SECTION 6

ENGINE

WARNING:
For vehicles equipped with Supplement Restraint (Air Bag) System

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

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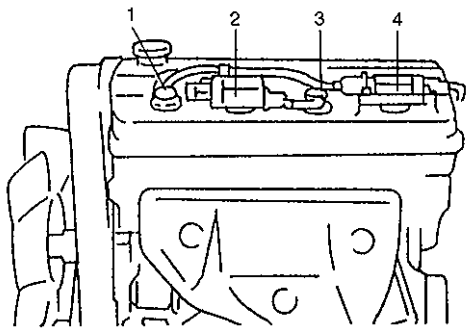
CONTENTS

GENERAL INFORMATION

STATEMENT ON CLEANLINESS AND CARE

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

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.



1. No.1 cylinder
2. No.2 cylinder
3. No.3 cylinder
4. No.4 cylinder

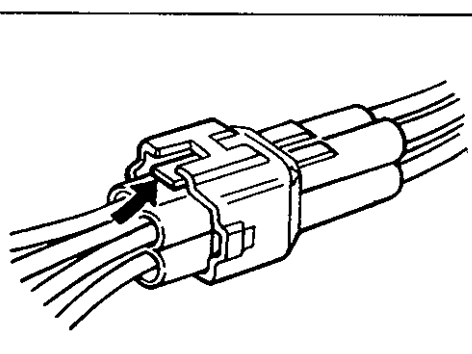
- Throughout this manual, the four cylinders of the engine are identified by numbers: No.1, No.2, No.3 and No.4 as counted from crankshaft pulley side to flywheel side.

GENERAL INFORMATION ON ENGINE SERVICE

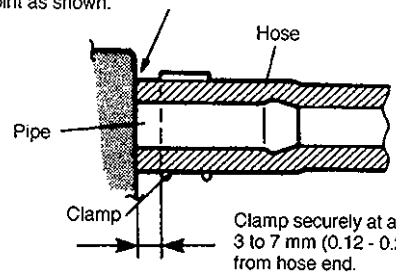
THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.

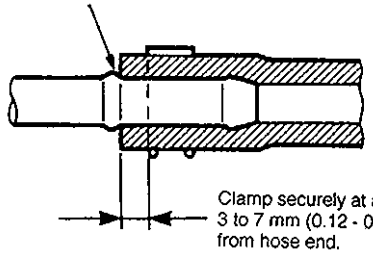
  When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, air intake hose, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.
- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock before disconnection. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.



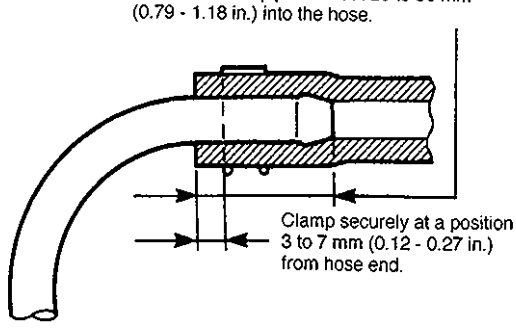
With short pipe, fit hose as far as it reaches pipe joint as shown.



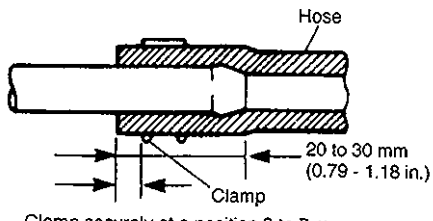
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 to 30 mm (0.79 - 1.18 in.) into the hose.



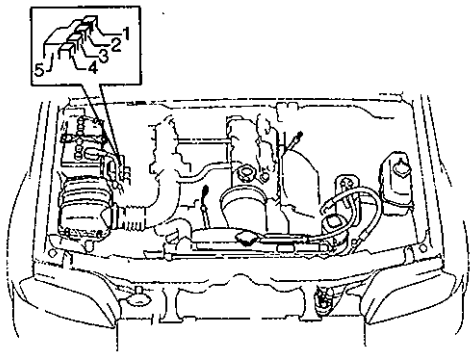
With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 - 1.18 in.) into the hose.



Clamp securely at a position 3 to 7 mm (0.12 - 0.27 in.) from hose end.

PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to "FUEL PRESSURE RELIEF PROCEDURE".
  A small amount of fuel may be released after the fuel line is disconnected.
  In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to left figure.
  After connecting, make sure that the hose has no twist or kink.
- When installing fuel union bolt gasket, always use new gasket and tighten union bolt to specified torque. See Section 6C for specified torque.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O-ring with gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.



1. Fuel pump relay
2. Main relay
3. A/C condensor fan motor relay
4. A/C compressor relay
5. Main fuse

FUEL PRESSURE RELIEF PROCEDURE

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, relief fuel pressure as follows.

1) Place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), set parking brake, and block drive wheels.
2) Remove fuel pump relay from relay box.
3) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
4) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2 – 3 times of about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
5) Upon completion of servicing, install fuel pump relay to relay box.

FUEL LEAKAGE CHECK PROCEDURE

After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn the ignition switch ON position for 3 seconds (to operate fuel pump) and then turn it OFF position.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line (till fuel pressure is felt by hand placed on fuel return hose).

2) In this state, check to see that there are no fuel leakages from any part of fuel system.

ENGINE DIAGNOSIS

This vehicle is equipped with an engine and emission control system, which controls the A/F mixture, ignition timing, emission, etc. suitably to engine conditions by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system.
When diagnosing a trouble in the engine including this system, be sure to have understanding of the outline of "On-Board Diagnostic system" and each item in "Precaution in Diagnosing Trouble" and follow "ENGINE DIAGNOSTIC FLOW TABLE" given below to obtain correct result smoothly.

ON-BOARD DIAGNOSTIC SYSTEM

Refer to "On-Board Diagnostic System" in Section 6E.

PRECAUTION IN DIAGNOSING TROUBLES

Be sure to read "Precaution in Diagnosing Troubles" in Section 6E and observe what is written there.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Customer Complaint Analysis 1) Perform customer complaint analysis. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) Check, Record and Clearance 1) Check for DTC referring to "DTC Check" in Section 6E. Is there any malfunction DTC(s)?	1) Print DTC or write it down and clear it by referring to "DTC Clearance" in section 6E. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the "Visual Inspection" in this section. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the "Visual Inspection" in this section. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the "Trouble-Symptom Confirmation" in this section. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC 1) Recheck for DTC referring to "DTC Check" in Section 6E. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC 1) Recheck for DTC referring to "DTC Check" in Section 6E. Is there any malfunction DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Diagnosis Table 1) Check and repair according to "Engine Basic Check" and "Engine Diagnosis Table" in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Trouble shooting for DTC 1) Check and repair according to applicable DTC diag. flow table in Section 6E. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to "Check for Intermittent Problem" in this section. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to "Final Confirmation Test" in this section. Is there any problem symptom, malfunction DTC or abnormal condition?	Go to Step 6.	End.

1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

User name:	Model:	VIN:	
Date of issue:	Date of Reg.:	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐ cold ☐ warm ☐ always) ☐ Other_____	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐ After fire ☐ Lack of power ☐ Surging ☐ Abnormal knocking ☐ Other
☐ **Poor idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐ High ☐ Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other_____	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐ Electric load ☐ P/S ☐ Other_____ ☐ Other_____
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐ Fair ☐ Cloudy ☐ Rain ☐ Snow ☐ Always ☐ Other_____ ☐ Hot ☐ Warm ☐ Cool ☐ Cold (°F/ °C) ☐ Always ☐ Always ☐ Sometimes (times/ day, month) ☐ Only once ☐ Under certain condition ☐ Urban ☐ Suburb ☐ Highway ☐ Mountainous (☐ Uphill ☐ Downhill) ☐ Tarmacadam ☐ Gravel ☐ Other_____
Vehicle Condition	
Engine Condition	☐ Cold ☐ Warming up phase ☐ Warmed up ☐ Always ☐ Other at starting ☐ Immediately after start ☐ Racing without load ☐ Engine speed (r/min)
Vehicle condition	☐ During driving: ☐ Constant speed ☐ Accelerating ☐ Decelerating ☐ Right hand corner ☐ left hand corner ☐ When shifting (Lever position) ☐ At stop ☐ Vehicle speed when problem occurs (km/h, Mile/h) ☐ Other_____

Malfunction indicator lamp condition	☐ Always ON ☐ Sometimes ON ☐ Always OFF ☐ Good condition	
Diagnostic trouble code	First check:	☐ No code ☐ Normal code ☐ Malfunction code ( )
	Second check:	☐ No code ☐ Normal code ☐ Malfunction code ( )

NOTE:

The above form is a standard sample. It should be modified according to conditions characteristic of each market.

2. DIAGNOSTIC TROUBLE CODE (DTC) CHECK, RECORD AND CLEARANCE

First, check DTC referring to "DTC Check" in Section 6E. If DTC is indicated, print it or write it down and then clear it by referring to "DTC Clearance" in Section 6E. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6 or 7.

Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

3. and 4. VISUAL INSPECTION

Be sure to perform visual check of the following items that support proper function of the engine.

INSPECTION ITEM	REFERRING SECTION
• Engine oil – – – – – level, leakage	Section 0B
• Engine coolant – – – – – level, leakage	Section 0B
• Fuel – – – – – level, leakage	Section 0B
• A/T fluid – – – – – level, leakage	Section 0B
• Air cleaner element – – – – – dirt, clogging	Section 0B
• Battery – – – – – fluid level, corrosion of terminal	
• Water pump belt and/or cooling fan belt – – – – – tension, damage	Section 0B
• Throttle cable – – – – – play, installation	Section 6E
• A/T throttle cable – – – – – play, installation	
• Vacuum hoses of air intake system – – – – – disconnection, looseness, deterioration, bend	
• Connectors of electric wire harness – – – – – disconnection, friction	
• Fuses – – – – – burning	Section 8
• Parts – – – – – installation, bolt – – – – – looseness	
• Parts – – – – – deformation	
• Other parts that can be checked visually	
Also check following items at engine start, if possible	
• Malfunction indicator lamp ("CHECK ENGINE" lamp)	Section 6E
• Charge warning lamp	Section 6H
• Engine oil pressure warning lamp — Operation	Section 8
• Engine coolant temp. meter	Section 8
• Fuel lever meter	Section 8
• Abnormal air being inhaled from air intake system	
• Exhaust system – – – – – leakage of exhaust gas, noise	
• Other parts that can be checked visually	

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 customer complaint analysis and Step 2 DTC check, confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" in Section 6E.

6. and 7. RECHECKING AND RECORD OF DTC

Refer to "DTC Check" in section 6E for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Inspection Flow Table" first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to ENGINE DIAGNOSIS TABLE and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

ENGINE BASIC INSPECTION FLOW TABLE

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to "DIAGNOSIS" in section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check engine idle speed/IAC duty referring to "Idle Speed/IAC Duty Inspection" in section 6E. Is check result as specified?	Go to Step 6.	Go to "ENGINE DIAGNOSIS TABLE" in this section.
6	Check ignition timing referring to "Ignition Timing Inspection" in section 6F. Is check result as specified?	Go to "ENGINE DIAGNOSIS TABLE" in this section.	Adjust ignition timing.
7	Check fuel supply as follows: 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn the ignition switch ON position for 3 seconds and then turn it OFF position. Repeat this a few times. Is fuel return pressure (returning sounds) felt from fuel return hose when the ignition switch is turned ON position?	Go to Step 9.	Go to Step 8.
8	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 3 seconds after turning the ignition switch ON position and stop?	Go to "Diag. Flow Table B-3" in section 6E.	Go to "Diag. Flow Table B-1" in section 6E.
9	Check ignition spark referring to "Ignition Spark Test" in section 6F. Is it in good condition?	Go to Step 10.	Go to "DIAGNOSIS" in section 6F.
10	Check fuel injector referring to "Fuel Injector Inspection" in section 6E. Is it in good condition?	Go to "ENGINE DIAGNOSIS TABLE" in this section.	Go to "Diag. Flow Table B-2 in section 6E.

9. TROUBLESHOOTING FOR DTC

Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in Section 6E, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM or other part and repair or replace faulty parts.

10. CHECK FOR INTERMITTENT PROBLEM

Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A and related circuit of DTC recorded in step 2.

11. FINAL CONFIRMATION TEST

Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no malfunction DTC (a normal code) is indicated.

ENGINE DIAGNOSIS TABLE

Condition	Possible Cause	Reference Item
Hard starting (Engine cranks OK)	**Engine and emission control system out of order.**	
	• Faulty CMP sensing rotor	CMP sensing rotor inspection in section 6E.
	• Faulty idle air control system	Diag. Flow Table B-4 in Section 6E.
	• Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Low compression.	Compression check in Section 6A.
	• Compression leak from valve seat	Valves inspection in Section 6A.
	• Sticky valve stem	Valves inspection in Section 6A.
	• Weak or damaged valve springs	Valves spring inspection in Section 6A.
	• Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A.
	• Sticking or damaged piston ring	Piston ring inspection in Section 6A.
	• Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A.
	Others	
	• Malfunctioning PCV valve	PCV system inspection in Section 6E.

Condition	Possible Cause	Reference Item
Engine has no power	**Engine overheating.**	Refer to "Overheating" Section.
	Ignition system out of order.	
	• Defective spark plug	Spark plugs in Section 6F.
	• Faulty ignition coil with ignitor	Ignition coil in Section 6F.
	Fuel system out of order.	
	• Fuel pressure out of specification	Diag. Flow Table B-3 in Section 6E.
	– Dirty fuel filter	
	– Dirty or clogged fuel hose or pipe	
	– Malfunctioning fuel pressure regulator	
	– Malfunctioning fuel pump	
	Engine and emission control system out of order.	
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Low compression.	Previously outlined.
	Others	
	• Dragging brakes	Diagnosis in Section 5.
	• Slipping clutch	Diagnosis in Section 7C.
Improper engine idling or engine fails to idle	**Ignition system out of order.**	
	• Faulty spark plug	Spark plugs in Section 6F.
	• Faulty ignition coil with ignitor	Ignition coil in Section 6F.
	Fuel system out of order.	
	• Fuel pressure out of specification	Diag. Flow Table B-3 in Section 6E.
	– Malfunctioning fuel pressure regulator	
	Engine overheating.	Refer to "Overheating" Section.
	Engine and emission control system out of order.	
	• Faulty idle air control system	Diag. Flow Table B-4 in Section 6E.
	• Faulty evaporative emission control system	Diag. Flow Table B-5 in Section 6E.
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Low compression	Previously outlined.
	Others	
	• Malfunctioning PCV valve	PCV system inspection in Section 6E.

Condition	Possible Cause	Reference Item
Engine hesitates (Momentary lack of response as the accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign.)	**Ignition system out of order.**	
	• Spark plug faulty or plug gap as out of adjustment	Spark plugs in Section 6F.
	Fuel system out of order.	
	• Fuel pressure out of specification	Diag. Flow Table B-3 in Section 6E.
	– Clogged fuel filter	
	– Faulty fuel pressure regulator	
	• Clogged fuel filter, hose or pipe	Fuel pressure check in Section 6E.
	Engine overheating	Refer to "Overheating" Section.
	Engine and emission control system out of order.	
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty ECM .	Inspection of ECM and its circuit in Section 6E.
	Low compression	Previously outlined.
Surges (Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and down with no change in the accelerator pedal.)	**Ignition system out of order.**	
	• Defective spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.)	Spark plugs in Section 6F.
	Fuel system out of order.	
	• Variable fuel pressure	Diag. Flow Table B-3 in Section 6E.
	– Clogged fuel filter	
	– Kinky or damaged fuel hose and line	
	– Faulty fuel pressure regulator	
	Engine and emission control system out of order.	
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty MAP sensor	MAP sensor in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.

Condition	Possible Cause	Reference Item
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating**	Refer to "Overheating" Section.
	Ignition system out of order.	
	• Faulty spark plug	Spark plugs in Section 6F.
	• Improper ignition timing	Ignition timing in Section 6F.
	Fuel system out of order.	
	• Clogged fuel filter and fuel lines	Fuel pressure check in Section 6E.
	Engine and emission control system out of order.	
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Others	
	• Excessive combustion chamber deposits	Piston and cylinder head cleaning in Section 6A.
Overheating	• Inoperative thermostat	Thermostat in Section 6B.
	• Poor water pump performance	Water pump in Section 6B.
	• Clogged or leaky radiator	Radiator in Section 6B.
	• Improper engine oil grade	Engine oil and oil filter change in Section 0B.
	• Clogged oil filter or oil strainer	Oil pressure check in Section 6A.
	• Poor oil pump performance	Oil pressure check in Section 6A.
	• Dragging brakes	Diagnosis in Section 5.
	• Slipping clutch	Diagnosis in Section 7C.
	• Blown cylinder head gasket	Cylinder head inspection in Section 6A.
Poor gasoline mileage	**Ignition system out of order.**	
	• Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc..)	Spark plugs in Section 6F.
	Engine and emission control system out of order.	
	• Fuel pressure out of specification	Diag. Flow Table B-3 in Section 6E.
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Low compression	Previously outlined.
	Others	
	• Poor valve seating	Valves inspection in Section 6A.
	• Dragging brakes	Diagnosis in Section 5.
	• Slipping clutch	Diagnosis in Section 7C.
	• Thermostat out of order	Thermostat in Section 6B.
	• Improper tire pressure	

Condition	Possible Cause	Reference Item
Excessive engine oil consumption	**Oil entering combustion chamber**	
	• Sticky piston ring	Piston cleaning in Section 6A.
	• Worn piston and cylinder	Cylinders, pistons and piston rings inspection in Section 6A.
	• Worn piston ring groove and ring	Pistons and piston rings inspection in Section 6A.
	• Improper location of piston ring gap	Pistons installation in Section 6A.
	• Worn or damaged valve stem seal	Valves and cylinder head in Section 6A.
	• Worn valve stem	Valves inspection in Section 6A.
Low oil pressure	• Improper oil viscosity	Engine oil and oil filter change in Section 0B.
	• Malfunctioning oil pressure switch	Oil pressure switch inspection in Section 8.
	• Clogged oil strainer	Oil pan and oil pump strainer cleaning in Section 6A.
	• Functional deterioration of oil pump	Oil pump in Section 6A.
	• Worn oil pump relief valve	Oil pump in Section 6A.
	• Excessive clearance in various sliding parts	
Engine noise Note: Before checking the mechanical noise, make sure that: • Ignition timing is properly adjusted. • Specified spark plug is used. • Specified fuel is used.	**Valve noise**	
	• Improper valve lash	Valve lash in Section 6A.
	• Worn valve stem and guide	Valves inspection in Section 6A.
	• Weak or broken valve spring	Valve springs inspection in Section 6A.
	• Warped or bent valve	Valves inspection in Section 6A.
	• Loose camshaft housing bolts	Camshafts in Section 6A.
	Piston, ring and cylinder noise	
	• Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Section 6A.
	Connecting rod noise	
	• Worn crankpin bearing	Crankpin and connecting rod bearing inspection in Section 6A.
	• Worn crankpin	Crankpin and connecting rod bearing inspection in Section 6A.
	• Loose connecting rod nuts	Connecting rod installation in Section 6A.
	• Low oil pressure	Previously outlined.
	Crankshaft noise	
	• Low oil pressure	Previously outlined.
	• Worn crankshaft journal bearing	Crankshaft and bearing inspection in Section 6A.
	• Worn crankshaft journal	Crankshaft and bearing inspection in Section 6A.
	• Loose lower crankcase (bearing cap) bolts	Crankshaft installation in Section 6A.
	• Excessive crankshaft thrust play	Crankshaft inspection in Section 6A.

Condition	Possible Cause	Referring Item
Excessive hydrocarbon (HC) emission or Excessive carbon monoxide (CO) emission	**Ignition system out of order** • Defective spark plug	
	Fuel system out of order • Fuel pressure out of specification	Fuel pressure check in Section 6E.
	Engine and Emission control system out of order. • Lead contamination of three way catalytic converter (if equipped)	Check for absence of filler neck restrictor.
	• Malfunctioning PCV valve	PCV valve in Section 6E.
	• Faulty EVAP control system	EVAP control system check in Section 6E.
	• Closed loop system (A/F feed back compensation) fails (vehicle with HO2S) – Faulty TP sensor – Faulty ECT sensor or MAP sensor – Faulty HO2S	Check oxygen sensor output voltage referring to DTC No.13 Diag. Flow Table in Section 6E.
	• Maladjusted CO adjusting resistor (vehicle without HO2S)	Idle mixture adjustment in Section 6E.
	• Faulty injector	Fuel injector in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.
	Low compression	Previously outlined.
Excessive nitrogen oxides (NOx) emission	**Fuel system out of order** • Fuel pressure out of specification	Fuel pressure check in Section 6E.
	Engine and emission control system • Lead contamination of three way catalytic converter (if equipped)	Check for absence of filler neck restrictor.
	• Faulty EGR system (if equipped)	Diag. Flow Table B-6 in Section 6E.
	• Closed loop system (A/F feed back compensation) fails (vehicle with HO2S) – Faulty TP sensor – Faulty ECT sensor or MAP sensor – Faulty HO2S	Check oxygen sensor output voltage referring to DTC No.13 Diag. Flow Table in Section 6E.
	• Faulty injector	Fuel injector Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in Section 6E.

SECTION 6A

ENGINE MECHANICAL

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

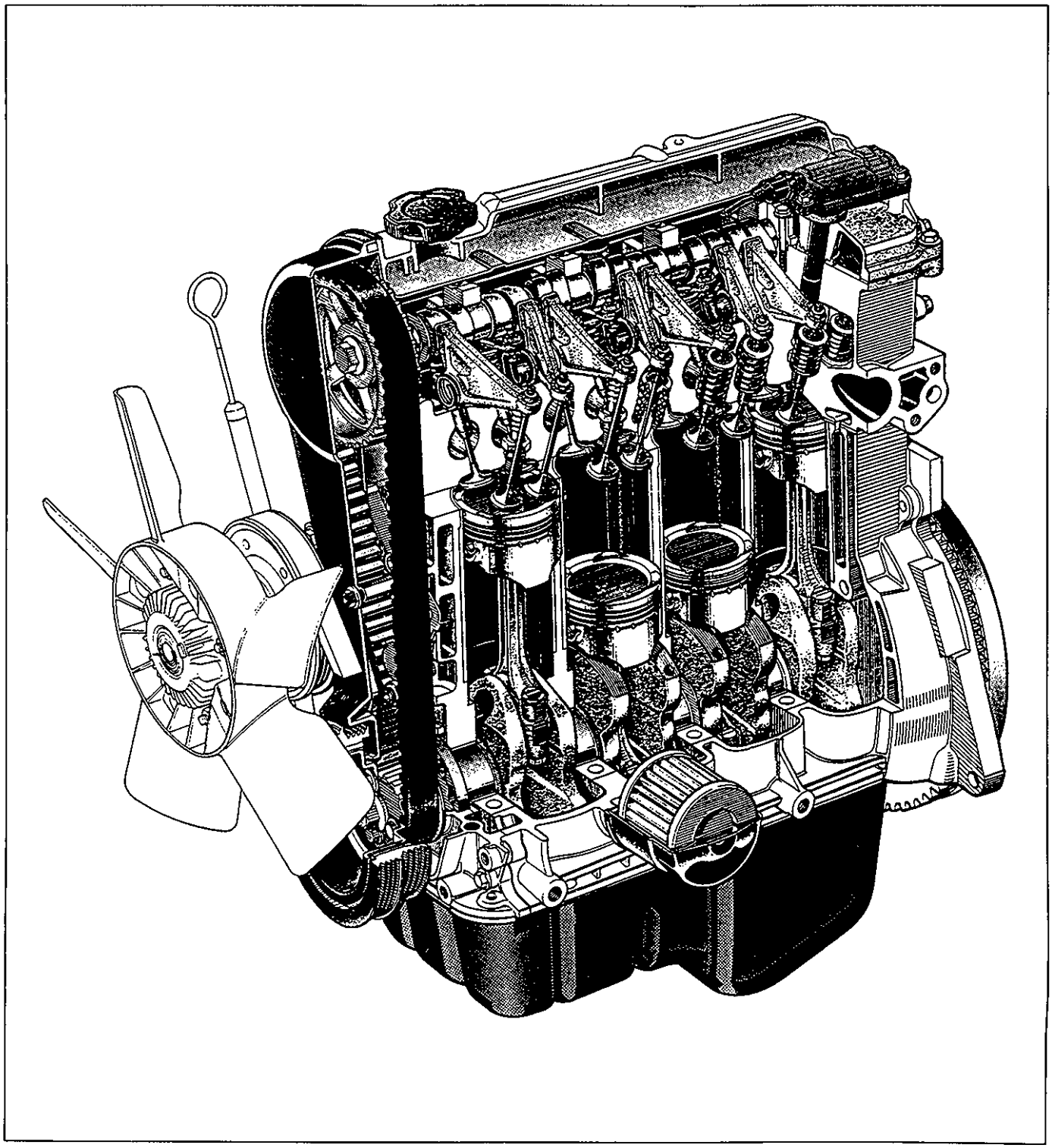
NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit equipped with its S.O.H.C. (Single Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration and 16 valves (IN 2 and EX 2/one cylinder).

The single overhead camshaft is mounted over the cylinder head: it is driven from crankshaft through timing belt and opens and closes its valves via the rocker arms.

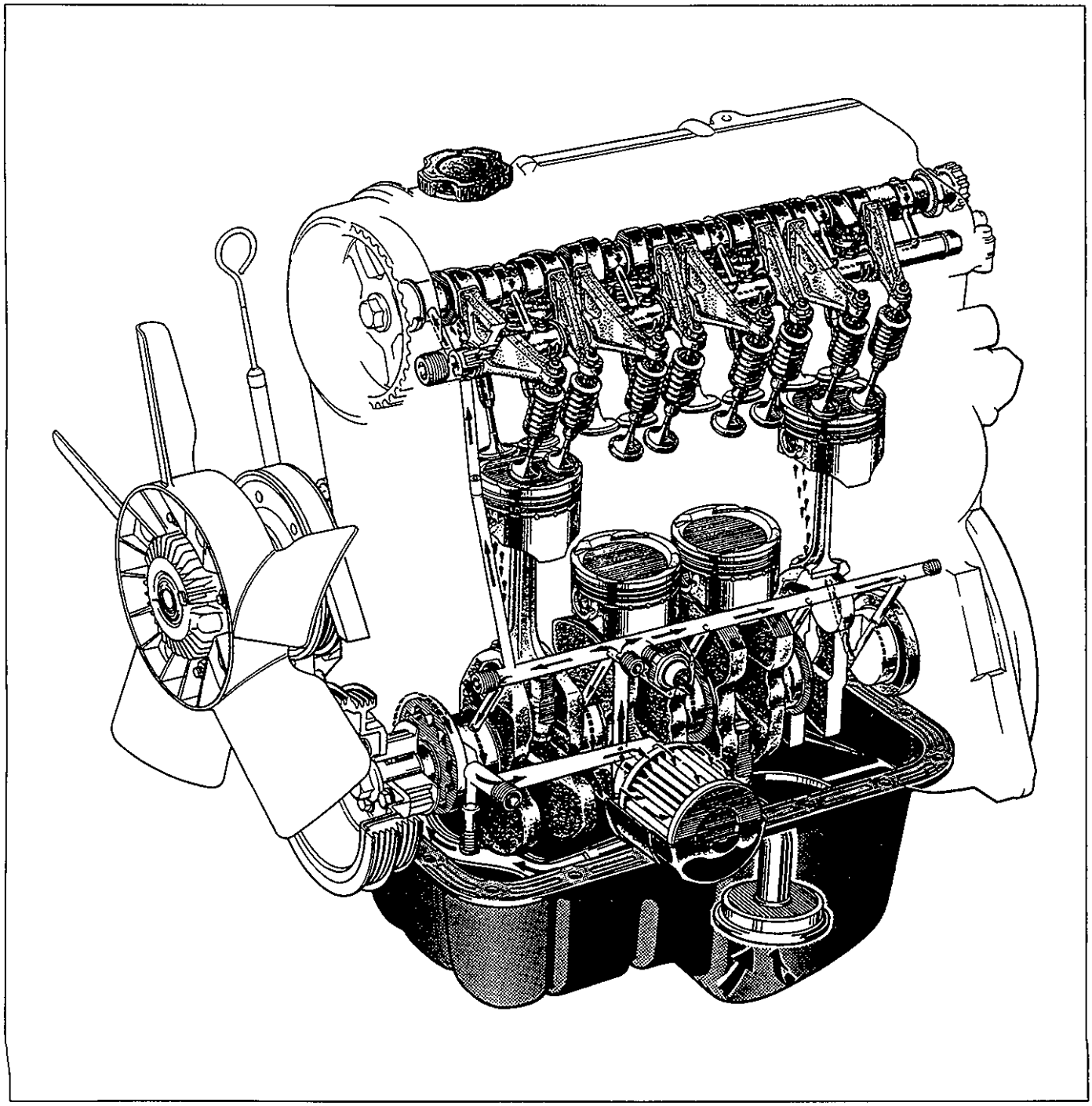


ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.
Oil is drawn up through oil pump strainer and passed through pump to oil filter.
The filtered oil flows into two paths in cylinder block.
In one path, oil reaches crankshaft journal bearings.
Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall.

In another path, oil goes up to cylinder head and lubricates camshaft journals, rocker arms, camshaft, etc., passing through oil gallery in rocker arm shaft.

An oil relief valve is provided on oil pump. This valve starts relieving oil pressure when the pressure comes over about 400 kPa (4.0 kg/cm^2, 56.9 psi). Relieved oil drains back to oil pan.



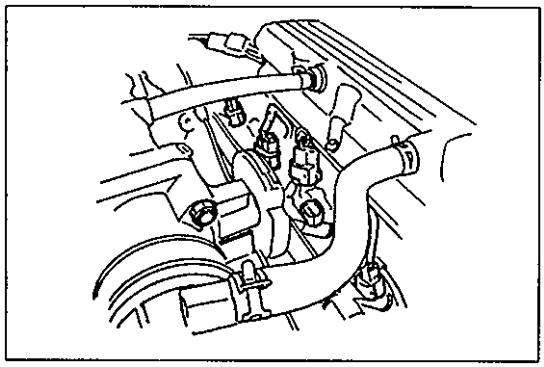
ON-VEHICLE SERVICE

COMPRESSION CHECK

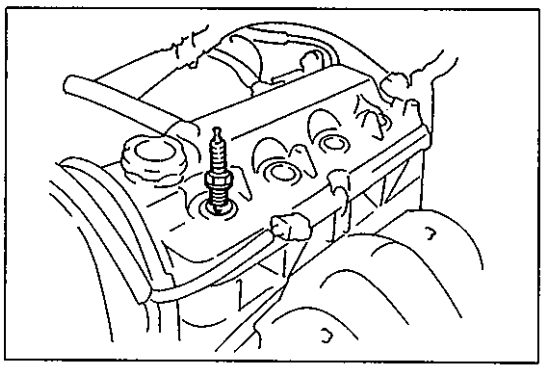
Check compression pressure on all four cylinders as follows:

1) Warm up engine.
2) Stop engine after warming up.

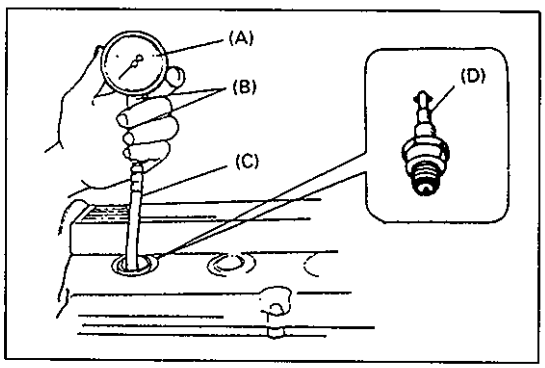
NOTE:
After warming up engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.



3) Disconnect fuel injector wire harness connector.

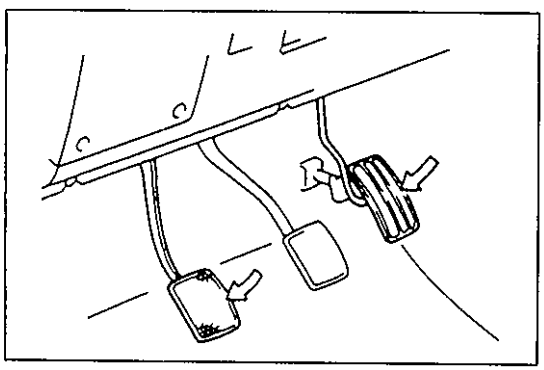


4) Remove ignition coil assemblies and all spark plugs referring to section 6F.



5) Install special tool (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510-001
(B): 09915-64510-002
(C): 09915-64530
(D): 09915-67010

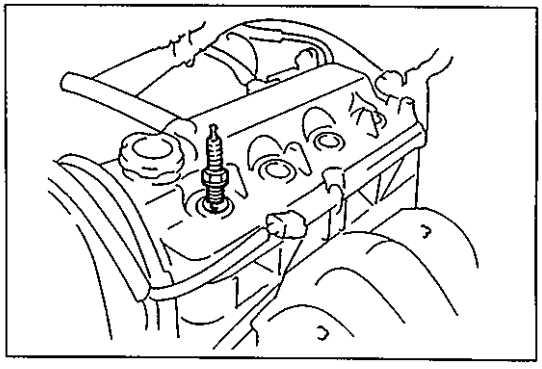


6) Disengage clutch (to lighten starting load on engine) for M/T model, and depress accelerator pedal all the way to make throttle valve full-open.

7) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

NOTE:
For measuring compression pressure, crank engine at least 250 r/min. by using fully charged battery.

	Compression pressure
Standard	1400 kPa (14.0 kg/cm^2, 199.0 psi)
Limit	1200 kPa (12.0 kg/cm^2, 170.0 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)



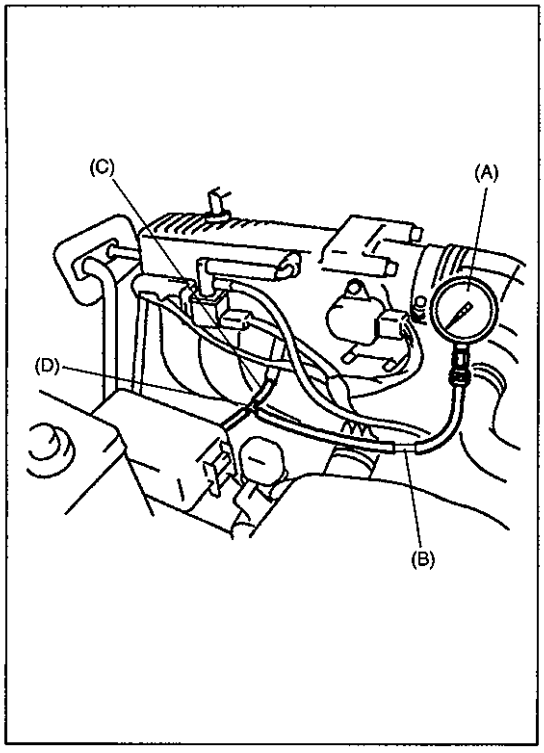
8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, install spark plugs and ignition coil assemblies and connect injector wire harness connector securely.

ENGINE VACUUM CHECK

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature.

NOTE:
After warming up engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.



2) With engine stopped, disconnect fuel pressure regulator vacuum hose from intake manifold and connect 3-way joint, hoses and special tool (vacuum gauge and joint) between intake manifold and vacuum hose disconnected.

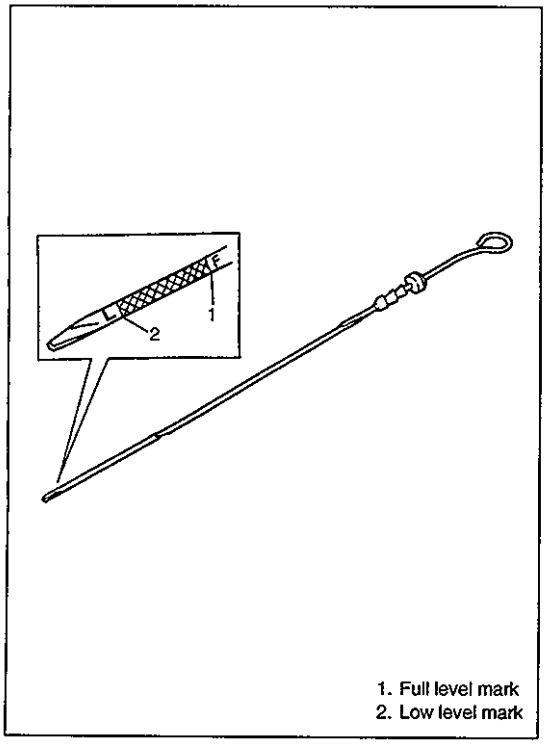
Special Tool
(A): 09915-67310
(B): 09918-08210

SUZUKI GENUINE PARTS
(C): Hose 09343-03087
(D): 3-way joint 09367-04002

3) Run engine at specified idle speed, and read vacuum gauge. Vacuum should be within following specification.

Vacuum specification (at sea level):
58.7 – 74.7 kPa (44 – 56 cmHg, 17.3 – 22.0 in.Hg) at specified idling speed

4) After checking, connect vacuum hose to intake manifold.

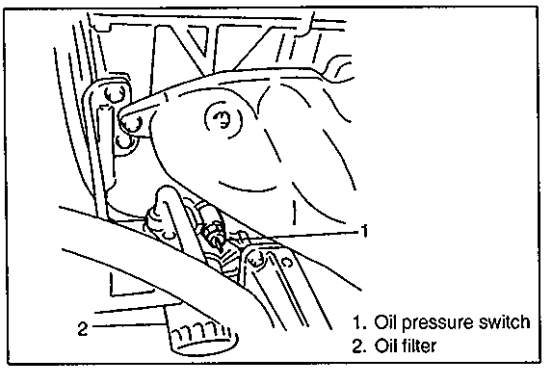


1. Full level mark
2. Low level mark

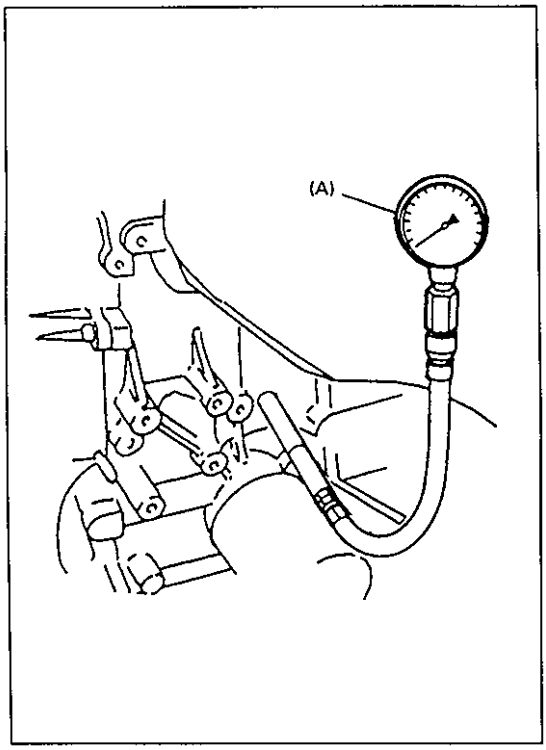
OIL PRESSURE CHECK

NOTE:
Prior to checking oil pressure, check following items.

- **Oil level in oil pan.**
  If oil level is low, add oil up to Full level mark on oil level gauge.
- **Oil quality.**
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to the table in "MAINTENANCE SERVICE" section.
- **Oil leaks.**
  If leak is found, repair it.



1) Remove oil pressure switch from cylinder block.



2) Install special tool (Oil pressure gauge) to vacated threaded hole.

Special Tool
(A): 09915-77310

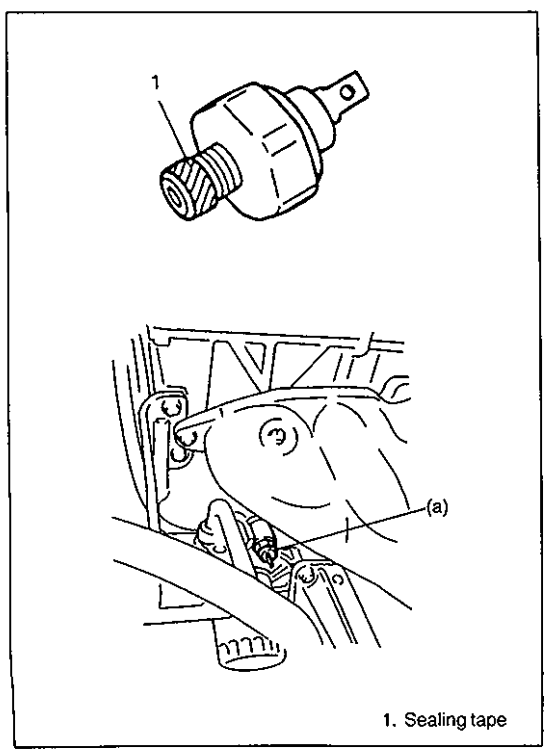
3) Start engine and warm it up to normal operating temperature.

NOTE:
Be sure to place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

4) After warming up, raise engine speed to 4,000 r/min and measure oil pressure.

Oil pressure specification:
330 – 430 kPa (3.3 – 4.3 kg/cm², 46.9 – 61.1 psi) at 4,000 r/min (rpm)

5) Stop engine and remove oil pressure gauge.

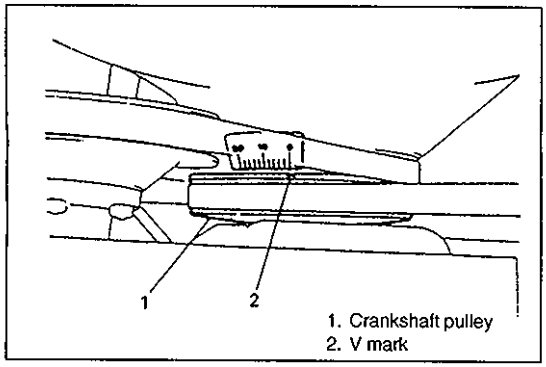


6) Before reinstalling oil pressure switch, be sure to wrap its screw threads with sealing tape and tighten switch to specified torque.

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

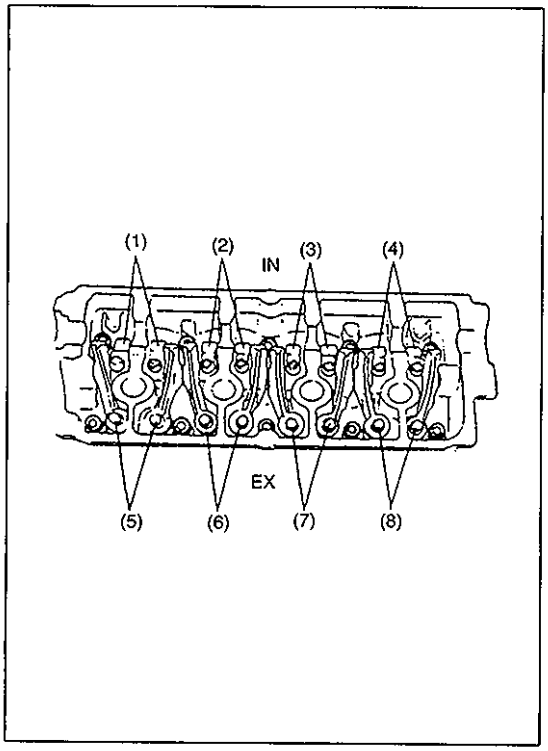
7) Start engine and check oil pressure switch for oil leakage.
8) Stop engine and connect terminal to pressure switch terminal and cover pressure switch by boot with certainty.



1. Crankshaft pulley
2. V mark

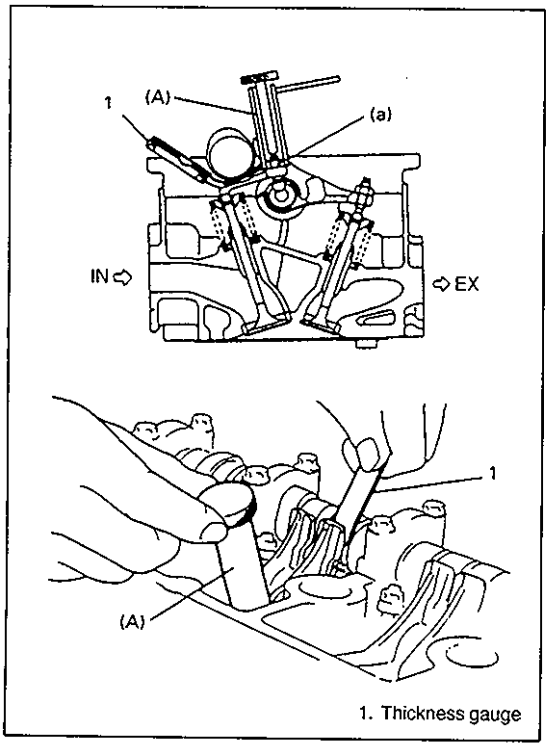
VALVE LASH (CLEARANCE)

1) Remove negative cable at battery.
2) Remove cylinder head cover referring to item "Cylinder Head cover".
3) Using 17 mm socket, turn crankshaft pulley clockwise until "V" mark (in white paint) on pulley aligns with "O" (zero) calibrated on timing belt cover.



4) Check if the rocker arms of No.1 cylinder are off the respective cam lobes (of camshaft); if so, valves (1), (2), (5) and (7) in left figure are ready for clearance checking and adjustment.
Check valve lashes at valves (1), (2), (5) and (7).
If the rocker arms of No.4 cylinder are off the respective cam lobes, check valve lashes at valves (3), (4), (6) and (8).

NOTE:
When checking valve clearance, insert thickness gauge between camshaft and cam-riding face of rocker arm.



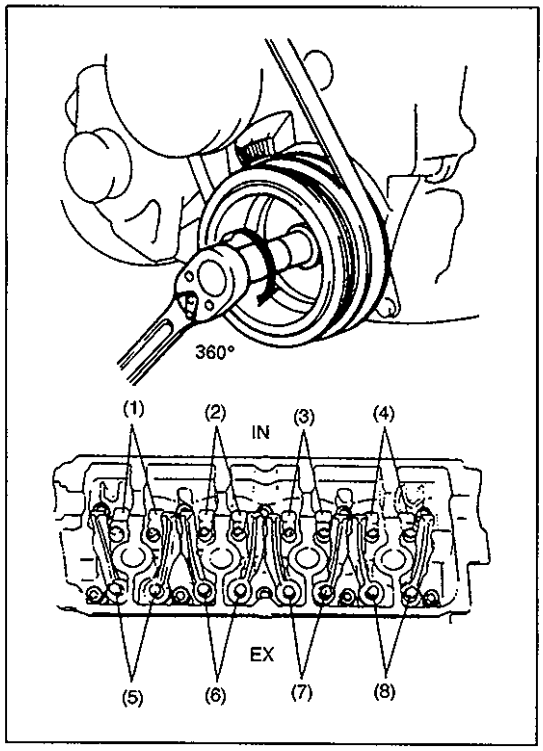
1. Thickness gauge

5) If valve lash is out of specification, adjust it to specification by turning adjusting screw after loosening lock nut.
After adjustment, tighten lock nut to specified torque while holding adjusting screw stationary, and then make sure again that valve lash is within specification.

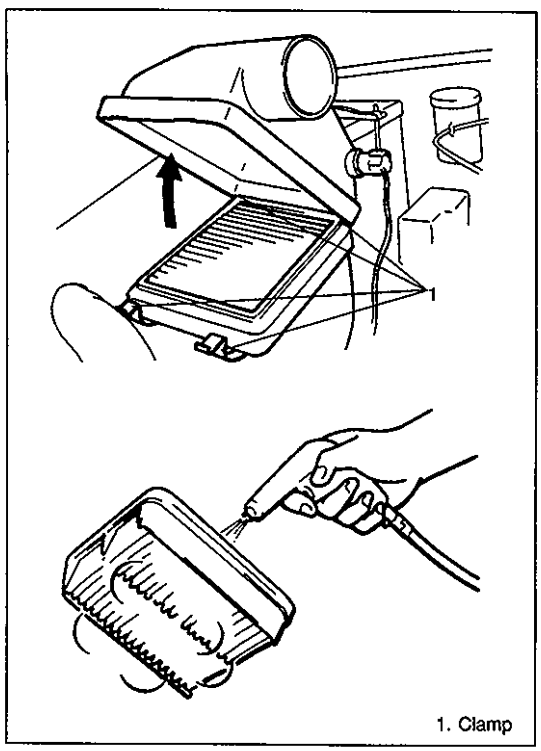
		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
Valve clearance specification	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.17 – 0.21 mm (0.007 – 0.008 in.)
	Exhaust	0.23 – 0.27 mm (0.009 – 0.011 in.)	0.27 – 0.31 mm (0.011 – 0.012 in.)

Special Tool
(A): 09917-18210

Tightening Torque
(a): 12 N·m (1.2 kg-m, 9.0 lb-ft)



6) After checking and adjusting valve lashes at valves (1), (2), (5) and (7), (or (3), (4), (6) and (8)) rotate crankshaft exactly one full turn (360°) and check the same at valves (3), (4), (6) and (8) (or (1), (2), (5) and (7)). Adjust them as necessary.
7) After checking and adjusting all valves, reverse removal procedure for installation.



AIR CLEANER ELEMENT

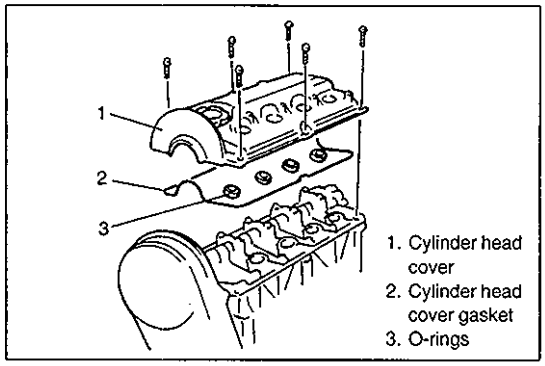
REMOVAL AND INSTALLATION

1) Remove air cleaner case clamps.
2) Remove air cleaner element from case.
3) Check air cleaner element for dirt.
4) If necessary, blow off dust by compressed air from air outlet side of element.
   If excessively dirty, replace element.
5) Reverse removal procedure for installation.

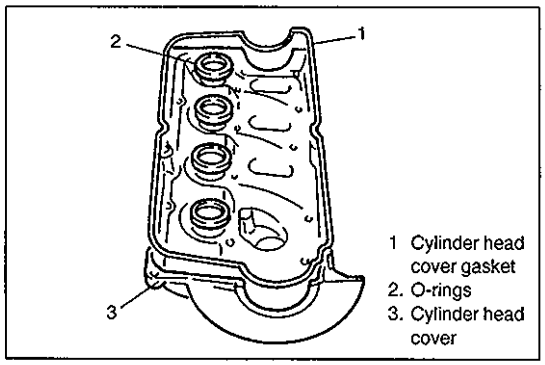
CYLINDER HEAD COVER

REMOVAL

1) Disconnect negative cable at battery.
2) Remove ignition coil assemblies with high-tension cord.
3) Disconnect PCV valve and breather hose from head cover.



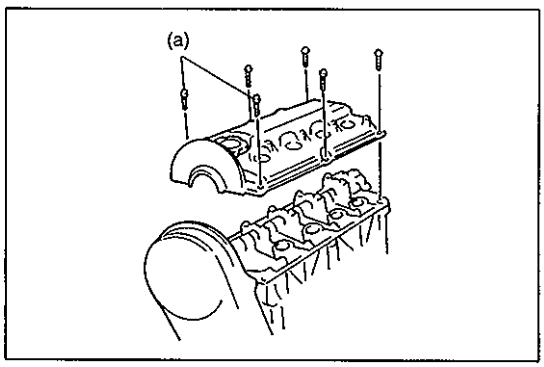
4) Remove cylinder head cover with cylinder head cover gasket and O-rings.



INSTALLATION

1) Install O-rings and cylinder head cover gasket to cylinder head cover.

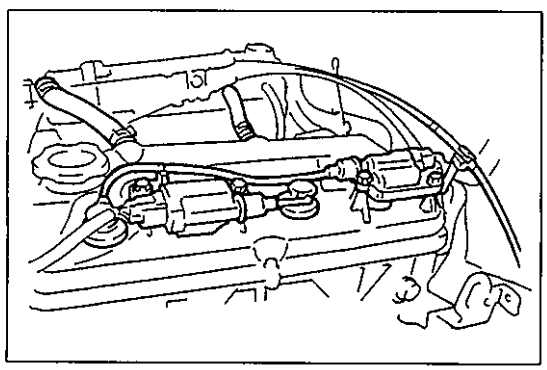
NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.



2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

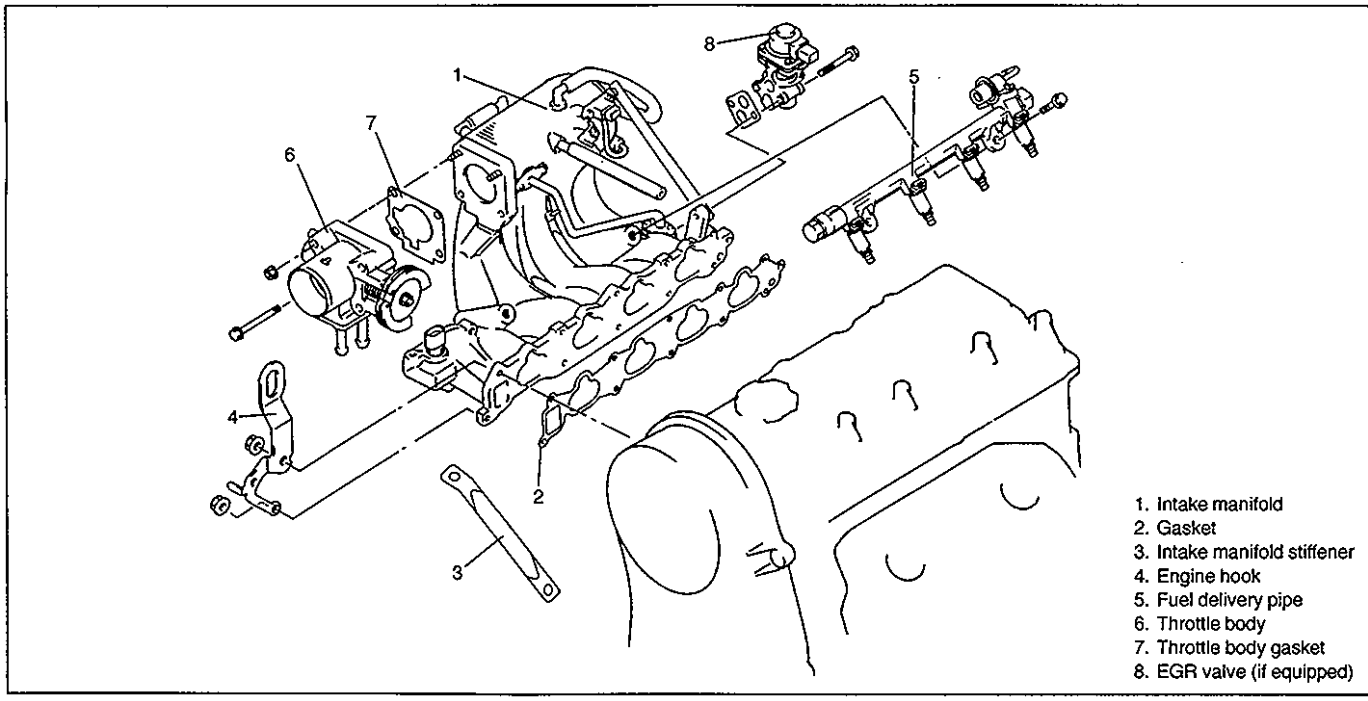
Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

NOTE:
When installing cylinder head cover, use care so that cylinder head cover gasket or O-rings will not get out of place or fall off.



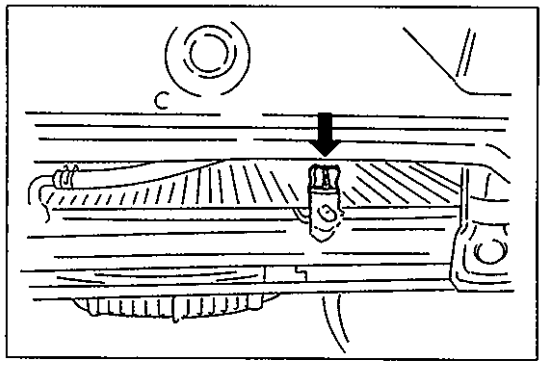
3) Install ignition coil assemblies with high-tension cord.
4) Connect PCV valve and breather hose to head cover.
5) Connect negative cable at battery.

THROTTLE BODY AND INTAKE MANIFOLD



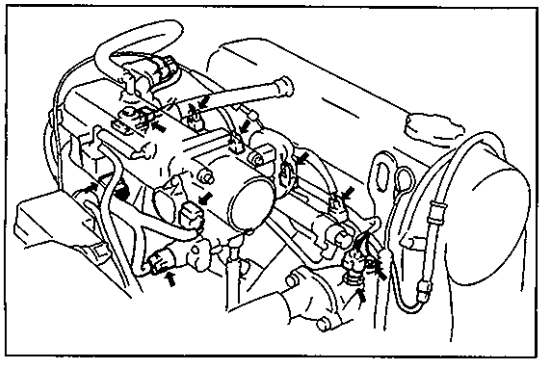
REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in section 6.
2) Disconnect negative cable at battery.

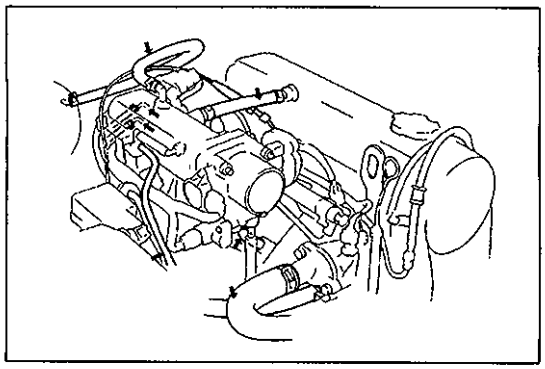


3) Drain cooling system.

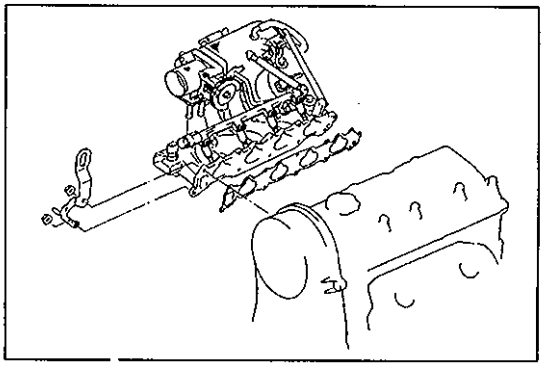
WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



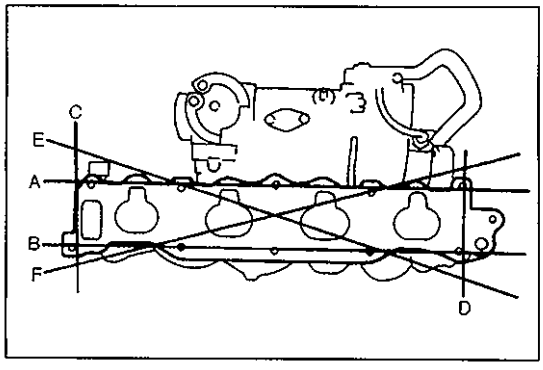
4) Remove air intake hose.
5) Disconnect following electric lead wires:
   - EGR valve (if equipped)
   - Ground wires from intake manifold
   - Engine coolant temperature sensor
   - Injectors lead wires at the coupler
   - EVAP canister purge valve
   - Throttle position sensorIdle air control valve



6) Disconnect accelerator cable from throttle body.
7) Disconnect following hoses:
   - Brake booster hose from intake manifold
   - Canister purge hose from EVAP canister purge valve
   - Engine cooling water (coolant) hose (outlet side) from throttle body
   - Radiator inlet hose from thermostat cap
   - PCV hoses from intake manifold and throttle body
   - Fuel feed hose and return hose from each pipe



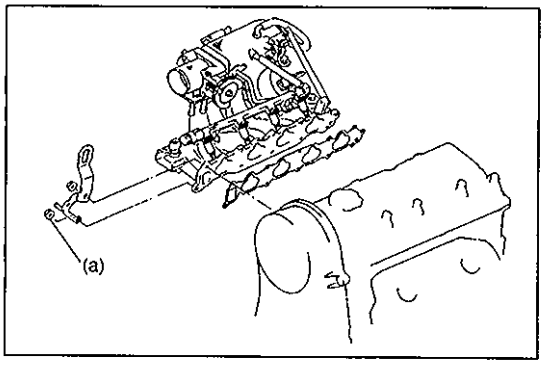
8) Remove intake manifold with throttle body from cylinder head, and then its gasket.



INSPECTION

- Using a straight edge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface or replace intake manifold.

  Limit of distortion: 0.07 mm (0.003 in.)



INSTALLATION

Reverse removal procedure for installation noting the followings.

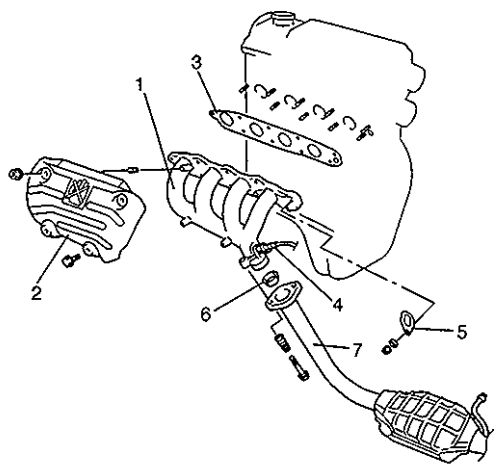
- Use new intake manifold gasket.
- Tighten nuts to specified torque.

  Tightening Torque
  (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

- Adjust accelerator cable play, referring to section 6E.
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Refill cooling system, referring to "ENGINE COOLING" section.
- Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

EXHAUST MANIFOLD

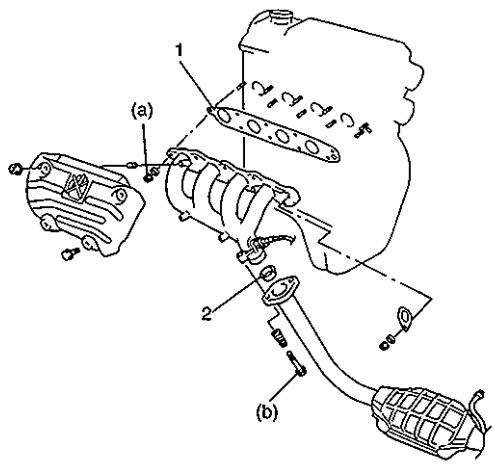
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.



1. Exhaust manifold
2. Exhaust manifold cover
3. Gasket
4. Heated oxygen sensor (if equipped)
5. Engine hook
6. Pipe gasket
7. Exhaust pipe

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect heated oxygen sensor coupler (if equipped).
3) Remove exhaust manifold cover of exhaust manifold.
4) Remove or disconnect exhaust pipe from exhaust manifold.
5) Remove exhaust manifold and its gasket from cylinder head.



1. Gasket
2. Pipe gasket

INSTALLATION

1) Install new gasket to cylinder head.
2) Install exhaust manifold.
   Tighten bolts and nuts to specified torque.

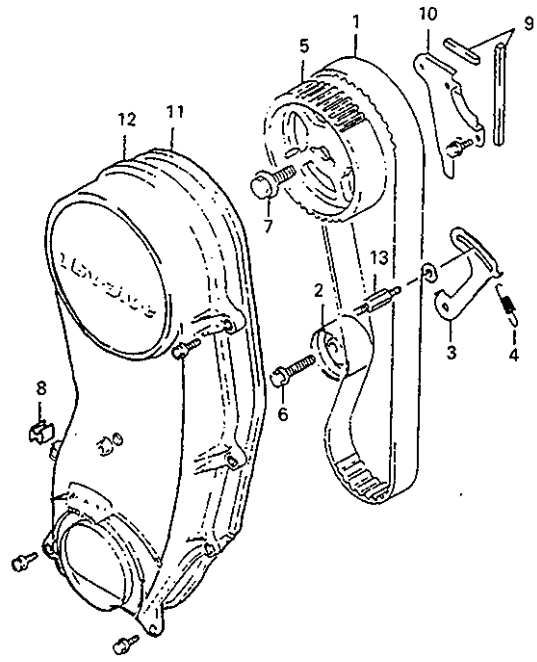
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install pipe gasket and install exhaust pipe to exhaust manifold.
   Before installing pipe gasket, check it for deterioration or damage, and replace as necessary.
   Tighten pipe fasteners to specified torque.

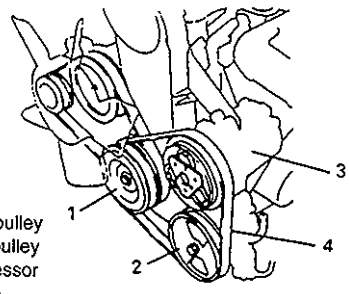
   Tightening Torque
   (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

4) Install upper cover to exhaust manifold.
5) Connect heated oxygen sensor connector and fit connector to bracket. (if equipped)
6) Connect negative cable at battery.
7) Check exhaust system for exhaust gas leakage.

TIMING BELT AND BELT TENSIONER



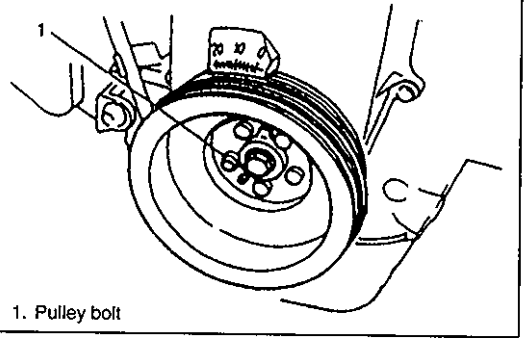
1. Timing belt
2. Tensioner
3. Tensioner plate
4. Tensioner spring
5. Camshaft timing pulley
6. Tensioner bolt
7. Pulley bolt
8. Seal
9. Inside cover seal
10. Inside cover
11. Outside cover seal
12. Outside cover
13. Tensioner stud



1. Crankshaft pulley
2. P/S pump pulley
3. A/C compressor (if equipped)
4. P/S belt

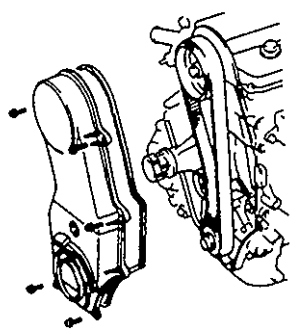
REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine coolant and disconnect inlet hose from radiator.
3) Remove power steering pump belt or A/C compressor belt, if equipped.
4) Remove radiator cooling fan, water pump pulley, water pump drive belt and fan shroud.

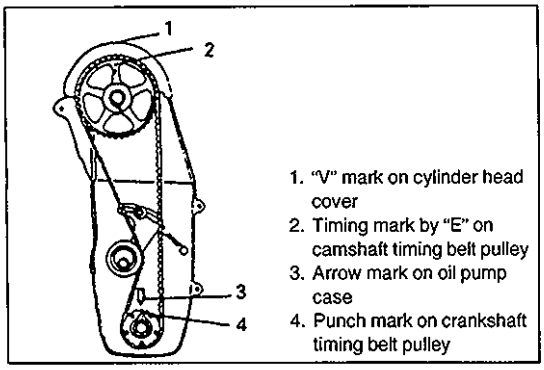


1. Pulley bolt

5) Remove crankshaft pulley by removing 5 pulley bolts.

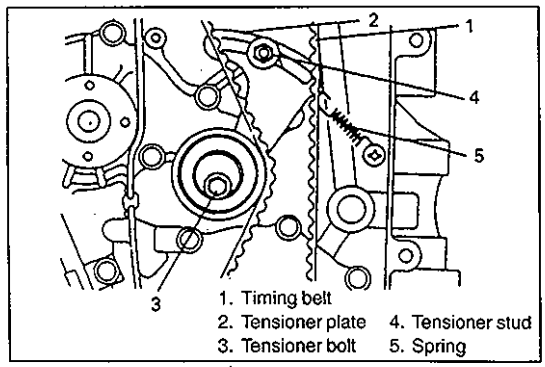


6) Remove timing belt outside cover.



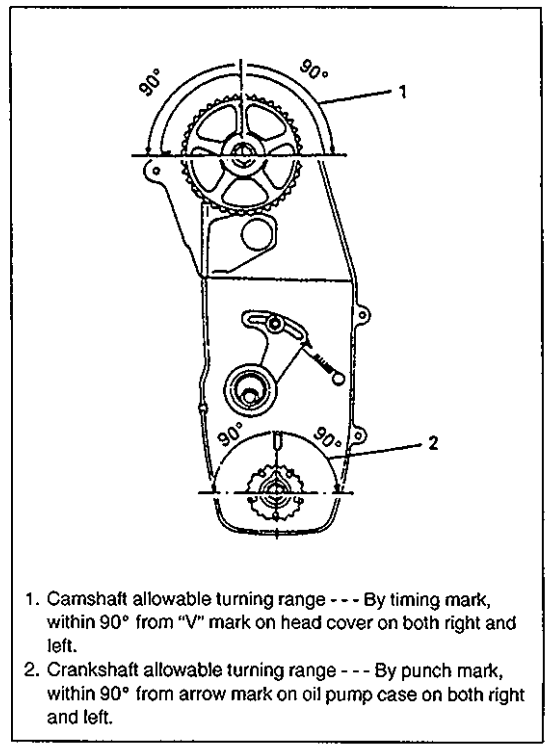
1. "V" mark on cylinder head cover
2. Timing mark by "E" on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

7) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



1. Timing belt
2. Tensioner plate
3. Tensioner bolt
4. Tensioner stud
5. Spring

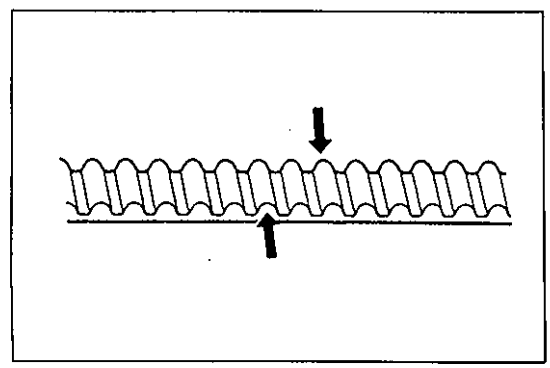
8) Remove timing belt tensioner, tensioner plate, tensioner spring and timing belt.



1. Camshaft allowable turning range - - - By timing mark, within 90° from "V" mark on head cover on both right and left.
2. Crankshaft allowable turning range - - - By punch mark, within 90° from arrow mark on oil pump case on both right and left.

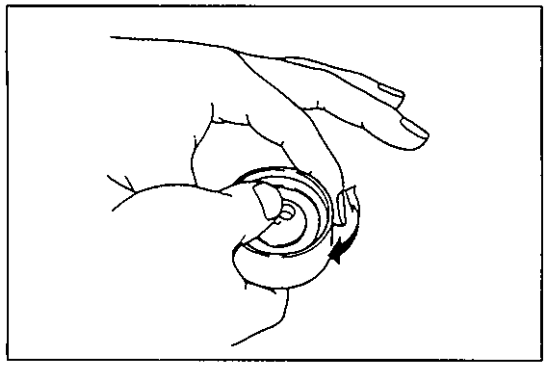
CAUTION:

- **After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown in figure. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.**
- **Never bend timing belt.**

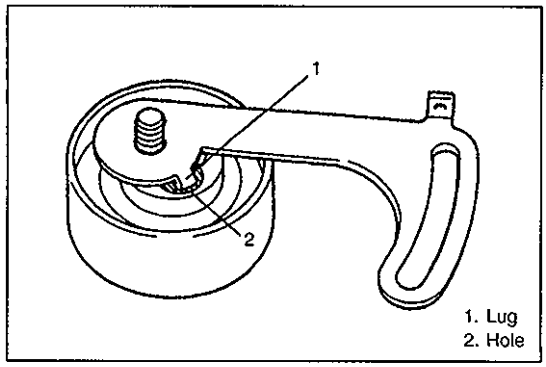


INSPECTION

- Inspect timing belt for wear or crack.
  Replace it as necessary.



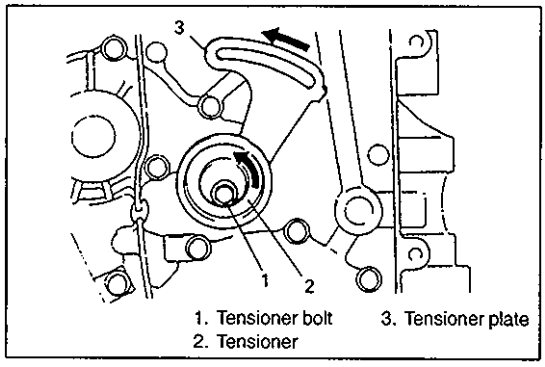
- Inspect tensioner for smooth rotation.



1. Lug
2. Hole

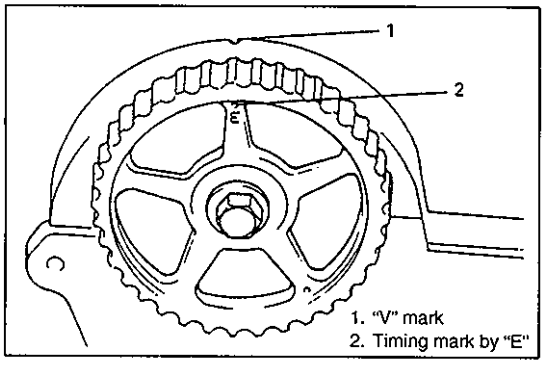
INSTALLATION

1) Install tensioner plate to tensioner.
   Insert lug of tensioner plate into hole in tensioner.



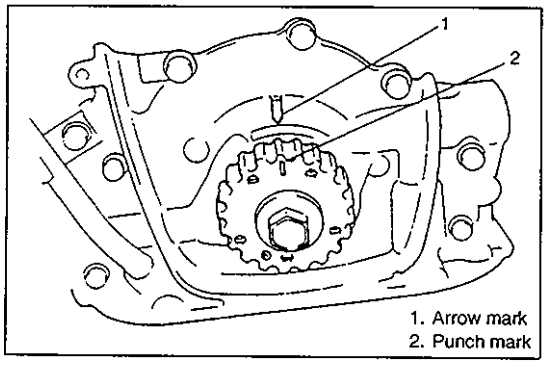
1. Tensioner bolt
2. Tensioner
3. Tensioner plate

2) Install tensioner and tensioner plate:
   Do not tighten tensioner bolt with wrench yet. Hand tighten only at this time.
   Check to ensure that plate movement in arrow direction as shown in figure causes tensioner to move in the same direction. If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.



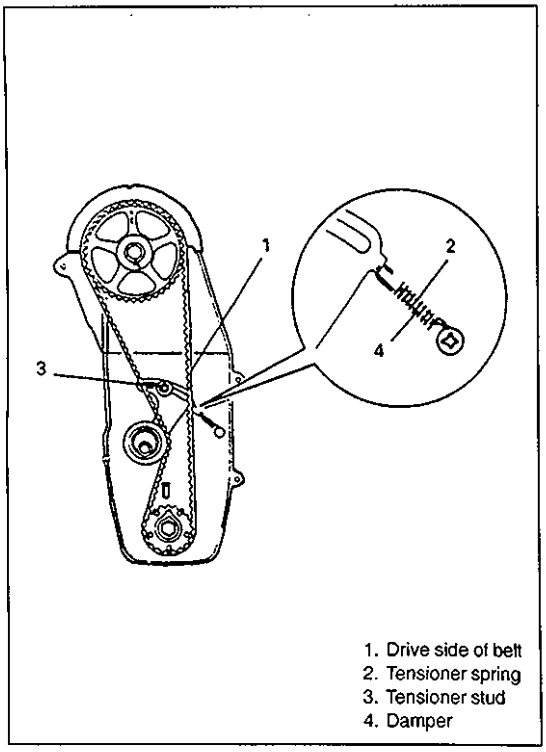
1. "V" mark
2. Timing mark by "E"

3) Check that timing mark on camshaft timing belt pulley is aligned with "V" mark on cylinder head cover. If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range which is described on page 6A-17.



1. Arrow mark
2. Punch mark

4) Check that punch mark on crankshaft timing belt pulley is aligned with arrow mark on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on page 6A-17.

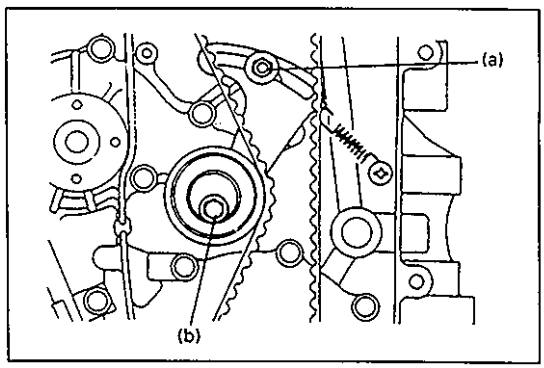


1. Drive side of belt
2. Tensioner spring
3. Tensioner stud
4. Damper

5) Install timing belt and tensioner spring.
With two sets of marks aligned and tensioner plate pushed up, install timing belt on two pulleys in such a way that drive side of belt is free from any slack.
And then install tensioner spring as shown in figure, and hand-tighten tensioner stud.

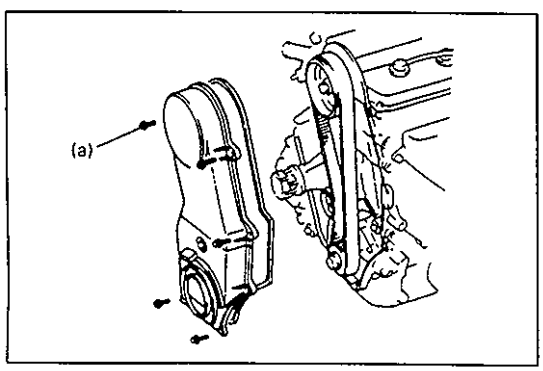
NOTE:

- **When installing timing belt, match arrow mark (⇨) on timing belt with rotating direction of crankshaft.**
- **In this state, No. 4 piston is at top dead center of compression stroke.**



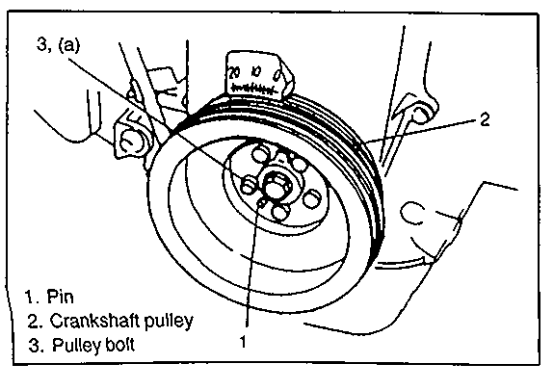
6) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud first and then tensioner bolt to each specified torque.
Then confirm again that two sets of marks are aligned respectively.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



7) Install timing belt outside cover.
Before installing, make sure that seal is between water pump and oil pump case.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



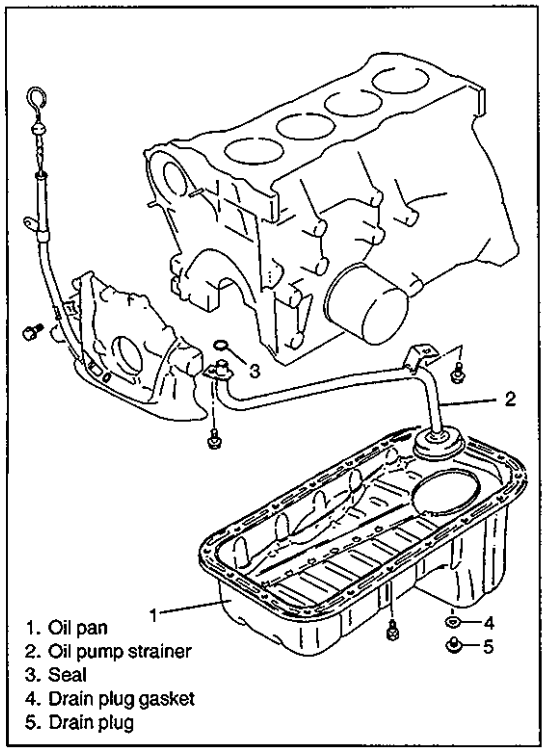
1. Pin
2. Crankshaft pulley
3. Pulley bolt

8) Install crankshaft pulley.
Fit hole of pulley to pin on crankshaft timing belt pulley, and tighten pulley bolts to specified torque.

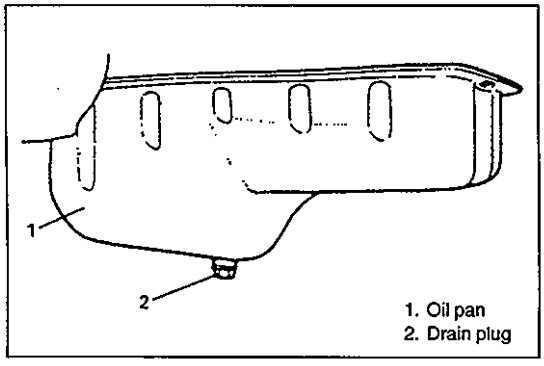
Tightening Torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

9) Install radiator fan shroud, water pump pulley, cooling fan and water pump drive belt.
   Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
10) Install power steering pump belt or A/C compressor belt, if equipped.
   Adjust its belt tension, referring to section 0B.
11) Connect radiator inlet hose to radiator.
12) Refill cooling system, referring to "ENGINE COOLING" section.
13) Connect negative cable to battery.
14) Verify that there is no coolant leakage at hose connection.

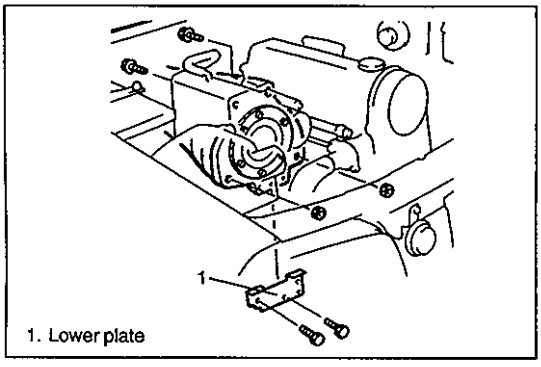
OIL PAN AND OIL PUMP STRAINER



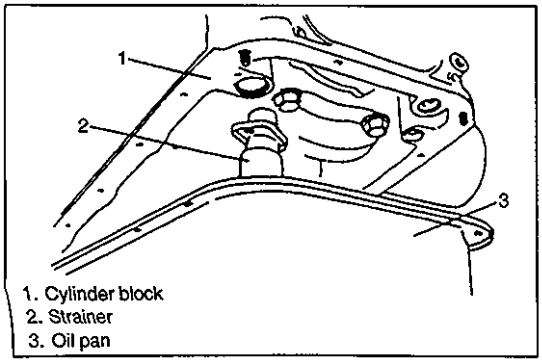
1) Drain engine oil by removing drain plug.

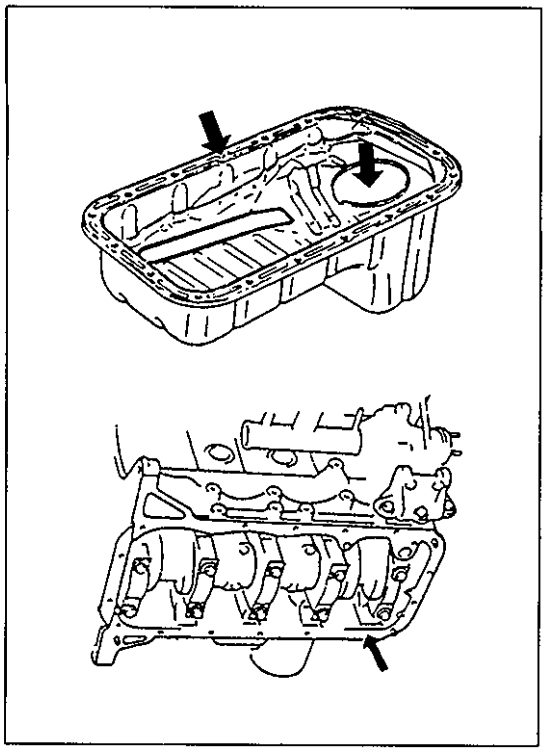


2) Remove clutch housing (torque converter housing for A/T) lower plate.



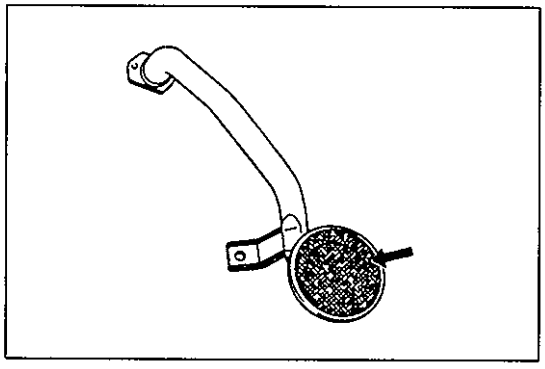
3) Remove oil pan and then oil pump strainer.



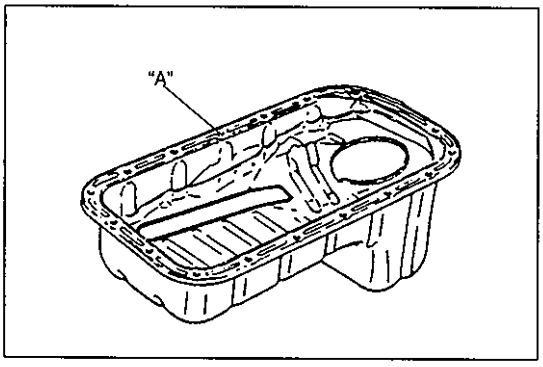


CLEANING

- Clean mating surfaces of oil pan and cylinder block. Remove oil, old sealant, and dusts from mating surfaces and oil pan inside.



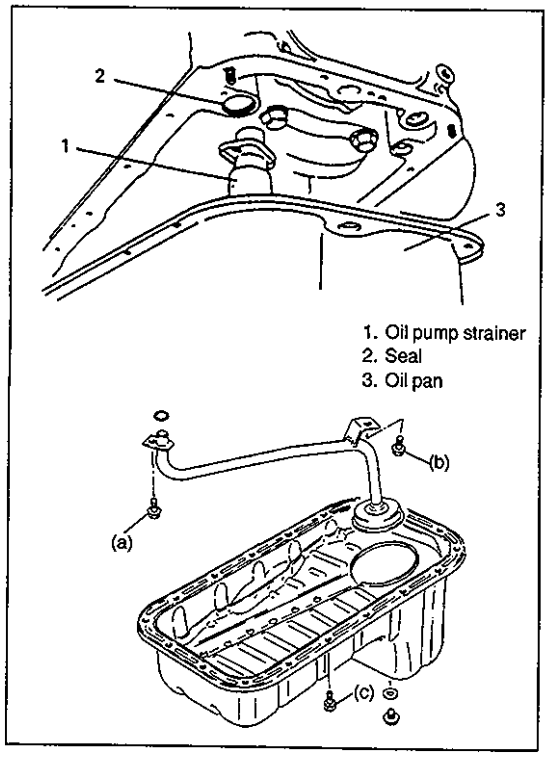
- Clean oil pump strainer screen.



INSTALLATION

1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150



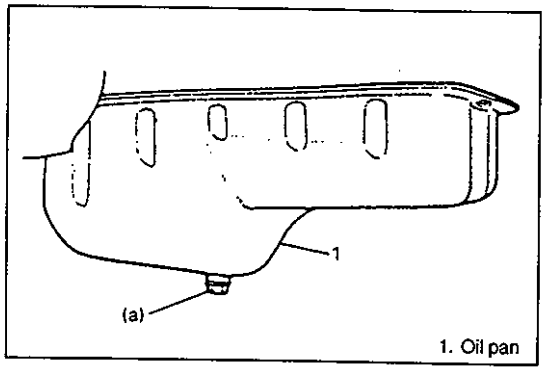
1. Oil pump strainer
2. Seal
3. Oil pan

2) Install oil pump strainer and oil pan.
Install seal in the position as shown in figure.
Tighten strainer bolt first and then bracket bolt to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)
(b): 10 N·m (1.0 kg-m, 7.5 lb-ft)

After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.
Tighten bolts to specified torque.

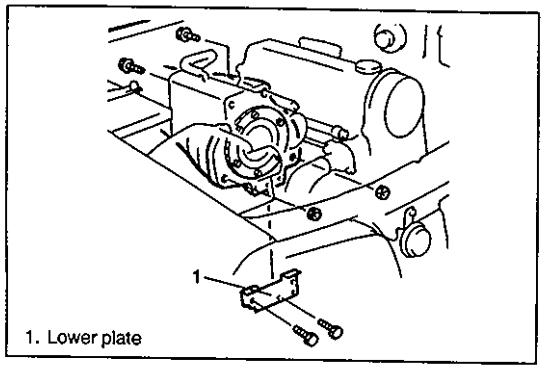
Tightening Torque
(c): 10 N·m (1.0 kg-m, 7.5 lb-ft)



1. Oil pan

3) Install gasket and drain plug to oil pan.
Tighten drain plug to specified torque.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

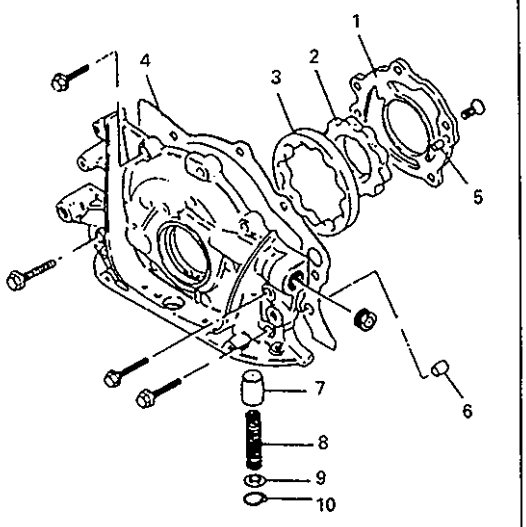


1. Lower plate

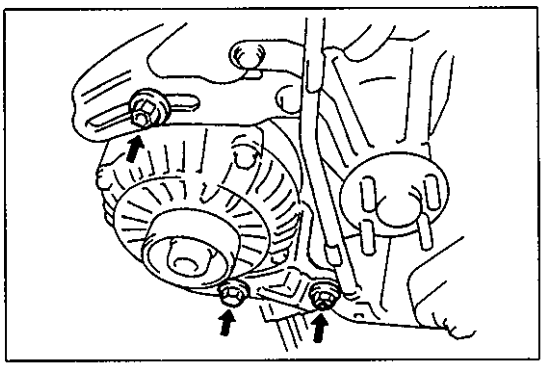
4) Install clutch (torque converter) housing lower plate.

5) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in section 0B.
6) Verify that there is no engine oil leakage and differential oil leakage at each connection.

OIL PUMP



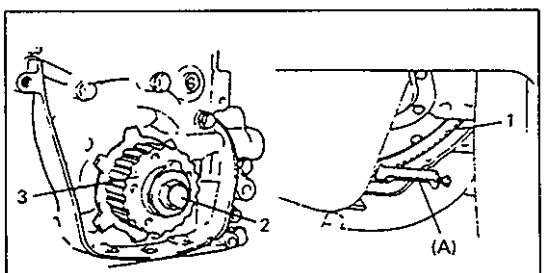
1. Rotor plate
2. Inner rotor
3. Outer rotor
4. Gasket
5. Pin
6. Pin
7. Relief valve
8. Spring
9. Retainer
10. Retainer ring



REMOVAL

1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.

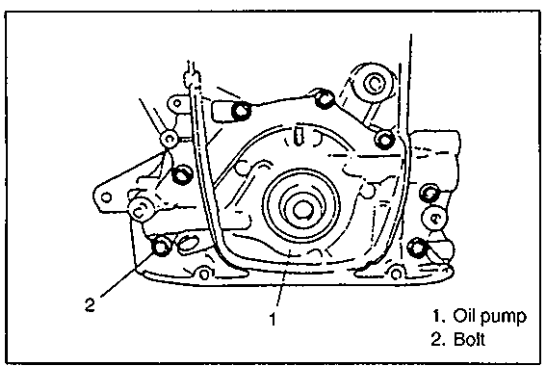
NOTE:
When installing bracket, fasten nut first.



1. Flywheel (Drive plate for A/T)
2. Pulley bolt
3. Crank timing belt pulley

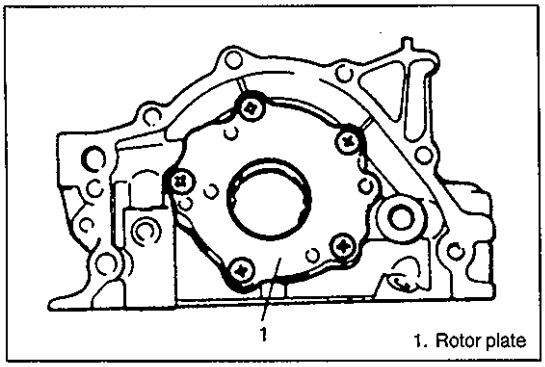
4) Remove crankshaft timing belt pulley.
To lock crankshaft, engage special tool (gear stopper) with flywheel ring gear (drive plate ring gear for A/T).
With crankshaft locked, remove crankshaft timing belt pulley bolt.

Special Tool
(A): 09927-56010



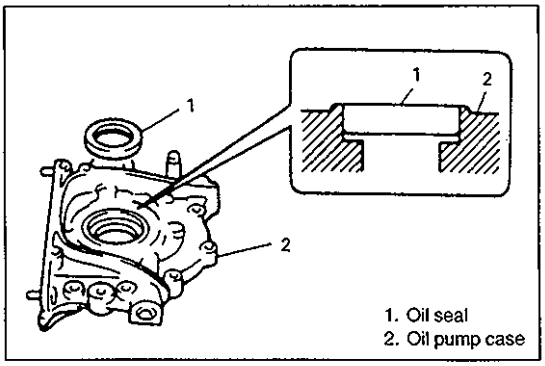
1. Oil pump
2. Bolt

5) Remove oil pan and oil pump strainer as previously outlined.
6) Remove oil pump assembly after removing bolts.



DISASSEMBLY

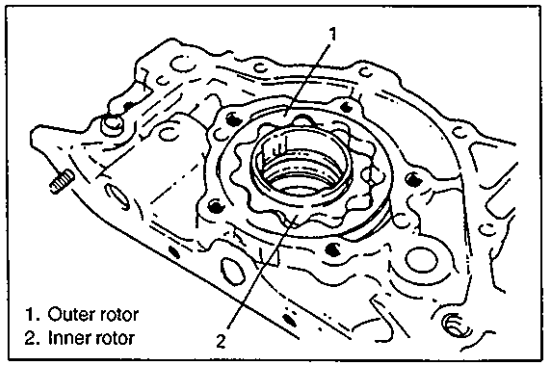
1) Remove oil level gauge guide bolt and pull out guide from oil pump.
2) Remove rotor plate.



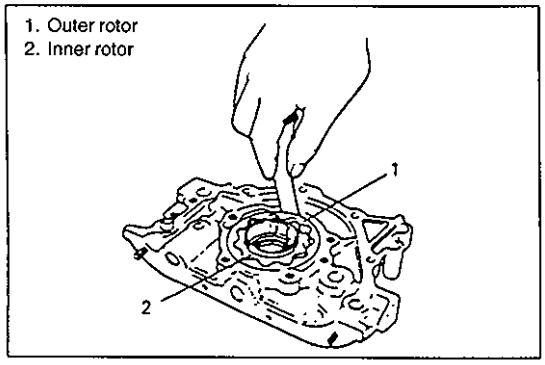
INSPECTION

- Check oil seal lip for fault or other damage. Replace as necessary.

NOTE:
When installing oil seal, press-fit it till its end face is flush with oil pump case end face.



- Check outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

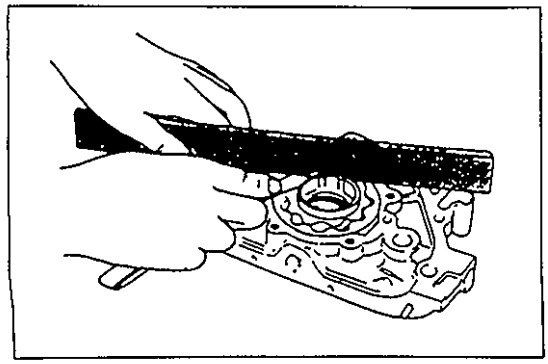


MEASUREMENT

- **Radial clearance**

Check radial clearance between outer rotor and case, using thickness gauge.
If clearance exceeds its limit, replace outer rotor or case.

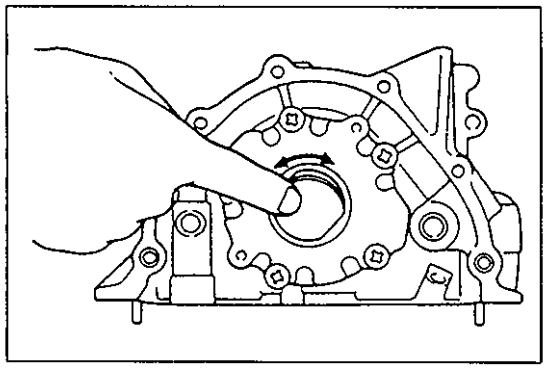
Limit on radial clearance between outer rotor and case: 0.310 mm (0.0122 in.)



- **Side clearance**

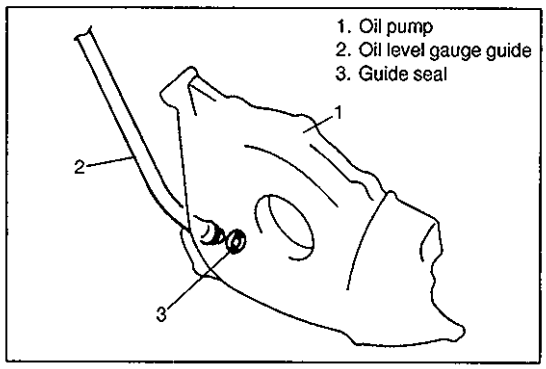
Using straight edge and thickness gauge, measure side clearance.

Limit on side clearance: 0.15 mm (0.0059 in.)

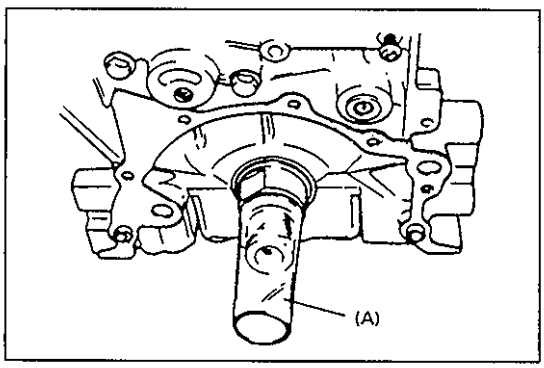


ASSEMBLY

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.
3) Install outer and inner rotors to pump case.
4) Install rotor plate. Tighten 5 screw securely.
   After installing plate, check to be sure that gears turn smoothly by hand.



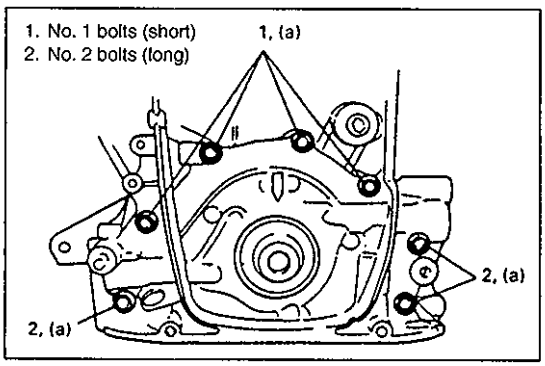
5) Apply engine oil to guide seal and install guide seal and guide.



INSTALLATION

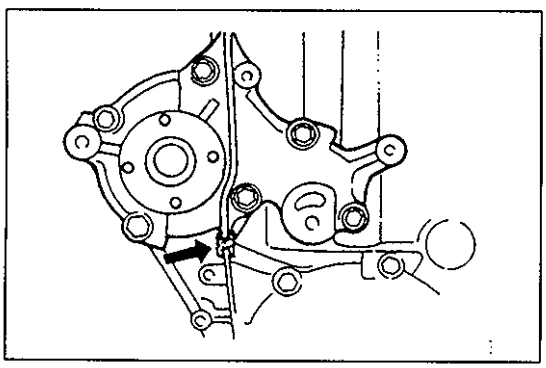
1) Install two oil pump pins and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft, and apply engine oil to special tool.

   Special Tool
   (A): 09926-18210

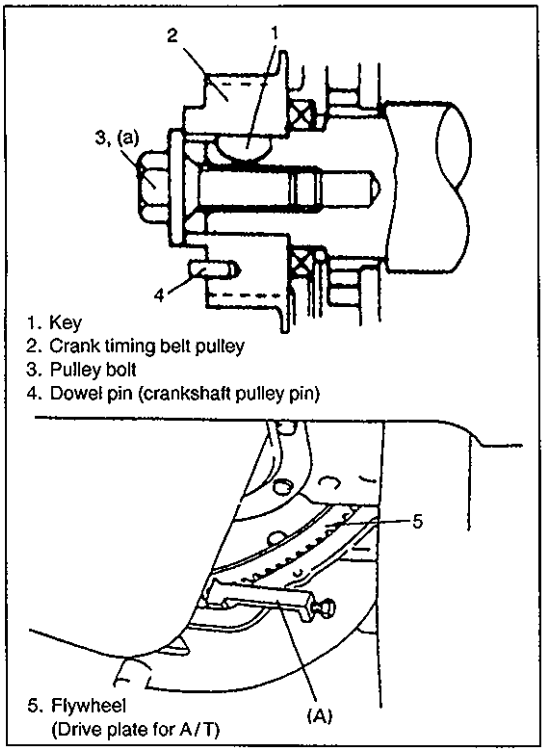


3) Install oil pump to cylinder block.
   As there are 2 types of oil pump bolts, refer to figure for their correct use and tighten them to specified torque.

   Tightening Torque
   (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



4) Install rubber seal between oil pump and water pump.



1. Key
2. Crank timing belt pulley
3. Pulley bolt
4. Dowel pin (crankshaft pulley pin)
5. Flywheel (Drive plate for A/T)

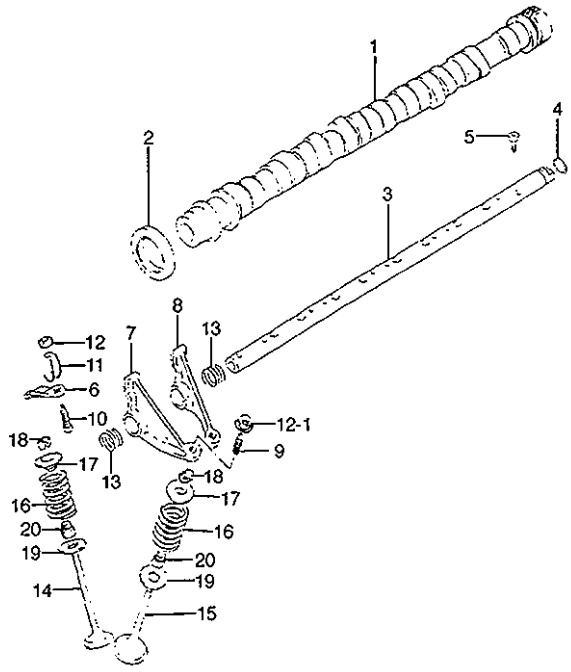
5) Install timing pulley key and crank timing belt pulley. Refer to figure for proper installation of these parts.
With crankshaft locked, tighten crank timing belt pulley bolt to specified torque.

Tightening Torque
(a): 128 N·m (12.8 kg-m, 92.5 lb-ft)

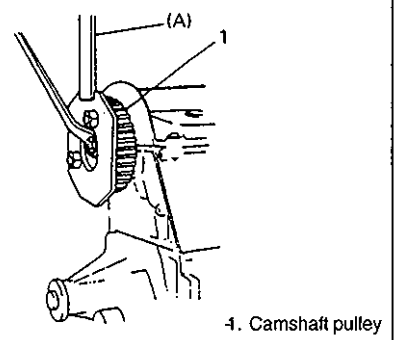
Special Tool
(A): 09927-56010

6) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
7) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
9) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
10) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in section 0B.
11) Connect negative cable at battery.
12) Verify that there is no coolant leakage and each oil leakage at each connection.
13) After completing installation, check oil pressure by running engine.

ROCKER ARMS, ROCKER SHAFT AND CAMSHAFT



1. Camshaft
2. Camshaft oil seal
3. Rocker arm shaft
4. O-ring
5. Rocker shaft bolt
6. Rocker arm (IN)
7. Rocker arm No. 1 (EX)
8. Rocker arm No. 2 (EX)
9. Valve adjusting screw
10. Valve adjusting screw
11. Clip
12. Lock nut (without flange)
12-1. Lock nut (with flange)
13. Rocker arm spring
14. Intake valve
15. Exhaust valve
16. Valve spring
17. Valve spring retainer
18. Valve cotter
19. Valve spring seat
20. Valve stem seal



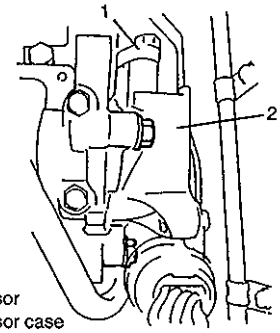
1. Camshaft pulley

REMOVAL

1) Disconnect negative cable at battery.
2) Remove radiator referring to "ENGINE COOLING" section.
3) Remove timing belt as previously outlined.
4) Remove camshaft timing belt pulley by using special tool.

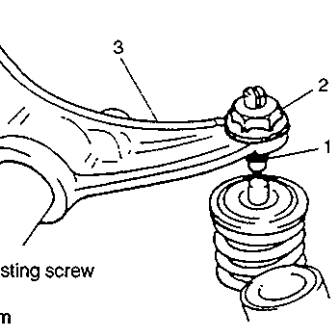
Special Tool
(A): 09917-68220

5) Remove cylinder head cover as previously outlined.



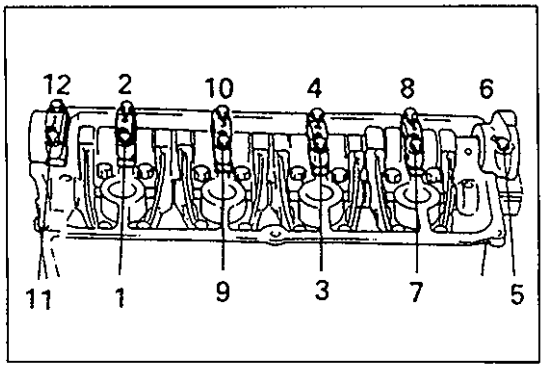
1. CMP sensor
2. CMP sensor case

6) Disconnect CMP sensor connector and remove CMP sensor case from cylinder head.
Place a container or rag under CMP sensor case, for a small amount of oil flows out during removal of case.



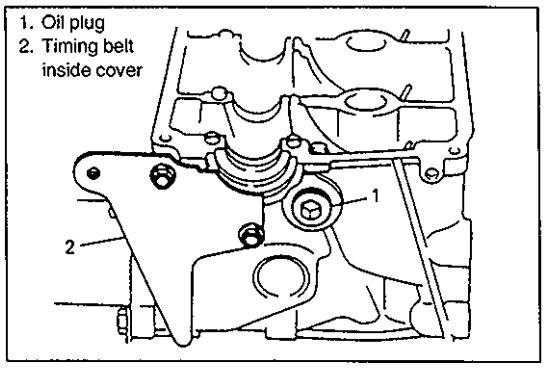
1. Valve adjusting screw
2. Lock nut
3. Rocker arm

7) After loosening all valve adjusting screw lock nuts, turn adjusting screws back all the way to allow all rocker arms to move freely.

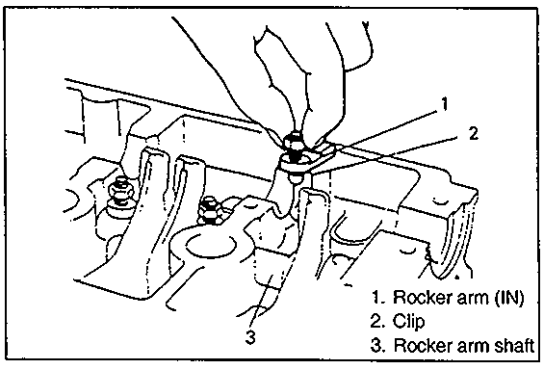


8) Remove camshaft housing and camshaft.

NOTE:
To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.

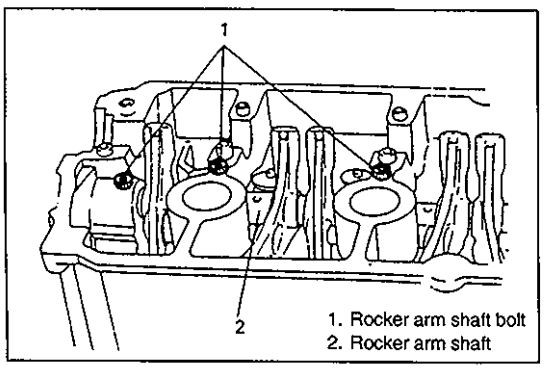


9) Remove rocker arm shaft plug and timing belt inside cover.

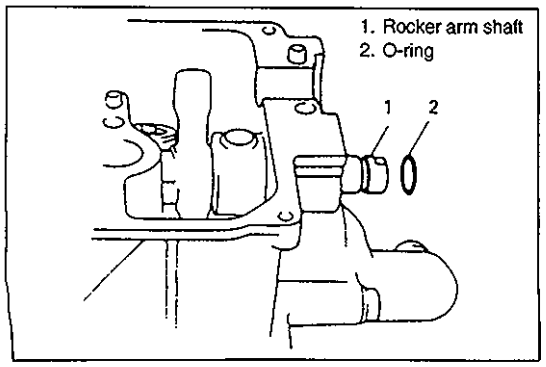


10) Remove intake rocker arm with clip from rocker arm shaft.

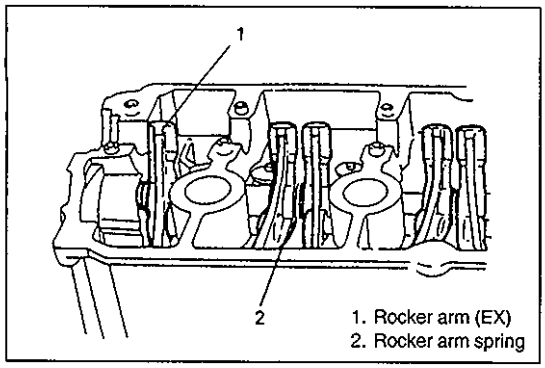
NOTE:
Do not bend clip when removing intake rocker arm.



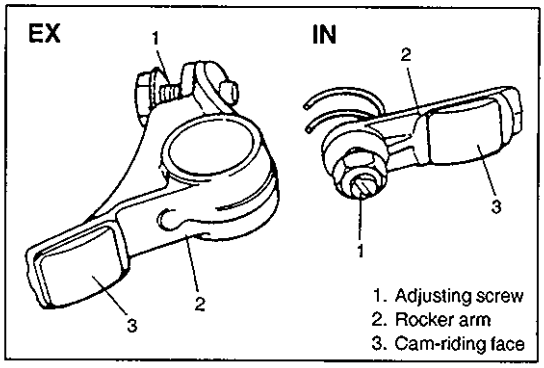
11) Remove rocker arm shaft bolts.



12) Push off rocker arm shaft end to CMP sensor case side and remove O-ring from shaft.



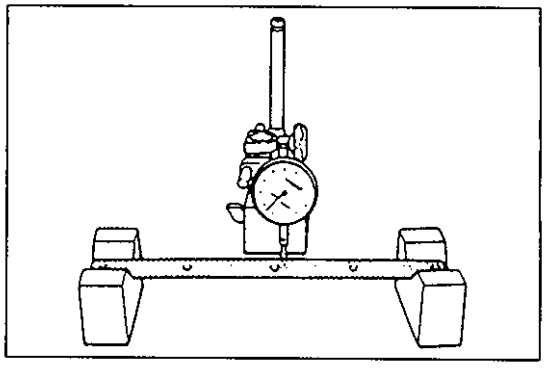
13) Remove exhaust rocker arms and rocker arm spring by pulling rocker arm shaft to front side.



INSPECTION

Adjusting Screw and Rocker Arm

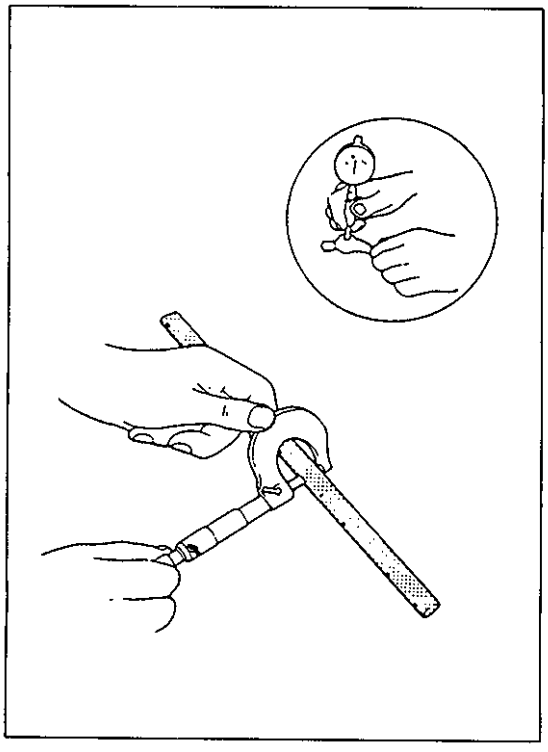
If tip of adjusting screw is badly worn, replace it.
Rocker arm must be replaced if its cam-riding face is badly worn.



Rocker Arm Shaft Runout

Using "V" blocks and dial gauge, check runout. If runout exceeds its limit, replace rocker arm shaft.

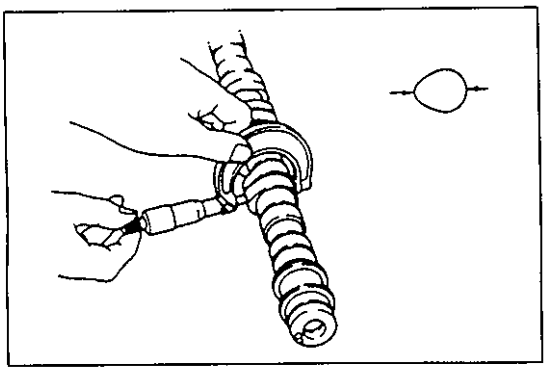
Runout limit: 0.20 mm (0.008 in.)



Rocker Arm-to-Rocker Arm Shaft Clearance

Using a micrometer and a bore gauge, measure rocker shaft dia. and rocker arm I.D.
Difference between two readings is arm-to-shaft clearance on which a limit is specified.
If limit is exceeded, replace shaft or arm, or both.

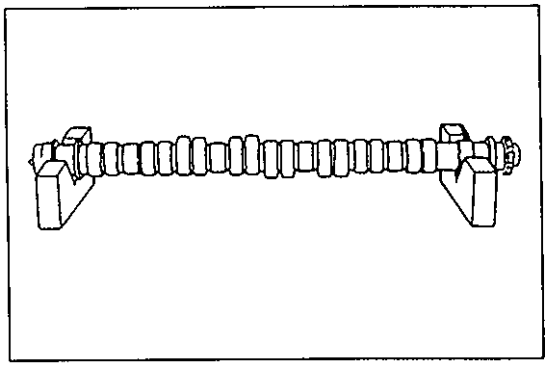
Item	Standard	Limit
Rocker arm I.D.	15.985 – 16.005 mm (0.629 – 0.630 in.)	——
Rocker arm shaft dia.	15.969 – 15.984 mm (0.6287 – 0.6293 in.)	——
Arm-to-shaft clearance	0.001 – 0.036 mm (0.0001 – 0.0014 in.)	0.09 mm (0.0035 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

Cam height	Standard	Limit
Intake cam	36.184 – 36.344 mm (1.4246 – 1.4308 in.)	36.084 mm (1.4206 in.)
Exhaust cam	35.900 – 36.060 mm (1.4134 – 1.4197 in.)	35.800 mm (1.4094 in.)

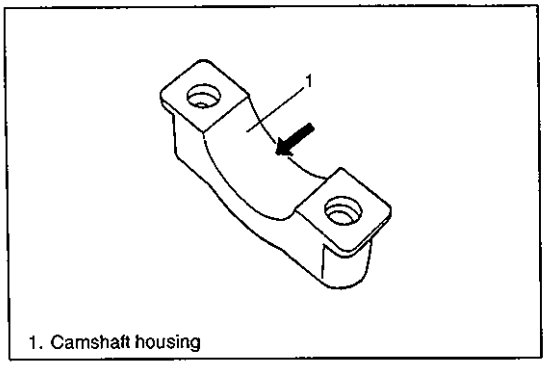


Camshaft Runout

Hold camshaft between two "V" blocks, and measure runout by using a dial gauge.

If runout exceeds the limit, replace camshaft.

Runout limit: 0.10 mm (0.0039 in.)

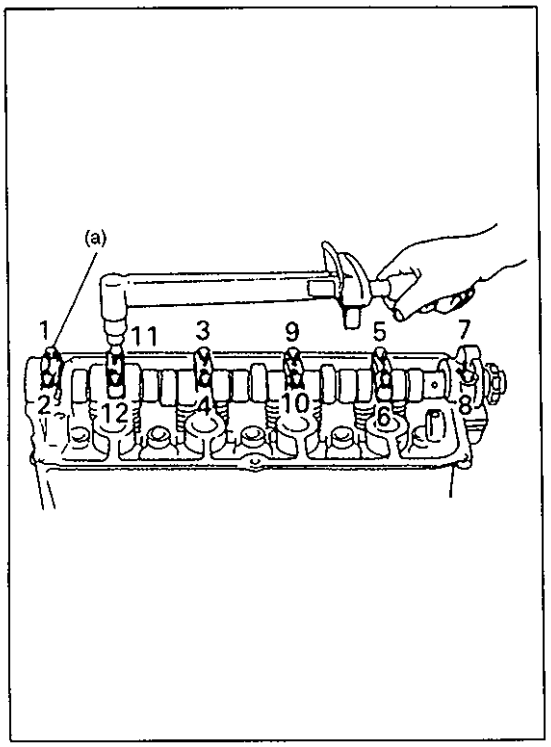


1. Camshaft housing

Camshaft Journal Wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.

If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housing.



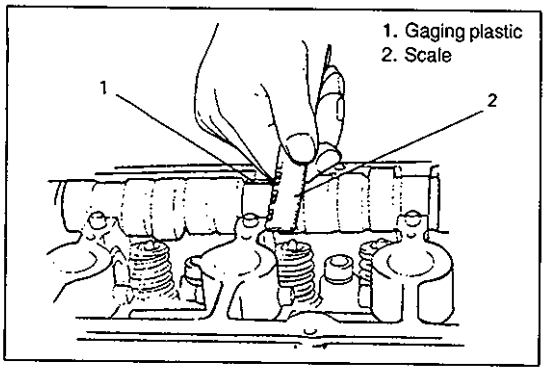
Check clearance by using gaging plastic.

The procedure is as follows.

1) Clean housing and camshaft journals.
2) Install camshaft to cylinder head.
3) Place a piece of gaging plastic the full width of journal of camshaft (parallel to camshaft).
4) Install camshaft housing, referring to page 6A-32.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

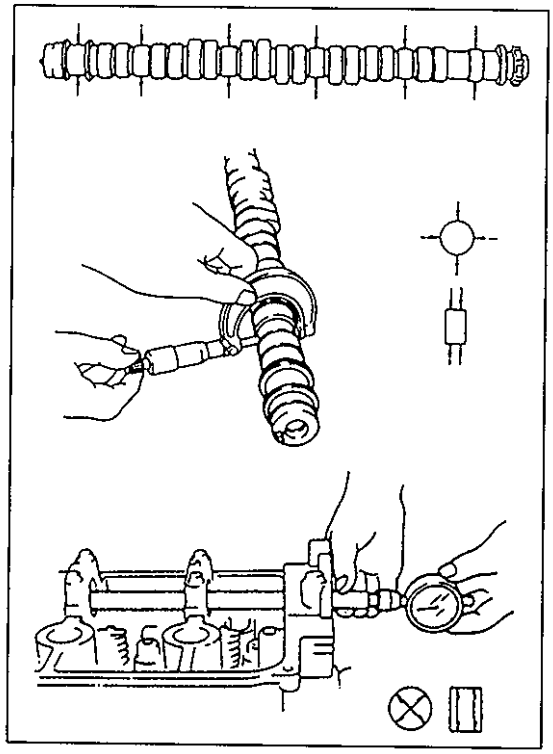
Tightening Torque
(a): 10 N·m (1.0kg-m, 7.5 lb-ft)

NOTE:
Do not rotate camshaft while gaging plastic is installed.



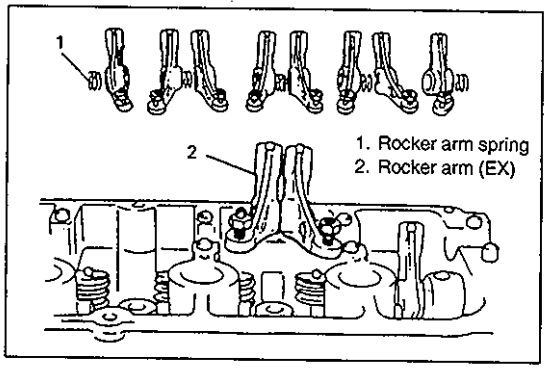
6) Remove housing and using scale on gaging plastic envelope, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.040 – 0.082 mm (0.0016 – 0.0032 in.)	0.12 mm (0.0047 in.)



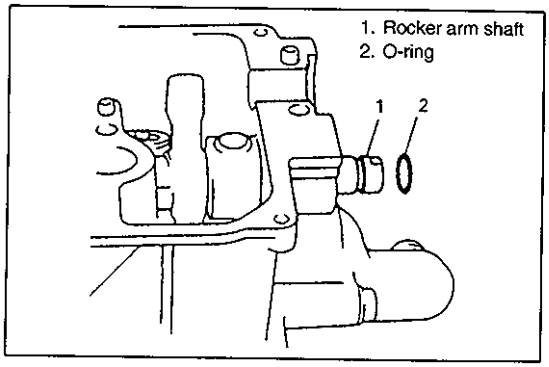
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item	Standard
Camshaft Journal bore dia.	28.000 – 28.021 mm (1.1024 – 1.1031 in.)
Camshaft journal O.D.	27.939 – 27.960 mm (1.1000 – 1.1008 in.)

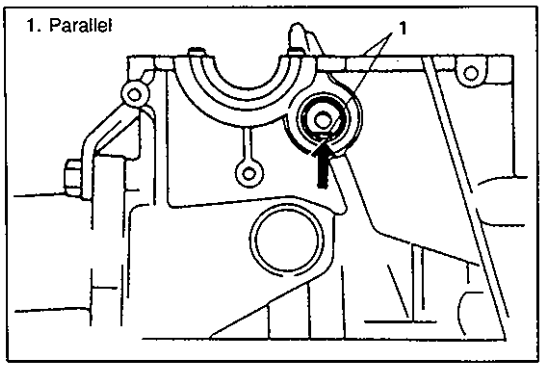


INSTALLATION

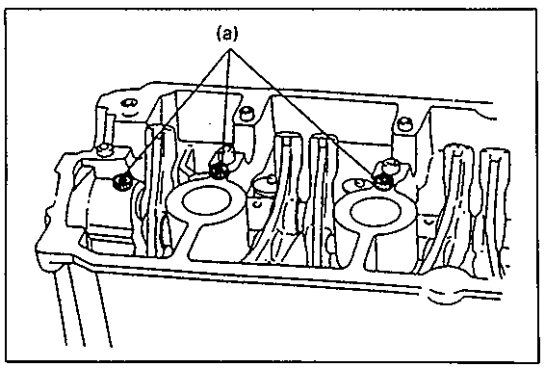
1) Apply engine oil to rocker arm shaft and rocker arms.
2) Install rocker arm shaft, rocker arm (exhaust side) and rocker arm spring.



3) Check O-ring for damage or deterioration. With O-ring groove in rocker arm shaft exposed to transmission side once, install O-ring to rocker arm shaft.

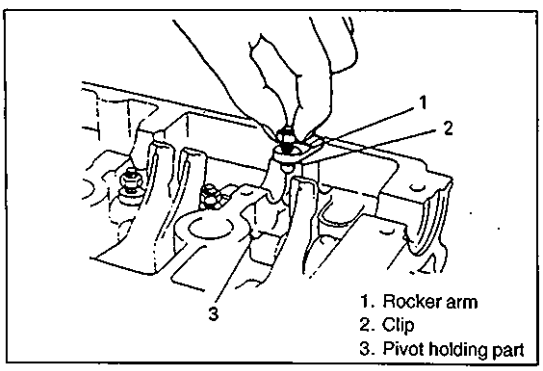


4) Set rocker arm shaft so that its cut part faces down and becomes in parallel with head cover mating surface.

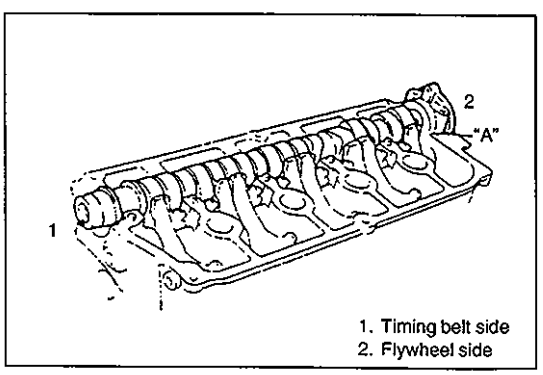


5) Install rocker arm shaft bolts and tighten them to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

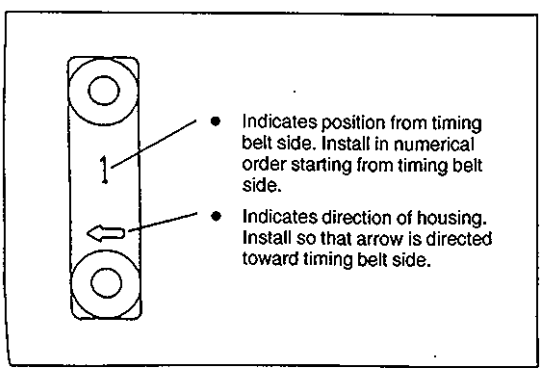


6) Fill small amount of engine oil into arm pivot holding part of rocker arm shaft. Install rocker arm (intake side) with clips to rocker arm shaft.

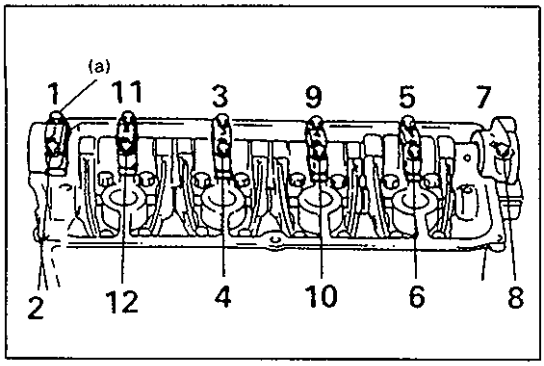


7) Apply engine oil to cams and journals on camshaft and put camshaft on cylinder head. Install camshaft housing to camshaft and cylinder head.
- Apply engine oil to sliding surface of each housing against camshaft journal.
- Apply sealant to mating surface of No.6 housing which will mate with cylinder head.

"A" Sealant: 99000-31110

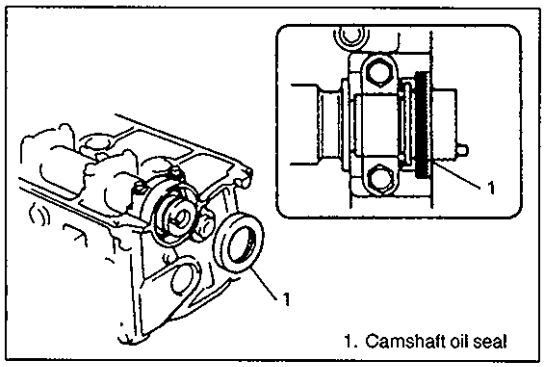


- Embossed marks are provided on each camshaft housing, indicating position and direction for installation.
  Install housing as indicated by these marks.
- As camshaft housing No. 1 retains camshaft in proper position as to thrust direction, make sure to first fit No. 1 housing to No. 1 journal of camshaft securely.



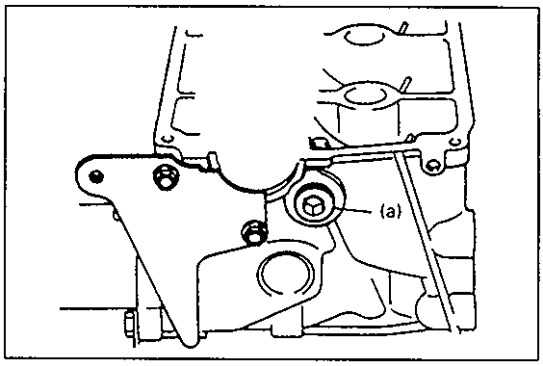
- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

  Tightening Torque
  (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



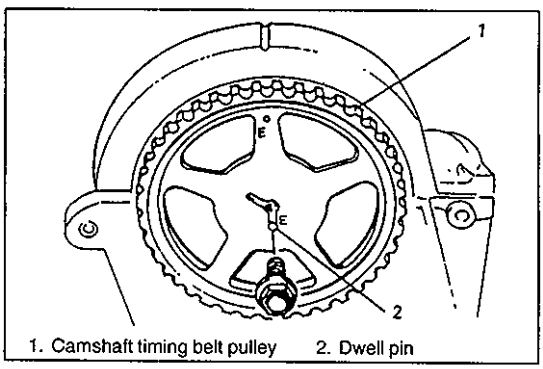
1. Camshaft oil seal

8) Install camshaft oil seal.
   After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.



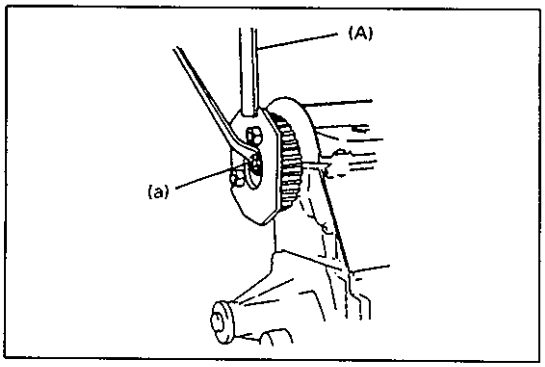
9) Install rocker arm shaft plug and timing belt inside cover. Then tighten rocker arm shaft plug to specified torque.

   Tightening Torque
   (a): 32 N·m (3.2 kg-m, 23.5 lb-ft)



1. Camshaft timing belt pulley 2. Dwell pin

10) Install camshaft timing belt pulley to camshaft while fitting pin on camshaft into slot at "E" mark.

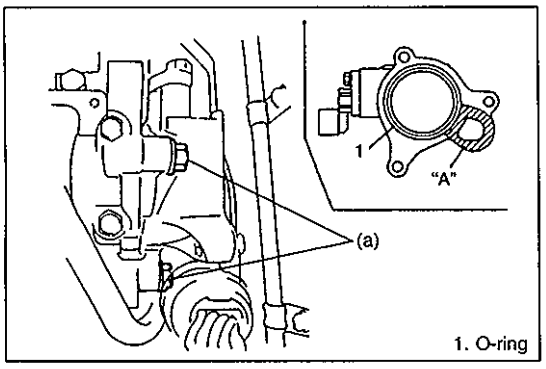


11) Using special tool, tighten pulley bolt to specified torque.

    Tightening Torque
    (a): 59 N·m (5.9 kg-m, 43.0 lb-ft)

    Special Tool
    (A): 09917-68220

12) Install belt tensioner, timing belt, outside cover, crankshaft pulley and water pump belt as previously outlined.



13) After applying sealant to part "A" as shown in figure at the left, install CMP sensor case to cylinder head and tighten its fixing bolts to specified torque.

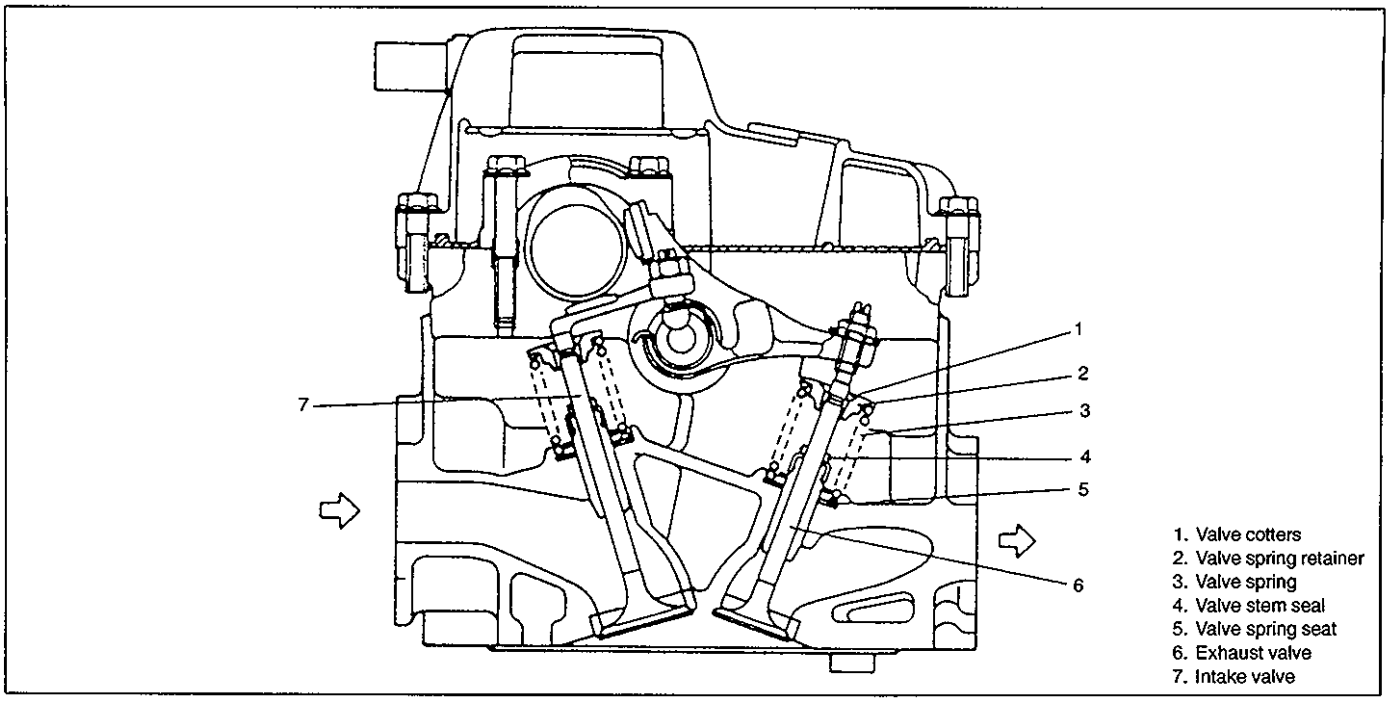
"A" Sealant: 99000-31110

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

Connect CMP sensor connector.

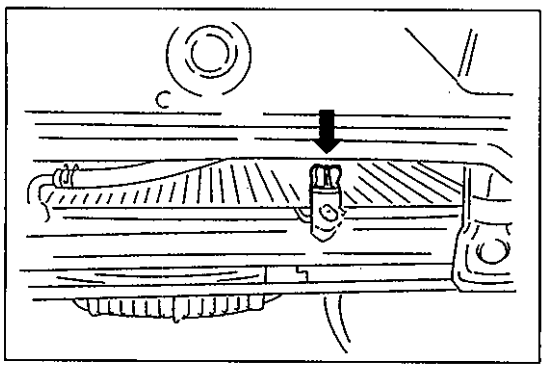
14) Adjust valve clearance as previously outlined.
15) Install cylinder head cover.
16) Install radiator and refill cooling system referring to "ENGINE COOLING" section.
17) Refill A/T fluid referring to "AUTOMATIC TRANSMISSION" section.
18) Connect negative cable at battery.
19) Upon completion of installation, verify that there is no coolant leakage or A/T fluid leakage (for A/T vehicle) at each connection.
20) Confirm that ignition timing is within specification referring to "IGNITION SYSTEM" section.

VALVES AND CYLINDER HEAD

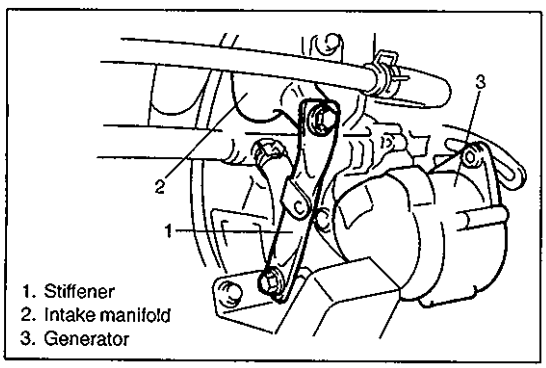


REMOVAL

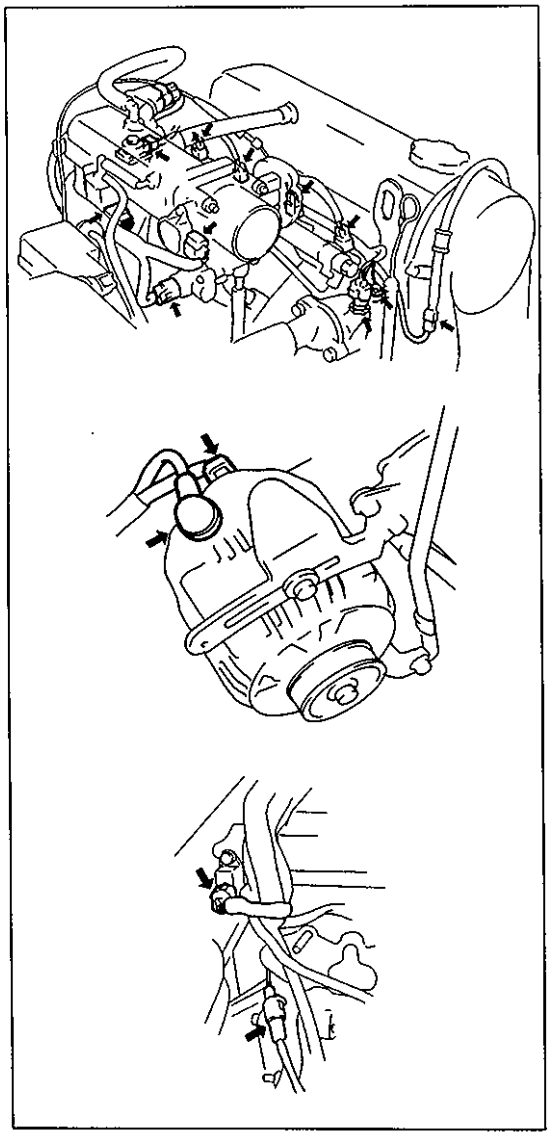
1) Relieve fuel pressure according to fuel pressure relief procedure described in section 6.
2) Disconnect negative cable at battery.



3) Drain cooling system.

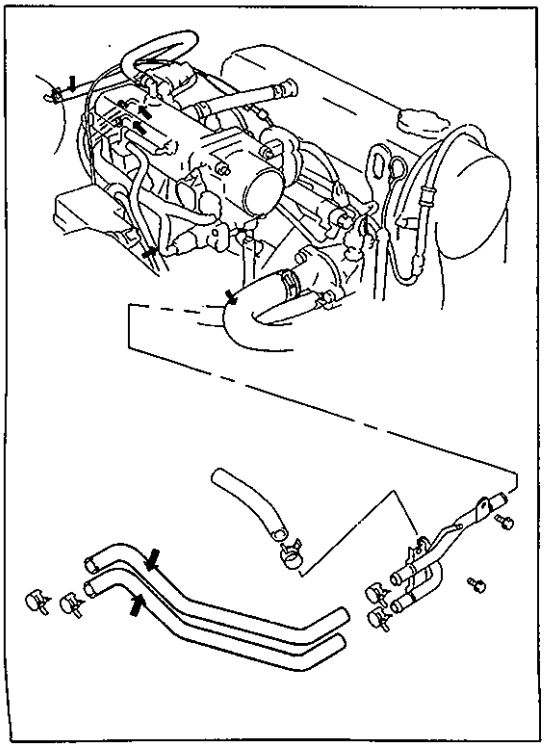


4) Remove intake manifold stiffener.

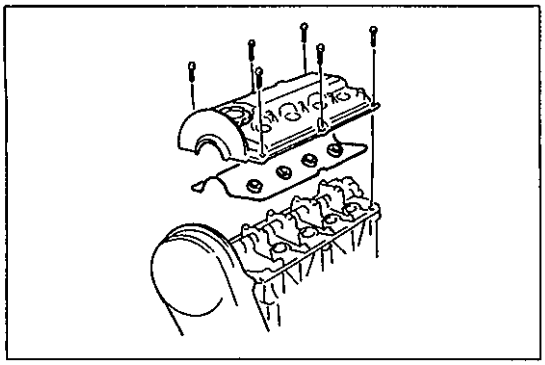


5) Remove air intake hose.
6) Disconnect following electric wires:
   - Ground wires from intake manifold
   - Camshaft position sensor
   - EGR valve (if equipped)
   - EVAP canister purge valve
   - Engine coolant temp. sensor
   - Throttle position sensor
   - Idle air control valve
   - Fuel injector wires at the connector
   - Generator
   - Ground cable from cylinder block
   - Heated oxygen sensor
   - Engine oil pressure switch

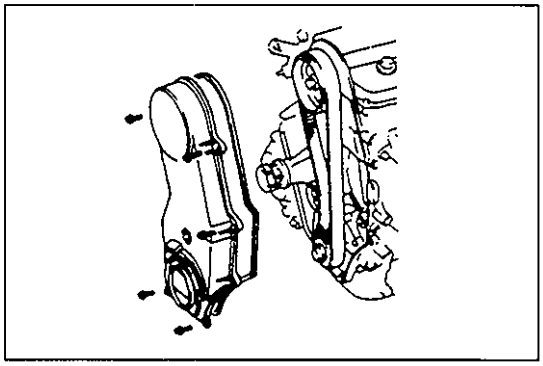
   and then release wire harnesses from clamps.



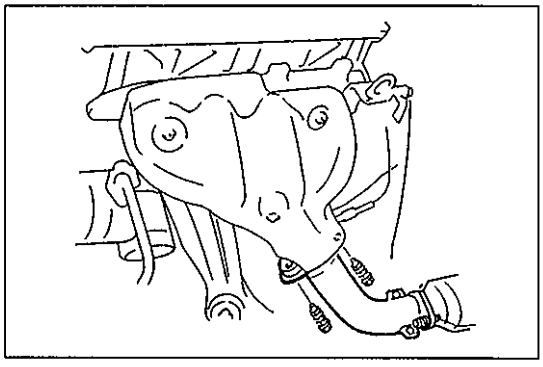
7) Disconnect following hoses:
   - Canister purge hose from EVAP canister purge valve
   - Radiator outlet hose from inlet pipe
   - Brake booster hose from intake manifold
   - Heater inlet and outlet hose from pipe
   - Fuel feed hose and return hose from each pipe
   - A/T fluid hose clamp from bracket
8) Disconnect accelerator cable from throttle body and each clamp.



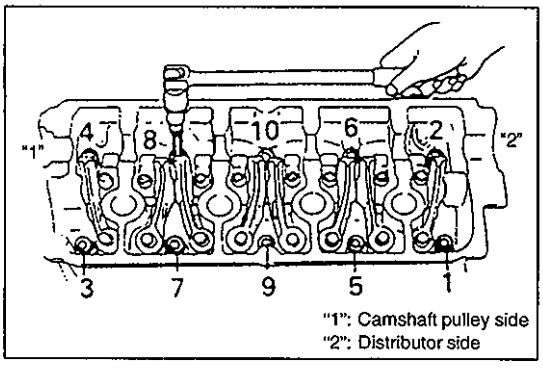
9) Remove cylinder head cover as previously outlined. Loosen all valve lash adjusting screws fully.



10) Remove timing belt and camshaft as previously outlined.
11) Remove generator adjust arm from intake manifold.
12) Remove air conditioning compressor adjust arm from cylinder head. (if equipped)

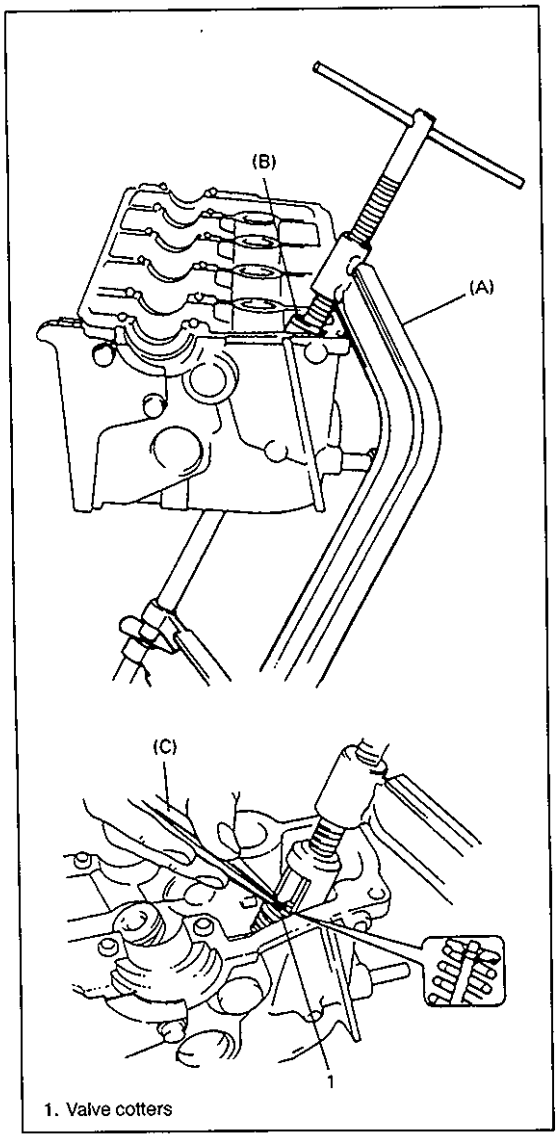


13) Disconnect exhaust pipe from exhaust manifold.



14) Loosen cylinder head bolts in such order as indicated in figure and remove them.
15) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.

16) Remove cylinder head with intake manifold and exhaust manifold, using lifting device.



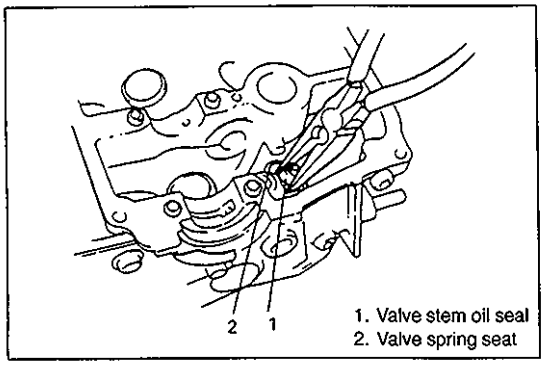
1. Valve cotters

DISASSEMBLY

1) For ease in servicing cylinder head, remove intake manifold with throttle body and exhaust manifold from cylinder head.
2) Remove intake rocker arm with clip from rocker arm shaft, remove rocker arm shaft bolts and remove exhaust rocker arms and springs by pulling its shaft out to transmission side.
3) Using special tool (Valve lifter), compress valve springs and then remove valve cotters by using special tool (Forceps) as shown.

Special Tool
(A): 09916-14510
(B): 09916-14910
(C): 09916-84511

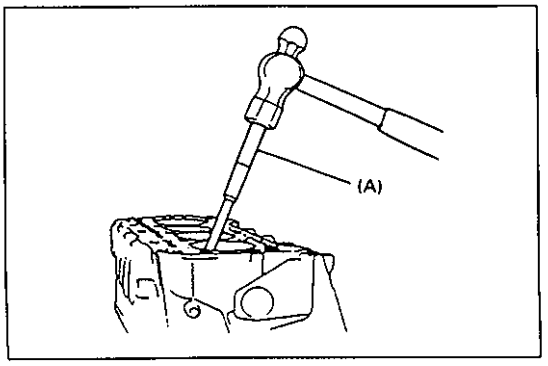
4) Release special tool, and remove spring retainer and valve spring.
5) Remove valve from combustion chamber side.



1. Valve stem oil seal
2. Valve spring seat

6) Remove valve stem oil seal from valve guide, and then valve spring seat.

NOTE:
Do not reuse oil seal once disassembled. Be sure to use new oil seal when assembling.

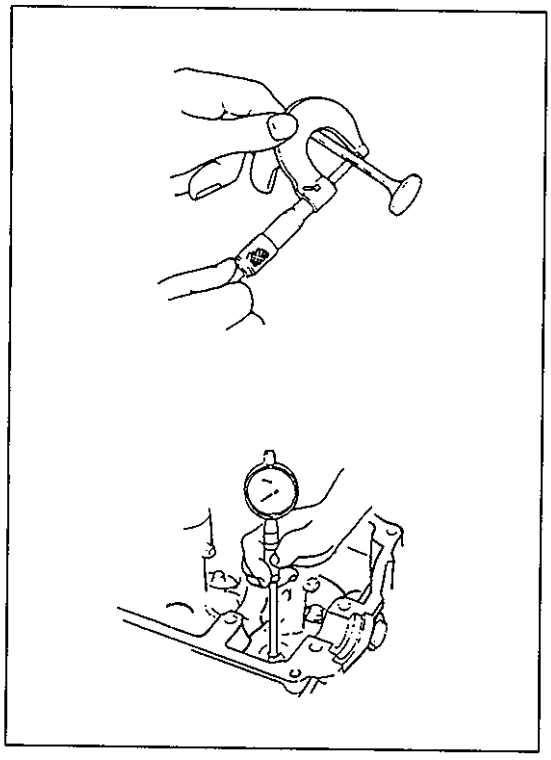


7) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

Special Tool
(A): 09916-44910

NOTE:
Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

8) Place disassembled parts except valve stem seal and valve guide in order, so that they can be installed in their original position.

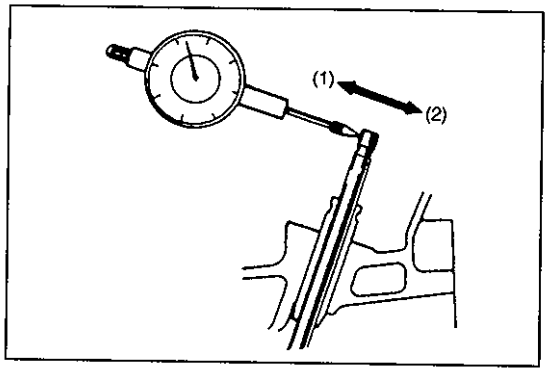


INSPECTION

Valve Guides

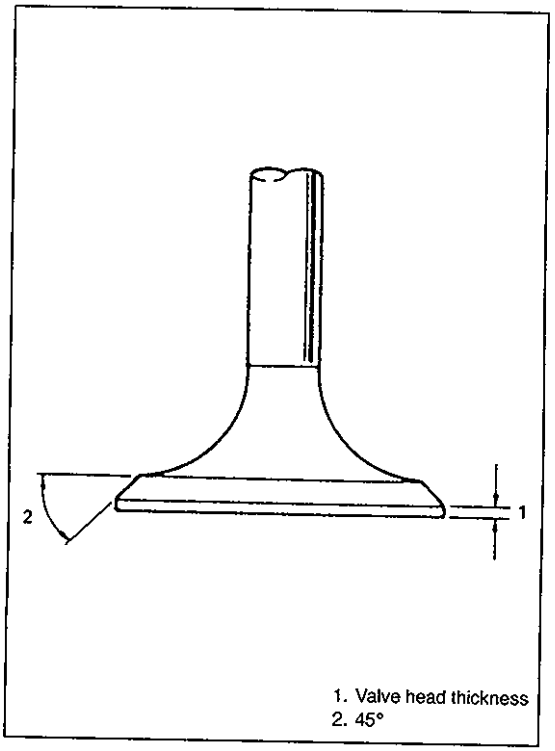
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.
Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

Item		Standard	Limit
Valve stem diameter	In	5.465 – 5.480 mm (0.2152 – 0.2157 in.)	—
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	—
Valve guide I.D.	In	5.500 – 5.512 mm (0.2166 – 0.2170 in.)	—
	Ex		
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)



If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.
Move stem end in directions (1) and (2) to measure end deflection.
If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)

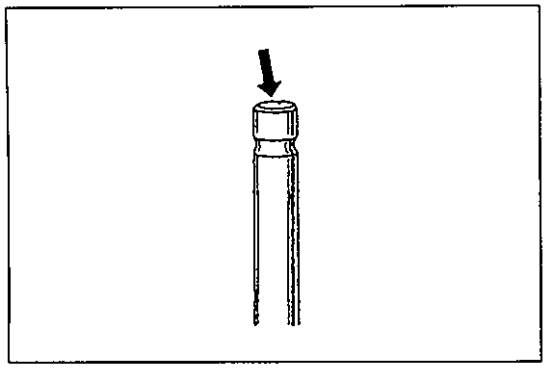


1. Valve head thickness
2. 45°

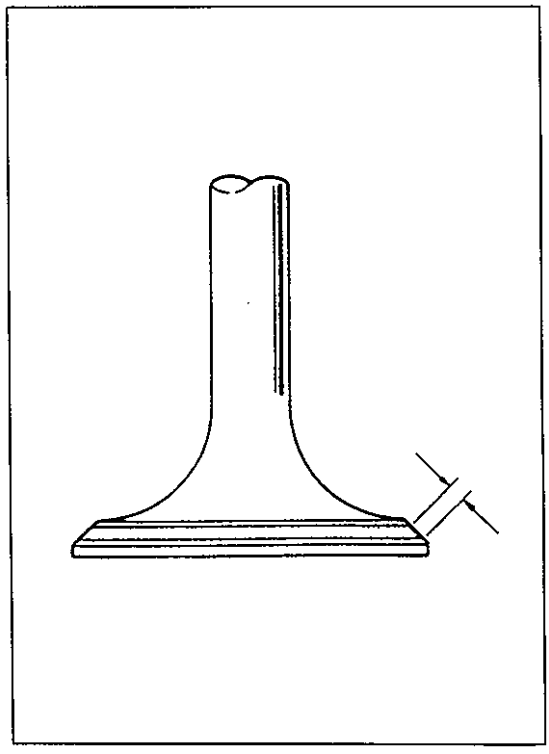
Valves

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem and, as necessary, replace it.
- Measure thickness of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness		
	Standard	Limit
IN	0.8 – 1.2 mm (0.03 – 0.047 in.)	0.6 mm (0.024 in.)
EX		0.7 mm (0.027 in.)



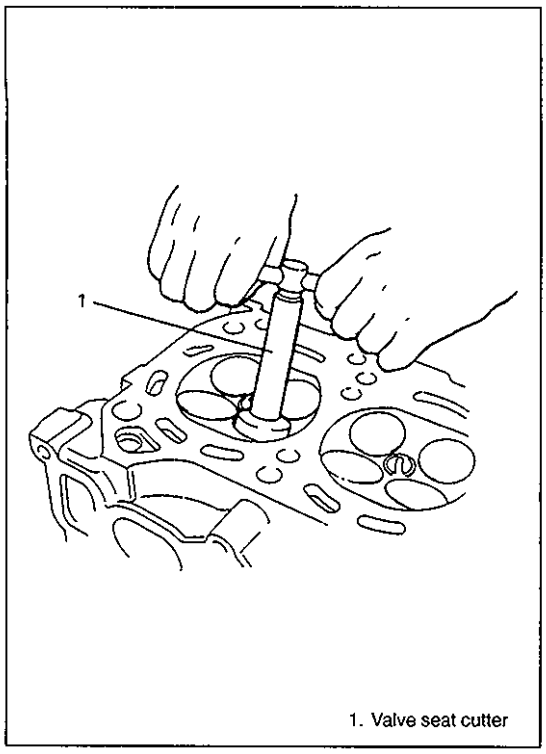
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- Seating contact width:
  Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.

  Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

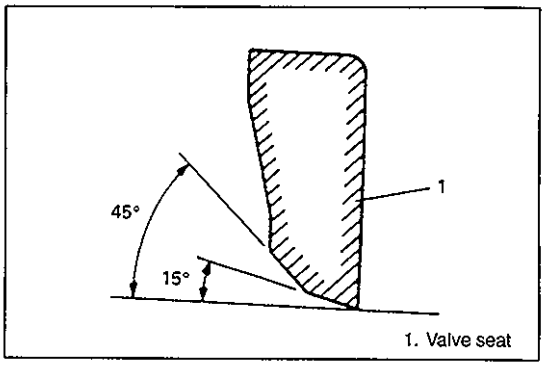
Standard seating width revealed by contact pattern on valve face	In	1.1 – 1.3 mm (0.0433 – 0.0512 in.)
	Ex	



1. Valve seat cutter

- Valve seat repair:
  A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.
  1) EXHAUST VALVE SEAT: Use valve seat cutters to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

     Seat width for exhaust valve seat:
     1.1 – 1.3 mm (0.0433 – 0.0512 in.)

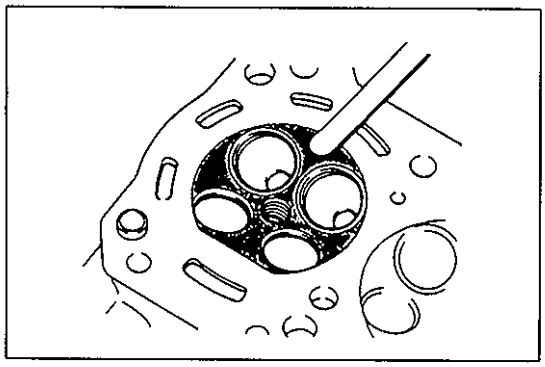


1. Valve seat

  2) INTAKE VALVE SEAT: Cutting sequence is the same as for exhaust valve seats.

     Seat width for intake valve seat:
     1.1 – 1.3 mm (0.0433 – 0.0512 in.)

  3) VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

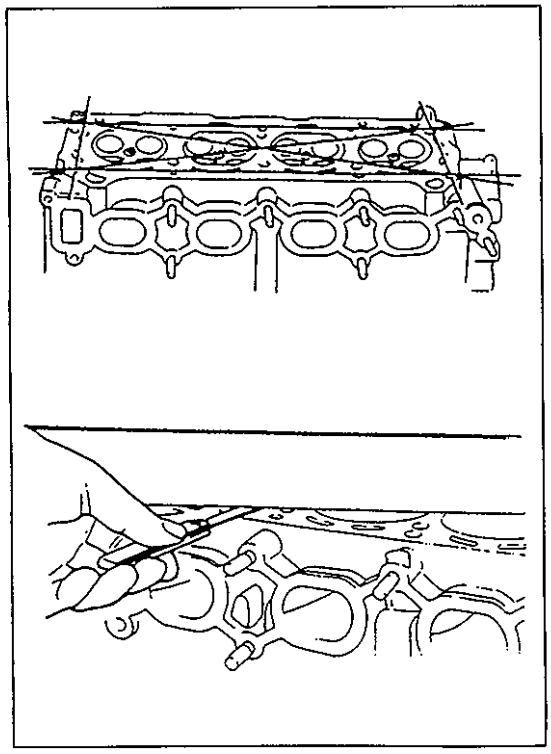


Cylinder Head

- Remove all carbon from combustion chambers.

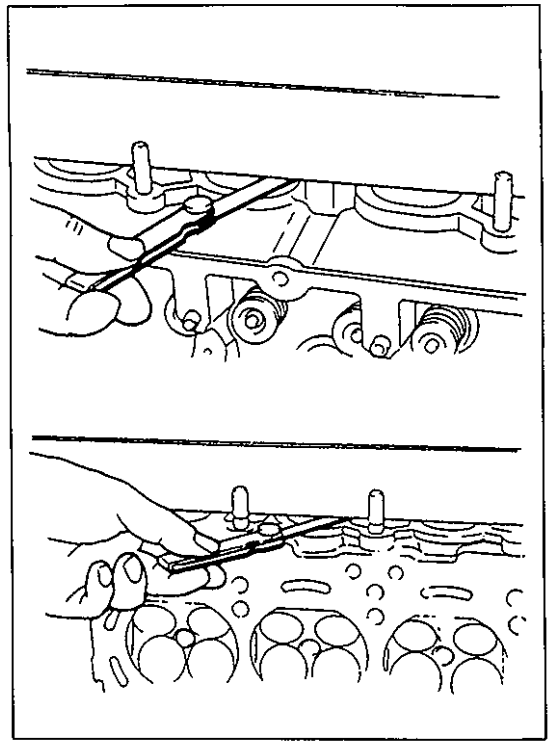
  NOTE:
  Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarboning. The same applies to valves and valve seats, too.

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.



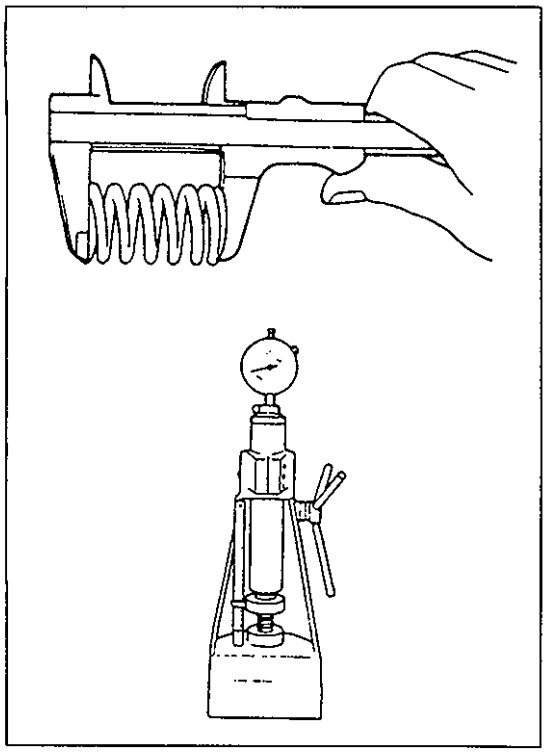
- Flatness of gasketed surface:
  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head. Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

  Limit of distortion: 0.05 mm (0.002 in.)



- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

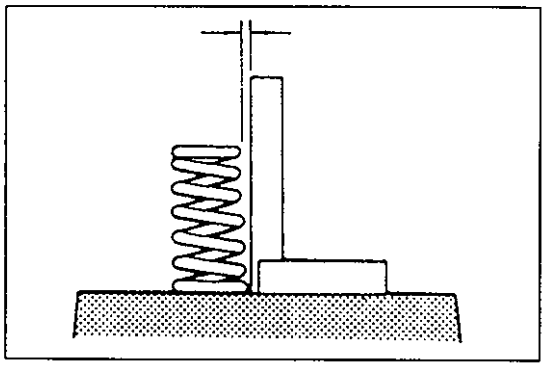
  Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

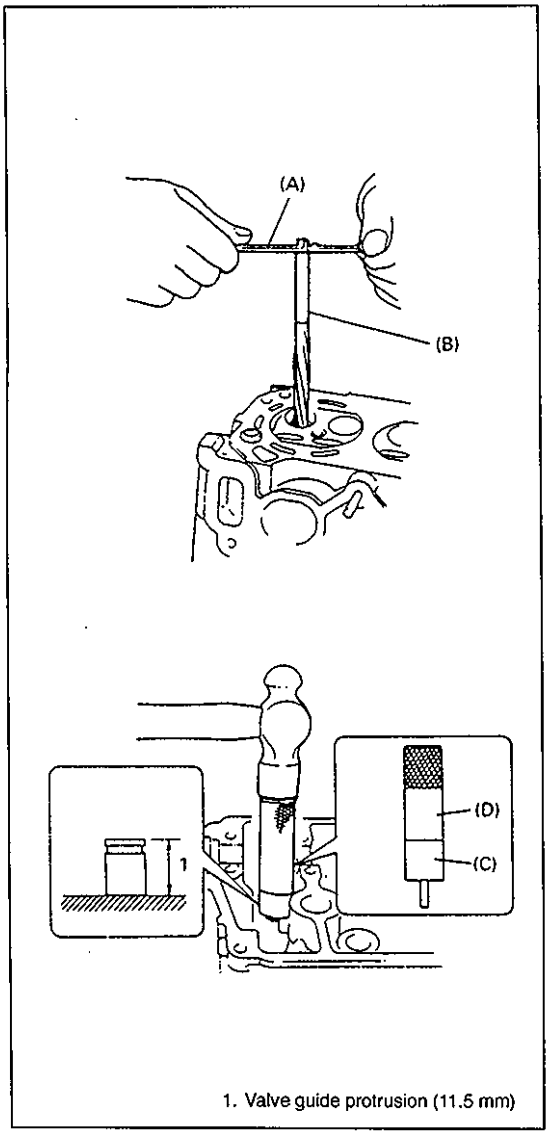
- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

Item	Standard	Limit
Valve spring free length	36.83 mm (1.4500 in.)	35.67 mm (1.4043 in.)
Valve spring preload	10.7 – 12.5 kg for 31.5 mm (23.6 – 27.5 lb/1.24 in.)	9.3 kg for 31.5 mm (20.5 lb/1.24 in.)



- Spring squareness:
  Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

  Valve spring squareness limit: 2.0 mm (0.079 in.)



1. Valve guide protrusion (11.5 mm)

ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so remove burrs and make it truly round.

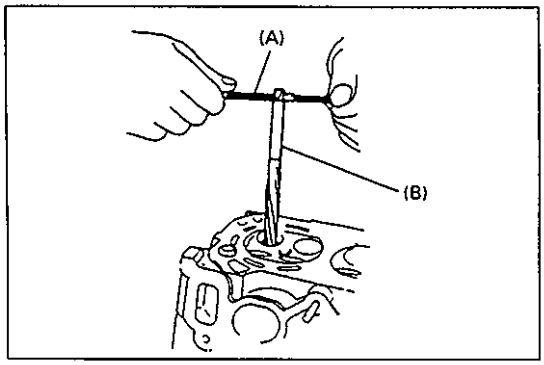
Special Tool
(A): 09916-34542
(B): 09916-38210

2) Install valve guide to cylinder head.
Heat cylinder head uniformly at a temperature of 80 to 100°C (176 to 212°F) so that head will not be distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head. After installing, make sure that valve guide protrudes by 11.5 mm (0.45 in.) from cylinder head.

Special Tool
(C): 09916-56011
(D): 09916-58210

NOTE:
- **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

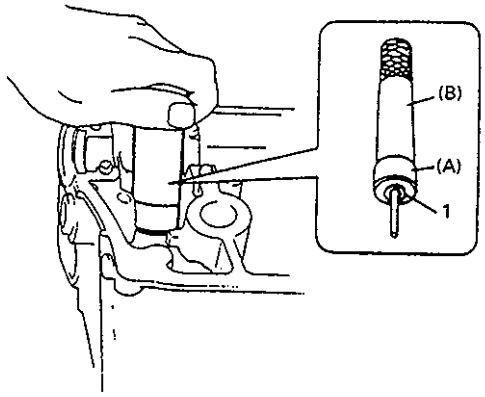
Valve guide oversize: 0.03 mm (0.0012 in.)
Valve guide protrusion (In and Ex): 11.5 mm (0.45 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

Special Tool
(A): 09916-34542
(B): 09916-34550

4) Install valve spring seat to cylinder head.

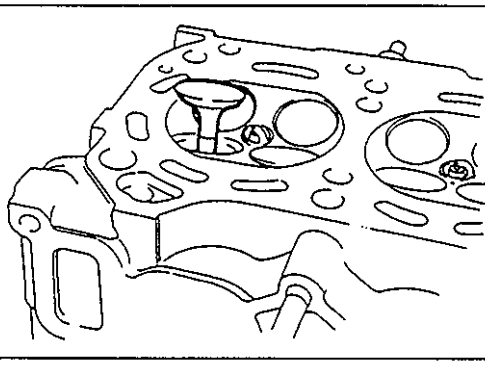


1. Valve stem seal

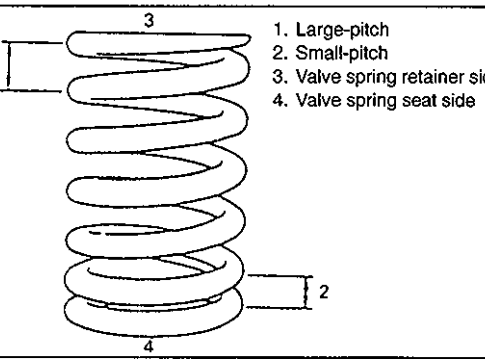
5) Install new valve stem seal to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

Special Tool
(A): 09917-98221
(B): 09916-58210

NOTE:
- **Do not reuse seal once disassembled. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**

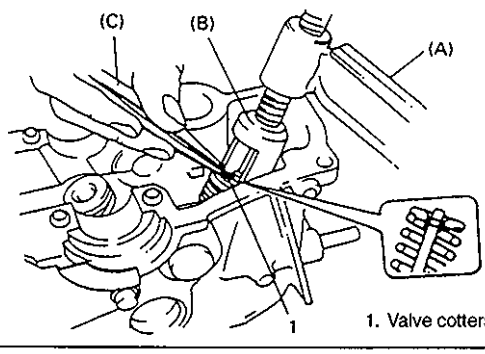


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



1. Large-pitch
2. Small-pitch
3. Valve spring retainer side
4. Valve spring seat side

7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).

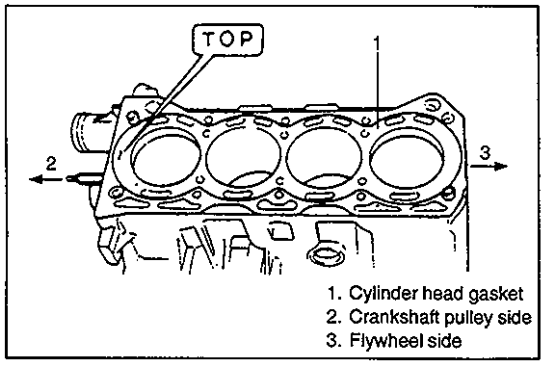


1. Valve cotters

8) Using special tool (Valve lifter), compress valve spring and fit two valve cotters into groove in valve stem.

Special Tool
(A): 09916-14510
(B): 09916-14910
(C): 09916-84511

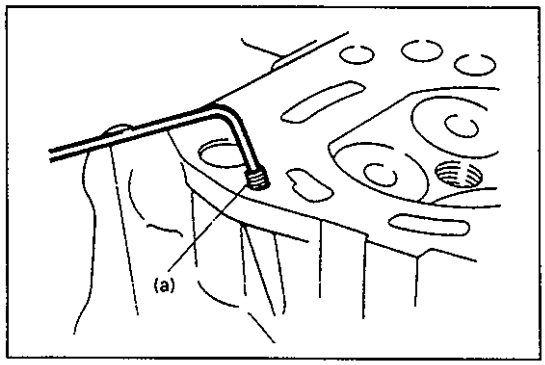
9) Install rocker arms, springs and rocker arm shaft as previously outlined.
10) Install intake manifold and exhaust manifold.



1. Cylinder head gasket
2. Crankshaft pulley side
3. Flywheel side

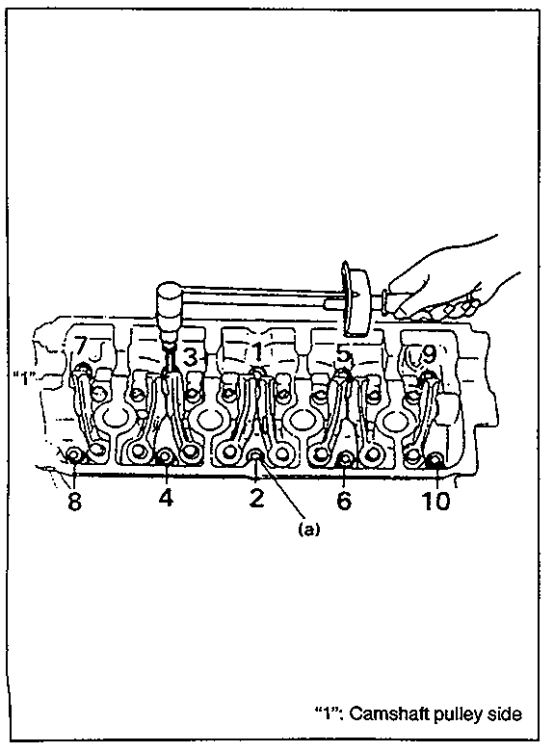
INSTALLATION

1) Remove old gasket and oil on mating surfaces and install new head gasket as shown in figure, that is, "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



2) Check to make sure that oil jet (venturi plug) is installed and if it is, that it is not clogged.
When installing it, be sure to tighten to specified torque.

Tightening Torque
(a): 5 N·m (0.5 kg-m, 4.0 lb-ft)

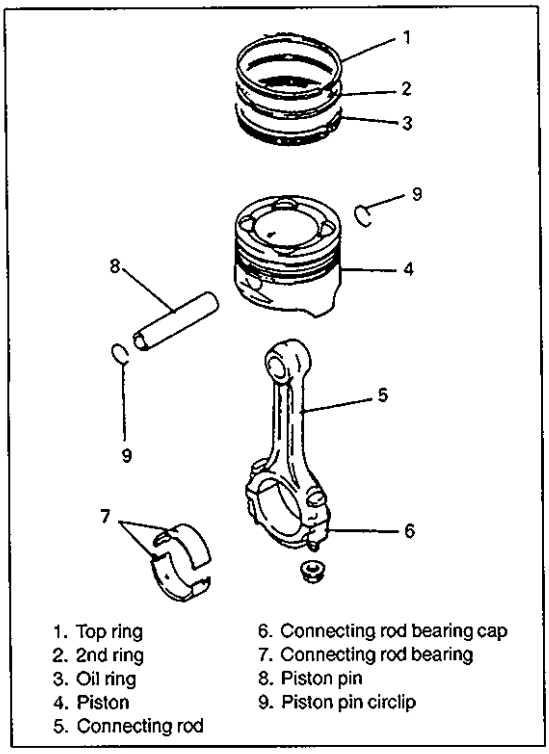


"1": Camshaft pulley side

3) Apply engine oil to cylinder head bolts and tighten them gradually as follows.
   (1) Tighten all bolts to 35 N·m (3.5 kg-m, 25.0 lb-ft) according to numerical order in figure.
   (2) In the same manner as in (1), tighten them to 55 N·m (5.5 kg-m, 40.0 lb-ft).
   (3) In the same manner as in (1) again, tighten them to specified torque.

Tightening Torque
(a): 68 N·m (6.8 kg-m, 49.5 lb-ft)

4) Reverse removal procedure for installation.
5) Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
6) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
7) Adjust intake and exhaust valve lashes as previously outlined.
8) Adjust accelerator cable play. Refer to section 6E.
9) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
10) Refill cooling system referring to "ENGINE COOLING" section.
11) Connect negative cable at battery.
12) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.
13) Confirm that ignition timing is within specification referring to "IGNITION SYSTEM" section.

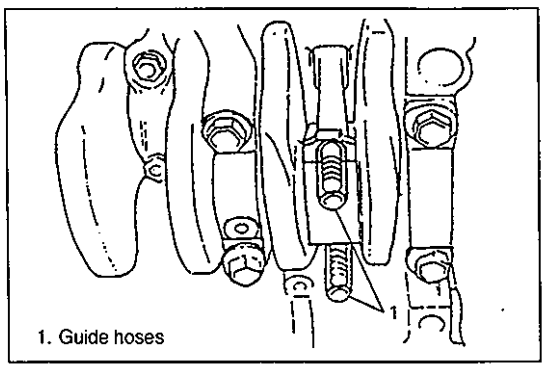


1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS

REMOVAL

1) Remove cylinder head from cylinder block as previously outlined.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer as previously outlined.
4) Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.

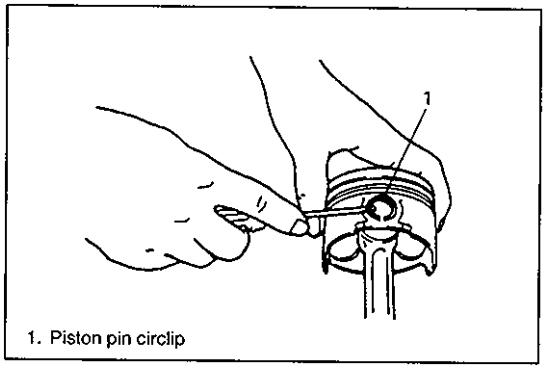


1. Guide hoses

5) Remove rod bearing caps.
6) Install guide hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.
7) Decarbon top of cylinder bore before removing piston from cylinder.
8) Push piston and connecting rod assembly out through the top of cylinder bore.

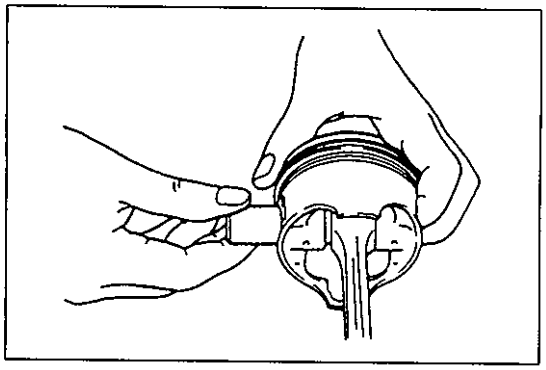
DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



1. Piston pin circlip

2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips, as shown.



- Force piston pin out.

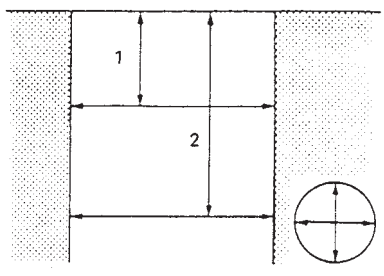
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

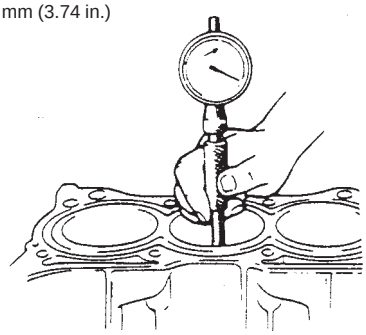
INSPECTION

Cylinders

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use oversize piston.



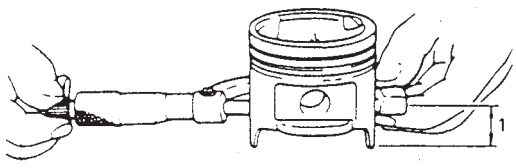
1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)



- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of following conditions is noted, rebore cylinder.
  1) Cylinder bore dia. exceeds limit.
  2) Difference of measurements at two positions exceeds taper limit.
  3) Difference between thrust and axial measurements exceeds out-of-round limit.

  Cylinder bore dia. limit: 74.15 mm (2.9193 in.)
  Taper and out-of-round limit: 0.10 mm (0.0039 in.)

  NOTE:
  If any one of four cylinders has to be rebored, rebore all four to the same next oversize. This is necessary for the sake of uniformity and balance.

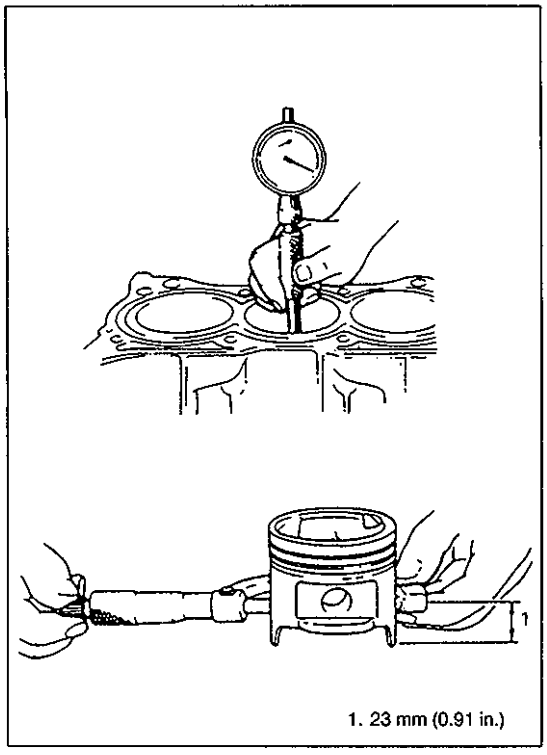


1. 23 mm (0.91 in.)

Pistons

- Inspect piston for faults, cracks or other damaged.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 23 mm (0.91 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	73.970 – 73.990 mm (2.9122 – 2.9130 in.)
	Oversize: 0.25 mm (0.0098 in.)	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
	0.50 mm (0.0196 in.)	74.470 – 74.480 mm (2.9319 – 2.9323 in.)

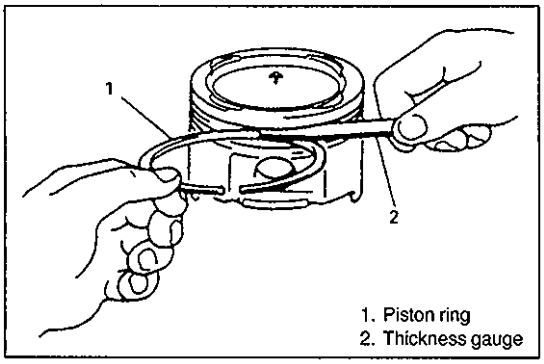


1. 23 mm (0.91 in.)

- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

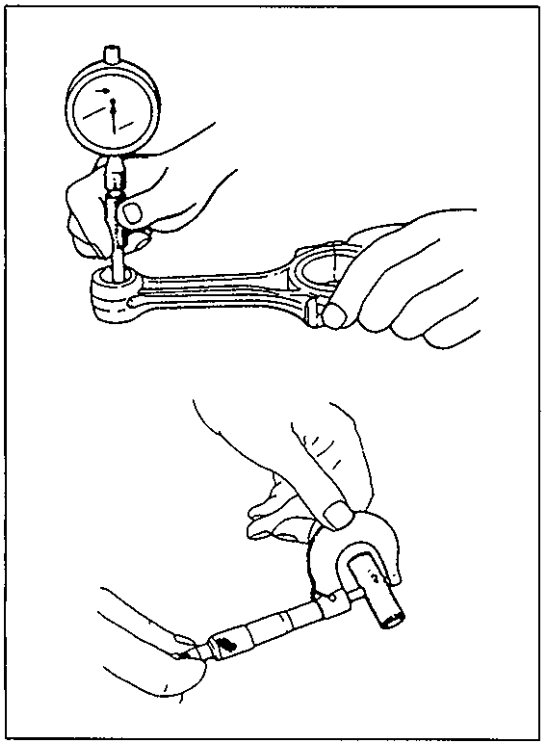
  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



1. Piston ring
2. Thickness gauge

- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon.
  Fit new piston ring into piston groove, and measure clearance between ring and ring land by using thickness gauge.
  If clearance is out of specification, replace piston.

  Ring groove clearance:
  Top: 0.03 – 0.07 mm (0.0012 – 0.0027 in.)
  2nd: 0.02 – 0.06 mm (0.0008 – 0.0023 in.)



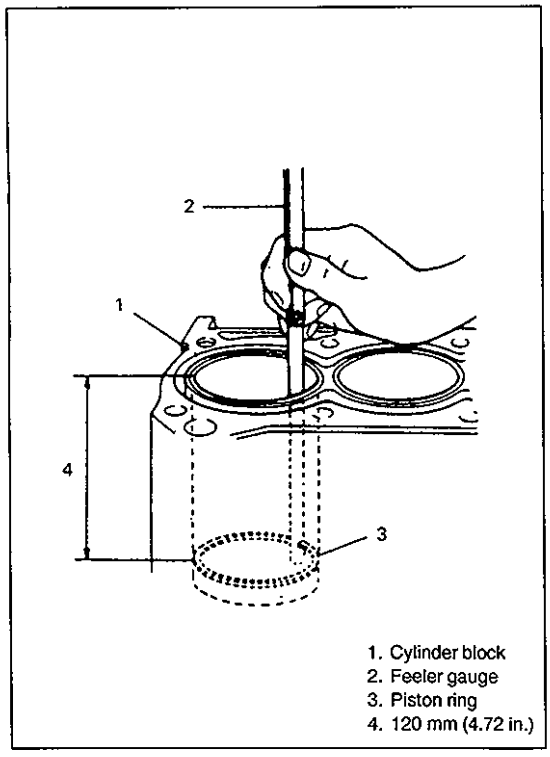
Piston Pin

- Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod or piston.
- Piston pin clearance:
  Check piston pin clearance in small end. Replace connecting rod if its small end is badly worn or damaged or if measured clearance exceeds limit.

Item	Standard	Limit
Piston clearance in small end	0.003 – 0.014 mm (0.0001 – 0.0006 in.)	0.05 mm (0.0020 in.)

Small-end bore:
19.003 – 19.011 mm (0.7482 – 0.7486 in.)

Piston pin dia.:
18.997 – 19.000 mm (0.7479 – 0.7480 in.)



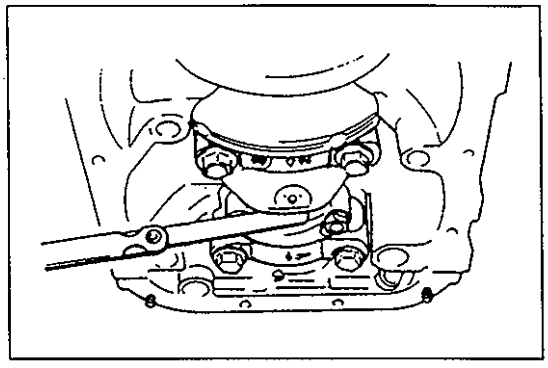
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.2 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.35 – 0.50 mm (0.0138 – 0.0197 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.1 – 0.4 mm (0.0039 – 0.0157 in.)	1.7 mm (0.0669 in.)



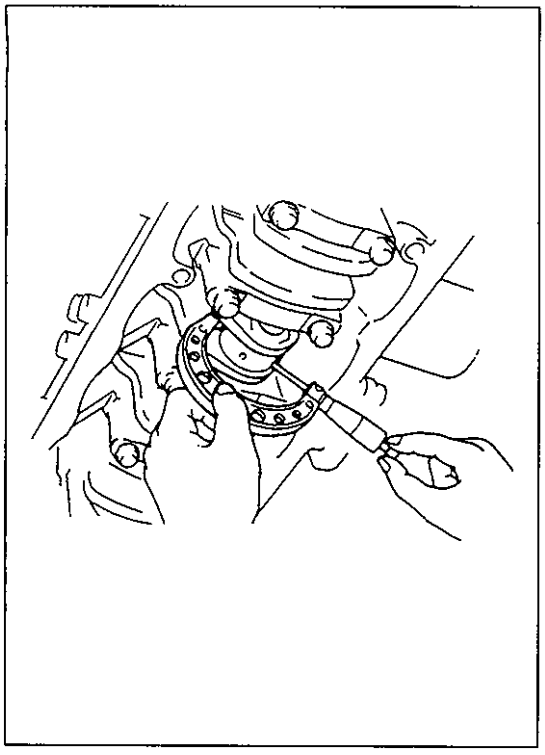
Connecting Rod

- Big-end side clearance:
  Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

Item	Standard	Limit
Big-end side clearance	0.10 – 0.25 mm (0.0039 – 0.0098 in.)	0.35 mm (0.0137 in.)

- Connecting rod alignment:
  Mount connecting rod on aligner to check it for bow and twist and, if limit is exceeded, replace it.

  Limit on bow: 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

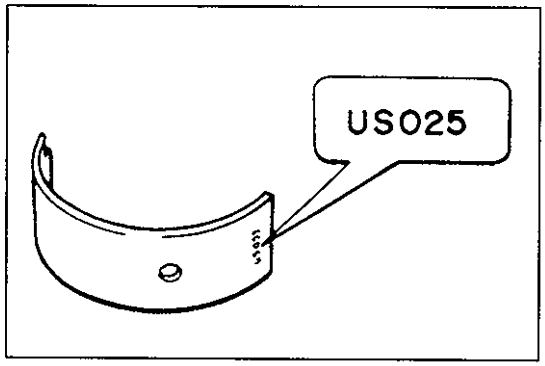


Crank Pin and Connecting Rod Bearings

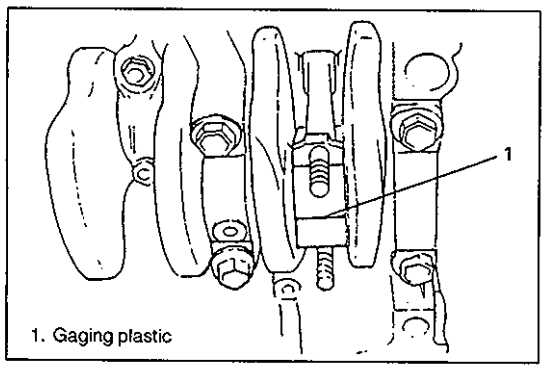
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin referring to following step 6).

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6528 – 1.6535 in.)
0.25 mm (0.0098 in.) undersize	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

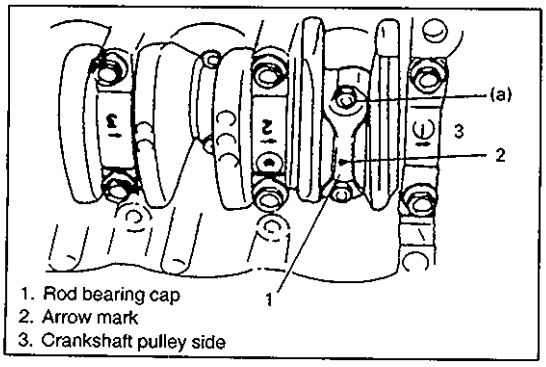
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0. 25 mm undersize bearing has the stamped number (US025) on its backside as indicated in figure, but standard size one has no number.

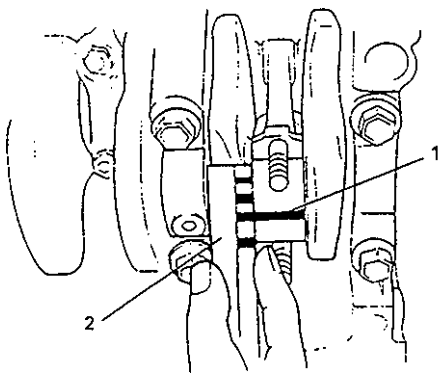


- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



4) Install rod bearing cap to connecting rod.
   When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, as shown in figure. After applying engine oil to rod bolts, tighten cap nuts to specified torque. DO NOT turn crankshaft with gaging plastic installed.

   Tightening Torque
   (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)



1. Gaging plastic
2. Scale

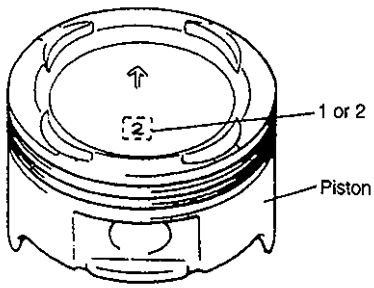
5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance). If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

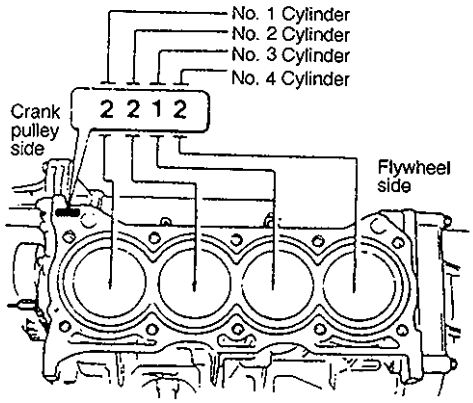
Item	Standard	Limit
Bearing clearance	0.020 – 0.050 mm (0.0008 – 0.0019 in.)	0.080 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, replace crankshaft or regrind crankpin to undersize as follows.
   - Install 0.25 mm undersize bearing to connecting rod big end.
   - Measure bore diameter of connecting rod big end.
   - Regrind crankpin to following finished diameter.

Finished crankpin dia.	=	Measured big end bore dia. (including undersize bearing)	–	0.035 mm (0.0014 in.)

   - Confirm that bearing clearance is within above standard value.





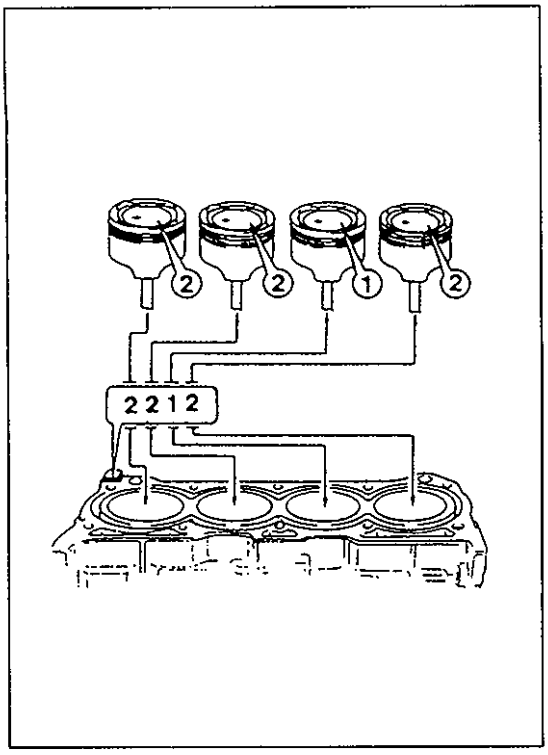
ASSEMBLY

NOTE:

Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.

a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.

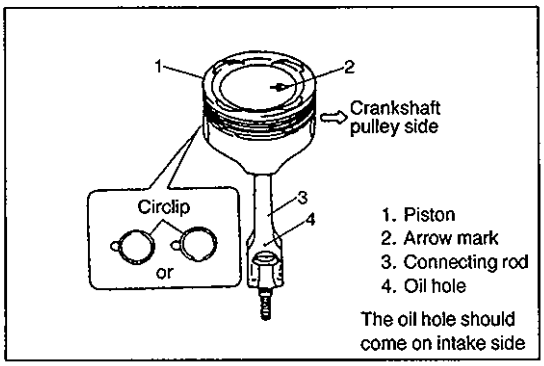
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown. The first number represents inner diameter of No.1 cylinder, the second number of No.2 cylinder, the third number of No.3 cylinder and the fourth number of No.4 cylinder.



c) Stamped number on piston and that on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with number 2 and a number 1 piston to cylinder with number 1.

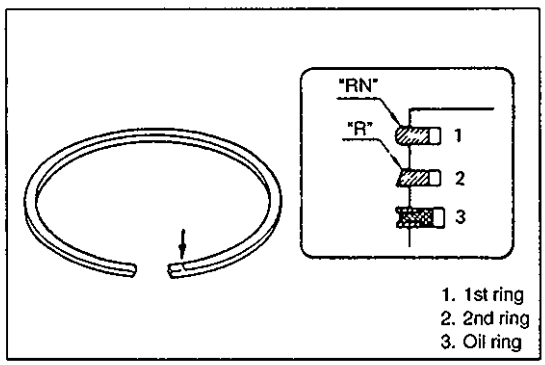
Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number (mark)	Bore diameter	
1	73.98 – 73.99 mm (2.9126 – 2.9130 in.)	1	74.01 – 74.02 mm (2.9138 – 2.9141 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	73.97 – 73.98 mm (2.9122 – 2.9126 in.)	2	74.00 – 74.01 mm (2.9134 – 2.9138 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.

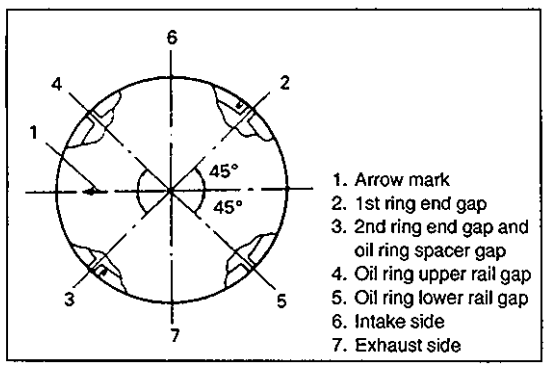


1) Install piston pin to piston and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

NOTE:
Circlip should be installed with its cut part facing either up or down as shown in figure.



2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN", "T" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st ring differs from 2nd ring in thickness, shape and color of surface contacting cylinder wall.
  Distinguish 1st ring from 2nd ring by referring to figure.
- When installing oil ring, install spacer first and then two rails.

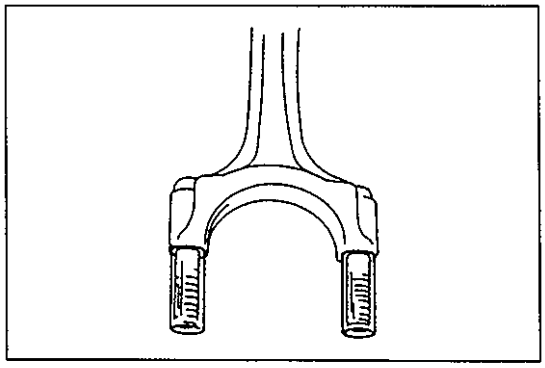


3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

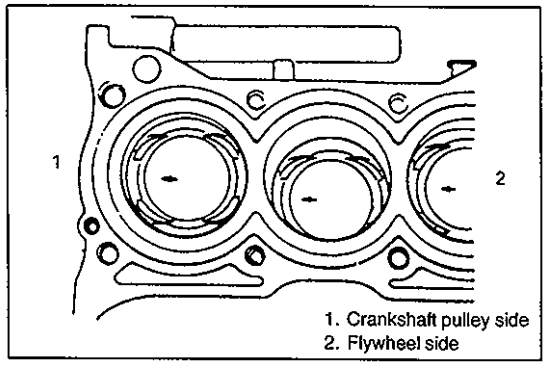
INSTALLATION OR CONNECTION

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crankpins.

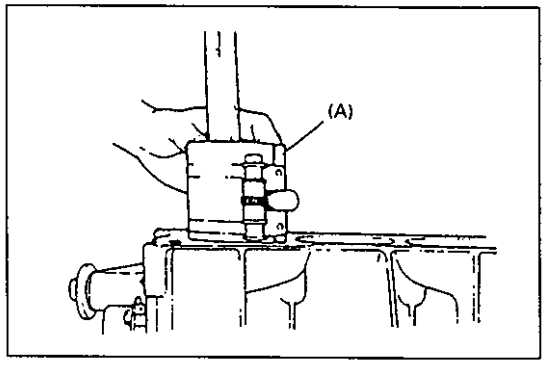
NOTE:
Do not apply oil between connecting rod and bearing or between bearing cap and bearing.



2) Install guide hoses over connecting rod bolts.
These guide hoses protect crankpin and threads of rod bolt from damage during installation of connecting rod and piston assembly.

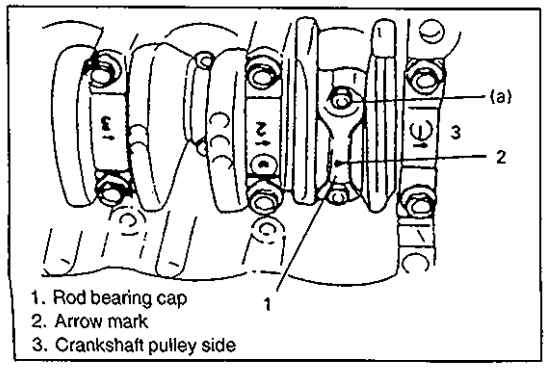


3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark on piston head to crankshaft pulley side.



4) Install piston and connecting rod assembly into cylinder bore.
Use special tool (Piston ring compressor) to compress rings.
Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special Tool
(A): 09916-77310



5) Install bearing cap:
Point arrow mark on cap to crankshaft pulley side.
Tighten cap nuts to specification.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

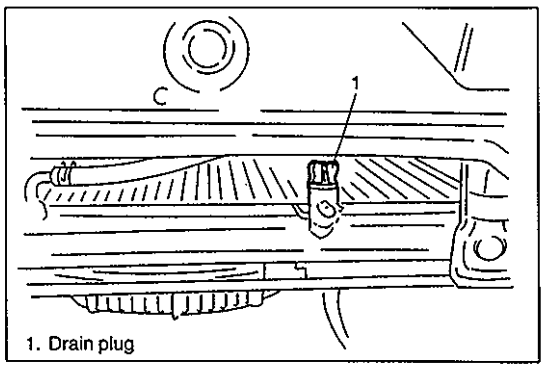
6) Reverse removal procedure for installation, as previously outlined.
7) Adjust water pump drive belt tension, referring to section 0B.
8) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
9) Adjust intake and exhaust valve lashes as previously outlined.
10) Adjust accelerator cable play. Refer to section 6E.
11) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
12) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in section 0B.
13) Refill cooling system referring to "ENGINE COOLING" section.
14) Connect negative cable at battery.
15) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.
16) Verify that ignition timing is within specification referring to "IGNITION SYSTEM" section.

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

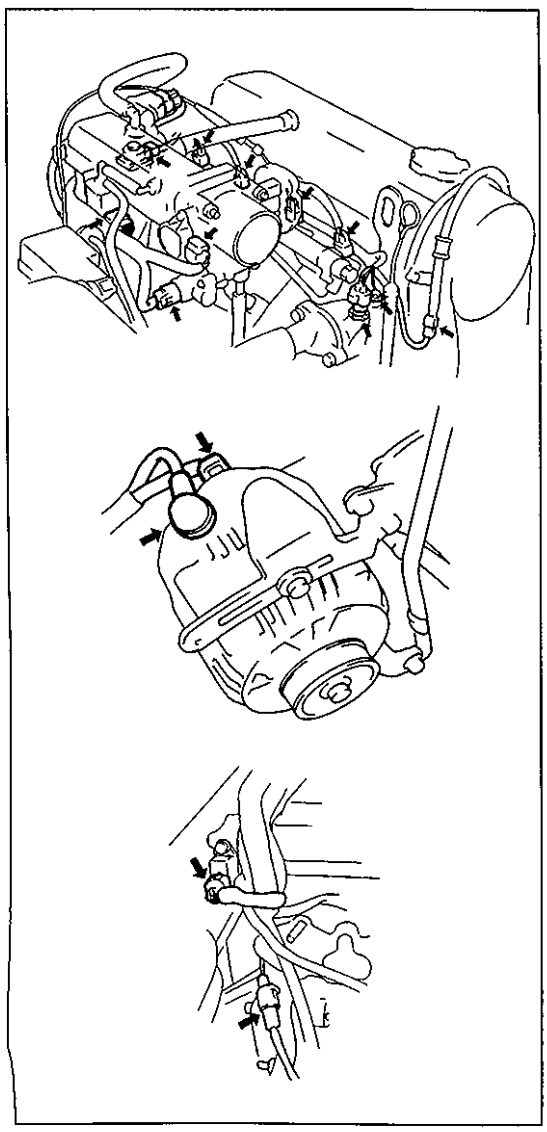
REMOVAL

1) Release fuel pressure in fuel feed line by referring to Fuel Pressure Relief Procedure in section 6.
2) Disconnect negative cable from battery.
3) Remove engine hood.



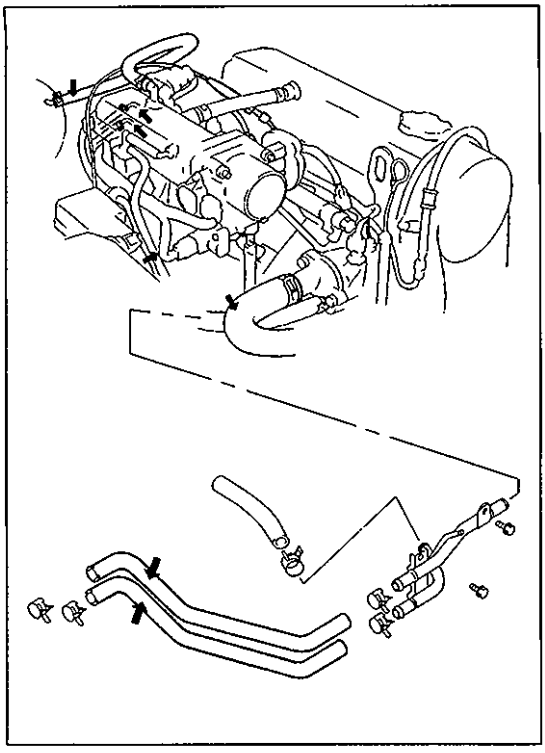
1. Drain plug

4) Drain cooling system.
5) Remove radiator fan and fan shroud.
   Refer to "ENGINE COOLING" section.

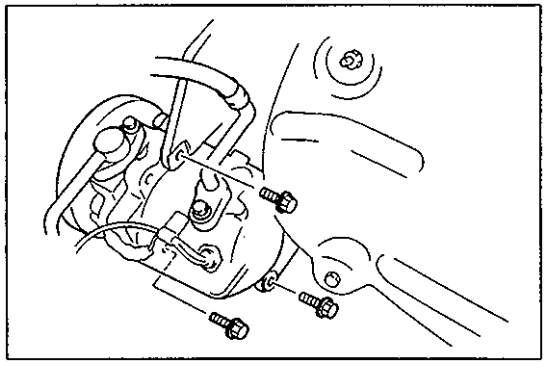


6) Remove air intake hose.
7) Disconnect following electric wires:
   - Ground wires from intake manifold
   - Camshaft position sensor
   - EGR valve (if equipped)
   - EVAP canister purge valve
   - Engine coolant temp. sensor
   - Throttle position sensor
   - Idle air control valve
   - Fuel injector wire at the connector
   - Generator
   - Ground cable from cylinder block
   - Heated oxygen sensor
   - Engine oil pressure switch

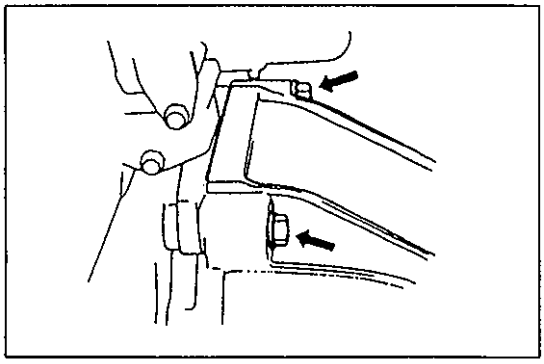
   and then release wire harnesses from clamps.
8) Remove starter motor.



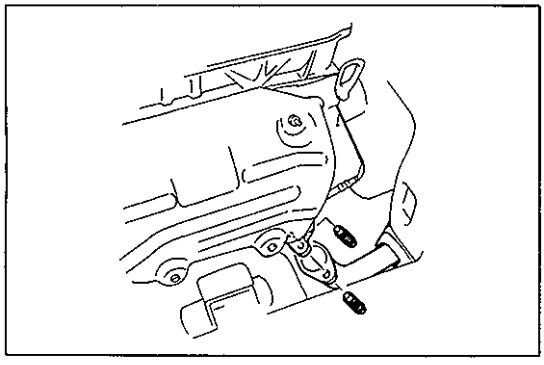
9) Disconnect following hoses:
   - Canister purge hose from EVAP canister purge valve
   - Radiator outlet hose from inlet pipe
   - Brake booster hose from intake manifold
   - Heater inlet and outlet hose from pipe
   - Fuel feed hose and return hose from each pipe
   - A/T fluid hose clamp from bracket
10) Disconnect accelerator cable from throttle body and each clamp.



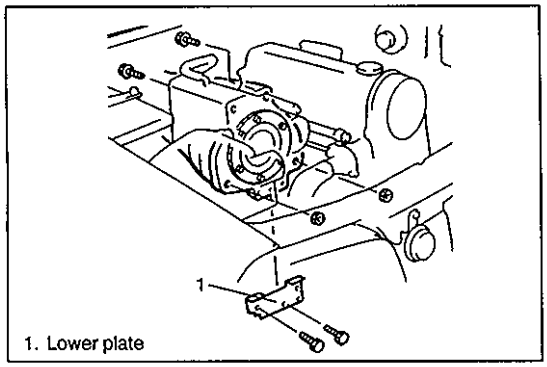
11) With hose connected, detach A/C compressor and/or power steering pump with bracket from cylinder block if equipped.



12) Loosen bolts fastening cylinder block and transmission.

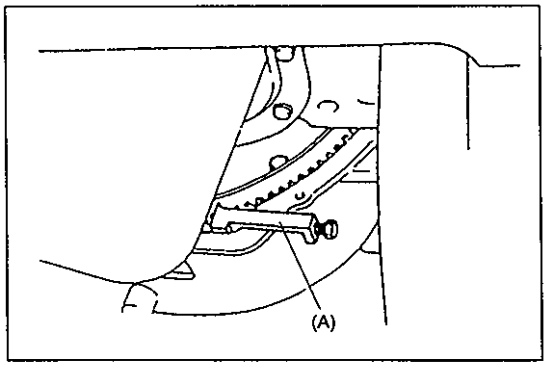


13) Hoist vehicle.
14) Drain engine oil if necessary.
15) Remove exhaust pipe bolts.



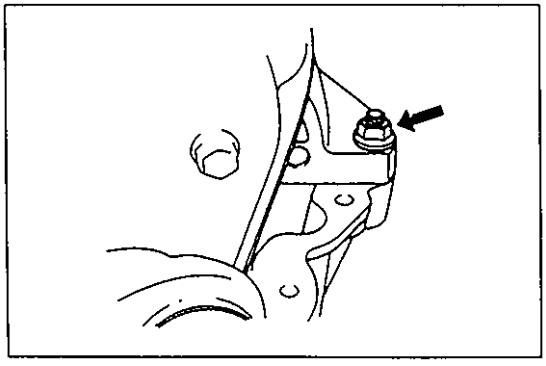
1. Lower plate

16) Remove clutch housing (torque converter housing) lower plate.

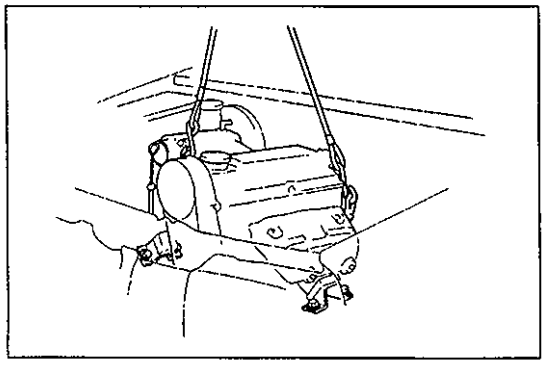


17) Remove torque converter bolts (A/T).

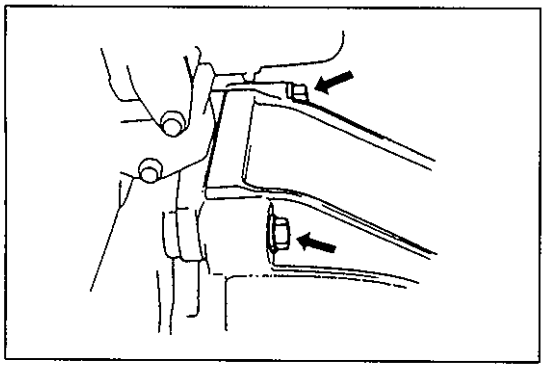
Special Tool
(A): 09927-56010



18) Remove nuts fastening cylinder block and transmission.
19) Lower vehicle.
20) Support transmission with jack.
With A/T vehicle, don't jack under A/T oil pan to support transmission.

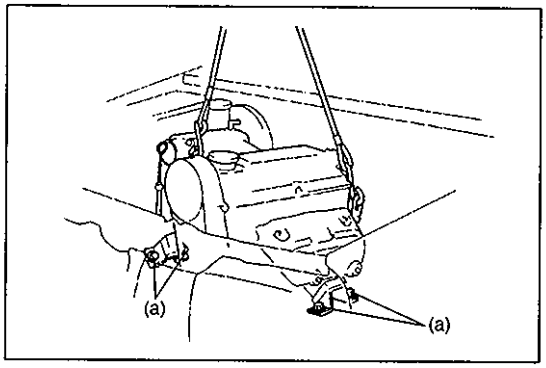


21) Install lifting device.
22) Remove engine mounting bracket nuts (R & L).
23) Before lifting engine, check to ensure all hoses, electric wires and cables are disconnected from engine.
24) Remove engine assembly from chassis and transmission by lifting a little, sliding towards the front side, and then carefully hoist engine assembly.



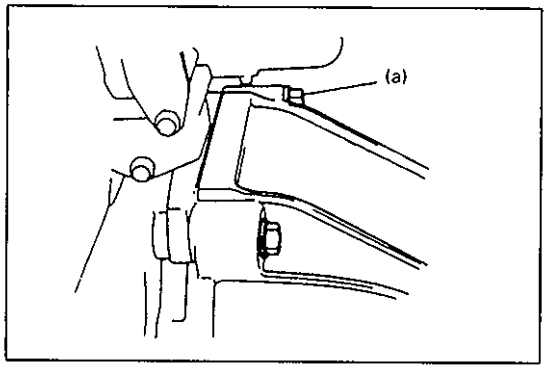
INSTALLATION

1) Lower engine assembly into engine compartment and connect engine to transmission.
   Hand-tighten bolts and nuts fastening cylinder block and transmission.



2) Tighten engine mounting bracket nuts (R & L).

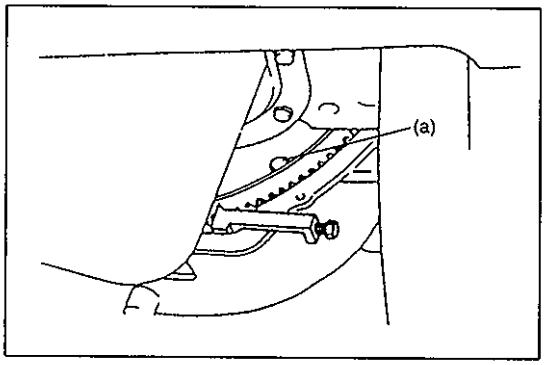
   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolts fastening cylinder block and transmission to specified torque.

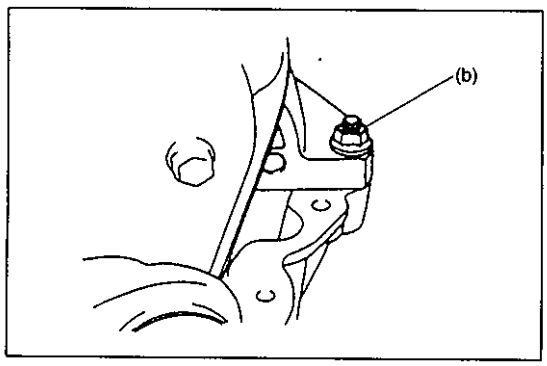
   Tightening Torque
   (a): 80 N·m (8.0 kg-m, 58.0 lb-ft)

4) Remove lifting device.



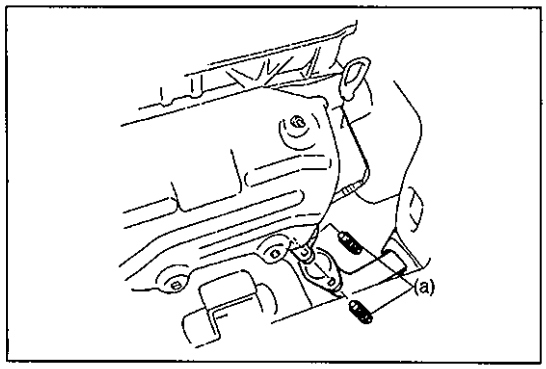
5) Reverse removal procedure for installation, noting the following.
   - Tighten torque converter bolts to specified torque (A/T).

     Tightening Torque
     (a): 65 N·m (6.5 kg-m, 47.0 lb-ft)



   - Tighten nuts fastening cylinder block and transmission to specified torque.

     Tightening Torque
     (b): 80 N·m (8.0 kg-m, 58.0 lb-ft)

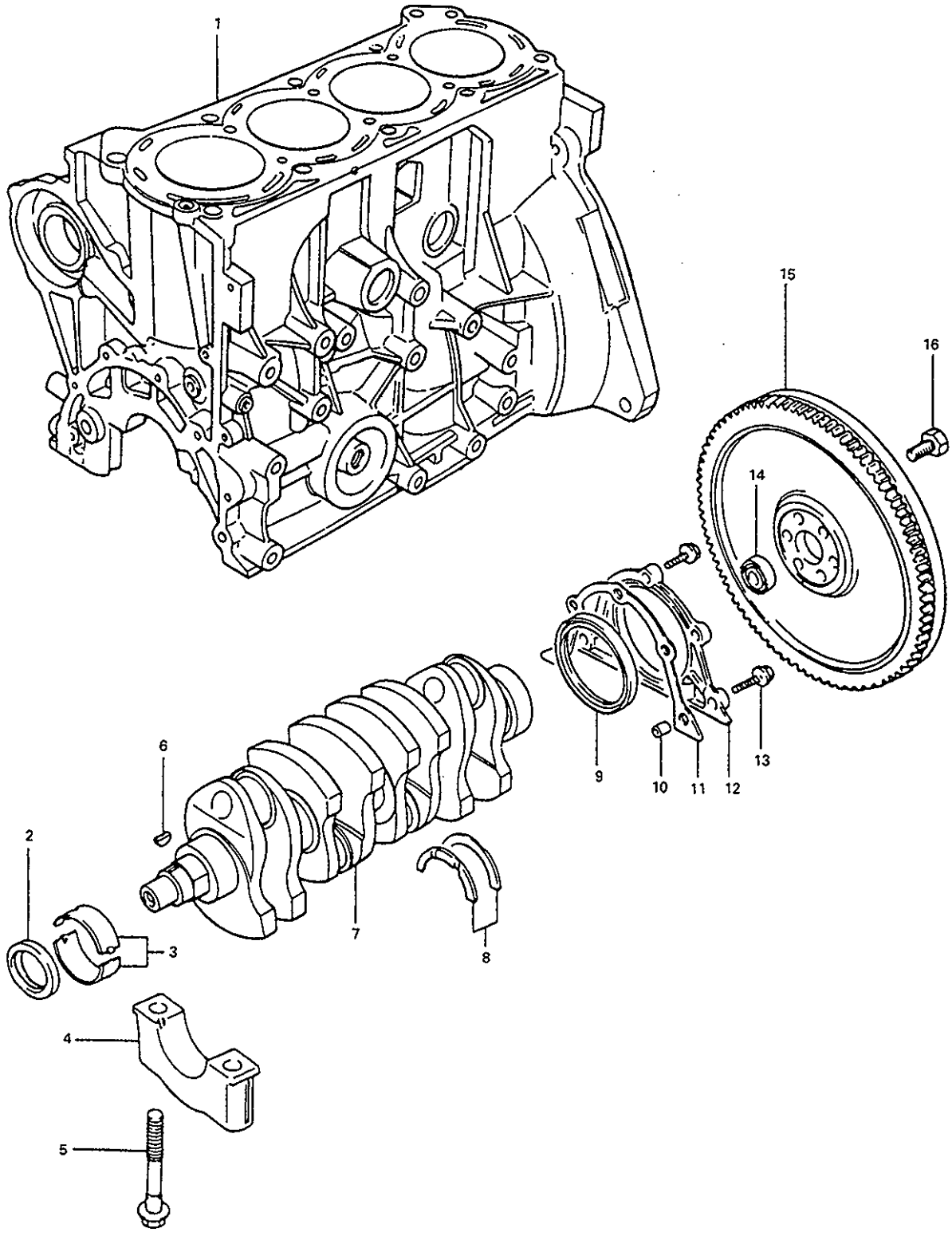


- Tighten bolts of exhaust pipes to specified torque.

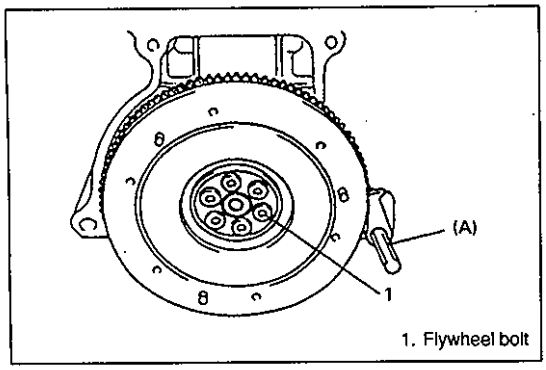
  Tightening Torque
  (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)

6) Adjust water pump drive belt tension, referring to "ENGINE COOLING" section.
7) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
8) Adjust accelerator cable play. Refer to section 6E.
9) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
10) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in section 0B.
11) Refill cooling system referring to "ENGINE COOLING" section.
12) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Front oil seal
3. Main bearing
4. Bearing cap
5. Cap bolt
6. Timing pulley key
7. Crankshaft
8. Thrust bearing
9. Rear oil seal
10. Pin
11. Oil seal housing gasket
12. Oil seal housing
13. Housing bolt
14. Input shaft bearing
15. Flywheel
16. Flywheel bolt

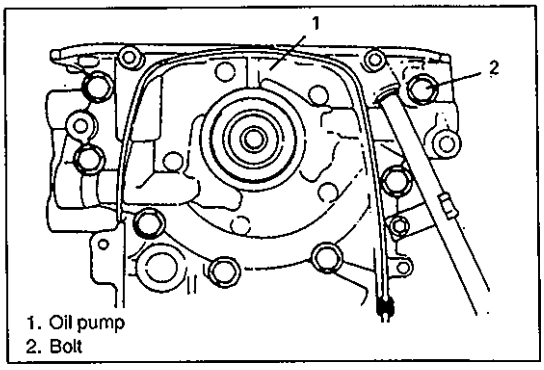


1. Flywheel bolt

REMOVAL

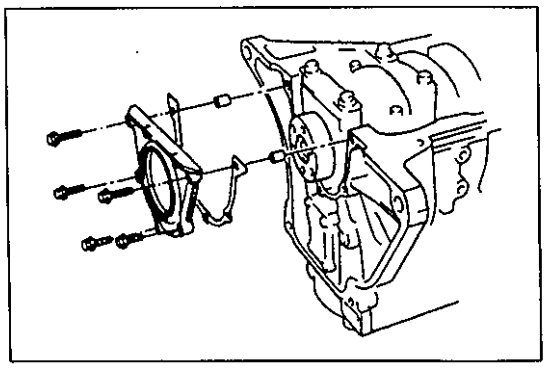
1) Remove engine assembly from body as previously outlined.
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T).

Special Tool
(A): 09924-17810

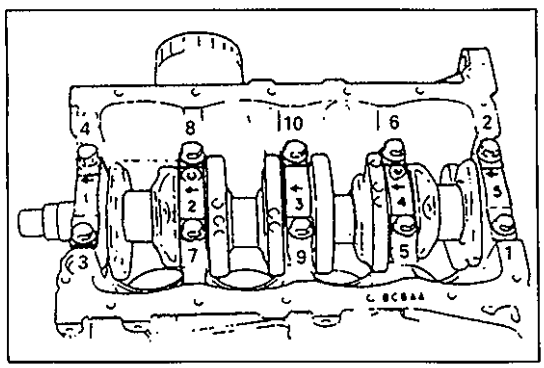


1. Oil pump
2. Bolt

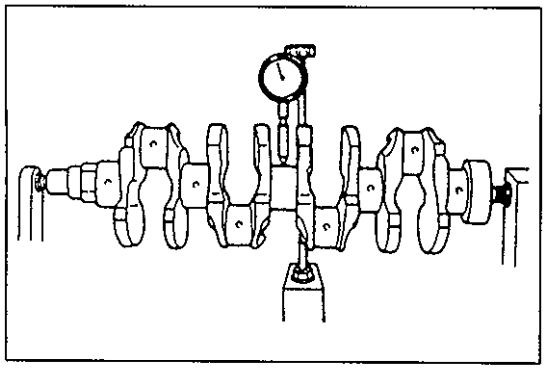
3) Remove crankshaft pulley, timing belt and crankshaft timing pulley.
4) Remove cylinder head assembly.
5) Remove oil pump.



7) Remove oil seal housing.
8) Remove connecting rod bearing caps.



9) Loosen crankshaft bearing cap bolts in such order as indicated in figure a little at a time and remove bearing caps.
10) Remove crankshaft from cylinder block.



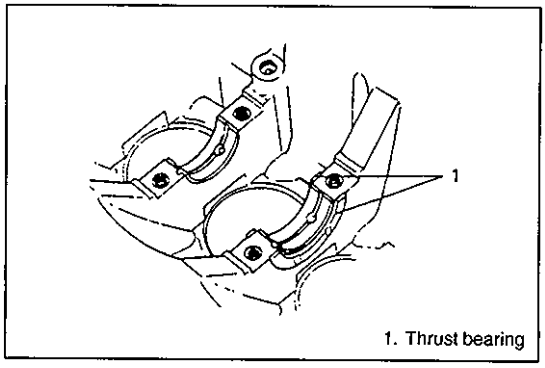
INSPECTION

Crankshaft

Crankshaft runout

Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

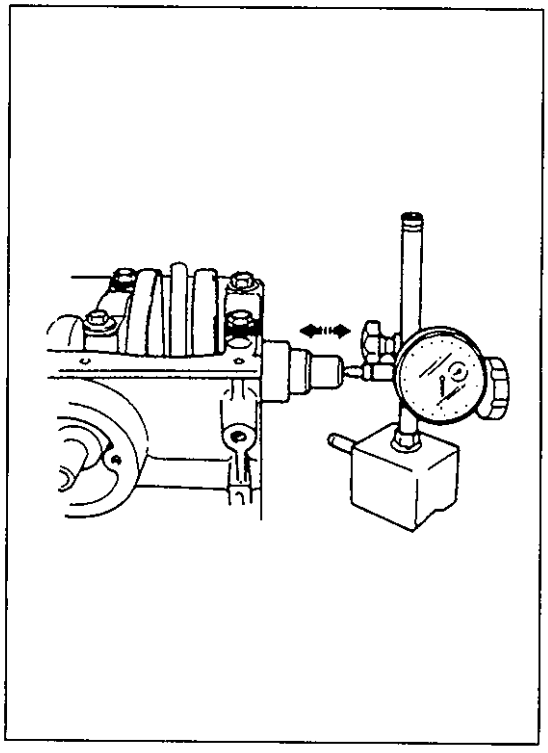
Limit on runout: 0.06 mm (0.0023 in.)



1. Thrust bearing

Crankshaft thrust play

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed.

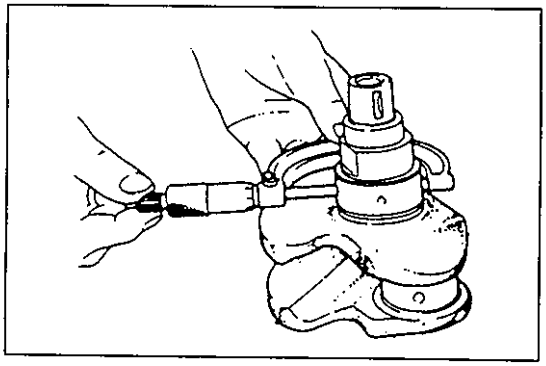


Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.

If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Item	Standard	Limit
Crankshaft thrust play	0.11 – 0.31 mm (0.0044 – 0.0122 in.)	0.38 mm (0.0149 in.)

Thickness of crankshaft thrust bearing	Standard		2.500 mm (0.0984 in.)
	Oversize:	0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)

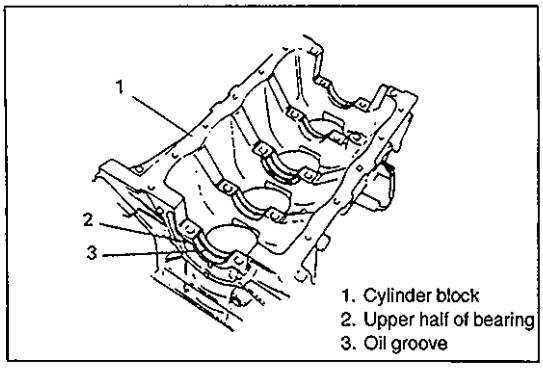


Out-of-round and taper (uneven wear) of journals

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings.

If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

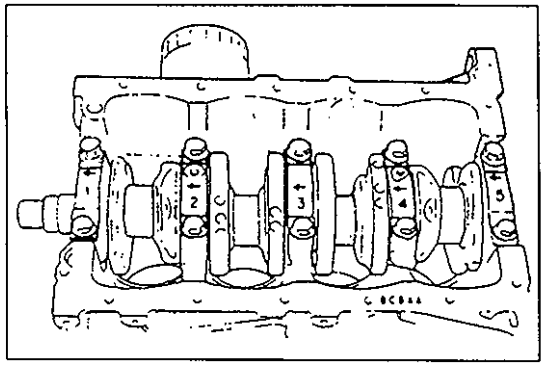
Limit on out-of-round and taper: 0.01 mm (0.0004 in.)



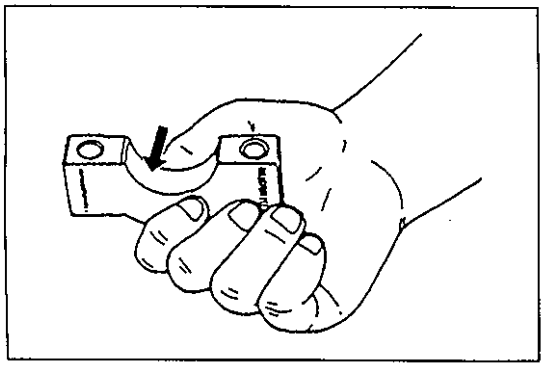
Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing has oil groove as shown in figure. Install this half with oil groove to cylinder block.

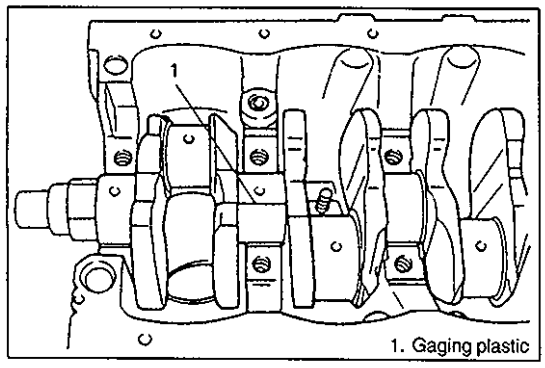


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers "1", "2", "3", "4" and "5". Tighten cap bolts to specified torque.



Inspection

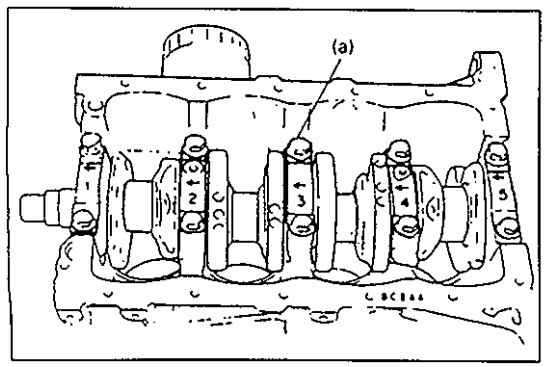
Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace one half without replacing the other half.



Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

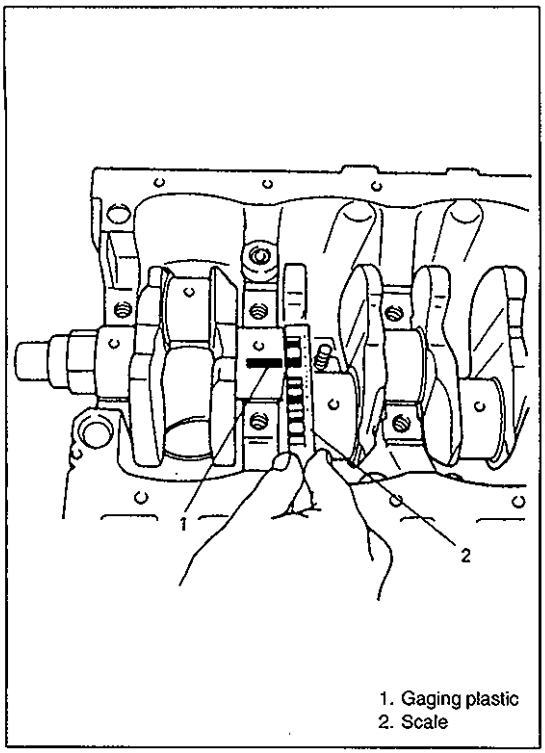
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly toque cap bolts to specified torque.
   Bearing cap MUST be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 52 N·m (5.2 kg-m, 38.0 lb-ft)

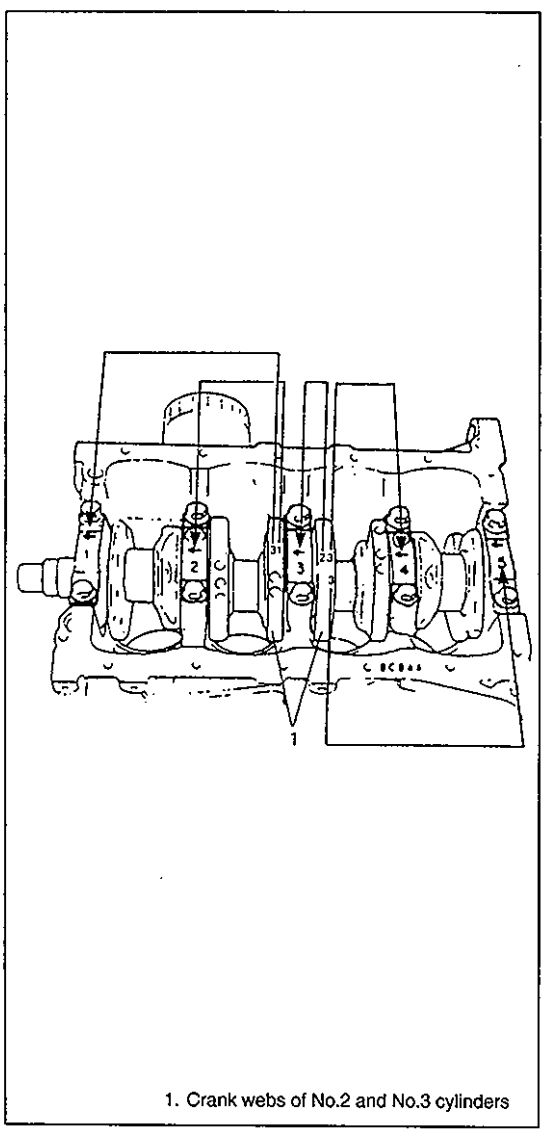
   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.



1. Gaging plastic
2. Scale

5) Remove cap and using scale on gaging plastic envelope, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
After selecting new bearing, recheck clearance.

	Standard	Limit
Bearing clearance	0.014 – 0.034 mm (0.0006 – 0.0013 in.)	0.060 mm (0.0023 in.)



1. Crank webs of No.2 and No.3 cylinders

Selection of main bearings

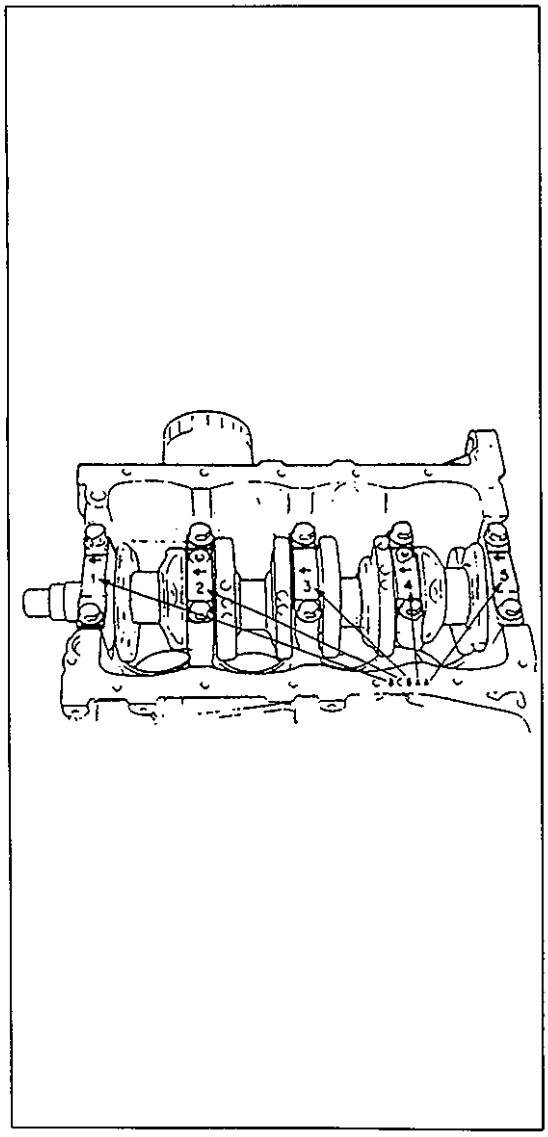
STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to following procedure and install it.

1) First check journal diameter by using following procedure.
As shown in figure, crank webs of No.2 and No.3 cylinders have five stamped numerals.
Three kinds of numerals ("1", "2" and "3") represent following journal diameters.

Numeral stamped	Journal diameter
1	44.994 – 45.000 mm (1.7714 – 1.7716 in.)
2	44.988 – 44.994 mm (1.7712 – 1.7714 in.)
3	44.982 – 44.988 mm (1.7709 – 1.7712 in.)

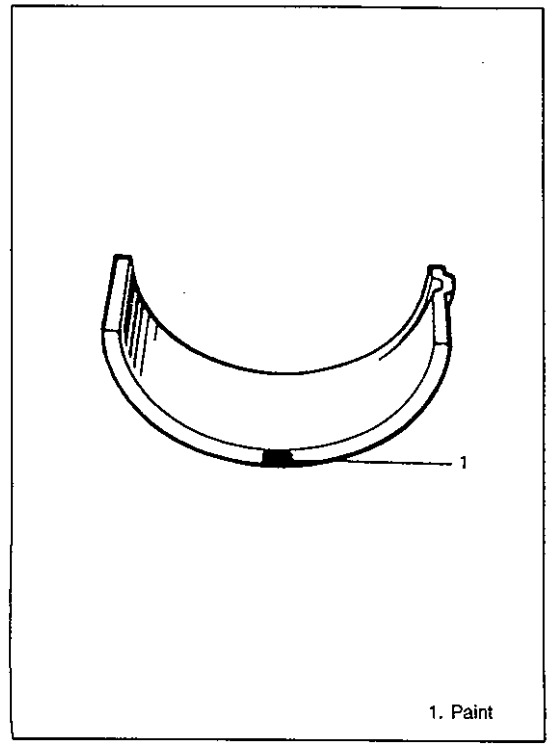
The first, second, third, fourth and fifth (left to right) stamped numerals represent journal diameters at bearing caps "1", "2", "3", "4" and "5" respectively.
For example, in figure, the first (leftmost) numeral "3" indicates that journal dia. at bearing cap "1" is within 44.982 – 44.988 mm, and second one "1" indicate that journal dia. at cap "2" is within 44.994 – 45.000 mm.



2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, four alphabets are stamped as shown in figure.
Three kinds of alphabets ("A", "B" and "C") represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	49.000 – 49.006 mm (1.9291 – 1.9294 in.)
B	49.006 – 49.012 mm (1.9294 – 1.9296 in.)
C	49.012 – 49.018 mm (1.9296 – 1.9298 in.)

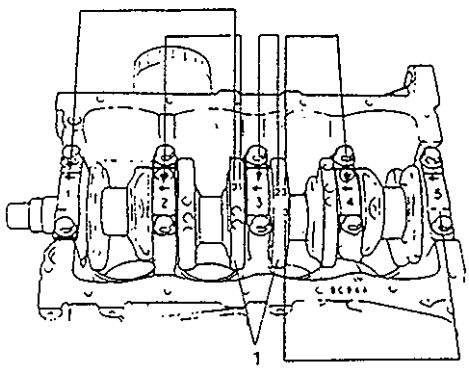
The first, second, third, fourth and fifth (left to right) stamped alphabets represent cap bore diameters of bearing caps "1", "2", "3", "4" and "5", respectively.
For example, in figure, the first (leftmost) alphabet "B" indicates that cap bore dia. of bearing cap "1" is within 49.006 – 49.012 mm, and the fifth (rightmost) alphabet "A" indicates that cap bore dia. of cap "5" is within 49.000 – 49.006 mm.



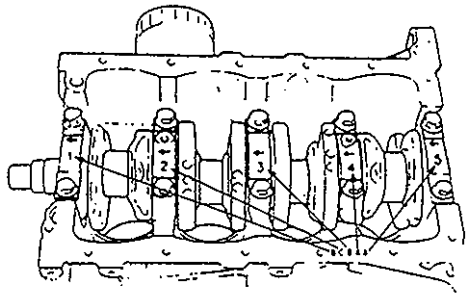
1. Paint

3) There are five kinds fo standard bearings differing in thickness. To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.999 – 2.003 mm (0.0787 – 0.0789 in.)
Black	2.002 – 2.006 mm (0.0788 – 0.0790 in.)
Colorless (no paint)	2.005 – 2.009 mm (0.0789 – 0.0791 in.)
Yellow	2.008 – 2.012 mm (0.0791 – 0.0792 in.)
Blue	2.011 – 2.015 mm (0.0792 – 0.0793 in.)

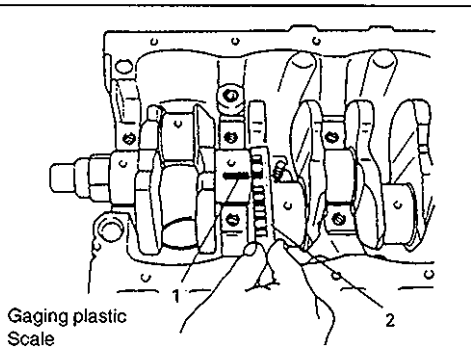


1. Crank webs of No.2 and No.3 cylinders



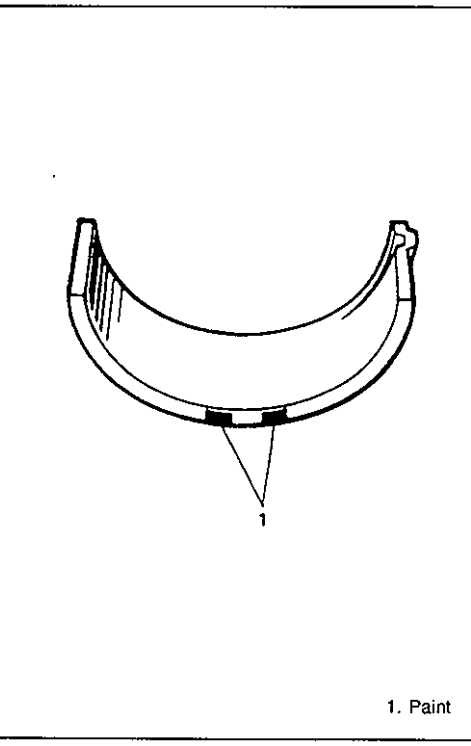
4) From numerals stamped on crank webs of No.2 and No.3 cylinders and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
For example, if numeral stamped on crank web is "1" and alphabet stamped on mating surface is "B", install a new standard bearing painted in "Black" to its journal.

		Numeral stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on mating surface (Bearing cap bore dia.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		



1. Gaging plastic
2. Scale

5) Using gaging plastic, check bearing clearance with newly selected standard bearing.
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to numerals stamped on new crankshaft or alphabets stamped on mating surface of new cylinder block.



1. Paint

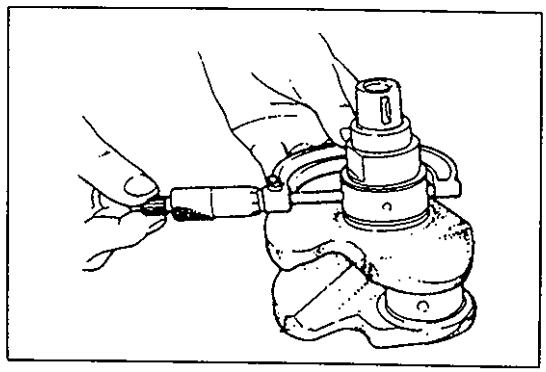
UNDERSIZE BEARING (0.25 mm):

- 0.25 mm undersize bearing is available, in five kinds varying in thickness.
To distinguish them, each bearing is painted in following colors at such position as indicated in figure.
Each color represents following thickness at the center of bearing.

Color painted	Bearing thickness
Green & Red	2.124 – 2.128 mm (0.0836 – 0.0838 in.)
Black & Red	2.127 – 2.131 mm (0.0837 – 0.0839 in.)
Red only	2.130 – 2.134 mm (0.0839 – 0.0840 in.)
Yellow & Red	2.133 – 2.137 mm (0.0840 – 0.0841 in.)
Blue & Red	2.136 – 2.140 mm (0.0841 – 0.0843 in.)

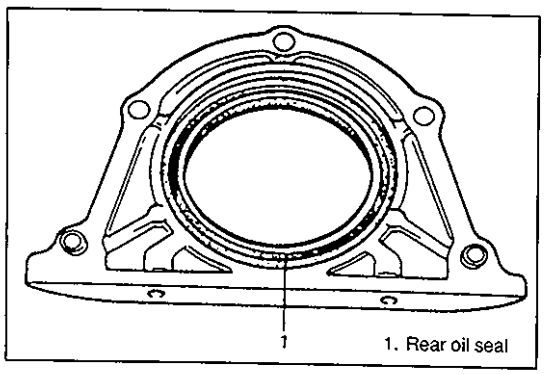
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

Finished diameter: 44.732 – 44.750 mm (1.7611 – 1.7618 in.)



2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an under-size bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

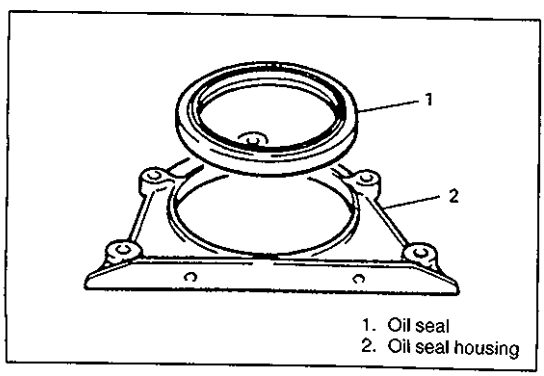
		Measured journal diameter		
		44.744 – 44.750 mm (2.0371 – 2.0373 in.)	44.738 – 44.744 mm (2.0369 – 2.0371 in.)	44.732 – 44.738 mm (2.0367 – 2.0369 in.)
Alphabet stamped on mating surface of cylinder block	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Undersize bearing to be installed		



1. Rear oil seal

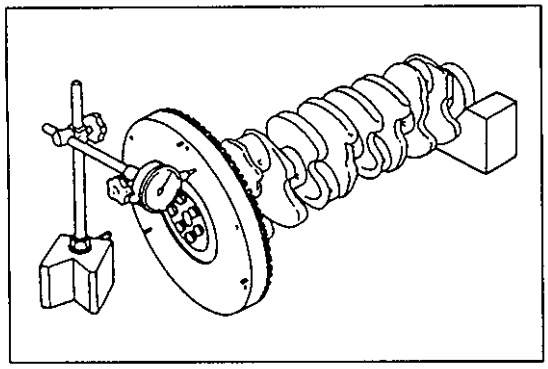
Rear Oil Seal

Carefully inspect oil seal for wear or damage. If its lip is worn or damaged, replace it.



1. Oil seal
2. Oil seal housing

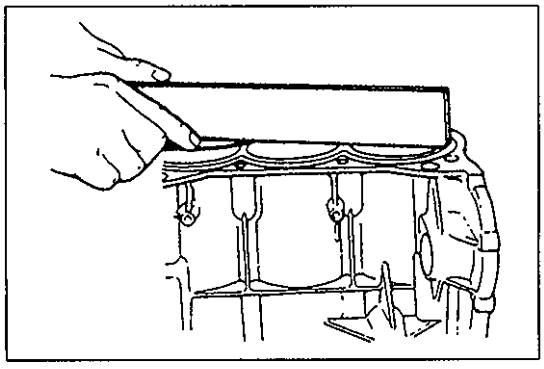
For oil seal installation, press-fit rear oil seal so that oil seal housing end face is flush with oil seal end face.



Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with dial gauge.
  If runout exceeds its limit, replace flywheel.

  Limit on runout: 0.2 mm (0.0078 in.)



Cylinder Block

Distortion of gasketed surface

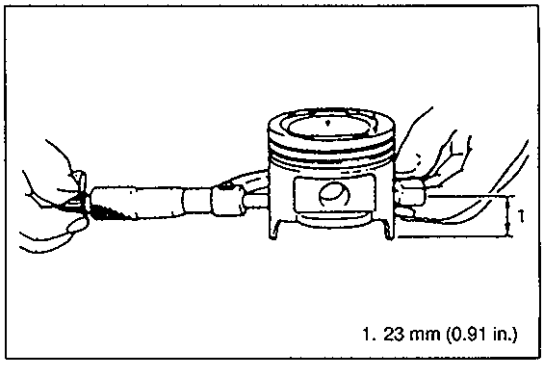
Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

Item	Standard	Limit
Flatness	0.03 mm (0.0012 in.)	0.06 mm (0.0024 in.)

Honing or reboring cylinders

1) When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Size	Piston diameter
O/S 0.25	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
O/S 0.50	74.470 – 74.480 mm (2.9319 – 2.9323 in.)



1. 23 mm (0.91 in.)

3) Using micrometer, measure piston diameter.

4) Calculate cylinder bore diameter to be rebored.

   $D = A + B - C$

   D: Cylinder bore diameter to be rebored.
   A: Piston diameter as measured.
   B: Piston clearance = 0.02 – 0.04 mm (0.0008 – 0.0015 in.)
   C: Allowance for honing = 0.02 mm (0.0008 in.)

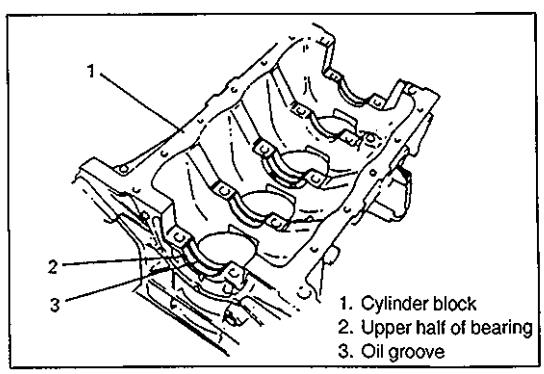
5) Rebore and hone cylinder to calculated dimension.

NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

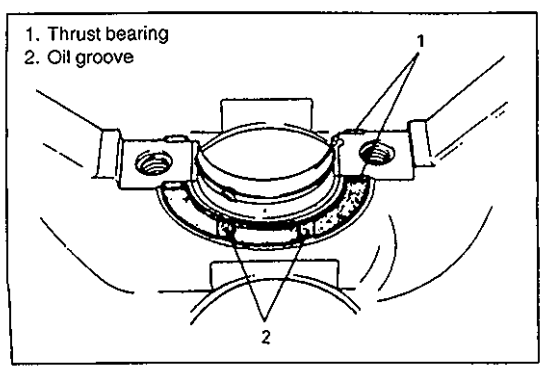
6) Measure piston clearance after honing.

INSTALLATION

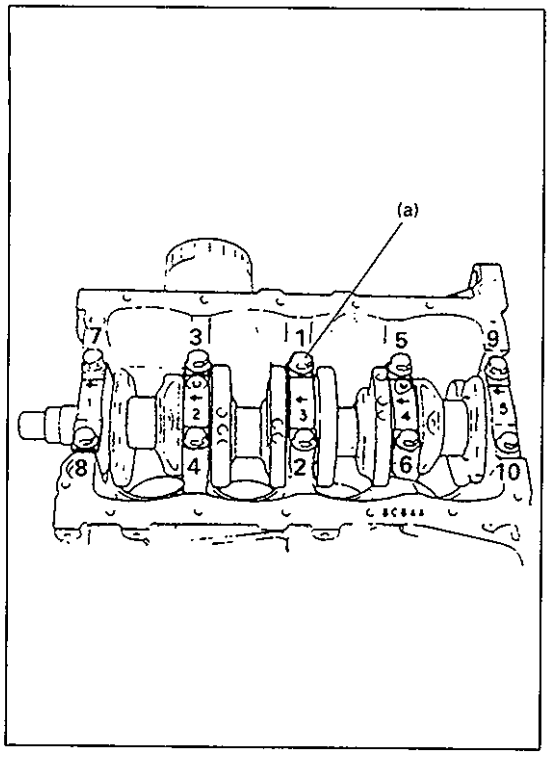
NOTE:
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**



1) Install main bearings to cylinder block.
One of two halves of main bearing, has an oil groove. Install it to cylinder block, and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



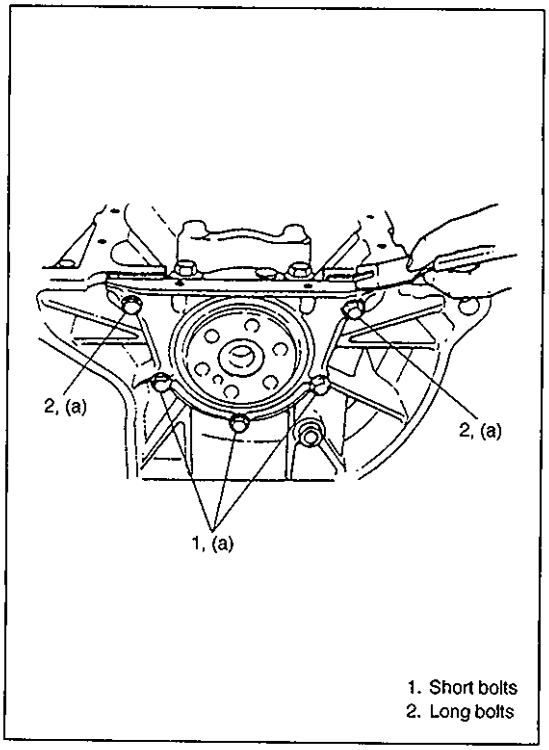
2) Install thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.



3) Install crankshaft to cylinder block.
4) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4 and 5, starting from pulley side.
After installing bearing cap stiffeners, tighten bearing cap bolts in such order as shown in figure a little at a time and repeat it till they are tightened to specified torque.

Tightening Torque
(a): 52 N·m (5.2 kg-m, 38.0 lb-ft)

NOTE:
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 8.0 N·m (0.8 kg-m, 5.8 lb-ft) torque or below.



1. Short bolts
2. Long bolts

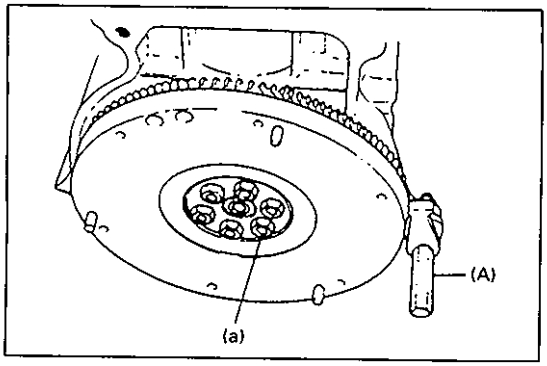
5) Install new gasket and oil seal housing.
Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

NOTE:
As there are 2 types of housing bolts, refer to figure for their correct use.

After installing oil seal housing, gasket edges might bulge out; if so, cut them off to make them flush with cylinder block and oil seal housing.

6) Install oil pump.
Refer to item "Oil pump" for installation of oil pump.

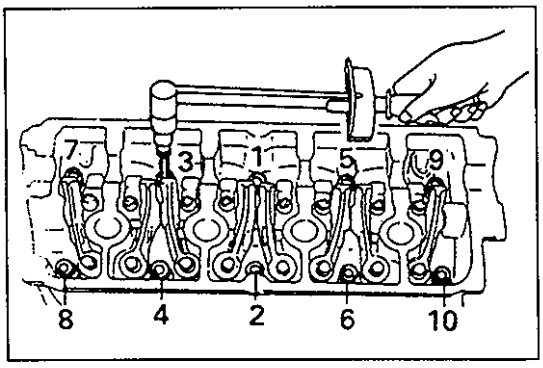


7) Install flywheel (M/T model) or drive plate (A/T model).
Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

Special Tool
(A): 09924-17810

Tightening Torque
(a): 76 N·m (7.6 kg-m, 55.0 lb-ft)

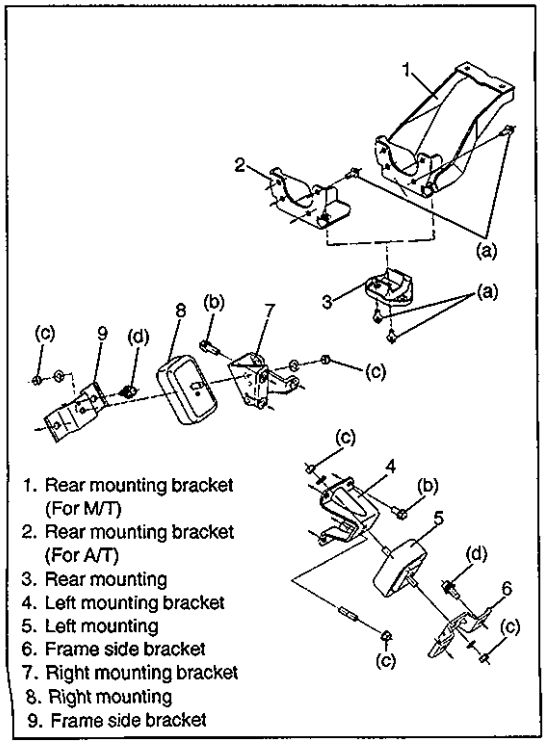
8) Install pistons and connecting rods as previously outlined.
9) Install oil pump strainer and oil pan as previously outlined.



10) Install cylinder head assembly to cylinder block as previously outlined.

NOTE:
Tighten cylinder head bolts to specified torque as previously outlined and loosen them once till tightening torque becomes "zero". And then torque them to specification again.

11) Install camshaft, crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to "CLUTCH" section.



13) Install engine mountings brackets.

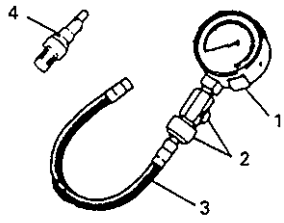
Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)
(b): 55 N·m (5.5 kg-m, 40.0 lb-ft)
(c): 45 N·m (4.5 kg-m, 32.5 lb-ft)
(d): 50 N·m (5.0 kg-m, 36.5 lb-ft)

14) Install engine assembly to vehicle as previously outlined.

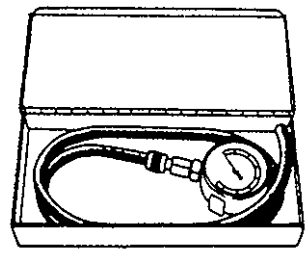
TIGHTENING TORQUE SPECIFICATIONS

FASTENING PARTS	TIGHTENING TORQUE		
	N·m	kg-m	lb-ft
Oil pressure switch	14	1.4	10.5
Valve adjusting screw lock nuts	12	1.2	9.0
Cylinder head cover bolts	10	1.0	7.5
Intake manifold nuts	23	2.3	17.0
Exhaust manifold nuts	23	2.3	17.0
Exhaust pipe bolts	50	5.0	36.5
Timing belt tensioner stud	10	1.0	7.5
Timing belt tensioner bolt	27	2.7	19.5
Timing belt cover bolts and nut	10	1.0	7.5
Crankshaft pulley bolt	16	1.6	11.5
Oil pump strainer bolt and stay bolt Oil pan bolts and nuts	10	1.0	7.5
Oil pan drain plug	35	3.5	25.5
Oil pump rotor plate screws Oil pump case bolts	10	1.0	7.5
Crankshaft timing belt pulley bolt	128	12.8	92.5
Camshaft housing bolts Rocker arm shaft bolts	10	1.0	7.5
Rocker arm shaft plug	32	3.2	23.5
Camshaft timing belt pulley bolt	59	5.9	43.0
CMP sensor bolts	10	1.0	7.5
Cylinder head venturi plug	5	0.5	4.0
Cylinder head bolts	68	6.8	49.5
Connecting rod bearing cap nuts	35	3.5	25.5
Bolt and nuts fastening T/M and cylinder block	80	8.0	58.0
Torque converter bolts (A/T)	65	6.5	47.0
Crankshaft main bearing cap bolts	52	5.2	38.0
Flywheel bolts (Drive plate bolts for A/T)	76	7.6	55.0
Engine mounting & bracket bolts and nuts	Refer to 6A-73.		

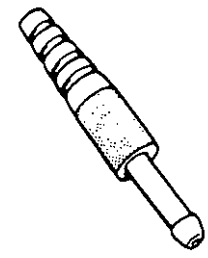
SPECIAL TOOLS



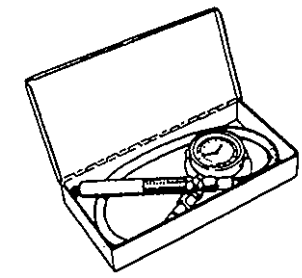
1. 09915-64510-001
   Compression gauge
2. 09915-64510-002
   Connector
3. 09915-64530
   Hose
4. 09915-67010
   Attachment



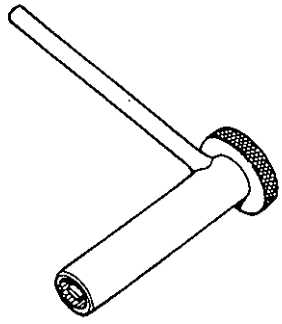
09915-67310
Vacuum gauge



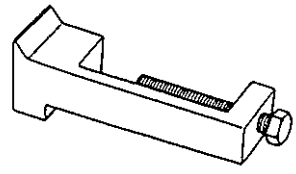
09918-08210
Vacuum gauge hose joint



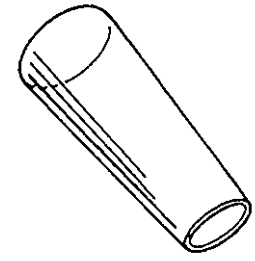
09915-77310
Oil pressure gauge



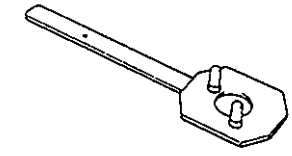
09917-18210
Tappet adjuster wrench



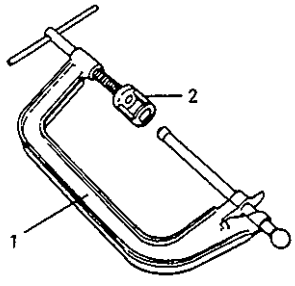
09927-56010
Gear stopper



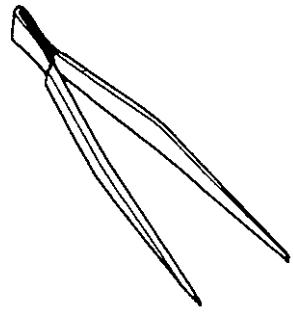
09926-18210
Oil seal guide
(Vinyl resin)



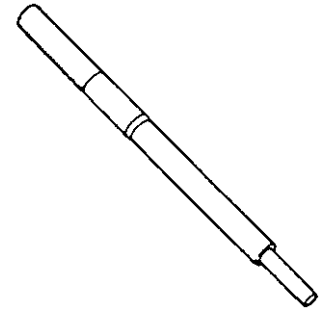
09917-68220
Camshaft pulley holder



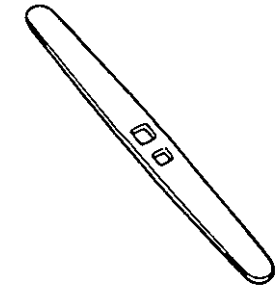
1. 09916-14510
   Valve lifter
2. 09916-14910
   Valve lifter attachment



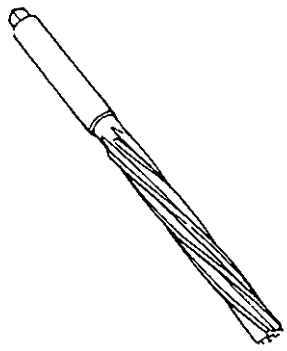
09916-84511
Forceps



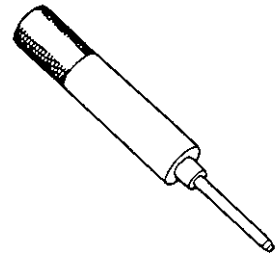
09916-44910
Valve guide remover



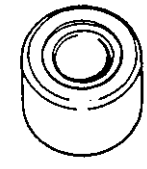
09916-34542
Reamer handle



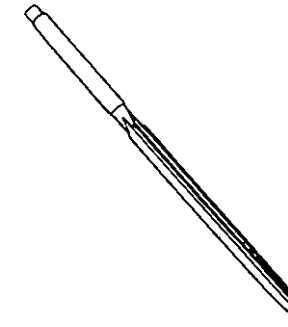
09916-38210
Reamer (11 mm)



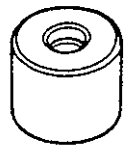
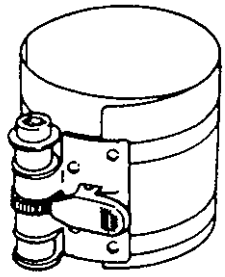
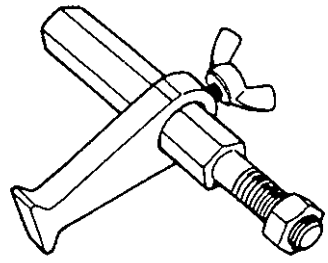
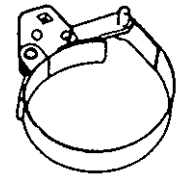
09916-58210
Valve guide installer
handle



09916-56011
Valve guide installer
attachment



09916-34550
Reamer (5.5 mm)

			
09917-98221 Valve stem seal installer	09916-77310 Piston ring compressor	09924-17810 Flywheel holder	09915-47330 Oil filter wrench

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1207C (99000-31150)	• Mating surfaces of cylinder block and oil pan.
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Mating surfaces of camshaft housings (No.6). • Mating surfaces of camshaft position sensor case and cylinder head.

SECTION 6B

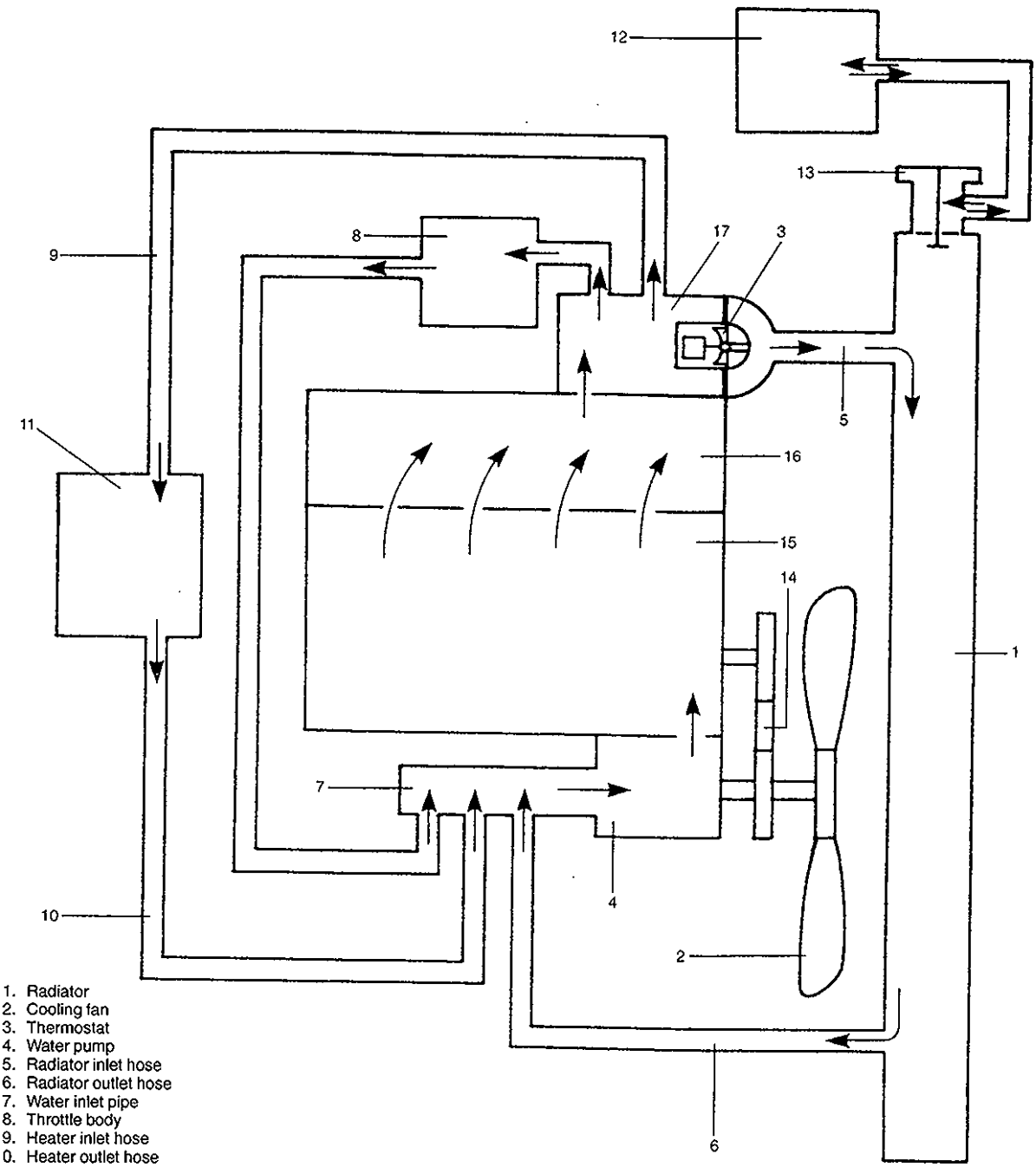
ENGINE COOLING

CONTENTS

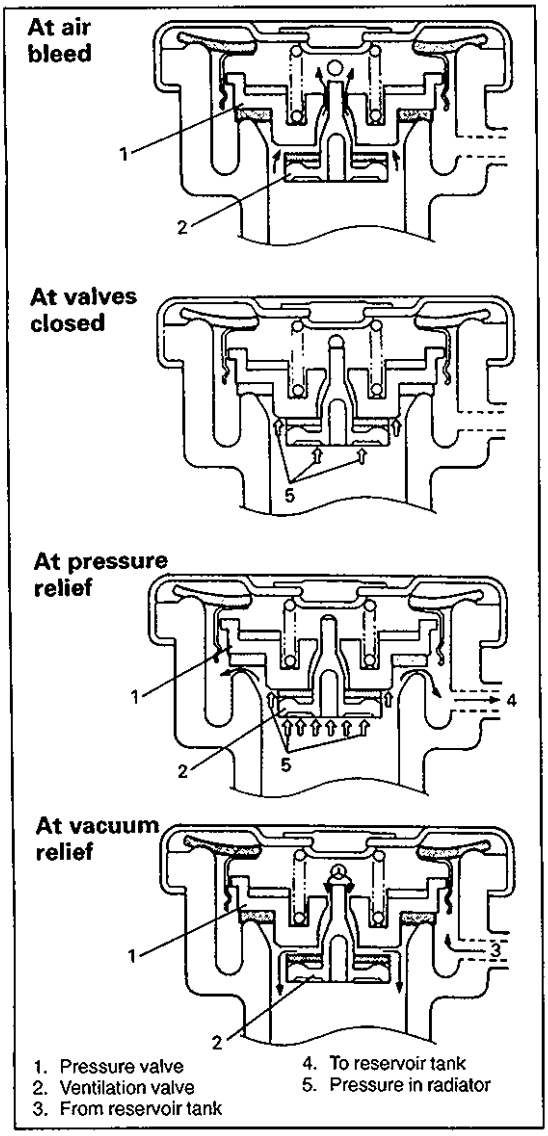
GENERAL DESCRIPTION

The cooling system consists of the radiator cap, radiator, reservoir tank, hoses, water pump, cooling fan & clutch, thermostat. The radiator is of tube-and fin type.

COOLING SYSTEM CIRCULATION



1. Radiator
2. Cooling fan
3. Thermostat
4. Water pump
5. Radiator inlet hose
6. Radiator outlet hose
7. Water inlet pipe
8. Throttle body
9. Heater inlet hose
10. Heater outlet hose
11. Heater core
12. Reservoir tank
13. Radiator cap
14. Water pump belt
15. Cylinder block
16. Cylinder head
17. Intake manifold



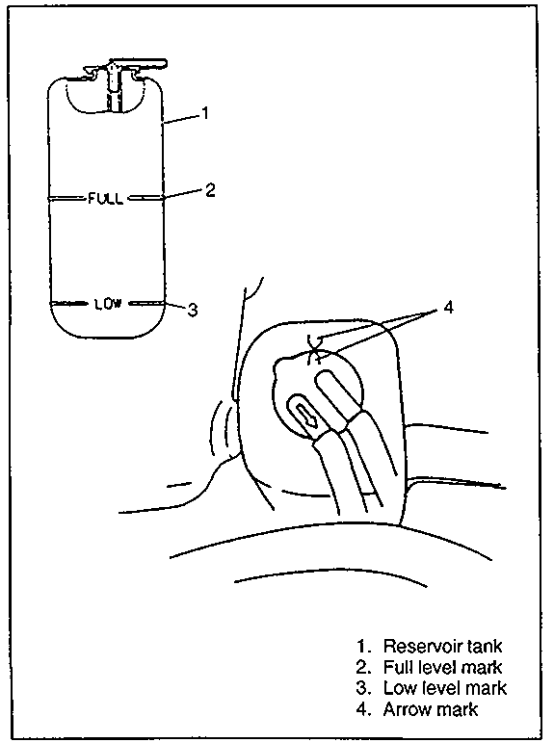
1. Pressure valve
2. Ventilation valve
3. From reservoir tank
4. To reservoir tank
5. Pressure in radiator

RADIATOR CAP

A pressure-vent cap is used on the radiator. The cap contains a pressure valve and ventilation valve.
The cap has its face marked 0.9, which means that its pressure valve opens at 0.9 kg/cm^2 (12.8 psi, 90 kPa).

NOTE:
Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir tank.
Coolant should be added only to reservoir tank as necessary.

WARNING:
As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility or causing a serious fire.

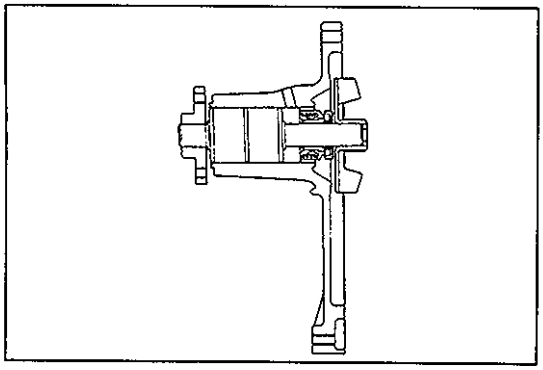


1. Reservoir tank
2. Full level mark
3. Low level mark
4. Arrow mark

COOLANT (WATER) RESERVOIR TANK

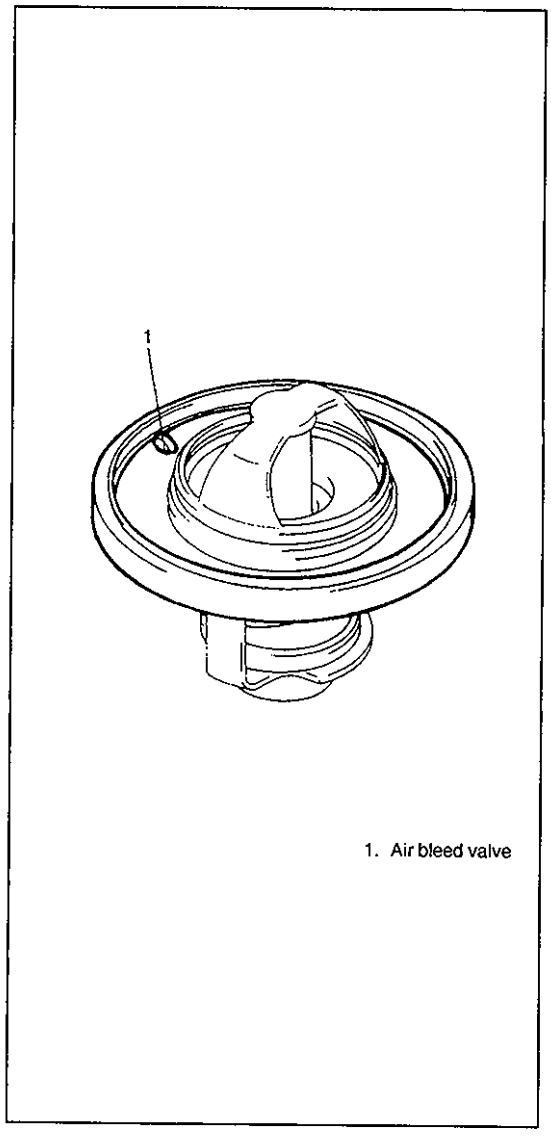
A "see-through" plastic reservoir tank is connected to the radiator by a hose.
Coolant level should be between "FULL" and "LOW" marks on the reservoir tank.
Coolant should be added only to the reservoir tank as necessary.

NOTE:
When installing reservoir tank cap, set arrow marks on the tank and cap as left figure.



WATER PUMP

The centrifugal type water pump is used in the cooling system.
The pump impeller is supported by a totally sealed bearing.
The water pump can not be disassembled.

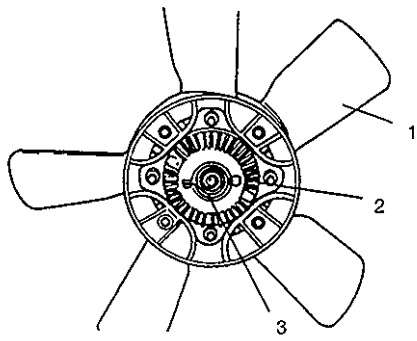


1. Air bleed valve

THERMOSTAT

A wax pellet type thermostat is used in the cooling system.
The temperature at which the valve begins to open is stamped on thermostat.
In the top portion of the thermostat, an air bleed valve is provided; this valve is for venting out the gas or air, if any, that is accumulated in the circuit.

Thermostat functional spec. ± 1.5°C (34.7°F)	
Temp. at which valve begins to open	88°C (190°F)
Temp. at which valve become fully open	100°C (212°F)
Valve lift	More than 8 mm at 100°C



1. Cooling fan
2. Fan clutch
3. Bimetal

COOLING FAN CLUTCH

Fluid is enclosed in the cooling fan clutch and at its center front, there is a bimetal whose thermal reaction and the engine speed control the cooling fan speed.

NOTE:
Do not disassemble clutch assembly.

WARNING:
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury.

COOLANT (WATER) TEMP. GAUGE

A water temp. gauge is located at intake manifold.
This gauge activates a temp. meter in the instrument cluster.
When installing, wind sealing tape on gauge thread and tighten it.

DIAGNOSIS

Condition	Possible cause	Correction
Engine overheats	• Loose or broken water pump belt	Adjust or replace.
	• Not enough coolant	Check coolant level and add as necessary.
	• Faulty thermostat	Replace.
	• Faulty water pump	Replace.
	• Dirty or bent radiator fins	Clean or remedy.
	• Coolant leakage on cooling system	Repair.
	• Defective cooling fan clutch	Check and replace as necessary.
	• Plugged radiator	Check and replace radiator as necessary.
	• Faulty radiator cap	Replace.
	• Maladjusted ignition timing	Adjust.
	• Dragging brakes	Adjust brake.
	• Slipping clutch	Adjust or replace.

MAINTENANCE

COOLANT

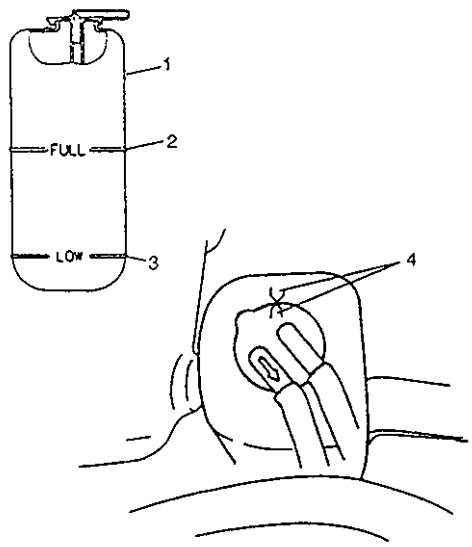
The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir tank.
When the system cools down, the coolant is drawn back into the radiator.
The cooling system has been filled at the factory with a quality coolant that is either 50/50 mixture of water and anti-freeze/anti-corrosion coolant (ethylene glycol antifreeze).
The 50/50 mixture coolant solution provides freezing protection to –36 °C (–33 °F).

- Maintain cooling system freeze protection at –36 °C (–33 °F) to ensure protection against corrosion and loss of coolant from boiling.
  This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than –36 °C (–33 °F).

		For manual and automatic transmission model		
ANTI-FREEZE PROPORTIONING CHART	Freezing temperature	°C	–16	–36
		°F	3	–33
	Anti-freeze/Anti-corrosion coolant concentration	%	30	50
	Ratio of compound to cooling water	ltr.	1.35/3.15	2.25/2.25
		US pt.	2.85/6.65	4.75/4.75
		Imp. pt.	2.37/5.53	3.95/3.95
COOLANT CAPACITY	Engine, radiator and heater	3.8 liters (8.0/6.7 US/Imp pt.)		
	Reservoir tank	0.7 liters (1.5/1.2 US/Imp pt.)		
	Total	4.5 liters (9.5/7.9 US/Imp pt.)		

NOTE:

- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene glycol antifreeze (Antifreeze/Anticorrosion coolant) should be used for the purpose of corrosion protection and lubrication.**



1. Reservoir tank
2. FULL level mark
3. LOW level mark
4. Arrow mark

COOLANT LEVEL

To check level, look at "see-through" reservoir tank.
It is not necessary to remove radiator cap to check coolant level.

WARNING:
To help avoid danger of being burned:
- **do not remove reservoir tank cap while coolant is "boiling", and**
- **do not remove radiator cap while engine and radiator are still hot.**

Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.

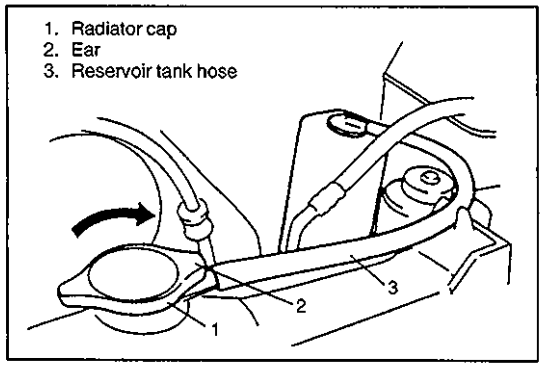
When engine is cool, check coolant level in reservoir tank.
A normal coolant level should be between "FULL" and "LOW" marks on reservoir tank.
If coolant level is below "LOW" mark, remove reservoir tank cap and add proper coolant to tank to bring coolant level up to "FULL" mark. Then, reinstall cap.

NOTE:
- **If proper quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system. They may be harmful to proper operation of system.**
- **When installing reservoir tank cap, set arrow marks on tank and cap as left figure.**

COOLING SYSTEM SERVICE

WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot.
Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

Cooling system should be serviced as follows.
1) Check cooling system for leakage or damage.
2) Wash radiator cap and filler neck with clean water by removing radiator cap when engine is cold.
3) Check coolant for proper level and freeze protection.
4) Using a pressure tester, check system and radiator cap for proper pressure holding capacity 0.9 kg/cm^2 (12.8 psi, 90 kPa). If replacement of cap is required, use proper cap specified for this vehicle.



NOTE:
After installing radiator cap to radiator, make sure that its ear is aligned with reservoir tank hose as shown in figure. If not, turn cap more to align its ear with hose.

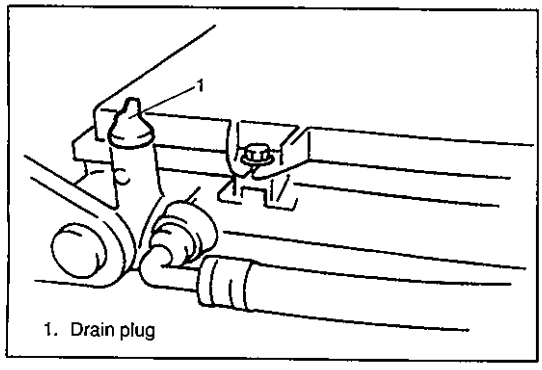
5) Tighten hose clamps and inspect all hoses.
Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

COOLING SYSTEM FLUSH AND REFILL

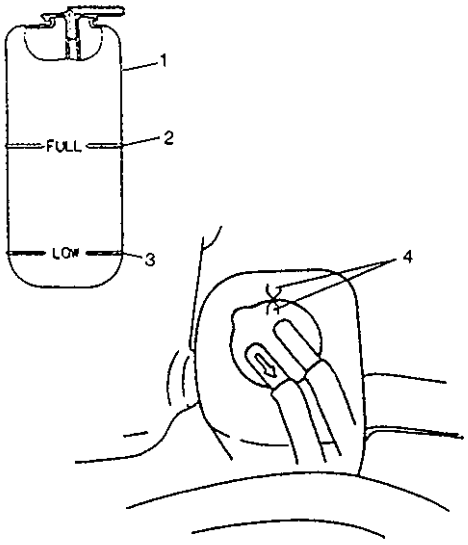
1) Remove radiator cap when engine is cool:
Turn cap slowly to the left until it reaches a "stop" (Do not press down while turning it).
Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it to the left.

WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

2) With radiator cap removed, run engine until upper radiator hose is hot (this shows that thermostat is open and coolant is flowing through system).



3) Stop engine and open radiator drain plug to drain coolant.
4) Close drain plug. Add water until system is filled and run engine until upper radiator hose is hot again.
5) Repeat steps 3 and 4 several times until drained liquid is nearly colorless.
6) Drain system and then close radiator drain plug tightly.



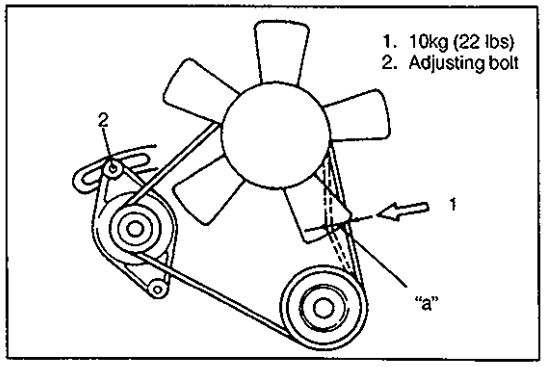
1. Reservoir tank
2. FULL level mark
3. LOW level mark
4. Arrow mark

7) Disconnect hose from water reservoir tank. Remove tank and pour out any fluid. Scrub and clean inside of tank with soap and water. Flush it well with clean water and drain.
   Reinstall tank and hose.
8) Add 50/50 mixture of good quality ethylene glycol antifreeze and water to radiator and tank.
   Fill radiator to the base of radiator filler neck and reservoir tank to "FULL" level mark. Reinstall reservoir tank cap setting the arrow marks on the tank and cap as left figure.
9) Run engine, with radiator cap removed, until radiator upper hose is hot.
10) With engine idling, add coolant to radiator until level reaches the bottom of filler neck. Install radiator cap, making sure that the ear of cap lines up with reservoir tank hose.

WATER PUMP BELT TENSION

WARNING:
Disconnect negative cable at battery before checking and adjusting belt tension.

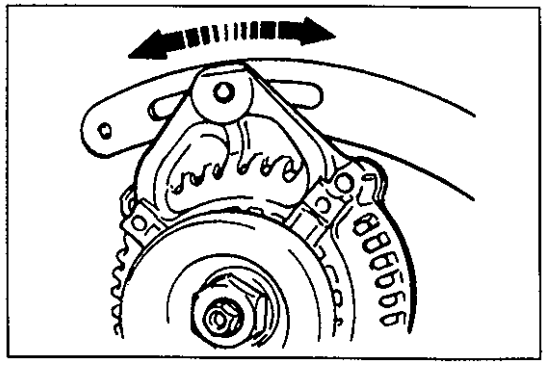
1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer to page 6B-14 for procedure.



2) Check belt for tension. Belt is in proper tension when it deflects 6 to 8 mm (0.24 – 0.32 in.) under thumb pressure (about 10kg or 22 lb.).

Belt tension "a": 6 – 8 mm (0.24 – 0.32 in.)
as deflection/10 kg (22 lbs)

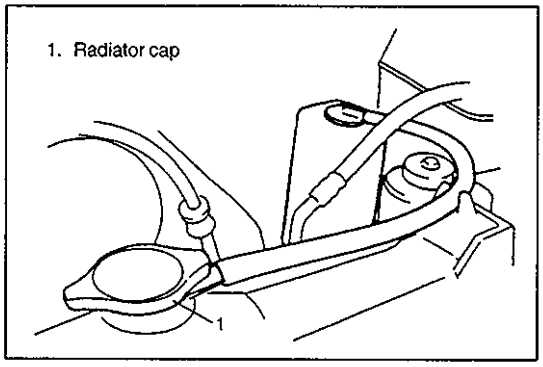
NOTE:
When replacing belt with a new one, adjust belt tension to 5 – 7 mm (0.20 – 0.27 in.).



3) If belt is too tight or too loose, adjust it to proper tension by displacing generator position.
4) Tighten generator adjusting bolt and pivot bolts.
5) Connect negative cable at battery terminal.

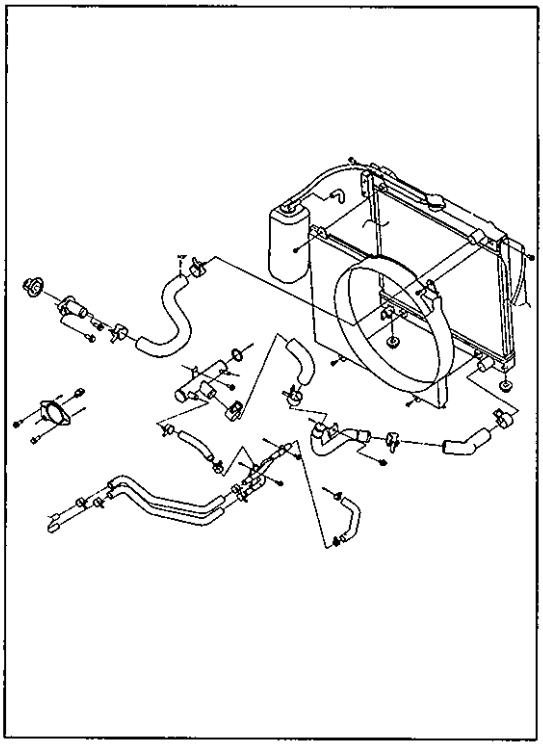
ON-VEHICLE SERVICE

WARNING:
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cord from battery terminal before removing any part.**



COOLANT DRAINING

1) Remove radiator cap.
2) Loosen drain plug on radiator to drain coolant.
3) After draining coolant, be sure to tighten drain plug securely.
4) Fill cooling system. (Refer to Item COOLANT of MAINTENANCE)



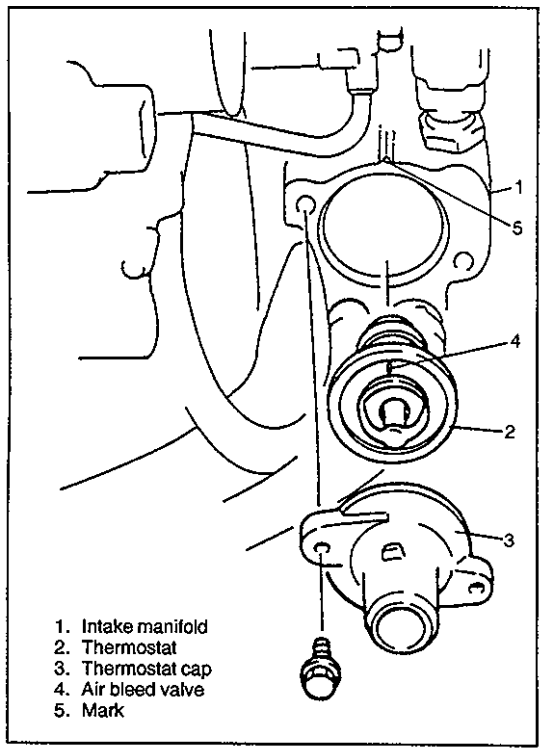
COOLING WATER PIPES OR HOSES

REMOVAL

1) Drain cooling system.
2) To remove these pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

INSTALLATION

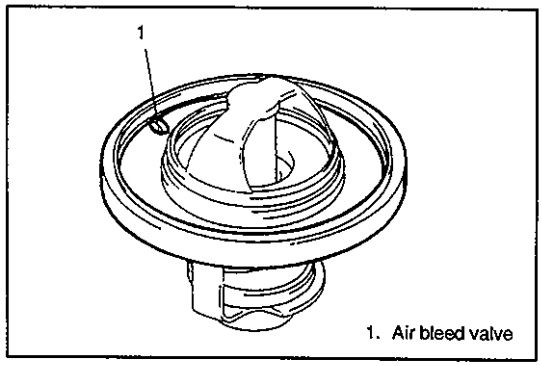
Install removed parts in reverse order of removal procedure, noting the following.
- Tighten each clamp bolt securely.
- Refill cooling system with proper coolant, referring to description on COOLANT of MAINTENANCE.



THERMOSTAT

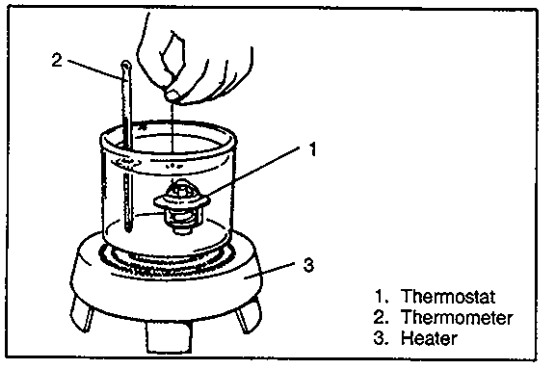
REMOVAL

1) Drain cooling system and tighten drain plug.
2) Disconnect thermostat cap from intake manifold.
3) Remove thermostat.

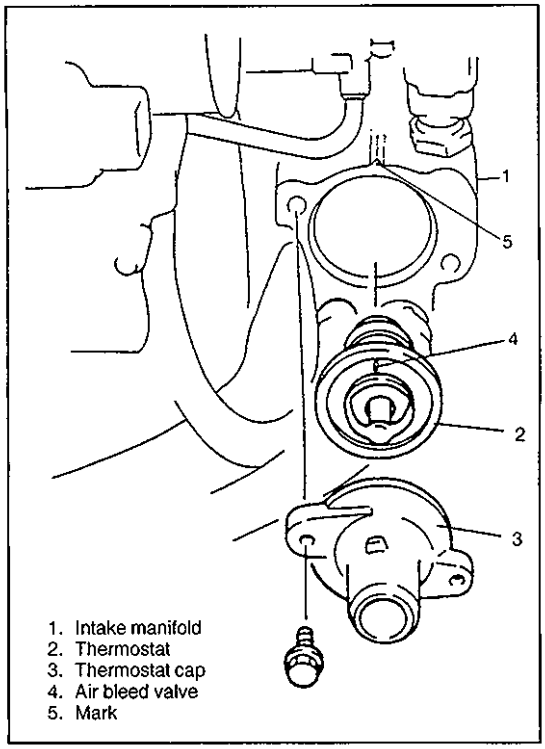


INSPECTION

1) Make sure that air bleed valve of thermostat is clear. Should this valve be clogged, engine would tend to overheat.
2) Check valve seat for some foreign matters being stuck which prevent valve from seating tight.



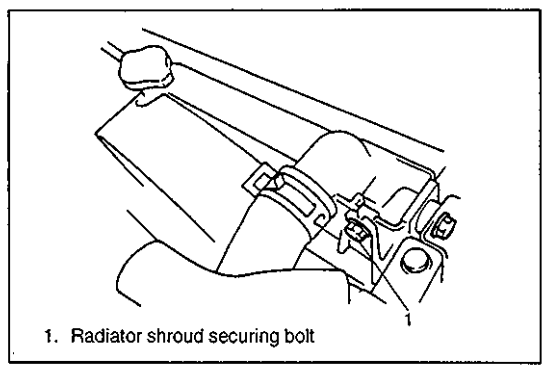
3) Check thermostatic movement of wax pellet as follows:
   - Immerse thermostat in water, and heat water gradually.
   - Check that valve starts to open at specification temp.
   - If valve starts to open at a temperature substantially below or above, thermostat unit should be replaced with a new one. Such a unit, if re-used, will bring about overcooling or overheating tendency.



1. Intake manifold
2. Thermostat
3. Thermostat cap
4. Air bleed valve
5. Mark

INSTALLATION

1) When positioning the thermostat on the intake manifold, be sure to align its air breather valve with mark.
2) Install thermostat cap to intake manifold.
3) Fill the cooling system.



1. Radiator shroud securing bolt

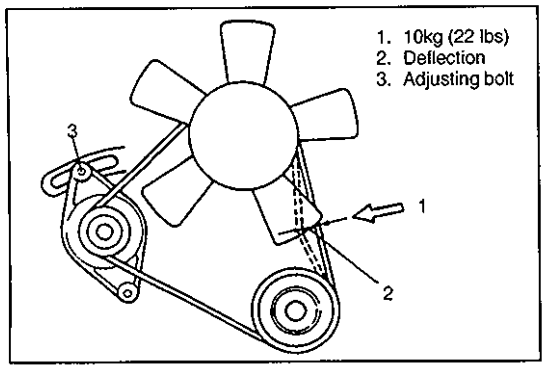
WATER PUMP BELT AND COOLING FAN

REMOVAL

1) Remove radiator shroud securing bolts and cooling fan securing nuts.
2) Then remove radiator shroud and cooling fan at the same time.
3) Loosen water pump drive belt tension.
   When servicing vehicle equipped with A/C, remove compressor drive belt before removing water pump belt.
4) Remove pump belt.

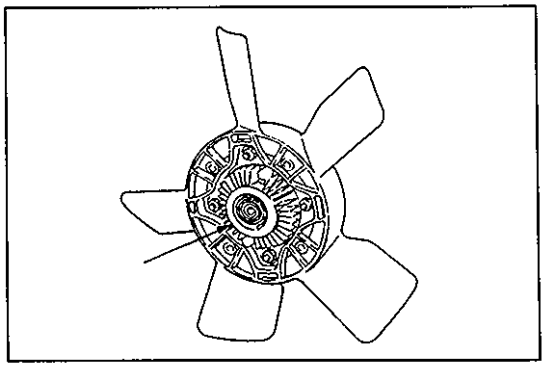
INSTALLATION

Once cooling fan or water pump belt has been removed, make sure to tighten bolts and nuts securely in reinstallation and adjust pump belt tension to specification. (For specified tension, refer to p. 6B-11)



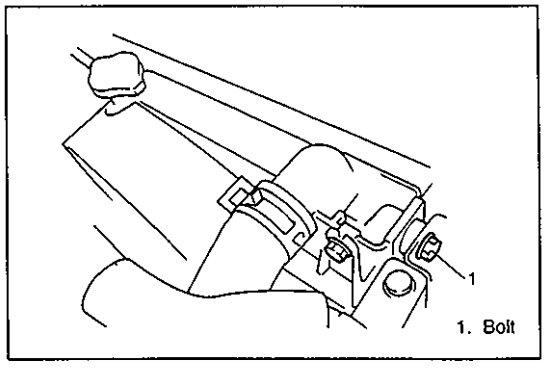
WATER PUMP BELT TENSION INSPECTION

1) Check belt tension. It should be within specification. Refer to page 6B-11.
2) If tension is out of specification, adjust it.
   For its adjustment, refer to WATER PUMP BELT TENSION on page 6B-11.
   After adjustment, be sure to tighten bolts.



COOLING FAN CLUTCH INSPECTION

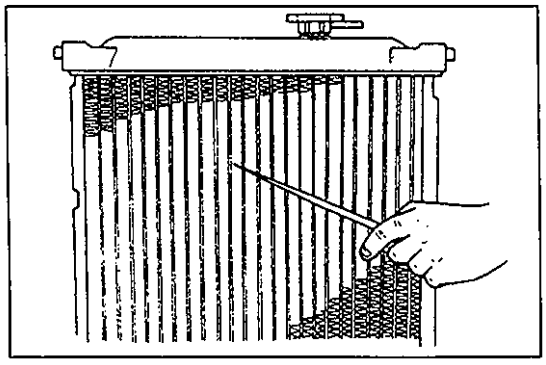
Inspect fluid coupling for oil leakage.
If necessary, replace fan clutch assembly. Do not disassemble clutch assembly.



RADIATOR

REMOVAL

1) Drain cooling system.
2) Loosen water pump drive belt tension.
3) Remove radiator shroud and cooling fan at the same time.
4) Disconnect water hoses from radiator.
5) With automatic transmission (A/T) vehicle, disconnect additional 2 fluid hoses from radiator.
   Place some container under radiator to receive A/T fluid which will flow out when hose is disconnected.
6) Remove radiator after removing 2 bolts.



INSPECTION

If the water side of the radiator is found excessively rusted or covered with scales, clean it by flushing with the radiator cleaner compound.
This flushing should be carried out at regular intervals for scale or rust formation advances with time even where a recommended type of coolant is used. Periodical flushing will prove more economical.
Inspect the radiator cores and straighten the flattened or bent fins, if any. Clean the cores, removing road grimes and trashes.
Excessive rust or scale formation on the wet side of the radiator lowers the cooling efficiency.
Flattened or bent fins obstruct the flow of air through the core to impede heat dissipation.

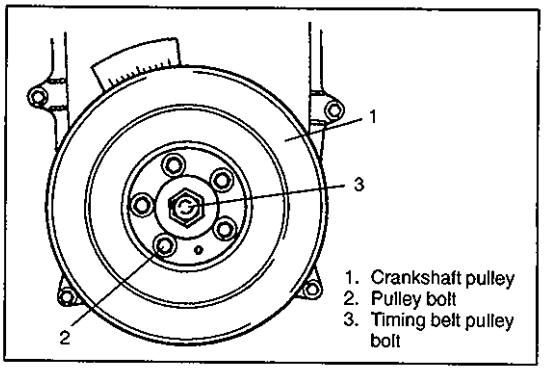
Radiator flushing interval	Two years (recommended)

INSTALLATION
Reverse removal procedures.

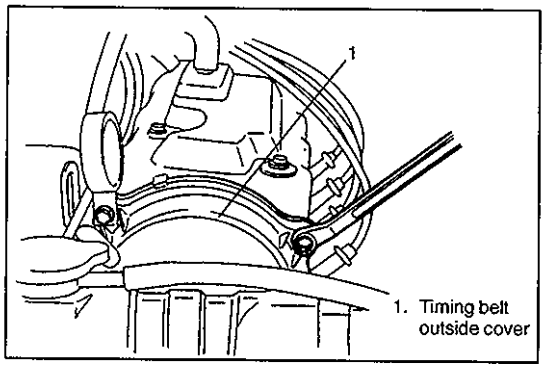
NOTE:
- **Refill cooling system with proper coolant referring to COOLANT item of MAINTENANCE.**
- **With automatic transmission car, fill A/T fluid up to specified level. (For procedure to check A/T fluid and its level, refer to SECTION 7B.)**
- **After installation, check each joint for leakage.**

WATER PUMP

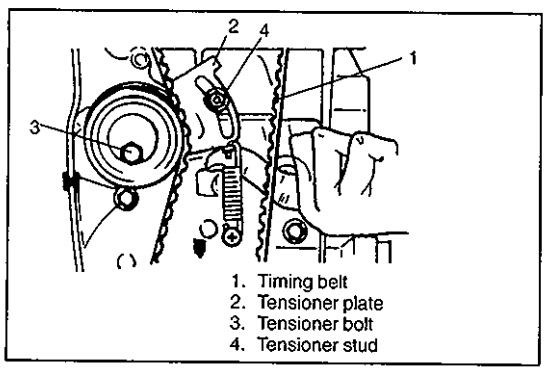
REMOVAL
1) Drain cooling system.
2) Remove the radiator shroud and cooling fan at the same time.
3) Loosen water pump drive belt tension.
   Then remove water pump pulley and pump drive belt.
4) Remove crankshaft pulley by removing pulley bolts. Crankshaft timing belt pulley bolt at the center is needs not to be loosened.



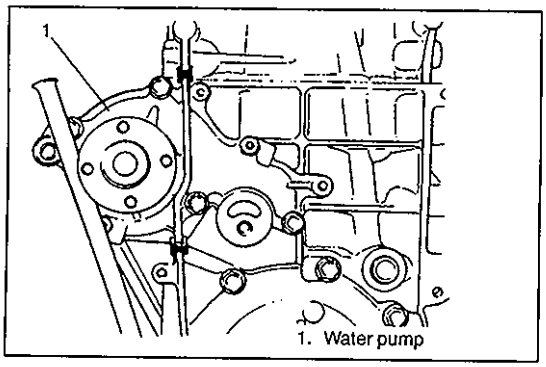
5) Remove timing belt outside cover.

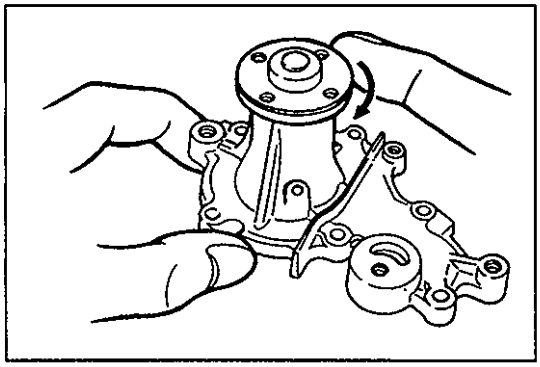


6) Loosen tensioner bolt and stud, and remove belt from crank timing belt pulley and camshaft pulley after pushing up tensioner plate fully with finger as shown in Figure.



7) Remove timing belt tensioner, plate and spring.
8) Remove water pump assembly.

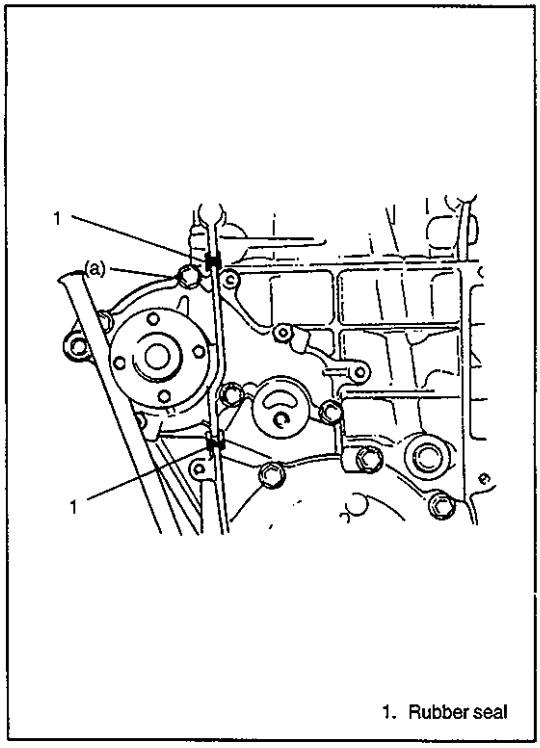




INSPECTION

NOTE:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.

- Rotate water pump by hand to check for smooth operation.
  If pump does not rotate smoothly or makes an abnormal noise, replace it.



1. Rubber seal

INSTALLATION

1) Install new pump gasket to cylinder block.
2) Install water pump to cylinder block.

   Tightening Torque
   (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

3) After installing water pump, install rubber seal between water pump and oil pump, and another between water pump and cylinder head.

4) Install belt tensioner plate, tensioner, tensioner spring, timing belt and timing belt outside cover.

   NOTE:
   - **Special care must be used when installing belt tensioner and timing belt. Be sure to refer to SECTION 6A "TIMING BELT" of this manual.**
   - **Torque each bolt and nut to specification.**

5) Install crankshaft pulley, water pump pulley, pump drive belt, cooling fan and radiator shroud.
6) Adjust intake and exhaust valve lashes.
   (For adjustment and related data, refer to SECTION 6A of this manual).
7) Adjust water pump belt tension.
   (Refer to p. 6B-11).
8) Connect negative cable at battery.
9) Fill the cooling system.

TIGHTENING TORQUE SPECIFICATION

FASTENING PARTS	TIGHTENING TORQUE		
	N·m	kg-m	lb-ft
Water pump bolt	10	1.0	7.5

REQUIRED SERVICE MATERIAL

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Engine coolant (Ethylene glycol base coolant)	Anti-freeze/Anti-corrosion coolant	Additive to engine cooling system for improving cooling efficiency and for protection against rusting.

SECTION 6C

ENGINE FUEL

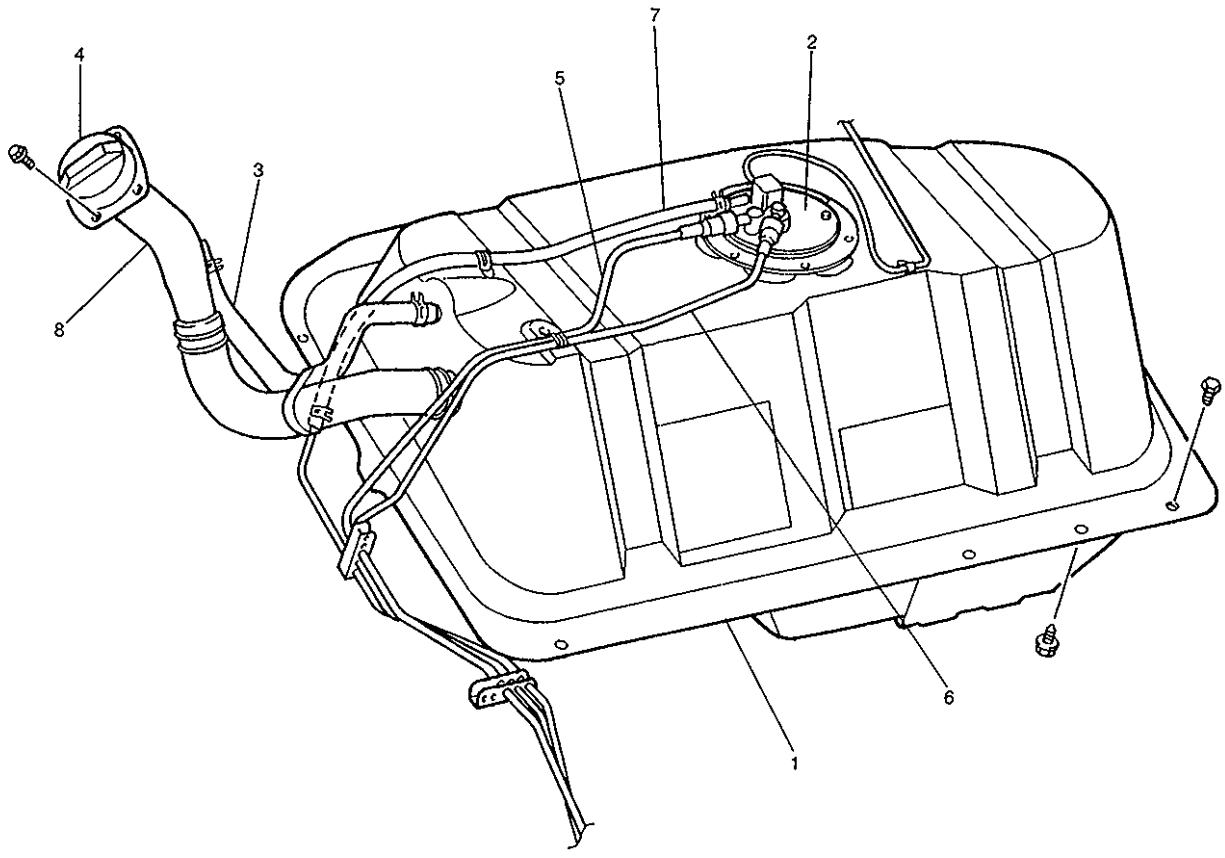
CONTENTS

CAUTION:
AMONG THE CARS OF THIS MODEL, THERE ARE THOSE EQUIPPED WITH A CATALYTIC CONVERTER AND THOSE WITHOUT ONE DEPENDING ON STATUTORY REGULATIONS OF EACH COUNTRY. FOR THOSE WITH A CATALYTIC CONVERTER, BE SURE TO USE UNLEADED FUEL ONLY. USE OF LEADED AND/OR LOW LEAD FUEL CAN RESULT IN ENGINE DAMAGE AND REDUCE THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEM.

GENERAL DESCRIPTION

FUEL SYSTEM

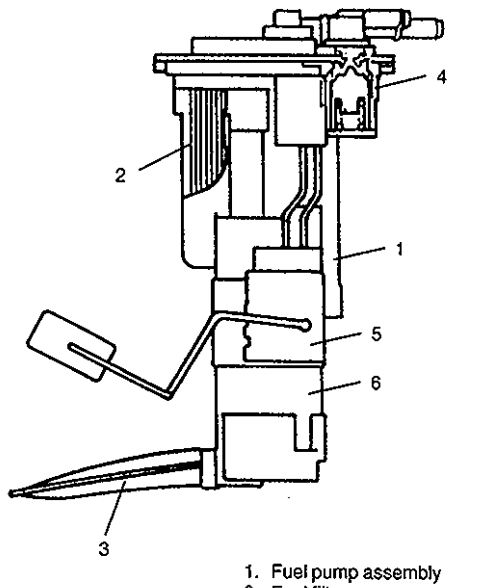
The main components of the fuel system are fuel tank, fuel pump assembly (with fuel filter and fuel level gauge and fuel cut valve), fuel feed line, fuel return line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to "ENGINE AND EMISSION CONTROL SYSTEM" section.



1. Fuel tank
2. Fuel pump assembly
3. Breather hose
4. Fuel filler cap
5. Fuel feed line
6. Fuel return line
7. Fuel vapor line
8. Fuel filler neck

FUEL TANK

The fuel tank is located under the rear section of the vehicle. The fuel pump assembly is installed in fuel tank. Whenever servicing the fuel pump assembly, the fuel tank must be removed from the vehicle.



1. Fuel pump assembly
2. Fuel filter
3. Suction filter (pump filter)
4. Fuel cut valve
5. Fuel sender (level) gauge
6. Fuel pump

FUEL PUMP ASSEMBLY (WITH FUEL FILTER, LEVEL GAUGE (SENSOR) AND FUEL CUT VALVE)

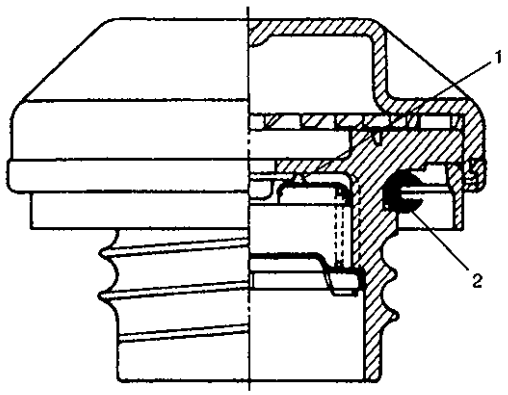
The fuel pump assembly consists of fuel pump, fuel filter, fuel sender (level) gauge (sensor) and fuel cut valve.

Fuel Pump

For structure and operation of the fuel pump, refer to Section 6E.

Fuel Cut Valve

The fuel cut valve consists of a float and a spring. It allows only the fuel vapor to flow into the canister and prevents the fuel from flowing into the canister.



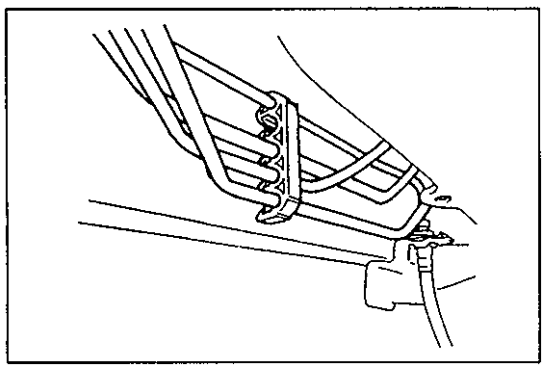
1. Vacuum relief valve
2. Gasket

FUEL FILLER CAP

The fuel tank filler neck has a vacuum cap.
A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would prevent sealing fuel vapors.
After the gasket on fuel filler cap and the filler neck flange contact, the ratchet produces a loud clicking noise, indicating the seal has been set.
This cap has a vacuum relief valve inside.
The vacuum relief valve opens to relieve the vacuum created in the fuel tank.

ON-VEHICLE SERVICE

Before work, refer to PRECAUTION ON FUEL SYSTEM SERVICE in SECTION 0A.

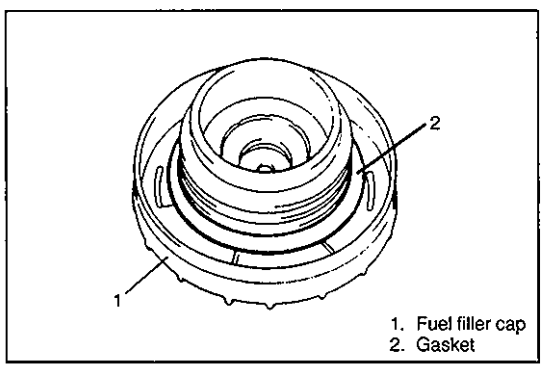


FUEL LINES

Due to the fact that fuel feed line is under high pressure, use special care when servicing it.

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration, or damage. Make sure all clamps are secure. Replace parts as needed.



1. Fuel filler cap
2. Gasket

FUEL FILLER CAP

Remove cap, and check gasket for even filler neck imprint, and deterioration or any damage. If gasket is in malcondition, replace cap.

NOTE:

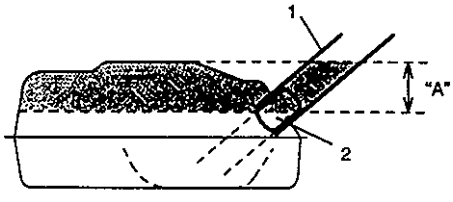
If cap requires replacement, only a cap with the same features should be used. Failure to use correct cap can result in critical malfunction of system.

FUEL TANK

REMOVAL

WARNING:
Refer to the WARNING at the beginning of ON-VEHICLE SERVICE in this section.

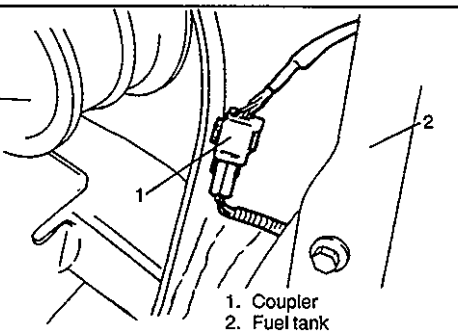
1) Relieve fuel pressure in fuel feed line according to procedure described in Section 6.
2) Disconnect negative cable at battery.



1. Fuel filler hose
2. Fuel tank inlet (check) valve

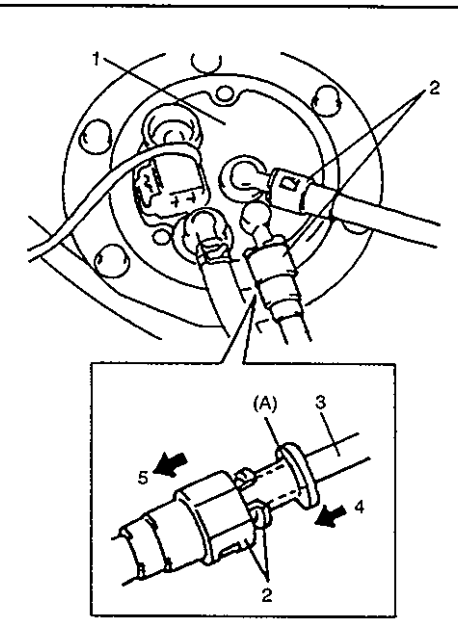
3) Remove fuel filler cap.
4) Insert hose of a hand operated pump into fuel filler hose and drain fuel in space "A" in the figure (drain fuel through it till fuel stops).

CAUTION:
Do not force hose of a hand operated pump into fuel tank. Doing so can damage inlet valve.



1. Coupler
2. Fuel tank
3. Rear suspension coil spring

5) Hoist vehicle.
6) Remove exhaust center pipe (refer to SECTION 6K) and rear propeller shaft (refer to SECTION 4B).
7) Disconnect coupler for fuel pump assembly.
(The coupler is by left rear suspension coil spring.)
8) Remove fuel tank filler hose protector.
Disconnect filler hose and breather hose from fuel filler neck.
9) Disconnect fuel vapor hose from pipe.

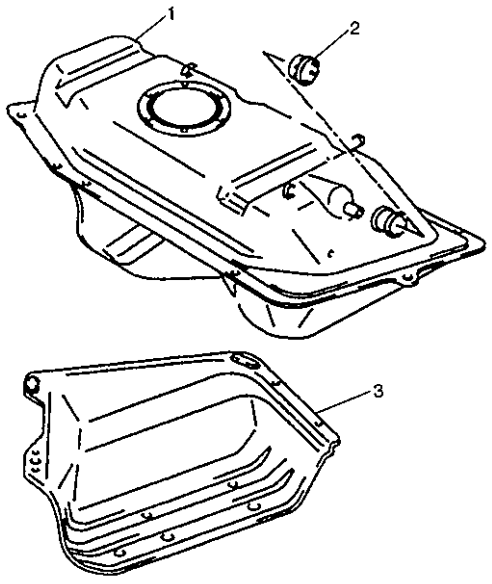


1. Fuel pump assembly
2. Quick joint
3. Pipe
4. Insert special tool
5. Disconnect joint

10) With fuel tank supported on a jack, remove fuel tank bolts.
11) Lower fuel tank a little and hold it. Unclamp fuel hoses and disconnect them from fuel pump assembly.
When disconnecting joint of fuel feed line and return line from pipe, unlock joint by inserting special tool between pipe and joint lock first.

Special Tool
(A): 09919-47020

WARNING:
Keep fuel tank horizontally and stably when removing it. Fuel may come out if tank is tilted. Also, fuel tank may drop and cause personal injury.



1. Fuel tank
2. Inlet valve
3. Fuel tank protector

12) Remove fuel tank from vehicle. Remove fuel tank protector and inlet valve as neccesary.

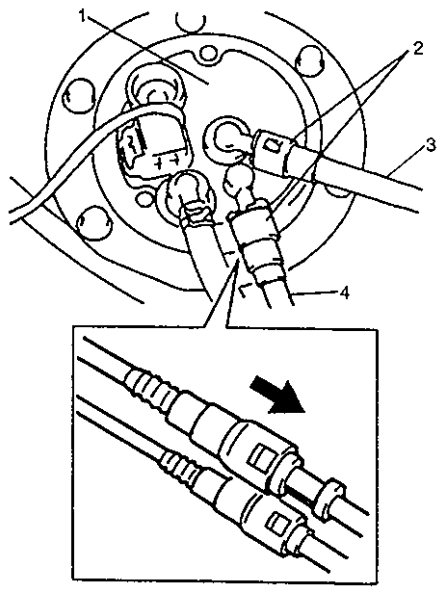
WARNING:
Keep fuel tank horizontally and stably when removing it. Fuel may come out if tank is tilted. Also, fuel tnak may drop and cause personal injury.

FUEL TANK PURGING PROCEDURE

CAUTION:
This purging procedure will NOT remove all fuel vapor. DO not attempt any repair on tank where heat or flame is required, as an explosion resulting in personal injury could occur.

The following procedure is used for purging the fuel tank.

1) After removing fuel tank, remove all hoses and fuel pump assembly from fuel tank.
2) Drain all remaining fuel from tank.
3) Move tank to flushing area.
4) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
5) Completely flush out remaining water after washing.



1. Fuel pump assembly
2. Quick joint
3. Fuel return hose
4. Fuel feed hose

INSTALLATION

1) Install fuel pump assembly to fuel tank. Refer to "FUEL PUMP ASSEMBLY" in this section. Install protector to fuel tank.
2) Install inlet valve to fuel tank.
   If deformed or damaged in any other way, replace with a new one.
3) Connect fuel filler and breather hoses to fuel tank and vapor hose to fuel pump assembly. Clamp them securely.
4) Lift up fuel tank on jack.
   Connect fuel feed and return hoses to pipes as shown in figure and clamp them securely.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

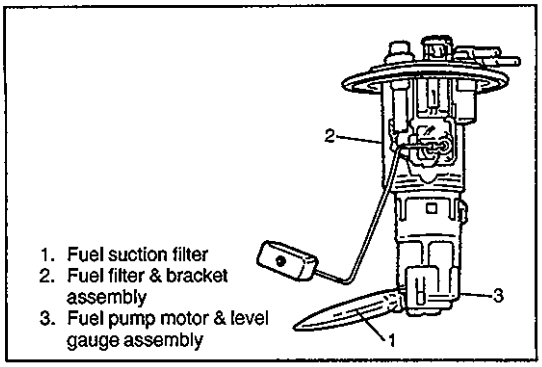
5) Install fuel tank to vehicle and connect wire harness coupler.
6) Connect fuel filler hose and breather hose to fuel filler neck. Connect fuel vapor hose to pipe. Clamp them securely.
7) Install fuel filler hose protector.

FUEL PUMP ASSEMBLY (WITH FUEL FILTER, FUEL LEVEL GAUGE AND FUEL CUT VALVE)

WARNING:
Refer to the WARNING at the beginning of ON-VEHICLE SERVICE in this section.

REMOVAL

1) Remove fuel tank from vehicle. Refer to "FUEL TANK REMOVAL" in this section.
2) Disconnect wire harness coupler and fuel vapor hose from fuel pump assembly.
3) Remove fuel pump assembly from fuel tank by removing bolts.

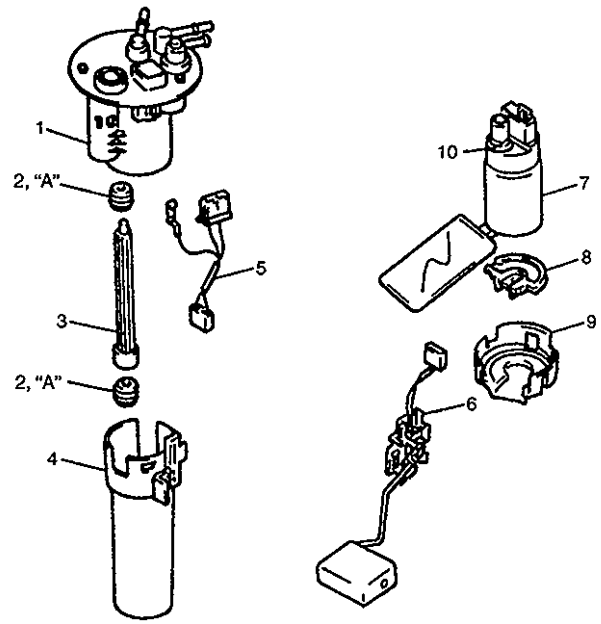


1. Fuel suction filter
2. Fuel filter & bracket assembly
3. Fuel pump motor & level gauge assembly

INSPECTION

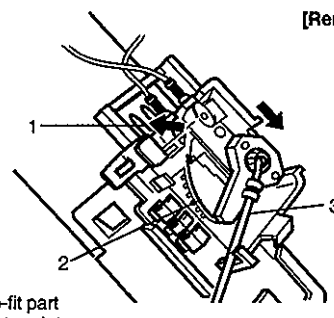
Check fuel pump assembly for damage.
Check fuel suction filter for evidence of dirt and contamination. If present, replace or clean and check for presence of dirt in fuel tank.
For inspection of fuel pump itself, refer to Section 6E of this manual.
For inspection of fuel level gauge, refer to Section 8 of this manual.

DISASSEMBLY/REASSEMBLY



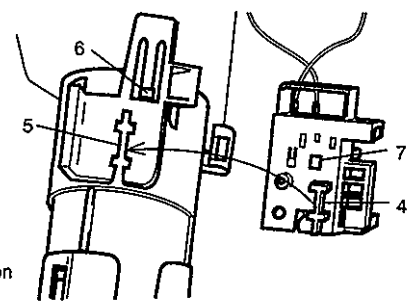
"A": Apply oil
1. Bracket sub assembly (including fuel filter)
2. Grommet
3. Tube
4. Housing
5. Lead wire
6. Fuel level gauge (Fuel sender gauge)
7. Fuel pump
8. Cushion
9. Bracket
10. Spacer

[Removal]



1. Snap-fit part
2. Resistor plate
3. Float arm

[Installation]



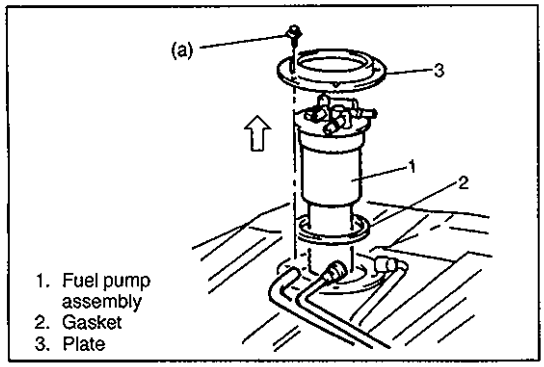
4. Protrusion
5. Groove
6. Lug
7. Window

CAUTION:

- **While removing fuel level gauge, do not contact resistor plate or deform arm. It may cause fuel level gauge to fail.**
- **When removing grommet from fuel tube or bracket sub assembly, be very careful not to cause damage to grommet installed section (sealed section in bore). Should it be damaged, replace it with new one, or fuel will leak from that part.**

NOTE

- **When removing fuel level gauge, press snap-fit part and slide it in the arrow direction as shown in figure.**
- **When installing fuel level gauge to housing, fit protrusion of fuel level gauge in groove in housing and slide it up till lug fits in window securely. Refer to figure shown left.**

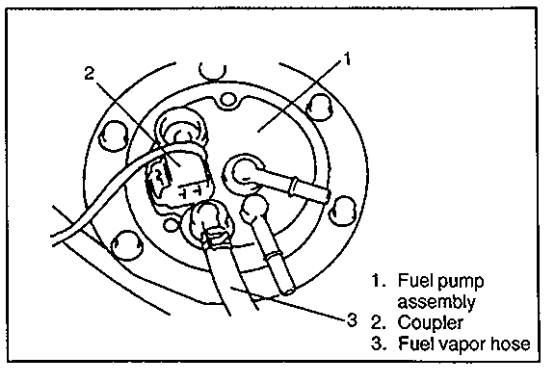


1. Fuel pump assembly
2. Gasket
3. Plate

INSTALLATION

1) Clean mating surfaces of fuel pump assembly and fuel tank.
2) Install new gasket and plate to fuel pump assembly then install fuel pump assembly to fuel tank.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



1. Fuel pump assembly
2. Coupler
3. Fuel vapor hose

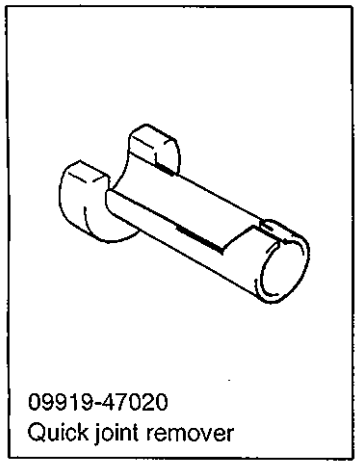
3) Connect wire horness coupler and fuel vapor hose to fuel pump assembly.

4) Install fuel tank to vehicle. Refer to FUEL TANK INSTALLATION in this section.

TIGHTENING TORQUE SPECIFICATION

Fastening parts	Tightening torque		
	N.m	kg-m	lb-ft
Fuel pump assembly bolt	10	1.0	7.5

SPECIAL TOOL


09919-47020
Quick joint remover

SECTION 6E

ENGINE AND EMISSION CONTROL SYSTEM

WARNING:
For vehicles equipped with Supplement Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either or these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:
Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.

- **EGR valve**
- **Evaporative emission control system**
- **Heated oxygen sensor or CO adjusting resistor**
- **Three way catalytic converter**

CONTENTS

GENERAL DESCRIPTION

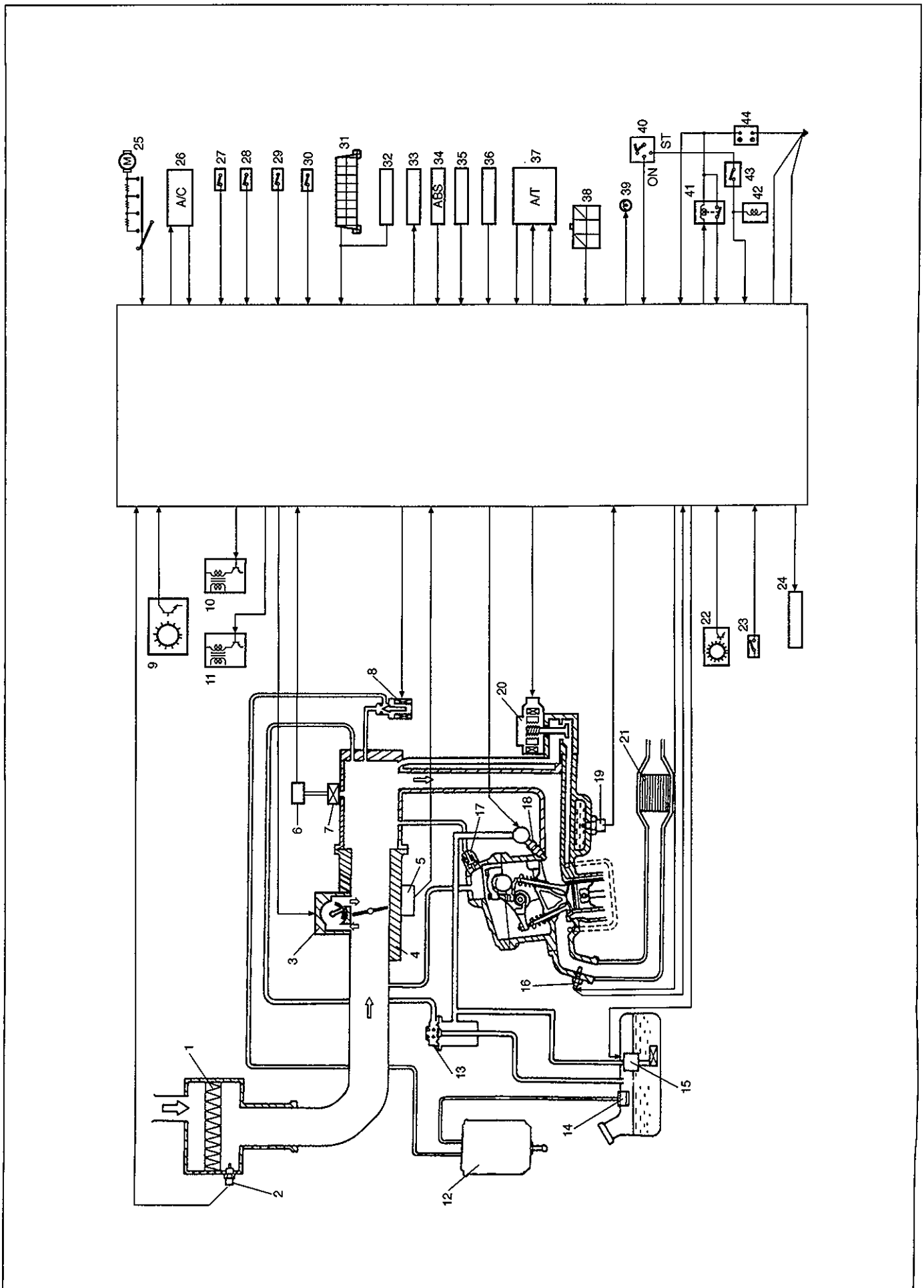
The engine and emission control system has 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

Air intake system includes air cleaner, throttle body, idle air control valve and intake manifold.

Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, fuel injectors, etc.

Electronic control system includes ECM, various sensors and controlled devices.

Emission control system includes EGR, EVAP and PCV systems.


A/C
ABS
A/T
ON
ST

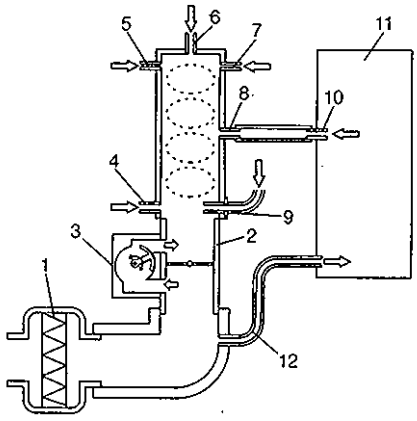
1. Air cleaner
2. Intake air temp. sensor
3. Idle air control valve
4. Throttle body
5. Throttle position sensor
6. Manifold absolute pressure sensor
7. Filter
8. EVAP canister purge valve (if equipped)
9. Camshaft position sensor
10. Ignition coil assembly for No.1 and No.4 spark plug
11. Ignition coil assembly for No.2 and No.3 spark plug
12. EVAP canister (if equipped)
13. Fuel pressure regulator
14. Tank pressure control valve
15. Fuel pump
16. Heated oxygen sensor (if equipped)
17. PCV valve
18. Fuel injector
19. Engine coolant temp. sensor
20. EGR valve (if equipped)
21. Three way catalytic converter (if equipped)
22. Vehicle speed sensor
23. Power steering pressure switch (if equipped)
24. A/C condenser fan (if equipped)
25. Heater blower fan switch
26. A/C control module (if equipped)
27. Lighting switch
28. Stop lamp switch
29. Rear defogger switch
30. "R" range switche (A/T)
31. Data link connector
32. Immobilizer control module (if equipeed)
33. Tachometer (if equipped)
34. ABS control module (if equipped)
35. Ignition timing adjusting resistor
36. CO adjusting resistor (if equipped)
37. A/T control module (A/T)
38. Monitor coupler
39. Malfunction indicator lamp
40. Ignition switch
41. Main relay
42. Starter magnetic switch
43. Park/Neutral position switch in TR switch (A/T)
44. Battery

AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, air cleaner outlet hose, throttle body, idle air control valve and intake manifold.

The air (by the amount corresponding to the throttle valve opening and engine speed) is filtered by the air cleaner, passes through the throttle body, is distributed by the intake manifold and finally drawn into each combustion chamber.

When the idle air control valve is opened according to the signal from ECM, the air bypasses the throttle valve through bypass passage and is finally drawn into the intake manifold.



1. Air cleaner
2. Throttle body
3. IAC valve
4. Union (EVAP purge)
5. Union (Air lock hub control valve)
6. Union (Brake booster)
7. Union (Fuel pressure regulator)
8. Union (PCV)
9. EGR pipe
10. PCV valve
11. Cylinder head cover
12. Breather hose

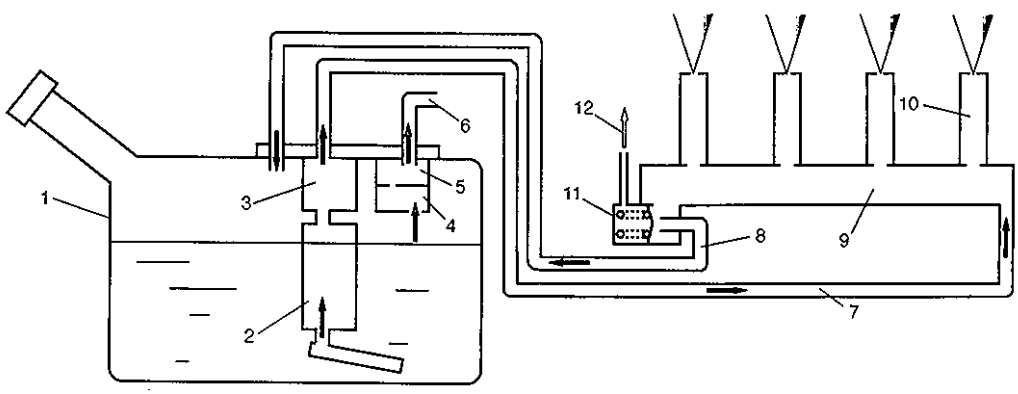
FUEL DELIVERY SYSTEM

The fuel delivery system consists of the fuel tank, fuel pump, fuel filter, fuel pressure regulator, delivery pipe and fuel injectors.

The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to each injector through the delivery pipe.

As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM.

The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.



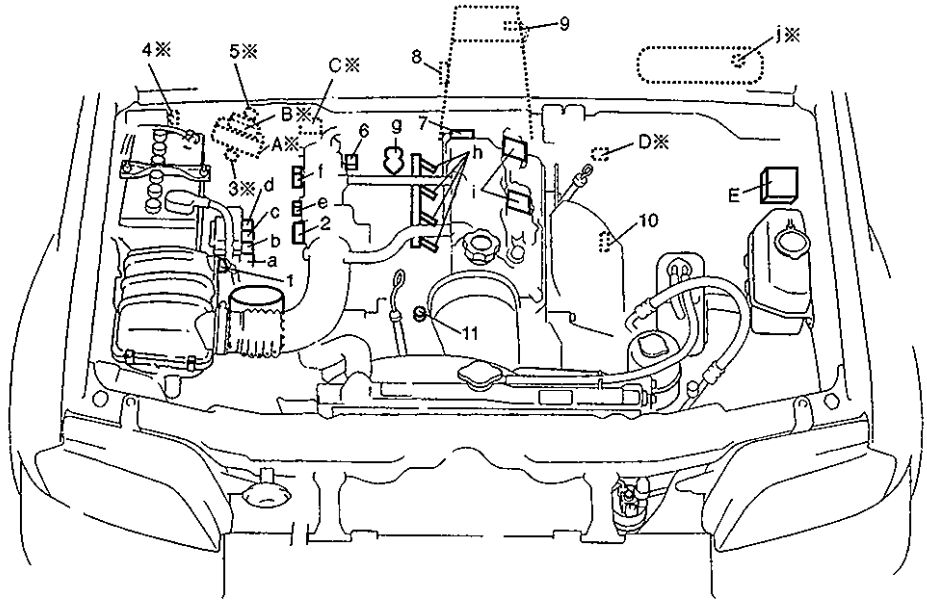
1. Fuel tank
2. Fuel pump
3. Fuel filter
4. Fuel cut valve
5. Fuel tank pressure control valve
6. To EVAP canister
7. Fuel feed line
8. Fuel return line
9. Fuel delivery pipe
10. Fuel injector
11. Fuel pressure regulator
12. To intake manifold (vacuum passage)

ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into the following sub systems:

- Main relay control system
- Fuel injection control system
- Heated oxygen sensor heater control system (if equipped)
- Idle air control system
- Fuel pump control system
- Evaporative emission control system (if equipped)
- Ignition control system
- EGR system (if equipped)

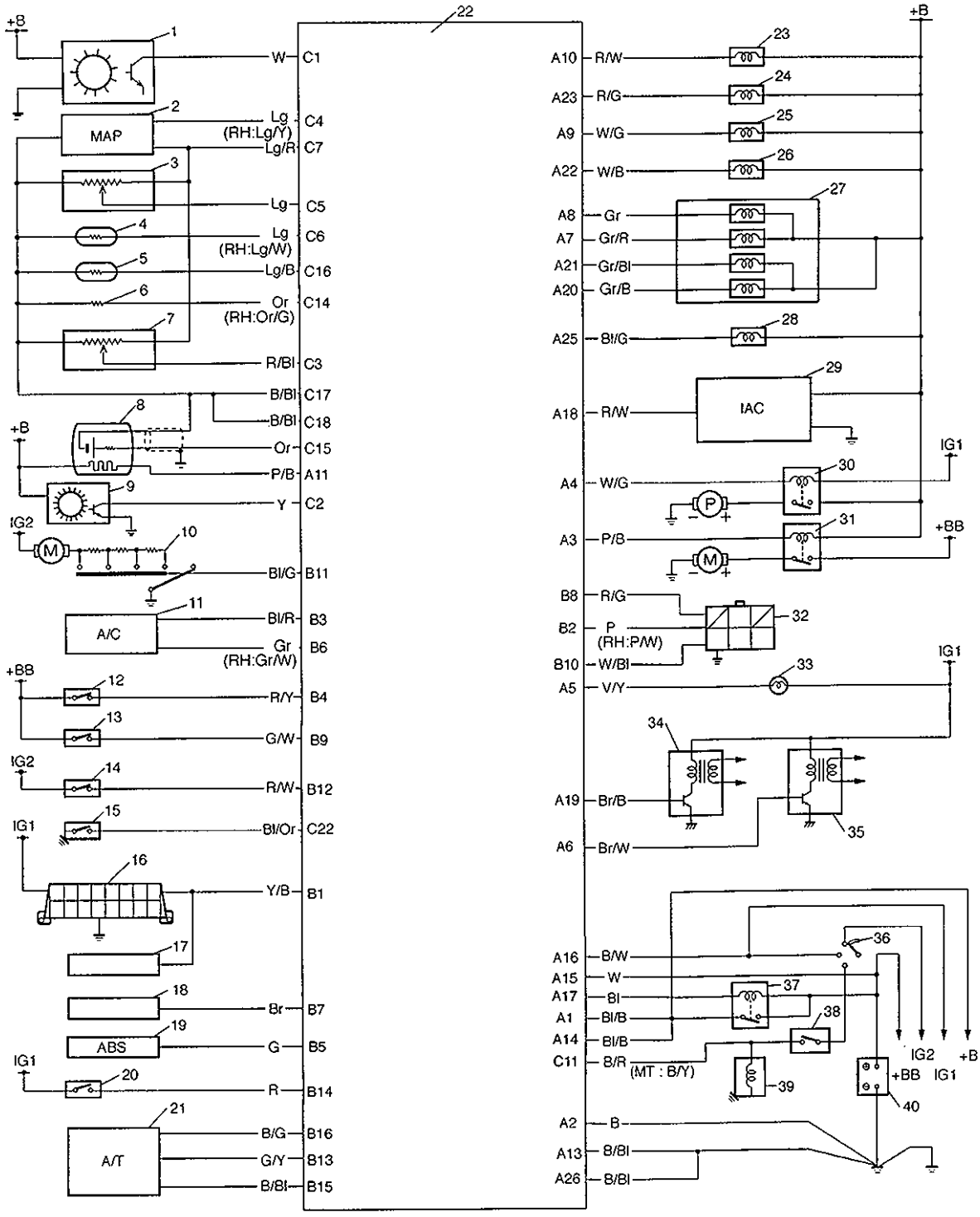


1. IAT sensor
2. TP sensor
3. Monitor coupler
4. CO adjusting resistor
5. Ignition timing adjusting resistor
6. MAP sensor
7. CMP sensor
8. Transmission range switch
9. VSS
10. HO2S
11. ECT sensor

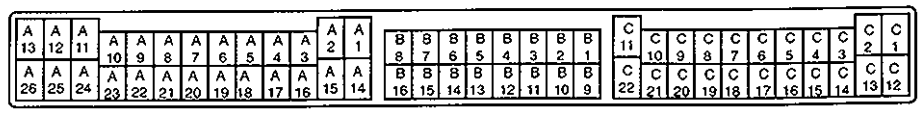
a A/C compressor relay
b A/C condenser fan motor relay
c Main relay
d Fuel pump relay
e IAC valve
f EVAP canister purge valve
g EGR valve
h Fuel injector
i Ignitor coil assemblies
j MIL

A ECM
B AT control module
C A/C control module
D DLC
E ABS control module

NOTE:
Above figure shows left-hand steering vehicle. For right hand steering vehicle, parts with (※) are installed at the other side.

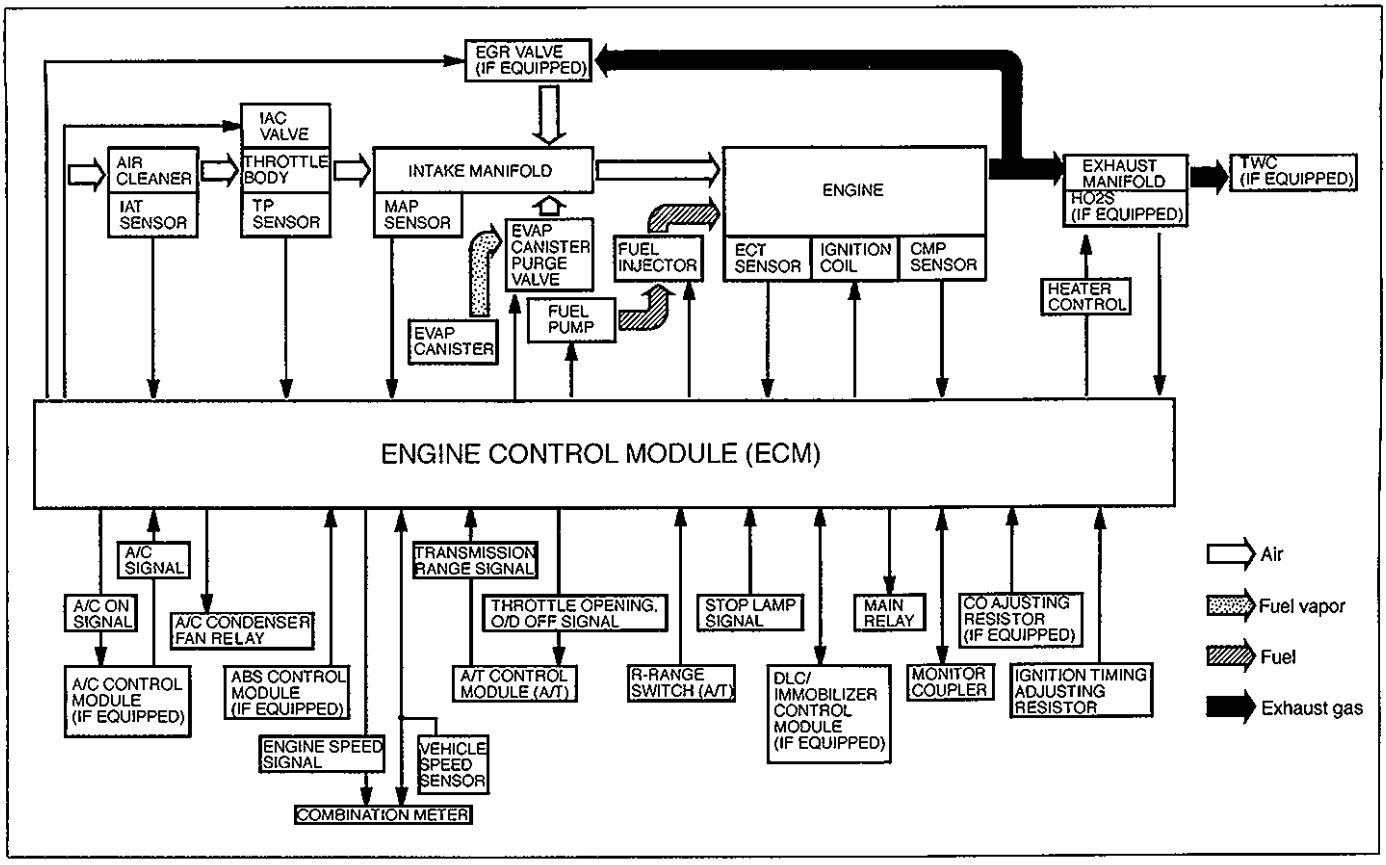


TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



1.Camshaft position sensor
2.Manifold absolute pressure sensor
3.Throttle position sensor
4.Engine coolant temp. sensor
5.Intake air temp. sensor
6.Ignition timing adjusting resistor
7.CO adjusting resistor (w/o HO2S)
8.Heated oxygen sensor (if equipped)
9.Vehicle speed sensor
10.Heater blower switch
11.A/C control module (if equipped)
12.Lighting switch
13.Stop lamp switch
14.Rear defogger switch (if equipped)
15.Power steering pressure switch
16.Data link connector
17.Immobilizer control module (if equipped)
18.Tacho meter (if equipped)
19.ABS control module (if equipped)
20.R-range switch (A/T)
21.A/T control module (A/T)
22.Engine control module
23.Fuel injector No.1
24.Fuel injector No.2
25.Fuel injector No.3
26.Fuel injector No.4
27.EGR valve (if equipped)
28.EVAP canister purge valve (if equipped)
29.IAC valve
30.Fuel pump relay
31.A/C condenser fan motor relay (if equipped)
32.Monitor connector
33.Malfunction indicator lamp
34.Ignition coil assembly for No.2 and No.3
35.Ignition coil assembly for No.1 and No.4
36.Ignition switch
37.Main relay
38.Park/Neutral position switch (A/T)
39.Starter magnetic switch
40.Battery

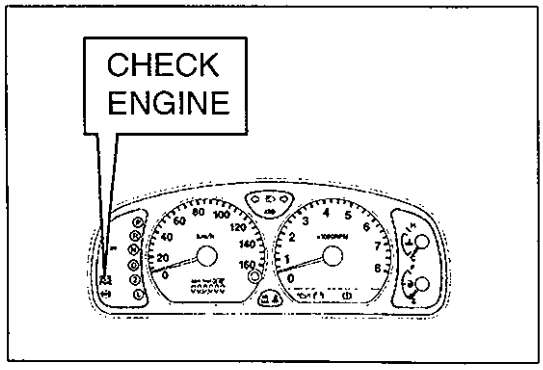
A1	Bl/B	Power source
A2	B	Ground
A3	P/B	A/C condenser fan motor relay (if equipped)
A4	W/G	Fuel pump relay
A5	V/Y	Malfunction indicator lamp
A6	Br/W	Ignition coil assembly for No.1 and No.4
A7	Gr/R	EGR valve (stepper motor coil 3, if equipped)
A8	Gr	EGR valve (stepper motor coil 1, if equipped)
A9	W/G	Fuel injector No.3
A10	R/W	Fuel injector No.1
A11	P/B	Heater of HO2S (if equipped)
A12	–	–
A13	B/Bl	Ground
A14	Bl/B	Power source
A15	W	Power source for back up
A16	B/W	Ignition switch (if equipped)
A17	Bl	Main relay
A18	R/W	IAC valve (stepper motor coil 1)
A19	Br/B	Ignition coil assembly for No.2 and No.3
A20	Gr/B	EGR valve (stepper motor coil 4, if equipped)
A21	Gr/Bl	EGR valve (stepper motor coil 2, if equipped)
A22	W/B	Fuel injector No.4
A23	R/G	Fuel injector No.2
A24	–	–
A25	Bl/G	EVAP canister purge valve (if equipped)
A26	B/Bl	Ground
B1	Y/B	Data link connector
B2	P (RH:P/W)	Test switch terminal
B3	Bl/R	A/C signal (if equipped)
B4	R/Y	Lighting switch
B5	G	ABS signal (if equipped)
B6	Gr (RH:Gr/W)	A/C cut signal (if equipped)
B7	Br	Tacho meter
B8	R/G	Duty output terminal
B9	G/W	Stop lamp switch
B10	W/Bl	Diag. Switch terminal
B11	Bl/G	Heater blower switch
B12	R/W	Rear defogger switch (if equipped)
B13	G/Y	Park/Neutral position signal
B14	R	R-range signal
B15	B/Bl	Throttle opening signal
B16	B/Y	Overdrive cut signal
C1	W	Camshaft position sensor
C2	Y	Vehicle speed sensor
C3	R/Bl	CO adjusting resistor (w/o H2S)
C4	Lg (RH:Lg/Y)	Manifold absolute pressure sensor
C5	Lg	Throttle position sensor
C6	Lg (RH:Lg/W)	Engine coolant temp. sensor
C7	Lg/R	Power source for MAP sensor, TP sensor, CO adjust resistor
C8, C9, C10		–
C11	B/R (MT:B/Y)	Engine start signal
C12, C13		–
C14	Or (RH:Or/G)	Ignition timing adjusting resistor
C15	Or	Heated oxygen sensor (if equipped)
C16	Lg/B	Intake air temp. sensor
C17	B/Bl	Ground
C18	B/Bl	Ground
C19, C20, C21		–
C22	Bl/Or	Power steering pressure switch



		SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE																				
		CMP SENSOR	MAP SENSOR	TP SENSOR	ECT SENSOR	IAT SENSOR	HO2S (IF EQUIPPED)	CO ADJUSTING RESISTOR (W/O HO2S)	VSS	IGNITION TIMING ADJUSTING RESISTOR	BLOWER FAN SWITCH	REAR DEFOGGER SWITCH (IF EQUIPPED)	LIGHTING SWITCH	PSP SWITCH (IF EQUIPPED)	IGNITION SWITCH	START SWITCH	STOP LAMP SWITCH	"R" RANGE SWITCH	A/T CONTROL MODULE	ABS CONTROL MODULE (IF EQUIPPED)	A/C CONTROL MODULE (IF EQUIPPED)	DIAGNOSIS SWITCH	TEST SWITCH
ELECTRIC CONTROL DEVICE	FUEL PUMP RELAY	○													○	○							
	FUEL INJECTOR	○	○	○	○	○	○	○								○			○	○			
	HO2S HEATER	○	○																				
	IAC VALVE	○	○	○	○	○			○		○	○	○	○			○		○	○	○		
	IGNITION COIL WITH IGNITER	○	○		○	○				○	○	○		○				○					○
	EGR VALVE	○	○	○	○	○																	
	EVAP CANISTER PURGE VALVE	○	○	○	○																		
	A/T CONTROL MODULE	○		○	○																		
	A/C CONTROL MODULE	○		○	○																○		
	A/C CONDENSER FAN RELAY				○																○		
	TACHOMETER	○																					
	MIL	○													○							○	
	MAIN RELAY														○								

DIAGNOSIS

The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system.
When diagnosing troubles, be sure to have full understanding of the outline of "On-Board Diagnostic System" and each item in "Precaution in Diagnosing Trouble" and execute diagnosis according to "Engine Diagnostic Flow Table" in section 6.



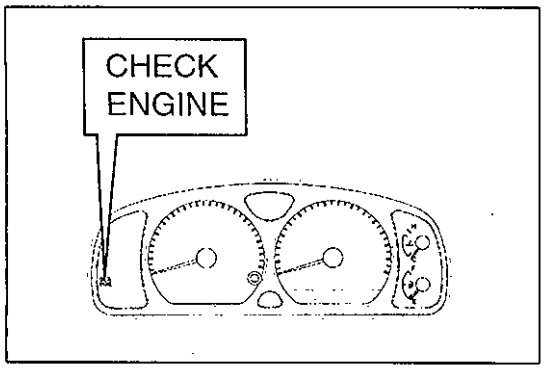
ON-BOARD DIAGNOSTIC SYSTEM

ECM performs on-board diagnosis (self-diagnosis) on the system and operates "CHECK ENGINE" lamp (malfunction indicator lamp) as follows.

- Malfunction indicator lamp ("CHECK ENGINE" light) lights when the ignition switch is turned ON position (but the engine at stop) regardless of the condition of Engine and emission control system. This is only to check the malfunction indicator lamp ("CHECK ENGINE" light) bulb and its circuit.
- If the areas monitored by ECM is free from any trouble after the engine start (while engine is running), malfunction indicator lamp ("CHECK ENGINE" light) turns OFF.
- When ECM detects a trouble which has occurred in the areas, it makes malfunction indicator lamp ("CHECK ENGINE" light) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the exact trouble area in ECM back-up memory.

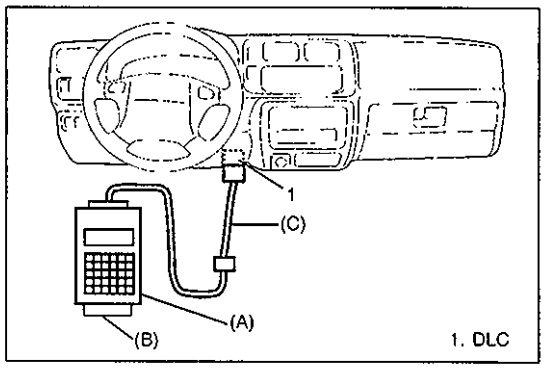
PRECAUTIONS IN DIAGNOSING TROUBLES

- Before identifying diagnostic trouble code, don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine. Such disconnection will erase memorized trouble in ECM memory.
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM replacement
  When substituting a known-good ECM, check for following conditions. Neglecting this check may cause damage to known-good ECM.
  – Resistance value of all relays, actuators is as specified respectively.
  – TP sensor and MAP sensor are in good condition and none of power circuits of these sensors is shorted to ground.



MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LAMP) CHECK

1) Turn the ignition switch ON position (but engine at stop) and check that malfunction indicator lamp ("CHECK ENGINE" lamp) lights. If lamp does not light up, go to "Diagnostic Flow Table A-1" in this section. If lamp flushes, go to "Diagnostic Flow Table A-2" in this section.
2) Start engine and check that malfunction indicator lamp ("CHECK ENGINE" lamp) turns OFF.
   If lamp remains ON, go to "Diagnostic Trouble Code Check".



DIAGNOSTIC TROUBLE CODE (DTC) CHECK

NOTE:
Diagnostic trouble code No.37 (ABS SIGNAL) is not read by using SUZUKI scan tool.

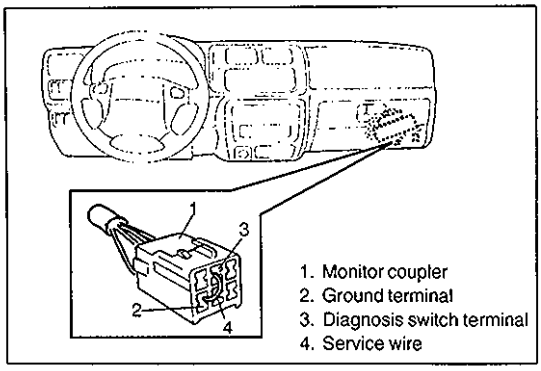
[Using SUZUKI scan tool]

NOTE:
It is not possible to read DTCs of immobilizer control system by using SUZUKI scan tool. If immobilizer control system is suspected to be defective (engine fails to start and "CHECK ENGINE" lamp flashes at ignition switch ON), check DTCs by using "CHECK ENGINE" lamp.

1) Check malfunction indicator lamp ("CHECK ENGINE" lamp) referring to "Malfunction Indicator Lamp ("CHECK ENGINE" lamp) Check" in this section.
2) Turn the ignition switch OFF position.
3) After setting cartridge to SUZUKI scan tool, connect it to data link connector (DLC) located on underside of instrument panel at driver's seat side.

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/14 pin DLC cable)

4) Turn the ignition switch ON position.
5) Read DTC according to instructions displayed on SUZUKI scan tool and print it or write it down. Refer to SUZUKI scan tool operator's manual for further details.
   "NO CODE" is displayed, recheck DTC by not using SUZUKI scan tool procedure.
   If communication between SUZUKI scan tool and ECM is not possible, check if SUZUKI scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, SUZUKI scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
6) After completing the check, turn the ignition switch OFF position and disconnect SUZUKI scan tool from data link connector (DLC).



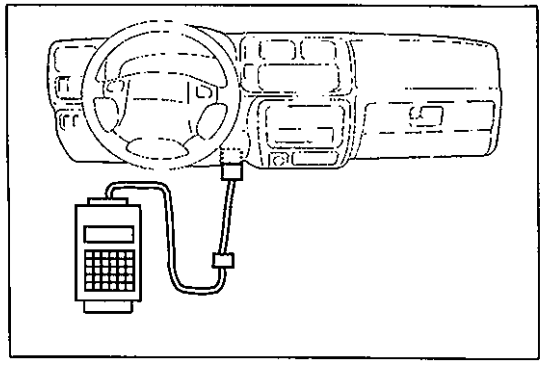
[Not using SUZUKI scan tool]

1) Check malfunction indicator lamp ("CHECK ENGINE" light) referring to "Malfunction Indicator Lamp ("CHECK ENGINE" light) Check" in this section.
2) With the ignition switch OFF position, disconnect SUZUKI scan tool if connected and using service wire, ground diagnosis switch terminal in monitor coupler.
3) With the ignition switch ON position and leaving engine OFF, read DTC from flashing pattern of malfunction indicator lamp ("CHECK ENGINE" light). Refer to "Diagnostic Trouble Code Table".
   If lamp remains ON, go to "Diagnostic Flow Table A-3".

NOTE:

- **If abnormality or malfunction lies in two or more areas, malfunction indicator lamp ("CHECK ENGINE" light) indicates applicable codes three times each.**
  And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- **Take a note of diagnostic trouble code indicated first.**

4) After completing the check, turn the ignition switch OFF position and disconnect service wire from monitor coupler.



DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

[Using SUZUKI scan tool]

1) Turn the ignition switch OFF position.
2) Connect SUZUKI scan tool to data link connector (DLC) in the same manner as when making this connection for DTC check.
3) Turn the ignition switch ON position.
4) Erase DTC according to instructions displayed on SUZUKI scan tool.
   Refer to SUZUKI scan tool operator's manual for further details.
5) After completing the clearance, turn the ignition switch OFF position and disconnect SUZUKI scan tool from data link connector (DLC).

[Not using SUZUKI scan tool]

1) Turn the ignition switch OFF position.
2) Disconnect battery negative cable for specified time below to erase diagnostic trouble code stored in ECM memory and reconnect it.

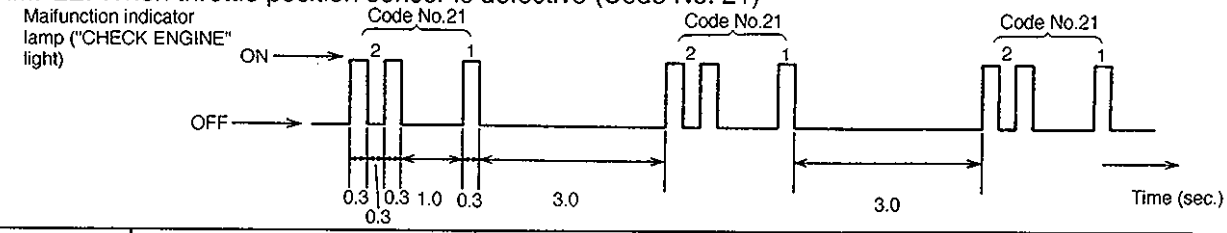
Time required to erase DTC:

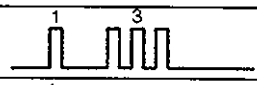
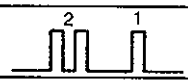
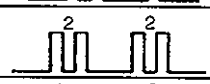
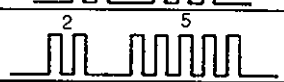
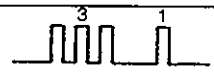
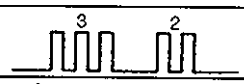
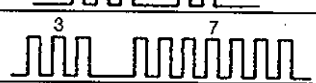
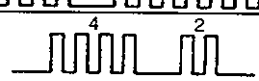
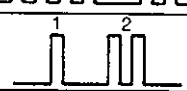
Ambient temperature	Time to cut power to ECM
Over 0°C (32°F)	30 sec. or longer
Under 0°C (32°F)	Not specifiable. Select a place with higher than 0°C (32°F) temperature.

DIAGNOSTIC TROUBLE CODE TABLE (M/T AND A/T)

NOTE: DTC No.37 is read by MIL flashing pattern only.

EXAMPLE: When throttle position sensor is defective (Code No. 21)



DIAGNOSTIC TROUBLE CODE NO.	MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) FLASHING PATTERN	DIAGNOSTIC ITEM	DIAGNOSIS
13		Heated oxygen sensor (if equipped)	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
14		Engine coolant temperature sensor	
15			
21		Throttle position sensor	
22			
23		Intake air temperature sensor	
25			
24		Vehicle speed sensor	
31		Manifold absolute pressure sensor	
32			
37		ABS signal (if equipped)	
42		Camshaft position sensor	
12		Normal	This code appears when none of the other codes (above codes) are identified.

DIAGNOSTIC TROUBLE CODE TABLE (FOR VEHICLE EQUIPPED WITH IMMOBILIZER CONTROL SYSTEM ONLY)

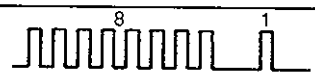
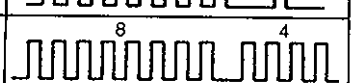
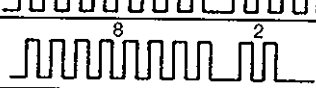
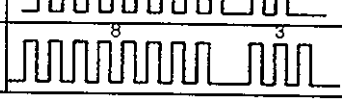
DIAGNOSTIC TROUBLE CODE NO.	MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) FLASHING PATTERN	DIAGNOSTIC ITEM	DIAGNOSIS
81		ECM/ICM code	Refer to "IMMOBILIZER CONTROL SYSTEM" section.
84			
82		ECM	
83		Serial data link	

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK
MIL DOES NOT COME ON AT IGNITION SWITCH ON LEAVING ENGINE OFF

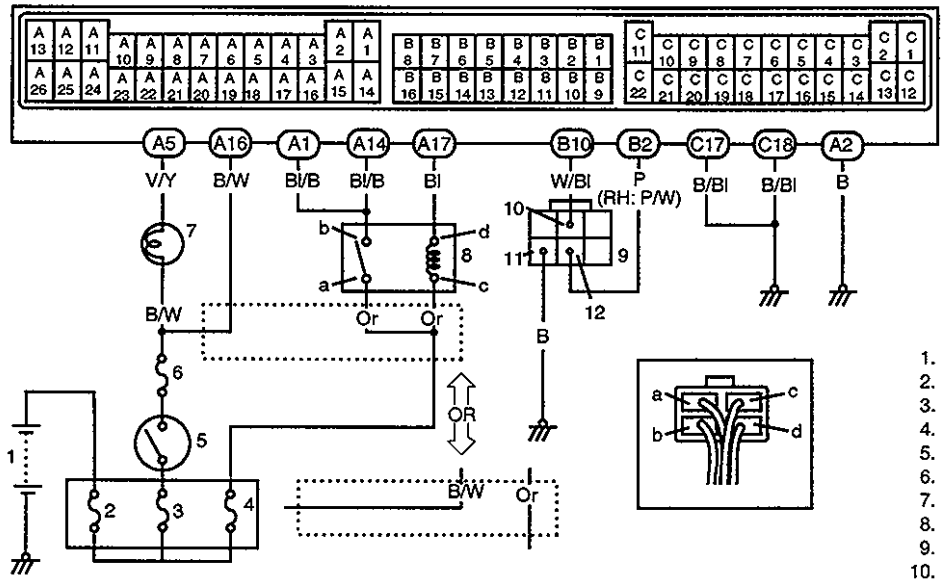
TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK
MIL FLASHES AT IGNITION SWITCH ON

TABLE A-3 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK
MIL DOES NOT FLASH, JUST REMAINS ON OR JUST REMAINS OFF EVEN WITH GROUNDING DIAGNOSIS SWITCH TERMINAL

TABLE A-4 ECM POWER AND GROUND CIRCUIT CHECK
MIL DOES NOT LIGHT AT IGNITION SWITCH ON AND ENGINE DOES NOT START THOUGH IT IS CRANKED UP

WIRING DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



1. Battery
2. "BATT" fuse
3. "IG" fuse
4. "FI" fuse
5. Ignition switch
6. "IG COIL METER" fuse
7. MIL (CHECK ENGINE LAMP)
8. Main relay
9. Monitor coupler
10. Diagnosis switch terminal
11. Ground terminal
12. Test switch terminal

TROUBLE SHOOTING

TABLE A-1

STEP	ACTION	YES	NO
1	Test switch terminal circuit check: (1) With the ignition switch ON position, check voltage between B2 terminal of ECM coupler and ground. Is voltage 4-5V?	Go to Step 2.	"P" (RH: "P/W") wire (test switch terminal) shorted to ground circuit. If OK, substitute a known good ECM and recheck.
2	MIL bulb and circuit check: (1) Using service wire, ground A5 terminal of ECM coupler. Does MIL turn ON at ignition switch ON position?	Go to TABLE A-4.	MIL bulb burned out. Fuse(s) blown. Ignition switch malfunction. "V/Y" wire open. "B/W" wire open.

TABLE A-2

STEP	ACTION	YES	NO
1	MIL flashing pattern check: (1) With the ignition switch ON position, check MIL flashing pattern. Does MIL flashing pattern indicate DTC (diagnostic trouble code) ?	Go to Step 2.	Go to "Diagnosis" in section 8A.
2	Diagnosis switch terminal check: (1) With the ignition switch ON position, check voltage between B10 terminal of ECM coupler and ground. Is voltage 4-5V?	Substitute a known good ECM and recheck.	"W/Bl" wire (diagnosis switch terminal) shorted to ground circuit. If OK, substitute a known good ECM and recheck.

TABLE A-3

STEP	ACTION	YES	NO
1	Diagnosis switch terminal check: (1) With grounding diagnosis switch terminal and turn the ignition switch ON position, check voltage between B10 terminal of ECM coupler and ground. Is voltage 0-1V?	Go to Step 2.	"W/Bl" wire (diagnosis switch terminal), "B" wire of monitor coupler open. If OK, substitute a known good ECM and recheck.
2	Test switch terminal circuit check: (1) With the ignition switch ON position, check voltage between B2 terminal of ECM coupler and ground. Is voltage 4-5V?	Substitute a known good ECM and recheck.	"P" (RH: "P/W") wire (test switch terminal) shorted to ground circuit. If OK, substitute a known good ECM and recheck.

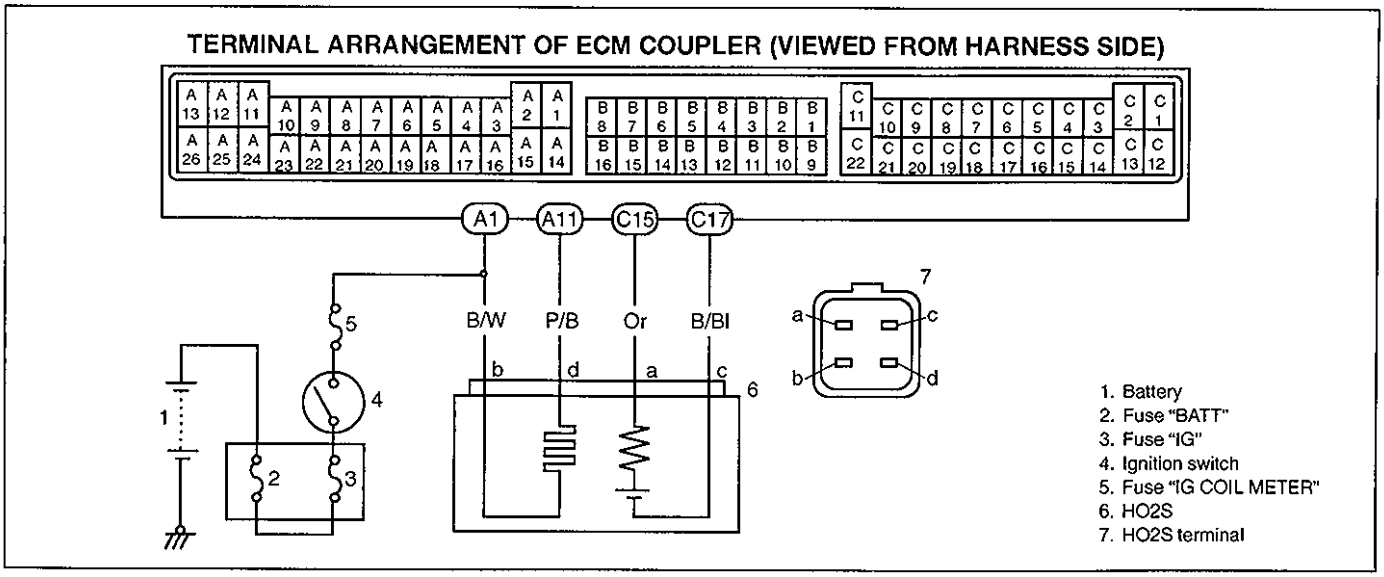
TABLE A-4

STEP	ACTION	YES	NO
1	Was "TABLE A-1" performed?	Go to Step 2.	Perform "TABLE A-1".
2	Ignition switch signal check: (1) With the ignition switch ON position, check voltage between A16 terminal of ECM coupler and ground. Is voltage 10-14V?	Go to step 3.	"B/W" wire open.
3	Main relay power circuit check: (1) With the ignition switch OFF position, Check voltage between "a" terminal of main relay coupler and ground, "c" terminal of main relay coupler and ground. Is each voltage 10-14V?	Go to Step 4.	Fuse blown. "Or", "B/W" wire open.
4	Main relay function check: (1) Check main relay function referring to "main relay inspection" in this section. Is main relay in good condition?	Go to Step 5.	Replace main relay and recheck.
5	ECM ground circuit check: (1) Disconnect ECM couplers. (2) Check continuity between C17 terminal of ECM coupler and ground C18 terminal of ECM coupler and ground A2 terminal of ECM coupler and ground Is each check result OK?	Go to Step 6.	"B/Bl","B" circuit open.
6	Main relay circuit check: (1) Check voltage between A17 terminal of ECM coupler and ground. Ignition switch OFF position : 10-14V Ignition switch ON position : 0-2V Is each check result as specified?	Go to Step 7.	"Bl" wire open. If OK, substitute a known-good ECM and recheck.
7	ECM power circuit check: (1) With the ignition switch ON position, check voltage between A1 terminal of ECM coupler and ground A14 terminal of ECM coupler and ground. Is each voltage 10-14V?	ECM power and ground circuit in good condition.	"Bl/B" wire open.

DTC NO.13 HEATED OXYGEN SENSOR CIRCUIT

(SIGNAL VOLTAGE LOW)

WIRING DIAGRAM



NOTE:

- **Before diagnosing trouble according to flow table given below, check to make sure that following system and parts other than Electronic Fuel Injection system are in good condition.**
  - **Air cleaner (clogged)**
  - **Vacuum leaks (air inhaling)**
  - **Spark plugs (contamination, gap)**
  - **High-tension cords (crack, deterioration)**
  - **Ignition timing**
  - **Engine compression**
  - **Any other system and parts which might affect A/F mixture or combustion.**
- **If code No.13 and another code No. are Indicated together, the latter has priority. Therefore, check and correct what is represented by that code No. first and then proceed to the following check.**
- **Be sure to use a voltmeter with high impedance (MΩ/V minimum) or digital type voltmeter for accurate measurement.**

TROUBLE SHOOTING

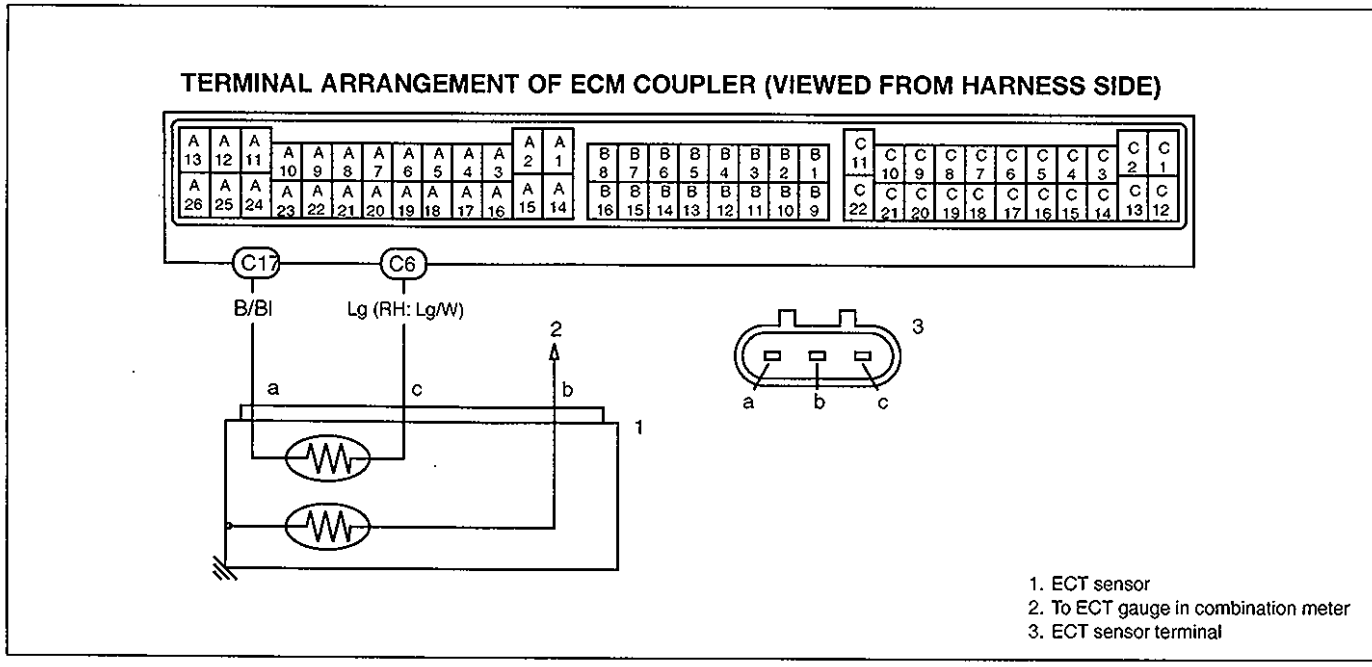
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	HO2S output signal check: (1) Connect voltmeter between C15 and C17 of ECM coupler. (2) Warm up engine to normal operating temperature. (3) Maintain engine speed at 2000 r/min. after 60 seconds, check voltmeter. Does the voltage deflect between above and below 0.55 V repeatedly?	Intermittent trouble. If Ok, substitute a known good ECM and recheck.	Go to Step 3.
3	Wiring harness check: (1) Check "Or" and "B/Bl" wire for open and short. Are they in good condition?	Replace HO2S and recheck.	Repair or replace.

NOTE:

Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.14 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH)
DTC NO.15 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW)

WIRING DIAGRAM



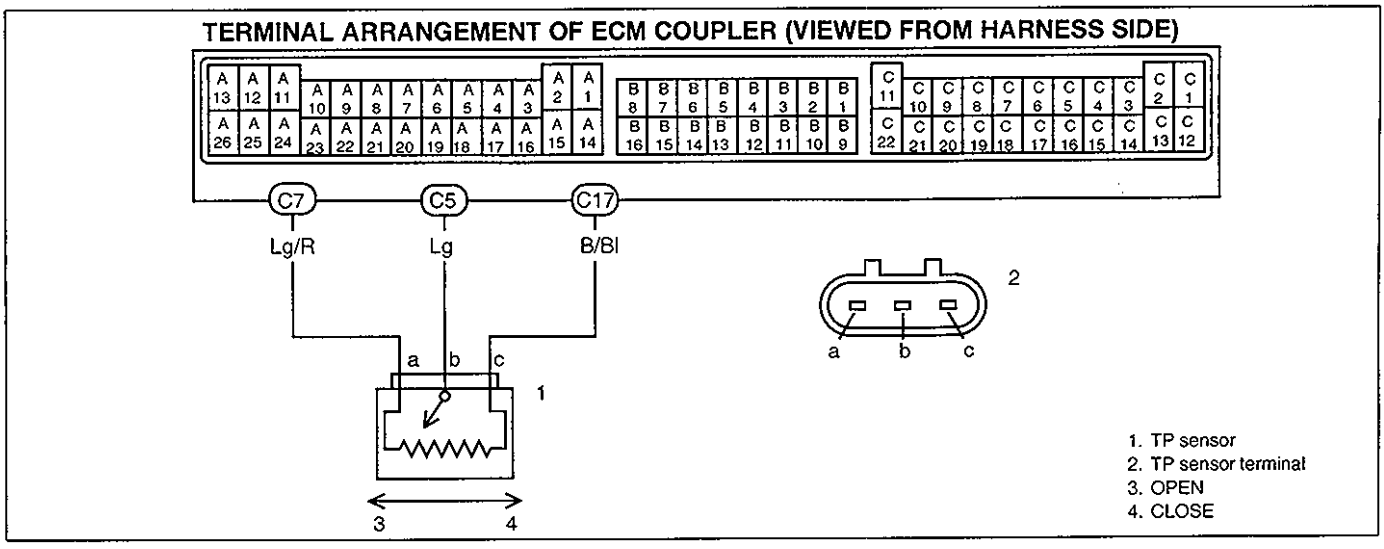
TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	(1) With the ignition switch OFF position, disconnect ECT sensor coupler. (2) With the ignition switch ON position, check voltage between "Lg" (RH: "Lg/W") wire terminal of ECT sensor coupler and ground. Is voltage 4-5V?	**DTC NO.14:** Go to Step 3.	**DTC NO.14:** "Lg" (RH: "Lg/W") wire open or shorted to power circuit. If OK, substitute a known good ECM and recheck.
		DTC NO.15: Go to Step 4.	**DTC NO.15:** "Lg" (RH: "Lg/W") wire shorted to ground circuit. If OK, substitute a known good ECM and recheck.
3	(1) Using service wire, connect "Lg" (RH: "Lg/W") wire terminal and "B/Bl" wire terminal. (2) With the ignition switch ON position, check voltage between "Lg" (RH: "Lg/W") wire terminal of ECT sensor coupler and ground. Is voltage below 0.15V?	Go to Step 4.	"B/Bl" wire open. If OK, substitute a known good ECM and recheck.
4	(1) Check ECT sensor referring to "ECT sensor inspection" in this section. Is check result as specified?	Poor ECT sensor terminal connection. If OK, intermittent trouble or faulty ECM.	Faulty ECT sensor.

NOTE:
Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.21 THROTTLE POSITION SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH)
DTC NO.22 THROTTLE POSITION SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW)

WIRING DIAGRAM



TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	(1) With the ignition switch OFF position, disconnect TP sensor coupler. (2) With the ignition switch ON position, check voltage between "Lg/R" wire terminal of TP sensor coupler and ground. Is voltage 4-5V?	Go to Step 3.	**DTC NO.21:** "Lg/R" wire shorted to power circuit. If OK, substitute a known good ECM and recheck. **DTC NO.22:** "Lg/R" wire shorted to ground circuit. If OK, substitute a known good ECM and recheck.
3	(1) With the ignition switch ON position, check voltage between "Lg" wire terminal of TP sensor coupler and ground. Is voltage 4-5V?	Go to Step 4.	**DTC NO.21:** "Lg" wire shorted to power circuit. If OK, substitute a known good ECM and recheck. **DTC NO.22:** "Lg" wire shorted to ground circuit. If OK, substitute a known good ECM and recheck.
4	(1) Check TP sensor referring to "TP sensor inspection" in this section. Is check result within specifications?	**DTC NO.21:** "B/Bl" wire open. If OK, substitute a known good ECM and recheck. **DTC NO.22:** If OK, substitute a known good ECM and recheck.	Replace TP sensor.

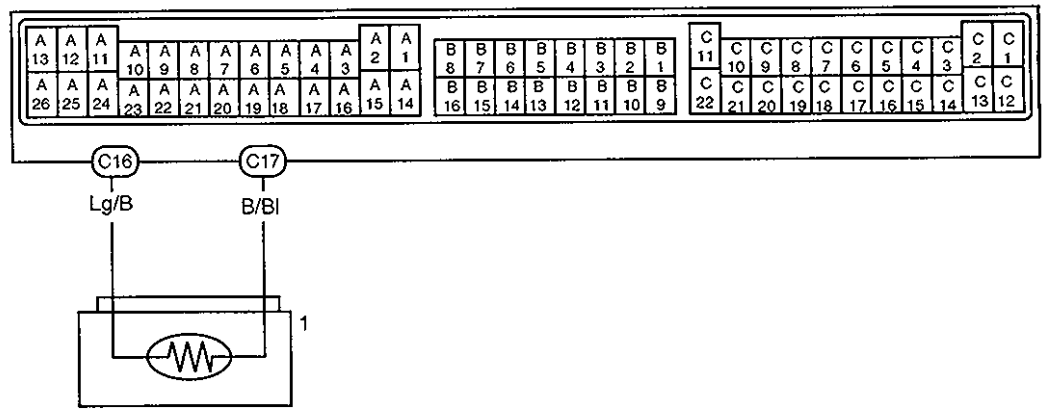
NOTE:

Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.23 INTAKE AIR TEMPERATURE SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH)
DTC NO.25 INTAKE AIR TEMPERATURE SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW)

WIRING DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



1. IAT sensor

TROUBLE SHOOTING

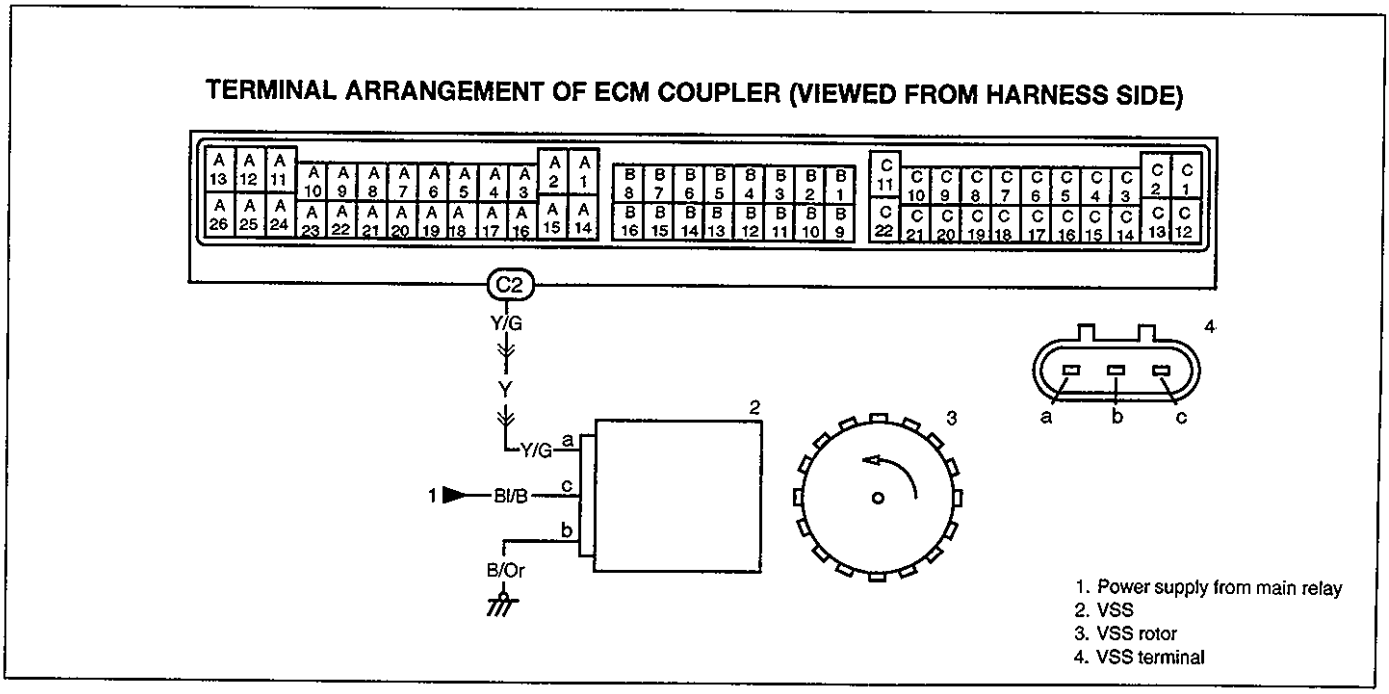
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	(1) With the ignition switch OFF position, disconnect ECT sensor coupler. (2) With the ignition switch ON position, check voltage between "Lg/B" wire terminal of IAT sensor coupler and ground. Is voltage 4-5V?	**DTC NO.23:** Go to Step 3.	**DTC NO.23:** "Lg/B" wire open or shorted to power circuit. If OK, substitute a known good ECM and recheck.
		DTC NO.25: Go to Step 4.	**DTC NO.25:** "Lg/B" wire shorted to ground circuit. If OK, substitute a known good ECM and recheck.
3	(1) Using service wire, connect "Lg/B" wire terminal and "B/Bl" wire terminal. (2) Check voltage between "Lg/B" wire terminal of IAT sensor coupler and ground. Is voltage below 0.15V?	Go to Step 4.	"B/Bl" wire open. If OK, substitute a known good ECM and recheck.
4	(1) Check IAT sensor referring to "IAT sensor inspection" in this section. Is check result as specified?	Poor IAT sensor terminal connection. If OK, intermittent trouble or faulty ECM.	Faulty IAT sensor.

NOTE:
Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.24 VEHICLE SPEED SENSOR CIRCUIT

(SIGNAL NOT INPUTTED ALTHOUGH FUEL IS KEPT CUT FOR LONGER THAN 4 SECONDS)

WIRING DIAGRAM



TROUBLE SHOOTING

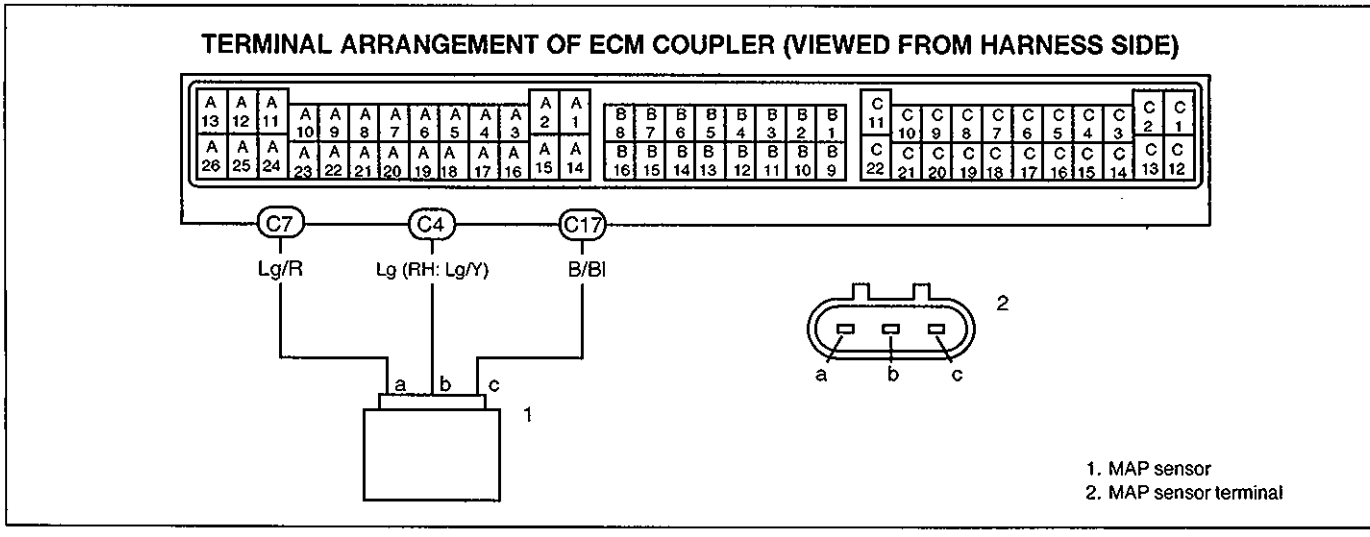
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	Does speedometer indicate vehicle speed?	Faulty "Y" wire. If OK, intermittent trouble or faulty ECM.	Go to Step 3.
3	(1) With the ignition switch OFF position, disconnect VSS coupler. (2) With the ignition switch ON position, check voltage between "Bl/B" wire terminal and "B/Or" wire terminal. Is voltage 10-14V?	Go to Step 4.	Faulty "Bl/B", "B/Or" wire.
4	(1) Under the same condition in Step 3, check voltage between "Y/G" wire terminal and ground. Is voltage 4V or more?	Go to Step 5.	Go to Step 6.
5	(1) Remove VSS referring to section 7D. (2) Check VSS rotor referring to section 7D. Is it in good condition?	Substitute a known good VSS and recheck.	Replace VSS rotor.
6	(1) Remove combination meter referring to section 8 and disconnect combination meter couplers. (2) With the ignition switch ON position, check voltage between "Y/G" wire terminal and ground. Is voltage 4-5V?	Speedometer malfunction.	Faulty "Y", "Y/G" wire. If OK, substitute a known good ECM and recheck.

NOTE:

Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.31 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW, PERFORMANCE PROBLEM)
DTC NO.32 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH)

WIRING DIAGRAM



TROUBLE SHOOTING

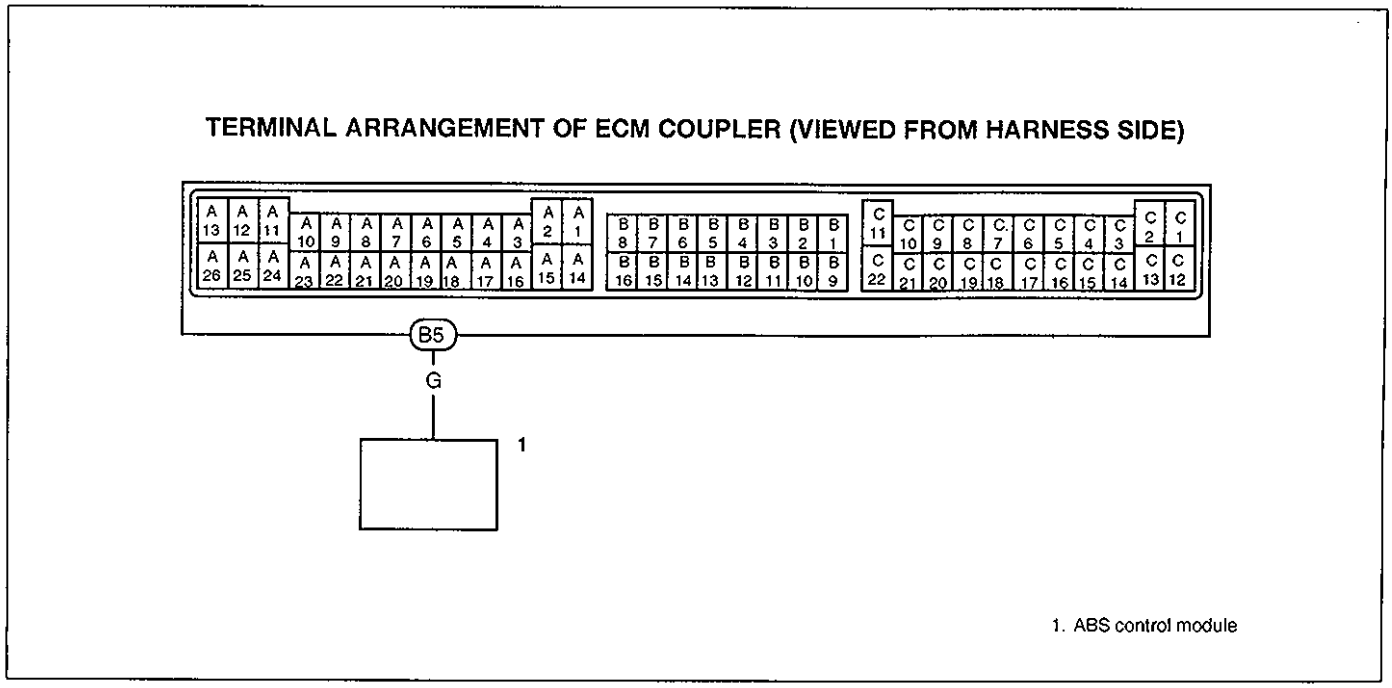
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	(1) With the ignition switch OFF position, disconnect MAP sensor coupler. (2) With the ignition switch ON position, check voltage between "Lg/R" wire terminal and ground. Is voltage 4-5V?	Go to Step 4.	**DTC NO.31:** "Lg/R" wire open or shorted to ground circuit. If OK, substitute a known good ECM and recheck. **DTC NO.32:** "Lg/R" wire shorted to power circuit. If OK, substitute a known good ECM and recheck.
3	(1) Check MAP sensor referring to "MAP sensor inspection" in this section. Is it in good condition?	Go to Step 4.	MAP sensor malfunction.
4	(1) Check vacuum passage filter and hose. Are they in good condition?	Go to Step 5.	Replace.
5	**DTC NO.31:** (1) Check "Lg" (RH: "Lg/Y") wire for shorted to ground circuit. Is "Lg" (RH: "Lg/Y") wire in good condition?	**DTC NO.31:** Intermittent trouble. If OK, substitute a known good ECM and recheck.	Repair or replace.
	DTC NO.32: (1) Check "Lg" (RH: "Lg/Y") wire for open or shorted to power circuit. Is "Lg" (RH: "Lg/Y") wire in good condition?	**DTC No.32:** "B/Bl" wire open or intermittent trouble. If OK, substitute a known good ECM and recheck.	

NOTE:
Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.37 ABS SIGNAL CIRCUIT

(ABS SIGNAL INPUTTED AT ENGINE STARTING)

WIRING DIAGRAM



TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	(1) With the ignition switch ON position, check voltage between B5 terminal of ECM coupler and ground. Is voltage 10-14V?	Intermittent trouble. If OK, substitute a known-good ECM and recheck.	Go to Step 3.
3	(1) Check "G" wire for shorted to ground circuit. Is "G" wire in good condition?	Go to Step 4.	Repair or replace.
4	(1) Disconnect coupler of ABS control module. (2) Clear DTC. (3) Start engine and check DTC. Is DTC No.37 detected?	Substitute a known good ECM and recheck.	Substitute a known good ABS control module and recheck.

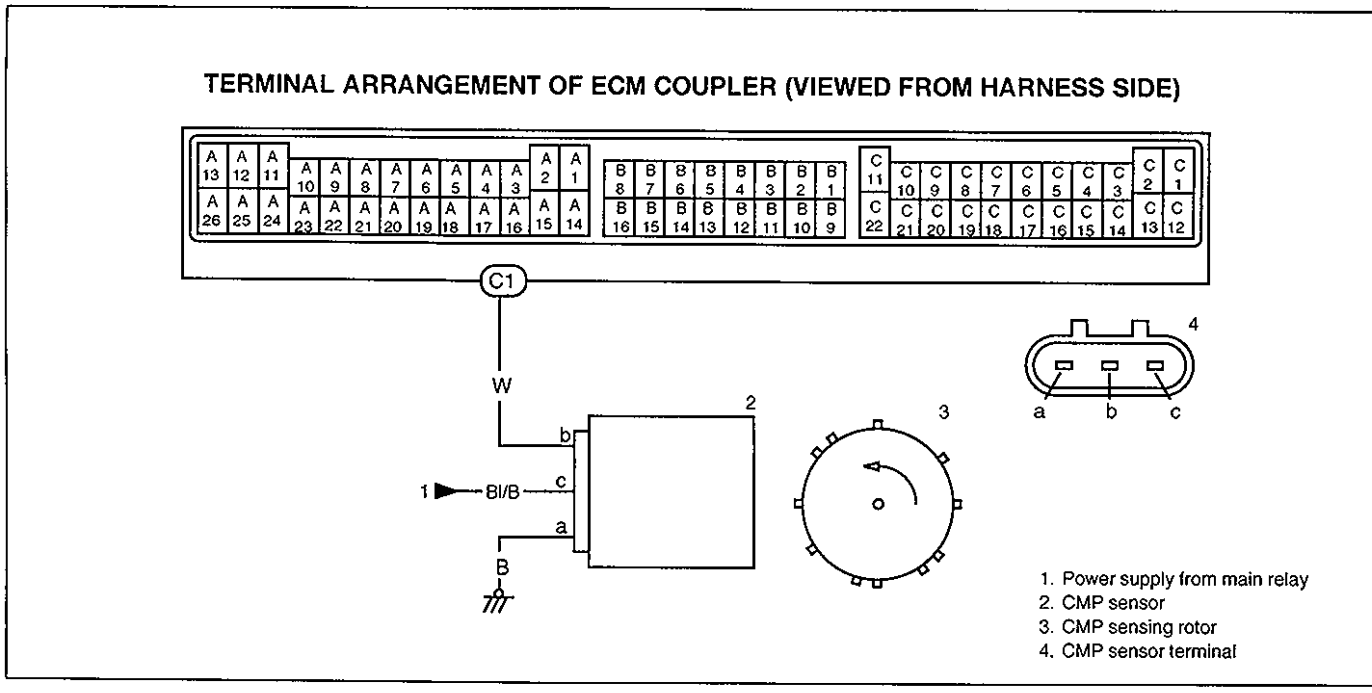
NOTE:

Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DTC NO.42 CAMSHAFT POSITION SENSOR CIRCUIT

(SIGNAL NOT INPUTTED ALTHOUGH START SIGNAL INPUTTED FOR LONGER THAN 2 SECONDS)

WIRING DIAGRAM



TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" in section6 performed?	Go to Step 2.	Go to"ENGINE DIAG. FLOW TABLE".
2	Is engine cranked?	Go to Step 3.	Go to Section 6G.
3	Does engine start?	Intermittent trouble.	Go to Step 4.
4	(1) With the ignition switch OFF position, disconnect CMP sensor coupler. (2) With the ignition switch ON position, check voltage between "B/W" wire terminal and "B" wire terminal. Is voltage10-14V?	Go to Step 5.	Faulty "B/W", "B" wire.
5	(1) Under the same condition in Step 3, check voltage between "W" wire terminal and ground. Is voltage4-5V?	Go to Step 6.	Faulty "W", wire. If OK, substitute a known good ECM and recheck.
6	(1) Check CMP sensor referring to "CMP sensor inspection" in this section. (2) Check CMP sensing rotor referring to "CMP sensing rotor inspection" in this section. Are they in good condition?	Intermittent trouble. If OK, substitute a known good ECM and recheck.	Repair or replace.

NOTE:

Upon completion of inspection and repair work, perform DTC Confirmation Procedure, referring to p.6E-26 to confirm that the trouble has been corrected.

DIAGNOSTIC TROUBLE CODE (DTC) CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is not traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Clear DTC stored in ECM memory referring to "DTC Clearance" in this section.
2) Perform DTC confirmation test under the following conditions.
3) Check DTC referring "DTC Check" in this section.

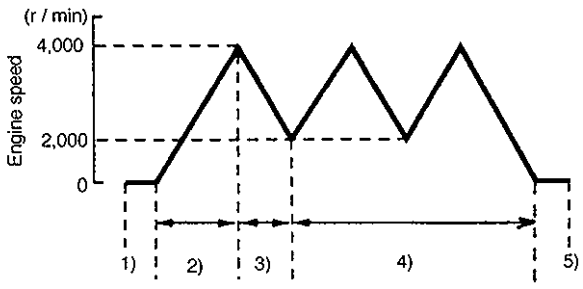
Test Condition for Code No.13
Perform HO2S output signal check referring to Step 2 of Code No.13 Diag. Flow Table.

Test Condition for Code No.14, 15, 21, 22, 23, 25, 32
Turn the ignition switch ON position for 5 seconds or more.

Test Condition for Code No.31, 37
Start engine and increase engine speed about 2,000 r/min for 2 seconds and stop engine.

Test Condition for Code No.42
Crank engine for 3 sec.

Driving Test Condition for Code No.24

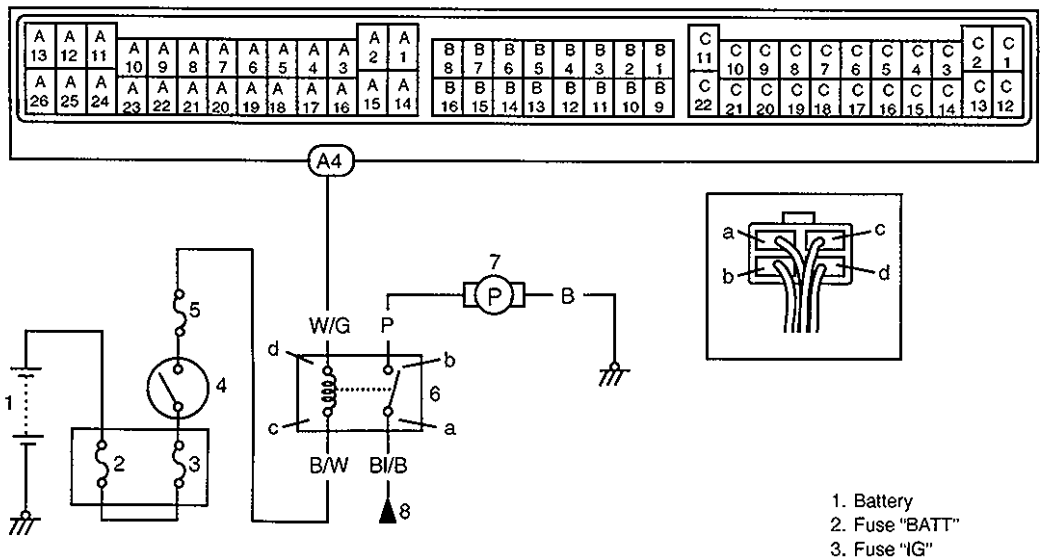


1) Start engine and warm up engine to normal operating temperature.
2) Increase engine speed to 4,000 r/min. in 3rd gear in case of M/T model and in "2" range in case of A/T model.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 7 to 10 seconds till engine speed reaches 2,000 r/min.
4) Repeat above steps 2) and 3) 3 times or more.
5) Stop vehicle.

TABLE B-1 FUEL PUMP CIRCUIT CHECK

WIRING DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



1. Battery
2. Fuse "BATT"
3. Fuse "IG"
4. Ignition switch
5. Fuse "IG COIL METER"
6. Fuel pump relay
7. Fuel pump
8. Power supply from main relay

CIRCUIT DESCRIPTION

Fuel pump relay is turned ON
- for 2 sec. after the ignition switch is turned ON position.
- while start engine signal is inputted.
- while engine is running.

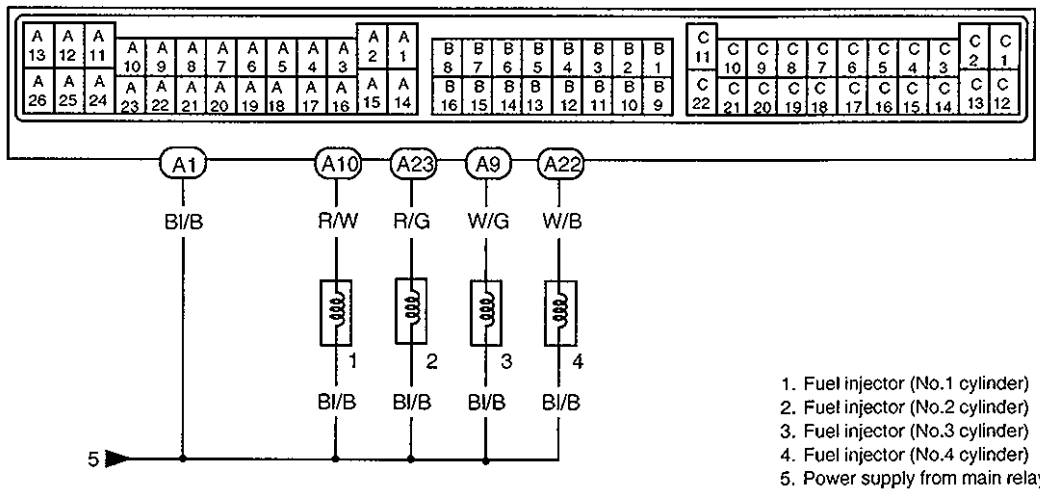
TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	Fuel pump operation check: (1) Remove fuel filler cap. (2) Turn the ignition switch ON position. Is fuel pump operation sound heard for 2 sec. after the ignition switch turned ON position?	Fuel pump circuit is in good condition.	Go to Step 3.
3	Fuel pump circuit check: (1) With ignition switch OFF, remove fuel pump relay. (2) Using service wire, connect "BI/B" and "P" wire terminal of fuel pump relay coupler. Is fuel pump operation sound heard with the ignition switch turned ON position?	Go to Step 4.	"BI/B", "P" wire open. "B" wire open. Fuel pump malfunction.
4	Fuel pump relay check: (1) Check fuel pump relay referring to "Fuel pump relay inspection" in this section. Is it in good condition?	"B/W", "W/G" wire open. If OK, substitute a known-good ECM and recheck.	Faulty fuel pump relay.

TABLE B-2 FUEL INJECTOR CIRCUIT CHECK

WIRING DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



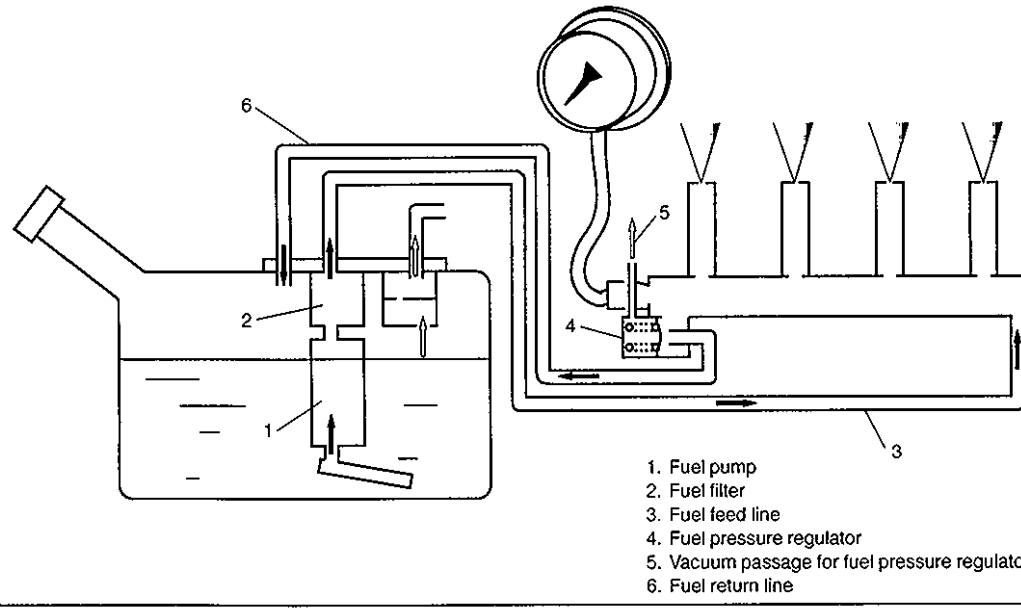
1. Fuel injector (No.1 cylinder)
2. Fuel injector (No.2 cylinder)
3. Fuel injector (No.3 cylinder)
4. Fuel injector (No.4 cylinder)
5. Power supply from main relay

TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	Fuel injector operation sound check: (1) Using sound scope, check each injector for operating sound at engine cranking. Do all 4 injectors make operating sound?	Go to Step 3.	Go to Step 4.
3	Fuel injection circuit check: (1) With the ignition switch OFF position, remove ECM couplers. (2) Check resistance between following terminals. A1 and A10 A1 and A23 A1 and A9 A1 and A22 10-15 Ω at 20°C Is each check result as specified?	Fuel injector circuit is in good condition.	"R/W", "R/G", "W/G", "W/B" shorted each other. Faulty fuel injector.
4	Does none of 4 injectors make operating sound at Step 2?	Go to Step 5.	Check wire harness of injector not making operating sound and injector itself referring to "Fuel injector inspection" in this section.
5	Fuel injector circuit check: (1) Check "BI/B", "R/W", "R/G", "W/G" and "W/B" wire for open and short. Is it normal?	Check all 4 injector for resistance. If OK, substitute a known good ECM and recheck.	Faulty fuel injector circuit.

TABLE B-3 FUEL PRESSURE CHECK

SYSTEM DIAGRAM



SYSTEM DESCRIPTION

Fuel pressure regulator keeps the fuel pressure applied to injector 290kPa higher than that in intake manifold at all times.

INSPECTION

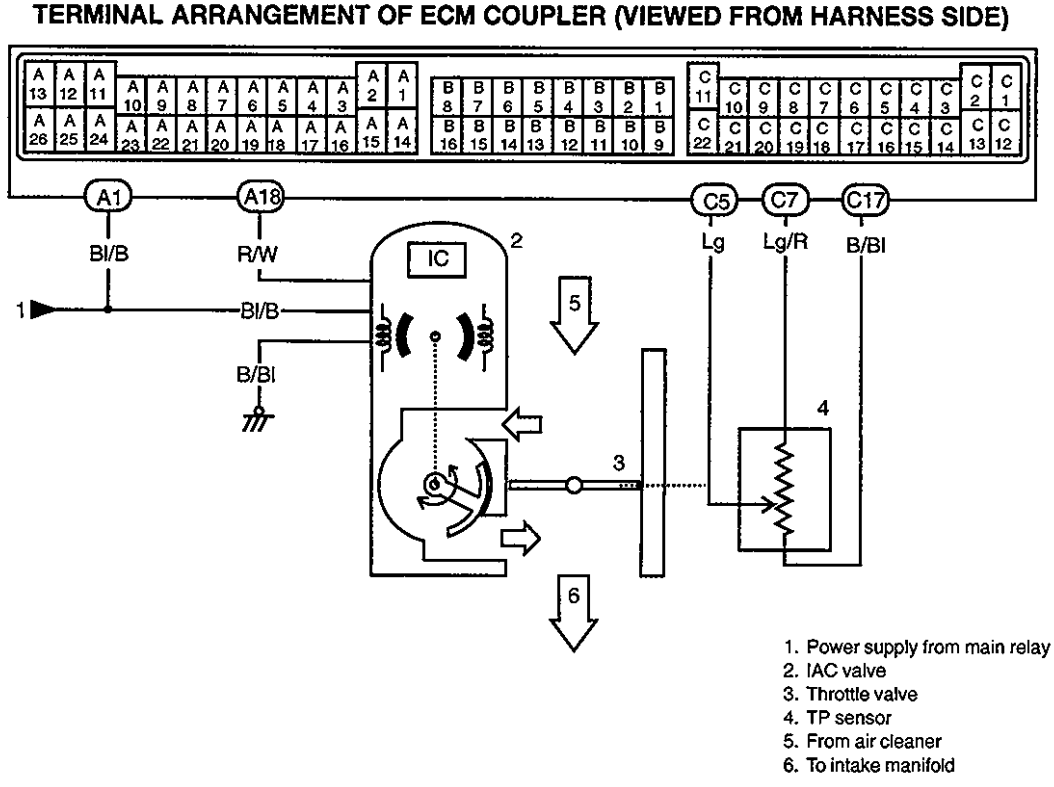
NOTE:
Before using following table, check to make sure that battery voltage is higher than 11V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	Fuel pressure check (engine stops): (1) Install fuel pressure gauge referring to "Fuel delivery system" in this section. (2) Turn the ignition switch ON position and after 3 seconds turn it OFF position. Repeat this 3 or 4 times and then check fuel pressure. Is fuel pressure 270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)?	Go to Step 3.	Go to Step 7.
3	Is 200 kPa (2.0 kg/cm^2, 28.4 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 2?	Go to Step 4.	Go to Step 6.
4	Fuel pressure check (idling): (1) Start engine and warm it up to normal operating temperature. (2) Keep it running at specified idle speed. Is fuel pressure 210 – 260 kPa (2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi)?	Go to Step 5.	Faulty vacuum passage for fuel pressure regulator or fuel pressure regulator.
5	Relief valve in fuel pump check: (1) With fuel pump operated and fuel return hose blocked by pinching. Is fuel pressure 441 – 637 kPa (4.5 – 6.5 kg/cm^2, 62.7 – 90.6 psi)?	Normal fuel pressure.	Faulty fuel pump.
6	Is there fuel leakage from fuel feed line hose, pipe or joint?	Repair or replace.	Fuel leakage from injector, fuel pressure regulator or fuel pump.

7	Was fuel pressure higher than specification in Step 2?	Go to Step 8.	Go to Step 9.
8	Fuel return line check : (1) Disconnect fuel return hose from fuel pipe and connect new hose to it. (2) Put the other end of new return hose into approved gasoline container. (3) Operate fuel pump. Is fuel pressure 270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.
9	Fuel pressure regulator check: (1) With fuel pump operated and fuel return hose blocked by pinching. Is fuel pressure applied then?	Faulty fuel pressure regulator.	Shortage of fuel. Clogged fuel filter. Restricted fuel feed hose or pipe. Faulty fuel pump or fuel leakage from hose connection in fuel tank. Faulty fuel pump circuit.

TABLE B-4 IDLE AIR CONTROL SYSTEM CIRCUIT CHECK

SYSTEM AND CIRCUIT DIAGRAM



CIRCUIT DESCRIPTION

ECM transmits duty signal to IC in IAC valve. Then, the IC controls current of IAC valve coils.

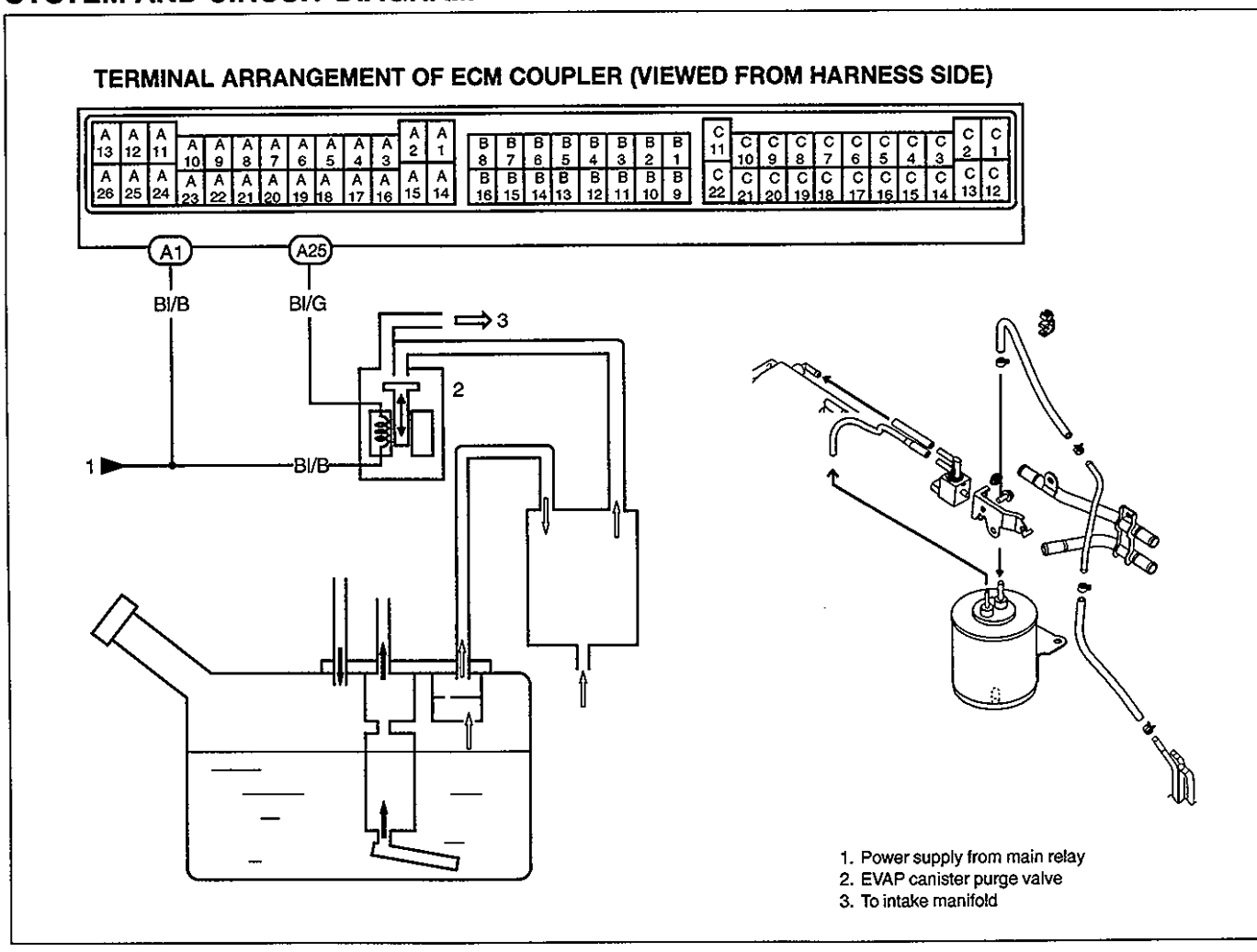
INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	IAC valve function check: (1) Check IAC valve referring to "IAC valve inspection" in this section. Is check result in good condition?	Go to Step 3.	Go to Step 6.
3	Closed throttle position check: (1) Connect SUZUKI scan tool to DLC. (2) With the ignition switch ON position, check "CLOSED THROT POS" in parameter data list. Throttle valve fully close : ON Throttle valve slight open : OFF Is each check result as specified?	Check for following: EVAP canister purge valve Accessory engine load PCV system Idle air passage EGR system A/C signal Transmission range switch signal	Go to Step 4.

4	Closed throttle position recheck: (1) With the ignition switch OFF position disconnect negative battery cable for 30 seconds and connect it. (2) Recheck closed throttle position referring to Step 3. Is each check result as specified?	Recheck engine idle speed.	Go to Step 5
5	TP sensor signal voltage check: (1) With the ignition switch ON position, check voltage between C5 and ground. Throttle valve fully close: 0.18–1 .03V Throttle valve fully open: 3.27–4.58V Is each check result as specified?	Substitute a known good ECM and recheck.	Check TP sensor referring to "TP sensor inspection" in this section.
6	IAC valve circuit check: (1) Check "R/W", "Bl/B" and "B/Bl" wire for open and short. Are they in good condition?	Go to Step 7.	Repair or replace.
7	IAC valve substitution: (1) Substitute a known good IAC valve. (2) Check IAC valve referring to "IAC valve inspection" in this section. Is check result in good condition?	IAC valve malfunction.	Substitute a known good ECM and recheck.

TABLE B-5 EVAPORATIVE EMISSION CONTROL SYSTEM CHECK

SYSTEM AND CIRCUIT DIAGRAM



CIRCUIT DESCRIPTION

ECM transmits duty signal to EVAP canister purge valve.

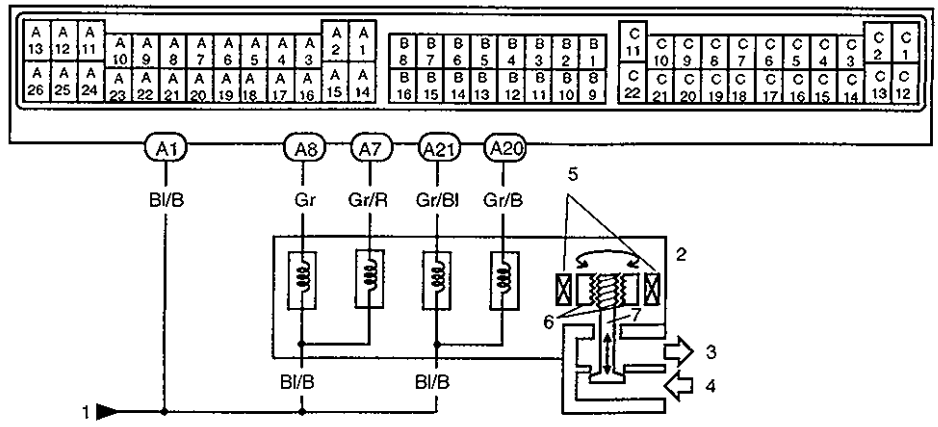
INSPECTION

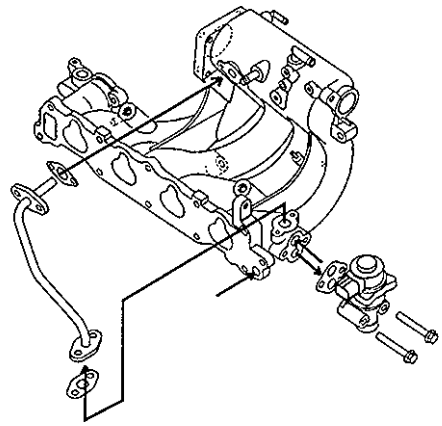
STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	(1) Check following items referring to inspection of each item in this section. Vacuum passage Vacuum hoses EVAP canister purge valve EVAP canister Are they in good condition?	Go to Step 3.	Repair or replace.
3	(1) With the ignition switch ON position, check voltage between "Bl/B" terminal of EVAP canister purge valve coupler and ground. Is voltage 10-14V?	Check "Bl/G" wire for open and short.	Check "Bl/B" wire for open and short.

TABLE B-6 EGR SYSTEM CHECK (IF EQUIPPED)

SYSTEM AND CIRCUIT DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)





1. Power supply from main relay
2. EGR valve
3. Exhaust gas flow to intake manifold
4. Exhaust gas flow from exhaust manifold
5. EGR valve stepper motor coil
6. EGR valve stepper motor rotor
7. EGR valve stepper motor rod

SYSTEM DESCRIPTION

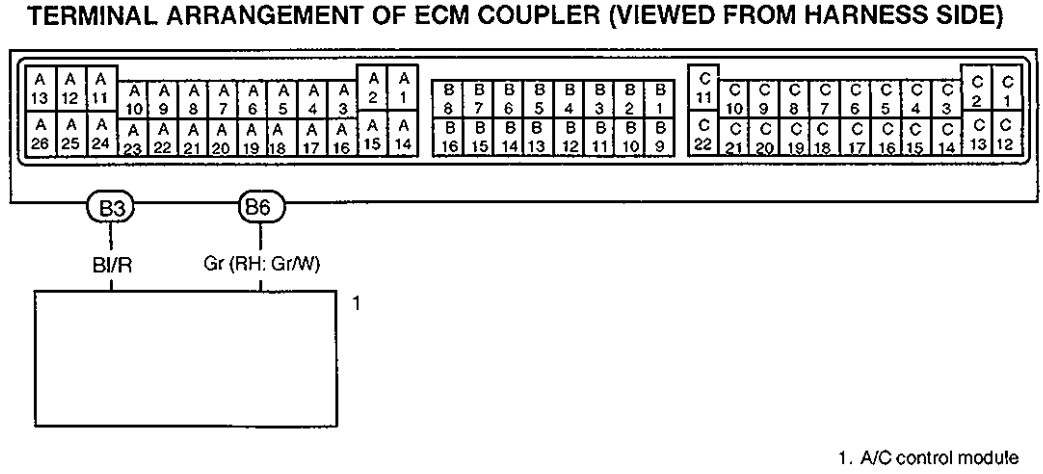
When EGR valve stepper motor receives open (close) signal from ECM, it turns in the open (close) direction according to the number of steps and pushes out (pulls up) the rod which is in mesh with the worm of the stepper motor. As the rod installed to the EGR valve opens by the amount corresponding to the number of steps of signal from ECM to let the exhaust gas flow from the exhaust manifold to the intake manifold.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Go to Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	(1) Check EGR valve referring to "EGR valve inspection" in this section. Is it in good condition?	Go to Step 3.	EGR valve malfunction.
3	(1) Install EGR valve. (2) Disconnect ECM coupler and check resistance between A1 and A7, A1 and A8, A1 and A20, A1 and A21. Is each resistance 20 – 24Ω (at 20°C)?	Check EGR passage. If OK, substitute a known good ECM and recheck.	Faulty "Bl/B", "Gr", "Gr/R", "Gr/Bl", "Gr/B" wire.

TABLE B-7 A/C SIGNAL AND A/C ON SIGNAL CIRCUIT CHECK (IF EQUIPPED)

CIRCUIT DIAGRAM



1. A/C control module

CIRCUIT DESCRIPTION

A/C control module transmits "A/C signal" to ECM when A/C ON conditions are satisfied on the A/C control module side.

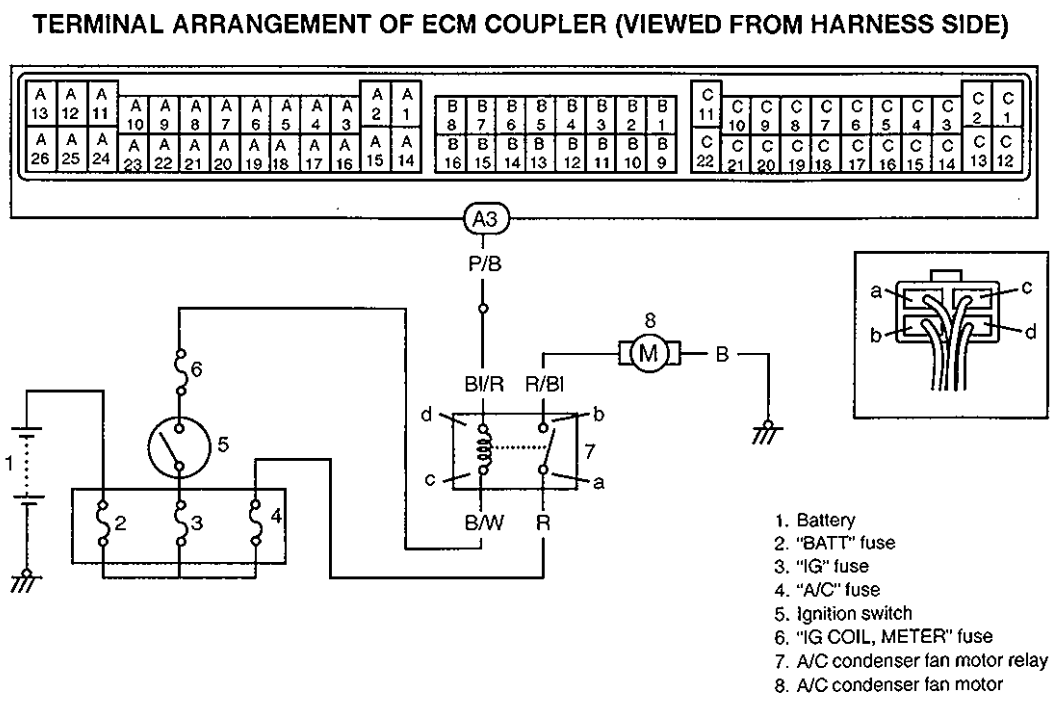
ECM transmits "A/C ON signal" to A/C control module when "A/C signal" inputted to ECM and A/C ON conditions are satisfied on the ECM side. Then, A/C is operated.

INSPECTION

STEP	ACTION	YES	NO
1	A/C signal circuit check: (1) Check voltage between B3 terminal of ECM coupler and ground under following condition. Ignition switch ON position and A/C switch OFF: 10-14V Is check result as specified?	Go to Step 3.	Go to Step 2.
2	(1) Disconnect A/C control module coupler. (2) Check voltage between B3 terminal of ECM coupler and ground under following condition. Ignition switch ON position and A/C switch OFF: 10-l4V Is check result as specified?	A/C control module malfunction.	Faulty "Bl/R" wire. If OK, substitute a known good ECM and recheck.
3	A/C signal circuit check: (1) Check voltage between B3 terminal of ECM coupler and ground under following conditions. A/C is working: 0-2.0V Is check result as specified?	Go to Step 4.	Faulty "Bl/R" wire. If OK, substitute a known good A/C control module and recheck.
4	A/C ON signal circuit check: (1) Check voltage between B6 terminal of ECM coupler and ground under following conditions. A/C is working: 10-14V Is check result as specified?	Go to Step 5.	Faulty "Gr" (RH: "Gr/W") wire. If OK, substitute a known good A/C control module and recheck.
5	A/C ON signal circuit check: (1) Check voltage between B6 terminal of ECM coupler and ground under following conditions. Engine running and A/C is not working: 0-1.0V Is check result as specified?	A/C signal circuit and A/C ON signal circuit are in good condition.	Substitute a known good ECM and recheck.

TABLE B-8 A/C CONDENSER FAN MOTOR RELAY CONTROL SYSTEM CHECK (IF EQUIPPED)

CIRCUIT DIAGRAM



CIRCUIT DESCRIPTION

A/C condenser fan is turned ON by ECM when engine coolant temperature is higher than specified value regardless A/C ON or OFF.

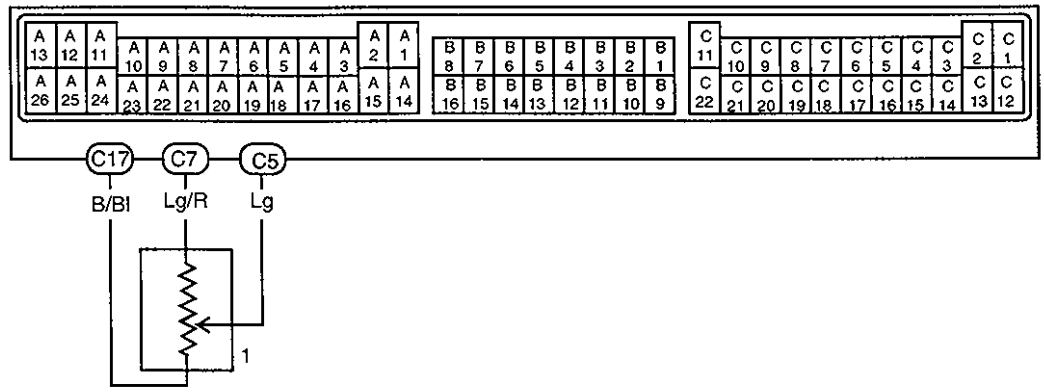
INSPECTION

STEP	ACTION	YES	NO
1	A/C condenser fan operation check: (1) Check A/C condenser fan for operation. A/C condenser fan should be operated under following condition A or B only. A: When engine is running and A/C is operating. B: When engine coolant temperature is more than 113°C with the ignition switch ON position. Is check result as specified?	This system is in good condition.	Go to Step2.
2	A/C condenser fan control signal check: (1) Check voltage between A3 and ground under following conditions. Other than conditions A and B in Step 1:10-14V Is check result as specified?	Go to Step 3.	Fuse blown. Faulty "B/W", "Bl/R", "P/B" wire. Faulty A/C condenser fan motor relay.
3	A/C condenser fan control signal check: (1) Check voltage between A3 and ground under following conditions. Under condition A or B in Step 1: 0-1 V Is check result as specified?	Fuse blown. Faulty "R", "R/Bl", "B" wire. Faulty A/C condenser fan motor or relay.	Substitute a known-good ECM and recheck.

TABLE B-9 FUEL CUT OPERATION CHECK

CIRCUIT DIAGRAM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



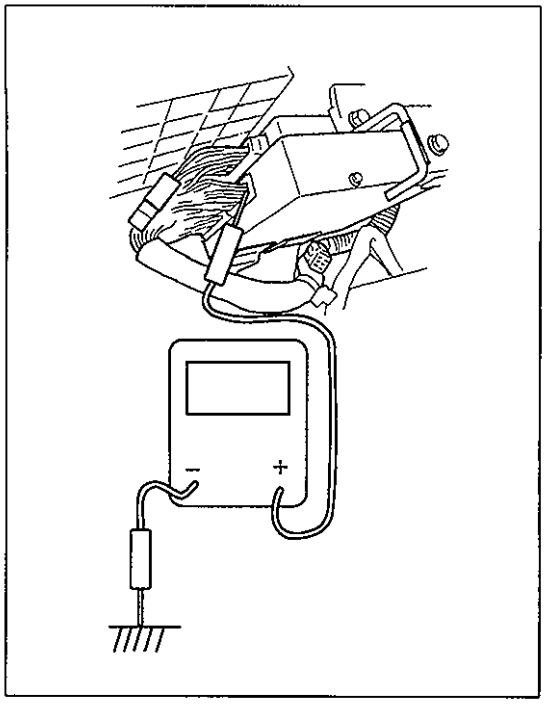
1. Throttle position sensor

CIRCUIT DESCRIPTION

Fuel injector stops when decelerating, so that unburned gas will not be exhausted and it starts again when above conditions for fuel recovery are fulfilled.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSTIC FLOW TABLE" in section 6 performed?	Goto Step 2.	Perform "ENGINE DIAGNOSTIC FLOW TABLE".
2	Closed throttle position check: (1) Connect Tech-1 to DLC. (2) With the ignition switch ON position, check "CLOSED THROT POS" in parameter data list. Throttle valve fully close : ON Throttle valve slight open : OFF Is each check result as specified?	Substitute a known good ECM and recheck.	Go to Step 3.
3	Closed throttle position recheck: (1) With the ignition switch OFF position disconnect negative battery cable for 30 seconds and connect it. (2) Recheck closed throttle position referring to Step 3. Is each check result as specified?	Recheck fuel cut operation.	Go to Step 4.
4	TP sensor signal voltage check: (1) With the ignition switch ON position, check voltage between C5 and ground. Throttle valve fully close: 0.18-1.03V Throttle valve fully open: 3.27-4.58V Is each check result as specified?	Substitute a known good ECM and recheck fuel cut operation.	Check TP sensor referring to "TP sensor inspection" in this section.



INSPECTION OF ECM AND ITS CIRCUITS

ECM and its circuits can be checked at ECM wiring couplers by measuring voltage and resistance.

CAUTION:
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from it.

Voltage Check

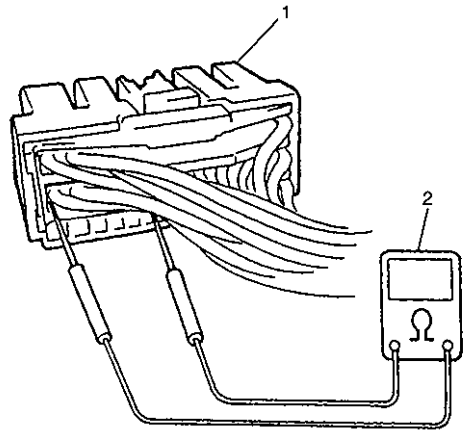
1) Remove glove box.
2) Check voltage at each terminal of couplers connected.

NOTE:
As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when the ignition switch is turned ON position.

TER-MINAL	COLOR	CIRCUIT	VOLTAGE	CONDITION
A1	Bl/B	Power source	10 – 14 V	Turn the ignition switch ON position
A2	B	Ground	–	–
A3	P/B	A/C condenser fan motor relay (if equipped)	0 – 1.0 V	A/C is working
			10 – 14 V	A/C is not working
A4	W/G	Fuel pump relay	0 – 2.5 V	For 2 seconds after turning the ignition switch ON position leaving engine OFF
A5	V/Y	Malfunction indicator lamp	10 – 14 V	Engine running
			0 – 1.0 V	Turn the ignition switch ON position leaving engine OFF
A6	Br/W	Ignition coil assembly for No.1 and No.4	0 – 1.0 V	Turn the ignition switch ON position leaving engine OFF
A7	Gr/R	EGR valve (stepper motor coil 3, if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A8	Gr	EGR valve (stepper motor coil 1, if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A9	W/G	Fuel injector No.3	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A10	R/W	Fuel injector No.1	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A11	P/B	Heater of HO2S (if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A12	–	–	–	–
A13	B/Bl	Ground	–	–
A14	Bl/B	Power source	10 – 14 V	Turn the ignition switch ON position
A15	W	Power source for back up	10 – 14 V	Turn the ignition switch ON and OFF position
A16	B/W	Ignition switch	10 – 14 V	Turn the ignition switch ON position
A17	Bl	Main relay	0 – 2.0 V	Turn the ignition switch ON position
A18	R/W	IAC valve	0 – 4.2 V	Engine running at idle speed
A19	Br/B	Ignition coil assembly for No.2 and No.3	0 – 1.0 V	Turn the ignition switch ON position leaving engine OFF
A20	Gr/B	EGR valve (stepper motor coil 4, if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A21	Gr/Bl	EGR valve (stepper motor coil 2, if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A22	W/B	Fuel injector No.4	10 – 14 V	Turn the ignition switch ON position leaving engine OFF

A23	R/G	Fuel injector No.2	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A24	–	–	–	–
A25	Bl/G	EVAP canister purge valve (if equipped)	10 – 14 V	Turn the ignition switch ON position leaving engine OFF
A26	B/Bl	Ground	–	–
B1	Y/B	Data link connector	4 – 5 V	Turn the ignition switch ON position
B2	P (RH: P/W)	Test switch terminal	4 – 5 V	Turn the ignition switch ON position
B3	Bl/R	A/C signal (if equipped)	0 – 2.0 V	A/C is working
			10 – 14 V	A/C is not working
B4	R/Y	Lighting switch	10 – 14 V	Lighting switch ON
			0 – 1.3 V	Lighting switch OFF
B5	G	ABS signal (if equipped)	10 – 14 V	Turn the ignition switch ON position
B6	Gr (RH: Gr/W)	A/C ON signal (if equipped)	10 – 14 V	A/C is working
			0 – 1.0 V	A/C is not working
B7	Br	Tacho meter	–	–
B8	R/G	Duty output terminal	0 – 1.0 V	Turn the ignition switch ON position
B9	G/W	Stop lamp switch	10 – 14 V	Brake pedal depressed
B10	W/Bl	Diag. Switch terminal	4 – 5 V	Turn the ignition switch ON position
B11	Bl/G	Heater blower switch	0 – 2.0 V	Turn the ignition switch ON position and heater blower switch ON
			10 – 14 V	Turn the ignition switch ON position and heater blower switch OFF
B12	R/W	Rear defogger switch (if equipped)	10 – 14 V	Turn the ignition switch ON position and rear defogger switch ON
			0 – 1.3 V	Turn the ignition switch ON position and rear defogger switch OFF
B13	G/Y	Park/ Neutral position signal	10 – 14 V	Turn the ignition switch ON position and shift select switch in P or N range
			0 – 1.6 V	Turn the ignition switch ON position and shift select switch in other than P and N range
B14	R	R-range signal	10 – 14 V	Turn the ignition switch ON position and shift select switch in R range
			0 – 1.3 V	Turn the ignition switch ON position and shift select switch in other than R range
B15	B/Bl	Throttle opening signal	9.4 – 13.2 V	Turn the ignition switch ON position and throttle valve fully closed
			4.4 – 6.2 V	Turn the ignition switch ON position and throttle valve fully open
B16	B/Y	Overdrive cut signal	0 – 1.0 V	Turn the ignition switch ON position and ECT less than 60°C
			10 – 14 V	Turn the ignition switch ON position and ECT more than 60°C
C1	W	Camshaft position sensor	0 – 0.8 or 4 – 5 V	Turn the ignition switch ON position
C2	Y	Vehicle speed sensor	deflect between 0 – 1.6 and 4 – 14 V	Turn the ignition switch ON position, rear right wheel turned slowly with rear left wheel locked
C3	R/ Bl	CO adjusting resistor (w/o H2S)	0 – 5 V	Turn the ignition switch ON position
C4	Lg (RH: Lg/ Y)	Manifold absolute pressure sensor	3.3 – 4.0 V	Turn the ignition switch ON position leaving engine OFF
C5	Lg	Throttle position sensor	0.18 – 1.03 V	Turn the ignition switch ON position and throttle valve fully closed
			3.27 – 4.58 V	Turn the ignition switch ON position and throttle valve fully open
C6	Lg (RH: Lg/W)	Engine coolant temp. sensor	0.55 – 0.95 V	Turn the ignition switch ON position (ECT=80°C)
C7	Lg/R	Power source for MAP sensor, TP sensor, CO adjusting resistor	4 – 5 V	Turn the ignition switch ON position.
C8, C9, C10		–	–	–
C11	B/R	Engine start signal	6 – 14 V	While engine cranking
C12, C13		–	–	–

C14	Or (RH: Or/G)	Ignition timing adjusting resistor	0 – 5 V	Turn the ignition switch ON position
C15	Or	Heated oxygen sensor	deflect between 0 – 0.3 and 0.7 – 1.0 V	Engine running at 2000 r/min after warmed up
C16	Lg/B	Intake air temp. sensor	2.0 – 2.7 V	Turn the ignition switch ON position (IAT=20°C)
C17	B/Bl	Ground	–	–
C18	B/Bl	Ground	–	–
C19, C20, C21		–	–	–
C22	Bl/Or	Power steering pressure switch	0 – 1.3 V	While engine running at idle speed, turning steering wheel to the right or left as far as it stops
			10 – 14 V	Turn the ignition switch ON position



1. ECM coupler disconnected
2. Ohmmeter

Resistance Check

1) Disconnect couplers from ECM with the ignition switch OFF position.

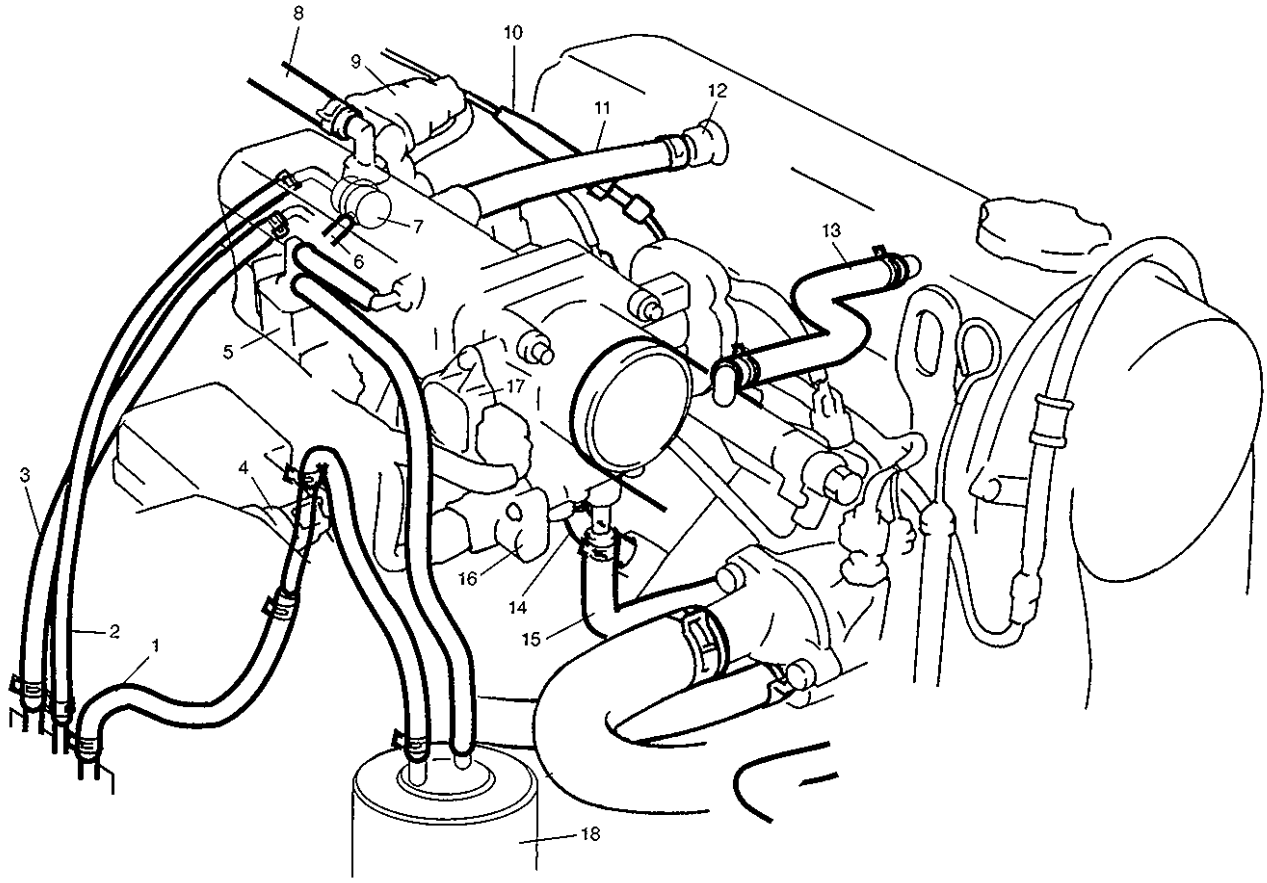
CAUTION:
Never touch terminals of ECM itself or connect voltmeter or ohmmeter.

2) Check resistance between each pair of terminals of disconnected couplers as listed in following table.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn the ignition switch OFF position for this check.**
- **Resistance in table represents that when parts temperature is 20 °C (68 °F).**

CIRCUIT		TERMINALS	STANDARD RESISTANCE	CONDITION
Fuel injector	No.1 cylinder	A10 – A1	10 – 15 Ω	—
	No.2 cylinder	A23 – A1	10 – 15 Ω	—
	No.3 cylinder	A9 – A1	10 – 15 Ω	—
	No.4 cylinder	A22 – A1	10 – 15 Ω	—
EGR valve	No.1 coil	A8 – A1	20 – 24 Ω	—
	No.2 coil	A21 – A1	20 – 24 Ω	—
	No.3 coil	A7 – A1	20 – 24 Ω	—
	No.4 coil	A20 – A1	20 – 24 Ω	—
EVAP canister purge valve		A25 – A1	30 – 34 Ω	—
HO2S heater		A11 – A1	11 – 15 Ω	—
Main relay		A17 – A15	56 – 146 Ω	—
Fuel pump relay		A4 – A16	56 – 146 Ω	—
TP sensor		B15 – C17	0.17 – 11.4 kΩ	Throttle valve fully close
		B15 – C17	1.72 – 15.5 kΩ	Throttle valve fully open
IAT sensor		C16 – C17	2.09 – 2.81 kΩ	IAT at 20 °C
ECT sensor		C6 – C17	2.28 – 2.61 kΩ	ECT at 20 °C

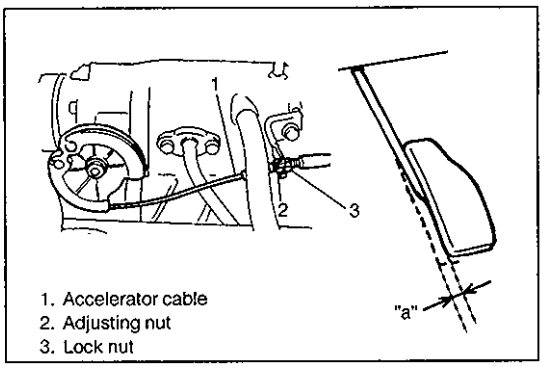
ON-VEHICLE SERVICE



1. EVAP hose (from fuel tank)
2. Fuel return hose
3. Fuel feed hose
4. IAT sensor
5. EVAP canister purge valve
6. Fuel pressure regulator vacuum hose
7. Fuel pressure regulator
8. Brake booster hose
9. MAP sensor
10. Accelerator cable
11. PCV hose
12. PCV valve
13. Breather hose
14. Coolant outlet hose
15. Coolant inlet hose
16. IAC valve
17. TP sensor
18. EVAP canister

GENERAL

When hoses are disconnected and system components are removed for service, reinstall components properly, and route and connect hoses correctly after service. Refer to figure on previous page for proper routing of hoses.



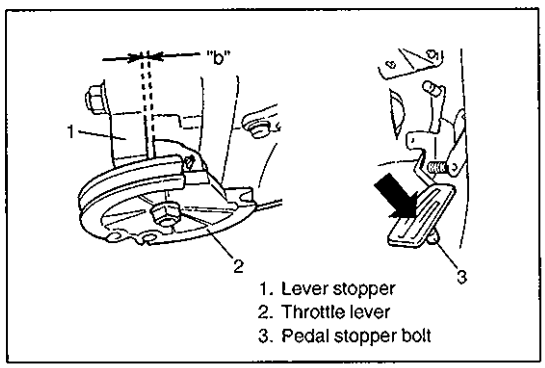
1. Accelerator cable
2. Adjusting nut
3. Lock nut

ACCELERATOR CABLE ADJUSTMENT

1) With throttle valve closed, check accelerator pedal play which should be within following specification.

   Pedal play "a": 2 – 7 mm (0.08 – 0.27 in.)

   If measured value is out of specification, adjust it to specification with cable adjusting nut.



1. Lever stopper
2. Throttle lever
3. Pedal stopper bolt

2) With accelerator pedal depressed fully, check clearance between throttle lever and lever stopper (throttle body) which should be within following specification.

   Clearance "b" : 0.5 – 2.0 mm (0.02 – 0.07 in.)
   (With pedal depressed fully)

   If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt.

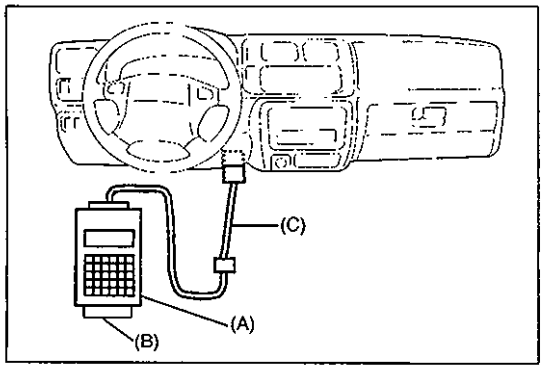
IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY INSPECTION

Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of engine/emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked and adjusted according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- ECM does not detect any malfunction DTC.

After above items are all confirmed, check idle speed and IAC duty as follows.

NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), and set parking brake and block drive wheels.



[Using SUZUKI scan tool]

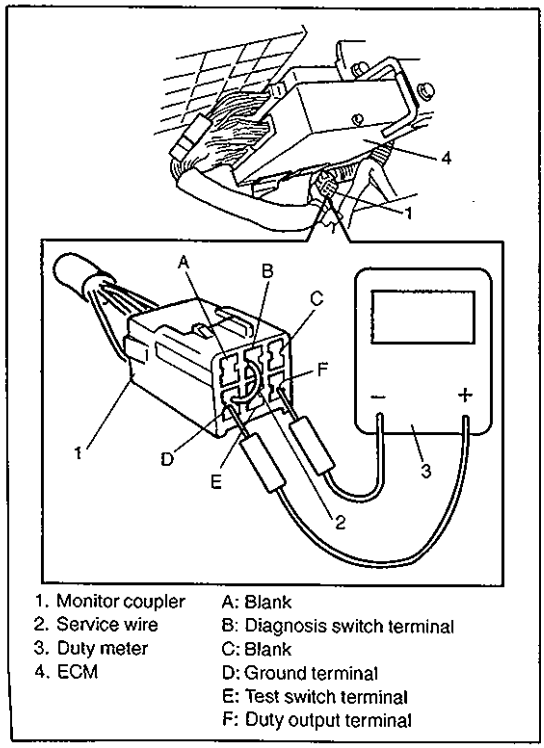
1) Connect SUZUKI scan tool to DLC with the ignition switch OFF position.

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/14 pin DLC cable)

2) Warm up engine to normal operating temperature.
3) Check IAC duty and idle speed by using "IAC CAL" mode of SUZUKI scan tool.

	MT		AT	
A/C	OFF	ON	OFF	ON
Engine speed [r / min]	750±50	900±50	750±50	875±50
IAC Duty [%]	4~30	–	4~30	–

   If duty and/or idle speed is out of specifications, check idle air control system referring to Diagnostic Flow Table B-4 "IDLE AIR CONTROL SYSTEM CHECK" in this section.
4) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C ON signal circuit and idle air control system.



1. Monitor coupler
2. Service wire
3. Duty meter
4. ECM

A: Blank
B: Diagnosis switch terminal
C: Blank
D: Ground terminal
E: Test switch terminal
F: Duty output terminal

[Not using SUZUKI scan tool]

1) Disconnect scan tool from DLC if connected.
2) Warm up engine to normal operating temperature.
3) Stop engine and connect duty meter between duty output terminal and ground terminal of monitor connector.
4) Using service wire, ground diagnosis switch terminal in monitor connector.
5) Set tachometer.
6) Start engine and warm it up completely.
7) Check IAC duty and idle speed. If duty and/or idle speed is out of specifications, check idle air control system referring to Diagnostic Flow Table B-4 "IDLE AIR CONTROL SYSTEM CHECK" in this section.

	MT		AT	
A/C	OFF	ON	OFF	ON
Engine speed [r / min]	750±50	900±50	750±50	875±50
IAC Duty [%]	4~30	–	4~30	–

NOTE:
IAC duty can be checked roughly by using voltmeter. IAC duty to voltage relation is as follows.

ON DUTY METER INDICATION (%)	OFF DUTY METER INDICATION (%)	VOLTMETER INDICATION (V)
0	100	0
50	50	0.5 x VB
100	0	VB

- **"OFF DUTY METER" is such duty meter that indicates approx. 100% when terminal voltage is approx. "0V".**
- **"VB" represents battery voltage while engine of vehicle being checked is running.**

7) Remove service wire from monitor connector.
8) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C ON signal circuit and idle air control system.

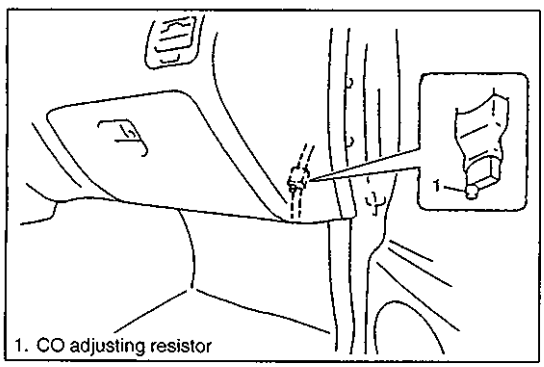
IDLE MIXTURE INSPECTION/ADJUSTMENT (VEHICLE WITHOUT HEATED OXYGEN SENSOR)

All vehicles not equipped with heated oxygen sensor are shipped with their CO% factory adjusted as follows.

Engine idle mixture (CO %)	0.8 – 1.3 % at specified idle speed

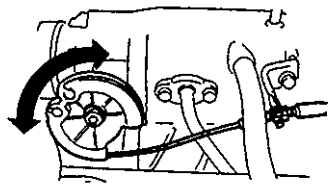
Idle mixture adjustment should never be changed from the original factory setting. However, if during diagnosis, the check indicates idle mixture to be the cause of a driver performance complaint or emission failure, the idle mixture can be adjusted using the following procedures.

NOTE:
For this inspection and adjustment, exhaust gas tester (CO meter) and engine tachometer are necessary.



1. CO adjusting resistor

1) Check idle speed according to "Idle Speed Inspection" section.
2) Using exhaust gas tester, check that idle mixture CO% is within above specification. If it is out of specification, adjust it to specification by turning resistor knob.
3) If idle mixture has been adjusted, confirm that idle speed is within specification.

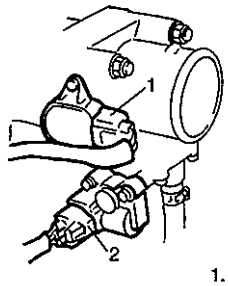


AIR INTAKE SYSTEM

THROTTLE BODY

On-Vehicle Inspection

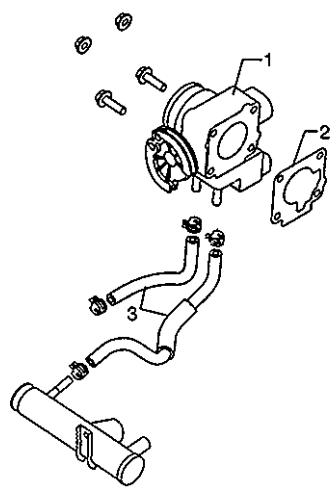
- Check that throttle valve lever moves smoothly.



1. TP sensor coupler
2. IAC valve coupler

Removal

1) Disconnect negative cable at battery.
2) Drain cooling system referring to section 6B.
3) Disconnect accelerator cable from throttle body.
4) Disconnect electric coupler from TP sensor and IAC valve.
5) Disconnect coolant hoses from throttle body.
6) Remove throttle body from intake manifold.

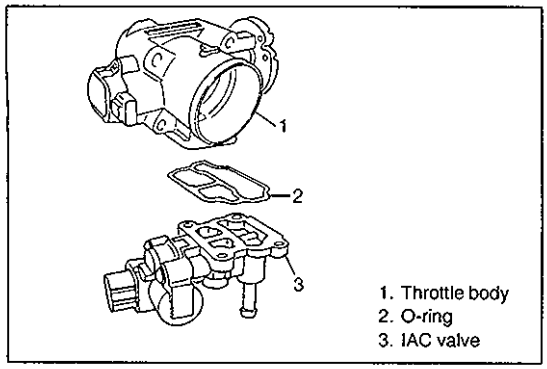


1. Throttle body
2. Throttle body gasket
3. Coolant hoses

CAUTION:
TP sensor, idle air control valve or other components containing rubber must not be places in a solvent or cleaner bath.
A chemical reaction will cause these parts to swell, harden or get distorted.

Installation

1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.
2) Install throttle body to intake manifold and tighten bolts and nuts to specified torque.
3) Connect coolant hoses to throttle body.
4) Connect couplers to TP sensor and IAC valve securely.
5) Install air cleaner outlet hose.
6) Connect accelerator cable and adjust cable play to specification referring to previous page.
7) Refill cooling system referring to section 6B.
8) Connect negative cable at battery.

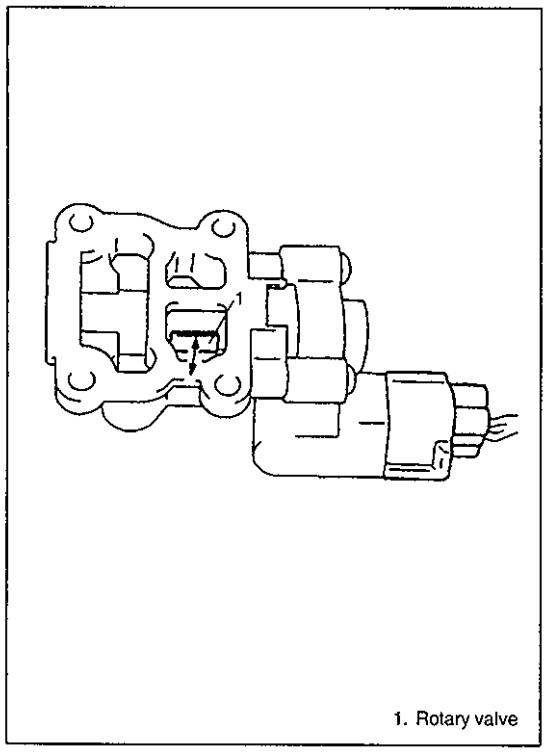


1. Throttle body
2. O-ring
3. IAC valve

IDLE AIR CONTROL VALVE (IAC VALVE)

Removal

1) Remove throttle body. (Refer to throttle body removal.)
2) Remove IAC valve from throttle body.



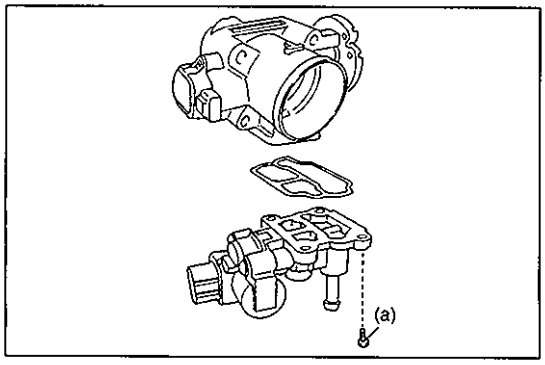
1. Rotary valve

Inspection

1) Connect each connector to IAC valve and TP sensor.
2) Check that rotary valve of IAC valve opens and closes once and then stops in about 60 ms as soon as the ignition switch is turned ON position.

NOTE:

- **This check should be performed by two people, one person turns the ignition switch ON position while the other checks valve operation.**
- **As valve operation is momentary, it may be overlooked. To prevent this, perform this operation check 3 times or more continuously.**
  If rotary valve of IAC valve does not operate at all, check wire harness for open and short. If wire harness are in good condition, replace IAC valve and recheck.
- **The built-in IC may brake when the battery is connected between terminals or installation resistance gauge is connected between terminals.**

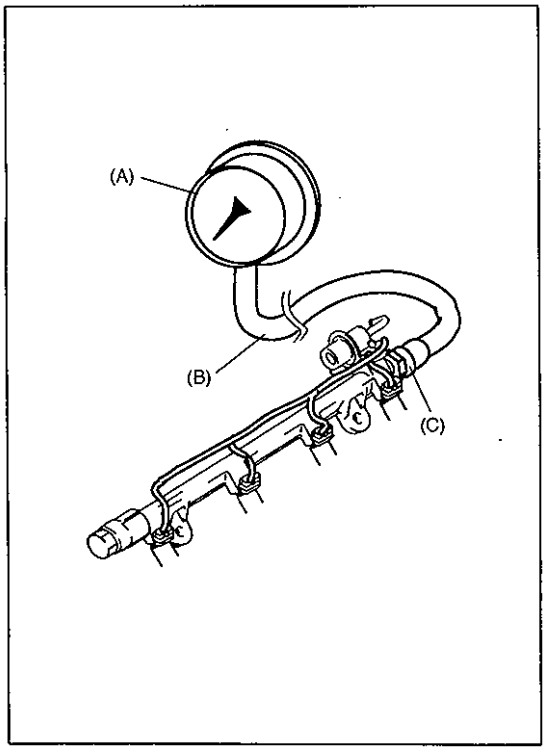


Installation

1) Install new O-ring to IAC valve.
2) Install IAC valve to throttle body.
   Tighten IAC valve screws to specified torque.

   Tightening Torque
   (a): 3.3 N·m (0.33 kg-m, 2.5 lb-ft)

3) Install throttle body to intake manifold referring to throttle body installation.



FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1) Relieve fuel pressure in fuel feed line referring to p. 6-4.
2) Using backup wrench, loosen plug bolt on fuel delivery pipe and remove it. Connect special tools (fuel pressure gauge) to delivery pipe.

> **CAUTION:**
> **A small amount of fuel may be released when plug bolt is loosened. Place container under the bolt or cover bolt hole with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.**

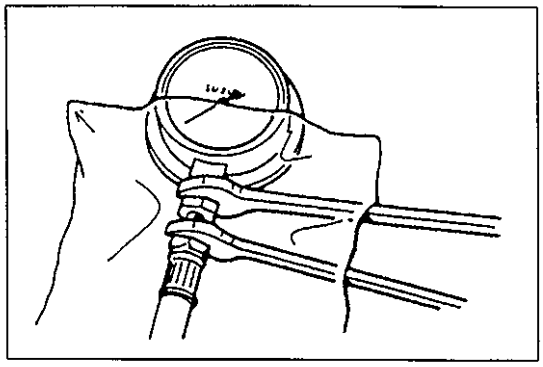
Special Tool
(A): 09912-58441
(B): 09912-58431
(C): 09919-46010

3) Check that battery voltage is above 11V.

CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	270 – 310 KPa 2.7 – 3.1 kg/cm^2 38.4 – 44.0 psi
At specified idle speed	210 – 260 KPa 2.1 – 2.6 kg/cm^2 29.8 – 37.0 psi
With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	over 200 kPa 2.0 kg/cm^2 28.4 psi

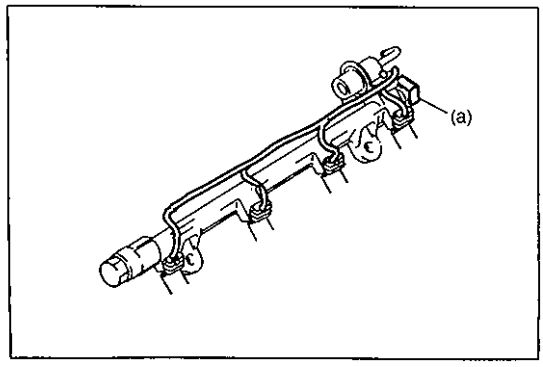
4) Turn the ignition switch ON position to operate fuel pump and after 3 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.
5) Start engine.
6) Measure fuel pressure at idling.

   If measured pressure doesn't satisfy specification, go to "Diagnostic Flow Table B-3" in this section.



7) After checking fuel pressure, remove fuel pressure gauge.

> **CAUTION:**
> **As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.**
> - **Place fuel container under joint.**
> - **Cover joint with rag and loosen joint nut slowly to release fuel pressure gradually.**



8) Install plug bolt to fuel delivery pipe.
   Use new gasket.
   Tighten it to specified torque, using backup wrench.

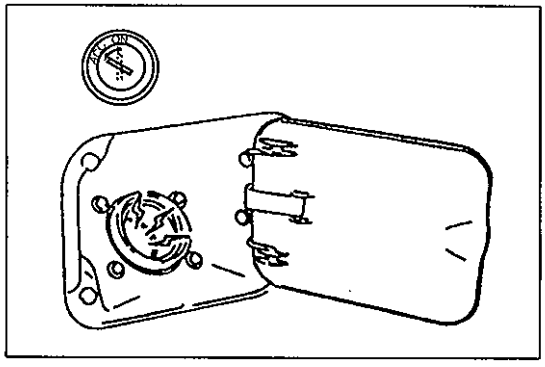
   Tightening Torque
   (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

9) With engine "OFF" and the ignition switch ON position, check for fuel leaks.

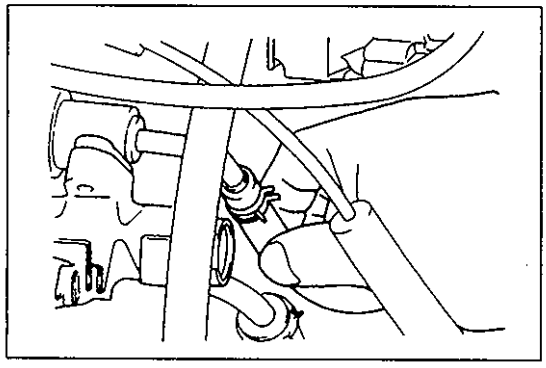
FUEL PUMP

On-Vehicle Inspection

CAUTION:
When fuel filler cap is removed in any procedure, work must be done in a well-ventilated area, keep away from any open flames and without smoking.



1) Remove filler cap and turn the ignition switch ON position. Then fuel pump operating sound be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to "Diagnostic Flow Table B-1" in this section.



2) Fuel pressure should be felt at fuel return hose for 2 seconds after turning the ignition switch ON position.
   If fuel pressure is not felt, advance to "Diagnostic Flow Table B-3" in this section.

Removal

1) Remove fuel tank from body according to procedure described in section 6C and remove fuel pump from fuel tank.

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

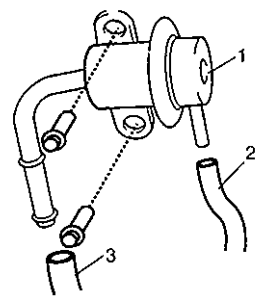
Installation

1) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in section 6C.

FUEL PRESSURE REGULATOR

On-Vehicle Inspection

Perform fuel pressure inspection according to procedure described in "Fuel Pressure Inspection".



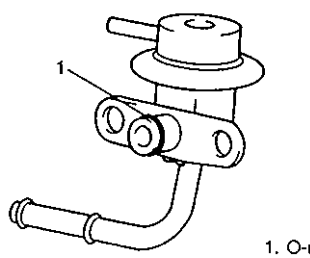
1. Fuel pressure regulator
2. Vacuum hose
3. Fuel return hose

Removal

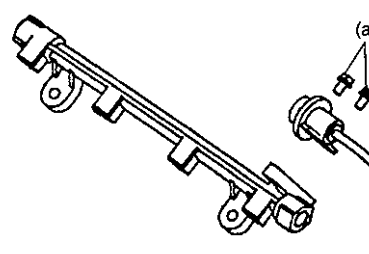
1) Relieve fuel pressure according to procedure described on p. 6-4.
2) Disconnect battery negative cable from battery.
3) Disconnect vacuum hose from fuel pressure regulator.
4) Remove fuel pressure regulator from fuel delivery pipe.

CAUTION:
A small amount of fuel may be released when it is from delivery pipe.
Place a shop cloth under delivery pipe so that released fuel is absorbed in it.

5) Disconnect fuel return hose from fuel pressure regulator.



1. O-ring



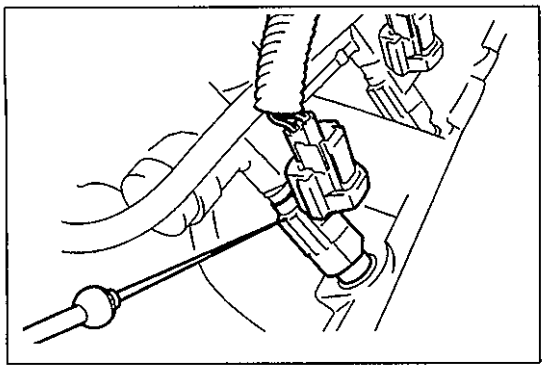
Installation

For installation, reverse removal procedure and note following precautions.

- Use new O-ring.
- Apply thin coat of gasoline to O-ring to facilitate installation.
- Tighten fuel pressure regulator bolts to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

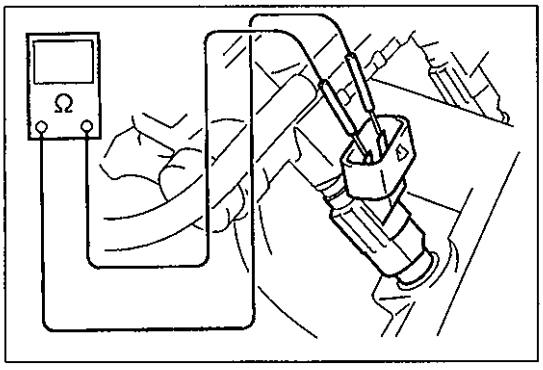
- With engine "OFF" and the ignition switch ON position, check for fuel leaks around fuel line connection.



FUEL INJECTOR

On-Vehicle Inspection

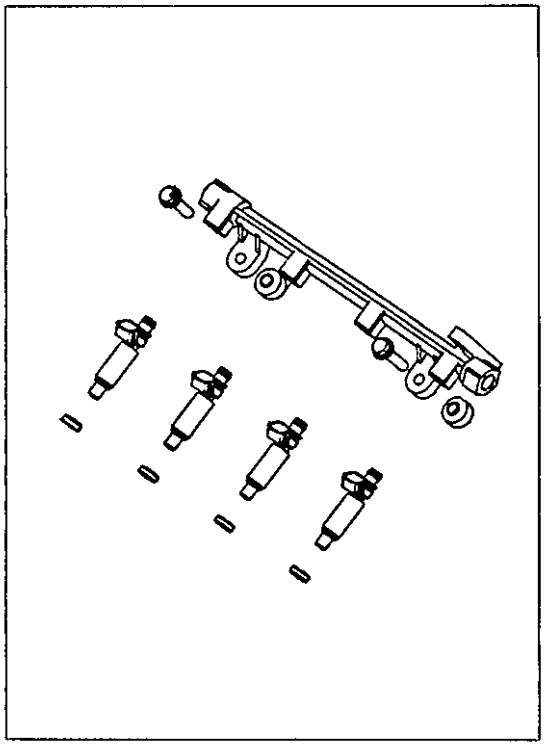
1) Using sound scope or such, check operating sound of injector when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, go to "Diagnostic Flow Table B2" in this section.



2) Disconnect coupler from injector, connect ohmmeter between terminals of injector and check resistance.

   Resistance of injector: 10 – 15 Ω at 20°C, 68 °F

   If resistance is out of specification, replace.
3) Connect coupler to injector securely.



Removal

NOTE:
Perform fuel pressure inspection before fuel injector inspection.

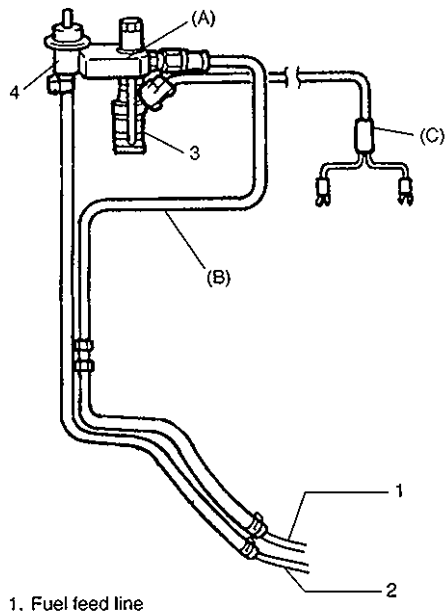
1) Relieve fuel pressure according to procedure described on p. 6-4.
2) Disconnect battery negative cable at battery.
3) Disconnect coupler from each injector.
4) Remove fuel delivery pipe bolts.
5) Remove fuel injector(s) from delivery pipe and intake manifold.

> **WARNING:**
> **A small amount of fuel may be released when fuel injector is removed. In order to reduce the chance of personal injury, cover than with a shop cloth.**

Inspection

> **WARNING:**
> **As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.**
> **Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.**

NOTE:
Confirm fuel pressure before this inspection.



1. Fuel feed line
2. Fuel return line
3. Fuel injector
4. Fuel pressure regulator

1) Install injector and fuel pressure regulator to special tool (injector checking tool).

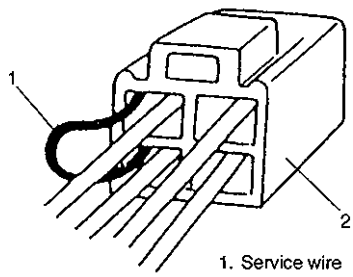
Special Tool
(A): 09912-58421

2) Connect special tools (hoses and attachment) to hose and pipe of vehicle.

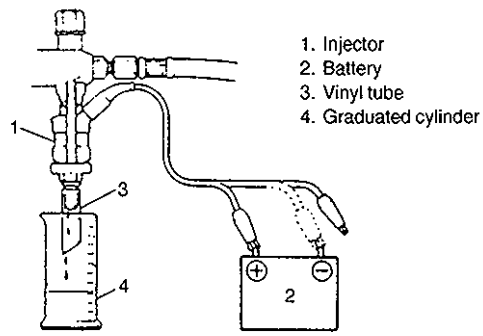
Special Tool
(B): 09912-58431

3) Connect special tool (test lead) to injector.

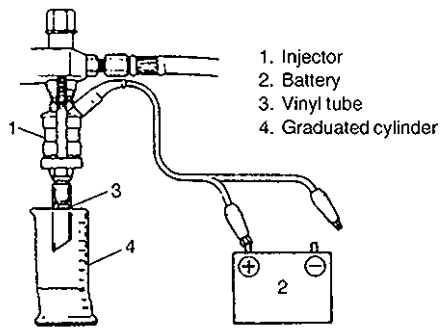
Special Tool
(C): 09930-88530



1. Service wire
2. Fuel pump relay coupler



1. Injector
2. Battery
3. Vinyl tube
4. Graduated cylinder



1. Injector
2. Battery
3. Vinyl tube
4. Graduated cylinder

4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector as shown.
6) Remove fuel pump relay.
7) To operate fuel pump and apply fuel pressure to injector, using wire harness as thick as the one used for fuel pump circuit, connect two terminals of relay connector as shown in figure.

CAUTION:
Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

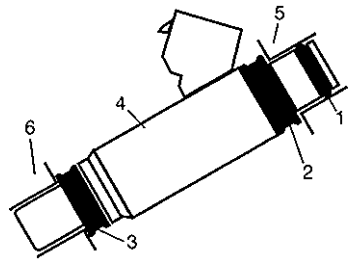
Turn the ignition switch ON position.

8) Apply battery voltage to injector for 15 seconds and measure injected fuel volume with graduated cylinder.
Test each injector two or three times.
If not within specification, replace injector.

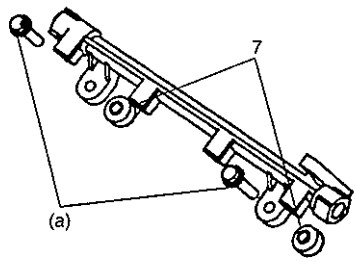
Injected fuel volume:
43 – 47 cc/15 sec. (1.59/1.51 – 1.59/1.65 US/Imp. oz/15 sec.)

9) Check fuel leakage from injector nozzle. Do not operate injector for this check (but fuel pump should be at work).
If fuel leaks more than following specifications, replace.

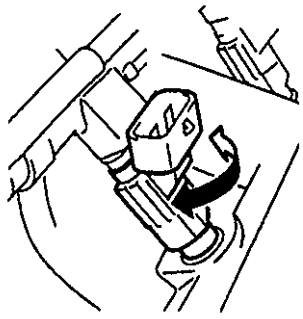
Fuel leakage: Less than 1 drop/min.



1. O-ring
2. Grommet
3. Cushion
4. Injector
5. Delivery pipe
6. Intake manifold



7. Insulator

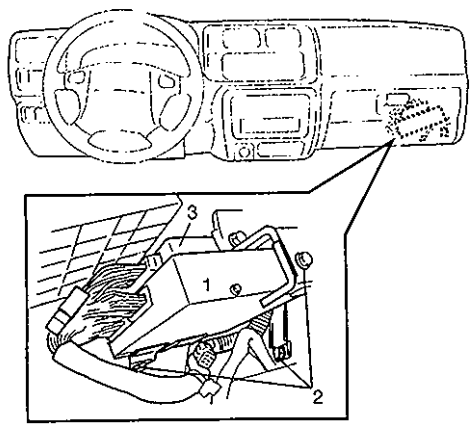


Installation

1) Replace injector O-ring with new one using care not to damage it. Install grommet to injector.
2) Check if insulator is scored or damaged. If it is, replace with new one.
   Install insulators and cushions to intake manifold.
3) Apply thin coat of fuel to O-rings and then install injectors into delivery pipe and intake manifold.
   Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring. Replace O-ring with new one.
4) Tighten delivery pipe bolts and make sure that injectors rotate smoothly.

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

5) Connect couplers to injectors securely.
6) Connect battery negative cable.
7) With engine OFF and the ignition switch ON position, check for fuel leaks around fuel line connection.



1. ECM
2. Bolt
3. A/T control module (A/T)

ELECTRONIC CONTROL SYSTEM

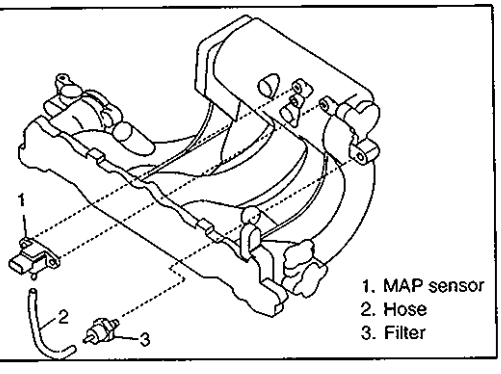
ENGINE CONTROL MODULE (ECM)

CAUTION:
As ECM consists of precision parts, be careful not to expose it to excessive shock.

Removal and Installation

1) Disconnect battery negative cable from battery.
2) Disable air bag system (if equipped) referring to "Disabling the Air Bag System" in Air Bag System section.
3) Remove glove box.
4) Disconnect connectors from ECM.
5) Remove ECM.

Reverse above procedure in case of installation.



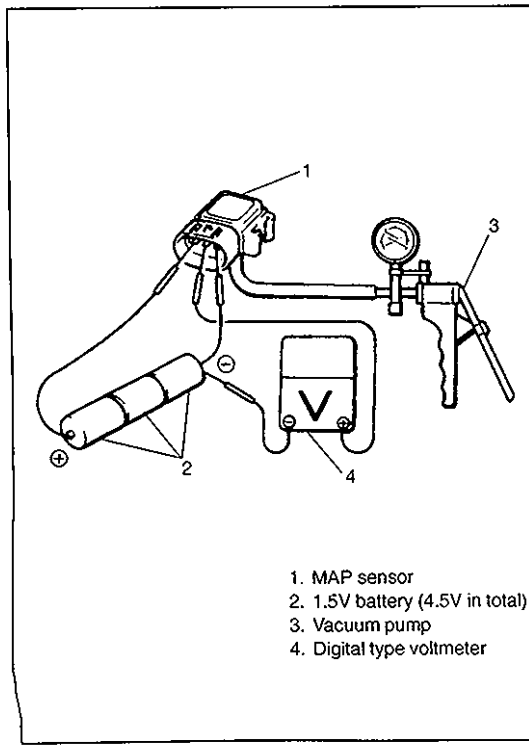
1. MAP sensor
2. Hose
3. Filter

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR)

Removal and Installation

1) Disconnect negative cable at battery.
2) Disconnect MAP sensor coupler and hose from MAP sensor.
3) Remove MAP sensor from intake manifold.

Reverse above procedure in case of installation.



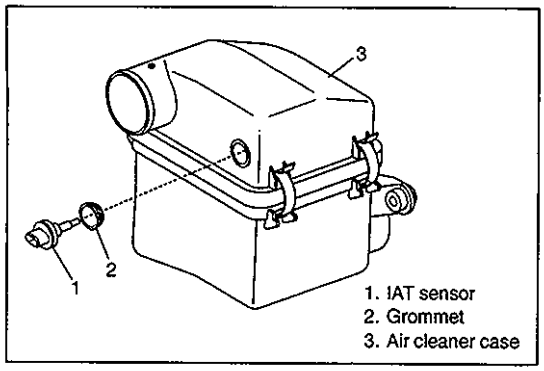
1. MAP sensor
2. 1.5V battery (4.5V in total)
3. Vacuum pump
4. Digital type voltmeter

Installation

1) Arrange 3 new 1.5V batteries in series (check that total voltage is 4.5–5.0V) and connect its positive terminal to "Vin" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".
Also, check if voltage reduces when vacuum is applied up to 400mmHg by using vacuum pump.

Output voltage (Vin voltage 4.5 – 5.0V, ambient temp. 20 – 30°C, 68 – 86°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE	OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(V)
0 – 2000	0 – 610	760 – 707	3.1 – 3.6
2001 – 5000	611 – 1524	707 – 634	2.8 – 3.4
5001 – 8000	1525 – 2438	634 – 567	2.6 – 3.1
8001 – 10000	2439 – 3048	567 – 526	2.4 – 2.9



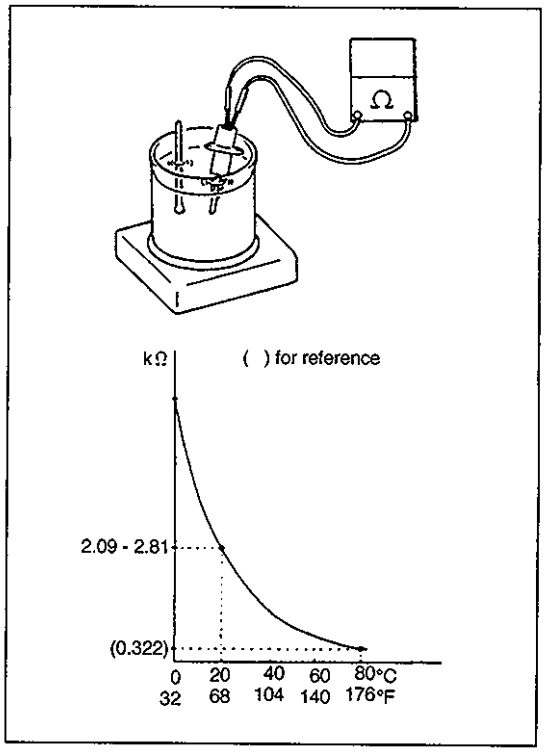
1. IAT sensor
2. Grommet
3. Air cleaner case

INTAKE AIR TEMPERATURE (IAT) SENSOR

Removal and Installation

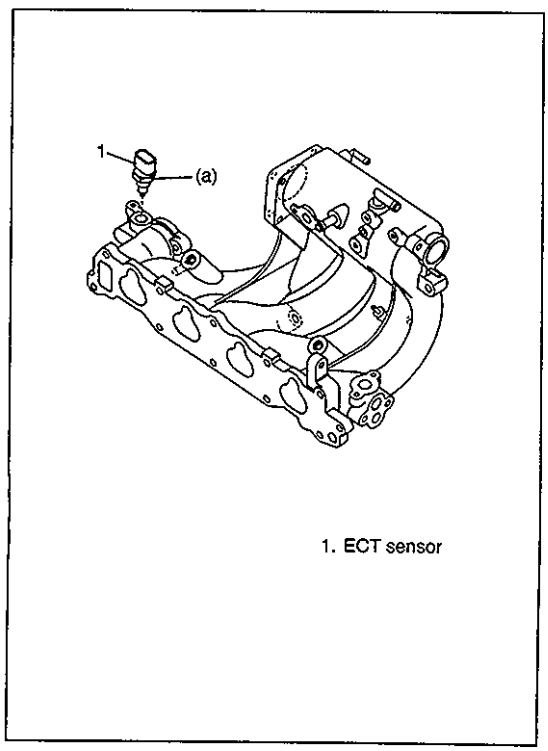
1) Disconnect negative cable from battery.
2) Disconnect IAT sensor coupler.
3) Remove IAT sensor from air cleaner case.

Reverse above procedure in case of installation.



Inspection

Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in figure, replace IAT sensor.



1. ECT sensor

ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

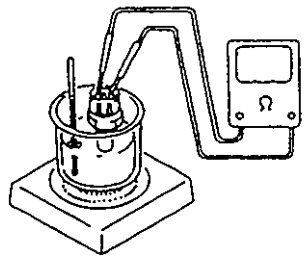
Removal and Installation

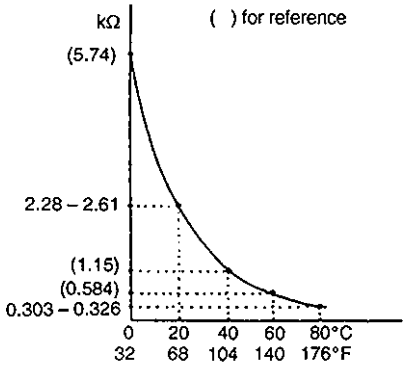
1) Disconnect negative cable from battery.
2) Drain cooling system.
3) Disconnect coupler from ECT sensor.
4) Remove ECT sensor from intake manifold.

Reverse removal procedure in case of installation noting the following.

- Clean mating surfaces of sensor and intake manifold.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor to specified torque.

Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

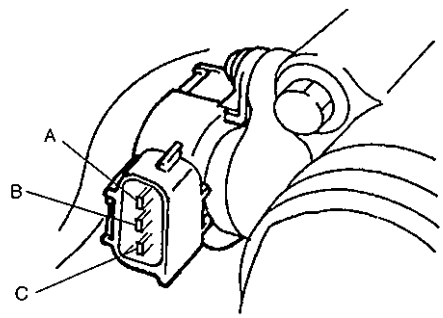




Inspection

Immerse temperature sensing part of ECT sensor in water and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't shown such characteristic as shown, replace ECT sensor.



TP SENSOR

Inspection

1) Disconnect negative cable at battery and coupler from TP sensor.
2) Using ohmmeter, check resistance between terminals under each condition given in table below.

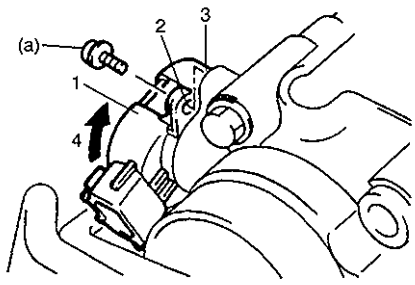
TERMINALS	RESISTANCE	
Between "A" and "B" terminals	2.5 – 6.0 kΩ	
Between "A" and "C" terminals	Throttle valve is at idle position	0.17 – 11.4 kΩ
	Throttle valve is fully opened	1.72 – 15.50 kΩ

NOTE:

There should be more than 1.5 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.

If check result is not satisfactory, replace TP sensor.

3) Connect TP sensor coupler securely.
4) Connect negative cable to battery.



1. TP sensor
2. TP sensor hole
3. TP sensor screw hole
4. Turn TP sensor after fitting and align holes

Removal

1) Disconnect battery negative cable at battery.
2) Disconnect coupler from TP sensor.
3) Remove TP sensor from throttle body.

Installation

1) Install TP sensor to throttle body.
   Fit TP sensor to throttle body in such way that its holes are a little away from TP sensor screw holes as shown in left figure and turn TP sensor clockwise so that those holes align.

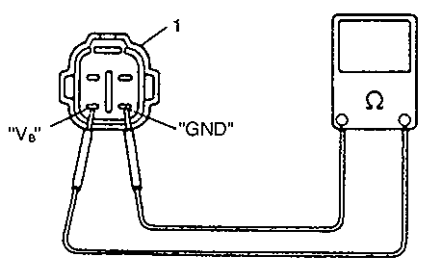
   Tightening Torque
   (a): 2 N·m (0.2 kg-m, 1.5 lb-ft)

2) Connect coupler to TP sensor securely.
3) Connect battery negative cable to battery.

HEATED OXYGEN SENSOR (HO2S) IF EQUIPPED

Oxygen Sensor Inspection

Inspect oxygen sensor and its circuit referring to flow table of diagnostic trouble code No. 13 in this section. If malfunction is found, replace.



1. Sensor coupler
   (Viewed from terminal side)

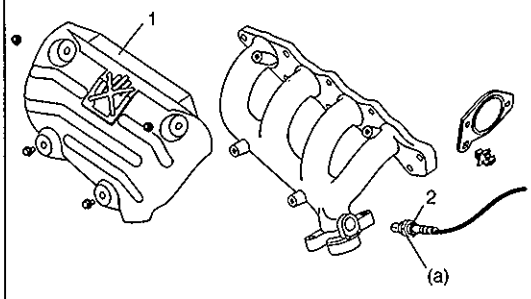
Oxygen Sensor Heater Inspection

1) Disconnect oxygen sensor coupler.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

   NOTE:
   Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

   Resistance of oxygen sensor heater:
   11 – 15 Ω (at 20°C, 68°F)

   If found faulty, replace oxygen sensor.
3) Connect oxygen sensor coupler securely.



1. Exhaust manifold upper cover
2. HO2S

Removal

WARNING:
To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1) Disconnect negative cable from battery.
2) Remove HO2S harness from bracket and disconnect coupler of oxygen sensor.
3) Remove exhaust manifold upper cover.
4) Remove oxygen sensor from exhaust manifold.

NOTE:
Be careful not to expose it to excessive shock.

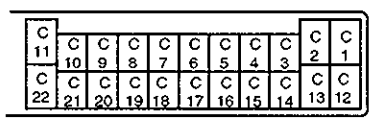
Installation

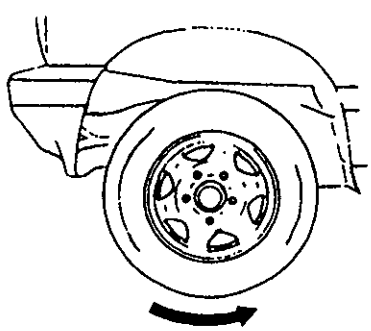
Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

Tightening Torque
(a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- Connect coupler of oxygen sensor and fit harness to bracket.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.





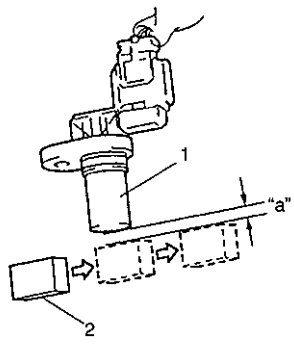
VEHICLE SPEED SENSOR (VSS)

On-Vehicle Inspection

1) Hoist vehicle.
2) Release parking brake lever, set transmission in neutral and transfer in "2H".
3) Connector voltmeter between "C2" terminal of ECM coupler and body ground.
4) Turn the ignition switch ON position and turn rear right tire slowly with rear left tire locked.
   Voltmeter should indicate deflection between 0 – 1 V and 4 – 14 V a few times while tire is turned one revolution.
   If check result is not satisfactory, proceed to flow table of diagnostic trouble code No.24 in this section.

Removal, Inspection and Installation

Refer to "VSS Removal, Inspection or Installation" in section 7D.



1. CMP sensor
2. Magnetic substance (iron)

CAMSHAFT POSITION SENSOR (CMP SENSOR)

On-Vehicle Inspection

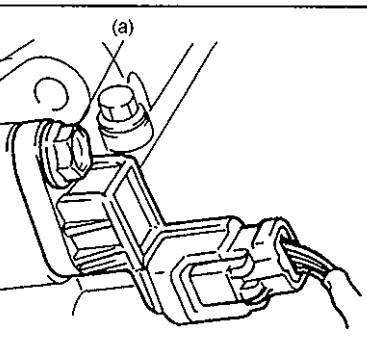
1) Remove CMP sensor from sensor case.
2) Remove metal particles on end face of CMP sensor, if any.
3) Connect coupler to CMP sensor.
4) Connect voltmeter between C1 terminal of ECM coupler and ground.
5) Disconnect couplers of fuel injectors and ignition coil assemblies. And connect negative cable to battery.
6) With the ignition switch ON position, pass magnetic substance (iron).
   Voltmeter should indicate deflection between 0–1V and 4–6V.

   "a": approximately 1mm (0.03 in)

   If check result is not satisfactory, proceed to flow table of diagnostic trouble code No.42 in this section.

Removal

1) Disconnect negative cable from battery.
2) Disconnect connector from CMP sensor.
3) Remove CMP sensor from sensor case.

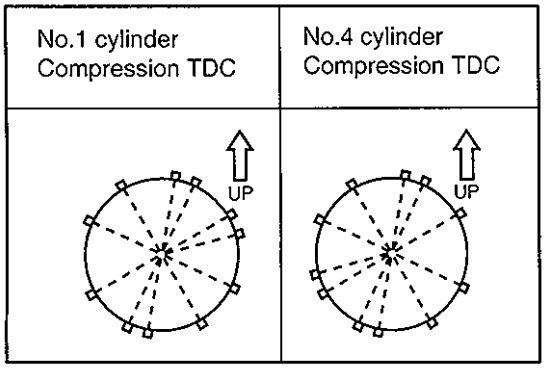


Installation

1) Check that O-ring is free from damage.
2) Check that CMP sensor and signal rotor tooth are free from any metal particles and damage.
3) Install CMP sensor to sensor case.

   Tightening Torque
   (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

4) Connect connector to it securely.
5) Connect negative cable to battery.



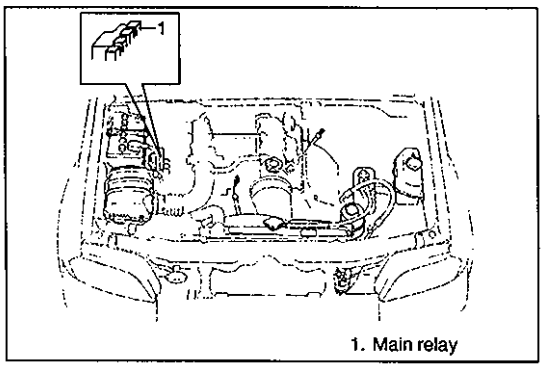
CMP SENSING ROTOR

Inspection

1) Remove CMP sensor case and cylinder head cover referring to Section 6A.
2) Turn crankshaft and align "V" mark on crankshaft pulley to "0" mark on timing belt cover.
   Then, confirm which cylinder is compression dead center and check CMP sensing rotor teeth and direction.
   If check result is not satisfied, replace camshaft.

Removal and Installation

Refer to "Rocker Arms, Rocker Shaft and Camshaft Removal and Installation" in this Section 6A.

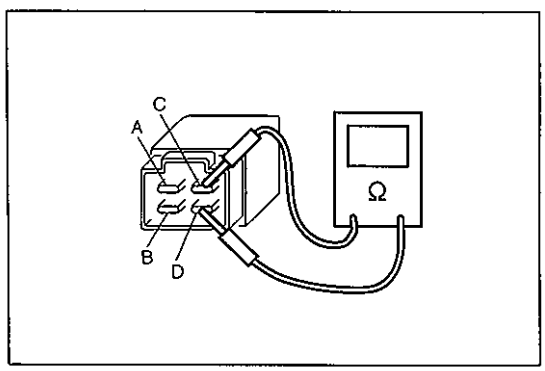


1. Main relay

MAIN RELAY

Inspection

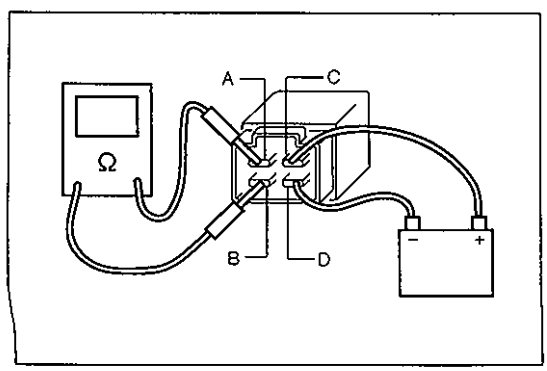
1) Disconnect negative cable at battery.
2) Remove main relay from relay box.



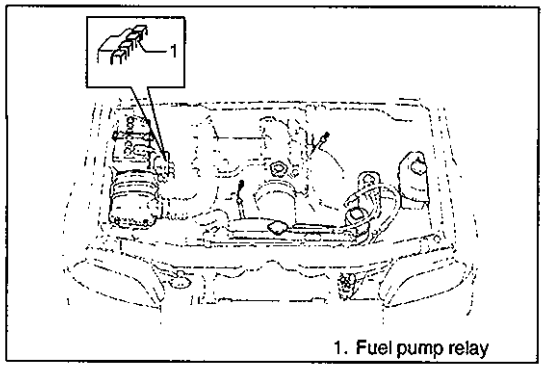
3) Check resistance between each two terminals as in table below.

TERMINALS	RESISTANCE
Between A and B	∞ (Infinity)
Between C and D	56 – 146 Ω at 20°C, 68°F

If check results are as specified, proceed to next operation check. If not, replace.



4) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".
   If malfunction is found, replace.

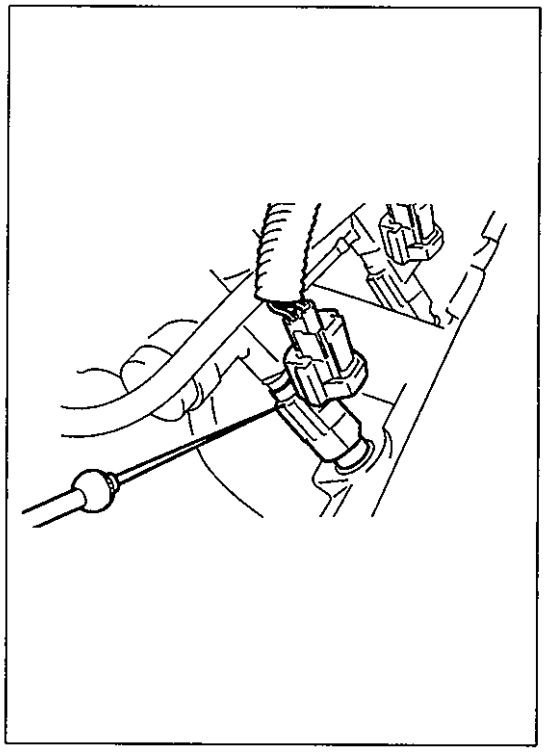


1. Fuel pump relay

FUEL PUMP RELAY

Inspection

1) Disconnect negative cable at battery.
2) Remove fuel pump relay from relay box.
3) Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If malfunction is found, replace.



FUEL CUT OPERATION

Inspection

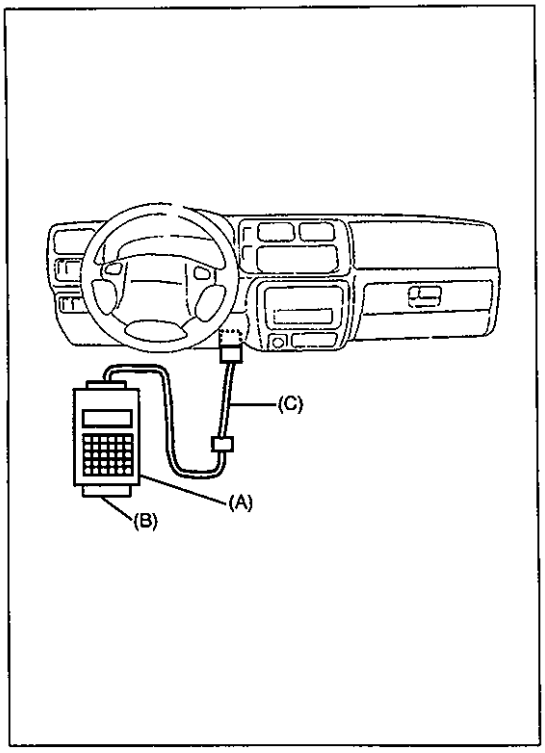
NOTE:
Before inspection, check to make sure that gear shift lever is in Neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1) Warm up engine to normal operating temperature.
2) While listening to sound of injector by using sound scope or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 2,000 r/min.
   If not, go to "Diagnostic Flow Table B9" in this section.

A/C SIGNAL, A/C ON SIGNAL A/C CONDENSER FAN MOTOR RELAY CONTROL SYSTEM (IF A/C EQUIPPED)

Inspection

1) Check A/C signal and A/C ON signal referring to "Diagnostic Flow Table B–7" in this section.
2) Check A/C condenser fan motor relay control system referring to "Diagnostic Flow Table B–8" in this section.



EMISSION CONTROL SYSTEM

EGR SYSTEM (IF EQUIPPED)

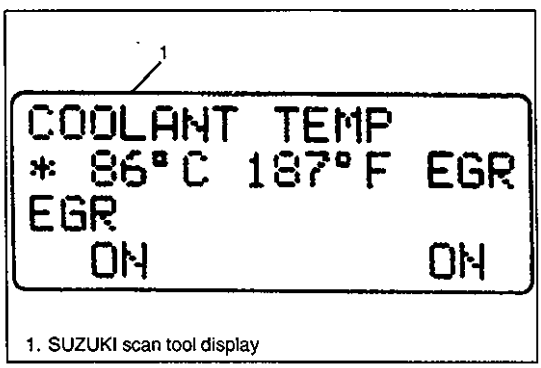
System Inspection [Using SUZUKI scan tool]

1) Connect Tech 1 to data link connector (DLC) with the ignition switch OFF position.

Special tool
(A): 09931-76011 (SUZUKI scan tool)
(B): Mass storage cartridge
(C): 09931-76030 (16/14 pin DLC cable)

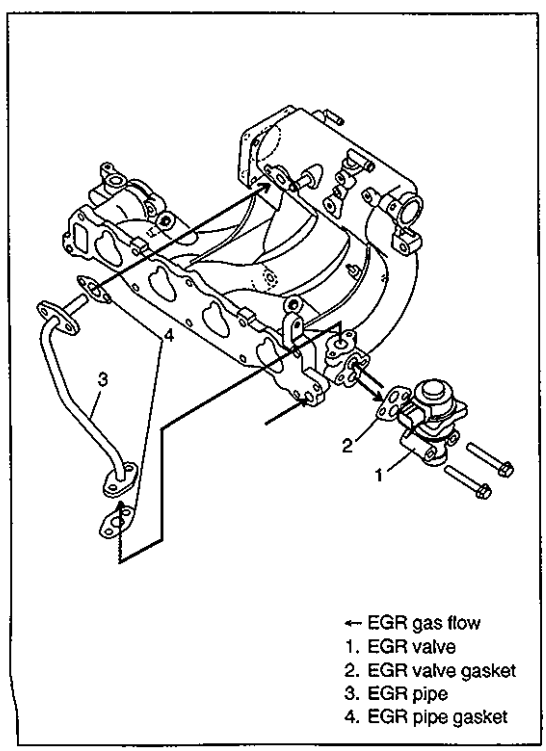
NOTE:
For operation procedure of cartridge, refer to its cartridge operator's manual.

2) Start engine and warm up it to normal operating temperature.



1. SUZUKI scan tool display

3) With engine speed between 1500 r/min and 4000 r/min, open EGR valve by using "MISC. TEST" mode.
In this state, according as EGR valve opening increases engine idle speed drops. If not, go to "Diagnostic Flow Table B6" in this section.



← EGR gas flow
1. EGR valve
2. EGR valve gasket
3. EGR pipe
4. EGR pipe gasket

EGR VALVE

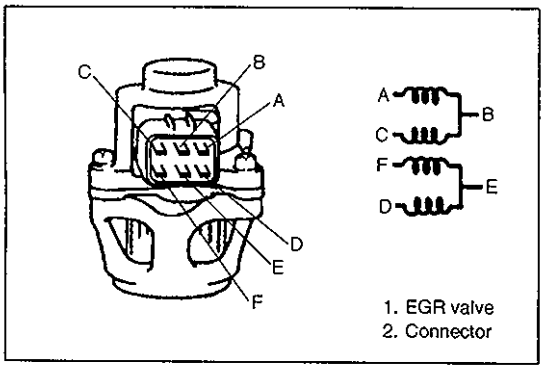
Removal

1) Disconnect negative cable at battery.
2) Disconnect EGR valve coupler.
3) Remove EGR valve and gasket from intake manifold.
4) Remove EGR pipe.

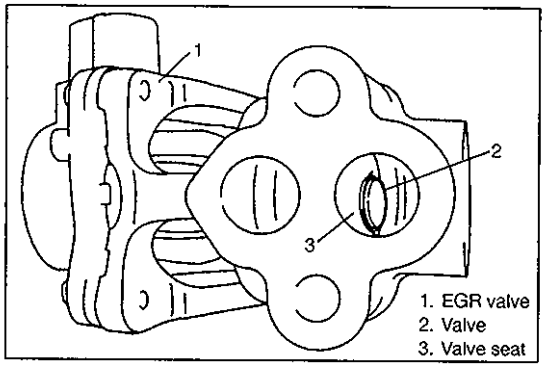
Installation

Reverse removal procedure noting following.

- Clean mating surface of valve and intake manifold.
- Use new gasket.



1. EGR valve
2. Connector



1. EGR valve
2. Valve
3. Valve seat

Inspection

1) Check resistance between following terminals of EGR valve in each pair.

Terminals	Standard resistance
A – B C – B F – E D – E	20 – 24 Ω at 20°C, 68F
B – valve body E – valve body	infinity (∞)

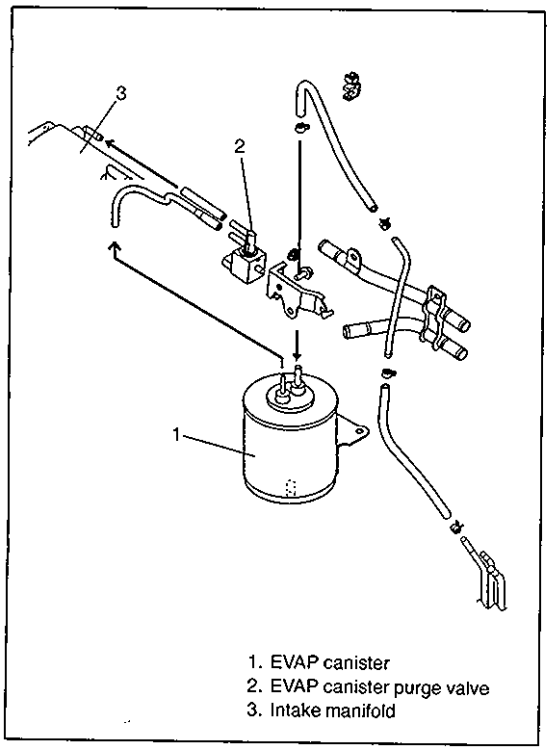
If found faulty, replace EGR valve assembly

2) Remove carbon from EGR valve gas passage.

NOTE:
Do not use any sharp–edged tool to remove carbon.
Be careful not to damage or bend EGR valve, valve seat and rod.

3) Inspect valve, valve seat and rod for fault, cracks, bend or other damage.
If found faulty, replace EGR valve assembly.

4) Inspect EGR passage for clogged or leak.
If found faulty, repair or replace.

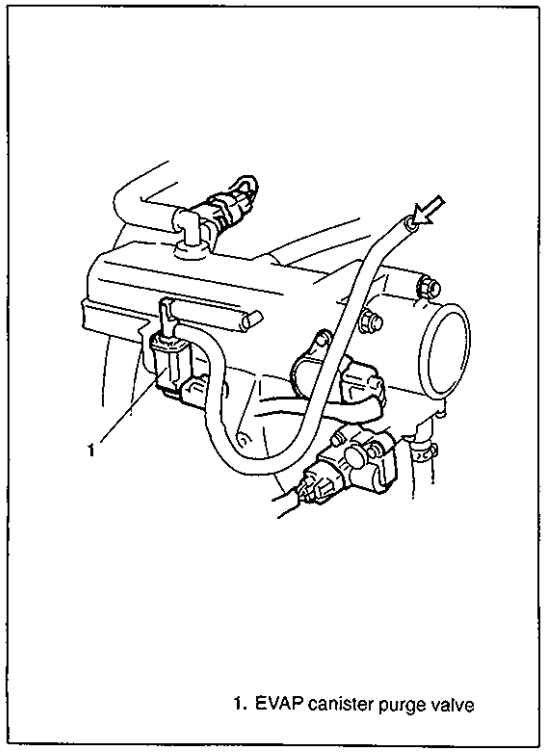


1. EVAP canister
2. EVAP canister purge valve
3. Intake manifold

EVAP EMISSION CONTROL SYSTEM (IF EQUIPPED)

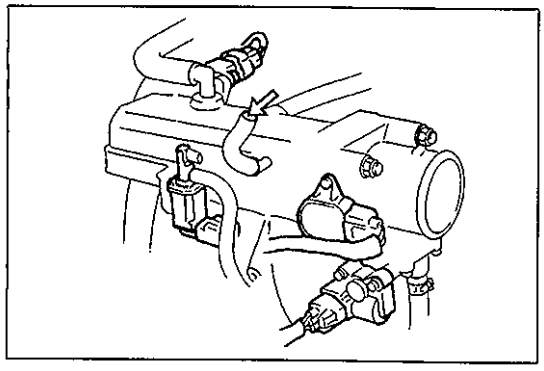
EVAP Canister Purge System Inspection

NOTE:
- **Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.**
- **A/C is out of service.**



1. EVAP canister purge valve

1) Warn up engine to normal operating temperature.
2) Disconnect purge hose from EVAP canister.
3) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
4) Also check that vacuum is felt when A25 terminal of ECM coupler shorted to ground.
   If check result is not satisfactory, go to "Diagnostic Flow Table B-5" in this section.

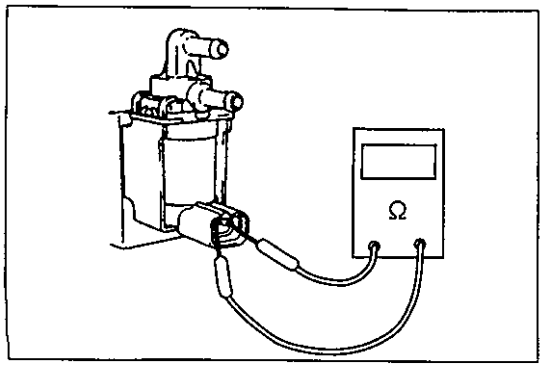


Vacuum Passage Inspection (For vehicle with EVAP canister purge valve)

Start engine and run it at idle speed. Disconnect vacuum hose from EVAP canister purge valve. With finger placed against hose disconnected,check that vacuum is applied.
If it is not applied, clean vacuum passage.

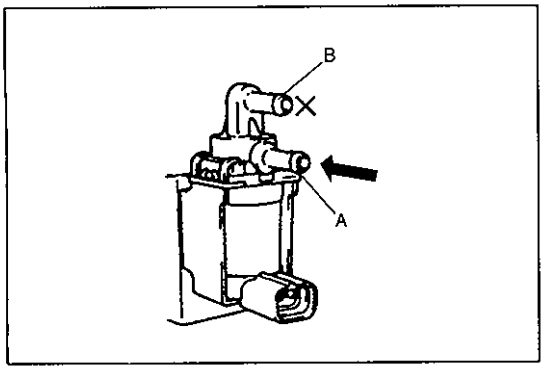
Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration.
Replace as necessary.

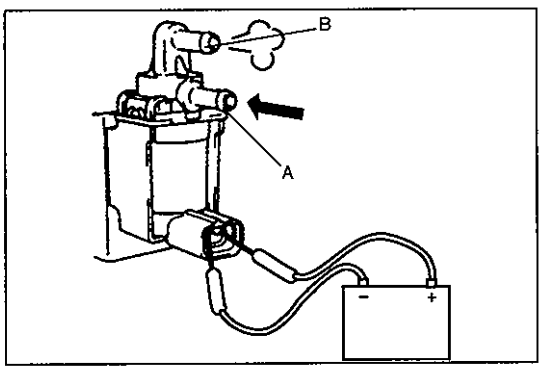


Evap Canister Purge Valve Inspection

1) With the ignition switch OFF position, disconnect coupler from EVAP canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.
   Resistance of EVAP canister purge valve:
   30 – 34 Ω at 20°C (68°F)
   If resistance is as specified, proceed to next operation check.
   If not, replace.



3) Disconnect vacuum hoses from intake manifold and its pipe.
4) With coupler disconnected, blow into pipe "A". Air should not come out of pipe "B".

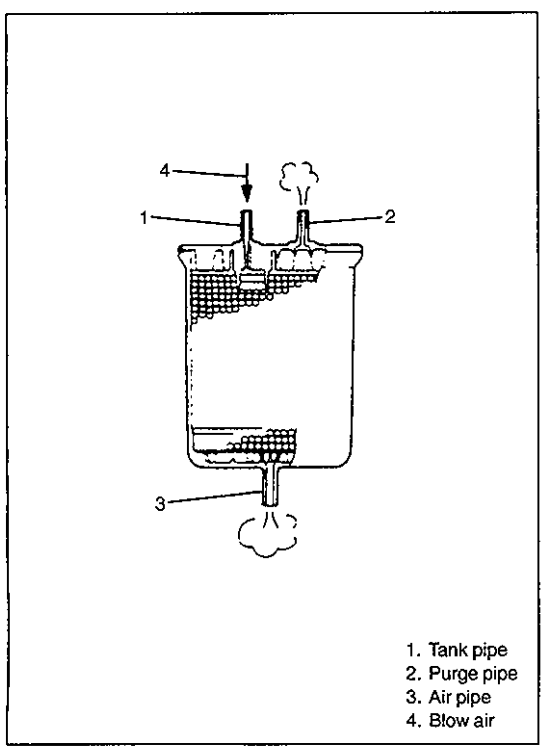


5) Connect 12V-battery to EVAP canister purge valve terminals. In this state, blow pipe "A".
Air should come out of pipe "B".

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.

If check result is not as described, replace canister purge valve.

6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.

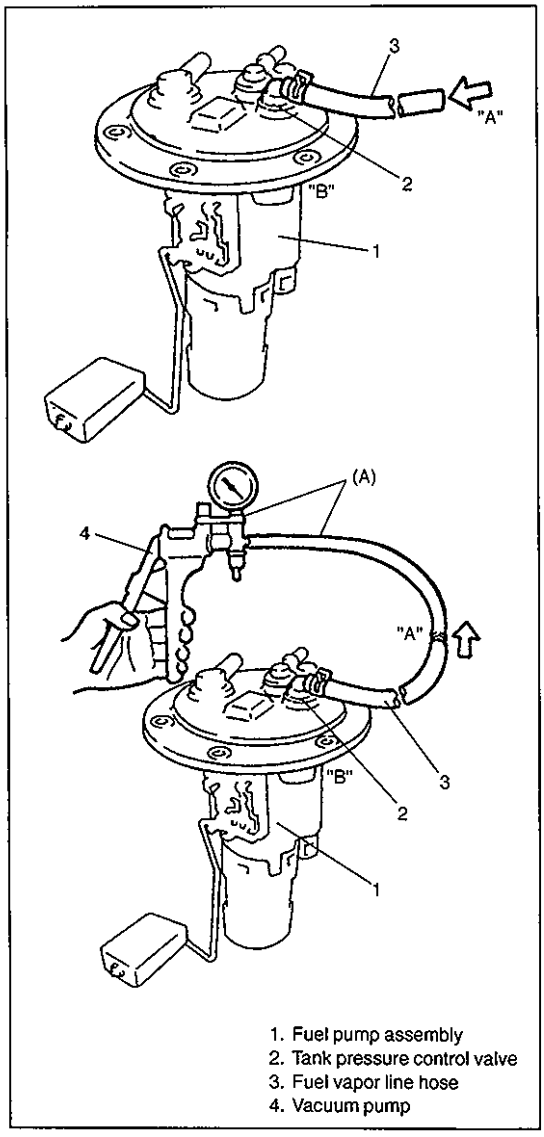


1. Tank pipe
2. Purge pipe
3. Air pipe
4. Blow air

EVAP Canister Inspection

WARNING:
DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

1) Disconnect vacuum hoses from EVAP canister and remove EVAP canister.
2) When air is blown into tank pipe, there should be no restriction of flow through purge pipe and air pipe.
If operation differs from above description, EVAP canister must be replaced.
3) Install EVAP canister and connect hoses to canister.



1. Fuel pump assembly
2. Tank pressure control valve
3. Fuel vapor line hose
4. Vacuum pump

Tank pressure Control Valve

Inspection

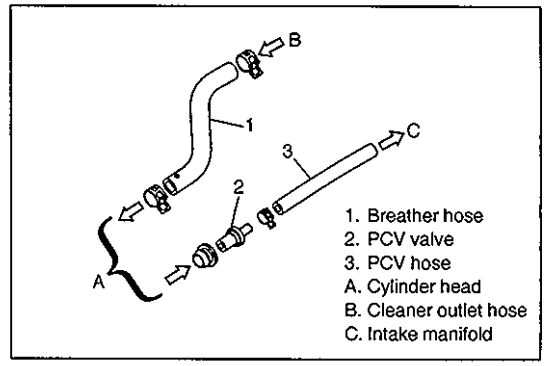
1) Remove fuel pump assembly installed on fuel tank, referring to SECTION 6C.
2) Air should pass through valve smoothly from fuel vapor line hose "A" to "B" when blown hard.
3) Also, when vacuum pump is connected to fuel vapor hose and load is applied gradually, air should pass from "B" to "A".

Special Tool
(A): 09917-47910

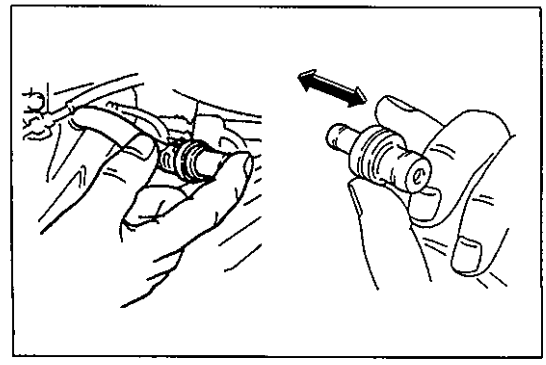
4) If air doesn't pass through valve in step 2) or hard blow is required in step 3), replace bracket sub assembly, referring to SECTION 6C.

> **WARNING:**
> **DO NOT SUCK air through fuel vapor line hose. Fuel vapor inside valve is harmful.**

5) Install fuel pump assembly to fuel tank, referring to SECTION 6C.



1. Breather hose
2. PCV valve
3. PCV hose
A. Cylinder head
B. Cleaner outlet hose
C. Intake manifold



PCV SYSTEM

Inspection

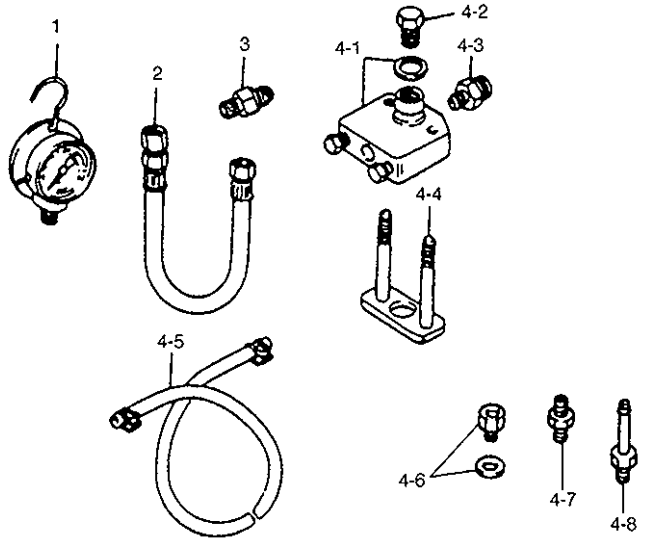
NOTE:
Be sure to check that there is no obstruction in PCV valve or its hoses before checking engine idle speed/IAC duty for obstructed PCV valve or hose hampers its accurate checking.

1) Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.
2) Disconnect PCV valve from cylinder head cover and plug head cover hole.
3) Run engine at idle.
4) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve and hose. Replace as necessary.
5) After checking vacuum, stop engine and remove PCV valve. Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.
6) After checking, connect PCV valve, PCV hose and clamp securely.

TIGHTENING TORQUE SPECIFICATIONS

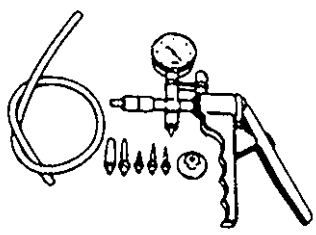
Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Delivery pipe plug bolt	30	3.0	22.0
Delivery pipe bolts	23	2.3	17.0
Camshaft position sensor bolt	9	0.9	6.5
Heated oxygen sensor	45	4.5	32.5
Fuel pressure regulator bolts	10	1.0	7.5
Engine coolant temp. (ECT) sensor	15	1.5	11.0

SPECIAL TOOLS

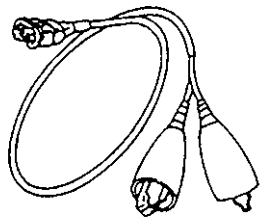


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. Attachment
   09919-46010
4. Checking tool set
   09912-58421

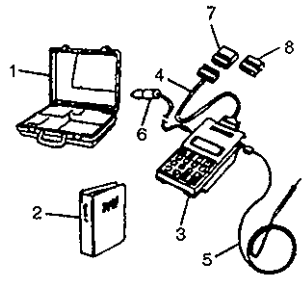
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47910
Vacuum pump gauge

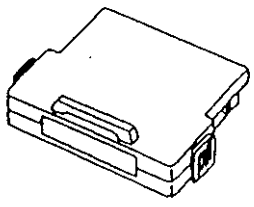


09930-88530
Injector test lead

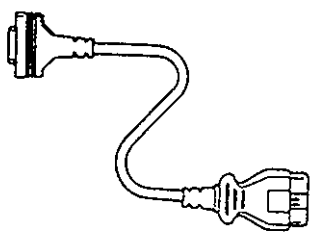


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self–test adaptor

09931-76011
Tech 1A kit



Mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6F

IGNITION SYSTEM

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

6F

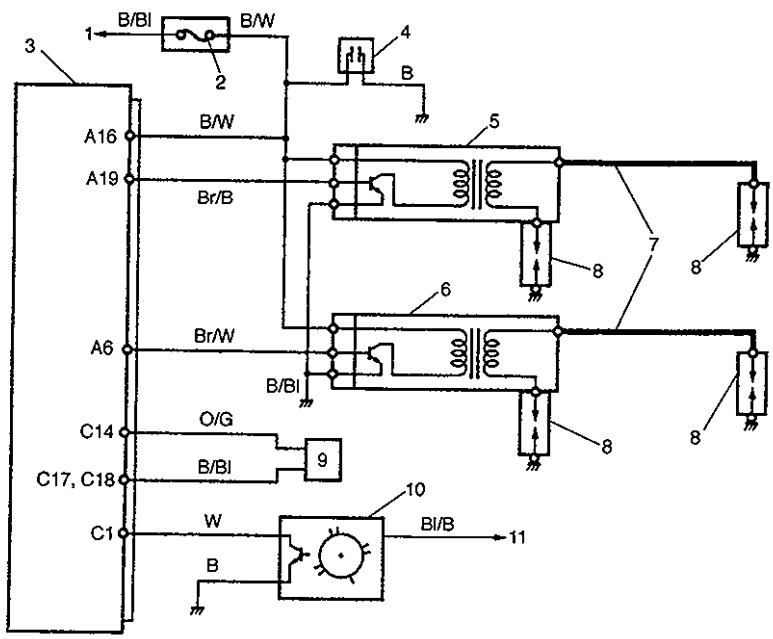
GENERAL DESCRIPTION

The ignition system is a distributorless ignition system. It consists of the parts as described below and has an electronic ignition system.

- ECM
  It detects the engine condition through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the igniter (in ignition coil assembly).
- Ignition coil assembly (including an igniter and an ignition coil)
  The ignition coil assembly has a built-in igniter and ignition coil which turns ON and OFF the primary current of the ignition coil according to the signal from ECM. When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary wiring.
- Ignition resistor
  ECM uses this resistor to correct initial ignition timing. Therefore, fine adjustment of initial ignition timing is possible by replacing it.
- Spark plug, high-tension cord and noise suppressor
- CMP sensor, TP sensor, ECT sensor and MAP sensor
  For their details, refer to SECTION 6E.

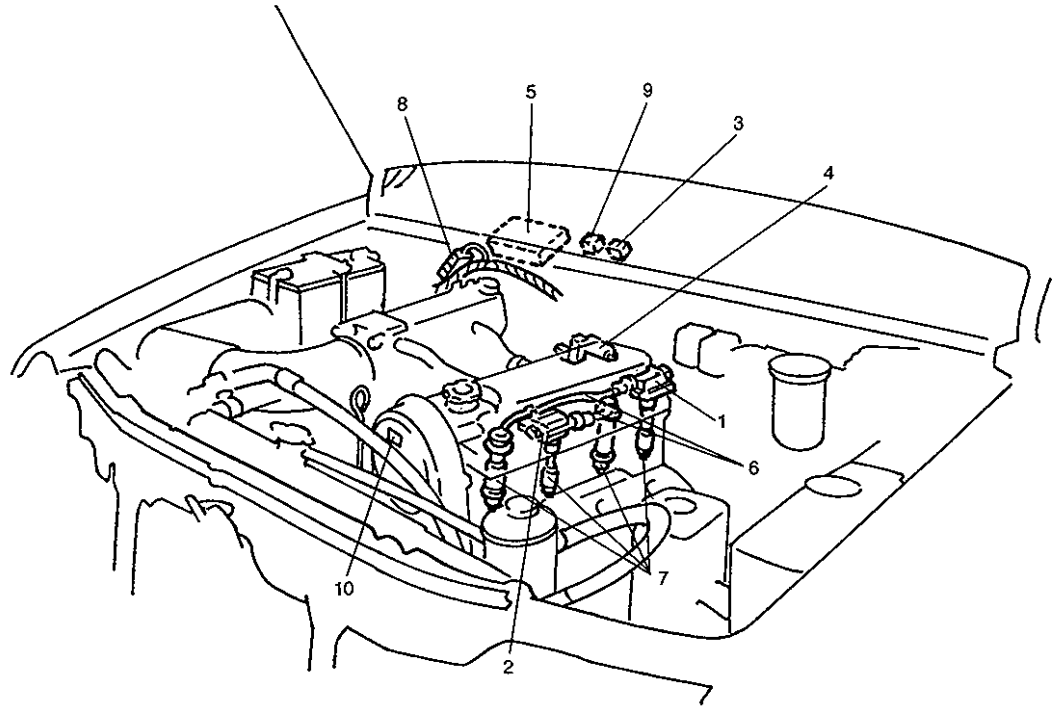
Although this distributorless ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM to the igniter in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil. Then, it is fed to No.1 spark plug through high-tension cords and to No.4 spark plug directly from ignition coil assembly to cause both of these plugs to spark simultaneously. Likewise, when an ignition signal is sent from ECM to the ignition coil assembly for No.2 and No.3 spark plugs, a high voltage is induced in the secondary coil. Then, it is fed to No.3 spark plug through high-tension cords and to No.2 spark plug directly from ignition coil assembly to cause both No.2 and No.3 spark plugs to spark simultaneously.

SYSTEM WIRING



1. To ignition switch
2. "IG COIL METER" fuse
3. ECM
4. Noise suppressor
5. Ignition coil assembly (igniter and ignition coil) for No.1 and No.4 cylinders
6. Ignition coil assembly (igniter and ignition coil) for No.2 and No.3 cylinders
7. High-tension cord
8. Spark plug
9. Ignition resistor
10. CMP sensor
11. To main relay

COMPONENTS



1. Ignition coil assembly for No.1 and No.4 cylinders
2. Ignition coil assembly for No.2 and No.3 cylinders
3. Monitor coupler (*)
4. CMP sensor
5. ECM (*)
6. High-tension cord
7. Spark plug
8. Noise suppressor
9. Ignition resistor (*)
10. Ignition Label

NOTE:
Above figure shows left hand steering vehicle. For right hand steering vehicle, parts with (*) are installed at the other side.

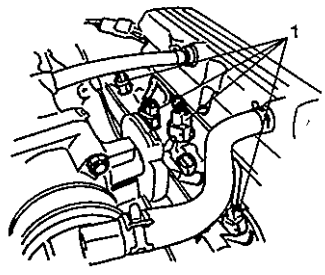
DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	**No spark**	
	• Blown fuse for ignition coil	Replace.
	• Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely.
	• Faulty high-tension cord(s)	Replace.
	• Faulty spark plug(s)	Adjust, clean or replace.
	• Faulty ignition coil assembly(s)	Replace.
	• Faulty CMP sensor	Clean, tighten or replace.
	• Faulty ECM	Replace.
Poor fuel economy or engine performance	• Incorrect ignition timing	Adjust.
	• Faulty high-tension cord(s)	Replace.
	• Faulty spark plug(s)	Adjust, clean or replace.
	• Faulty ignition coil assembly(s)	Replace.
	• Faulty CMP sensor	Clean, tighten or replace.
	• Faulty ECM	Replace.

DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was "Engine Diagnostic Flow Table" in SECTION 6 performed?	Go to Step 2.	Go to "Engine Diagnostic Flow Table" in SECTION 6.
2	Ignition Spark Test 1) Check all spark plug for condition and type, referring to "Spark Plug" in this section. 2) If OK, perform ignition spark test, referring to "Ignition Spark Check" in this section. Is spark emitted from all spark plugs?	Go to Step 11 on the next page.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check 1) Check DTC stored in ECM, referring to "Diagnostic Trouble Code (DTC) Check" in SECTION 6E. Is DTC stored?	Go to applicable flow table corresponding to that code No. in SECTION 6E.	Go to Step 4.
4	Electrical Connection Check 1) Check ignition coil assemblies for electrical connection. Are they connected securely?	Go to Step 5.	Connect securely.
5	High-tension Cord Check 1) Check high-tension cord for resistance, referring to "High-tension Cord and Ignition Coil Assembly (Igniter and Ignition Coil)" in this section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).
6	Ignition Coil Assembly Power Supply And Ground Circuit Check 1) Check ignition coil assembly power supply ("B/Bl" wire) circuit for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Assembly Check 1) Check ignition coil assembly for resistance, referring to "High-tension Cord and Ignition Coil Assembly (Igniter and Ignition Coil)" in this section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly(s).
8	A known-good Ignition Coil Assembly Substitution 1) Substitute a known-good ignition coil assembly and then repeat STEP 2. Is check result of STEP 2 satisfactory?	Replace ignition coil assembly.	Go to Step 9.
9	CMP Sensor Check 1) Check CMP sensor and signal rotor, referring to STEP 5 and 6 of "Diagnostic Flow Table Code 42" in SECTION 6E. Is check result satisfactory?	Go to Step 10 on the next page.	Tighten CMP sensor bolt, replace CMP sensor.

STEP	ACTION	YES	NO
10	Ignition Trigger Signal Circuit Check 1) Check ignition trigger signal ("Br/W" and "Br/B" wire) circuit for open, short and poor connection. Are circuits in good condition?	Go to Step 11.	Repair or replace.
11	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance, referring to "Ignition Timing Check And Adjustment" in this section. Is check result satisfactory?	Substitute a known-good ECM and then repeat STEP 2.	Go to Step 12.
12	Ignition Timing Adjustment And Recheck 1) Adjustment initial ignition timing and ignition timing advance, referring to "Ignition Timing Check And Adjustment" in this section. 2) Recheck initial ignition timing and ignition timing advance, referring to "Ignition Timing Check And Adjustment" in this section. Is check result satisfactory?	System is in good condition.	Repair or replace. Check CMP sensor, input signals related to ignition system and exhaust camshaft installation.



1. Injector coupler

IGNITION SPARK CHECK

1) Disconnect injector coupler.

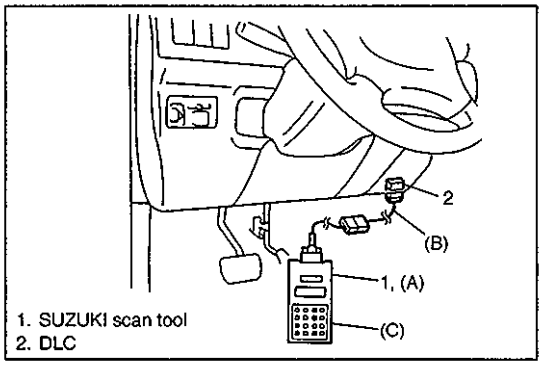
WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

2) Remove spark plug and check it for condition and type, referring to "Spark Plug" under "On-Vehicle Service" later in this section.
3) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
4) Crank engine and check if each spark plug sparks.
   If no spark is emitted, inspect the related parts as described under "Diagnosis" earlier in this section.
5) After checking, install spark plug and ignition coil, referring to "Spark Plug" and "High-tension Cord and Ignition Coil Assembly (Igniter and Ignition Coil)" under "On-Vehicle Service" later in this section.
6) Connect injector coupler.

IGNITION TIMING CHECK AND ADJUSTMENT

NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

1) Start engine and warm it up to normal operating temperature.
2) Make sure that all of electrical loads except ignition are switched off.

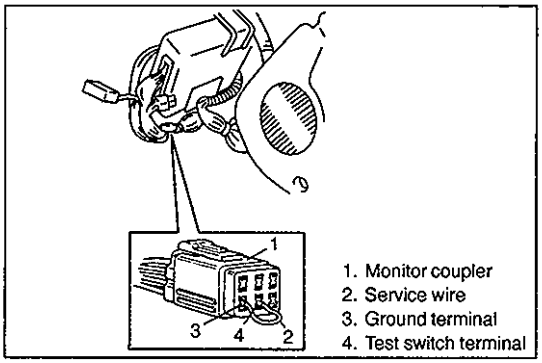


1. SUZUKI scan tool
2. DLC

3) Check to be sure that idle speed is within specification. (Refer to SECTION 6E.)
4) [Using SUZUKI scan tool]
Connect SUZUKI scan tool to DLC with ignition switch OFF, restart engine and fix ignition timing by using fixed spark mode of SUZUKI scan tool.

Special Tool
(A): 09931-76011 (SUZUKI scan tool)
(B): 09931-76030 (16/14 pin DLC cable)
(C): Mass storage cartridge

[Not using SUZUKI scan tool]
i) Remove monitor coupler cap.
ii) Ground test switch terminal in monitor coupler by using service wire so that ignition timing is fixed on initial one.

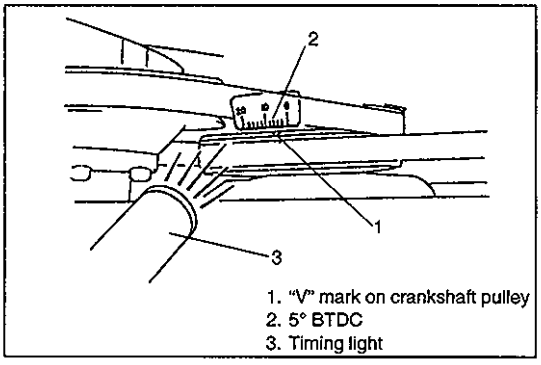


1. Monitor coupler
2. Service wire
3. Ground terminal
4. Test switch terminal

5) Set timing light to high-tension cord for No.1 cylinder.
6) Using timing light, check that timing is within specification.

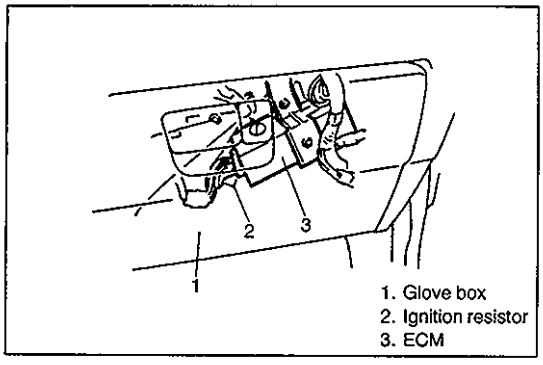
Initial ignition timing of viewpoint
(test switch terminal grounded): 5 ± 1° BTDC
Ignition order: 1-3-4-2

Special Tool
(A): 09930-76420

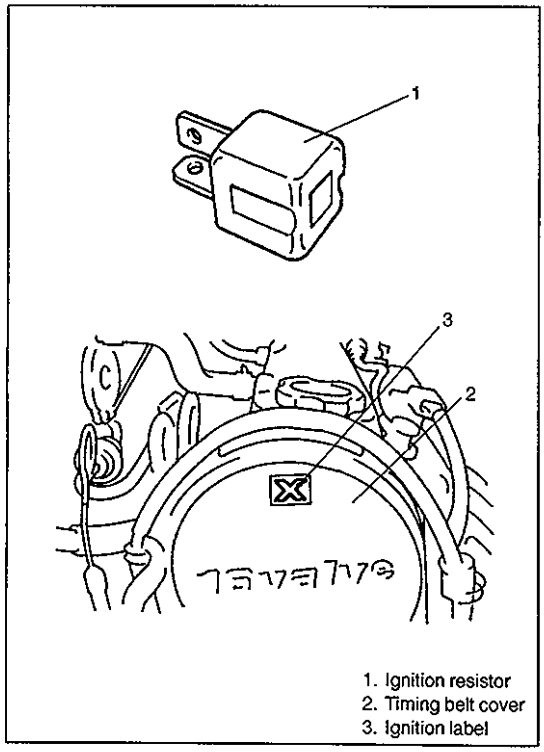


1. "V" mark on crankshaft pulley
2. 5° BTDC
3. Timing light

7) If ignition timing is out of specification, check resistance of ignition resistor, referring to "Ignition Resistor" under "On-Vehicle Service" later in this section.



1. Glove box
2. Ignition resistor
3. ECM



1. Ignition resistor
2. Timing belt cover
3. Ignition label

8) If check result is not satisfactory, change ignition resistor and recheck that initial ignition timing is within specification.
For example, if the vehicle being serviced has an ignition resistor with an "X" mark, initial ignition timing can be changed by replacing it with the following ignition resistor.

Characters printed on the ignition resistor	1	2	3	4
Difference in advance degrees as compared with those of "X" (before replacement)	–5°	–4°	–3°	–2°

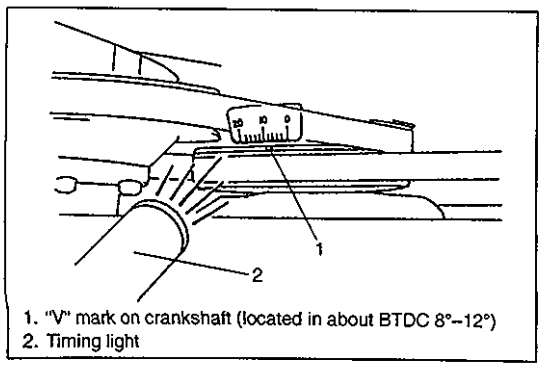
5	X	6	7	8	9	10	11
–1°	0°	1°	2°	3°	4°	5°	6°

NOTE:
If ignition resistor has been replaced, be sure to also replace ignition label attached to timing belt cover with the one that has the same symbol as that marked on ignition resistor.

9) [Using SUZUKI scan tool]
After checking and/or adjusting, end fixed spark mode of SUZUKI scan tool.
[Not using SUZUKI scan tool]
After checking and/or adjusting, disconnect service wire from monitor coupler.

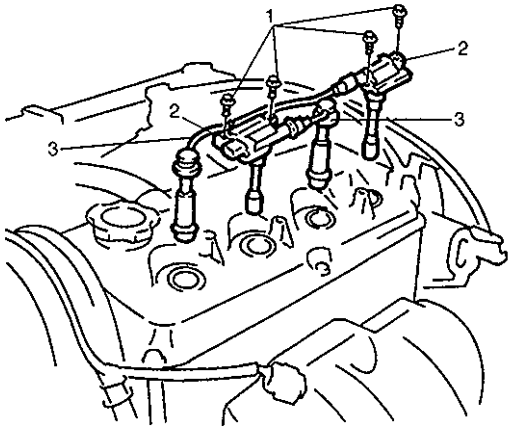
CAUTION:
Driving with test switch terminal grounded will cause damage to catalyst. Be sure to disconnect service wire after adjustment.

NOTE:
In this state, ignition timing may vary more or less of initial ignition timing but it is nothing abnormal.



1. "V" mark on crankshaft (located in about BTDC 8°–12°)
2. Timing light

10) With engine idling (closed throttle position and vehicle stopped), check that ignition timing is about BTDC 8°–12° (shown in the figure). Also, check that increasing engine speed advances ignition timing. If above check results are not satisfactory, check TP sensor, test switch terminal circuit and ECM.



1. Ignition coil bolt
2. Ignition coil assembly
3. High-tension cord

ON-VEHICLE SERVICE

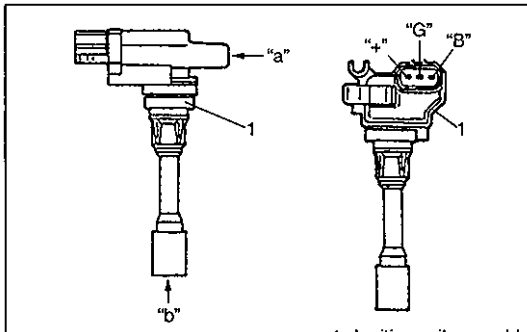
HIGH-TENSION CORD AND IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL)

REMOVAL

1) Disconnect ignition coil coupler.
2) Disconnect high-tension cord from ignition coil assembly while gripping its cap.
3) Pull out high-tension cord from spark plug while gripping its cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**

4) Remove ignition coil bolt, and then pull out ignition coil assembly.



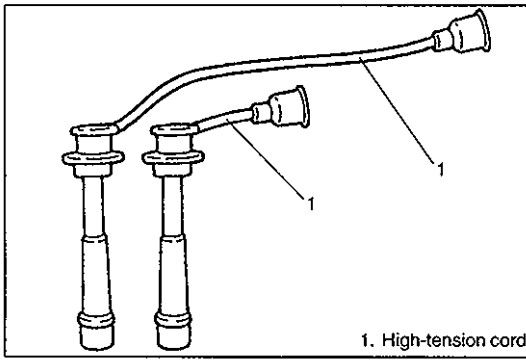
1. Ignition coil assembly

INSPECTION

- Check resistance between terminals as follows by using analog type ohmmeter.

  "a" – "b" : 7.5 – 14 kΩ (at 20°C, 68°F)
  "B" – "G" : Neither 0 Ω or ∞ (infinity)
  "+" – "B" : Not 0 Ω
  "+" – "G" : Not 0 Ω

  If check result is not satisfactory, replace ignition coil assembly.

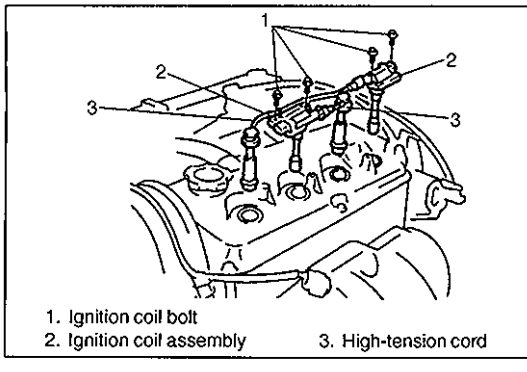


1. High-tension cord

- Measure resistance of high-tension cord by using ohmmeter.

  High-tension cord resistance: 4 – 10 kΩ/m (1.2 – 3.0 kΩ/ft)

  If resistance exceeds specification, replace high-tension cord(s).

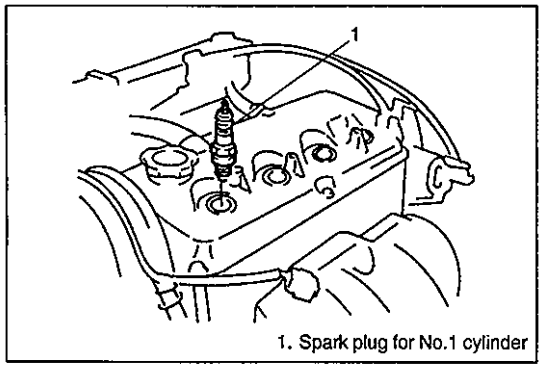


1. Ignition coil bolt
2. Ignition coil assembly
3. High-tension cord

INSTALLATION

Reverse removal procedure for installation.

CAUTION:
- **Never attempt to use metal conductor high-tension cord(s) as replacing parts.**
- **Insert each cap potion fully when installing high-tension cords.**

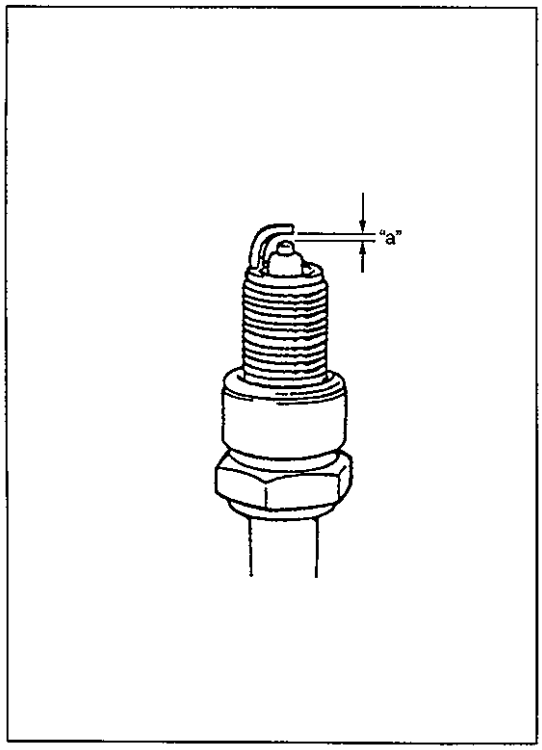


1. Spark plug for No.1 cylinder

SPARK PLUG

REMOVAL

1) Pull out high-tension cord while gripping its cap.
2) Remove ignition coil assembly, referring to "High-tension Cord and Ignition Coil Assembly (Igniter and Ignition Coil)" under "On-Vehicle Service" earlier in this section.
3) Remove spark plug.



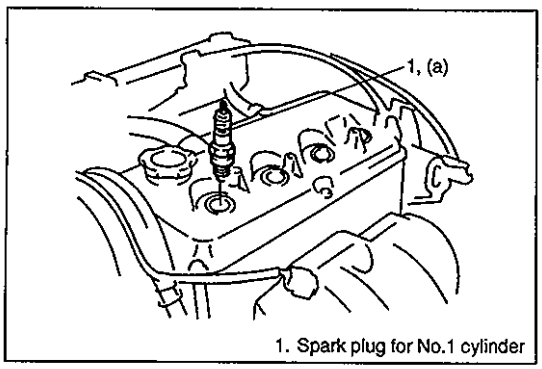
INSPECTION

Inspect them for:

- Electrode wear
- Carbon deposits
- Insulator damage

If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plug.

Spark plug air gap "a": 0.7 – 0.8 mm (0.028 – 0.031 in.)
Spark plug type: NGK BKR6E
DENSO K20PR-U



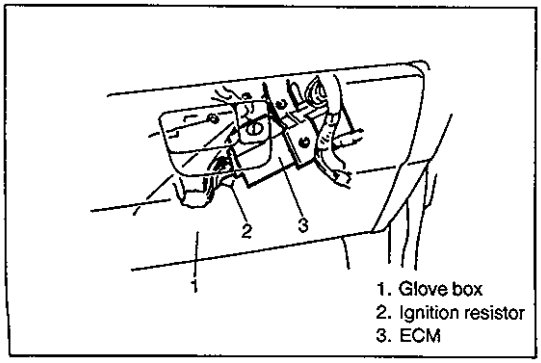
1. Spark plug for No.1 cylinder

INSTALLATION

1) Install spark plug and tighten them to specified torque.

   Tightening Torque
   (a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

2) Install ignition coil assembly, referring to "High-tension Cord and Ignition Coil Assembly (Igniter and Ignition Coil)" under "On-Vehicle Service" earlier in this section.
3) Install high-tension cord while gripping its cap.

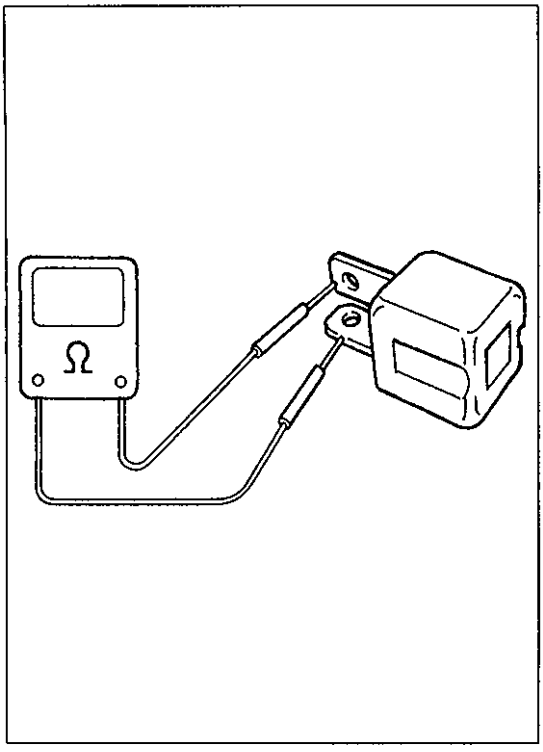


1. Glove box
2. Ignition resistor
3. ECM

IGNITION RESISTOR

REMOVAL

1) With ignition switch OFF, remove ECM, referring to "ECM" under "On-Vehicle Service" in SECTION 6E.
2) Remove ignition resistor.



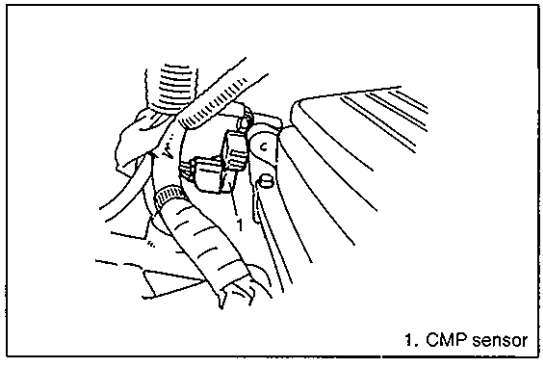
INSPECTION
Measure resistance of ignition resistor by using ohmmeter.

NOTE:
Depending on number marked on ignition resistor, resistor value varies as follows.

1:	0 Ω	6:	980 – 1020 Ω
2:	80 – 84 Ω	7:	1.35 – 1.53 kΩ
3:	157 – 163 Ω	8:	2.16 – 2.24 kΩ
4:	265 – 274 Ω	9:	3.53 – 3.67 kΩ
5:	421 – 439 Ω	10:	6.08 – 6.32 kΩ
X:	666 – 694 Ω	11:	11.8 – 12.2 kΩ

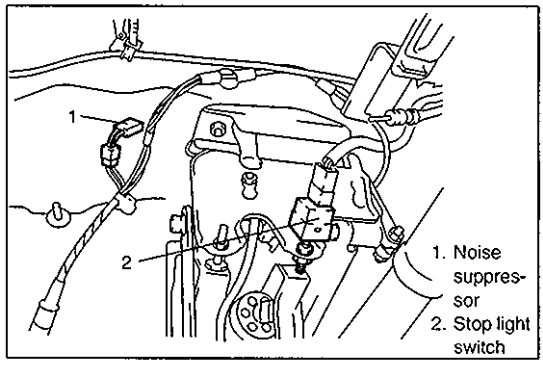
If check result is not satisfactory, replace ignition resistor.

INSTALLATION
For installation, reverse removal procedure.



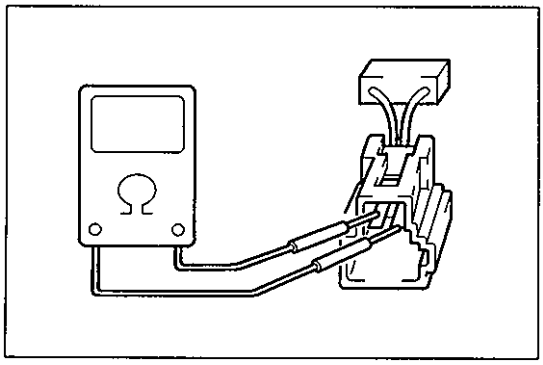
1. CMP sensor

CMP SENSOR
Refer to "CMP Sensor" under "On-Vehicle Service" in SECTION 6E for removal, inspection and installation.



1. Noise suppressor
2. Stop light switch

NOISE SUPPRESSOR
REMOVAL
1) Disconnect coupler of noise suppressor.
2) Remove noise suppressor.



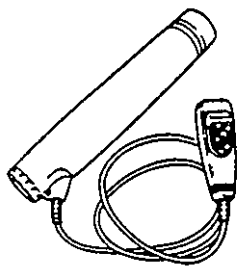
INSPECTION
Using ohmmeter, check to be sure that capasitor (condenser) in noise suppressor is not conductive.
If check result is not satisfactory, replace noise suppressor.

INSTALLATION
For installation, reverse removal procedure.

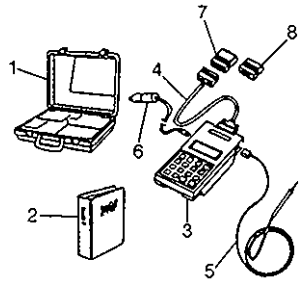
TIGHTENING TORQUE SPECIFICATION

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Spark plug	25	2.5	18.0

SPECIAL TOOLS

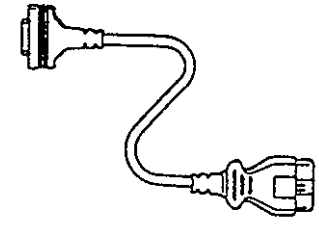


09930-76420
Timing light (Dry cell type)

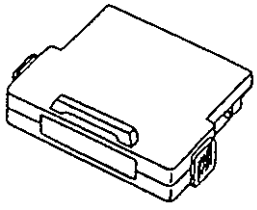


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
Tech 1A kit



09931-76030
16/14 pin DLC cable



Mass storage cartridge

SECTION 6G

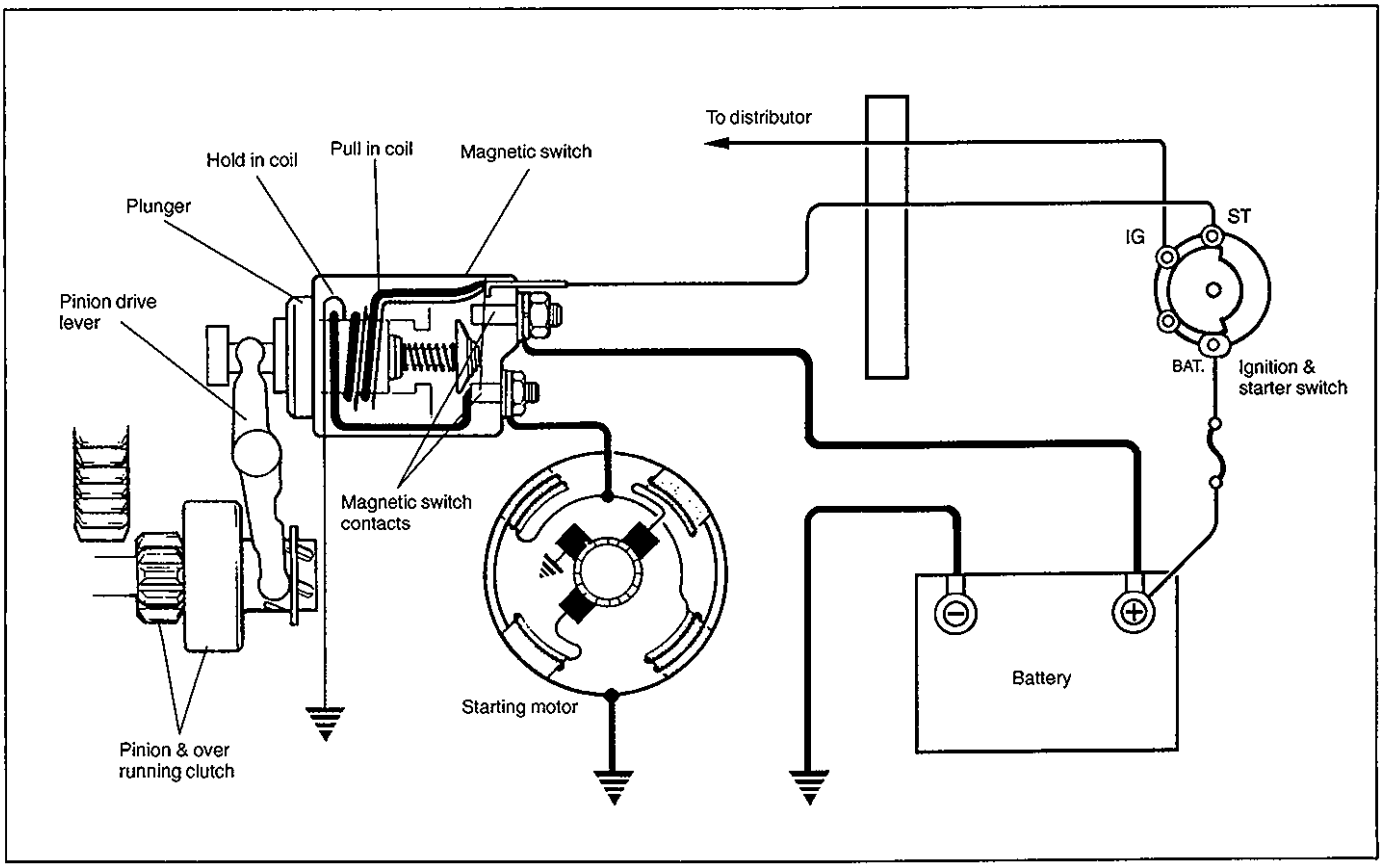
CRANKING SYSTEM
(0.9 kW No-Reduction Type)

CONTENTS

GENERAL DESCRIPTION

CRANKING CIRCUIT

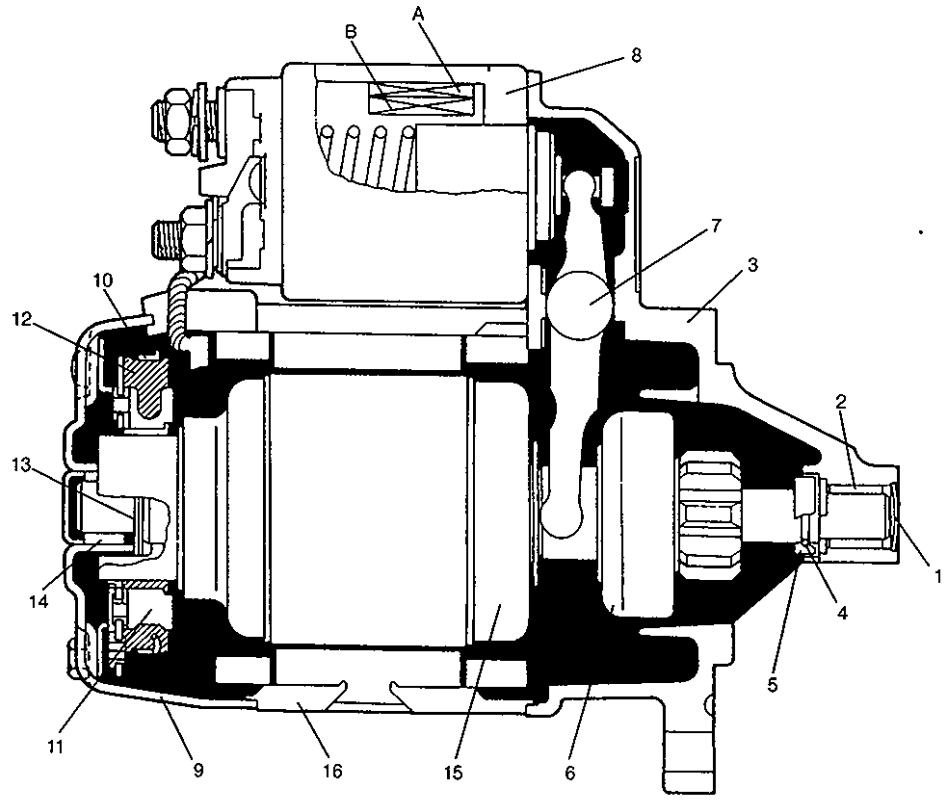
The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically as shown below.
Only the starting motor will be covered in this section.



STARTING MOTOR

The starting motor consist of parts shown following page and has field coils mounted in starting motor yoke (frame). The magnetic switch assembly and parts in the starting motor are enclosed in the housings so that they will be protected against possible dirt and water splash.
In the circuit shown above, the magnetic (motor) switch coils are magnetized when the ignition switch is closed. The resulting plunger and pinion drive lever movement causes the pinion to engage the engine flywheel gear and the magnetic switch main contacts to close, and cranking takes place. When the engine starts, the pinion overrunning clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.

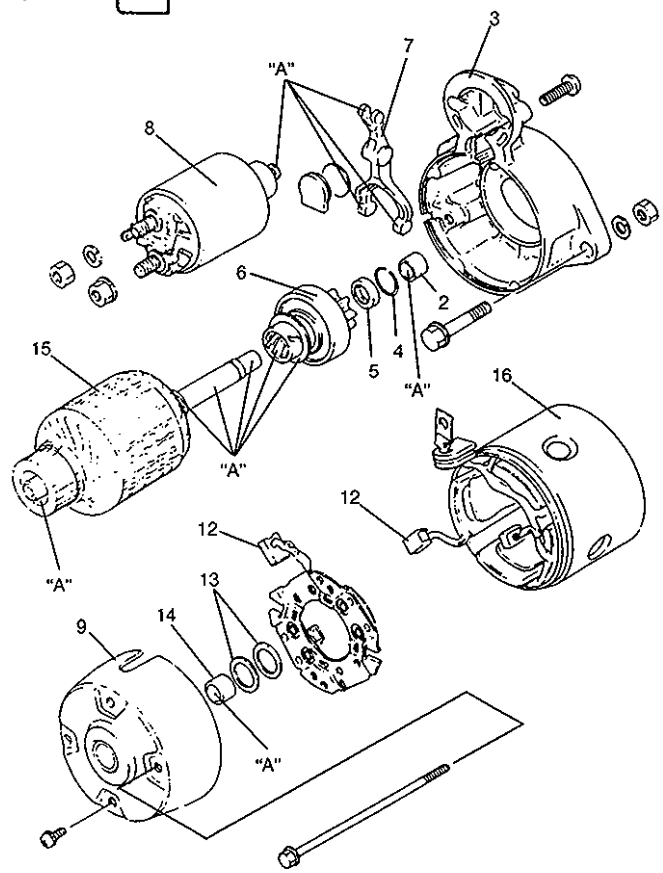
NOTE:
- **Starting motor does not require lubrication except during overhaul.**
- **Make sure to apply grease before assembly where so indicated "A" in the figure below.**



1. Drive housing cover
2. Drive bush
3. Drive housing
4. Armature ring
5. Armature stop ring
6. Over running clutch
7. Pinion drive lever
8. Magnetic switch
9. Commutator end cover
10. Brush spring
11. Brush holder
12. Brush
13. Washer
14. Commutator end bushing
15. Armature
16. Starting motor yoke

A: Hold-in coil
B: Pull-in coil

"A" : Apply grease (99000-25010)



DIAGNOSIS

Possible symptoms due to starting system trouble would be as follows:
- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard

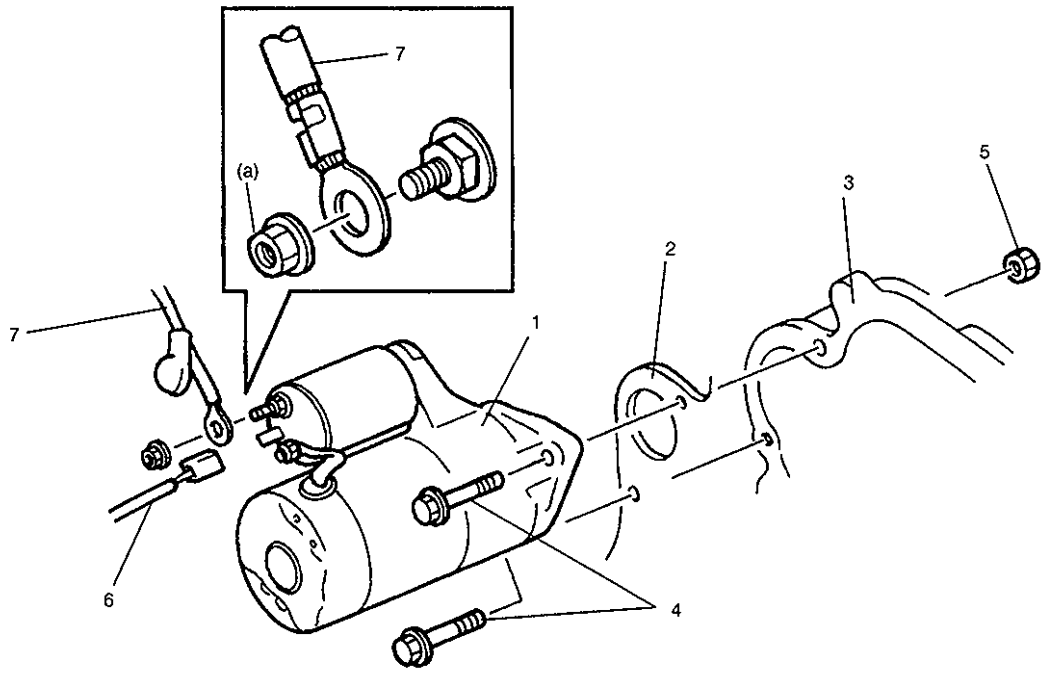
Proper diagnosis must be made to determine exactly where the cause of each trouble lies ..... in battery, wiring harness, (including ignition and starter switch), starting motor or engine.

Do not remove motor just because starting motor does not run. Check following items and narrow down scope of possible causes.
1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running	**No operating sound of magnetic switch**	
	• Battery run down	Recharge battery.
	• Battery voltage too low due to battery deterioration	Replace battery.
	• Poor contact in battery terminal connection	Retighten or replace.
	• Loose grounding cable connection	Retighten.
	• Fuse set loose or blown off	Tighten or replace.
	• Poor contacting action of ignition switch and magnetic switch	Replace.
	• Lead wire coupler loose in place	Retighten.
	• Open-circuit between ignition switch and magnetic switch	Repair.
	• Open-circuit in pull-in coil	Replace magnetic switch.
	• Poor sliding of plunger and/or pinion	Repair.
	• Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	• Brushes are seating poorly or worn down	Repair or replace.
	Operating sound of magnetic switch heard	
	• Battery run down	Recharge battery.
	• Battery voltage too low due to battery deterioration	Replace battery.
	• Loose battery cable connections	Retighten.
	• Burnt main contact point, or poor contacting action of magnetic switch	Replace magnetic switch.
	• Brushes are seating poorly or worn down	Repair or replace.
	• Weakened brush spring	Replace.
	• Burnt commutator	Replace armature.
	• Poor grounding of field coil	Repair.
	• Layer short-circuit of armature	Replace.
	• Crankshaft rotation obstructed	Repair.

Condition	Possible Cause	Correction
Starting motor running but too slow (small torque)	**If battery and wiring are satisfactory, inspect starting motor**	
	• Insufficient contact of magnetic switch main contacts	Replace magnetic switch.
	• Layer short-circuit of armature	Replace.
	• Disconnected, burnt or worn commutator	Repair or replace.
	• Poor grounding of field coil	Repair.
	• Worn brushes	Replace brush.
	• Weakened brush springs	Replace spring.
	• Burnt or abnormally worn end bush	Replace bush.
Starting motor running, but not cranking engine	• Worn pinion tip	Replace over-running clutch.
	• Poor sliding of over-running clutch	Repair.
	• Over-running clutch slipping	Replace over-running clutch.
	• Worn teeth of ring gear	Replace flywheel (M/T) or drive plate (A/T).
Noise	• Abnormally worn bush	Replace bush.
	• Worn pinion or worn teeth of ring gear	Replace over-running clutch or flywheel (M/T), drive plate (A/T).
	• Poor sliding of pinion (failure in return movement)	Repair or replace.
	• Lack of grease in each part	Lubricate.
Starting motor does not stop running	• Fused contact points of magnetic switch	Replace magnetic switch.
	• Short-circuit between turns of magnetic switch coil (layer short-circuit)	Replace magnetic switch.
	• Failure of returning action in ignition switch	Replace.

UNIT REPAIR OVERHAUL



1. Starting motor
2. Clutch housing upper plate
3. Transmission case
4. Starting motor mounting bolt
5. Starting motor mounting nut
6. Magnetic switch lead wire
7. Battery cable

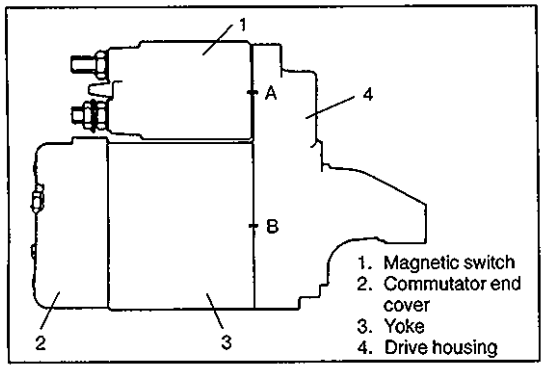
DISMOUNTING

1) Disconnect negative battery lead at battery.
2) Disconnect magnetic switch lead wire and battery cable from starting motor.
3) Remove starting motor mounting bolts and nut.
4) Remove starting motor.

REMOUNTING

Reverse the dismounting procedure.

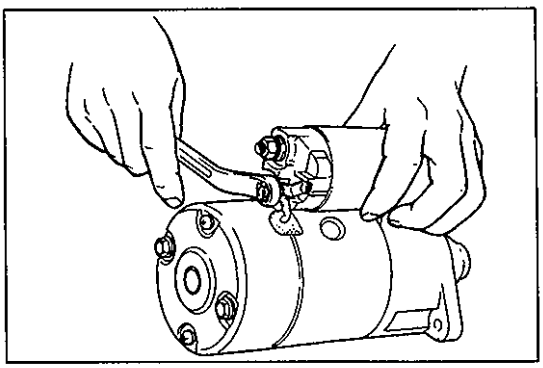
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



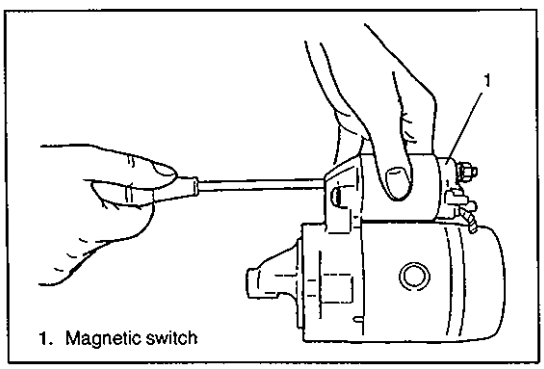
DISASSEMBLY

NOTE:

- **Before disassembling starting motor, be sure to put match marks at two locations (A and B) as shown in the left figure so that any possible mistakes can be avoided.**
- **Do not clamp yoke in a vise or strike it with a hammer during disassembling and reassembling.**

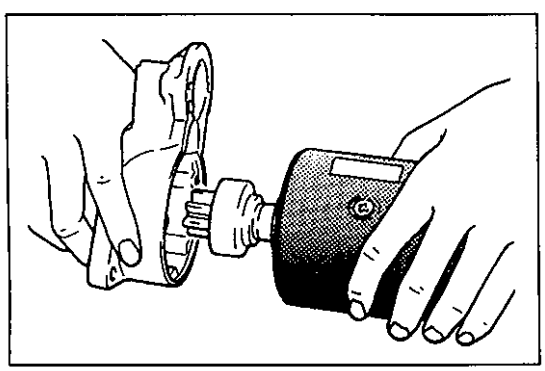


1) Remove nut securing the end of field coil lead to terminal on the head of magnetic switch.

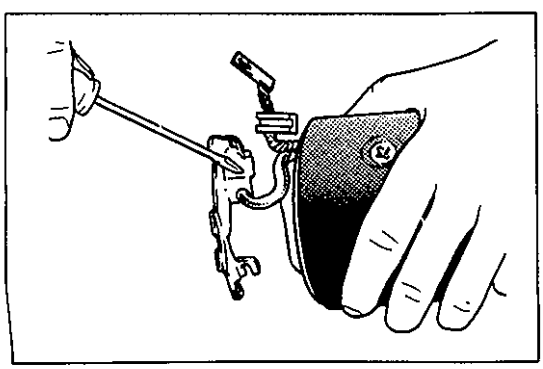


2) Take off magnetic switch from starting motor body by removing 2 mounting screws.

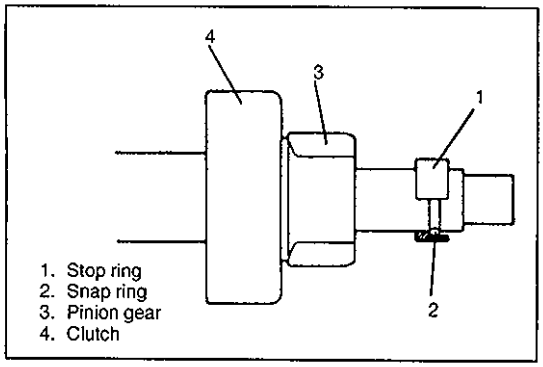
NOTE:
Don't disassemble this switch. If defective, replace as a complete assembly.



3) Loosen 2 bolts and 2 screws to remove commutator end cover.
4) Separate drive housing and armature from yoke.



5) Draw brushes out of holder.



6) Draw off over running clutch, as follows:
(1) Draw stop ring toward clutch side.
(2) Remove snap ring and side off clutch.

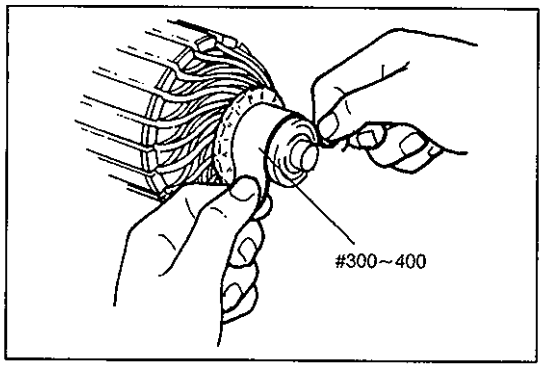
Special Tool :
09900-06107

REASSEMBLY

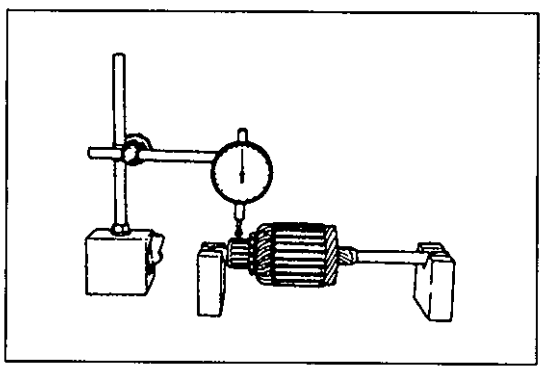
Assemble in reverse order of Disassembly, noting the following.
1) Apply grease. (Refer to page 6G-3.)
2) Install pinion drive lever into drive housing, referring to 6G-3 especially for its direction.
3) Upon completion of assembly, carry out "PERFORMANCE TEST". (Refer to page 6G-12.)
4) Tighten battery cable nut to specified torque. (Refer to page 6G-6)

INSPECTION

1. ARMATURE



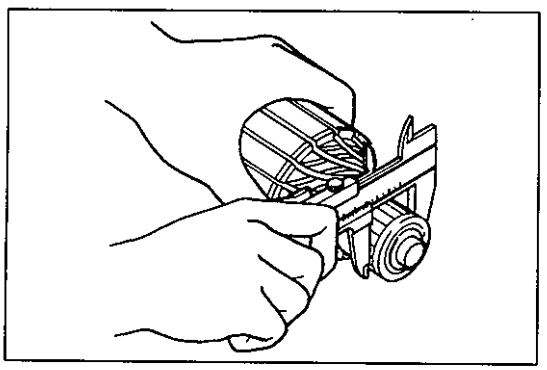
- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



- Check commutator for uneven wear. If deflection of dial gauge pointer exceeds limit, repair or replace.

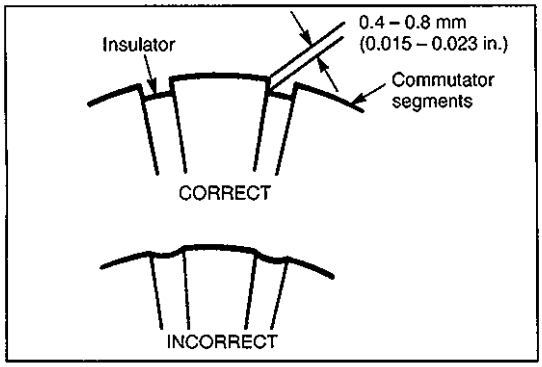
NOTE:
Below specification presupposes that armature is free from bend. Bent shaft must be replaced.

Commutator out round
Standard: 0.05 mm (0.0019 in.) or less
Limit: 0.4 mm (0.015 in.)



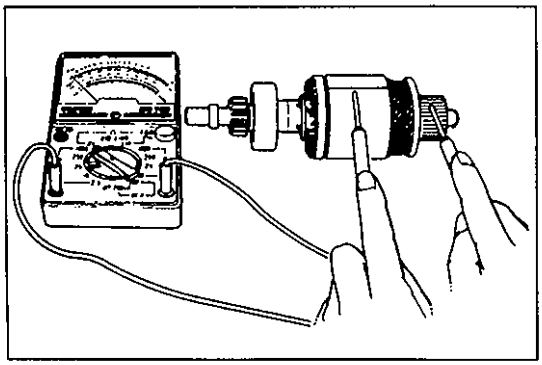
- Inspect commutator for wear.
If below limit, replace armature.

Commutator outside diameter
Standard: 32.0 mm (1.26 in.)
Limit: 31.4 mm (1.24 in.)

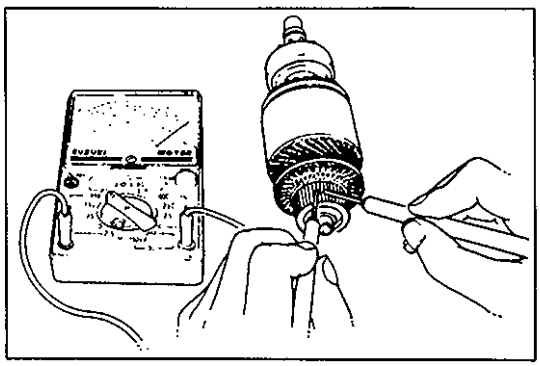


- Inspect commutator for insulator depth. Correct or replace if below limit.

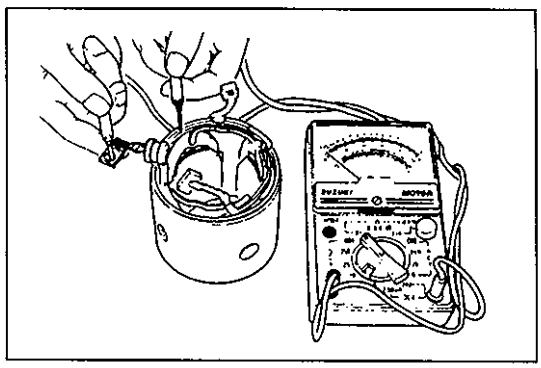
Commutator mica depth
Standard: 0.4 – 0.6 mm (0.015 – 0.023 in.)
Limit: 0.2 mm (0.0078 in.)



- **Ground test**
Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.

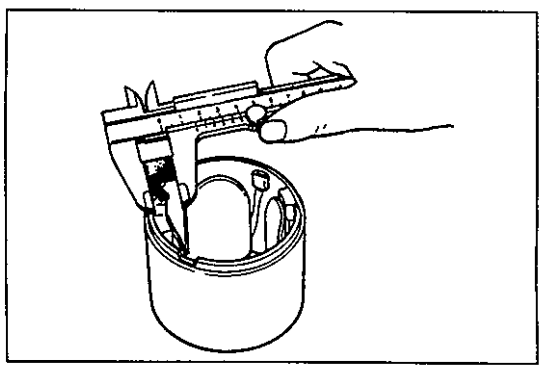


- **Open circuit test**
Check for continuity between segments. If there is no continuity at any point, there is an open circuit and armature must be replaced.



2. FIELD COIL

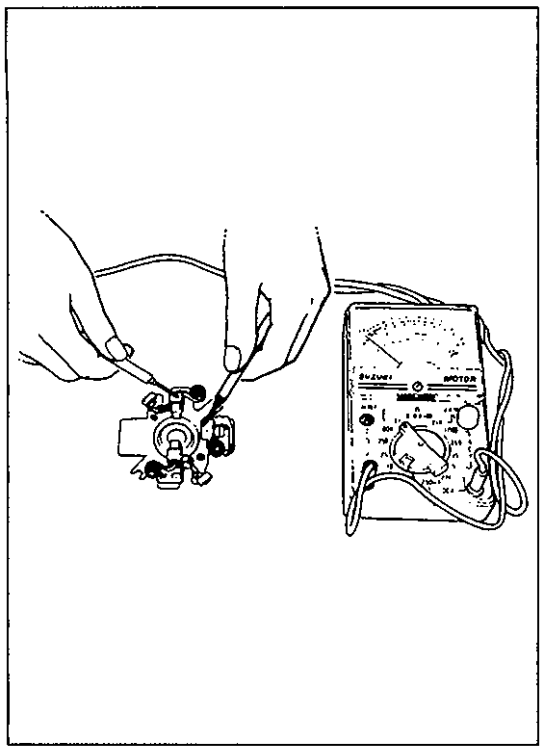
Ground test
Check continuity between brush and bare surface.
If there is continuity, field windings are grounded.
The yoke ass'y must be replaced.



3. BRUSH

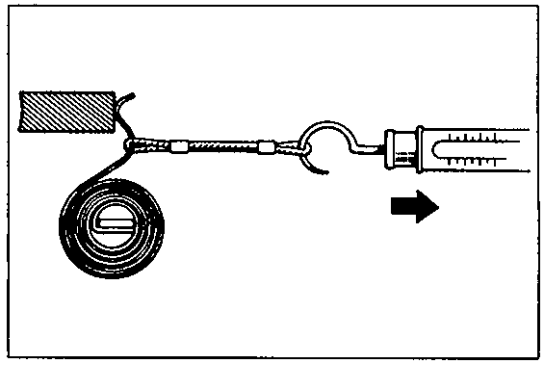
Check brushes for wear. If below limit, replace brush.

Brush length
Standard: 17.0 mm (0.67 in.)
Limit: 11.5 mm (0.45 in.)



4. BRUSH HOLDER

Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for correct contamination.
Clean or correct as necessary.
Clean for continuity across insulated brush holder (positive side) and grounded brush holder (negative side).
If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

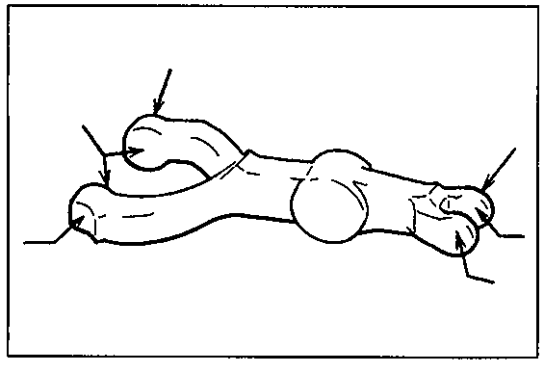


5. SPRING

Inspect brush spring for wear, damage or other abnormal conditions. Replace if necessary.

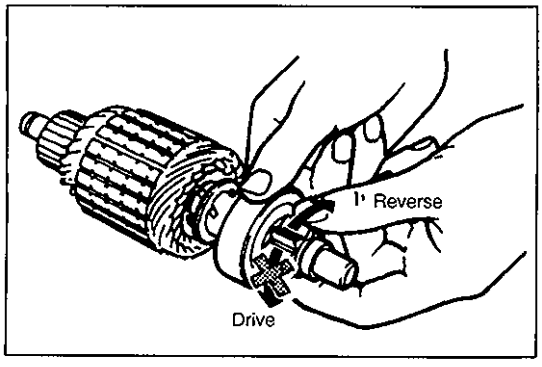
Brush spring tension

Standard: 1.95 kg (4.3 lb)
Limit: 0.9 kg (1.98 lb)



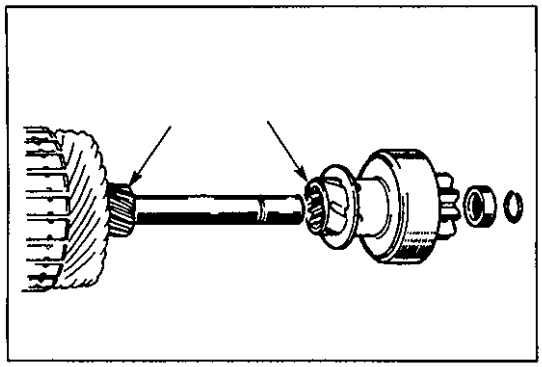
6. DRIVE LEVER

Inspect drive lever for wear. Replace if necessary.

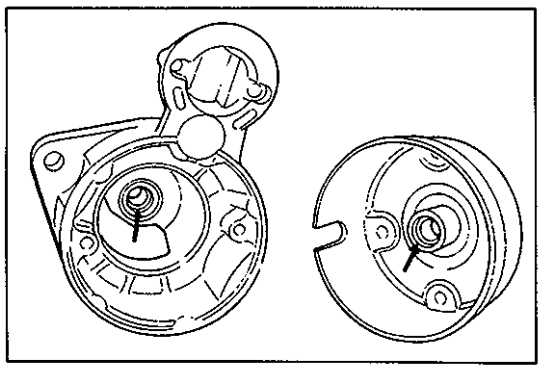


7. PINION AND OVER-RUNNING CLUTCH

- Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.

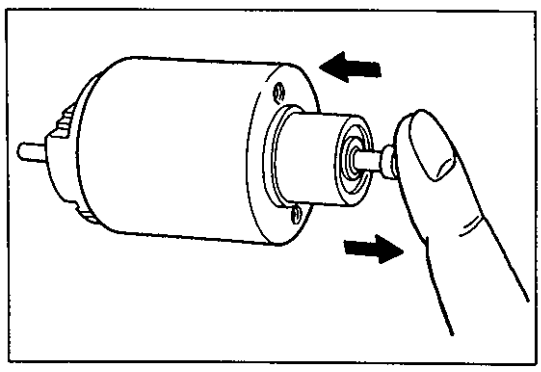


- Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.



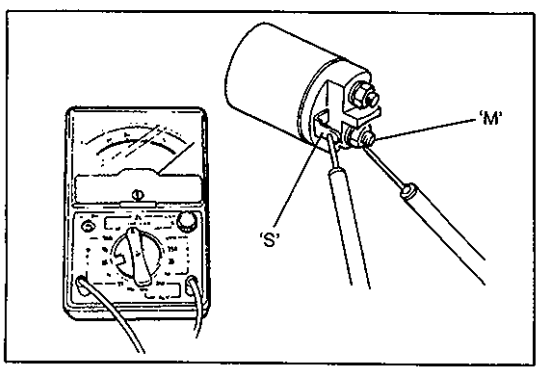
8. ARMATURE SHAFT BUSH

Inspect bushes for wear or damage. Replace if necessary.



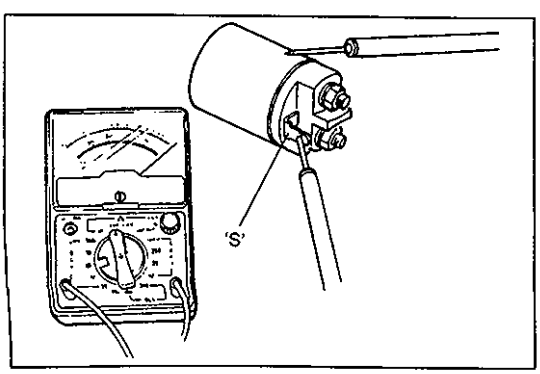
9. MAGNETIC SWITCH

Push in plunger and release it. Plunger should return quickly to its original position. Replace if necessary.



- **Pull-in coil open circuit test**

Check for continuity across magnetic switch 'S' terminal and 'M' terminal. If no continuity exists, coil is open and should be replaced.

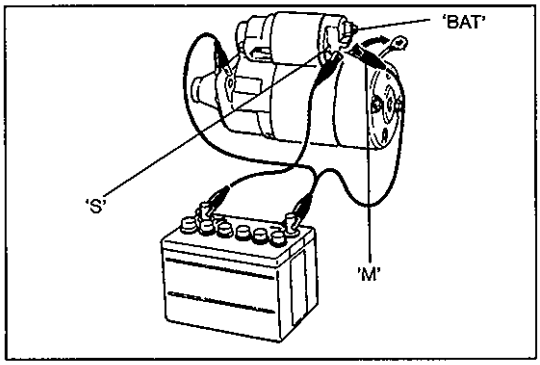


- **Hold-in coil open circuit test**

Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.

PERFORMANCE TEST

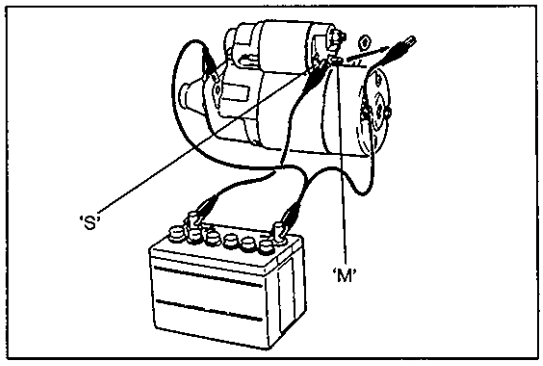
CAUTION:
These tests must be performed within 3 - 5 seconds to avoid coil from burning.



- **PULL-IN TEST**

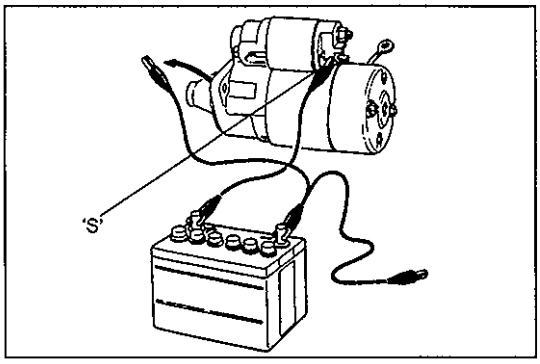
Connect battery to magnetic switch as shown.
Check that pinion moves outward.
If pinion does not move, replace magnetic switch.

NOTE:
Before testing, disconnect field coil lead from Terminal 'M'.



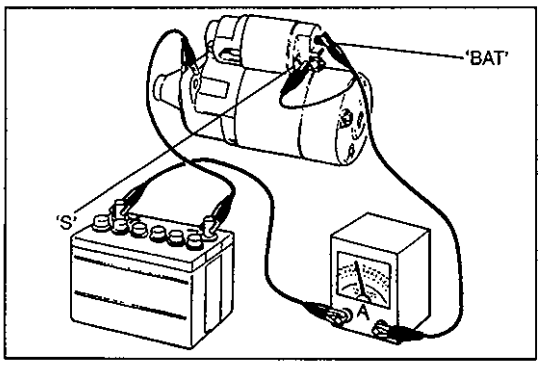
- **HOLD-IN TEST**

While connected as left figure with pinion out, disconnect negative lead from terminal 'M'.
Check that pinion remains out.
If pinion returns inward, replace magnetic switch.



- **CHECK PINION RETURN**

Disconnect negative lead from magnetic switch body.
Check that pinion returns inward.
If pinion does not return, replace magnetic switch.



- **NO-LOAD PERFORMANCE TEST**

a) Connect battery and ammeter to starter as shown.
b) Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter reads specified current.

Specified current: Less than 60 A at 11.5 V

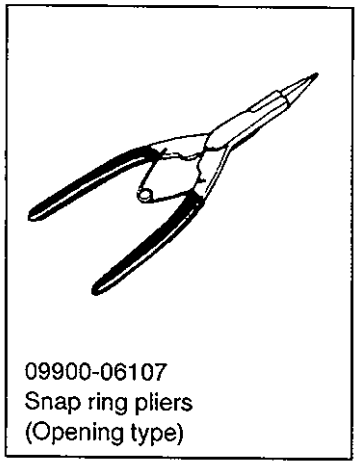
SPECIFICATIONS

Voltage			12 volts
Output			0.9 kW
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			17.0 mm (0.67 in.)
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20°C (68°F)	No load characteristic	11.5V	60 A maximum 6600 rpm minimum
	Load characteristic	9 V 150 A	2.8 N·m (0.28 kg-m, 2.0 lb-ft) 1900 rpm minimum
	Locked rotor current	5 V	500 A maximum 11.3 N·m (1.13 kg-m, 8.2 lb-ft) minimum
	Magnetic switch operating voltage		8 volts maximum

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Armature shaft. • Over-running clutch. • Commutator end cap. • Drive lever.

SPECIAL TOOL



09900-06107
Snap ring pliers
(Opening type)

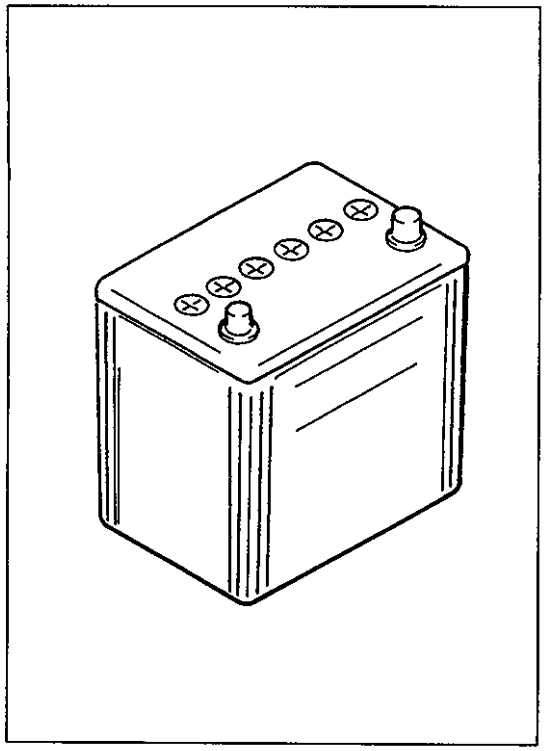
SECTION 6H

CHARGING SYSTEM

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS



GENERAL DESCRIPTION

BATTERY

The battery has three major functions in the electrical system.

- It is a source of electrical energy for cranking the engine.
- It acts as a voltage stabilizer for the electrical system.
- It can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

CARRIER AND HOLD-DOWN

The battery carrier should be in good condition so that it will support the battery securely and keep it level.

Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.

To prevent the battery from shaking in its carrier, the hold-down bolts should be tight enough but not over-tightened.

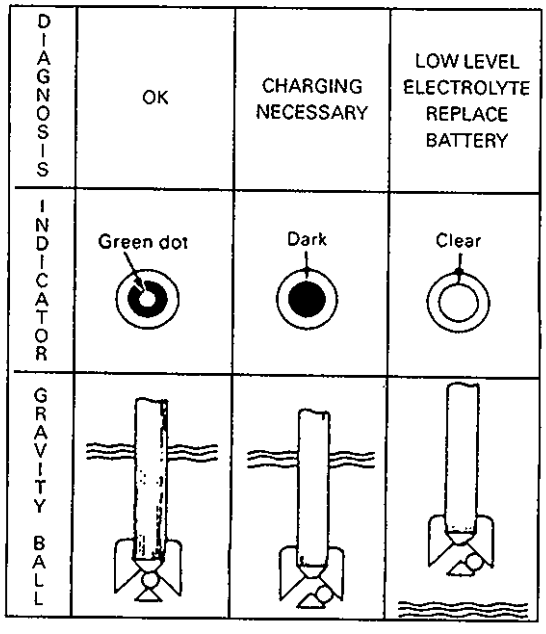
ELECTROLYTE FREEZING

The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition. If a battery is frozen accidentally, it should not be charged until it is warmed.

SULFATION

If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. "Sulfation" means the result as well as the process of that reaction.

Such a battery can be revived by very slow charging and may be restored to usable condition but its capacity is lower than before.



BUILT-IN INDICATOR (IF EQUIPPED)

The battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.

Three types of indication available under normal operation are as follows.

1. **Green Dot**
   Battery is sufficiently charged for testing.
2. **Dark**
   Battery must be charged before testing.
   If there is a cranking complaint, battery should be tested as described in Diagnosis section. Charging and electrical systems should also be checked at this time.
3. **Clear or Light Yellow**
   This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration.
   When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

CARE OF BATTERY

WARNING:
- **Never expose battery to open flame or electric spark because of battery generate gas which is flammable and explosive.**
- **Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces as fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly.**
- **Batteries should always be kept out of reach of children.**

1) The battery is a very reliable component, but needs periodical attentions.
   - Keep the battery carrier clean
   - Prevent rust formation on the terminal posts
   - Keep the electrolyte up to the upper level uniformly in all cells.

   When keeping battery on vehicle over a long period of time, follow instructions given below.
   - Weekly, start the engine and run it until it reaches normal operating temperature with engine speed of 2000 to 3000 rpm. Make sure all electric switches are off before storing the vehicle.
   - Recharge the battery twice a month to prevent it from discharging excessively. This is especially important when ambient temperature is low.
     The battery discharges even when it is not used, while vehicles are being stored. Battery electrolyte can freeze and battery case can crack at cold ambient condition if battery is not properly charged.

2) Keep the battery cable connections clean.
   The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current. Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.

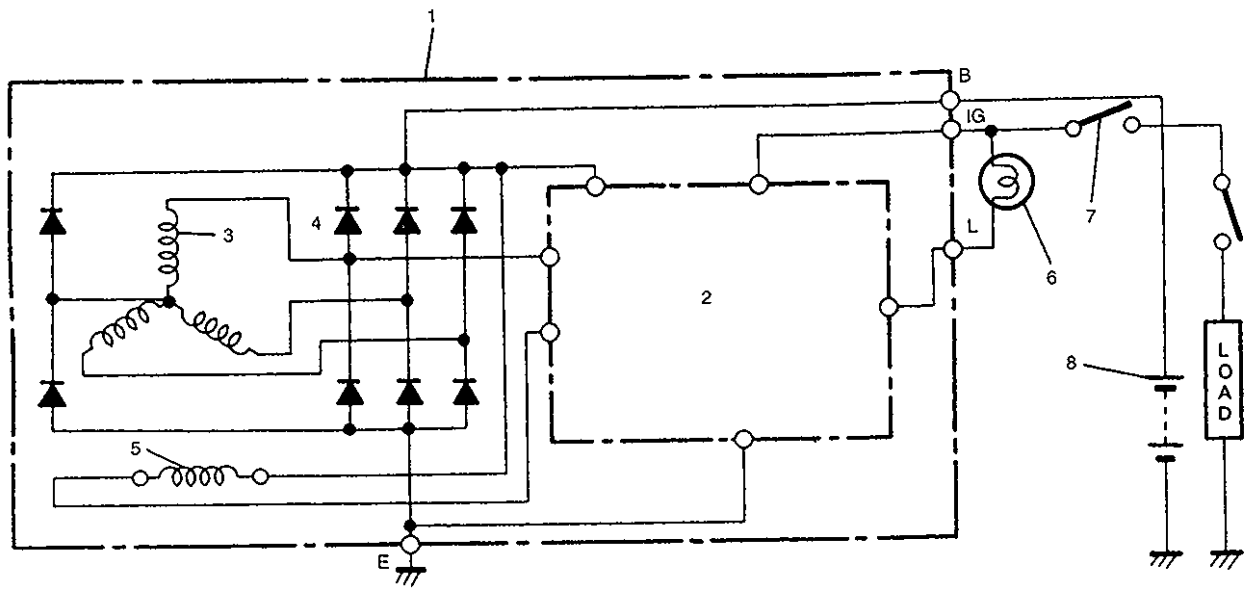
3) Be always in the know as to the state of charge of the battery.
   The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an instrument for measuring the specific gravity (S.G.) of the battery electrolyte. The S.G. of the electrolyte is indicative of the state of charge. Refer to "DIAGNOSIS" of BATTERY in this section.

GENERATOR

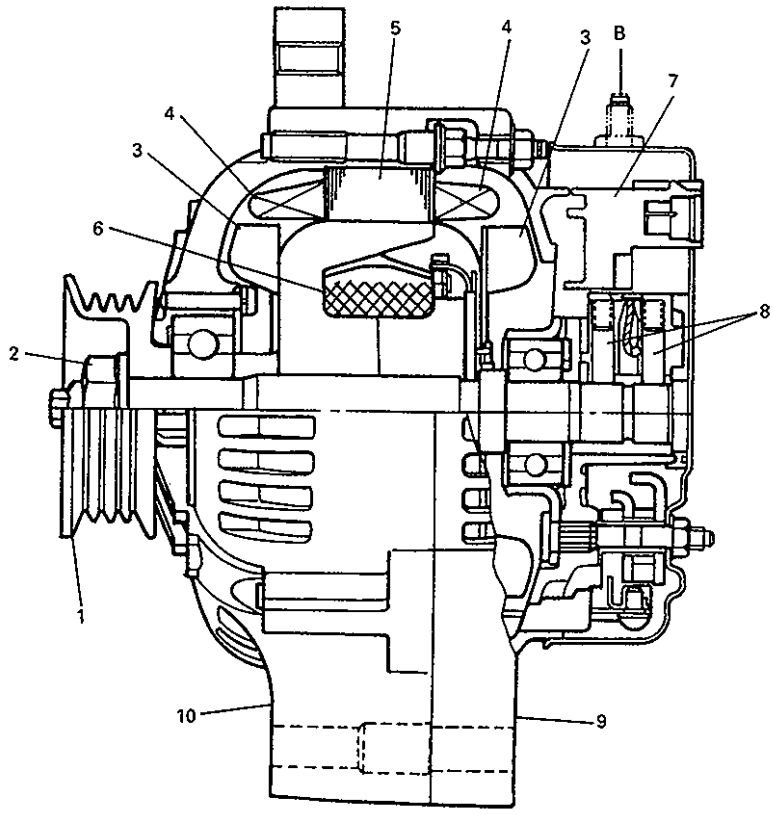
The generator is a small and high performance type with an IC regulator incorporated.
The internal components are connected electrically as shown below figure.

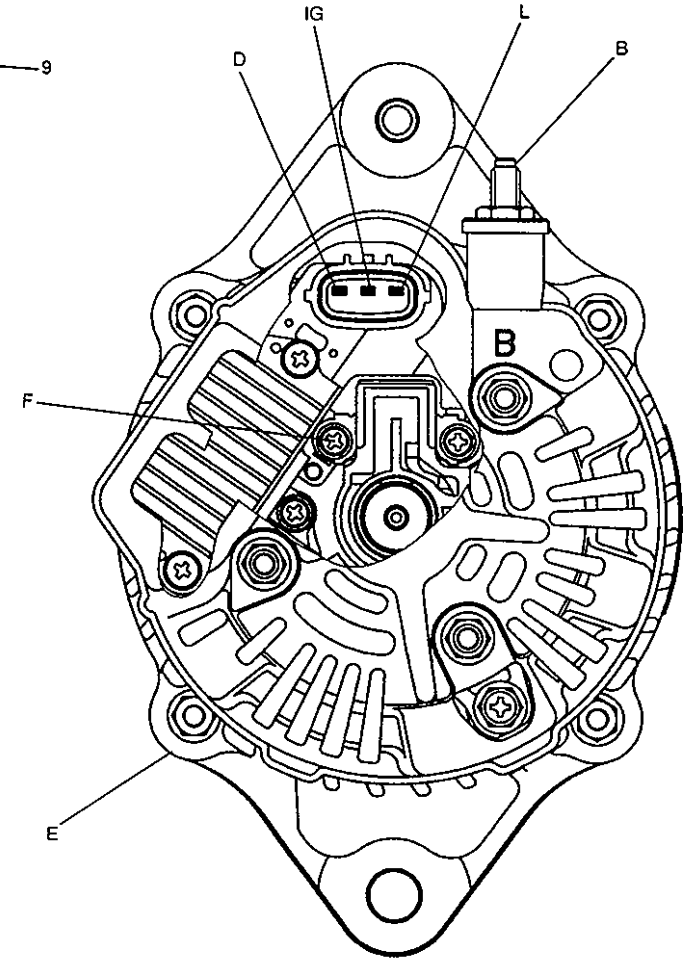
The generator features are as follows:

- Solid state regulator is mounted inside the generator.
- All regulator components are enclosed into a solid mold.
- This unit along with the brush holder assembly is attached to the rear housing.
- The IC regulator uses integrated circuits and controls the voltage produced by the generator, and the voltage setting cannot be adjusted.
- The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.
- The stator windings are assembled on the inside of a laminated core that forms part of the generator frame.
- A condenser mounted in the rear housing suppresses radio noise.



1. Generator with regulator ass'y
2. I.C. regulator
3. Stator coil
4. Diode
5. Field coil (rotor coil)
6. Charge indicator light
7. Main switch
8. Battery





1. Pulley
2. Pulley nut
3. Rotor fan
4. Stator coil
5. Stator core
6. Field coil
7. Regulator
8. Brush
9. Rear end frame
10. Drive end frame

B : Generator output (Battery terminal)
D : Dummy terminal
E : Ground
F : Field coil terminal
IG : Ignition terminal
L : Lamp terminal

DIAGNOSIS

BATTERY

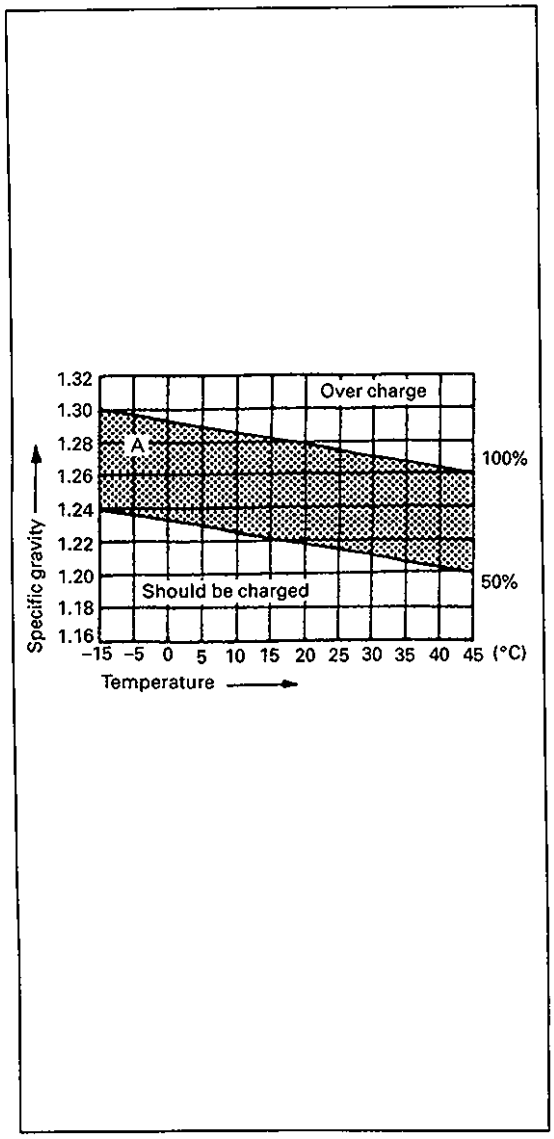
COMMON CAUSES OF FAILURE

A battery is not designed to last indefinitely; however, with proper care, it will provide many years of service. If the battery performs satisfactorily during test but fails to operate properly for no apparent reason, the following are some factors that may point to the cause of trouble:

- Accessories left on overnight or for an extended period without the generator operating.
- Slow average driving speeds for short periods.
- Electrical load exceeding generator output particularly with addition of after market equipment.
- Defects in charging system such as high resistance, slipping drive belt, loose generator output terminal, faulty generator or voltage regulator. Refer to "GENERATOR" in this "DIAGNOSIS" section.
- Battery abuse, including failure to keep battery cable terminals clean and tight or loose battery hold down.
- Mechanical problems in electrical system such as shorted or pinched wires.

VISUAL INSPECTION

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed.



HYDROMETER TEST

The direct method of checking the battery for state of charge is to carry out a high rate discharge test, which involves a special precise voltmeter and an expensive instrument used in the service shops, but not recommendable to the user of the vehicle.

At 20 °C of battery temperature (electrolyte temperature):

– The battery is in FULLY CHARGED STATE if the electrolyte S.G. is 1.280.
– The battery is in HALF CHARGED STATE if the S.G. is 1.220.
– The battery is in NEARLY DISCHARGED STATE if the S.G. is 1.150 and is in danger of freezing.

As the S.G. varies with the temperature, if battery temperature is not at 20°C (68°F), you have to correct your S.G. reading (taken with your hydrometer) to the value at 20°C (68°F) and apply the corrected S.G. value to the three-point guide stated value.

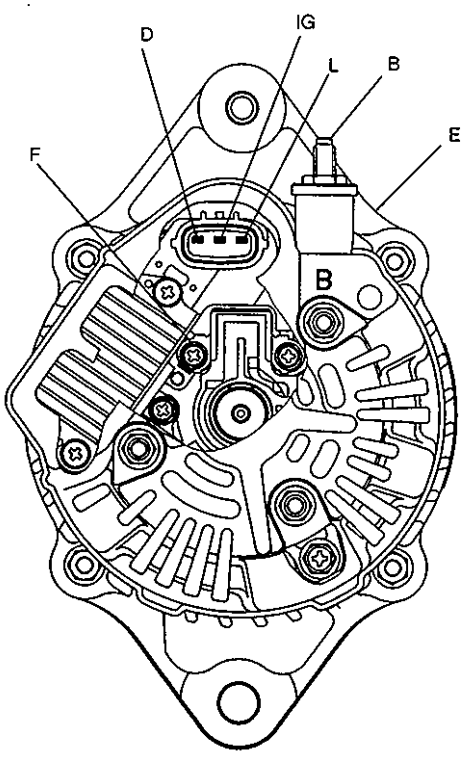
For the manner of correction, refer to the graph showing the relation between S.G. value and temperature at the left.

How to use the temperature-corrected state-of-charge graph

Suppose your S.G. reading is 1.28 and the battery temperature is –5 °C (23°F). Locate the intersection of the –5 °C line and the 1.28 S.G. line.

The intersection is within the "A" zone (shaded area in the graph) and that means CHARGED STATE.

To know how much the battery is charged, draw a line parallel to the zone demarcation line and extend it to the right till it meets with the percentage scale. In the present example, the line meets at about 85% point on the percentage scale. Therefore, the battery is charged up to the 85% level.



B : Generator output (Battery terminal)
D : Dummy terminal
E : Ground
F : Field coil terminal
IG : Ignition terminal
L : Lamp terminal

GENERATOR

CAUTION:
- **Do not mistake polarities of IG terminal and L terminal.**
- **Do not create a short circuit between IG and L terminals. Always connect these terminals through a lamp.**
- **Do not connect any load between L and E.**
- **When connecting a charger or a booster battery to vehicle battery, refer to this section describing battery charging.**

Trouble in charging system will show up as one or more of following conditions:
1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

Noise from generator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

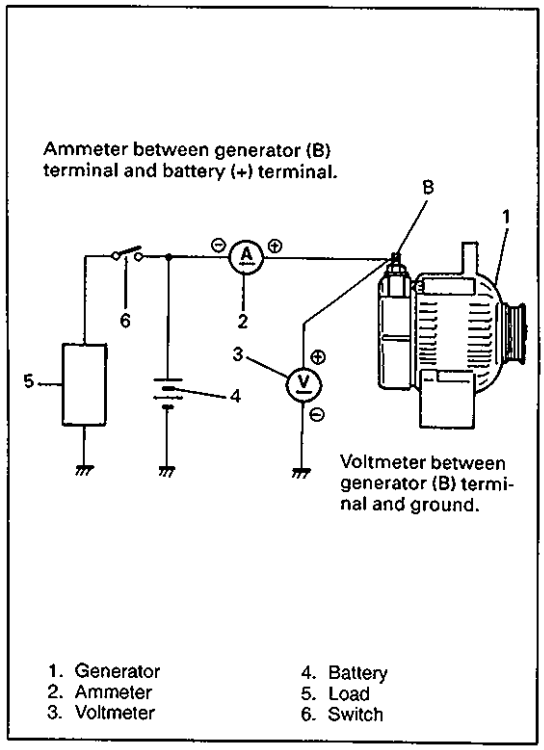
FAULTY INDICATOR LAMP OPERATION

PROBLEM	POSSIBLE CAUSE	CORRECTION
Charge light does not light with ignition ON and engine off	• Fuse blown • Light burned out • Wiring connection loose • IC regulator or field coil faulty • Poor contact between brush and slip ring	Check fuse. Replace light. Tighten loose connection. Check generator. Repair or replace.
Charge light does not go out with engine running (battery requires frequent recharging)	• Drive belt loose or worn • IC regulator or alternator faulty • Wiring faulty	Adjust or replace drive belt. Check charging system. Repair wiring.

UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking or indicator clear with red dot can be caused by one or more of the following conditions even though indicator lamp may be operating normal.
Following procedure also applies to cars with voltmeter and ammeter.

1) Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
2) Check drive belt for proper tension.



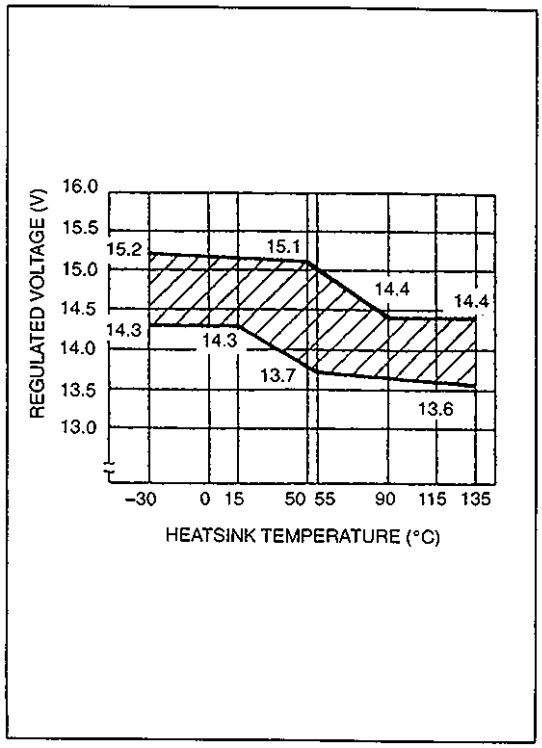
3) If battery defect is suspected, refer to Battery section.
4) Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starter and ignition ground cable.
5) Connect voltmeter and ammeter as shown in left figure.

Voltmeter
Set between generator B terminal and ground.

Ammeter
Set between generator B terminal and battery (+) terminal.

NOTE:
Use fully charged battery.

6) Measure current and voltage.



No-load Check

1) Run engine from idling up to 2,000 rpm and read meters.

NOTE:
Turn off switches of all accessories (wiper, heater etc.).

Standard current	10 A maximum
Standard voltage	14.1 – 15.2 v at 20 °C (68 °F)

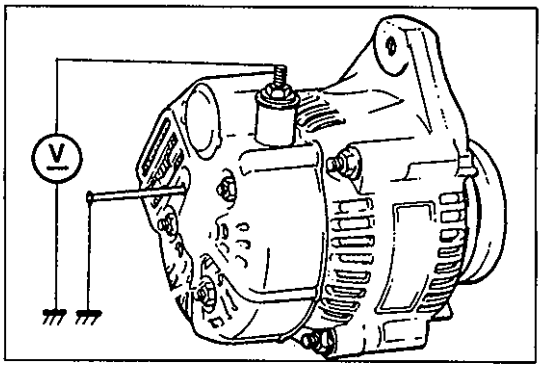
NOTE:
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in left figure.

Higher Voltage

If voltage is higher than standard value, check ground of brush.
If brush ground is correct, replace IC regulator.

Lower Voltage

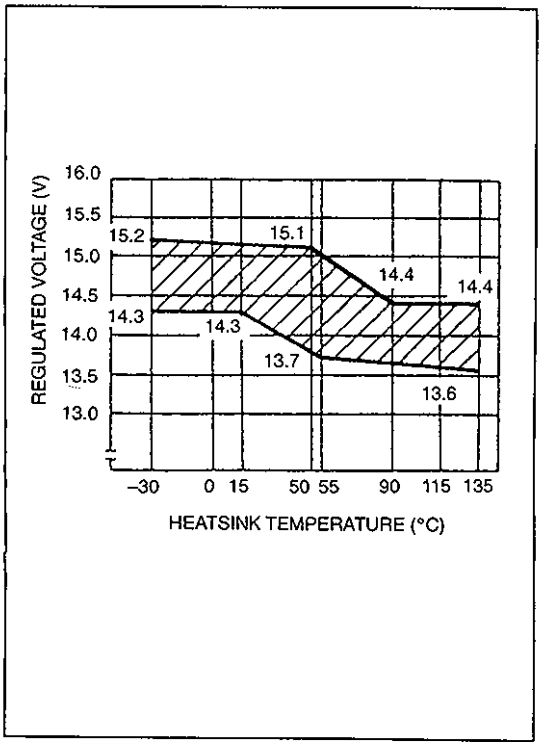
If voltage is lower than standard value, proceed to following check.



2) Ground F terminal and start engine, then measure voltage at B terminal as shown in left figure.
   - Voltage is higher than standard value
     It is considered that generator itself is good but IC regulator has been damaged, replace IC regulator.
   - Voltage is lower than standard value
     Generator itself has problem, check the generator.

Load Check

1) Run engine at 2,000 rpm and turn on head light and heater motor.
2) Measure current and if it is less than 20 A repair or replace generator.



OVERCHARGED BATTERY

1) To determine battery condition, refer to Battery section.
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, proceed to disassembly section of generator service and check field windings for grounds and shorts. If problem exists, replace rotor.
3) With engine running at 2,000 rpm, measure voltage.
4) If measured voltage is out of standard value, check brush ground or IC regulator.

ON-VEHICLE SERVICE

BATTERY

JUMP STARTING IN CASE OF EMERGENCY

WITH AUXILIARY (BOOSTER) BATTERY

CAUTION:
If vehicle is manual transmission model and has a catalytic converter, do not push or tow it to start. Damage to its emission system and/or to other parts may result.

Both booster and discharged battery should be treated carefully when using jumper cables. Follow procedure outlined below, being careful not to cause sparks.

WARNING:
- **Departure from these conditions or procedure described below could result in:**
  (1) Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns.
  (2) Damage to electronic components of either vehicle.
- **Remove rings, watches, and other jewelry. Wear approved eye protection.**
- **Be careful so that metal tools or jumper cables do not contact positive battery terminal (or metal in contact with it) and any other metal on vehicle, because a short circuit could occur.**

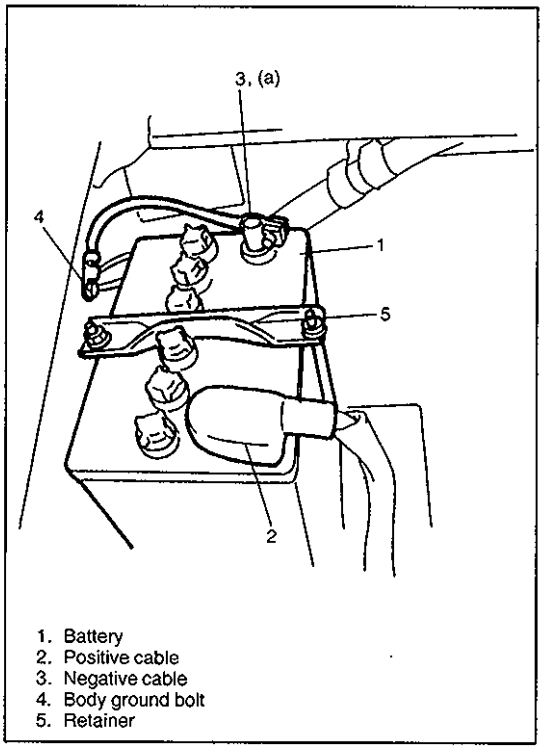
1) Set parking brake and place automatic transmission in PARK (NEUTRAL on manual transmission). Turn off ignition, turn off lights and all other electrical loads.
2) Check electrolyte level. If it is below low level line, add distilled water.
3) Attach end of one jumper cable to positive terminal of booster battery and the other end of the same cable to positive terminal of discharged battery. (Use 12-volt battery only to jump start engine).
4) Attach one end of the remaining negative cable to negative terminal of booster battery, and the other end to a solid engine ground (such as exhaust manifold) at least 45 cm (18 in.) away from battery of vehicle being started.

WARNING:
Do not connect negative cable directly to negative terminal of dead battery.

5) Start engine of vehicle with booster battery and turn off electrical accessories. Then Start engine of the vehicle with discharged battery.
6) Disconnect jumper cables in the exact reverse order.

WITH CHARGING EQUIPMENT

CAUTION:
When jump starting engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.



1. Battery
2. Positive cable
3. Negative cable
4. Body ground bolt
5. Retainer

DISMOUNTING

1) Disconnect negative cable.
2) Disconnect positive cable.
3) Remove retainer.
4) Remove battery.

HANDLING

When handling battery, following safety precautions should be followed:

- Hydrogen gas is produced by battery. A flame or spark near battery may cause the gas to ignite.
- Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately.

REMOUNTING

1) Reverse removal procedure.
2) Torque battery cables to specification.

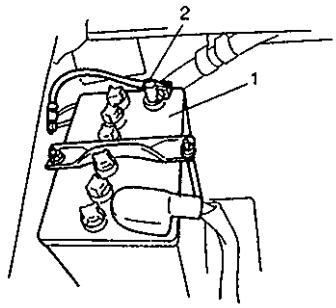
NOTE:
Check to be sure that ground cable has enough clearance to hood panel by terminal.

Tightening Torque
(a): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

GENERATOR

GENERATOR BELT

Refer to "COOLING FAN BELT" in SECTION 6B "ENGINE COOLING".



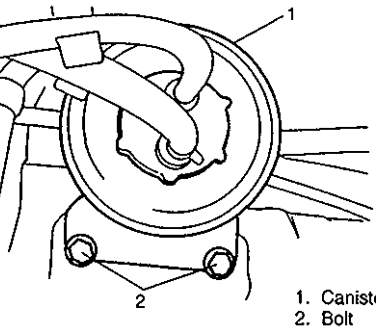
1. Battery 2. Negative (–) battery cable

UNIT REPAIR OVERHAUL

GENERATOR

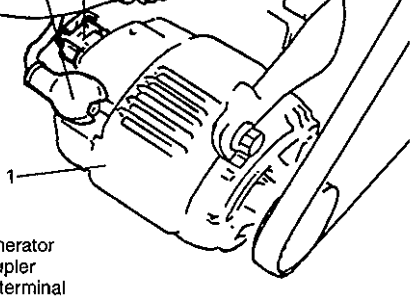
DISMOUNTING

1) Disconnect negative (–) cable at battery.



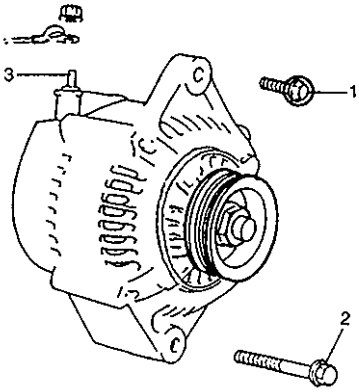
1. Canister
2. Bolt

2) Remove bolts and then canister together with its bracket.



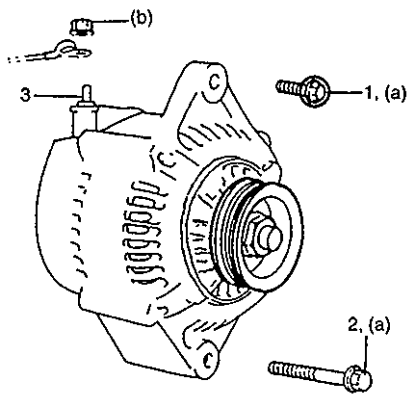
1. Generator
2. Coupler
3. "B" terminal

3) Disconnect "B" terminal wire and coupler from generator.



1. Upper generator bolt (Short)
2. Lower generator bolt (Long)
3. "B" terminal

4) Remove generator belt. Refer to SECTION 6B "ENGINE COOLING" in this manual.
5) Remove generator.



1. Upper generator bolt (Short)
2. Lower generator bolt (Long)
3. "B" terminal

REMOUNTING

1) Mount generator on the generator bracket.
2) Tighten generator bolts.

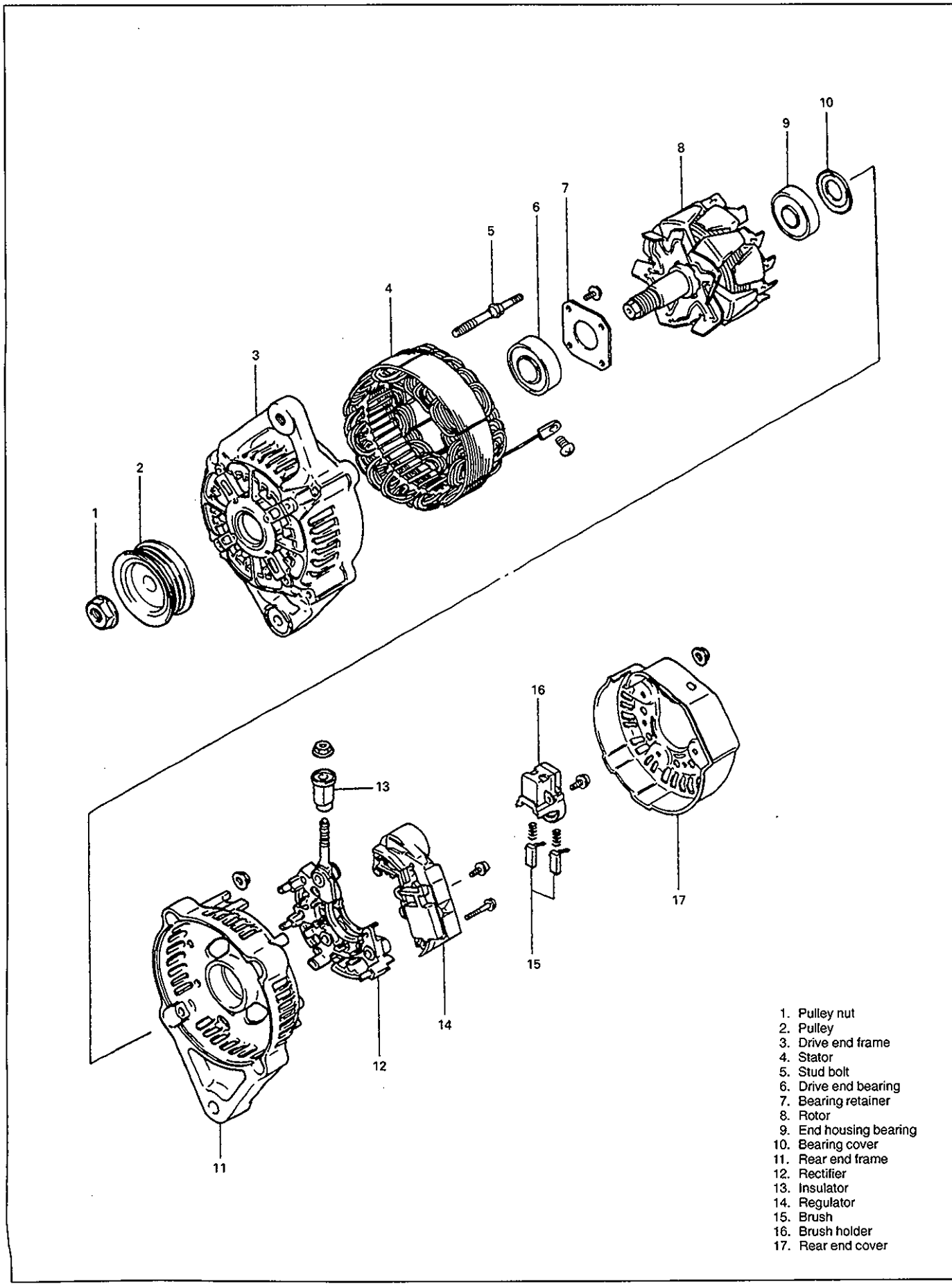
Tightening Torque
(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)

3) Install generator (cooling fan) belt. Refer to SECTION 6B "ENGINE COOLING" in this manual.
4) Connect "B" terminal wire and coupler to generator.

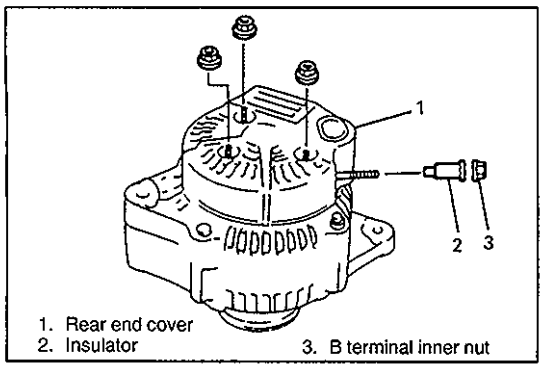
Tightening Torque
(b): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

5) Install canister.
6) Connect negative (–) cable at battery.

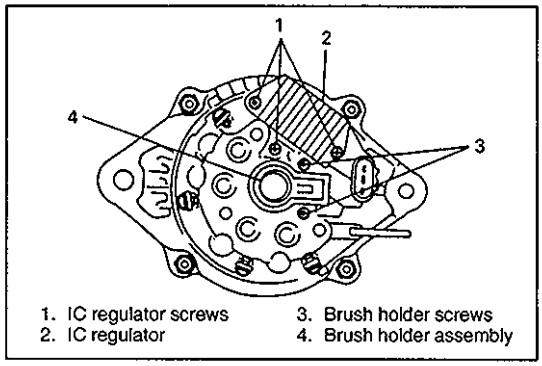
DISASSEMBLY



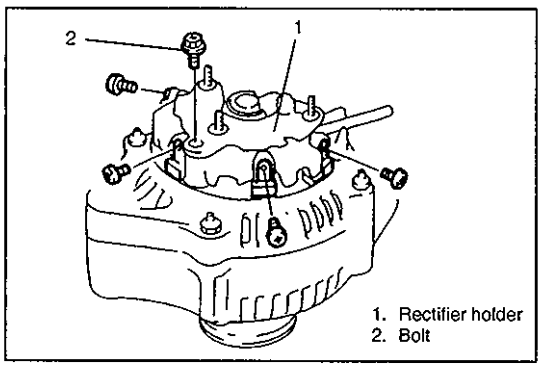
1. Pulley nut
2. Pulley
3. Drive end frame
4. Stator
5. Stud bolt
6. Drive end bearing
7. Bearing retainer
8. Rotor
9. End housing bearing
10. Bearing cover
11. Rear end frame
12. Rectifier
13. Insulator
14. Regulator
15. Brush
16. Brush holder
17. Rear end cover



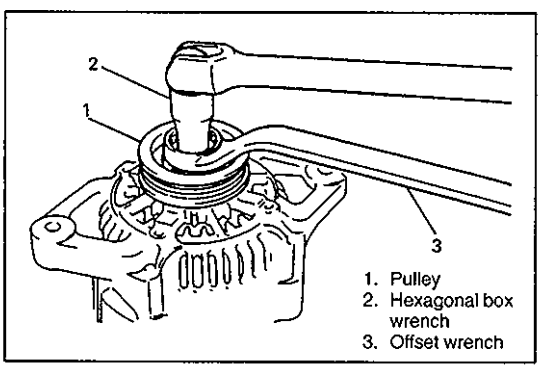
1) Remove B terminal inner nut and insulator.
2) Remove rear end cover.



3) Remove 2 screws and pull out brush holder assembly.
4) Remove 3 screws and IC regulator.
5) Remove brush holder cover from brush holder.

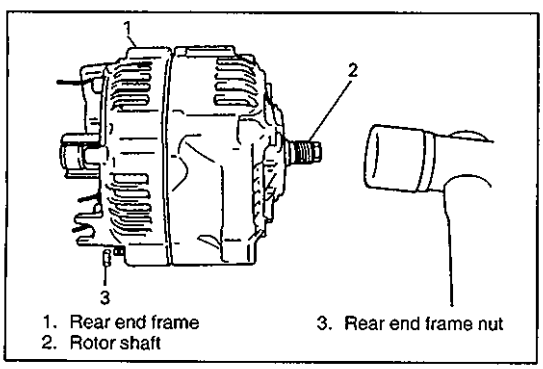


6) Remove rectifier holder.



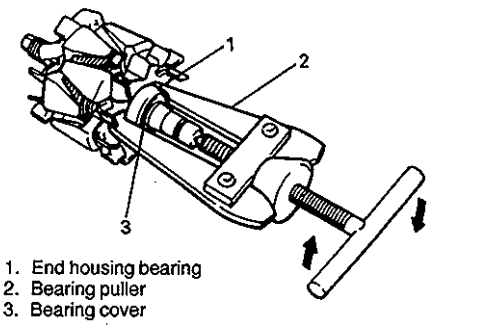
7) Hold shaft by using hexagonal box wrench and remove pulley nut, and then pull out pulley.

CAUTION:
- **To hold shaft, use hexagonal box. Duodecimal box may cause slipping and consequential shaft or tool damage.**
- **Do not attempt to hold pulley by using vise or pipe wrench so as not to distort it.**



8) Remove 4 rear end frame nuts.
9) Drive out rear end frame with rotor tapping shaft lightly by using plastic hammer.
10) Separate rear end frame from rotor evenly by using plastic hammer.

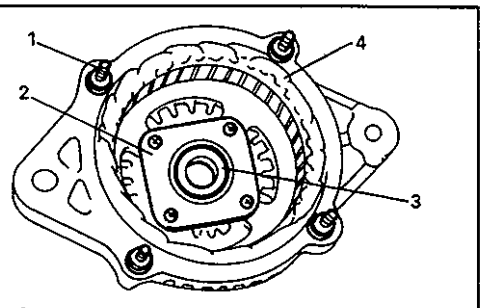
CAUTION:
Do not hit shaft at slip ring side, when separating rotor and rear end frame.



1. End housing bearing
2. Bearing puller
3. Bearing cover

11) If required, use bearing puller to remove end housing bearing and bearing cover.

CAUTION:
Care must be exercised so as not to distort cooling fan blade while applying puller.

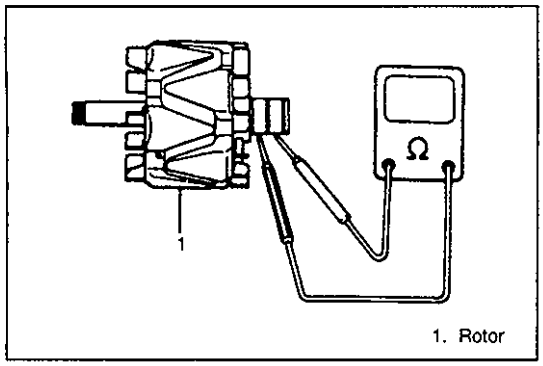


1. Stud bolt
2. Retaining plate
3. Drive end bearing
4. Stator

12) If required, remove 4 screws, retainer plate and then drive out drive end bearing.

13) If required, remove stud bolts and then pull out stator.

NOTE:
Heating drive end frame may facilitate removal of stator.



1. Rotor

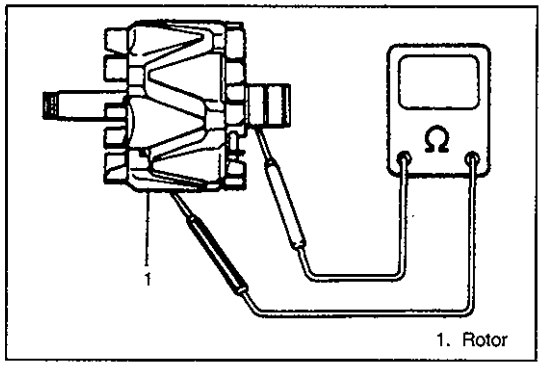
INSPECTION

1. ROTOR

Open Circuit

Using ohmmeter, check for continuity between slip rings of rotor. If there is no continuity, replace rotor.

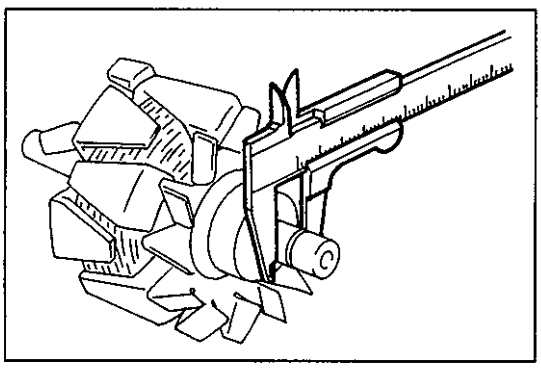
Standard resistance: About 2.9 Ω



1. Rotor

Ground

Using ohmmeter, check that there is no continuity between slip ring and rotor. If there is continuity, replace rotor.

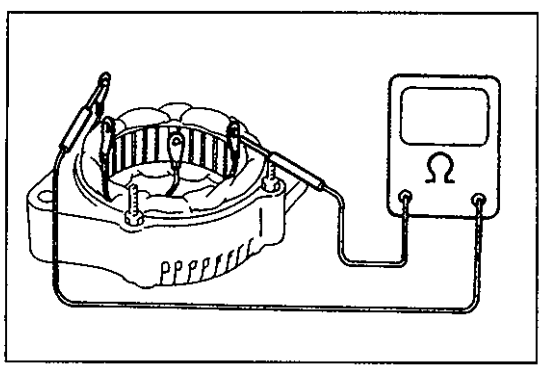


Slip Rings

- Check slip rings for roughness or scoring. If rough or scored, replace rotor.
- Using a vernier caliper, measure the slip ring diameter.

Standard diameter: 14.4 mm (0.567 in.)
Minimum diameter: 14.0 mm (0.551 in.)

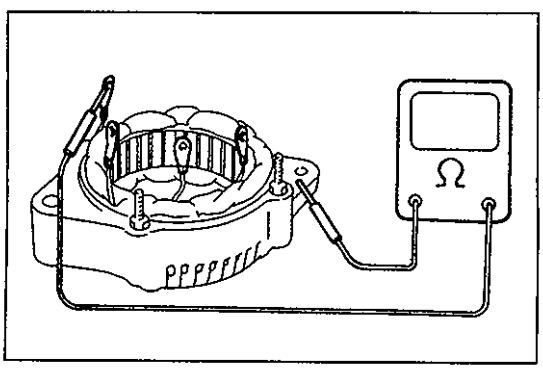
If the diameter is less than minimum, replace the rotor.



2. STATOR

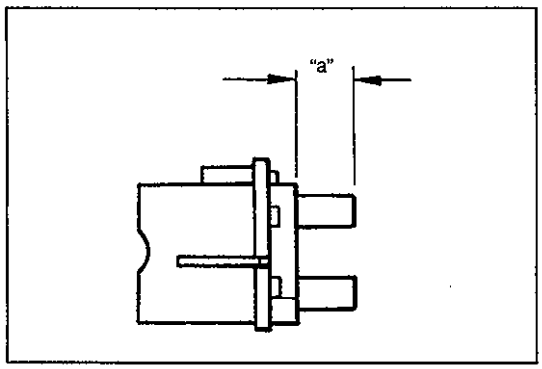
Open Circuit

Using ohmmeter, check all leads for continuity. If there is no continuity, replace stator.



Ground

Using ohmmeter, check that there is no continuity between coil leads and stator core. If there is continuity, replace stator.

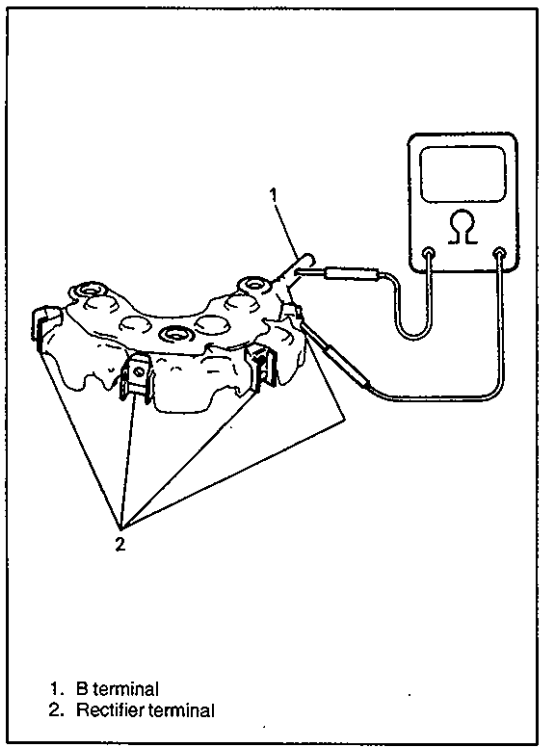


3. BRUSH

Exposed Brush Length

Check each brush for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush. Refer to "Replace Brush" in this section.

Exposed brush length "a"
Standard: 10.5 mm (0.413 in.)
Limit : 4.5 mm (0.351 in.)

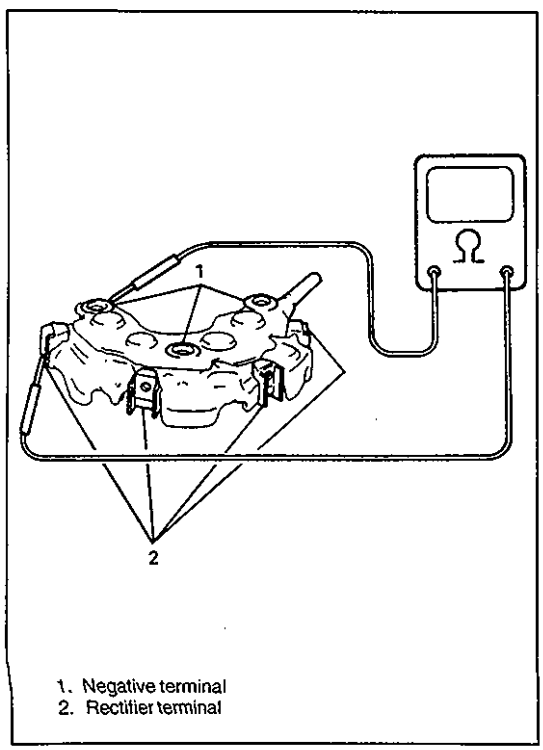


1. B terminal
2. Rectifier terminal

4. RECTIFIER

Positive Rectifier

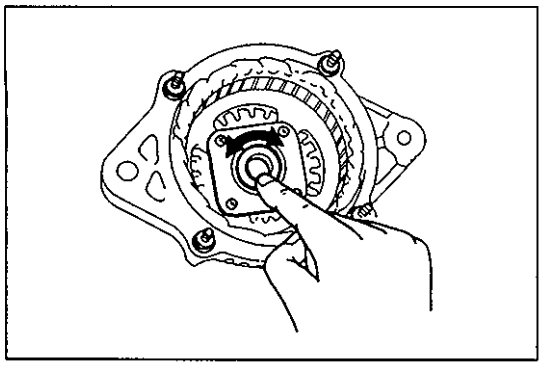
1) Using an ohmmeter, connect one tester probe to the B terminal and the other to each rectifier terminal.
2) Reverse the polarity of the tester probes and repeat step 1).
3) Check that one shows continuity and the other shows no continuity.
   If there is continuity, replace the rectifier holder.



1. Negative terminal
2. Rectifier terminal

Negative Rectifier

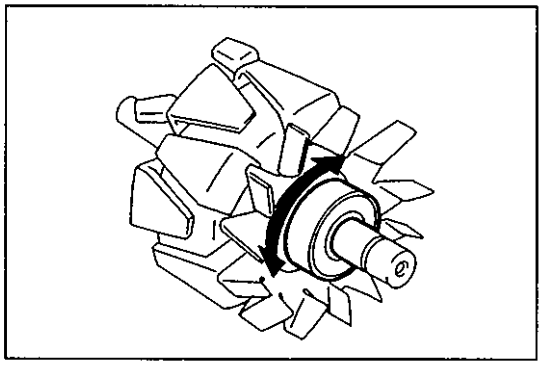
1) Using an ohmmeter, connect one tester probe to each negative terminal and the other to each rectifier terminal.
2) Reverse the polarity of the tester probes and repeat step 1).
3) Check that one shows continuity and the other shows no continuity.
   If there is continuity, replace the rectifier holder.



5. BEARING

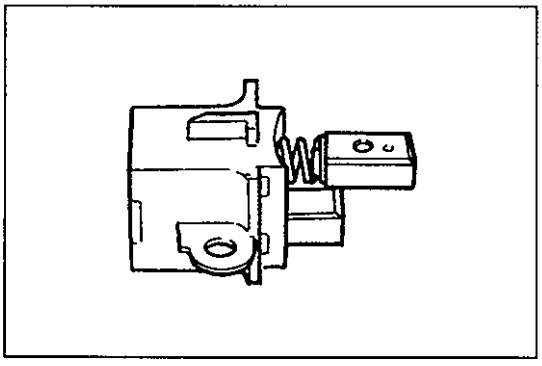
Drive End Bearing

Check that the bearing is not rough or worn.



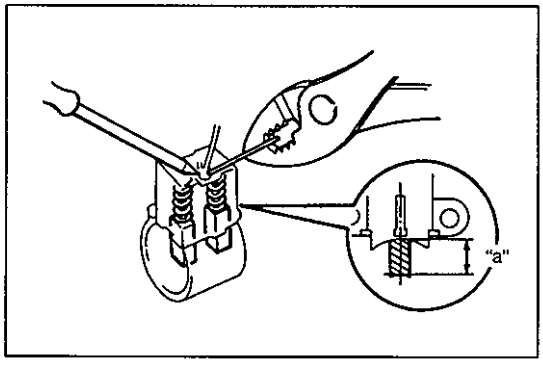
End Housing Bearing

Check that the bearing is not rough or worn.
When removal is necessary, refer to 6H-17.



REPLACE BRUSH

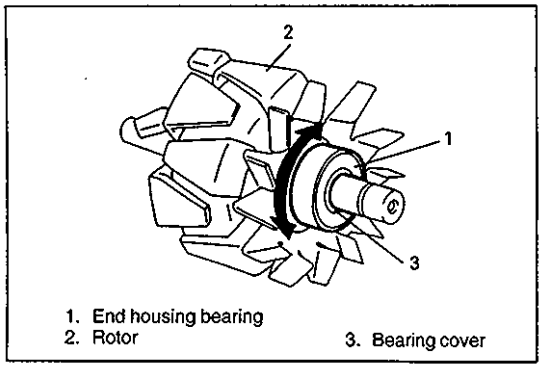
1) Unsolder and remove the brush and spring.
2) Run the wire of a new brush through the spring and the hole in the brush holder, and insert the spring and brush into the brush holder.



3) Solder the brush wire to the brush holder at specified exposed length.

Exposed length "a": 10.5 mm (0.413 in.)

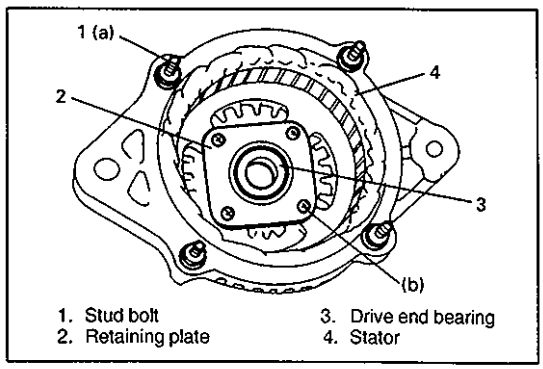
4) Check that the brush moves smoothly in the brush holder.
5) Cut off the excess wire.
6) Apply insulation paint to the soldered area.



1. End housing bearing
2. Rotor
3. Bearing cover

REASSEMBLY

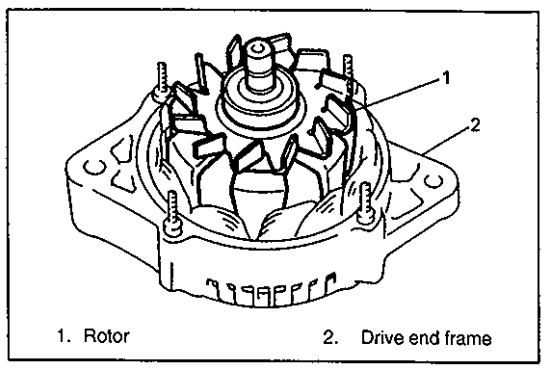
1) If end housing bearing is removed, install it.
2) Check end housing bearing turns smoothly.



1. Stud bolt
2. Retaining plate
3. Drive end bearing
4. Stator

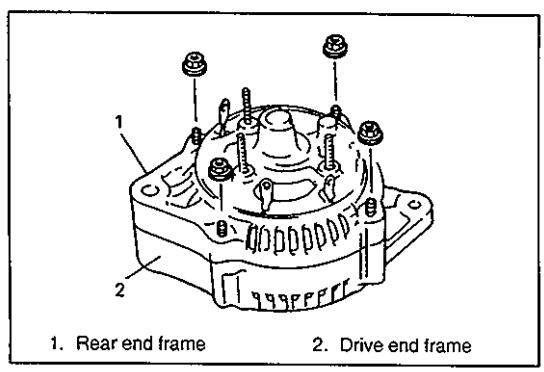
3) If stator is removed, install stator and tighten stud bolts.
4) If drive end bearing is removed, install it.
5) Check drive end bearing turns smoothly.

Tightening Torque
(a): 8.8 N·m (0.88 kg-m, 6.5 lb-ft)
(b): 2.6 N·m (0.26 kg-m, 2.0 lb-ft)



1. Rotor
2. Drive end frame

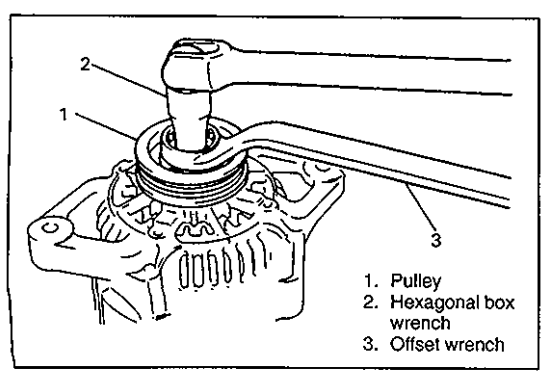
6) Place drive end frame on pulley, and then install rotor to drive end frame.



1. Rear end frame
2. Drive end frame

7) Install rear end frame to drive end frame.
8) Tighten 4 nuts to specified torque.

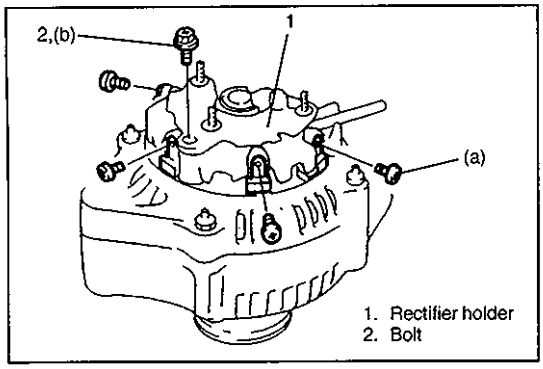
Tightening Torque
4.5 N·m (0.45 kg-m, 3.5 lb-ft)



1. Pulley
2. Hexagonal box wrench
3. Offset wrench

9) Install pulley and tighten pulley nut with holding shaft by using hexagonal box wrench to specified torque.

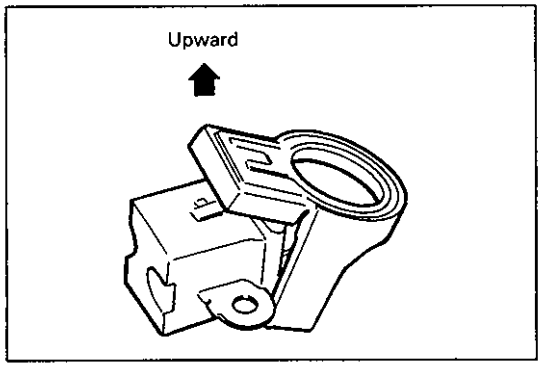
Tightening Torque
111 N·m (11.1 kg-m, 80.5 lb-ft)



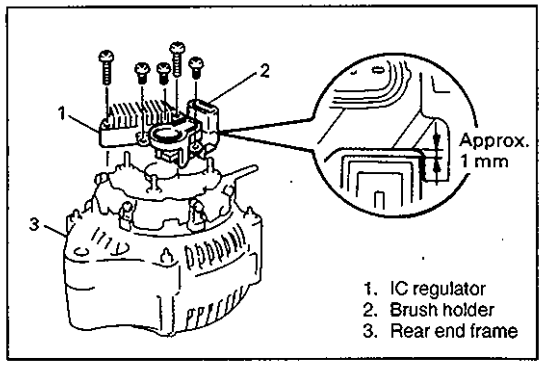
10) Install rectifier holder.

CAUTION:
When installing rectifier, check to confirm that stator leads have enough clearance with cooling fan blades.

Tightening Torque
(a): 2.0 N·m (0.2 kg-m, 1.5 lb-ft)
(b): 4.0 N·m (0.4 kg-m, 3.0 lb-ft)

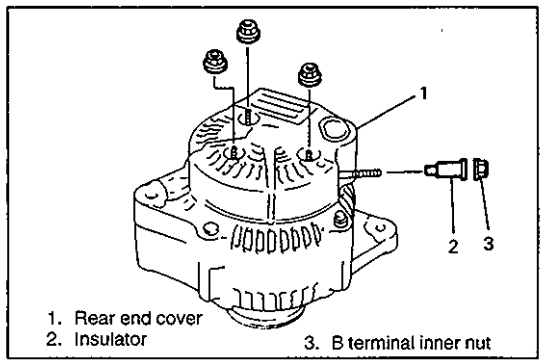


11) Install brush holder cover to brush holder.



12) Place the IC regulator together with the brush holder horizontally on the rear end frame.
13) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.

Tightening Torque
2.0 N·m (0.2 kg-m, 1.5 lb-ft)

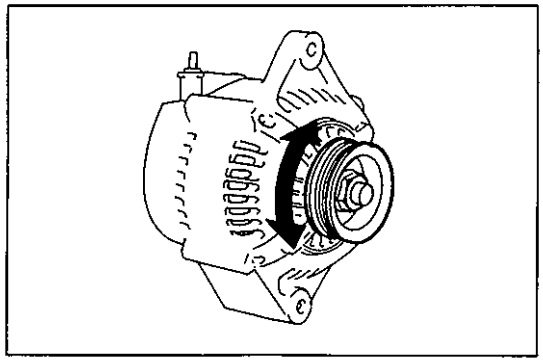


14) Install rear end cover.

Tightening Torque
4.5 N·m (0.45 kg-m, 3.5 lb-ft)

15) Install insulator and tighten B terminal inner nut to specified torque.

Tightening Torque
4.2 N·m (0.42 kg-m, 3.0 lb-ft)



16) Make sure that rotor turns smoothly.

SPECIFICATIONS

BATTERY

55B24R TYPE

Rated capacity	36 AH/5HR, 12 Volts
Electrolyte	3.1 L (6.55/5.46 US/Imp pt)
Electrolyte S.G.	1.28 when fully charged at 20°C (68°F)

38B20R TYPE

Rated capacity	28 AH/5HR, 12 Volts
Electrolyte	2.1 L (4.44/3.70 US/Imp pt)
Electrolyte S.G.	1.28 when fully charged at 20°C (68°F)

GENERATOR

Rated voltage	12 V	Permissible ambient temperature	– 30 to 90 °C (– 22 to 194 °F)
Nominal output	60 A (at 13.5 V)		
Permissible max. speed	18,000 rpm	Polarity	Negative ground
No-load speed	1,150 rpm	Rotation	Clockwise viewed from pulley side
Setting voltage	13.6 to 14.4 V		

TIGHTENING TORQUE SPECIFICATIONS

Fastening	Tightening torque		
	N·m	kg-m	lb-ft
1. Body ground bolt	8	0.8	6.0
2. Generator mounting bolts	23	2.3	16.5
3. "B" terminal inner nut	4	0.4	3.0
4. "B" terminal outer nut	8	0.8	6.0
5. Pulley nut	111	11.1	80.5
6. Rear end frame nuts	4.5	0.45	3.5
7. Rear end cover nuts			
8. Negative rectifier fin bolt	4.0	0.4	3.0

SECTION 6K

EXHAUST SYSTEM

CONTENTS

NOTE:
Whether following parts are used in the particular vehicle or not depends on specification. Be sure to bear this in mind when performing service work.
- **TWC (in exhaust center pipe)**

GENERAL DESCRIPTION

The exhaust system of this vehicle consists of the exhaust manifold, exhaust center pipe, muffler, seals, etc. The catalytic converter is an emission control device added to the exhaust system to lower the level of Hydrocarbon (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx) pollutants in the exhaust gas. The catalyst in the catalytic converter is of "Three way" type.

CAUTION:
Be sure to use UNLEADED FUEL for the catalytic converter equipped vehicle. Use of LEADED FUEL will affect performance of the catalytic converter adversely to a great extent.