid</li> <li>• Error in control valve spool sliding</li> <li>• Malfunction of low clutch accumulator</li> <li>• Faulty TCM</li> <li>• Faulty engine system</li> </ul>			
Step	Check		Action
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• ATF temperature sensor</li> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the transaxle range switch positioned properly?	YES	Go to step 3.
		NO	Adjust the positioning of the transaxle range switch.
3	Check the TCM itself.		Check whether the problem is rectified by replacing the TCM with that of the same vehicle type. <ul style="list-style-type: none"> <li>• If the problem is rectified, replace the TCM.</li> <li>• If not, go to step 4.</li> </ul>



4	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the low clutch</li> <li>• Operation of the low clutch accumulator</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>

<b>4-5</b>	<b>Harsh shock during driving when selector is moved from “N” to “R” range</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• High line pressure</li> <li>• Improper positioning of transaxle range switch</li> <li>• Malfunction of reverse clutch</li> <li>• Breakage of or damage to oil pump</li> <li>• Faulty ATF temperature sensor</li> <li>• Malfunction of line pressure solenoid</li> <li>• No steel ball in control valve</li> <li>• Malfunction of low &amp; reverse clutch</li> <li>• Faulty TCM</li> <li>• Faulty engine system</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• ATF temperature sensor</li> <li>• Line pressure solenoid</li> </ul>
		NO	Go to step 2.
2	Is the transaxle range switch positioned properly?	YES	Go to step 3.
		NO	Adjust the positioning of the transaxle range switch.
3	Check the TCM itself.	Check whether the problem is rectified by replacing the TCM with that of the same vehicle type. <ul style="list-style-type: none"> <li>• If the problem is rectified, replace the TCM.</li> <li>• If not, go to step 4.</li> </ul>	
4	Is the line pressure measured during the primary check within the specified range?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Operation of the reverse clutch</li> <li>• Operation of the low &amp; reverse clutch</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>

<b>5-1</b>	<b>Noise when idling</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Pump noise caused by trouble in oil circuit or oil control system</li> <li>• Noise from engine auxiliaries</li> </ul>			
<b>Step</b>	<b>Check</b>		<b>Action</b>
1	Does the tone change according to the engine speed? And, does the noise level increase when the line pressure is maximized in intentional fail safe mode?	YES	Check the following: (Visual inspection, A/T disassembly) <ul style="list-style-type: none"> <li>• Dent in the oil pan</li> <li>• Clogging up in the strainer</li> <li>• Error in the oil pump rotor</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Error in the engine auxiliaries</li> </ul>

<b>5-2</b>	<b>Noise when selector is moved</b>	
<b>Probable cause</b> <ul style="list-style-type: none"> <li>Faulty low clutch (N→D)</li> <li>Faulty reverse clutch (N→R)</li> <li>Faulty low &amp; reverse brake (N→R)</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
1	Is the line pressure measured during the primary check within the specified range?	<b>YES</b> Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>Low clutch assembly</li> <li>Burn or wear of the low clutch</li> <li>Reverse clutch assembly</li> <li>Burn or wear of the reverse clutch</li> </ul>
		<b>NO</b> Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>Operation of the control valve spool</li> <li>Damage to or wear of the oil pump</li> </ul>
<b>5-3</b>	<b>Noise when vehicle is moving</b>	
<b>Probable cause</b> <ul style="list-style-type: none"> <li>Planetary gear noise</li> <li>Output gear noise</li> <li>Final gear noise</li> <li>Low one-way clutch sliding noise</li> <li>Bearing noise</li> <li>Oil pump noise</li> <li>Torque converter noise</li> <li>Noise from engine auxiliary</li> <li>Noise from vehicle drive shaft</li> <li>Noise from vehicle wheel bearing</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>

1	Does the tone change according to the engine speed? Does the tone change according to the engine speed?	YES	Check the following: (Visual inspection, A/T disassembly) <ul style="list-style-type: none"> <li>• Dent in the oil pan</li> <li>• Clogging up in the strainer</li> <li>• Error in the oil pump rotor</li> <li>• Torque converter</li> </ul>
		NO	Go to step 2.
2	Does the noise occur in a specific range other than in 3rd gear? Also, does the tone change according to vehicle speed?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage or abnormal wear of the planetary gear</li> </ul>
		NO	Go to step 3.
3	Does the noise occur in all ranges? Also, does the tone change according to vehicle speed?	YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage or abnormal wear of output and final gears</li> <li>• Flaw or abnormal wear of the low one-way clutch</li> <li>• Flaw or abnormal wear of each bearing</li> <li>• Rattle or abnormality in the vehicle drive shaft</li> <li>• Abnormal wear or flaws in the vehicle wheel bearing</li> </ul>
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Errors related to engine auxiliary</li> </ul>

<b>5-4</b>	<b>Noise when shifting</b>			
<b>Probable cause</b>				
<ul style="list-style-type: none"> <li>• Clutch slip or error when shifting</li> <li>• Planetary gear noise when shifting</li> <li>• Control valve operation noise when shifting</li> </ul>				
<b>Step</b>	<b>Check</b>		<b>Action</b>	
1	Is the line pressure measured during the primary check within the specified range?		YES	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Clutches related to shifting</li> <li>• Damage to or abnormal wear of the planetary gear</li> </ul>
			NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>

<b>6-1</b>	<b>Engine stalls</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Incorrect ATF level adjustment</li> <li>• Line pressure out of specification</li> <li>• Malfunction of line pressure solenoid</li> <li>• Malfunction of lock-up solenoid</li> <li>• Error in control valve spool sliding</li> <li>• Malfunction of torque converter</li> <li>• Faulty engine system</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Has the diagnostic code been output during the primary check?	YES	According to the diagnostic code check, verify the following parts : <ul style="list-style-type: none"> <li>• Line pressure solenoid</li> <li>• Lock-up solenoid</li> </ul>
		NO	Go to step 2.
2	Is the ATF level correct when checked during the primary check?	YES	Go to step 3.
		NO	Adjust the ATF level as specified. *If the ATF is burnt or dirty, replace the A/T.
3	Is the line pressure measured during the primary check within the specified range?	YES	Go to step 4.
		NO	Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>
4		Replace the torque converter.	

<b>6-2</b>	<b>Oil blows out from air breather</b>	
<b>Probable cause</b>		
<ul style="list-style-type: none"> <li>• Too much ATF</li> </ul>		
<b>Step</b>	<b>Check</b>	<b>Action</b>
1		Check and adjust the ATF level.



<b>6-3</b>	<b>Starter will not rotate in “P” and/or “N”</b>		
<b>Probable cause</b>			
<ul style="list-style-type: none"> <li>• Improper adjustment of select linkage</li> <li>• Faulty engine system</li> <li>• Improper positioning of inhibitor switch</li> <li>• Faulty TCM</li> </ul>			
<b>Step</b>	<b>Check</b>	<b>Action</b>	
	<b>Carry out an engine performance check to ensure that the engine is behaving normally. Then proceed with the A/T check.</b>		
1	Were any faults detected in the select linkage during the primary check?	YES	Check and adjust the select linkage.
		NO	Go to step 2.
2	Is the transaxle range switch positioned properly?	YES	Following the transaxle range switch inspection, check and adjust the positioning of the transaxle range switch.
		NO	Go to step 3.
3		Check the following : (A/T disassembly) <ul style="list-style-type: none"> <li>• Damage to or wear of the oil pump</li> <li>• Operation of the control valve spool</li> </ul>	

## PRIMARY CHECK EKTC0130

Be sure to carry out this check before carrying out any other.

Do not replace, add to or adjust the level of the automatic transaxle fluid before carrying out the reproducing test of the problem.

### ATF FLUID LEVEL AND CONDITION

1. Drive the vehicle until the ATF reaches normal temperature (70-80°C). This temperature will be reached after approximately 5 km of urban driving.
2. Park the vehicle on level ground and apply the parking brake while the engine is idling. Move the select lever slowly from “P” to “L” and then move it back to “P”.
3. While the engine is running, pull out the oil level gauge, wipe it clean with a paper towel and insert it to check the ATF level. The level of the fluid should be within the range specified on the level gauge. If the level is too low, add the recommended ATF. Check the ATF for abnormal smell, foreign matter, or discoloration.

#### NOTE

- **The fluid level changes before and after the engine is warmed up. Be sure to follow the procedure above when carrying out this check.**
- **Before carrying out the check, be sure to wipe away dirt and grime from around the level gauge to prevent anything from entering the transmission.**

Recommended ATF : ESSO JWS3314

#### 4. ATF fluid level

The ATF level should be within the specified range. If the level is low, visually check the transmission for leakage.

##### ATF condition

Normal ATF is red and has moderate viscosity. If the fluid has become dark, very viscous, or smells abnormally (a burnt smell), carry out the road, stall, and oil pressure tests. If the vehicle operates normally, change the fluid and carry out the road test again.

If the fluid has become light in color, the oil cooler may be damaged.

### TIME LAG

#### NOTE

- **In this test, be sure to wait for at least one minute after moving the select lever back to “N” range before starting the next measurement.**
  - **Be sure to take the measurement when the engine is fully warmed up.**
1. After checking the ATF level, position scotches at the front and rear wheels securely and depress the foot brake.
  2. Start the engine and move the select lever from “N” to “D”. Using a stop watch, measure the time it takes from this point until shift shock is felt.

3. Similarly, measure the time lag from “N” to “R” range.

Time lag standard (S) :

“N” range to “D” range : 0.8

“N” range to “R” range : 0.8

Result	Probable cause	
Time lag in shifting from “N” to “D” exceeds the specified level.	<ul style="list-style-type: none"> <li>○ Low clutch slip</li> <li>○ One-way clutch slip</li> <li>○ Damage of the clutch piston oil seal</li> </ul>	<ul style="list-style-type: none"> <li>○ Low line pressure</li> </ul>
Time lag in shifting from “N” to “R” exceeds the specified level	<ul style="list-style-type: none"> <li>○ Low &amp; reverse brake slip</li> <li>○ Reverse clutch slip</li> <li>○ Damage of the brake or clutch piston oil seal</li> </ul>	

#### STALL SPEED

#### NOTE

- **Do not hold the stall condition for longer than 5 seconds at a time.**
  - **Be sure to cool the transmission, idling for at least 30 seconds before starting the next test.**
1. Check the AT fluid level and condition.
  2. Position scotches at the front and rear wheels and apply the parking brake fully.
  3. Attach an engine tachometer.
  4. Start the engine. Move the select lever to "D" and depress the accelerator pedal while monitoring the engine speed. Quickly read the engine speed (stall speed) at the point that the engine speed becomes constant (stall point).
  5. Carry out this test in “D” and “L” also.

Stall speed (rpm) : 2,670

Result	Probable cause
Lower than the specified level in all ranges	<ul style="list-style-type: none"> <li>○ Insufficient engine output</li> <li>○ Faulty torque converter</li> </ul>
Higher than the specified level in “D” and “2”	<ul style="list-style-type: none"> <li>○ One-way clutch slip</li> <li>○ Low clutch slip</li> </ul>
Higher than the specified level in “D”, “2” and “L”	<ul style="list-style-type: none"> <li>○ Low clutch slip</li> </ul>
Higher than the specified level in “R”	<ul style="list-style-type: none"> <li>○ Reverse clutch slip</li> <li>○ Low &amp; reverse brake slip</li> </ul>
Higher than the specified level in “R” and “L”	<ul style="list-style-type: none"> <li>○ Low &amp; reverse brake slip</li> </ul>
Higher than the specified level in all ranges	<ul style="list-style-type: none"> <li>○ Low line pressure</li> <li>○ Faulty oil pump</li> <li>○ Faulty pressure regulator</li> </ul>

#### OIL PRESSURE

1. Check the ATF level and condition.
2. Attach the special tool to the oil pressure inspection hole in the transaxle case.  
Special tool : oil pressure gauge set
3. Position scotches at the front and rear wheels and apply the parking brake fully.
4. Start the engine and depress the foot brake. Measure oil pressure in “D” and “R” ranges when idling and when the engine has stalled.

#### NOTE

- **Ensure that the ATF does not leak after installing the oil pressure gauge.**
- **Do not hold the stall condition for longer than 5 seconds at a time. Be sure to cool the transaxle, idling for at least 30 seconds before starting the next test.**

Oil pressure standard Engine operation	"D" range	"R" range
Idling	340 {3.5}	440 {4.5}
Stall	1,225 {12.5}	1,560 {15.9} [kPa {kgf/cm <sup>2</sup> }]

Result	Probable cause	
	"D" range	"R" range
Higher than the specified oil pressure when idling Higher than the	<ul style="list-style-type: none"> <li>○ Faulty valve body</li> </ul>	

specified oil pressure when the engine has stalled		
Lower than the specified oil pressure when idling Lower than the specified oil pressure when the engine has stalled	<ul style="list-style-type: none"> <li>○ Faulty oil pump</li> <li>○ Damaged low clutch piston oil seal</li> </ul>	<ul style="list-style-type: none"> <li>○ Damaged reverse clutch piston oil seal</li> <li>○ Damaged low &amp; reverse brake piston oil seal</li> </ul>

#### ROAD TEST

A road test is carried out to assess the problem accurately and as a post-maintenance check.

1. Check the ATF level and condition.
2. Drive the vehicle to check that the shift points concur with the shift diagram. Check that neither shift shock nor noise occur.

#### NOTE

- **When carrying out the road test, pay attention to the traffic situation and keep safety in mind.**
- **The shift diagram shows the speeds at which shifting starts. The vehicle speed at which shifting has been completed when accelerating differs 2-8 km/h from that of the diagram.**

#### “P” RANGE TEST CHECK

1. Park the vehicle on an upward slope. (with more than 5° gradient) and select “P” range. Release the parking brake to check that the vehicle does not move.
2. Under the same conditions, check that the vehicle moves when the selector lever is moved from “P” range to the other ranges.
3. Similarly, carry out the test on a downward slope.

#### AUTOMATIC TRANSAXLE FLUID REPLACEMENT

1. Remove the drain plug and drain the ATF while the engine is stopped.

**NOTE**

**The fluid can not be drained completely.**

2. Replace the drainage plug and tighten it with the specified torque.  
Tightening torque : 44Nm (430kgf·cm)
3. Replace the same quantity of specified fluid as was drained from the filler tube.  
Specified ATF : ESSO JWS3314

Reference : Total quantity of fluid 5.2L

**NOTE**

- **Do not mix different kinds of oil.**
  - **Using a different type of ATF may cause problems with the clutch and brake.**
4. Start the engine and allow it to idle for at least five minutes.
  5. Lift up the vehicle. Drive the engine gradually until the engine speed reaches approximately 50 km/h in the “D” range; then depress the brake pedal to allow the engine to idle. Release the brake for about 10 seconds in the “R” range, and depress the brake again to allow the engine to idle. Repeat this sequence of steps two or three times.
  6. Repeat steps 1-5 above twice.
  7. Now check the ATF level.

**NOTE**

**The fluid level check must be carried out while the engine idles and after the transaxle has warmed up.**

#### TRANSAXLE RANGE SWITCH

Removal (Dismount the automatic transaxle from the vehicle and disassemble it with the manual shaft attached.)

1. Punch the spring pin and remove the select lever assembly.
2. Remove the transaxle range switch fixing bolt and the transaxle range switch.  
Installation should be carried out following the steps for removing the assembly in reverse order.  
Adjustment will be necessary after installation.

#### ADJUSTMENT

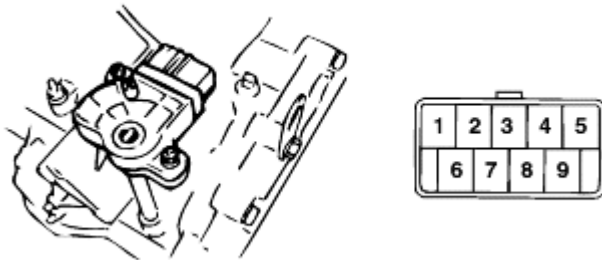
1. Position the select lever assembly to “N”.
2. Loosen the transaxle range switch fixing bolt.
3. Fix the select lever assembly by inserting a 3 mm pin (drill) into the location holes of the assembly and the transaxle range switch.
4. Tighten the fixing bolt.  
Tightening torque : 3.2Nm (33kgf·cm)

## CHECK

Check the shift switch and intermediate coupler to ensure that the continuity in each position corresponds to the following table.

Terminal mark	INH1	INH2	BAT	P	R	N	D	2	L
Shift position	4	6	5	2	1	3	7	4	8
"P"	○ — ○		○ — ○						
"R"			○ — ○		○ — ○				
"N"	○ — ○		○ — ○		○ — ○	○ — ○			
"D"			○ — ○				○ — ○		
"2"			○ — ○					○ — ○	
"L"			○ — ○						○ — ○

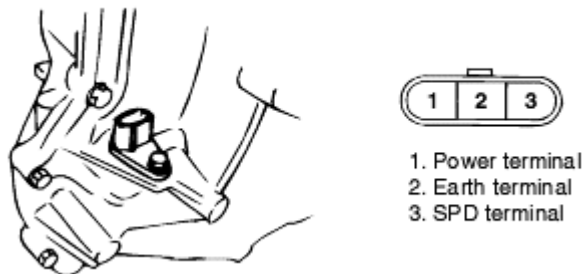
Transaxle range switch



## VEHICLE SPEED SENSOR CHECK

1. Move the select lever to the "N" range and release the parking brake.
2. Lift up the vehicle until the wheels leave the ground.
3. Connect the resistor (1-10 kΩ) between the power terminal and the SPD terminal of the speed sensor coupler or the intermediate harness coupler. Then connect the circuit tester.
4. Turn the ignition switch to ON to turn the wheels.  
The circuit tester should output 0V and 12V alternately. If it does not, replace the speed sensor.

Vehicle speed sensor



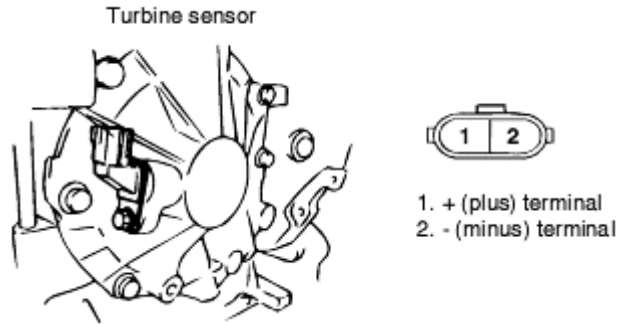
1. Power terminal
2. Earth terminal
3. SPD terminal

## TURBINE SENSOR (INPUT SPEED)

### CHECK

1. Remove the turbine sensor connector.
2. Check the resistance between terminals of the turbine sensor. If the resistance is too low or too high, replace the turbine sensor.

Resistance :  $540\Omega$  ( $20\mu\text{EC}$ )



## THROTTLE POSITION SENSOR

### CHECK

Remove the throttle sensor connector and connect the circuit tester between the TPS signal and sensor (+) terminals.

Check that the resistance falls when the throttle valve is opened.

## SHIFT CONTROL SOLENOID VALVE A, B

### CHECK

1. Remove the solenoid connector or the intermediate harness connector.
2. Apply battery voltage to the terminals of shift solenoids A and B. Ensure that you hear an operation click from inside the transaxle case.
3. Check the resistance between the terminal of shift solenoids A, B and the transaxle case. If the resistance is too low or too high, replace the shift solenoid in question. For replacement details, refer to the “Valve body” section.

Resistance : approx.  $25\Omega$  ( $20\mu\text{EC}$ )

## LINE PRESSURE SOLENOID

### CHECK

1. Remove the solenoid connector or the intermediate harness connector.
2. Check the resistance between the terminal of the line pressure solenoid and the transaxle case. If the resistance is too low or too high, replace the line pressure solenoid. For replacement details, refer to the “Valve body” section.

Resistance :  $29\Omega$  ( $20\mu\text{EC}$ )

## LOCK-UP SOLENOID

### CHECK

1. Remove the solenoid connector or the intermediate harness connector.



2. Check the resistance between the terminal of the lock-up solenoid and the transaxle case. If the resistance is too low or too high, replace the lock-up solenoid.  
For replacement details, refer to the “Valve body” section.

Resistance :  $13\Omega$  ( $20\text{j}\text{ÆC}$ )

#### ATF TEMPERATURE SENSOR CHECK

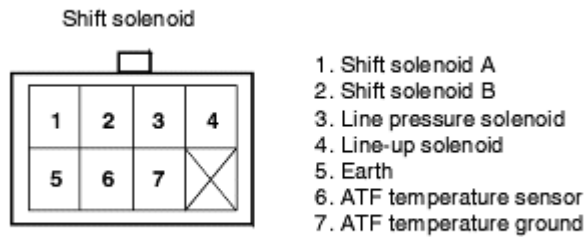
1. Remove the solenoid connector or the intermediate harness connector.
2. Check the resistance between the terminals of the ATF temperature sensor, the ATF temperature sensor earth, and the earth. If the resistance is too low or too high, replace the ATF temperature sensor.  
For replacement details, refer to the “Valve body” section.

#### Resistance

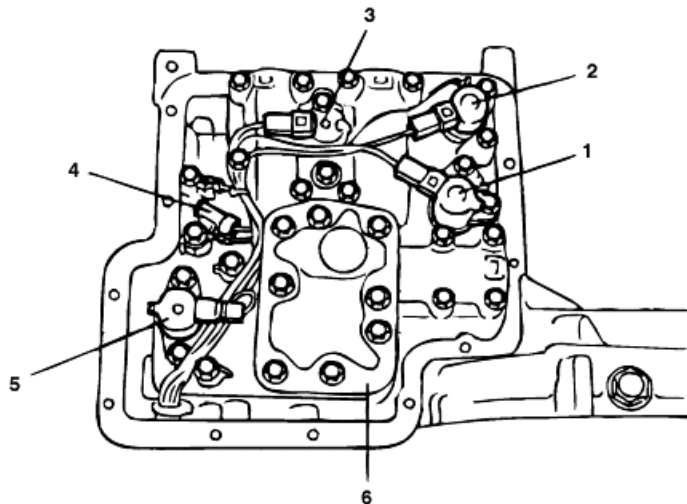
20°C : approx. 2.5 k $\Omega$

50°C : approx. 0.33 k $\Omega$

80°C : approx. 0.17 k $\Omega$



#### Valve body



1. Shift solenoid A
2. Shift solenoid B
3. Line pressure solenoid
4. ATF temperature sensor
5. Line-up solenoid
6. Oil strainer

## REMOVAL

1. Remove the negative(-) terminal of the battery.
2. Remove the drain plug to drain the ATF.
3. Remove the oil pan.
4. Remove the coupler from the solenoid.
5. Remove the ATF temperature sensor installation bolt.
6. Remove the strainer.
7. Remove the valve body assembly and the shift solenoid.

### NOTE

Since ATF remains inside the assembly, place a receptacle under the transaxle when removing the oil pan.

## INSTALLATION

Installation should be carried out following the steps for removing the pan in reverse order, tightening according to the torque below.

Replace the ATF and then check the level of the fluid.

### Tightening torque :

- Shift solenoid bolt 8Nm (80kgf·cm)
- Valve body installation bolt (80kgf·cm)
- Strainer installation bolt (80kgf·cm)
- Drain plug 8Nm (80kgf·cm)

## DISASSEMBLY EKT0150

### PRECAUTIONS WHEN DISASSEMBLING AND REASSEMBLING TRANSAXLE

Because automatic transaxle consist of precision parts, pay attention to the following during assembly and disassembly :

- Carry out disassembly in a clean, dust-free location.
- Place a rubber mat on the bench; be careful not to scratch the parts.
- Do not use gloves or wastes. (Use nylon cloth or paper towels.)
- When disassembling the case connecting section, do not force anything with a screwdriver or similar tool; gently knock the parts of the case with a rubber-headed hammer to remove them.
- Before disassembling, clean the external of the transaxle. (To prevent any contamination from entering the transaxle)
- Clean the disassembled parts with ATF, and check the oil passages by blowing air. (Be careful not to allow the ATF to splash or spill.) Clean the disk, brake band, resin washer and rubber parts using the ATF.
- Replace the gasket, oil seal, and the “O” and “D” rings with new ones.
- Apply the ATF to the sliding and rotating sections before re-assembly.
- Use new disc and brake band after soaking them in ATF for more than two hours.
- Do not use the oils other than those specified.

Inspections and measures Item	Points to be inspected	Measure
----------------------------------	------------------------	---------

Inspections of casting parts and machining parts	Scratches and burrs Clogged oil passages Remainings of gasket  Cracked parts	Replace parts. Put wire through or blow air to clean. Remove the gasket. Replace parts.
Inspection of bearings	Those that do not turn smoothly Streaks, pitching, scratches, cracks	Replace Replace
Inspection of bush and thrust washer	Scratches, burrs, wears, scorch	Replace
Inspection of oil seal and gasket	Scratches and hardened material on seal ring Margin and lateral wear of seal ring Piston seal ring, oil seal, gasket	Replace Replace Replace
Inspection of gear	Scratches or burrs Teeth worn considerably	Replace Replace
Inspection of spline	Burrs, scratches, deformation	Replace
Inspection of snap ring	Wear, scratches, deformation Parts with no interference	Replace
Inspection of screws	Burrs, damaged parts	Replace
Inspection of spring	Settling, scorching	Replace
Inspection of clutch disk and brake disk	Wear, scorching, plate warp, clutch, distortion, damaged claw	Replace
Inspection of clutch plate and brake plate	Wear, scorch, distortion, damaged claw	Replace
Inspection of seal face (Face where the lip touches)	Scratches, dry spots, wear Clogged with foreign matter	Replace Repair

#### INSPECTION PROCEDURE

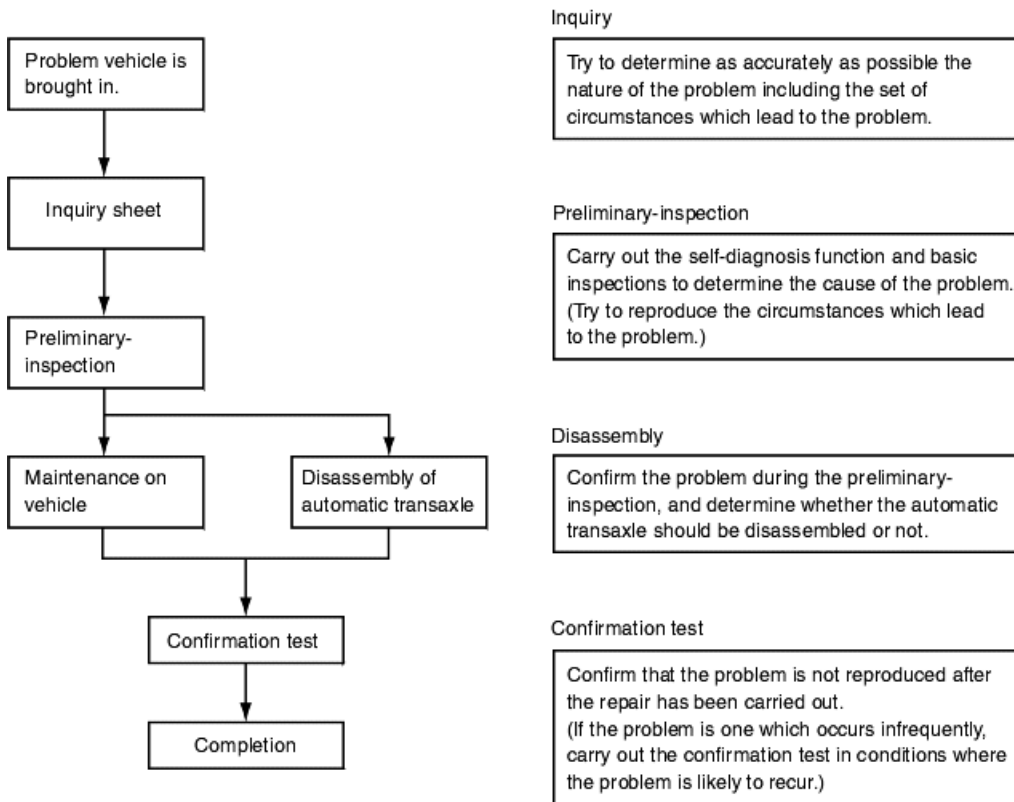
When carrying out maintenance of the automatic transaxle, check the transaxle in the vehicle first to find the root of the problem, and then determine whether the transaxle should be disassembled or not.

Disassembling the transaxle without finding the root of the problem will result in wasted time and may cause secondary problems.

Automatic transaxle problems are categorized as follows :

1. Improper inspection or adjustment
2. Poor engine performance
3. Failure of hydraulic control mechanism
4. Failure of electric control unit
5. Mechanical failure in transaxle

In order to properly diagnose the problem in the vehicle, try to determine as accurately as possible from the customer the nature of the problem. Try to reproduce the problem if possible.



## NUTS AND BOLTS

### METRIC THREAD

Vehicle dimensions are generally specified in metric units. Metric threads are used for most of the parts. These are almost the same size as inch threads. Therefore, when replacing screws, be sure to use screws of proper nominal diameter, pitch and strength.

### IDENTIFICATION OF SCREW STRENGTH

Generally, the strength of metric threads is categorized as “4T” and “7T”. This can be identified by the mark curved on the bolt head. “T” indicates the tensile strength.

When replacing metric threads, use the screws of the specified strength or stronger (that is, with the same strength number or larger). It is also important to use the proper size screws.

The general sizes and pitches (not including exceptions) are as shown in the table.

Metric coarse screw thread		Metric fine screw thread	
Nominal diameter	Pitch (mm)	Nominal diameter	Pitch (mm)
M1.6	0.35	M8x1	1
M2	0.4	M10x1.25	1.25
M2.2	0.45	M12x1.25	1.25
M2.5	0.45	M14x1.5	1.5
M3x0.5	0.5	M16x1.5	1.5
M3.5	0.6	M18x1.5	1.5
M4x0.7	0.7	M20x1.5	1.5
M4.5	0.75	M22x1.5	1.5
M5x0.8	0.8	M24x2	2
M6	1	M27x2	2
M7	1	M30x2	2
M8	1.25	M33x2	2
M10	1.5	M36x2	2

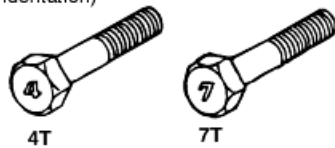
M12	1.75	M39x2	2
M14	2		
M16	2		
M18	2.5		
M20	2.5		
M22	2.5		
M24	3		
M27	3		
M30	3.5		
M33	3.5		
M36	4		
M39	4		

**CAUTION**

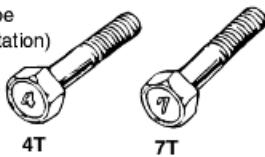
- In the standard screws used here: Screws of up to nominal size M8 have coarse threads; screws of M10 or more have fine threads.
- As shown in the table, the relationship between the nominal size and pitch is different depending on the thread (coarse or fine). When replacing the screws, even if the new screw is a metric thread of the same nominal size, be sure to check the pitch.

Indication of bolt strength

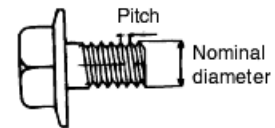
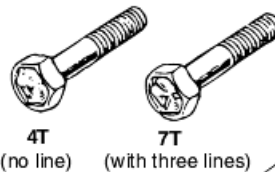
Trimming shape  
(Without indentation)



Upset shape  
(Flat indentation)



DR-shape  
(Counter-sunk indentation)



Indication of  
nut strength

Indentation	Strength
Without indentation	5T
With indentation	8T

**STANDARD TIGHTENING TORQUE**

Tighten the nuts and bolts with the specified torque (tolerance:  $\pm 10\%$ ). When the torque is not specified, refer to the table below. When the bolts and nuts are replaced with new ones of higher strength than original, the tightening torque should be the same as that of the original nuts and bolts.

**CAUTION**

- For nuts and the bolts with a flange, tighten them with a 10% higher torque than that specified in the table below.
- The table below is for metal or light metal nuts and bolts.

Strength (Torque)		
----------------------	--	--

Screw diameter (mm)		
4	1.5Nm (15kgf·cm)	2.3Nm (23kgf·cm)
5	3.0Nm (31kgf·cm)	4.5Nm (46kgf·cm)
6	5.5Nm (56kgf·cm)	10Nm (102kgf·cm)
8	13Nm (133kgf·cm)	23Nm (235kgf·cm)
10	29Nm (296kgf·cm)	50Nm (510kgf·cm)
12	45Nm (459kgf·cm)	85Nm (867kgf·cm)
14	65Nm (663kgf·cm)	135Nm (1,377kgf·cm)
16	105Nm (1,071kgf·cm)	210Nm (2,141kgf·cm)
18	160Nm (1,632kgf·cm)	240Nm (2,447kgf·cm)

#### UNIT SYSTEM

SI units (International units) are generally used in this manual.

SI units are indicated in the table below without brackets ( ). Conventional units are indicated in brackets.

Quantity	Unit	Quantity	Unit	Quantity	Unit
Length	m	Temperature	°C	Torque	Nm (kgf·cm)
Mass (weight)	kg	Plane angle	°, ', ''	Force	N (kgf)
Time	s	Area	m <sup>2</sup>	Pressure	Pa (kgf·cm <sup>2</sup> )
Negative pressure	Pa (mmHg)	Current	A	Volume	cm <sup>3</sup> (cc, L)
Voltage	V	Speed	km/h	Quantity of electricity	A - h
Resistance	&ohm;	Revolution	rpm	Spring constant	Nmm (kgf·mm)

#### Reference :

- “SI” is the abbreviation for the international unit system, and stands for the French, **Système International d'Unités**.

The tightening torque is indicated in SI units (1) and is followed in brackets by the conventional units (2).

However, only conventional units are used in the documentation to be submitted for approval, for example engine dimensions, etc.

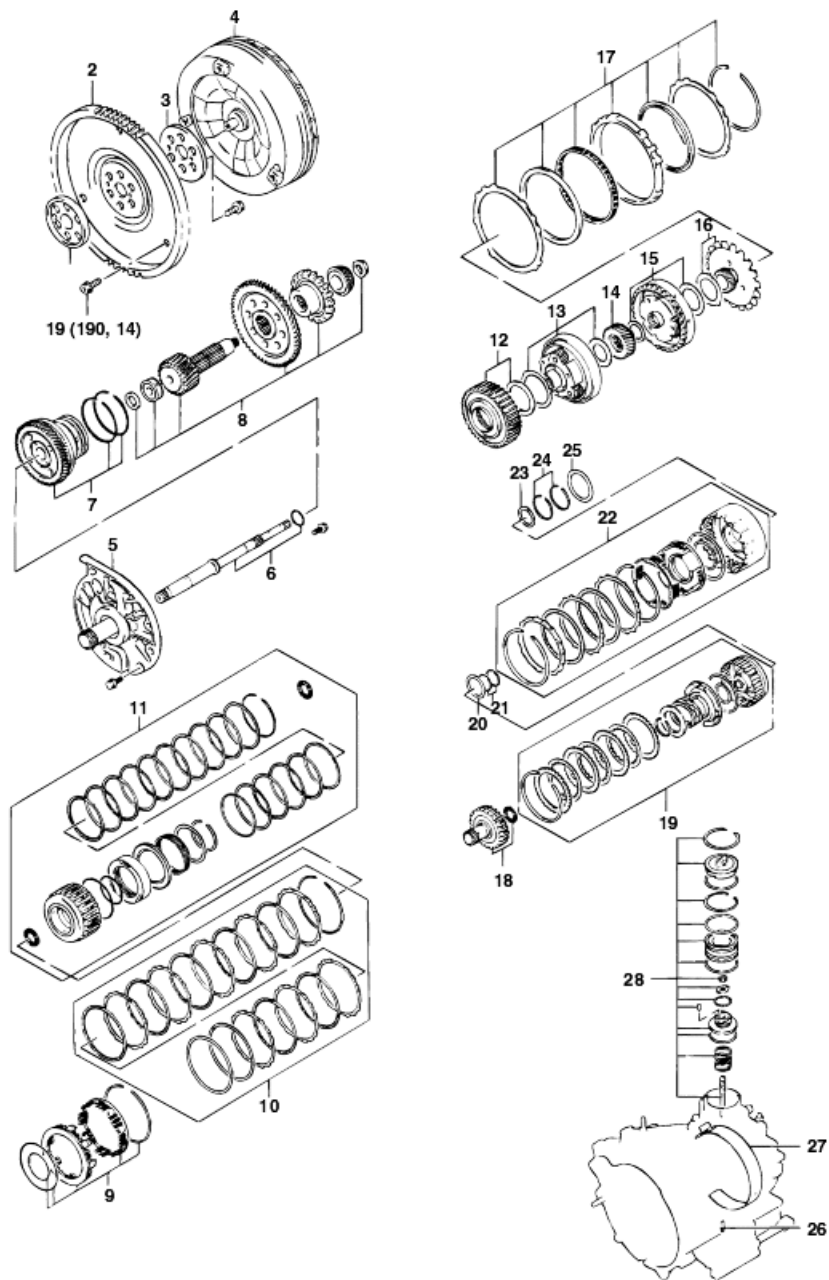
**Example : Tightening torque :  $\frac{23Nm}{(1)}$  ( $\frac{235kgf\cdot cm}{(2)}$ )**

#### CAUTION

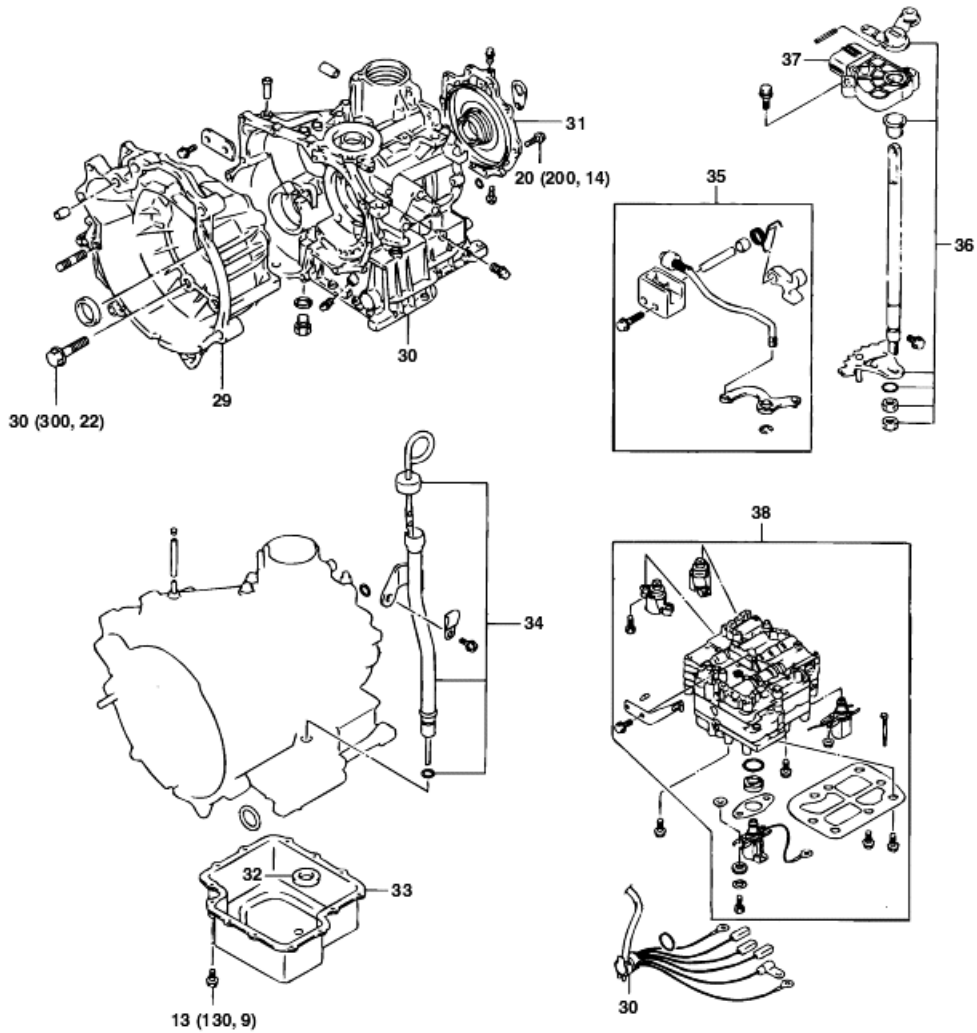
The mid-range tolerance value is indicated for the tightening torque, therefore,  $\pm 10\%$  of the indicated value is the tolerance.

Terms Term	Description
Standard values	Indicates the inspection and adjustment tolerance values.
Limit values	Indicates the maximum and minimum inspection and adjustment values.
Caution	Indicates operations, which require special caution, and prohibited operations.
Special tools	Indicates the part numbers of special tools to be used for operation.
Tightening torque	Indicates the centre value of the specified tightening torque. Carry out tightening within $\pm 10\%$ of the specified value.

COMPONENTS EKTC0200



**TORQUE : Nm (kg-cm, lb-ft)**



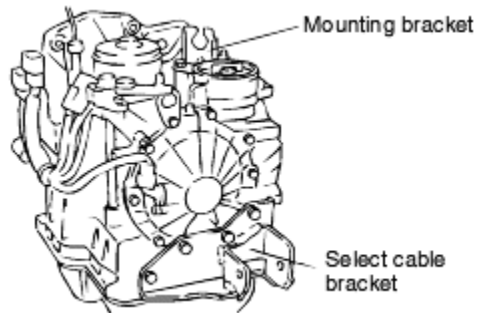
- |  |                                      |                                     |
|--|--------------------------------------|-------------------------------------|
| 1. Drive plate flange                  | 14. Rear sun gear                    | 27. Brake band                      |
| 2. Drive plate                         | 15. Front planetary carrier assembly | 28. Bend servo piston assembly      |
| 3. Rear drive plate                    | 16. Front sun gear assembly          | 29. Converter housing               |
| 4. Torque converter                    | 17. Low one-way clutch assembly      | 30. Transaxle case                  |
| 5. Oil pump assembly                   | 18. High clutch hub assembly         | 31. Transaxle side cover            |
| 6. Input shaft assembly                | 19. High clutch assembly             | 32. Magnet                          |
| 7. Output gear assembly                | 20. Bearing                          | 33. Oil pan                         |
| 8. Reduction gear assembly             | 21. Seal ring                        | 34. Oil level gauge/oil filler tube |
| 9. Low & reverse brake piston assembly | 22. Reverse clutch assembly          | 35. Parking lock assembly           |
| 10. Low & reverse brake assembly       | 23. Bearing race                     | 36. Manual shaft assembly           |
| 11. Low clutch assembly                | 24. Seal ring                        | 37. Shift lever switch              |
| 12. Rear internal gear assembly        | 25. Washer                           | 38. Control valve assembly          |
| 13. Rear planetary carrier assembly    | 26. Anchor end pin                   | 39. Solenoid terminal               |

**TORQUE : Nm (kg·cm, lb·ft)**

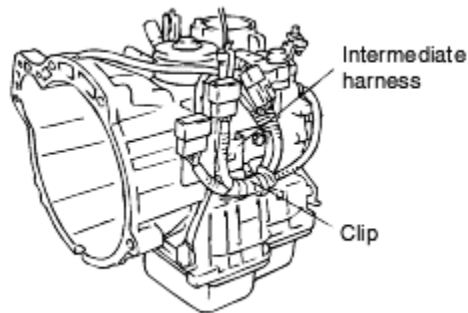


DISASSEMBLY EKTC0210

1. Remove the torque converter.
2. Remove the bolts, the mounting bracket and the select cable bracket.



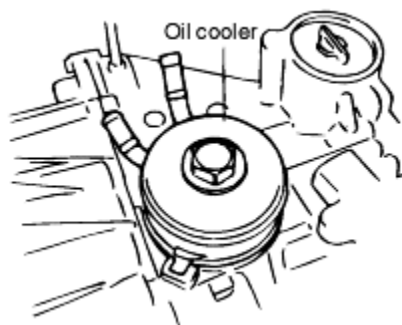
3. Remove the intermediate harness and clip.



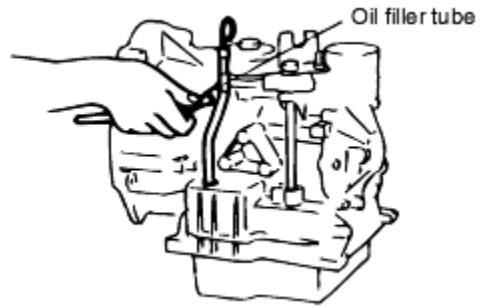
4. Remove the bolts and the oil cooler.

**NOTE**

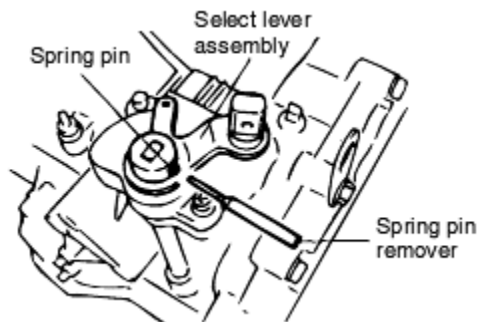
- **Remove the O-ring.**
- **Do not reuse the O-ring.**



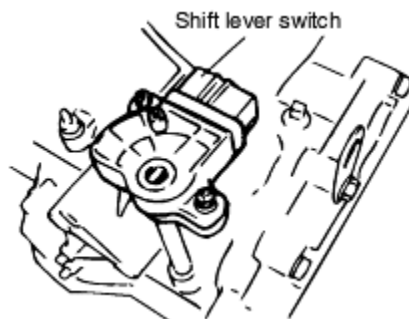
5. Remove the bolts, and the oil filler tube.



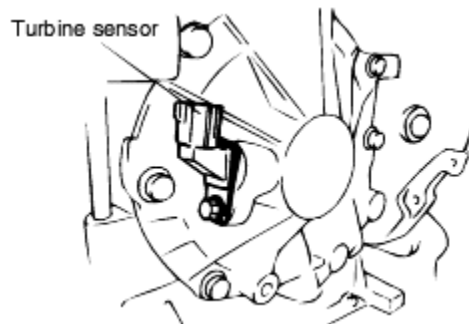
6. Remove the spring pin and the select lever assembly.



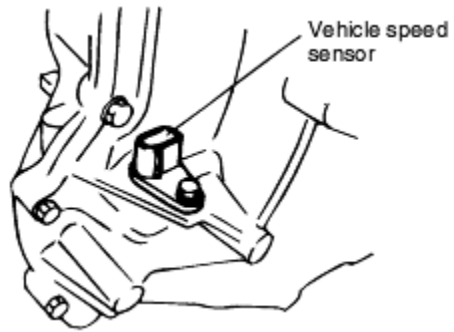
7. Remove the bolt and the shift lever switch.



8. Remove the bolt and the turbine sensor.



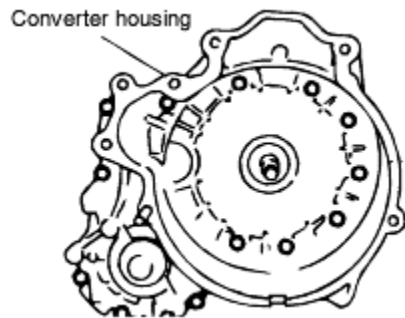
9. Remove the bolt and the vehicle speed sensor.



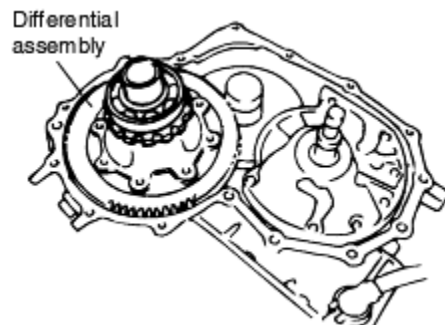
10. With the converter housing upward, remove the installation bolts. Then remove the housing, tapping it lightly with a plastic hammer.

**NOTE**

- **Remove any residual sealant from the housing and case surfaces.**
- **Ensure that all sealant has been removed.**



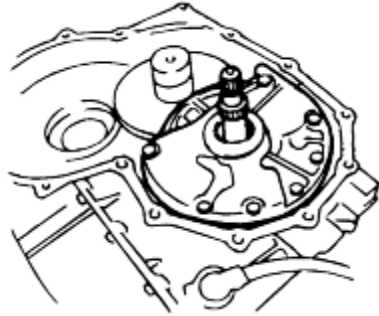
11. Remove the differential assembly.



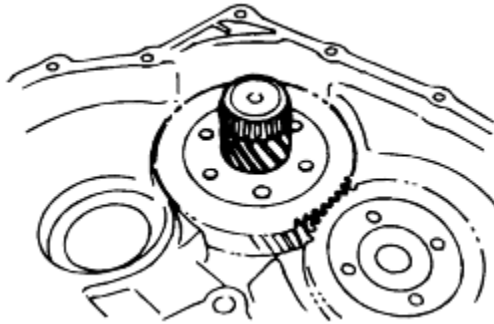
12. Remove the bolts and the oil pump.

**NOTE**

- **When removing the oil pump, be careful not to drop the input shaft.**
- **For a transaxle with lock-up function, be careful not to damage the O-ring between the input shaft and the torque converter.**

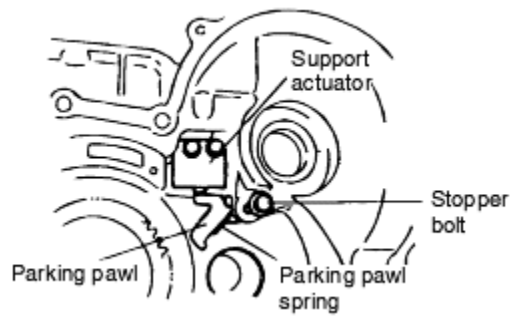


13. Remove the reduction gear.



14. Remove the stopper bolt, the parking pawl, the pawl spring, the pawl shaft, and the pawl collar.

15. Remove the bolts and the support actuator.

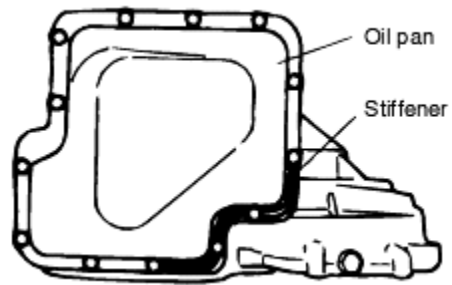


16. Remove the oil pan installation bolts with the pan facing upward. Then, remove the stiffener and the pan, tapping lightly with a plastic hammer.

**NOTE**

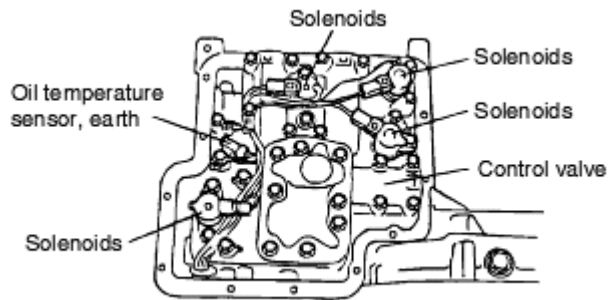
- **Do not separate the stiffener from the pan with a screwdriver.**
- **Remove any residual sealant from the pan and case surfaces.**
- **Ensure that all sealant has been removed.**

17. Remove the magnets from the oil pan.



18. Remove the coupler from each solenoid.

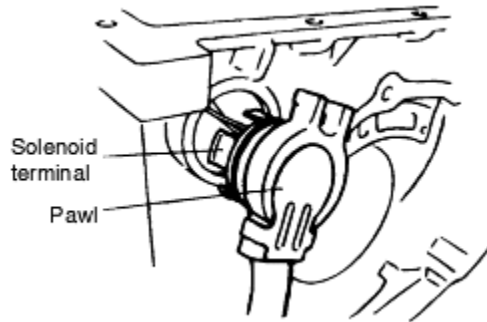
19. Remove the bolts, which fix the oil temperature sensor to the earth, and remove the control valve installation bolts. Then, remove the valve itself.



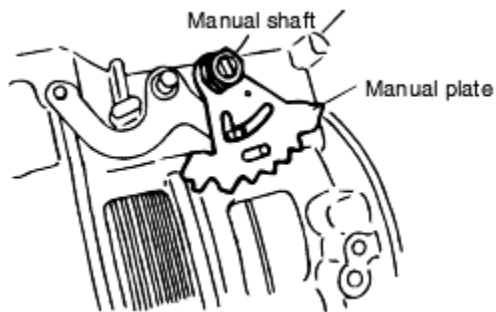
20. While pushing the pawl, pull the solenoid terminal out from the case.

**NOTE**

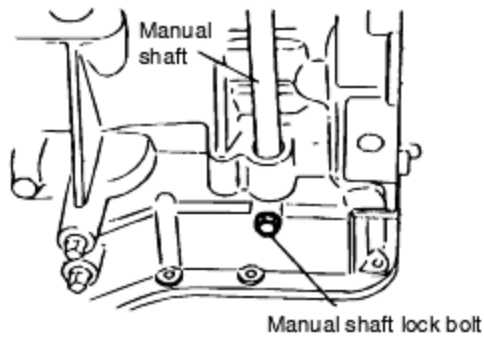
**Do not pull the harness when pulling the terminal out.**



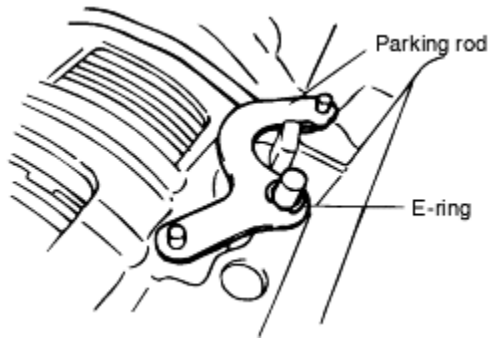
21. Remove the nut while holding the width across flats of the manual shaft, then remove the manual plate.



22. Remove the manual shaft lock bolt, and pull out the shaft.



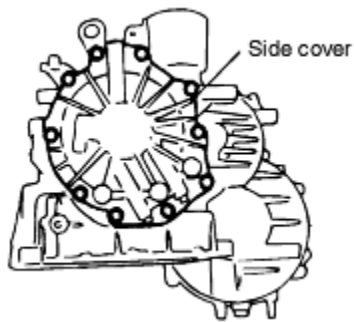
23. Remove the E-ring; then remove the parking lever and the parking rod as a unit.



24. Remove the side cover installation bolts with cover facing upward, and then remove the covers.

**NOTE**

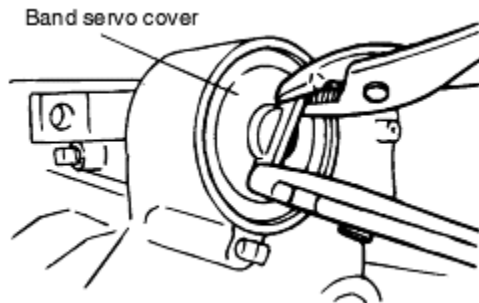
- **Remove the three O-rings from the end face of the case.**
- **Do not separate the side cover from the case with a screwdriver.**
- **Remove any residual sealant from the surfaces of the side cover and case completely.**
- **Ensure that all sealant has been removed.**



25. Remove the snap ring with a flathead screwdriver, and pull the band servo cover out with a pliers.

**NOTE**

To prevent the case from being scratched when removing the snap ring with a screwdriver, smooth the surface of the case with sandpaper. (This also prevents the O-ring from being scratched when re-assembling.)

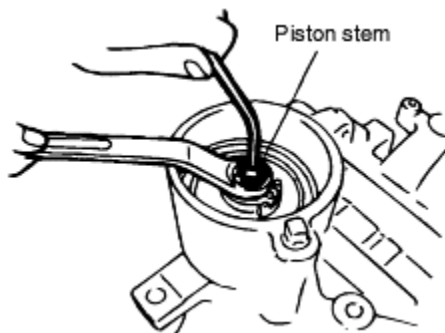


26. Hold the piston stem, and loosen the lock nut.

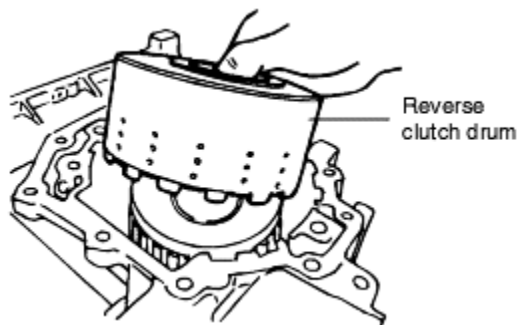
27. Loosen the piston stem.

**NOTE**

Temporarily tighten the lock nut to prevent the air vent pin from coming out.



28. Remove the reverse clutch drum.



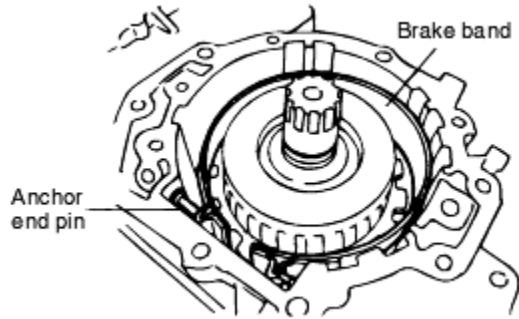
29. Remove the brake band.

**NOTE**

To prevent cracking when expanding the brake band, bind it with wire.



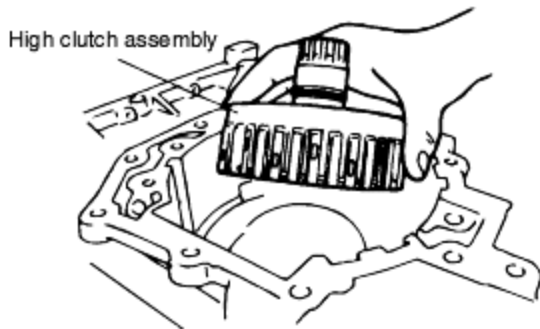
30. Remove the anchor end pin.



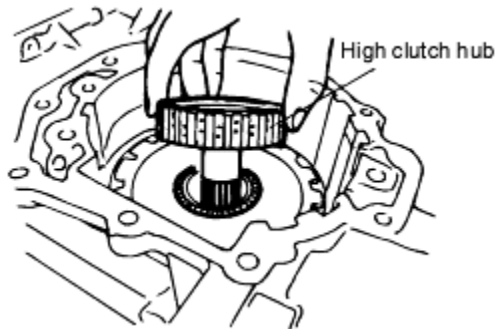
31. Remove the high clutch assembly.

**NOTE**

Be careful not to drop the bearings from the both sides of the high clutch assembly.



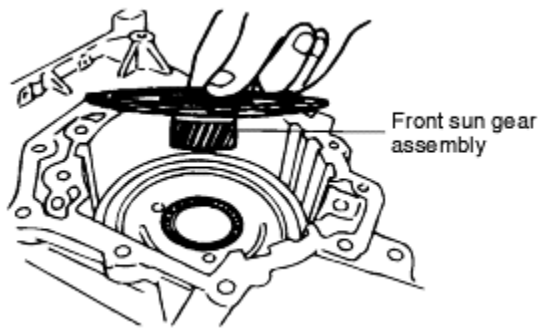
32. Remove the high clutch hub.



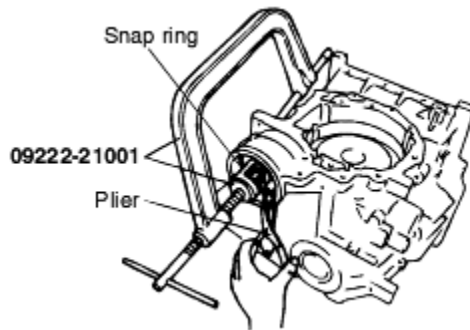
33. Remove the front sun gear assembly.

**NOTE**

Be careful not to drop bearings from the side cover side and the bearing race on the torque converter side of the front sun gear assembly.



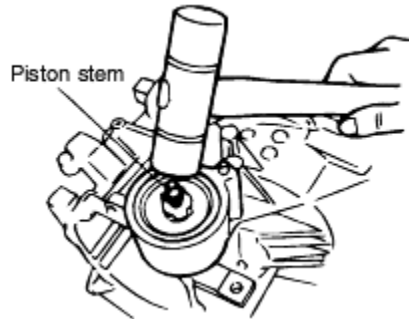
34. Using the special tool (valve spring compressor), remove the snap ring from the band servo piston.



35. Lightly tap the piston stem with a plastic hammer, and remove the band servo piston with the reaction force of the piston spring.

**NOTE**

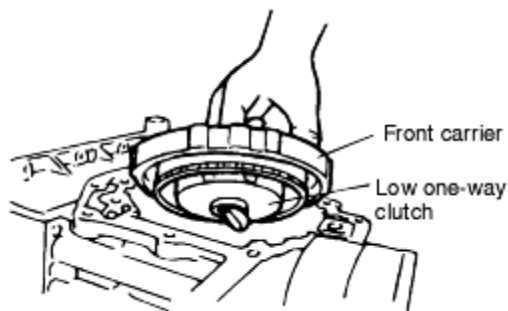
The band servo piston may spring out because of the piston spring force. Be careful not to drop the piston.



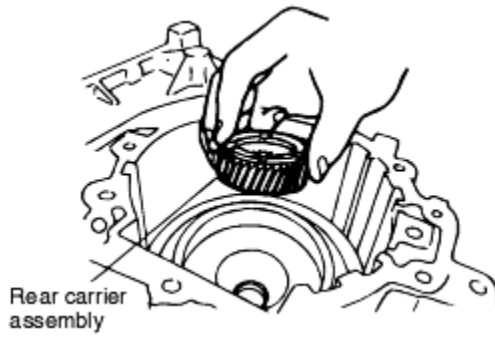
36. Remove the snap ring; then remove the front carrier and the low one-way clutch as a unit.

**NOTE**

Be careful not to drop the bearing from the side cover side and the race-combined bearing from the torque converter side of the front carrier.



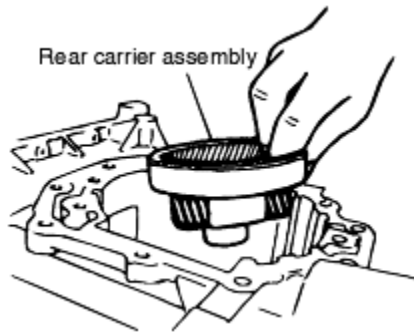
37. Remove the rear sun gear.



38. Remove the rear carrier assembly.

**NOTE**

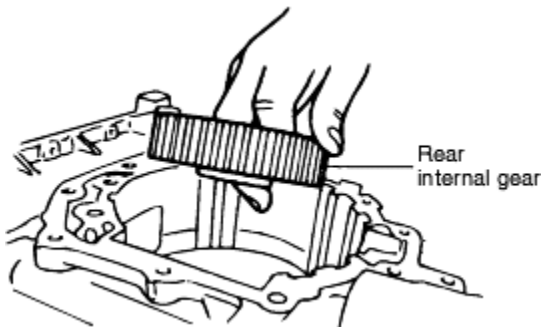
Be careful not to drop the bearing from the side cover side and the race-combined bearing from the torque converter side of the rear carrier assembly.



39. Remove the rear internal gear.

**NOTE**

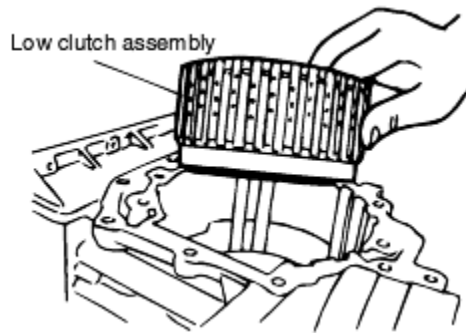
Be careful not to drop the bearing from the side cover side and the race-combined bearing from the torque converter of the rear internal gear.



40. Remove the low clutch assembly as a unit.

**NOTE**

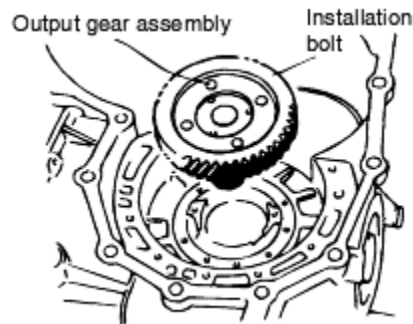
Be careful not to drop the race-combined bearings from the torque converter side of the low clutch assembly.



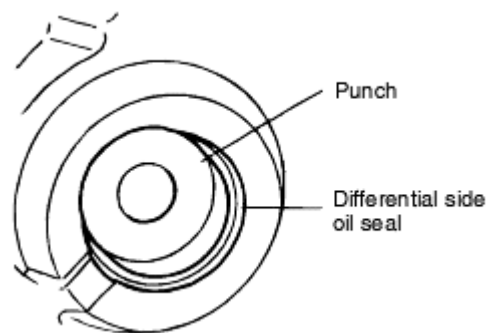
41. With the converter housing surface upward, loosen and remove the output gear assembly installation bolts using a hexagon wrench.

**NOTE**

- **Do not separate with a flathead screwdriver.**
- **Loosen the installation bolts evenly.**
- **If the low & reverse brake is to be disassembled, check the operation and remove it at this point.**



42. With the side cover installation upward, remove the seal ring. Remove the output gear bearing support installation bolts with a hexagon wrench.
43. Punch the converter housing and the differential side oil seal of the case.
44. Remove the input shaft oil seal from the converter housing.

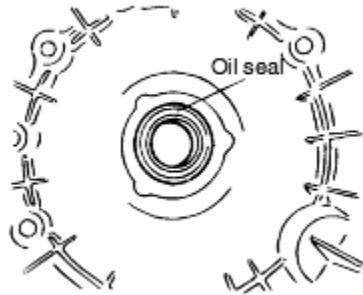


## REASSEMBLY EKTC0420

1. Punch the input shaft oil seal of the converter housing.

### NOTE

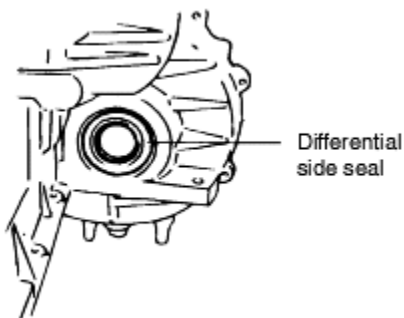
- **Do not reuse the oil seal.**
- **Apply grease to the lip of the oil seal.**
- **The oil seal must be flush with the converter housing surface when installed.**



2. Punch the differential side oil seal of the converter housing case.

### NOTE

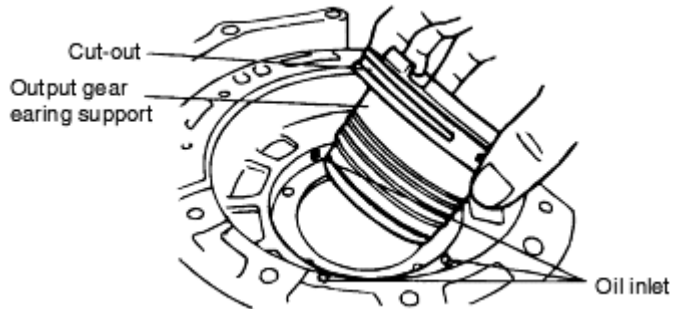
- **Do not reuse the oil seal.**
- **Apply grease to the lip of the seal.**
- **Push the oil seal to the end.**



3. Install the output gear bearing support with converter housing facing upward.

**NOTE**

Align the two oil inlets out of three oil inlets on the oil pan side of the case with the oil inlet cut-out of the output gear bearing support.

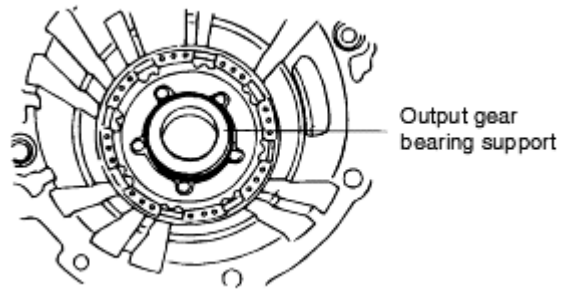


4. With the side cover installation facing upward, tighten the output gear bearing support installation bolts with the specified torque.

Tightening torque : 4.7Nm (47.5kgf·cm)

**NOTE**

Tighten the installation bolts diagonally and evenly.

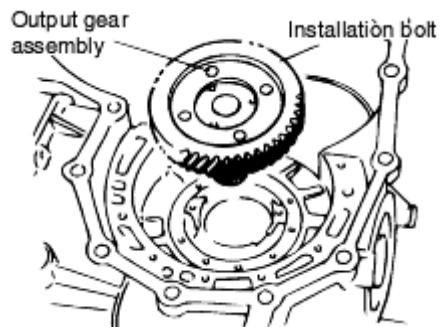


5. With the converter housing facing upward, install the output gear and tighten with the specified torque.

Tightening torque : 5Nm (50kgf·cm)

**NOTE**

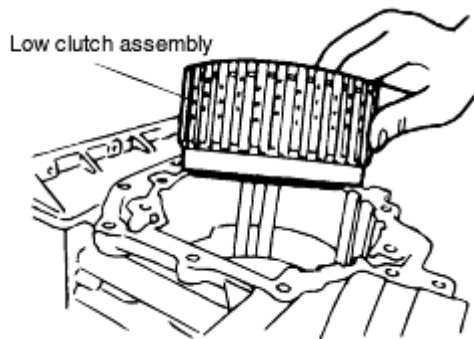
Tighten the installation bolts diagonally and evenly.



6. Attach the race-combined bearings to the bottom of the low clutch with petroleum jelly, and install the low clutch drum so that it is engaged with the low & reverse brake plates.

**NOTE**

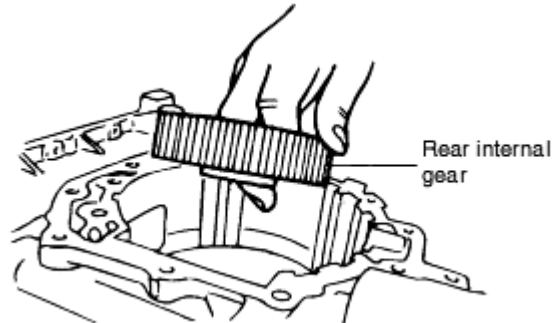
**Be careful not to drop the bearing.**



7. Attach the bearing to the side cover side and the race-combined bearing to the torque converter side of the rear internal gear with petroleum jelly, and install the rear internal gear so that it is engaged with the low clutch plates.

**NOTE**

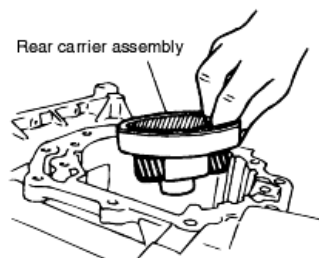
- **When installing the internal gear, be careful not to catch the Teflon ring of the case side inner race.**
- **Be sure to install at the bottom of the low clutch.**
- **Be careful not to drop the bearing.**



8. Attach the bearing to the side cover side and the race to the engine side of the rear carrier assembly with petroleum jelly, and install the rear carrier assembly so that it is engaged with the internal gear.

**NOTE**

**Be careful not to drop the bearing race.**

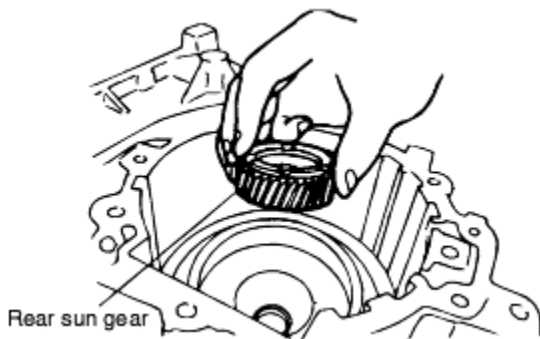




9. Install the rear sun gear to the rear carrier assembly with the polished face downward.

**NOTE**

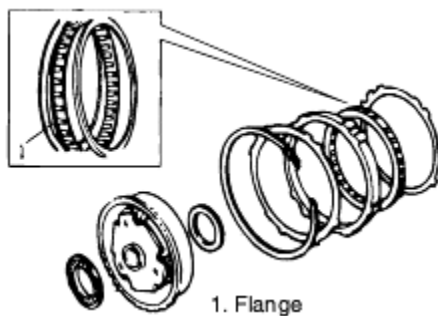
Note the direction of the rear sun gear.



10. Install the low one-way clutch in the front carrier so that the flange side of the clutch faces the torque converter side.

**NOTE**

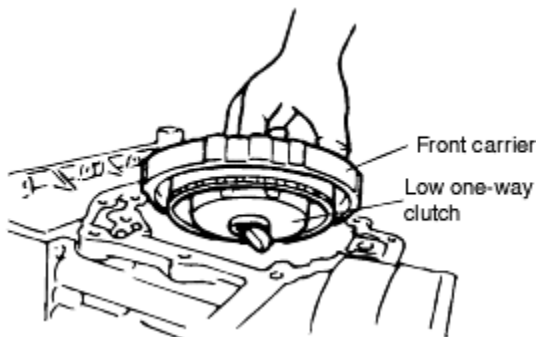
After installation, ensure that the clutch rotates clockwise smoothly and locks in the counter-clockwise direction.



11. Attach the bearings to the side cover side and the race-combined bearing to the torque converter side of the front carrier with petroleum jelly; then install the front carrier and the low one-way clutch as a unit, following the guide of the case.

**NOTE**

Ensure that the front carrier periphery spline is engaged with that of the low clutch. Ensure that the low one-way clutch is flush with the top of the front carrier.

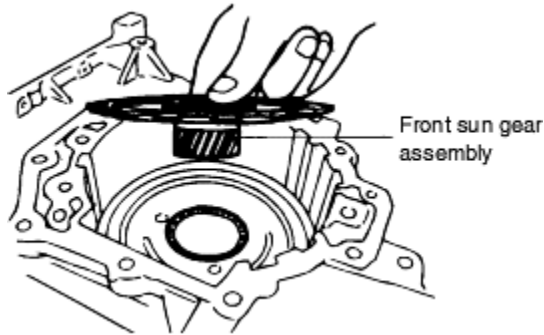


12. Install the snap ring.

**NOTE**

**Be careful not to scratch the one-way clutch with a screwdriver.**

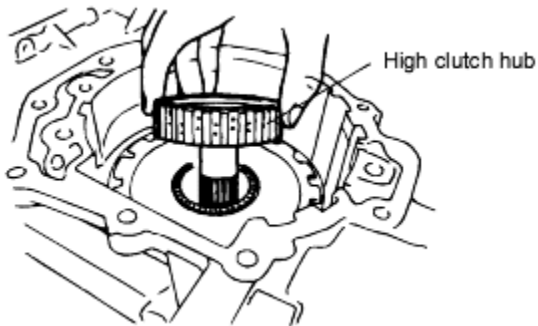
13. Attach the bearing to the side cover side and the race to the torque converter side of the front sun gear assembly with petroleum jelly, and install the assembly in the front carrier.



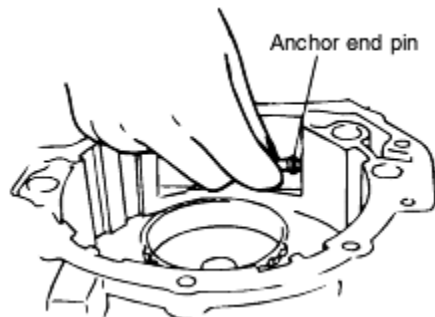
14. Attach the bearing to the side cover side of the high clutch hub with petroleum jelly, and install the hub in the front sun gear assembly.

**NOTE**

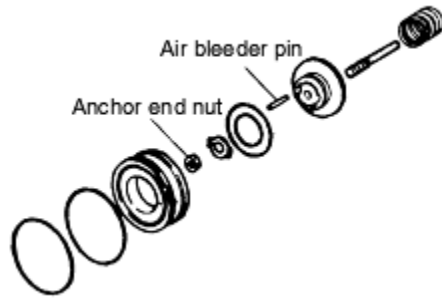
**The bearing to be installed in the hub is small in diameter. Be sure to position in the centre.**



15. Install the brake band anchor end pin in the case.



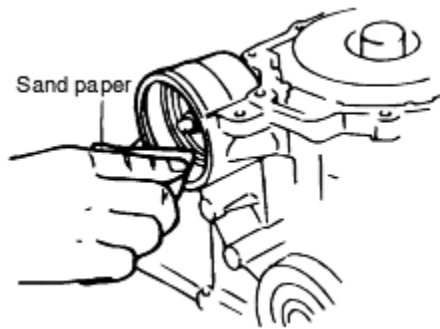
16. Apply ATF to the new O-ring; then install it in the band servo piston.



17. Before installing the band servo cover, remove any scratches from the case surface with sandpaper.

**NOTE**

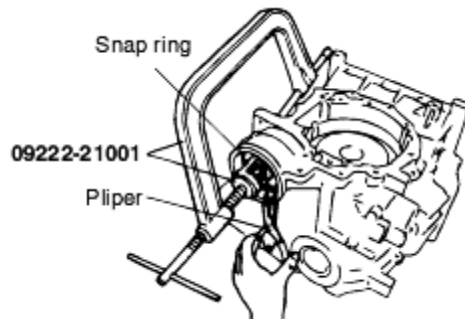
**Be sure to take this step to prevent O-ring breakage.**



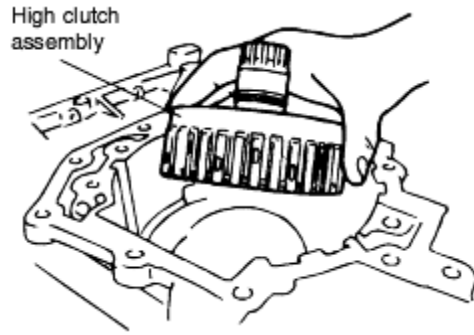
18. Insert the band servo piston into the case and push it into the snap ring groove using the special tool (Valve spring compressor) then fasten the snap ring.

**NOTE**

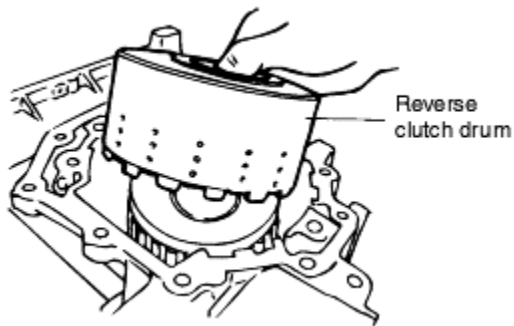
- **Gently tighten the anchor end nut of the band servo stem shaft so that the air vent pin does not drop.**
- **Fix the spring to the centre of the piston with petroleum jelly.**



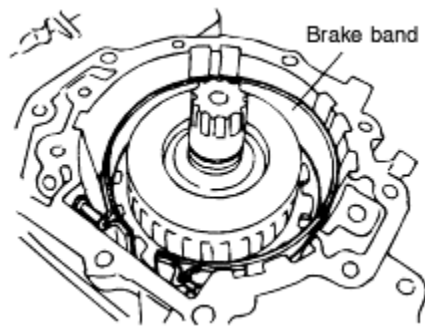
19. Attach the bearing to the side cover side of the high clutch assembly with petroleum jelly, and install the high clutch assembly so that it is engaged to the high clutch hub.



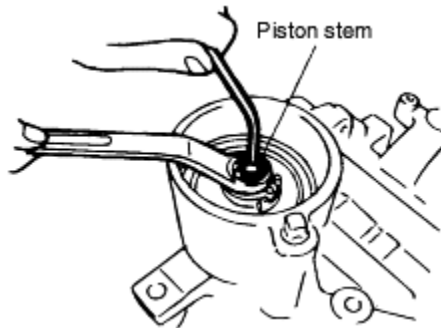
20. Install the reverse clutch so that it is engaged to the high clutch hub.



21. Through the anchor end pin and the piston, install the brake band level with the reverse clutch; then gently tighten the piston.



22. Loosen the anchor end nut as much as possible.  
Tighten the band servo stem with the specified torque; then loosen it back by 2.5 turns from that position. Then tighten the anchor end nut with the specified torque while holding the piston stem.
- Band servo stem torque : 3Nm (30kgf·cm)  
Anchor end nut torque : 19Nm (1900kgf·cm)



23. Insert the band servo cover horizontally.

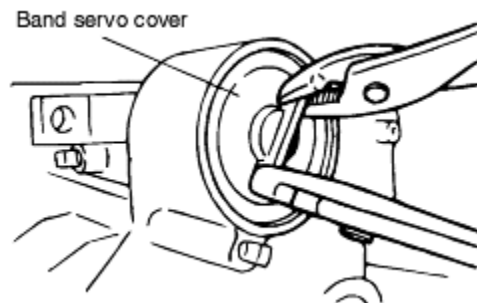
**NOTE**

**Before installation, apply ATF to the O-ring.**

24. Install the snap ring.

**NOTE**

**Be sure that the snap ring is entirely in the groove.**

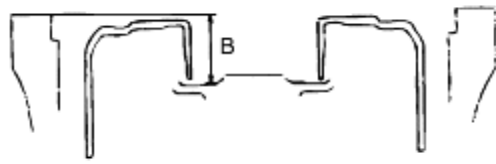


25. Measure the side cover end play and select a suitable thrust washer.

- Measure dimension A from the case installation surface of the side cover to the seating surface of the race bearing.

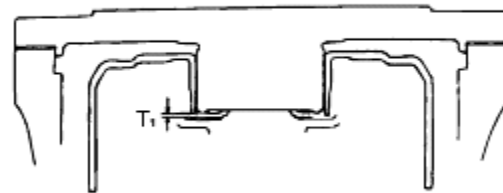


- Measure dimension B from the side cover installation surface of the case to the top of the high clutch bearing.



- Calculate the clearance by the formula “Dimension B - Dimension A”, and select a suitable race so that Dimension T1 will be the specified clearance.

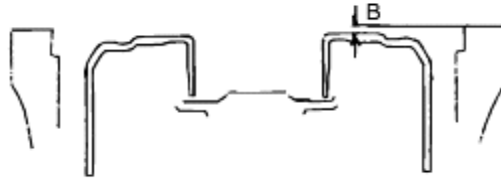
T<sub>1</sub> specified clearance : 0.25 - 0.55 (mm)



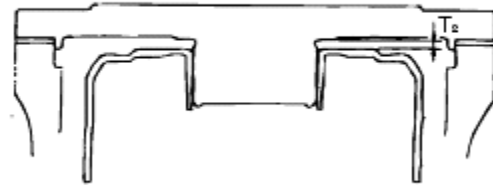
- Measure Dimensions A<sub>1</sub> and A<sub>2</sub> of the side cover.
- Calculate Dimension A by the formula “A<sub>2</sub> - A<sub>1</sub>”.



- Measure Dimension B from the side cover installation surface of the case to the washer seating surface of the reverse clutch.



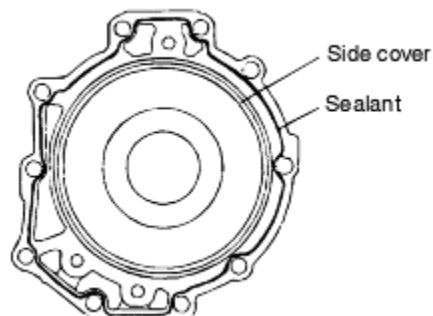
- Calculate the clearance by the formula “Dimension B - Dimension A”, and select a suitable thrust washer so that Dimension T<sub>2</sub> will be the specified clearance.  
T<sub>2</sub> specified clearance : 0.55 - 0.90 (mm)



26. Apply sealant to the side cover as shown in the figure on the left.  
Sealant (Three-bond 1216B)

**NOTE**

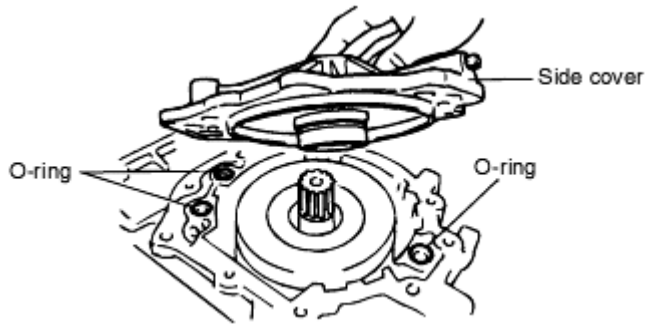
- **The coat of sealant should be wide and thick, approximately 2 mm in width and 1 mm thick.**
- **The sealant should be applied thoroughly and evenly.**



27. Position the three O-rings in the case.

**NOTE**

**Do not reuse the O-rings. Apply ATF to the new O-rings before installation.**

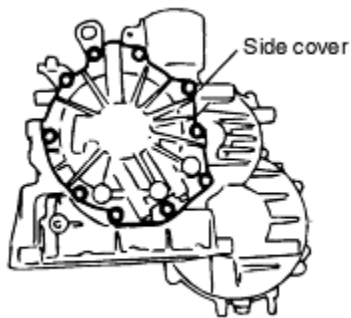


28. Install the side cover in the case, and tighten the bolts with the specified torque.

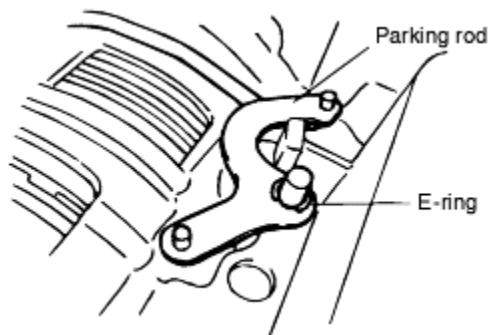
Tightening torque : 21Nm (210kgf·cm)

**NOTE**

**Be careful not to damage the Teflon rings attached to the high clutch and the side cover.**



29. Install the parking rod and the parking lever as a unit in the case, and install the E-ring.

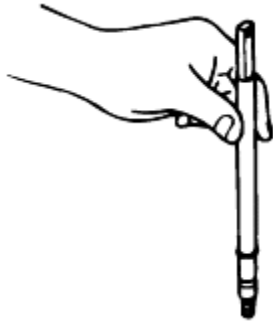




30. Install the O-ring in the manual shaft, and insert the manual shaft from inside the case.

**NOTE**

- **Be sure to insert from inside the case; damage may occur if installed from the outside.**
- **Before installing, apply ATF to the O-ring.**

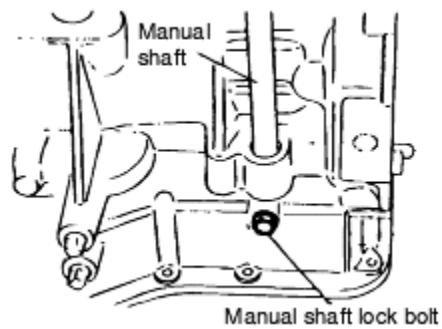


31. Tighten the manual shaft lock bolt.

Tightening torque : 7Nm (70kgf·cm)

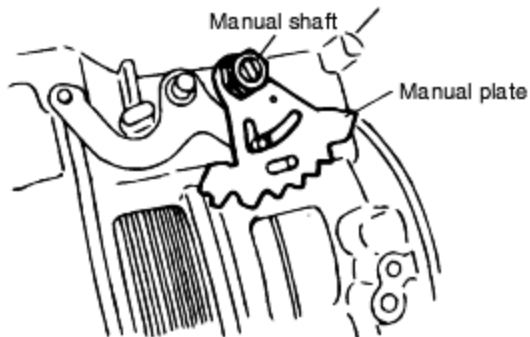
**NOTE**

**Do not reuse the lock bolt as sealant may be attached to it.**

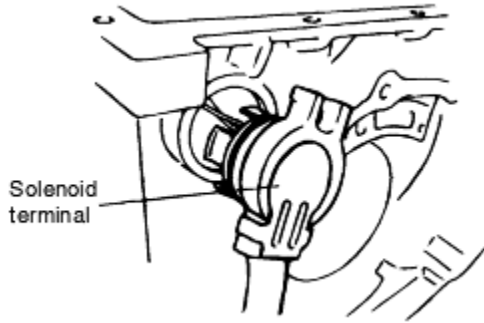


32. Install the manual plate in the manual shaft. Fix the manual shaft outside the transmission case and tighten the manual plate nut.

Tightening torque : 13Nm (130kgf·cm)



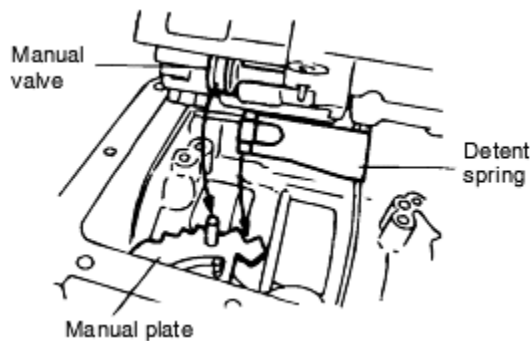
33. Install the solenoid terminal in the case.



34. While hanging the detent spring on the manual plate, engage the manual valve with the manual plate pin, and install the control valve.

**NOTE**

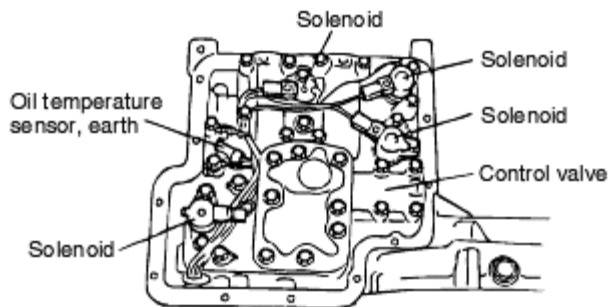
- **Ensure that the valve is fixed to the location pin.**
- **After installing the valve, ensure again with your fingers that the manual valve is engaged with the manual plate pin.**



35. Tighten the control valve installation bolts with the specified torque.

36. Tighten the oil temperature sensor and the earth terminal together.  
Tightening torque : 8Nm (80kgf-cm)

37. Install the same colored terminal in each solenoid.



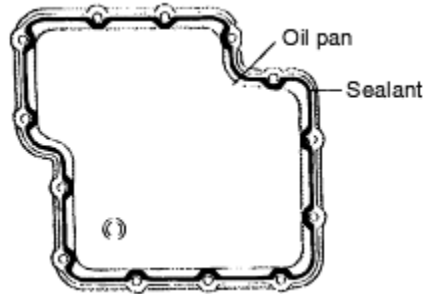
38. Install the magnet in the oil pan.

39. Apply sealant to the oil pan as shown in the figure on the left.

Sealant (Three-bond  
1216B)

**NOTE**

- **The coat of sealant should be wide and thick, approximately 3mm in width and 1.5mm thick.**
- **The sealant should be applied thoroughly and evenly.**

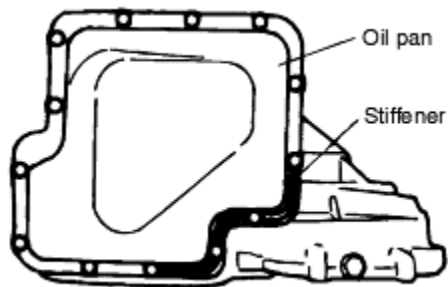


40. While fixing the stiffener to the four oil pan bolts, tighten the oil pan installation bolts with the specified torque.

Tightening torque : 13Nm (130kgf·cm)

**NOTE**

**The four bolts, which fix the stiffener, are of different lengths. Be sure to position them in the right places.**

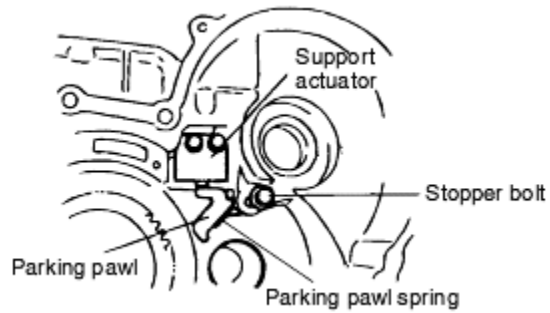


41. Install the parking lock support, and tighten with the specified torque.

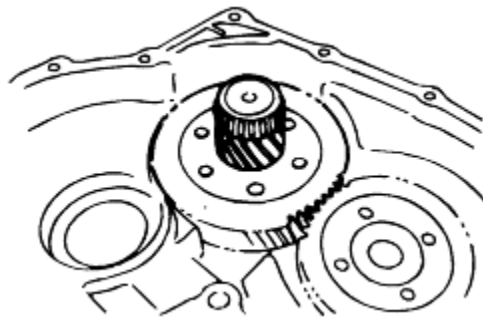
Tightening torque : 5Nm (50kgf·cm)

42. Position the parking pawl and the parking spring in the hole, and fix them by inserting the shaft.

43. Tighten the stopper bolt of the parking pawl shaft.  
Tightening torque : 5Nm (50kgf·cm)



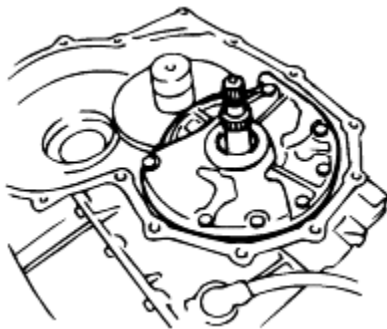
44. Install the reduction gear with the converter housing facing upward.



45. Insert the input shaft in the centre of the output gear. Install the oil pump and tighten the bolts with the specified torque.  
Tightening torque : 13Nm (130kgf·cm)

**NOTE**

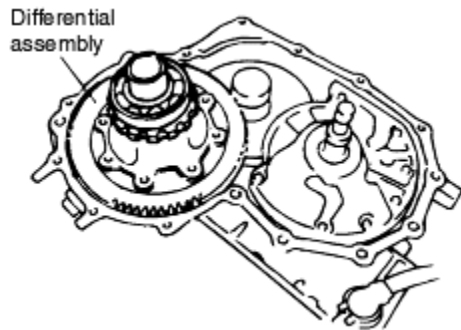
**Do not reuse the input shaft seal ring. Apply ATF to a new seal ring before installation.**



46. Install the differential assembly so that it is engaged with the reduction gear.

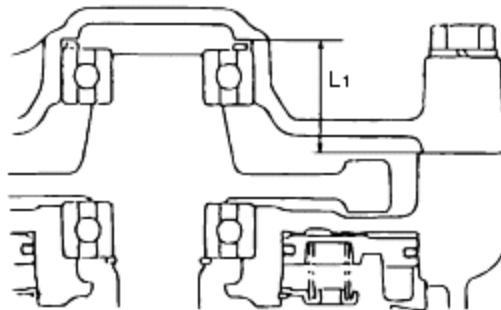
**NOTE**

**Ensure that the differential assembly is flush with the reduction gear.**

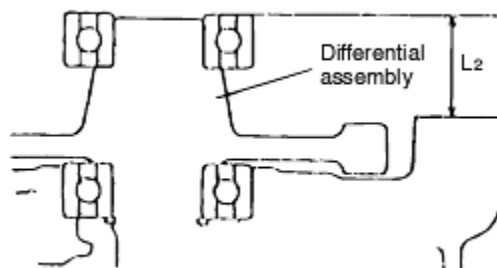


47. Select a differential assembly shim.

- Measure dimension  $L_1$  from the case installation surface of the converter housing to the seating surface of the shim bearing.

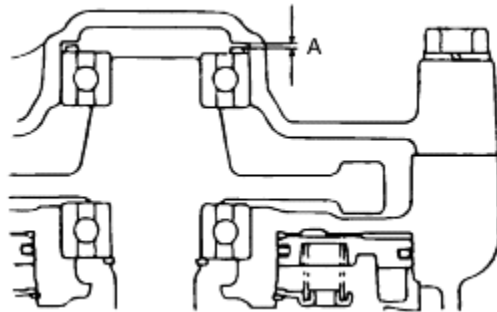


- Measure dimension  $L_2$  from the converter housing installation surface of the case to the top of the differential assembly side bearing.



- Calculate the clearance by the formula Dimension  $L_1$  - Dimension  $L_2$ , and select a suitable shim so that Dimension A will be the specified clearance.

Specified clearance A : 0 - 0.1 (mm)

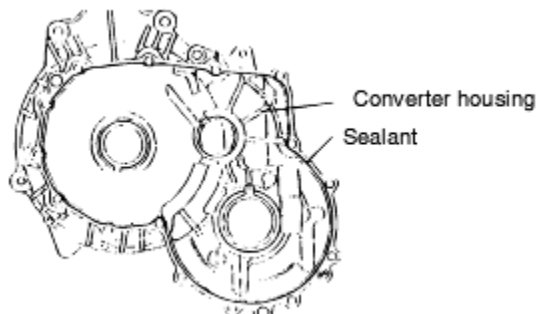


48. Apply sealant to the converter housing as shown in the figure on the left.

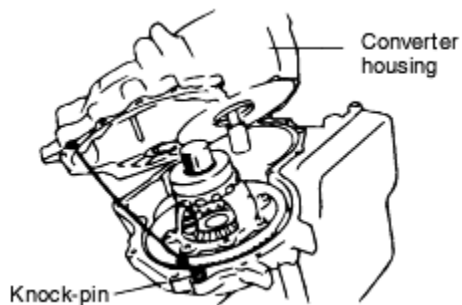
Sealant (Three-bond 1216B)

**NOTE**

- **The coat of sealant should be wide and thick, approximately 2mm in width and 1mm thick.**
- **The sealant should be applied thoroughly and evenly.**

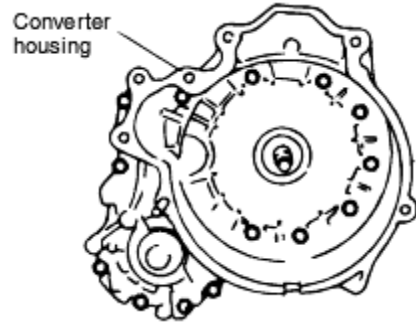


49. Install the converter housing aligning with the case knock-pin.



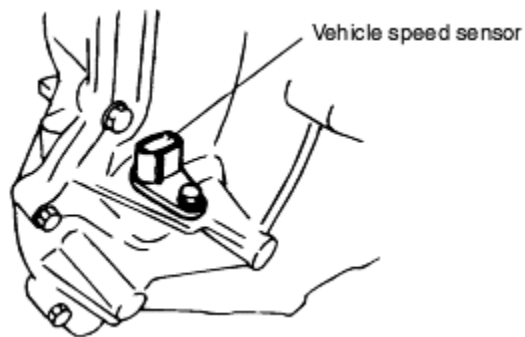
50. Tighten the converter housing installation bolts with the specified torque.

Tightening torque : 30Nm (310kgf·cm)



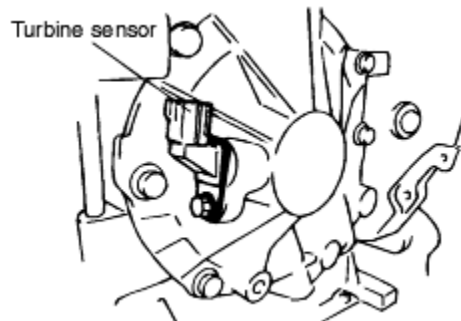
51. Install the vehicle speed sensor, and tighten the bolt with the specified torque.

Tightening torque : 7Nm (70kgf·cm)



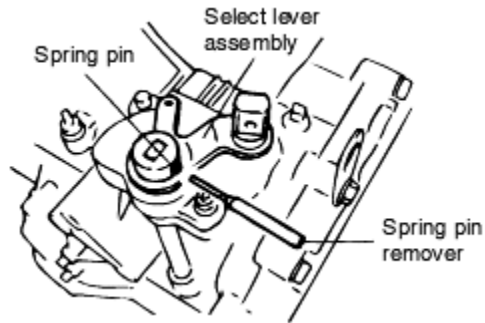
52. Install the turbine sensor, and tighten the bolt with the specified torque.

Tightening torque : 7Nm (70kgf·cm)



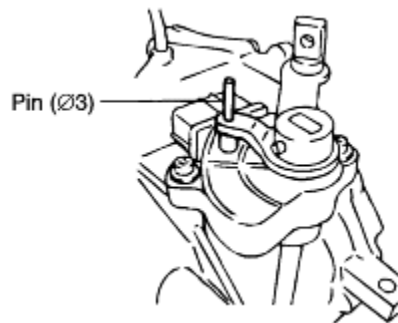
53. Install the shift lever switch through the manual shaft, and temporarily tighten the bolt.

54. Embed the select lever assembly in the manual shaft, and punch the spring pin



55. Move the select lever assembly to shift into the “N” range. Insert the pin (about Ø3) in the location holes of the shift lever switch and the select lever assembly; then tighten the bolts of the shift lever switch.

Shift lever switch tightening torque :  
3Nm (30kgf·cm)

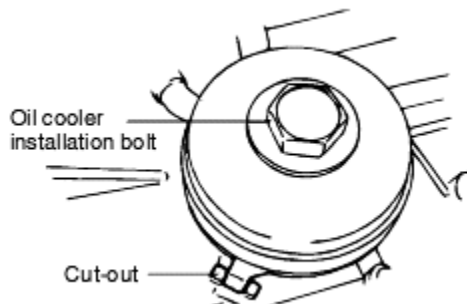


56. Align the convex section of the oil cooler with the case cut-out, and tighten the oil cooler installation bolt with the specified torque.

Tightening torque : 27Nm (270kgf·cm)

**NOTE**

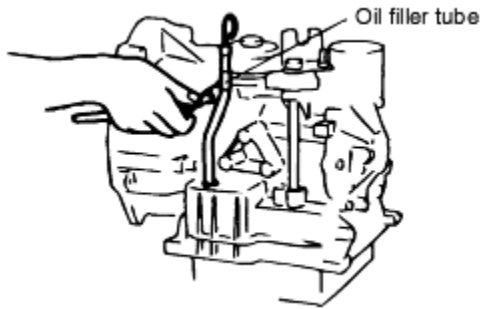
- **Before installation, attach the O-ring to the oil cooler with petroleum jelly.**
- **Do not reuse the O-ring.**





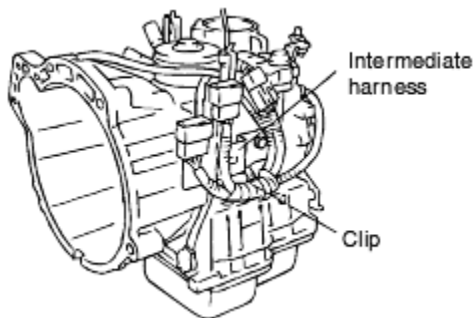
57. Insert the oil filler tube in the case, and fix it to the case together with the solenoid terminal.

Tightening torque : 7Nm (70kgf·cm)



58. Install the clip, and tighten the bolts with the specified torque. Then attach the intermediate harness to the clip.

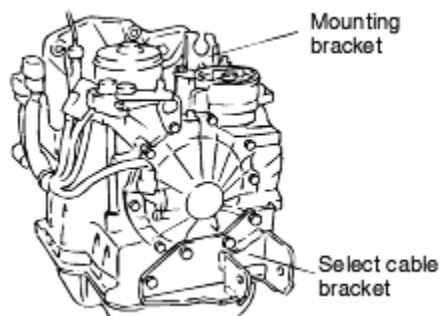
Tightening torque : 20Nm (200kgf·cm)



59. Install the select cable bracket and the engine mounting bracket, and tighten the bolts with the specified torque.

Select cable bracket tightening torque :  
20Nm (200kgf·cm)

Mount bracket tightening torque :  
45Nm (450kgf·cm)



60. Install the torque converter.

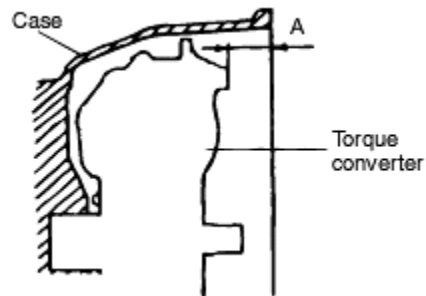
- Pour ATF to the extent that the ATF does not spill when setting up the converter.

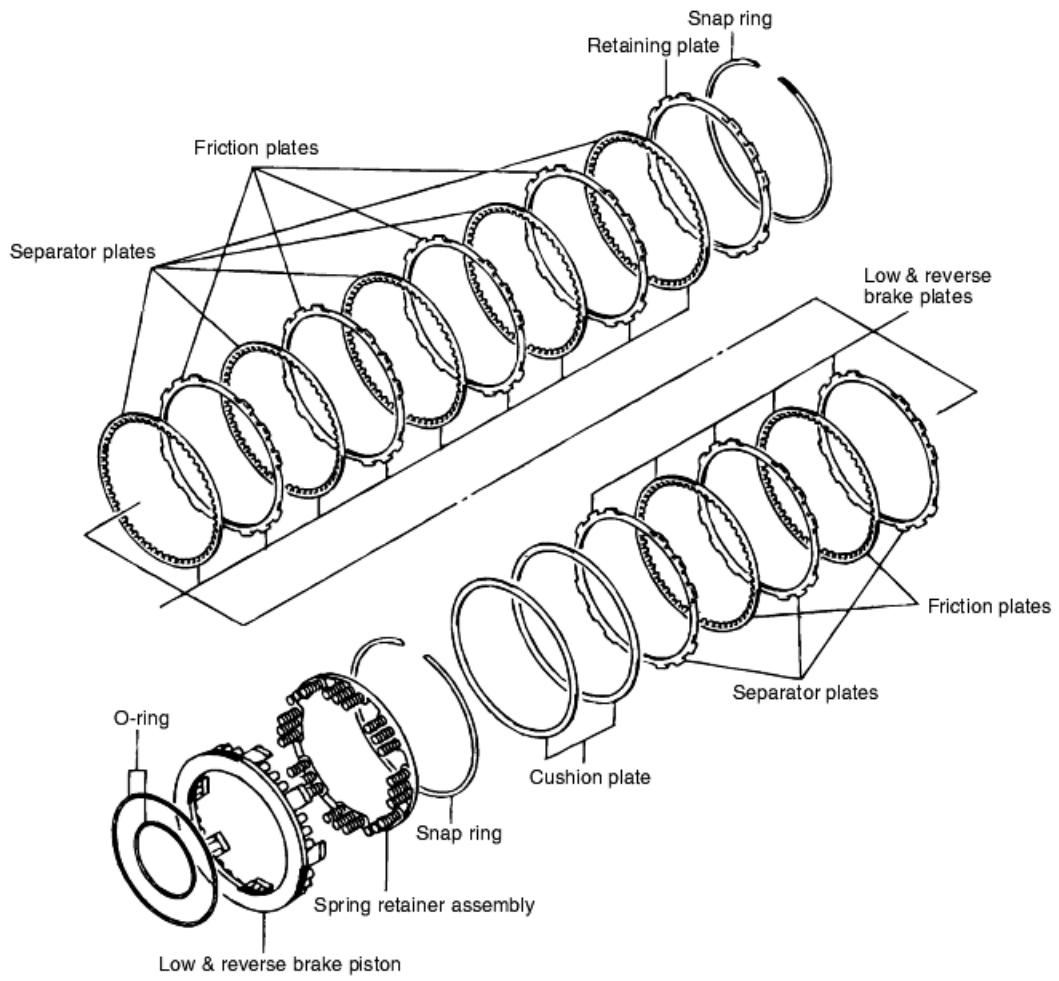
- Install the converter, turning it until the converter sleeve cut-out is aligned with the input shaft.
- Measure dimension A from the edge of the converter to the edge of the case to ensure that the converter is installed properly.  
(The oil pump may be damaged if the transaxle case is mounted on a vehicle with the torque converter attached incorrectly.)

Dimension A : 23.7mm or more

**NOTE**

- **Before installing the converter, Apply ATF to the oil seal lip. (To prevent lip breakage)**
- **Be careful not to scratch or damage the lip of the oil seal with the sleeve during installation.**
- **Do not use force during installation.**
- **Remove all ATF which has fallen to the bottom of the housing when applying the ATF to the oil seal**
- **If ATF drops when installing the converter, remove it completely.**





## DISASSEMBLY EKTC0390

1. Using a thickness gauge, measure the clearance between the snap ring and the retaining plate.

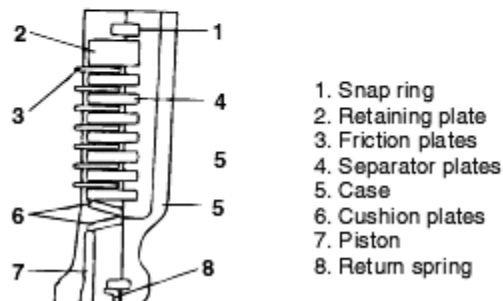
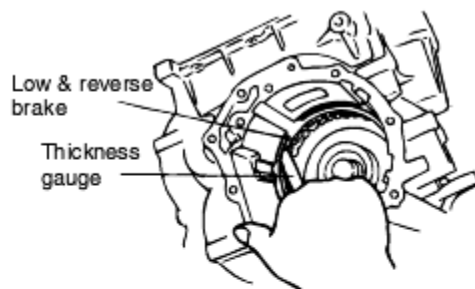
Clearance (mm)

Standard 0.8 - 1.1

Application limit 1.3

### NOTE

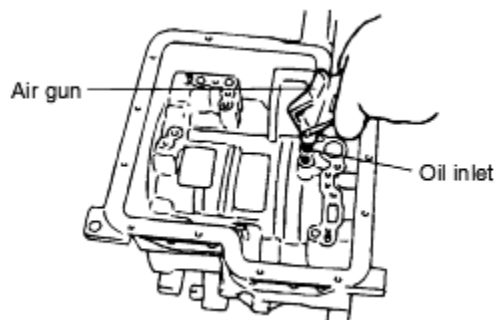
- If the application limit is exceeded, replace the friction plate and the separator plate with new ones, and select a suitable retaining plate so that specified clearance will be obtained.
- If clearance is less than the application limit, select a suitable retaining plate so that the clearance will fall within the desired range.



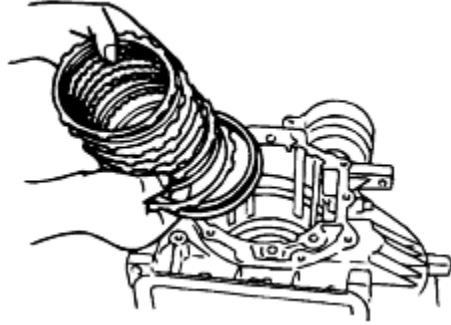
2. Blow air into the oil inlet of the low clutch drum, and check the functioning of the piston.

### NOTE

Close the other holes when blowing air using an air gun.



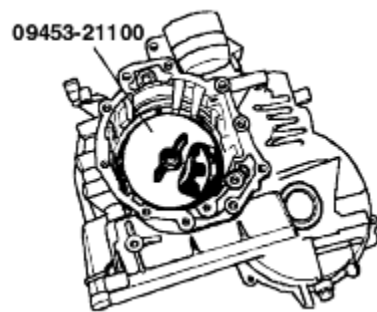
3. Remove the snap ring; then remove each plate.



4. Using the special tool (spring compressor), depress the cancel cover and remove the snap ring; then remove the cancel cover and the return spring.

**NOTE**

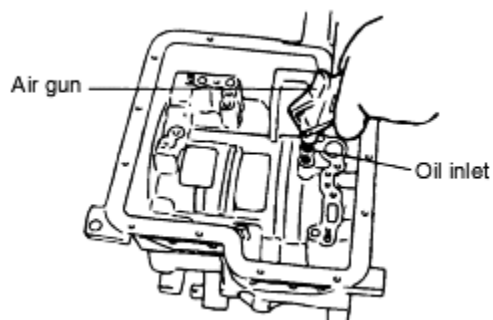
- **Do not apply undue stress to the spring retainer.**
- **Use the special tools so that force will be applied evenly to the spring retainer.**



5. Blow air into the oil inlet of the control valve installation face to remove the low & reverse brake piston.

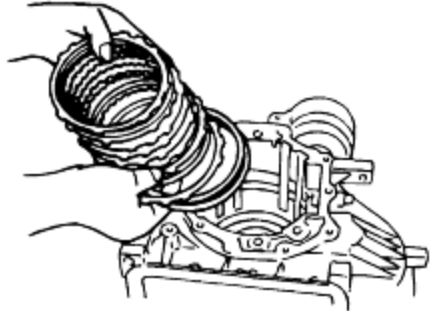
**NOTE**

- **Air must be blown gradually at low pressure so as not to tilt the piston.**
- **If the piston is hard to remove by blowing air, pull it out using pliers.**



## INSPECTION EKT0400

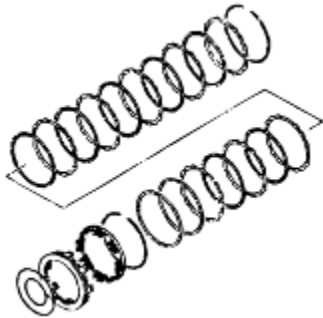
1. Check the plates for burns, damage, or distortion.
2. Check the O-ring for breakage or damage.
3. Check the other components for damage or distortion.



## REASSEMBLY EKT0410

Re-assembly should be carried out following the steps for disassembly in reverse order. Caution the following during re-assembly :

1. Replace the O-ring with a new one. Apply ATF to the new O-ring, and then install it in the low clutch piston.
2. Be careful not to twist or come out the O-ring when inserting the low & reverse clutch piston.

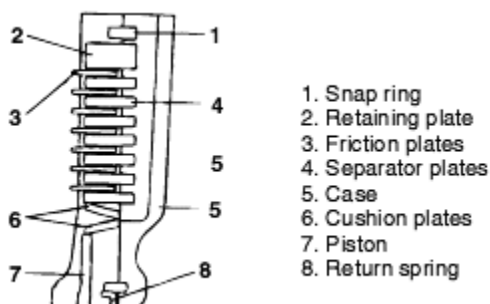


3. Assemble with the cushion plate periphery touching the low & reverse clutch.

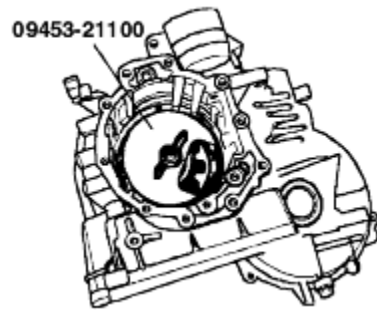
### NOTE

**Note the direction of the cushion plate.**

4. Be sure to assemble the low & reverse brake plate set components in the below order.



5. Be careful not to distort the spring retainer when using the special tools.
6. Ensure that the snap ring fits snugly in the drum groove.
7. Ensure that the snap ring opening is not aligned with the stopper.
8. Ensure that the snap ring opening is aligned with the concave aperture.
9. Before using a new low & reverse brake plate set, soak it in ATF for more than two hours.



#### SECOND BRAKE BAND

1. Check second brake band for damage, wear, or discoloration. If the result is not satisfactory, replace the band with a new one.

**NOTE**

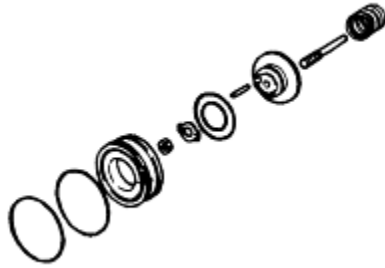
**Before putting the new band into position, soak it in ATF for more than two hours.**

- 2.



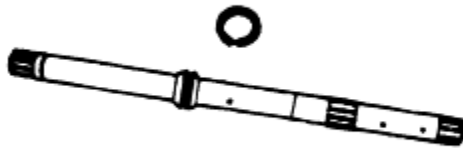
## SECOND BRAKE PISTON

1. Check the piston seal ring for damage.
2. Check the piston bore of the transaxle case for damage or abnormal wear.



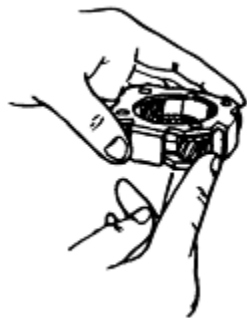
## INPUT SHAFT

1. Check the spline for damage or wear.
2. Check the seal ring for breakage or wear.



## PLANETARY GEAR

1. Check each gear for damage or discoloration.
2. Ensure that each gear rotates smoothly and without abnormal noise.





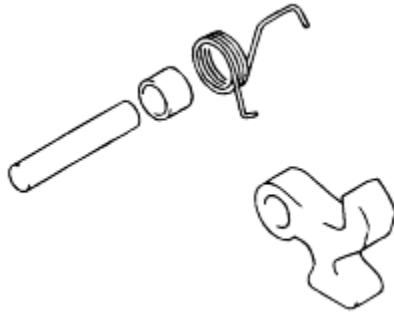
## ONE-WAY CLUTCH

1. Check the one-way clutch for damage or wear.



## PARKING LOCK PAWL, RETURN SPRING

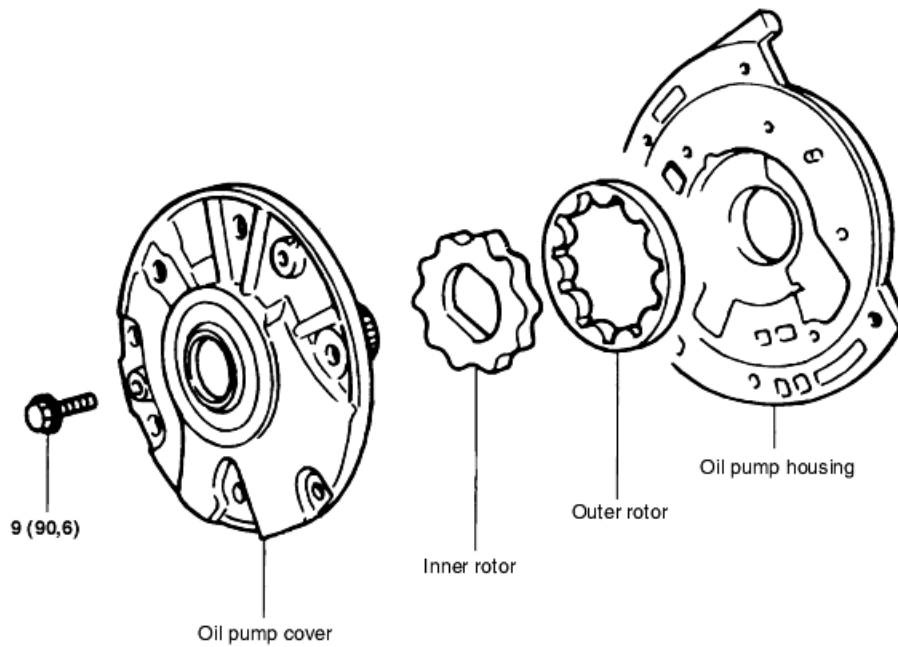
1. Check the parking lock pawl for damage or wear.
2. Check the return spring for distortion or damage.



## INTERNAL GEAR, SUN GEAR

1. Check the gear teeth for abnormal wear or damage.

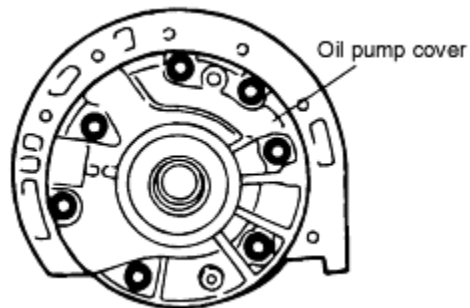




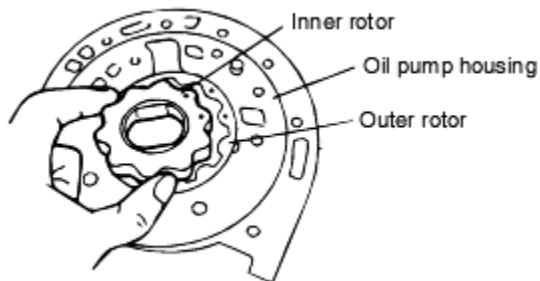
**TORQUE : Nm (kg-cm, lb-ft)**

**DISASSEMBLY EKTC0230**

1. Remove the bolts and the oil pump cover.

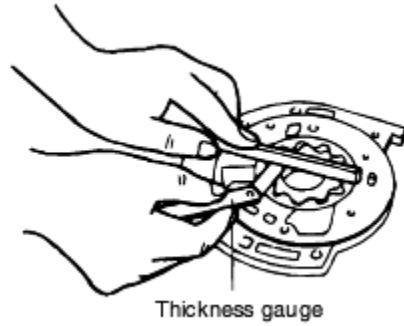


2. Pull the inner and outer rotors out from the oil pump housing.

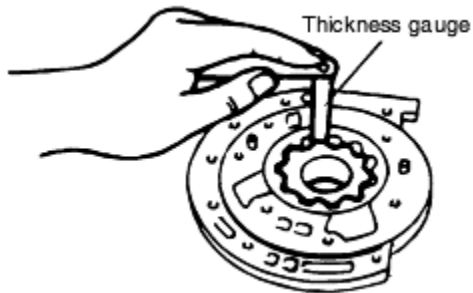


## INSPECTION EKTC0240

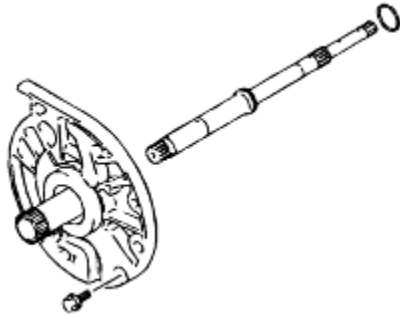
1. Using a thickness gauge, measure the side clearances of the inner and outer rotors.  
Clearance (mm) : Standard 0.02 - 0.04



2. Measure the tip clearances of the inner and outer rotors.  
Clearance (mm) : Standard 0.02 - 0.15



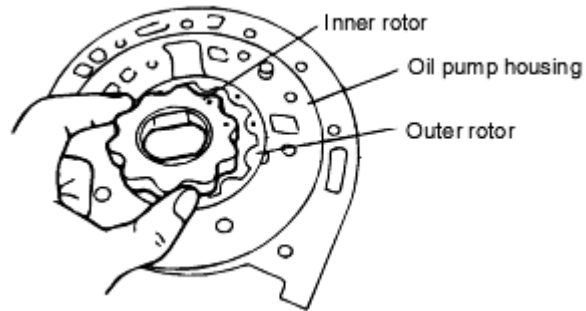
3. Check the other components for damage or abnormal wear.



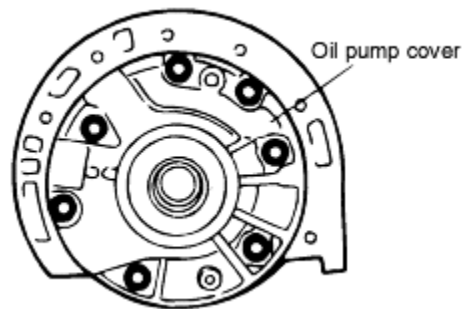
## REASSEMBLY EKTC0250

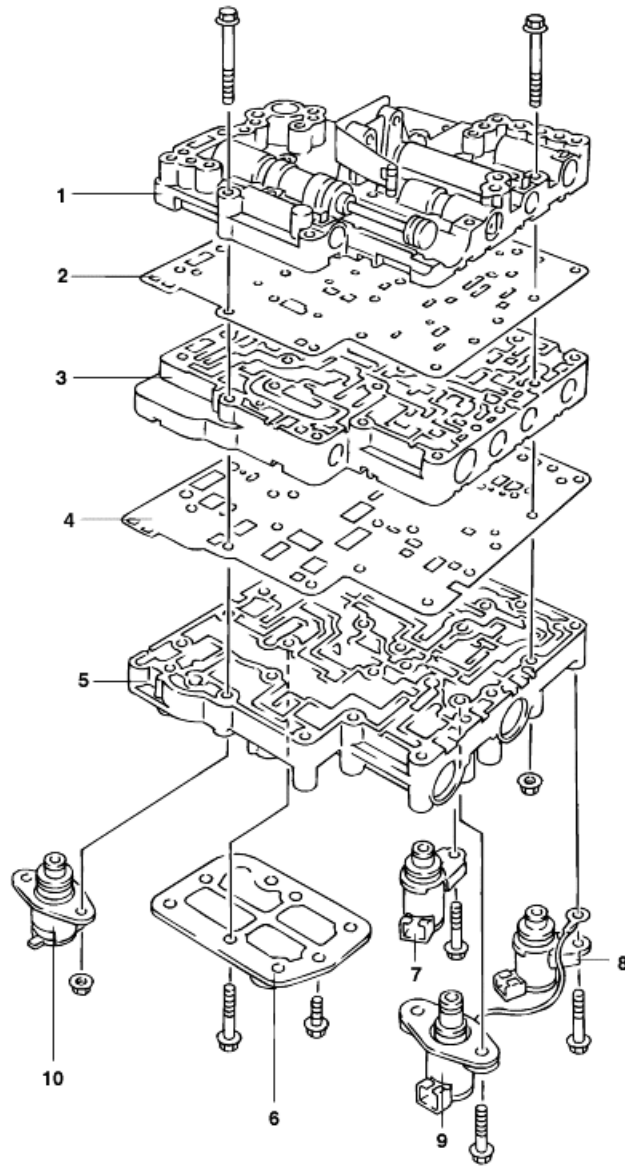
Re-assembly should be carried out following the steps for disassembly in reverse order. Take heed of the following during re-assembly :

1. Install the inner and outer rotors in the oil pump housing with the punch marks visible.



2. Install the oil pump cover in the oil pump body, and tighten the bolts with the specified torque.  
Tightening torque: 9Nm (90kgf·cm)

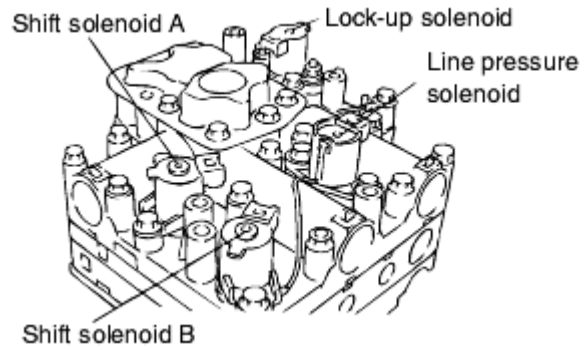




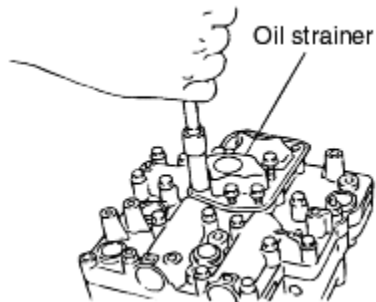
- |                                    |                           |
|------------------------------------|---------------------------|
| 1. Upper control valve body        | 6. Oil strainer           |
| 2. Separator plate                 | 7. Shift solenoid A       |
| 3. Intermediate control valve body | 8. Shift solenoid B       |
| 4. Separator plate B               | 9. Line pressure solenoid |
| 5. Lower control valve body        | 10. Lock-up solenoid      |

## DISASSEMBLY EKTC0440

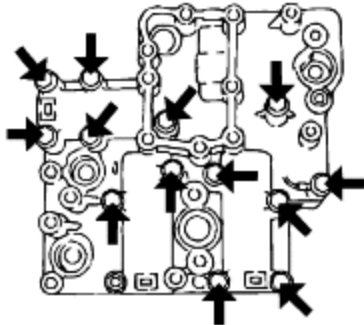
1. Remove the shift solenoid A, the shift solenoid B, the line pressure solenoid and the lock-up solenoid from the lower control valve body.



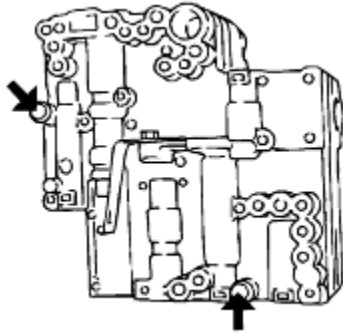
2. Remove the oil strainer from the lower control valve body.



3. Remove the bolt from the side of the lower control valve body (shown in the figure on the left).



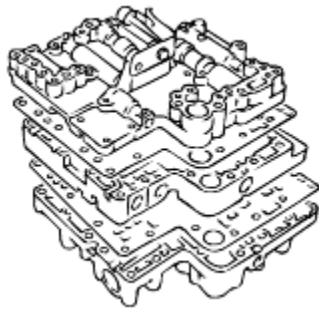
4. With the upper control valve body upward, remove the bolt and the nut.



5. Remove the upper control valve body and the separator plate as a unit.

**NOTE**

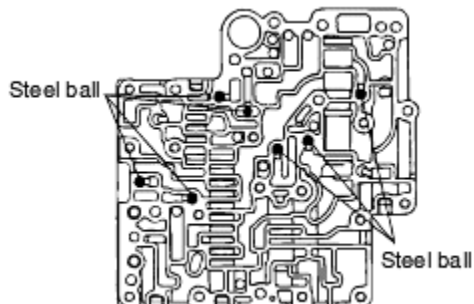
Since there is a steel ball inside the body of each valve, remove each body and the separator plate as a unit with the lower control valve body facing downward.



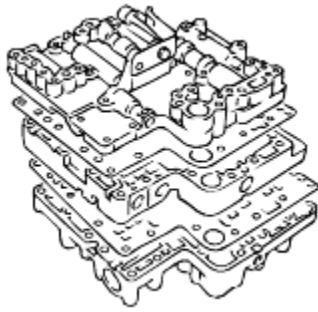
6. With the upper control valve body downward, remove the separator plate and the steel ball.

**NOTE**

Be careful not to drop or lose the steel ball.



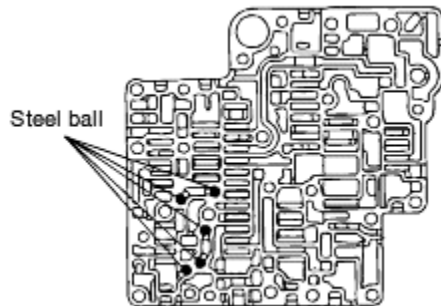
7. With the upper side of the intermediate control valve body upward, remove it as a unit with the separator plate B.



8. With the upper side of the intermediate control valve body downward, remove the separator plate B and the steel ball.

**NOTE**

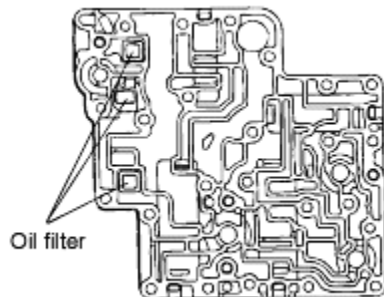
**Be careful not to drop or lose the steel ball.**



9. Remove the oil filter from the lower control valve body.

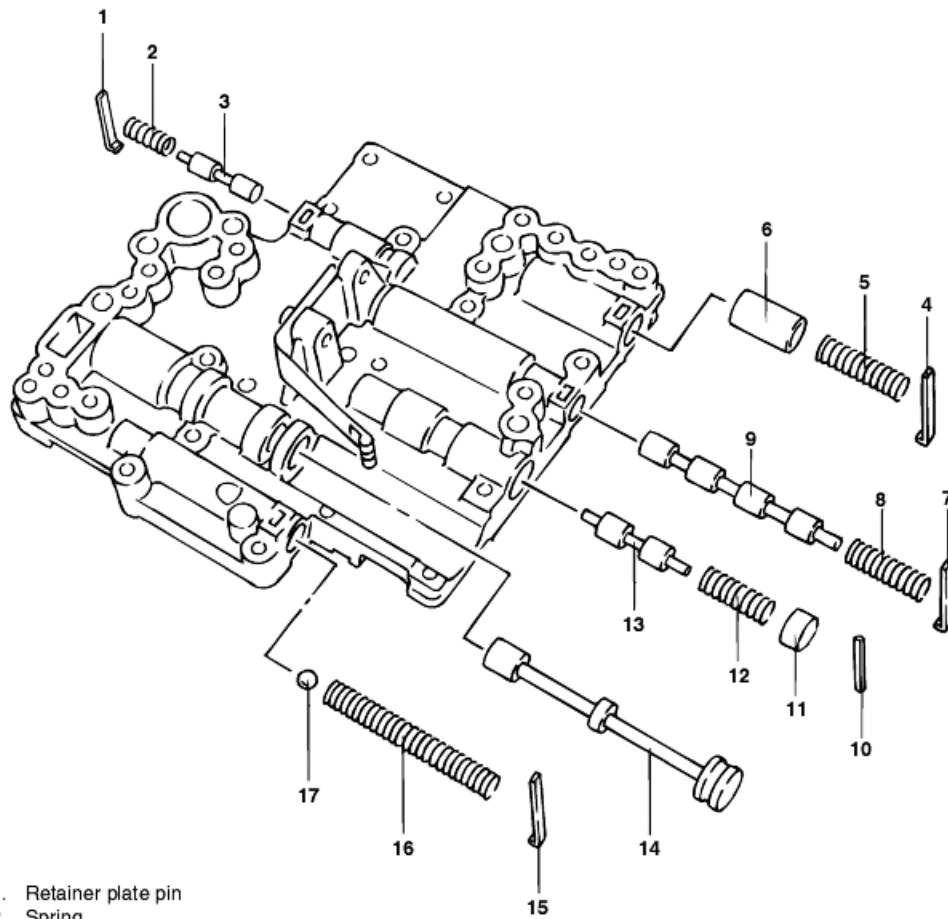
**NOTE**

**Be careful not to drop or lose the oil filter.**





## UPPER VALVE BODY EKTC0450



1. Retainer plate pin
2. Spring
3. Neutral shift valve
4. Retainer plate pin
5. Spring
6. Throttle pressure accumulator
7. Retainer plate pin
8. Spring
9. Shift valve A
10. Parallel pin
11. Plug
12. Spring
13. Pressure modifier valve
14. Manual valve
15. Retainer plate pin
16. Spring
17. Line pressure relief valve

## DISASSEMBLY EKT0460

1. Remove the retainer plate pin, the spring and the neutral shift valve.
2. Remove the retainer plate pin, the spring and the throttle pressure accumulator.
3. Remove the retainer plate pin, the spring and the shift valve A.
4. Remove the parallel pin, the plug, the spring and the pressure modifier valve.
5. Remove the manual valve.
6. Remove the retainer plate pin, the spring and the line pressure relief valve.

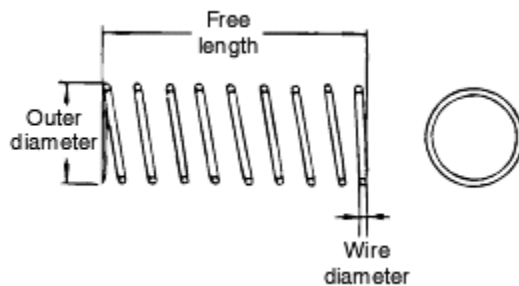
### NOTE

- Each valve can be removed by being slid with the weight of the valve itself.
- If the valve will not slide in this manner, push it out with a wire or face the valve inserting side downward and tap the valve lightly with a rubber-headed hammer. Do not scratch the valve and damage its surface or hole.
- Do not use a magnet. It may cause residual magnetism.
- Be careful not to drop or lose the valve and internal components.

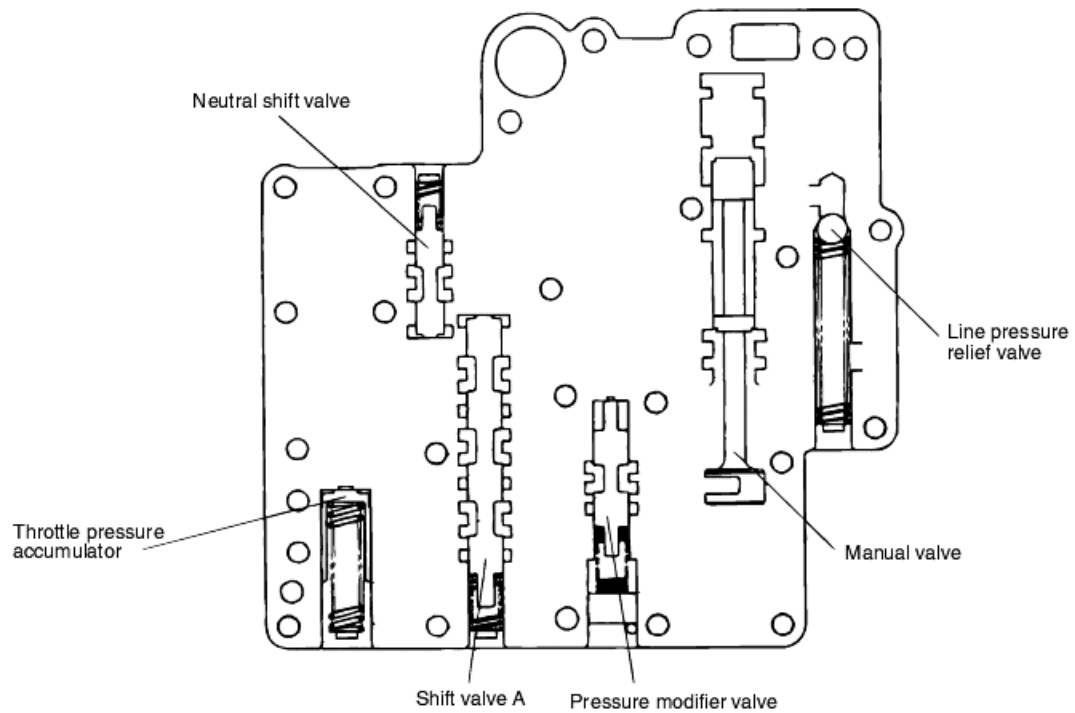
## INSPECTION EKT0470

### SPRING

1. Take the following spring measurements.
2. If the measured value is too low or too high, replace the spring.



STANDARD Item	Outer diameter (mm)	Free length (mm)	No. of effective coils	Wire diameter (mm)
<b>Spring name</b>				
Neutral shift valve spring	7.0	19.9	7.3	0.65
Throttle pressure accumulator spring	10.0	36.0	9.77	1.6
Shift valve A spring	9.0	28.7	8.25	0.8
Pressure modifier valve spring	9.0	27.0	8.4	0.7
Line pressure relief valve spring	9.6	69.3	22.5	1.6



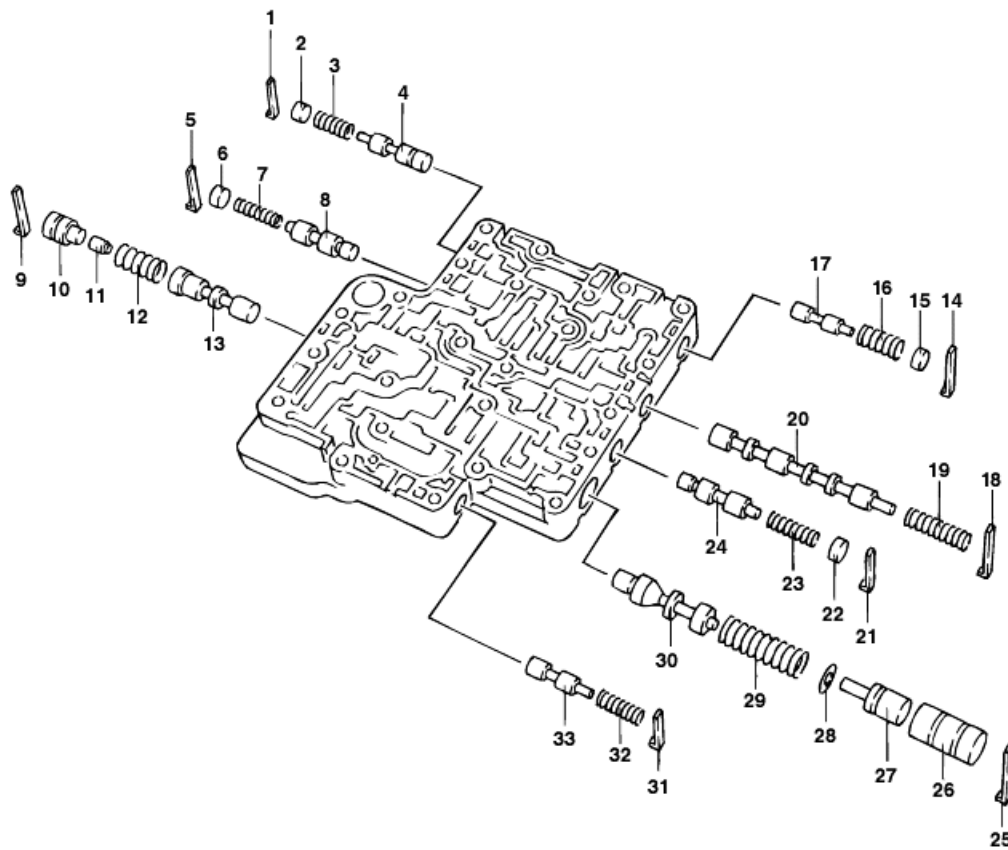
## REASSEMBLY EKTC0480

1. Install the line pressure relief valve.
2. Install the manual valve.
3. Install the pressure modifier valve.
4. Install the shift valve A.
5. Install the throttle pressure accumulator.
6. Install the neutral shift valve.

### NOTE

- **Before assembly, wash all the components thoroughly.**
- **Apply ATF to all of the components and holes.**
- **Do not use components, which may have been dropped.**
- **With plastic tape, tape the screwdrivers and rods to be used for inserting the valve.**
- **Note the orientation of valves and plugs.**

## INTERMEDIATE VALVE BODY EKTC0490



- |                                |                               |
|--------------------------------|-------------------------------|
| 1. Retainer plate pin          | 18. Retainer plate pin        |
| 2. Plug                        | 19. Spring                    |
| 3. Spring                      | 20. Shift valve B             |
| 4. 1-2 modulator valve         | 21. Retainer plate pin        |
| 5. Retainer plate pin          | 22. Plug                      |
| 6. Plug                        | 23. Spring                    |
| 7. Spring                      | 24. Accumulator control valve |
| 8. Neutral control valve       | 25. Retainer plate pin        |
| 9. Retainer plate pin          | 26. Valve sleeve              |
| 10. Valve sleeve               | 27. Valve plug                |
| 11. Valve plug                 | 28. Spring seat               |
| 12. Spring                     | 29. Spring                    |
| 13. Lock-up control valve      | 30. Pressure regulator valve  |
| 14. Retainer plate pin         | 31. Retainer plate pin        |
| 15. Plug                       | 32. Spring                    |
| 16. Spring                     | 33. Pilot valve               |
| 17. Servo release timing valve |                               |

## DISASSEMBLY EKTC0500

1. Remove the retainer plate pin, the plug, the spring and the 1-2 modulator valve.
2. Remove the retainer plate pin, the plug, the spring and the neutral control valve.
3. Remove the retainer plate pin, the valve sleeve, the valve plug, the spring and the lock-up control valve.
4. Remove the retainer plate pin, the plug, the spring and the servo release timing valve.
5. Remove the retainer plate pin, the spring and the shift valve B.

6. Remove the retainer plate pin, the plug, the spring and the accumulator control valve.
7. Remove the retainer plate pin, the valve sleeve, the valve plug, the spring seat, the spring and the pressure regulator valve.
8. Remove the retainer plate pin, the spring and the pilot valve.

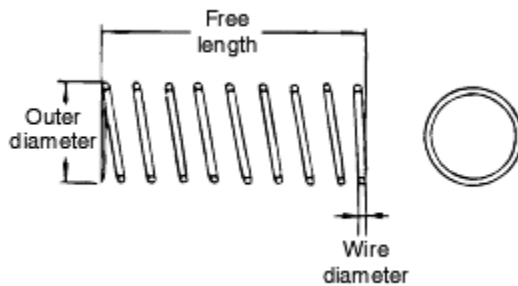
**NOTE**

- **Each valve can be removed by being slid with the weight of the valve itself.**
- **If the valve will not slide in this manner, push it out with a wire or face the valve inserting side downward and tap the valve lightly with a rubber-headed hammer. Do not scratch the valve and damage its surface or hole.**
- **Do not use a magnet. It may cause residual magnetism.**
- **Be careful not to drop or lose the valve and internal components.**

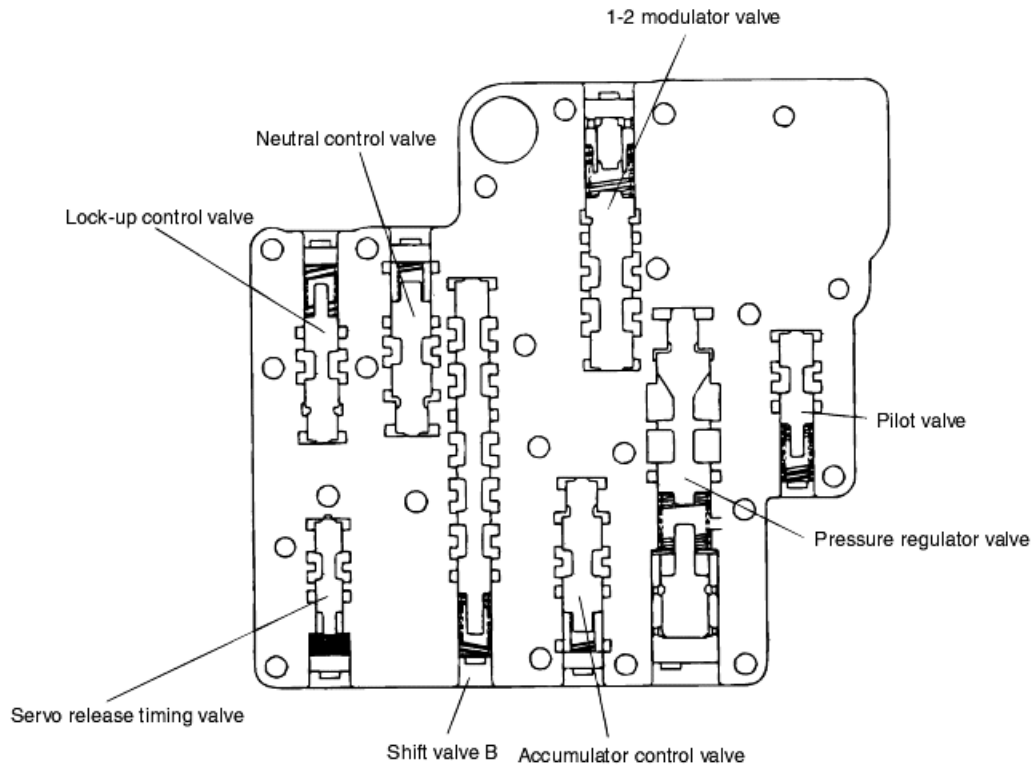
**INSPECTION** EKTC0510

**SPRING**

1. Take the following spring measurements.
2. If the measured value is too low or too high, replace the spring.



STANDARD Item	Outer diameter (mm)	Free length (mm)	No. of effective coils	Wire diameter (mm)
<b>Spring name</b>				
1-2 modulator valve spring	9.0	23.0	7.3	0.6
Neutral control valve spring	7.8	27.6	5.57	0.4
Lock-up control valve spring	14.0	33.0	4.7	1.1
Servo release timing valve spring	11.0	20.7	9.9	0.65
Shift valve B spring	10.0	35.0	8.1	0.9
Accumulator control valve spring	7.8	27.6	8.5	0.4
Pressure regulator valve spring	15.0	44.6	8.3	1.0
Pilot valve spring	9.1	25.4	8.1	1.1



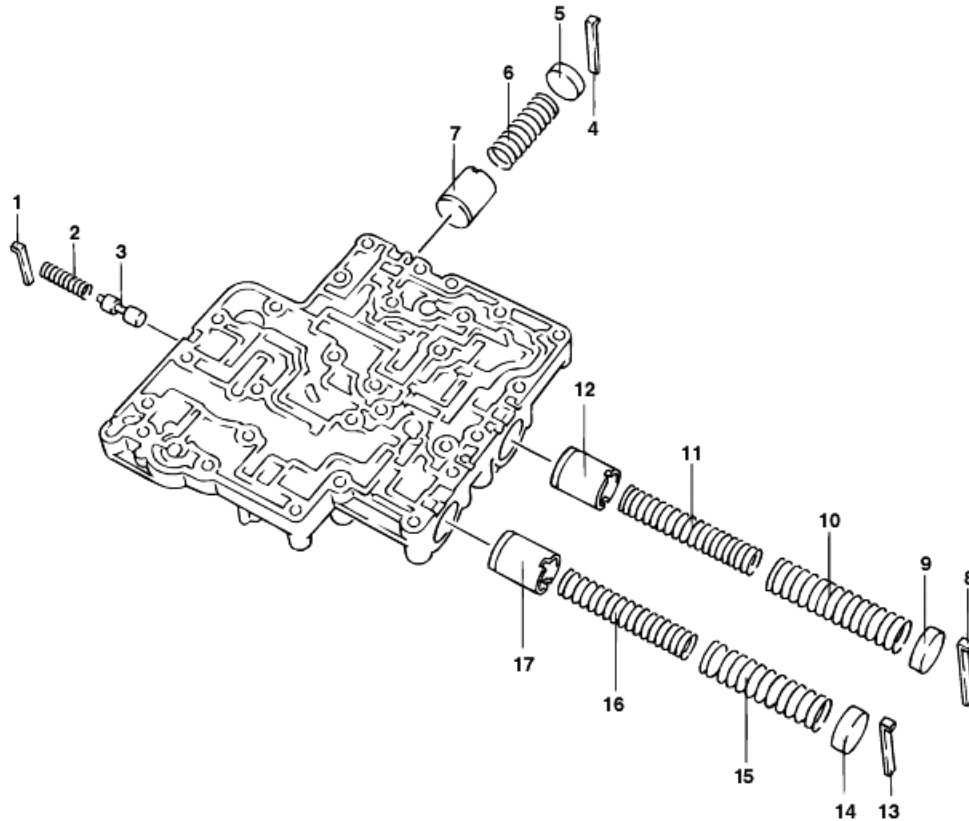
## REASSEMBLY EKTC0520

1. Install the pilot valve.
2. Install the pressure regulator valve.
3. Install the accumulator control valve.
4. Install the shift valve B.
5. Install the servo release timing valve.
6. Install the lock-up control valve.
7. Install the neutral control valve.
8. Install the 1-2 modulator valve.

### NOTE

- **Before assembly, wash all the components thoroughly.**
- **Apply ATF to all of the components and holes.**
- **Do not use components, which may have been dropped.**
- **With plastic tape, tape the screwdrivers and rods to be used for inserting the valve.**
- **Note the orientation of valves and plugs.**

## LOWER VALVE BODY EKTC0530



1. Retainer plate pin
2. Spring
3. Torque converter relief valve
4. Retainer plate pin
5. Plug
6. Spring
7. 1-2 accumulator
8. Retainer plate pin
9. Plug
10. Spring (OUT)
11. Spring (IN)
12. Throttle pressure accumulator
13. Retainer plate pin
14. Plug
15. Spring (OUT)
16. Spring (IN)
17. Low clutch accumulator

## DISASSEMBLY EKTC0540

1. Remove the retainer plate pin, the spring and the torque converter relief valve.
2. Remove the retainer plate pin, the plug, the spring and the 1-2 accumulator.
3. Remove the retainer plate pin, the plug, the OUT spring, the IN spring and the throttle pressure accumulator.
4. Remove the retainer plate pin, the plug, the OUT spring, the IN spring and the low clutch accumulator.

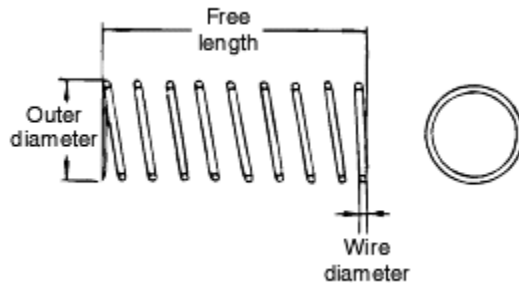
## NOTE

- Each valve can be removed by being slid with the weight of the valve itself.
- If the valve will not slide in this manner, push it out with a wire or face the valve inserting side downward and tap the valve lightly with a rubber-headed hammer. Do not scratch the valve and damage its surface or hole.
- Do not use a magnet. It may cause residual magnetism.
- Be careful not to drop or lose the valve and internal components.

## INSPECTION EKT0510

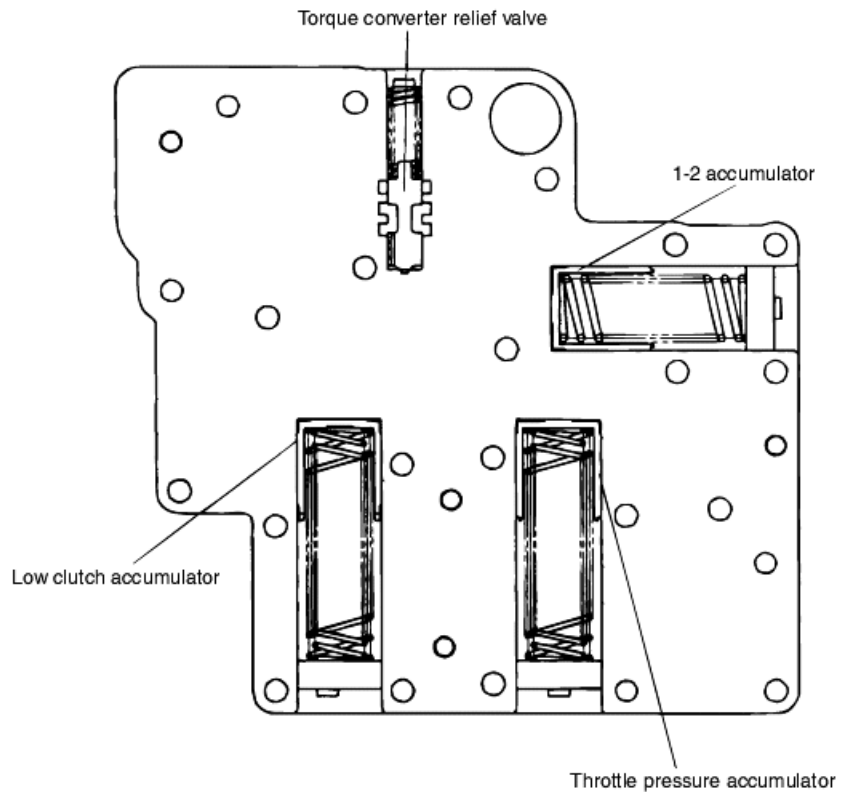
### SPRING

1. Take the following spring measurements.
2. If the measured value is too low or too high, replace the spring.



STANDARD Item		Outer diameter (mm)	Free length (mm)	No. of effective coils	Wire diameter (mm)
Spring name					
Torque converter relief valve spring		9.0	34.4	12.1	1.4
1-2 accumulator spring		19.0	52.8	9.5	2.1
Throttle pressure accumulator spring	OUT	19.0	76.0	11.5	1.6
	IN	15.3	76.0	12.7	1.2
Low clutch accumulator spring	OUT	19.0	76.0	11.5	1.6
	IN	15.3	76.0	12.7	1.2





## REASSEMBLY EKTC0560

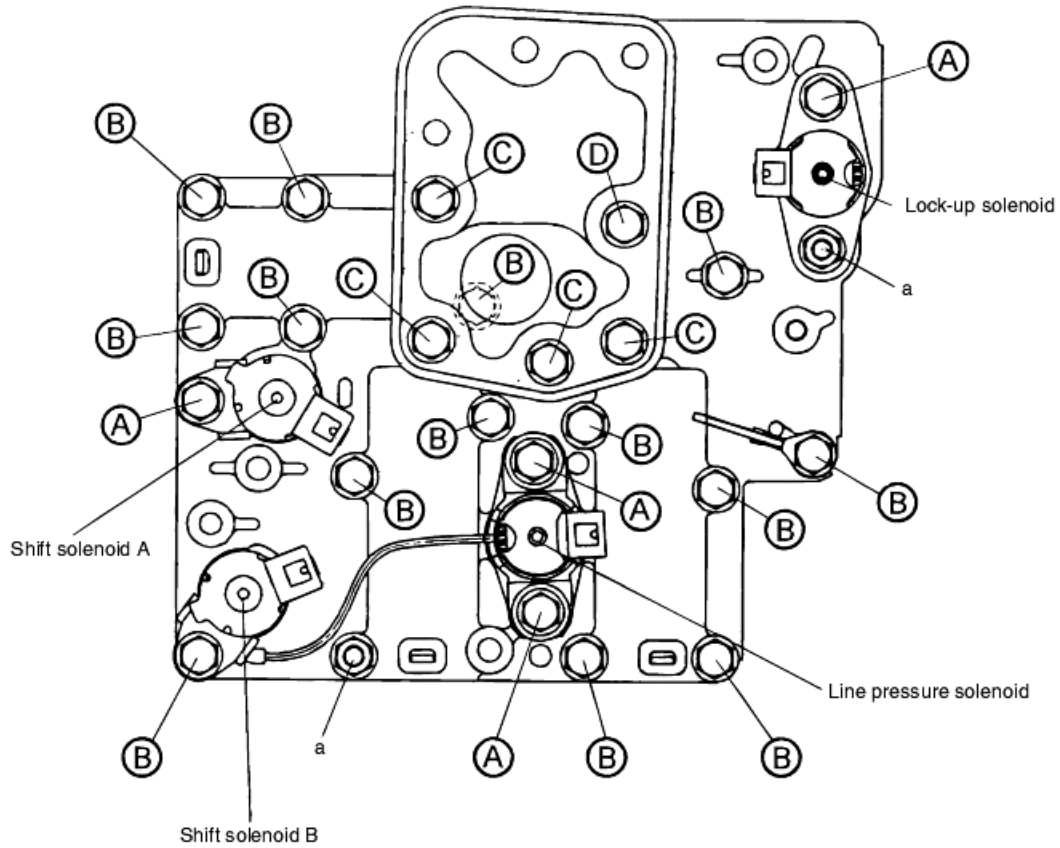
1. Install the low clutch accumulator.
2. Install the throttle pressure accumulator.
3. Install the 1-2 accumulator.
4. Install the torque converter relief valve.

### NOTE

- **Before assembly, wash all the components thoroughly.**
- **Apply ATF to all of the components and holes.**
- **Do not use components, which may have been dropped.**
- **With plastic tape, tape the screwdrivers and rods to be used for inserting the valve.**
- **Note the orientation of valves and plugs.**

# CONTROL VALVE BODY EKTC0570

## Bolt installation position

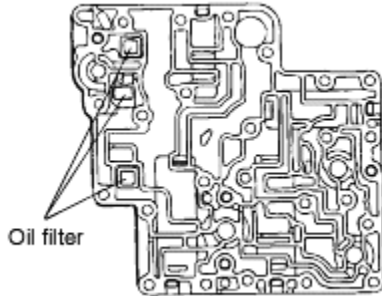


Reference mark	Bolt	Length (mm)	Tightening torque Nm (kgf-cm)
a		90	8 (80)
A		20	
B		77	
C		12	
D		87	

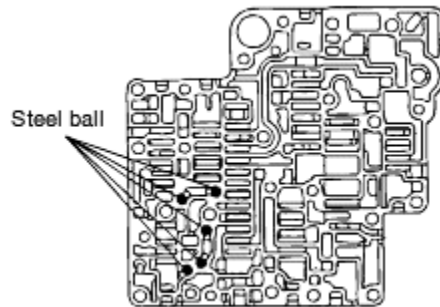
## REASSEMBLY EKTC0580

### NOTE

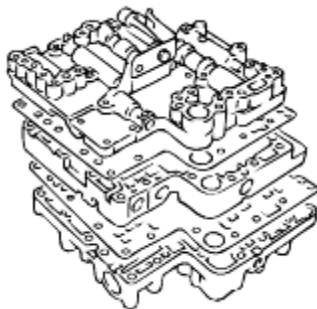
- Before re-assembly, ensure that all the components have been washed thoroughly.
  - Apply ATF to all of the components.
1. Apply ATF to the oil filter and install it in the lower control valve body.



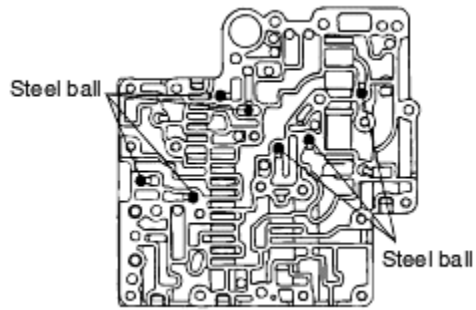
2. Apply ATF to the steel ball and the new separator plate B; then install these items in the lower side of the intermediate control valve body.



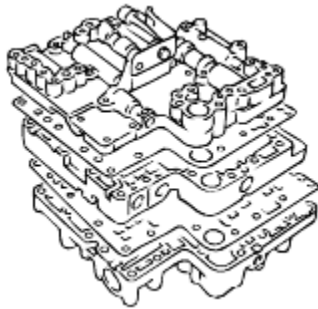
3. Install the intermediate control valve body and the separator plate B as a unit in the lower control valve body.



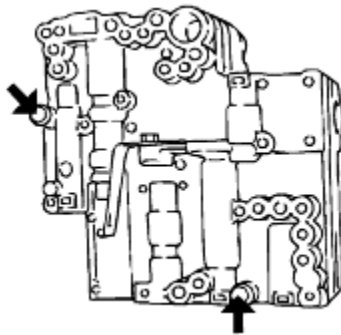
4. Apply ATF to the steel ball and the new separator plate; then install these items in the upper control valve body.



5. Install the upper control valve body and the separator plate as a unit in the upper side of the intermediate control valve body.

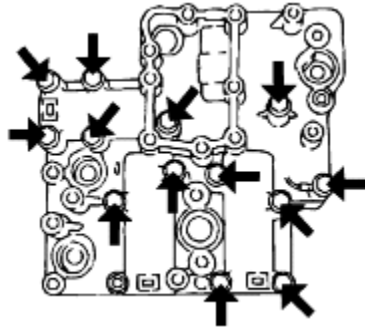


6. With the upper control valve body upward, tighten the bolt and the nut.  
Tightening torque : 8Nm (80kgf·cm)



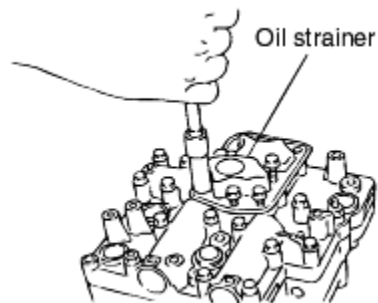
7. Tighten the bolts on the side of the lower control valve body (shown in the figure on the left) equally.

Tightening torque : 8Nm (80kgf-cm)



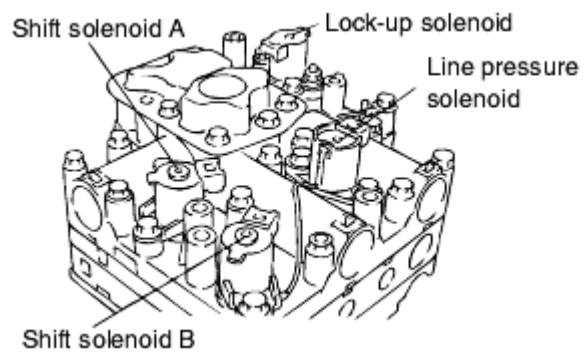
8. Install the oil strainer in the lower control valve body.

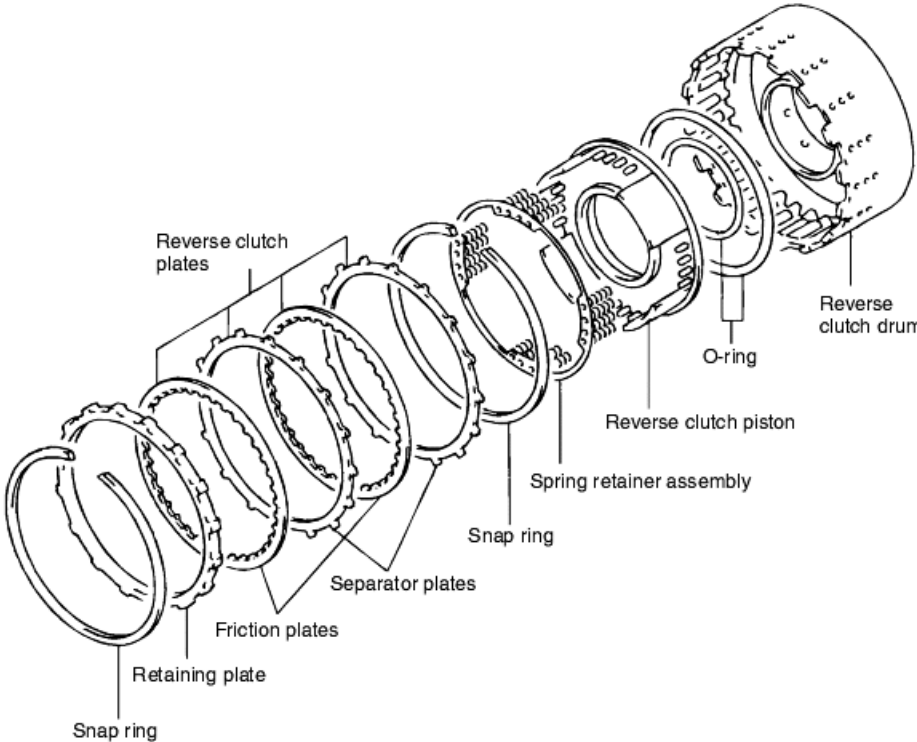
Tightening torque : 8Nm (80kgf-cm)



9. Install the shift solenoid A, the shift solenoid B, the line pressure solenoid and the lock-up solenoid in the lower control valve body.

Tightening torque : 8Nm (80kgf-cm)





## DISASSEMBLY EKTC0270

1. Using a thickness gauge, measure the clearance between the snap ring and the retaining plate.

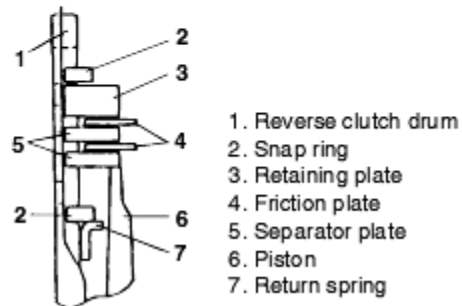
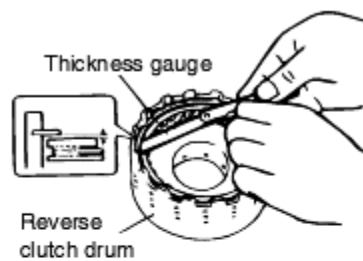
Clearance (mm)

Standard 0.5 - 0.8

Application limit 1.0

### NOTE

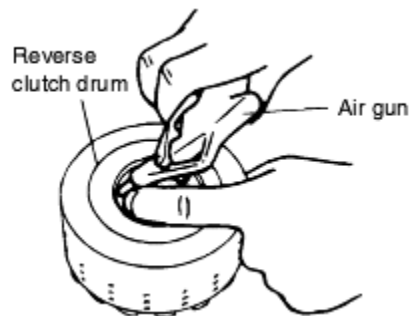
- If the application limit is exceeded, replace the friction plate and the separator plate with new ones, and select a suitable retaining plate so that the specified clearance will be obtained.
- If the clearance is less than the application limit, select a suitable retaining plate so that the clearance will fall within the desired range.



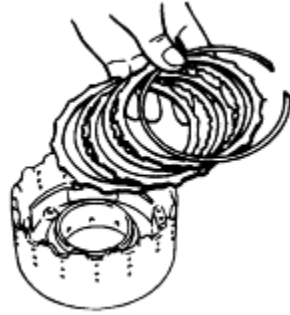
2. Blow air into the oil inlet of the reverse clutch drum, and check the functioning of the piston.

### NOTE

Close the other holes when blowing air using an air gun.



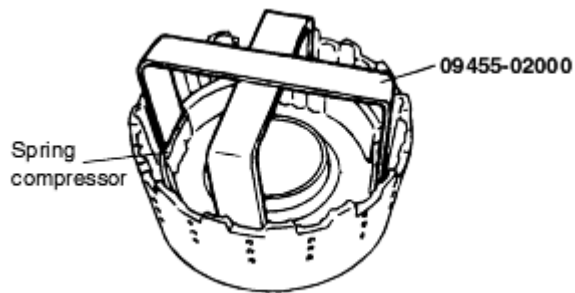
3. Remove the snap ring, then remove each plate.



4. Using the special tool (spring compressor), depress the spring retainer and remove the snap ring; then remove the return spring.

**NOTE**

**Do not apply undue stress to the retainer.**

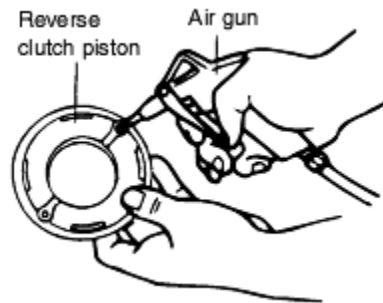


5. Blow air into the oil inlet of the reverse clutch drum to drive out the reverse clutch piston.

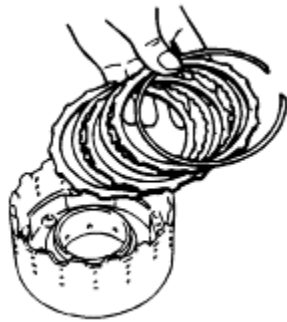


## INSPECTION EKT0280

1. Ensure that the check valve moves freely by shaking the reverse clutch piston.
2. Ensure that air does not escape when blown into the functioning side of the reverse clutch piston, nor when blown into the release side.
3. Check the seal ring for breakage or damage.



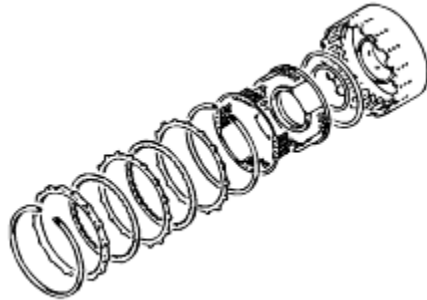
4. Check the plates for burns, damage, or distortion.
5. Check the reverse clutch drum for burns or damage.
6. Check the other components for damage or distortion.



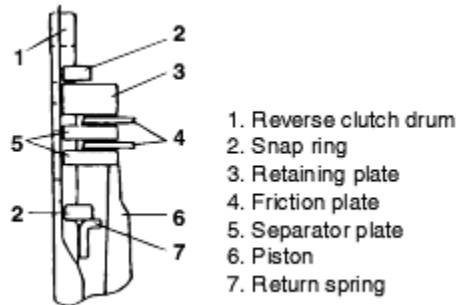
## REASSEMBLY EKTC0290

Re-assembly should be carried out following the steps for disassembly in reverse order. Caution the following during re-assembly :

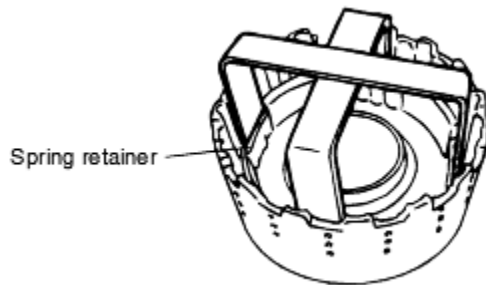
1. Replace the O-ring with a new one. Apply ATF to the new O-ring, and then install in to the reverse clutch piston.
2. Be careful not to twist or come out the O-ring when inserting the piston.

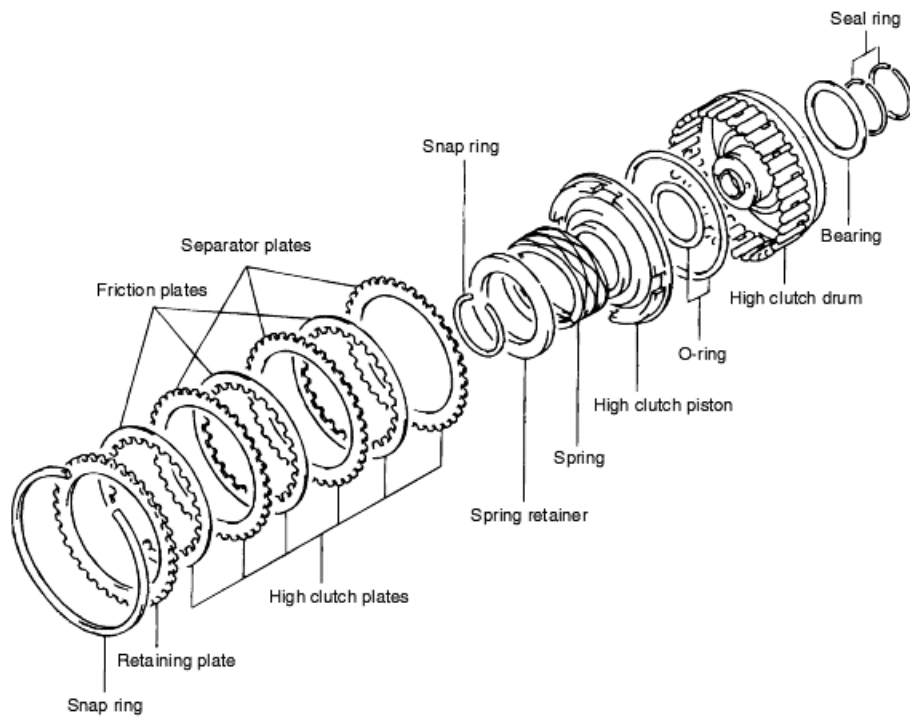


3. Be sure to assemble the components of the clutch plate in the right order.



4. Be careful not to distort the reverse clutch return spring plate when pressing into position.
5. Ensure that the snap ring fits snugly into the drum groove.
6. Ensure that the snap ring opening is not aligned with the stopper.
7. Ensure that the snap ring opening is aligned with the concave aperture.
8. Before using a new reverse clutch plate set, soak it in ATF for more than two hours.





## DISASSEMBLY EKTC0310

1. Using a thickness gauge, measure the clearance between the snap ring and the retaining plate.

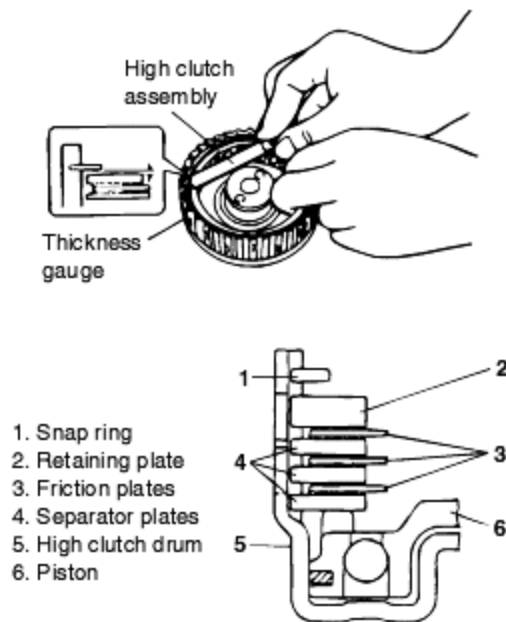
Clearance (mm)

Standard 1.8 - 2.2

Application limit 2.4

### NOTE

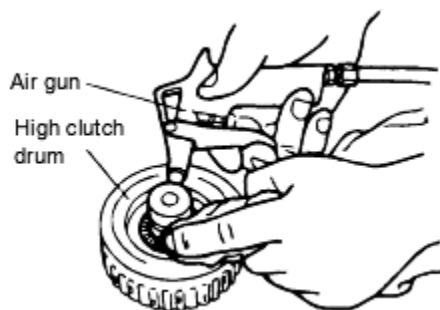
- If the application limit is exceeded, replace the friction and separator plates with new ones, and select a suitable retaining plate so that specified clearance will be obtained.
- If clearance is less than the application limit, select a suitable retaining plate so that the clearance will fall within the desired range.



2. Blow air into the oil inlet of the high clutch drum, and check the functioning of the piston.

### NOTE

Close the other holes when blowing air using an air gun.



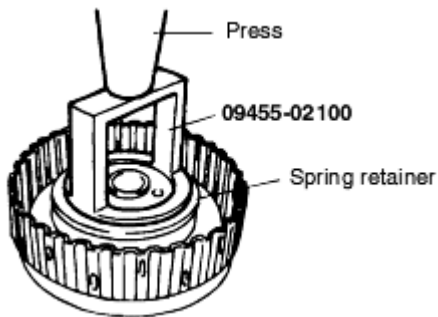
3. Remove the snap ring, then remove each plate.



4. Using the special tool (spring compressor), depress the spring retainer and remove the snap ring; then remove the return spring.

**NOTE**

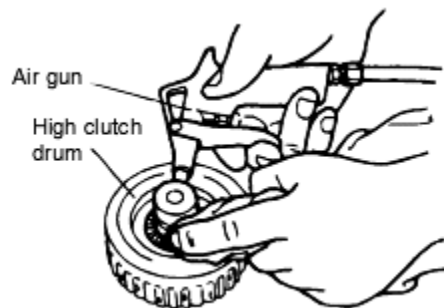
**Do not apply undue stress to the retainer.**



5. Blow air into the oil inlet of the high clutch drum to drive out the high clutch piston.

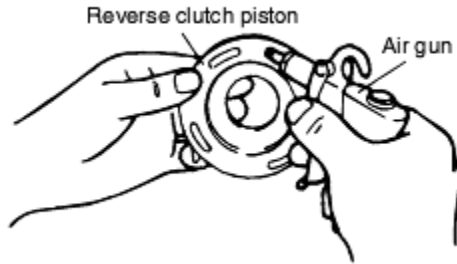
**NOTE**

- Air must be blown gradually at low pressure so as not to tilt the high clutch piston.
- If the piston is hard to remove by blowing air, pull it out using a pliers.



## INSPECTION EKT0320

1. Ensure that the check valve moves freely by shaking the reverse clutch piston.
2. Ensure that air does not escape when blown into the functioning side of the reverse clutch piston, when blown into the release side.



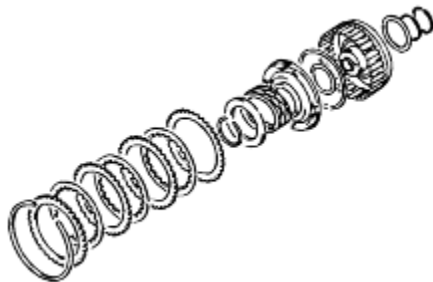
3. Check the plates for burns, damage, or distortion.
4. Check the seal ring and O-ring for breakage or damage.
5. Check the other components for damage or distortion.



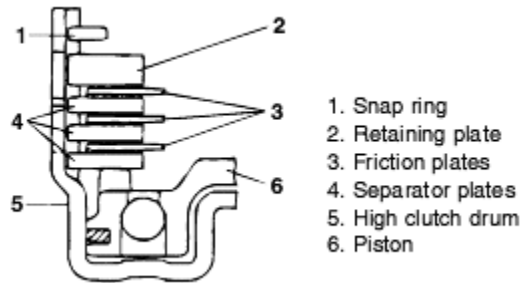
## REASSEMBLY EKT0330

Re-assembly should be carried out following the steps for disassembly in reverse order. Caution the following during re-assembly :

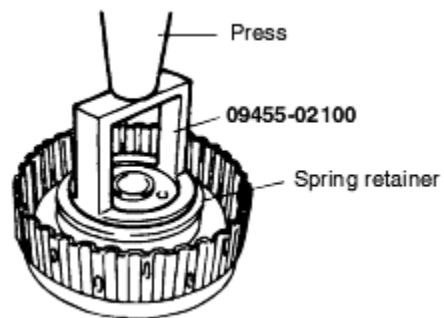
1. Replace the O-ring and the seal ring with new ones. Apply ATF to the new O-ring and seal ring; then install these in the high clutch piston.
2. Be careful not to twist or come out the O-ring when inserting the piston.

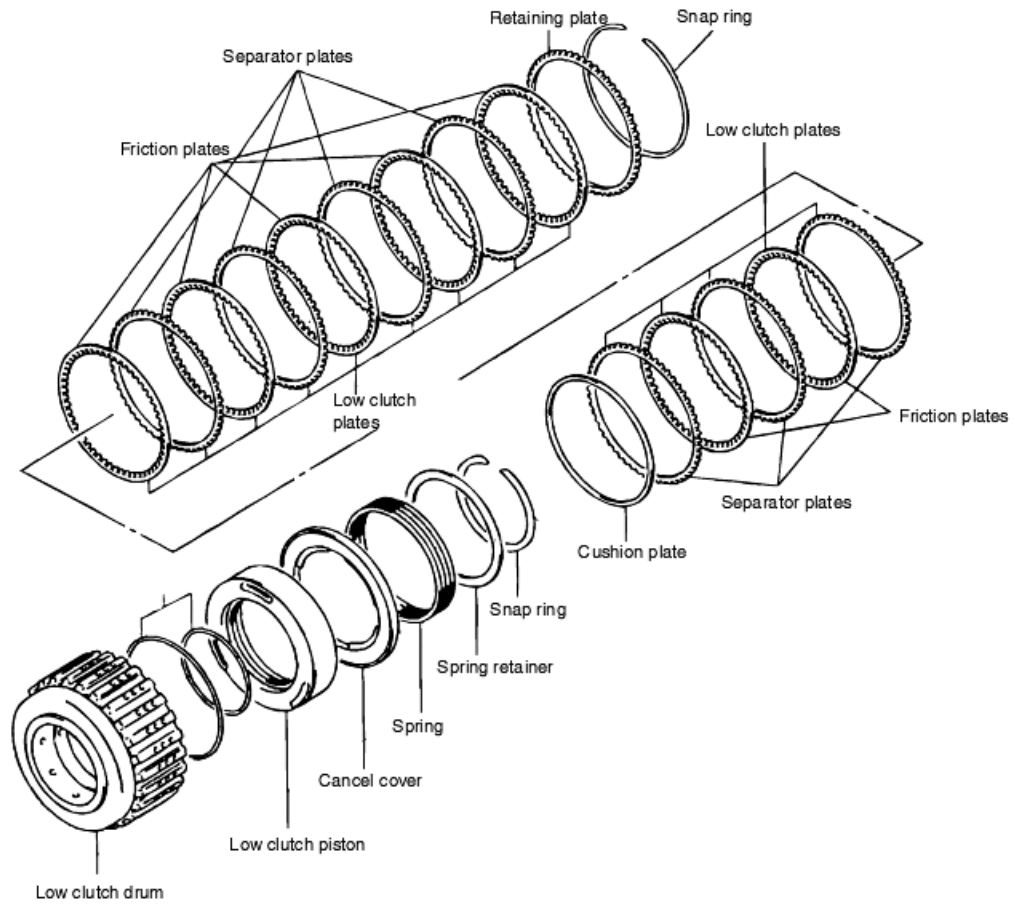


3. Be sure to assemble the high clutch plate set components in the below order.



4. Be careful not to distort the high clutch return spring plate when pressing into position.
5. Ensure that the snap ring fits snugly in the drum groove.
6. Ensure that the snap ring opening is not aligned with the stopper.
7. Ensure that the snap ring opening is aligned with the concave aperture.
8. Before using a new high clutch plate set, soak it in ATF for more than two hours.







## DISASSEMBLY EKTC0350

1. Using a thickness gauge, measure the clearance between the snap ring and the retaining plate.

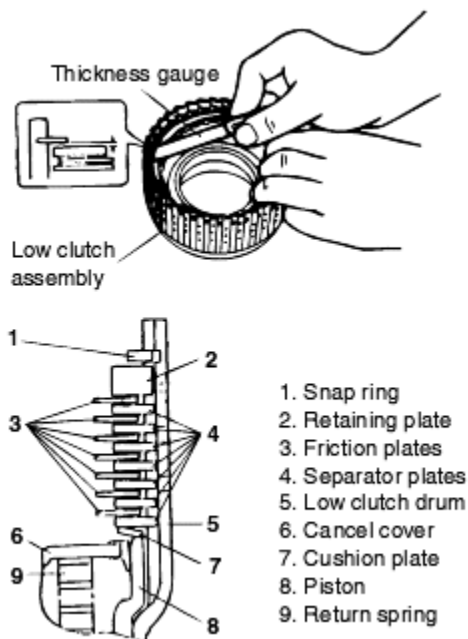
Clearance (mm)

Standard 0.8 - 1.1

Application limit 1.3

### NOTE

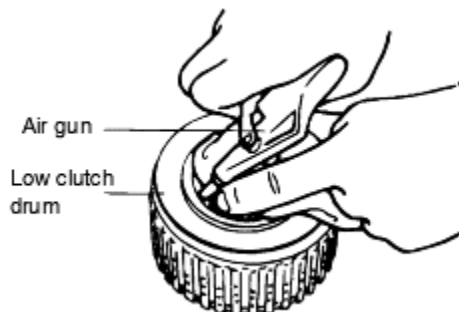
- If the application limit is exceeded, replace the friction plate and the separator plate with new ones, and select a suitable retaining plate so that specified clearance will be obtained.
- If clearance is less than the application limit, select a suitable retaining plate so that the clearance will fall within the desired range.



2. Blow air into the oil inlet of the low clutch drum, and check the functioning of the piston.

### NOTE

Close the other holes when blowing air using an air gun.



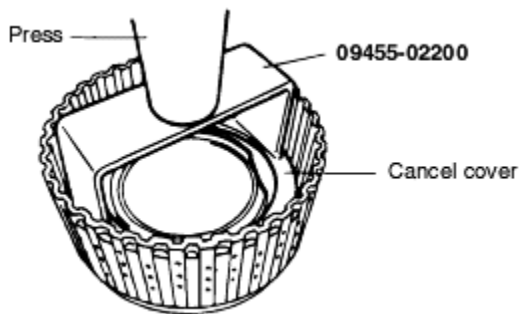
3. Remove the snap ring; then remove each plate.



4. Using the special tool (spring compressor), depress the cancel cover and remove the snap ring; then remove the cancel cover and the return spring.

**NOTE**

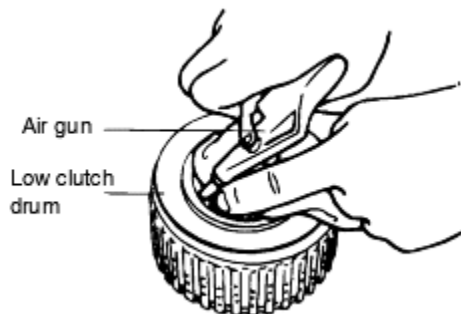
**Do not apply undue stress to the retainer.**



5. Blow air into the oil inlet of the low clutch drum to drive out the low clutch piston.

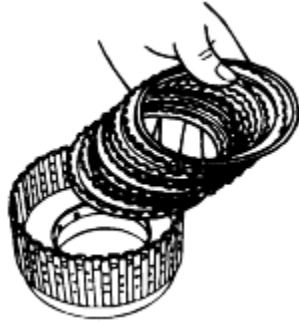
**NOTE**

- **Air must be blown gradually at low pressure so as not to tilt the low clutch piston.**
- **If the low clutch piston is hard to remove by blowing air, pull it out by using a pliers.**

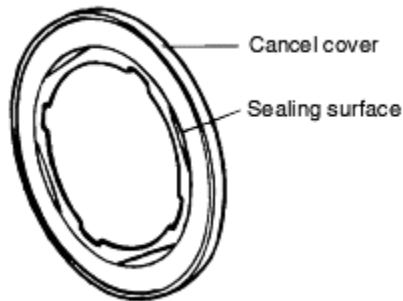


## INSPECTION EKT0360

1. Check the plates for burns, damage, or distortion.
2. Check the O-ring for breakage or damage.



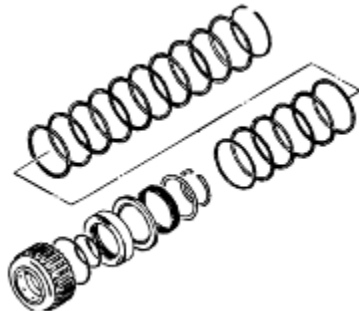
3. Check the sealing surface of the cancel cover for breakage or damage.
4. Check the other components for damage or distortion.



## REASSEMBLY EKT0370

Re-assembly should be carried out following the steps for disassembly in reverse order. Caution the following during re-assembly :

1. Replace the O-ring with a new one. Apply ATF to the new O-ring and then install it in the low clutch piston.
2. Be careful not to twist or come out the O-ring when inserting the piston.

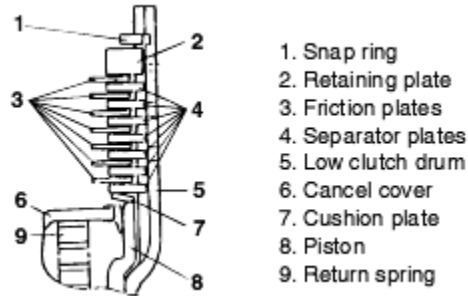


3. Assemble with the cushion plate periphery touching the low clutch.

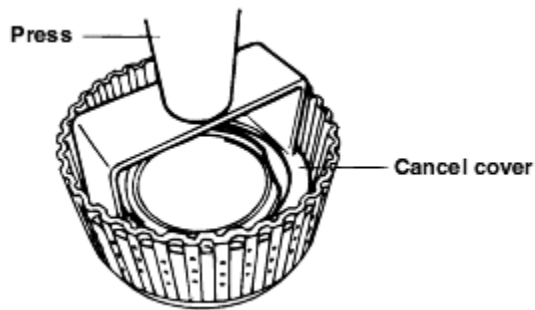
### **NOTE**

**Note the direction of the cushion plate.**

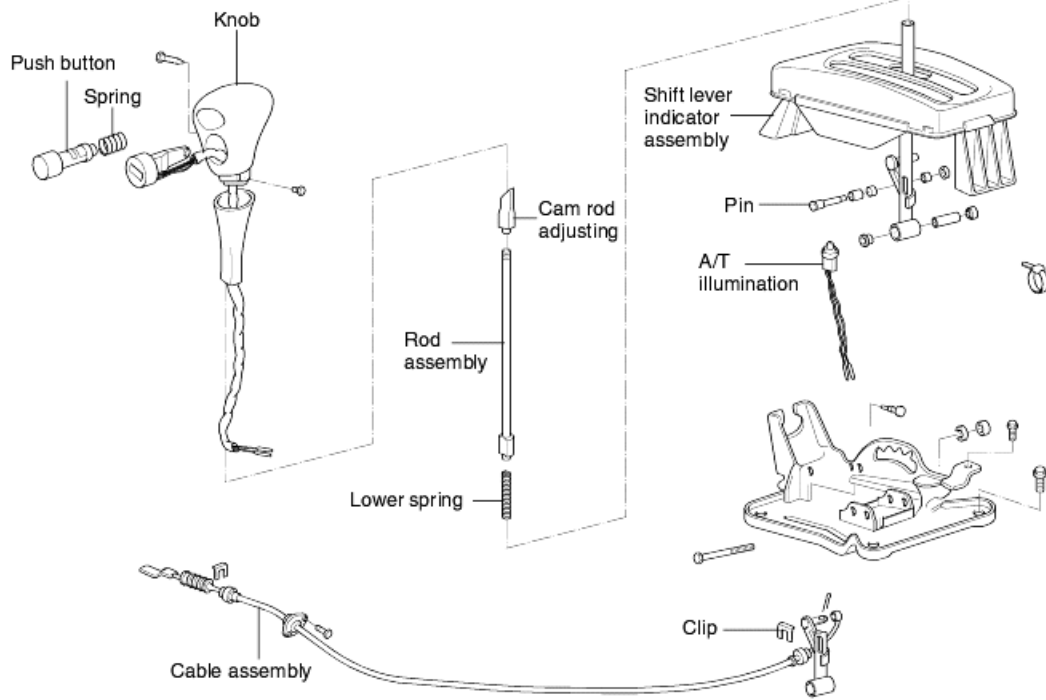
4. Be sure to assemble the low clutch plate set components in the below order.



5. Be careful not to distort the cancel cover when pressing it into position.
6. Ensure that the snap ring fits snugly in the drum groove.
7. Ensure that the snap ring opening is not aligned with the stopper.
8. Ensure that the snap ring opening is aligned with the concave aperture.
9. Before using a new low clutch plate set, soak it in ATF for more than two hours.

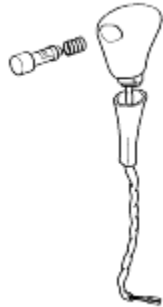


# COMPONENTS EKT0600

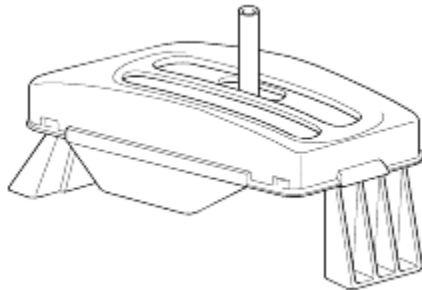


## REMOVAL EKTC0610

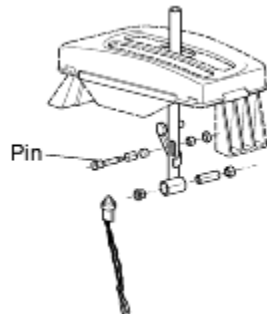
1. Remove the console box assembly. (Refer to BD group)
2. Remove the knob installation screw.
3. Disconnect the overdrive switch connector with small driver. And then remove the selector knob assembly.



4. Disconnect the position indicator light connector.
5. Remove the shift lever indicator assembly.

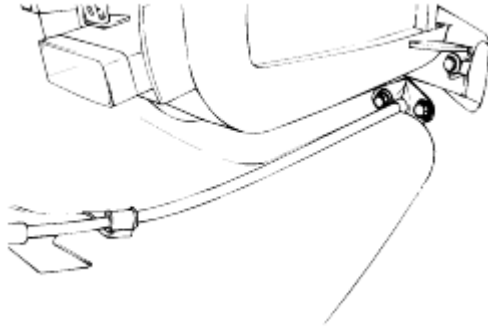


6. Remove the pin from the link.



7. Remove the clip from the shift lever side.

8. Remove the bolts located on dash panel.



9. Remove the clip from the transaxle side.
10. Remove the transaxle control cable assembly.

### **INSPECTION** EKTC0620

1. Check the control cable for function and or damage.
2. Check the bushing for wear or damage.
3. Check the spring for damage or deterioration.

## 7 Drive Shaft and Axle

### 7.1 General

#### SPECIFICATIONS EITC0100

Drive-shaft		
Joint type	M/T	A/T
Outer	B.J.	B.J.
Inner	T.J.	T.J.
Length (Joint to joint) mm (in.)		
Left	380 (14.96)	349 (13.74)
Right	593 (23.35)	623 (24.53)
Maximum permissible joint angle		
B.J.	45.3° or more	45.3° or more
T.J.	22.3° or more	22.3° or more

B.J. : Birfield joint T.J. : Tripod joint

M/T : 5 speed manual transaxle

A/T : 3 speed automatic transaxle

#### TIGHTENING TORQUE EITC0200

	Nm	Kg·cm	lb·ft
Wheel nut	90 - 110	900 - 1100	67 - 81
Drive-shaft nut	200 - 260	2000 - 2600	148 - 192
Knuckle to strut assembly	75 - 90	750 - 900	55 - 66
Lower arm ball joint to knuckle	35 - 45	350 - 450	26 - 33
Tie rod end to knuckle	16 - 34	160 - 340	12 - 25
Rear hub flange nut	180 - 220	1800 - 2200	133 - 163

#### **CAUTION**


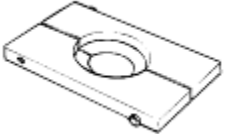
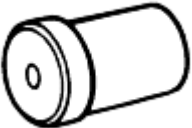

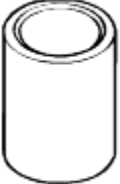


**Replace the self-locking nuts with new ones after.**



#### LUBRICATIONS EITC0300

	Recommended lubricant	Quantity
T.J.-B.J. type drive-shaft		
B.J. boot grease	CENTOPLEX 278M/136K	70 ± 6gr. (Joint : 30 ± 3gr., Boot 40 ± 3gr.)
T.J. boot grease	KLK TJ41-182 (MS511-50, KOREA KLUBER)	95 ± 6gr. (Joint : 60 ± 3gr., Boot : 35 ± 3gr.)



SPECIAL TOOLS EITC0400

Tool (Number and Name)	Illustration	Use
09495-33000 Bearing and gear puller		Removal of front wheel bearing inner race
09547-34000 Removing plate		Removal of the front hub from knuckle (Use with 09532-11301)
09495-33100 Centre bearing remover and installer		<ul style="list-style-type: none"> <li>○ Removal of the wheel bearing outer race (Use with 09517-02000)</li> <li>○ Installation of the front hub to knuckle</li> </ul>
09517-21500 Front hub remover and installer		Measurement of front wheel bearing starting torque (Use with 09532-11600)
09517-02000 Front hub remover and installer		Removal of the wheel bearing outer race from knuckle (Use with 09495-33100)
09532-11301 Hub bearing remover		Removal of the front hub from knuckle (Use with 09457-34000)
09532-11600 Pre-load socket		Measurement of front wheel bearing starting torque (Use with 09517-21500, 30mm socket and torque wrench)

09532-31200A Oil seal installer		Installation of the front bearing to knuckle
09568-34000 Ball joint remover		Separation of the lower arm ball joint

### TROUBLESHOOTING EIDA1500

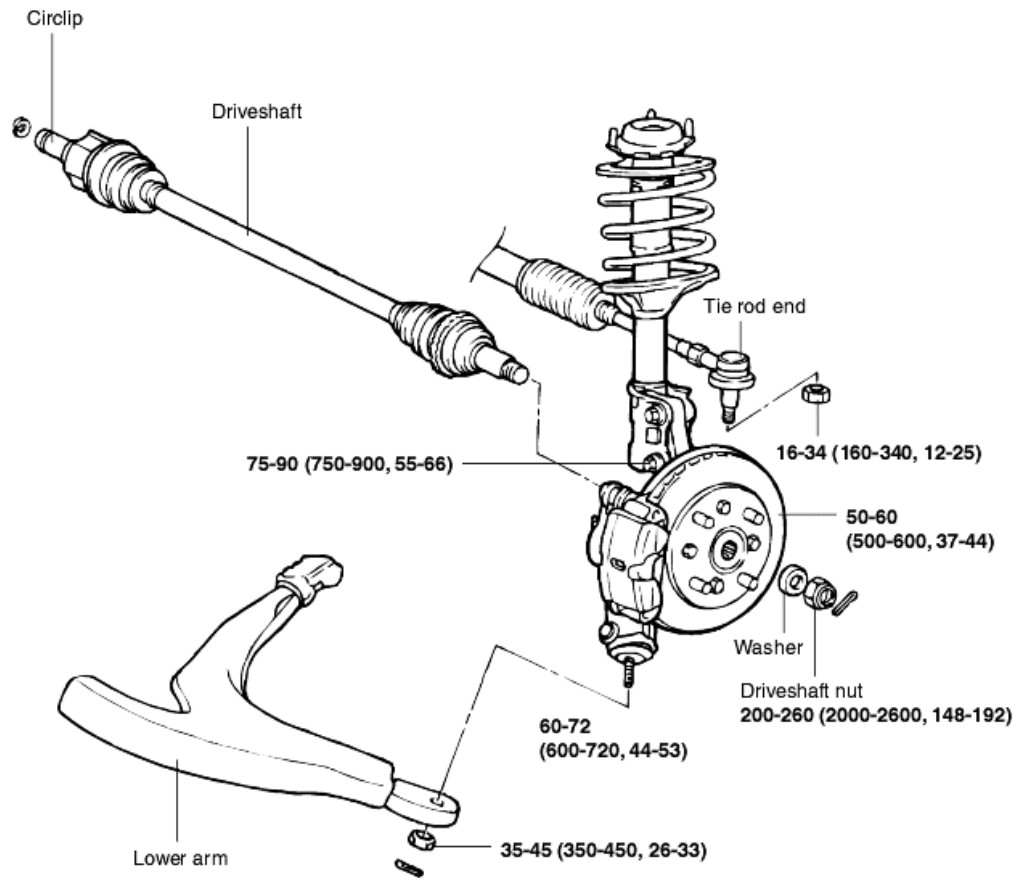
Symptom	Possible cause	Remedy
Vehicle pulls to one side	Galling of drive-shaft ball joint	Replace
	Wear, rattle or galling of wheel bearing	Replace
	Defective front suspension and steering	Adjust or replace
Vibration	Wear, damage or bending of drive-shaft	Replace
	Drive-shaft rattle and hub serration	Replace
	Wear, rattle or sintering of wheel bearing	Replace
Shimmy	Improper wheel balance	Adjust or replace
	Defective front suspension and steering	Adjust or replace
Excessive noise	Wear, damage or bending of drive-shaft	Replace
	Drive-shaft rattle and hub serration	Replace
	Drive-shaft rattle and side gear serration	Replace
	Wear, rattle or galling of wheel bearing	Replace
	Loose hub nut	Adjust or replace
	Defective front suspension and steering	Adjust or replace

## WHEEL BEARING TROUBLESHOOTING EITC0600

Symptom	Probable cause	Remedy
Bent cage	Cage damage due to improper handling or tool usage	Replace bearing
Galling	Metal smears on roller end due to overheating, lubricant problem or overloading	Replace bearing Check seals, check for proper lubrication
Cracked inner race	Race cracked due to improper fit, cocking or poor bearing seats	Replace bearing
Etching	Bearing surfaces appear gray or grayish black in color with related etching away of material usually at roller spacing	Replace bearing Check seals, check for proper lubrication
Brinelling	Surface indentations, on race surface caused by rollers either under impact loading or vibration while the bearing is not rotating	Replace bearing
Heat discoloration	Heat discoloration is dark blue resulting from overload or no lubricant (Yellow or brown color is normal)	Check seals and other parts
Fatigue spalling	Flaking of surface metal resulting from fatigue	Replace bearing Clean all related parts

## 7.2 Drive-shaft

COMPONENTS EITC0700



**TORQUE : Nm (kg-cm, lb-ft)**

## REMOVAL EITC0800

1. Lift up the vehicle and remove the tires.
2. Remove the drive-shaft nut from the front hub.
3. Drain the transaxle fluid.
4. Remove the lower arm ball joint from the lower arm.

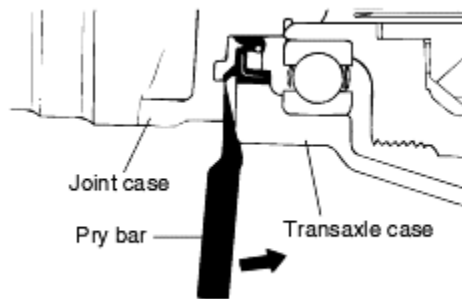
### **CAUTION**

**Be sure to tie the cord of the special tool to a nearby part.**

5. Insert a pry bar between the transaxle case and joint case, and pry the drive-shaft from the transaxle case.

### **CAUTION**

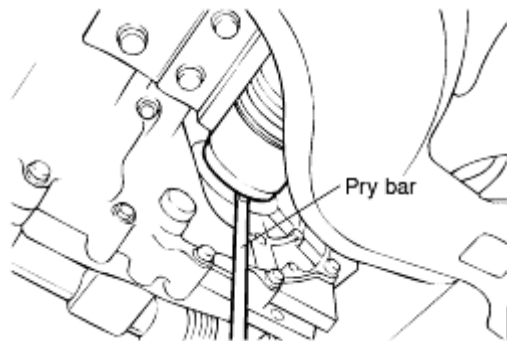
- **Be sure to apply the pry bar to the rib of the transaxle case.**
- **Do not insert the pry bar too deep, as this may cause damage to the oil seal. [Max. depth : 5 mm]**



6. Pull out the drive-shaft from the transaxle case.

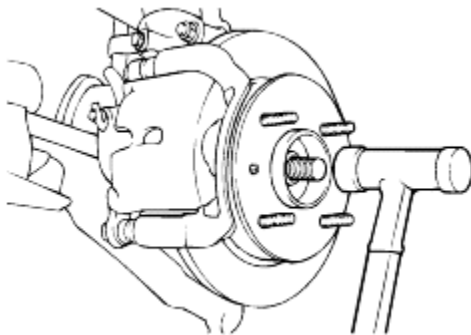
**CAUTION**

- **Place a shop towel in the hole of the transaxle case to prevent contamination.**
- **Support the drive-shaft properly.**
- **Replace the circlip each time the drive-shaft is removed from the transaxle case.**
- **For automatic transaxle equipped vehicles, insert a pry bar into the groove of the drive-shaft to remove the drive-shaft from the transaxle.**
- **Do not pull on the drive-shaft; doing so will damage the T.J.: be sure to use the pry bar.**



7. Using a plastic hammer disconnect the drive-shaft from the axle hub.

8. Push the front axle hub toward the outside of the vehicle, and separate the drive-shaft from the axle hub.



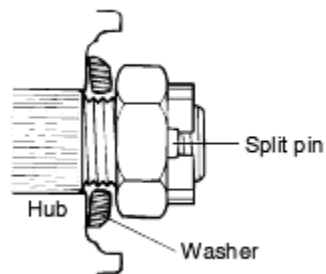
## INSPECTION EITC0900

1. Check the drive-shaft boot for damage and deterioration.
2. Check the ball joints for wear and operating condition.
3. Check the splines for wear and damage.
4. Check the dynamic damper for damage or cracking.
5. Check the T.J. case for sliding smoothly in the thrust direction.

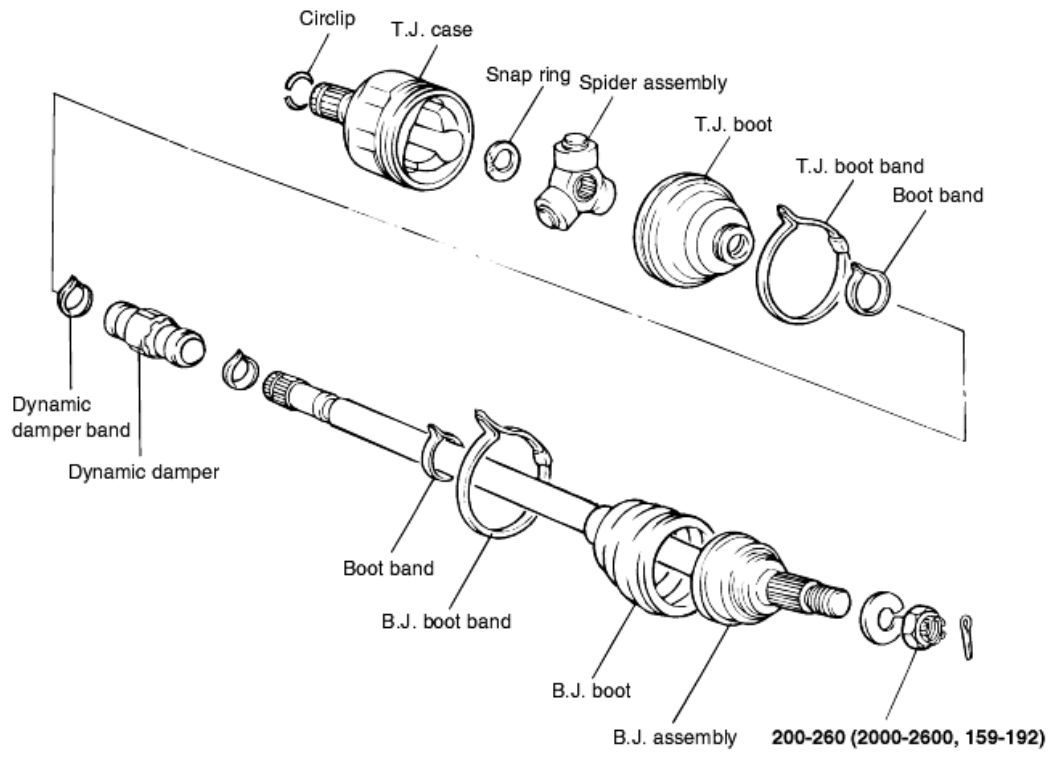


## INSTALLATION EIKB0060

1. Apply gear oil on the drive-shaft splines and differential case contacting surface.
2. Before installing the drive-shaft, set the opening side of the circlip facing downward.
3. After installation, check that the drive-shaft cannot be removed by hand.
4. Position the convex side of the washer to face outside and install the nut and split pin.
5. Replace the self-locking nuts and split pin with new ones after removal.


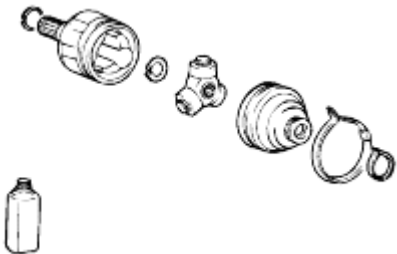

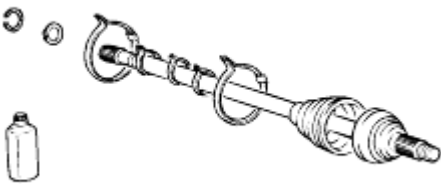



COMPONENTS EITC1100



**TORQUE : Nm (kg·cm, lb·ft)**



REPAIR KITS Kit name	Illustration	Contents
T.J boot kit		<ul style="list-style-type: none"> <li>○ Circlip</li> <li>○ Snap ring</li> <li>○ T.J. boot</li> <li>○ T.J. boot band</li> <li>○ Boot band</li> <li>○ Grease</li> </ul>
T.J. joint kit		<ul style="list-style-type: none"> <li>○ Circlip</li> <li>○ T.J. case</li> <li>○ Snap ring</li> <li>○ Spider assembly</li> <li>○ T.J. boot</li> <li>○ T.J. boot band</li> <li>○ Boot band</li> <li>○ T.J. grease</li> </ul>
B.J. boot kit		<ul style="list-style-type: none"> <li>○ Circlip</li> <li>○ Snap ring</li> <li>○ T.J. boot band</li> <li>○ B.J. boot bands</li> <li>○ Dynamic damper band (ATM only)</li> <li>○ B.J. boot band</li> <li>○ B.J. boot</li> <li>○ T.J. grease</li> <li>○ B.J. grease</li> </ul>
B.J. joint and shaft kit		<ul style="list-style-type: none"> <li>○ Circlip</li> <li>○ Snap ring</li> <li>○ T.J. boot band</li> <li>○ Boot bands</li> <li>○ Dynamic damper bands</li> </ul>

		<ul style="list-style-type: none"> <li>○ B.J. boot band</li> <li>○ B.J. boot</li> <li>○ B.J. assembly</li> <li>○ T.J. grease</li> </ul>
Damper kit		<ul style="list-style-type: none"> <li>○ Circlip</li> <li>○ Snap ring</li> <li>○ T.J. boot band</li> <li>○ Boot band</li> <li>○ Dynamic damper bands</li> <li>○ Dynamic damper</li> <li>○ T.J. grease</li> </ul>

## DISASSEMBLY EIKB0094

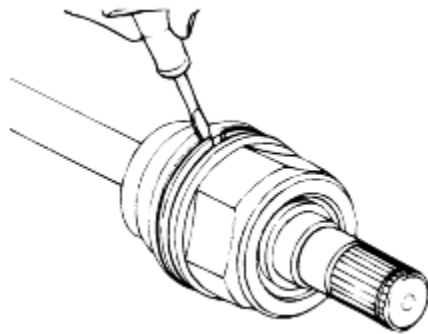
### NOTE

- Do not disassemble the B.J. assembly.
- Special grease must be applied to the drive-shaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

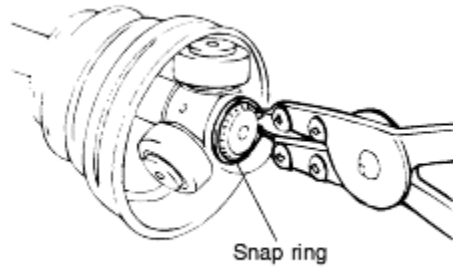
1. Remove the T.J. boot bands and pull the T.J. boot from the T.J. case.

### NOTE

Be careful not to damage the boot.



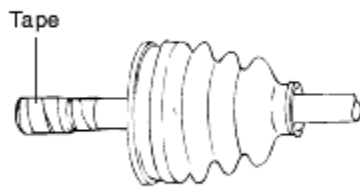
2. Remove the snap ring and spider assembly from the drive-shaft.



3. Clean the spider assembly.
4. Remove the B.J. boot bands and pull out the T.J. boot and B.J. boot.

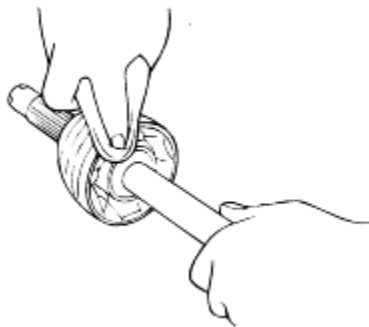
**NOTE**

**If the boot is to be reused, wrap tape around the drive-shaft splines to protect the boot.**



**INSPECTION** EIKB0097

1. Check the drive-shaft spline for wear or damage.
2. Check that there is no water or foreign material in the B.J.
3. Check the spider assembly for roller rotation, wear or corrosion.
4. Check the groove inside the T.J. case for wear or corrosion.
5. Check the dynamic damper for damage or cracks.



## REASSEMBLY EITC1400

1. Wrap tape around the drive-shaft splines (T.J. side) to prevent damage to the boots.
2. Apply grease to the drive-shaft and install the boots.

Recommended lubricant

B.J. Boot grease : Centoplex 278M/136K

T.J. Boot grease : KLKTJ41-182 (MS511-50, KOREA KLUBER)

3. To install the dynamic damper, keep the B.J. and drive-shaft in a straight line and secure the dynamic damper with the dynamic damper band in the direction illustrated.

	mm (in.)
A/T	
LH	-
RH	288.2 (11.35)

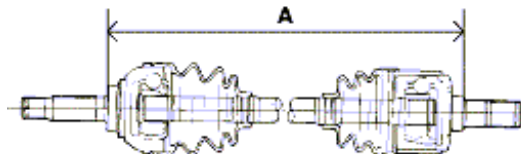


4. Apply grease into the T.J. boot and install the boot.

T.J. boot grease gr.	
Total	95 ± 6
In the joint	65 ± 3
In the boot	40 ± 3

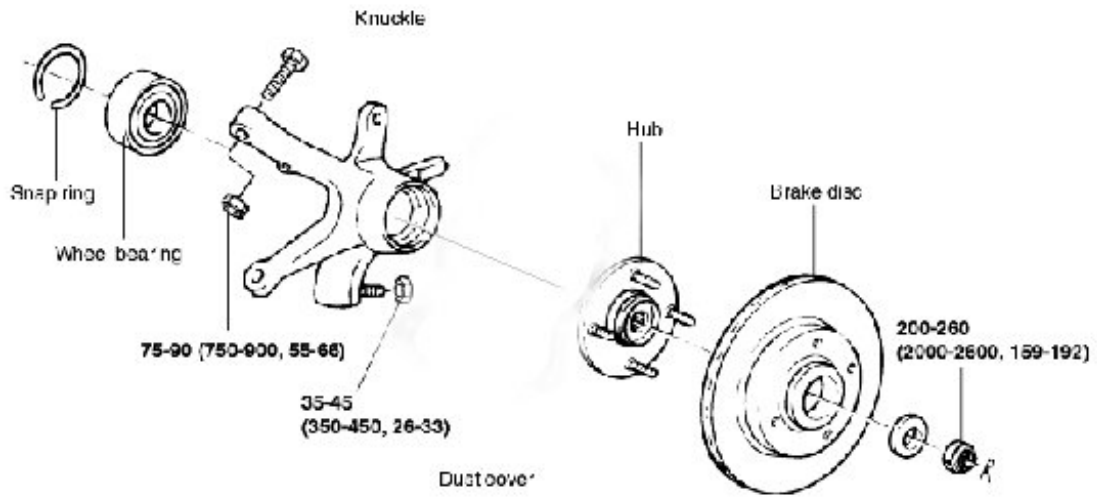
5. Tighten the T.J. boot bands.
6. Add the specified grease to the B.J. as much as was wiped away at inspection.
7. Install the boots.
8. Tighten the B.J. boot bands.
9. To control the air in the T.J. boot, keep the specified distance between the boot bands when they are tightened.

	Standard value (A)		mm (in.)
	M/T	A/T	
LH	473 ± 2	442 ± 2	
	(18.62 ± 0.08)	(17.40 ± 0.08)	
RH	686 ± 2	716 ± 2	
	(27.01 ± 0.08)	(28.19 ± 0.08)	



## 7.2 Rear Hub

COMPONENTS EITC1500



**TORQUE : Nm (kgf-cm, lb-ft)**

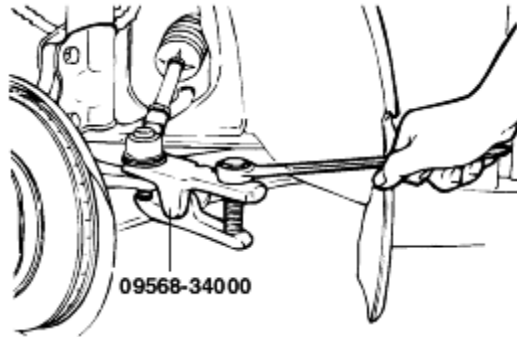
## REMOVAL EIKB0120

1. Remove the rear wheel.
2. Remove the split pin and drive-shaft nut from the rear hub.
3. Remove the rear brake assembly from the knuckle and suspend it with a wire.
4. Remove the vehicle speed sensor from the knuckle.
5. Disconnect the tie rod end ball joint from the knuckle by using the Special Tool (09568 - 34000).

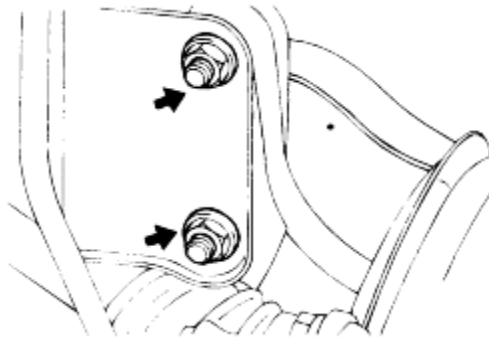
### NOTE

**Be sure to tie the special tool (09568 - 34000) to the near part with cord not to fall.**

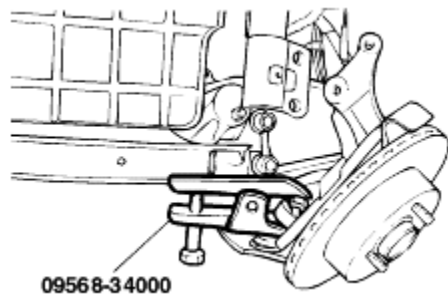
6.



7. Disconnect the strut assembly from the knuckle.



8. Disconnect the drive-shaft from the hub.
9. Disconnect the lower arm ball joint from the knuckle by using the Special Tool (09568 - 34000).



10. Remove the hub and knuckle as an assembly.

## INSTALLATION EITC0130

1. Installation is the reverse of removal.

### NOTE

- **Tighten the components below to the specified torque as follows :**

**Items**  
**Torque Nm (kg·cm, lb·ft)**

Drive-shaft nut

200-260

(2000-2600, 148-192)

Lower arm ball joint to knuckle nut

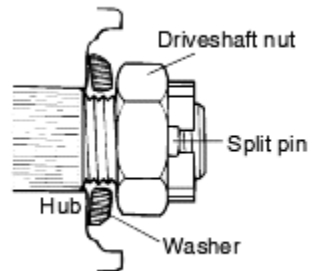
35-45 (350-450, 26-33)

Knuckle to strut assembly nut

75-90

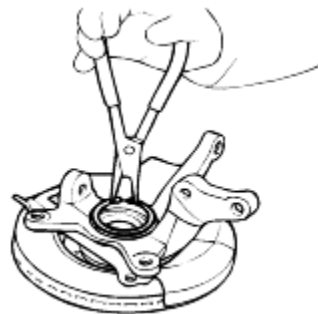
(750-900, 55-66)

- **Install the washer behind the drive-shaft nut with the convex side outward as shown in the illustration.**



## DISASSEMBLY EITC1800

1. After removing the screws (2) mounting the brake disc, remove the brake disc from the hub.
2. Remove the snap ring.

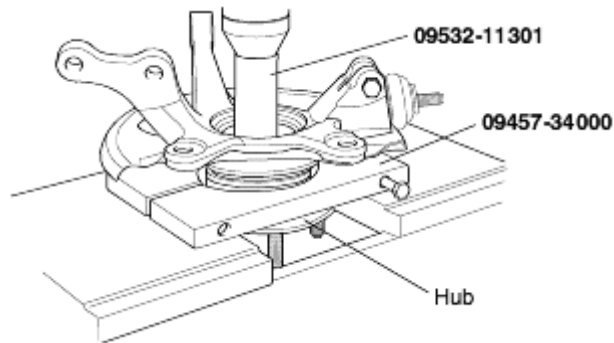


3. Remove the knuckle from the hub by using the special tools (09532-11301, 09457-34000).

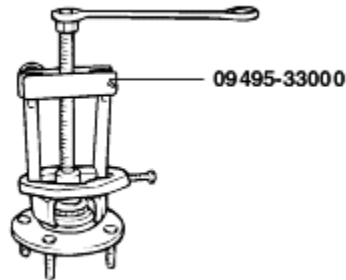
### CAUTION

- **Be sure to use the special tool.**

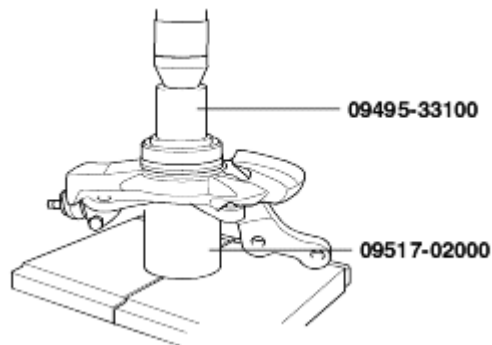
- **If the hub and knuckle are disassembled by striking with a hammer, the bearing will be damaged.**
- **When removing the hub from the knuckle, take care not to damage the hub by dropping.**



4. Remove the bearing inner race from the hub by using the Special Tool (09495-33000).



5. Using the special tools (09495-33100, 09517-02000), remove the wheel bearing outer race from the knuckle.



## INSPECTION EIKB0137

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks.



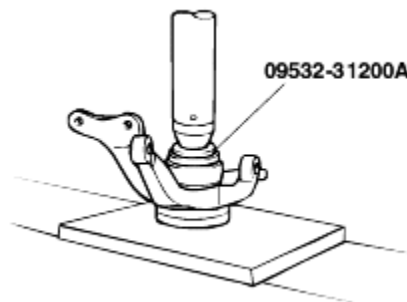
4. Check the bearing for cracks or damage.

## **REASSEMBLY** EITC2000

1. Apply multi-purpose grease to the contacting surface of the knuckle hub and bearing thinly.
2. Using the Special Tool (09532-31200A), press-in the bearing to the knuckle.

### **NOTE**

- **Press-in the outer race of the wheel bearing to prevent damage to the bearing assembly.**
- **When installing a bearing assembly, always use a new one.**

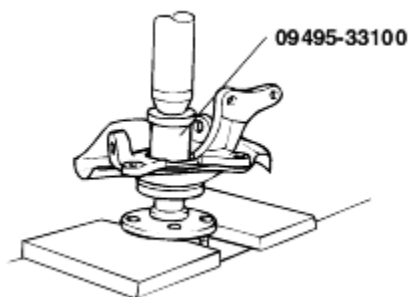


3. Install the dust cover.
4. Using the Special Tool (09495 - 33100), press-in the hub to the knuckle.

### **NOTE**

**Press-in the inner race of the wheel bearing to prevent damage to the bearing assembly.**

- 5.

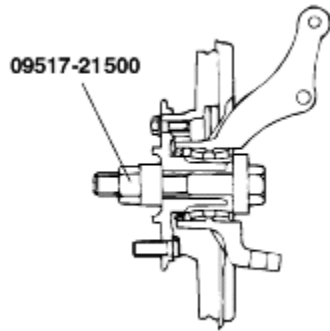


6. Install the brake disc and snap ring.

7. Tighten the hub and the knuckle to the specified torque by using the Special Tool (09517 - 21500).

**Specified torque Nm (kg·cm, ft·lb) :**

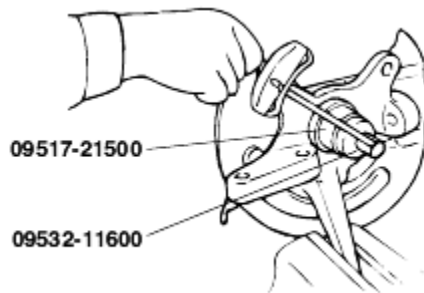
200 - 260 (2000 - 2600, 159 - 192)



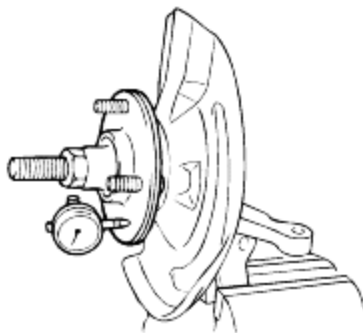
8. Rotate the hub several times to seat the bearing.
9. Measure the hub bearing starting torque.

**Hub bearing starting torque [Limit] :**

1.8 Nm (18 kg·cm, 16 lb·in) or less



10. If the starting torque is 0 Ncm (0 in.lbs.), measure the hub bearing axial play.



11. If the hub axial play exceeds the limit while the nut is tightened to 200-260 Nm (2000-2600Kg·cm, 159-192 ft·lb), the bearing, hub and knuckle are not installed correctly. Repeat the disassembly and assembly procedure.

**Hub bearing axial play [Limit] :**

0.08 mm (0.0031 in.) or less

12. Remove the Special Tool (09517 - 21500).

## 8 Suspension

### 8.1 General

#### SPECIFICATIONS EHTC0100

Rear suspension system	Macpherson strut with coil spring
Shock absorber	
Type	Hydraulic cylindrical double-acting type
Stroke mm (in.)	163.8 (6.45)
Damping force at 0.8 m/s	General suspension
Expansion N(kg)	820 ± 130 (82 ± 13)
Compression N(kg)	300 + 80 (30 + 8)
I.D. color	Green(CBS), Red(ABS)

Coil spring free height and identification color

#### SERVICE STANDARD EHTC0200

Wheel and Tire		Steel wheel
Wheel size		4.0B x 13, 5.0J x 13
Wheel runout		
Radial	mm (in.)	0.6 (0.023)
Axle	mm (in.)	1.0 (0.039)
Tire size		155 x 80 x 13R
Tire inflation pressure	Kpa(psi)	207 (30)

Wheel alignment		
Toe-in mm (in.)	Rear	+ .9906 (.039)
Camber	Rear	0°+

## TIGHTENING TORQUE EHTC0300

Items	Nm	kg-cm	lb-ft
Wheel nut	90 - 110	900 – 1100	66 - 81
Strut upper installation nut	40 - 50	400 – 500	30 - 37
Strut assembly to knuckle	75 - 90	750 – 900	55 - 66
Strut mounting self locking nut	20 - 30	200 – 300	15 - 22
Lower arm ball joint to lower arm	35 - 45	350 – 450	26 - 33
Lower arm mounting bracket to sub-frame	60 - 80	600 - 800	43 - 58
Lower arm mounting self-locking nut	95 - 120	950 - 1200	69 - 87
Lower arm shaft bolt	90 - 110	900 - 1100	66 - 81
Stabilizer link mounting nut	20 - 30	200 - 300	15 - 22
Stabilizer bar bracket mounting bolt	17 - 26	170 - 260	12 - 19
Tie rod end ball joint to knuckle	16 - 34	160 - 340	11 - 25
Lateral rod to body frame	70 - 95	700 - 950	52 - 70
Lateral rod mounting nut	20 - 30	200 - 300	15 - 22
Trailing arm mounting bolt	100 - 120	1000 - 1200	74 - 88
Rear shock absorber mounting nut	60 - 80	600 - 800	44 - 59
Brake tube flare nut	13 - 17	130 -173	10 - 12
Rear hub flange nut	180 - 220	1800 - 2200	132 - 163

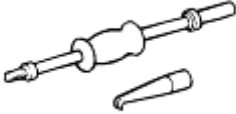
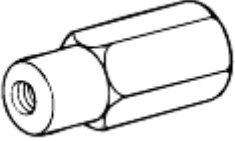
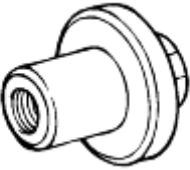
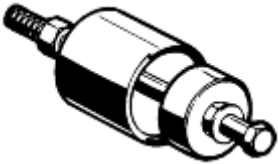




### CAUTION



Replace the self-locking nuts with new ones after removal.

## LUBRICANTS EHTC0400

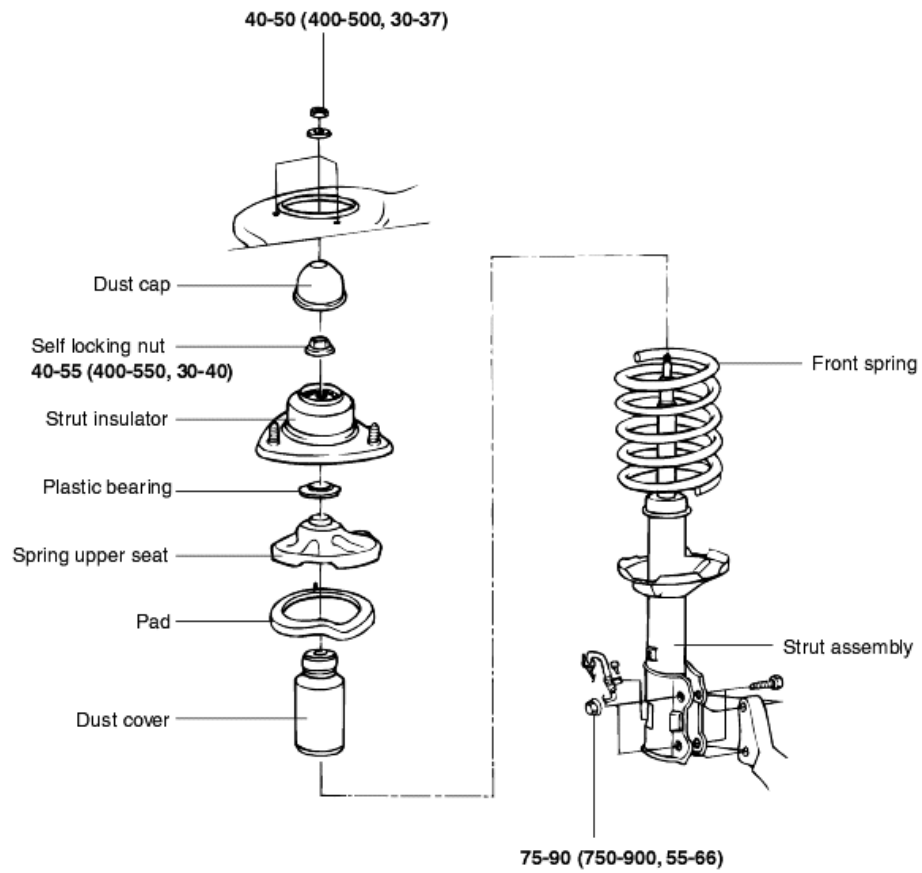
Item	Recommended lubricants	Quantity
Rear wheel bearing	SAE J310a Multi-purpose grease NLGI-2 or equivalent	As required
In ball joint of lower arm	Polylub gly 801K	As required
In insulator bearing of strut	SAE J310a, Chassis grease (NLGI No.0 or equivalent)	As required
Inside surface and lip of ball joint dust cover	Sunlight MB-2	As required

**SPECIAL TOOLS** EHTC0500

Tool (Number and Name)	Use	Illustration
09526-11100 Sliding hammer		Removal of lower arm ball joint
09526-02000 Slide hammer adapter		Removal of lower arm ball joint (Use with 09526-11100)
09529-21000 Wheel alignment gage		Front wheel alignment for aluminium type wheel
09545-02000 Lower arm bushing remover and installer		Removal and installation of lower arm bushing
09545-21100 Ball joint dust cover		Installation of ball joint and dust cover
09546-21000 Special spanner		<ol style="list-style-type: none"> <li>1. Removal and installation of the front coil spring</li> <li>2. Removal and installation of the shock absorber oil seal</li> </ol>
09565-11100 Pre-load socket		Measurement of the front lower arm ball joint starting torque (Use with torque wrench)
09568-34000 Ball joint remover		Separation of the tie rod end ball joint and lower arm ball joint

<p>A-20 Strut compressor adapter</p>		<p>Compression of front coil spring (Use with J38402)</p>
<p>J38402 Strut spring compressor</p>		<p>Compression of the front coil spring (Use with A-20)</p>

## 8.2 Rear Suspension System



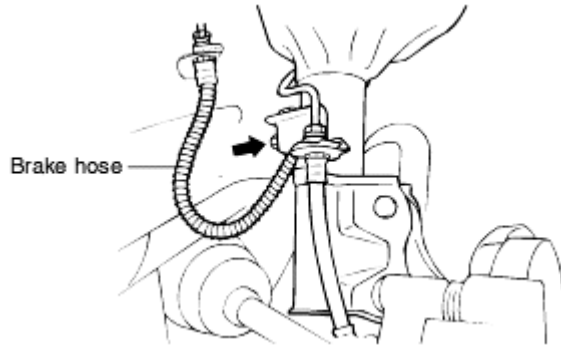
**TORQUE : Nm (kg-cm, lb-ft)**

## REMOVAL EHTC0800

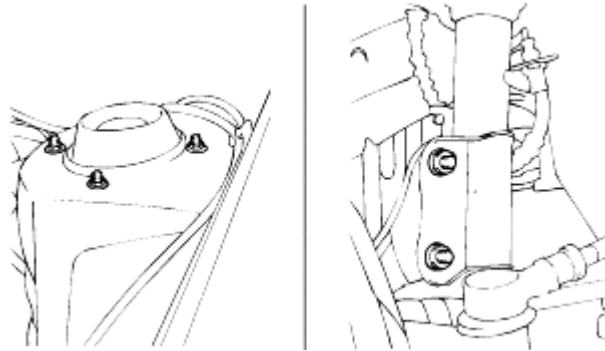
1. Remove the wheel and tire.
2. Detach the brake hose and the vehicle speed sensor from the strut assembly.

### NOTE

**Do not pry or force the components.**



3. Remove the strut assembly from the knuckle and wheel house.

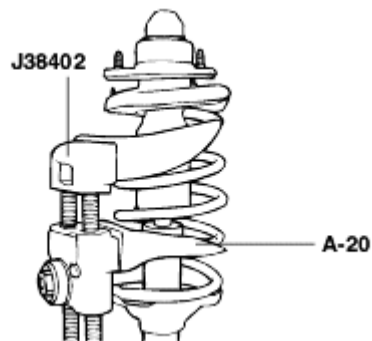


## DISASSEMBLY EHTC0900

1. Using a plastic hammer, remove the insulator dust cap.
2. Using special tools (J38402, A-20), spring compressor, compress the coil spring.

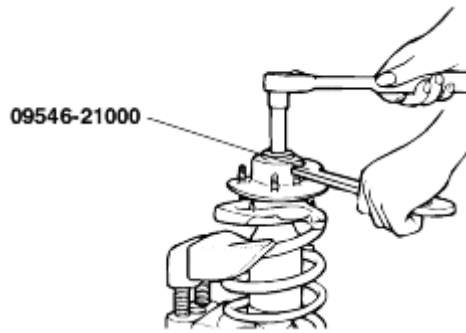
### NOTE

**Do not use the impact wrench.**





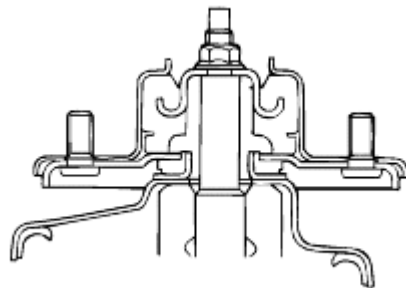
3. Holding the insulator assembly with special tool (09546-21000), loosen the nut at the top end of the shock absorber and remove the insulator.



4. Remove the spring seat, spring and rubber bumper.

### INSPECTION EHTC1000

1. Check the bearing for wear.
2. Check the rubber parts for cracks and wear.
3. Check the coil spring for sagging and weakness.

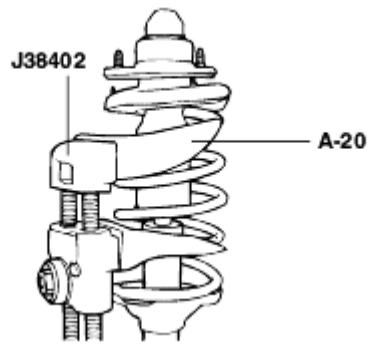


### REASSEMBLY EHTC1100

1. Install special tools (J38402, A-20), on the coil spring and compress the spring. After spring is fully compressed, install it on the strut subassembly.

#### NOTE

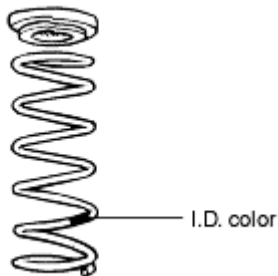
- a. **Install the coil spring with the identification color directed toward the knuckle.**



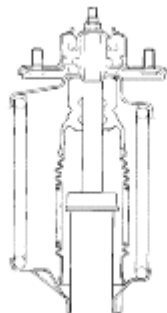
**b. Coil spring installation chart to load classification.**

LH spring		RH spring
Yellow	←→	Yellow
Red	←- - -→	Red

←→ Best combination  
 ←- - -→ Permissible combination



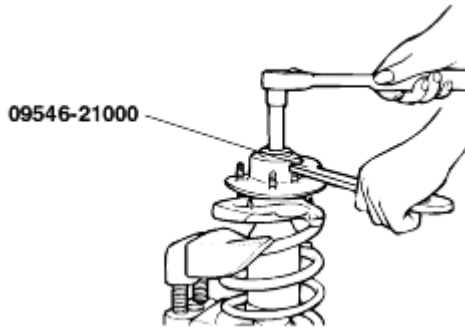
2. Install the dust cover, spring upper seat, insulator bearing, insulator assembly in that order and hand tighten the new self-locking nut.



3. After having correctly seated the upper and lower ends of the coil spring in the upper and lower spring seat grooves, loosen special tool.
4. Using special tool, hold the upper spring seat and tighten the self-locking nut to the specified torque.

**Tightening torque**

spring seat to piston rod :  
40-55 Nm (400-550 kg·cm, 30-40 lb·ft)



5. Install the insulator dust cap.

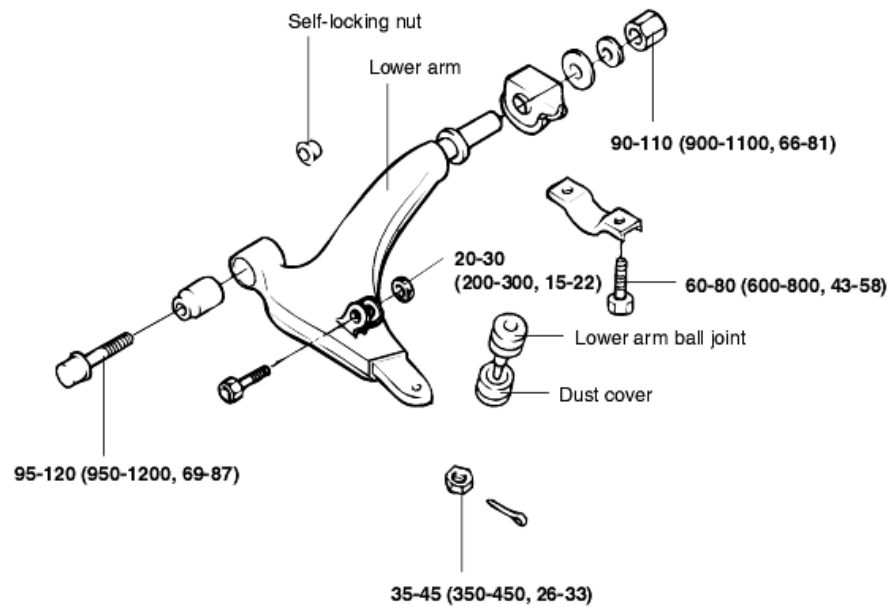
**INSTALLATION EHTC1200**

1. When installing the strut, the mating surface must be clean.
2. Tighten the following parts to the specified torque.

<b>Tightening torque</b>	<b>Nm (kg·cm, lb·ft)</b>
Strut upper installation nut	40-50 (400-500, 30-37)
Strut assembly to knuckle	75-90 (750-900, 55-66)

3. Install the brake hose and vehicle speed sensor.

## COMPONENTS EHTC1300



**TORQUE : Nm (kg-cm, lb-ft)**

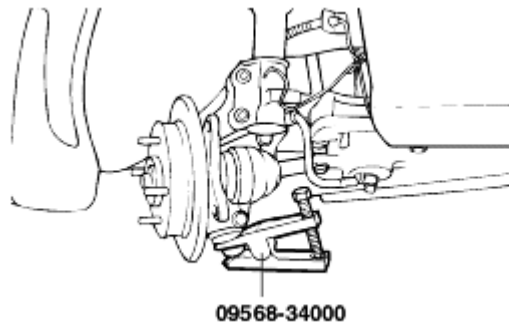
## REMOVAL EHTC1400

1. Using the special tool (06568-34000), disconnect the lower arm ball joint from the knuckle.

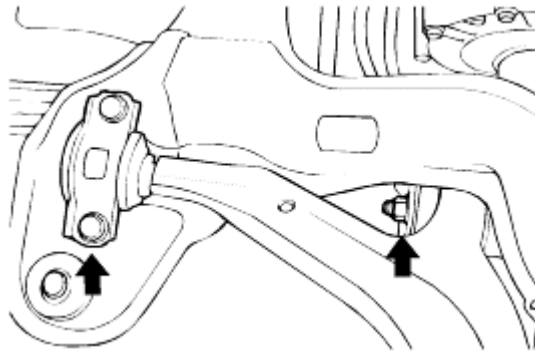
### NOTE

Be sure to tie a cord to the special tool and to a nearby part.

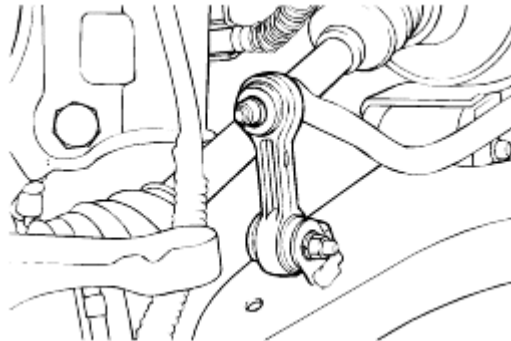
- 2.



3. Remove the lower arm mounting nut and bolt.



4. Remove the stabilizer link mounting self-locking nut, and detach the stabilizer bar from the lower arm.

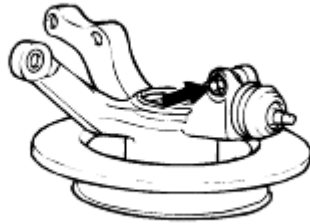


## **INSPECTION EHTC1500**

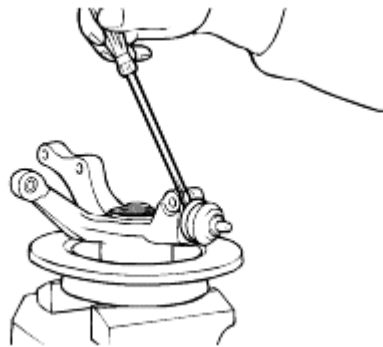
1. Check the lower arm for bend or breakage.
2. Check the clamp for deterioration or damage.
3. Check the ball joint dust cover for cracks.
4. Check all bolts for condition and straightness.

## BALL JOINT AND DUST COVER REPLACEMENT EHTC1600

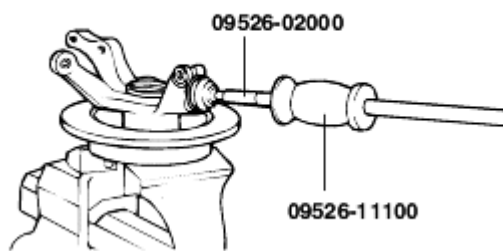
1. Remove the ball joint mounting bolt.



2. Using a screw driver, remove the dust cover.



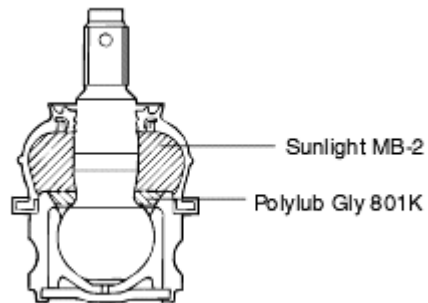
3. Using the special tool (09526-02000, 09526-11100)



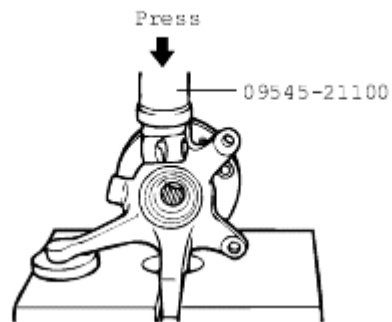
4. Apply the specified grease or equivalent in the new dust cover.

In ball joint : Polylub Gly 801K

Inside surface and lip of ball joint dust cover : Sunlight MB-2



5. Using special tool (09545-21100), install the ball joint and dust cover to the knuckle.

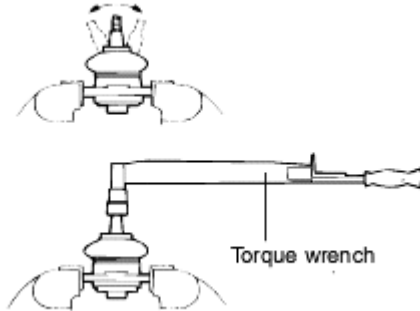




## INSPECTION OF BALL JOINT

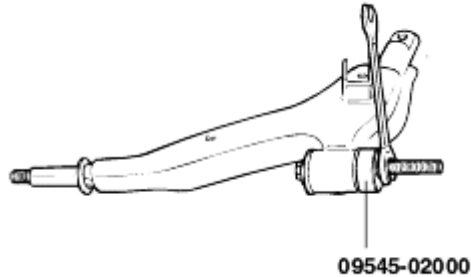
1. Remove the ball joint assembly from the knuckle.
2. Inspect the ball joint for rotation condition.  
As shown in the figure, shake the ball joint stud several times.  
Using a torque gauge, measure rotation starting torque.

Rotation condition [Standard value]	Nm (kg·cm, lb·in)
Rotation starting	1-7 (10-70, 8.8-62.0)
Rotating	1-3 (10-30, 8.8-26.6)

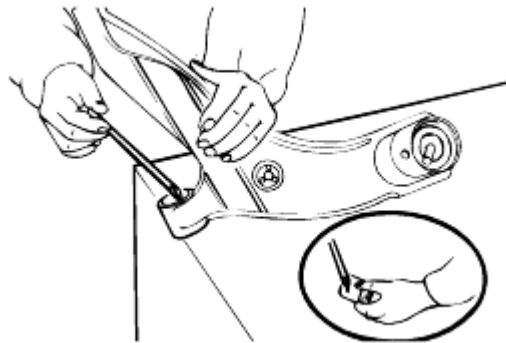


**EHTC1700**  
**LOWER ARM BUSHING (A) REPLACEMENT**

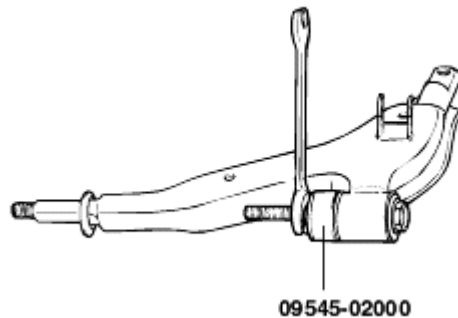
1. Install the Special Tool (09545-02000) onto the lower arm.
2. Remove the bushing.



3. Apply soap solution to the following portions.
  - Outer surface of the new bushing.
  - Inner surface of the lower arm bushing mount.
  - Inner surface of the Special Tool (09545-02000).



4. Install the new bushing onto the lower arm by using the special tool (09545-02000).



Centre the bushing by the following procedure, if necessary.

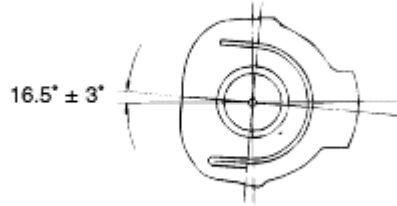
- Reset the Special Tools and lower arm.
- Centre the bushing.

**NOTE**

After centering the bushing, wipe off the soap solution.

**LOWER ARM BUSHING (B) REPLACEMENT**

After positioning the lower arm bushing (B) as indicated in the illustration, install the nut.



Lower arm shaft mounting nut :

90-110 Nm (900-1100 kg·cm, 66-80 lb·ft)

**INSTALLATION ETHC1800**

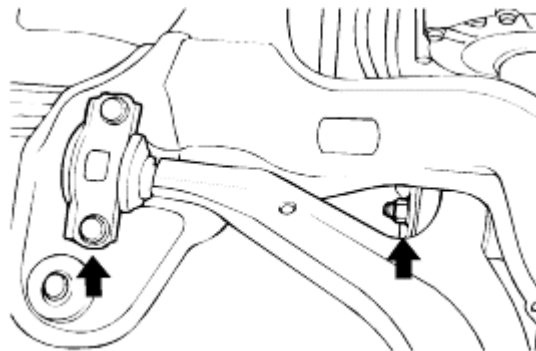
1. Install the lower arm mounting bolt and nut.

Lower arm mounting bracket to the lower arm :

60-80 Nm (600-800 kg·cm, 43-58 lb·ft)

Lower arm mounting bolt :

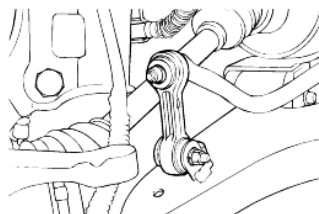
95-120 Nm (950-1200 kg·cm, 69-87 lb·ft)



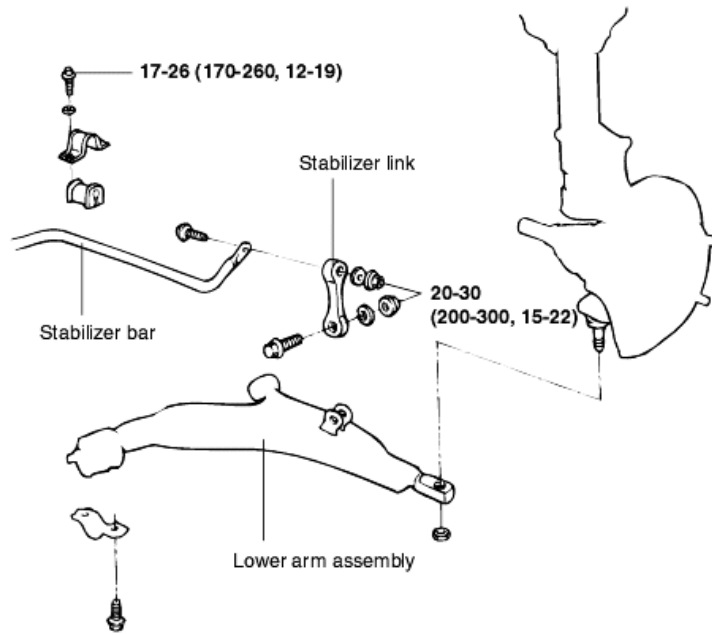
2. Install the stabilizer link mounting bolt from the front to the rear as illustrated and tighten to the specified torque.

Stabilizer link to lower arm :

20-30 Nm (200-300 kg·cm, 15-22 lb·ft)



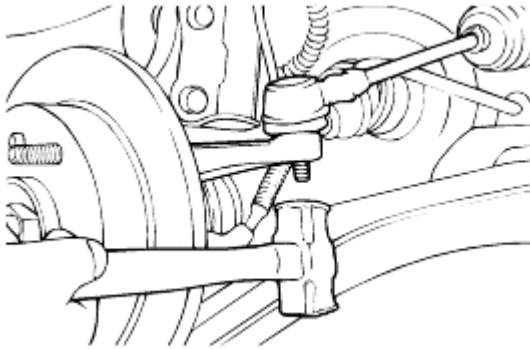
# COMPONENTS EHTC1900



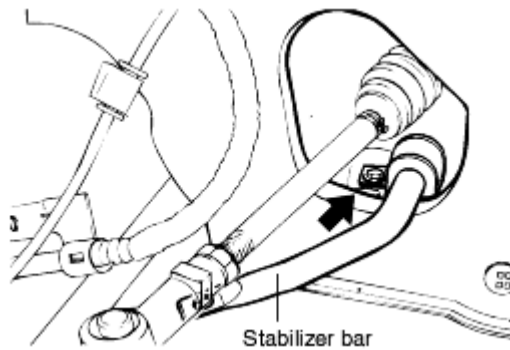
**TORQUE : Nm (kg-cm, lb-ft)**

## REMOVAL EHTC2000

1. Disconnect the tie rod end ball joint from the knuckle using a plastic hammer.



2. Remove the stabilizer link assembly.
3. Remove the upper bracket.
4. Remove the stabilizer bar through the opened access.



## INSPECTION EHTC2100

1. Check the stabilizer bar for deterioration and damage.
2. Check all bolts for condition and straightness.

## Front Wheel Bearing Service

### Front Hub assembly Removal

-See front shock removal to remove front hub assembly. Remove tire and slide calliper off of disc.



Bearing service:

1. Use front axle supports in a vice or soft jaw vice to support the hub with the axle nut up.



2. Remove the axle nut and discard ( A new nut must be used )
3. Remove axle sleeve and lift hub from the axle. NOTE- if the hub cannot be removed from the axle it may be necessary to press the axle out of the hub. Be careful not to damage the threads on the axle.
4. Pry out the seals, remove the bearings, and thoroughly clean all grease out of hub and bearings.



5. Inspect the bearings for any damage or wear. NOTE- If the bearings need to be replaced you must also replace the bearing races in the hub.
6. Repack the bearings with grease and pack the hub full of grease.
7. Clamp the axle in a vice and slide bearing onto the axle tapered side up.
8. Put the second bearing into the wheel side of the hub tapered side down.
9. Slide hub onto the axle disc side up. Hold the bearing into the hub with the axle sleeve polished side down.
10. Clean all excess grease away and install a new axle nut.



11. Torque the axle nut to 240 in/lbs while turning the hub. NOTE- it may take more then 240 in/lbs to start new threads in plastic nut once started it will tighten to proper torque.
12. Back nut off one eighth to one and a quarter turn, you may have to tap up and down in hub lightly to free up the bearings.
13. Install new seals (must be counter sunk into the hub) and new seal shields.
14. Install calliper onto disc, install front tire and reassemble on car.

### **Front Hub assembly Installation**

-See front shock removal to remove front hub assembly. Remove tire and slide calliper off of disc.

### **Front Shock Installation**

-See front shock removal to remove front hub assembly. Remove tire and slide calliper off of disc.

1. Tap small flat screwdrivers into the slots of the upper and lower fork support castings. Slide the front shock in. NOTE – The upper shoulder of the front shock must slide all the way into the upper fork support casting.

2. Remove the screwdrivers and tighten the hex head bolts to 240 in/lbs.
3. Install the front fender but do not completely tighten the 4 mounting bolts at this time.
4. Use some of the anti-seize compound to coat the lower axle supports and bottom of the front shocks before installing the front wheel and hub assembly.
5. Lower the vehicle onto the front wheel assembly. NOTE – Be sure the calliper mount is held upright and slides onto the studs on the right hand shock.
6. Install the lower axle supports and tighten to 50 ft/lbs.



7. Tap the calliper and mount down onto the axle and tighten the mount nuts to 240 in/lbs.
8. Loosen lower axle support nuts and centre axle. NOTE – Use a 0.060 in spaces between the bottom of the front calliper and ridge on the front disc, then tighten the right hand axle support nuts.
9. Attach the brake line to the calliper with new copper washers and tighten to 240 in/lbs, then bleed front brake.
10. Stand on the front bumper, with the front fender and left hand axle support nuts loose, and bounce 3 or 4 times to prevent the front shocks front binding.
11. Tighten the front fender bolts in a criss-cross to 240 in/lbs.

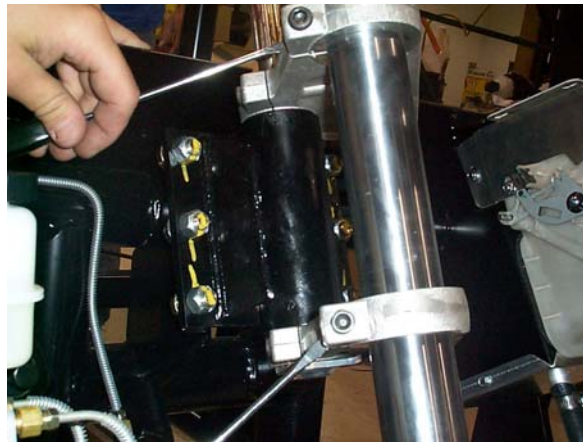




12. Tighten the left-hand axle support nuts and torque to 50 ft/lbs.
13. Road test the vehicle.

### Front Shock Removal

1. Set the park brake and remove the front hood.
2. Block the front end of the car so the front wheel is at least 6 inches from the floor.
3. Loosen the front calliper mounts and front shock nuts.
4. Remove and secure the front brake line from the calliper.
5. Remove the lower axle supports, and then roll out the front tire, hub and calliper assembly.
6. Remove the front fender.
7. Loosen the 4 hex head bolts securing the front shocks to the fork support assembly.
8. Tap small flat screwdrivers into the slots of the upper and lower fork support castings and remove the front shocks. NOTE – It may be necessary to raise the front of the vehicle higher to remove the front shocks.



### TIGHTENING TORQUE EPTC0200

Item	Nm	Kg·cm	lb·ft
Steering column and shaft to body	13-18	130-180	10-13
Steering shaft and joint	15-20	150-200	11-15
Pinion gear and joint	15-20	150-200	11-15
Steering wheel to steering shaft	35-45	350-450	26-33
Gear box to sub frame	60-80	600-800	44-59
Tie rod lock nut	50-55	500-550	37-41
Tie rod ball joint to knuckle arm	16-34	160-340	12-25
Power steering reservoir mounting bolt	9-14	90-140	7-10
Oil pump mounting bolt	20-55	200-550	15-41
Oil pump adjusting bolt	25-33	250-330	18-24
Oil hose to gear box	12-18	120-180	9-13

**LUBRICANTS EPTC0300**

<b>Items</b>	<b>Recommended lubricant</b>	<b>Quantity</b>
Horn contact ring of steering wheel	LONG TIME PD2 (OPTIMOL, GERMAN)	1.5g
Bearing of steering shaft	ALVANIA #2 OR #3 (KEUK DONG SHELL, KOREA)	As required
Ball joint of tie rod end	VALIANT R-2 (SHOSEK I, JAPAN)	As required
Steering gear housing	ONE-LUBER RP (KYODOYUSHI, JAPAN)	As required
Inner ball joint of gear box	LONG TIME PD2 (OPTIMOL, GERMAN)	As required
Contact area of gear box bellows & tie rod	SILICON GREASE	As required
Power steering fluid	PSF-3	0.9 litre (0.95 qts.)

## 8.2 Service Adjustment Procedures: Rear Wheel Alignment

When using a wheel alignment tester to inspect wheel alignment, always position the car on a level surface and the front wheels in the straight-ahead position. Prior to inspection make sure that the suspension is in normal operating condition, wheels and tires are free of deflection, and tires are inflated to specification.

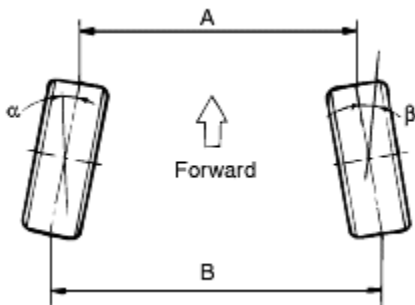
### TOE-IN

Toe-in (B-A or angle  $\alpha+\beta$ ) is adjusted by turning the tie rod turn-buckles. Turning the tie rod toward the rear of the car can reduce toe in on the left rear wheel. Toe change is achieved by turning the tie rod for the right and left wheels simultaneously the same amount as follows:

Toe-in (B-A) mm (in.): +5~-1 (+0.197~-0.039)

Toe-in ( $\alpha+\beta$ ): 31'30"~6'30"

Description		Toe changes (deg)
No. of turns of tie rod (Same amount for right and left)	1/2	Approx. 3.5 mm (22')
	1	Approx. 7mm (44')



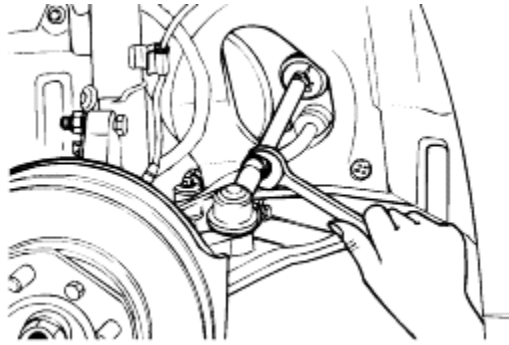
### 9 NOTE

1. Turning the right and left tie rods the same amount should make toe-in adjustment.
2. When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.
3. After the adjustment, firmly tighten the tie rod end lock nuts and reinstall the bellows clip.

### Tightening torque

Tie rod end lock nuts:

50-55 Nm (500-550 kg·cm, 36-40 lb·ft)



### ***CAMBER***

The knuckle, which is integral with the strut assembly, is pre-adjusted to the specified camber at the factory and requires no adjustment.

---

#### **Standard value**

Camber

General suspension:  $32' \pm 30'$

High suspension:  $34' \pm 30'$

---

### ***CASTER***

Caster is pre-set at the factory and cannot be adjusted. If caster is not within standard value, replace the bent or damaged parts.

---

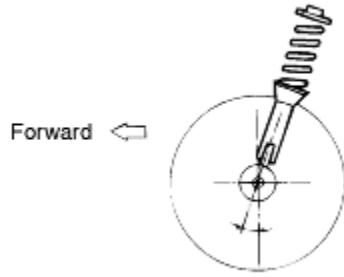
#### **Standard value**

Caster

General suspension:  $2^{\circ}29' \pm 30'$

High suspension:  $2^{\circ}26' \pm 30'$

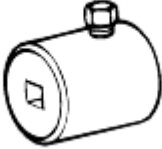

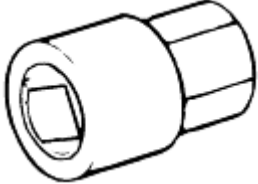
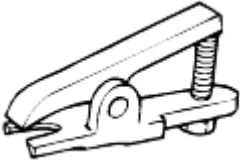
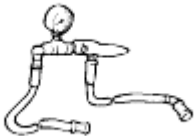


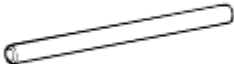
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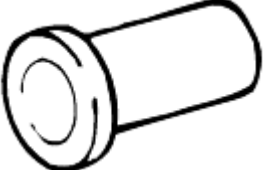
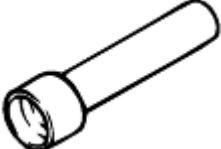
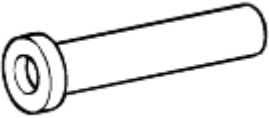


**NOTE**

1. The rear suspension assembly must be free of worn, loose or damaged parts prior to measuring front wheel alignment.
2. Camber and caster are pre-set at the factory and cannot be adjusted.
3. If camber and caster are not within specifications, replace bent or damaged parts.

**SPECIAL TOOLS** EPTC0400

Tool (Number and Name)	Illustration	Use
09565-11100 Pre-load socket		Measurement of the main shaft pre-load
09565-21000 Pinion bearing remover and installer		Removal and installation of the pinion bearing
09565-21100 Torque wrench socket		Removal, installation and adjustment of the steering gear yoke plug
09568-31000 Tie rod end puller		Separation of the tie rod end ball joint
09572-21000 Oil pressure gauge (Power steering only)		Measurement of the oil pressure (use with 09572-21100, 09572-21200)
09572-21100 Oil pressure gauge adapter (Power steering only)		Measurement of the oil pressure (use with 09572-21000, 09572-21200)
09572-21200 Oil pressure gauge adapter (Power steering only)		Measurement of the oil pressure (use with 09572-21000, 09572-21100)
09517-21400 Drift (Power steering only)		Removal ball bearing and gear housing

<p>09573-21200 Oil seal guide (Power steering only)</p>		<ul style="list-style-type: none"> <li>○ Removal of the oil seal from gear housing</li> <li>○ Installation of the oil seal to gear housing</li> </ul>
<p>09555-21000 Bar (Power steering only)</p>		<ul style="list-style-type: none"> <li>○ Removal of the oil seal from gear housing</li> <li>○ Installation of the oil seal to gear housing</li> </ul>
<p>09573-21000 Oil seal installer gauge (Power steering only)</p>		<p>Installation of the oil seal</p>
<p>09431-21600 Bearing installer (Power steering only)</p>		<ul style="list-style-type: none"> <li>○ Installation of the needle bearing to gear housing</li> <li>○ Installation of ball bearing and oil seal to valve body</li> </ul>
<p>09222-21100 Valve stem oil seal installer (Power steering only)</p>		<p>Installation of the ball bearing to gear housing</p>
<p>09434-14200 Counter shaft bearing installer (Power steering only)</p>		<p>Installation of the oil seal to rack bushing and valve body</p>

## TROUBLESHOOTING EPTC0500

Manual steering Symptom	Possible cause	Remedy
Excessive play in steering wheel	Loose rack support cover	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie-rod end stud	Retighten or replace as necessary
Steering wheel operation is hard	Excessive turning resistance of tie-rod ball joint	Replace
	Excessively tightened rack support cover	Adjust
	Rough turning of inner tie-rod and/or ball joint	Lubricate or replace ball joint
	Distorted rack	Replace
	Worn steering shaft joint	Replace
	Damaged pinion bearing	Replace
Steering wheel does not return properly	Excessive turning resistance of tie-rod ball joint	Replace
	Excessively tightened rack support cover	Adjust
	Rough turning of inner tie-rod and/or ball joint	Replace
	Worn steering shaft joint	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace



## TROUBLESHOOTING EPTC0600

POWER STEERING Symptom	Possible cause	Remedy	
Excessive play of steering wheel	Loose rack support cover	Retighten	
	Loose steering gear mounting bolts	Retighten	
	Loose or worn tie-rod end stud	Retighten or replace as necessary	
Steering wheel operation is heavy (Insufficient power assist)	V-belt slippage	Check	
	Damaged V-belt	Replace	
	Low fluid level	Replenish	
	Air in the fluid	Bleed air	
	Twisted or damaged hoses	Correct the routing or replace	
	Insufficient oil pump pressure	Repair or replace the oil pump	
	Sticky flow control valve	Replace	
	Excessive internal oil pump leakage	Replace damaged parts	
	Excessive oil leaks from rack and pinion in gear box	Replace damaged parts	
The steering wheel does not return properly	Distorted or damaged gear box or valve	Replace	
	Excessive turning resistance of tie-rod end	Replace	
	Excessively tightened rack support cover	Adjust	
	Rough turning or inner tie-rod and/or ball joint	Replace	
	Loose mounting of gear box to sub frame	Retighten	
	Worn steering shaft	Correct or replace	
	Distorted rack	Replace	
	Damaged pinion bearing	Replace	
	Twisted or damaged hoses	Re-route or replace	
Noise	Damaged oil pressure control valve	Replace	
	Damaged oil pump pressure shaft bearing	Replace	
	<p><b>Hissing Noise in Steering Gear</b></p> <p>There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned with the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied.</p> <p>There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and replacement is not always a cure for noise.</p>		
	Rattling or chucking noise in rack and pinion	Interference with hoses from vehicle body	Re-route
		Loose gear box bracket	Retighten
		Loose tie-rod end and/or ball joint	Retighten
		Worn tie-rod end and/or ball joint	Replace
	Noise in the oil pump	Low fluid level	Replenish
		Air in the fluid	Bleed air
		Loose pump mounting bolts	Retighten

### NOTE

A slight "grinding noise" may be heard immediately after the engine is started in extremely cold weather conditions (below -20°C): This is due to power steering fluid characteristics in extreme cold conditions and is not an indication of malfunction.

## 9 Manual Steering System

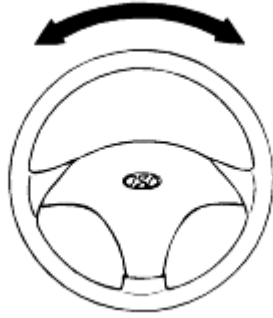
### SERVICE ADJUSTMENT PROCEDURE EPTC0700

#### CHECKING STEERING WHEEL FREE PLAY

1. Place the steering wheel in the straight-ahead position.
2. Measure the steering wheel free play by turning the steering wheel left and right.

**Limit**

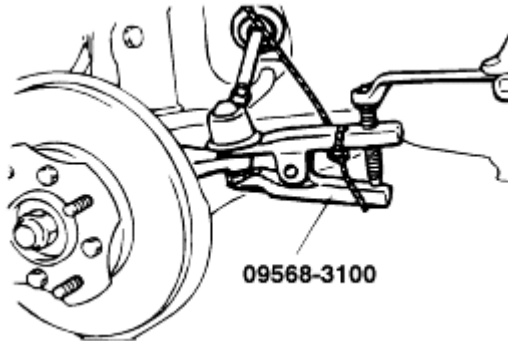
Steering wheel free play : 0-30 mm



3. If the play exceeds the limit, inspect the connection between the steering shaft and steering linkage and then repair or replace as necessary.
4. If the free play is within the limit, remove the steering gear box and then check the starting torque.

#### CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE EPTC0850

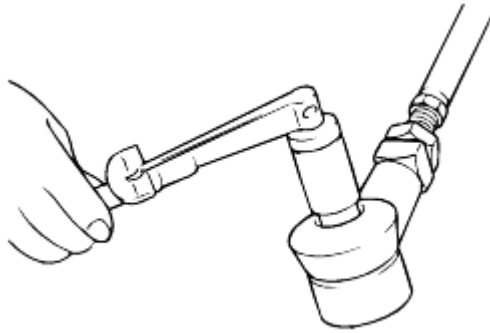
1. Disconnect the tie rod knuckle using the special tool.



2. After shaking the ball joint stud several times, mount the nuts on the ball joint, and then measure the ball joint starting torque.

**Limit**

Tie rod end ball joint starting torque:  
0.5-2.5 Nm (5-25 kg·cm, 0.36-1.78 lb·ft.)



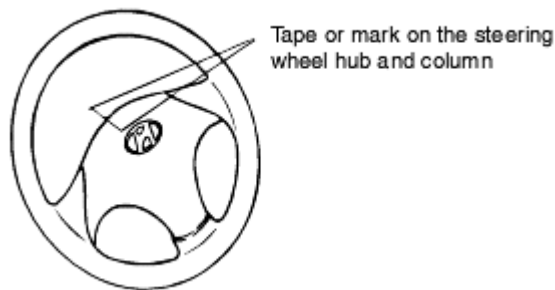
3. If the starting torque exceeds the upper limit replace the tie rod end.
4. Even if the starting torque is below the lower limit check the play of the ball joint and installation condition.

## **SIMPLIFIED STEERING WHEEL CENTERING EPTC0900**

### **DETERMINING STEERING WHEEL'S OFF CENTRE**

For the road test, take along chalk or tape and a ruler.

1. Drive straight ahead on an unencumbered level surface.
2. When the vehicle's wheels are pointing straight ahead, mark the steering wheel hub and column cover with a chalk or tape line.



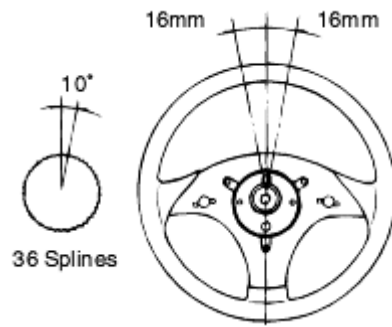
3. Stop the vehicle and line up the marks on the hub and column cover.
4. Place a tape strip or mark on the steering wheel rim.
5. Hold a ruler next to the rim as shown in the illustration, and then steer the steering wheel until it is in the desired centered position.
6. Record the distance the strip or mark on the rim has moved. This is how far the steering wheel is off Centre. If it is more than 16 mm (0.63 in.) off Centre, it can be centered by indexing it ten degrees towards the Centre.

### **INDEXING STEERING WHEEL TO CENTRE IT**

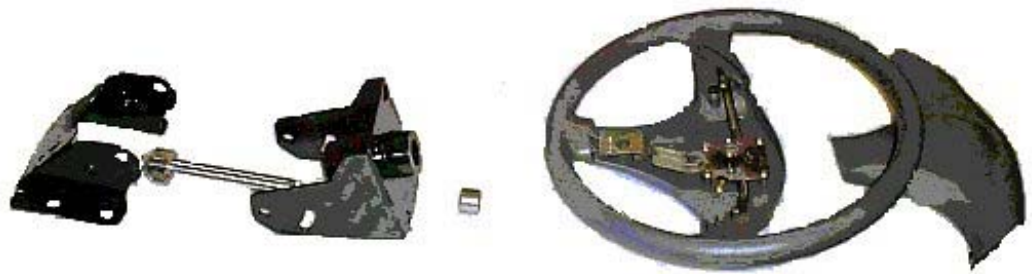
The steering wheel shaft has 36 splines, allowing the steering wheel to be indexed in ten-degree increments.

1. Remove the steering wheel.

- Without disturbing the position of the steering wheel shaft, re-install the wheel as near on-Centre as possible.



## COMPONENTS EPTC1900



## REMOVAL EPTC2000

- Disconnect the battery negative terminal.
- Remove the airbag module.

### **NOTE**

**For the vehicle without airbag, remove the horn cover assembly.**



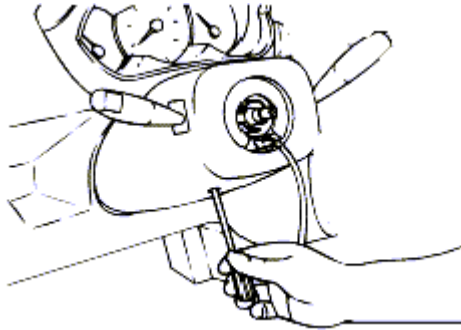
3. Remove the steering wheel lock nut.
4. After making alignment marks on the steering shaft and wheel, remove the steering wheel using the special.

**CAUTION**

**Do not hammer on the steering wheel to remove it: doing so may damage the steering column.**



5. Remove the column upper and lower cover.



6. Remove the multifunction switch.
7. Remove the bolt connecting the universal joint and pinion.
8. After removing the mounting bolts and nuts, remove the steering column and shaft assembly.

**INSPECTION EPTC2100**

1. Check the steering column and shaft for damage and distortion.
2. Check the joints for play, damage, or rough movement.
3. Check the ball joint bearing for wear and damage.

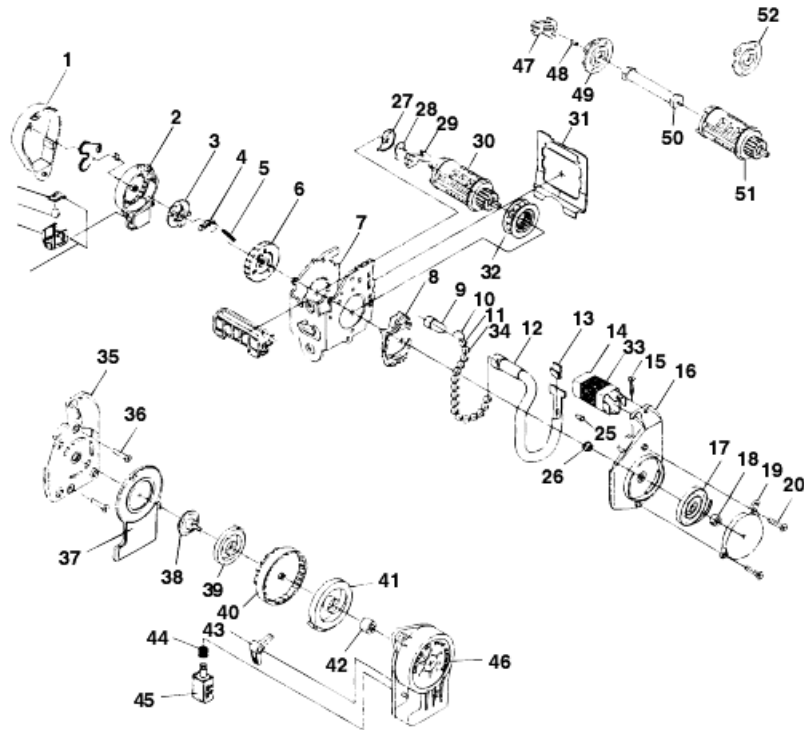
**ASSEMBLY EPTC2200**

Assembly is the reverse of disassembly.

# Restraints

## 10 General

### COMPONENTS ERJB0260



- |                       |                           |                          |                                  |
|-----------------------|---------------------------|--------------------------|----------------------------------|
| 1. COVER-L/RH         | 13. BALL STOPPING SPRING  | 31. DISTANCE SHEET       | 43. SOLENOID ASSY                |
| 2. BEARING PLATE-L/RH | 14. BALL TRAP-L/RH        | 32. PINION GEAR          | 44. RETURN SPRING                |
| 3. INERTIA MASS       | 15. SCREW                 | 33. LABEL                | 45. SOLENOID LEVER-L/RH          |
| 4. WEB SENSOR PAWL    | 16. TUBE COVER-L/RH       | 34. BALL ALUMINUM        | 46. T/R COVER-L/RH               |
| 5. WEB SENSOR SPRING  | 17. REWINDING SPRING      | 35. TUB COVER (T/R)-L/RH | 47. LOCK G ELEMENT (L/L)-L/RH    |
| 6. STEERING DISC-L/RH | 18. SPRING CORE-L/RH      | 36. RIVET (T/R)          | 48. NECK                         |
| 7. BASE L/RH          | 19. SPRING COVER-L/RH     | 37. RETAINER-L/RH        | 49. TREAD HEAD (W/STOP)-L/RH     |
| 8. BALL L/RH          | 20. RIVET                 | 38. BUSH SHAFT           | 50. TORSION BAR-5.5KN            |
| 9. GAS GENERATOR      | 27. RETAINING WASHER-L/RH | 39. REDUCE SPRING        | 51. SPINDLE (L/L)-L/RH           |
| 10. TUBE SPRING       | 28. LOCK DISC SPRING      | 40. HOLDER-L/RH          | 52. TREAD HEAD (W/OUT STOP)-L/RH |
| 11. PISTON            | 29. LOCKING ELEMENT-L/RH  | 41. NORMAL SPRING        |                                  |
| 12. TUBE-L/RH         | 30. SPINDLE-L/RH          | 42. STAY SHAFT           |                                  |

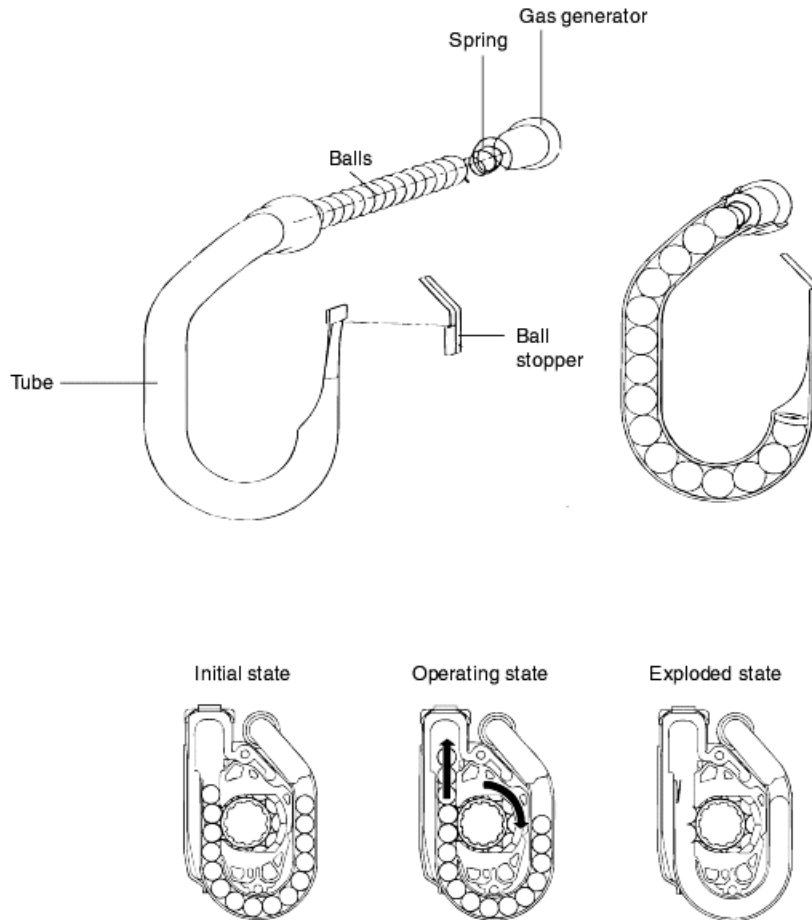
## FUNCTION OF PRETENSIONER ERHA0900

When a vehicle crashes with a certain degree of frontal impact, the gas generator will ignited an electrical firing signal from the SRSCM (Supplemental Restraint System Control Module).

Gas from the gas generator causes movement of the piston in the manifold case (cylinder), which operates the rack gear.

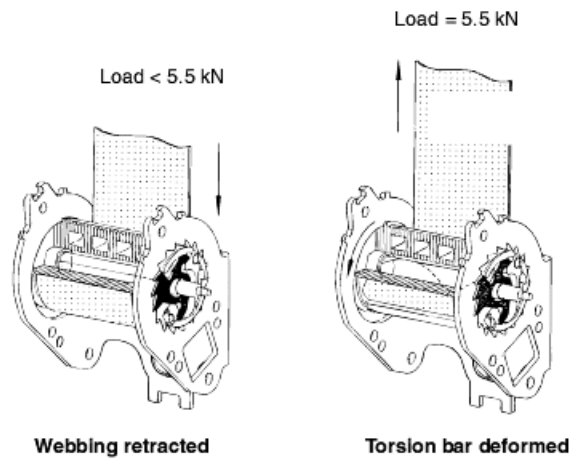
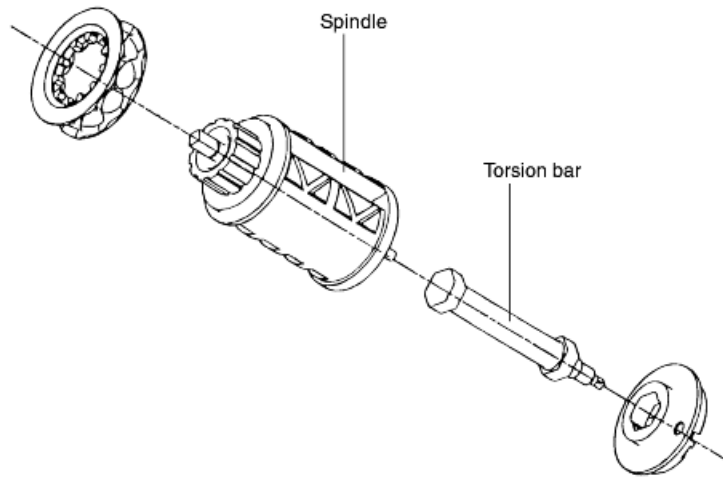
The rack gear, rotates a piston gear and a pinion rotates the planet gears.

Finally, the webbing is retracted by the rotation of the spool. Therefore, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupant by retracting the seat belt webbing. This prevents the occupant from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.



## LOAD LIMITER

The load limiter is designed to relieve the impact force to an occupant's chest of the seat belt webbing when the occupant is restrained by the seat belt during a crash. If the crash force reaches a certain value, the torsion bar in the pretensioned seat belt will deform and cause the webbing to be extracted from the seat belt, thus, relieving the impact force.





## REMOVAL ERFB0090

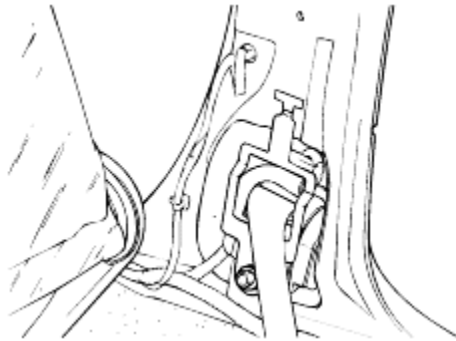
1. Disconnect the battery negative (-) terminal.

### CAUTION

Wait at least 30 seconds.



2. Remove the door scuff trim.
3. Remove the centre pillar lower trim after removing seat belt lower anchor bolt.
4. Remove the upper anchor plate cover and upper anchor plate.
5. Remove the lower anchor plate and front seat belt.



### CAUTION

- a. Never attempt to disassemble or repair the BPT.
- b. Do not drop the BPT or allow contact with water, grease, and oil. Replace it if a dent, crack, deformation or rust are detected.
- c. Do not place anything on the BPT.
- d. Do not expose the BPT to temperature over 93°C (200°F).
- e. BPT functions one time only. Be sure to replace the BPT after it is deployed.
- f. Be sure to wear gloves and safety goggles when handling the deployed BPT.

# 11 Brake System

## 11.1 General

### SPECIFICATIONS EJTC0010

#### Master cylinder

Type	Tandem type
I.D. mm(in.)	20.64 mm (0.813 in.)
Fluid level warning sensor	Provided

#### Brake booster

Type	Vacuum
Boosting ratio	4.0 : 1

#### Proportioning valve

Cut-in pressure (Split point)	15 kg/cm <sup>2</sup>
Decompression ratio	0.27 : 1

#### Front brake

Type	Floating type with ventilated disc
Disc O.D.	234 mm (9.213 in.)
Disc thickness	18 mm (0.709 in.)
Pad thickness	10 mm (0.39 in.)
Pad effective thickness	8 mm (3.15 in.)
Cylinder I.D.	51.1 mm (2.01 in.)

#### Parking brake

Type	Mechanical brake acting on rear wheels
Braking Type	Lever type (cam shape)
Cable arrangement	V type

### SERVICE STANDARD EJTC0020

	Standard value	Service limit
Brake pedal height	145.2-150.2 mm (5.72-5.91 in.)	
Brake pedal stroke	118.4 mm (4.66 in.)	
Stop lamp switch outer case to pedal stopper clearance	0.5-1.0 mm (0.020-0.040 in.)	
Brake pedal free play	3-8 mm (0.118-0.315 in.)	
Brake pedal to floorboard clearance	50 mm (1.969 in.) or more	
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N (20kg, 44lb force)	10-14 clicks	
Front disc brake pad thickness	10 mm (0.39 in.)	2.0 mm (0.079 in.)
Front disc thickness (minimum )	18 mm (0.709 in.)	16 mm (0.63 in.)
Front disc runout	-	0.05 mm (0.02 in.)

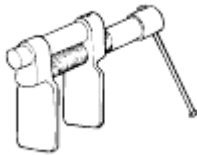
## TIGHTENING TORQUE EJTC0030

	Nm	Kg-cm	lb-ft
Master cylinder to booster mounting nut	8-12	80-120	6-9
Brake booster mounting nut	8-12	80-120	6-9
Brake booster vacuum hose fitting to surge tank	8-12	80-120	6-9
Bleeder screw : Front	7-13	70-130	5-10
Bleeder screw : Rear	7-9	70-90	5-7
Brake tube flare nut, brake hose	13-17	130-170	10-13
Proportioning valve mounting nut	8-12	80-120	6-9
Caliper guide rod bolt	22-32	220-320	16-24
Caliper pin bolt	35-45	350-450	26-33
Caliper assembly to knuckle	65-75	650-750	48-55
Brake hose to front caliper	25-30	250-300	18-22

### CAUTION

Replace the self-locking nuts with new ones after removal.

## SPECIAL TOOLS EJTC0040

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander		Spreading the front brake piston.

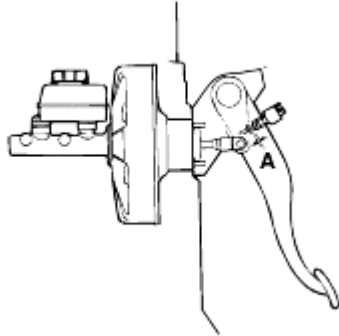
## TROUBLESHOOTING EJDA0440

Symptom	Probable cause	Remedy
Noise or vibration when brakes are applied	Calliper improperly mounted	Correct
	Calliper mounting bolts	Retighten
	Unevenly worn brake disc	Replace
	Seized pad or lining contact surface	Replace
	Excessive caliper to pad assembly clearance	Correct
	Uneven pad contact	Correct
	Lack of lubrication in sliding parts	Lubricate
	Loose suspension parts	Retighten
Vehicle pulls to one side when brakes are applied	Difference in left and right tire inflation pressure	Adjust
	Inadequate contact of pad	Correct
	Grease or oil on pad surface	Replace
	Drum warpage or uneven wear	Replace
Insufficient braking power	Air in the brake system	Bleed the system
	Brake booster malfunction	Correct
	Inadequate contact of pad	Correct
	Grease or oil on pad	Replace
	Low or deteriorated brake fluid	Refill or change
	Overheated brake rotor due to dragging of pad	Correct
	Restricted brake line	Replace
	Proportioning valve malfunction	Replace
	Air in the system	Bleed the system
Increased pedal stroke required (Reduced pedal to floorboard clearance)	Brake fluid leaks	Correct
	Excessive push rod to master cylinder clearance	Adjust
	Incomplete release of parking brake	Adjust
	Incorrect parking brake adjustment	Adjust
Brake drag	Worn brake pedal return spring	Replace
	Restricted master cylinder return port	Correct
	Lack of lubrication in sliding parts	Lubricate
	Defective master cylinder check valve or piston return spring	Replace
	Insufficient push rod to master cylinder clearance	Replace
Insufficient parking brake function	Parking brake cable sticking	Replace
	Excessive parking brake lever stroke	Adjust the parking brake lever stroke or check the parking brake cable routing
	Worn brake lining or pad	Replace
	Grease or oil on lining or pad surface	Replace

## BRAKE PEDAL INSPECTION AND ADJUSTMENT EJTC0050

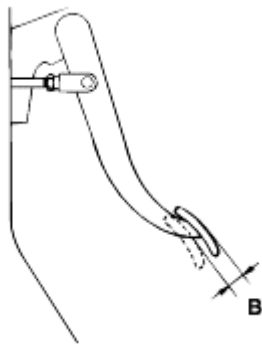
1. Turn the stop lamp switch until the clearance between the stop lamp switch outer case and pedal arm reaches the standard value, and secure the stop lamp switch with the lock nut.

**Clearance between pedal and stop lamp switch A :**  
0.5-1.0 mm (0.02-0.039 in.)



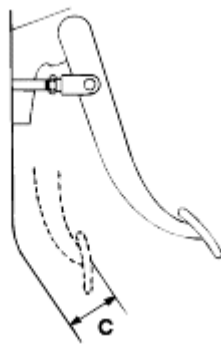
2. Brake pedal free play.

**Brake pedal free play B :**  
3-8 mm (0.118-0.315 in.)



3. Start the engine, apply the brake pedal with approximately 50kg (110 lbs.) of force, and measure the clearance between the brake pedal and the floor board.

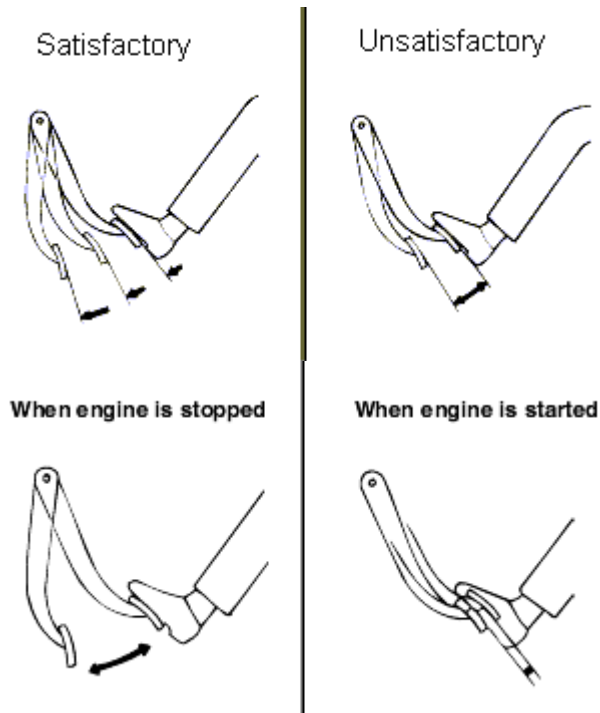
**Pedal to floor board clearance C :**  
45.1 mm (1.78 in.) or more



## **BRAKE BOOSTER OPERATION TEST WITHOUT A TESTER** EJTC0060

For a simple check of brake booster operation, perform the following tests.

1. Run the engine for one or two minutes, then stop it. Depress the brake pedal several times using normal foot pressure. If the pedal goes down further at the first time, but gradually rises after the second or third time, the brake booster is functioning properly. Go to step 2.
2. With the engine stopped, depress the brake pedal several times. Depress the brake pedal and start the engine. If the pedal goes down slightly, the booster is in good condition. Go to step 3.
3. With the engine running, depress the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition. If the pedal height does not change, the booster is in good condition. If one of the above three tests is not okay, check the vacuum hoses, the check valve and the brake booster, make any necessary corrections. If all the tests are OK, unit is good.



## BLEEDING THE BRAKE SYSTEM EJTC0070

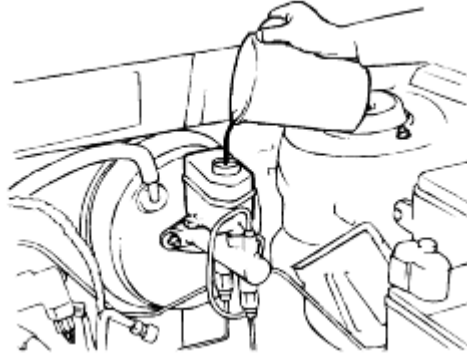
1. Remove the reservoir cap and fill the brake fluid to reservoir.

### CAUTION

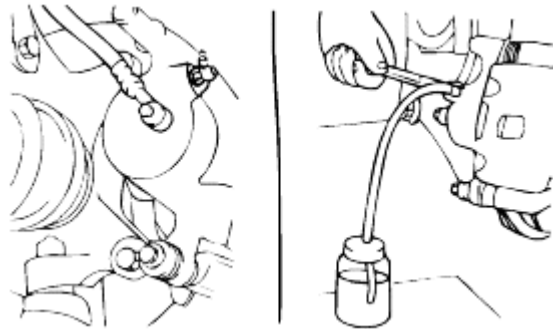
Do not allow brake fluid to remain on a painted surface. Wash it off immediately.

### NOTE

When bleeding by pressurized fluid; do not depress the brake pedal.



2. Connect a vinyl tube to the calliper bleeder screw and insert the other end of tube in a half full container of brake fluid.
3. Slowly pump the brake pedal several times.
4. While depressing the brake pedal fully, loosen the bleeder screw until fluid starts to run out. Then close the bleeder screw.



5. Repeat steps 3 and 4 step until there are no more bubbles in the fluid.
6. Tighten the bleeder plug screw.

### Bleeder screw tightening torque :

Front : 7-13 Nm (70-130 kg·cm, 5-10 lb·ft)

Rear : 7-9 Nm (70-90 kg·cm, 5-6.5 lb·ft)

7. Repeat the above procedure for each wheel.

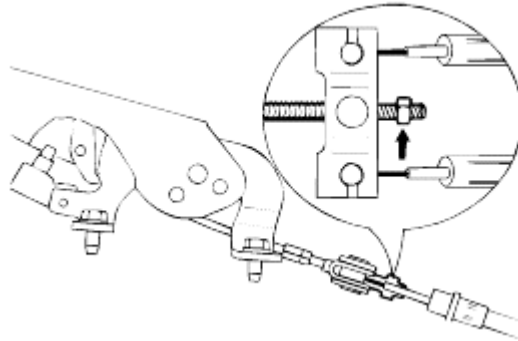
## PARKING BRAKE STROKE ADJUSTMENT EJTC0080

1. Pull the brake lever with a force of approximately 196 N (20 kg, 44 lbs.), and count the number of clicks.

**Parking brake lever stroke (Standard value) :**

7-8 clicks

2. If the number of notches is not within the standard value, adjust the cable length with the adjusting nut of the equalizer.

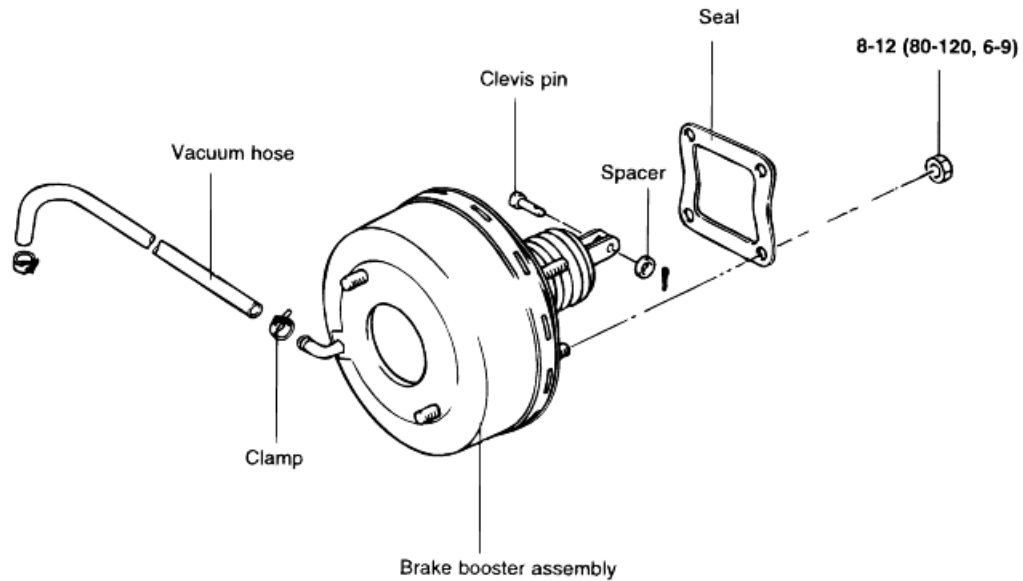


3. The indicator light will go out when the brake lever is fully released, and will light when the lever is pulled up one notch. If it does not operate, replace it.
4. After the adjustment, check that the rear brakes do not drag with the parking brake lever released.



## 11.2 Brake System

### COMPONENTS EJTC0190



**TORQUE : Nm (kg-cm, lb-ft)**

### REMOVAL EJTC0210

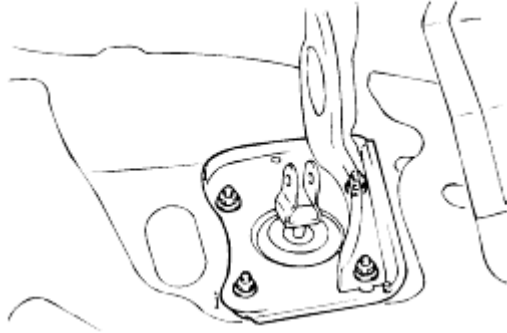
1. Disconnect the brake tube from the master cylinder.
2. Remove the master cylinder.

**CAUTION**

**Do not allow brake fluid to remain on a painted surface. Wash it off immediately.**

3. Disconnect the vacuum hose from the booster.
4. Remove Knee Guard and retaining bolts
5. Remove the brake pedal.
6. Pry console back and use a block to hold it
7. Loosen the booster mounting nuts.

8. Lift out the booster assembly.



## INSTALLATION EJTC0220

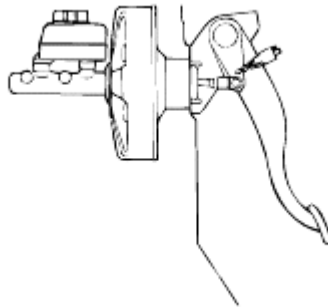
1. When the booster assembly is installed, replace the packing at each end of the booster mounting holder, if necessary.

2. Install brake booster and tighten the mounting nuts.

**Tightening torque :**

8-12 Nm (80-120 kg·cm, 6-9 lb·ft)

3. Connect clevis to brake pedal with clevis pin and install the split pin to the clevis pin.
4. Install master cylinder and connect the brake tube to the master cylinder.
5. Connect vacuum hose to brake booster.
6. Fill brake reservoir with brake fluid and bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal.
9. After installation, apply sufficient grease to the clevis and brake pedal contacting points.

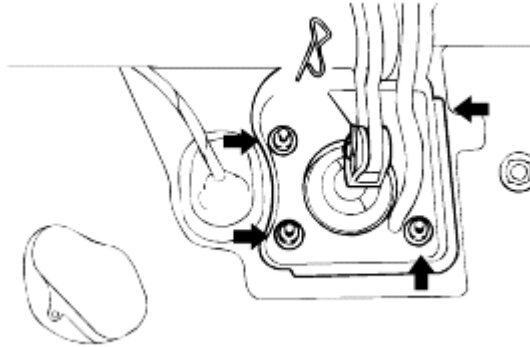


COMPONENTS EJTC0090



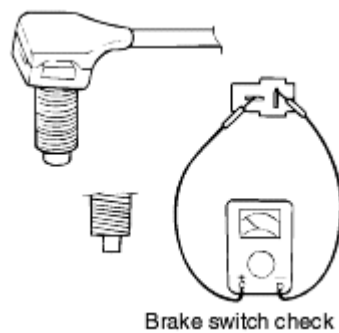
## REMOVAL EJTC0100

1. Remove the knee guard
2. Remove the through-bolt.
3. Remove the clevis pin.
4. Remove the brake pedal assembly.



## INSPECTION EJTC0110

1. Check the bushing for wear.
2. Check the brake pedal for distortion.
3. Check the stop lamp switch
  - With an ohmmeter connected to the stop lamp switch terminals, check for continuity.
  - If there is no continuity when the plunger is depressed and there is continuity when the plunger is released, the stop lamp switch is normal.



## INSTALLATION EJTC0120

1. Apply chassis grease to the sliding surface of the brake pedal and operating rod clevis pin.

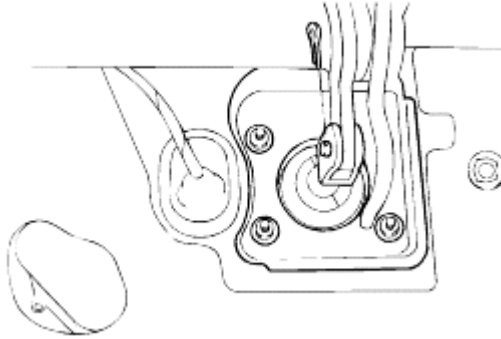
### **CAUTION**

**Be sure to install the split pin on the operating rod clevis pin.**

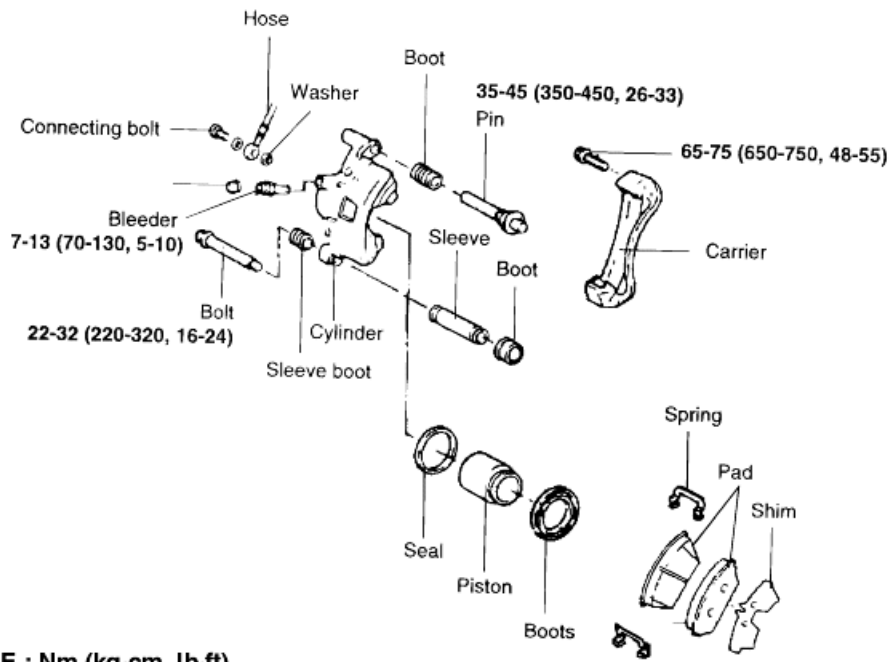
2. Install the brake pedal assembly and tighten the through-bolt.

### **Tightening torque :**

8-12 Nm (80-120 kg·cm, 6-9 lb·ft)

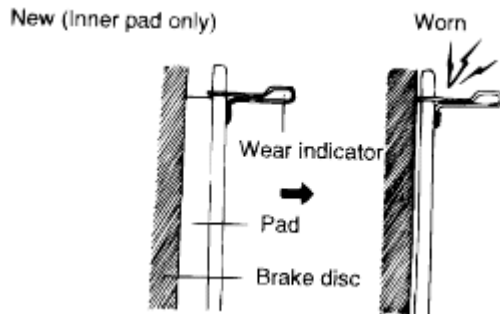


# COMPONENTS EJTC0230



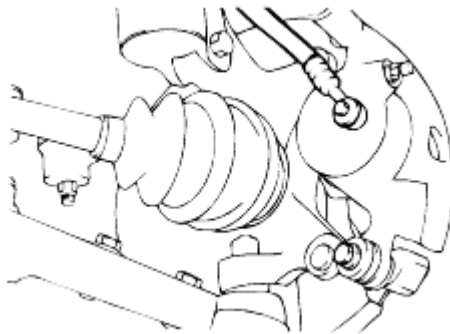
## BRAKE PAD EJTC0240

The brake pads have wear indicators that contact the brake disc when the brake pad thickness becomes 2 mm (0.08 in.). The wear indicators will generate a squealing sound to warn the driver.



## REMOVAL

1. Remove the lower bolt and lift the caliper assembly up and out of the way. Secure it with a wire or some other retaining method.



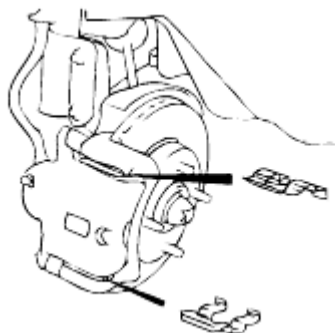
2. Remove the pads.

### **CAUTION**

**Do not depress the brake pedal while disassembling the pads.**

## INSTALLATION EJTC0260

1. Install the pad clips.

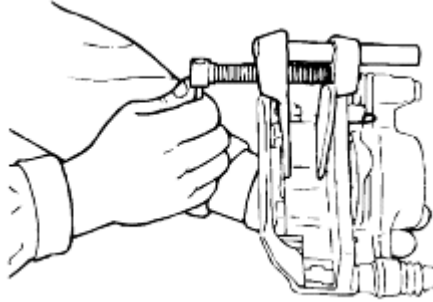


2. Install the pads onto each pad clip.

### **NOTE**

**Position the pad with its wear indicator toward the disc side and facing upward.**

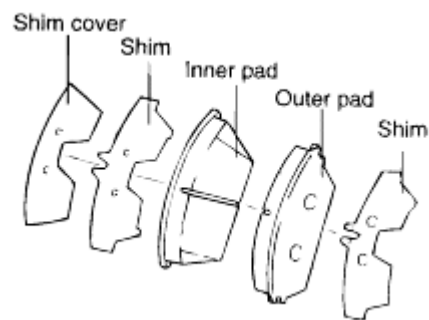
3. Seat the piston in the cylinder using Special Tool (09581-11000).



4. Install the new pads. The shims are attached to the each pad as illustrated.

**CAUTION**

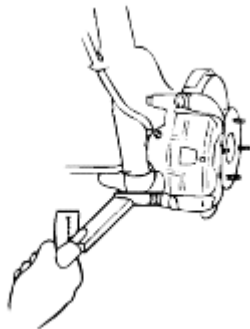
**Never apply grease to the disc or pads.**



5. Install the bolt and tighten to the specified value.

**Tightening torque :**

22-32 Nm (220-320 kg·cm, 16-24 lb·ft)



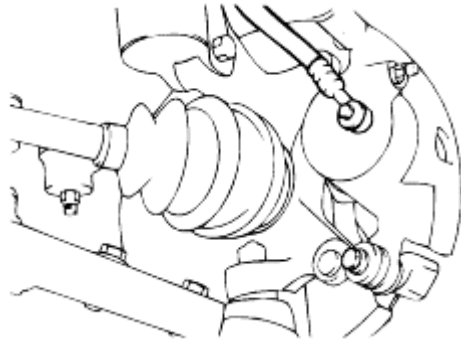


## CALIPER ASSEMBLY EJTC0270 REMOVAL

1. Remove the wheel and tire.
2. Disconnect the brake hose.

### NOTE

**Plug the brake hose, to prevent brake fluid from running out.**



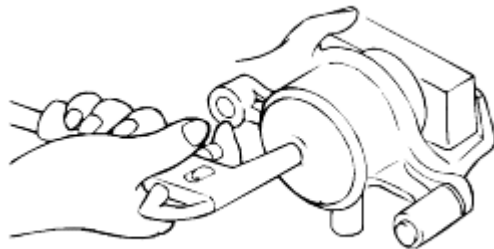
3. Remove the cylinder mounting bolt.
4. Remove cylinder and pads.
5. Remove the caliper mounting bolts (2EA) from knuckle.
6. Remove the carrier.

## DISASSEMBLY EJTC0280

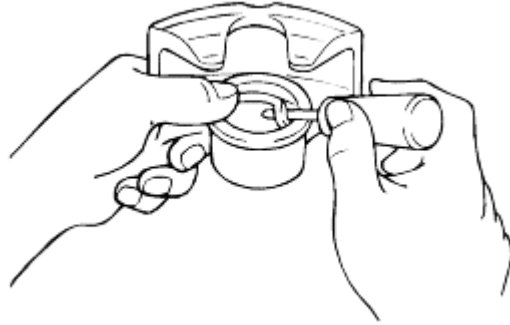
1. Remove the piston boot.
2. Remove the piston using compressed air.

### CAUTION

- a. **Do not place fingers in front of the piston when using compressed air.**
- b. **Be careful not to splatter the brake fluid.**



3. Remove the piston seal from the caliper using a screw driver.



## INSPECTION EJTC0290

1. Check the caliper for wear, damage, cracks and rust.
2. Check the piston for rust, damage, cracks and wear on the outer surface.
3. Check the sleeve and pin for damage and rust.
4. Check the pad spring and boots for damage.
5. Check the carrier for damage, rust, wear and cracks.

### CAUTION

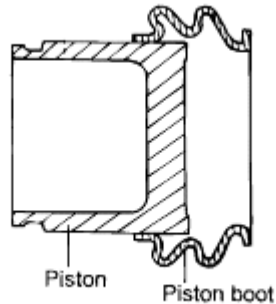
- a. **Do not use sand paper on the piston surface.**
  - b. **All rubber parts must be replaced with new parts.**
6. Inspect the disc using a calipers and dial gauge.

	<b>Standard value</b>	<b>Service limit</b>
Thickness of disc mm (in.)	18 (0.709)	16 (0.63)
Total runout of front axle assembly mm (in.)	-	0.05 (0.002)

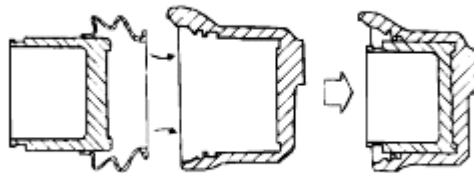
7. If necessary, replace the brake disc.

## REASSEMBLY EJTC0300

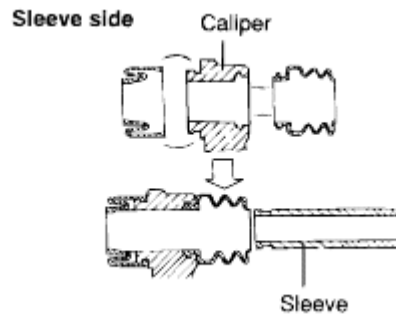
1. Clean all components with isopropyl alcohol except the pads and shim.
2. Apply rubber grease to the piston seal and install the piston seal in the cylinder.



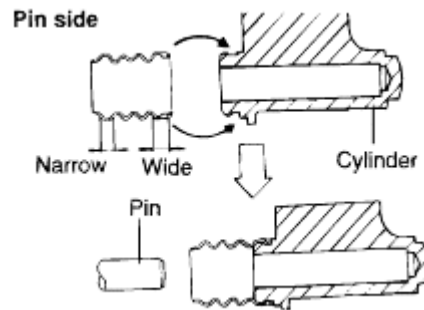
3. Assemble the piston and piston boots according to the following procedure.
  - Apply rubber grease to the caliper bore, outside surface of the piston and piston boot.
  - Install the piston boot on the piston as illustrated.
  - Insert the piston boot in the inner groove of caliper and slide the piston into the caliper.



4. Assemble the sliding parts according to the following procedure.
  - Apply rubber grease to the outside surface of the sleeve and pin, pin and sleeve bore of the caliper, pin boot and sleeve boot.



- Insert the boots into the groove of the caliper.



5. Install the pads.

**NOTE**

**Do not apply grease to the disc or pads.**

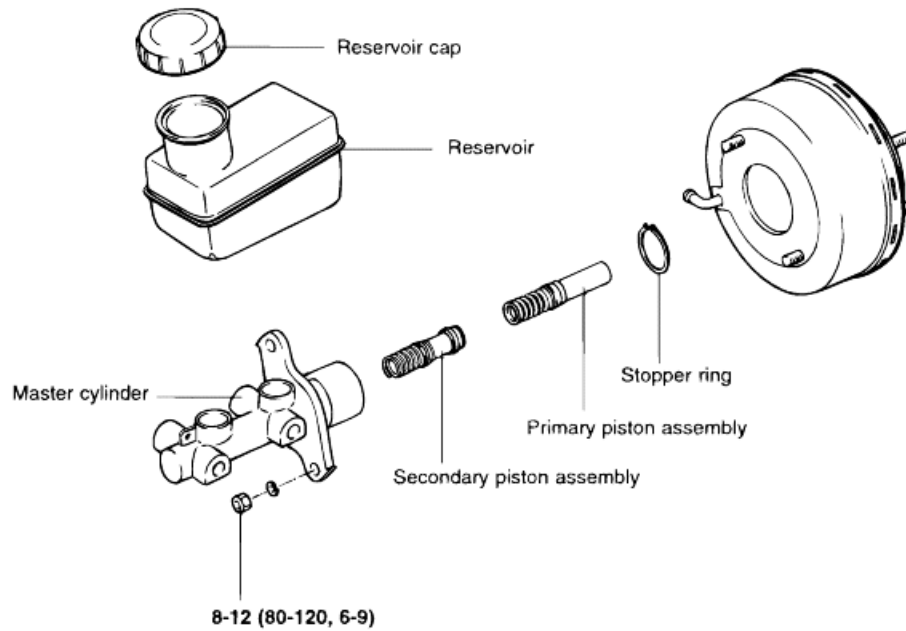
6. Tighten the brake hose connecting bolt.

Tightening torque	Nm (kg-cm, lb-ft)
Sliding pin	35-45 (350-450, 26-33)
Sliding bolt	22-32 (220-320, 16-24)
Carrier mounting bolt	65-75 (650-750, 48-55)
Brake hose mounting bolt	25-30 (250-300, 19-22)

**NOTE**

- a. Check that the surface of the pin and bolts are not damaged before tightening.
- b. Bleed the system. Depress the pedal several times and check for fluid leakage from all connecting parts.

## COMPONENTS EJTC0130



**TORQUE : Nm (kg-cm, lb-ft)**

## REMOVAL EJTC0140

1. Remove the fluid level warning device connector.
2. Disconnect the brake lines from the master cylinder, and plug the open ports.
3. Remove knee guard.
4. Remove Brake pedal.
5. Pry back console and use block to hold it.

### **CAUTION**

**Do not allow brake fluid to remain on a painted surface. Wash it off immediately.**

- 6.
7. Remove the master cylinder mounting nuts. Then lift out the master cylinder.

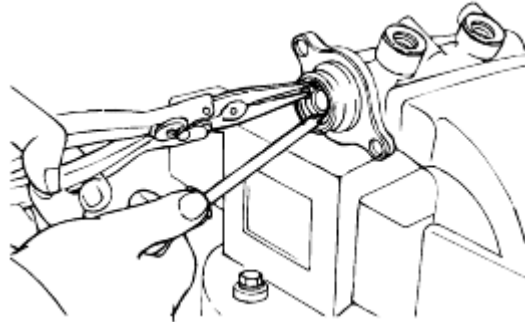
## DISASSEMBLY EJTC0150

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the reservoir from the master cylinder.

### NOTE

If necessary, support the master cylinder in a vice at its flange not at its bore.

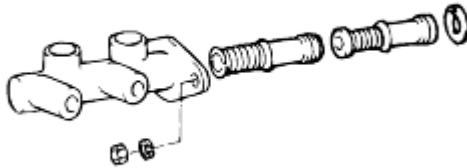
3. While depressing the piston, remove the snap ring.



4. Remove the primary and secondary piston from the master cylinder body.

### NOTE

- a. Be careful not to damage the cylinder bore.
- b. Do not disassemble the primary and secondary piston assemblies.



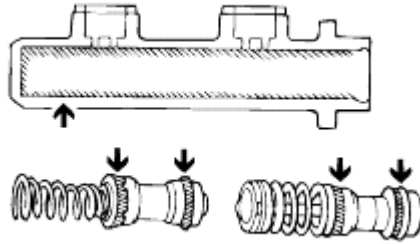
## INSPECTION EJTC0160

1. Check the inner surface of the master cylinder body for rust or scoring.
2. Check the primary and secondary pistons for rust, scoring, wear, damage or deterioration.
3. Check the primary and secondary piston spring for deterioration.

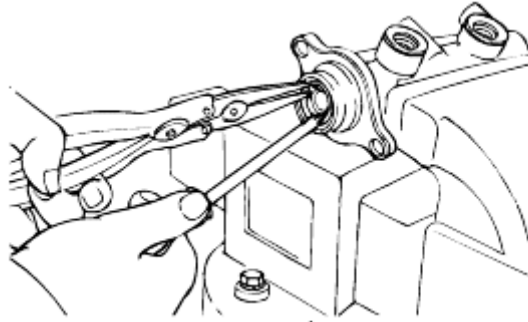
## REASSEMBLY EJTC0170

1. Apply the specified brake fluid to the inner surface of the master cylinder body and to the outside of the secondary and primary pistons.

**Recommended brake fluid :** DOT 3 or DOT 4



2. Carefully insert the spring and secondary piston assembly in the master cylinder bore.
3. Carefully insert the primary piston assembly in the master cylinder bore.
4. Depress the primary piston and install the retaining ring in the cylinder bore groove as illustrated.

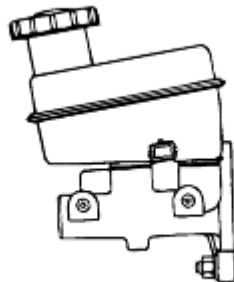


5. Install the reservoir cap on the master cylinder.
6. Lubricate the two grommets at both inside and outside with genuine brake fluid and then insert them into the master cylinder body.

### **NOTE**

**Whenever the reservoir is replaced, the grommets must also be replaced.**

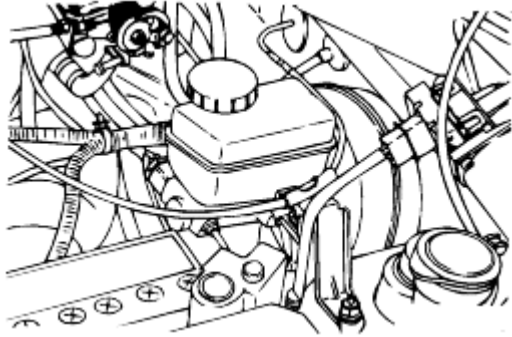
7. Press the reservoir into the grommets with the fluid level indicator socket facing inboard. The reservoir should snap in place indicating that it is secure as illustrated.



8. Connect the fluid level warning connector in the socket on the reservoir.

## INSTALLATION EJTC0180

1. Install the master cylinder to the brake booster with two nuts.  
**Nut :** 8-12 Nm (80-120 kg·cm, 6-9 lb·ft)
2. Connect two brake tubes and fluid level warning connector.  
**Brake tube flare nut :**  
13-17 Nm (130-170 kg·cm, 10-13 lb·ft)
3. Fill the master cylinder reservoir with brake fluid and bleed the system.





## PROPORTIONING VALVE EJTC0183

The proportioning valve distributes the proper fluid pressure to the front and rear wheels to obtain greater braking efficiency and prevents premature rear wheel lock-up. You should not disassemble it because the performance of the valve is closely connected with the mounting tension of the spring.

### PROPORTIONING VALVE FUNCTION TEST

1. Remove the proportioning valve from the master cylinder.
2. Connect two pressure gauges; one to the input side, and one to the output side.

#### NOTE

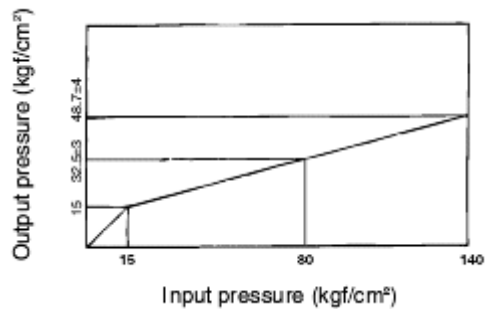
**Be sure to bleed the system after connecting the pressure gauges.**

3. With the brakes applied, measure the input pressure and the output pressure. If the measured pressures are within the specified range as illustrated, the proportioning valve is good.
4. Reconnect the brake lines in their original positions and bleed the system.

#### NOTE

**This figure shows characteristics of the proportioning valve as the pressure increases.**

5.



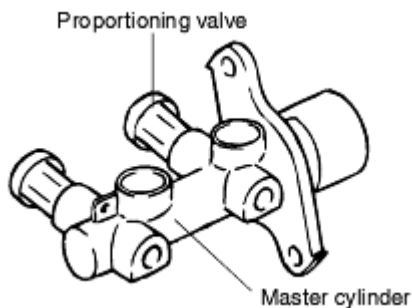
### INSTALLATION OF PROPORTIONING VALVE

1. Install the master cylinder according to the illustration.
2. Tighten the flare nuts and bleed the system.

#### Tightening torque Nm (kg-cm, lb-ft)

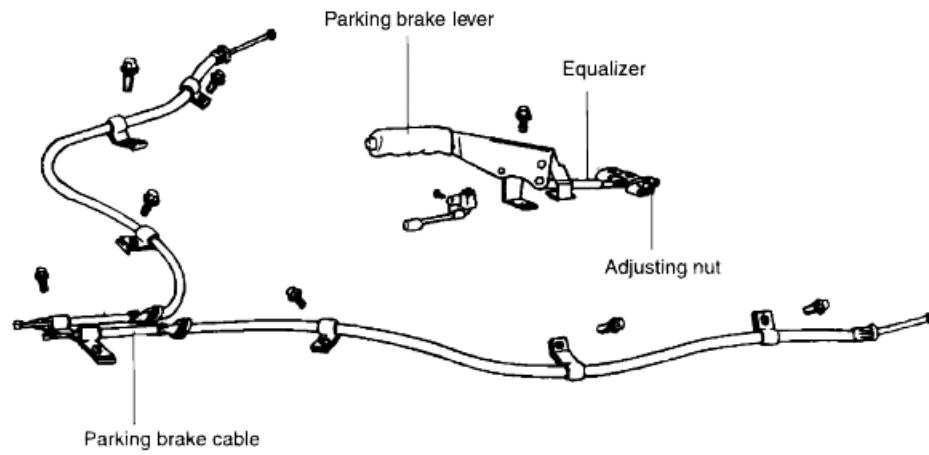
Brake tube flare nut : 13-17 (130-170, 9-12)

Proportioning valve mounting nut : 8-12 (80-120, 6-9)



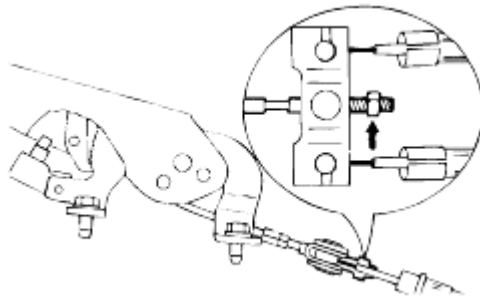
## 11.3 Parking Brake System

### COMPONENTS EJTC0360



## REMOVAL EJTC0370

1. Remove the shifter cover.
2. Loosen the adjusting nut and detach the parking brake cable.



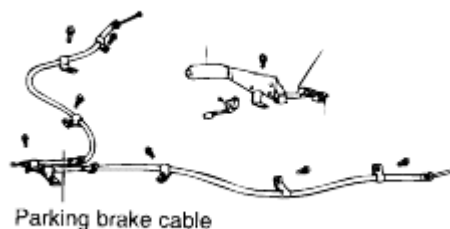
3. Detach the parking brake switch assembly.
4. Remove the parking brake lever assembly. .
5. Loosen the parking brake cable clamp and remove the parking brake cable assembly.

## INSPECTION EJTC0380

1. Check the parking brake switch operation.
2. Check the parking brake lever ratchet for wear.
3. Check the parking brake cable for fraying or damage.

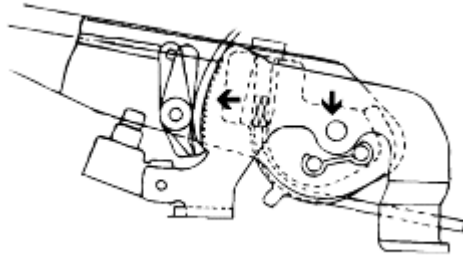
## INSTALLATION EJTC0390

2. Check the parking brake cables for left and right identification marks and install accordingly. The right cable is slightly longer.



### Specified grease

Multipurpose grease SAE J310, NLGI NO.2



3. After installing the cable adjuster, adjust the parking brake lever stroke.

## 11.4 BLEEDING OF BRAKE SYSTEM

This procedure should be followed to ensure adequate bleeding of air and filling of the unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

### **CAUTION**

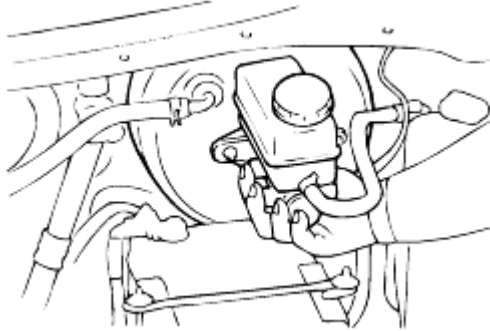
**Do not allow brake fluid to contact with painted surfaces.**

**Wash any off immediately.**

### **NOTE**

**When pressure bleeding, do not depress the brake pedal.**

**Recommended fluid.....DOT3 or equivalent**



3. Connect a clear plastic tube to the calliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
4. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
5. Repeat step 5 until there are no more bubbles in the fluid for each wheel.
6. Tighten the bleeder screw.

### **Bleeder screw tightening torque :**

7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

## 12 Body (Interior/Exterior)

### 12.1 General

### 12.2 EXTERIOR

#### Front Hood Removal

1. Remove the two slot screws at the top corners of the hood.
2. Pull forward at the top and tip the hood out of the lower holding channel.



#### Front Bumper Removal

1. Disconnect the electrical connectors from the harness to the lights, left and right sides and the horn.



2. Remove the eight bolts attaching the bumper from the outside corners.

3. Remove the marker light screws.

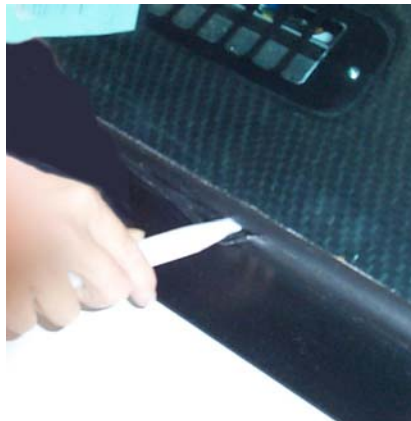


## Windshield Removal

1. Using the Glass Seal tool, unlock the windshields rubber seal.



2. Make sure that the seal is not stuck to the glass.



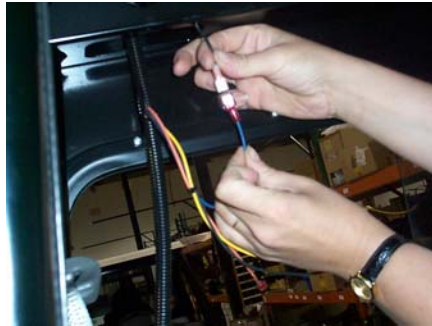
3. Push the glass outward. Try not to twist the glass too much, also do not chip the edges of the glass this can cause the glass to crack.

## Roof Removal

1. Disconnect the wire connectors from the harness to the roof top lamps



4. Disconnect Dome light electrics.



5. Drill out rivets
6. Lift off roof

## Upper Trunk Removal

1. Remove the wing nut and panel clamp.
2. Lift and pull the upper back to remove it from the Scooter.

**CAUTION:** Trunk assembly is awkward and assistance is recommended for lifting off.

## Gas Tank Removal

1. Raise the Scooter to gain access to the lower wiring trays.
2. Remove the four tray attaching bolts to allow the tank to be lowered from the under side of the Scooter.

**CAUTION:** - Empty the fuel tank before removing.

- Relieve fuel pressure from lines by disconnecting fuel pump and run the engine until it stalls out.
- Start to lower the tank until access to the fuel pump can be gained
- Disconnect electrical connector and fuel lines.  
Now fuel tank may be removed.



## Lower Trunk Removal

1. Remove the bolts attaching the inner wheel wells to the trunk box.
2. Remove the three bolts inside the lower rear that attach the lower trunk to the rear bumper.
3. Disconnect the electrical harness connector.
4. Remove the bolts on the left and right hand sides that attach the fender to the box.
5. Remove the fuel line clamp.
6. Remove the four bolts that attach the box to the upper door rails.
7. Lift the box up to clear the bumper and slide it back removing it from the Scooter.

## Right Inner Fender Well Removal

1. Remove the four attaching bolts.
2. Remove the fuel line clamp.
3. Remove the fender well through the engine compartment.

## Left Inner Fender Well (see above)

## Rear Bumper Removal

1. Remove the light cover inside the lower trunk.



2. Disconnect the license plate light.
3. Remove the three bolts from inside the lower trunk.



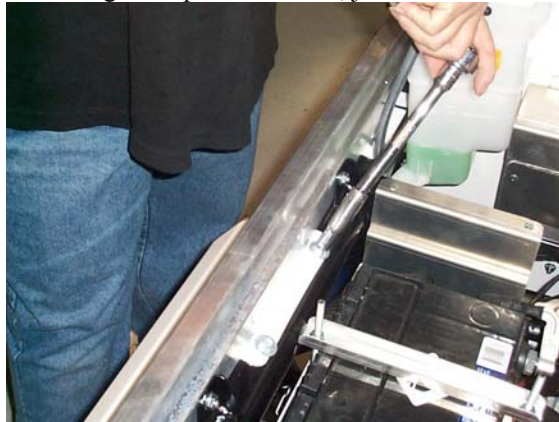
4. Remove the four carriage bolts that attach the frame and the bumper.
5. Remove the bumper assembly.

## Left Rear Fender Removal (with door off)

1. Remove the two pan head screws that hold the inspection panels in place.



2. Remove the two pan head screws that are holding the lower front fender.
3. Loosen the three body bolts along the top of the fender, just to the inside of the upper door rails.



4. Remove the four screws holding the gas filler to the fender.
5. Remove one ¼ " at the top rear of the fender.
6. Tip the fender out and lift up to remove the fender from the Scooter.

### **Right Rear Fender** (with door off)

The Right Rear fender removal is the same as the Left except there is no Gas Filler Spout.

## **12.3 INTERIOR**

### **Lower Dash Cover Removal**

1. Remove the four self-tapping screws along the top of the lower dash panel.
2. Disconnect the wiring if equipped.



## Console Removal

1. Remove the two carriage bolts holding the brake pedal mount on.
2. Remove the clip from the pin.
3. Remove the pin from the brake booster rod.



4. Pull the front of the floor mat back to expose the floor panel and console attaching screws.
5. Drill out the rivets from the centre console.



6. Tip the centre console back to remove.
7. Pull back left or right side.

## Seat Removal

1. Remove the four attaching nuts from the under side of the seat box.

## Shifter Cover Removal

1. Remove the six fastening screws (access to top screws from inside electrical box)

## Dash Top Removal

1. Remove the six pan head screws from the lower front of the dash face.



2. Lift up the dash top to clear the dash face.

3. Disconnect from the assembly the three multi-wire connectors from the right side of the splitting harness. Leave the cluster harness attached to the dash top.



4. Disconnect the hazard connectors at the switch located in the dash panel to the left of the steering column.
5. Tip up the dash to the right hand side and guide the assembly over the steering wheel.

## Floor Mat Removal

1. Remove and discard twenty button fasteners.



2. Remove two 5/16 " pins and cotter keys.



**CAUTION:** The floor mat is glued down, pulling the entire mat out could damage the mat.

## Lower Dash Face Removal

1. Remove twelve pan head screws holding the panel in place.
2. Loosen the two heater control cables and slide cables out of the slots

**NOTE:** The lower dash cover must be removed and the console top must be pulled back to allow the face to be removed.

## Seat Box Removal

1. Remove the rivets along the top of the seat box.



2. Remove the two rivets along the front edge of the seat box, and the two rivets securing the seat sides to the frame pipes.
3. Remove the seat belt attaching bolt and retractor bolt.
4. Remove the two pan head screws holding the box to the under seat compartment.
5. Disconnect the shifter cable pin clip.
6. Remove the cable-mounting clip from the shifter mount.
7. Disconnect the park break cables at the rear of the seat box.
8. Remove the bolt at the front of the break lever.



9. Remove the electrical box top cover.
10. Disconnect all the connectors to allow the control harness to be removed from the electrical box.
11. Lift up the front of the seat box and pull it forward, removing the seat box from inside of the pass compartment.

## **13 Electrical Troubleshooting Manual**

### **13.1 General**

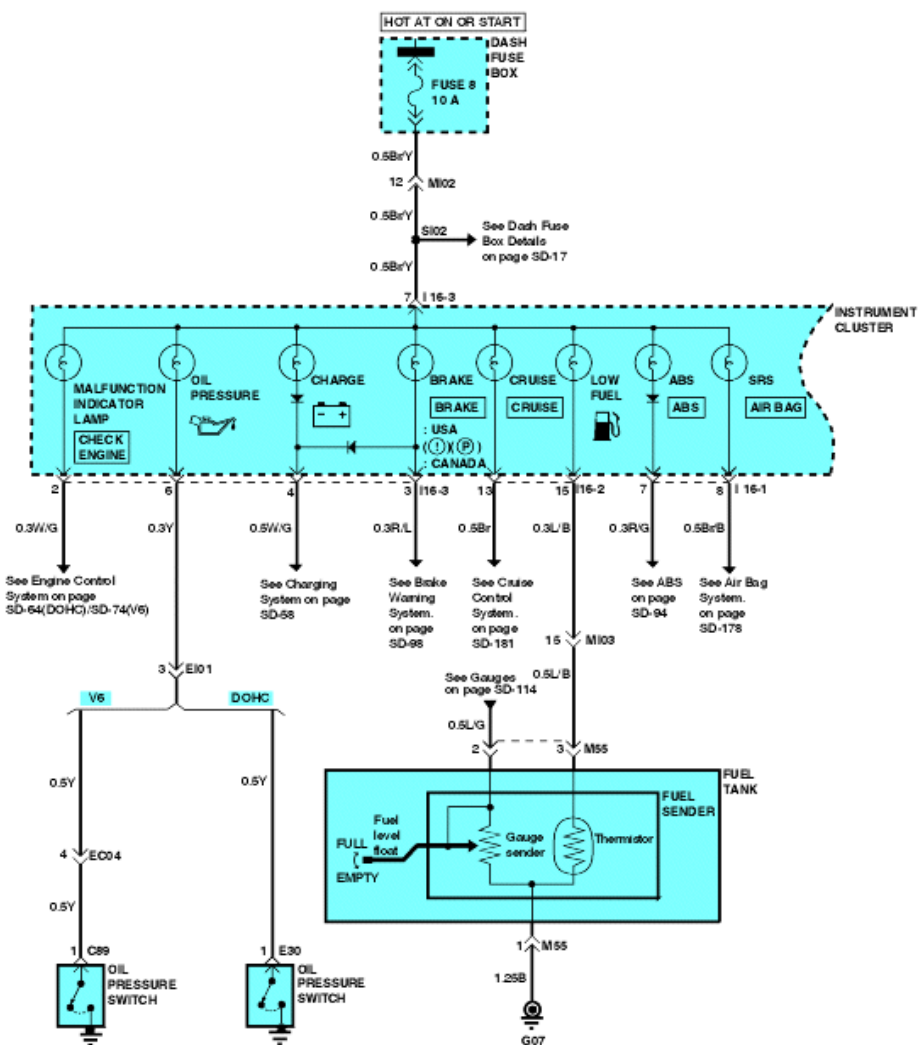
#### INTRODUCTION E1KB0010

This Manual consists of five major diagnostic sections for electrical problem troubleshooting.

- Schematic diagrams
- Component location indexes
- Component locations
- Connector configurations
- Harness layouts

## SCHEMATIC DIAGRAM

The starting point of each system section is the schematic diagram. These diagrams show how all the components work together, such as electrical current paths from power source to ground (via electrical load), switch connections at each position, and other related



circuit functions.

It is important to fully understand how a circuit works prior to troubleshooting and diagnosis.



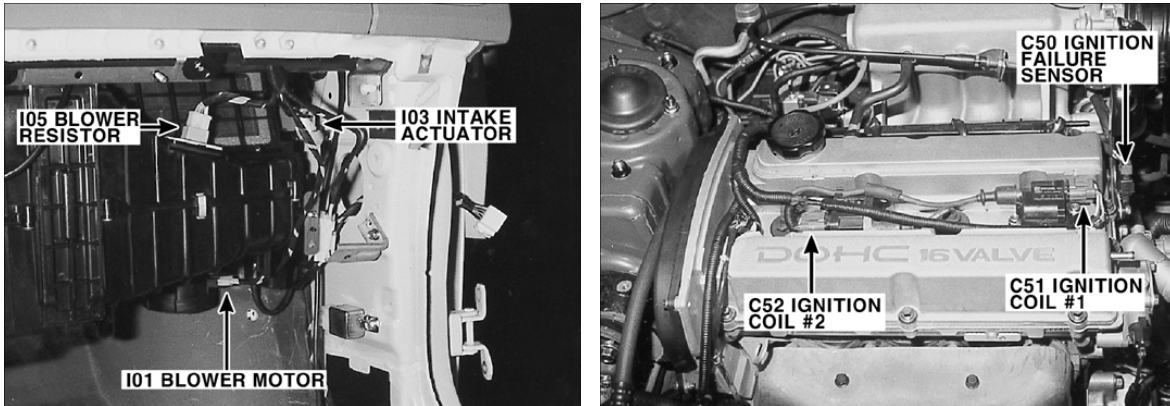
## COMPONENT LOCATION INDEXES

When you want to locate the schematic components on the vehicle, use the Component Location Index which follows each schematic. A Component Location Index lists major components, connectors, grounds, diodes, and their physical location and page reference. Almost all components, connectors or grounds, and diodes shown on a schematic can be pinpointed visually by using the Component Location Illustrations.

<b>Components</b>	<b>Location Reference Page</b>
I12 Digital clock ( <i>not used</i> )	CL-15
I16-1 Instrument cluster	CL-15
M55 Fuel sender	CL-19
M56 Fuel pump	CL-19
C34 Engine coolant temperature sender	CL-5, CL-8
<b>Connectors</b>	
MI01/MI02/MI03	CL-21
MC02	CL-21
CC02	CL-8
<b>Grounds</b>	
G04	CL-23
G07	CL-23
<b>Diodes</b>	
Z01	CL-24
Z02	CL-24

## COMPONENT LOCATIONS

Component Locations make it easy to find the schematic components on the vehicle shown in the Component Location Index.

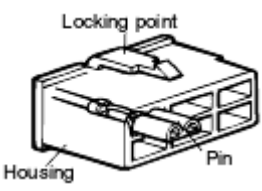
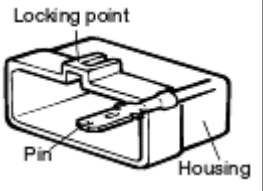
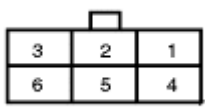
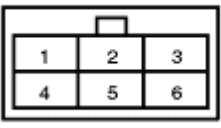


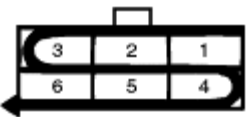
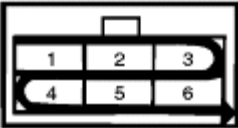
## CONNECTOR CONFIGURATIONS

This section shows the cavity or terminal locations in all the multi-pin connectors shown in the schematic diagrams. It will help you to locate check points, together with the wire colors and terminal numbers in the schematic. The configuration drawings show the connector view as seen from a component after the harness connector has been disconnected. When more than one connector is connected to a component, the connectors are all shown together. Both halves of in-line connectors are shown together.

D15	D35	D16	D36	D17	D37	
						<b>BLANK</b>
MD05	MD06					
				<b>BLANK</b>		<b>BLANK</b>

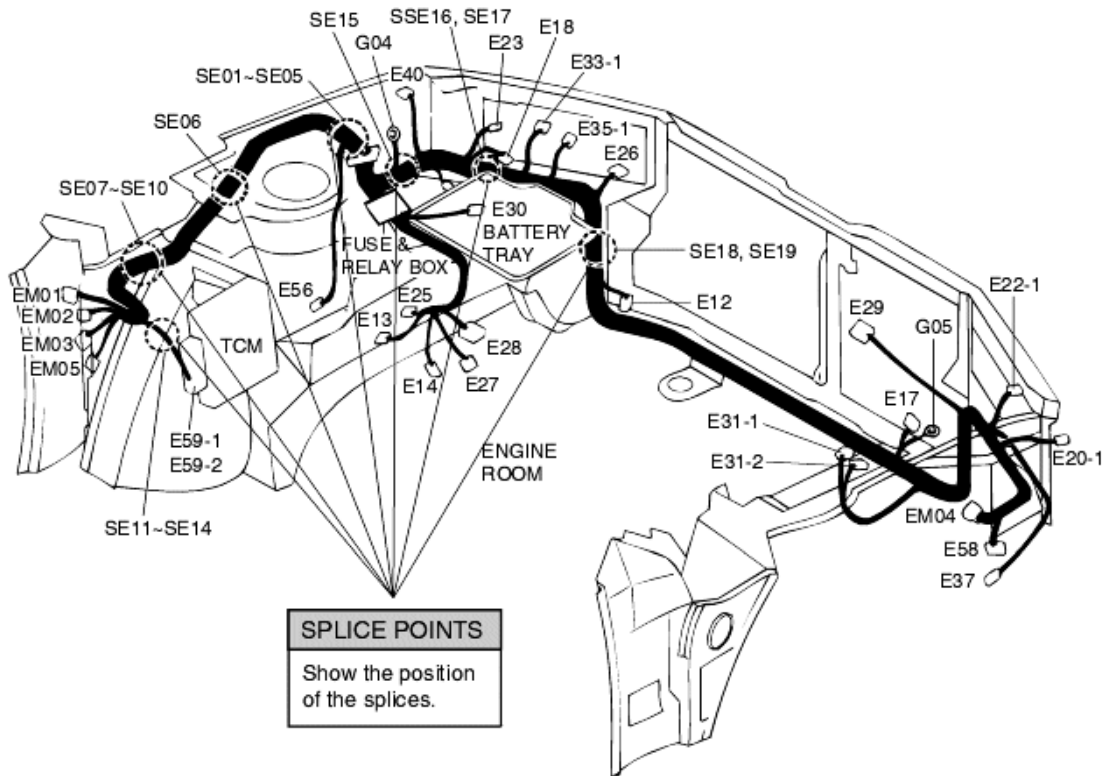
## CONNECTOR VIEW AND NUMBERING ORDER

1. CONNECTOR VIEW			
	Female	Male	Remarks
Actual Illustration			<p>It is not the shape of the connector housing, but the connector pin that distinguishes between male or female connectors.</p> <p>When numbering female and male connectors, refer to the numbering order in the following table.</p> <p>Some connectors may not follow this method of numbering order. For individual detailed numbering, refer to the CONNECTOR CONFIGURATIONS.</p>
Illustration in the Shop manual			

2. NUMBERING ORDER		
	Numbering order	Remarks
Female Connector		Numbered in order from upper right to lower left
Male Connector		Numbered in order from upper left to lower right

## HARNESS LAYOUTS

Harness layouts show the routing of the major wiring harnesses, the in-line connectors and the splices between the major harnesses. These layouts will make electrical troubleshooting easier.



# SYMBOLS E11C0020

The symbols and abbreviations explained in this section are used throughout the manual.

## SYMBOLS IN SCHEMATIC

### Components



A solid line means the entire component is shown.



A broken line indicates only part of the component is shown.

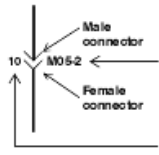


**STOP LAMP SWITCH**  
Closed with pedal depressed

The name of the component appears next to its upper right corner.

Notes about component function follow its name.

### Connectors

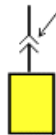


Connector number

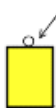
Connector cavity number



This means the connector connects directly to the component.



This indicates the connector connects to a lead (pigtail), wired directly to the component.



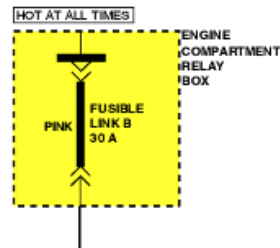
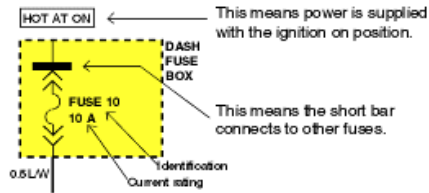
This indicates a screw terminal on the component.

### Diode



This diode allows current to flow only in the direction of the arrow.

### Fuse and Fusible link

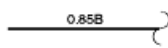


### Circuit Breaker

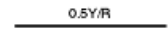


Basically a reusable fuse, a circuit breaker will heat and open if too much current flows through it. Some units automatically reset when cool, others must be manually reset.

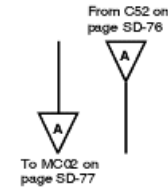
## Wires



A wavy line means the wire is broken but is to be continued.



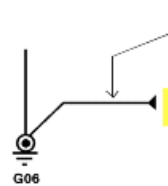
Wire insulation is yellow with a red strip.



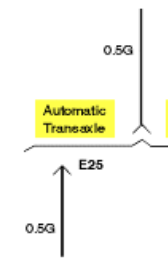
Current path is continued on the same page or another page. The arrow shows the direction of current flow. You should look for the "A" in the marked position.



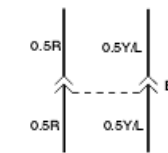
A wire connects to another circuit. The wire is shown again on that circuit which the arrow is pointing.



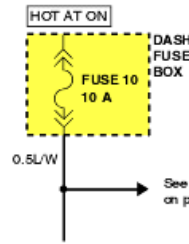
A broken line means only some of the circuit is shown: refer to the circuit listed for the complete schematic.



Wire choices for options or different models are labeled and shown with a "choice" bracket like this.



This dashed line means the RED and YELLOW/BLUE wires are both in connector E35.

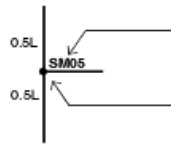


DASH FUSE BOX

See Power Distribution on page SD-15

Where separate wires join, only the splice is shown: for details on the additional wiring, refer to the circuit listed.

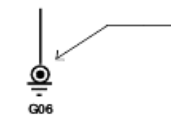
## Splices



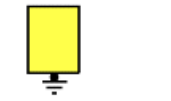
Splice number

Splices are numbered and shown as a dot with circle. The exact location and connection of these splices may vary among vehicles.

## Ground - "G"

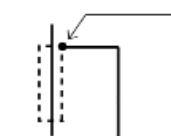


This symbol means the end of the wire is attached to a metal part of the vehicle.



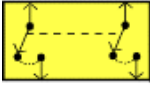
This ground symbol (dot and 3 lines overlapping the component) means the housing of the component is attached to a metal part of the vehicle.

## Shield Wire



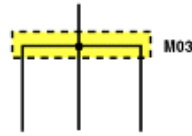
This represents RFI (Radio Frequency Interference) Shielding around a wire. The shielding is always connected to ground.

## Switches



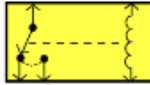
These switches move together: a dashed line shows a mechanical connection between them.

## Joint Connectors

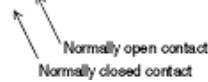


This is a connector showing the joining wires.

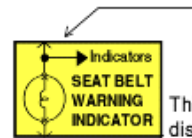
## Relays



This is a relay shown with no current flowing through its coil. When a current flows through coil, contact will toggle.



## Indicator



This indicates seat belt warning indicator continues to other indicators within instrument cluster.

This is an indicator which displays the lighted symbol.

## WIRE COLOR ABBREVIATIONS

The following abbreviations are used to identify wire colors in the circuit schematics :

Symbol	Color of wire	Symbol	Color of wire
B	Black	O	Orange
Br	Brown	P	Pink
G	Green	Pp	Purple
Gr	Gray	R	Red
L	Blue	T	Tawny
Lg	Light green	W	White
Ll	Light blue	Y	Yellow

## HARNESS CLASSIFICATION

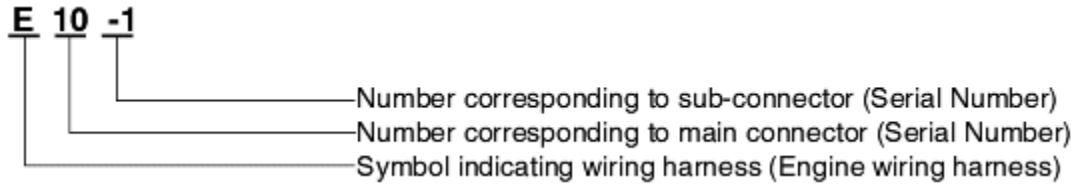
Electrical wiring connectors are classified according to the wiring parts in the Harness Layouts.

Harness name	Location	Symbol
Engine harness	Engine compartment	E
Control harness	Engine compartment	C
Rear and Trunk lid (Tail gate) harness	Rear and Trunk lid	R
Instrument harness	Under dash panel	I

## CONNECTOR IDENTIFICATION

A connector identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector. These connector locations can be found in the HARNESS LAYOUTS.

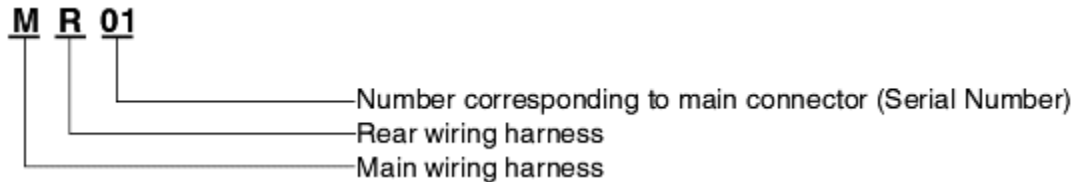
For example :



## NOTE

Connectors which connect each wiring harness are represented by the following symbols.

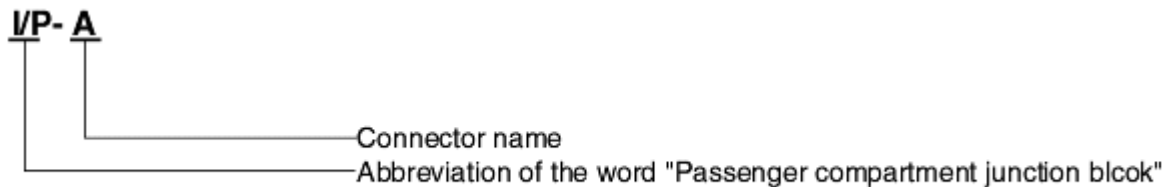
For example :



## JUNCTION BLOCK IDENTIFICATION

A junction block identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector in the junction block.

For example :





## TROUBLESHOOTING PROCEDURES

The following five-step troubleshooting procedure is recommended.

**1. Verify the customer's complaints**

Turn on all the components in the problem circuit to check the accuracy of the customer's complaints. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the probable causes.

**2. Read and analyze the schematic diagram**

Locate the schematic for the problem circuit. Determine how the circuit is supposed to work by tracing the current paths from the power source through the system components to ground. If you do not understand how the circuit should work, read the circuit operation text. Also check other circuits that share with the problem circuit. The name of circuits that share the same fuse, ground, or switch, for example, are referred to on each diagram. Try to operate any shared circuits you did not check in step 1. If the shared circuit works, the shared wiring is okay, and the cause must be within the wiring used only by the problem circuit. If several circuits fail at the same time, the fuse or ground is a likely cause.

**3. Inspect the circuit/ component with the problem isolated**

Make a circuit test to check the diagnosis you made in step 2. Remember that a logical, simple procedure is the key to efficient troubleshooting. Narrow down the probable causes using the troubleshooting hints and system diagnosis charts. Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.

**4. Repair the problem**

Once the problem is found, make the necessary repairs.

**5. Make sure the circuit works**

Repeat the system check to be sure you have repaired the problem. If the problem was a blown fuse, be sure to test all of the circuits on that fuse.

## TROUBLESHOOTING EQUIPMENT

**VOLTMETER AND TEST LAMP**

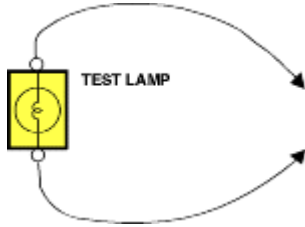
Use a test lamp or a voltmeter on circuits without solid-state units and use a test lamp to check for voltage. A test lamp is made up of a 12-volt light bulb with a pair of leads attached. After grounding one lead, touch the other lead to various points along the circuit where voltage should be present. When the bulb goes on, there is voltage at the point being tested.

**CAUTION**

**A number of circuits include solid-state modules, such as the Engine Control Module (ECM), used with computer command control injection. Voltage in these circuits should be tested only with a 10-megaohm or higher impedance digital voltmeter. Never use a test**

**lamp on circuits that contain solid-state modules. Damage to the modules may result.**

A voltmeter can be used in place of a test lamp. While a test lamp shows whether the voltage is present or not, a voltmeter indicates how much voltage is present.



**SELF-POWERED TEST LAMP AND OHMMETER**

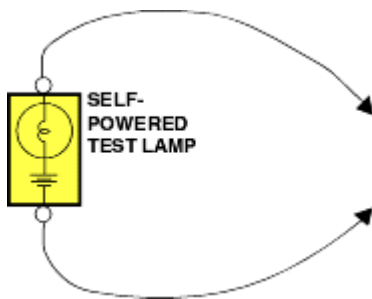
Use a self-powered test lamp or an ohmmeter to check for continuity. A self-powered test lamp is made of a bulb, battery and two leads. That will light a lamp when touched together. Prior to checking the points, first disconnect the battery ground cable or remove the fuse which feeds the circuit you are working on.

**CAUTION**

**Never use a self-powered test lamp on circuits that contain solid state modules. Damage to these modules may result.**

An ohmmeter can be used in place of a self-powered test lamp. The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

Circuits which include any solid-state devices should be tested only with a 10-megaohm or higher impedance digital multimeter. When measuring resistance with a digital multimeter, the battery negative terminal should be disconnected. Otherwise, there may be incorrect readings. Diodes and solid-state devices in a circuit can make an ohmmeter give a false reading. To find out if a component is affecting a measurement, take one reading, reverse the leads and take a second reading. If different the solid-state device is affecting the measurement.



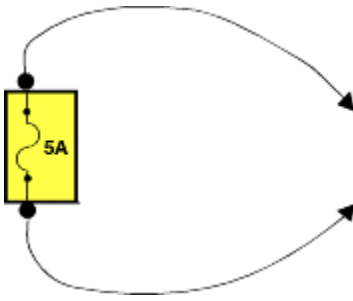
**JUMPER WIRE WITH FUSE**

Use a jumper wire with a fuse to by-pass an open circuit.

A jumper wire is made up of an in-line fuse holder connected to a set of test leads. This tool is available with small clamp connectors providing adaption to most connectors without damage.

**CAUTION**

**Do not use a fuse with a higher rating than the specified fuse that protects the circuit being tested. Do not use this tool in any situation to substitute an input or output at the solid-state control module, such as ECM, TCM, etc.**



## SHORT FINDER

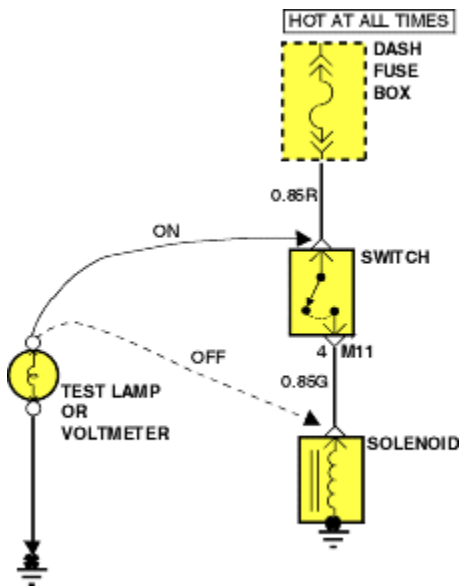
A short finder is available to locate a short to ground. The short finder creates a pulsing magnetic field in the shorted circuit and shows you the location of the short through body trim or sheet metal.

## TROUBLESHOOTING TEST

### TESTING FOR VOLTAGE

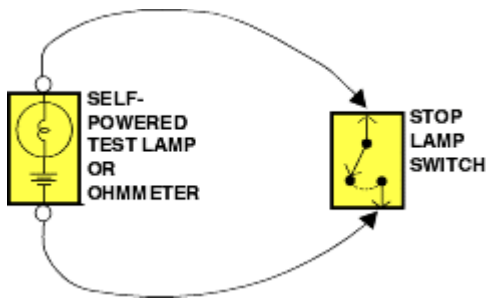
This test measures voltage in a circuit. When testing for voltage at a connector, you do not have to separate the two halves of the connector. Instead, probe the connector from the back (back-probe). Always check both sides of the connector because dirt and corrosion between its contact surfaces can cause electrical problems.

1. Connect one lead of a test lamp or voltmeter to a ground. If you are using a voltmeter, be sure it is the voltmeter's negative test lead you have connected to ground.
2. Connect the other lead of the test lamp or voltmeter to a selected test point (connector or terminal).
3. If the test lamp glows, there is voltage present. If you are using a voltmeter, note the voltage reading. Too close a loss of more than 1 volt from specification indicates a problem.



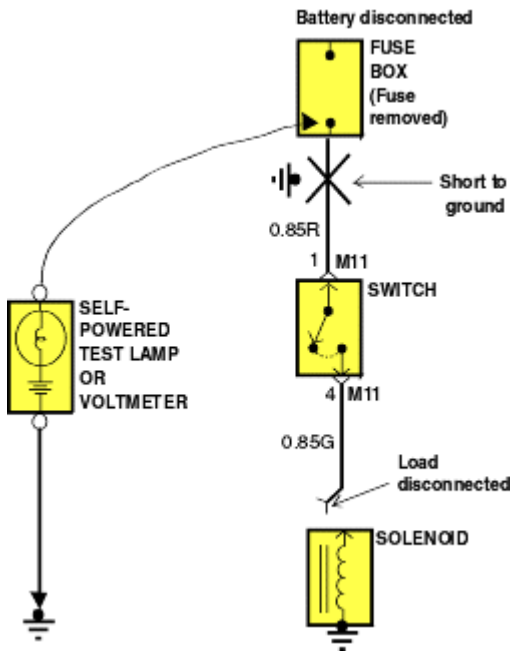
## TESTING FOR CONTINUITY

1. Disconnect the battery negative terminal.
2. Connect one lead of a self-powered test lamp or ohmmeter to one end of the part of the circuit you wish to test. If you are using an ohmmeter, hold the leads together and adjust the ohmmeter to read zero ohms.
3. Connect the other lead to the other end.
4. If the self-power test lamp glows, there is continuity. If you are using an ohmmeter, low or zero resistance means good continuity.



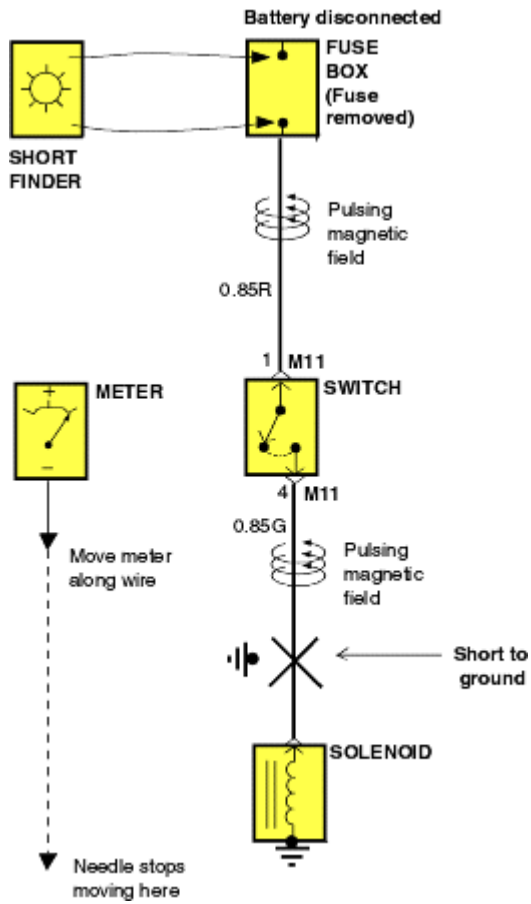
## TESTING FOR SHORT TO GROUND

1. Disconnect the battery negative terminal.
2. Connect one lead of a self-powered test lamp or an ohmmeter to the fuse terminal on the load side.
3. Connect the other lead to a ground.
4. Beginning near the fuse block move the harness from side to side. Continue this procedure (about six inches apart) while watching the self-powered test lamp or ohmmeter.
5. When the self-powered test lamp glows, or ohmmeter registers, there is a short to a ground in the wiring near that point.



### TESTING FOR A SHORT WITH A SHORT FINDER

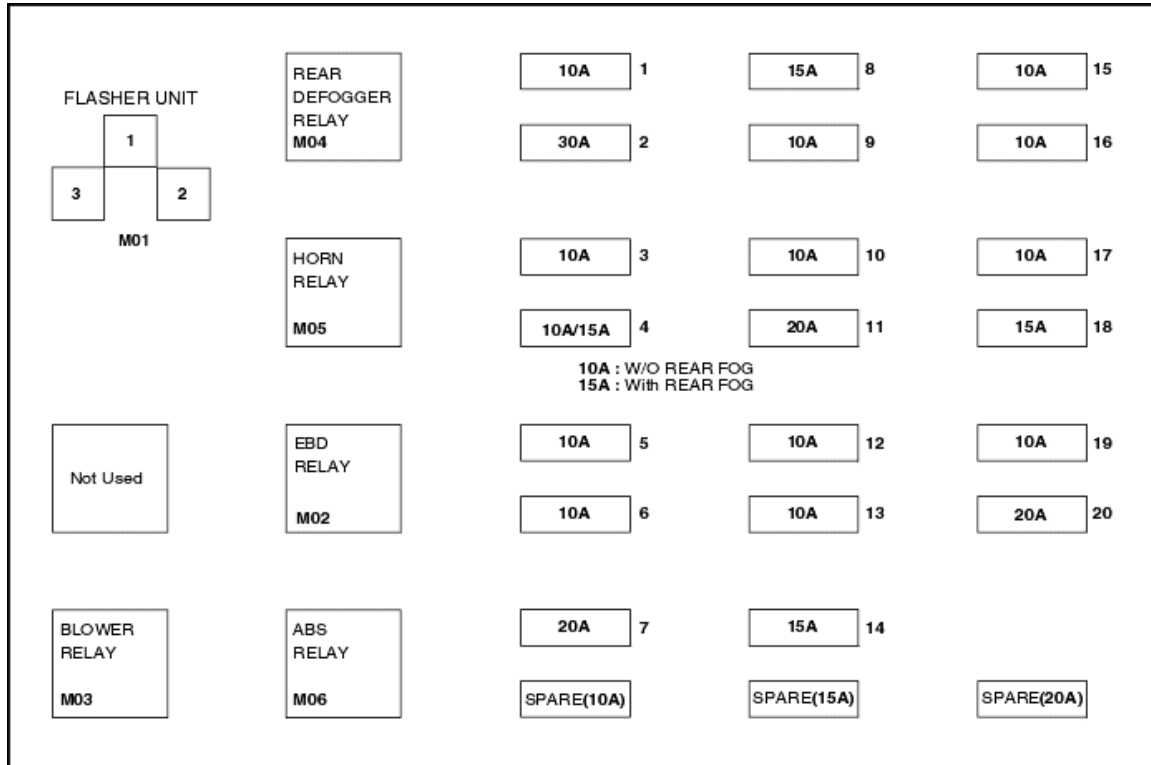
1. Remove the blown fuse. Leave the battery connected.
2. Connect the short finder across the fuse terminals.
3. Close all switches in series in the circuit that are being testing.
4. Turn on the short circuit locator. It sends pulses of current to the short. This creates a pulsing magnetic field around the wiring between the fuse box and the short.
5. Beginning at the fuse box, slowly move the short finder along the circuit wiring. The meter will show current pulses through sheet metal and body trim. As long as the meter is between the fuse and the short, the needle will move with each current pulse. Once the meter is moved past the point of the short, the needle will stop moving. Check around this area to locate the cause of the short circuit.



## 13.2 Schematic Diagram

FUSE & RELAY INFORMATION E21C0010

### PASSENGER COMPARTMENT RELAY & FUSE BOX (located behind LTI) LAYOUT

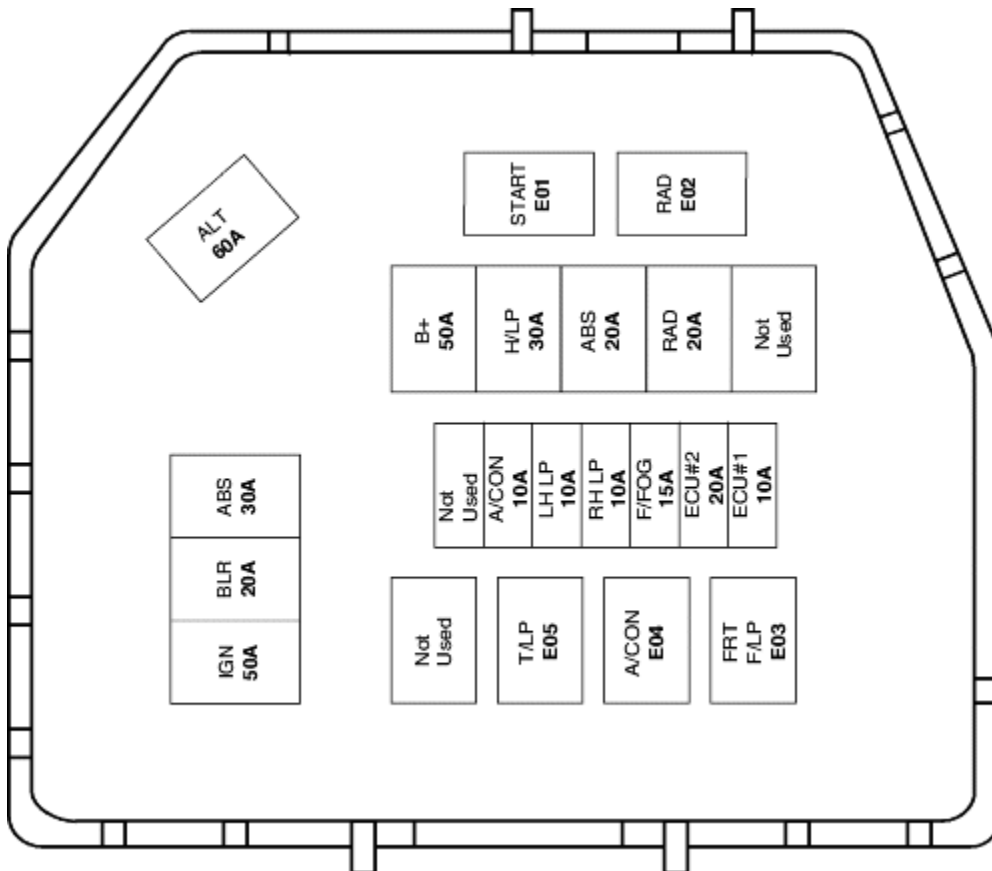


### CIRCUIT

Fuse	Amperages	Circuit
1	10A	Horn
2	30A	Power window ( <i>not used</i> )
3	10A	ABS ( <i>not used</i> )
4	10A	Left head lamp
5	10A	Right head lamp
6	10A	Blower, rear window defogger
7	20A	Wiper, washer
8	15A	Power door lock, door warning control ( <i>not used</i> )
9	10A	Hazard warning, data link connector
10	10A	Stop lamp, shift & key lock control
11	20A	Rear window defogger ( <i>not used</i> )
12	10A	Digital clock, audio, room lamp, instrument cluster, rear fog lamp, luggage room lamp ( <i>not used</i> )
13	10A	A/T interlock control
14	15A	Seat warmer, cigarette lighter ( <i>not used</i> )
15	10A	Generator, TCM, turn signal
16	10A	Instrument cluster, seat belt timer, EBD, A/T interlock control

- 17      10A      Instrument cluster
- 18      15A      Air bag (*not used*)
- 19      10A      A/C & blower control
- 20      20A      ECM, Ignition coil

**ENGINE COMPARTMENT RELAY & FUSE BOX (*located under front hood*)  
LAYOUT**

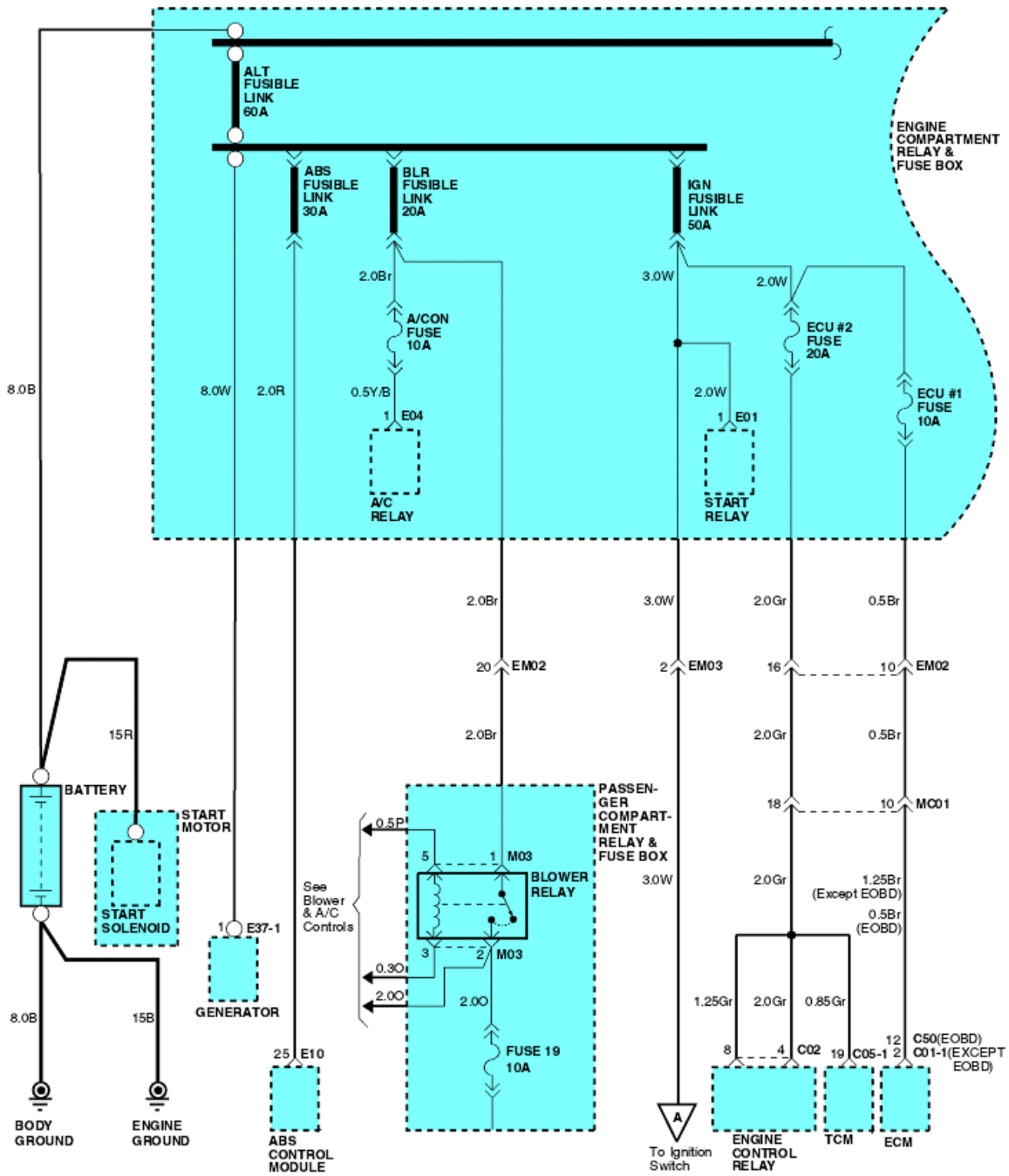


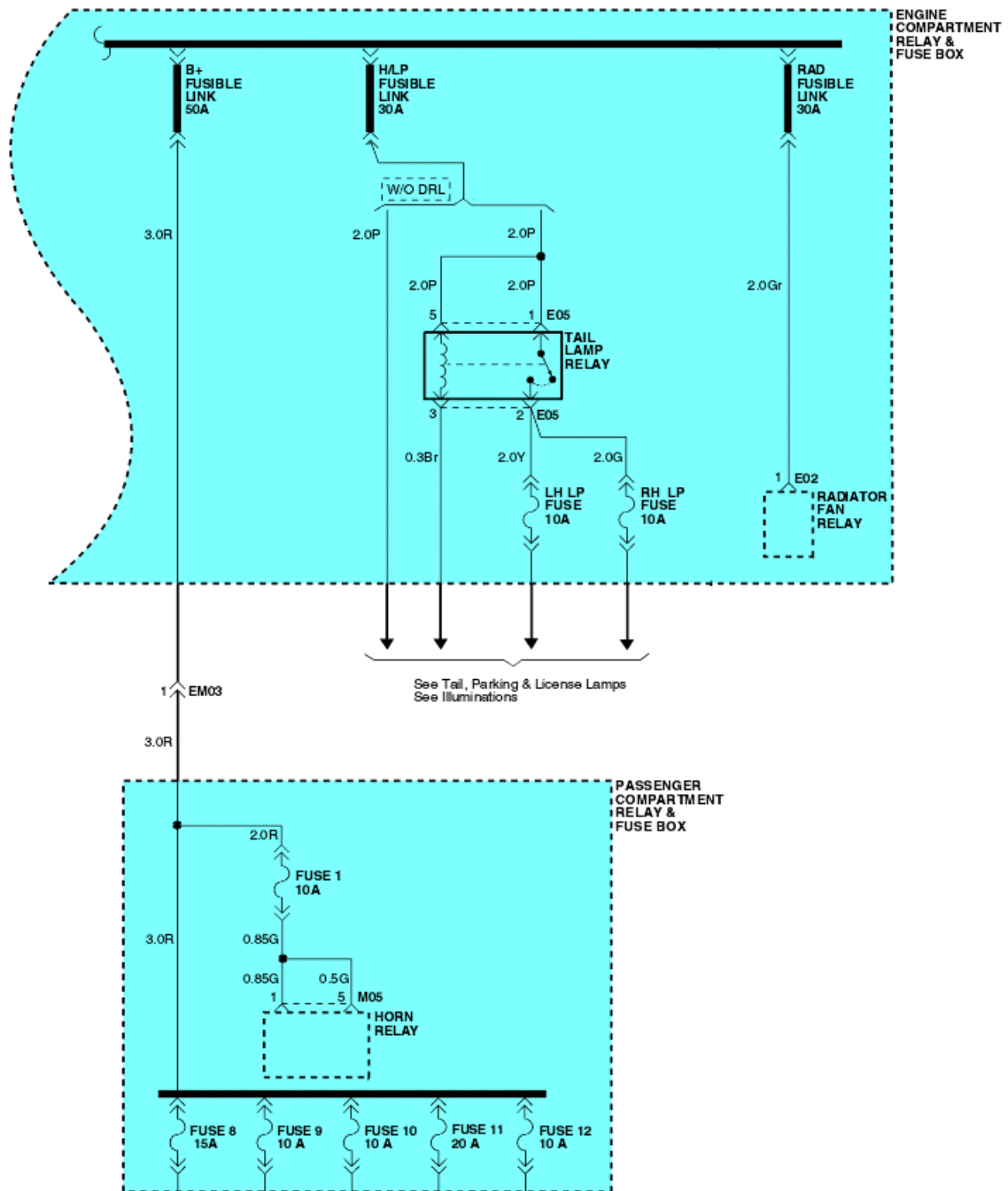


## FUSE & RELAY INFORMATION

<b>Description</b>	<b>Amperages</b>	<b>Circuit protected</b>	<b>Remark</b>
Fusible link			
ALT	60A	Generator	
ABS	30A	ABS control	
BLR	20A	Blower control	
IGN	50A	Ignition power source	
B+	50A	Battery power source	
H/LP	30A	Lamps	
ABS	20A	ABS control	
RAD	20A	Radiator fan control	
Fuse			
A/CON	10A	A/CON controls	
LH LP	10A	Left tail lamps	
RH LP	10A	Right tail lamps	
F/FOG	15A	Front fog lamps	<i>Not used</i>
ECM #2	20A	Engine control relay	
ECU #1	10A	ECM	

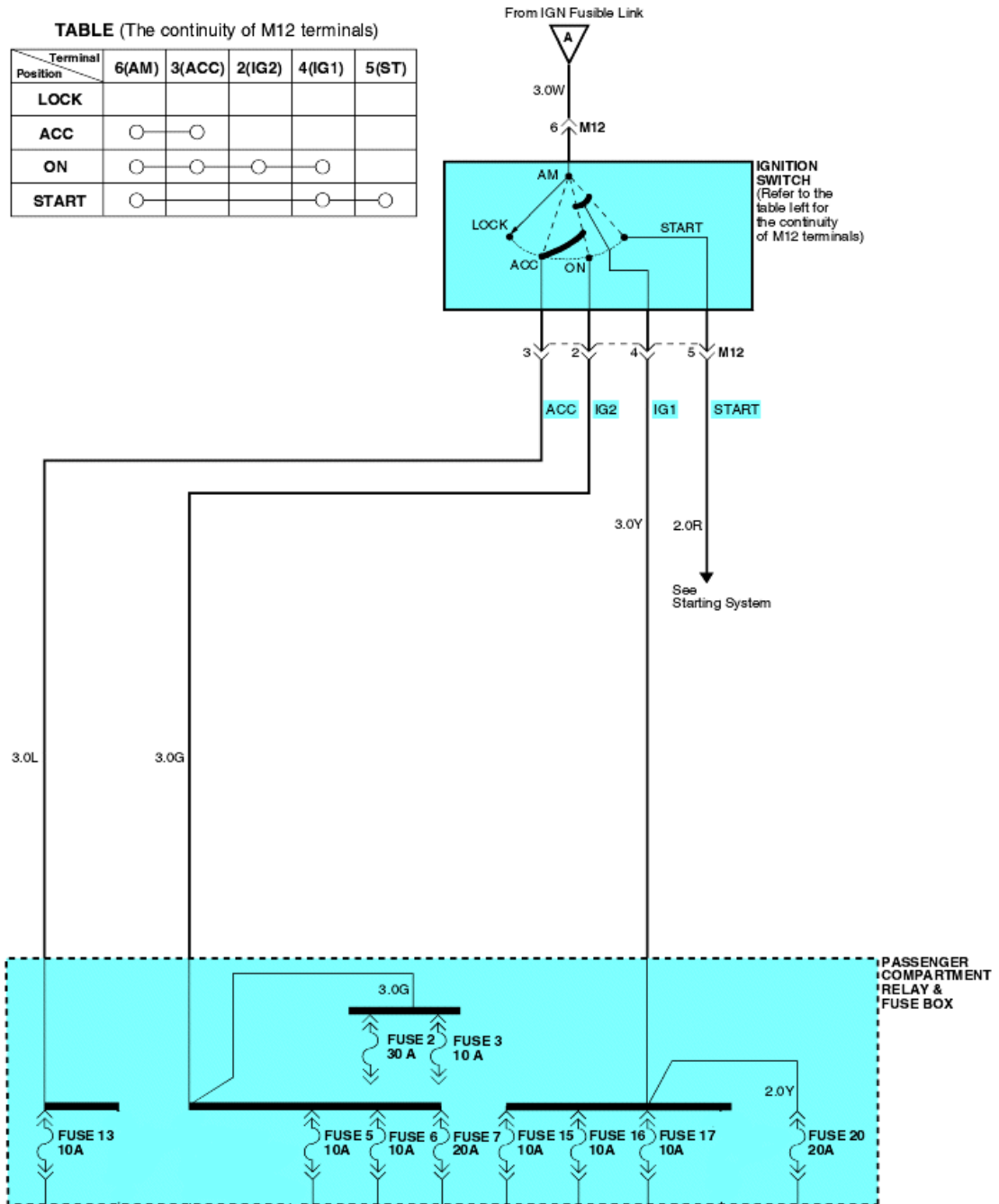
POWER DISTRIBUTION E21C0020





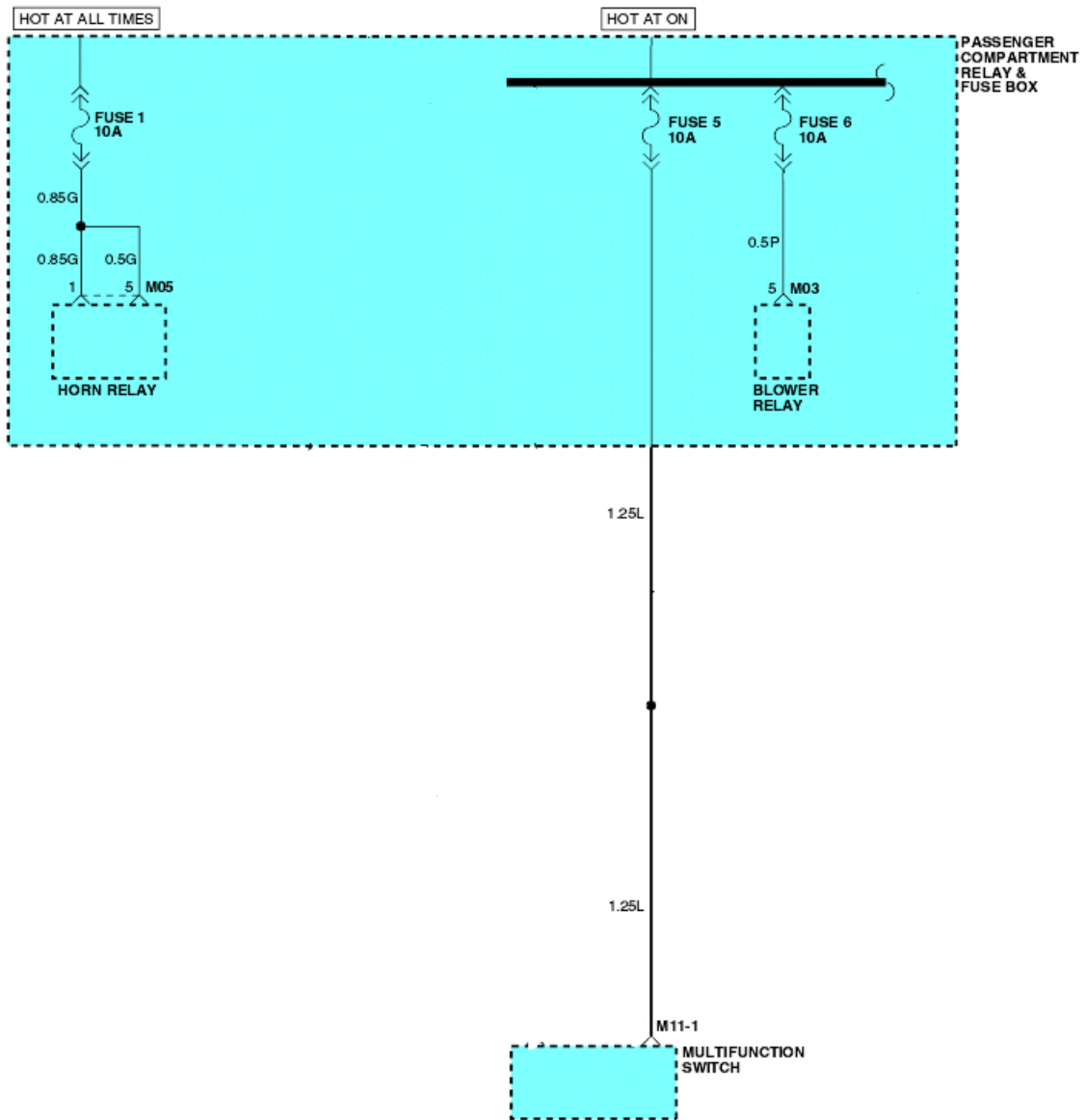
**TABLE** (The continuity of M12 terminals)

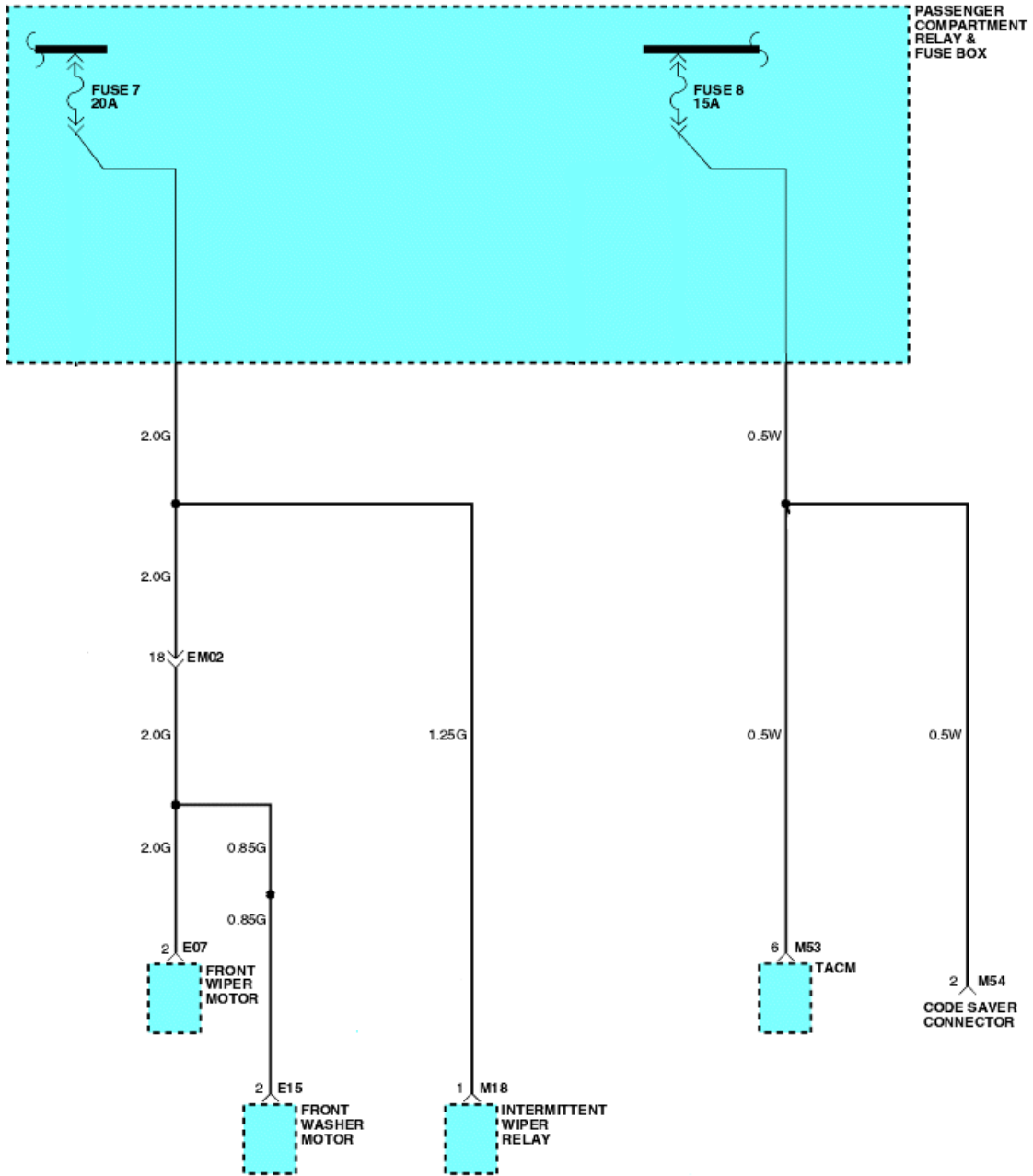
Terminal Position	6(AM)	3(ACC)	2(IG2)	4(IG1)	5(ST)
LOCK					
ACC	○	○			
ON	○	○	○	○	
START	○			○	○



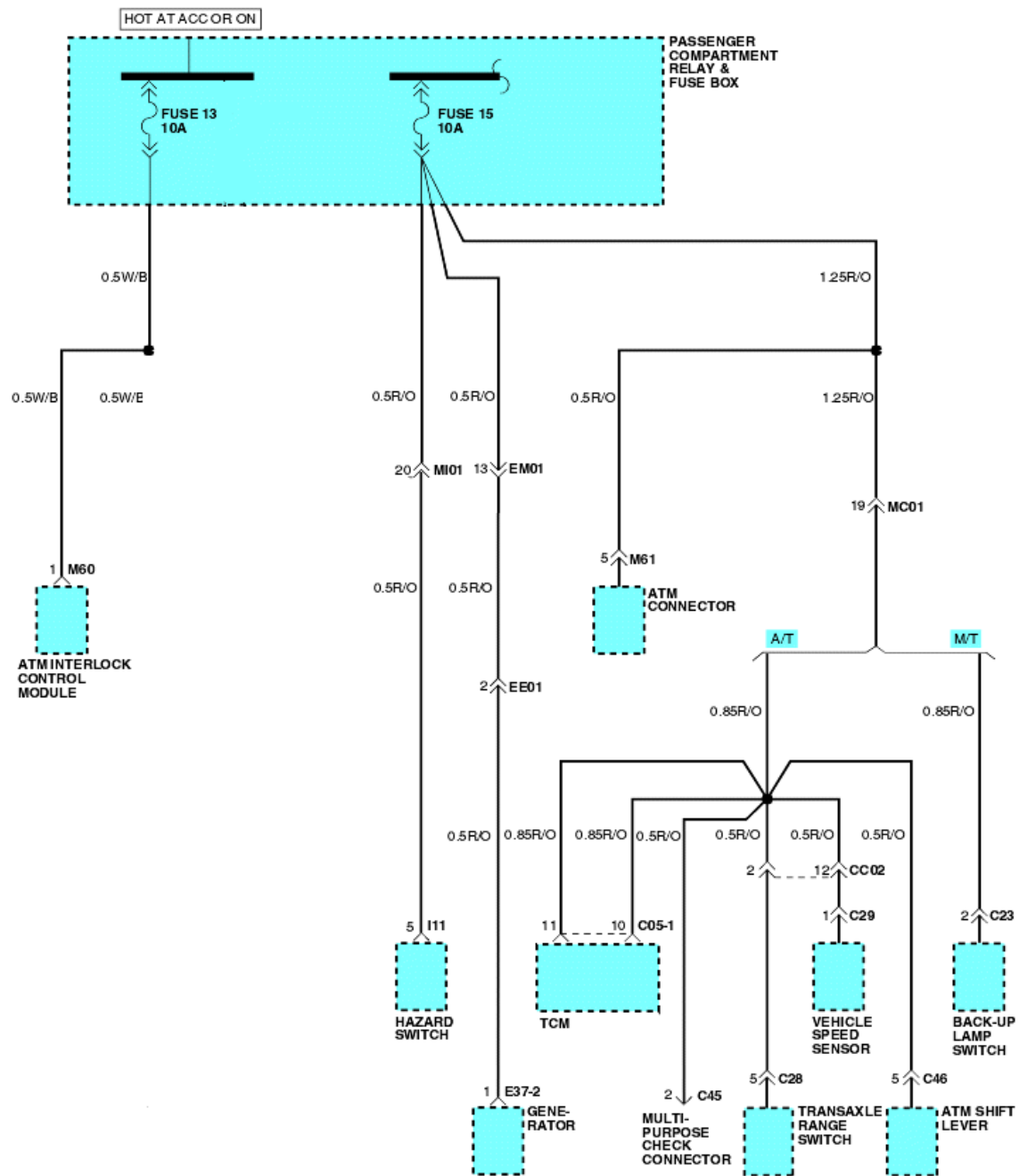
**MEMO**

DASH FUSE DETAILS E21C0030

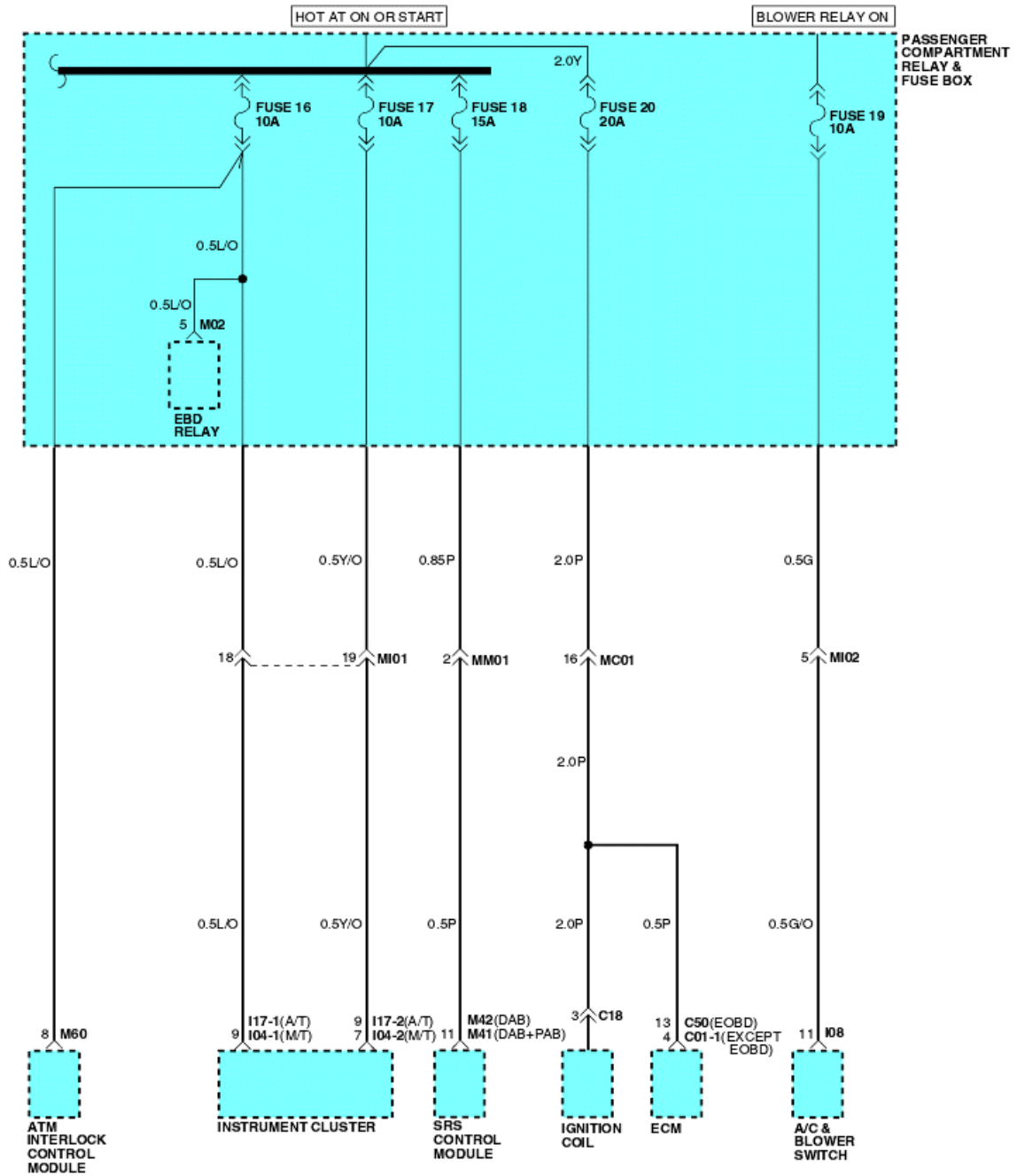






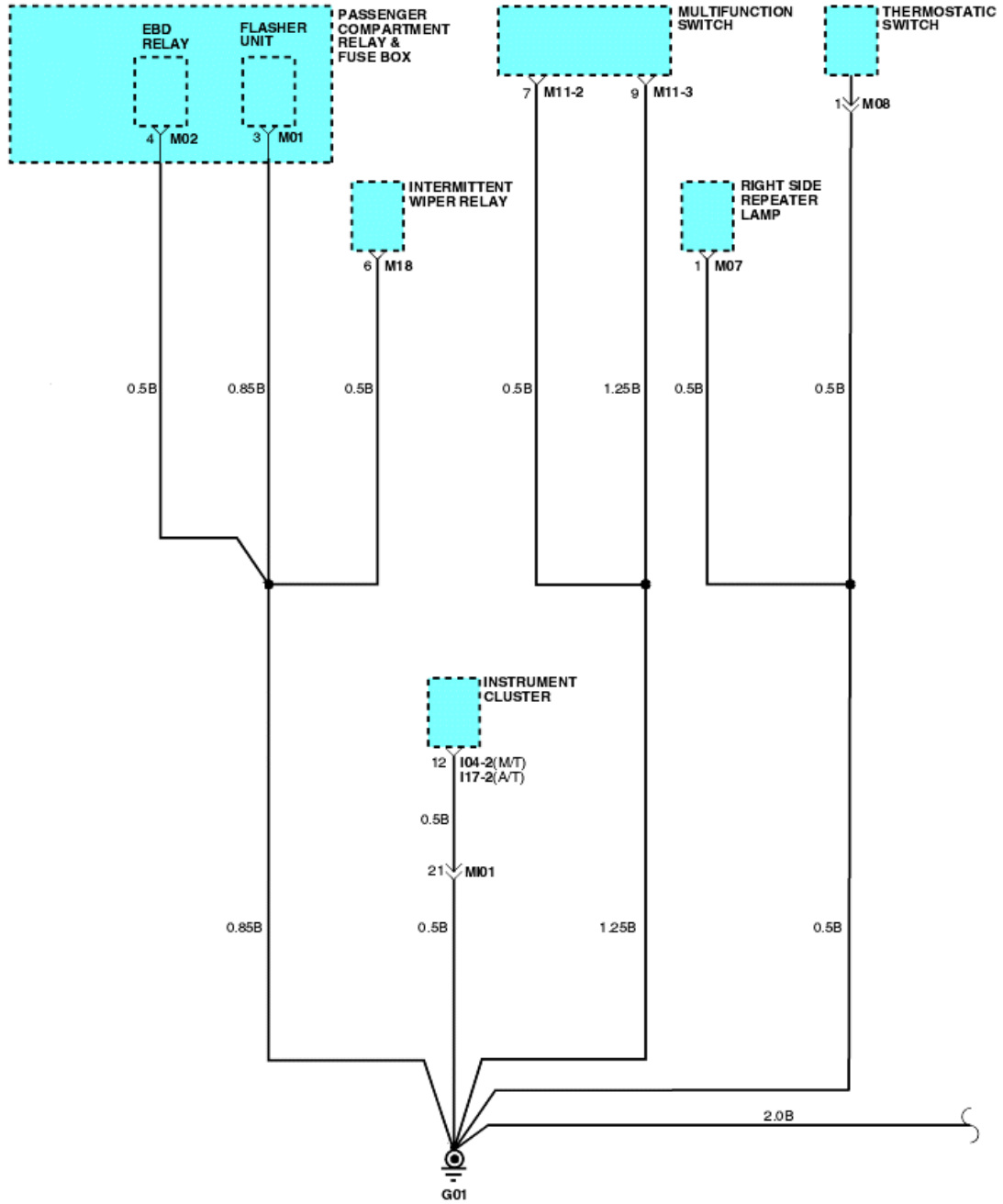


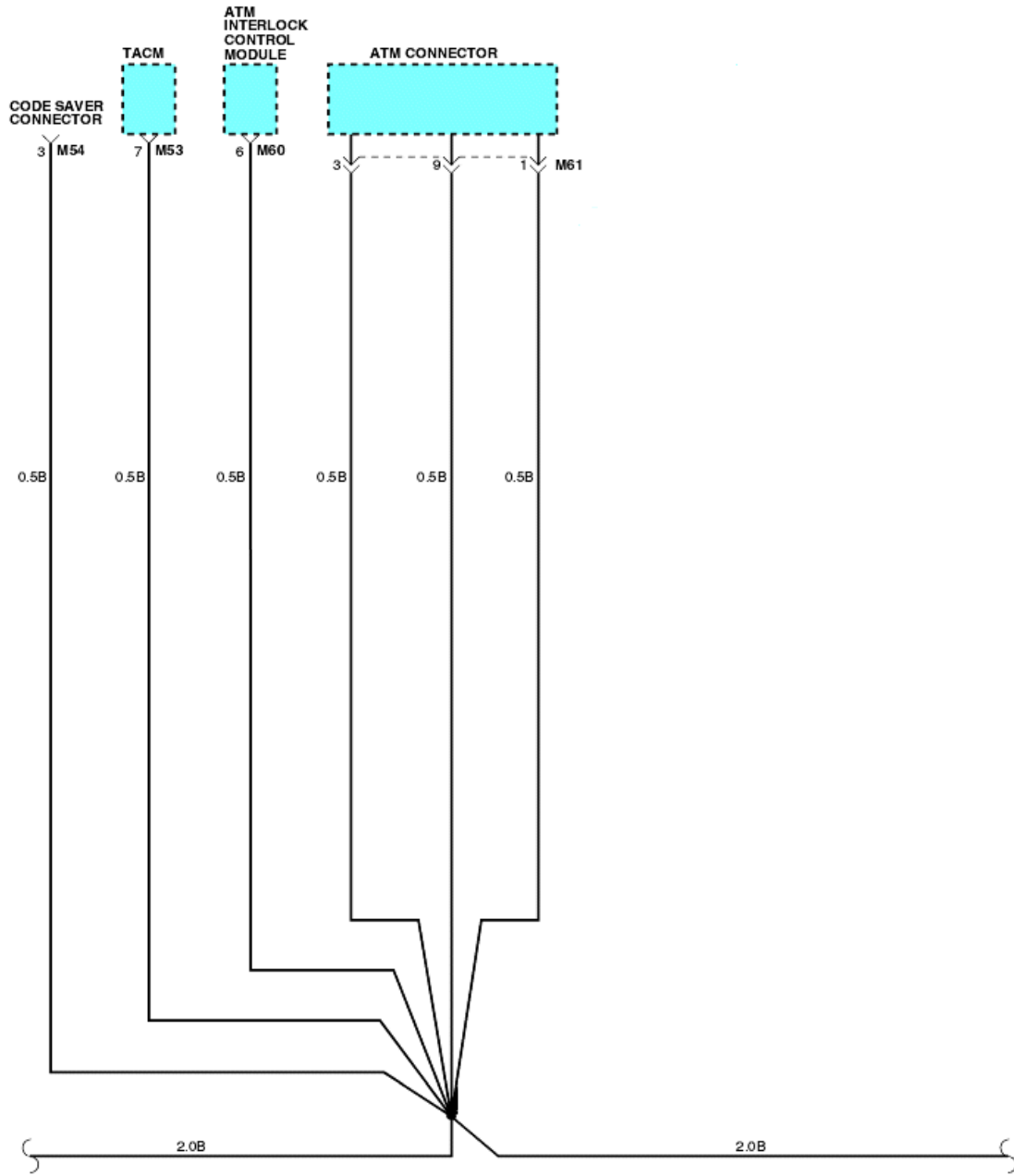


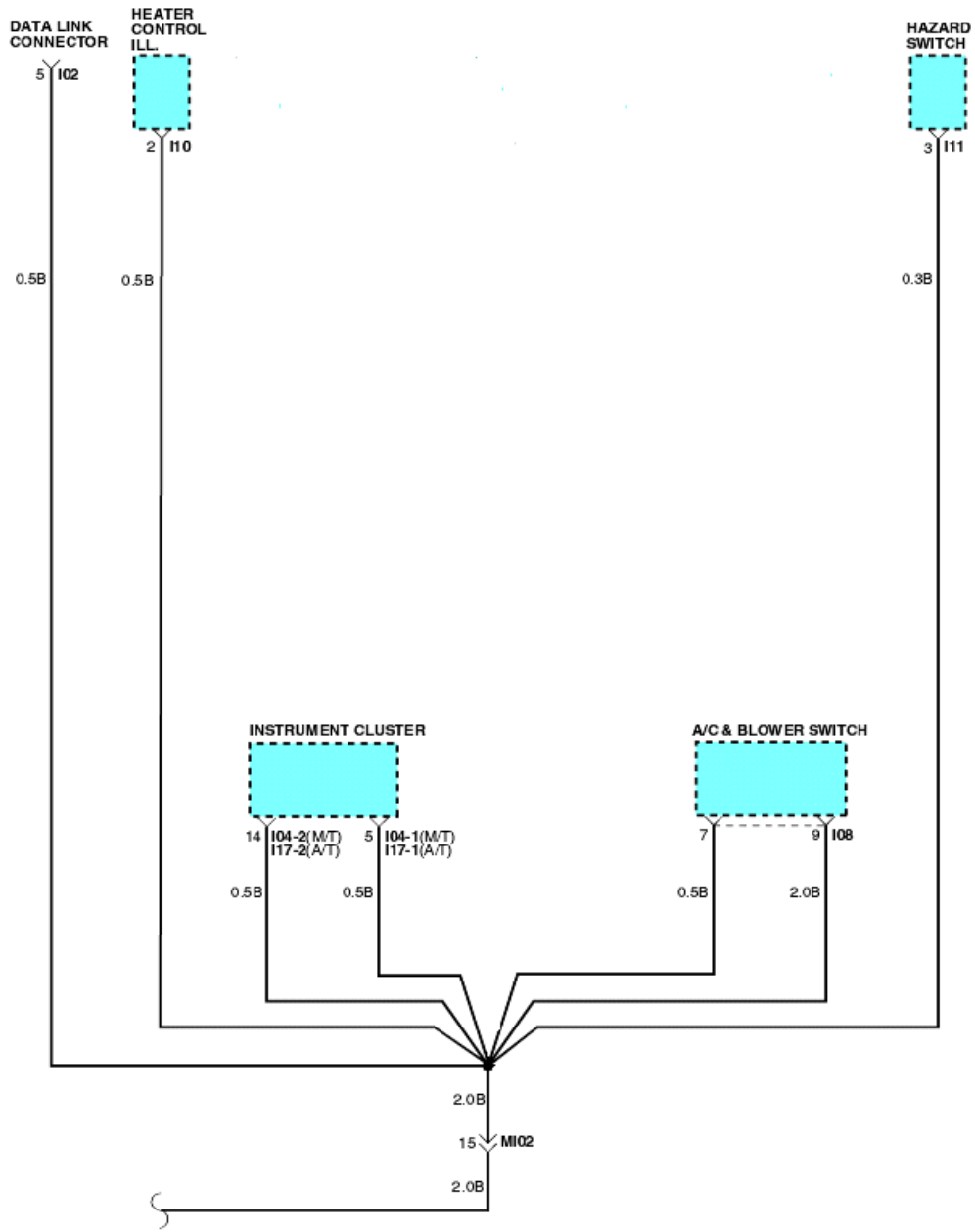


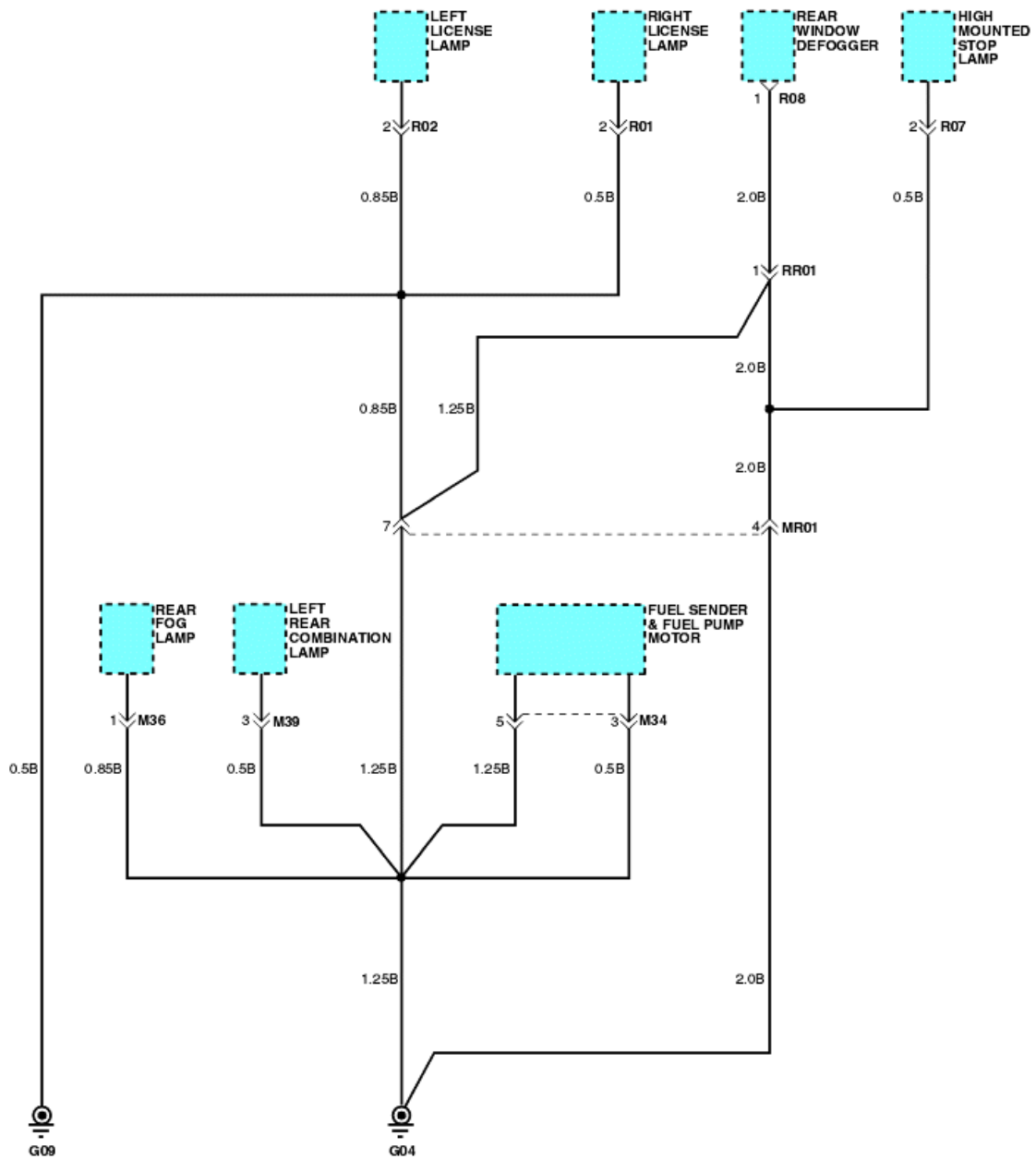
**MEMO**

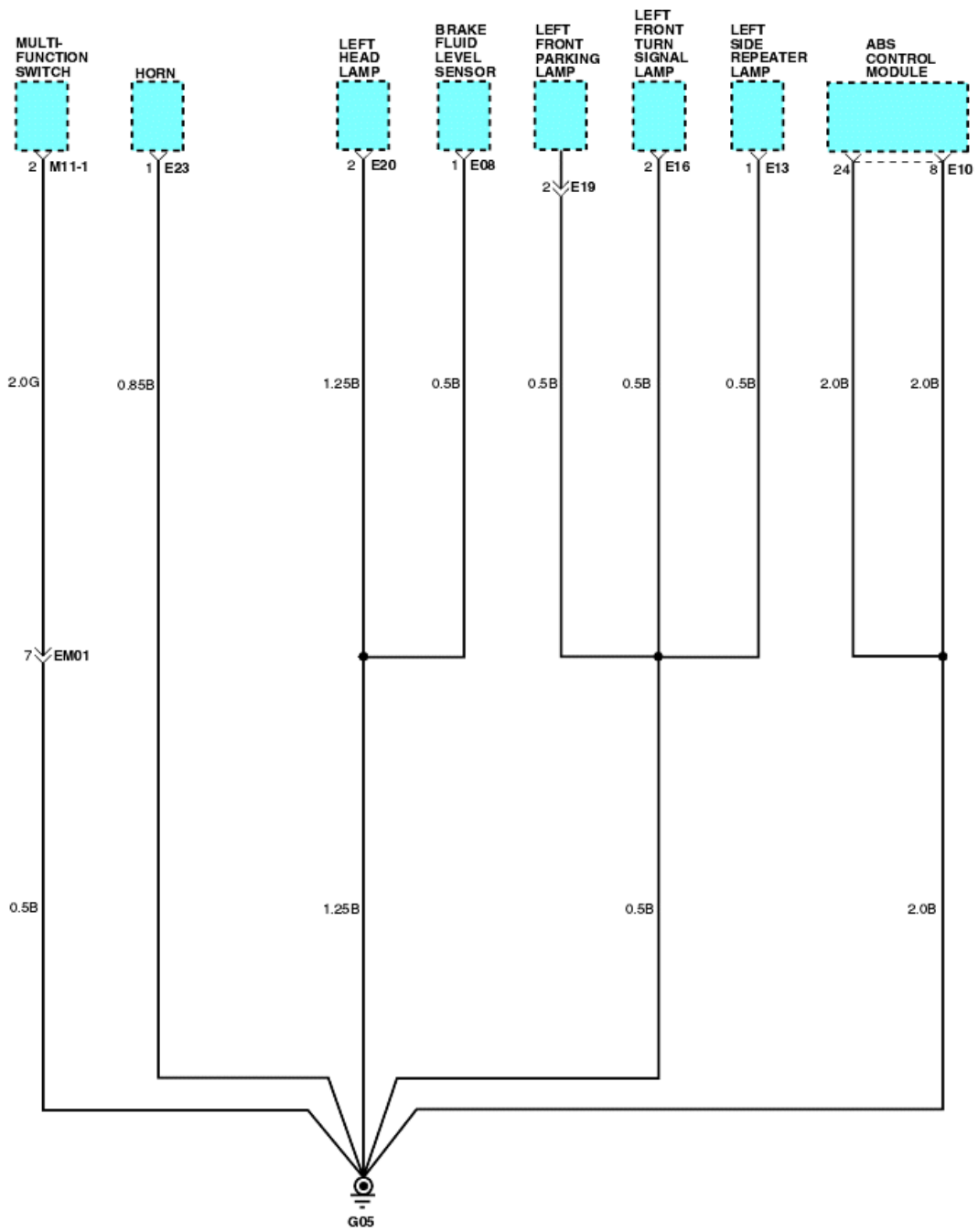
GROUND DISTRIBUTION E21C0040

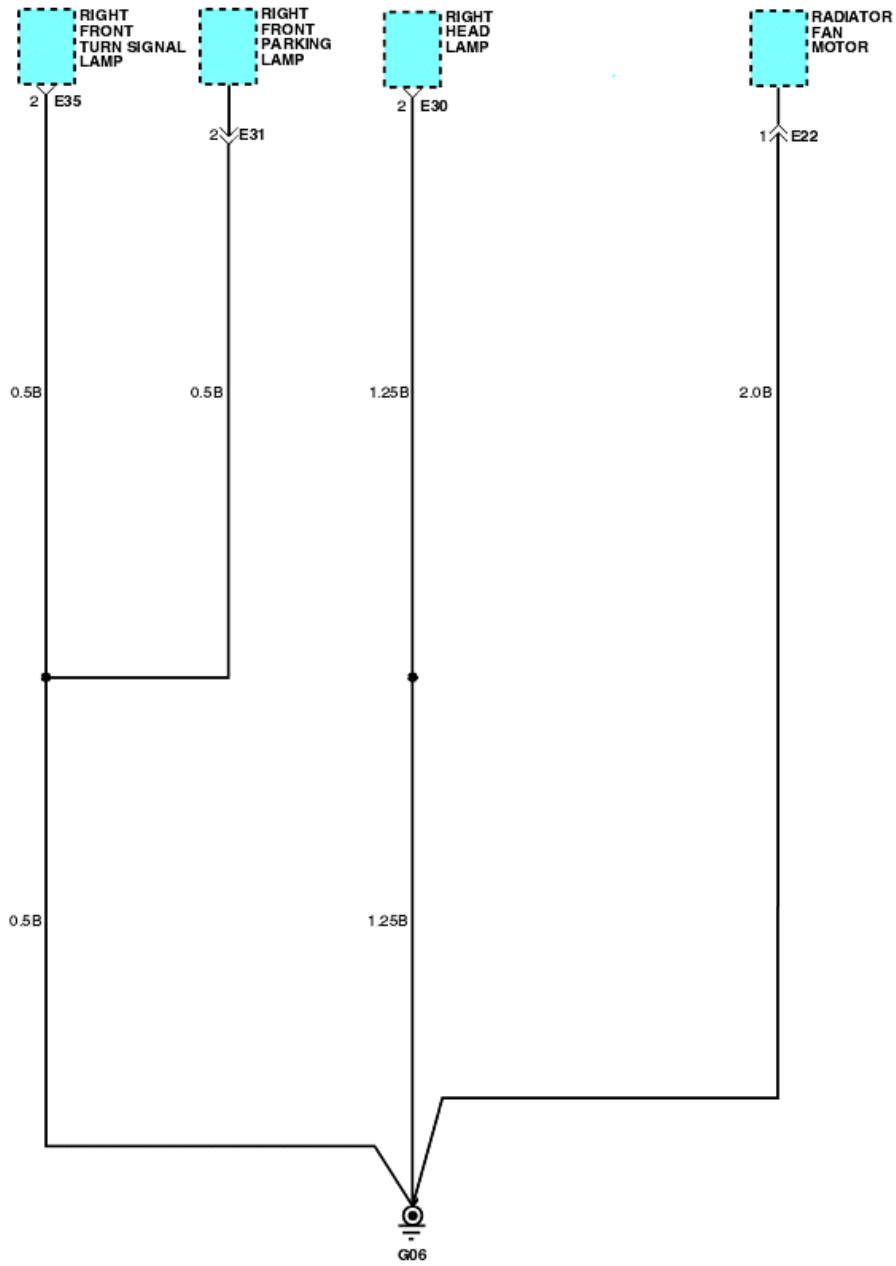


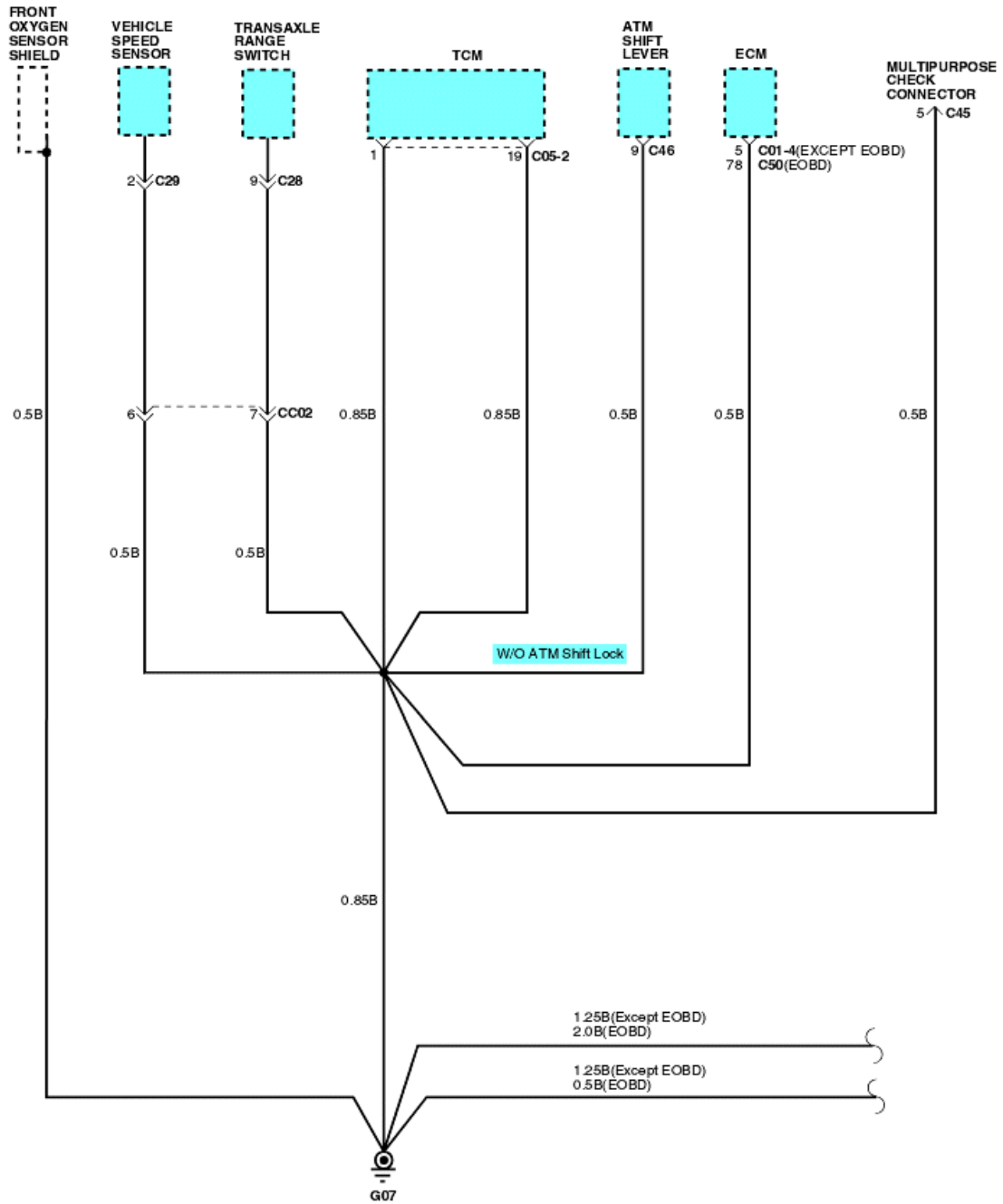




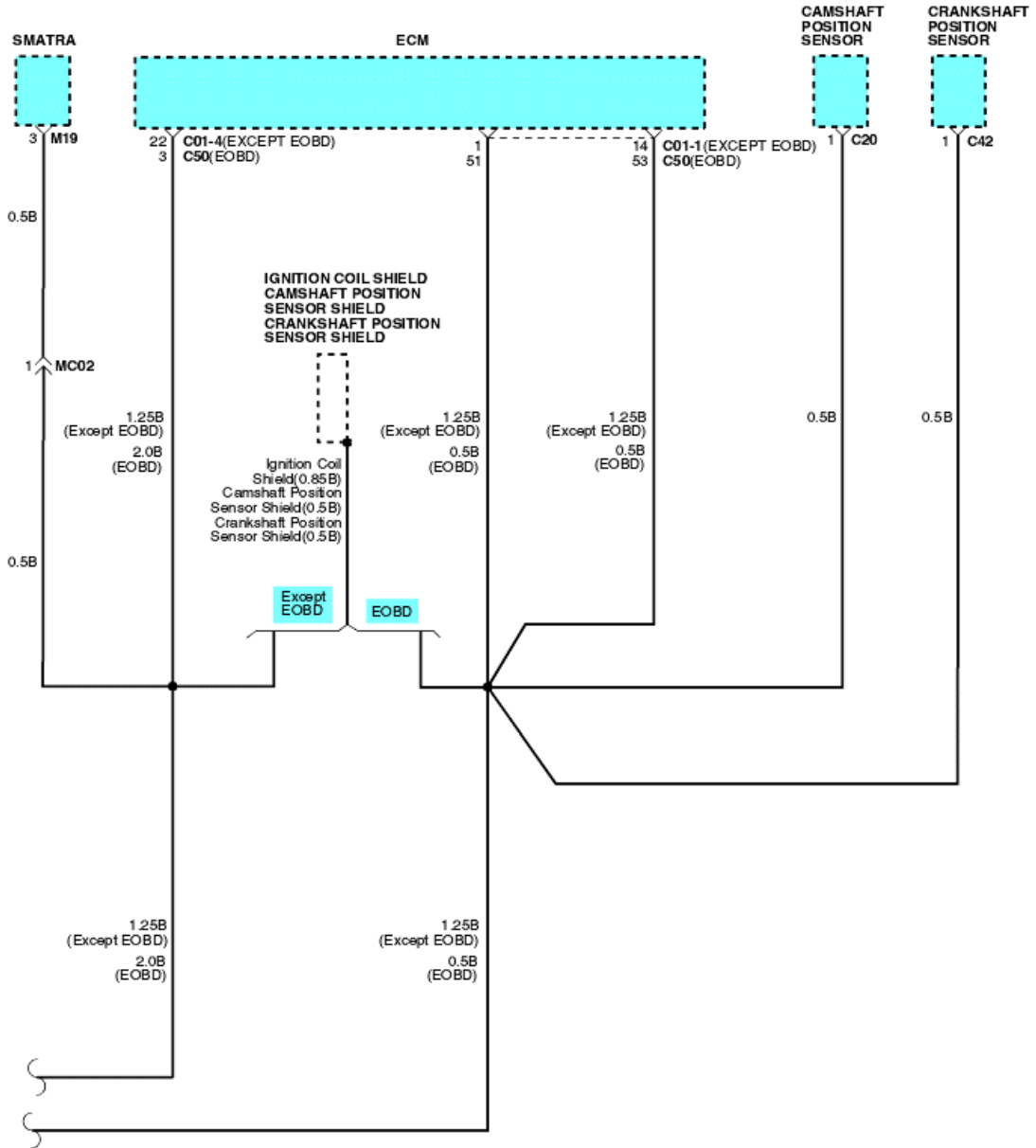


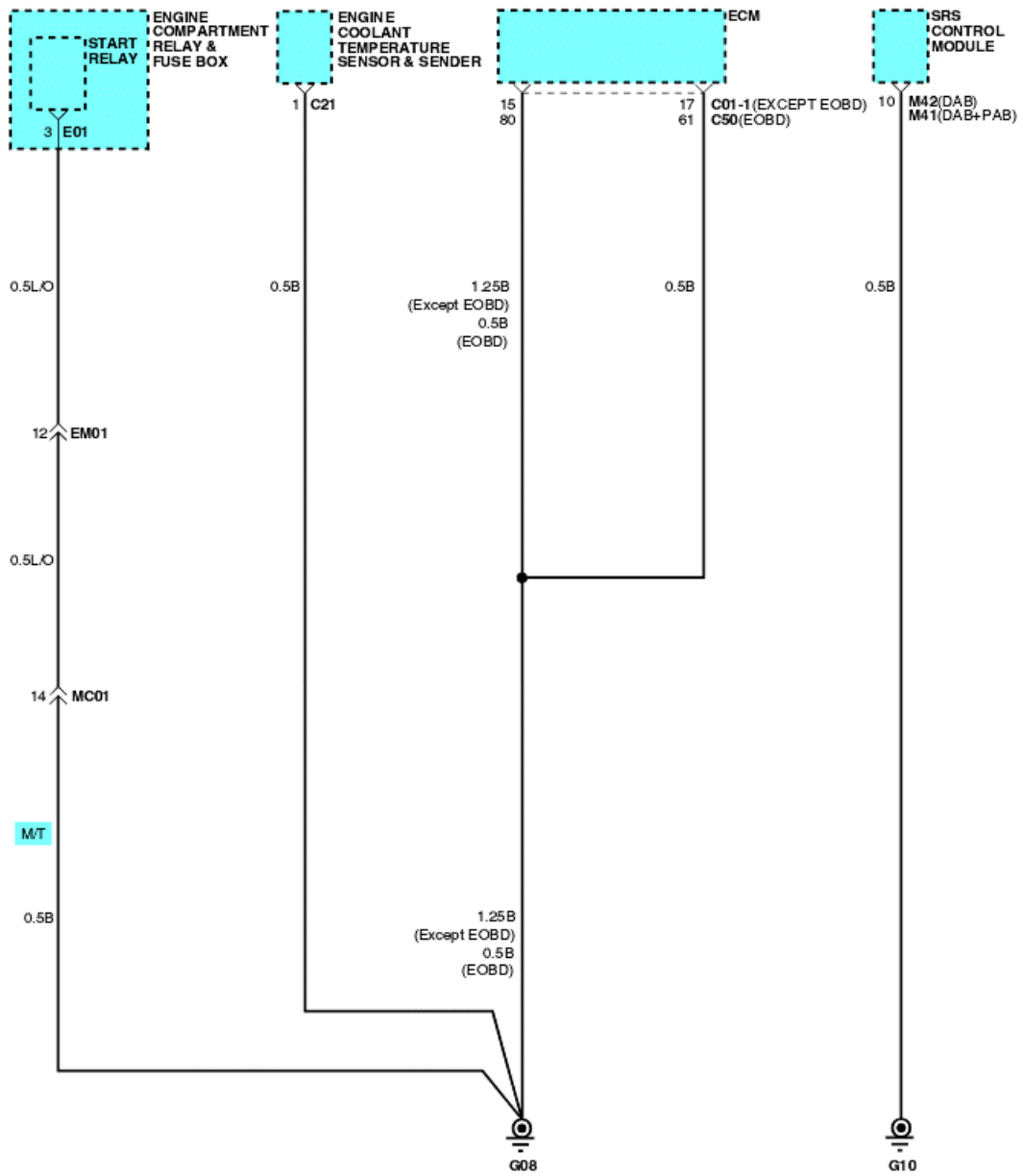




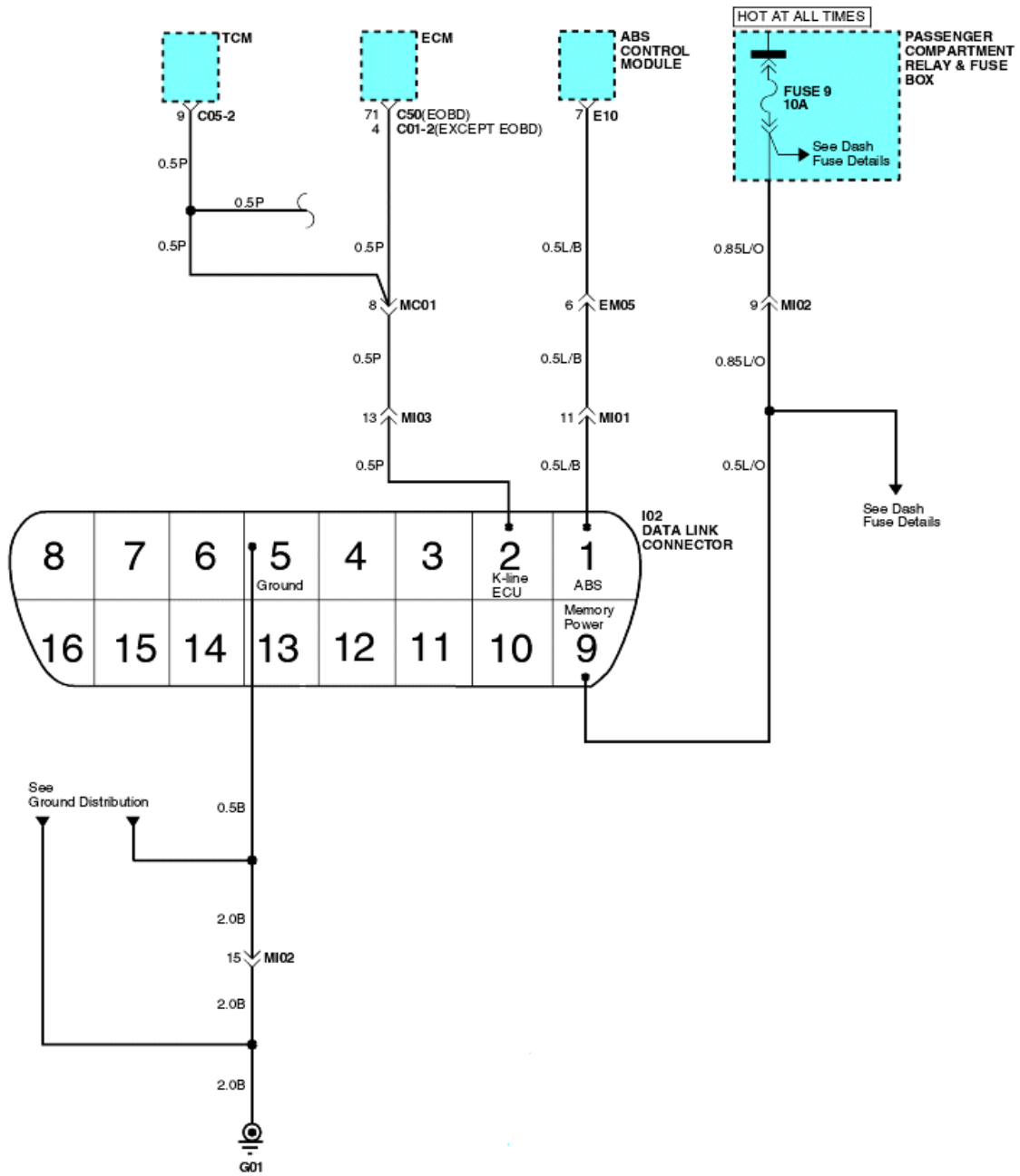


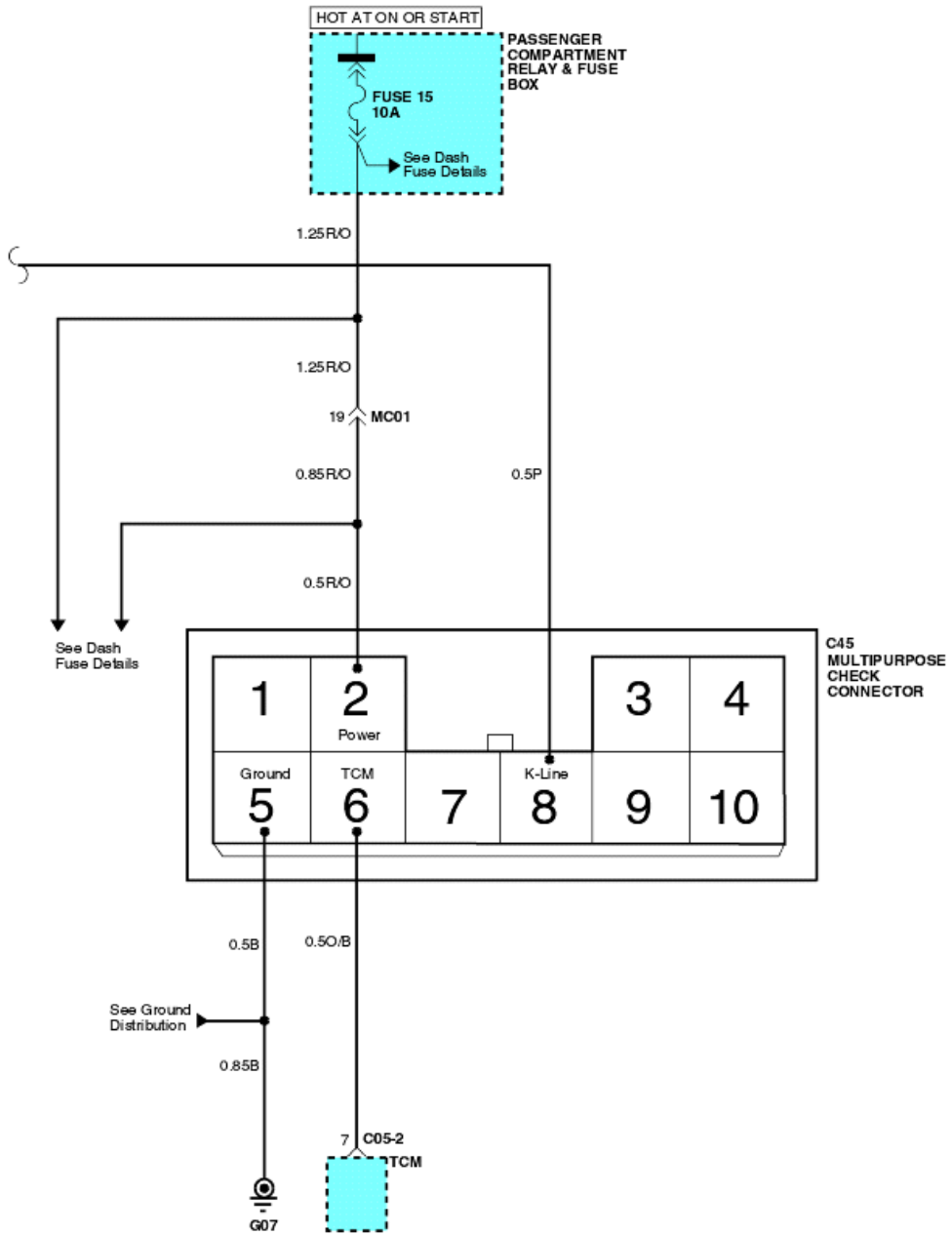






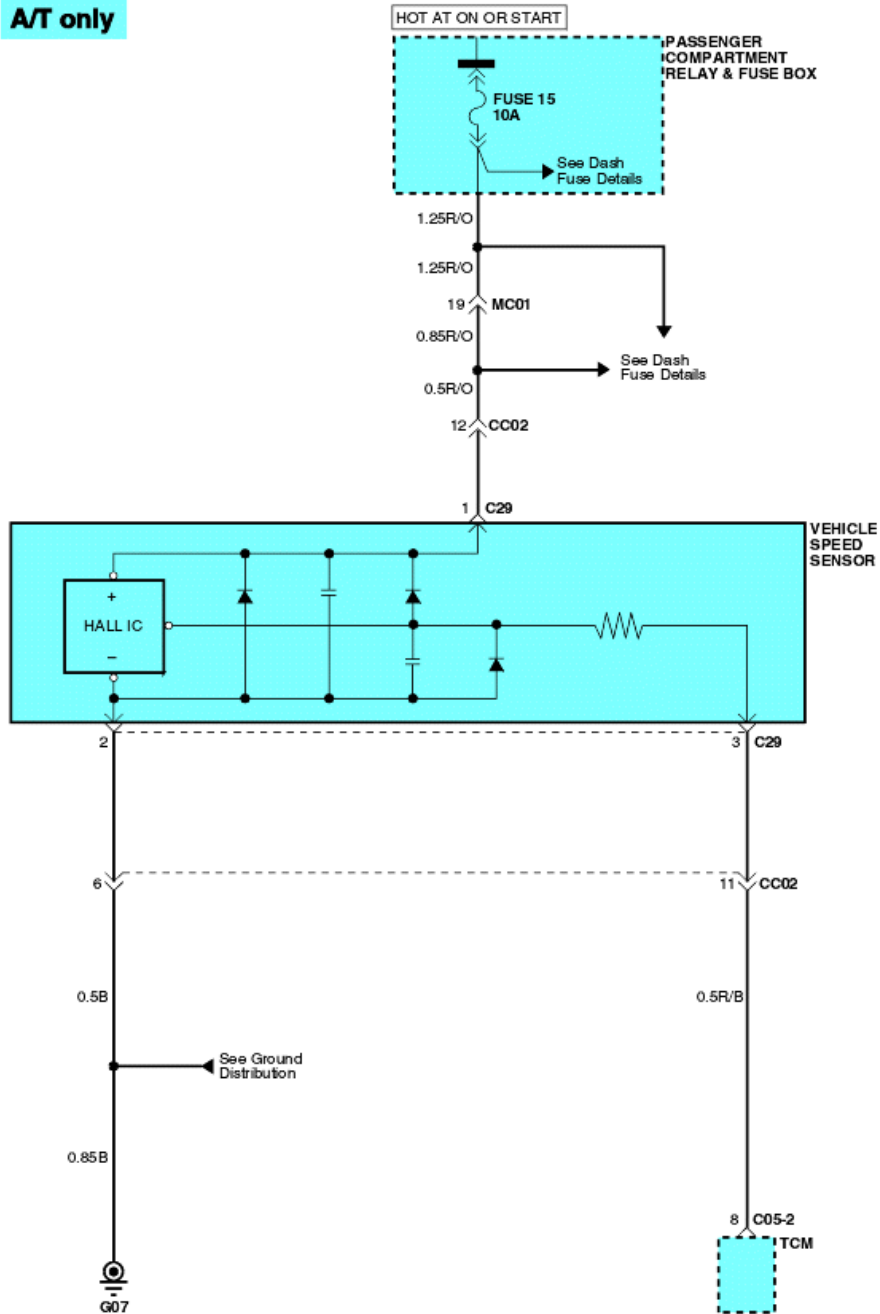
DATA LINK DETAILS E21C0050



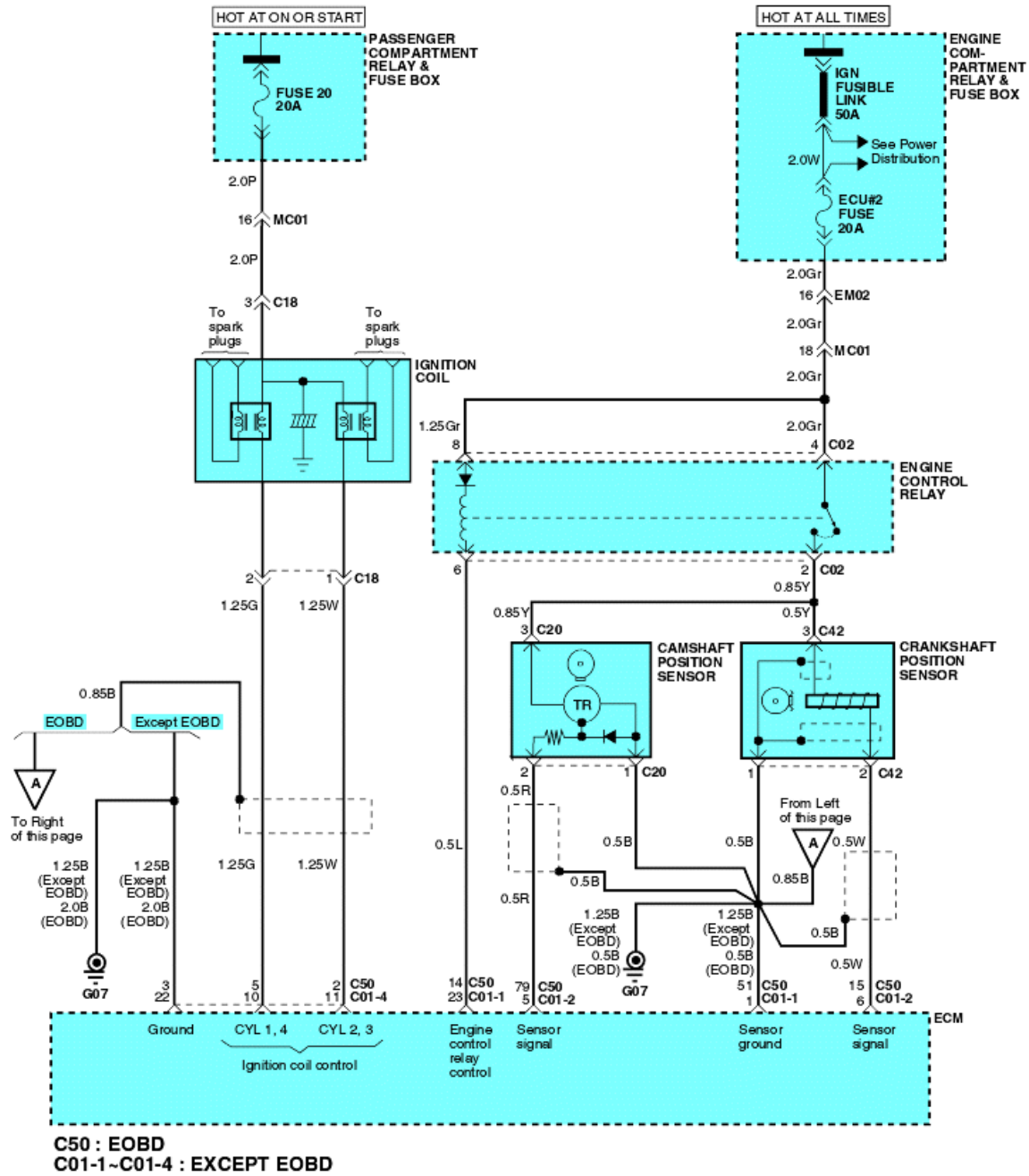


# VEHICLE SPEED SENSOR E21C0430

**A/T only**

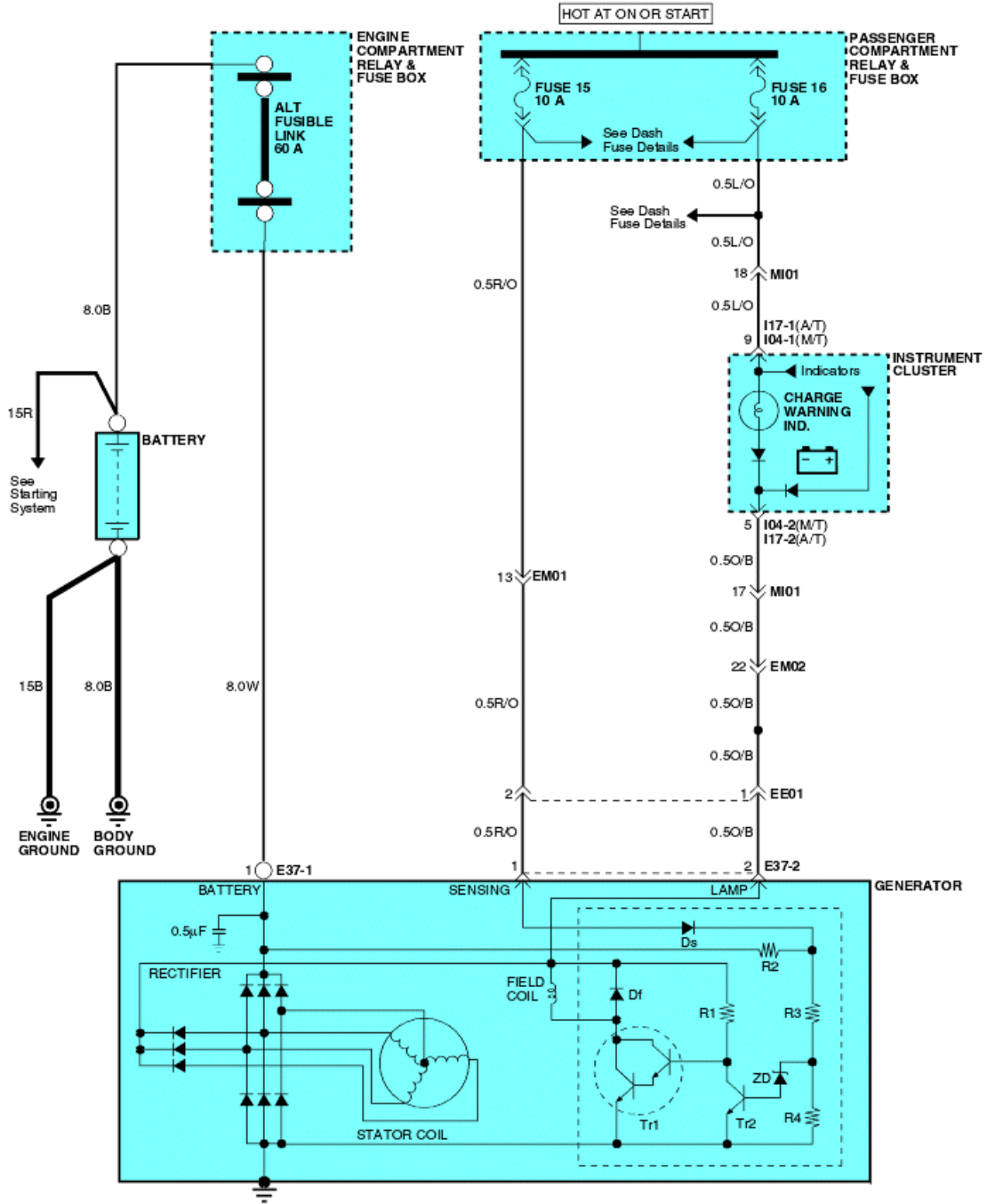


# IGNITION SYSTEM E21C0060



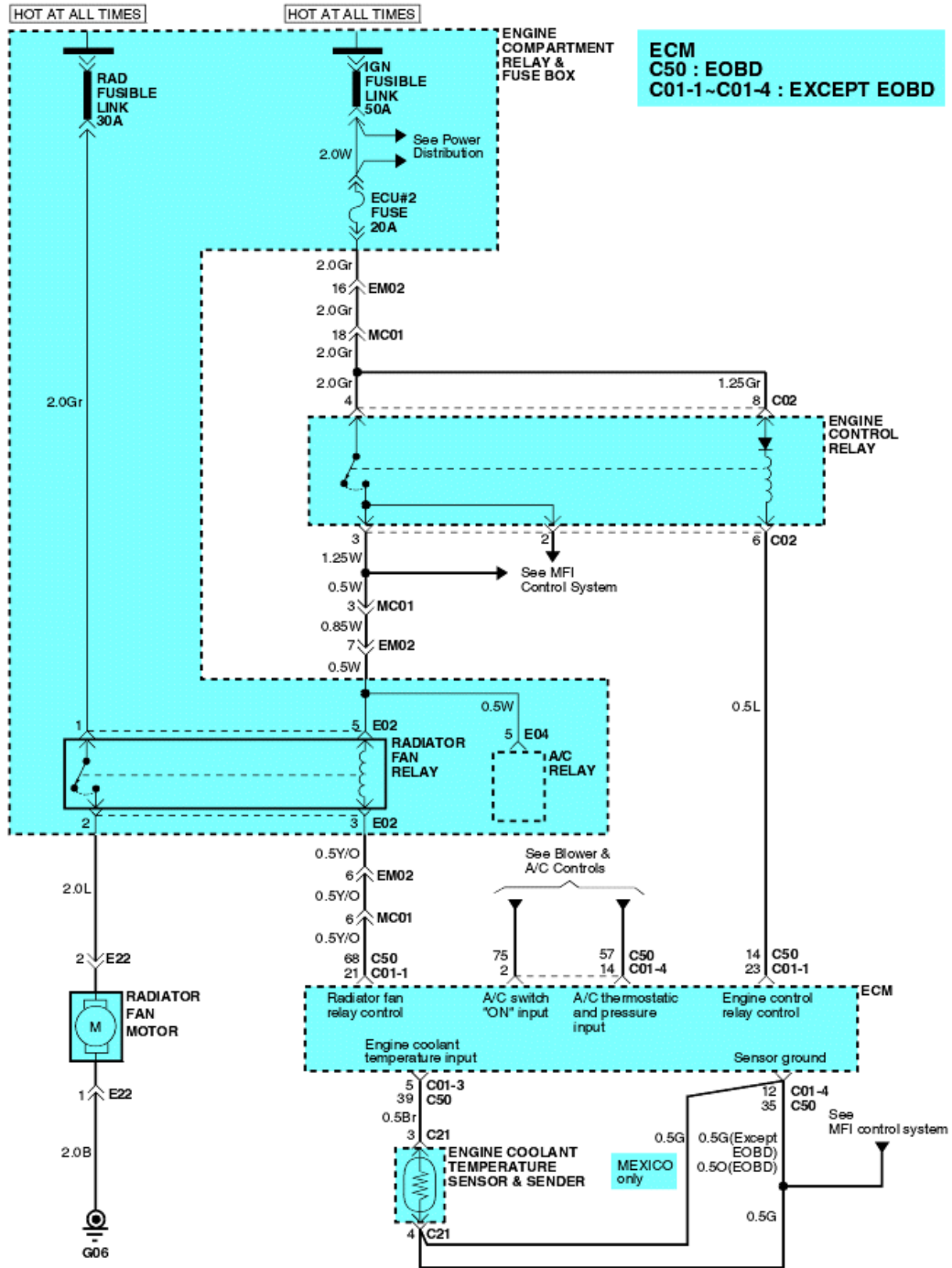


# CHARGING SYSTEM E21C0080

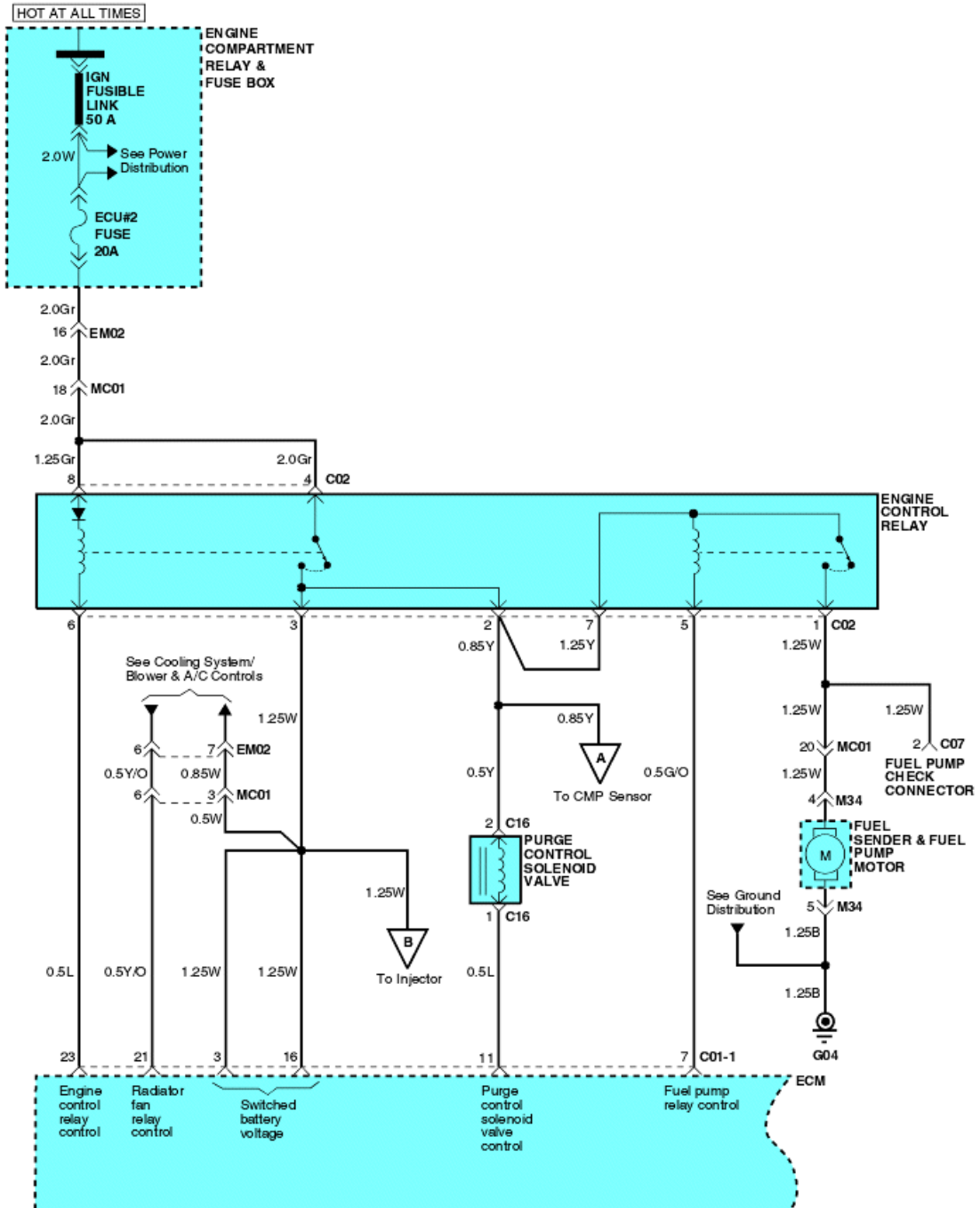


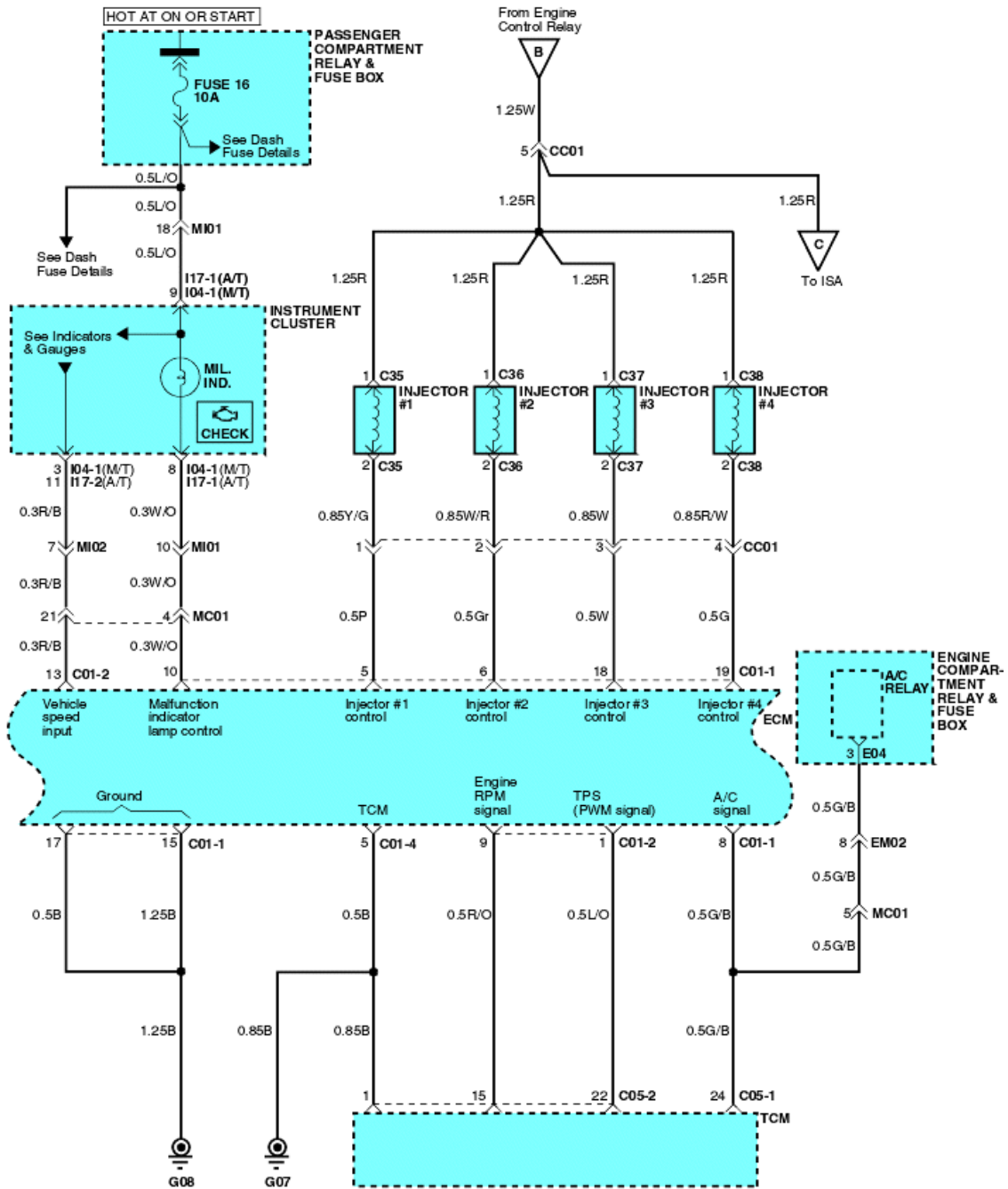


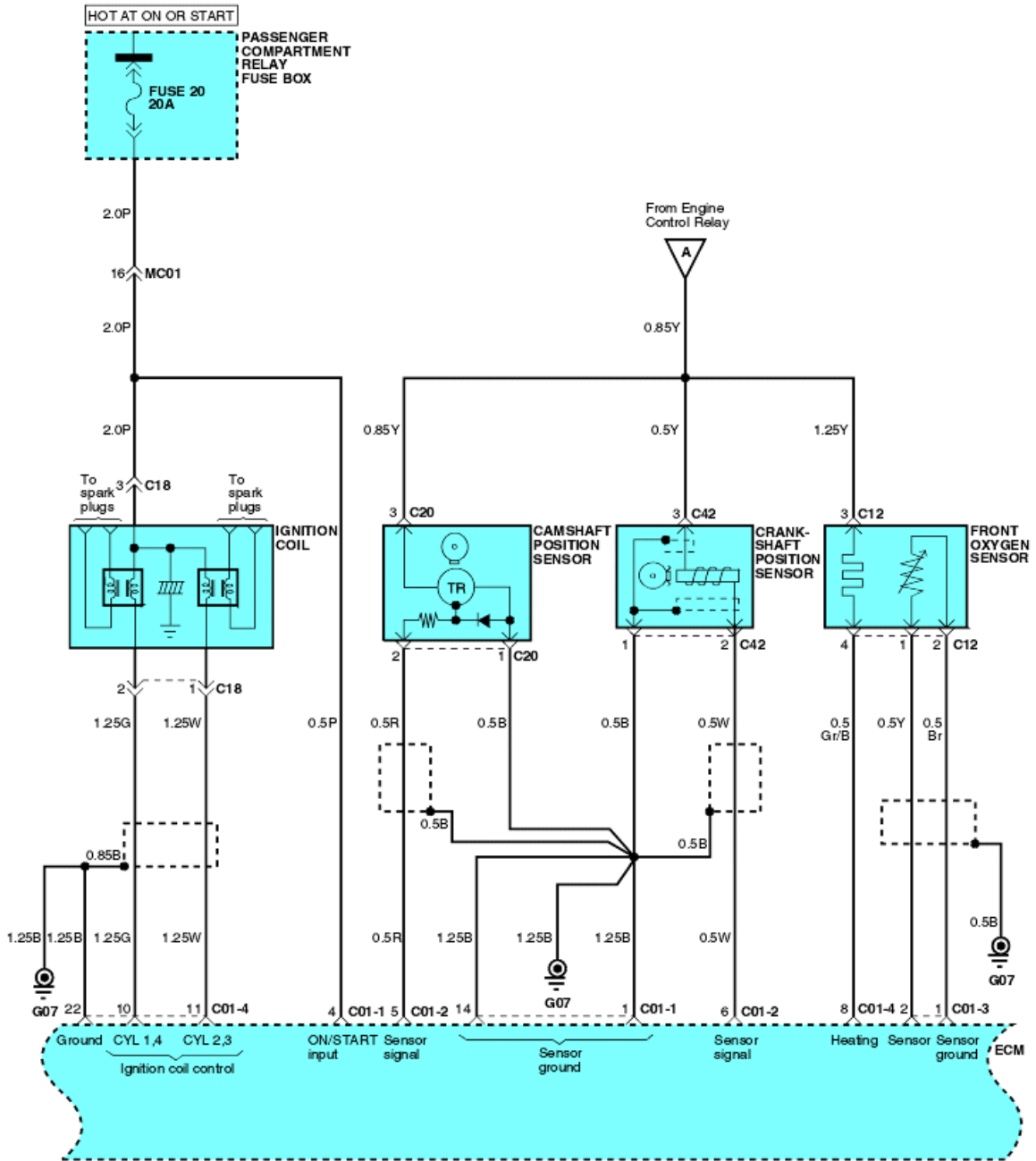
COOLING SYSTEM E21C0090

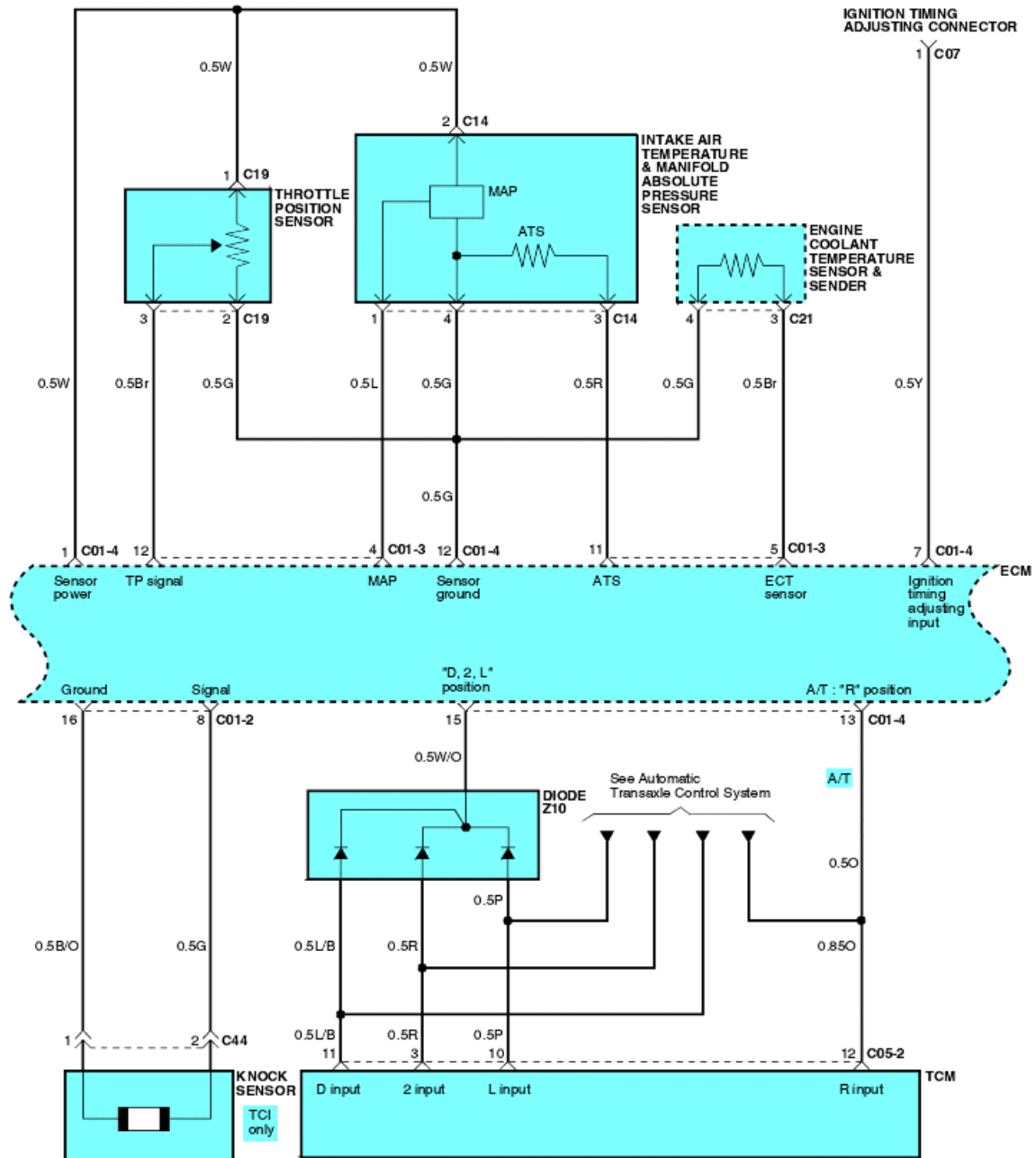


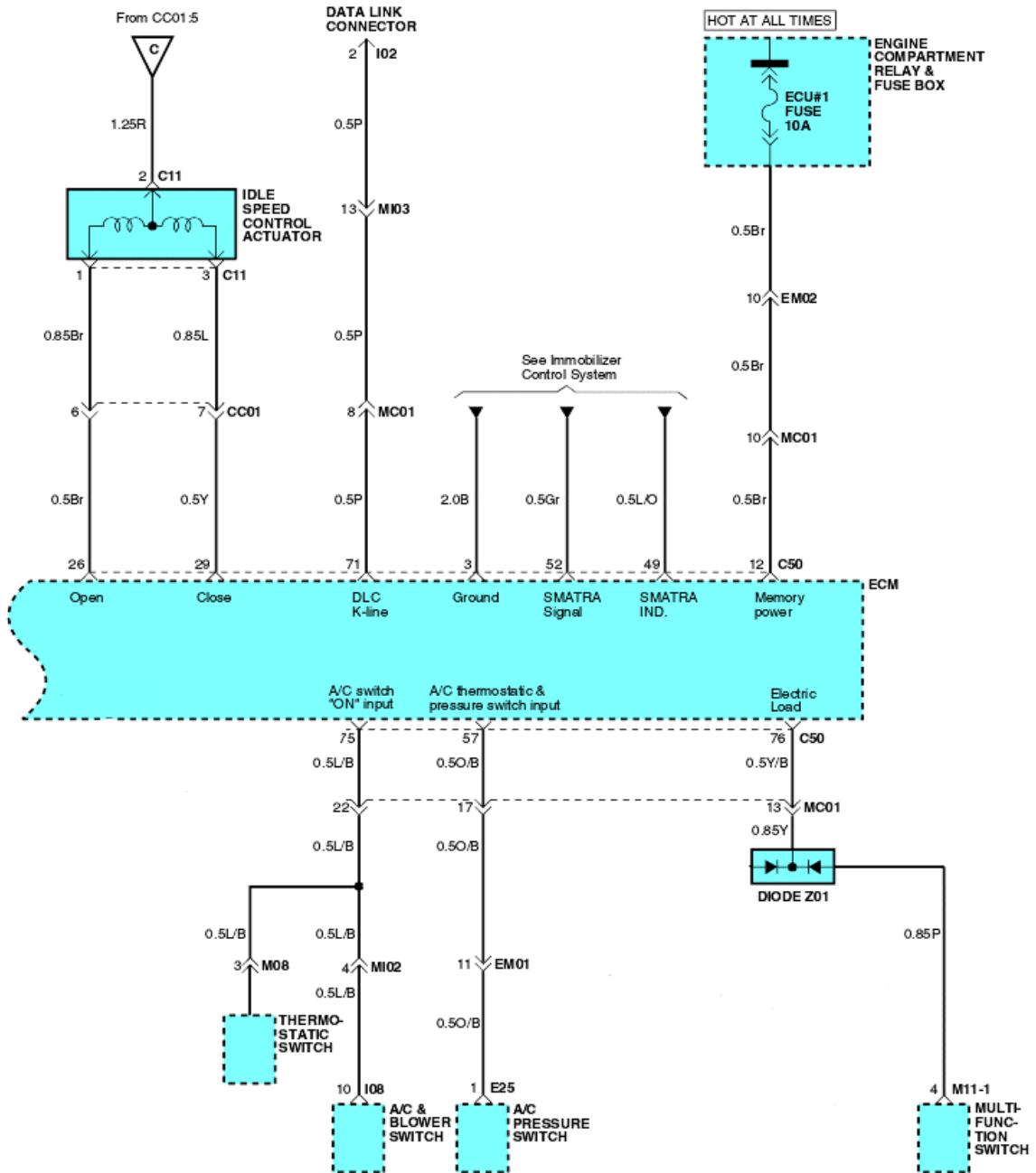
# MFI CONTROL SYSTEM(EXCEPT EOBD) E21C0100



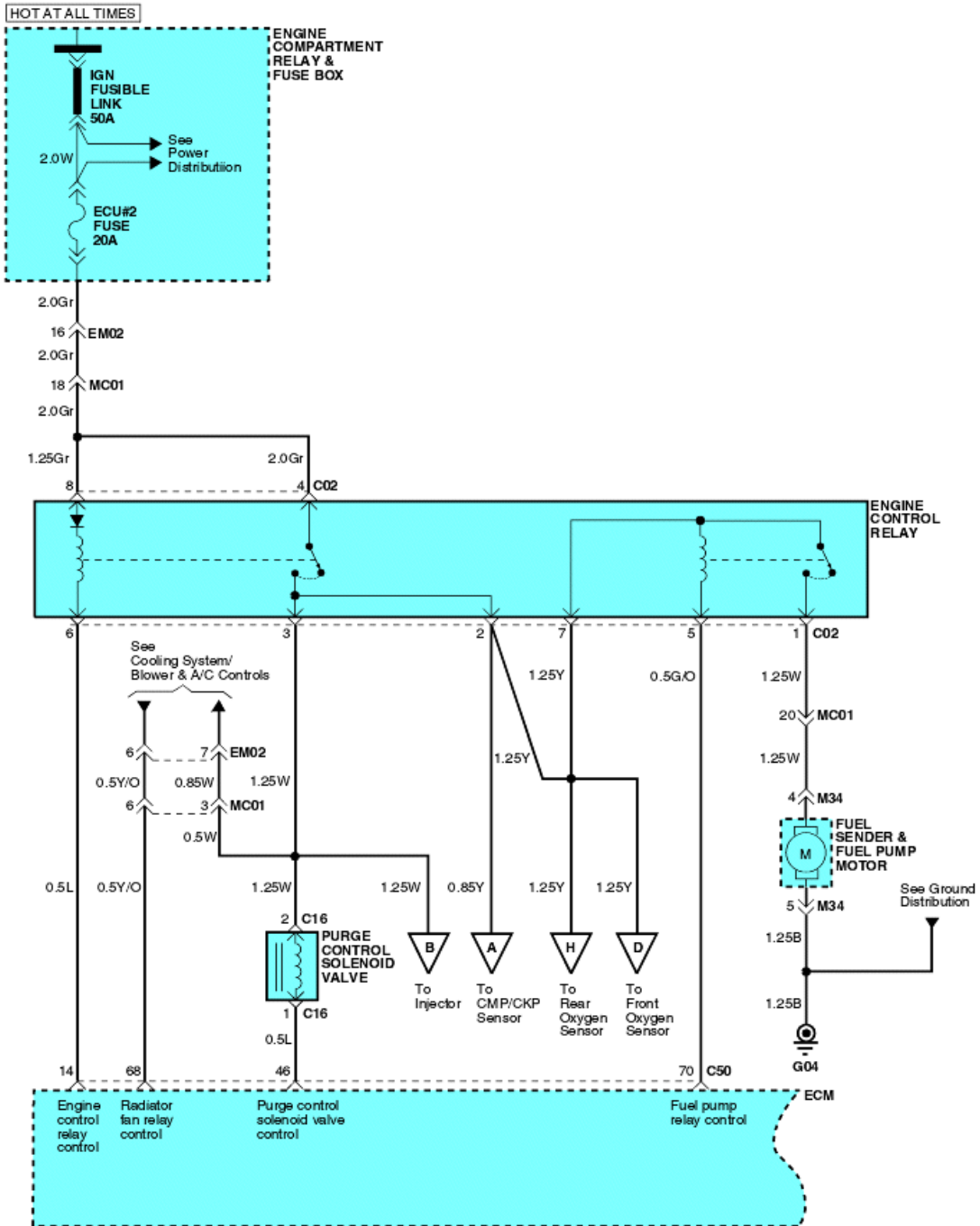


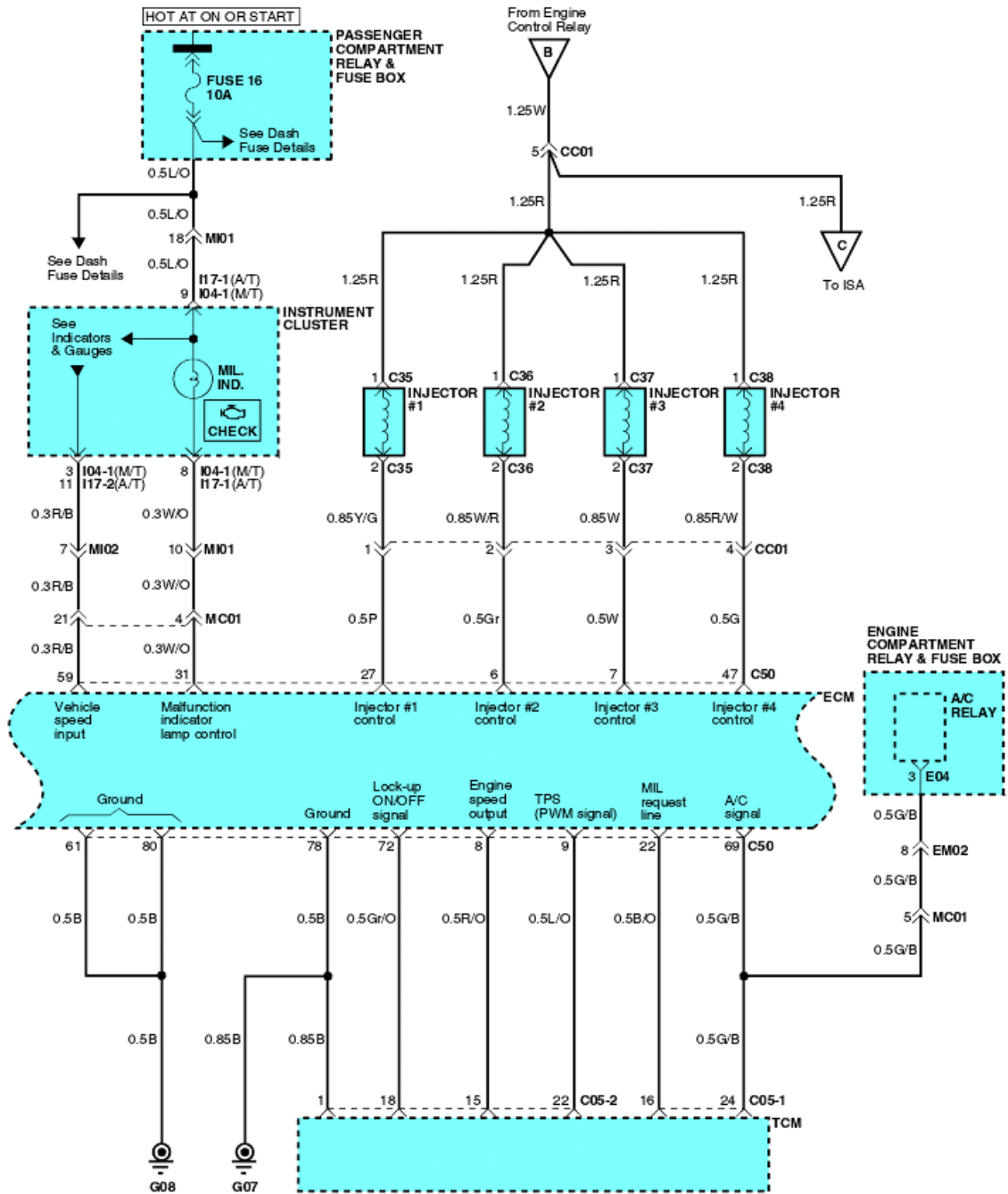




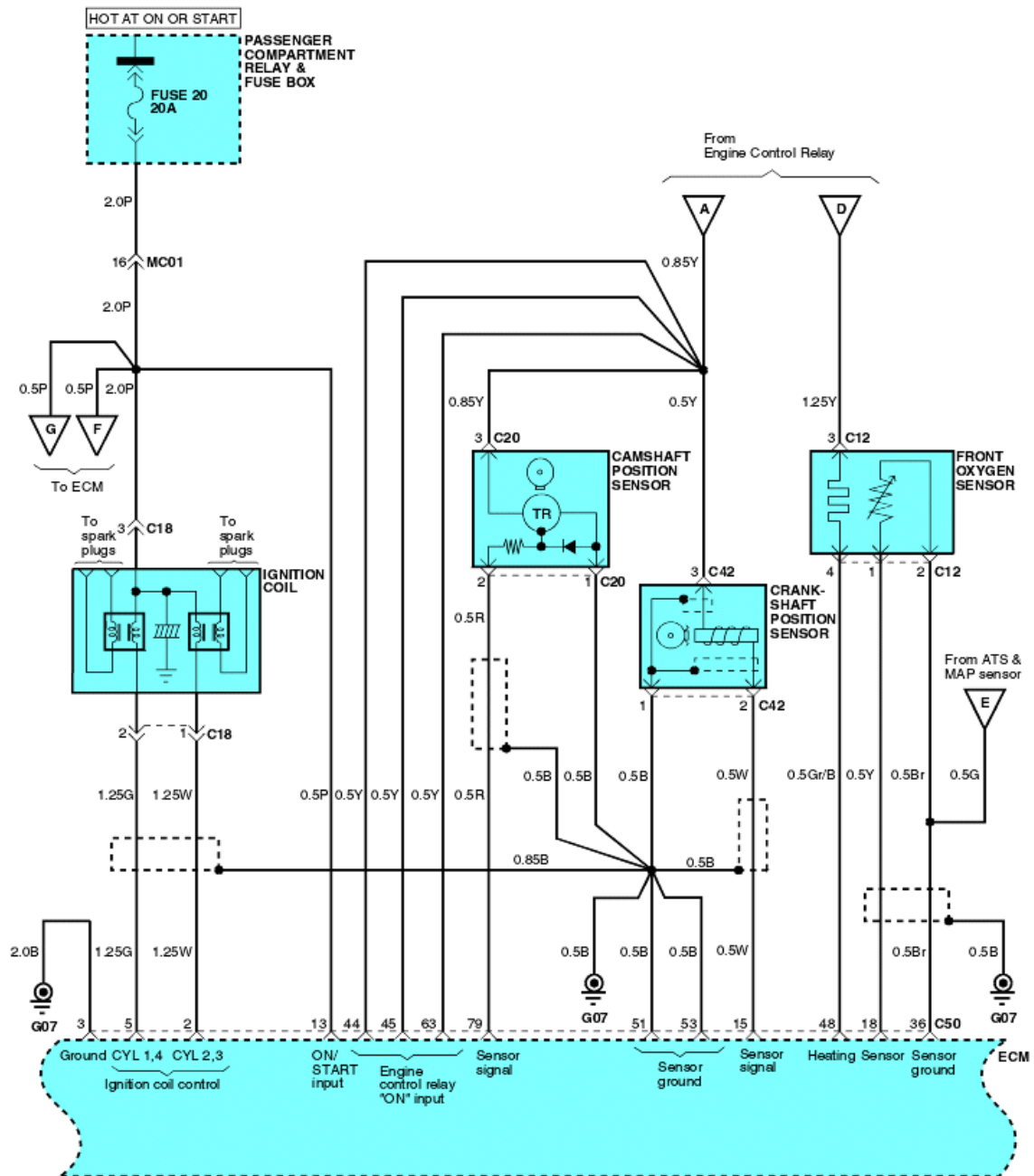


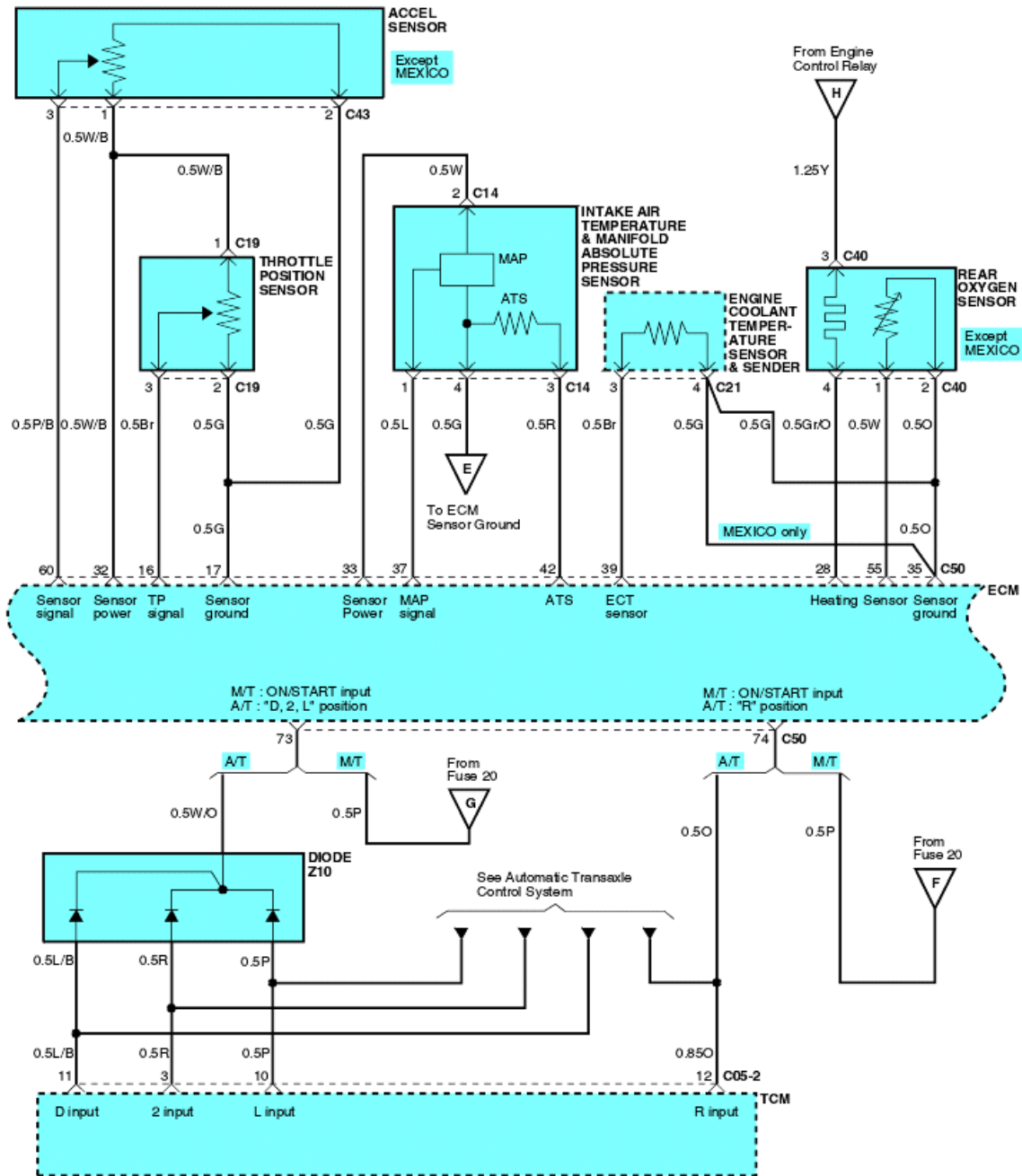
MFI CONTROL SYSTEM(EOBD) E21C0110

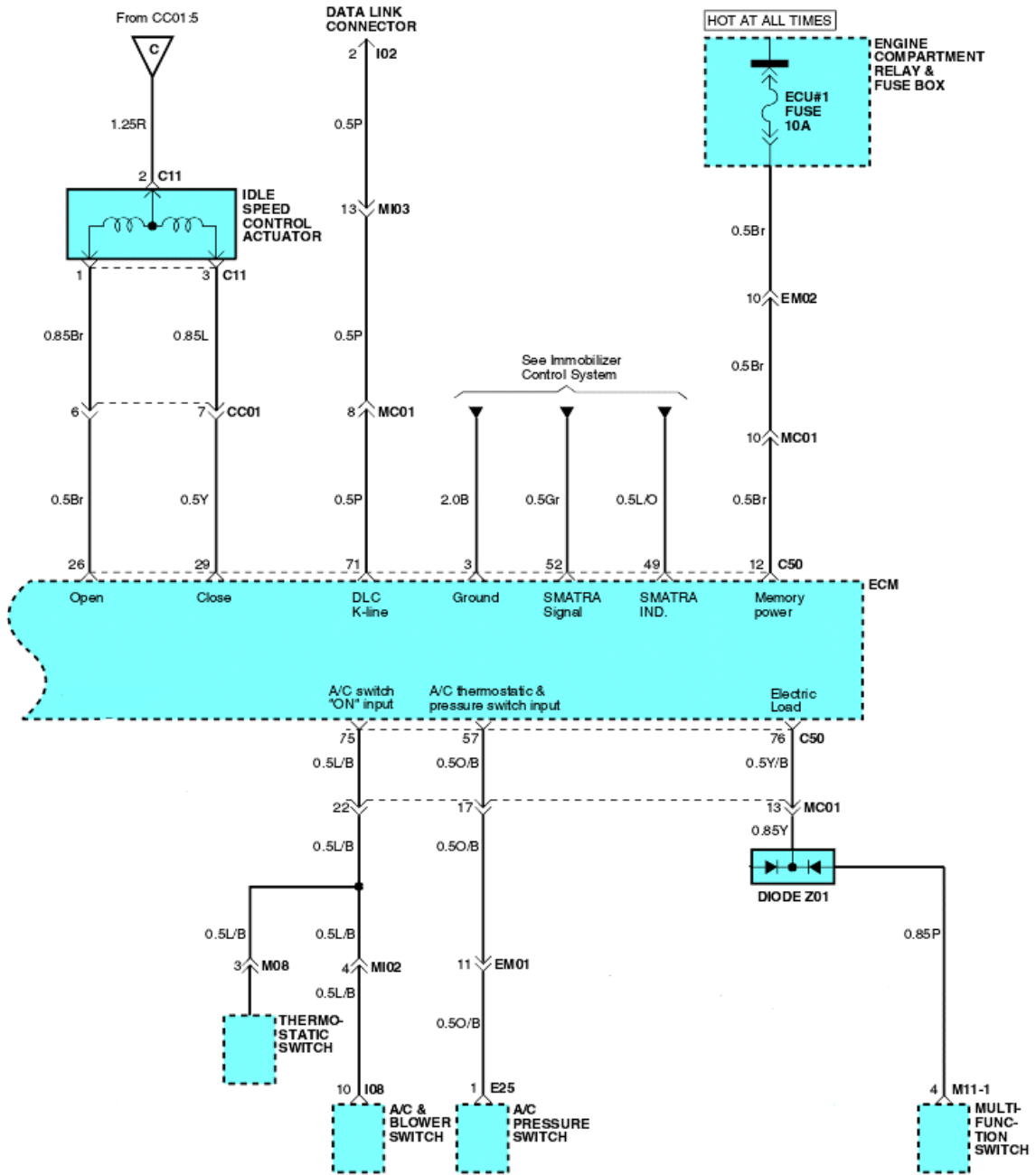




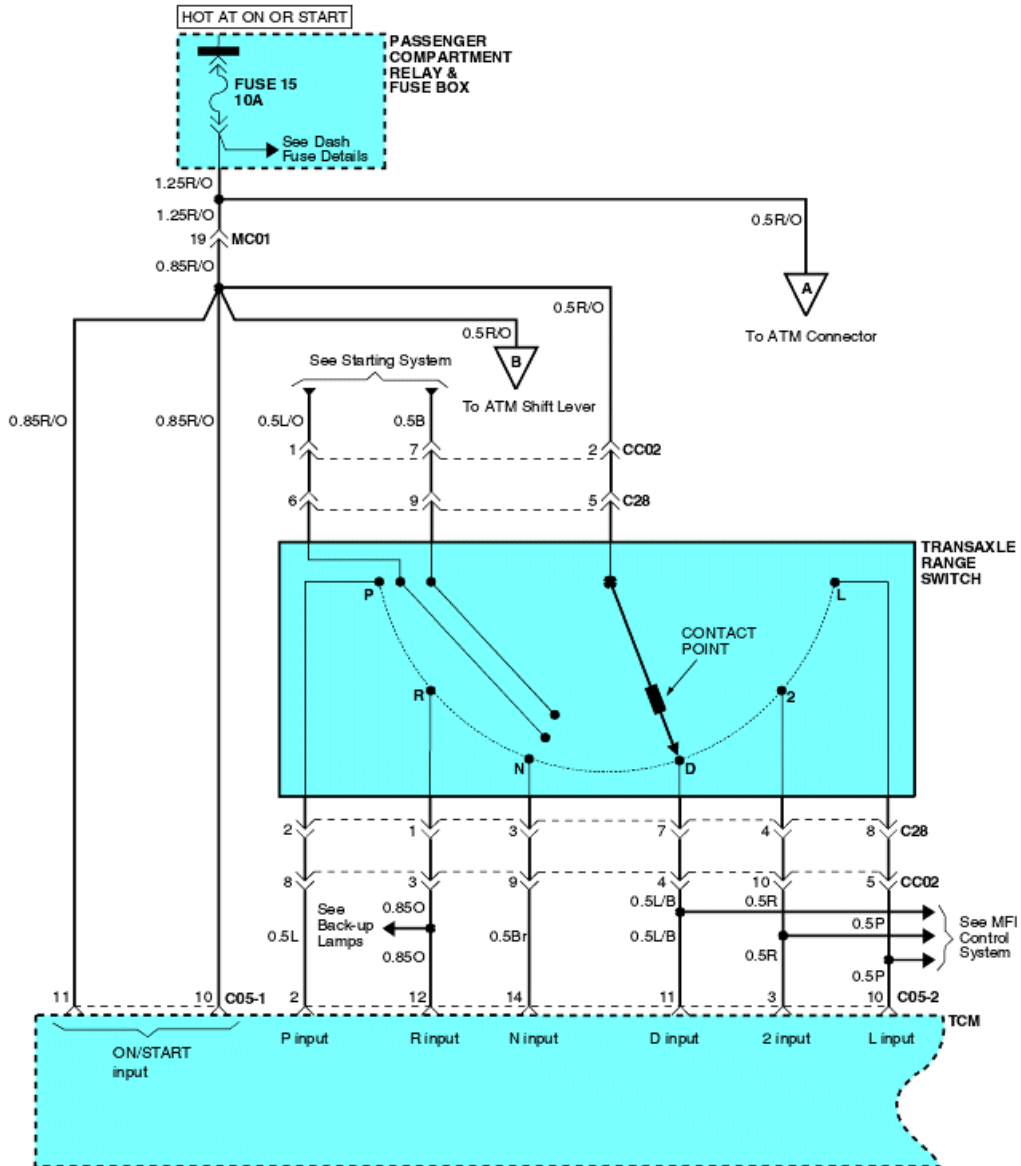




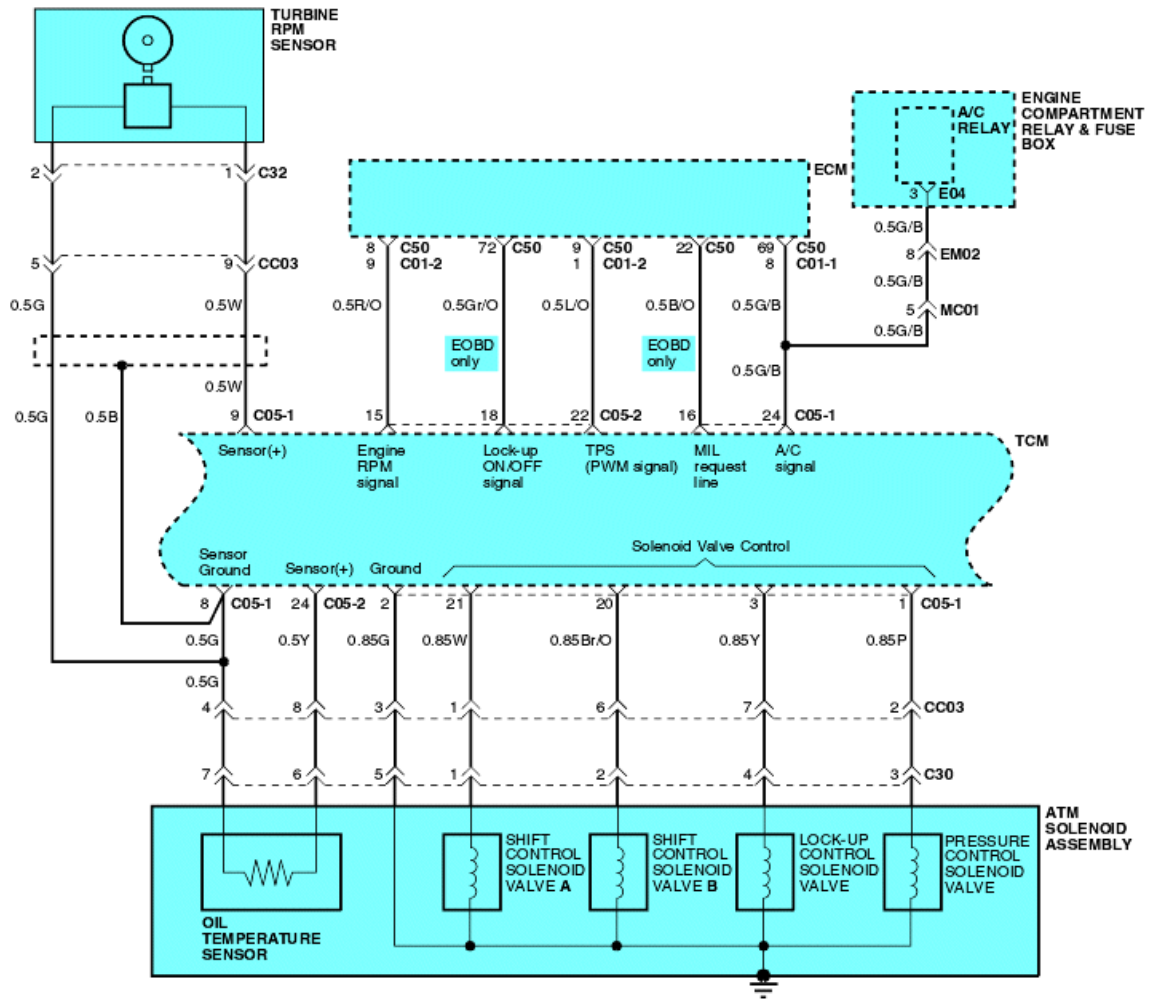


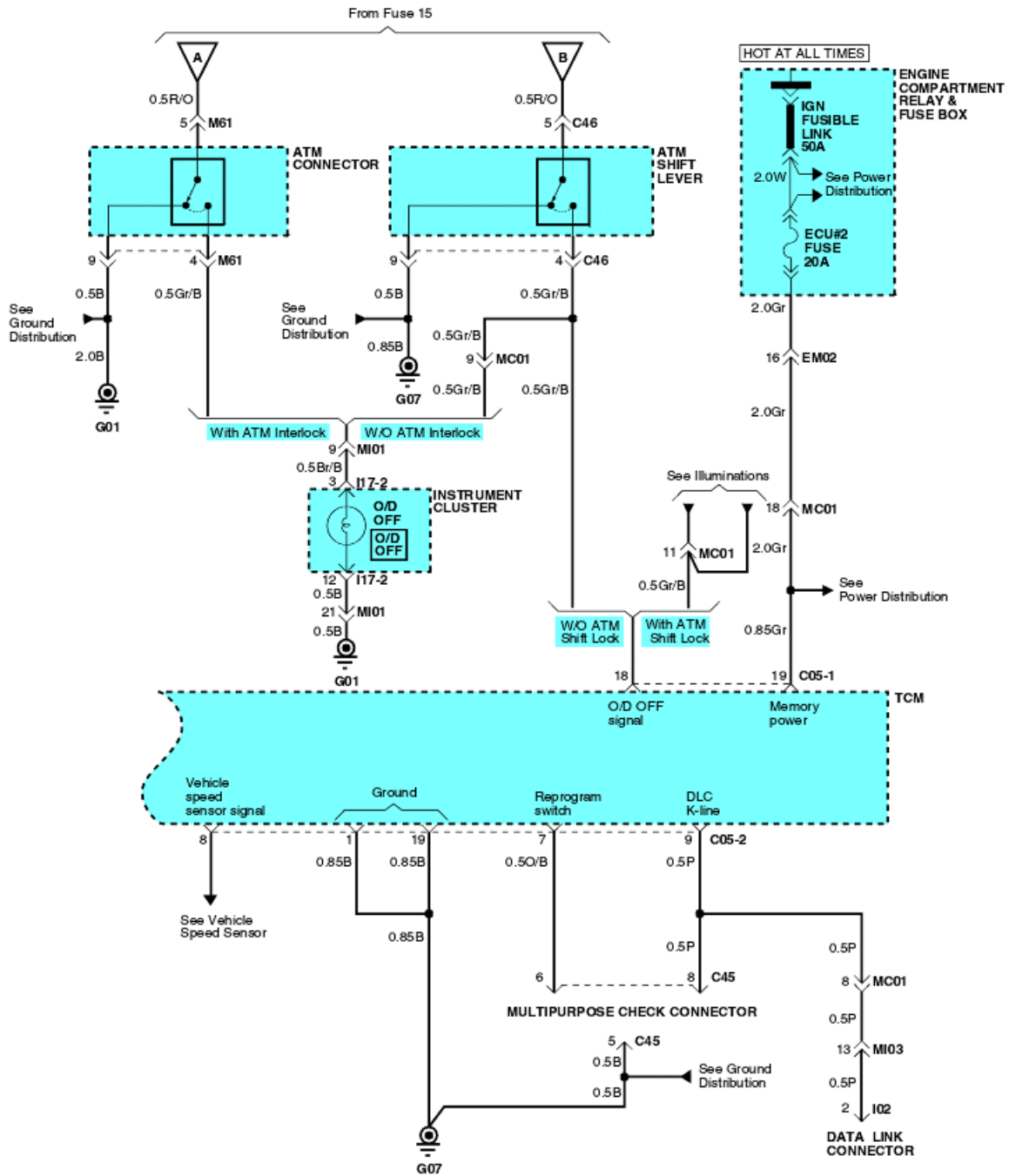


AUTOMATIC TRANSAXLE CONTROL SYSTEM E21C0120

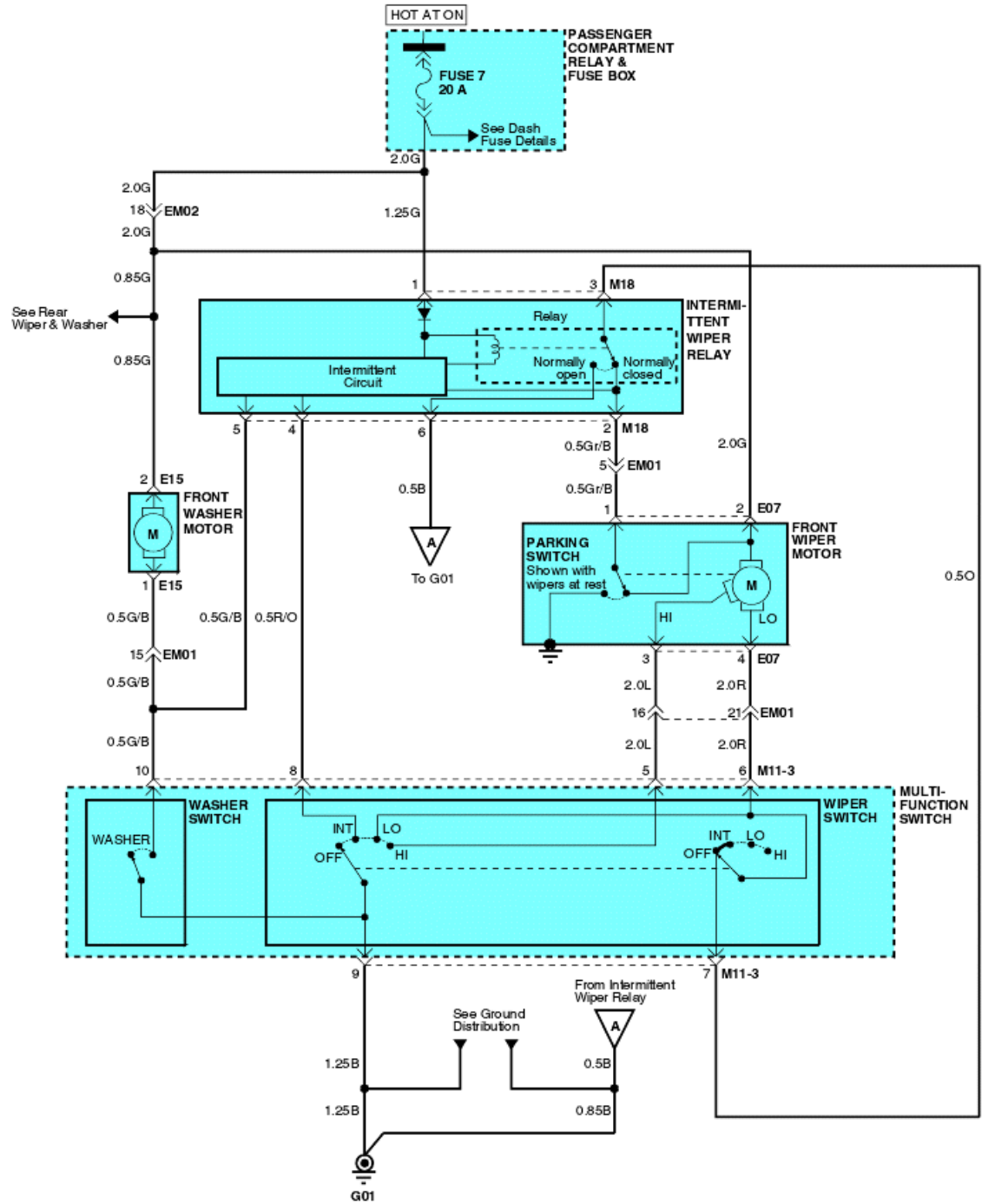


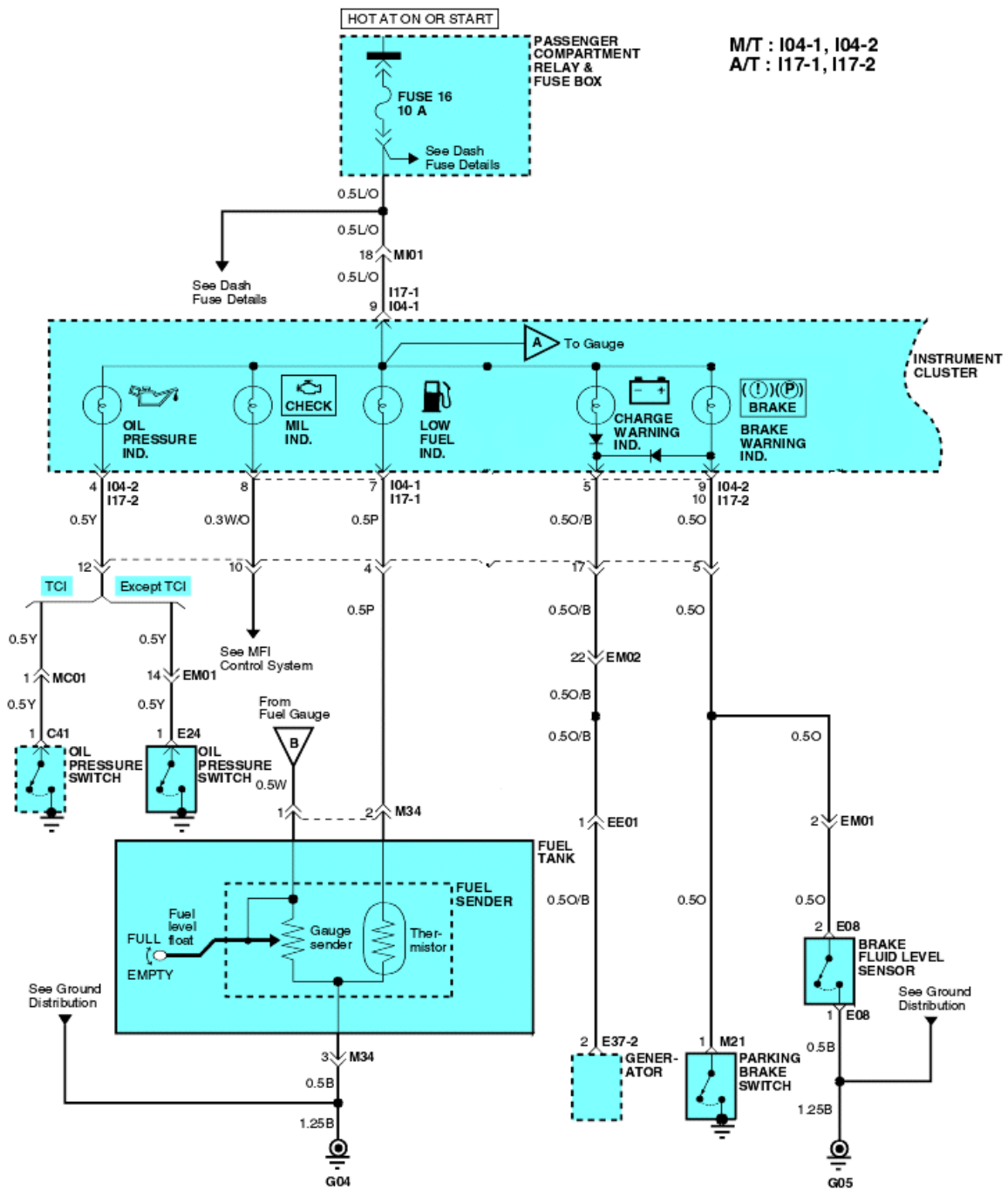
**C50 : EOBD**  
**C01-1, C01-2 : EXCEPT EOBD**



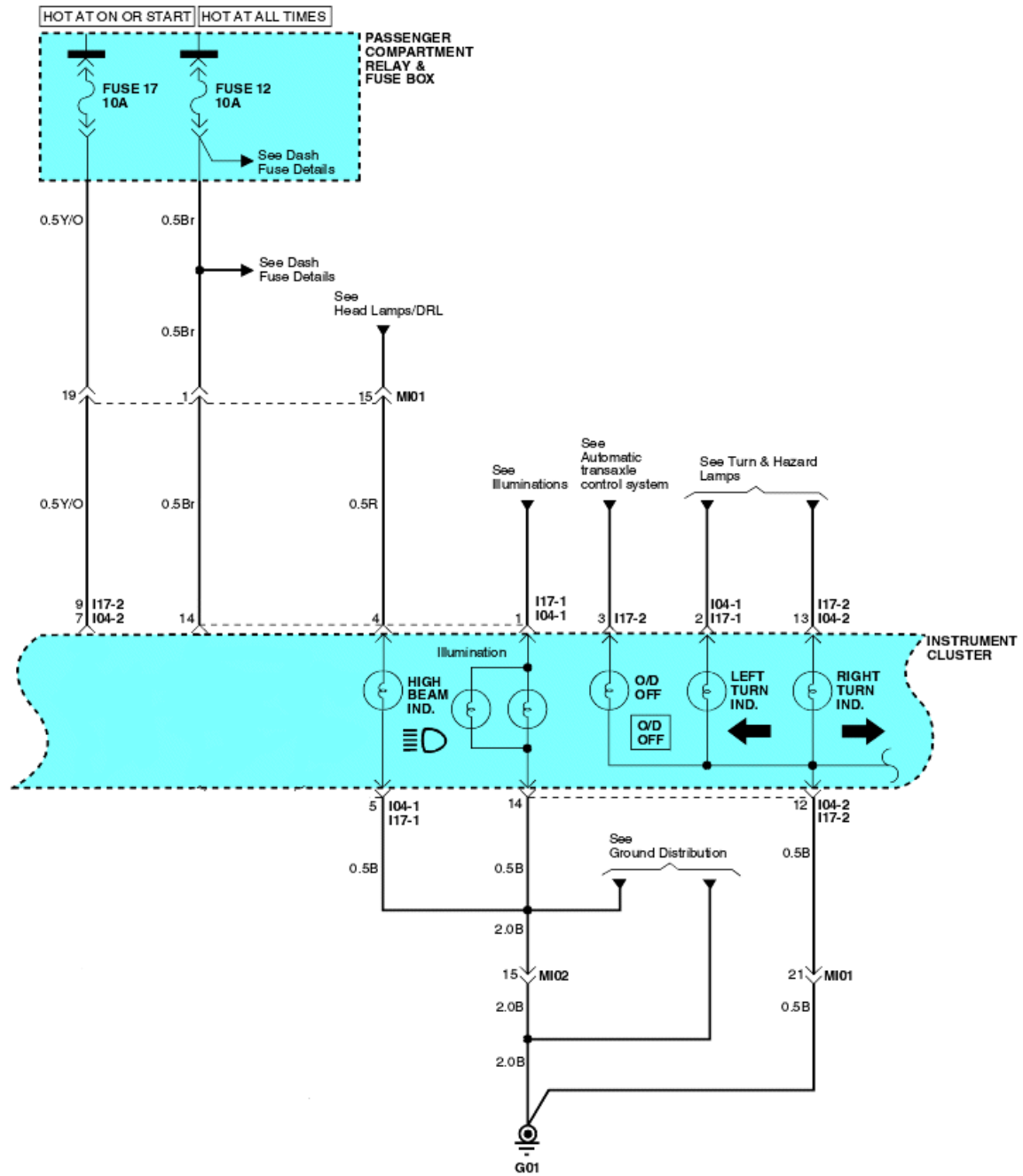


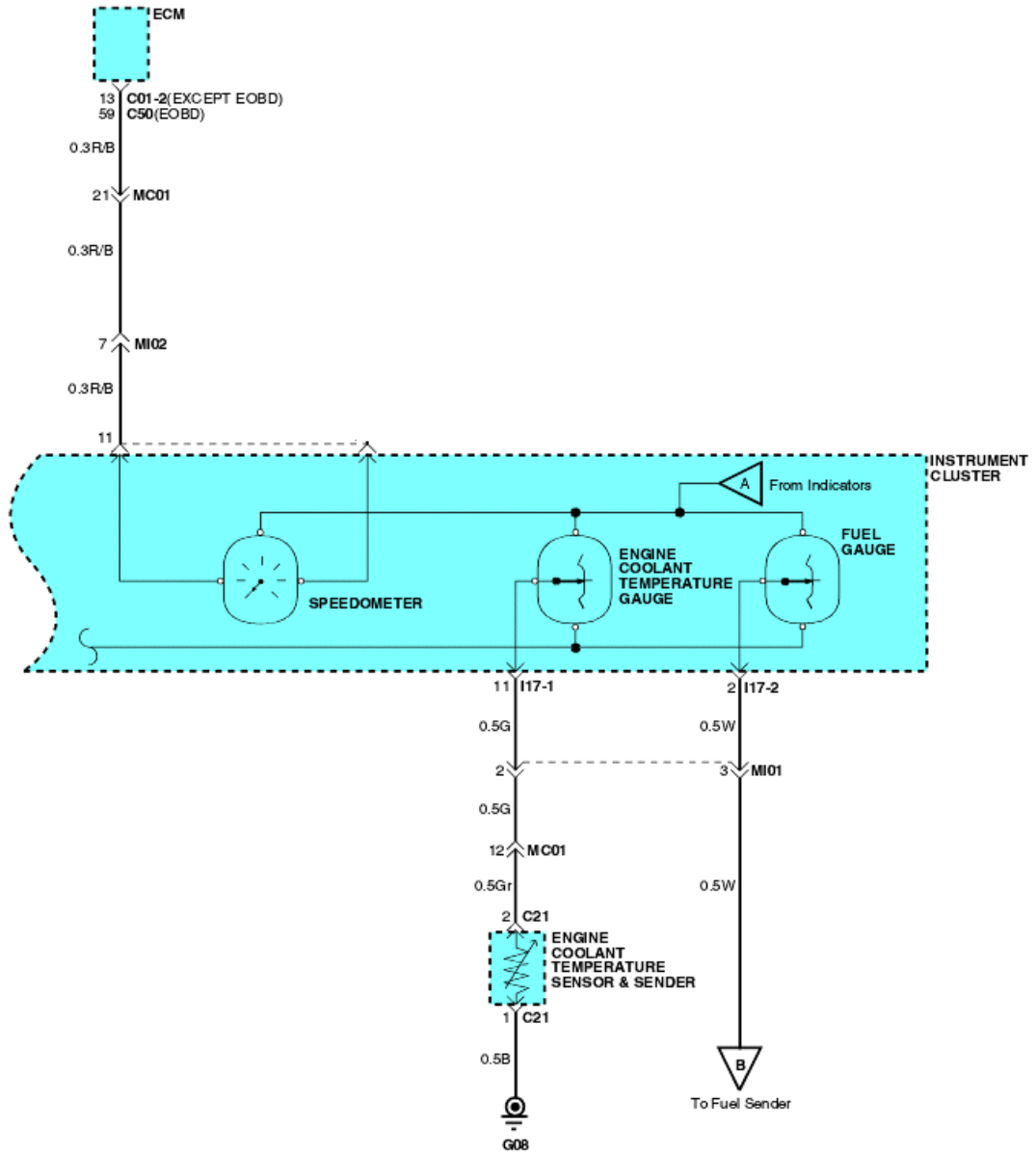
# INTERMITTENT WIPER & WASHER E21C0190



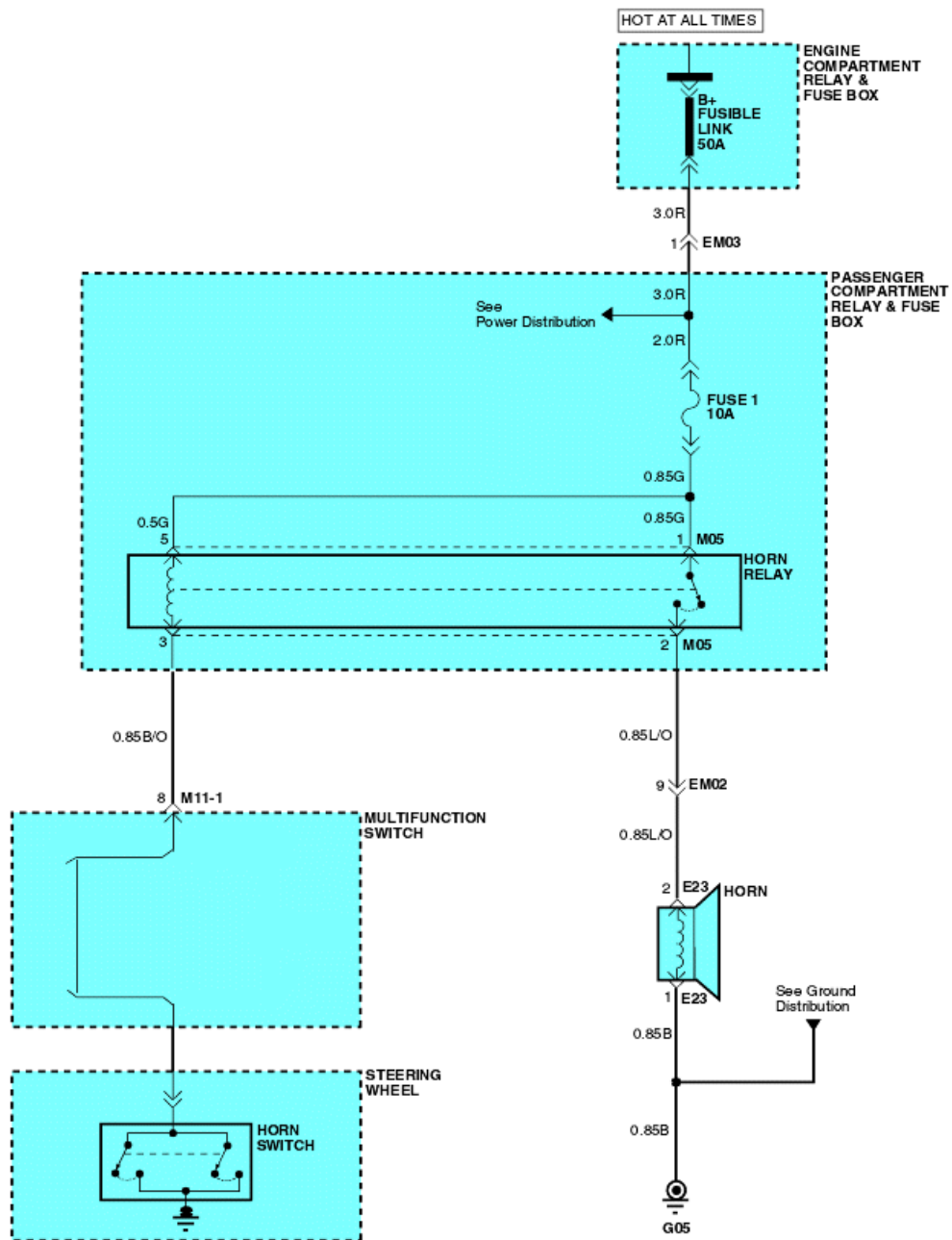




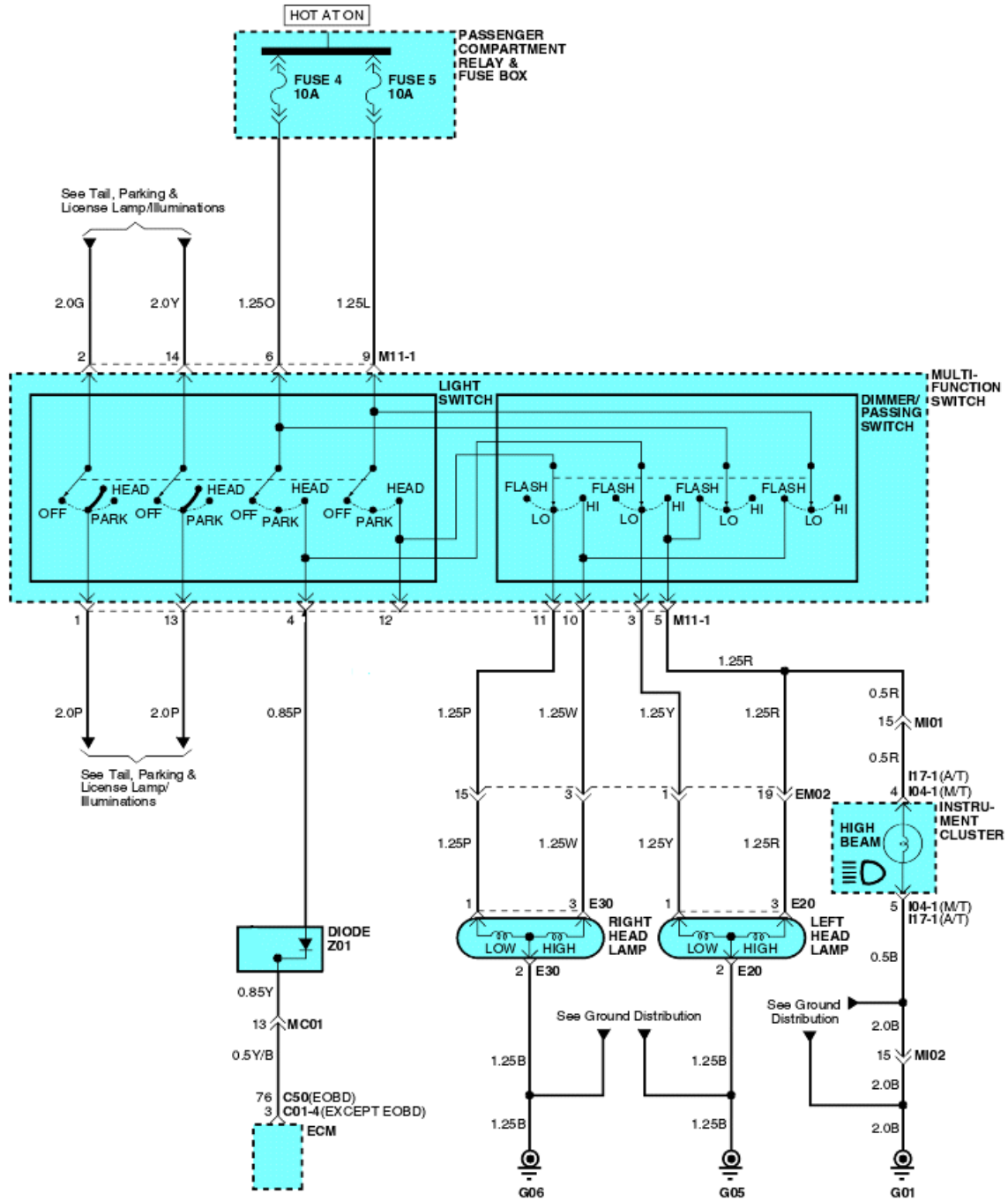




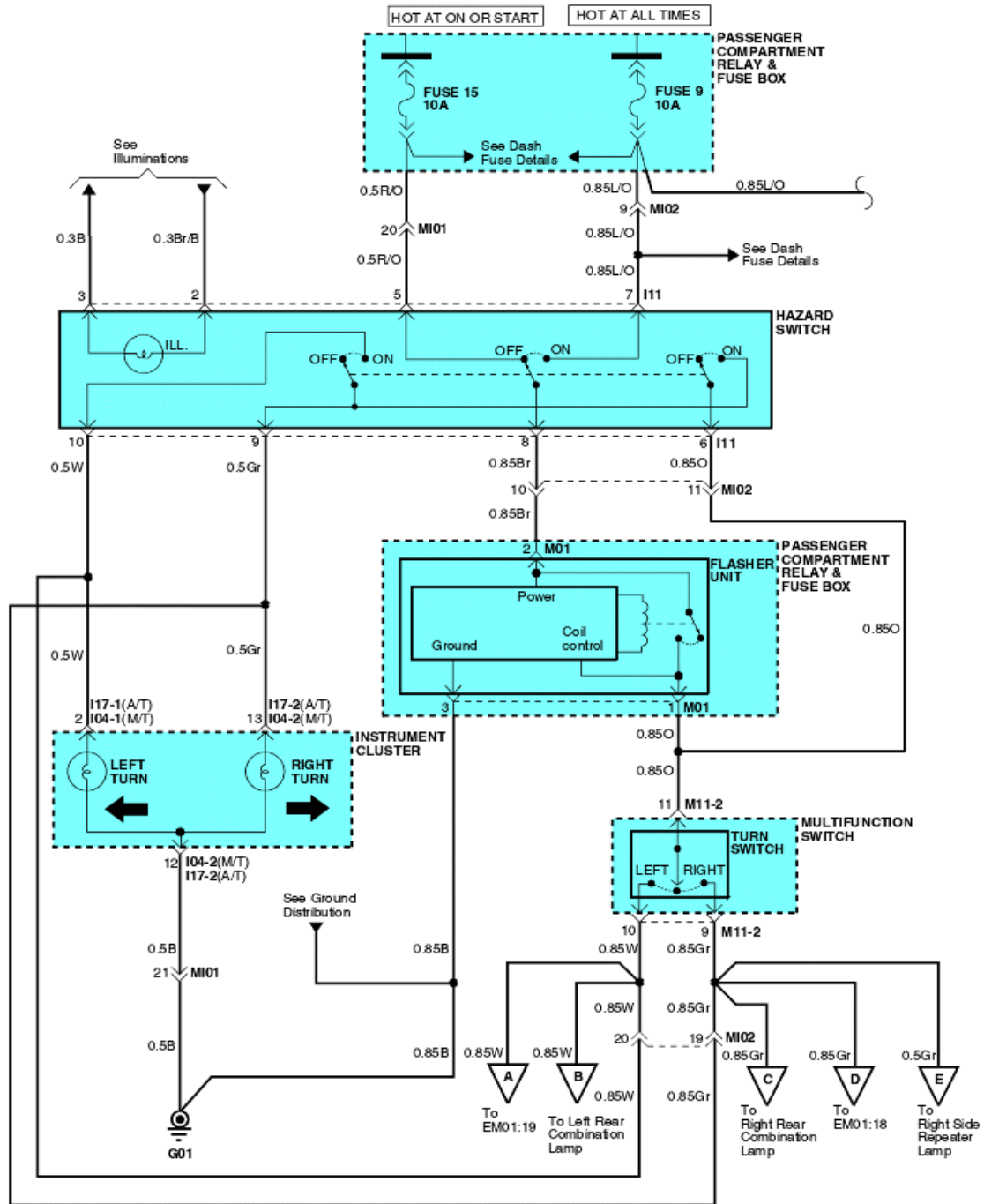
# HORNS E21C0290

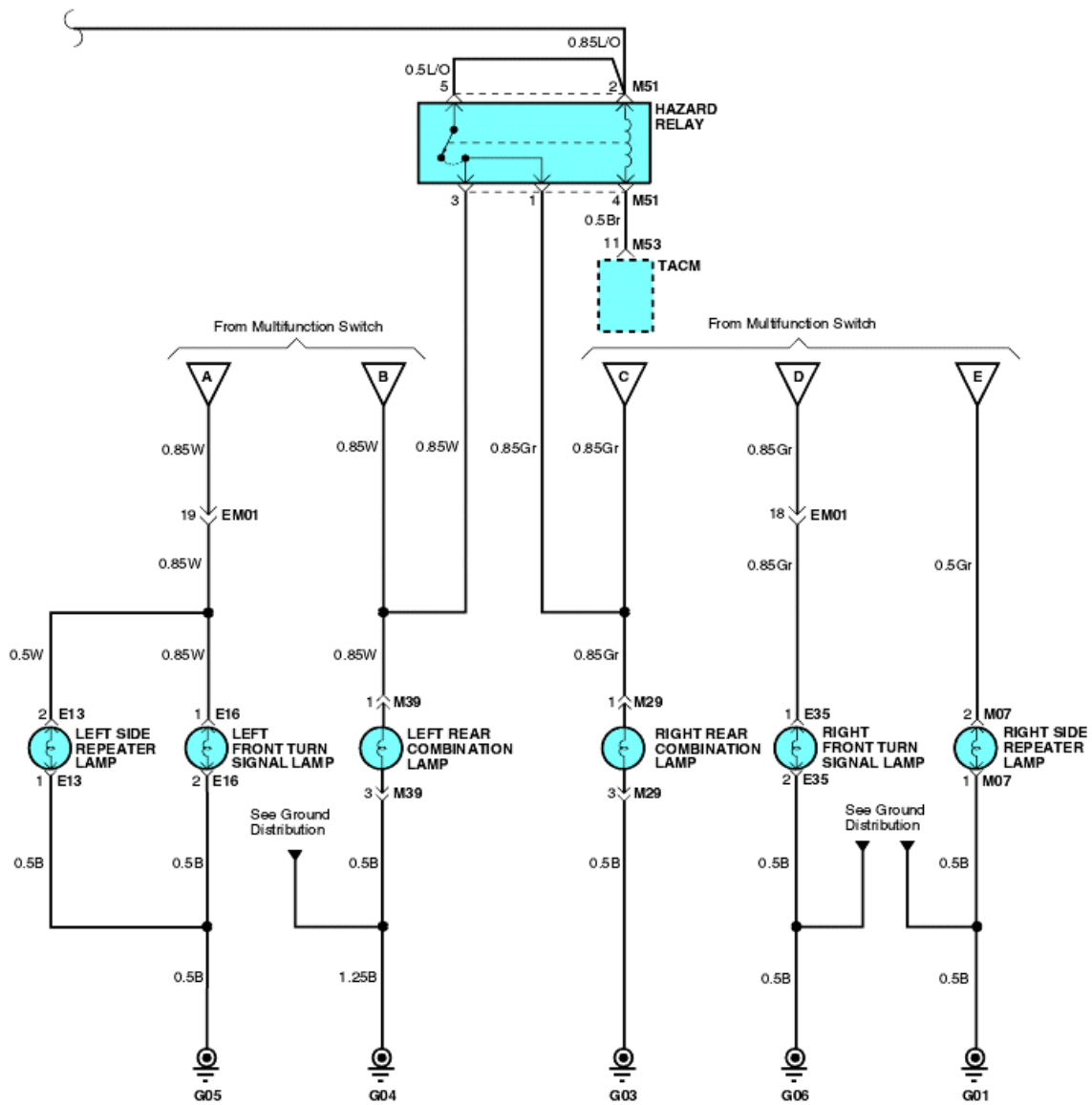


# HEAD LAMPS E21C0300



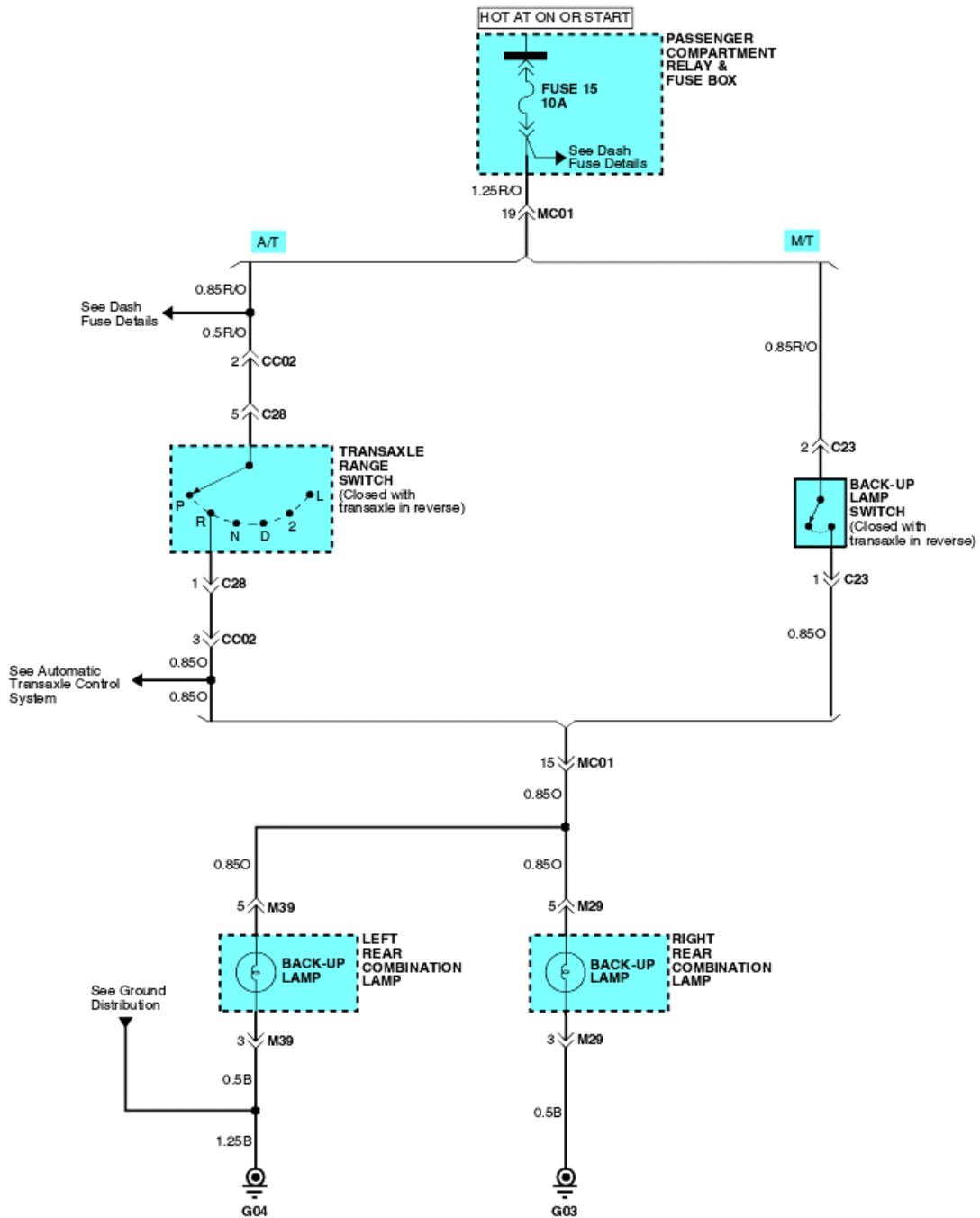
# TURN & HAZARD LAMPS E21C0330





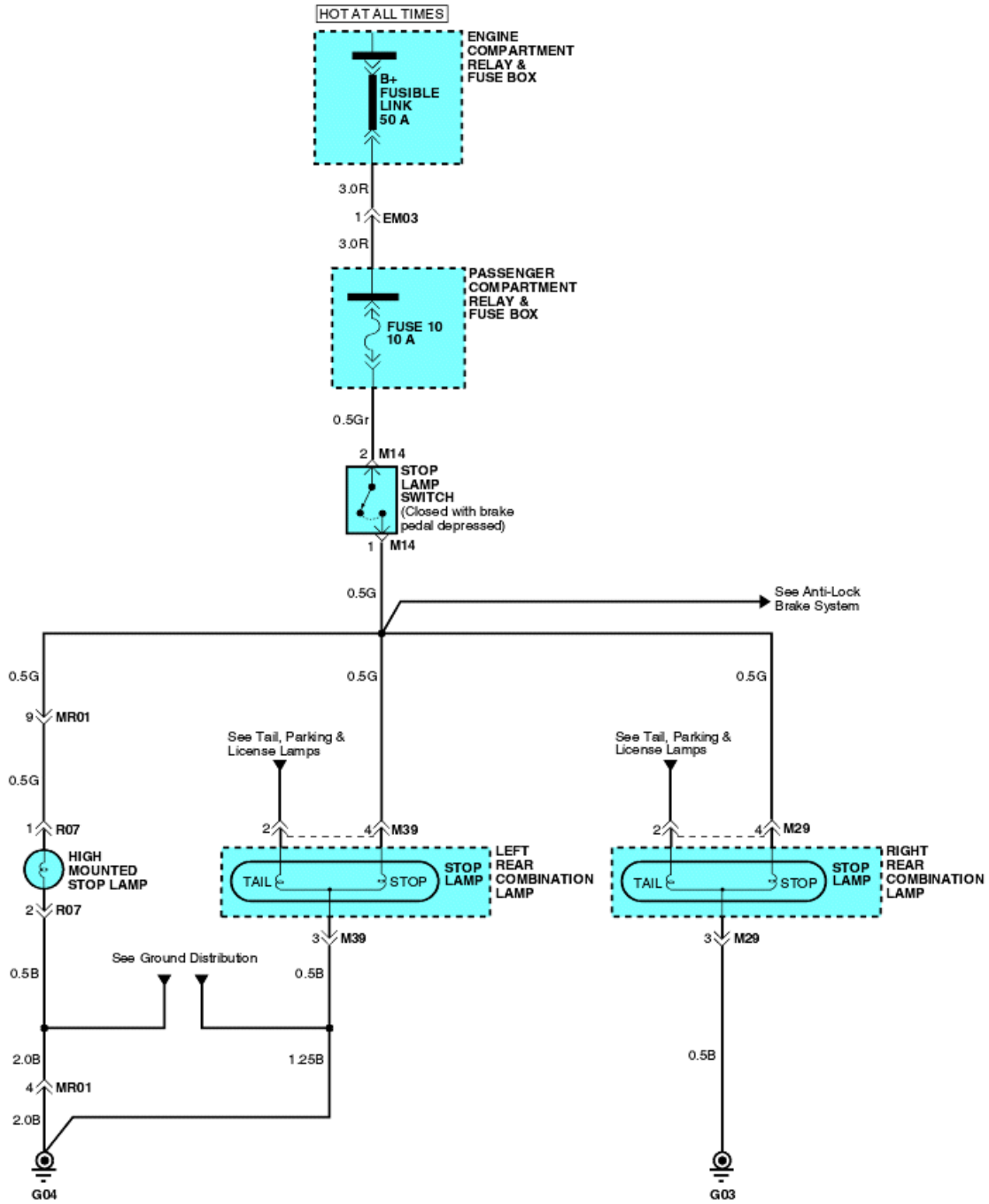


# BACK-UP LAMPS E21C0370

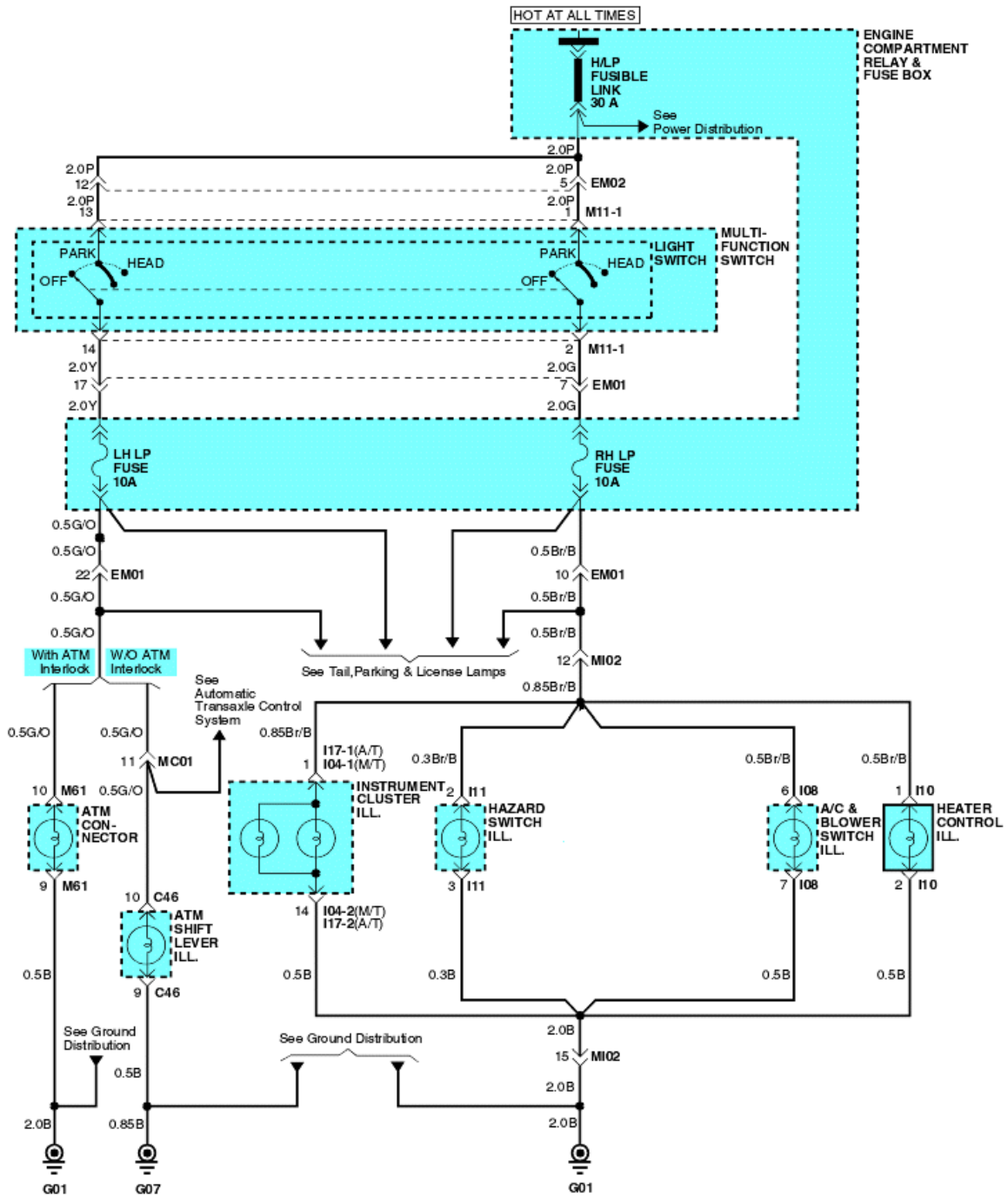




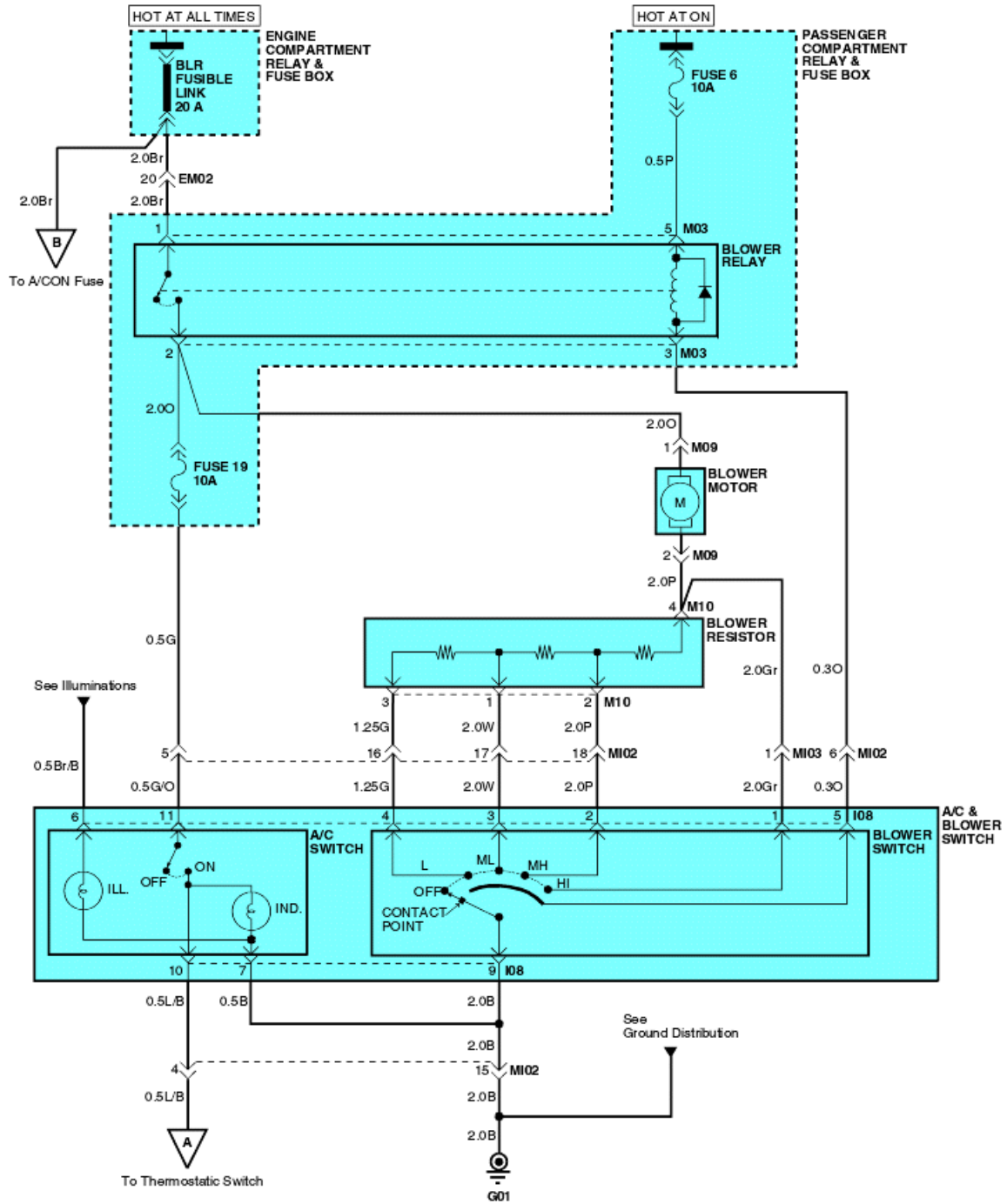
# STOP LAMPS E21C0380

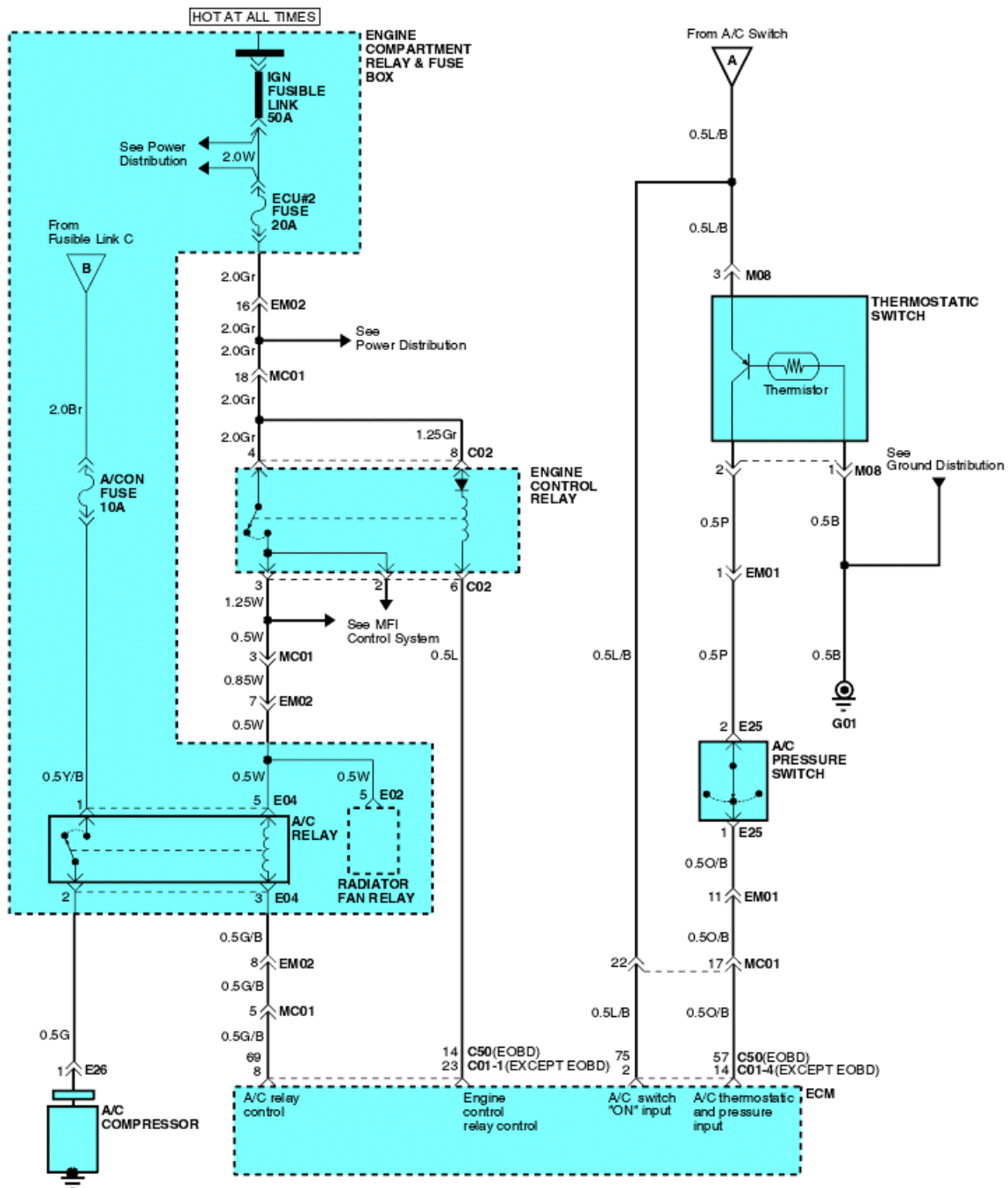


ILLUMINATIONS E21C0400



# BLOWER & A/C CONTROLS E21C0420

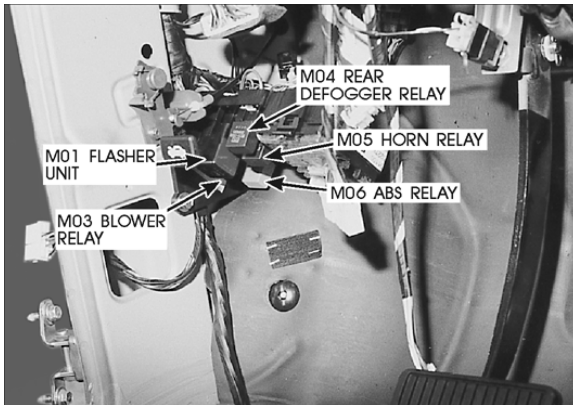




### 13.3 Component Location

MAIN HARNESS E31B0010

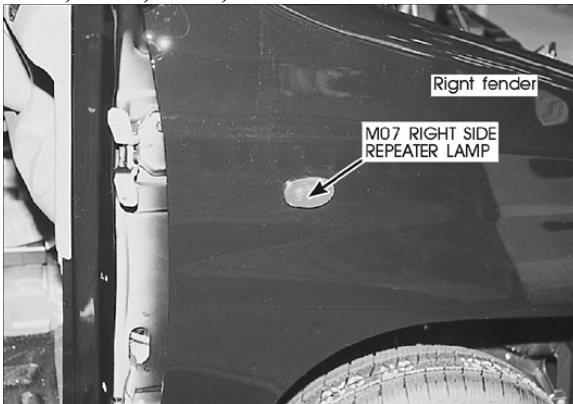
#### MAIN HARNESS (1)



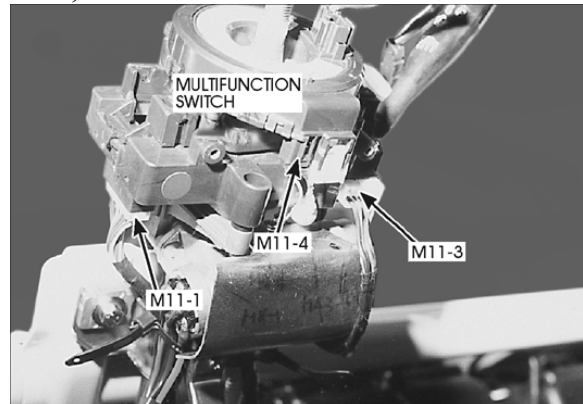
**M01, M02, M05, M06**



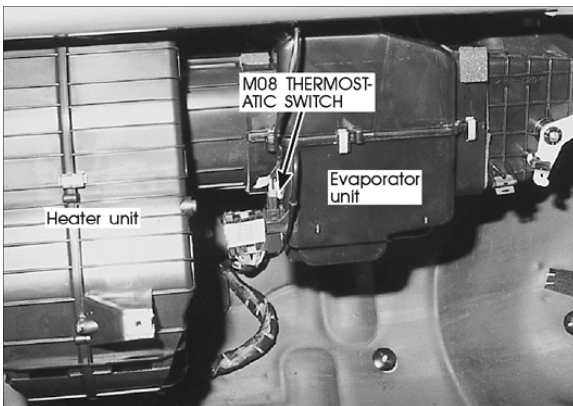
**M09, M10**



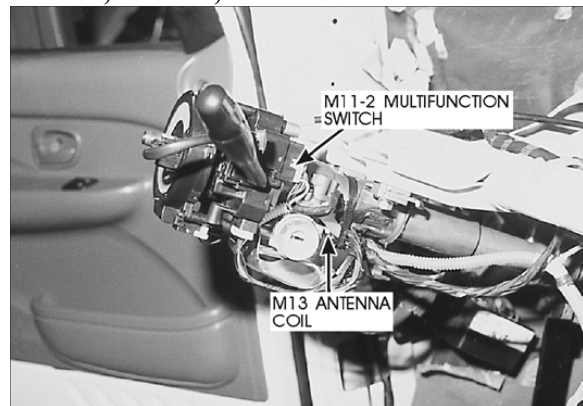
**M07**



**M11-1, M11-3, M11-4**

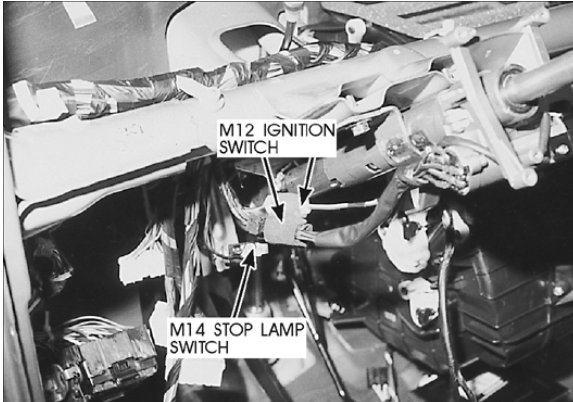


**M08**

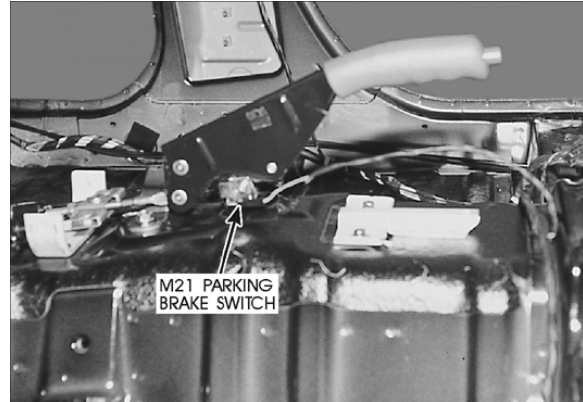


**M11-2, M13**

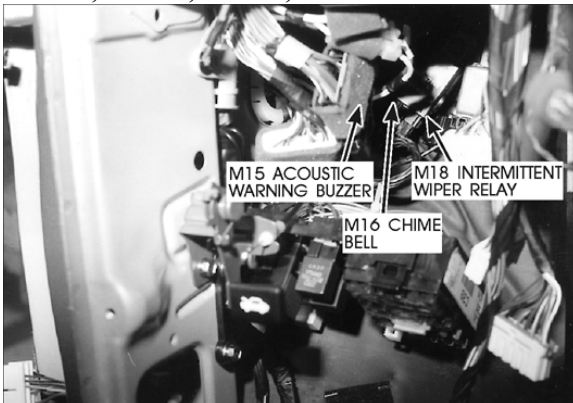
## MAIN HARNESS (2)



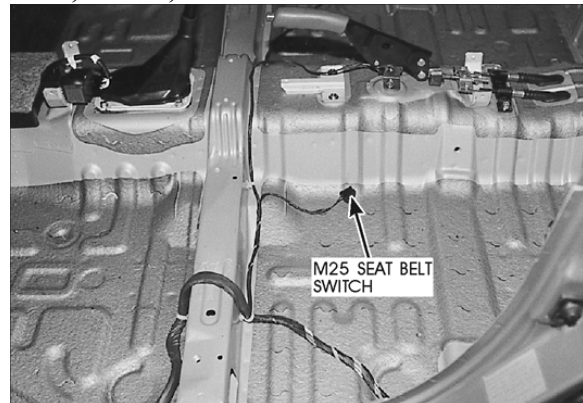
M15-1,M15-2,M15-3,M15-4



M23,M32-1,M32-2



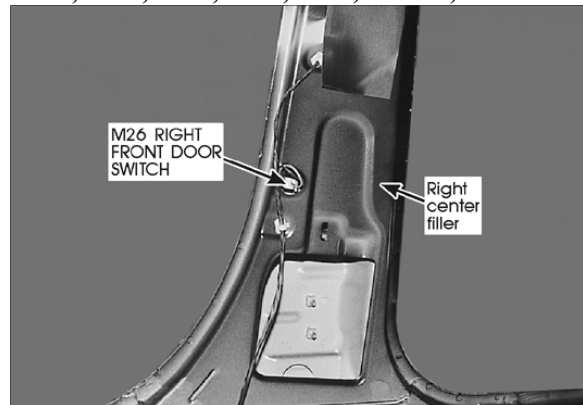
M16,M18



M26,M27,M28,M29,M30,M32-1,M32-2

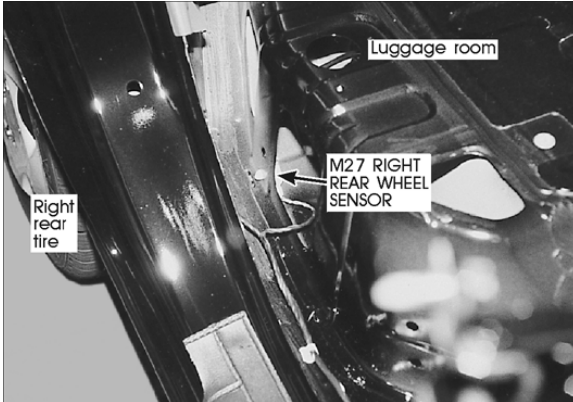


M20-1,M20-2,M20-3

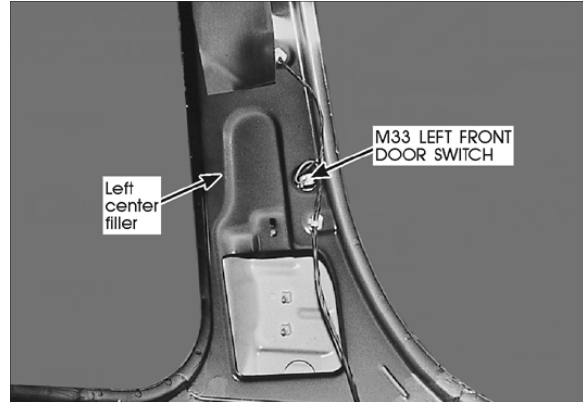


M31

### MAIN HARNESS (3)



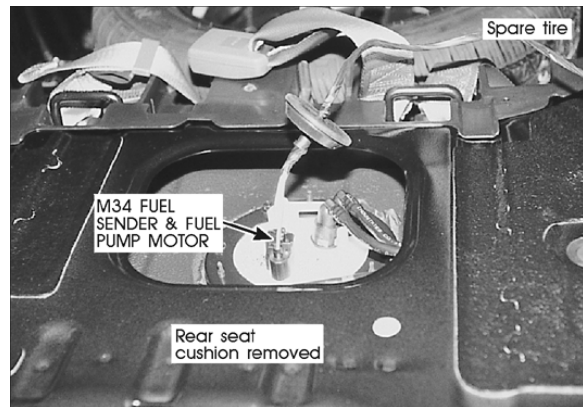
**M27**



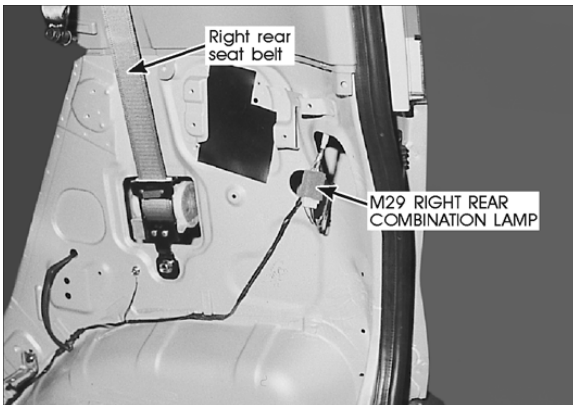
**M33**



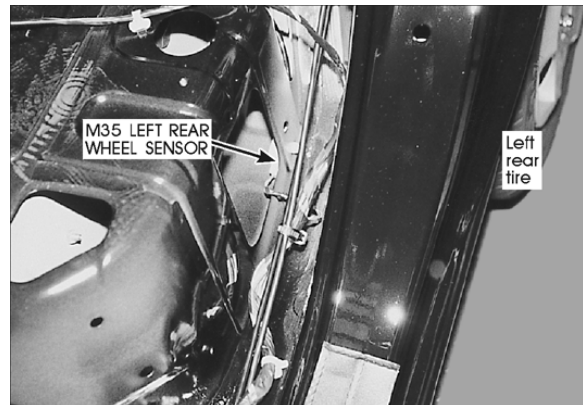
**M28**



**M34**



**M29**

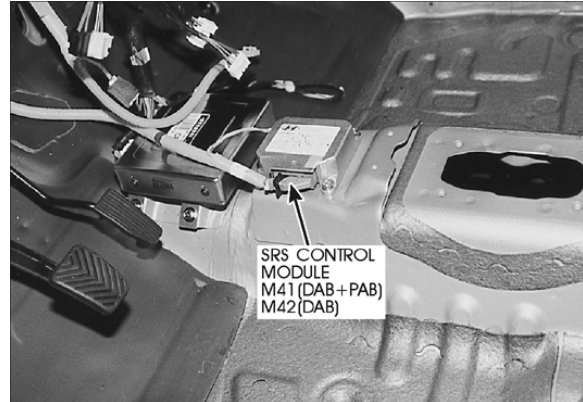


**M35**

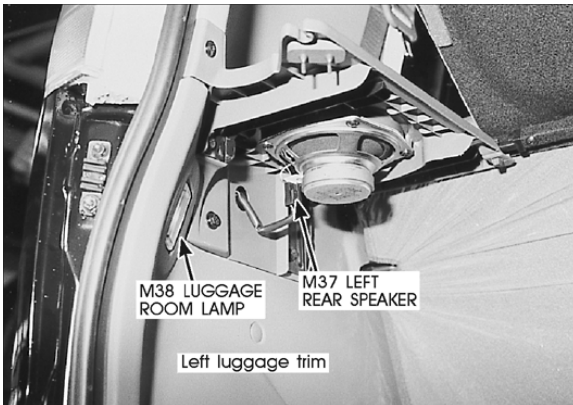
## MAIN HARNESS (4)



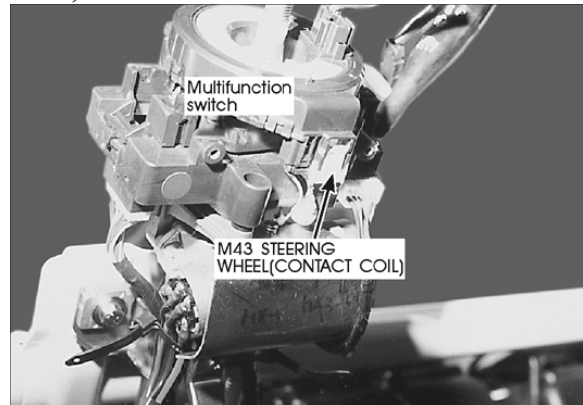
**M36**



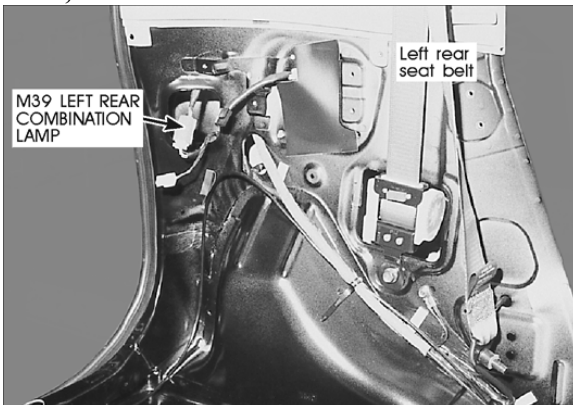
**M41, M42**



**M37, M38**



**M43**



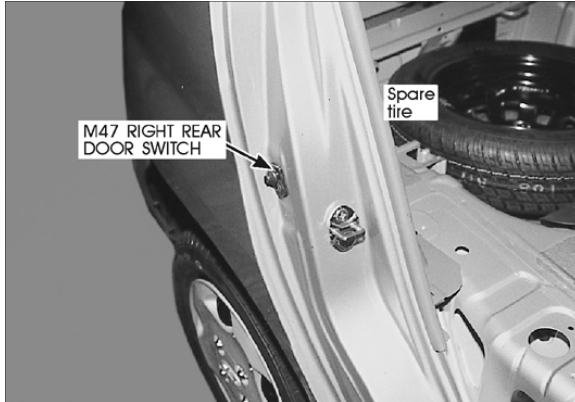
**M39**



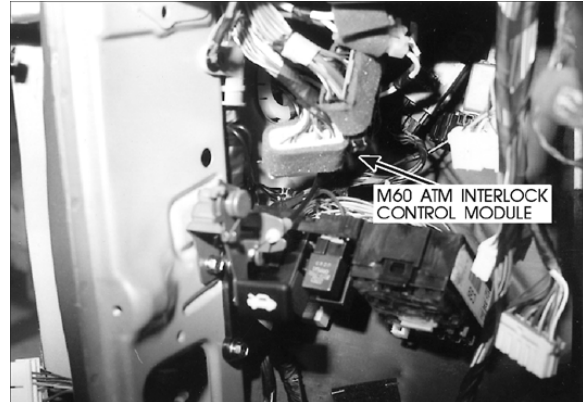
**M46**



## MAIN HARNESS (5)



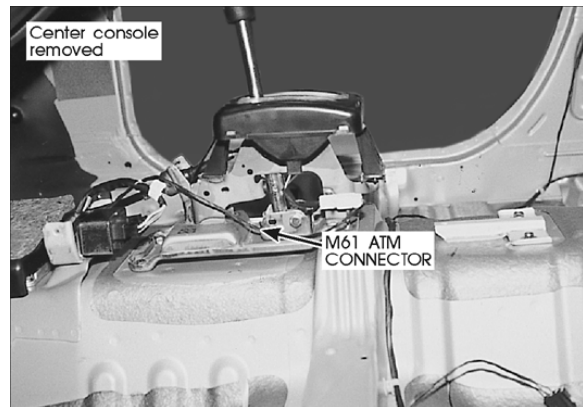
**M47**



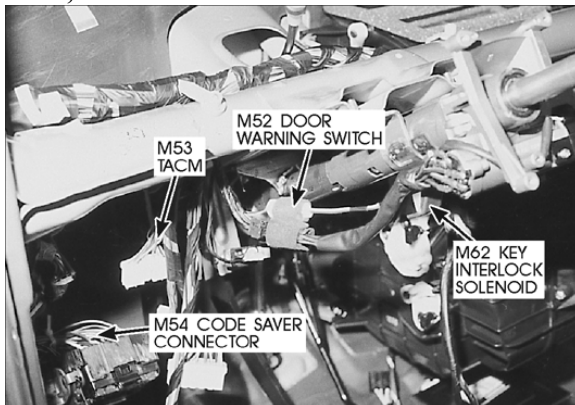
**M60**



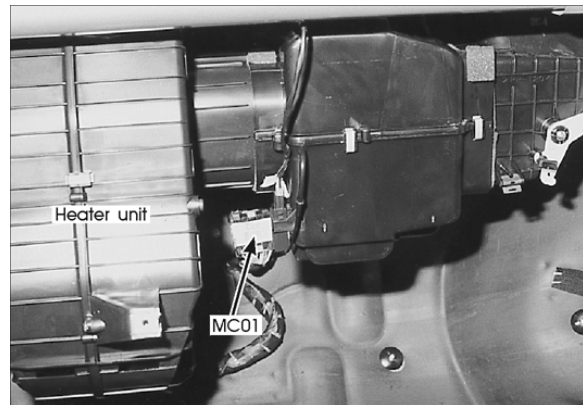
**M50, M51**



**M61**

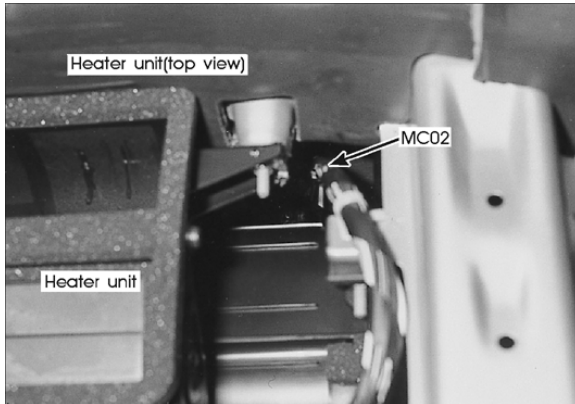


**M62**

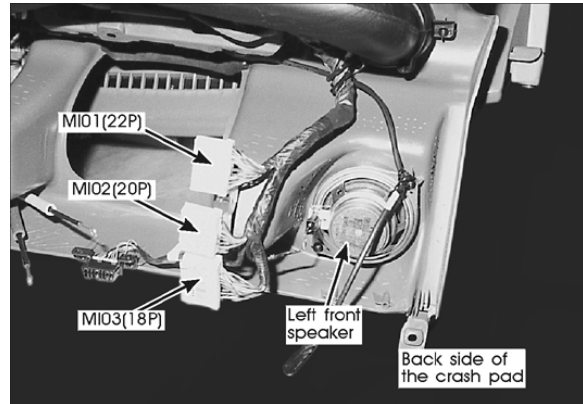


**MC01**

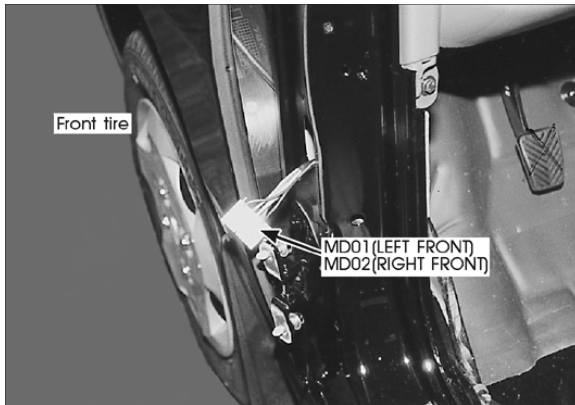
## MAIN HARNESS (6)



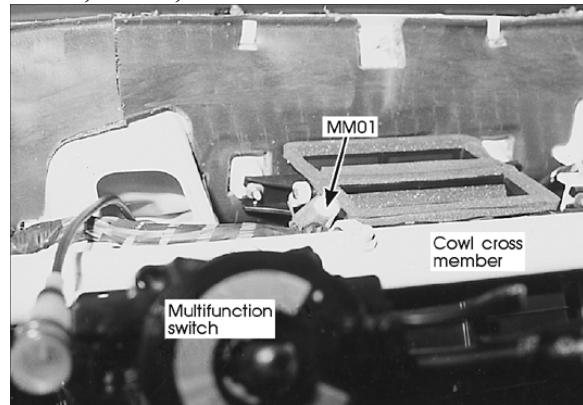
**MC02**



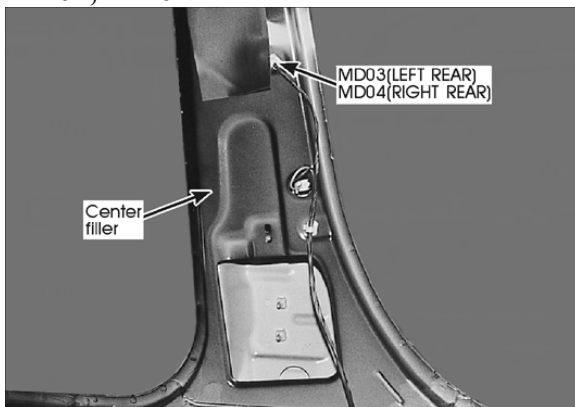
**MI01, MI02, MI03**



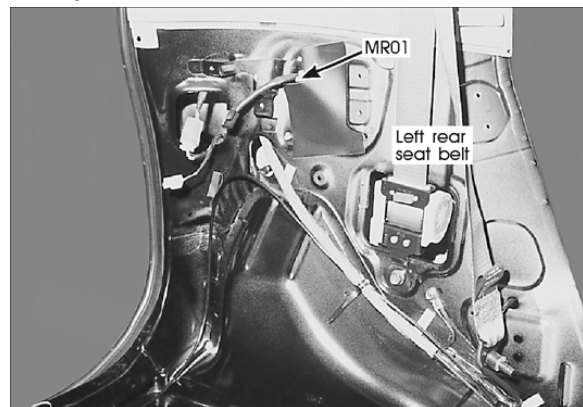
**MD01, MD02**



**MM01**

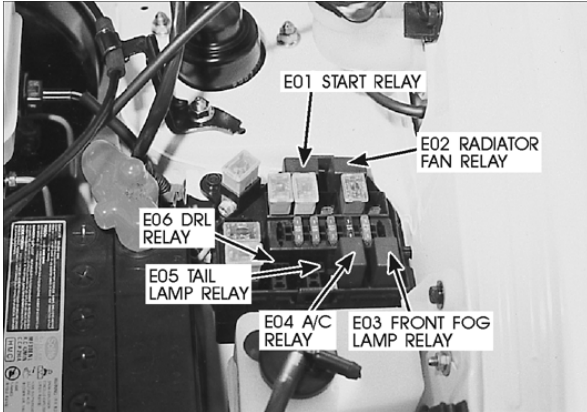


**MD03, MD04**

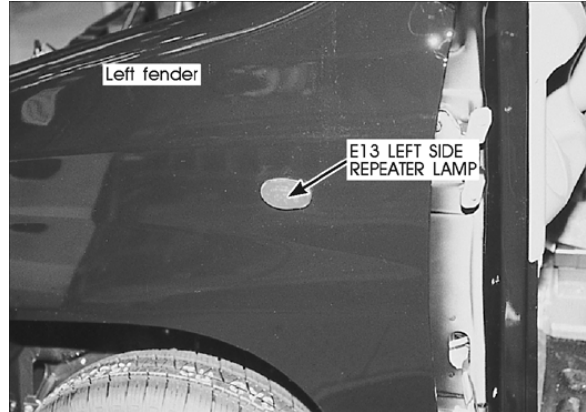


**MR01**

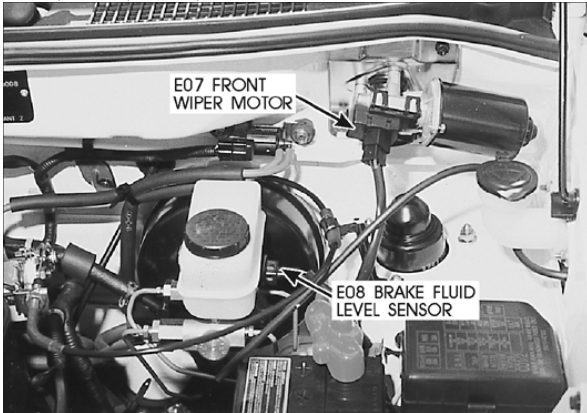
ENGINE HARNESS E31B0020  
**ENGINE HARNESS (1)**



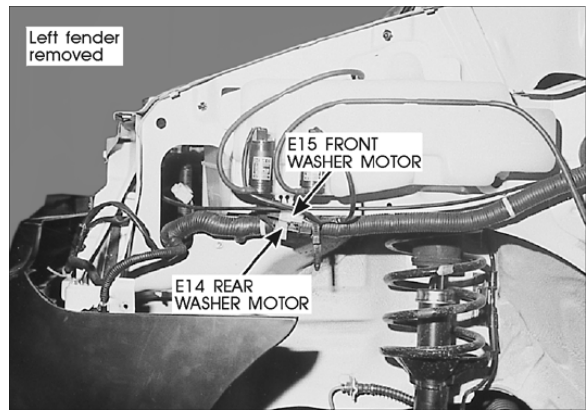
**E01, E02, E03, E04**



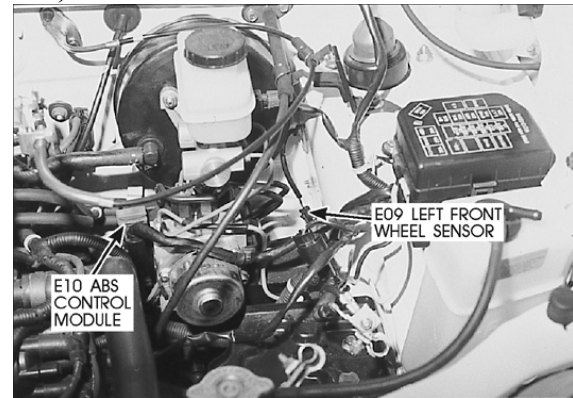
**E13**



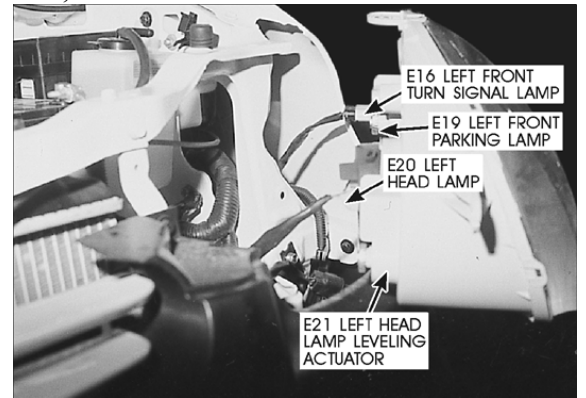
**E07, E08**



**E14, E15**

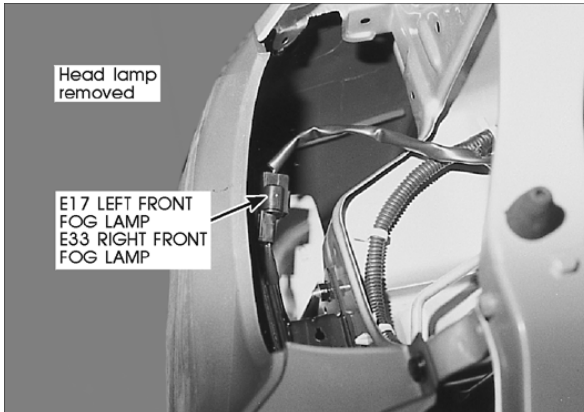


**E09, E10**

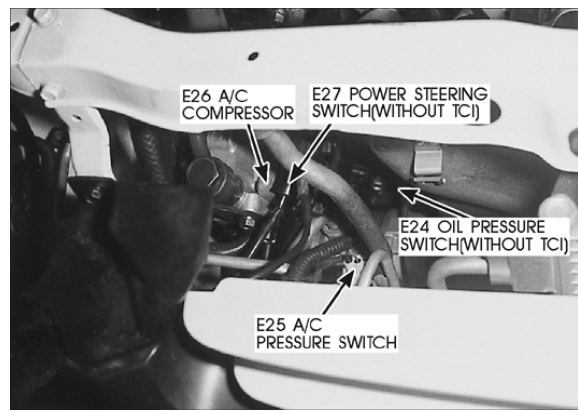


**E16, E19, E20, E21**

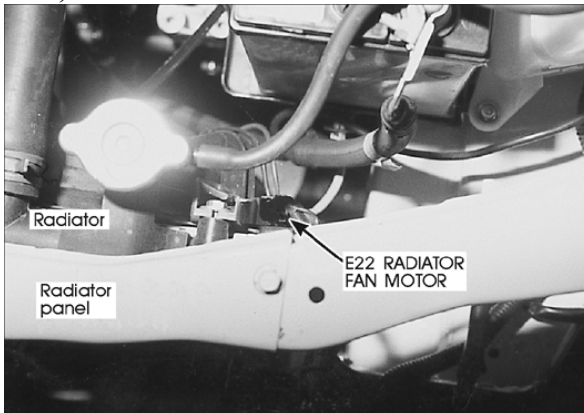
## ENGINE HARNESS (2)



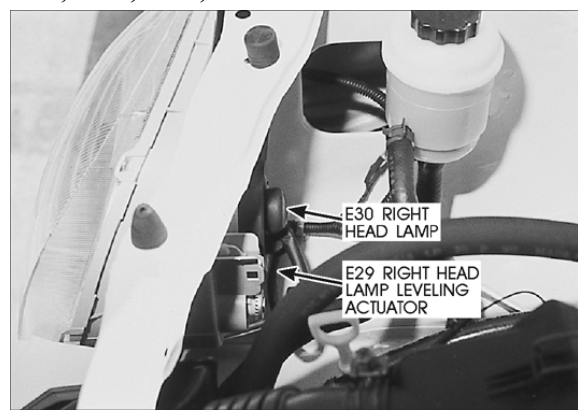
**E17, E33**



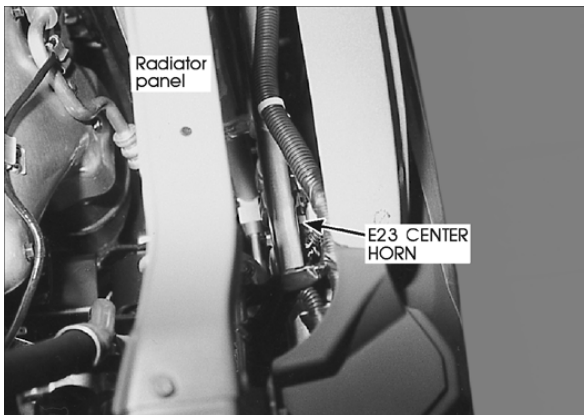
**E24, E25, E26, E27**



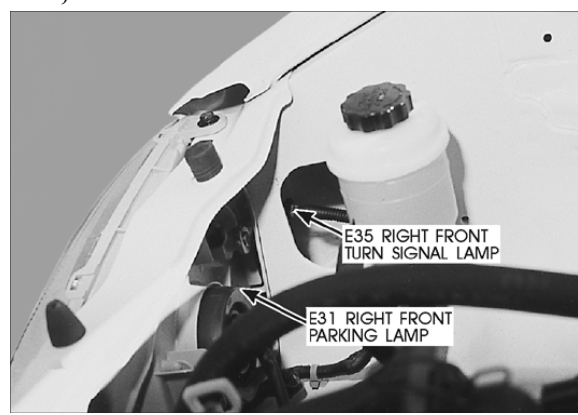
**E22**



**E29, E30**



**E23**

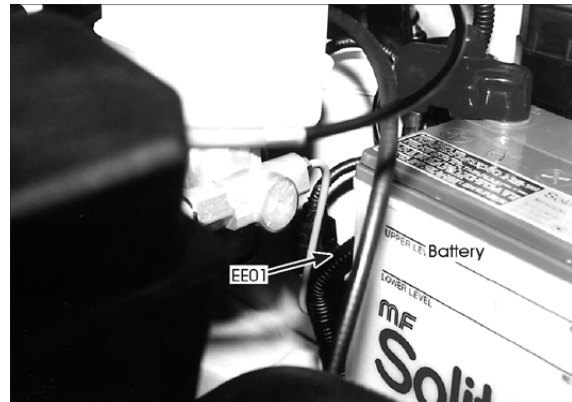


**E31, E35**

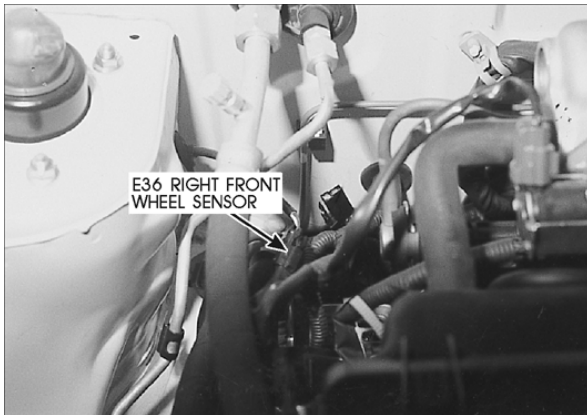
### ENGINE HARNESS (3)



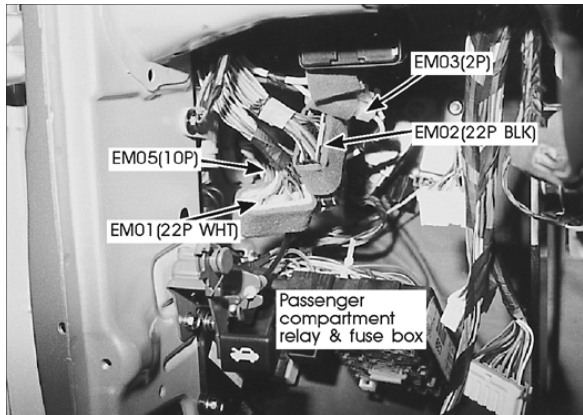
**E34**



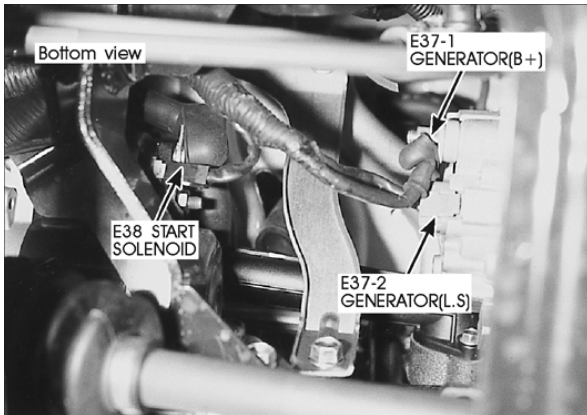
**EE01**



**E36**

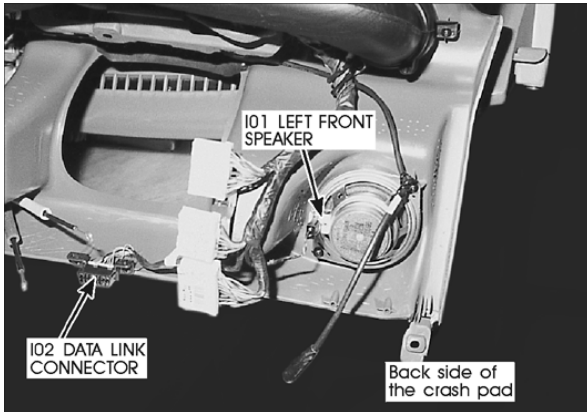


**EM01, EM02, EM03, EM05**

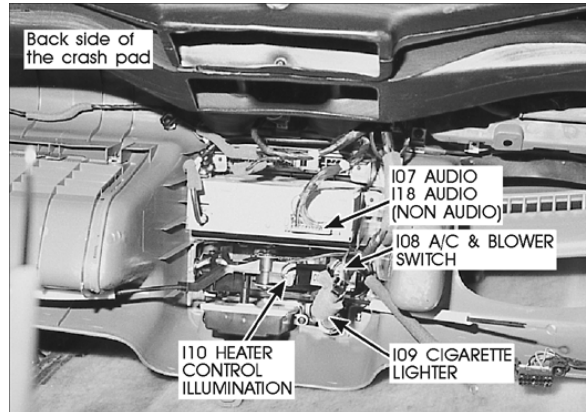


**E37-1, E37-2, E38**

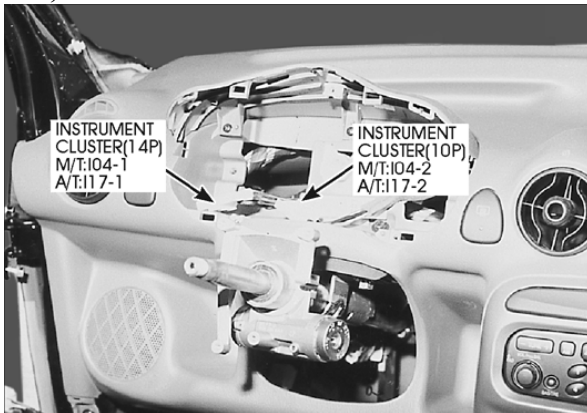
**INSTRUMENT HARNESS E31B0030**  
**INSTRUMENT HARNESS (1)**



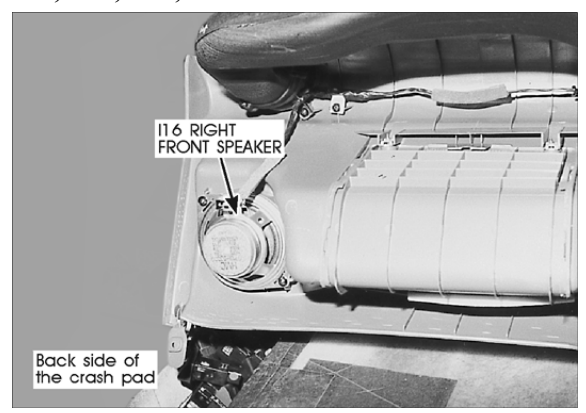
**I01, I02**



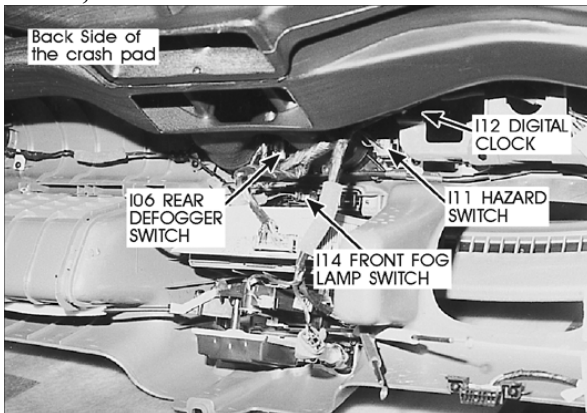
**I07, I08, I09, I10**



**I04-1, I04-2**

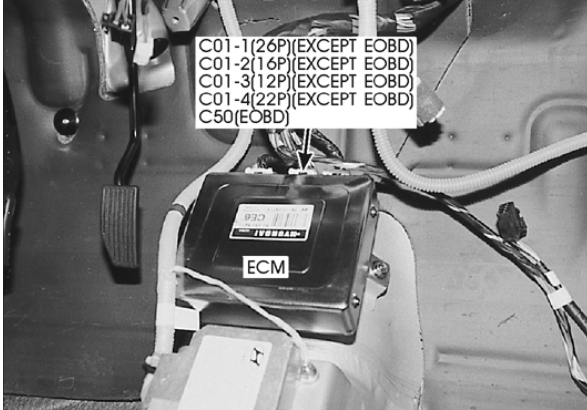


**I16**

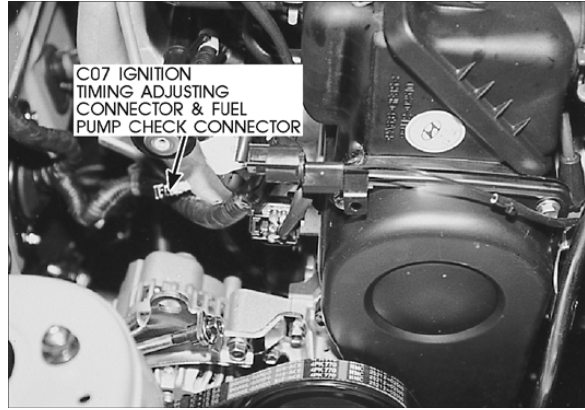


**I06, I11, I12, I14**

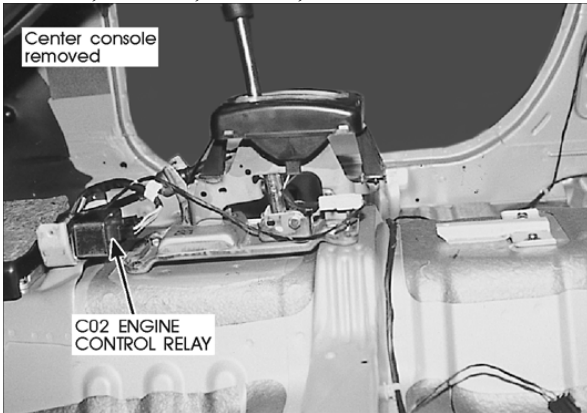
**CONTROL HARNESS E31B0040**  
**CONTROL HARNESS (1)**



**C01-1, C01-2, C01-3, C01-4**



**C07**



**C02**



**C11, C14**

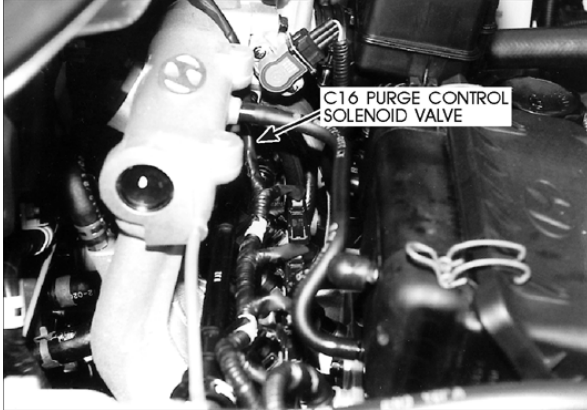


**C05-1, C05-2**



**C12**

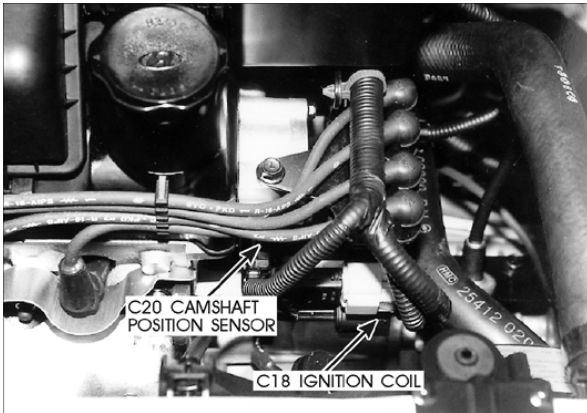
## CONTROL HARNESS (2)



C16



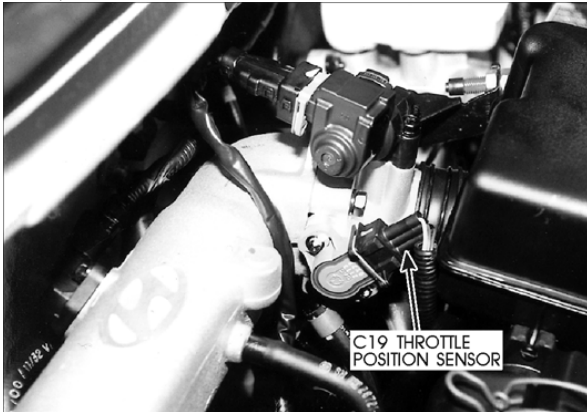
C21



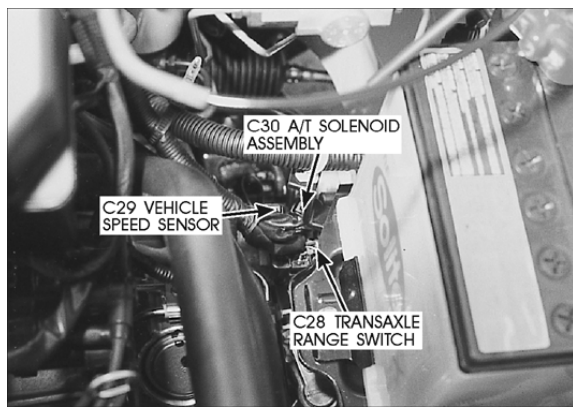
C18, C20



C23



C19



C28, C29, C30



### CONTROL HARNESS (3)



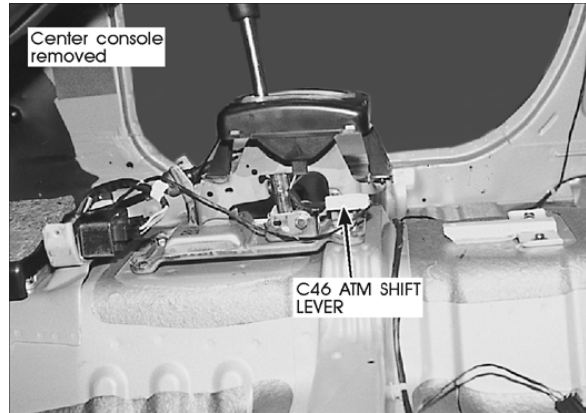
C35, C36, C37, C38



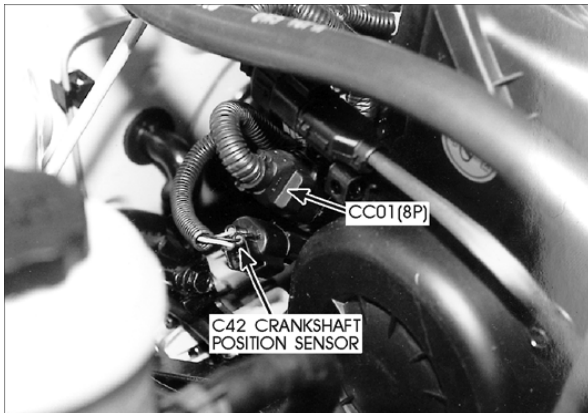
C43



C40

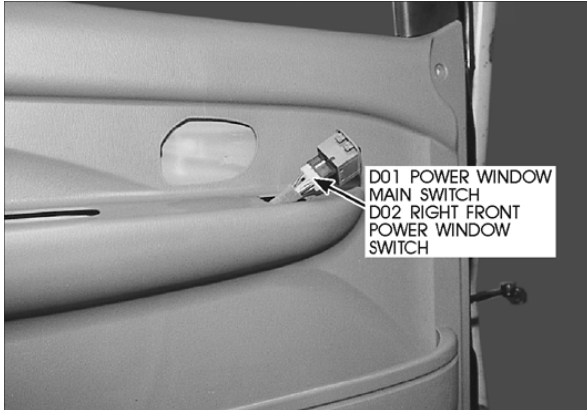


C46

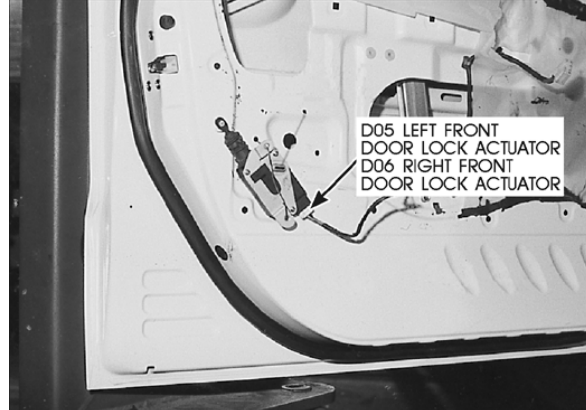


C42, CC01

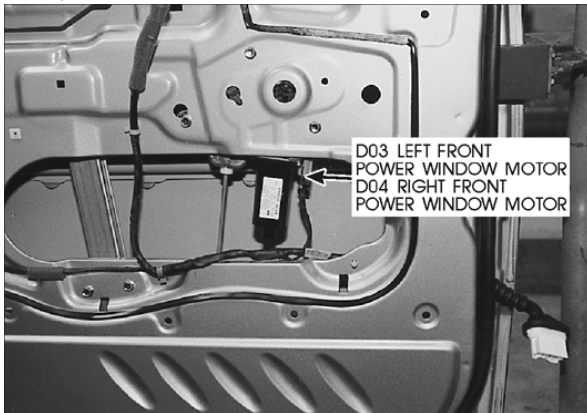
DOOR HARNESS E31B0050  
DOOR HARNESS (1)



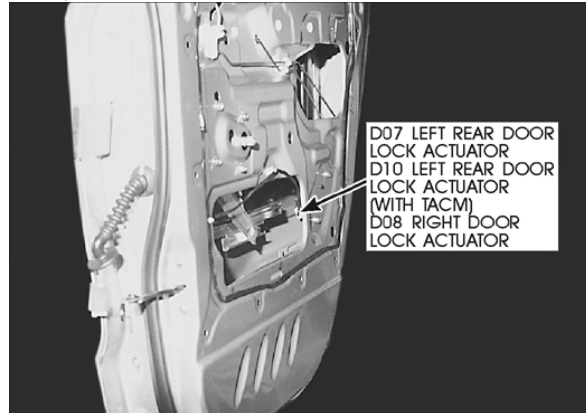
D01, D02



D05, D06

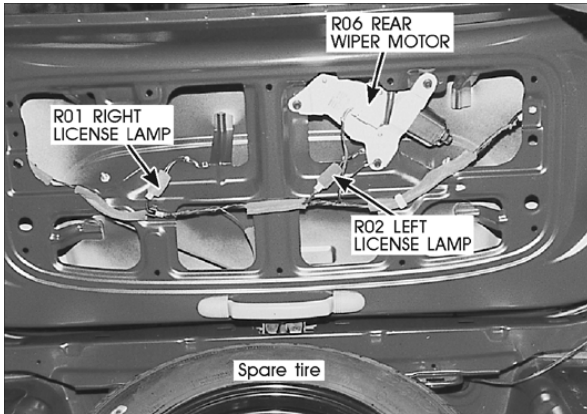


D03, D04

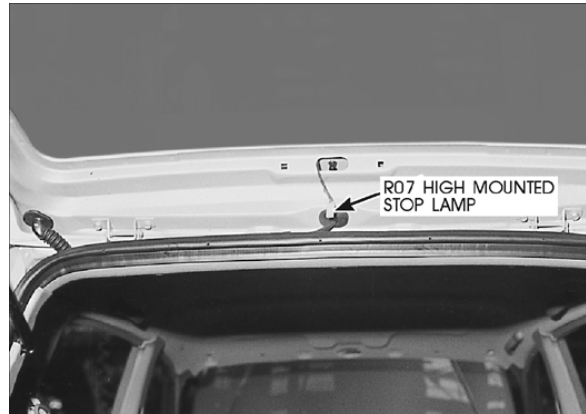


D07, D08, D10

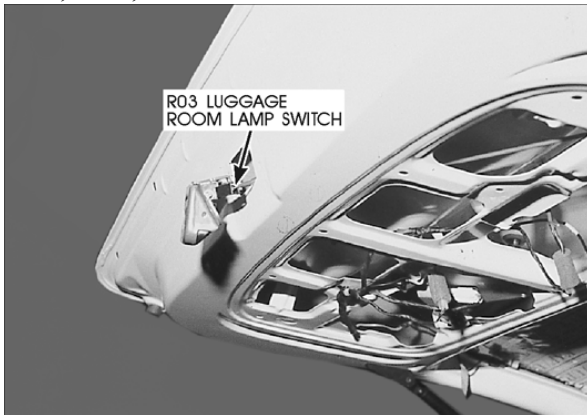
REAR HARNESS E31B0060  
REAR HARNESS(TAIL GATE) (1)



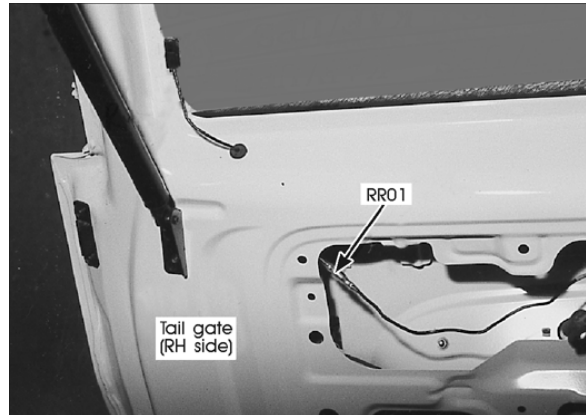
R01, R02, R06



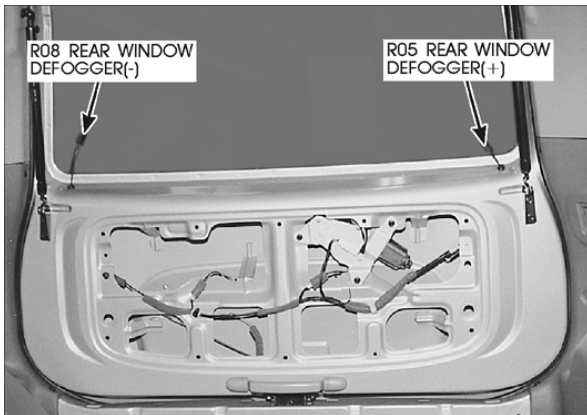
R07



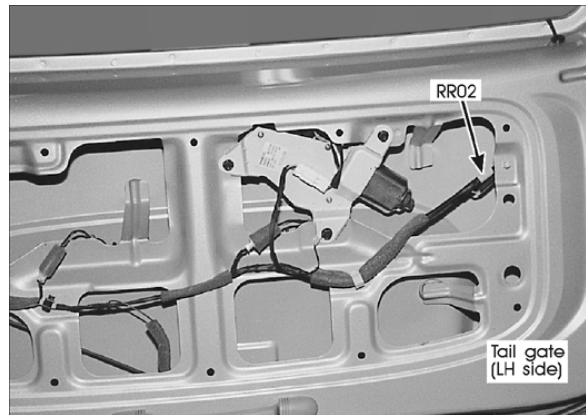
R03



RR01

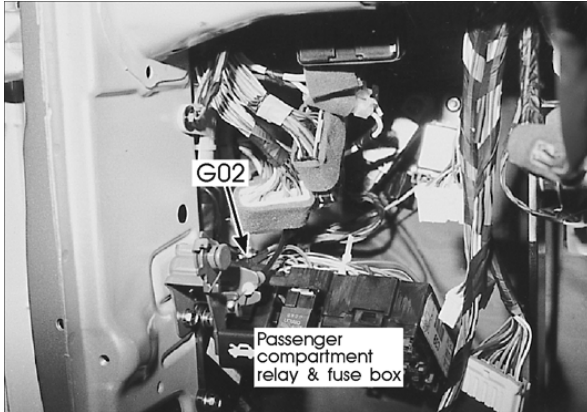


R05, R08

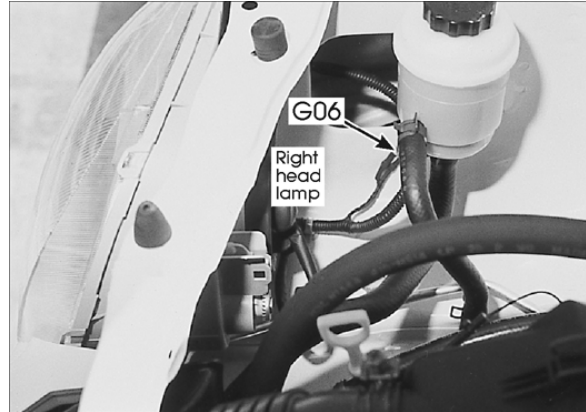


RR02

GROUND E31B0070  
GROUND (1)



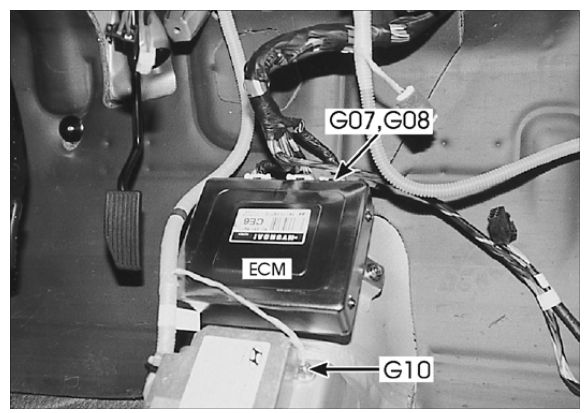
G01



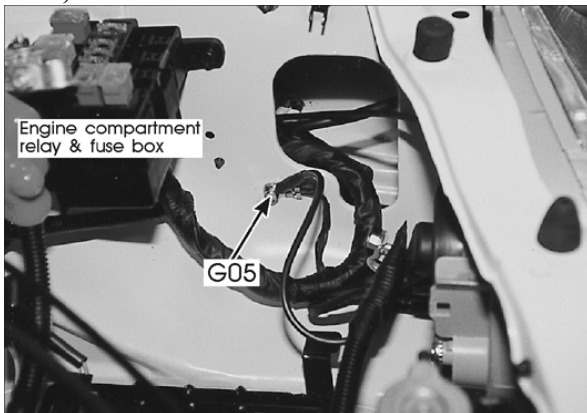
G06



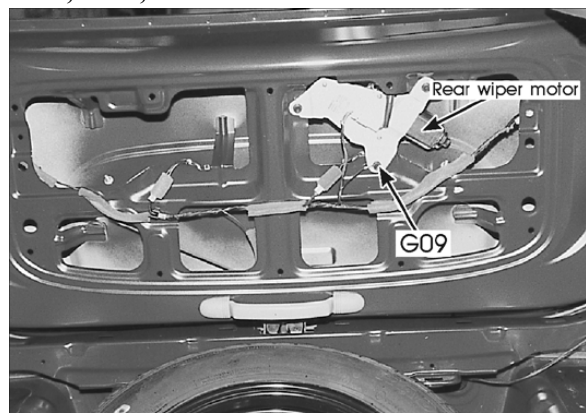
G03, G04



G07, G08, G10



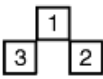



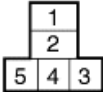
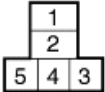

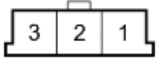


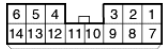
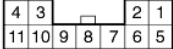
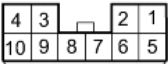
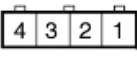
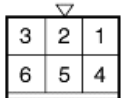



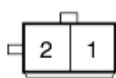
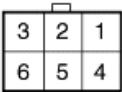
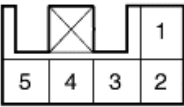


G05



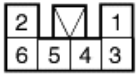
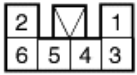








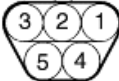





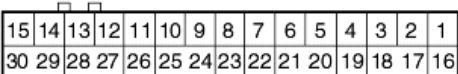
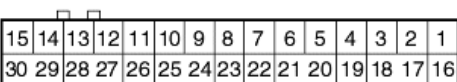
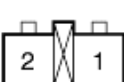
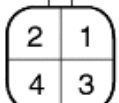
G09

### 13.4 Connector Configurations

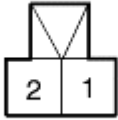
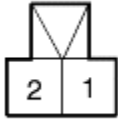

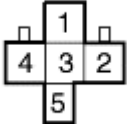
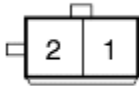
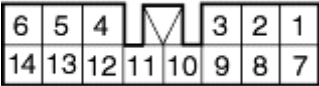
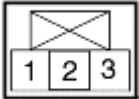
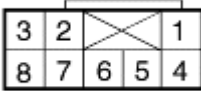
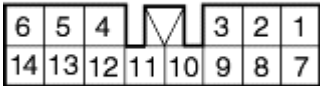
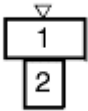

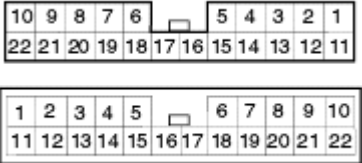
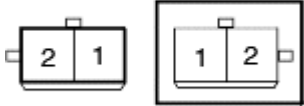
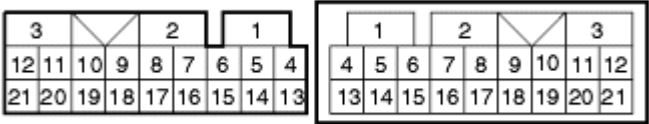
MAIN HARNESS E41C0010

MAIN HARNESS (1)			
<b>M01</b>	<b>M02</b>	<b>M03</b>	<b>M04</b>
			
<b>M05</b>	<b>M06</b>	<b>M07</b>	<b>M08</b>
			
<b>M09</b>	<b>M10</b>	<b>M11-1</b>	<b>M11-2</b>
			
<b>M11-3</b>	<b>M11-4</b>	<b>M12</b>	<b>M13</b>
			
<b>M14</b>	<b>M15</b>	<b>M16</b>	<b>BLANK</b>
			
<b>M18</b>	<b>M19</b>	<b>M20</b>	<b>M21</b>
			

# MAIN HARNESS (2)

<b>M23</b>	<b>M24</b>	<b>M25</b>	<b>M26</b>
			
<b>M27</b>	<b>M28</b>	<b>M29</b>	<b>M30</b>
			
<b>M31</b>	<b>BLANK</b>	<b>M33</b>	<b>M34</b>
			
<b>M35</b>	<b>M36</b>	<b>M37</b>	<b>M38</b>
			
<b>M39</b>	<b>BLANK</b>	<b>M41</b>	
			
<b>M42</b>		<b>M43</b>	<b>M44</b>
			

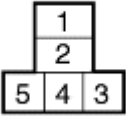
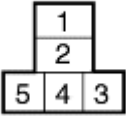
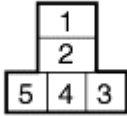
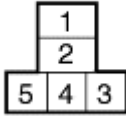
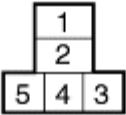
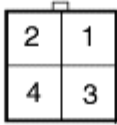
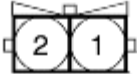
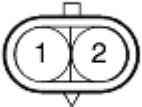
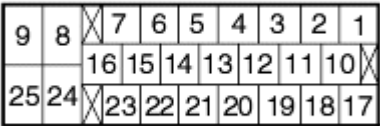
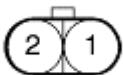
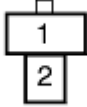
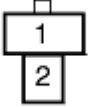
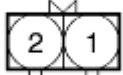

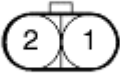

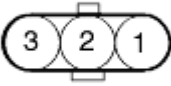
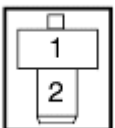
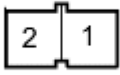

**MAIN HARNESS (3)**

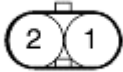


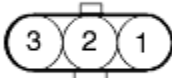
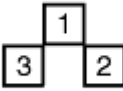
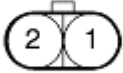
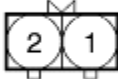
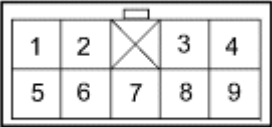
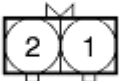
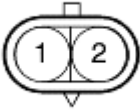

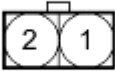



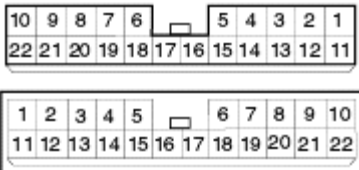

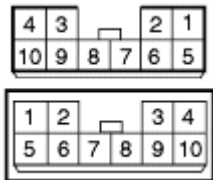
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<b>M51</b>		<b>M52</b>		<b>M53</b>		
						
<b>M54</b>		<b>BLANK</b>		<b>M60</b>		
						
<b>M61</b>			<b>M62</b>		<b>M64</b>	
						
<b>MC01</b>			<b>MC02</b>		<b>BLANK</b>	
						
<b>MD01</b>					<b>BLANK</b>	
						

**MAIN HARNESS (4)**

<b>MD02</b>		<b>MD03</b>	
<b>MD04</b>		<b>MI01</b>	
		<b>BLANK</b>	
<b>MI02</b>		<b>MI03</b>	
<b>MM01</b>		<b>MR01</b>	

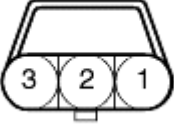
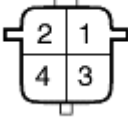



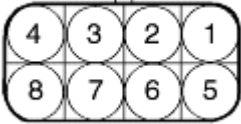
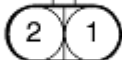
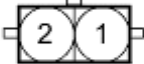
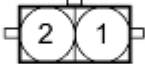
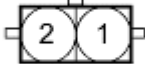
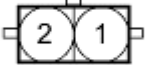
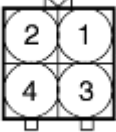
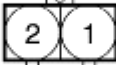
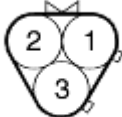

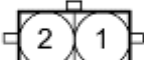
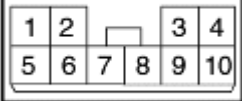
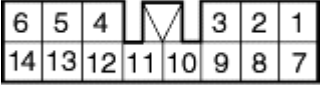



<b>ENGINE HARNESS (1)</b>			
<b>E01</b>	<b>E02</b>	<b>E03</b>	<b>E04</b>
			
<b>E05</b>	<b>BLANK</b>	<b>E07</b>	<b>E08</b>
			
<b>E09</b>	<b>E10</b>		<b>BLANK</b>
			
<b>E13</b>	<b>E14</b>	<b>E15</b>	<b>E16</b>
			
<b>E17</b>	<b>BLANK</b>	<b>E19</b>	<b>E20</b>
			
<b>E21</b>	<b>E22</b>	<b>E23</b>	<b>E24</b>
			
<b>ENGINE HARNESS (2)</b>			
<b>E25</b>	<b>E26</b>	<b>E27</b>	<b>E29</b>

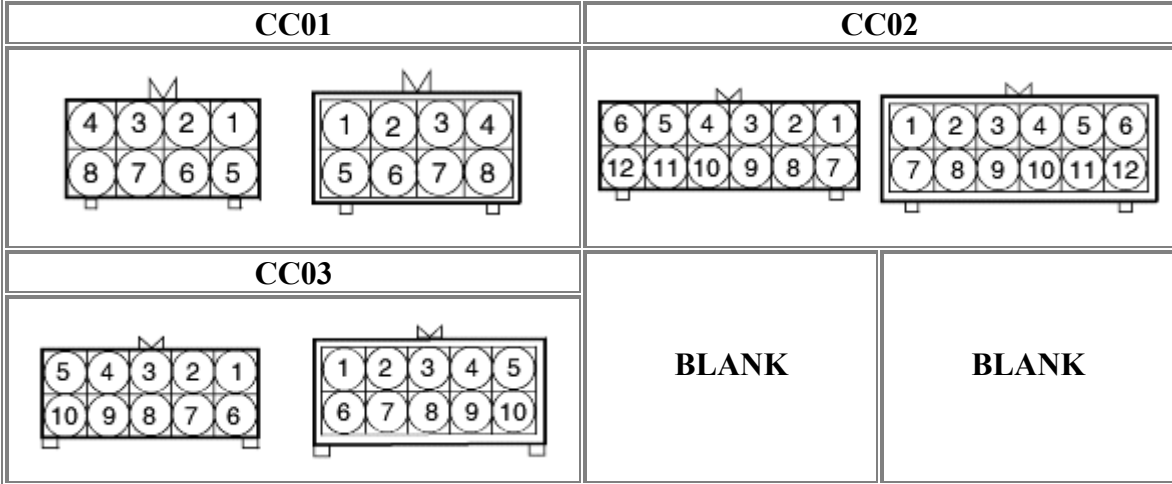
			
<b>E30</b>	<b>E31</b>	<b>BLANK</b>	<b>E33</b>
			
<b>E34</b>	<b>E35</b>	<b>E36</b>	<b>E37-1</b>
			
<b>E37-2</b>	<b>E38</b>	<b>E01</b>	
			
<b>EM01</b>		<b>EM02</b>	
			
<b>EM03</b>		<b>EM05</b>	
		<b>BLANK</b>	
			

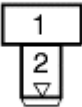
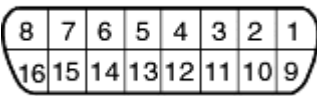
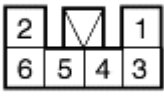
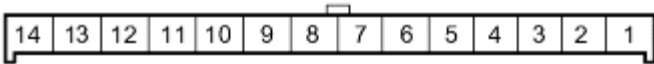
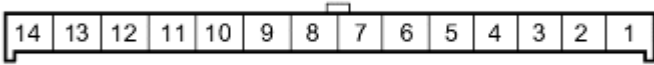
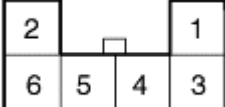
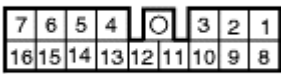
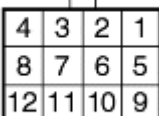
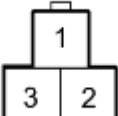
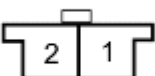
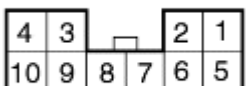
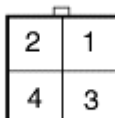
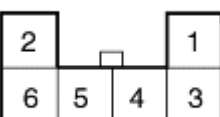
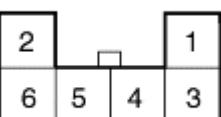

CONTROL HARNESS (1)	
<b>C01-1</b>	<b>C01-2</b>
<b>C01-3</b>	<b>C01-4</b>
<b>C02</b>	<b>C05-1</b>
<b>BLANK</b>	<b>BLANK</b>
<b>C05-2</b>	<b>C07</b>
<b>BLANK</b>	<b>BLANK</b>
<b>C11</b>	<b>C12</b>
<b>BLANK</b>	<b>BLANK</b>
<b>C14</b>	<b>BLANK</b>
	<b>BLANK</b>
<b>C16</b>	<b>C18</b>
<b>BLANK</b>	<b>BLANK</b>
<b>C19</b>	<b>BLANK</b>
	<b>BLANK</b>

**CONTROL HARNESS (2)**

<b>C20</b>	<b>C21</b>	<b>C23</b>	<b>BLANK</b>
			
<b>C28</b>	<b>C29</b>	<b>C30</b>	<b>C32</b>
			
<b>BLANK</b>	<b>C35</b>	<b>C36</b>	<b>C37</b>
			
<b>C38</b>	<b>C40</b>	<b>C41</b>	<b>C42</b>
			
<b>C43</b>	<b>C44</b>	<b>C45</b>	<b>C46</b>
			
<b>C50</b>			
			

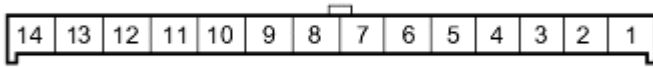
**CONTROL HARNESS (3)**



INSTRUMENT HARNESS (1)			
<b>I01</b>	<b>I02</b>	<b>I03</b>	<b>BLANK</b>
			
<b>I04-1</b>			<b>BLANK</b>
			
<b>I04-2</b>			<b>I06</b>
			
<b>I07</b>		<b>I08</b>	<b>I09</b>
			
<b>I10</b>	<b>I11</b>	<b>I12</b>	<b>BLANK</b>
			
<b>I14</b>	<b>I15</b>	<b>I16</b>	<b>BLANK</b>
			

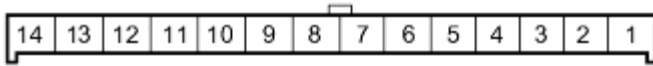
**INSTRUMENT HARNESS (2)**

**I17-1**

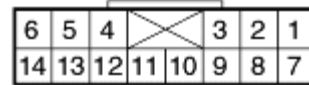


**BLANK**

**I17-2**

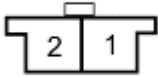
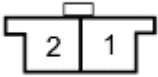



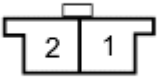

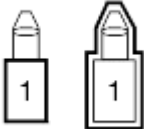
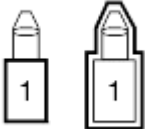


**I18**



<b>DOOR HARNESS (1)</b>			
<b>D01</b>	<b>D02</b>	<b>D03</b>	<b>D04</b>
<b>D05</b>	<b>D06</b>	<b>D07</b>	<b>D08</b>
<b>BLANK</b>	<b>D10</b>	<b>BLANK</b>	<b>BLANK</b>



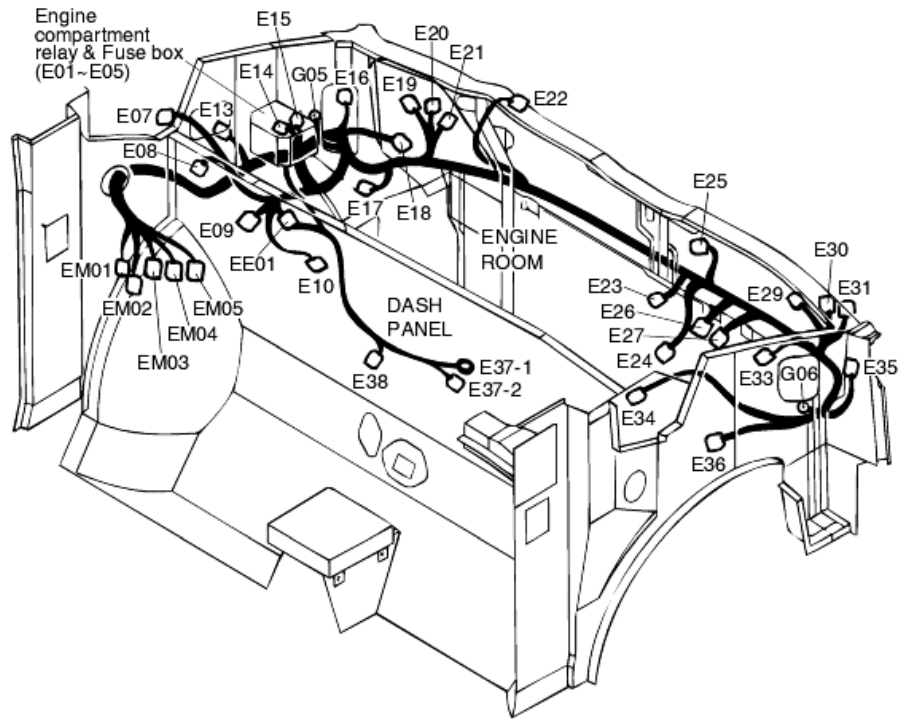
<b>REAR HARNESS (1)</b>			
<b>R01</b>	<b>R02</b>	<b>R03</b>	<b>BLANK</b>
			
<b>R05</b>	<b>R06</b>	<b>R07</b>	<b>R08</b>
			
<b>RR01</b>	<b>RR02</b>	<b>BLANK</b>	<b>BLANK</b>
			



M01	Flasher unit	M39	Left rear combination lamp
M02	EBD relay	M41	SRS control module (DAB+PAB)
M03	Blower relay	M42	SRS control module (DAB)
M04	Rear defogger relay	M43	Steering wheel (Contact coil)
M05	Horn relay	M44	Passenger air bag
M06	ABS relay	M46	Left rear door switch
M07	Right side repeater lamp	M47	Right rear door switch
M08	Thermostatic switch	M50	Door lock relay
M09	Blower motor	M51	Hazard relay
M10	Blower resistor	M52	Door warning switch
M11–	Multifunction switch	M53	TACM
1			
M11–	Multifunction switch	M54	Code saver connector
2			
M11–	Multifunction switch	M60	ATM interlock control module
3			
M11–	Multifunction switch	M61	ATM connector
4			
M12	Ignition switch	M62	ATM key interlock solenoid
M13	Antenna coil	M64	Seat belt timer
M14	Stop lamp switch	EM0	Connection with ENGINE harness
M15	Acoustic warning buzzer	1	
M16	Chime bell	EM0	Connection with ENGINE harness
M18	Intermittent wiper relay	2	
M19	SMATRA	EM0	Connection with ENGINE harness
M20	Courtesy lamp	3	
M21	Parking brake switch	EM0	Connection with ENGINE harness (ABS)
M23	Right seat warmer switch	5	
M24	Left seat warmer switch	MC0	Connection with CONTROL harness
M25	Seat belt switch	1	(Immobilizer)
M26	Right front door switch	MC0	Connection with CONTROL harness
M27	Right rear wheel sensor	2	(Immobilizer)
M28	Right rear speaker	MD0	Connection with LH FRONT DOOR
M29	Right rear combination lamp	1	harness
M30	Right seat warmer	MD0	Connection with RH FRONT DOOR
		2	harness
		MD0	Connection with LH REAR DOOR
		3	harness
		MD0	Connection with RH REAR DOOR
		4	harness
		MI01	Connection with INSTRUMENT harness
		MI02	Connection with INSTRUMENT harness
		MI03	Connection with INSTRUMENT harness
		MM0	Connection with AIR BAG harness
		1	
		MR0	Connection with TAIL GATE harness
		1	

M31	Left seat warmer	G01	Left front ground
M33	Left front door switch	G03	Right rear ground
M34	Fuel sender & Fuel pump motor	G04	Left rear ground
M35	Left rear wheel sensor	G10	Air bag ground
M36	Rear fog lamp		
M37	Left rear speaker		
M38	Luggage room lamp		

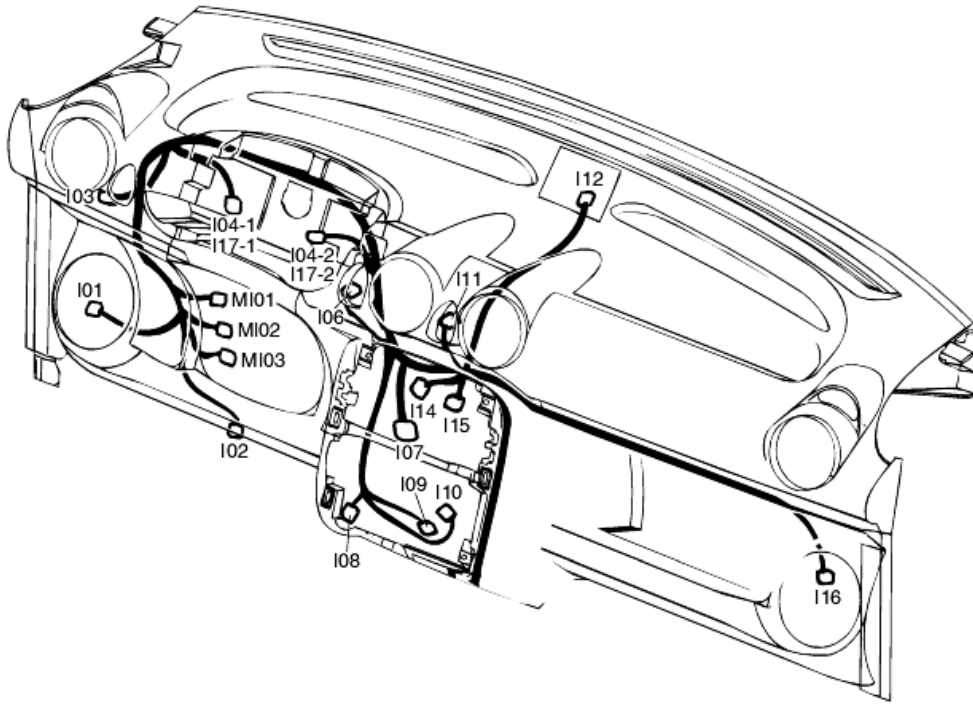
ENGINE HARNESS(1)



E0	Start relay	E26	A/C compressor
1		E27	Power steering switch (without TCI)
E0	Radiator fan relay	E29	Right head lamp leveling actuator
2		E30	Right head lamp
E0	Front fog lamp relay	E31	Right front parking lamp
3		E33	Right front fog lamp
E0	A/C relay	E34	DRL control module
4		E35	Right front turn signal lamp
E0	Tail lamp relay	E36	Right front wheel sensor
5		E37-	
E0	Front wiper motor	1	Generator (B+)
7		E37-	
E0	Brake fluid level sensor	2	Generator (L, S)
8		E38	Start solenoid
E0	Left front wheel sensor		
9			
E1	ABS control module		
0			
E1	Left side repeater lamp		
3			
E1	Rear washer motor		
4			
E1	Front washer motor		

5			
E1 6	Left front turn signal lamp	EE01	Connection with BATTERY EXT. harness
E1 7	Left front fog lamp	EM0 1	Connection with MAIN harness
E1 9	Left front parking lamp	EM0 2	Connection with MAIN harness
E2 0	Left head lamp	EM0 3	Connection with MAIN harness
E2 1	Left head lamp leveling actuator	EM0 5	Connection with MAIN harness (ABS)
E2 2	Radiator fan motor	G05	Left ground
E2 3	Horn	G06	Right ground
E2 4	Oil pressure switch (without TCI)	Z04	Diode
E2 5	A/C pressure switch		

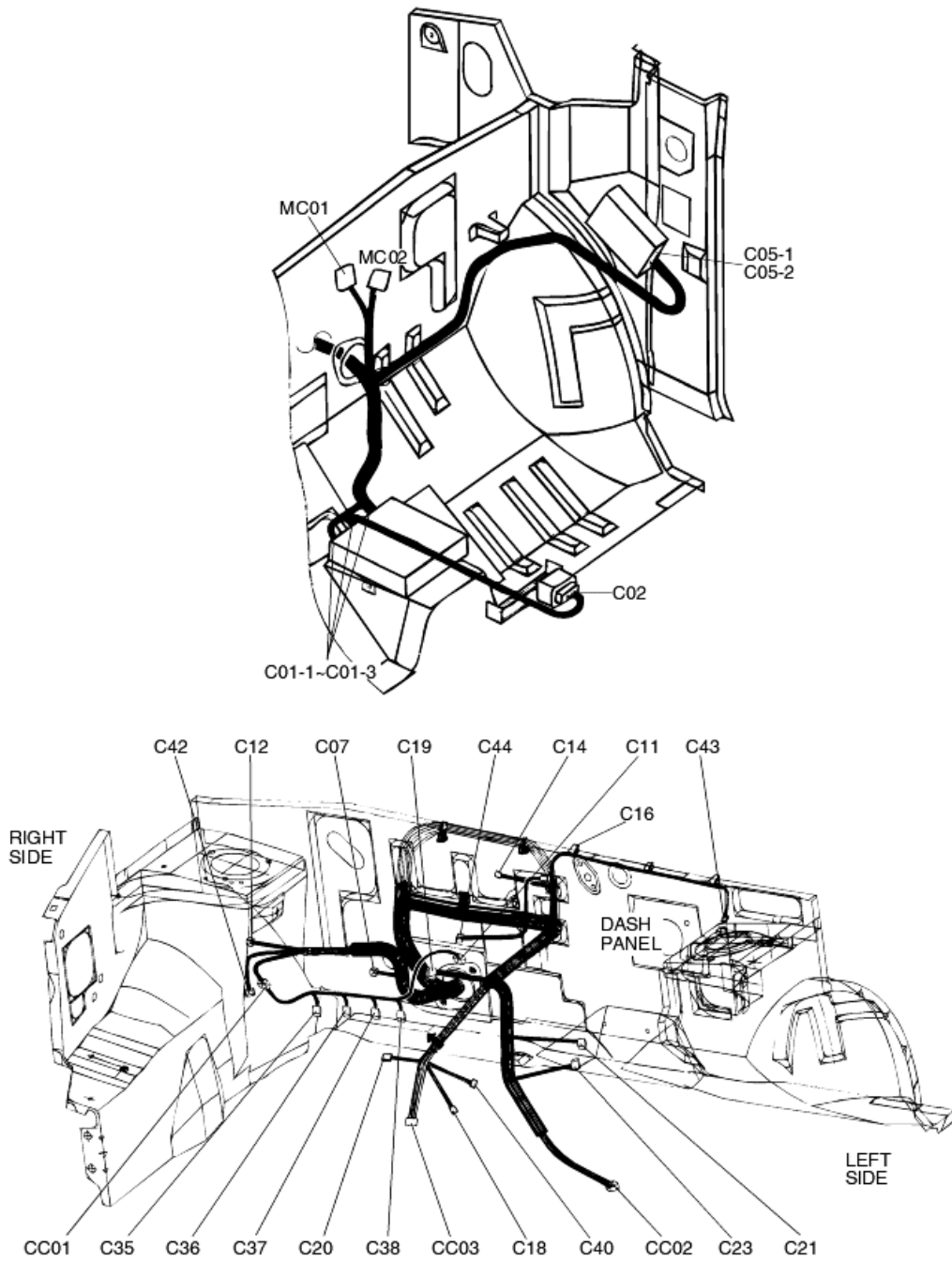
INSTRUMENT HARNESS (1)



I01	Left front speaker	I12	Digital clock
I02	Data link connector	I14	Front fog lamp switch
I03	Head lamp leveling switch	I15	Rear fog lamp switch
I04-1	Instrument cluster (M/T)	I16	Right front speaker
I04-2	Instrument cluster (M/T)	I17-1	Instrument cluster (A/T)
I06	Rear defogger switch	I17-2	Instrument cluster (A/T)
I07	Audio	I18	Audio (Non audio)
I08	A/C & Blower switch	MI01	Connection with MAIN harness
I09	Cigarette lighter	MI02	Connection with MAIN harness
I10	Heater control illumination	MI03	Connection with MAIN harness
I11	Hazard switch		

CONTROL HARNESS E51C0040

CONTROL HARNESS (1)

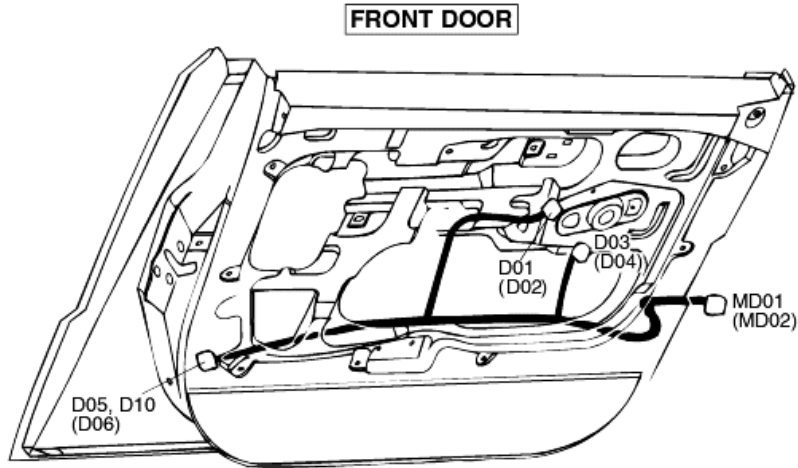


- |  |                                 |
|--|---------------------------------|
| C01– Engine Control Module (Except 1 EOBD) | C30 ATM solenoid assembly (A/T) |
| C01– Engine Control Module (Except 2 EOBD) | C32 Turbine RPM sensor          |
| C01– Engine Control Module (Except 3 EOBD) | C35 Injector #1                 |

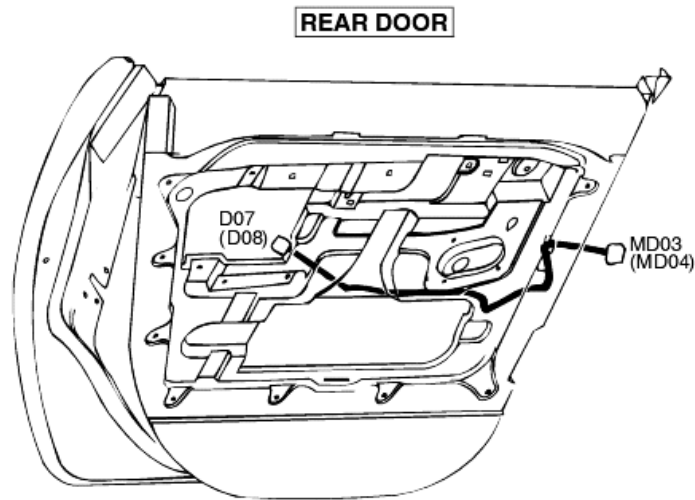


3	EOBD)		
C01–	Engine Control Module (Except	C36	Injector #2
4	EOBD)		
C02	Engine Control relay	C37	Injector #3
C05–	Transaxle control module (TCM)	C38	Injector #4
1			
C05–	Transaxle control module (TCM)	C40	Rear oxygen sensor (EOBD)
2			
C07	Ignition timing adjusting connector & Fuel pump check connector  (Except EOBD)	C41	Oil pressure switch &  Power steering switch (TCI)
C11	Idle speed control actuator	C42	Crankshaft position sensor
C12	Front oxygen sensor	C43	Accel sensor (EOBD)
C14	Intake air temperature & Manifold absolute pressure sensor	C44	Knock sensor (TCI)
C16	Purge control solenoid valve	C45	Multipurpose check connector
C18	Ignition coil	C46	ATM shift lever
C19	Throttle position sensor	C50	Engine Control Module (EOBD)
C20	Camshaft position sensor	CC0	Connection with INJECTOR EXT. 1 harness
C21	Engine coolant temperature sensor & sender	CC0	2 Connection with ATM harness
C23	Back-up lamp switch (M/T)	CC0	3 Connection with ATM harness
C28	Transaxle range switch (A/T)	MC0	1 Connection with MAIN harness
C29	Vehicle speed sensor (A/T)	MC0	2 Connection with MAIN harness (Immobilizer)
		G07	Ground
		G08	Ground

DOOR HARNESS (1)



( ): RIGHT



( ): RIGHT

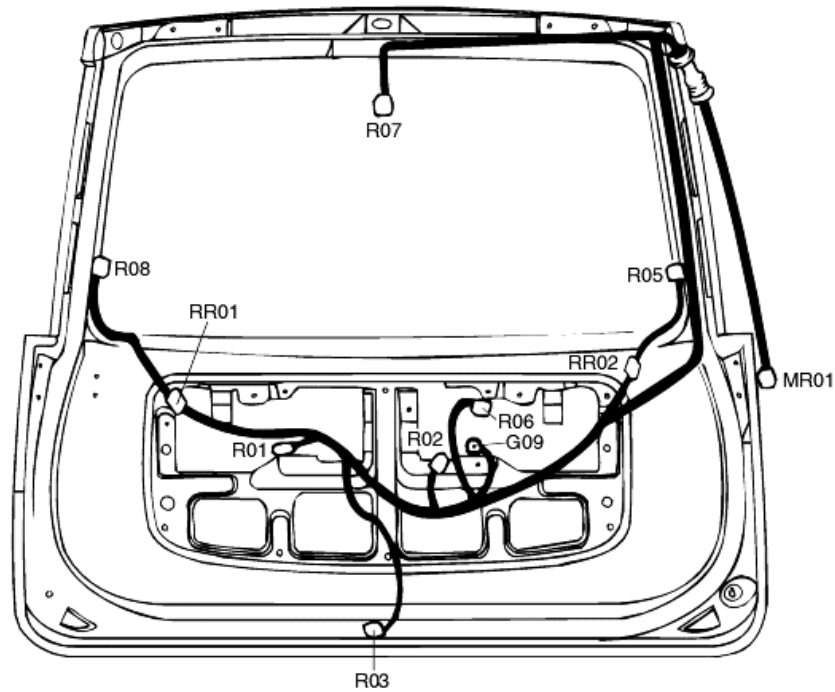
- |      |  |       |   |
|------|--|-------|---|
| D0 1 | Power window main switch                 | D08   | Right rear door lock actuator             |
| D0 2 | Right front power window switch          | D10   | Left front door lock actuator (with TACM) |
| D0 3 | Left front power window motor            | MD0 1 | Connection with LH MAIN harness           |
| D0 4 | Right front power window motor           | MD0 2 | Connection with RH MAIN harness           |
| D0 5 | Left front door lock actuator (W/O TACM) | MD0 3 | Connection with LH MAIN harness           |
| D0 6 | Right front door lock actuator           | MD0 4 | Connection with RH MAIN harness           |

D0 Left rear door lock actuator

7

REAR HARNESS E51B0060

REAR HARNESS (TAIL GATE)



R0	Right license lamp	MR0	Connection with MAIN harness
1		1	
R0	Left license lamp	RR0	Connection with REAR WINDOW
2		1	DEFOGGER
R0	Luggage room lamp		EXTENSION (-) harness
3	switch		
R0	Rear window defogger	RR0	Connection with REAR WINDOW
5	(+)	2	DEFOGGER
R0	Rear wiper motor		EXTENSION (+) harness
6			
R0	High mounted stop	G09	Tail gate ground
7	lamp		
R0	Rear window defogger		
8	(-)		