

SUZUKI

SV620

SERVICE MANUAL

SUZUKI
Caring for Customers

99500-85F00-01E

(英)

IMPORTANT

WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the words **WARNING**, **CAUTION**, and **NOTE** have, special meanings. Pay special attention to the messages highlighted by these signal words.

WARNING:

Indicates a potential hazard that could result in death or injury.

CAUTION:

Indicates a potential hazard that could result in vehicle damage.

NOTE:

Indicates special information to make maintenance easier or instructions clearer.

FOREWORD

This SERVICE MANUAL is a supplement to VITARA (SE416) series SERVICE MANUALS (SERVICE MANUAL 99500-60A10, SUPPLEMENTARY SERVICE MANUALS 99501-60A60 • 99501-60A70).

Applicable model: VITARA (SV620)

It describes only different service information of VITARA (SV620) as compared with VITARA (SE416), 3 door/5 door models. Therefore, whenever servicing VITARA (SV620), consult this service manual first. And for any section, item or description not found in this service manual, refer to the above mentioned SERVICE MANUAL and SUPPLEMENTARY SERVICE MANUALS.

When replacing parts or servicing by disassembling, it is recommended to use SUZUKI genuine parts, tools and service materials (lubricants, sealants, etc.) as specified in each description.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others. Therefore, note that illustrations may differ from the vehicle being actually serviced. The right is reserved to make changes at any time without notice.

RELATED SERVICE MANUALS:

- VITARA (SE416) SERVICE MANUAL (99500-60A10)
- VITARA (SE416) SUPPLEMENTARY SERVICE MANUAL FOR 5-DOOR MODEL WITH SLIDING ROOF (99501-60A60)
- VITARA (SE416) SUPPLEMENTARY SERVICE MANUAL (99501-60A70)

SUZUKI MOTOR CORPORATION

AUTOMOBILE DEPARTMENT
OVERSEAS SERVICE DIVISION

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SECTION 0A

0A

GENERAL INFORMATION

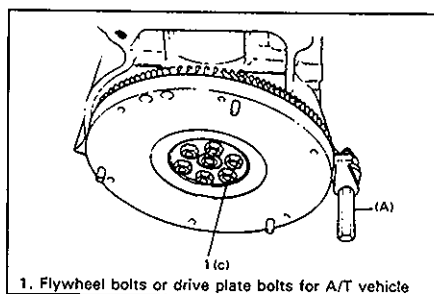
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HOW TO USE THIS MANUAL

- 1) There is a TABLE OF CONTENTS FOR THE WHOLE MANUAL on the first page of this manual, whereby you can easily find the section that offers the information you need. Also, there is a TABLE OF CONTENTS on the first page of EACH SECTION, where the main items in that section are listed.
- 2) Each section of this manual has its own pagination. It is indicated at the top of each page along with the Section name.
- 3) The SPECIAL TOOL usage and TORQUE SPECIFICATION are given as shown in figure below.



- 6) Install oil pump. Refer to Item "Oil pump" for installation of oil pump.
- 7) Install flywheel (M/T vehicle) or drive plate (A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specification.

Special Tool**(A): 09924-17810****Tightening Torque****(c): 78 N·m (7.8 kg·m, 56.0 lb·ft)**

- 4) A number of abbreviations are used in the text.
For their full explanations, refer to "ABBREVIATIONS MAY BE USED IN THIS MANUAL" of this section.
- 5) The SI, metric and foot-pound systems are used as units in this manual.
- 6) DIAGNOSIS and CORRECTION are included in each section as necessary.
- 7) At the end of each section, there are descriptions of SPECIAL TOOLS, REQUIRED SERVICE MATERIALS and TIGHTENING TORQUE SPECIFICATIONS that should be used for the servicing work described in that section.

PRECAUTIONS

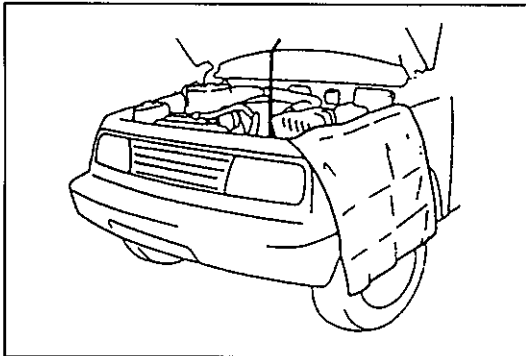
GENERAL PRECAUTIONS

The WARNING and CAUTION below describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures described in this manual, and they will not necessarily be repeated with each procedure to which they apply.

WARNING:

- Whenever raising a vehicle for service, be sure to follow the instructions under "VEHICLE LIFTING POINTS" on SECTION 0A.
- When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles). Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.
- When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.
- Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.
- To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tailpipe, muffler, etc.
- New and used engine oil can be hazardous. Children and pets may be harmed by swallowing new or used oil. Keep new and used oil and used engine oil filters away from children and pets. Continuous contact with used engine oil has been found to cause [skin] cancer in laboratory animals. Brief contact with used oil may irritate skin. To minimize your exposure to used engine oil, wear a long-sleeve shirt and moisture-proof gloves (such as dishwashing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil. Recycle or properly dispose of used oil and filters.

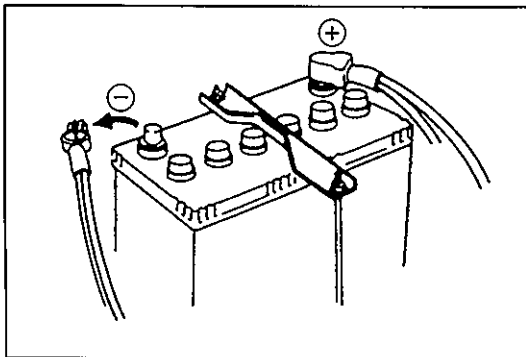
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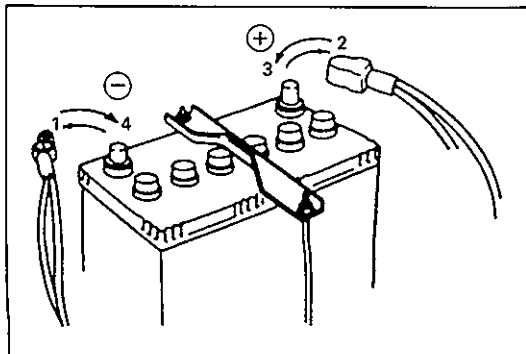
CAUTION:

- Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.



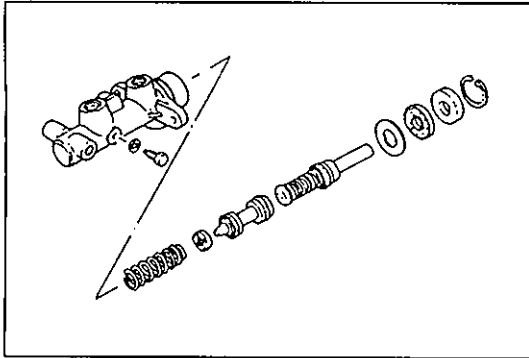
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- When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.

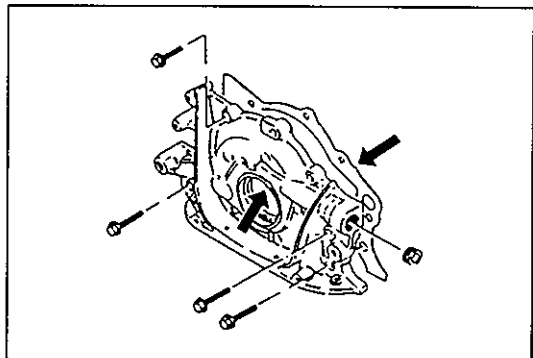


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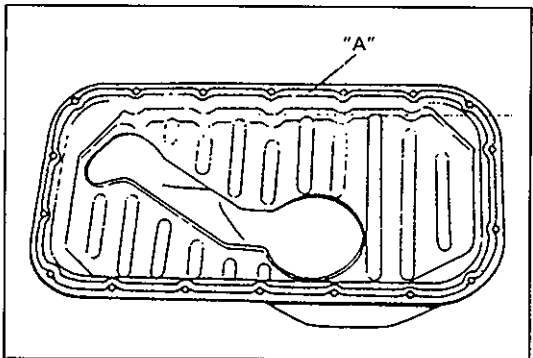
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.



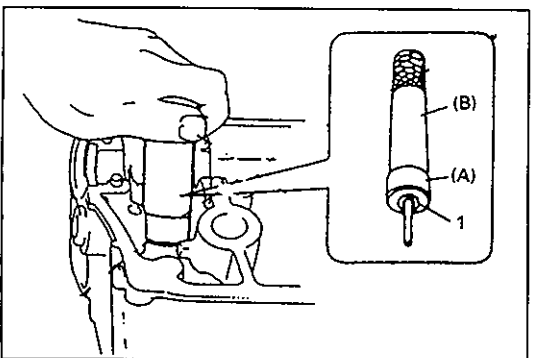
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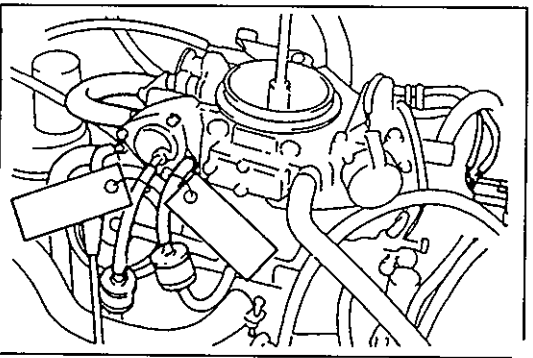
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- When removing parts that are to be reused, be sure to keep them arranged in an orderly manner so that they may be reinstalled in the proper order and position.

- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.

- Make sure that all parts used in reassembly are perfectly clean.
- When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

"A": Sealant 99000-31150

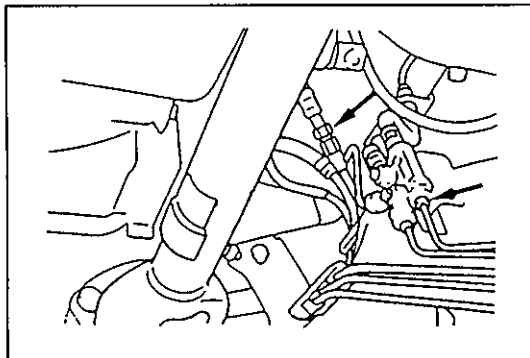
- Be sure to use special tools when instructed.

Special Tool

(A): 09917-98221

(B): 09916-58210

- When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be reinstalled correctly.



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- After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.

- For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.

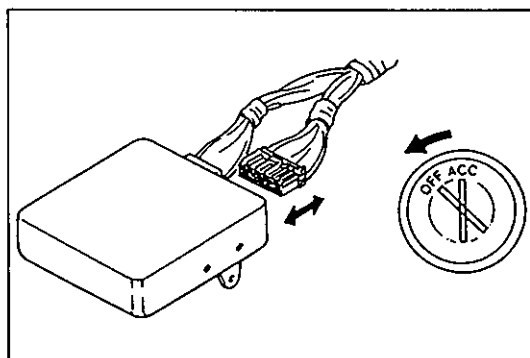
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PRECAUTION FOR CATALYTIC CONVERTER

For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

- Conduct a spark jump test only when necessary, make it as short as possible, and do not open the throttle.
- Conduct engine compression checks within the shortest possible time.
- Avoid situations which can result in engine misfire (e.g. starting the engine when the fuel tank is nearly empty).

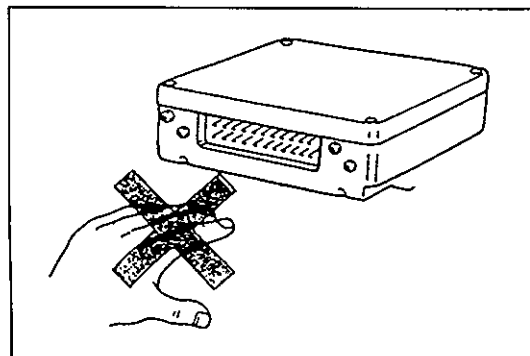
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PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE

- When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.

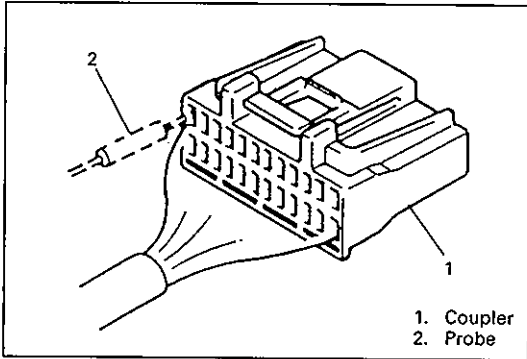


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- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, TCM, ABS control module, SDM etc). The static electricity from your body can damage these parts.

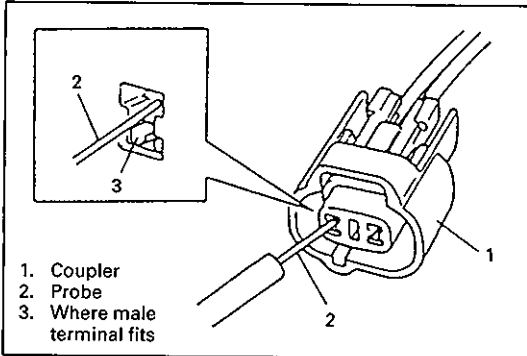
- Never connect any tester (voltmeter, ohmmeter, or whatever) to electronic control unit when its coupler is disconnected. Attempting to do it may cause damage to it.
- Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempting to do it may cause damage to electronic control unit and sensors.
- Be sure to use a specified voltmeter/ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result.

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- When taking measurements at electrical connectors using a tester probe, be sure to insert the probe from the wire harness side (backside) of the connector.

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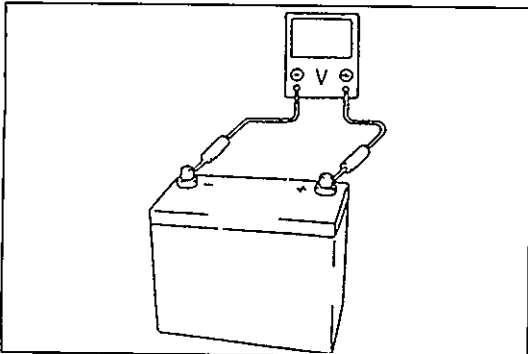


- When connecting meter probe from terminal side of coupler because it can't be connected from harness side, use extra care not to bend male terminal of coupler or force its female terminal open for connection. In case of such coupler connect probe to avoid opening female terminal as shown. Never connect probe where male terminal is supposed to fit.

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- When checking connection of terminals, check its male half for bend and female half for excessive opening and both for locking (looseness), corrosion, dust, etc.

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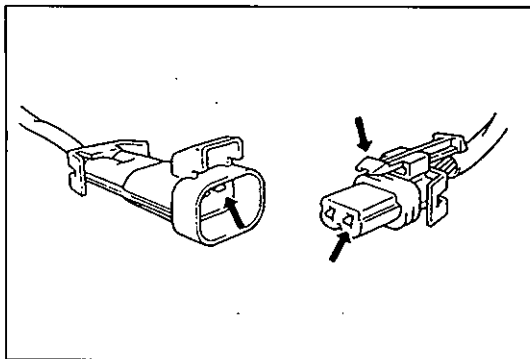
- Before measuring voltage at each terminal, check to make sure that battery voltage is 11V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.

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INTERMITTENTS AND POOR CONNECTION

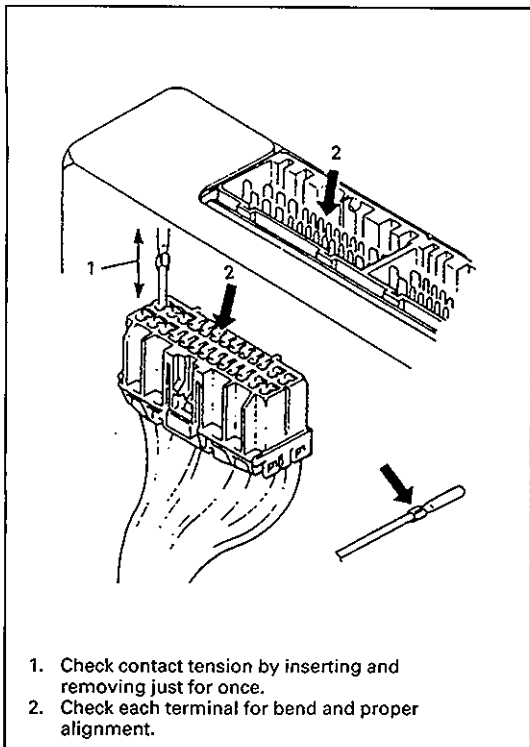
Most intermittents are caused by faulty electrical connections or wiring, although a sticking relay or solenoid can occasionally be at fault. When checking it for proper connection, perform careful check of suspect circuits for:

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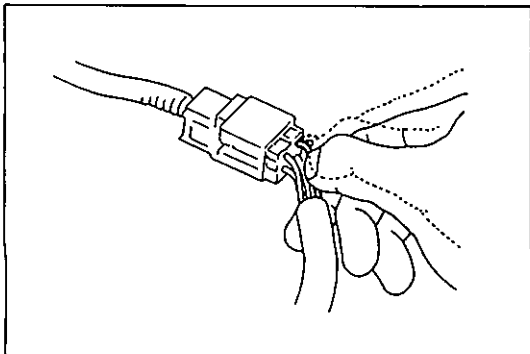
- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact. However, cleaning the terminal with a sand paper or the like is prohibited.

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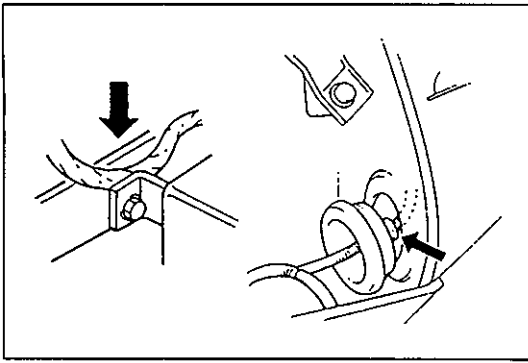
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.
- Improperly formed or damaged terminals. Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal. If contact tension is not enough, reform it to increase contact tension or replace.

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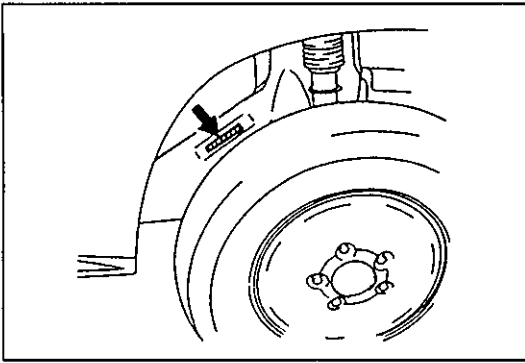
- Poor terminal-to-wire connection. Check each wire harness in problem circuits for poor connection by shaking it by hand lightly. If any abnormal condition is found, repair or replace.

60G00-0A-10-5



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- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause a continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.
If any abnormality is found, repair or replace.

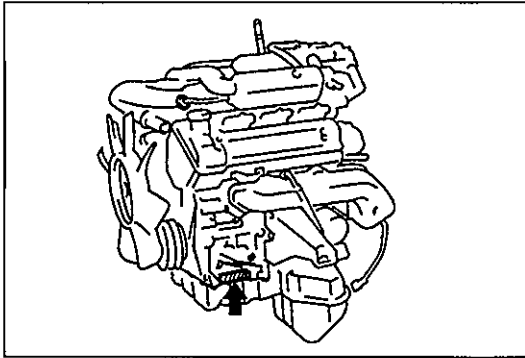


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IDENTIFICATION INFORMATION

BODY NUMBER

The vehicle body number is punched on the chassis inside the tire housing on the right front side.

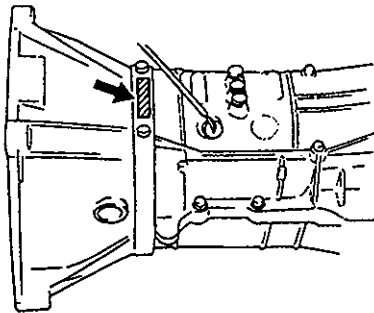


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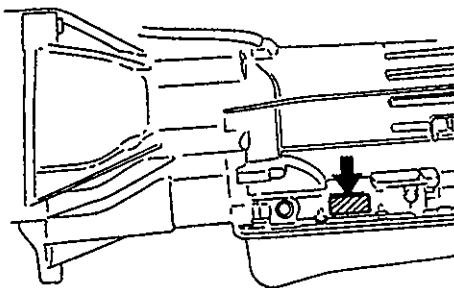
ENGINE IDENTIFICATION NUMBER

The number is punched on the cylinder block.

Manual Transmission



Automatic Transmission



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TRANSMISSION IDENTIFICATION NUMBER

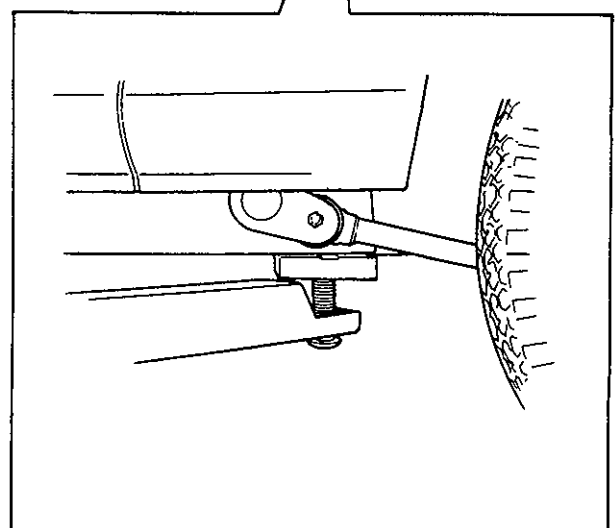
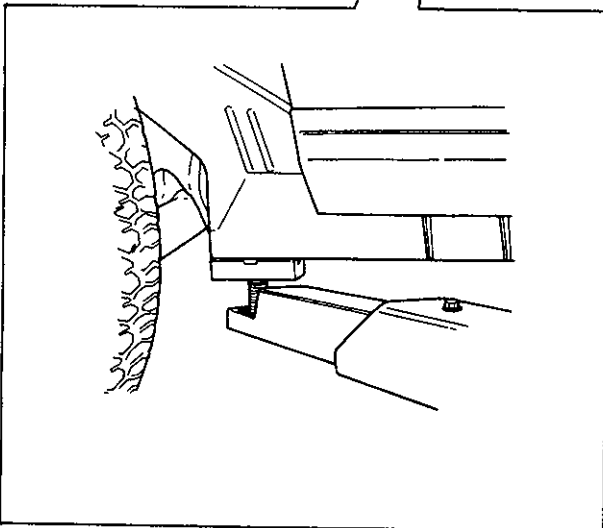
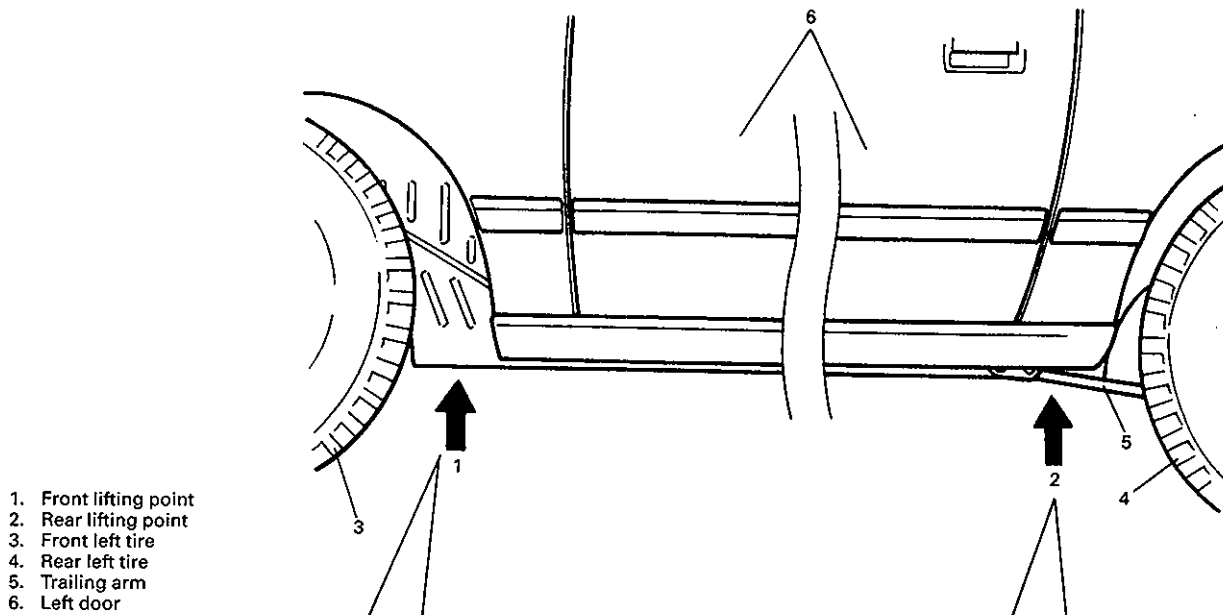
The number is located on the transmission case.

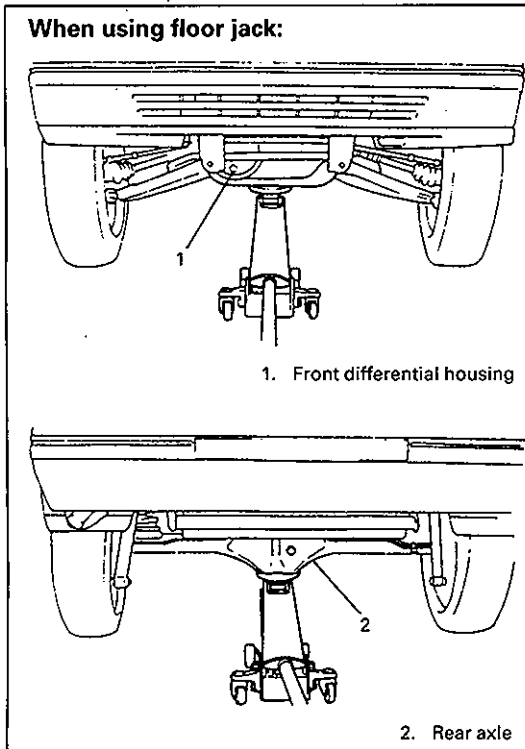
VEHICLE LIFTING POINTS

WARNING

- When using frame contact hoist, apply hoist as shown (right and left at the same position). Lift up the vehicle till 4 tires are a little off the ground and make sure that the vehicle will not fall off by trying to move vehicle body in both ways. Work can be started only after this confirmation.
- Before applying hoist to underbody, always take vehicle balance throughout service into consideration. Vehicle balance on hoist may change depending on what part to be removed.
- Make absolutely sure to lock hoist after vehicle is hoisted up.
- Before lifting up the vehicle, check to be sure that end of hoist arm is not in contact with brake pipe, fuel pipe, bracket or any other part.

When using frame contact hoist:



When using floor jack:

60A20-0A-12-1

In raising front or rear vehicle end off the floor by jacking, be sure to put the jack against the center portion of the front suspension frame or rear axle housing.

To perform service with either front or rear vehicle end jacked up, be sure to place safety stands under chassis frame so that body is securely supported. And then check to ensure that chassis frame does not slide on safety stands and the vehicle is held stable for safety's sake.

WARNING:

- Never apply jack against suspension parts (i.e., stabilizer, etc) or vehicle floor, or it may get deformed.
- If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels on ground in order to ensure safety.

After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone.

85F00-0A-11-3

ABBREVIATIONS MAY BE USED IN THIS MANUAL

A

ABS	: Anti-lock Brake System
ATDC	: After Top Dead Center
API	: American Petroleum Institute
ATF	: Automatic Transmission Fluid
ALR	: Automatic Locking Retractor
AC	: Alternating Current
A/T	: Automatic Transmission
A/C	: Air Conditioning
ABDC	: After Bottom Dead Center
A/F	: Air Fuel Mixture Ratio
A-ELR	: Automatic-Emergency Locking Retractor

B

B+	: Battery Positive Voltage
BTDC	: Before Top Dead Center
BBDC	: Before Bottom Dead Center

C

CKT	: Circuit
CMP Sensor	: Camshaft Position Sensor (Crank Angle Sensor, CAS)
CO	: Carbon Monoxide
CPP Switch	: Clutch Pedal Position Switch (Clutch Switch, Clutch Start Switch)
CPU	: Central Processing Unit
CRS	: Child Restraint System

D

DC	: Direct Current
DLC	: Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)
DOHC	: Double Over Head Camshaft
DOJ	: Double Offset Joint
DRL	: Daytime Running Light
DTC	: Diagnostic Trouble Code (Diagnostic Code)

E

EBCM	: Electronic Brake Control Module, ABS Control Module
ECM	: Engine Control Module
ECT Sensor	: Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
EGR	: Exhaust Gas Recirculation
EGR Pressure Transducer	: EGR Modulator
EGRT Sensor	: EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)
EFE Heater	: Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
ELR	: Emergency Locking Retractor
EVAP	: Evaporative Emission
EVAP Canister	: Evaporative Emission Canister (Charcoal Canister)
EVAP Canister Purge Valve	: EVAP Solenoid Purge Valve (SP Valve)

F

4WD	: 4 Wheel Drive
-----	-----------------

G

GEN	: Generator
GND	: Ground

H

HC	: Hydrocarbons
HO2S	: Heated Oxygen Sensor

I

IAC Valve	: Idle Air Control Valve (Idle Speed Control Solenoid Valve, ISC Solenoid Valve)
IAT Sensor	: Intake Air Temperature Sensor (Air temperature Sensor, ATS)
IG	: Ignition
ISC Actuator	: Idle Speed Control Actuator (Motor)

L		T	
LH	: Left Hand	TBI	: Throttle Body Fuel Injection (Single-Point Fuel Injection, SPI)
M		TCC	: Torque Converter Clutch
MAF Sensor	: Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)	TCM	: Transmission Control Module (A/T Controller, A/T Control Module)
MAP Sensor	: Manifold Absolute Pressure Sensor (Pressure Sensor, PS)	TP Sensor	: Throttle Position Sensor
Max	: Maximum	TVV	: Thermal Vacuum Valve (Thermal Vacuum Switching Valve, TVSV, Bimetal Vacuum Switching Valve, BVSV)
MFI	: Multiport Fuel Injection (Multipoint Fuel Injection)	TWC	: Three Way Catalytic Converter (Three Way Catalyst)
Min	: Minimum	2WD	: 2 Wheel Drive
MIL	: Malfunction Indicator Lamp (“CHECK ENGINE” Light)	V	
M/T	: Manual Transmission	VIN	: Vehicle Identification Number
N		VSS	: Vehicle Speed Sensor
NOx	: Nitrogen Oxides	W	
O		WU-OC	: Warm Up Oxidation Catalytic Converter
OBD	: On-Board Diagnostic System (Self-Diagnosis Function)	WU-TWC	: Warm Up Three-Way Catalytic Converter
O/D	: Overdrive		
OHC	: Over Head Camshaft		
O2S	: Oxygen Sensor		
P			
PNP	: Park/Neutral Position		
P/S	: Power Steering		
PSP Switch	: Power Steering Pressure Switch (P/S Pressure Switch)		
PCV	: Positive Crankcase Ventilation		
R			
RH	: Right Hand		
S			
SAE	: Society of Automotive Engineers		
SDM	: Sensing and Diagnostic Module		
SFI	: Sequential Multiport Fuel Injection		
SIR	: Supplemental Inflatable Restraint		
SOHC	: Single Over Head Camshaft		

METRIC INFORMATION

METRIC FASTENERS

Most of the fasteners used for this vehicle are metric. When replacing any fasteners, it is most important that replacement fasteners be the correct diameter, thread pitch and strength.

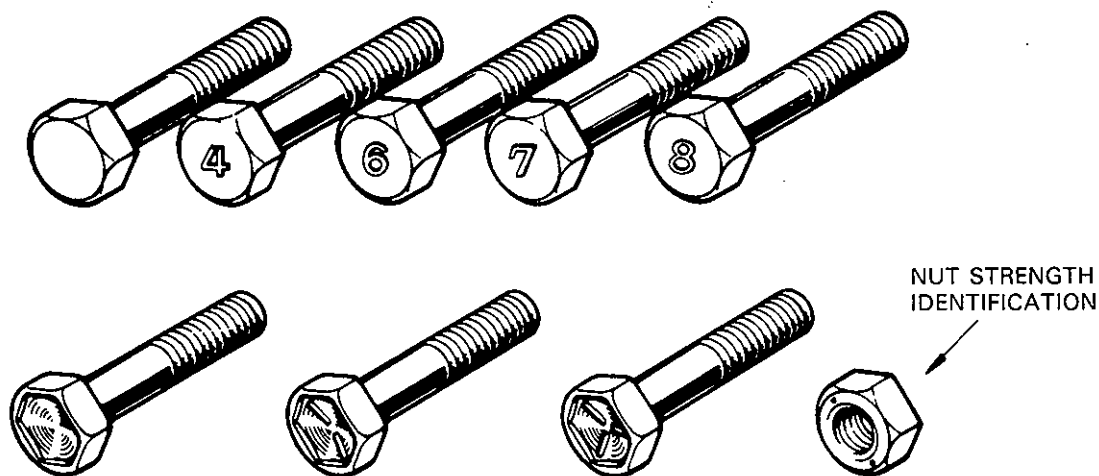
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FASTENER STRENGTH IDENTIFICATION

Most commonly used metric fastener strength property classes are 4T, 7T and radial line with the class identification embossed on the head of each bolt. Some metric nuts will be marked with punch mark strength identification on the nut face. Figure shows the different strength markings.

When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct size. Correct replacement bolts and nuts are available through the parts division.

64B40-0A-8-2



METRIC BOLTS—IDENTIFICATION CLASS NUMBERS OR MARKS CORRESPOND TO BOLT STRENGTH—INCREASING NUMBERS REPRESENT INCREASING STRENGTH.

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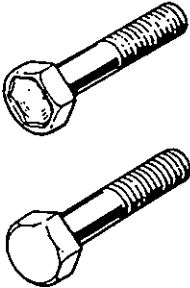
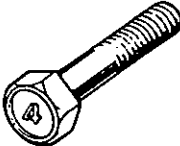
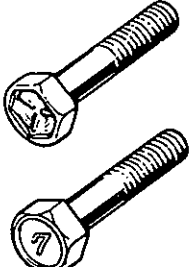
STANDARD TIGHTENING TORQUE

Each fastener should be tightened to the torque specified in each section of this manual. If no description or specification is provided, refer to the following tightening torque chart for the applicable torque for each fastener. When a fastener of greater strength than the original one is used, however, use the torque specified for the original fastener.

NOTE:

- For the flanged bolt and nut, add 10% to the tightening torque given in the chart below.
- The chart below is applicable only where the fastened parts are made of steel light alloy.

Tightening torque chart

STRENGTH THREAD DIAMETER (mm)	 Conventional bolt			 "4T" bolt			 "7T" bolt		
	N·m	kg·m	lb·ft	N·m	kg·m	lb·ft	N·m	kg·m	lb·ft
4	1.5	0.15	1.0				2.3	0.23	2.0
5	3.0	0.30	2.5				4.5	0.45	3.5
6	5.5	0.55	4.0				10	1.0	7.5
8	13	1.3	9.5				23	2.3	17.0
10	29	2.9	21.0				50	5.0	36.5
12	45	4.5	32.5				85	8.5	61.5
14	65	6.5	47.0				135	13.5	98.0
16	105	10.5	76.0				210	21	152.0
18	160	16	116.0				240	24	174.0

SECTION 0B

0B

MAINTENANCE AND LUBRICATION

CONTENTS

MAINTENANCE SCHEDULE 0B- 2

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MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE UNDER NORMAL DRIVING CONDITIONS

Interval: This interval should be judged by odometer reading or months, whichever comes first.		This table includes services as scheduled up to 80,000 km (48,000 miles) mileage. Beyond 80,000 km (48,000 miles), carry out the same services at the same intervals respectively.								
		km (x 1,000)	10	20	30	40	50	60	70	80
		miles (x 1,000)	6	12	18	24	30	36	42	48
		Months	6	12	18	24	30	36	42	48
ENGINE										
1-1. Drive belt (tension, damage)		–	–	–	I	–	–	–	R	
1-2. Engine oil (API Grade SE, SF, SG or SH) and oil filter		Replace every 10,000 km, 6,000 miles or 6 months								
1-3. Engine coolant		–	–	–	R	–	–	–	R	
1-4. Cooling system hoses and connections		–	–	–	I	–	–	–	I	
1-5. Exhaust pipes and mountings (except catalyst)		–	–	–	I	–	–	–	I&(R)	
IGNITION SYSTEM										
2-1. Spark plugs	When unleaded fuel is used	–	–	–	–	R	–	–	–	
	When leaded fuel is used, refer to "Severe Driving Condition" schedule									
FUEL SYSTEM										
3-1. Air cleaner filter element		I	I	I	R	I	I	I	R	
3-2. Fuel tank cap, fuel lines and connections		–	–	–	I	–	–	–	I&(R)	
3-3. Fuel filter	For vehicle with heated oxygen sensor	–	–	–	**R	–	–	–	R	
	For vehicle without heated oxygen sensor	–	–	–	R	–	–	–	R	
EMISSION CONTROL SYSTEM										
4-1. Heated oxygen sensor		Replace every 80,000 km or 60 months								
4-2. PCV valve		Inspect every 80,000 km or 60 months								
4-3. Fuel vapor storage (Evaporative Emission control) system		Inspect every 80,000 km or 60 months								
ELECTRICAL SYSTEM										
5-1. Wiring harness connections and headlights		–	–	–	I	–	–	–	I	

NOTES:

"R" : Replace or change

"I" : Inspect and correct or replace if necessary

- Item 1-5 (R) is applicable to exhaust mounting rubber only.
- Item 3-2 (R) is applicable to fuel tank cap only.
- Item 3-3 **R is recommended maintenance item.
- For Sweden, item 4-1, 4-2 and 4-3 should be performed by odometer reading only.

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services as scheduled up to 80,000 km (48,000 miles) mileage. Beyond 80,000 km (48,000 miles), carry out the same services at the same intervals respectively.								
	km (x 1,000)	10	20	30	40	50	60	70	80
	miles (x 1,000)	6	12	18	24	30	36	42	48
	Months	6	12	18	24	30	36	42	48
CHASSIS AND BODY									
6- 1. Clutch (pedal and fluid level)		–	I	–	I	–	I	–	I
6- 2. Brake discs and pads (front) Brake drums and shoes (rear)		–	I	–	I	–	I	–	I
6- 3. Brake hoses and pipes		–	I	–	I	–	I	–	I
6- 4. Brake fluid		–	I	–	R	–	I	–	R
6- 5. Brake pedal		–	I	–	I	–	I	–	I
6- 6. Brake lever and cable		–	I	–	I	–	I	–	I
6- 7. Tires		I	I	I	I	I	I	I	I
6- 8. Wheel discs and free wheeling hubs (if equipped)		I	I	I	I	I	I	I	I
6- 9. Wheel bearings		–	I	–	*I	–	I	–	*I
6-10. Suspension system		*I	I	–	I	–	I	–	I
6-11. Propeller shafts		–	I	–	I	–	I	–	I
6-12. Manual transmission oil		I	I	I	R	I	I	I	R
6-13. Automatic transmission	Fluid level	I	I	I	I	I	I	I	I
	Fluid change	Replace every 160,000 km (100,000 miles)							
	Fluid hose	–	–	–	–	–	R	–	–
6-14. Transfer and differential oil		I	I	I	R	I	I	I	R
6-15. Steering system		I	I	I	I	I	I	I	I
6-16. Power steering (if equipped)		I	I	I	I	I	I	I	I
6-17. Door hinges		L	L	L	L	L	L	L	L

NOTES:

"R" : Replace or change

"I" : Inspect and correct or replace if necessary

"L" : Lubricate

"T" : Tighten to the specified torque

- Item 6-9 *I is applicable to not only rattled wear but also their grease.
- Item 6-10 *I should be performed at 10,000 km only.

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as given in the chart below.

Severe condition code

A – Towing a trailer

B – Repeated short trips

C – Driving on rough and/or muddy roads

D – Driving on dusty roads

E – Driving in extremely cold weather and/or salted roads

F – Repeated short trips in extremely cold weather

G – Leaded fuel use

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
— — C D — —	Drive belt	I	Every 12,000 miles (20,000 km) or 12 months
		R	Every 24,000 miles (40,000 km) or 24 months
A — — D E F	Engine oil and oil filter	R	Every 3,000 miles (5,000 km) or 3 months
A B C — E —	Exhaust pipes and mountings	I	Every 6,000 miles (10,000 km) or 6 months
— — — D — —	Air cleaner filter element *1	I	Every 1,500 miles (2,500 km)
		R	Every 12,000 miles (20,000 km) or 12 months
A B C D — F G	Spark plugs	R	Every 6,000 miles (10,000 km) or 6 months
A B C D — —	Brake discs and pads (Front) Brake drums and shoes (Rear)	I	Every 6,000 miles (10,000 km) or 6 months
A B C — E —	Propeller shafts	I	Every 6,000 miles (10,000 km) or 6 months
A — C — — F	Manual transmission, transfer and differential oil	R	Every 12,000 miles (20,000 km) or 12 months
A — C — — F	Automatic transmission fluid	R	Every 12,000 miles (20,000 km) or 12 months
— — C — — —	Drive axle shaft boots	I	Every 6,000 miles (10,000 km) or 6 months
— — C — — —	Bolts and nuts on chassis	T	Every 6,000 miles (10,000 km) or 6 months

NOTES:

"I" : Inspect and correct or replace if necessary "T": Tighten to the specified torque

"R" : Replace or change

● *1: Inspect or replace more frequently if the vehicle is used under dusty conditions.

MAINTENANCE SERVICE

ENGINE

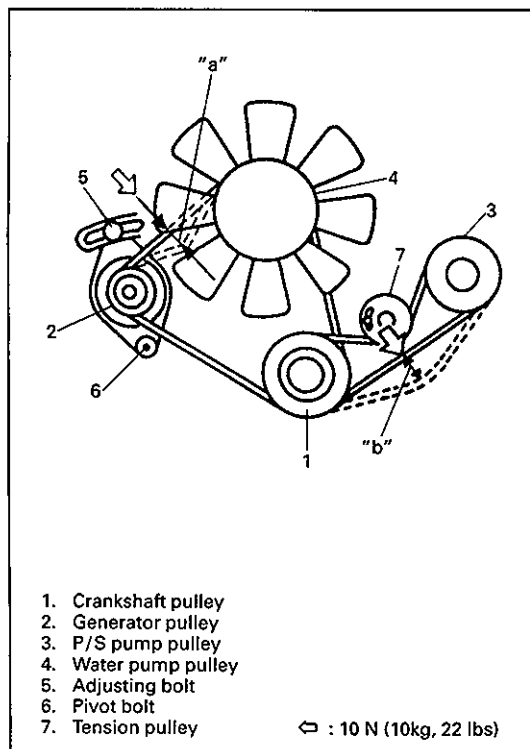
ITEM 1-1

Drive Belt Inspection and Replacement

WARNING:

All inspection and replacement are to be performed with ENGINE NOT RUNNING.

85F00-0B-5-1



[Inspection]

- 1) Disconnect negative cable at battery.
- 2) Inspect belt(s) for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace. Check each belt tension by measuring how much it deflects when pushed at intermediate point between pulleys with about 10 N (10 kg, 22 lb) force.

Belt Deflection

For Water Pump Belt

"a": 6 – 8 mm (0.24 – 0.31 in.)

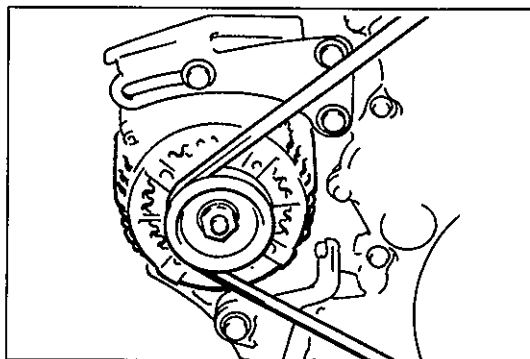
NOTE:

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

For P/S Pump Belt

"b": 6 – 9 mm (0.24 – 0.35 in.)

85F00-0B-5-2



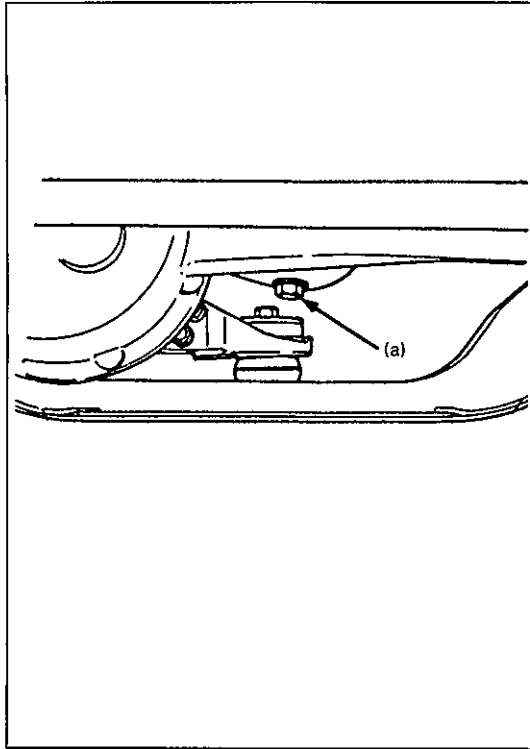
- 3) If the belt is too tight or too loose, adjust it to specification by adjusting generator position or tension pulley position.
- 4) Tighten generator adjusting bolt and pivot bolts or tension pulley bolts.
- 5) Connect negative cable at battery.

85F00-0B-5-4

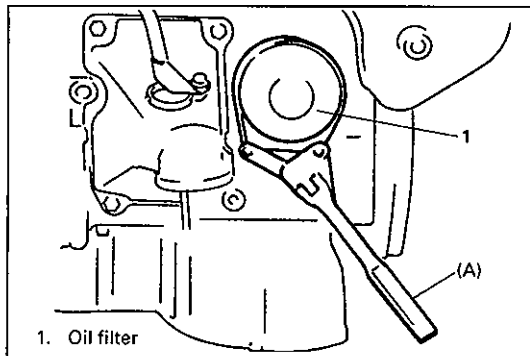
[Replacement]

- 1) Disconnect negative cable at battery.
- 2) Loosen P/S pump (A/C compressor) drive belt adjusting bolt and then remove the belt.
- 3) Loosen generator adjusting bolt and pivot bolts.
- 4) Replace water pump belt.
- 5) Adjust belt tension to specification and tighten generator adjusting bolt and pivot bolts.
- 6) Replace P/S pump (A/C compressor) drive belt.
For adjustment of P/S pump (A/C compressor) drive belt tension, refer to SECTION 3B3 of this manual.

85F00-0B-5-5



85F00-0B-6-1



85F00-0B-6-3

ITEM 1-2**Engine Oil and Filter Change**

Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before proceeding to the following work.

- 1) Drain engine oil by removing drain plug.
- 2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

Tightening Torque

(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

- 3) Loosen oil filter by using oil filter wrench (special tool)

Special Tool

(A): 09915-47310

NOTE:

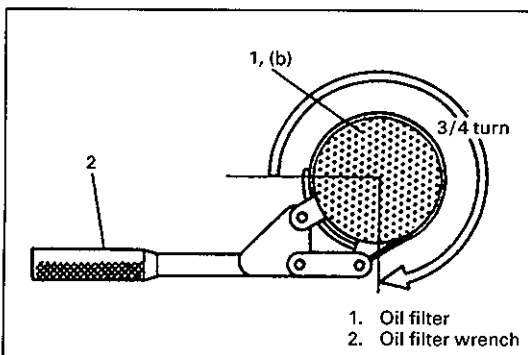
Before fitting new oil filter, be sure to oil its O-ring. Use engine oil for this purpose.

- 4) Screw new filter on oil filter stand by hand until the filter O-ring contacts the mounting surface.

CAUTION:

To tighten oil filter properly, it is important to accurately identify the position at which at filter O-ring first contacts the mounting surface.

85F00-0B-6-4



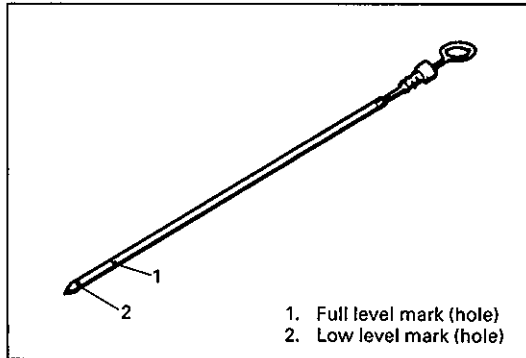
85F00-0B-6-5

- 5) Tighten the filter 3/4 turn from the point of contact with the mounting surface using an oil filter wrench.

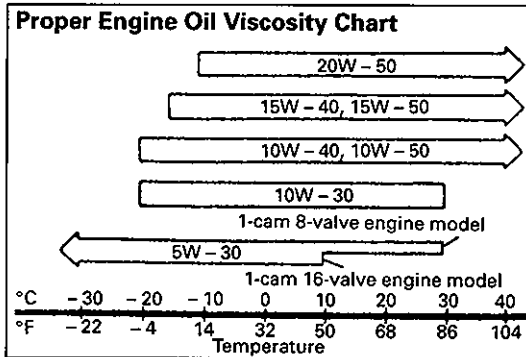
Tightening Torque

(b): 14 N·m (1.4 kg-m, 10.5 lb-ft)

- 6) Replenish oil until oil level is brought to FULL level mark on dipstick. (about 5.5 liters or 11.6/9.7 US/Imp pt.). The filler inlet is atop the cylinder head cover.



85F00-0B-7-1



85F00-0B-7-2

Oil pan capacity	about 5.0 liters (10.6/8.8 US/Imp pt.)
Oil filter capacity	about 0.5 liters (1.1/0.9 US/Imp pt.)
Others	about 0.6 liters (1.3/1.0 US/Imp pt.)
Total	about 6.1 liters (12.9/10.7 US/Imp pt.)

85F00-0B-7-3

- Start engine and run it for three minutes. Stop it and wait another three minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

NOTE:

Step 1) – 6) outlined above must be performed with **ENGINE NOT RUNNING**. For step 7), be sure to have adequate ventilation while engine is running.

It is recommended to use engine oil of SE, SF, SG or SH grade.

NOTE:

For temperature between -20°C (-4°F) and 30°C (86°F), it is highly recommended to use SAE 10W – 30 oil.

NOTE:

Engine oil capacity is specified.

However, note that the amount of oil required when actually changing oil may somewhat differ from the data in the table depending on various conditions (temperature, viscosity, etc.)

- Check oil filter and drain plug for oil leakage.

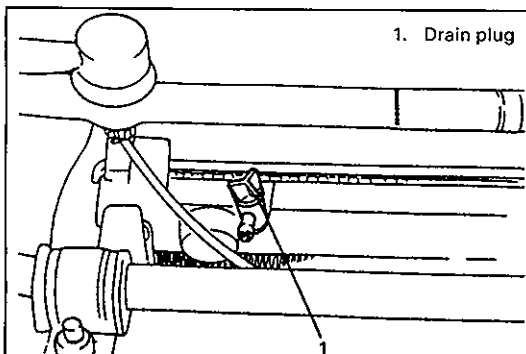
ITEM 1-3

Engine Coolant Change

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.

85F00-0B-7-4

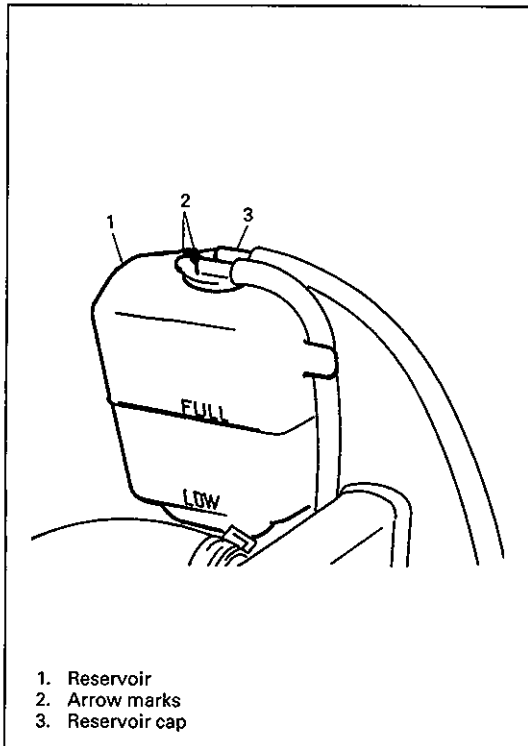


85F00-0B-7-5

- Remove radiator cap when engine is cool.
- Loosen radiator drain plug to drain coolant.
- Remove reservoir, which is on the side of radiator, and drain.
- Tighten plug securely. Also reinstall reservoir.

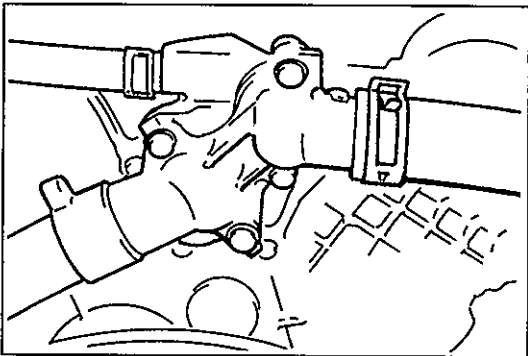
- 5) Fill radiator with specified amount of coolant, and run engine for 2 or 3 minutes at idle. This drives out any air which may still be trapped within cooling system. STOP ENGINE. Add coolant as necessary until coolant level reaches the filler throat of radiator. Reinstall radiator cap.

60A20-0B-9-5



1. Reservoir
2. Arrow marks
3. Reservoir cap

85F00-0B-8-2



85F00-0B-8-4

- 6) Add coolant to reservoir so that its level aligns with Full mark. Then, reinstall cap aligning arrow marks on reservoir and cap.

NOTE:

When installing reservoir cap, align arrow marks on reservoir and cap.

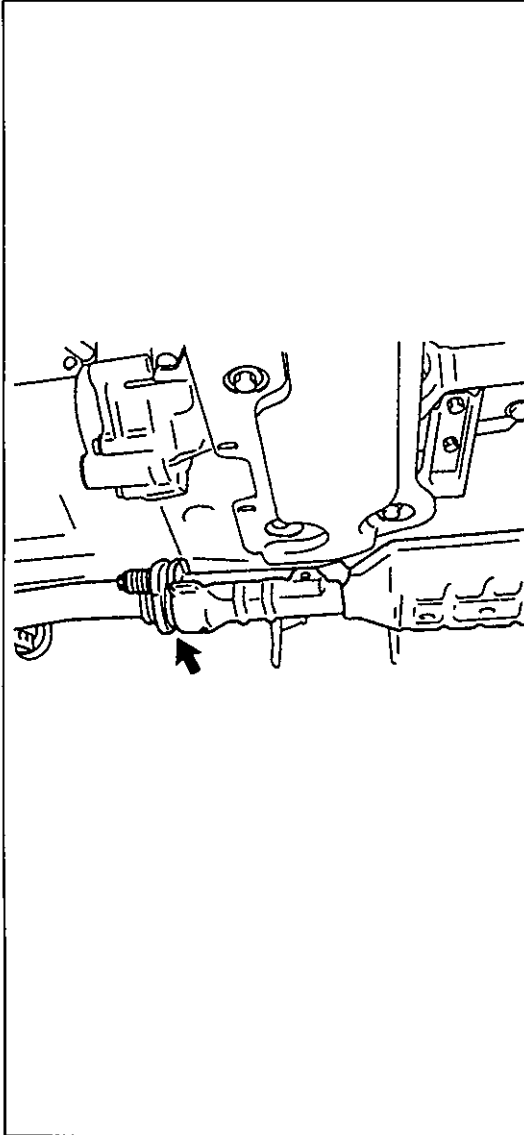
CAUTION:

When changing engine coolant, use mixture of 50% water and 50% ANTIFREEZE / ANTICORROSION COOLANT for the market where ambient temperature falls lower than -16°C (3°F) in winter, and mixture of 70% water and 30% ANTIFREEZE / ANTICORROSION COOLANT for the market where ambient temperature doesn't fall lower than -16°C (3°F).

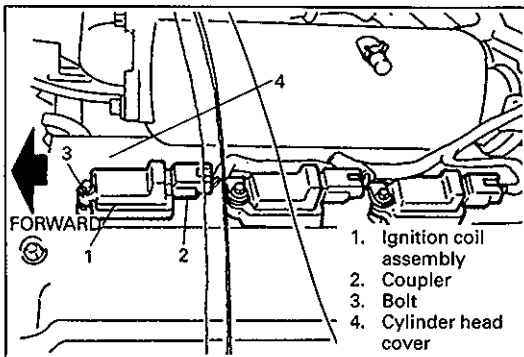
Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ANTIFREEZE / ANTICORROSION COOLANT should be used for the purpose of corrosion protection and lubrication.

ITEM 1-4**Cooling System Hoses and Connections Inspection**

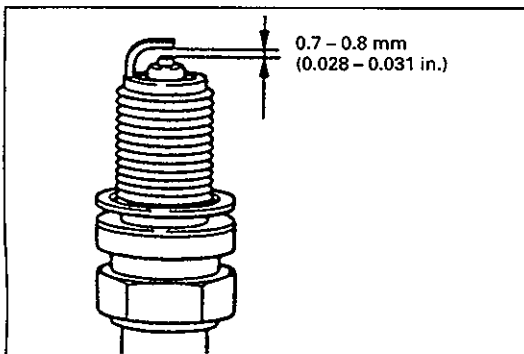
- 1) Visually inspect cooling system hoses for any evidence of leakage and cracks. Examine them for damage, and check connection clamps for tightness.
- 2) Replace all hoses which show evidence of leakage, cracks or other damage. Replace all clamps which cannot maintain proper tightness.



85F00-0B-9-1



85F00-0B-9-4



85F00-0B-9-5

ITEM 1-5

Exhaust Pipes and Mountings Inspection

WARNING:

To avoid danger of being burned, do not touch exhaust system when it is still hot.

Any service on exhaust system should be performed when it is cool.

When carrying out periodic maintenance, or the vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents, and damages.
If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into the vehicle.
- Make sure that exhaust system components have enough clearance from the underbody to avoid overheating and possible damage to the floor carpet.
- Any defects should be fixed at once.

Replace muffler rubber mountings with new ones periodically.

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

- 1) Remove ignition coil cover(s).
- 2) Disconnect ignition coil couplers.
- 3) Remove ignition coil mounting bolts from cylinder head covers.
- 4) Disconnect ignition coil assemblies from spark plugs.
- 5) Using a spark plug wrench, loosen and remove plugs.
- 6) Install new spark plugs.

NOTE:

Make sure to use new plugs of specified heat range and size.

Maker	Type
NGK	BKR6E
Nippondenso	K20PR-U
BOSCH	FR7DC

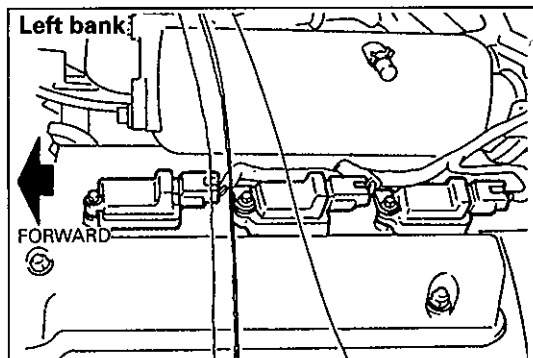
7) Tighten spark plugs to specified torque.

Tightening Torque

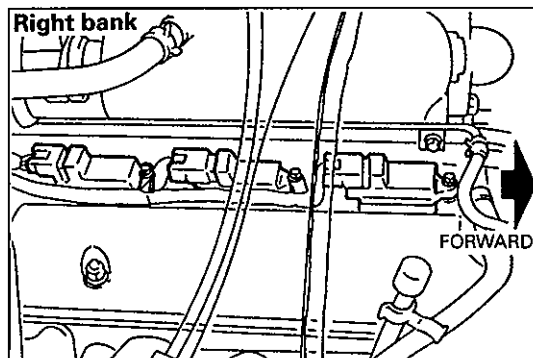
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

8) Connect ignition coil assemblies to spark plugs.

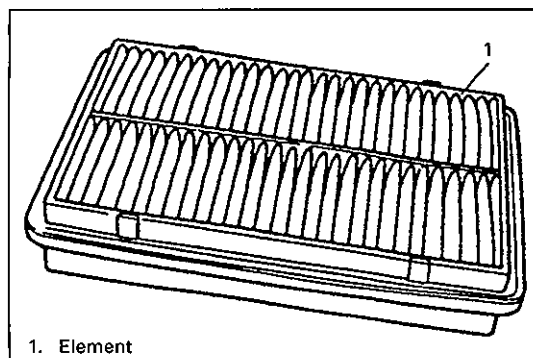
85F00-08-10-1



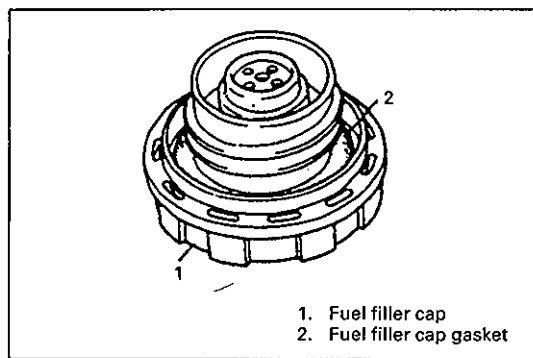
85F00-08-10-2



85F00-08-10-3



85F00-08-10-4



85F00-08-10-5

9) Install ignition coil mounting bolts, harness bracket and harness to cylinder head covers as shown in figure.

10) Connect ignition coil couplers

11) Install ignition coil cover(s).

FUEL SYSTEM

ITEM 3-1

Air Cleaner Element Replacement

- 1) Remove air cleaner cap.
- 2) Take cleaner element out of air cleaner case.
- 3) Install new cleaner element into air cleaner case.
- 4) Install air cleaner cap securely.

ITEM 3-2

Fuel Tank Cap Gasket Inspection and Replacement

Visually inspect gasket of fuel tank cap. If it is damaged or deteriorated, replace fuel filler cap with new one.

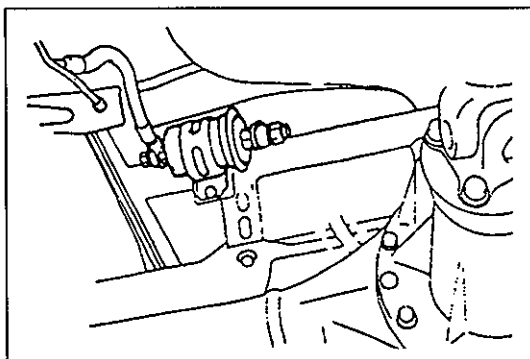
ITEM 3-3

Fuel Filter Replacement

WARNING:

This work must be performed in a well ventilated area and away from any open flames (such as gas hot water heaters).

85F00-0B-11-1



85F00-0B-11-2

Fuel filter is located at the front part of fuel tank, inside the right-hand side of chassis.

Replace fuel filter with new one periodically, referring to SECTION 6C for proper procedure.

EMISSION CONTROL SYSTEM

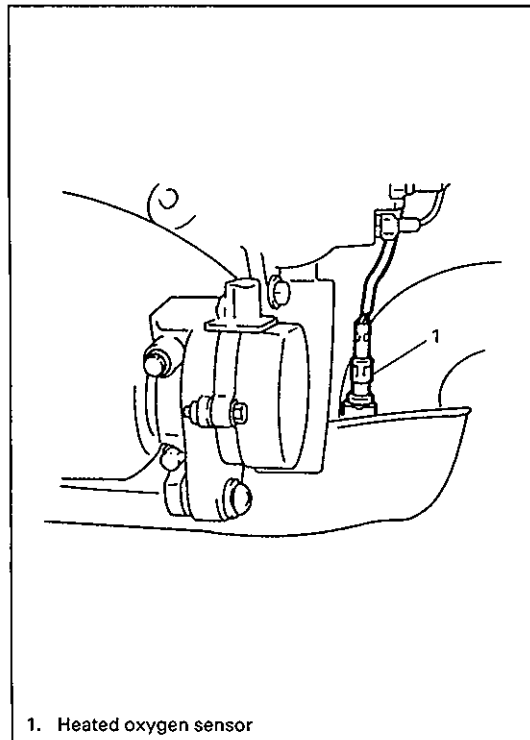
ITEM 4-1

Heated Oxygen Sensor Replacement

WARNING:

To avoid danger of being burned, do not touch exhaust system when it is still hot. This work should be performed when it is cool.

85F00-0B-11-3



1. Heated oxygen sensor

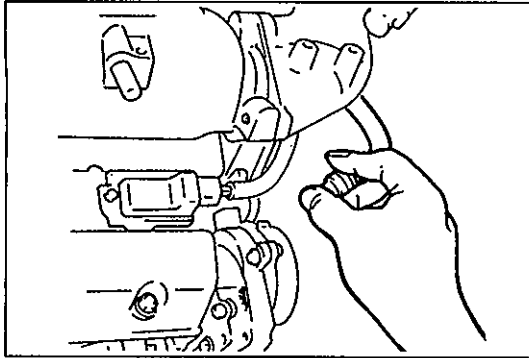
85F00-0B-11-4

- 1) Disconnect negative cable at battery and disconnect left bank and right bank heated oxygen sensor wires at their couplers.
- 2) Remove heated oxygen sensors from exhaust manifolds.
- 3) Install heated oxygen sensors and tighten them to specification.

Tightening Torque

(a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- 4) Connect heated oxygen sensor wires at the couplers securely.
- 5) Connect negative cable at battery.
- 6) Start engine and check for gas leak.

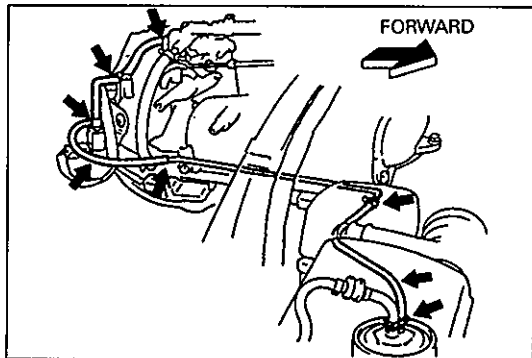


85F00-0B-12-1

ITEM-4-2

PCV (Positive Crankcase Ventilation) Valve Inspection

Check PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to ON VEHICLE SERVICE of SECTION 6J for PCV valve checking procedure.

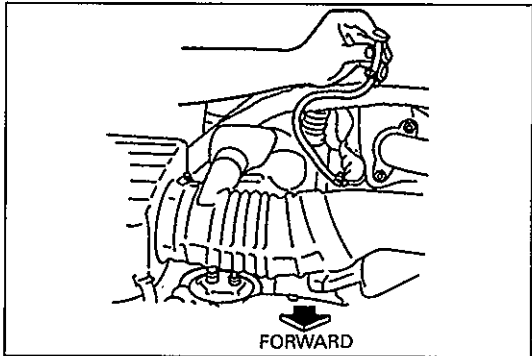


85F00-0B-12-2

ITEM 4-3

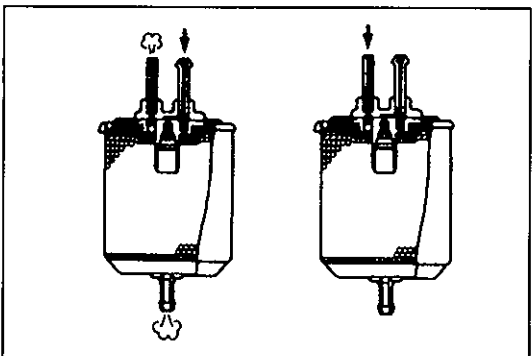
Fuel Vapor Storage System Inspection

1) Visually inspect hoses for cracks, damage, or excessive bends. Inspect all clamps for damage and proper position.



85F00-0B-12-3

2) Check canister purge control system for operation, referring to SECTION 6E2.



85F00-0B-12-4

3) Check charcoal canister for operation and clog, referring to SECTION 6E2.

4) Check 2-way check valve for operation, referring to SECTION 6E2.

ELECTRICAL SYSTEM

ITEM 5-1

Wiring Harness and Connections Inspection

1) Visually inspect all wires in engine compartment for evidence of breakage.

Inspect condition of insulation (cracks). All clips and clamps should have solid connection to wires.

2) Replace any wires in a deteriorated or otherwise defective condition.

CHASSIS AND BODY

ITEM 6-1

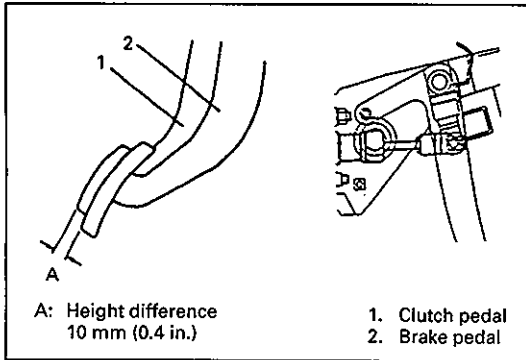
Clutch

Pedal Inspection (M/T)

- 1) Check clutch pedal for height.

With left-hand steering vehicle, clutch pedal height should exceed brake pedal height by 10 mm (0.4 in.).

With right-hand steering wheel vehicle, clutch pedal height should be the same as brake pedal height.

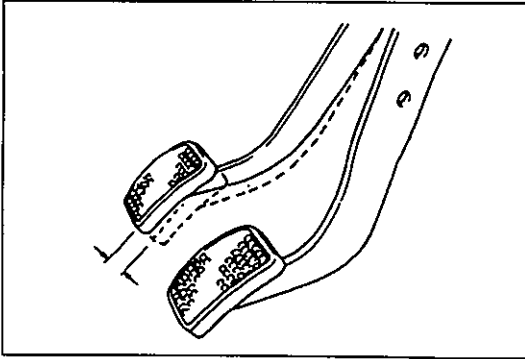


85F00-0B-13-1

- 2) Check clutch pedal for free travel.

Clutch pedal free travel: 15 – 25 mm (0.6 – 1.1 in.)

Refer to "CLUTCH" section for details.



85F00-0B-13-2

Fluid Inspection and Change

Inspection

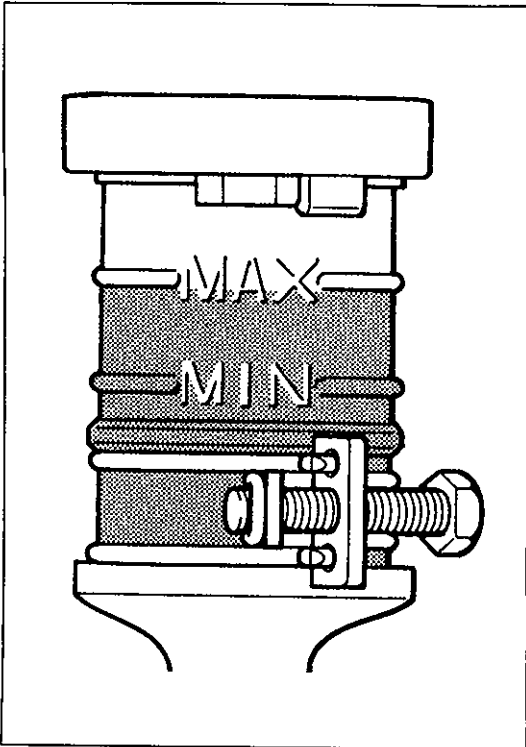
- 1) Check around master cylinder and reservoir for fluid leakage.
If found leaky, correct.
- 2) Check fluid level.
If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid.

Clutch fluid (Brake fluid)	Specification
	DOT 3 or SAE J1703

For the details, refer to ON VEHICLE SERVICE in SECTION 7C1.

CAUTION:

Since clutch system of this vehicle is factory-filled with glycol-base brake fluid, do not use or mix different type of fluid when refilling system; otherwise serious damage will occur. Do not use old or used brake fluid, or one taken from unsealed container.



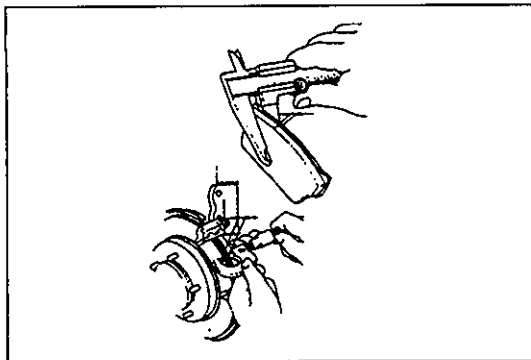
85F00-0B-13-3

Change

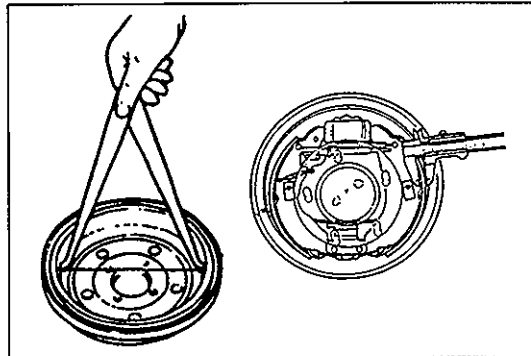
Change brake fluid as follows.

Drain existing fluid from brake system completely, fill system with above recommended fluid and carry out air purge operation.

For air purging procedure, refer to SECTION 7C1.



85F00-0B-14-1



85F00-0B-14-2

ITEM 6-2

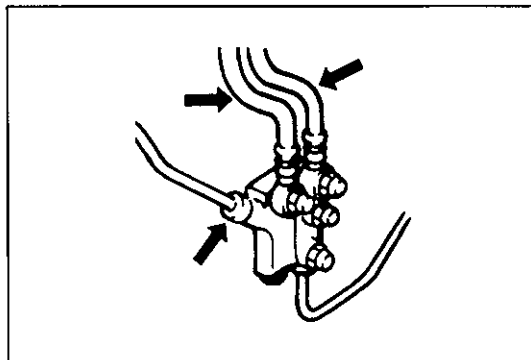
Brake Discs, Pads, Brake Drums and Shoes Inspection

Brake discs and pads

- 1) Remove wheel and caliper but don't disconnect brake hose from caliper.
 - 2) Check front disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For details, refer to SECTION 5.
- Be sure to torque caliper pin bolts to specification.

Brake drums and shoes

- 1) Remove wheel and brake drum.
 - 2) Check rear brake drums and brake linings for excessive wear and damage, while wheels and drums are removed. At the same time, check wheel cylinders for leaks. Replace these parts as necessary.
- For details, refer to SECTION 5.



85F00-0B-15-1

ITEM 6-3

Brake Hoses and Pipes Inspection

Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.

Replace any of these parts as necessary.

CAUTION:

After replacing any brake pipe or hose, be sure to carry out air purge operation.

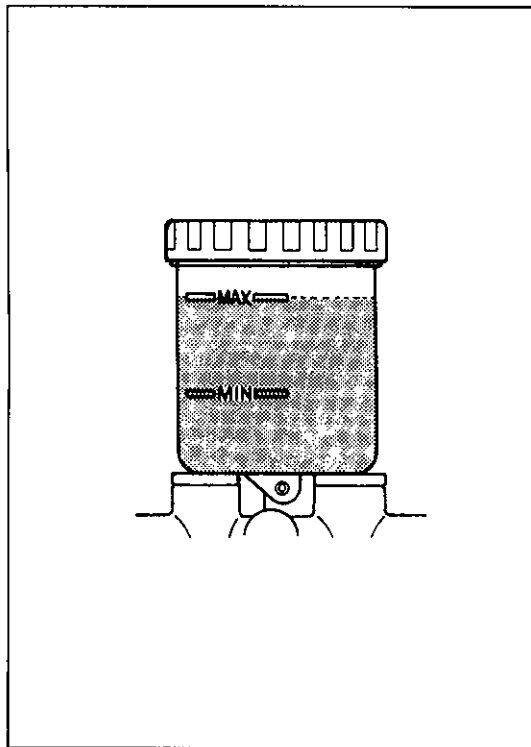
ITEM 6-4

Brake Fluid Inspection and Change

1) Check around master cylinder and reservoir for fluid leakage.

If found leaky, correct.

85F00-0B-15-2



85F00-0B-15-3

2) Check fluid level.

If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid.

Brake fluid	Specification
	DOT 3 or SAE J1703

For the details, refer to ON VEHICLE SERVICE in SECTION 5.

CAUTION:

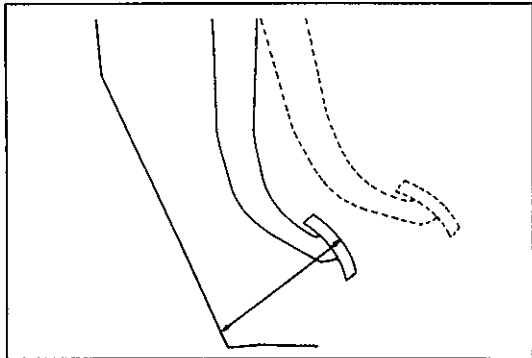
Since brake system of this vehicle is factory-filled with glycol-base brake fluid, do not use or mix different type of fluid when refilling system; otherwise serious damage will occur. Do not use old or used brake fluid, or one taken from unsealed container.

Change

Change brake fluid as follows.

Drain existing fluid from brake system completely, fill system with above recommended fluid and carry out air purge operation.

For air purging procedure, refer to SECTION 5.



85F00-0B-16-1

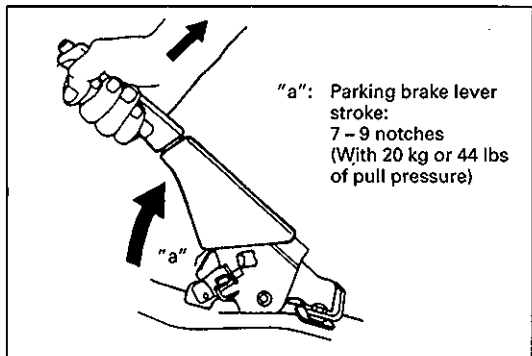
ITEM 6-5

Brake Pedal Inspection

Check brake pedal travel.

Brake pedal-to-wall clearance: Over 80 mm (3.15 in.)

For checking procedure, refer to PEDAL TRAVEL CHECK of SECTION 5.



60A90-0B-26-2S

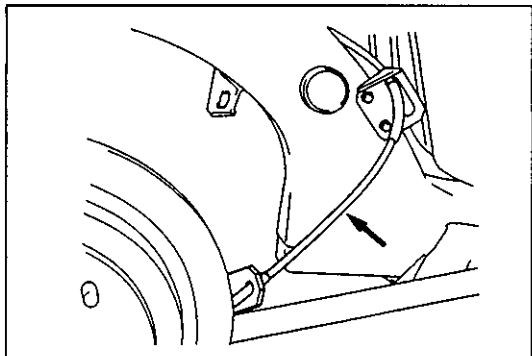
ITEM 6-6

Parking Brake Lever and Cable Inspection

Parking brake lever

- 1) Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
- 2) Check parking brake lever for proper operation and stroke, and adjust it if necessary.

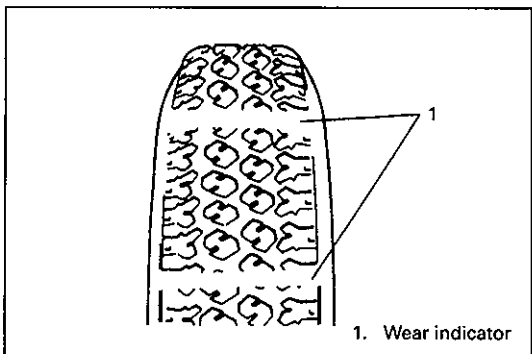
For checking and adjusting procedures, refer to PARKING BRAKE INSPECTION AND ADJUSTMENT of SECTION 5.



60A50-0B-23-2S

Parking brake cable

Inspect brake cable for damage and smooth movement. Replace cable if it is in deteriorated condition.



85F00-0B-16-4

ITEM 6-7

Tire Inspection and Rotation

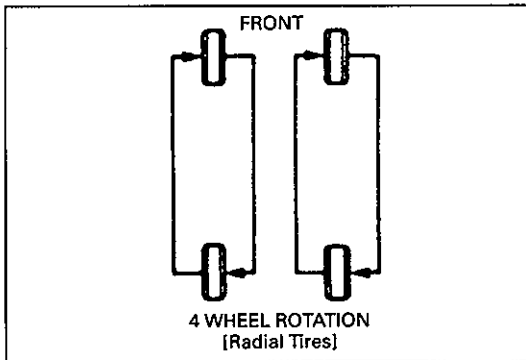
- 1) Check tires for uneven or excessive wear, or damage. If defective, replace.

Refer to SECTION 3 of service manual mentioned in FOREWORD of this manual for details.

- 2) Check inflating pressure of each tire and adjust pressure to specification as necessary. Refer to SECTION 3F for details.

NOTE:

- Tire inflation pressure should be checked when tires are cool.
- Specified tire inflation pressure should be found on tire placard or in owner's manual which came with the vehicle.



60A90-0B-27-1S

3) Rotate tires.

For details, refer to SECTION 3F.

ITEM 6-8

Wheel Discs and Free Wheeling Hubs (if equipped) Inspection

Wheel disc

Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.

85F00-0B-17-2

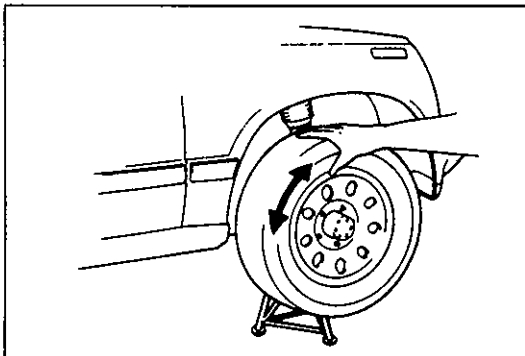
Free wheeling hub

This is applicable to the vehicle equipped with free wheeling hubs.

Check free wheeling hub for proper operation (LOCK and FREE positions). (The same check on both right and left wheels.)

For checking procedure, refer to SECTION 3D.

60A50-0B-24-2S



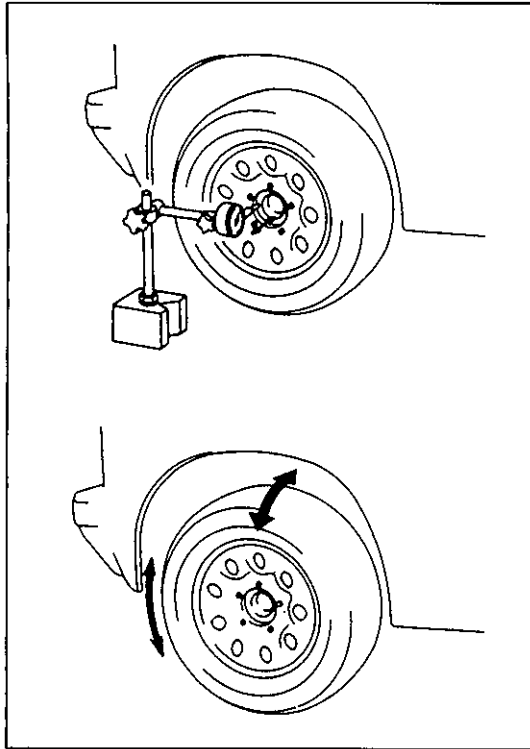
85F00-0B-17-4

ITEM 6-9

Wheel Bearing Inspection

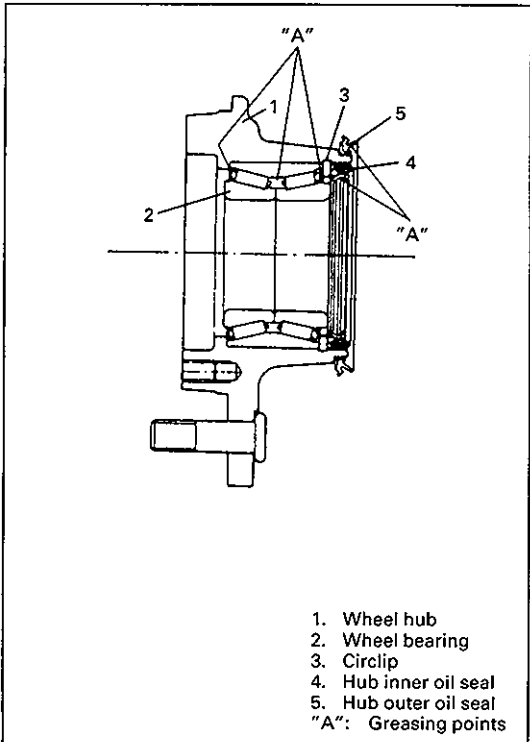
Inspection of wheel bearing

- 1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to FRONT SUSPENSION INSPECTION of SECTION 3D.



85F00-08-18-1

- 2) Check rear wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to WHEEL BEARING INSPECTION of SECTION 3E.



60A90-08-28-3S

Inspection of front wheel bearing grease

- 1) Remove wheel hub referring to FRONT WHEEL HUB REMOVAL of SECTION 3D.
- 2) Check grease around front wheel bearing rollers for deterioration and capacity.
If grease is deteriorated, remove grease thoroughly and apply enough amount of new wheel bearing grease. If grease is found insufficient, add some more.
- 3) For reinstallation, refer to WHEEL HUB INSTALLATION in SECTION 3D.

NOTE:

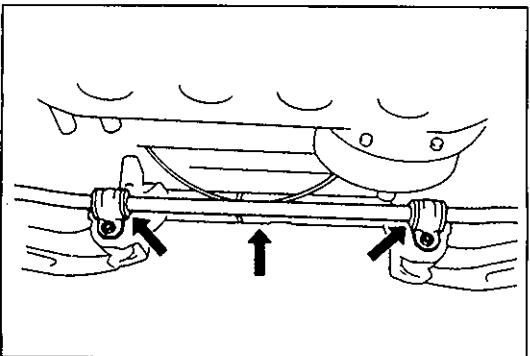
- To reinstall bearing lock nut and lock plate, make sure to torque them to specification.
 - Be sure to tighten each bolt and nut to specified torque when reinstalling them.
- 4) Upon completion of reinstalling all parts, check to make sure that front wheel bearing is not loose and wheel turns smoothly.

ITEM 6-10

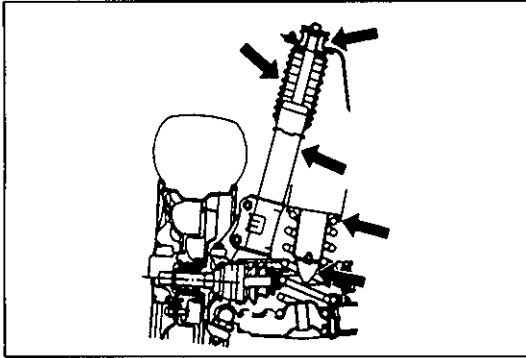
Suspension Inspection

Front

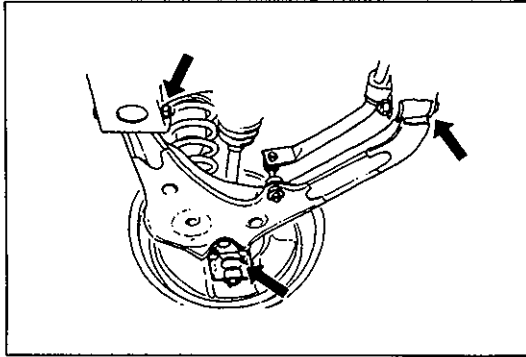
- 1) Check stabilizer bar for damage or deformation.
- 2) Check bushing for damage, wear or deterioration.



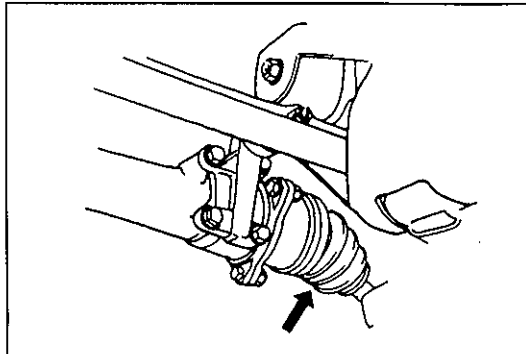
85F00-08-18-5



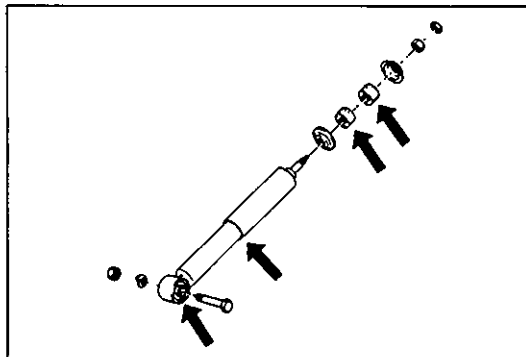
85F00-0B-19-1



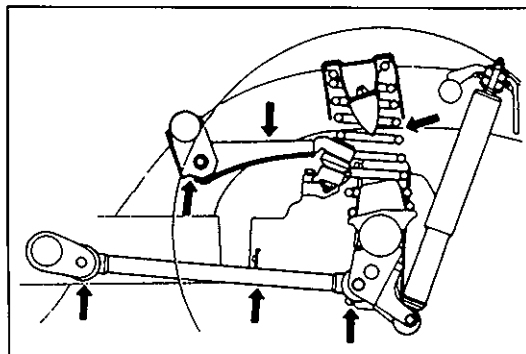
60A90-0B-29-2S



60A90-0B-29-3S



60A90-0B-29-4S



60A90-0B-29-5S

3) Inspect strut for damage, deformation, oil leakage and operation. If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.
Refer to FRONT SUSPENSION INSPECTION of SECTION 3D for operation check.

4) Inspect strut boot for damage or crack.

5) Inspect for cracks or deformation in spring seat.

6) Inspect for deterioration of bump stopper.

7) Inspect strut mount for wear, cracks or deformation.

8) Check ball joint stud dust seal (boot) for leaks, detachment, tear or other damage. Check suspension arm bushing for damage, wear or deterioration.

9) Check drive axle boots (wheel side and differential side) for leaks, detachment, tear or other damage.
Replace boot as necessary.

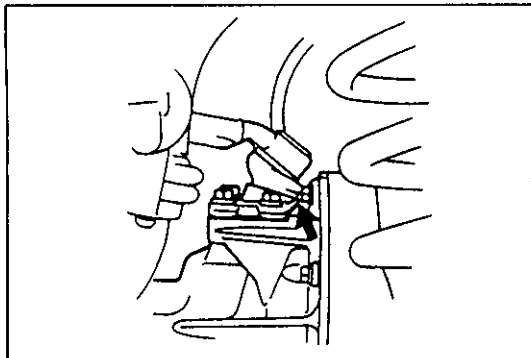
Rear

10) Check shock absorber for damage, deformation, oil leakage and operation.

11) Check bushings for wear and damage.

12) Check coil spring, trailing rod and upper arm for deformation and damage.

13) Check trailing rod and upper arm bushings for wear, damage and deterioration.



60A90-0B-30-1S

14) Check joint boot for breakage and damage.

15) Check other suspension parts for damage, loose or missing parts; also for parts showing signs of wear or lack of lubrication.

Replace any parts found defective in step 1) to 15).

60A90-0B-30-2S

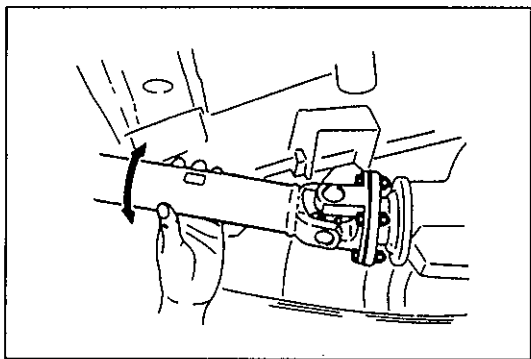
16) Check suspension bolts and nuts for tightness and retighten them as necessary.

Repair or replace defective parts, if any.

NOTE:

For details of check points, refer to tables of **TIGHTENING TORQUE SPECIFICATION** in **SECTION 3D** and **3E**.

60A90-0B-30-3S



85F00-0B-20-4

ITEM 6-11

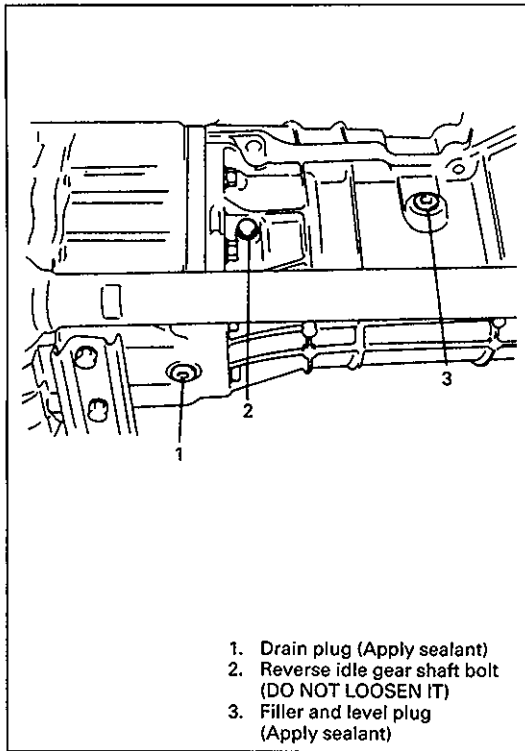
Propeller Shafts Inspection

- 1) Check universal joint and spline of propeller shaft for rattle. If rattle is found, replace defective part with a new one.
- 2) Check propeller shaft (front & rear) flange yoke bolts for tightness, and retighten them as necessary:
Refer to **SECTION 4B** of service manual mentioned in **FOREWORD** of this manual for tightening torque.

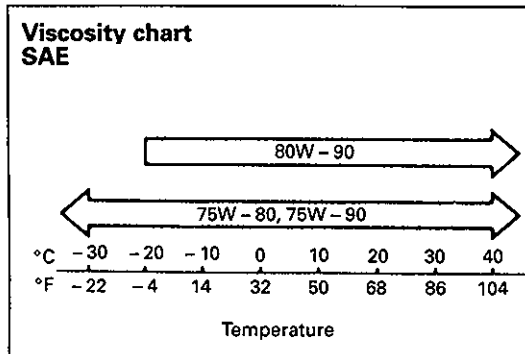
ITEM 6-12 (Manual transmission)

**Transmission Oil Inspection and Change
Inspection**

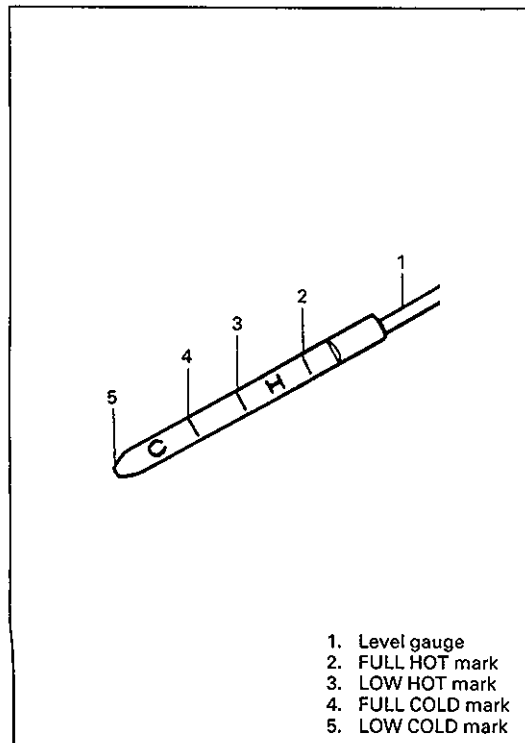
- 1) Inspect transmission case for evidence of oil leakage.
Repair leaky point if any.
- 2) Make sure that vehicle is placed level for oil level check.



60A90-0B-31-1S



60A90-0B-31-3S



85F00-0B-21-4

3) Remove level plug of transmission.

4) Check oil level.

Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.

If oil is found insufficient, pour specified amount of specified oil.

5) Tighten level plug to specified torque.

Refer to SECTION 7A for tightening torque.

Change

- 1) Place vehicle level and drain oil by removing drain plug.
- 2) Tighten drain plug to specified torque. Pour specified amount of specified oil and tighten filler plug to specified torque.

It is highly recommended to use SAE 75W-90 gear oil.

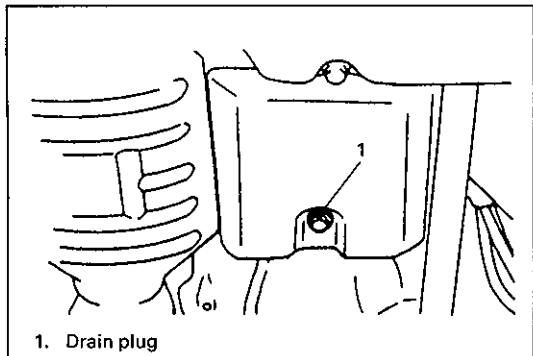
ITEM 6-13

Automatic Transmission

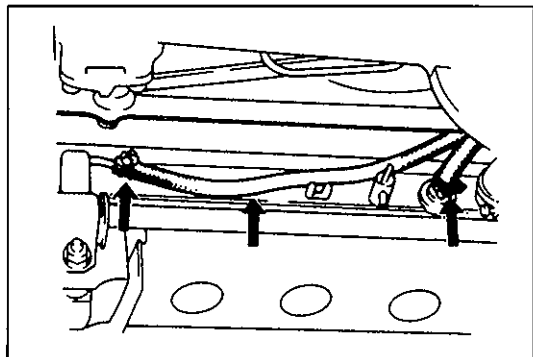
Fluid level inspection

- 1) Inspect transmission case for evidence of fluid leakage.
Repair leaky point, if any.
- 2) Make sure that vehicle is placed level for fluid level check.
- 3) Check fluid level.

For fluid level checking procedure, refer to ON VEHICLE SERVICE in SECTION 7B1 (4 A/T) and be sure to perform it under specified conditions. If fluid level is low, replenish specified fluid.



85F00-0B-22-1



85F00-0B-22-2

Fluid change

- 1) Perform steps 1) and 2) of previous page Fluid Level Inspection.
- 2) Change fluid. For its procedure, refer to ON VEHICLE SERVICE in SECTION 7B1.

CAUTION:

Use of specified fluid is absolutely necessary.

Fluid cooler hose change

Replace inlet and outlet hoses of cooler hose and their clamps. For replacement procedure, refer to ON VEHICLE SERVICE in SECTION 7B1 (4 A/T).

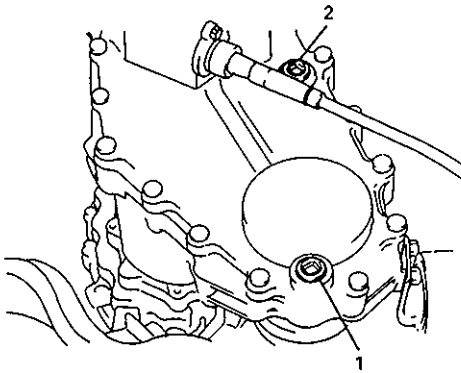
ITEM 6-14

Transfer and Differential Oil Inspection and Change Inspection

- 1) Check transfer case and differential for evidence of oil leakage.
Repair leaky point if any.
- 2) Make sure that vehicle is placed level for oil level check.

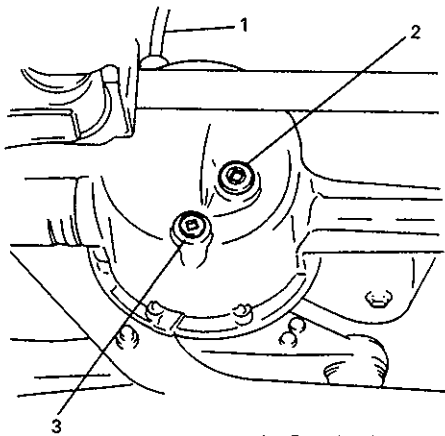
85F00-0B-22-3

Transfer



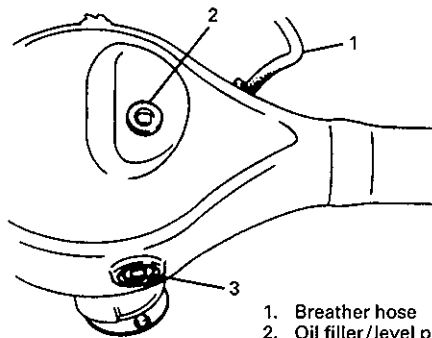
1. Drain plug (Apply sealant)
2. Filler and level plug (Apply sealant)

Front differential



1. Breather hose
2. Oil filler/level plug
3. Front drain plug

Rear differential



1. Breather hose
2. Oil filler/level plug
3. Rear drain plug (Apply sealant)

85F00-0B-23-1

- 3) Remove level plug of transfer and differentials (front and rear) and check oil level.

Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.

If oil is found insufficient, pour specified amount of specified oil.

CAUTION:

Hypoid gear oil must be used for differential.

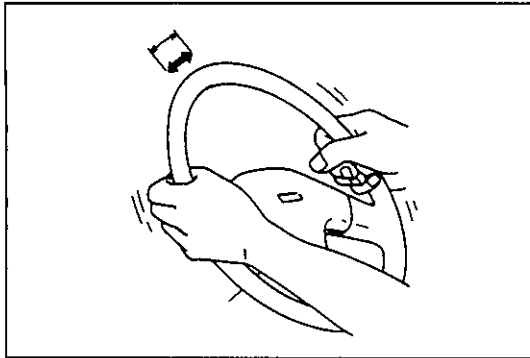
- 4) Tighten level plug to specified torque.
Refer to SECTION 7D or SECTION 7E for tightening torque.

Change

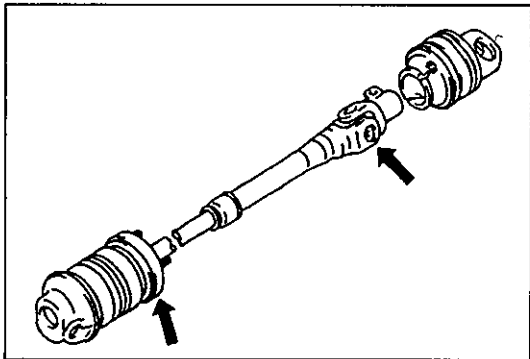
- 1) Place vehicle level and drain oil by removing drain plug.
- 2) Tighten drain plug to specified torque.
- 3) Pour specified amount of specified oil, referring to viscosity chart in item 6-12 and tighten filler plug to specified torque.
For details, refer to SECTION 7D or SECTION 7E.

CAUTION:

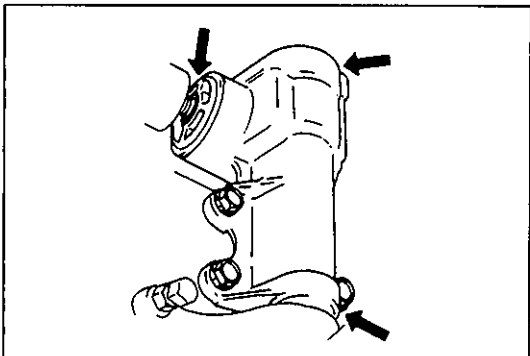
Hypoid gear oil must be used for differential.



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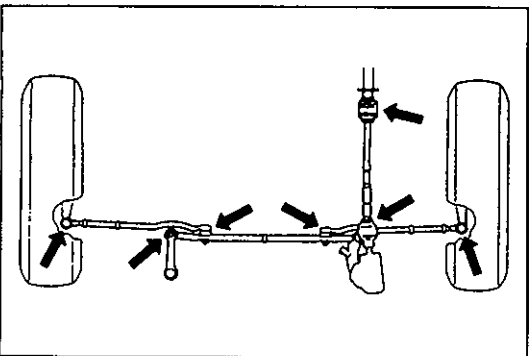


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60A90-0B-34-3S

85F00-0B-24-4



60A90-0B-34-5S

ITEM 6-15

Steering System Inspection

- 1) Check steering wheel for play and rattle, holding vehicle in straight forward condition on the ground.

Steering wheel play: 10 – 30 mm (0.4 – 1.2 in.)

- 2) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.

- 3) Inspect steering gear box for evidence of oil leakage. If leakage is found, check oil level in gear box.

- 4) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any. Refer to table of TIGHTENING TORQUE SPECIFICATION of SECTION 3B3 and 3C2 for particular check points.

NOTE:

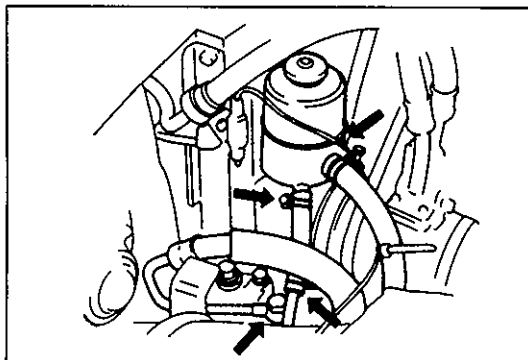
For details of the above steps 1 to 4, refer to SECTION 3B3 and 3C2.

- 5) Check boots of steering linkage for damage (leaks, detachment, tear, etc.). If damage is found, replace defective boot with new one.

- 6) Check wheel alignment.

NOTE:

For details of wheel alignment, refer to WHEEL ALIGNMENT of SECTION 3A.

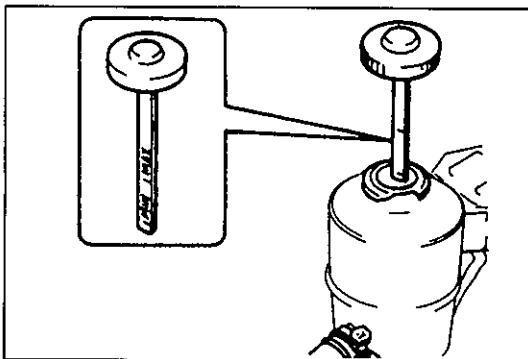


85F00-0B-25-1

ITEM 6-16

Power Steering (P/S) System Inspection (if equipped)

- 1) Visually check power steering system for fluid leakage and hose for damage and deterioration.
Repair or replace defective parts, if any.

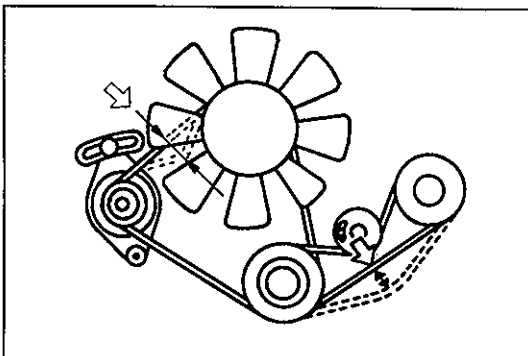


85F00-0B-25-2

- 2) Remove oil tank cap and check fluid level indicated on level gauge, which should be between MAX and MIN marks. If it is lower than MIN, fill fluid up to MAX mark.

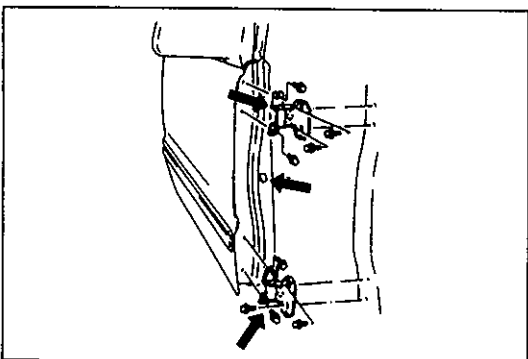
NOTE:

- Be sure to use an equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III for P/S fluid.
- Fluid level should be checked when fluid is cool.



85F00-0B-25-3

- 3) Visually check pump drive belt for cracks and wear.
- 4) Check belt for tension, referring to ITEM 6-1 of "ENGINE".
If necessary, have belt adjusted or replaced.



85F00-0B-25-4

ITEM 6-17

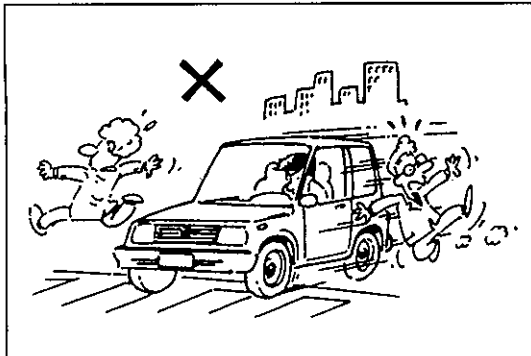
Door Hinges Lubrication

Lubricate door hinges for smooth operation.

FINAL INSPECTION

WARNING:

When carrying out road tests, select a safe place where no man or no running vehicle is seen so as to prevent any accident.

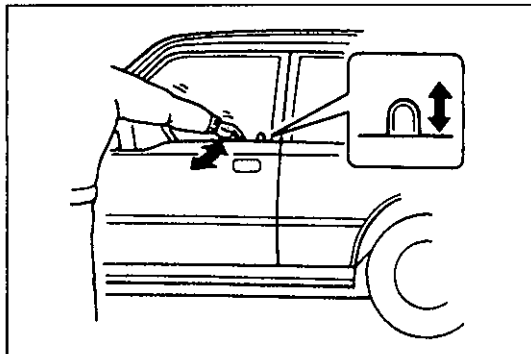


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Engine Hood Latch

Check that hood opens and closes smoothly and properly. Lubricate if necessary. Also check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way.) and hood locks securely when closed.

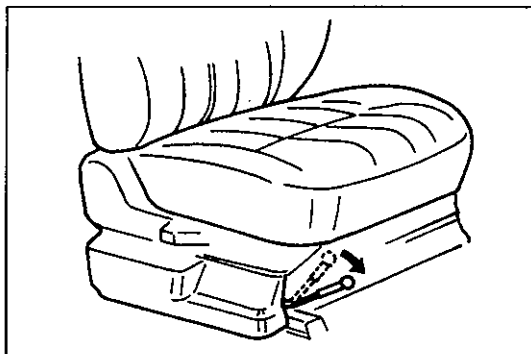
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Doors

Check that each door opens and closes smoothly and locks securely when closed.

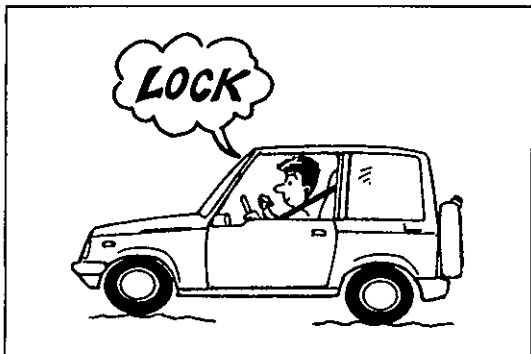
85F00-0B-26-3



Seats

Check that seat slides smoothly and locks securely at any position. Also check that reclining mechanism of front seat back allows it to be locked at any angle.

85F00-0B-26-4



Seat Belt

Inspect belt system, including webbing, buckles, latch plates, retractors and anchors.

Check that seat belt is securely locked.

85F00-0B-26-5

Battery Electrolyte Level Check

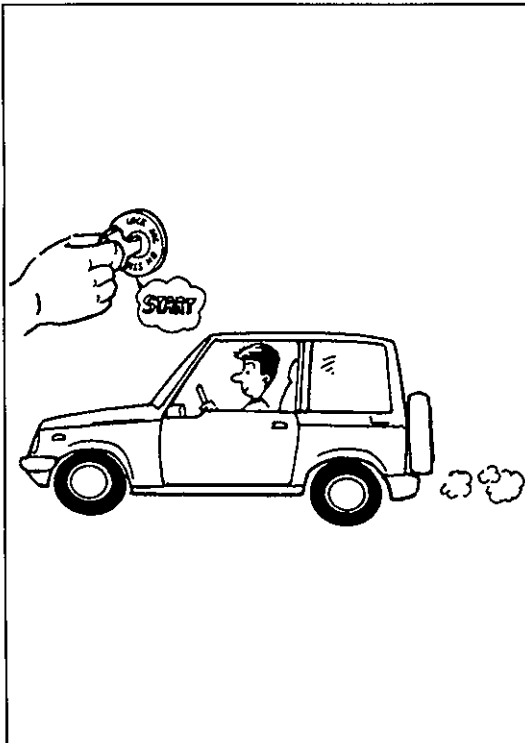
Check that the electrolyte level of all battery cells is between the upper and lower level lines on the case. If battery is equipped with built-in indicator, check battery condition by the indicator.

85F00-0B-27-1

Accelerator Pedal Operation

Check that pedal operates smoothly without getting caught or interfered by any other part.

85F00-0B-27-2

**Engine Start**

Check engine start for readiness.

WARNING:

Before performing the following check, be sure to have enough room around the vehicle. Then, firmly apply both the parking brake and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition promptly. Take these precautions because the vehicle could move without warning and possibly cause personal injury or property damage.

On automatic transmission equipped vehicles, try to start the engine in each gear. The starter should crank only in "P" (Park) or "N" (Neutral).

On manual transmission equipped vehicles, place the shift lever in "Neutral", push the clutch halfway and try to start. The starter should crank only when the clutch is fully depressed.

85F00-0B-27-3

Exhaust System Check

Check for leakage, cracks or loose supports.

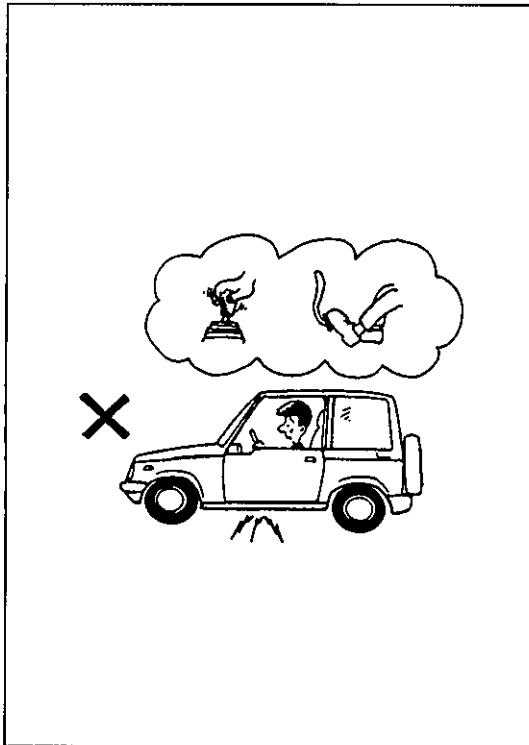
85F00-0B-27-5

Clutch (For Manual transmission)

Check for the following.

- Clutch is completely released when depressing clutch pedal,
- No slipping clutch occurs when releasing pedal and accelerating,
- Clutch itself is free from any abnormal condition.

85F00-0B-28-1

**Gearshift or Selector Lever (Transmission)**

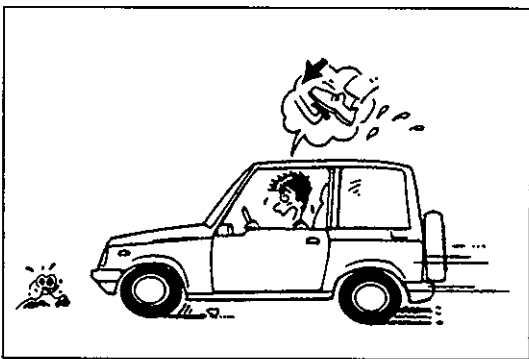
Check gear shift or selector lever for smooth shifting to all positions and for good performance of transmission in any position.

With automatic transmission equipped vehicle, also check that shift indicator indicates properly according to which position selector lever is shifted to.

CAUTION:

With automatic transmission equipped vehicle, make sure that vehicle is at complete stop when shifting selector lever to "P" range position and release all brakes.

85F00-0B-28-2

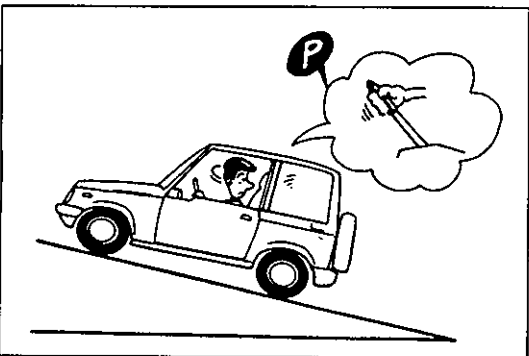
**Brake**

[Foot brake]

Check the following;

- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that braking force is applied equally on all wheels,
- and that brake does not drag.

85F00-0B-28-4



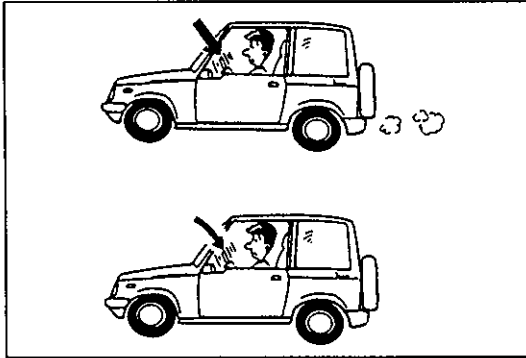
[Parking brake]

Check to ensure that parking brake is fully effective when vehicle is stopped on a slope with brake lever pulled all the way. Check that lever has proper travel.

WARNING:

With vehicle parked on a fairly steep slope, make sure nothing is in the way downhill to avoid any personal injury or property damage. Be prepared to apply regular brake quickly even if vehicle should start to move.

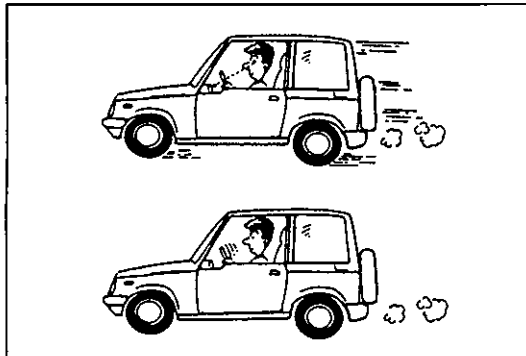
85F00-0B-28-5



60A50-0B-33-3S

Steering

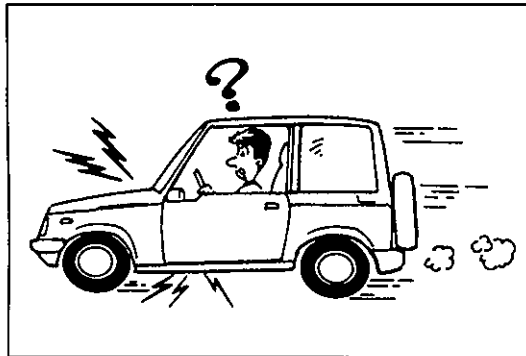
- Check to ensure that steering wheel is free from instability, or abnormally heavy feeling while driving.
- Check that vehicle does not wander or pull to one side.



60A50-0B-33-4S

Engine

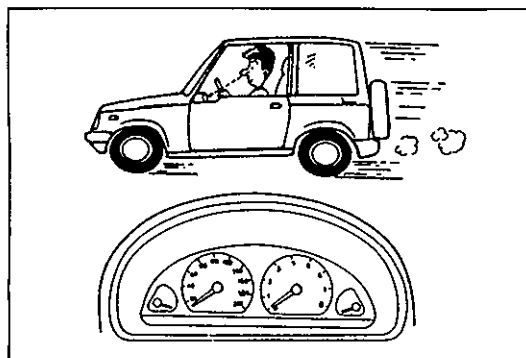
- Check that engine responds readily at all speeds.
- Check that engine is free from abnormal noise and abnormal vibration.



60A50-0B-33-5S

Body, Wheels and Power Transmitting System

Check that body, wheels and power transmitting system are free from abnormal noise and abnormal vibration or any other abnormal condition.



85F00-0B-29-4

Meters and Gauge

Check that speedometer, odometer, fuel meter, temperature gauge, etc. are operating accurately.

Lights

Check that all lights operate properly.

Windshield Defroster

Periodically check that air comes out from defroster outlet when operating heater or air conditioning.

Set fan switch lever to "HI" position for this check.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SE, SF, SG or SH, SAE 10W-30
Engine coolant (Ethylene glycol base coolant)	"Antifreeze/Anticorrosion coolant"
Brake fluid	DOT 3 or SAE J1703
Manual transmission oil	API GL-4, SAE 75W-90 (Refer to p. OB-23)
Transfer oil	
Differential oil (front & rear)	API GL-5, SAE 80W-90 Hypoid gear oil
Automatic transmission fluid and Power steering fluid	An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III
Clutch linkage pivot points	Water resistance chassis grease (SUZUKI SUPER GREASE A 99000-25010)
Gear shift control lever and shaft	Water resistance chassis grease (SUZUKI SUPER GREASE A 99000-25010)
Door hinges	Engine oil
Hood latch assembly	Engine oil
Key lock cylinder	Spray lubricant

SECTION 1A

HEATER AND VENTILATION

1A

NOTE:
For the descriptions (items) not found in this section, refer to SECTION 1A of the Service Manual mentioned in FOREWORD of this manual.

60A50-1A-1-1S

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Heater Blower Motor Switch	1A- 5
Control Cables	1A- 6
Heater Unit	1A- 8
BODY VENTILATION	1A-11

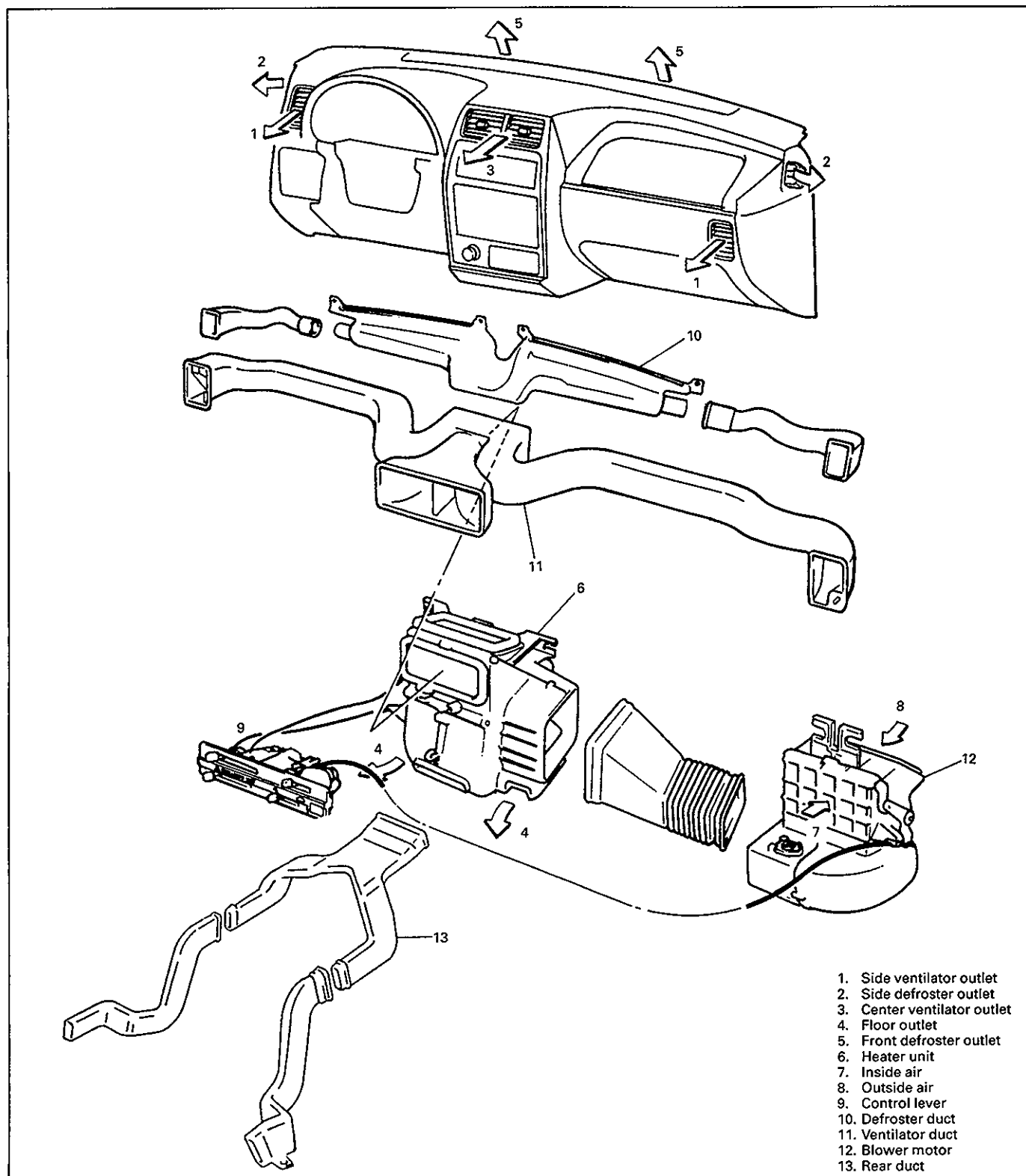
85F00-1A-1-2

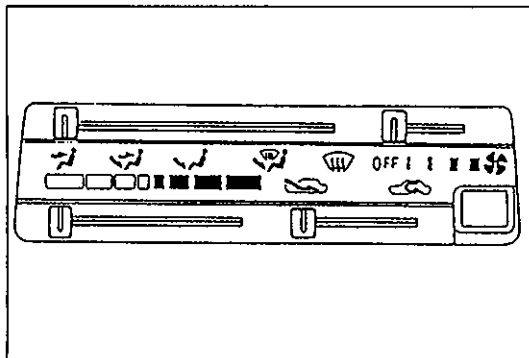
GENERAL DESCRIPTION

HEATER

The heater, an in and out air selectable-type hot water heater, is so constructed that it is possible to assure an agreeable ventilation at all times by providing the ventilator air outlets at the center and both sides (right and left) of the instrument panel, the hot air outlet at a place close to the feet of front passengers, and the defroster air outlets at places, right and left, along the windshield glass.

The heater and ventilation consist of following parts.



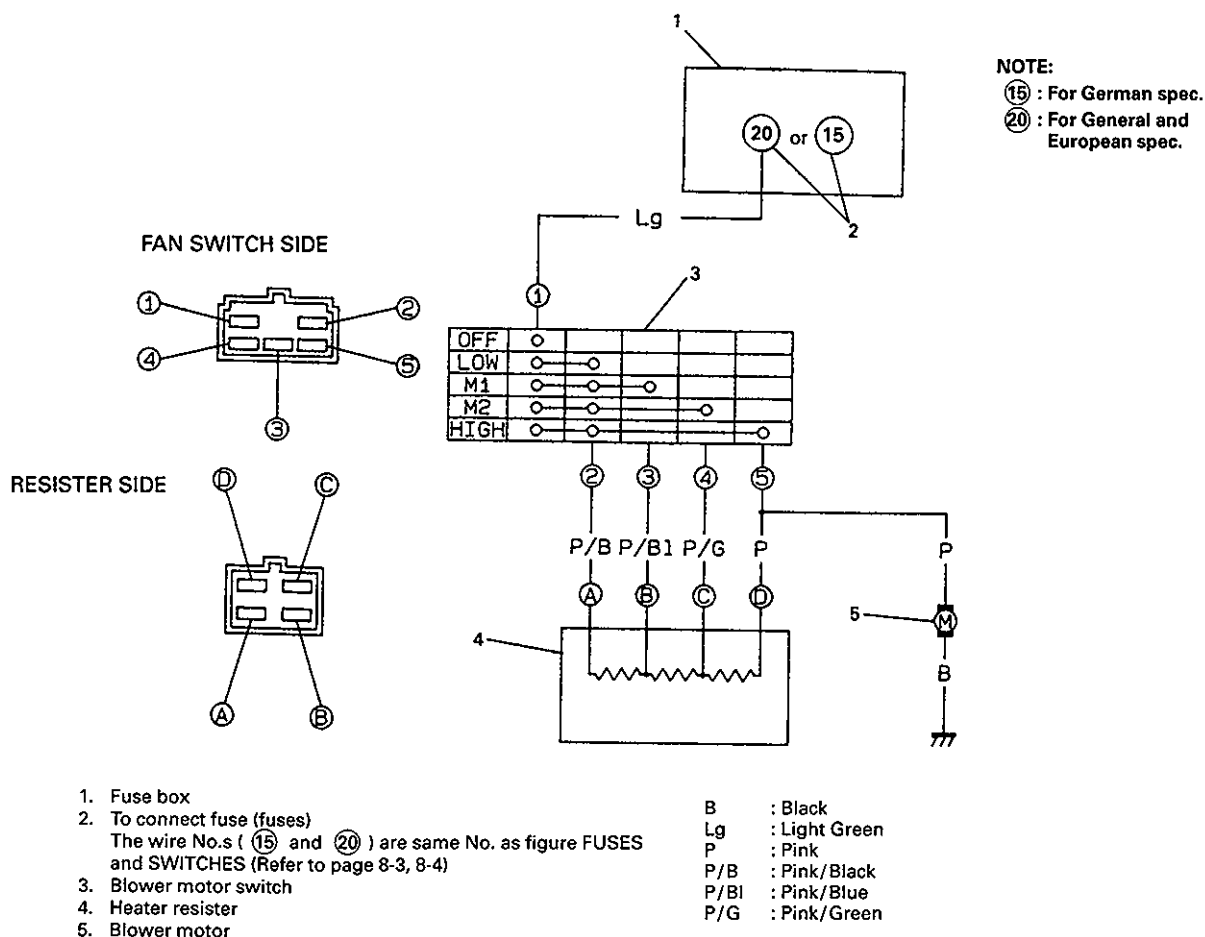


85F00-1A-3-1

HEATER CONTROL OPERATION

For control lever operation, refer to SECTION 1A of Service Manual mentioned in FOREWORD of this manual.

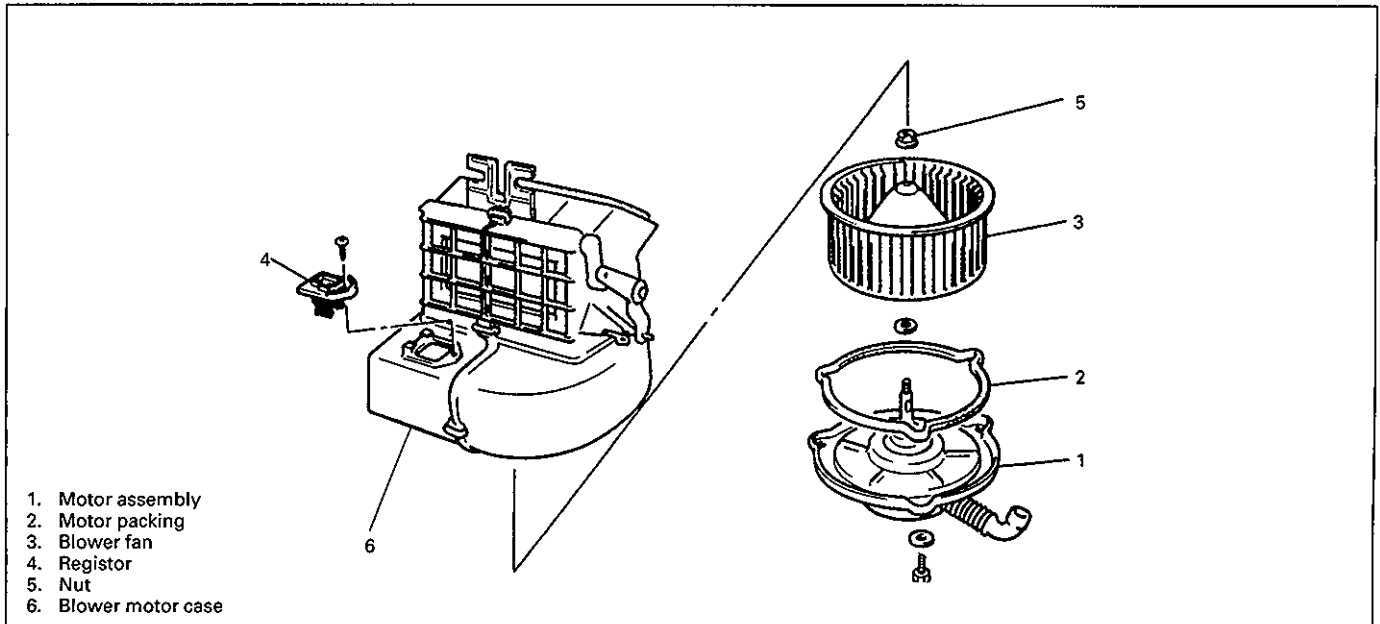
WIRING CIRCUIT



85F00-1A-3-2

ON VEHICLE SERVICE

HEATER BLOWER MOTOR

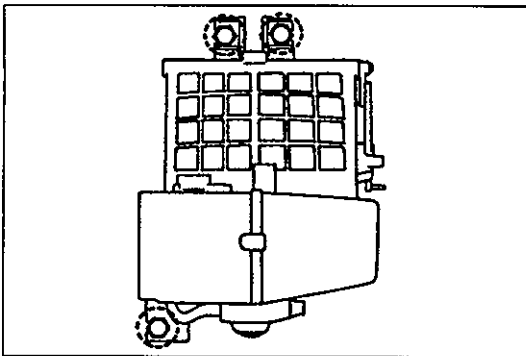


85F00-1A-4-1

REMOVAL

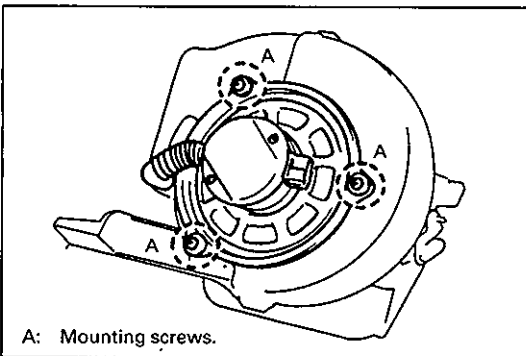
- 1) Disconnect negative (-) cable at battery.
- 2) Remove glove box and glove box holder stay.
- 3) Remove relays and relay bracket from blower motor case.
- 4) Disconnect blower motor and register lead wires at couplers.
- 5) Disconnect fresh air control cable from blower motor case.

85F00-1A-4-3



- 6) Remove blower motor unit.

85F00-1A-4-4

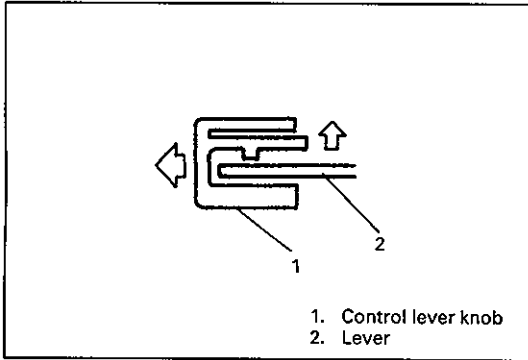


- 7) Remove blower motor.

INSTALLATION

Install in the reverse order of removal

85F00-1A-4-5

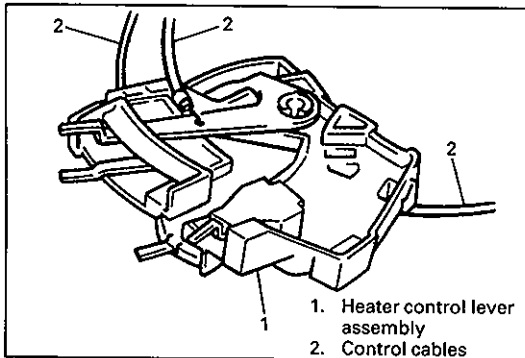


85F00-1A-5-1

HEATER BLOWER MOTOR SWITCH

- 1) Remove control lever knobs.
- 2) Remove heater control lever panel.
- 3) Remove ashtray and center garnish mounting screw.
- 4) Remove center garnish.
- 5) Remove glove box and column hole cover.
- 6) Remove instrument glove box compartment.
- 7) Disconnect control cables from blower motor unit and heater unit.
- 8) Disconnect switch connector.
- 9) Remove heater control lever assembly.

85F00-1A-5-2



85F00-1A-5-3

INSPECTION

Check heater blower motor switch for each terminal-to-terminal continuity.

	Lg	P/B	P/Bl	P/G	P
LOW	○	○			
M1	○	○	○		
M2	○	○		○	
HIGH	○	○			○

Lg : Light green

P/B : Pink/Black

P/Bl : Pink/Blue

P/G : Pink/Green

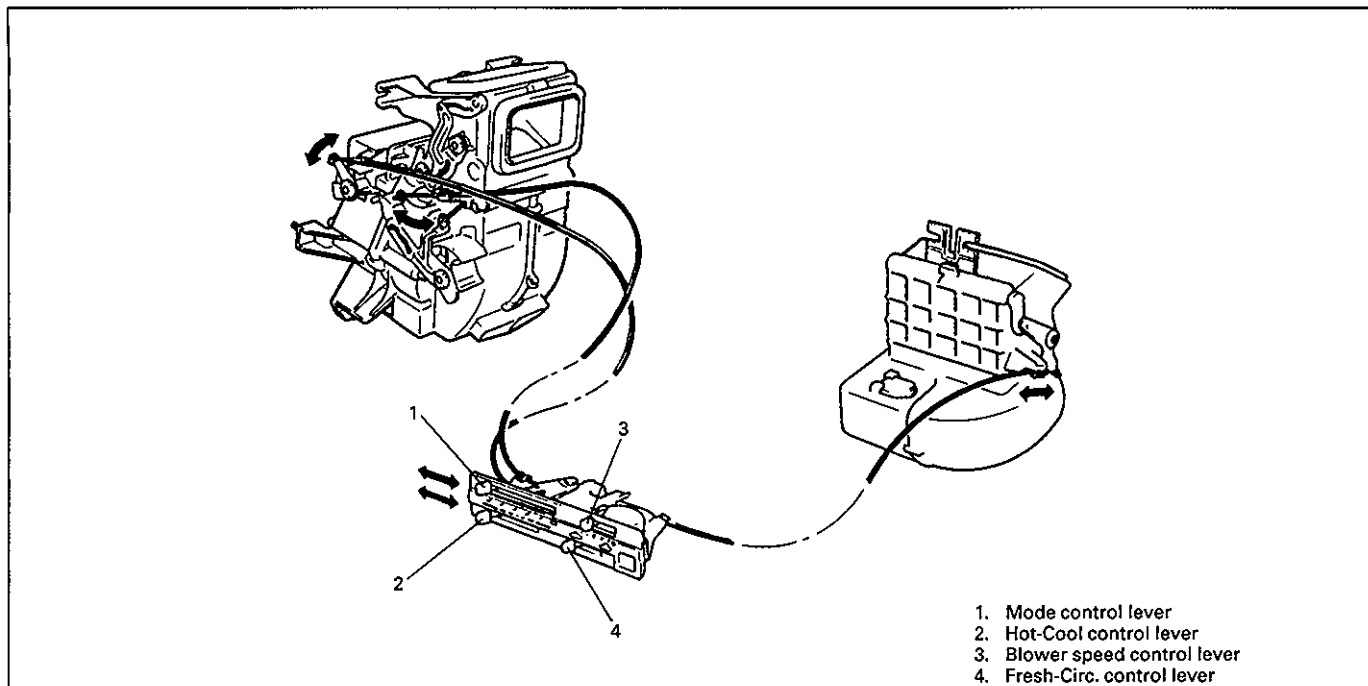
P : Pink

85F00-1A-5-4

INSTALLATION

Install in reverse order of removal.

CONTROL CABLES

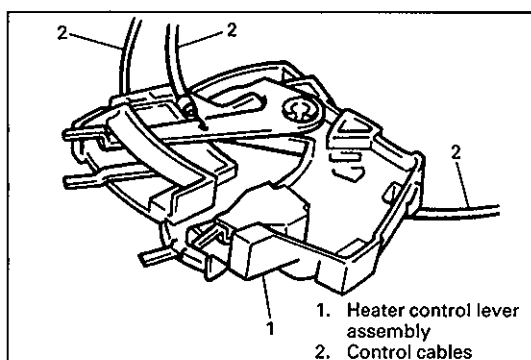


85F00-1A-6-1

REMOVAL

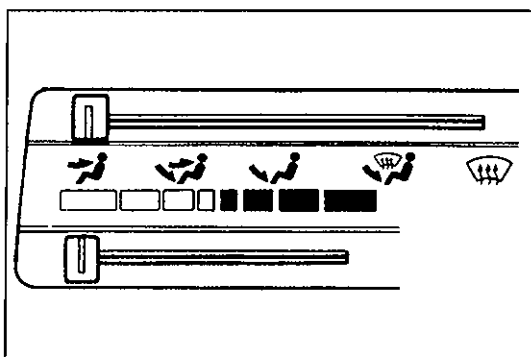
- 1) Remove heater control lever assembly.
Refer to "HEATER BLOWER MOTOR SWITCH" in this section.

85F00-1A-6-3



85F00-1A-6-4

- 2) Disconnect control cables from control lever.

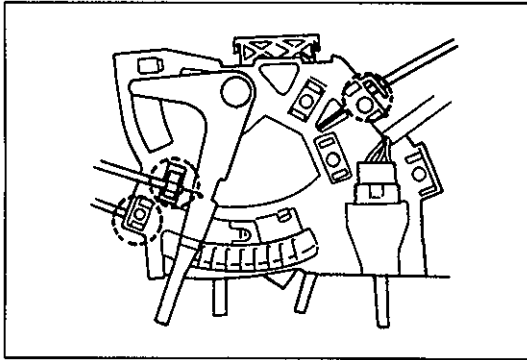


85F00-1A-6-5

ADJUSTMENT

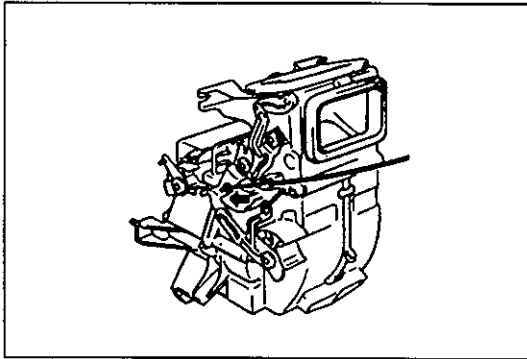
A. Air Control Cable

1. Move control lever to VENT position.



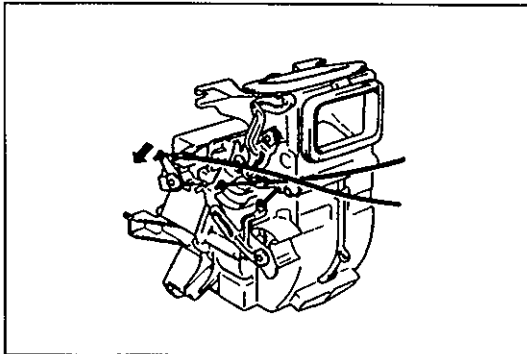
85F00-1A-7-1

2. At its control lever-side, clamp outer cable with touching stopper of cable holder.
3. Place outer cable in cable guide of control lever assembly properly and clamp it securely.



85F00-1A-7-2

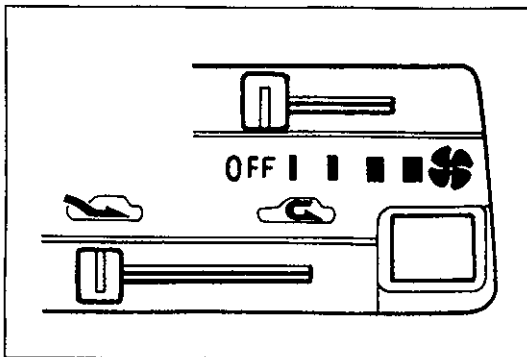
4. As shown, push lever fully in arrow direction to fix cable and rod in position.



85F00-1A-7-3

B. Heater Control (COOL-HOT Selector) Cable

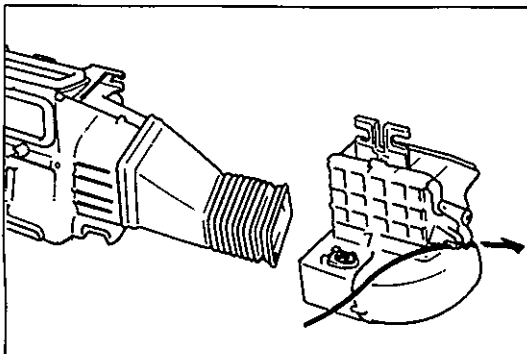
1. Move control lever to COOL position.
2. Push lever fully in arrow direction and fix cable with clamp in position, as shown in left figure.



85F00-1A-10-4

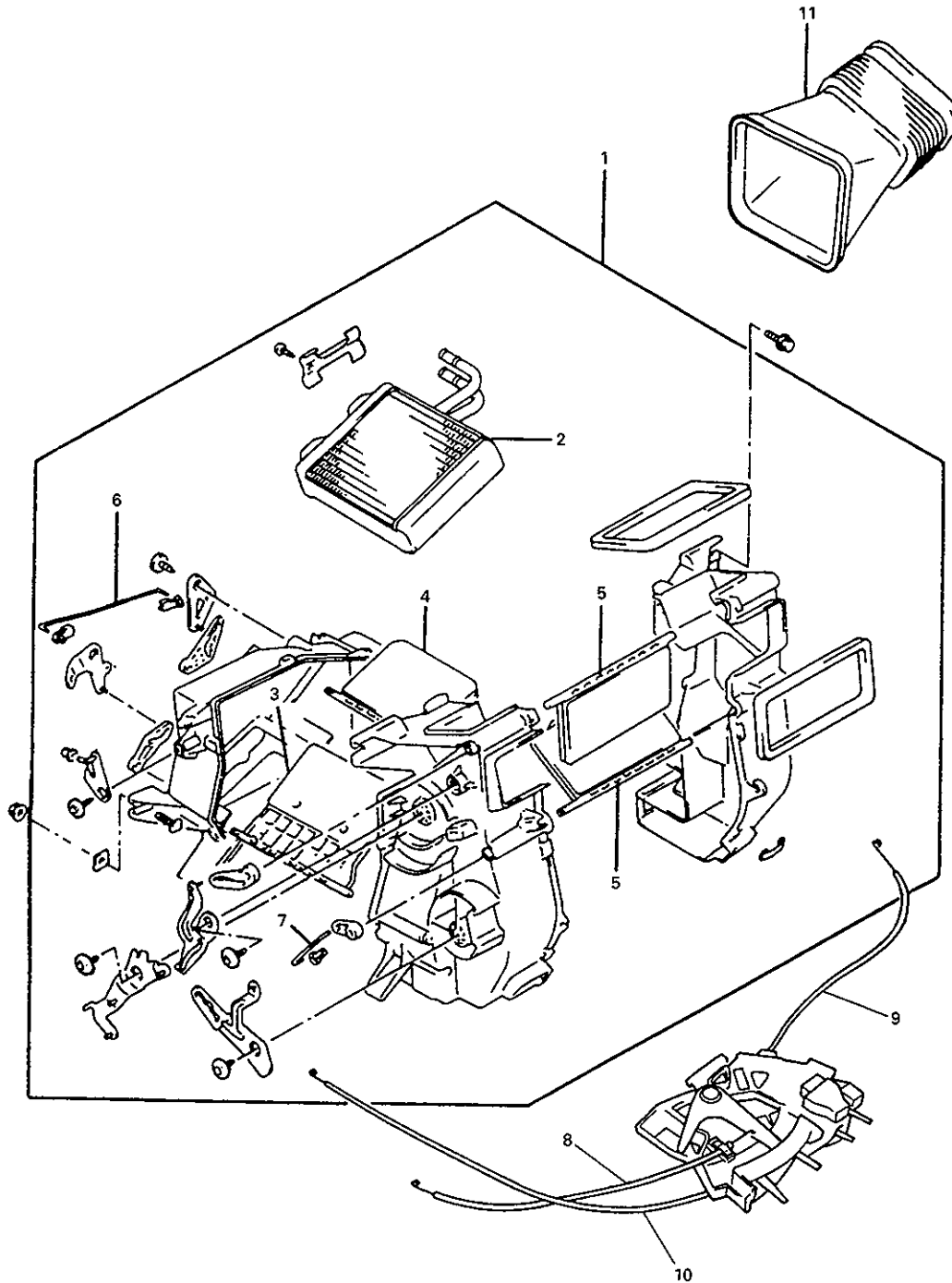
C. Fresh Air Control (FRESH-CIRC Selector) Cable

1. Move control lever to FRESH position.
2. Push lever fully in arrow direction and fix cable with clamp in position as shown in left figure.

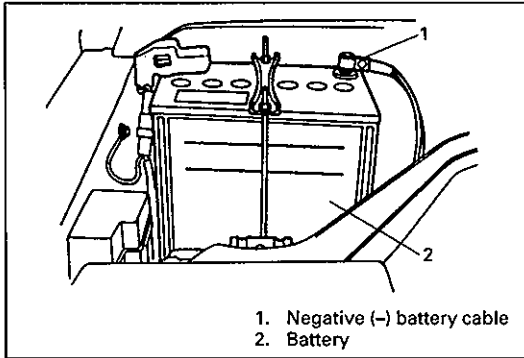


85F00-1A-7-5

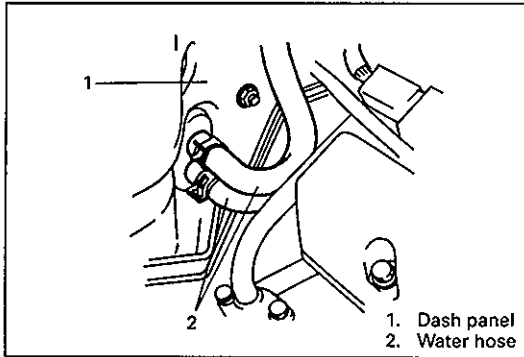
HEATER UNIT



- 1. Heater ass'y
- 2. Radiator core
- 3. Damper
- 4. Damper
- 5. Damper
- 6. Shaft
- 7. Shaft
- 8. Mode control cable
- 9. Fresh-Circ. control cable
- 10. Hot-cool control cable
- 11. Heater duct (without A/C)



85F00-1A-9-1



85F00-1A-9-2

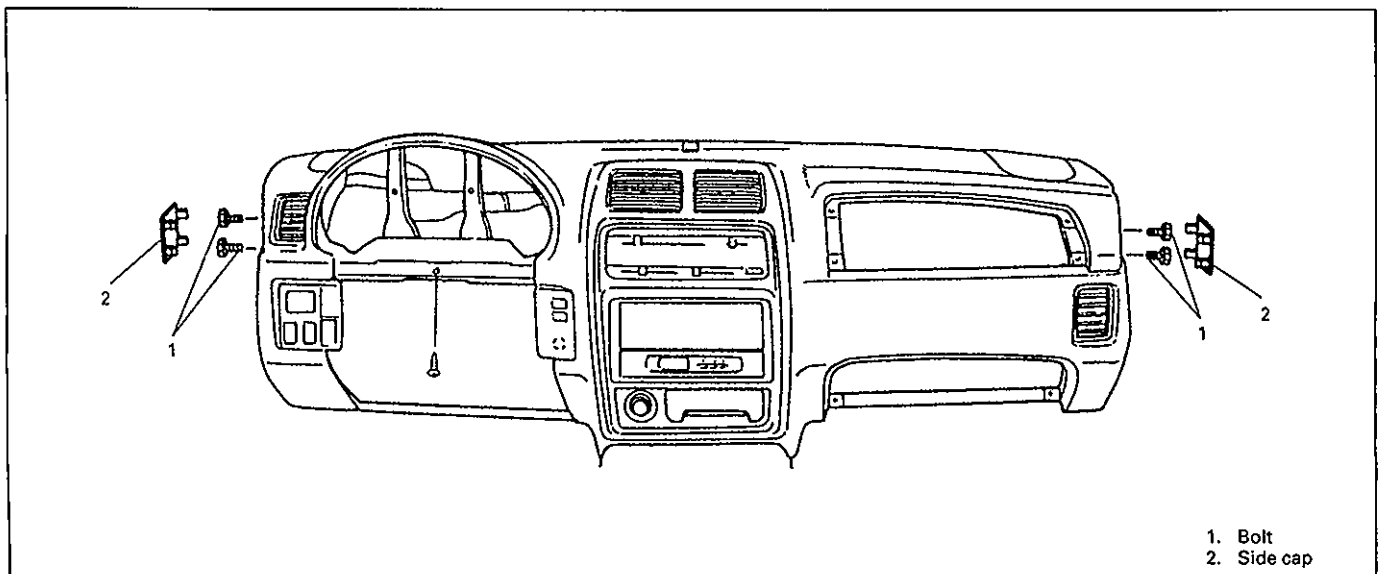
REMOVAL

1) Disconnect negative (-) cable at battery.

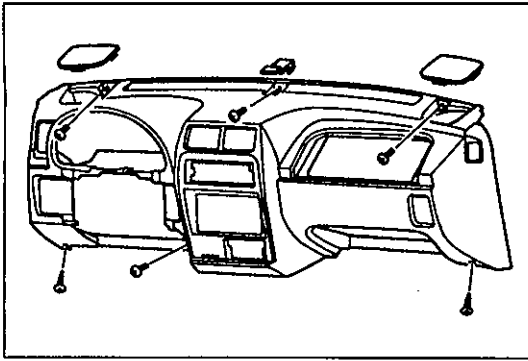
2) Drain engine coolant and disconnect water hoses from heater unit.

3) Remove instrument panel as follows:

- ① Remove console box.
- ② Remove glove box and column hole cover.
- ③ Disconnect wires and cables from heater unit and blower motor assembly.
- ④ Remove steering wheel and combination switch and steering column.
- ⑤ Disconnect speedometer cable and remove speedometer assembly.
- ⑥ Remove engine hood opener.
- ⑦ Disconnect couplers which need to be disconnected for removal for instrument panel.
- ⑧ Remove bolts, as shown below.

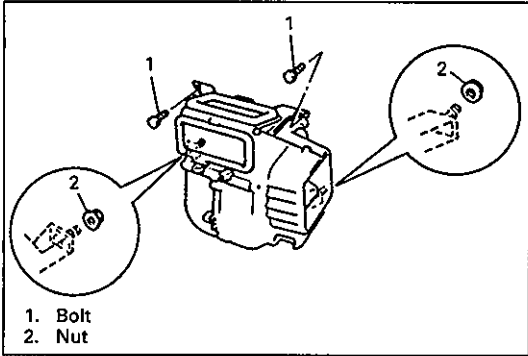


85F00-1A-9-5



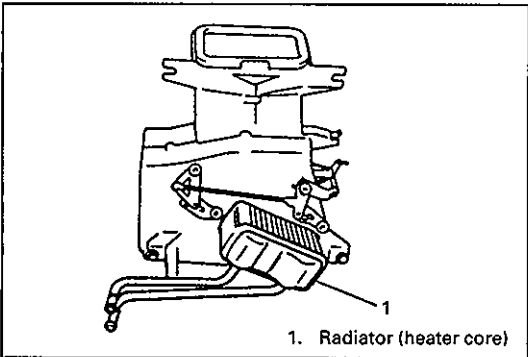
85F00-1A-10-1

- ⑨ Remove instrument panel together with instrument panel member.



85F00-1A-10-2

- 4) Remove heater unit.



85F00-1A-10-3

- 5) Pull out heater core from heater unit.

INSTALLATION

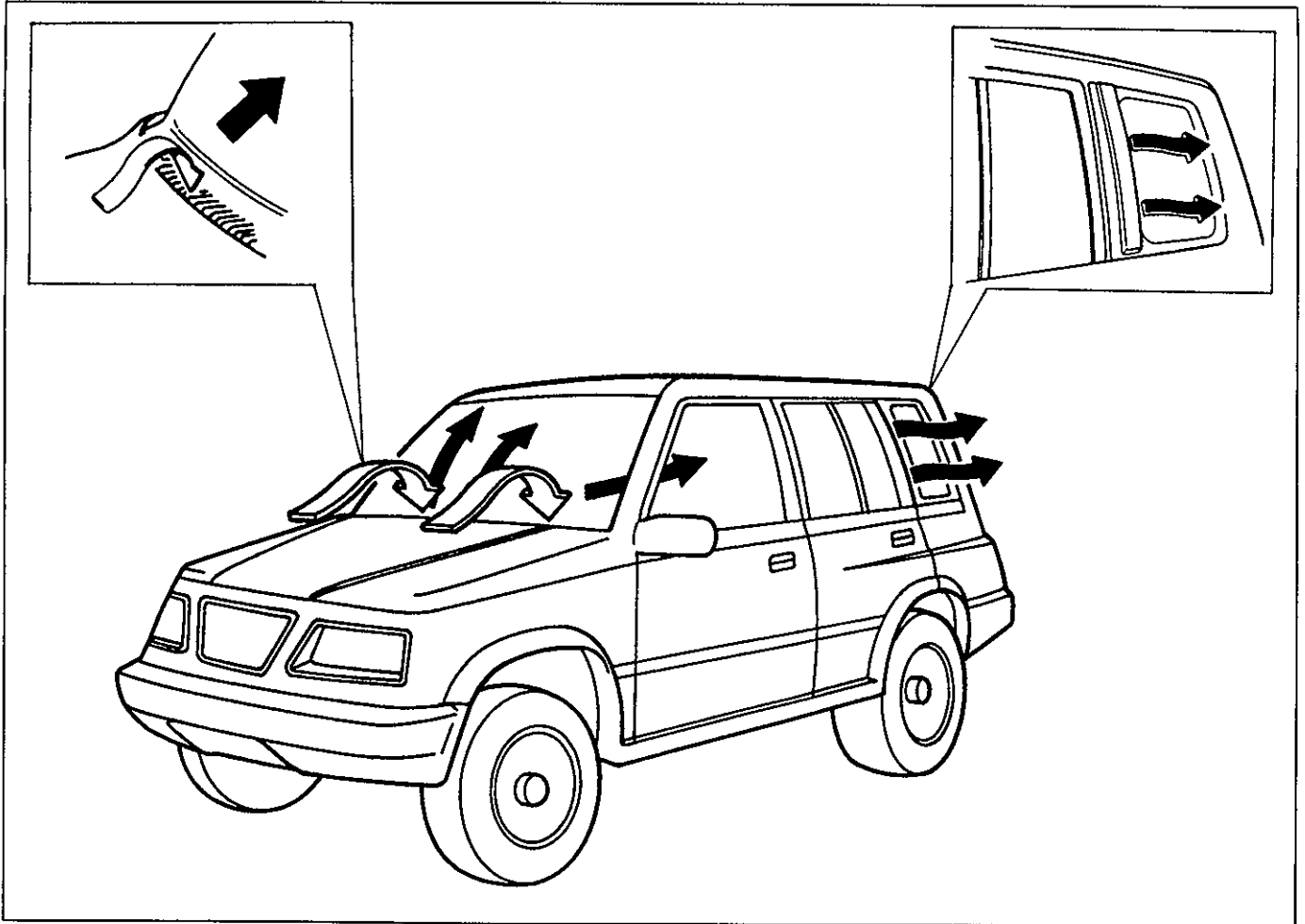
Install heater unit by reversing removal procedure, noting the following items.

- When installing each part, be careful not to catch any cable or wiring harness.
- Adjust control cables.
- Fill engine coolant to radiator.

85F00-1A-10-4

BODY VENTILATION

When fresh air control lever is at FRESH position, air is drawn into the interior from cowl top panel and drawn out from the ventilator outlet provided at body outer panel (both right and left side).



85F00-1A-11-1

SECTION 2

BUMPERS AND SPLASH GUARD

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.
- Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

85F00-2-1-1

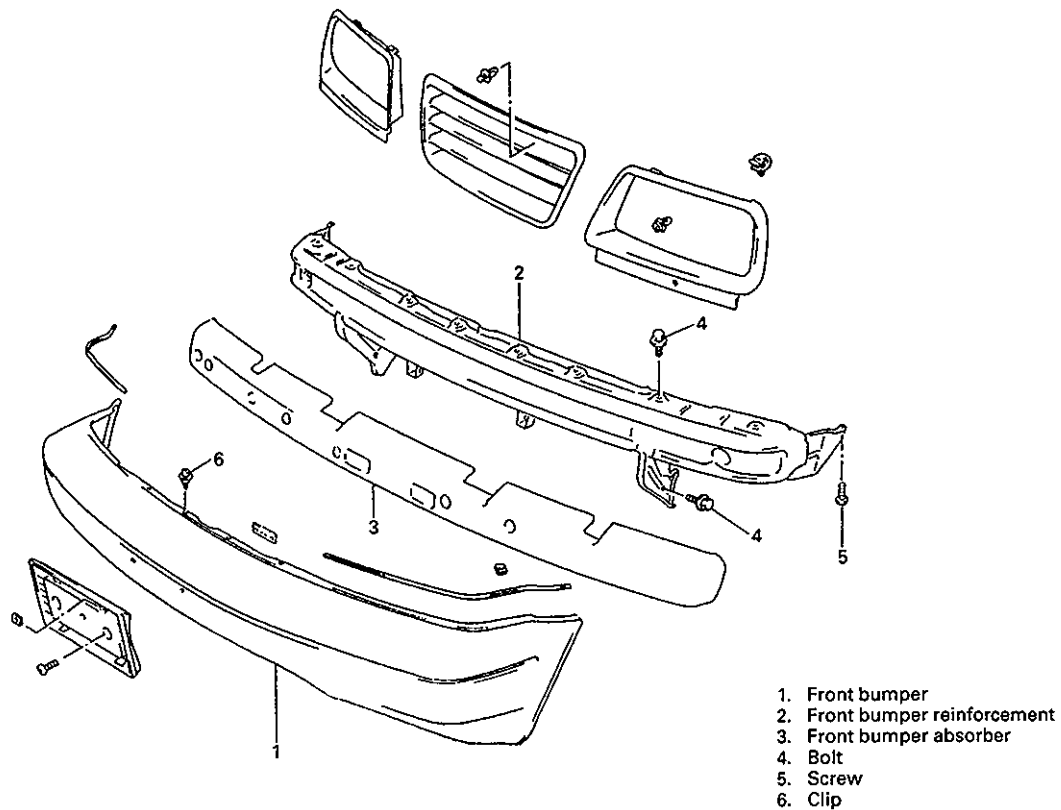
CONTENTS

FRONT BUMPER 2- 2

REAR BUMPER 2- 2

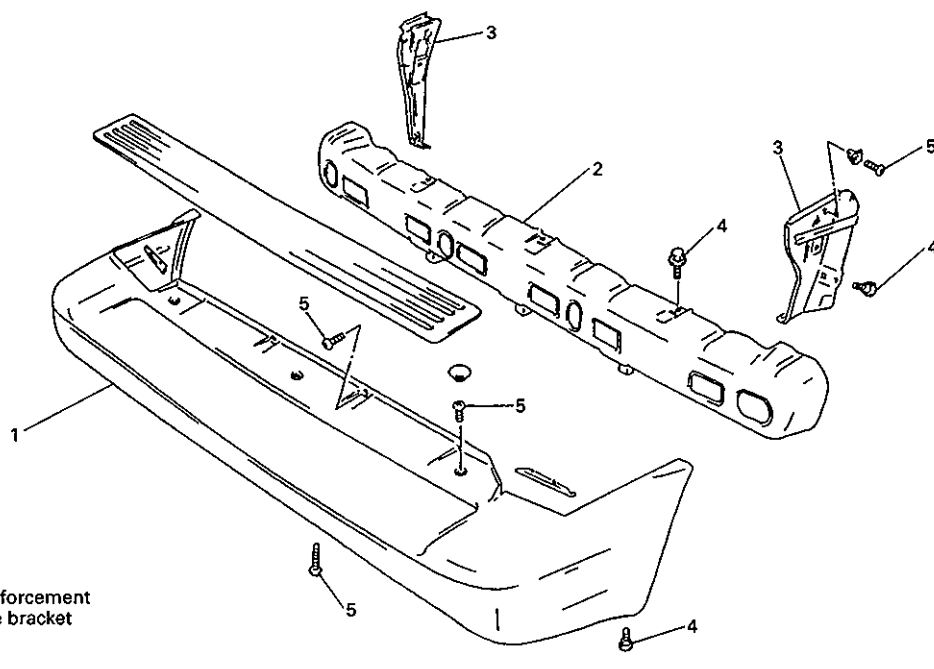
SPLASH GUARD 2- 3

FRONT BUMPER



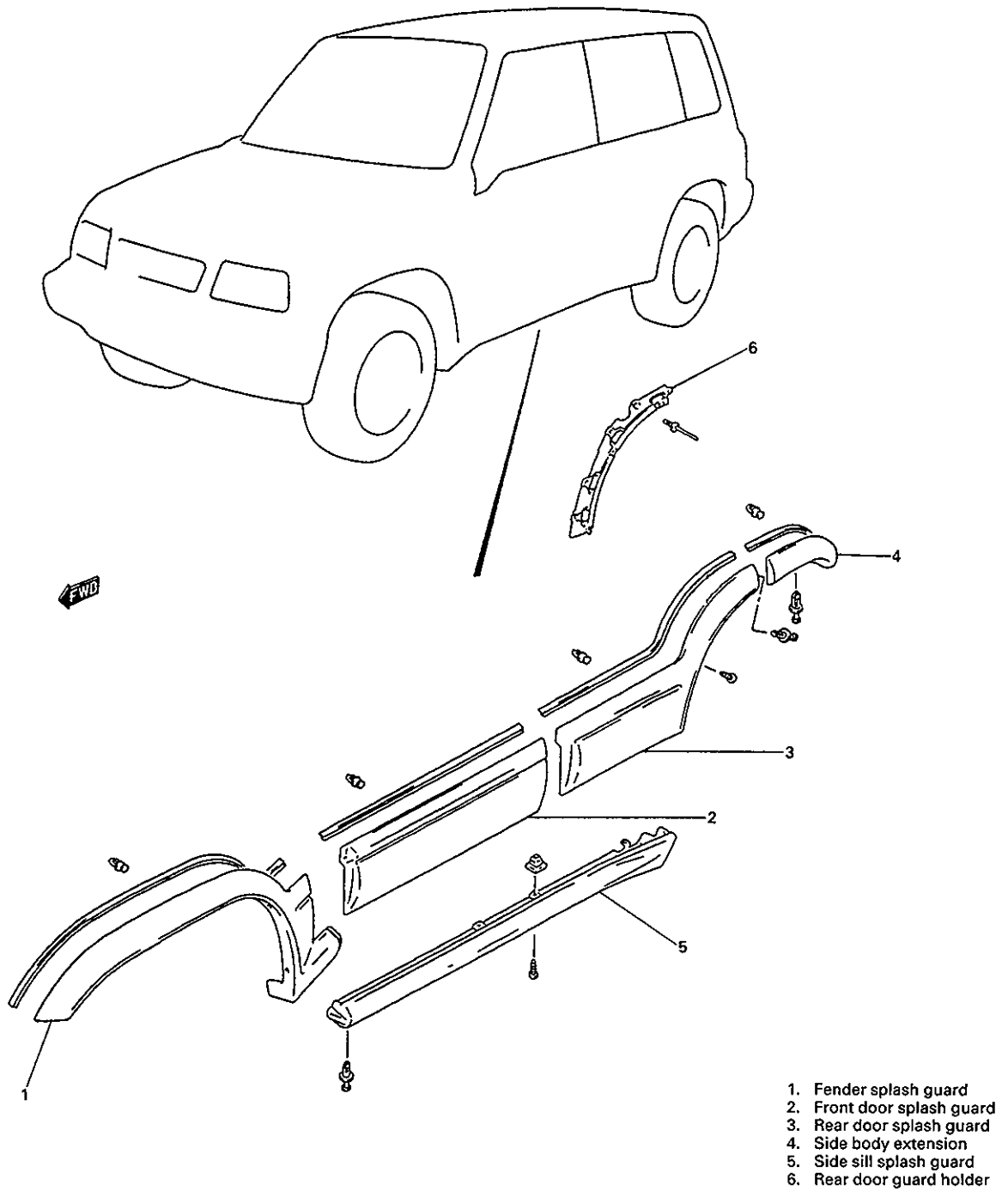
85F00-2-2-1

REAR BUMPER



85F00-2-2-2

SPLASH GUARD



SECTION 3A

FRONT END ALIGNMENT

NOTE:

For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

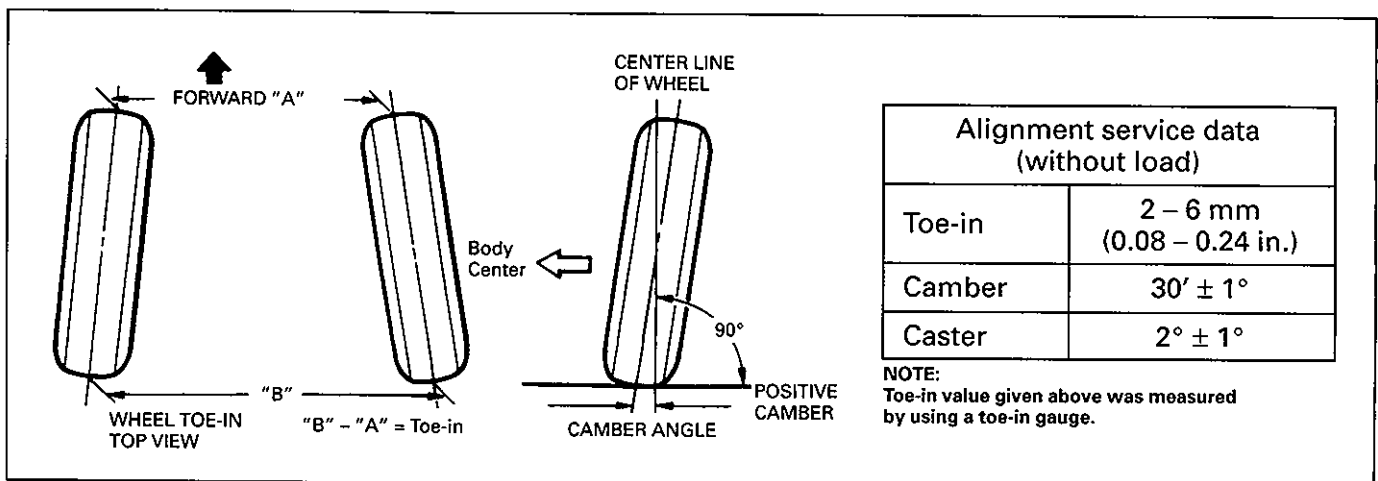
3A

CONTENTS

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85F00-3A-1-1

GENERAL INFORMATION



85F00-3A-1-2

Front alignment refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground. Generally, the only adjustment required for front alignment is toe setting. Camber and caster can't be adjusted. Therefore, should camber or caster be out of specification due to the damage caused by hazardous road conditions or collision, whether the damage is in body or in suspension should be determined. If the body is damaged, it should be repaired and if suspension is damaged, it should be replaced.

85F00-3A-1-3

SECTION 3B3

POWER STEERING (P/S) SYSTEM (OPTIONAL)

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.
- All steering gear fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

85F00-3B3-1-1

3B3

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Power Steering (P/S) Pump	3B3- 3
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Disassembly	3B3-10
Inspection	3B3-12
Assembly	3B3-13
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SPECIAL TOOLS	3B3-17

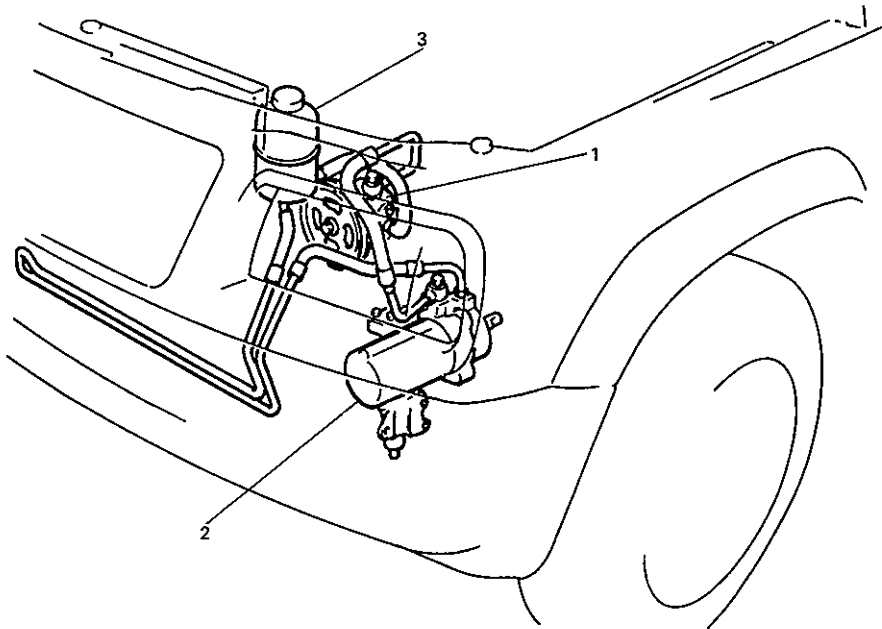
85F00-3B3-1-2

GENERAL DESCRIPTION

The power steering (P/S) system in this vehicle reduces the driver's effort needed in turning the steering wheel by utilizing the hydraulic pressure generated by the power steering (P/S) pump which is driven by the engine.

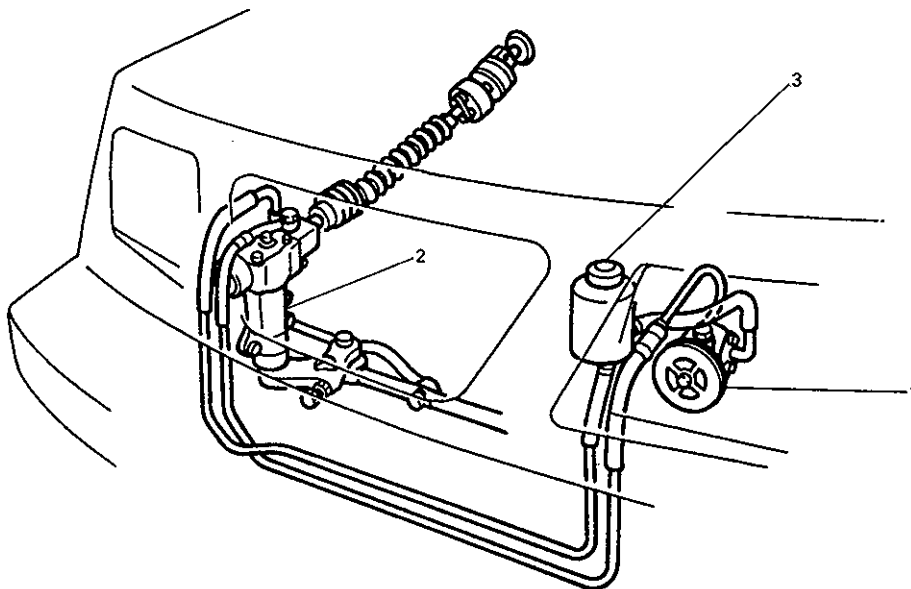
It is an integral type with the mechanical gear unit, hydraulic pressure cylinder unit and control valve unit all built in the gear box.

For LH Steering Model



- 1. Power steering pump
- 2. Power steering gear box
- 3. Oil tank

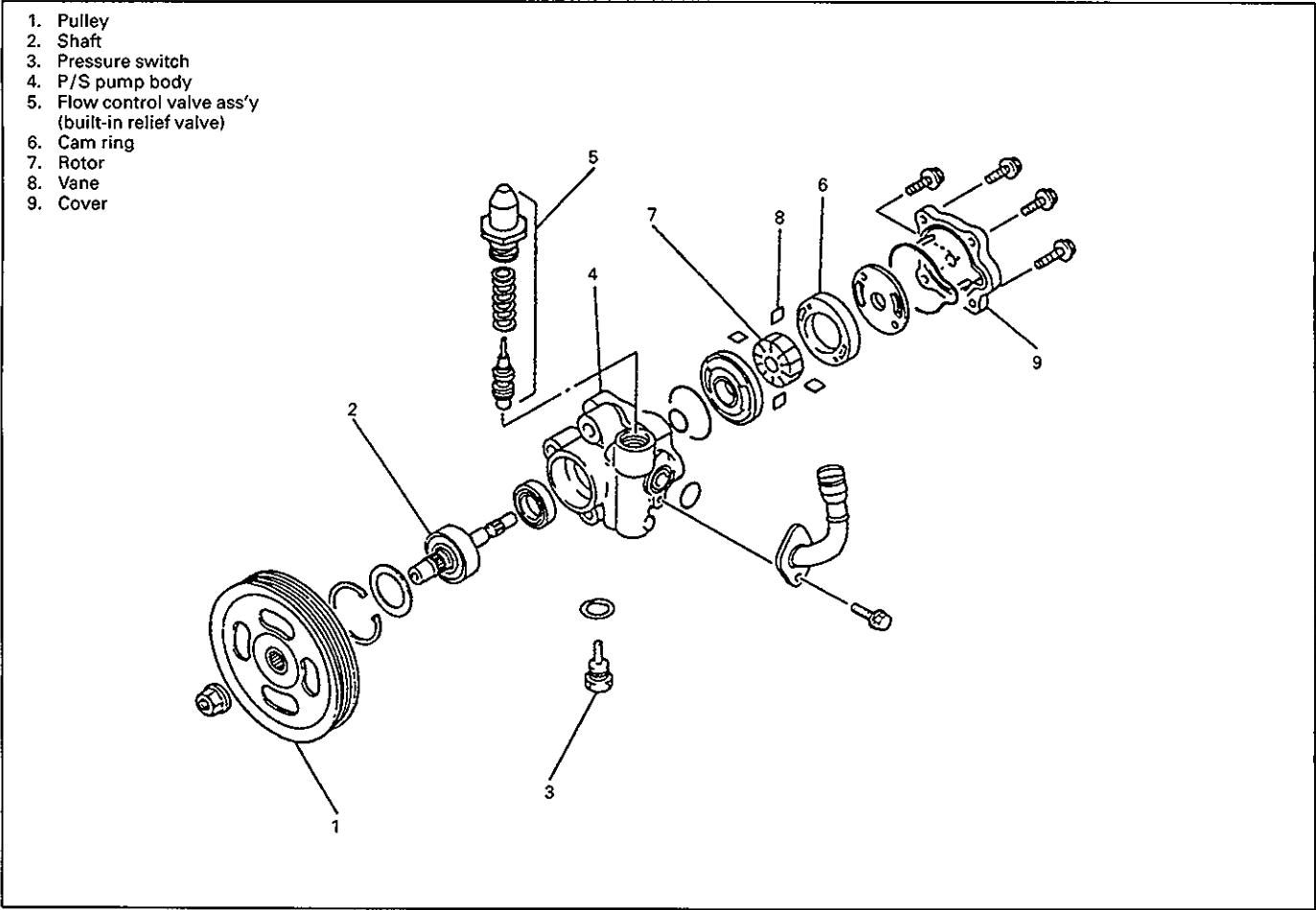
For RH Steering Model



CONSTRUCTION AND OPERATION

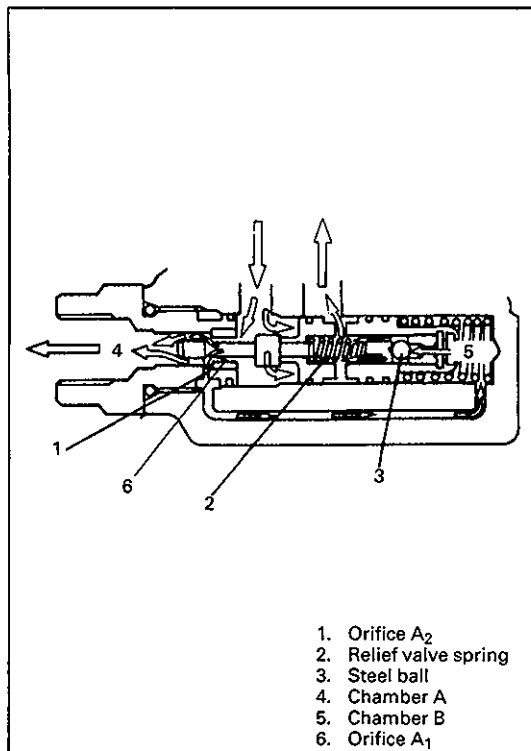
POWER STEERING (P/S) PUMP

The power steering pump is a vane type and is driven by the belt from the crankshaft.



85F00-3B3-3-1

Model		Vane type
Discharge rate		7.3 cm ³ /rev
Hydraulic pressure control	Hydraulic pressure	80 kg/cm ² (1138 psi)
	Control device	Flow control valve Relief valve
Specified fluid		DEXRON®-II, DEXRON®-III (A/T fluid) or equivalent
Capacity (fluid)		0.6 ℓ (1.26/1.05 US/Imp. pt)
Idle-up system		When hydraulic pressure in P/S pump increases to 22 to 28 kg/cm ² (313 to 398 psi), pressure switch turns ON to start idle-up operation.



85F00-3B3-4-1

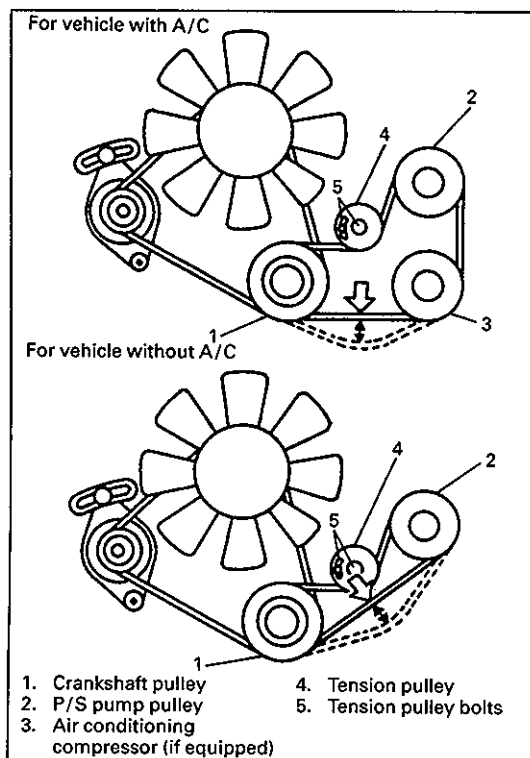
RELIEF VALVE

The relief valve located in the flow control valve controls the maximum hydraulic pressure.

The steel ball in the relief valve is under the hydraulic pressure in the circuit coming through orifice A₂. When the steering wheel is turned and the hydraulic pressure increases higher than 80 kg/cm² (1138 psi), it compresses the relief spring to push the steel ball which then allows the fluid to flow to the P/S pump.

Such relief valve operation causes a pressure difference to occur between chambers A and B.

Then the flow control valve moves to the right to make opening in orifice A₁ narrower, maintaining the hydraulic pressure constant.



85F00-3B3-5-1

ON VEHICLE SERVICE

INSPECTION

POWER STEERING BELT TENSION

- Check that belt is free from any damage and properly fitted in pulley groove.
- Check belt tension by measuring how much it deflects when pushed at intermediate point between P/S pump pulley and crank pulley with about 10 kg (22 lb) force.

Deflection of P/S belt: 6 – 9 mm (0.24 – 0.35 in.)

POWER STEERING BELT TENSION ADJUSTMENT

- 1) Loosen tension pulley bolts.
- 2) To adjust P/S belt tension, turn tension pulley using hexagon wrench.
- 3) Adjust belt tension to above specification.
Then tighten tension pulley bolts to specified torque.

Tightening Torque

Tension pulley bolts: 25 N·m (2.5 kg·m, 18.5 lb·ft)

85F00-3B3-5-3

FLUID LEAKAGE

Start engine and turn steering wheel fully to the right and left so that maximum hydraulic pressure is provided. Then visually check gear box, P/S pump and oil tank themselves and each joint of their connecting pipes for leakage.

CAUTION:

Never keep steering wheel turned fully for longer than 10 seconds.

60A20-3B3-11-1

AIR BLEEDING PROCEDURE

- 1) Jack up the front end of vehicle and apply rigid rack.
- 2) Fill oil tank with fluid up to specified level.
- 3) After running engine at idling speed for 3 to 5 seconds, stop it and add fluid to satisfy specification.
- 4) With engine stopped, turn steering wheel to the right and left as far as it stops, repeat it a few times and fill fluid to specified level.

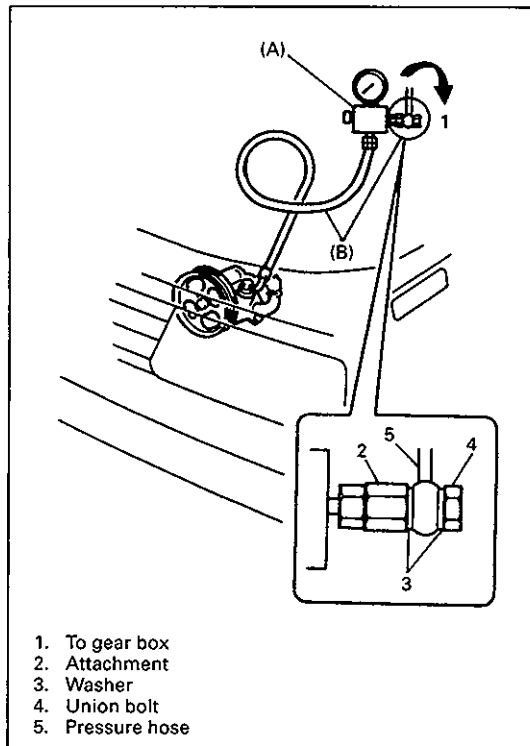
85F00-3B3-5-5

- 5) With engine running at idling speed, repeat stop-to-stop turn of steering wheel till all foams are gone.
- 6) Finally check to make sure that fluid is filled to specified level.

NOTE:

When air bleeding is not complete, it is indicated by foaming fluid on level gauge or humming noise from P/S pump.

60A20-3B3-11-3


HYDRAULIC PRESSURE IN P/S CIRCUIT

- 1) Clean where pipe is connected thoroughly, then disconnect pressure hose from P/S pump and connect oil pressure gauge (special tool), its attachment and hose set (special tools) as shown.

CAUTION:

When connecting special tools, be careful so that hose connecting P/S pump and gauge does not contact P/S belt and it does not hinder movement of center link.

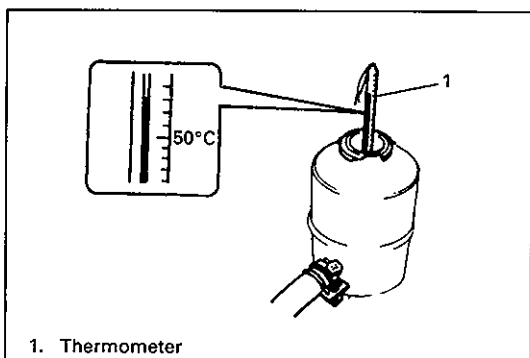
Special Tool

(A): 09915-77410

(B): 09915-77420

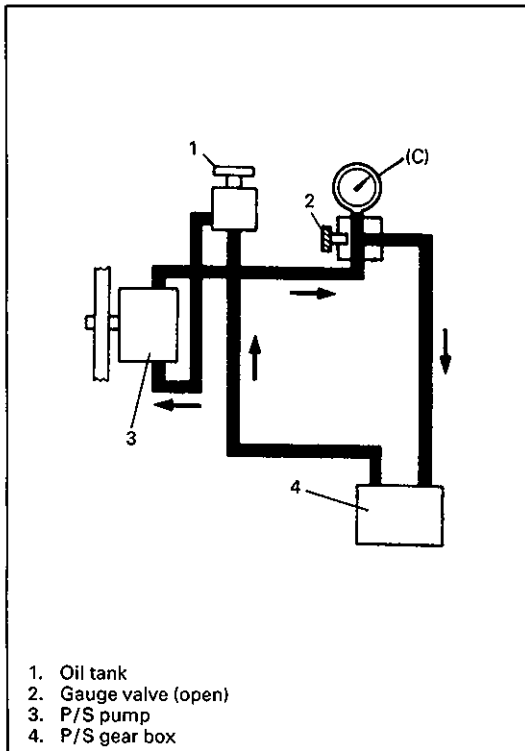
- 2) Fill fluid up and bleed air.

85F00-3B3-6-2



- 3) With engine running at idling speed, turn steering wheel to the right and left as far as it stops, repeat it and warm up fluid in oil tank to 50 to 60°C (122 to 140°F).

60A40-3B3-12-3



60A20-3B3-12-4

4) Back pressure check

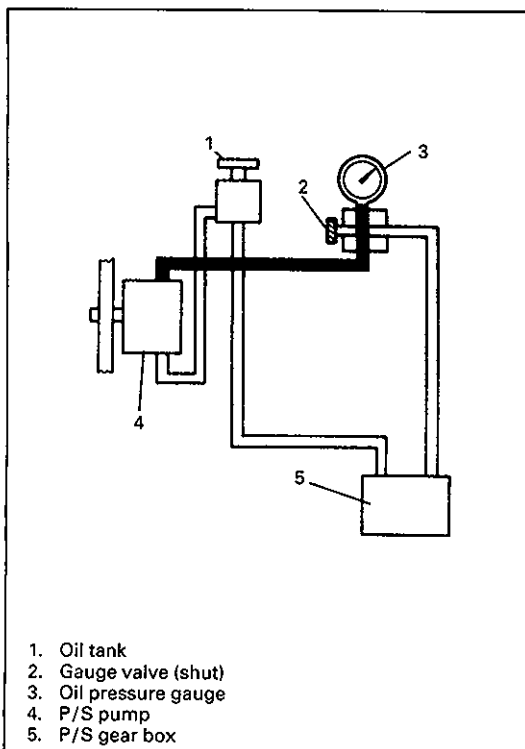
With straightforward state, while keeping engine running at idling speed and check hydraulic pressure.

Back pressure: Lower than 10 kg/cm² (142 psi)

If back pressure is higher than 10 kg/cm² (142 psi), check control valve and pipes for obstruction.

Special Tool

(C): 09915-77410



85F00-3B3-7-3

5) Relief pressure check

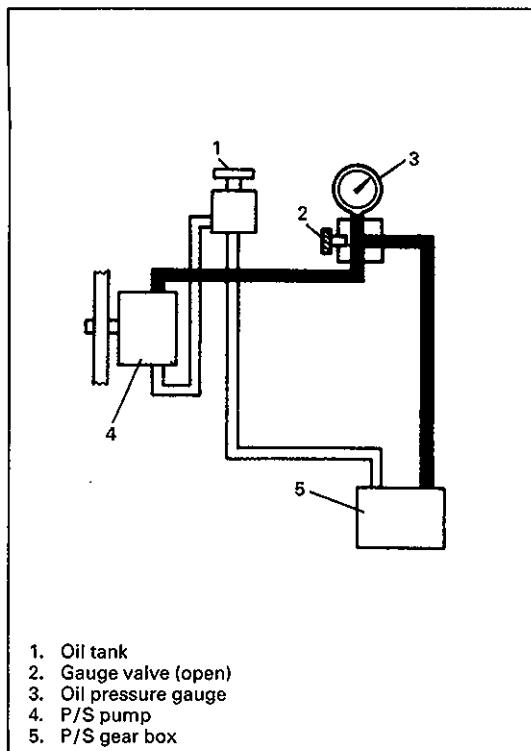
- Increase engine speed to about 1,500 r/min (rpm). Close gauge valve gradually while watching pressure increase indicated by gauge and take reading of relief pressure (maximum hydraulic pressure).

Relief pressure: 78 – 85 kg/cm² (1110 – 1205 psi)

- * When it is higher than 85 kg/cm² (1205 psi), possible cause is malfunction of relief valve. Replace P/S pump.
- * When it is lower than 78 kg/cm² (1110 psi), possible cause is either failure of P/S pump or settling of relief valve spring. Replace P/S pump.

CAUTION:

Be sure not to close gauge valve for longer than 10 seconds.



- Next, open gauge valve fully and increase engine speed to about 1,500 r/min. Then turn steering wheel to the left or right fully and take reading of relief pressure.

Relief pressure: 78 – 85 kg/cm² (1110 – 1205 psi)

- * When it is lower than 78 kg/cm² (1110 psi), possible cause is failure in steering gear box.
Replace gear box.

CAUTION:

Be sure not to hold steering wheel at fully turned position for longer than 10 seconds.

POWER STEERING (P/S) PUMP

NOTE:

Before removing joints at inlet and outlet ports of P/S pump, make sure to clean dirt thoroughly.

60A20-3B3-16-1

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Remove coolant reservoir.
- 3) Loosen P/S belt tension pulley bolts.
- 4) Remove P/S belt.
- 5) Take out P/S fluid in oil tank with syringe or such.

85F00-3B3-9-2

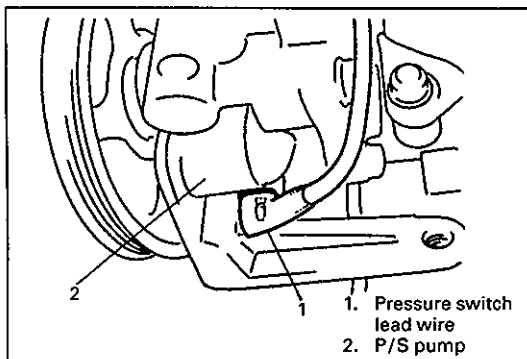
- 6) Disconnect P/S pump suction hose from P/S pump. If equipped with A/C, remove oil tank with P/S pump suction hose too.

NOTE:

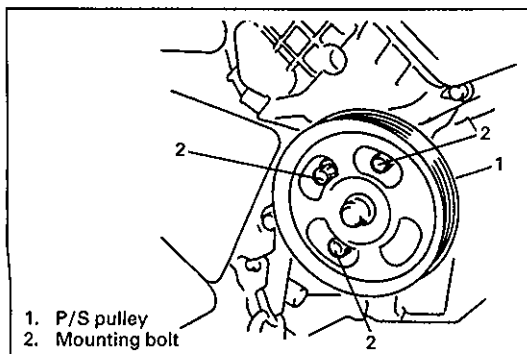
As fluid flows out of disconnected hoses, put a plug to them or a cloth under them.

- 7) When removing union bolt, hold discharge connector with wrench or the like to prevent it from getting loose and drain P/S fluid.
- 8) Disconnect power steering pressure switch lead wire at switch terminal.

85F00-3B3-9-3



85F00-3B3-9-4

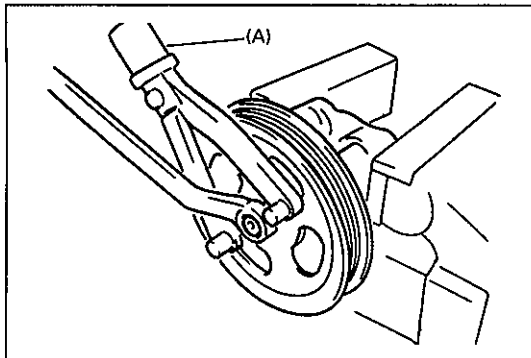


- 9) Remove P/S pump adjusting bolt and mounting bolts.
- 10) Remove P/S pump.

NOTE:

Plug ports of removed pump to prevent dust and any foreign object from entering.

85F00-3B3-9-5



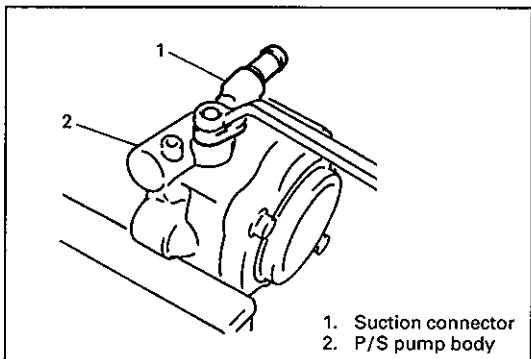
85F00-3B3-10-1

DISASSEMBLY

1) Using special tool, remove P/S pump pulley.

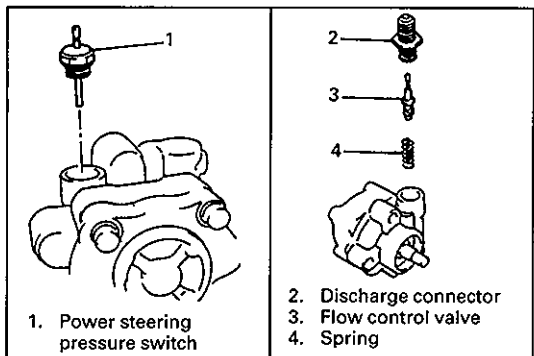
Special Tool

(A): 09930-40113



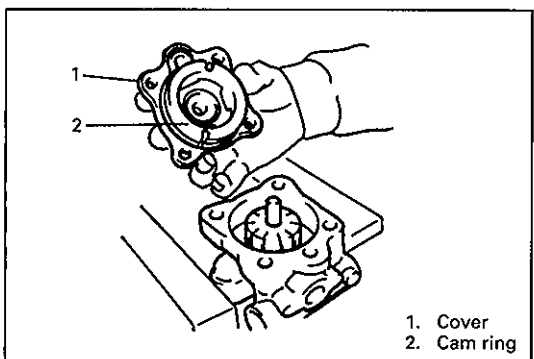
85F00-3B3-10-2

2) Remove suction connector and O-ring.



85F00-3B3-10-3

3) Remove power steering pressure switch (terminal set) and discharge connector.

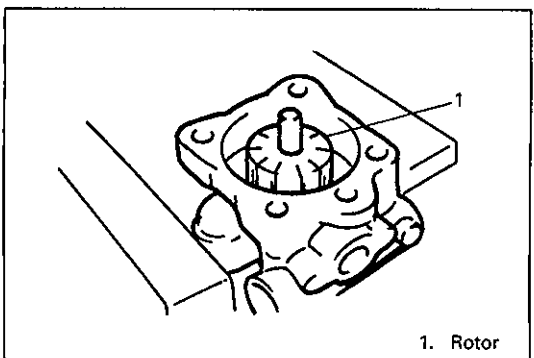


85F00-3B3-10-4

4) Remove P/S pump cover with cam ring and cover seal.

NOTE:

When removing P/S pump cover, be careful not to drop cam ring.

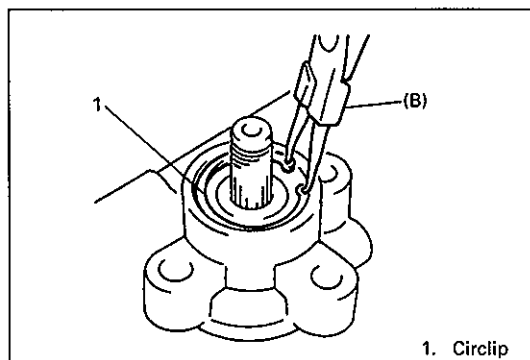


85F00-3B3-10-5

5) Pull out rotor and vanes.

NOTE:

When pulling rotor out of shaft, be careful not to lose vane.

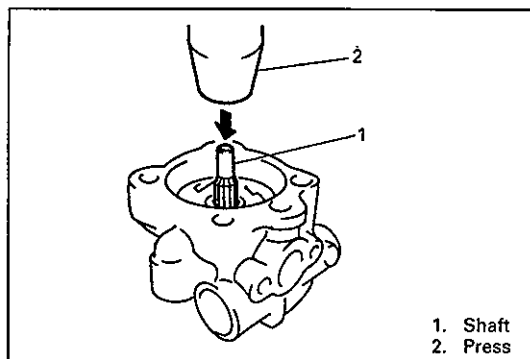


85F00-3B3-11-1

6) Remove circlip.

Special Tool

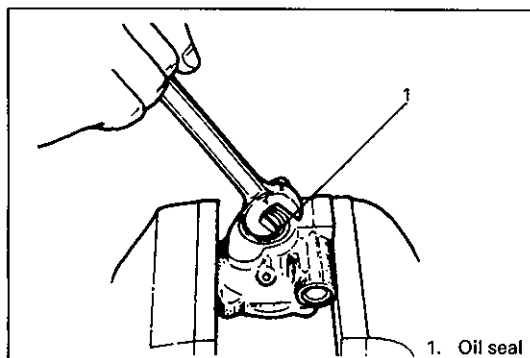
(B): 09900-06108



85F00-3B3-11-2

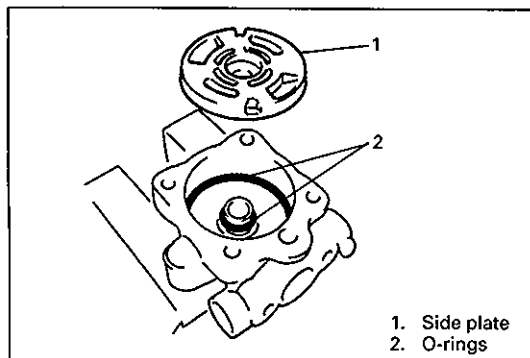
7) Using hydraulic press, pull out shaft slowly from pump body.

8) Remove spacer.



85F00-3B3-11-3

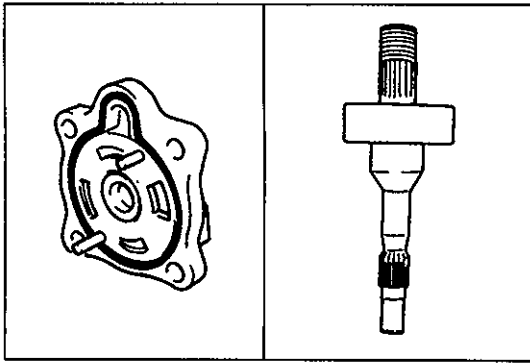
9) Remove oil seal.



85F00-3B3-11-4

10) Remove side plate.

11) Remove O-rings



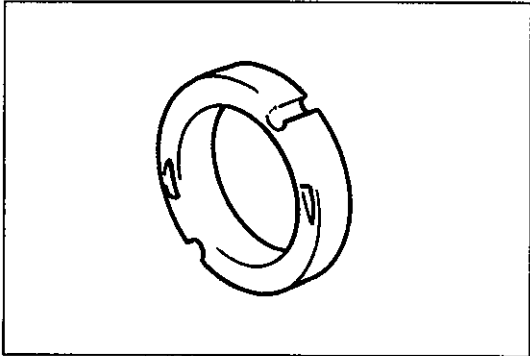
85F00-3B3-12-1

INSPECTION

P/S Pump Body, Cover, Side Plate and Shaft

- Wear and damage of pump body, cover and side plate sliding surfaces.
- Stepped wear and damage of shaft where bushing slides against.

Replace P/S pump if any of the above is found.

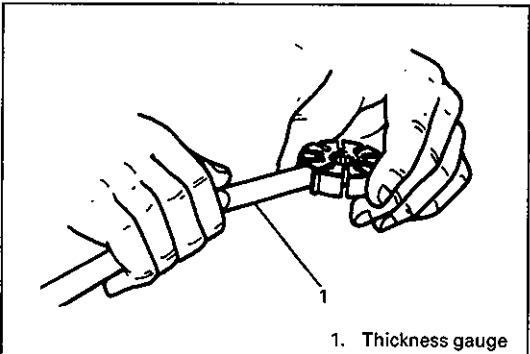


85F00-3B3-12-2

Cam Ring

Inspect vane sliding surface of cam ring for wear and damage.

Replace P/S pump if either of the above is found.



1. Thickness gauge

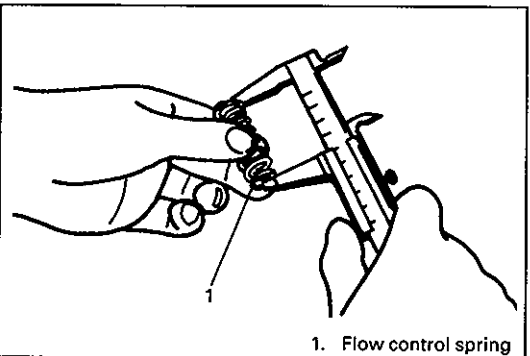
85F00-3B3-12-3

Rotor Vane

- Wear and damage of rotor sliding surface against pump body.
- Wear and damage of vane sliding surface against cam ring.
- Vane to rotor clearance.

Clearance:	Standard	0.02 mm (0.0008 in.)
	Limit	0.05 mm (0.0019 in.)

Replace P/S pump if any of the above is found.



1. Flow control spring

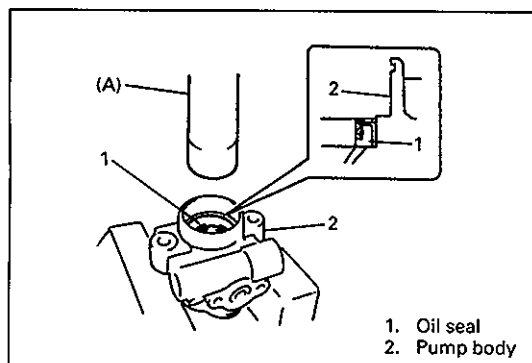
85F00-3B3-12-4

Flow Control Valve

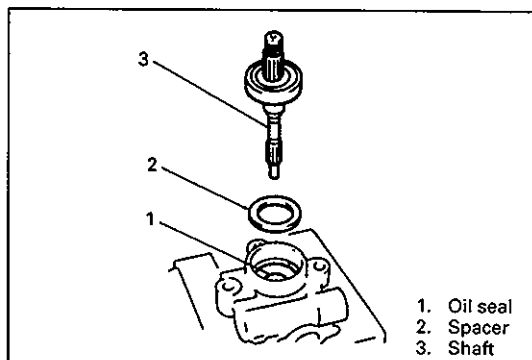
- Wear and damage on outside of valve.
- Obstruction in connector orifice.
- Free length of flow control spring.

Length:	Standard	33.5 mm (1.32 in.)
	Limit	30.5 mm (1.20 in.)

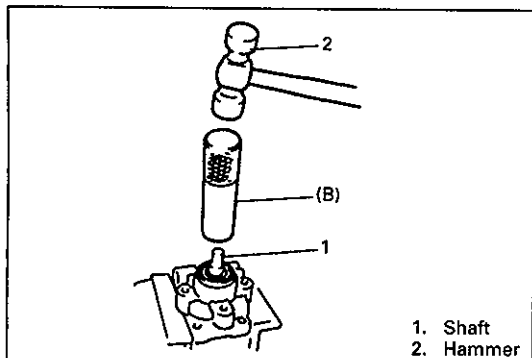
Replace P/S pump if any of the above is found.



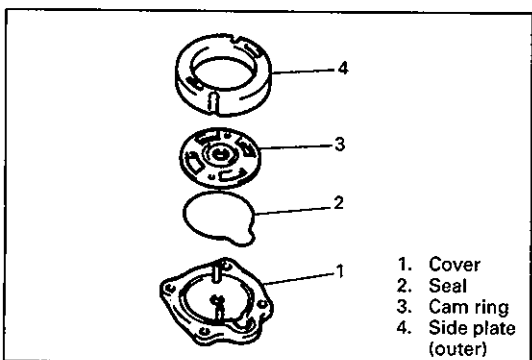
85F00-3B3-13-1



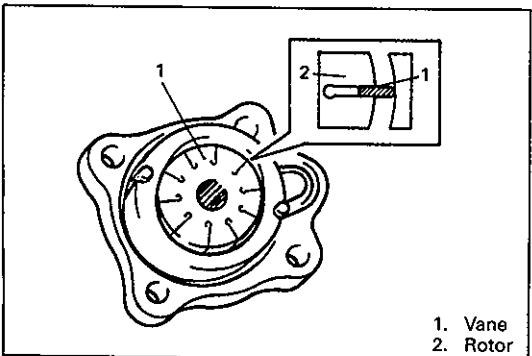
85F00-3B3-13-2



85F00-3B3-13-3



85F00-3B3-13-4



85F00-3B3-13-5

ASSEMBLY

- 1) Using special tool and hammer, drive oil seal into pump body until it becomes flush with pump body surface as shown.

Special Tool

(A): 09913-80112

NOTE:

Refer to figure so that oil seal is installed in proper direction.

- 2) Apply specified fluid to shaft where bushing slides against.
- 3) Install spacer and insert shaft from oil seal side.

- 4) Install shaft by using special tool and hammer.

Special Tool

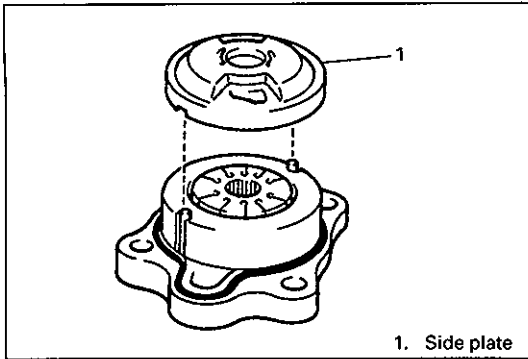
(B): 09913-84510

- 5) Install cam ring and cover seal to P/S pump cover.

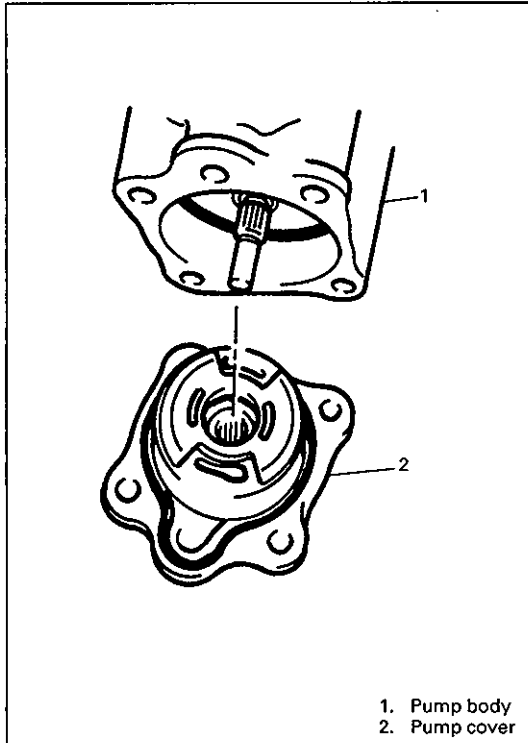
NOTE:

When removing side plate (outer) from P/S pump cover, install it as shown.

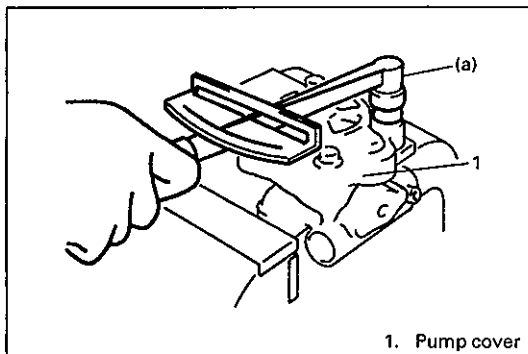
- 6) Install rotor.
- 7) Apply specified fluid to each vane and install it to rotor with its R part faced outward as shown.



85F00-3B3-14-1



85F00-3B3-14-2



85F00-3B3-14-4

8) Install side plate as shown.

9) Apply specified fluid to O-rings and install them to pump body and side plate securely.

10) Install pump body to pump cover as shown.

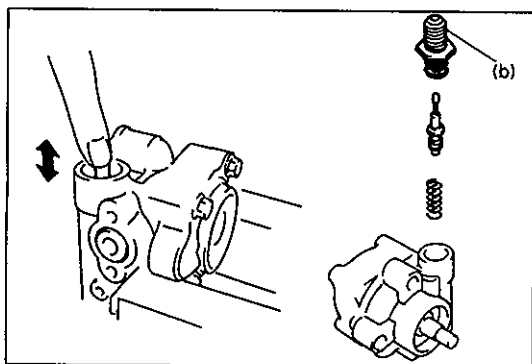
11) Tighten cover bolts to specified torque.

NOTE:

After installing cover, check to make sure that shaft can be turned by hand.

Tightening Torque

(a): 20 N·m (2.0 kg-m, 14.5 lb-ft)

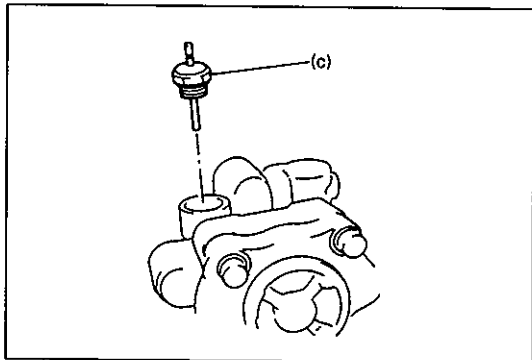


85F00-3B3-15-1

- 12) Check that flow control valve slides smoothly and tighten discharge (delivery) connector to specified torque.

Tightening Torque

(b): 55 N·m (5.5 kg-m, 40.0 lb-ft)

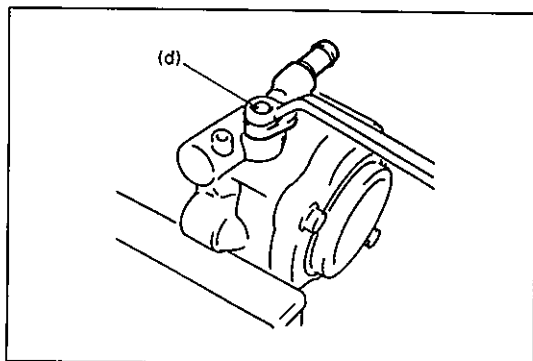


85F00-3B3-15-2

- 13) Tighten power steering pressure switch (terminal set) to specified torque.

Tightening Torque

(c): 20 N·m (2.0 kg-m, 14.5 lb-ft)

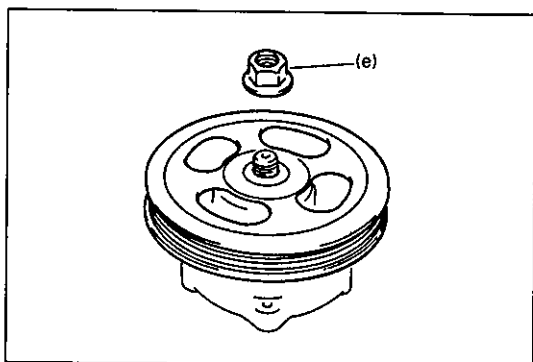


85F00-3B3-15-3

- 14) Tighten suction connector bolts to specified torque.

Tightening Torque

(d): 11 N·m (1.1 kg-m, 8.0 lb-ft)



85F00-3B3-15-4

- 15) Install pulley to shaft

Tightening Torque

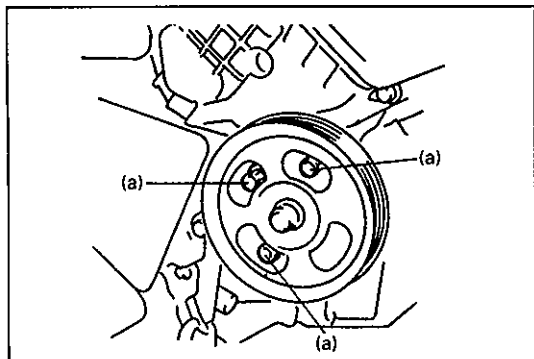
(e): 66 N·m (6.6 kg-m, 48.0 lb-ft)

INSTALLATION

- 1) Install P/S pump by using mounting bolts.

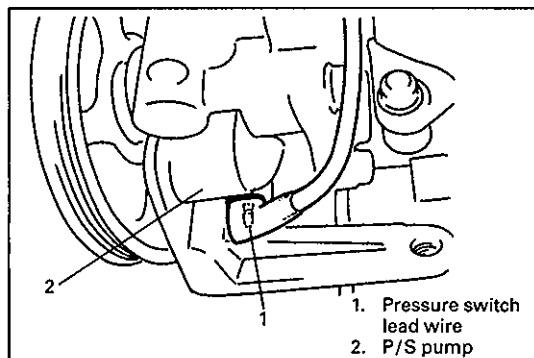
Tightening Torque

(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



85F00-3B3-16-1

- 2) Connect P/S pump pressure switch lead wire to switch terminal.

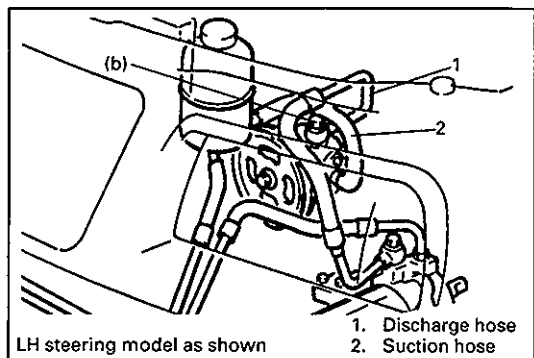


85F00-3B3-16-2

- 3) Install oil tank (If equipped with A/C).
- 4) Connect discharge hose and suction hose to P/S pump.

Tightening Torque

(b): 60 N·m (6.0 kg-m, 43.5 lb-ft)



85F00-3B3-16-3

- 5) Install P/S belt.
- 6) Adjust P/S belt tension to specification referring to previous page.
- 7) Install coolant reservoir.
- 8) Fill oil tank with specified P/S fluid.

Power steering fluid: DEXRON®-II, DEXRON®-III (A/T fluid) or equivalent

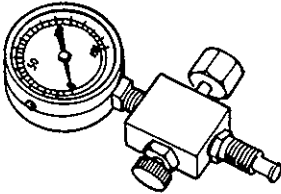
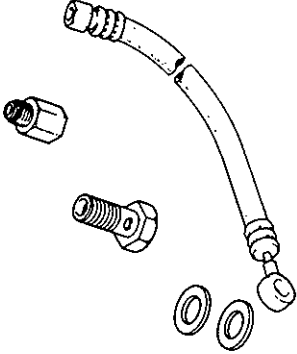
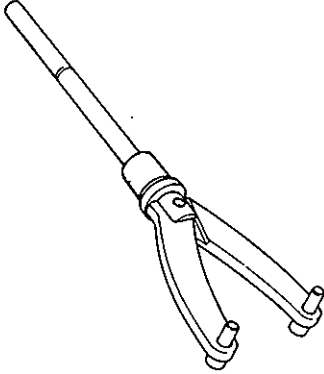
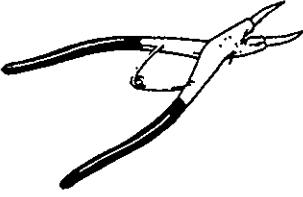
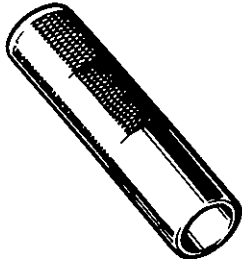
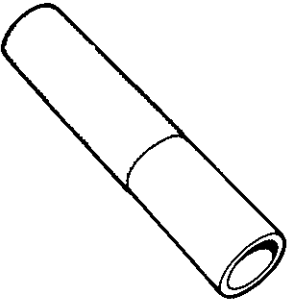
- 9) Purge air in P/S circuit.
Refer to item AIR BLEEDING PROCEDURE in this section.
- 10) Connect negative cable at battery.
- 11) Start engine and check P/S system for fluid leakage.

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Power steering fluid (Automatic transmission fluid)	an equivalent of DEXRON®-II or DEXRON®-III	• To fill oil tank • Parts lubrication when installing

85F00-3B3-17-1

SPECIAL TOOLS

 09915-77410 Oil pressure gauge	 09915-77420 Oil pressure gauge attachment and hose set	 09930-40113 Transfer flange lock holder	 09900-06108 Snap ring pliers (closing type)
 09913-80112 Bearing installer	 09913-84510 Bearing installer		

85F00-3B3-17-2

SECTION 3C2

STEERING WHEEL, COLUMN AND SHAFT

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.
- All steering wheel and column fasteners are important parts in that they could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

85F00-3C2-1-1

CONTENTS

DESCRIPTION 3C2-1

CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE 3C2-3

85F00-3C2-1-2

DESCRIPTION

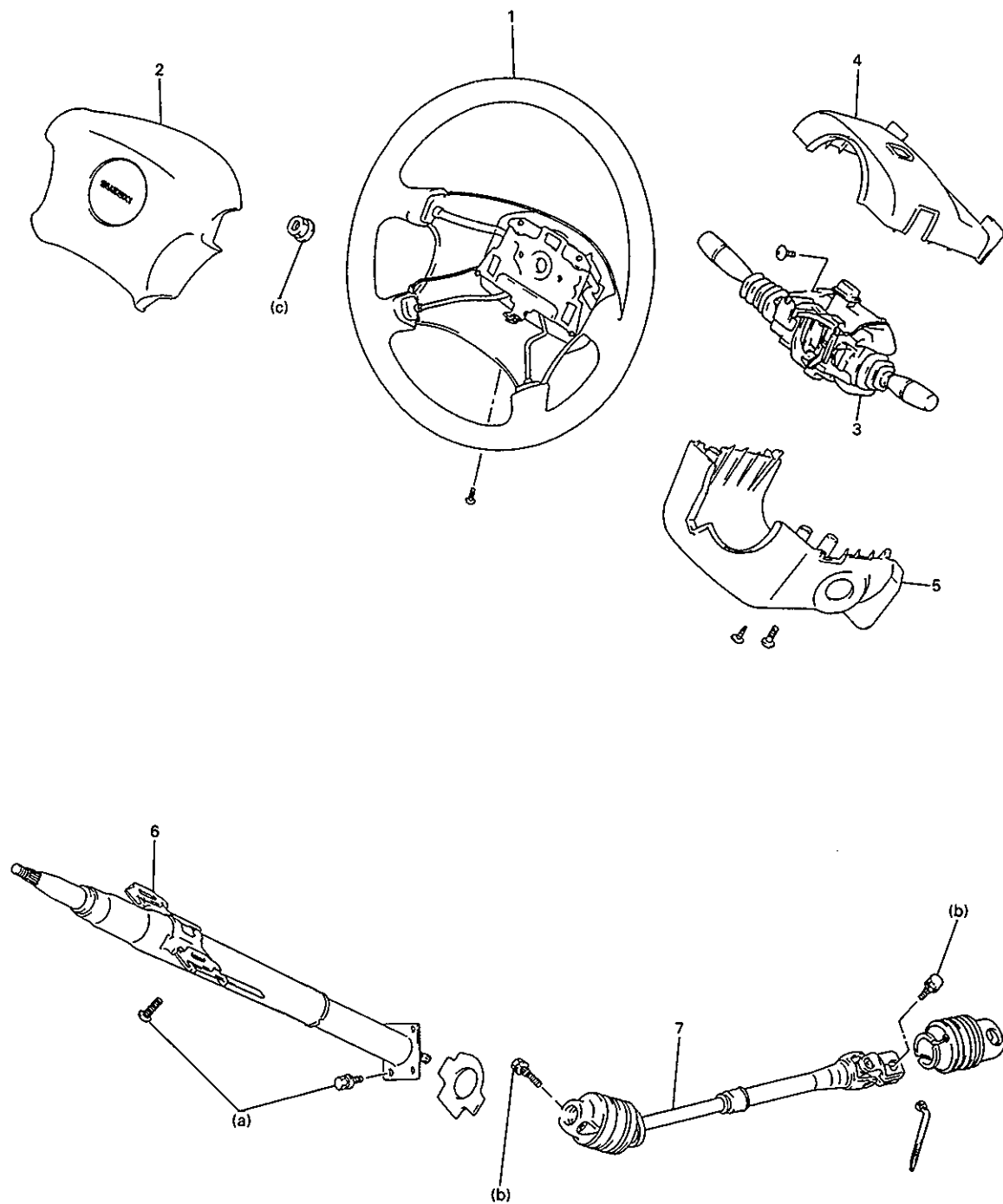
The double tube type steering column includes three important features in addition to the steering function.

1. The column is energy absorbing designed to compress in a front end collision to minimize the possibility of injury to the driver of the vehicle.
2. The ignition switch and lock are mounted conveniently on this column.
3. With the column mounted lock, the ignition and steering operations can be locked to inhibit theft of the vehicle.

85F00-3C2-1-3

To insure the energy absorbing action, it is important that only the specified screws, bolts and nuts to be used as designated and that they are tightened to the specified torque.

When the column assembly is removed from the vehicle, special care must be taken in handling it. The tilt type steering column has been used in some vehicles, depending on specifications.



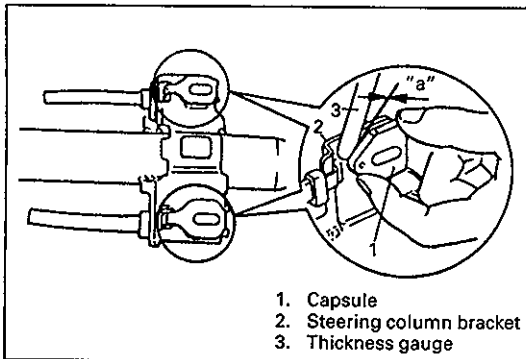
CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

NOTE:

Vehicles involved in accidents resulting in body damage or where steering column has been impacted may also have a damaged or misaligned steering column.

In such a case, following steps should be performed.

60A20-3C2-9-1

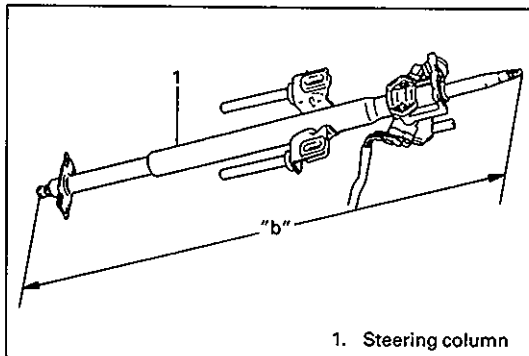


CHECKING PROCEDURE

- 1) Check clearance between capsules and steering column bracket as shown. Clearance should be 0.0 mm (0.0 in.) on both sides.

Clearance "a": 0.0 mm (0.0 in.)

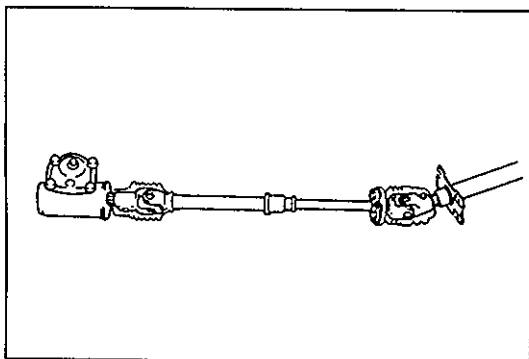
85F00-3C2-3-2



- 2) Take measurement "b" as shown. If it is shorter than specified length, replace column assembly with new one.

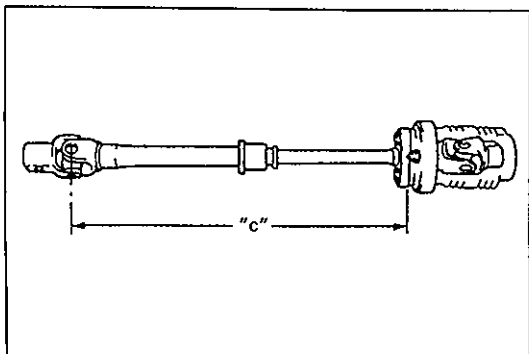
Specified length "b": 764.6 ± 0.8 mm (30.10 ± 0.03 in.)

85F00-3C2-3-3



- 3) Check steering shaft joints and shaft for any damages such as crack, breakage, malfunction or excessive play. If anything is found faulty, replace as shaft assembly.
- 4) Check steering shaft for smooth rotation. If found defective, replace as column assembly.

85F00-3C2-3-4



- 5) Check steering lower shaft for specified length. If it is shorter than specified length, replace it with new one.

Length "c": 273 mm (10.7 in.)

85F00-3C2-3-5

SECTION 3D

FRONT SUSPENSION

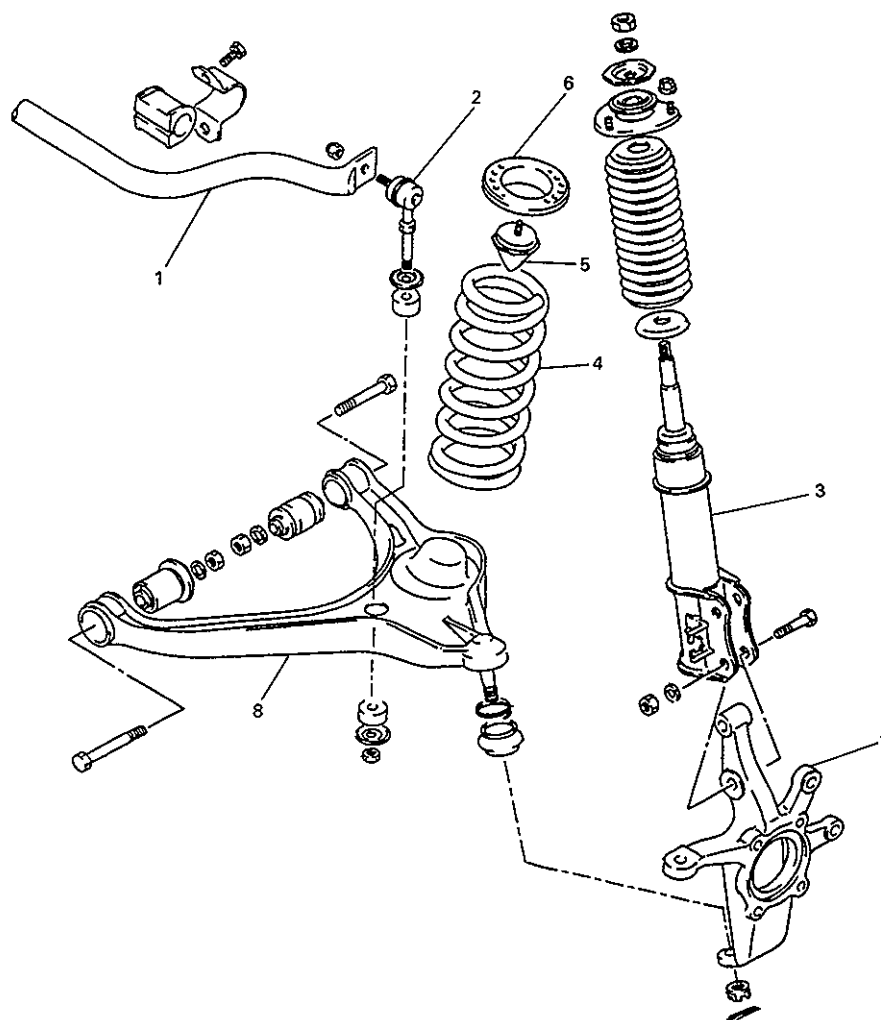
NOTE:

- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.
- All front suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.
- Never attempt to heat, quench or straighten any front suspension part. Replace it with a new part or damage to the part may result.

3D

85F00-3D-1-1

GENERAL DESCRIPTION



1. Stabilizer bar
2. Stabilizer ball joint
3. Strut
4. Coil spring
5. Bump stopper
6. Spring rubber seat
7. Knuckle
8. Control arm

85F00-3D-1-2

SECTION 3E

REAR SUSPENSION

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.
- All suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.
- Never attempt to heat, quench or straighten any suspension part. Replace it with a new part, or damage to the part may result.

85F00-3E-1-1

3E

CONTENTS

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ON VEHICLE SERVICE 3E- 3

 Coil Spring 3E- 3

 Rear Axle Shaft and Wheel Bearing 3E- 5

TIGHTENING TORQUE SPECIFICATIONS 3E- 9

REQUIRED SERVICE MATERIALS 3E-10

SPECIAL TOOLS 3E-10

85F00-3E-1-2

GENERAL DESCRIPTION

Rear suspension is coil spring type of rigid axle which consists of coil springs, rear axle, shock absorbers, upper arm and trailing rods.

The trailing rod is connected with the axle and body by using bushes so that axle moves up and down with bushes as their supporting points.

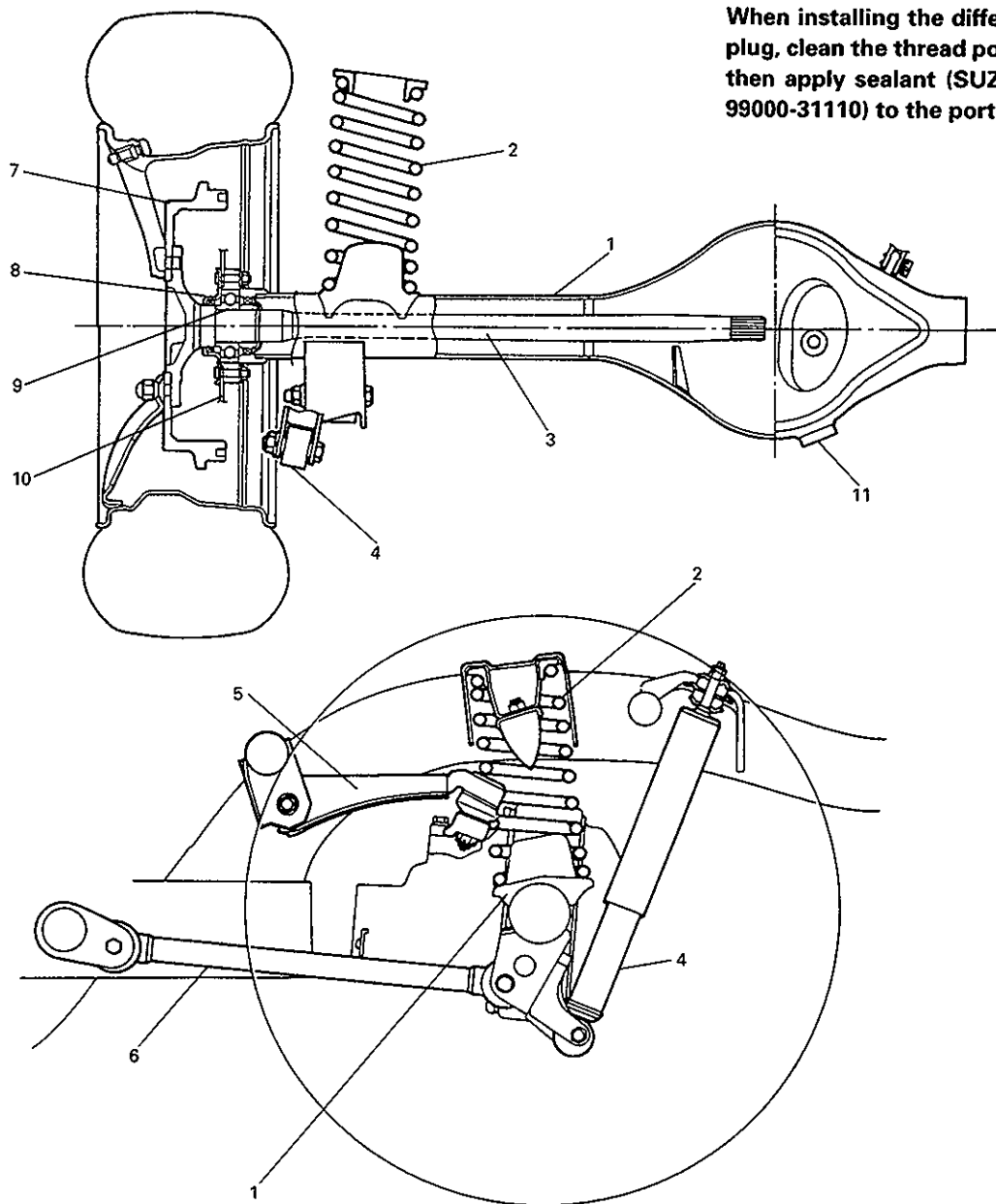
The upper arm is installed to the body and the axle (differential carrier) by using bushes and ball joint so as to prevent axle movement in the lateral direction.

It also prevents axle from turning in forward and backward direction, which occurs due to reaction when brake is applied and when engine is driven.

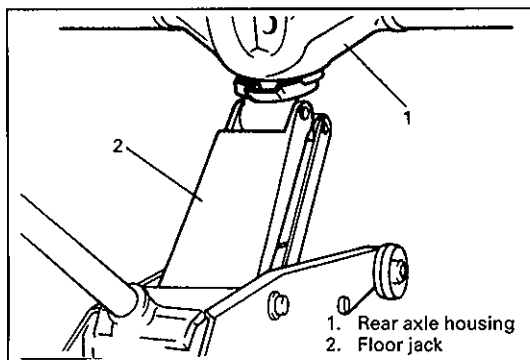
The shock absorber is installed between the body and axle to absorb up-and-down movement of the vehicle body.

NOTE:

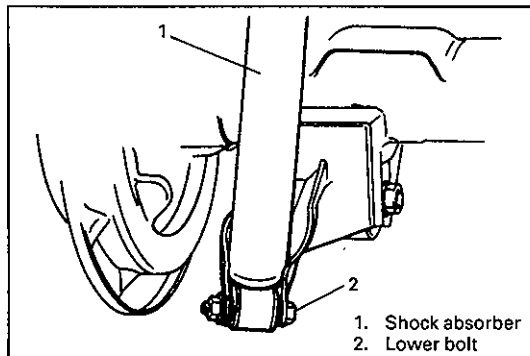
When installing the differential gear oil drain plug, clean the thread portion of the plug and then apply sealant (SUZUKI BOND No.1215, 99000-31110) to the portion.



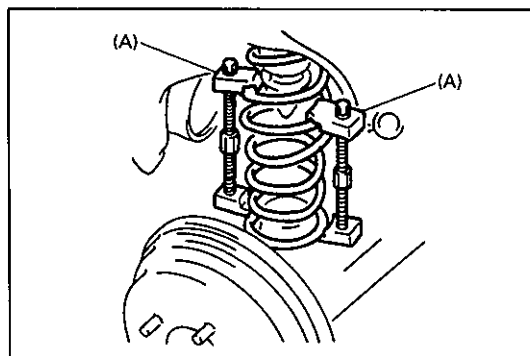
1. Rear axle housing
2. Coil spring
3. Axle shaft
4. Shock absorber
5. Upper arm
6. Trailing rod
7. Brake drum
8. Wheel bearing retainer
9. Rear wheel bearing
10. Brake back plate
11. Oil drain plug



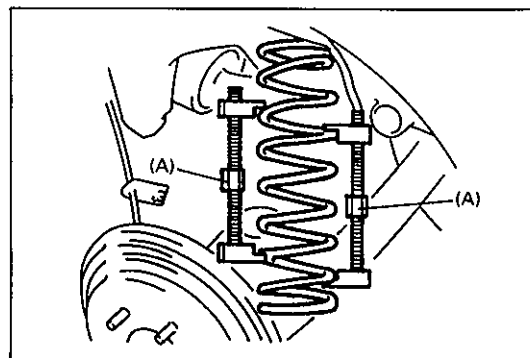
85F00-3E-3-1



60A20-3E-3-3



85F00-3E-3-3



85F00-3E-3-4

ON VEHICLE SERVICE

COIL SPRING

REMOVAL

- 1) Hoist vehicle and remove rear wheel.
- 2) Support rear axle housing by using floor jack.

- 3) Remove shock absorber lower mounting bolt.

- 4) Install special tool (A) to coil spring.

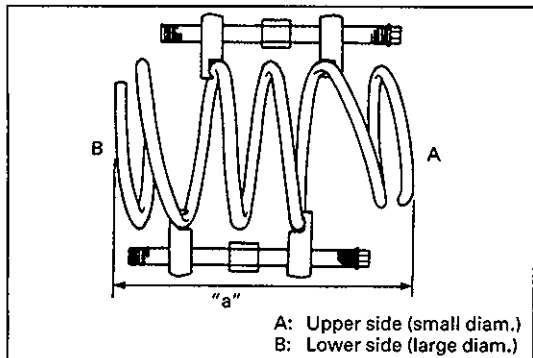
Special Tool

(A): 09940-71430

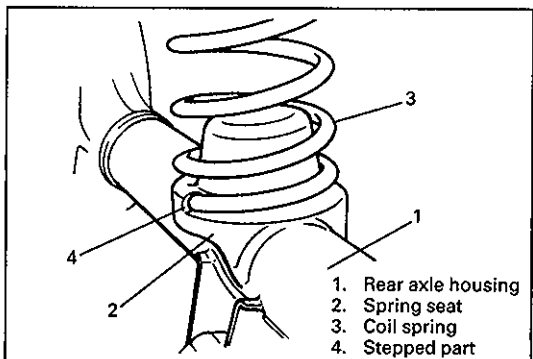
NOTE:

Special tool (A) should be apply to coil spring only. It needs not to compress coil spring.

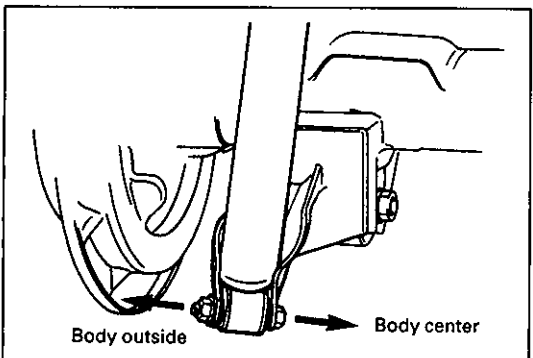
- 5) Lower rear axle housing gradually.
- 6) Remove coil spring with special tool (A).
- 7) Remove special tool (A) from coil spring.



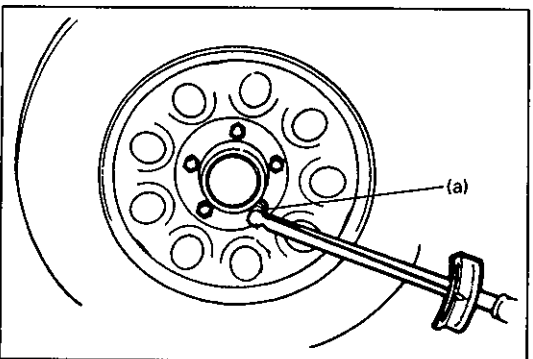
85F00-3E-4-1



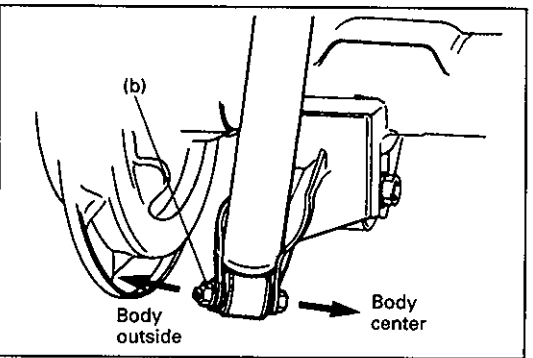
85F00-3E-4-2



85F00-3E-4-3



85F00-3E-4-4



85F00-3E-4-5

INSTALLATION

- 1) Compress spring with special tool (A) until total length becomes about 305 mm (12.0 in.) as shown.

Length "a": 305 mm (12.0 in.)

NOTE:

Upper and lower diameters of coil spring are different. Bring larger diameter end at bottom.

- 2) Install coil spring with special tool (A) on spring seat of axle housing and then raise axle housing.

NOTE:

When seating coil spring, mate spring end with stepped part of rear axle spring seat as shown.

- 3) Remove special tool (A) from coil spring.

- 4) Install shock absorber lower bolt. For its proper installing direction, refer to figure. Nut should not be tightened.

- 5) Install wheel and tighten wheel nuts to specified torque.

Tightening Torque

(a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

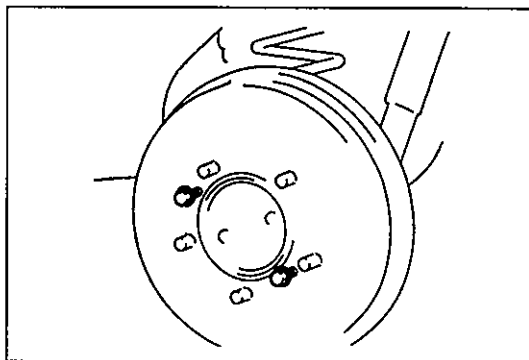
- 6) Lower hoist and tighten shock absorber lower nut to specified torque.

Tightening Torque

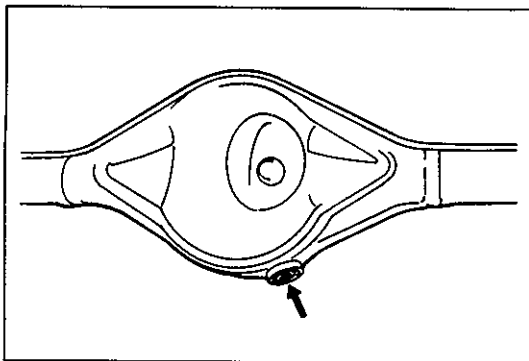
(b): 85 N·m (8.5 kg-m, 61.5 lb-ft)

NOTE:

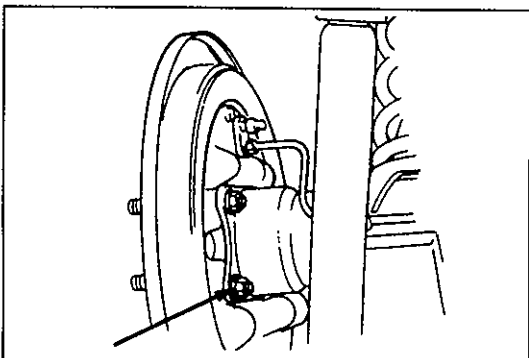
Tighten lower nut with vehicle off hoist and in nonloaded condition.



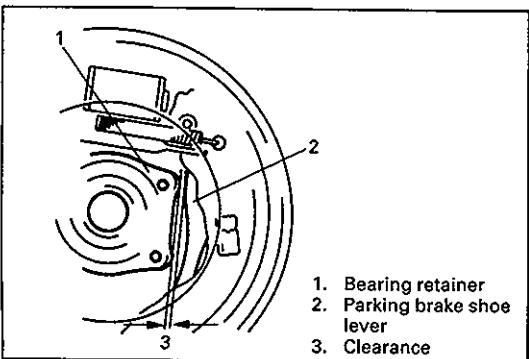
85F00-3E-5-1



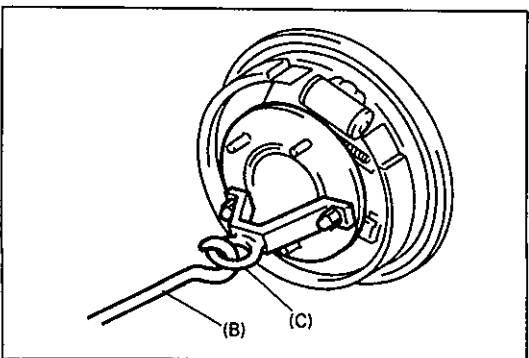
60A20-3E-12-2



60A20-3E-12-3



85F00-3E-5-4



85F00-3E-5-5

REAR AXLE SHAFT AND WHEEL BEARING

REMOVAL

1) Remove rear brake drum. For details, refer to REAR BRAKE DRUM REMOVAL of SECTION 5.

2) Drain gear oil from rear axle housing by loosening drain plug.

3) Remove rear wheel bearing retainer nuts from axle housing.

4) Check to ensure that there is clearance between rear wheel bearing retainer and parking brake shoe lever. If no clearance is found, loosen cable locking nut further to obtain clearance.

5) Using special tools (B) & (C) indicated below, draw out axle shaft.

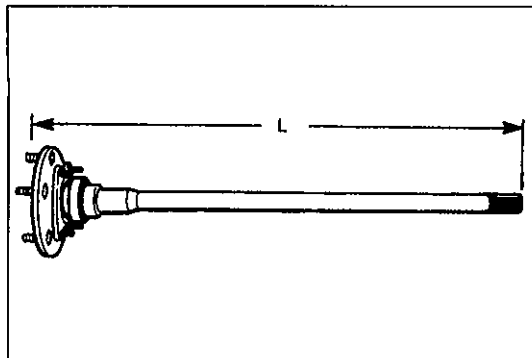
NOTE:

Use care not to pull brake back plate along with shaft.

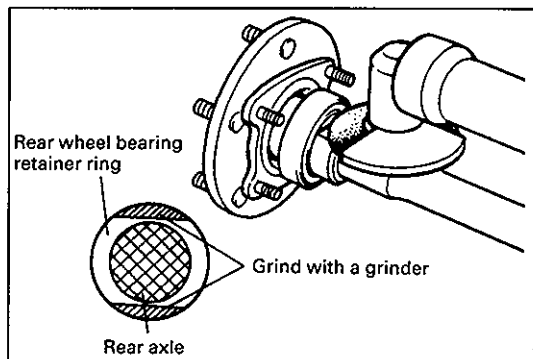
Special Tool

(C): 09943-35511

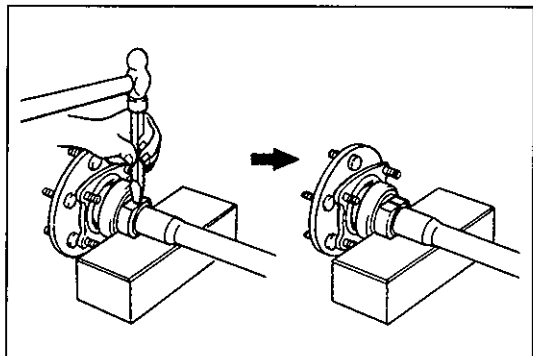
(B): 09942-15510



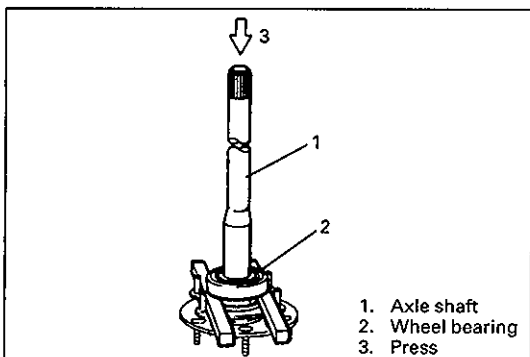
85F00-3E-6-1



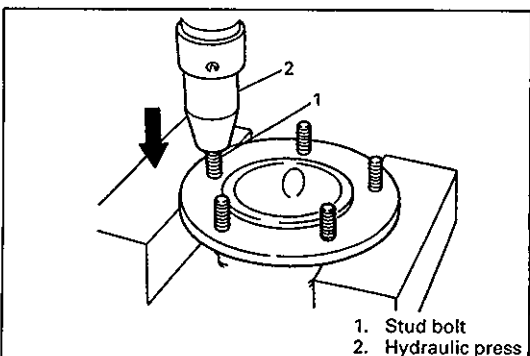
85F00-3E-6-2



85F00-3E-6-3



85F00-3E-6-4



85F00-3E-6-5

6) Rear axle shaft that was drawn out.

Shaft length "L"	
Left side	708.5 mm (27.9 in.)
Right side	751.5 mm (29.6 in.)

7) In order to remove the retainer ring from the shaft, grind with a grinder two parts of the bearing retainer ring as illustrated till it becomes thin.

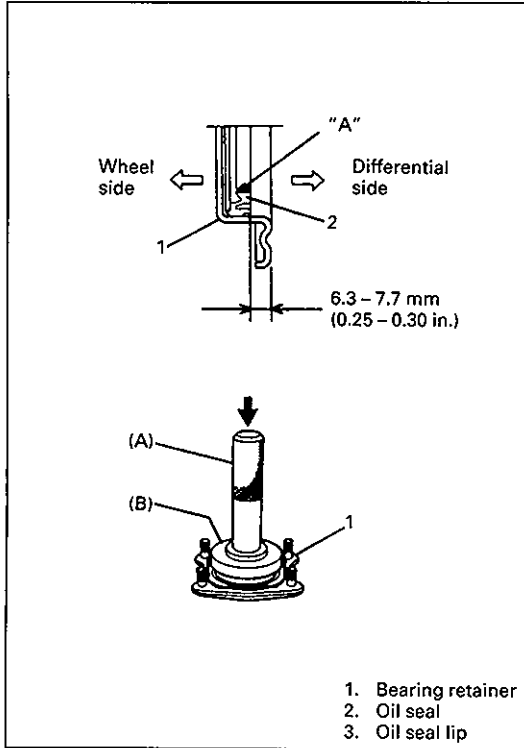
CAUTION:

Be careful not to grind too far not to damage the shaft.

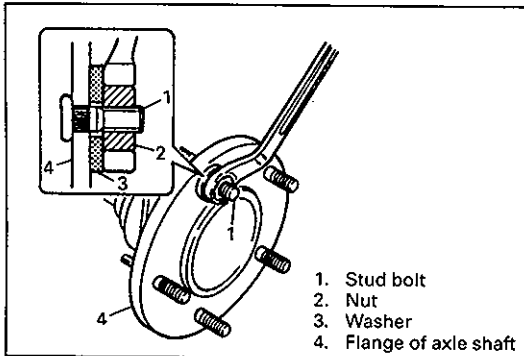
8) Break with a chisel the thin ground retainer ring, and it can be removed.

9) Remove bearing from shaft by using hydraulic press.
10) Remove bearing retainer.

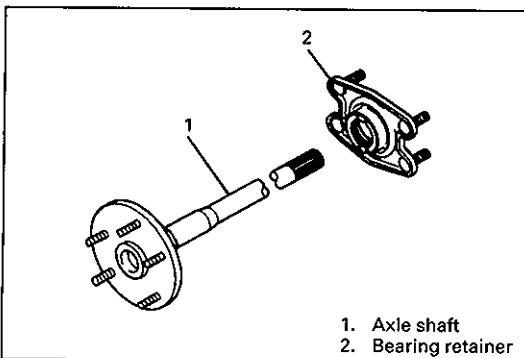
11) Remove stud bolt(s) by using hydraulic press.



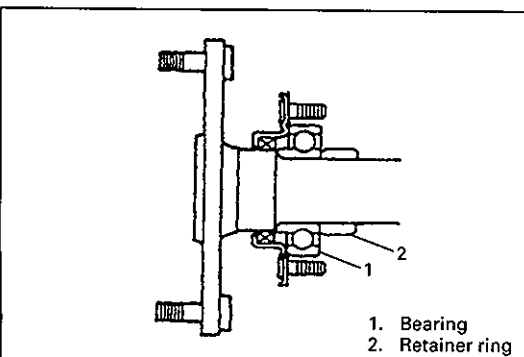
85F00-3E-7-1



85F00-3E-7-3



85F00-3E-7-4



85f00-3E-7-5

INSTALLATION

Install removed parts in reverse order of removal procedure, noting the following.

- 1) To install bearing retainer oil seal, be sure to apply small amount of grease to its periphery and press-fit it by using special tools (A & B). Be careful to press-fit in proper direction, to proper extent and evenly. For its proper installing direction and extent, refer to figure.

Apply grease to oil seal lip as shown and install it to axle shaft.

Special Tool

(A): 09924-74510

(B): 09926-88310

"A": Grease 99000-25010

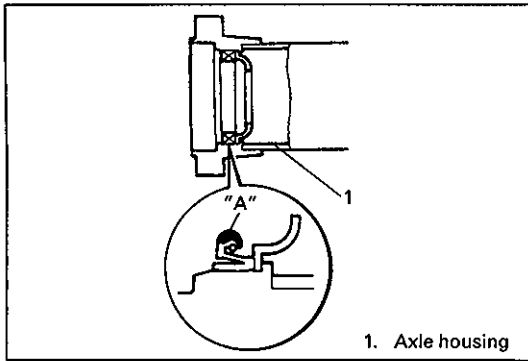
- 2) Aligning serrations between new stud bolt(s) and flange, install new stud bolt(s) by tightening nut as shown.

- 3) Install bearing retainer to shaft.

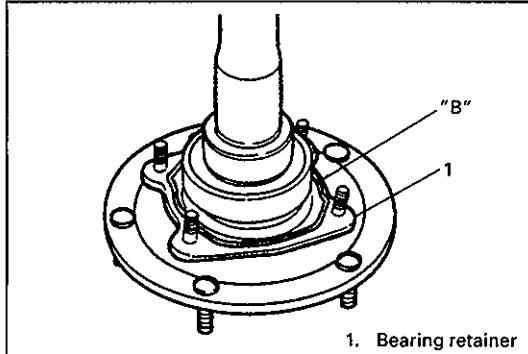
- 4) Press-fit wheel bearing and retainer ring as shown.

NOTE:

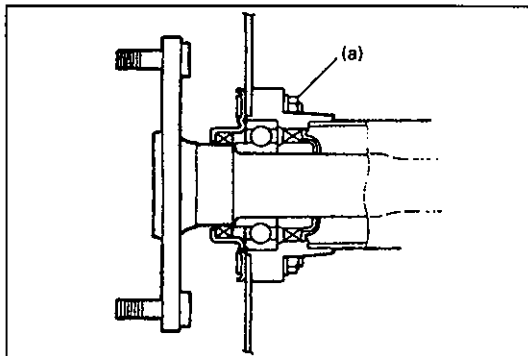
- Use care not to cause any damage to outside of retainer ring.
- Refer to figure so that wheel bearing is installed in proper direction.



85F00-3E-8-1



85F00-3E-8-2



85F00-3E-8-3

- 5) Apply grease to axle shaft inner oil seal lip as shown.

"A": Grease 99000-25010

- 6) Apply sealant to mating surface of bearing retainer with brake back plate.

NOTE:

Make sure to remove old sealant before applying it anew.

"B": Sealant 99000-31110

- 7) Install rear axle shaft to rear axle housing and tighten bearing retainer nuts to specified torque.

NOTE:

When installing rear axle shaft, be careful not to cause damage to oil seal lip in axle housing.

Tightening Torque

(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

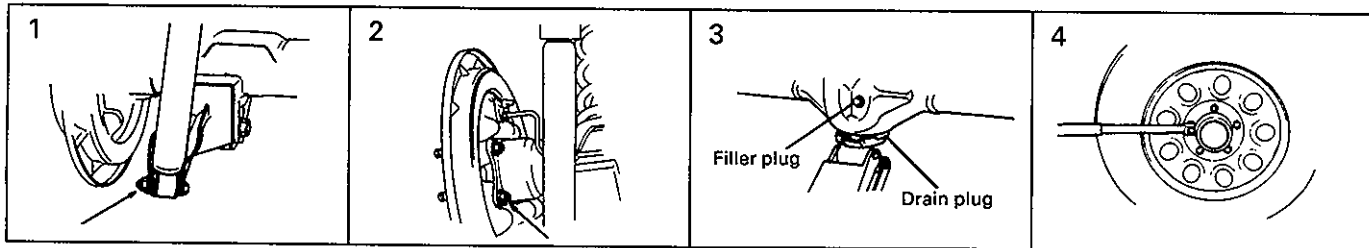
- 8) Refill rear axle (differential) housing with new specified gear oil. Refer to SECTION 7E of Service Manual mentioned in FOREWORD of this manual for refill.

- 9) Install brake drum. (For details, refer to BRAKE DRUM INSTALLATION of SECTION 5.)

85F00-3E-8-4

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts		Tightening torque		
		N·m	Kg-m	lb-ft
1. Shock absorber lower nut		85	8.5	61.5
2. Bearing retainer nut		23	2.3	17.0
3. Differential gear oil filler & drain plug	Filler plug	50	5.0	36.5
	Drain plug	22	2.2	16.0
4. Wheel nut		95	9.5	69.0



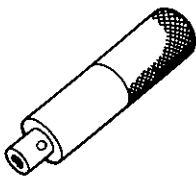
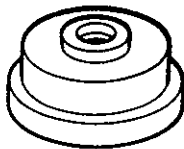
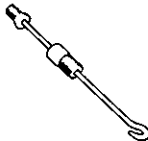
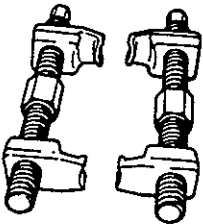
85F00-3E-9-1

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lip
Brake fluid	DOT 3	Brake reservoir
Sealant	SUZUKI BOND NO.1215 (99000-31110)	• Joint seam of bearing retainer and brake back plate • Drain plug
Gear oil	For gear oil information, refer to SECTION 7E of Service Manual mentioned in FOREWORD of this manual.	Differential gear (Rear axle housing)

85F00-3E-10-1

SPECIAL TOOLS

 09924-74510 Bush remover handle	 09926-88310 Oil seal installer	 09942-15510 Sliding hammer	 09943-35511 Axle shaft remover (Brake drum remover)
 09940-71430 Spring compressor			

85F00-3E-10-2

SECTION 3F

WHEELS AND TIRES

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.
- All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts.

There is to be no welding as it may result in extensive damage and weakening of the metal.

85F00-3F-1-1

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3F

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Replacement Tires	3F-1

85F00-3F-1-2

GENERAL DESCRIPTION

TIRES

This vehicle is equipped with following tire.

215/65R16

The tires are of tubeless type. The tires are designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressure.

Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

85F00-3F-1-3

WHEELS

Standard equipment wheels are following steel or aluminum wheels.

16 x 6 ½ J

REPLACEMENT TIRES

When replacement is necessary, the original equipment type tire should be used. Refer to the Tire Placard. Replacement tires should be of the same size, load range and construction as those originally on the vehicle. Use of any other size or type tire may affect ride, handling, speedometer/odometer calibration, vehicle ground clearance and tire or snow chain clearance to the body and chassis.

NOTE:

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

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

85F00-3F-1-4

kPa	kgf/cm ²	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44
320	3.2	47
340	3.4	50
Conversion: 1 psi = 6.895 kPa 1 kgf/cm ² = 98.066 kPa		

The metric term for tire inflation pressure is the kilopascal (kPa). Tire pressures will usually be printed in both kPa and psi on the Tire Placard. Metric tire gauges are available from tool suppliers. The chart, left table, converts commonly used inflation pressures from kPa to psi.

SECTION 5

BRAKES

NOTE:

- For the descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.
- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and / or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

85F00-5-1-1

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GENERAL DESCRIPTION

When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and four in rear).

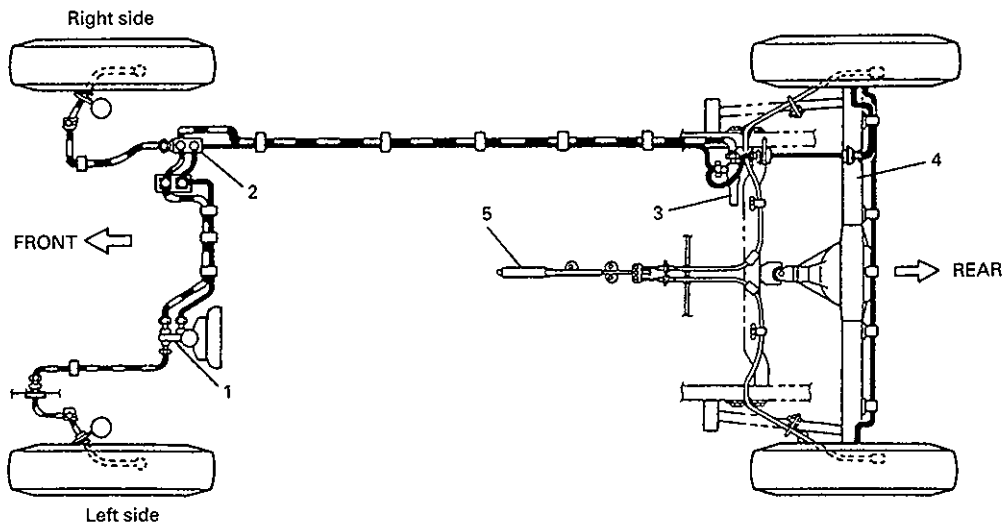
The master cylinder is a tandem master cylinder. Three brake pipes are connected to the master cylinder and they make two independent circuits. One connects front brakes (right and left) and the other connects rear brakes (right and left).

The load sensing proportioning valve (LSPV) is included in these circuits between the master cylinder and rear brake.

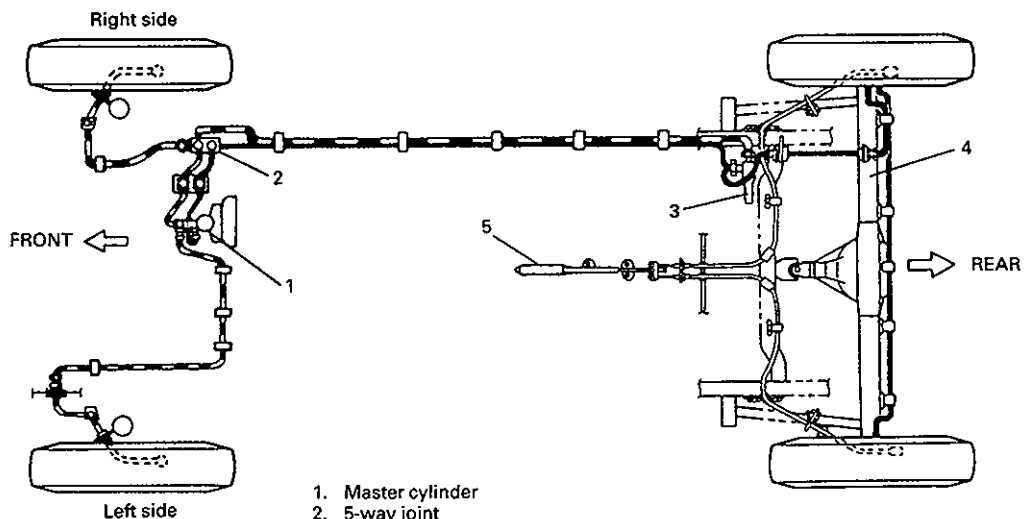
In this brake system, the disc brake type is used for the front wheel brake and a drum brake type (leading/trailing shoes) for the rear brake.

The parking brake system is mechanical. It applies brake force to only rear wheels by means of the cable and mechanical linkage system. The same brake shoes are used for both parking and foot brakes.

[FOR LEFT STEERING WHEEL VEHICLE]



[FOR RIGHT STEERING WHEEL VEHICLE]



1. Master cylinder
2. 5-way joint
3. LSPV (Load Sensing Proportioning Valve)
4. Rear axle housing
5. Parking brake lever

DISC BRAKE CALIPER ASSEMBLY

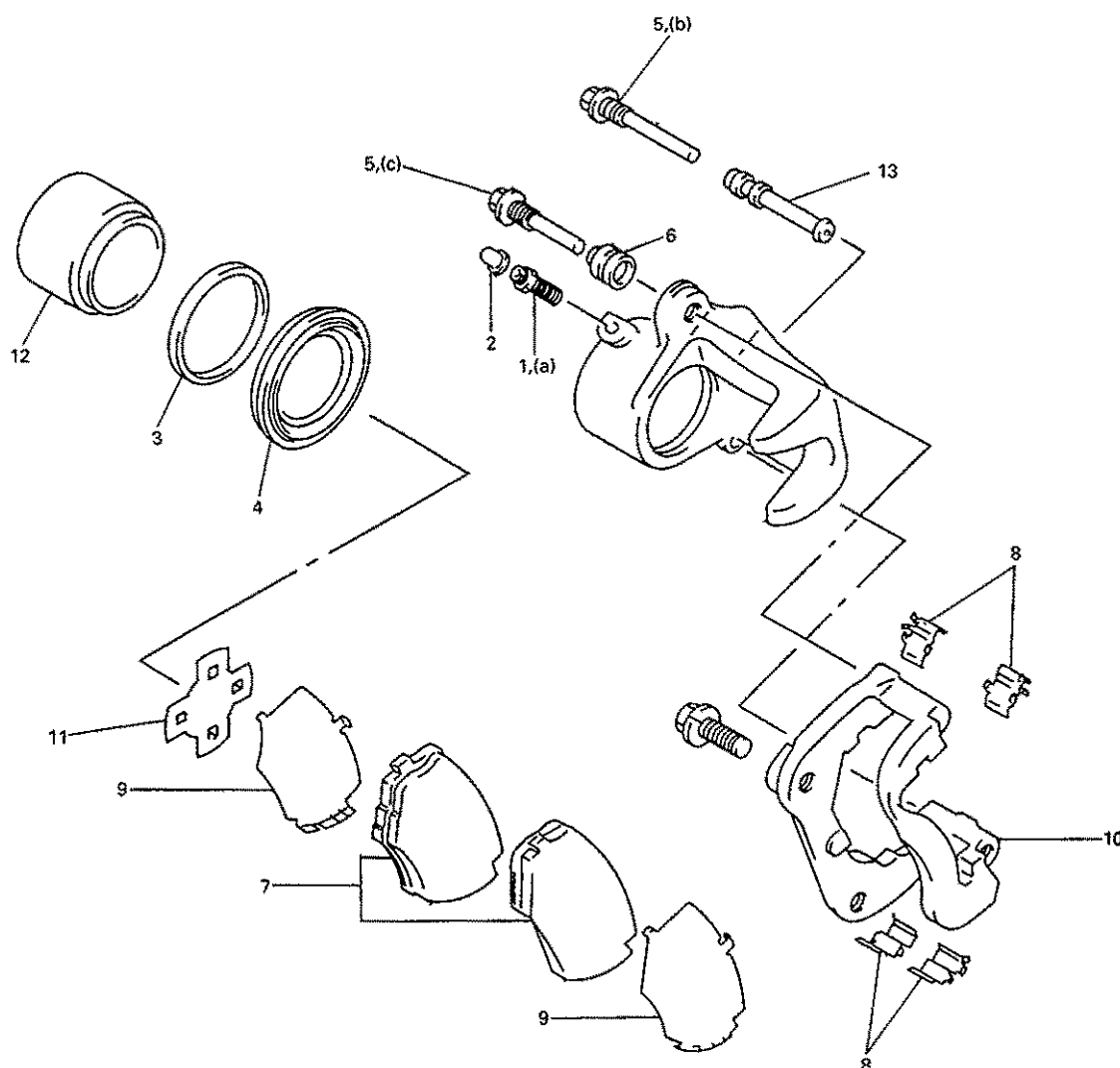
GENERAL DESCRIPTION

This caliper has a single 57.2 mm (2.252 in.) bore and is mounted to the brake caliper carrier with two caliper pin bolts. Hydraulic force, created by applying force to the brake pedal, is converted by the caliper to friction. The hydraulic force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move (slide) the caliper inward, resulting in a clamping action on the disc.

This clamping action forces the pads (linings) against the disc, creating friction to stop the vehicle.

NOTE:

Lubricate parts as specified. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any component is removed or line disconnected, bleed the brake system. Replace pads in axle sets only. The torque values specified are for dry, unlubricated fasteners.



1. Bleeder plug
2. Bleeder plug cap
3. Piston seal
4. Cylinder boot
5. Caliper pin bolt
6. Boot
7. Pad
8. Pad spring
9. Anti noise shim
10. Brake caliper carrier
11. Anti noise shim
12. Disc brake piston
13. Bush

Tightening Torque
 (a): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)
 (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)
 (10 mm thread diameter)
 (c): 58 N·m (5.8 kg-m, 42.0 lb-ft)
 (12 mm thread diameter)

DRUM BRAKE ASSEMBLY

GENERAL DESCRIPTION

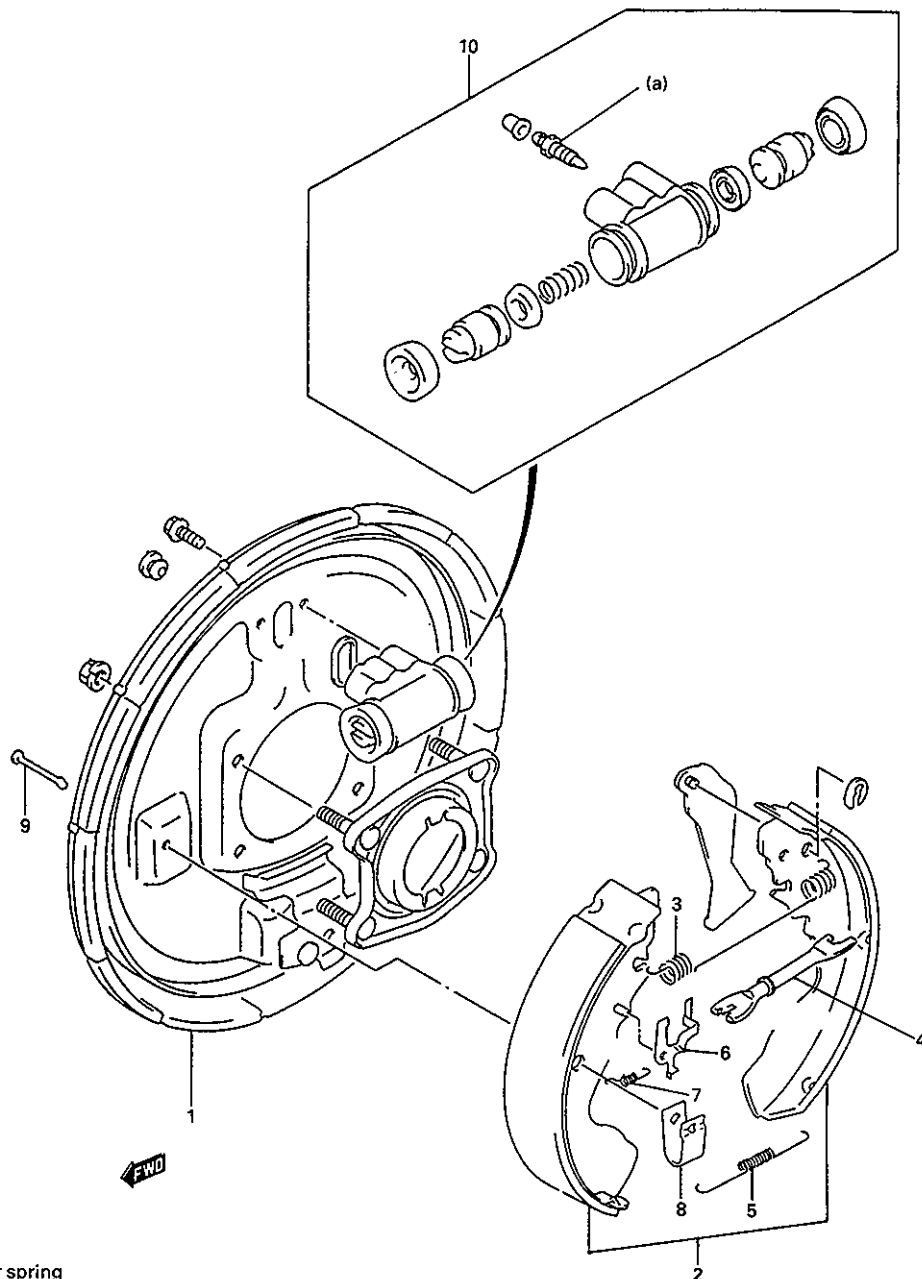
The drum brake assembly has a self shoe clearance adjusting system so that drum-to-shoe clearance is maintained appropriate at all times. For details, refer to **Compensation of rear brake clearance** on next page.

NOTE:

Replace all components included in repair kits to service this drum brake. Lubricate parts as specified.

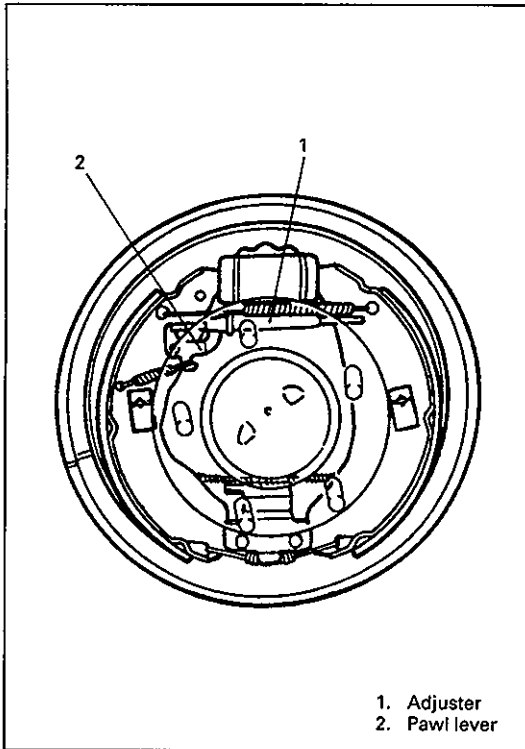
WARNING:

If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.



1. Brake back plate
2. Brake shoe
3. Shoe return upper spring
4. Adjuster
5. Shoe return lower spring
6. Pawl lever
7. Adjuster spring
8. Shoe hold down spring
9. Shoe hold down pin
10. Wheel cylinder

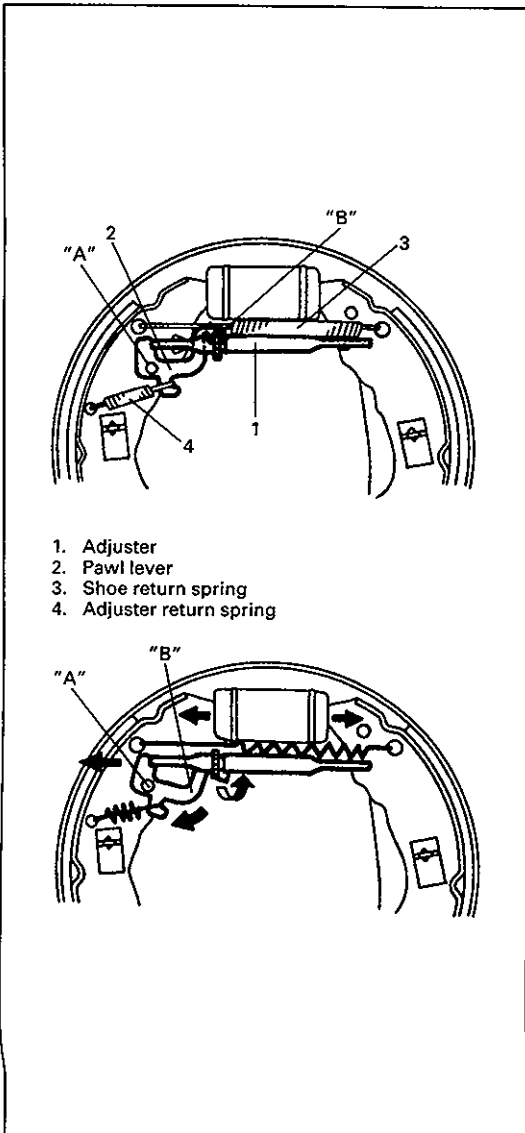
Tightening Torque
(a): 8.0 N·m (0.8 kg·m, 6.0 lb·ft)



85F00-5-5-1

Compensation of rear brake clearance

The brake is equipped with an auto-adjust mechanism which consists of an adjuster, pawl lever, etc.. When the brake pedal is depressed, shoe clearance is adjusted automatically.



85F00-5-5-3

The pawl lever supported by pin "A" is subject to the turning force caused by the spring but prevented from turning by the end of the adjuster. In this state, when the brake pedal is depressed, the gap between shoes increases while the length of the adjuster remains unchanged. As a result, the pawl lever moves in the direction as shown in the figure. At this time, with the tip "B" of the pawl lever engaged with the gear of the adjuster, the gear turns in the direction as indicated in the figure and the overall length of the adjuster increases. This is because the external thread of the adjuster gear is in mesh with the internal thread of the adjuster body and the gear turns in the unscrewing direction.

When the shoe clearance is large, every time the brake pedal is depressed, the gear turns by one notch. Once the clearance has reached the appropriate level, even when the brake pedal is depressed, the shoe stroke is not enough to cause the gear to turn by 1 notch (i.e., pawl lever does not move) and thus the clearance remains unchanged.

MASTER CYLINDER ASSEMBLY

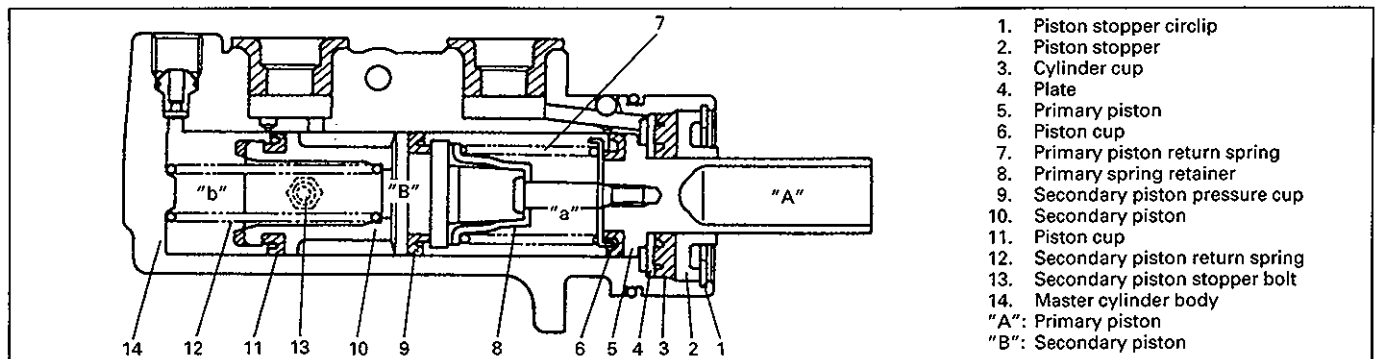
GENERAL DESCRIPTION

The master cylinder has two pistons and three piston cups. Its hydraulic pressure is produced in the primary ("a" in the below figure) and secondary ("b") chambers. The hydraulic pressure produced in the primary chamber ("a") acts on the rear wheel brakes (left and right).

Also, the hydraulic pressure produced in the secondary chamber ("b") acts on the front wheel brakes (left and right).

NOTE:

Replace all components included in repair kits to service this master cylinder. Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.



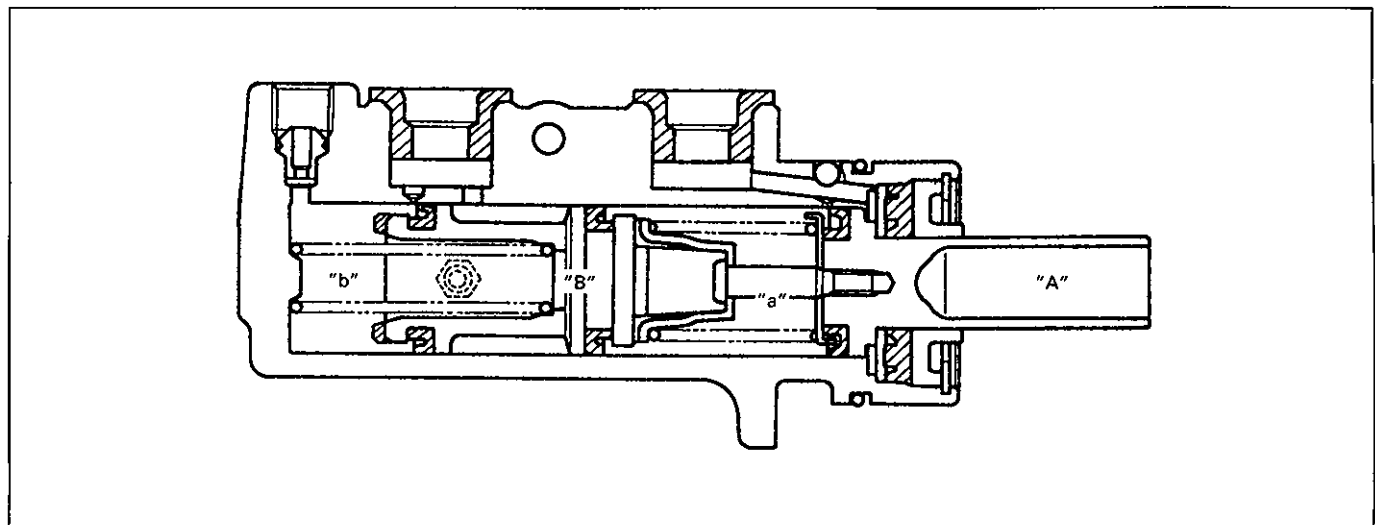
85F00-5-6-1

Master Cylinder OPERATION

Normal operation

Depressing the brake pedal forces the primary piston "A" to move to the left in the below figure and consequently the hydraulic pressure is produced in the chamber "a".

By means of this pressure and the return spring force, the secondary piston "B" is also pushed to the left and thus the hydraulic pressure is produced in the chamber "b".



60A40-5-8-2

Returning

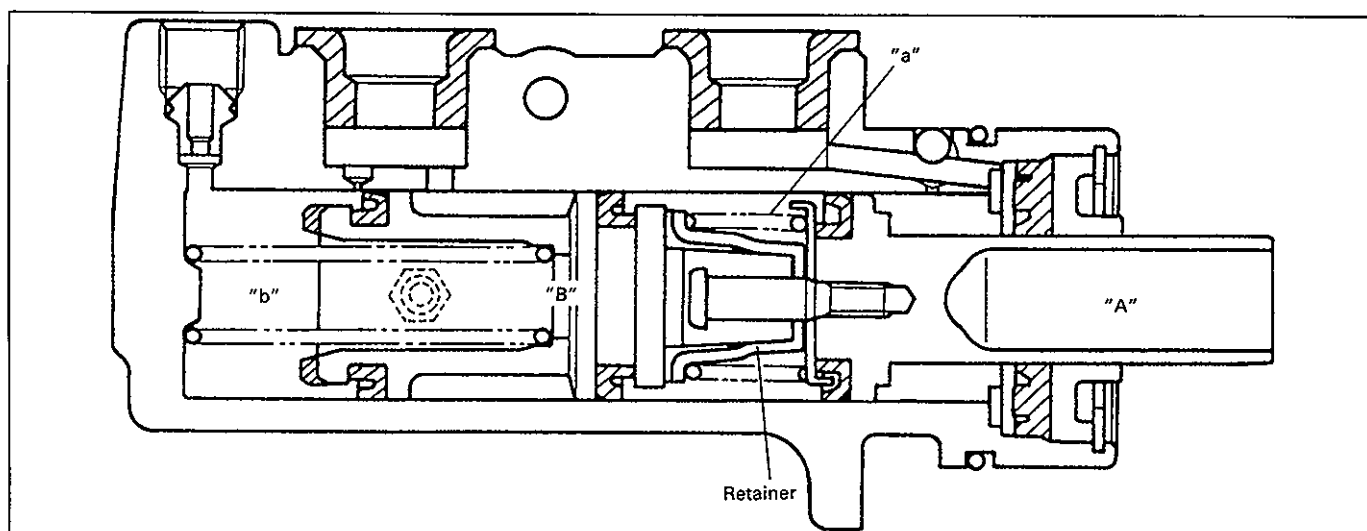
When the master cylinder returns in the usual way, the piston of the master cylinder moves back to its original position by the returning brake fluid and the return spring force.

When the brake fluid returns from the wheel later than usual (after air-bleeding or auto-adjuster operation), negative pressure occurs in chambers "a" on the primary side and "b" on the secondary side.

Then the brake fluid flows from the reservoir tank through the groove between the cap and sleeve, between the piston guide and sleeve, and then through the clearance around the primary cup into the chamber "a". Also, the brake fluid from the reservoir tank flows between the cylinder body and piston guide and then through the clearance around the secondary cup into the chamber "b".

One-circuit operation (Primary chamber "a" circuit failure)

Depressing the brake pedal forces the primary piston "A" to move as described previously, but since the brake circuit connected to the chamber "a" cannot hold the pressure, no pressure is produced in the fluid immediately ahead of the piston "A". The piston "A" keeps moving while compressing the spring and when it reaches the retainer, the piston "B" is pushed and begins to move. This causes the pressure to rise in the chamber "b" and the pressure acts on the front wheel brakes (right and left).

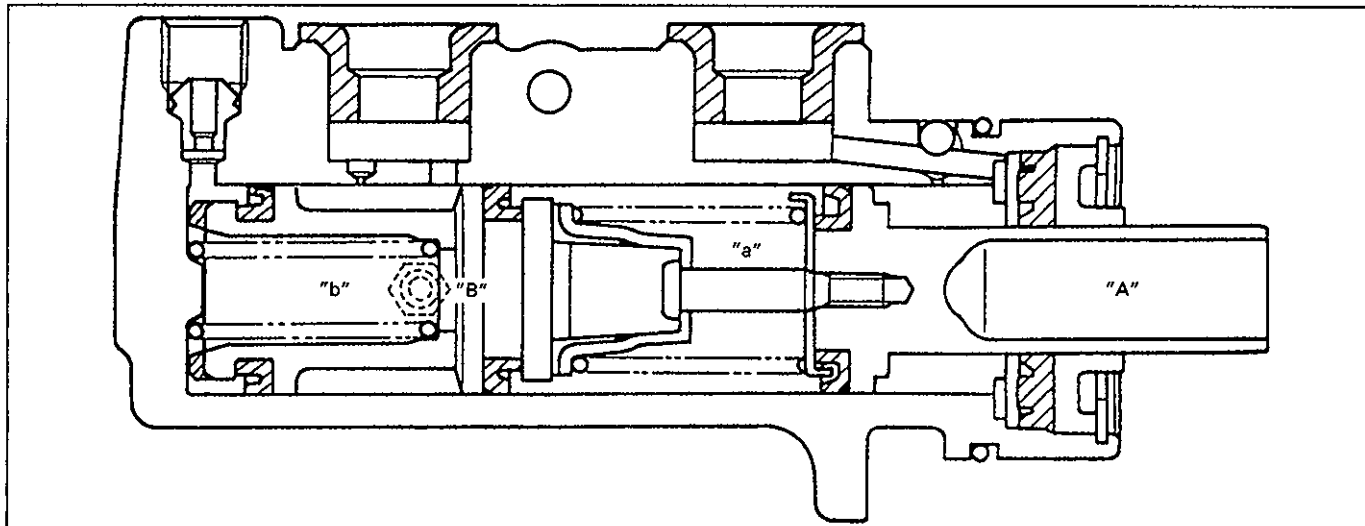


85F00-5-7-1

One-circuit operation (Secondary chamber "b" circuit failure)

In this case, the leftward movement of the piston "A" has but little effect in causing the fluid pressure to rise in the chamber "a" in the beginning, because the initial rise of the fluid pressure causes the piston "B" to promptly yield and move to the left. However, when the forward end of the piston "B" comes to the head of the cylinder and stops there, the leftward movement of the piston "A" becomes effective. Thus the fluid pressure is produced in the chamber "a" and it acts on the rear wheel brakes (right and left).

The below figure shows secondary piston "B" at halt.



BOOSTER ASSEMBLY

GENERAL DESCRIPTION

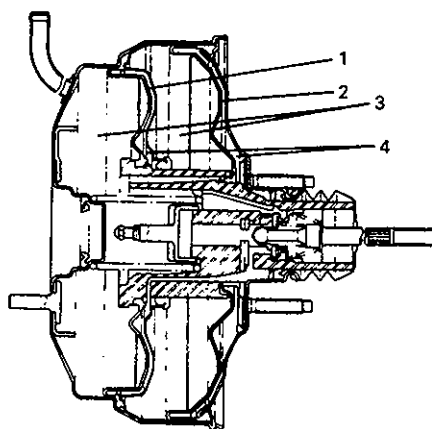
The booster is located between the master cylinder and the brake pedal. It is so designed that the force created when the brake pedal is depressed is mechanically increased combined with the engine vacuum. The booster has two diaphragms of $\varnothing$ 7 & 8 in. (178 & 203 mm) effective diameter. Its operation is described in the following pages, and characteristic diagram is shown below.

WARNING:

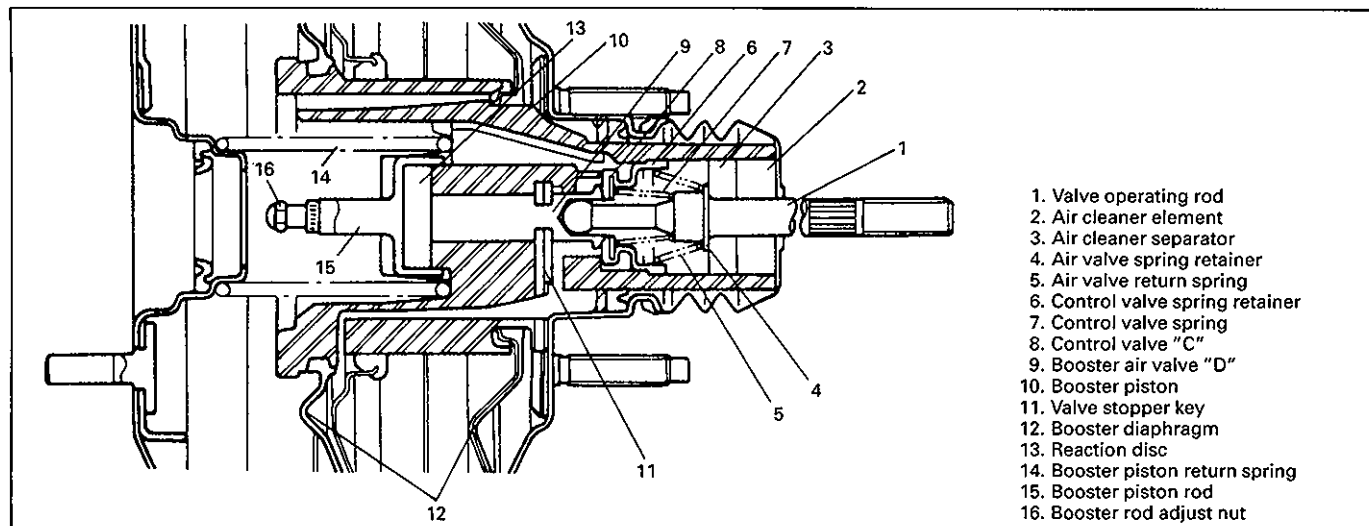
Never disassemble brake booster assembly. If it is found faulty, replace it with new assembly.

CAUTION:

The torque values specified are for dry, unlubricated fasteners. If any hydraulic component is removed or brake line disconnected, bleed the brake system.



- 1. 7 in. diaphragm
- 2. 8 in. diaphragm
- 3. Chamber "A"
- 4. Chamber "B"

Booster OPERATION

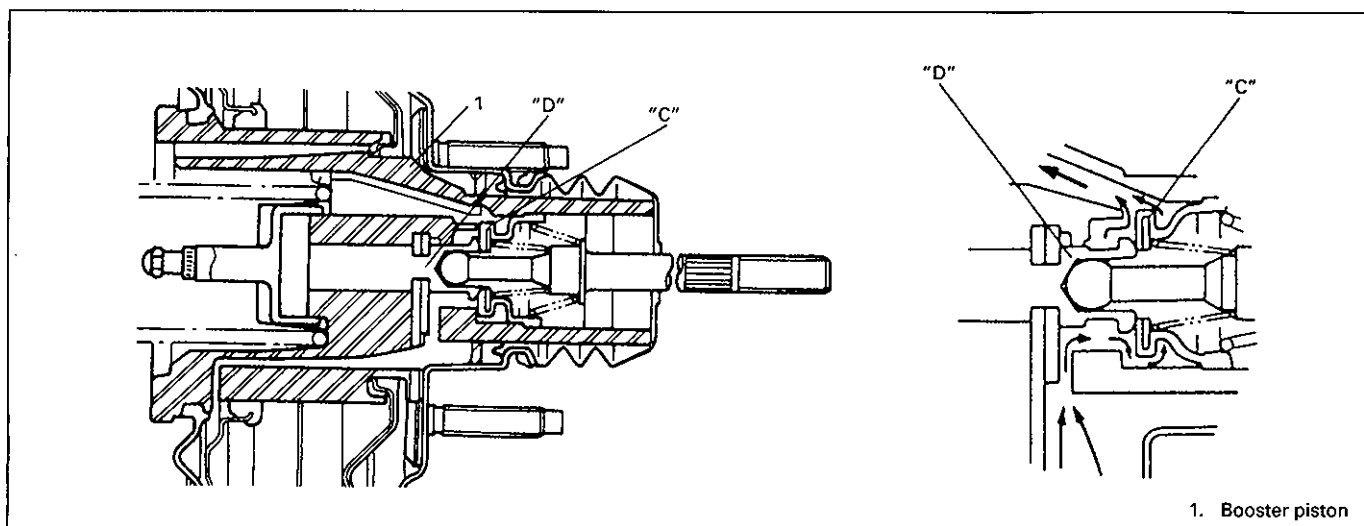
60A70-5-10-1S

When the brake pedal is depressed, the force is transmitted to the piston of the master cylinder through the valve operating rod, booster air valve, reaction disc and piston rod. At the same time, the force of the booster piston developed due to the pressure difference between the four chambers "A" and "B" in the above figure is added to it.

The end of the booster control valve has a double function of a vacuum valve and air valve. That is, as shown in the figure, the booster control valve closes between the "A" and "B" chambers as its outer end "C" contacts the booster piston seat and opens as "C" leaves the booster piston seat (vacuum valve function). Also it closes between the "B" chamber and outside air as its inner end "D" contacts the air valve seat and opens as "D" leaves the air valve seat (air valve function).

When foot brake pedal is not depressed

The valve operating rod is pushed to the right by the spring force as shown. The air valve is also enough to the right to contact the valve stopper key as shown. In this state, the vacuum valve (control valve "C") is open and the air valve (air valve "D") is closed. Thus the chambers "A" and "B" conduct and share the same negative pressure (because of no pressure difference) which allows the return spring to push the booster piston to the right.

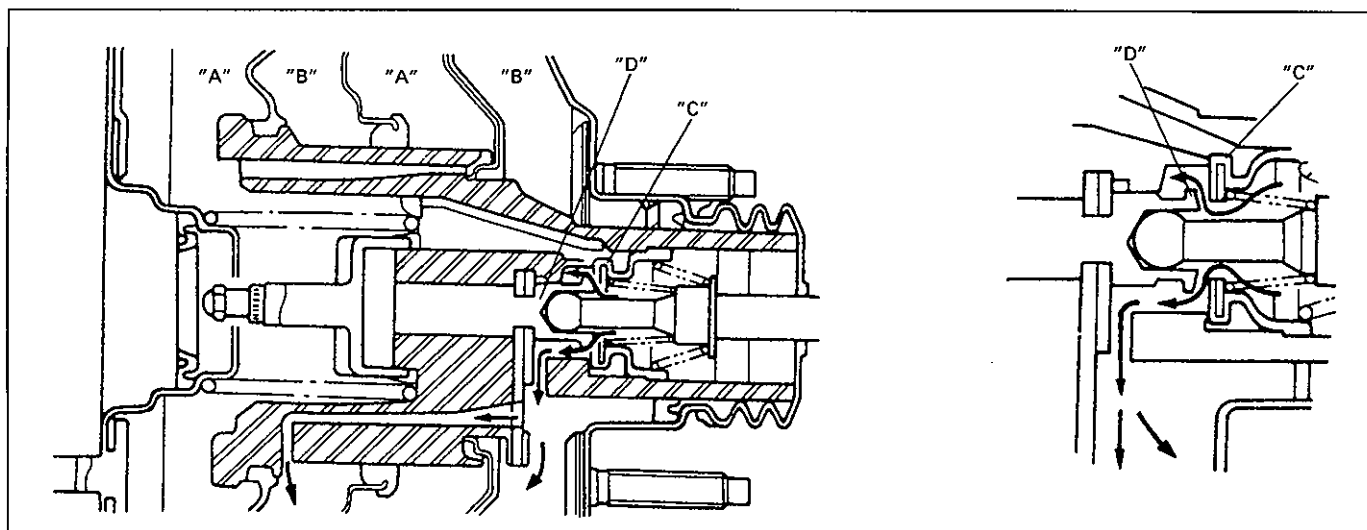


60A70-5-10-2S

When foot brake pedal is depressed

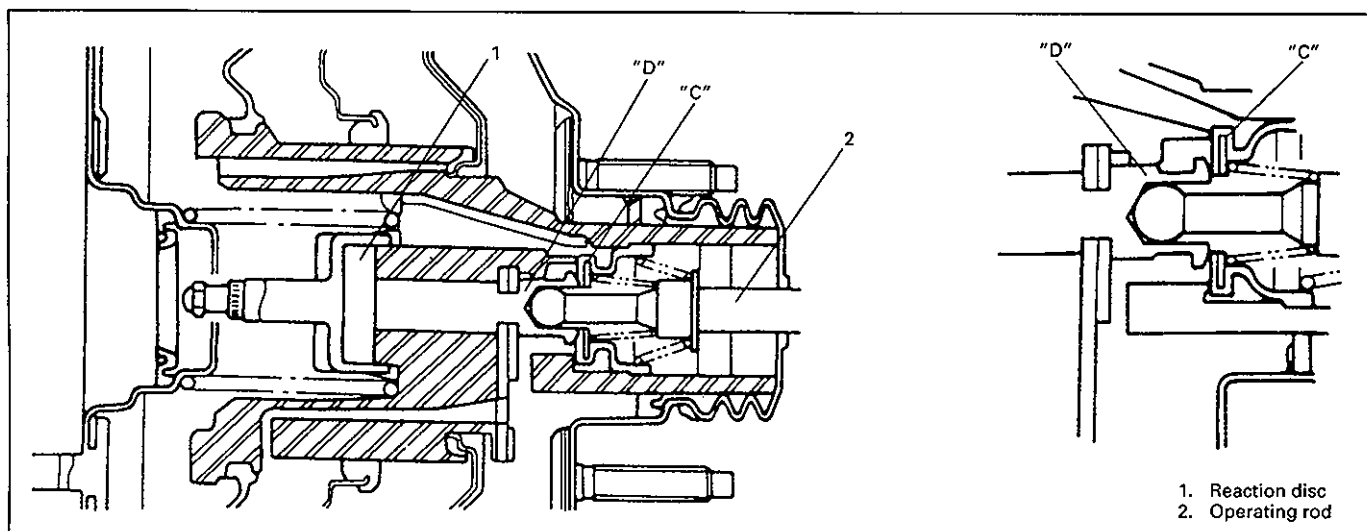
1) At the beginning of brake pedal depression

When the brake pedal is depressed, the operating rod opens up the air valve "D" and closes the control valve "C", so that chambers "A" and chambers "B" are shut off and the atmospheric pressure is drawn into chambers "B" through the air valve "D". Then the pressure in chamber "B" increases while the vacuum in chamber "A" remains unchanged, and the pressure difference between these chambers will cause the booster piston to move to the left, resulting in a condition as described in 2) or 3) below.



60A70-5-12-1S

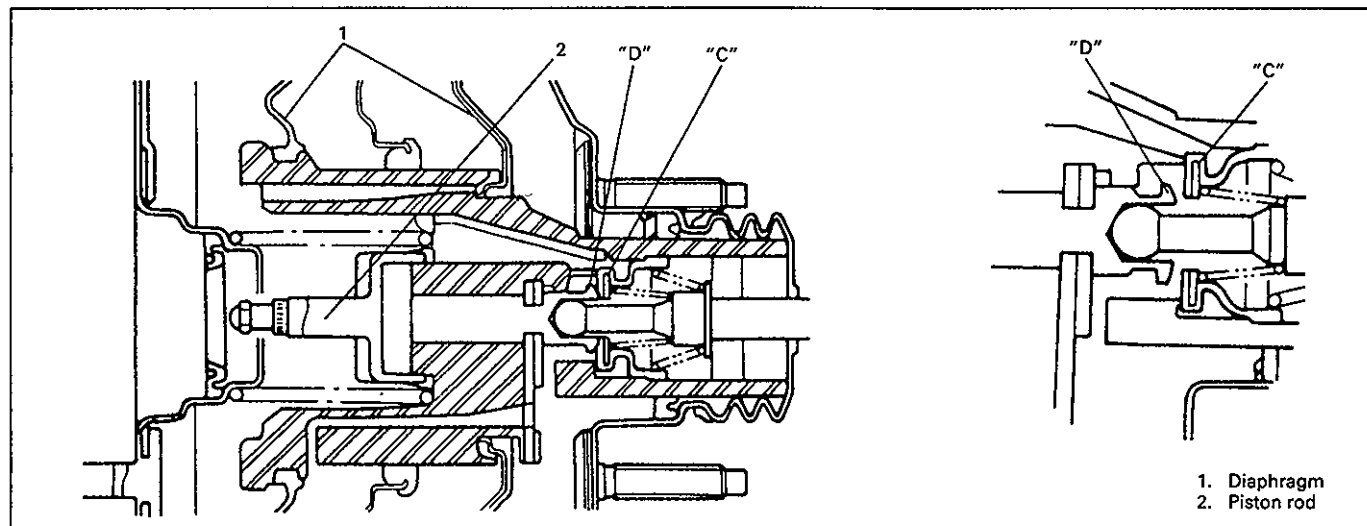
- 2) When the brake pedal depressing force becomes constant within the amplification range of the booster
- The depressing force is transmitted through the operating rod and air valve "D", pushing the central part of the reaction disc. On the other hand, the oil pressure reaction force from the master cylinder is transmitted through the piston rod and applied to the central part of the reaction disc. When these forces are balanced, the air valve "D" and control valve "C" close. And if the brake pedal depressing force remains unchanged in this state, amplification corresponding to the force will be maintained.



60A70-5-12-2S

3) When brake pedal depressing force exceeds the amplification range of the booster

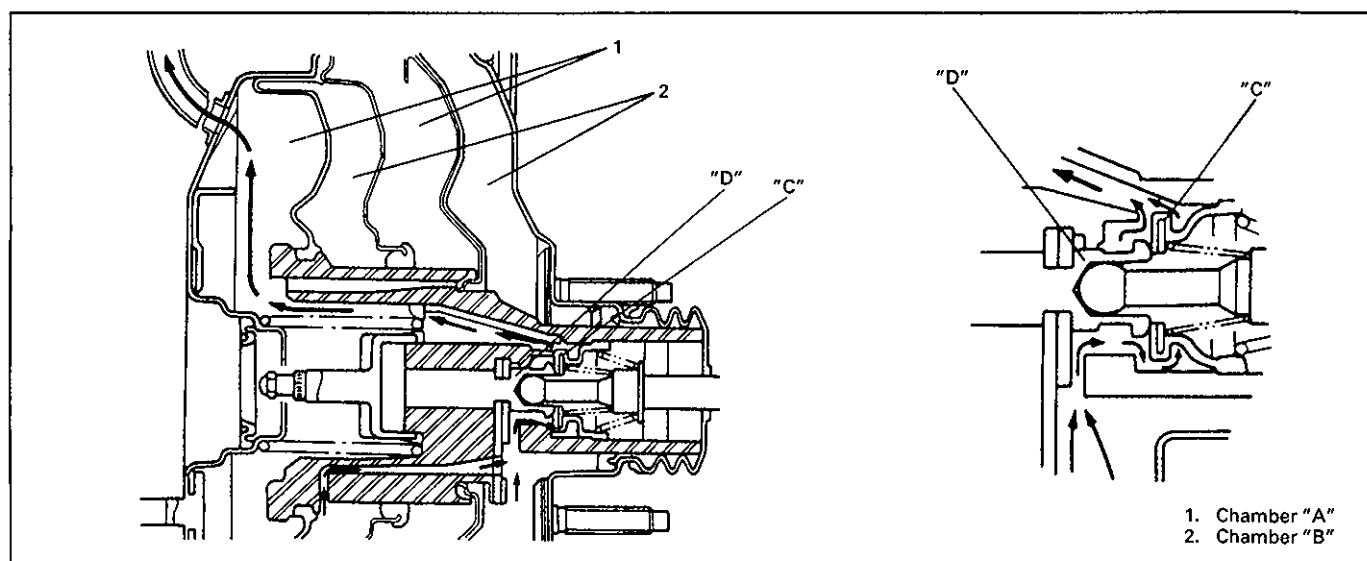
While the brake pedal is depressed, the air valve remains open. As a result, vacuum in chambers "B" keeps reducing and when it becomes equal to the atmospheric pressure, the force applied to the diaphragm becomes maximum. As the brake pedal is depressed further, the force applied to the piston rod increases by the amount corresponding to increase in the depressing force while that applied to the diaphragms remains the same.



60A70-5-13-1S

When foot brake pedal is released

When the brake pedal is released, the booster air valve returns to the right by the master cylinder piston return force and the air valve return spring force as shown. Then the vacuum valve (control "C") opens and causes negative pressure in the chamber "B". The result is that the master cylinder piston and booster piston return to their original positions. This is the same state as described under "When foot brake pedal is not depressed".



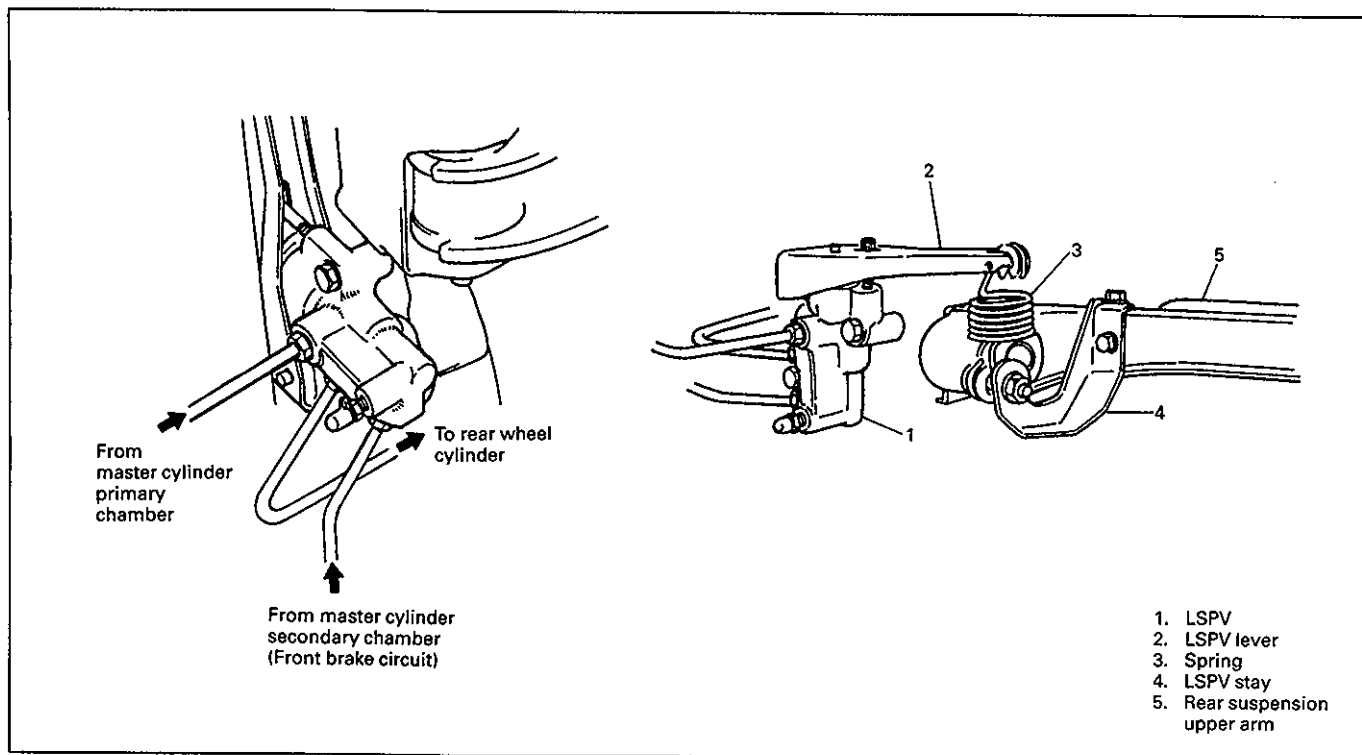
60A70-5-13-2S

LSPV (Load Sensing Proportioning Valve) ASSEMBLY

GENERAL DESCRIPTION

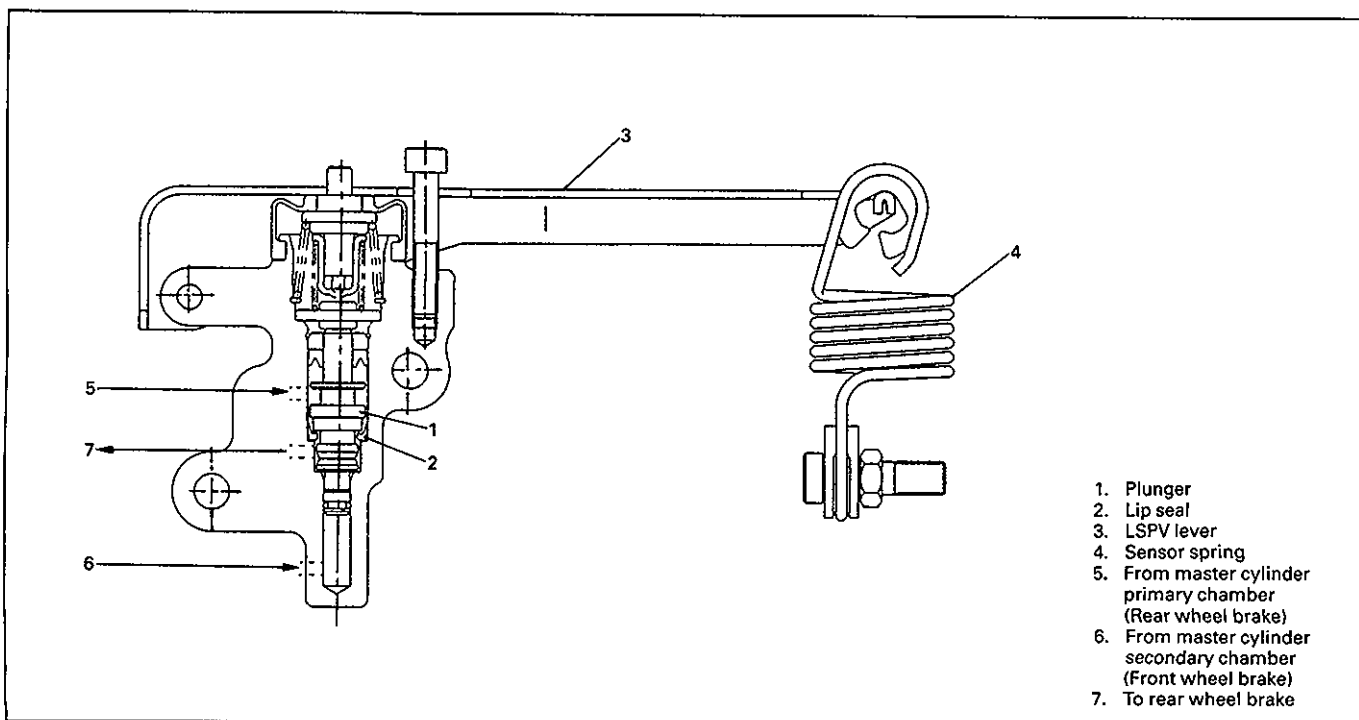
As shown in figure below, LSPV is included within the brake circuit which connects the master cylinder and the rear wheel brake. It controls the hydraulic pressure applied to the rear wheel brake according to the loaded state of the vehicle (or weight of the load), whereby preventing the rear wheels from getting locked prematurely.

If the front hydraulic pressure fail to increase (failure in the front brake circuit), it is so designed that the fail-safe mechanism works and a hydraulic pressure higher than in normal condition is applied to rear wheel cylinders.



85F00-5-13-1

CONSTITUTION



85F00-5-13-2

OPERATION

LSPV is installed to the vehicle body, with the end of the lever at its top connected to the upper arm of the rear suspension by way of the sensor spring and the LSPV stay.

When some load is placed on the vehicle, the distance between the axle housing of the rear suspension and the vehicle body (chassis) (i.e. coil spring height) changes, whereby the sensor spring length also changes.

As the sensor spring length changes, the force affecting the plunger in LSPV by way of the lever changes so that the hydraulic characteristic suitable for the load weight becomes available.

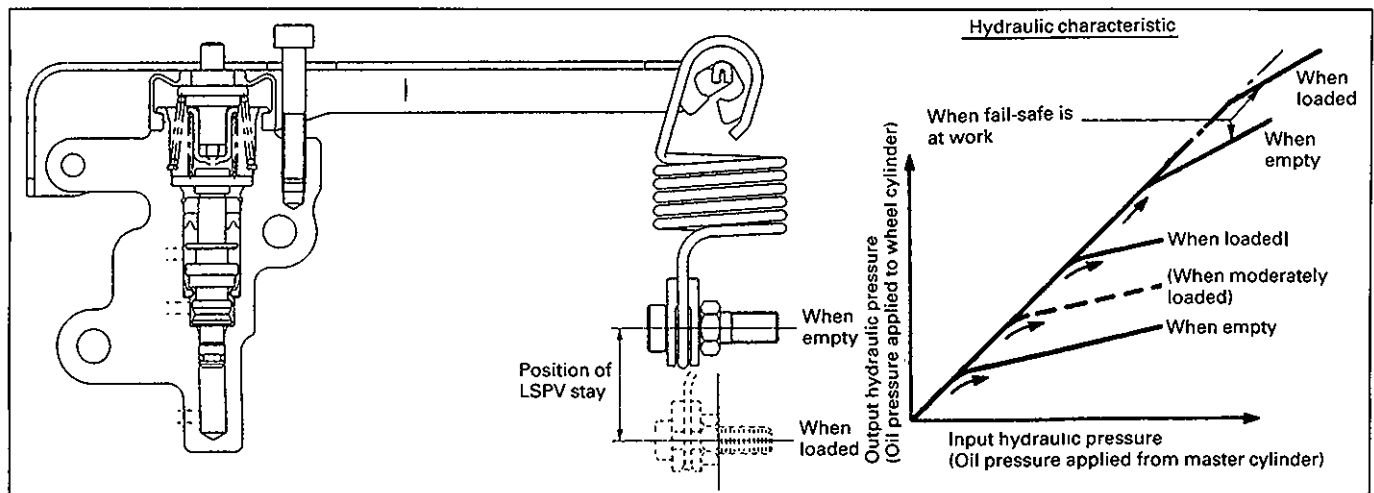
When empty

As the sensor spring is pulled by comparatively weak force, the force applied to the plunger is also small and the hydraulic characteristic takes a low bend point as shown in the graph below.

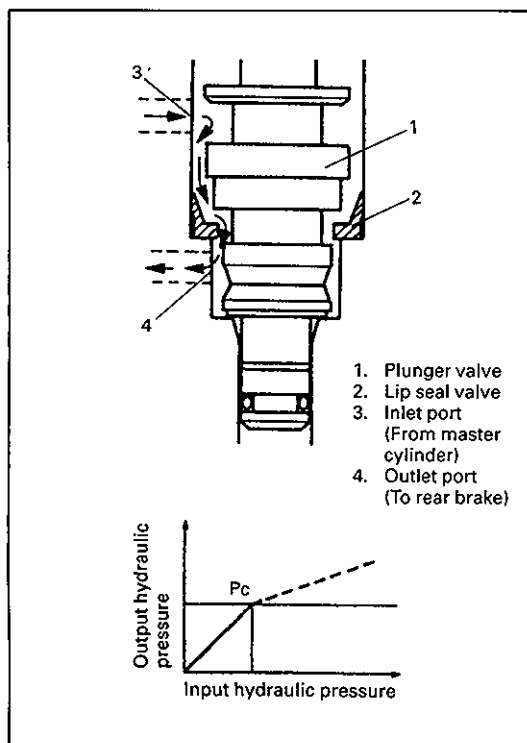
When loaded

As the sensor spring is pulled by comparatively strong force, a larger force is applied to the plunger so that the hydraulic characteristic takes a higher bend point in the graph below.

The relationship between the force applied to the plunger and the bend point in the hydraulic characteristic graph is described on the following page.



85F00-5-14-1

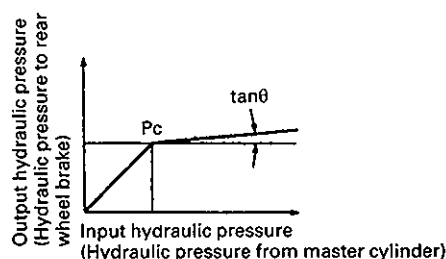
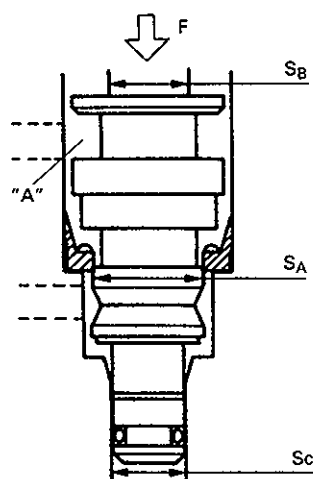


85F00-5-14-4

When LSPV not at work

Operation from the inoperative state till the input hydraulic pressure (fluid pressure from the master cylinder) reaches the bend point P_c in the graph as shown.

The input hydraulic pressure passes between the plunger and lip seal (valve) and without receiving any control, it is discharged through the outlet port.

**Reference:**

The bend point P_c and gradient $\tan \theta$ are obtained by using the following equations.

$$P_c = \frac{F}{S_B} \quad \tan \theta = \frac{S_A - S_B - S_C}{S_A - S_C}$$

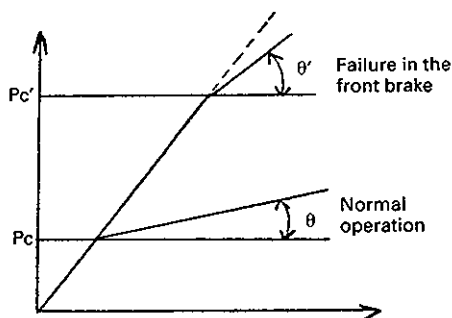
F : Force from sensor spring

S_A : Larger diameter sectional area of plunger

S_B : Smaller diameter sectional area of plunger

S_C : Sectional area of plunger to lip seal contact

85F00-5-15-1



$$P_{c'} = \frac{F}{S_B - S_C} \quad \tan \theta' = \frac{S_A - S_B}{S_A - S_C}$$

$$P_c < P_{c'}$$

$$\tan \theta < \tan \theta'$$

85F00-5-15-4

When LSPV at work

As the input hydraulic pressure increases, the force applied to the plunger grows stronger than the sensor spring force and moves the plunger upward in the figure and as a result, the valve closes the fluid passage. The hydraulic pressure then is represented by the bend point P_c in the graph.

As the incoming hydraulic pressure rises even higher, the hydraulic pressure "A" increases and pushes down the plunger, opening the fluid passage.

By repeating this operation (open/close), the valve controls the output hydraulic pressure (hydraulic pressure to the rear brake).

Therefore its characteristic is represented as a line with a certain gradient.

When fail-safe at work

When the hydraulic pressure is not applied to the front brake (secondary), the force to push up the plunger reduces by the amount corresponding to that of the front brake. This means that in order for the plunger to operate, a higher than normal hydraulic pressure is required for the rear brake (primary). Thus, a hydraulic pressure exceeding the normal level is supplied to the rear brake (rear wheel cylinder).

ON VEHICLE SERVICE

BRAKE PEDAL FREE HEIGHT ADJUSTMENT

- 1) When booster push rod clevis has been reinstalled, it is important that measurement between booster mounting surface and center of clevis pin hole is adjusted.

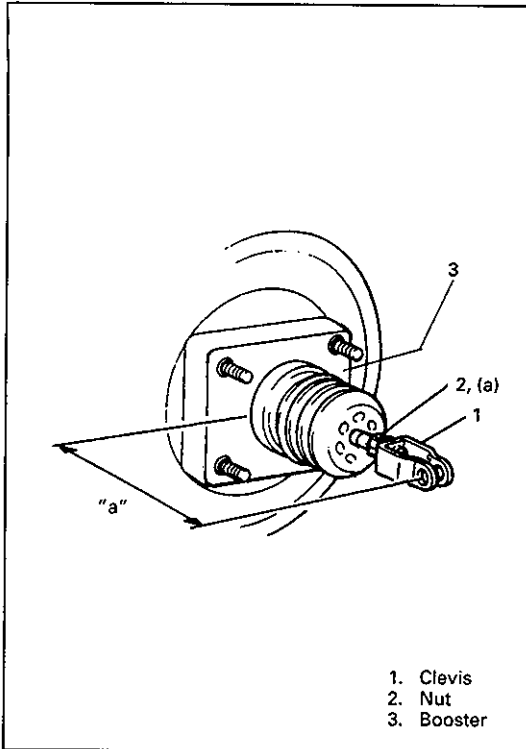
Length "a": 126.1 – 127.1 mm (4.96 – 5.00 in.)

Tightening Torque

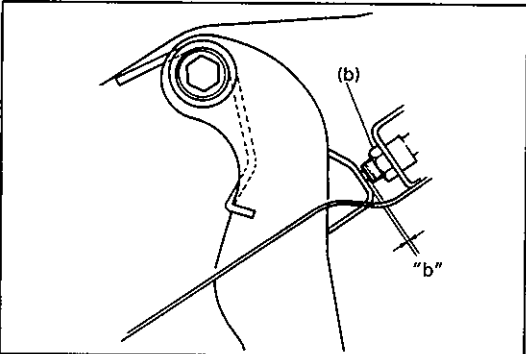
(a): 26 N·m (2.6 kg-m, 19.0 lb-ft)

- 2) When stop light switch has been removed, refer to the following STOP LIGHT SWITCH ADJUSTMENT for proper installation.

Services in above steps 1) and 2) may affect brake pedal height.



85F00-5-16-1



85F00-5-16-3

STOP LIGHT SWITCH ADJUSTMENT

Adjustment should be made as follows when installing switch. Pull up brake pedal toward you and while holding it there, adjust switch position so that clearance between end of thread and brake pedal return cushion (shown as "b" in figure). Then tighten lock nut to specified torque.

Clearance "b": 1.5 – 2.0 mm (0.06 – 0.08 in.)

Tightening Torque

(b): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

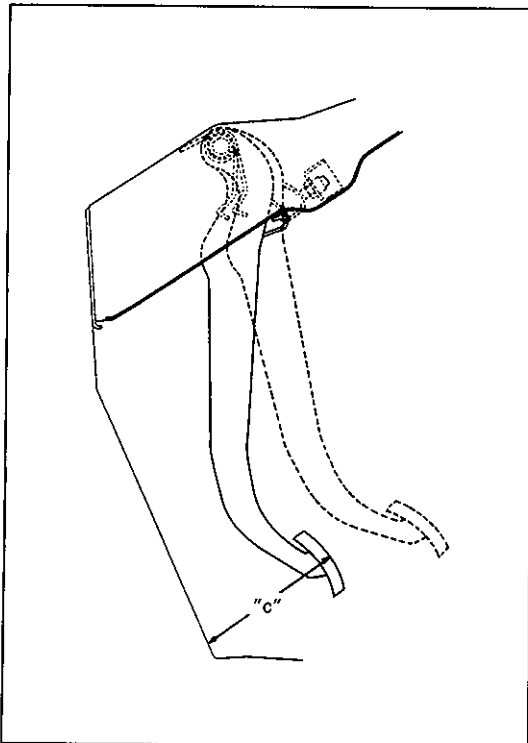
EXCESSIVE PEDAL TRAVEL CHECK

- 1) Start engine.
- 2) Depress brake pedal a few times.
- 3) With brake pedal depressed with approximately 30 kg (66 lbs) load, measure pedal to wall clearance "c". It mustn't be less than 80 mm (3.15 in.).

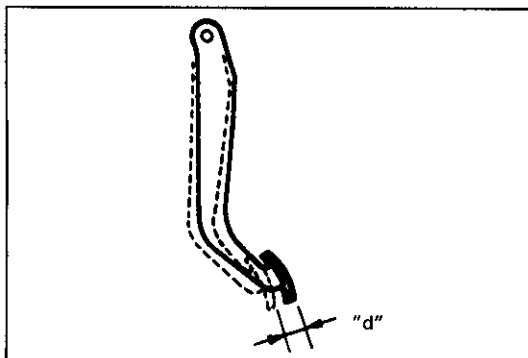
Clearance "c": over 80 mm (3.15 in.)

- 4) If clearance "c" is less than 80 mm (3.15 in.), the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.

Should clearance "c" remain less than 80 mm (3.15 in.) even after replacement of brake shoes and bleeding of system, other possible but infrequent cause is malfunction of rear brake shoe adjusters or booster push rod length out of adjustment for the vehicle with brake booster.



85F00-5-16-4



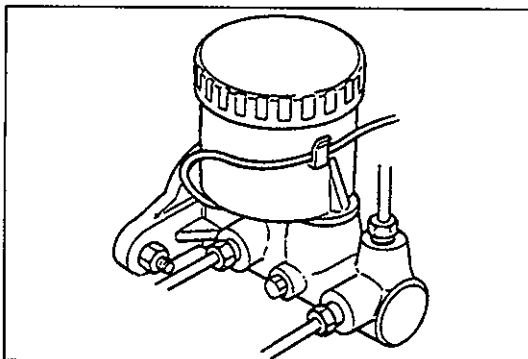
85F00-5-17-1

BRAKE PEDAL PLAY INSPECTION

Pedal play should be within specification. If out of specification, check stop light switch for proper installation position and adjust if necessary.

Also check pedal shaft bolt and master cylinder pin installation for looseness and replace if defective.

Pedal play "d": 1 – 8 mm (0.04 – 0.32 in.)



85F00-5-17-2

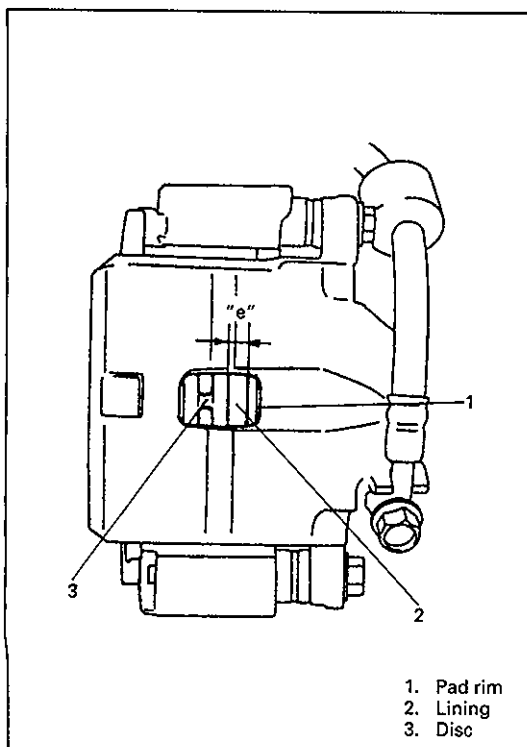
MASTER CYLINDER INSPECTION

Check for a cracked master cylinder casting or brake fluid around the master cylinder. Leaks are indicated only if there is at least a drop of fluid. A damp condition is not abnormal.

DISC INSPECTION

Refer to item DISC BRAKE INSPECTION of this section for inspection point and procedure.

85F00-5-17-3



1. Pad rim
2. Lining
3. Disc

85F00-5-17-4

PAD LINING INSPECTION

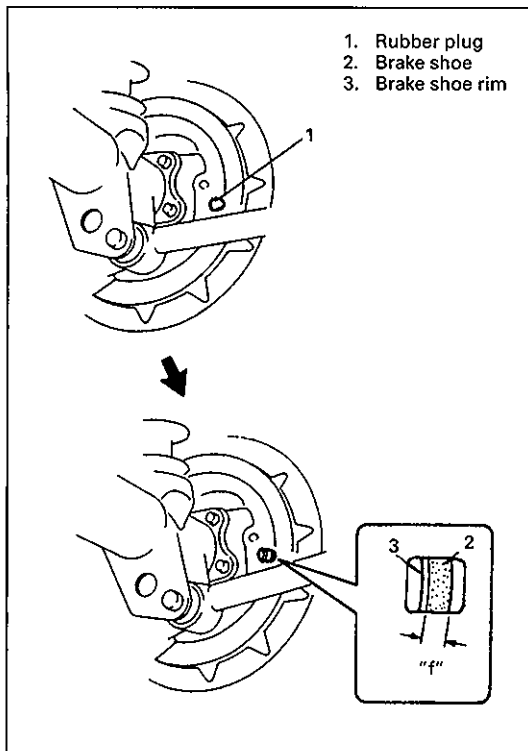
Inspect pad linings periodically according to maintenance schedule whenever wheels are removed (for tire rotation or other reason). Take a look through hole of caliper and check lining thickness of inside pad.

Thickness "e"

Standard: 10.0 mm (0.39 in.)

Service Limit: 2.5 mm (0.10 in.)

If one of brake pad is worn to service limit, all linings must be replaced at the same time.



85F00-5-18-1

REAR BRAKE SHOE INSPECTION

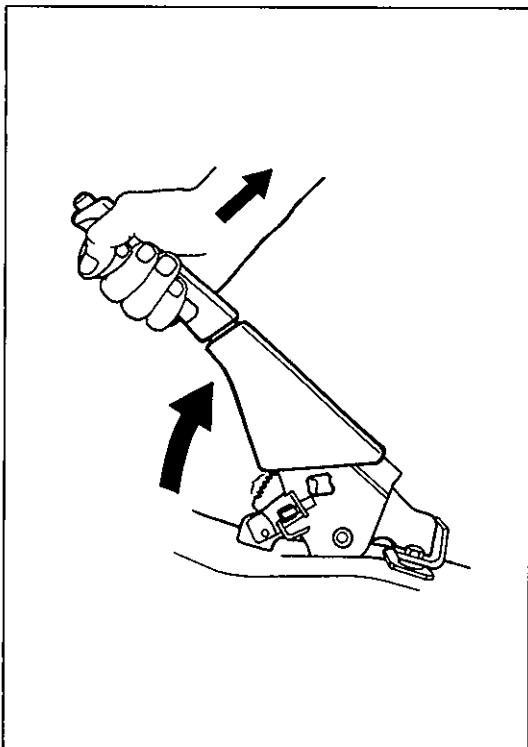
Inspection should be carried out on following points after brake pedal travel "c" (pedal arm to wall clearance) check as described on previous page of this section, even when it is more than 80 mm (3.15 in.)

Amount of brake shoe wear can be checked as follows.

- 1) Hoist vehicle.
- 2) Remove rubber plug from brake back plate.
- 3) Through hole of back plate, visually check for thickness of brake shoe lining. If lining thickness "e" is found less than below specified wear limit, replace with new brake shoes.

Thickness "f"

Service Limit: 1.0 mm (0.04 in.)



PARKING BRAKE INSPECTION AND ADJUSTMENT

a) Inspection

Hold center of parking brake lever grip and pull it up with 20 kg (40 lbs) force.

With parking brake lever pulled up as shown, count ratchet notches.

There should be 6 to 8 notches.

Also, check if both right and left rear wheels are locked firmly. To count number of notches easily, listen to click sounds that ratchet makes while pulling parking brake lever without pressing its button.

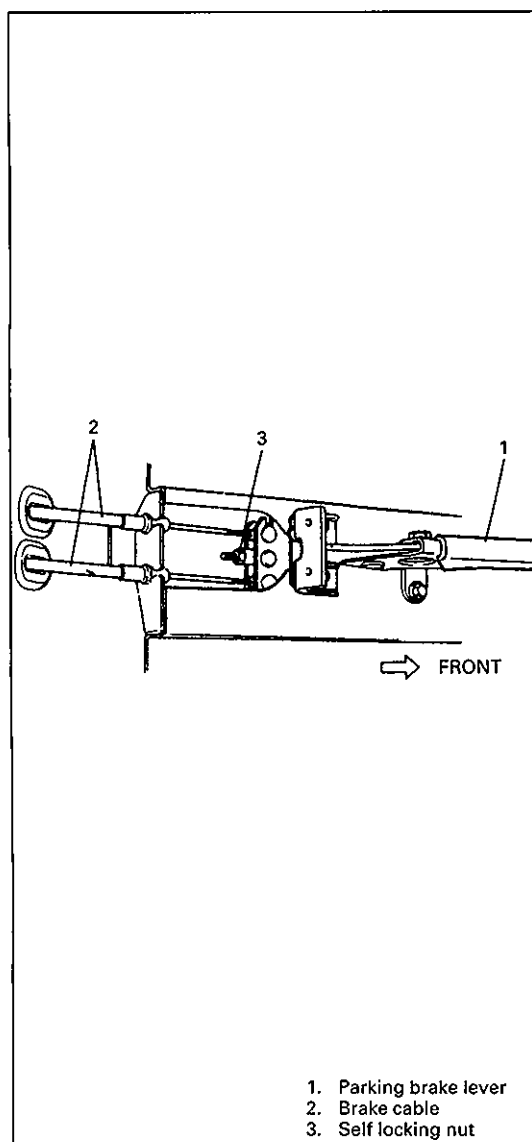
One click sound corresponds to one notch.

If number of notches is out of specification, adjust cable by referring to adjustment procedure described on the following step b) so as to obtain specified parking brake stroke.

NOTE:

Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking brake lever.

85F00-5-18-3



60A40-5-23-1

b) Adjustment

NOTE:

Make sure for following conditions before cable adjustment.

- No air is trapped in brake system.
- Brake pedal travel is proper.
- Brake pedal has been depressed a few times with about 30 kg (66 lbs) load.
- Parking brake lever has been pulled up a few times with about 20 kg (44 lbs) force.
- Rear brake shoes are not worn beyond limit, and self adjusting mechanism operates properly.
- To slacken parking brake cable, loosen self locking nut as far as end of bolt. Then depress brake pedal a few times with about 30 kg (66 lbs) load.

After confirming that above 6 conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening locking nut.

NOTE:

Check brake drum for dragging after adjustment.

Parking brake stroke; when lever is pulled up at 20 kg (44 lbs)	6 to 8 notches
---	----------------

FLUSHING BRAKE HYDRAULIC SYSTEM

It is recommended that entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in hydraulic system.

Periodical change of brake fluid is also recommended.

85F00-5-19-4

BLEEDING BRAKES

CAUTION:

Brake fluid is extremely damaging to paint. If fluid should accident ally touch painted surface, immediately wipe fluid from paint and clean painted surface.

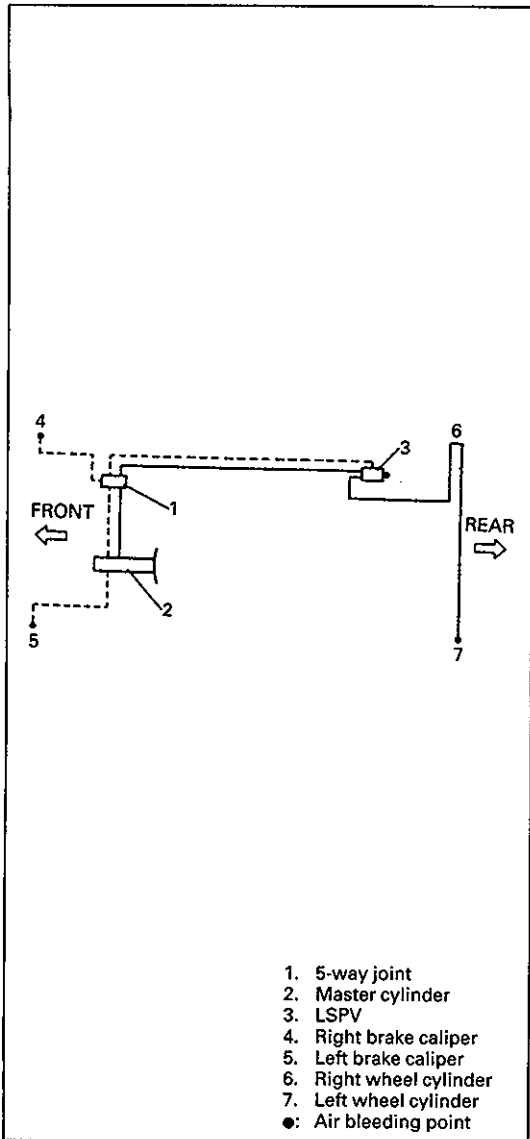
NOTE:

When master cylinder has removed or disassembled, or brake pipe has been disconnected from master cylinder, bleed air from master cylinder to facilitate bleeding air of brake system. Then proceed to following operation.

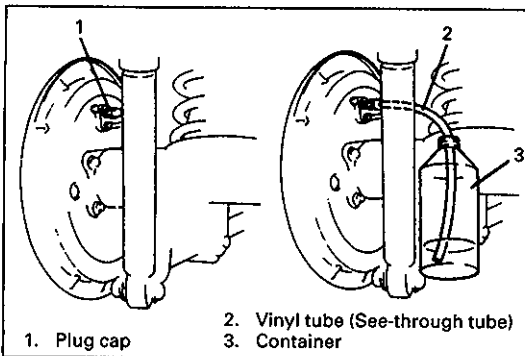
Bleeding operation is necessary to remove air whenever it entered hydraulic brake system.

Hydraulic lines of brake system consists of two separate lines, one for front wheel brakes and the other for rear wheel brakes. Air bleeding is necessary at right and left front wheel brakes, left rear wheel brake and LSPV, i.e. 4 places in all.

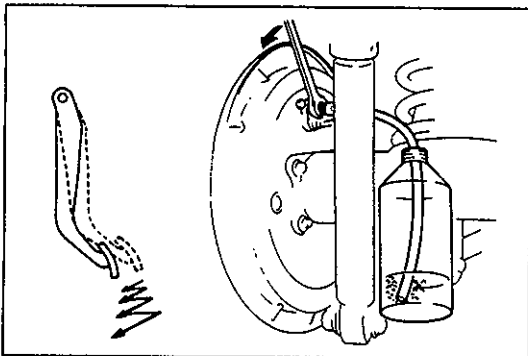
Be sure to bleed air of brake system according to following procedure when its oil hydraulic circuit has been disconnected.



85F00-5-20-1



60A40-5-24-4



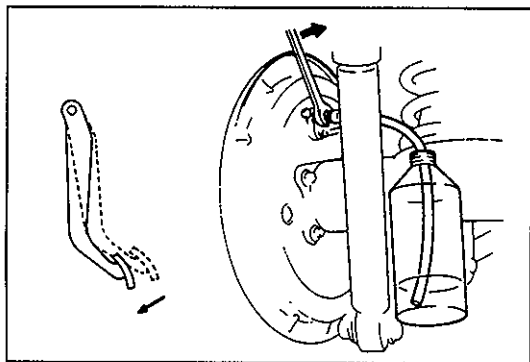
60A40-5-24-5

1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.

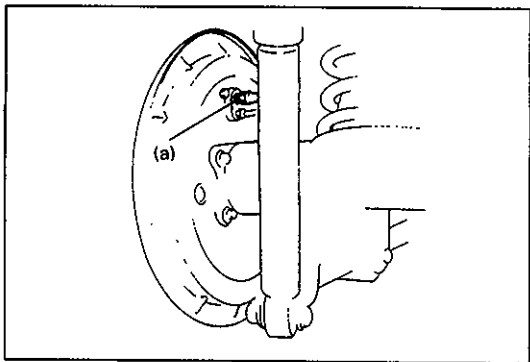
2) Remove bleeder plug cap.

Attach a vinyl tube to bleeder plug of wheel cylinder, and insert the other end into container.

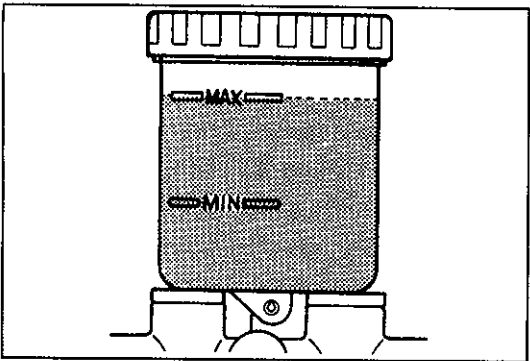
3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to one half turn.



60A40-5-25-1



85F00-5-21-2



60A40-5-25-3

4) When fluid pressure in the cylinder is almost depleted, re-tighten bleeder plug.

5) Repeat this operation until there are no more air bubbles in hydraulic line.

6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug.

Tightening Torque

(a): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

7) Then attach bleeder plug cap.

8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.

9) Replenish fluid into reservoir up to specified level.

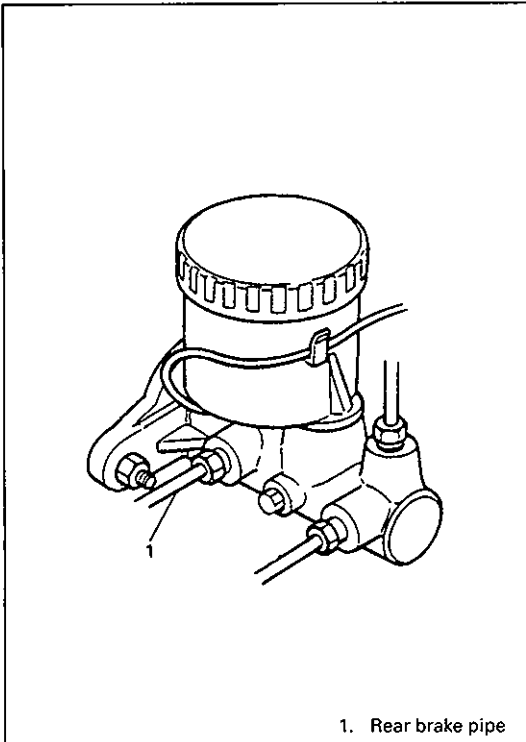
10) Check brake pedal for "sponginess". If found spongy, repeat entire procedure of bleeding.

BLEEDING AIR FROM MASTER CYLINDER

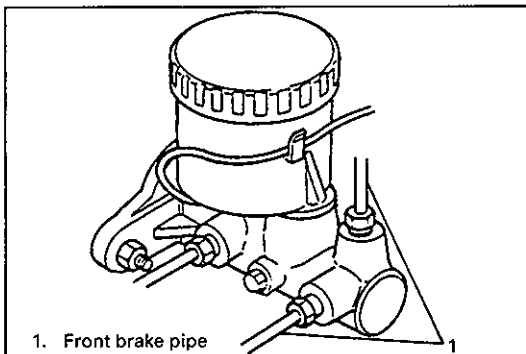
CAUTION:

Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

85F00-5-22-1



85F00-5-22-2



85F00-5-22-4

When master cylinder has been removed or disassembled, or brake pipe has been disconnected from master cylinder, bleed air from master cylinder first to facilitate bleeding air of brake system.

Bleeding air from master cylinder

- 1) Fill master cylinder reservoir with specified brake fluid and wait for at least 1 minute.
- 2) Disconnect brake pipe from primary side (for rear brake).
- 3) With discharge port opened, depress brake pedal gradually.
Then with discharge port closed with finger, release brake pedal gradually and keep it closed for about 5 seconds before depressing brake pedal again.
- 4) Repeat what is described in above 3) till liquid comes out of discharge port. After that, repeat still the same procedure at least 3 times and then connect primary side brake pipe.

- 5) Disconnect 2 brake pipes from secondary side (for front brake).
- 6) With 2 discharge ports closed with fingers, repeat the same procedure as described in above 3) till liquid comes out of discharge port. After that repeat still the same procedure at least 3 times and then reconnect 2 brake pipes.

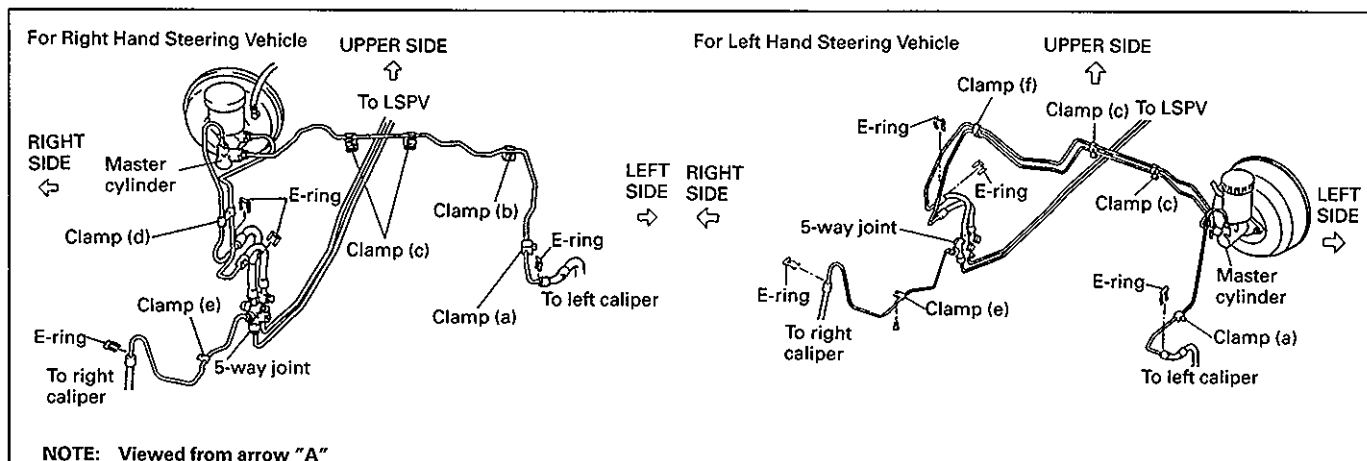
- 7) Upon completion of above steps, proceed to operation as described under item BLEEDING BRAKES.

BRAKE HOSE/PIPE R & I

REMOVE AND INSTALL FRONT BRAKE HOSE/PIPE

- 1) Raise and suitably support vehicle. Remove tire and wheel.
This operation is not necessary when removing pipes connecting master cylinder and flexible hose.
- 2) For LH steering vehicle, drain coolant and disconnect heater hoses from body side connection. This operation is necessary when removing pipes connecting master cylinder and flexible hose.
- 3) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.
- 4) Reverse brake hose installation procedure.

For installation, make sure that steering wheel is in straightforward position and hose has no twist or kink. Check to make sure that hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and correct. Fill and maintain brake fluid level in reservoir. Bleed brake system.

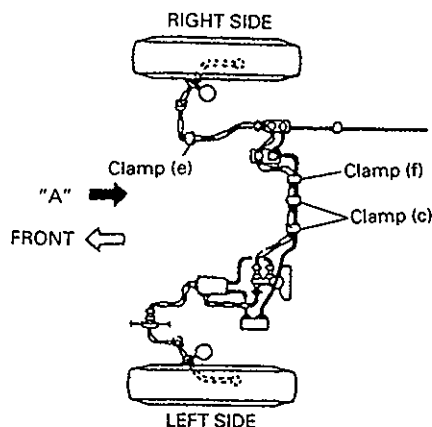
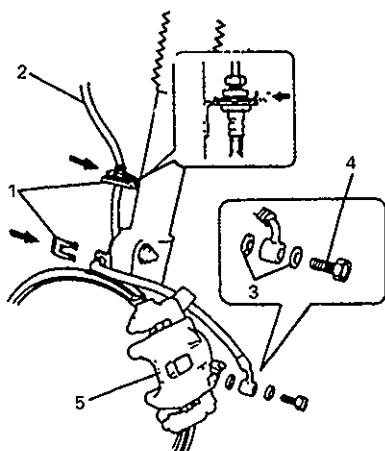


NOTE: Viewed from arrow "A"

Clamp (a)	Clamp (b)	Clamp (c)	Clamp (d)	Clamp (e)	Clamp (f)
Upper side Clamp Brake pipe Left side	Upper side Brake pipe Forward Clamp	Upper side Brake pipe Forward Clamp	Upper side Brake pipes Forward Clamp	Upper side Left side Clamp Brake pipe	Upper side Forward

NOTE:
Insert E-ring till its end surface is flush with or lower than bracket and surface.

Tightening torque for brake pipe flare nuts	N·m	kg-m	lb-ft
	16	1.6	12.0
Tightening torque for 5-way joint bolt	10	1.0	7.5



DISC BRAKE INSPECTION

1. INSPECT BRAKE PAD LINING

Check pad lining for wear. When wear exceeds limit, replace with new one.

CAUTION:

Never polish pad lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage disc. When pad lining requires correction, replace it with a new one.

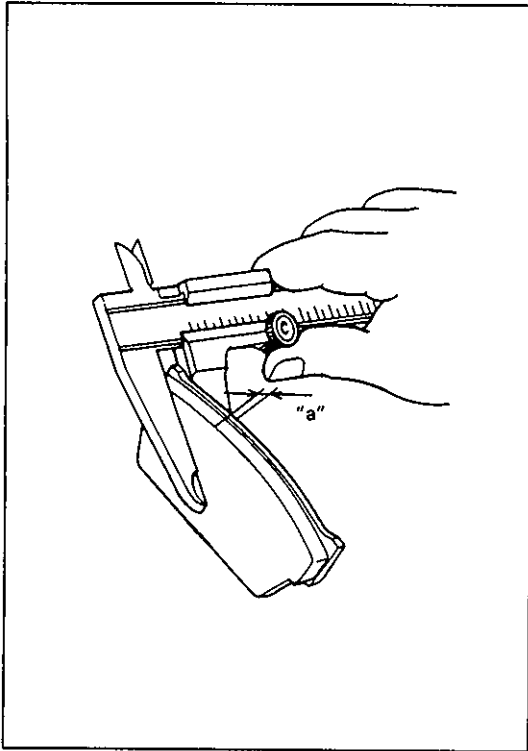
Pad thickness (lining + rim) "a"

Standard: 15.0 mm (0.590 in.)

Service limit: 7.0 mm (0.275 in.)

NOTE:

When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.



85F00-5-24-1

2. INSPECT BRAKE DISC

Before this inspection, brake pads must be removed.

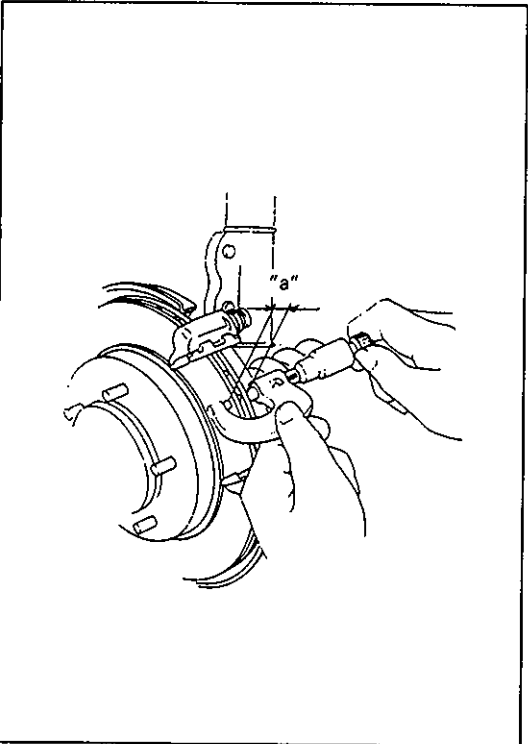
Check disc surface for scratches in wearing parts. Scratches on disc surface noticed at the time of specified inspection or replacement are normal and disc is not defective unless they are serious.

But when there are deep scratches or scratches all over disc surface, replace it. When only one side is scratched, polish and correct that side.

Disc thickness "a"

Standard: 22.0 mm (0.866 in.)

Service limit: 20.0 mm (0.787 in.)



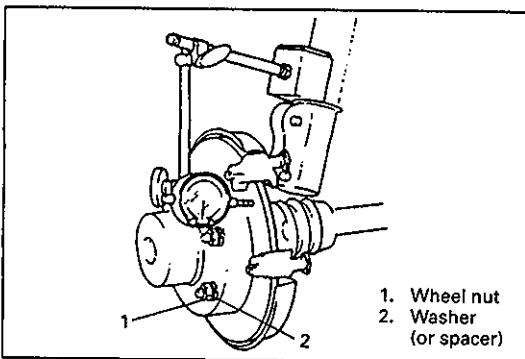
85F00-5-24-3

Use wheel nuts and suitable plain washers to hold the disc securely against the hub, then mount a dial indicator as shown and measure the runout at 25 mm (0.98 in.) from the outer edge of the disc.

Limit on disc deflection: 0.15 mm (0.006 in.)

NOTE:

Check front wheel bearing for looseness before measurement.



85F00-5-24-5

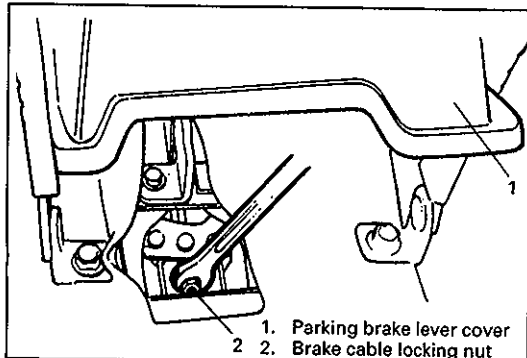
DRUM AND COMPONENTS R & I

1. REMOVE AND INSTALL BRAKE DRUM

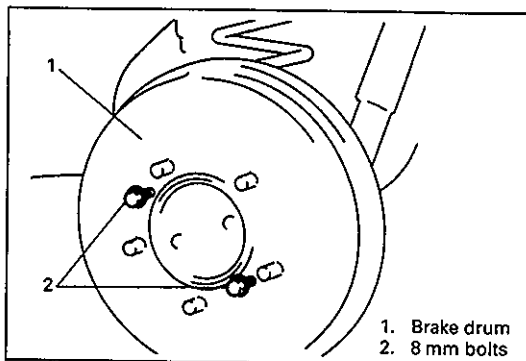
REMOVAL

- 1) Hoist vehicle and pull up parking brake lever.
- 2) Remove wheel.

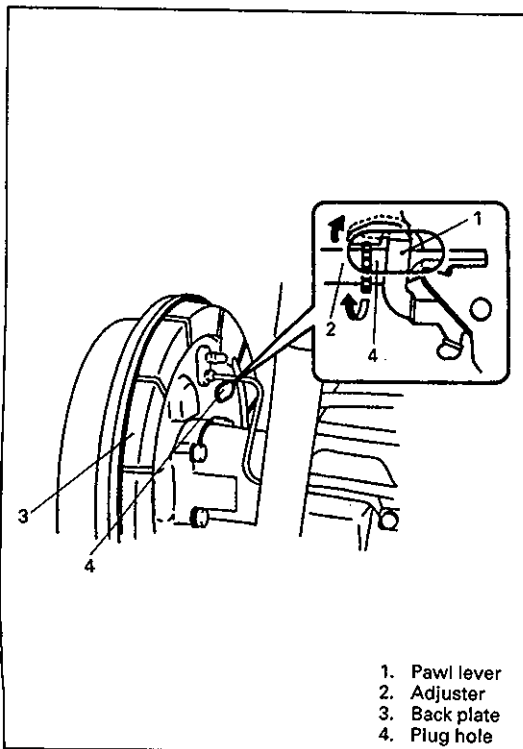
85F00-5-25-1



85F00-5-25-2



85F00-5-25-3



85F00-5-25-4

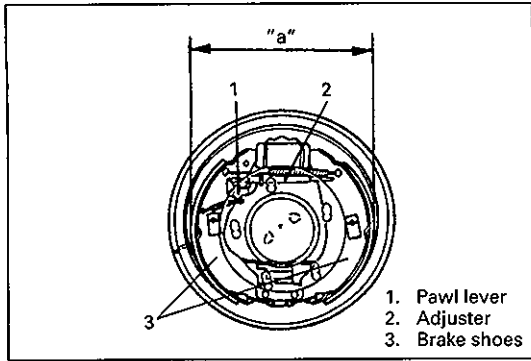
- 3) Release parking brake lever.
- 4) Remove parking brake lever cover screws and with rear part of brake lever cover lifted a little, loosen parking brake cable locking nut.

- 5) Remove brake drum by using 8 mm bolts (2 pcs).

NOTE:

- If brake shoe is in the way and makes brake drum removal difficult, increase clearance between brake shoes and brake drum as follows.

Remove back plate plug installed to backside of brake back plate and insert 2 screwdrivers into plug hole. Then push up pawl lever with one screwdriver and turn adjuster with another in such direction as indicated in figure so as to obtain larger clearance.



85F00-5-26-1

INSTALLATION

NOTE:

See NOTE at the beginning of the section.

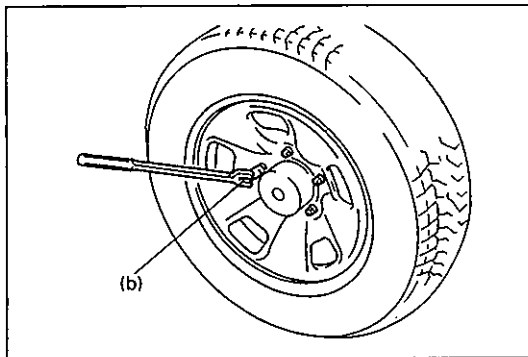
- 1) Before installing brake drum, check outer diameter of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

Outer diameter of brake shoes

"a": 253.5 ± 0.2 mm

- 2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.
- 3) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to ten times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable. (For adjustment, see page 5-19)
- 4) Tighten parking brake lever cover screws.

85F00-5-26-2



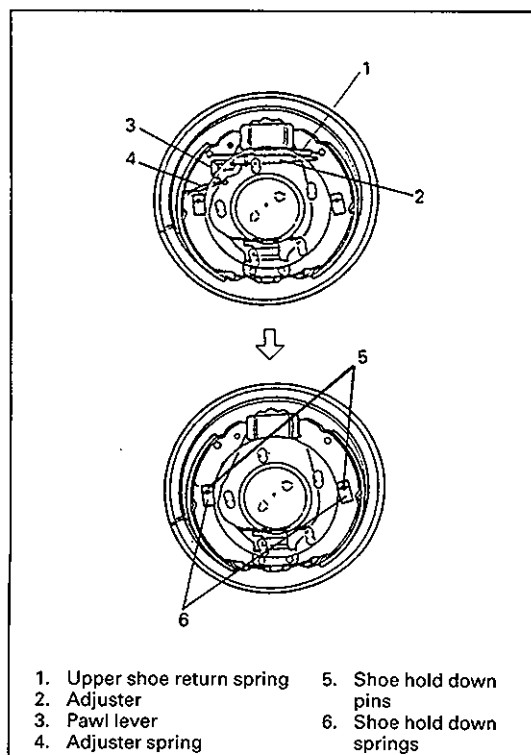
85F00-5-26-3

- 5) Install wheel and tighten wheel nuts to specified torque.

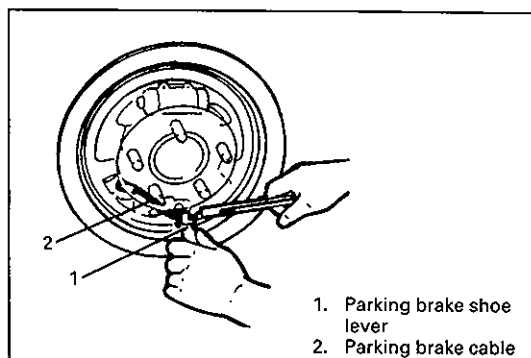
Tightening Torque

(b): 95 N·m (9.5 kg·m, 69.0 lb·ft)

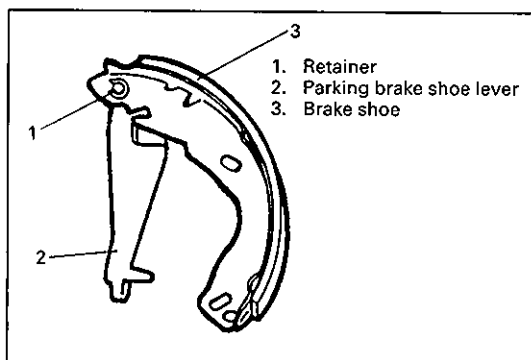
- 6) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).



85F00-5-27-1



85F00-5-27-3



85F00-5-27-4

2. REMOVE AND INSTALL BRAKE SHOE

REMOVAL

- 1) Perform steps 1) to 5) of brake drum REMOVAL. (See page 5-25)
- 2) Remove pawl lever and adjuster spring.
- 3) Remove upper shoe return spring and adjuster.

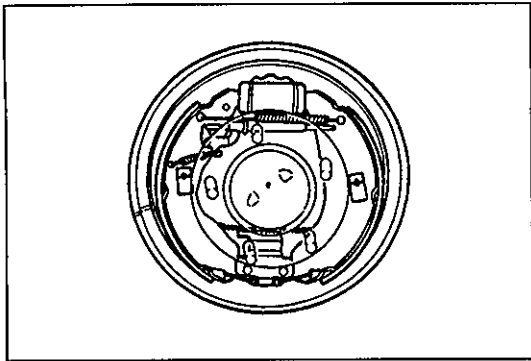
WARNING:

Use special care when installing brake shoe return spring. Failure in its proper installation may allow it to springback and cause personal injury.

- 4) Remove shoe hold down springs by turning shoe hold down pins as shown.
- 5) Remove brake shoes and lower shoe return spring.

- 6) Remove brake shoes and disconnect parking brake cable from parking brake shoe lever.

- 7) Remove parking brake shoe lever from brake shoe.

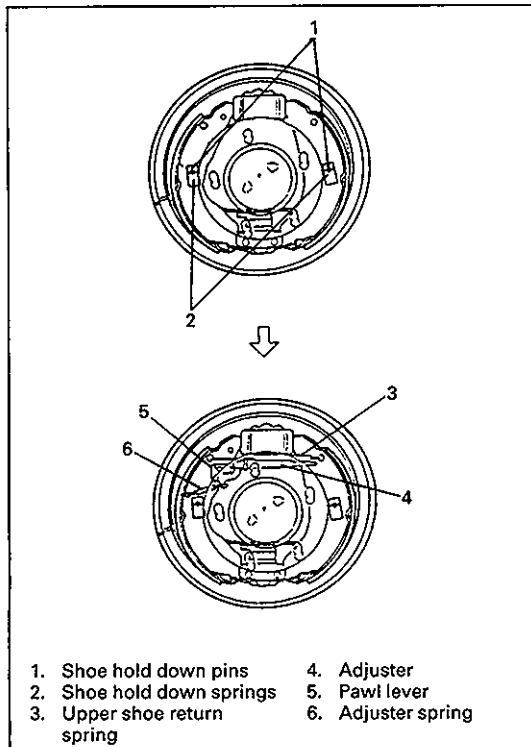


85F00-5-28-1

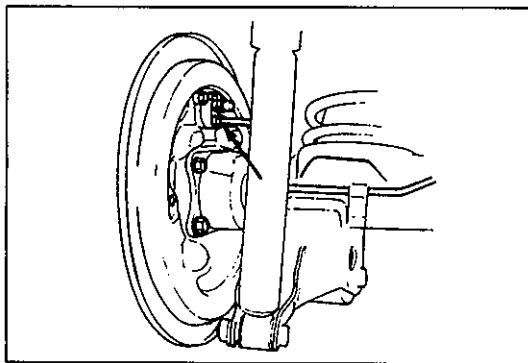
INSTALLATION

1) Assemble parts as shown in reverse order of removal.

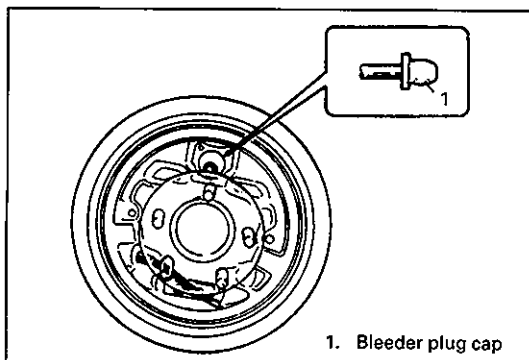
- 2) Install shoe hold down springs by pushing them down in place and turning hold down pins.
- 3) Install adjuster and upper shoe return spring.
- 4) Install pawl lever and adjuster spring.
- 5) For procedure hereafter, refer to steps 1) to 6) of BRAKE DRUM INSTALLATION on page 5-26.



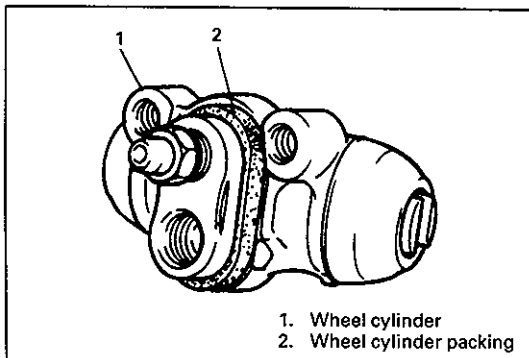
85F00-5-28-2



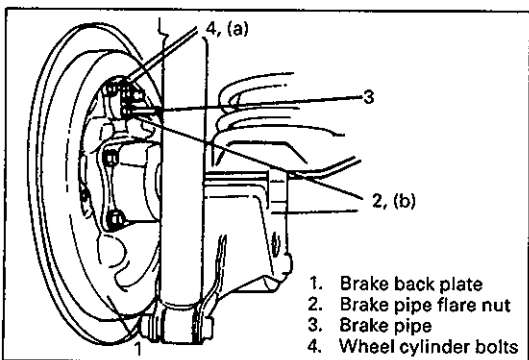
85F00-5-29-1



85F00-5-29-2



85F00-5-29-3



85F00-5-29-4

3. REMOVE AND INSTALL WHEEL CYLINDER

REMOVAL

- 1) Perform steps 1) to 5) of brake drum REMOVAL. (See page 5-25)
- 2) Perform steps 2) to 5) of brake shoe REMOVAL. (See page 5-27)
- 3) Loosen brake pipe flare nut (or nuts) but only within the extent that fluid does not leak.
- 4) Remove wheel cylinder mounting bolts. Disconnect brake pipe (or pipes) from wheel cylinder and put wheel cylinder bleeder plug cap onto pipe to prevent fluid from spilling.

INSTALLATION

- 1) Install wheel cylinder packing. Then take off bleeder plug cap from brake pipe and connect pipe (for pipes) to wheel cylinder just enough to prevent fluid from leaking.
- 2) Tighten wheel cylinder to brake back plate to specified torque.
- 3) Torque flare nut (or nuts) of brake pipe which was connected in step 1) to specification.

Tightening Torque

(a): 12 N·m (1.2 kg-m, 9.0 lb-ft)

(b): 16 N·m (1.6 kg-m, 12.0 lb-ft)

- 4) Install bleeder plug cap taken off from pipe back to bleeder plug.
- 5) For procedure hereafter, refer to steps 1) to 5) of brake shoe INSTALLATION.

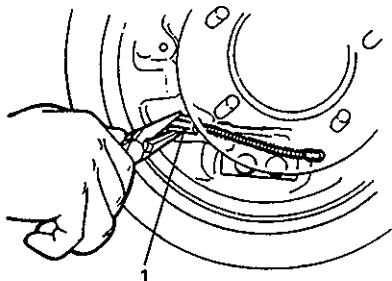
NOTE:

Be sure to bleed brake system. (for bleeding operation, see page 5-20)

4. REMOVE AND INSTALL BRAKE BACK PLATE

REMOVAL

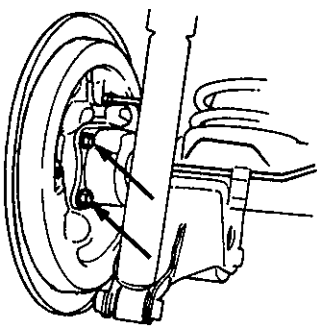
- 1) Perform steps 1) to 5) of brake drum REMOVAL on page 5-25.
- 2) Perform steps 2) to 5) of brake shoe REMOVAL on page 5-27.
- 3) Perform steps 3) and 4) of wheel cylinder REMOVAL on page 5-29.
- 4) Remove cable from brake back plate by squeezing parking brake cable stopper ring.



1. Brake cable stopper ring

85F00-5-30-1

- 5) Drain rear differential gear oil.
- 6) Remove wheel bearing retainer nuts from rear axle housing.



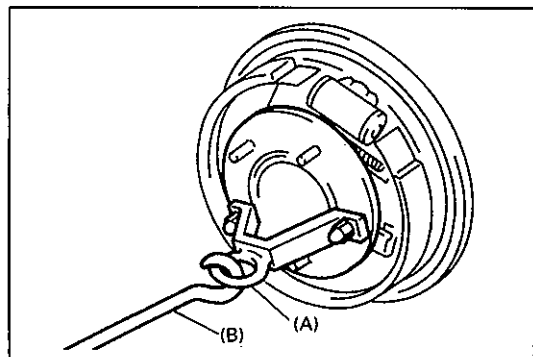
85F00-5-30-3

- 7) Using special tools, draw out rear axle shaft with brake back plate.

Special Tool

(A): 09943-35511

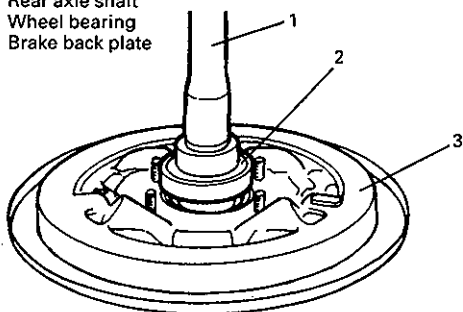
(B): 09942-15510



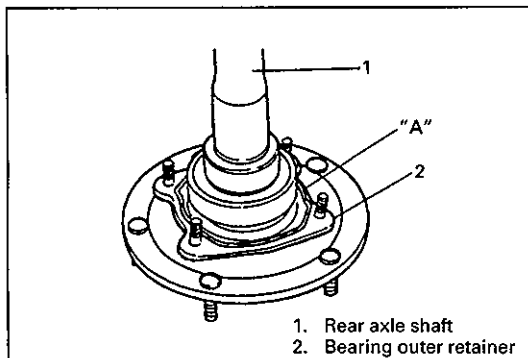
85F00-5-30-4

- 8) Remove brake back plate from rear axle shaft.

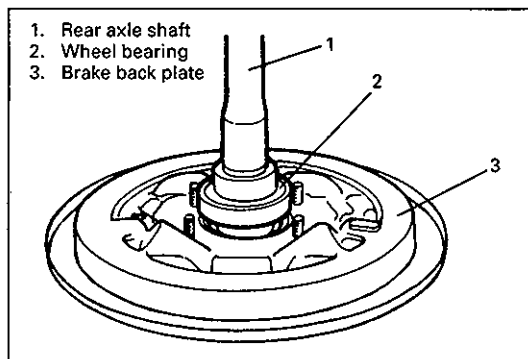
1. Rear axle shaft
2. Wheel bearing
3. Brake back plate



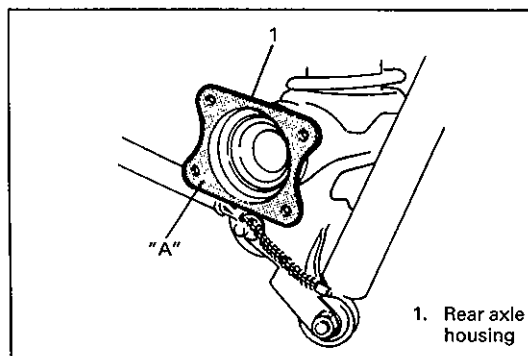
85F00-5-30-5



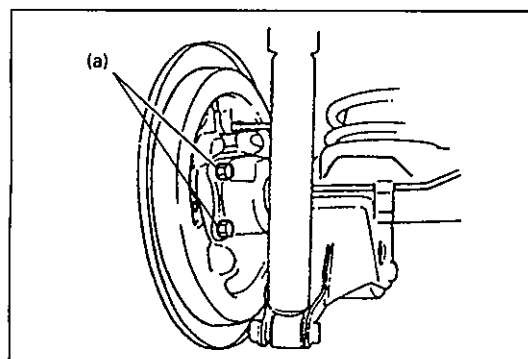
85F00-5-31-1



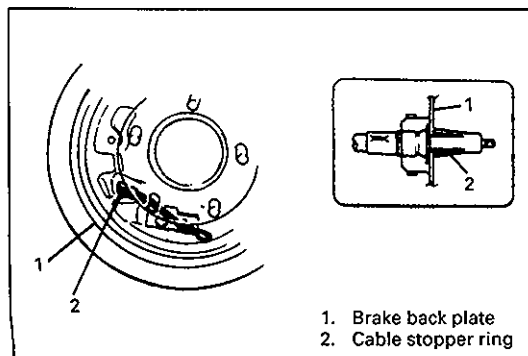
60A40-5-50-2



60A40-5-50-3



85F00-5-31-4



85F00-5-31-5

INSTALLATION

- 1) Apply sealant to mating surface of bearing retainer with brake back plate.

"A": Sealant 99000-31110

NOTE:

Make sure to remove old sealant before applying it anew.

- 2) Install brake back plate to rear axle shaft.

- 3) Apply sealant to joint seam of rear axle housing and brake back plate.

"A": Sealant 99000-31110

NOTE:

Make sure to remove old sealant before applying it anew.

- 4) Install rear axle shaft to rear axle housing.
- 5) Tighten brake back plate nuts to specified torque.

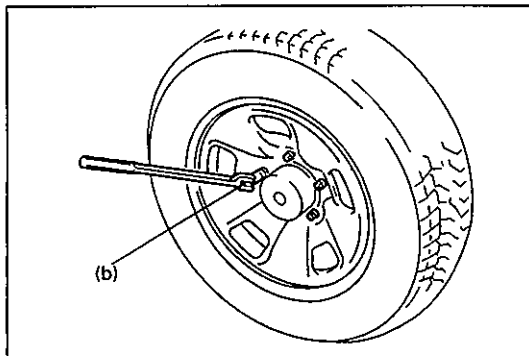
Tightening Torque

(a): 23 N·m (2.3 kg·m, 17.0 lb·ft)

- 6) Install wheel cylinder, and tighten wheel cylinder bolts and brake pipe flare nut (or nuts) to specified torque. (Refer to steps 1) to 4) of wheel cylinder INSTALLATION on page 5-29 of this section.)
- 7) Install parking brake cable to brake back plate.

- 8) Install brake shoes, referring to steps 1) to 4) of its INSTALLATION on page 5-28.
- 9) Install brake drum. Refer to steps 1) and 2) of its INSTALLATION on page 5-26 of this section.
- 10) Refill differential housing with new specified gear oil. Refer to "ON-VEHICLE SERVICE" in SECTION 7E of service manual mentioned in FOREWORD of this manual..
- 11) Fill reservoir with brake fluid and bleed brake system. (For bleeding operation, see page 5-20)

85F00-5-32-1



85F00-5-32-2

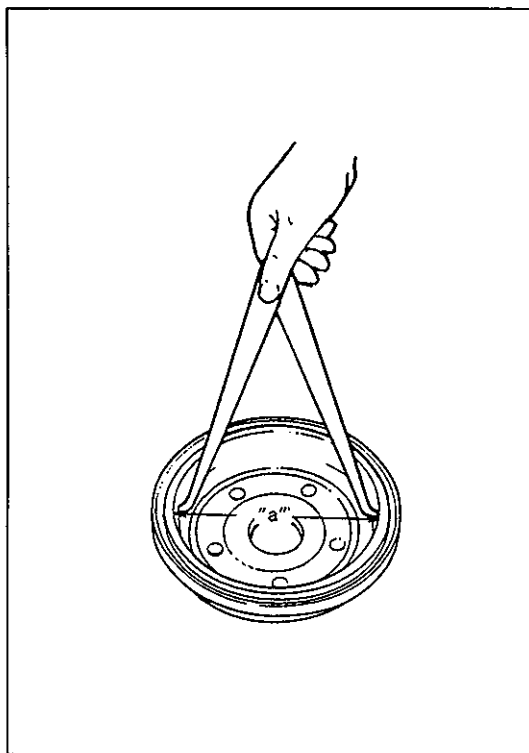
- 12) Install wheel and tighten wheel nuts to specified torque.

Tightening Torque

(b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

- 13) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to ten times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable. (For adjustment, see page 5-19)
- 14) Tighten parking brake lever cover screws.
- 15) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).
- 16) Check each installed part for oil leakage.

85F00-5-32-3



85F00-5-33-1

BRAKE DRUM AND COMPONENTS INSPECTION

1. INSPECT BRAKE DRUM

Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

Inside diameter "a"

Standard: 254 mm (10.00 in.)

Service Limit: 256 mm (10.07 in.)

Whenever brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves.

Cracked, Scored, or Grooved Drum

A cracked drum is unsafe for further service and must be replaced. Do not attempt to weld a cracked drum.

Smooth up any slight scores. Heavy or extensive scoring will cause excessive brake lining wear and it will probably be necessary to resurface drum braking surface.

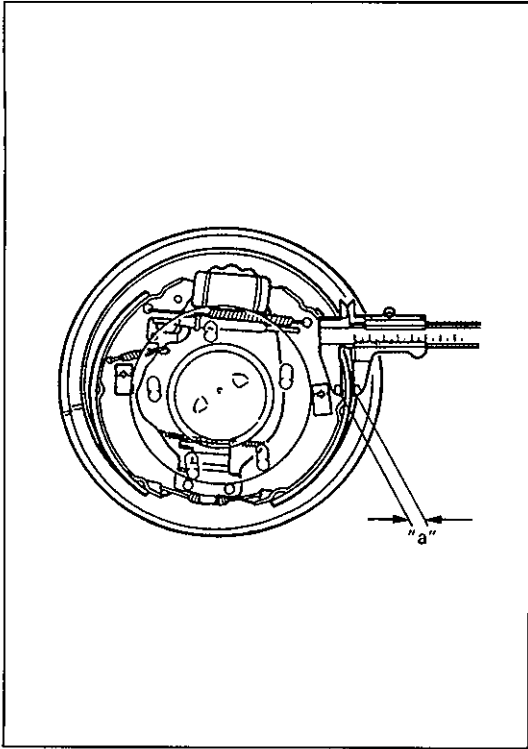
If brake linings are slightly worn and drum is grooved, drum should be polished with fine emery cloth but should not be turned.

NOTE:

When drum is removed, visually inspect wheel cylinder for brake fluid leakage. Correct leaky point, if any.

60A40-5-52-3

60A40-5-52-4



85F00-5-34-1

2. INSPECT BRAKE SHOE & LINING

Where lining is worn out beyond service limit, replace shoe.

Thickness "a"

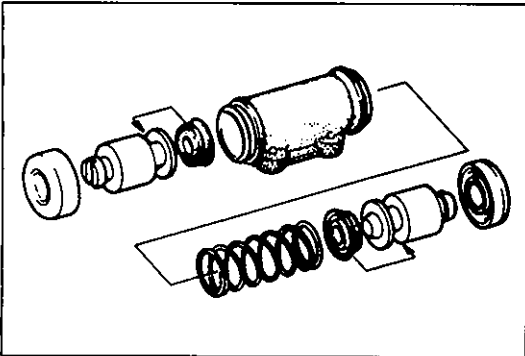
Standard: 6.5 mm (0.24 in.)

Service limit: 3.0 mm (0.12 in.)

If one of brake linings is to service limit, all linings must be replaced at the same time.

CAUTION:

Never polish lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage drum. When it is required to correct lining, replace it with a new one.



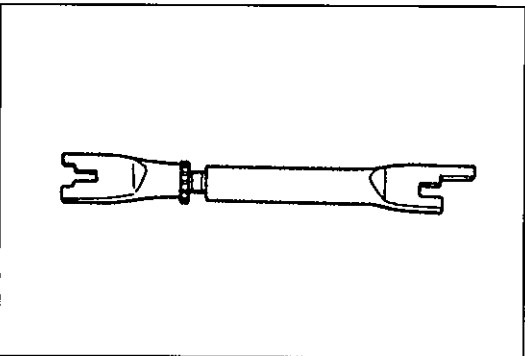
60A40-5-53-3

3. INSPECT WHEEL CYLINDER

Inspect wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

NOTE:

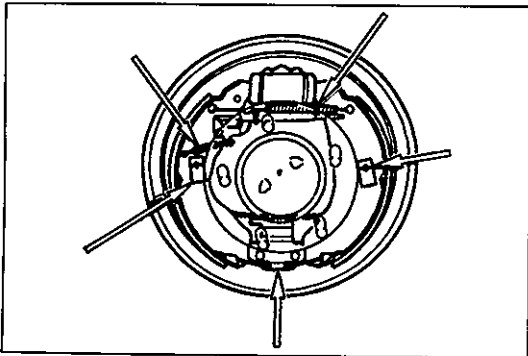
Clean wheel cylinder components with brake fluid.



85F00-5-34-4

4. INSPECT ADJUSTER

Check thread of adjuster for sticking and corrosion.



85F00-5-34-5

5. INSPECT SPRINGS

Inspect for damage or weakening.

Inspect each part with arrow for rust. If found defective, replace.

MASTER CYLINDER REPAIR

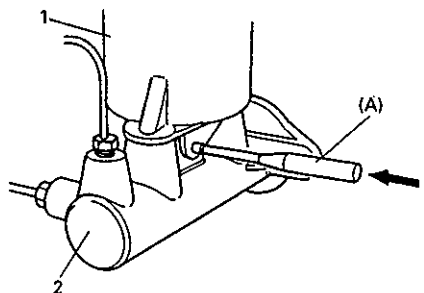
1. REMOVE AND INSTALL MASTER CYLINDER RESERVOIR

REMOVAL

- 1) Disconnect reservoir lead wire at coupler.
- 2) Clean outside of reservoir.
- 3) Take out fluid with syringe or such.
- 4) Remove reservoir connector pin by using special tool.

Special Tool

(A): 09922-85811



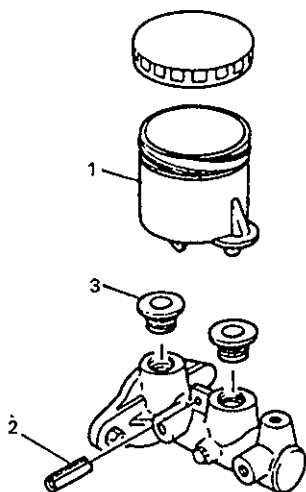
1. Reservoir
2. Master cylinder

85F00-5-35-1

- 5) Remove reservoir.

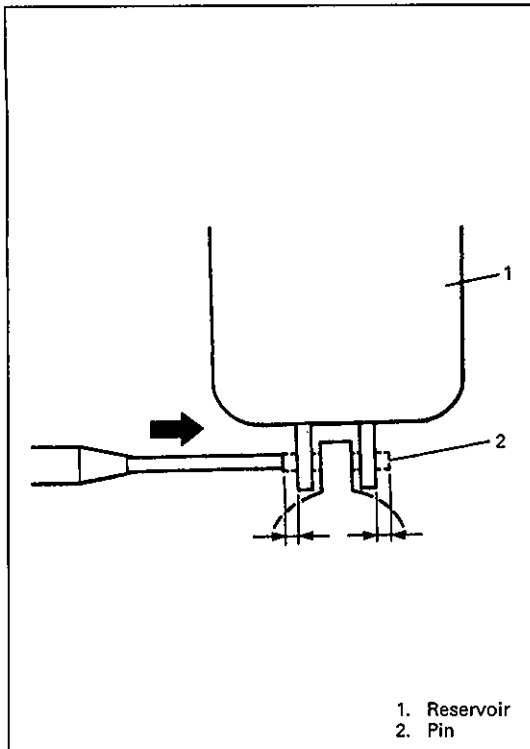
NOTE:

Do not allow brake fluid to get on painted surfaces.

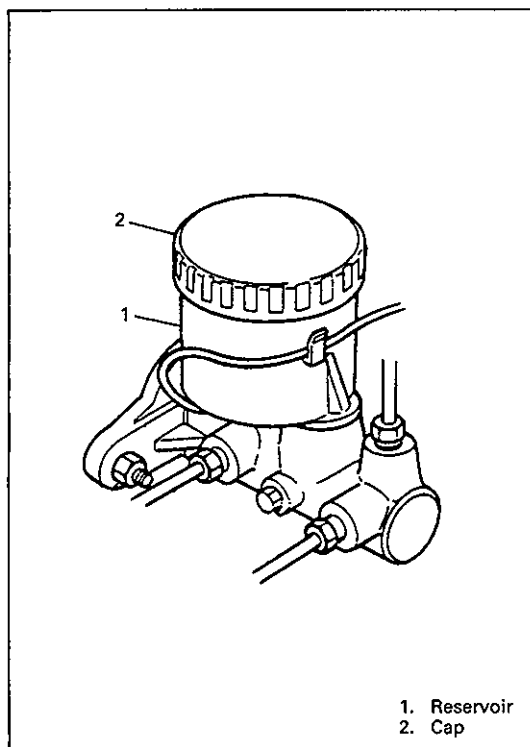


1. Reservoir
2. Connector pin
3. Grommets

85F00-5-35-3



85F00-5-36-1



85F00-5-36-3

INSTALLATION

NOTE:

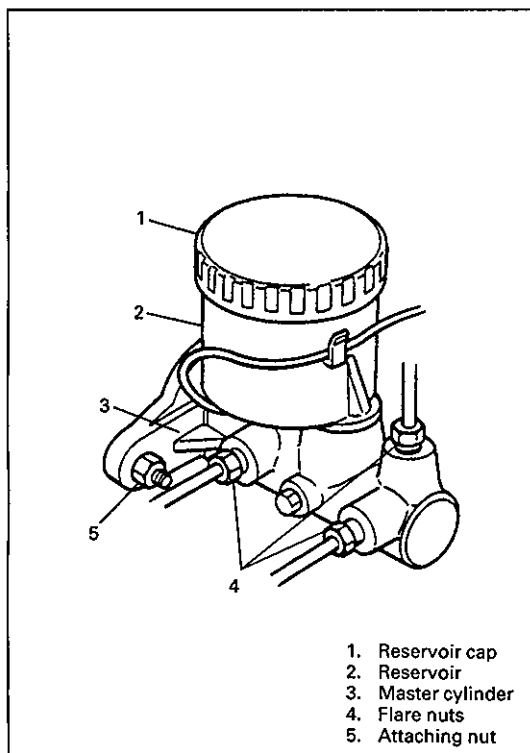
See NOTE at the beginning of this section.

- 1) When using new grommets, lubricate them with the same fluid as the one to fill reservoir with. Then press-fit grommets to master cylinder. Grommets must be seated in place.
- 2) Install reservoir and drive in reservoir pin.

NOTE:

Drive in reservoir pin till both of its ends at the right and left of reservoir becomes the same length.

- 3) Connect reservoir lead wire.
- 4) Fill reservoir with specified fluid.
- 5) Upon completion of installation, check for fluid leakage.



85F00-5-37-1

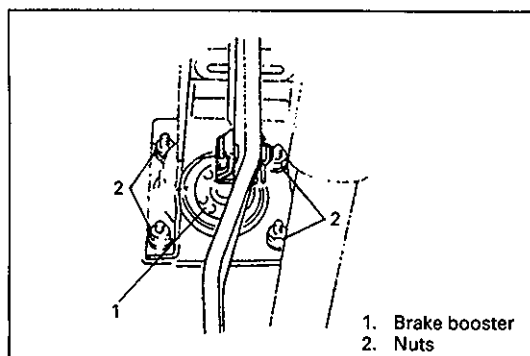
2. REMOVE AND INSTALL MASTER CYLINDER ASSEMBLY

REMOVAL

NOTE:

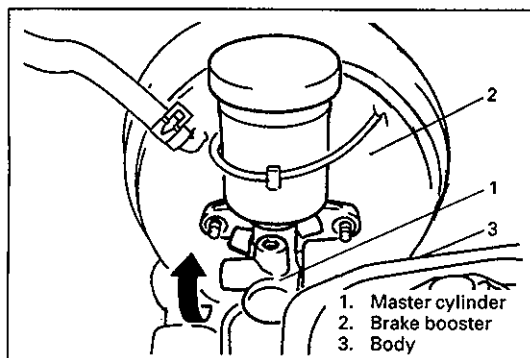
Do not allow brake fluid to get on painted surfaces.

- 1) Disconnect reservoir lead wire at coupler.
- 2) Clean around reservoir cap and take out fluid with syringe or such.
- 3) Disconnect brake pipes from master cylinder.
- 4) Remove attaching nuts/washers.



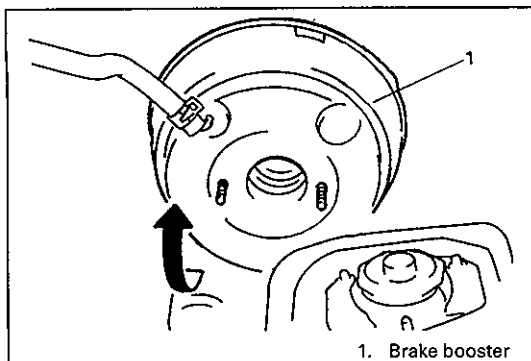
85F00-5-37-3

- 5) Loosen brake booster attaching nuts to such extent as to allow brake booster to move

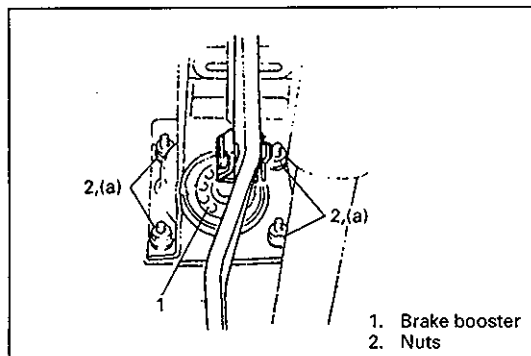


85F00-5-37-4

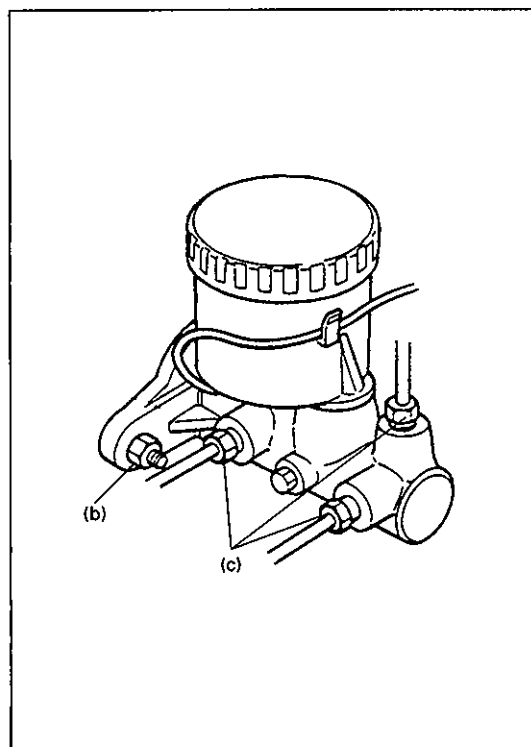
- 6) Move brake booster and master cylinder together as shown in figure and remove master cylinder only.



85F00-5-38-1



85F00-5-38-3



85F00-5-38-4

INSTALLATION

NOTE:

- See NOTE at the beginning of this section.
- Adjust clearance between booster piston rod and primary piston with special tool (See page 5-44)

1) After moving brake booster a little as shown in figure, install master cylinder to brake booster.

2) Torque booster attaching nuts to specification.

Tightening Torque

(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

3) Torque master cylinder attaching nuts to specification.

Tightening Torque

(b): 13 N·m (1.3 kg-m, 9.5 lb-ft)

4) Connect hydraulic lines and torque flare nuts to specification.

Tightening Torque

(c): 16 N·m (1.6 kg-m, 12.0 lb-ft)

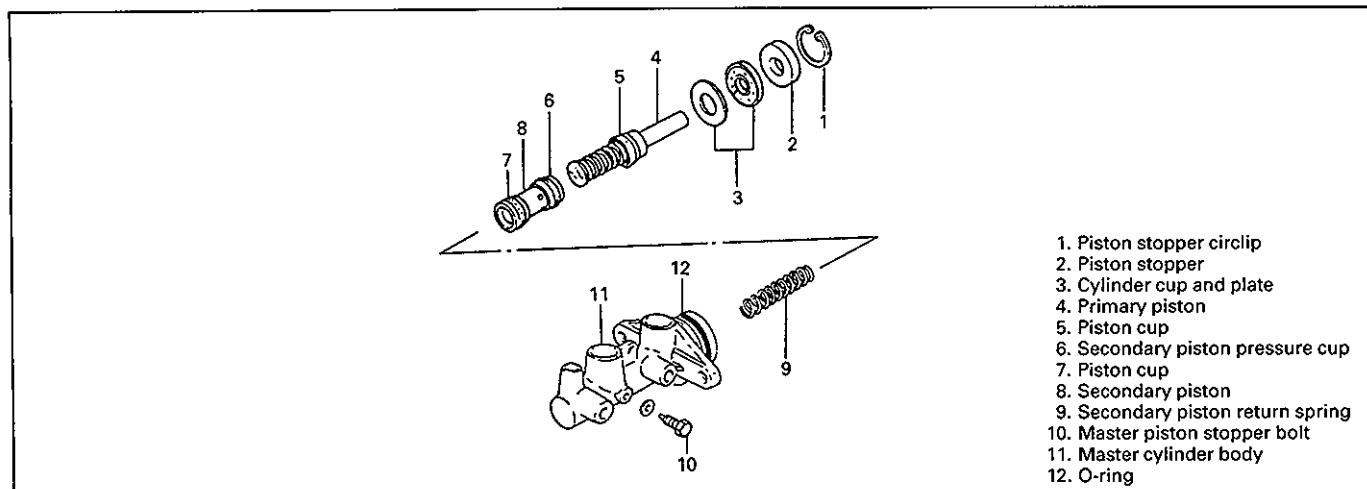
5) Connect reservoir lead wire.

6) Fill reservoir with specified brake fluid.

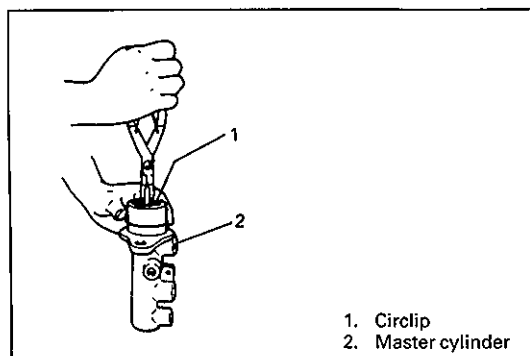
7) After installing, check brake pedal play and bleed air from system (See pages 5-20 and 5-21).

8) Perform brake test and check each installed part for fluid leakage.

3. DISASSEMBLE AND ASSEMBLE MASTER CYLINDER



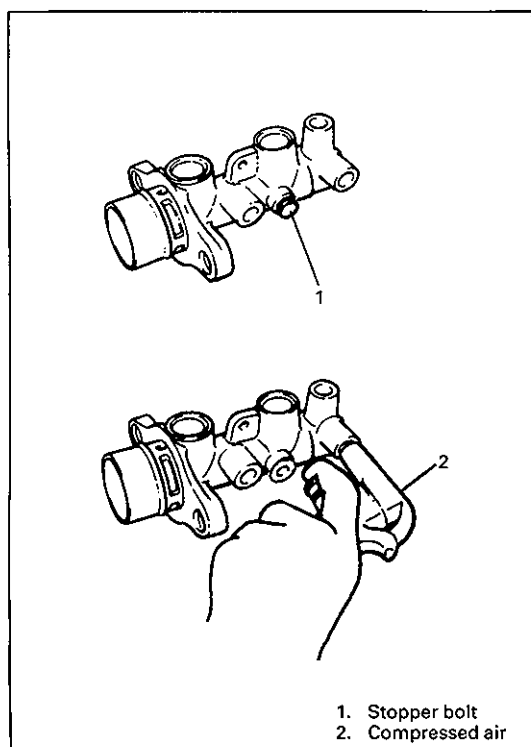
85F00-5-39-1



64B40-5-51-3

DISASSEMBLY

- 1) Remove circlip.
- 2) Remove primary piston.



85F00-5-39-4

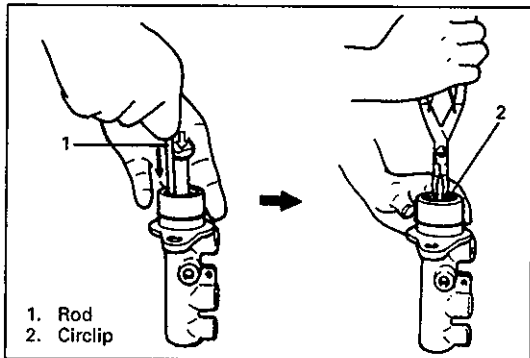
- 3) Remove piston stopper bolt. Then remove secondary piston by blowing compressed air into hole from which piston stopper bolt was removed.
 Be cautious during removal as secondary piston jumps out.

ASSEMBLY**NOTE:**

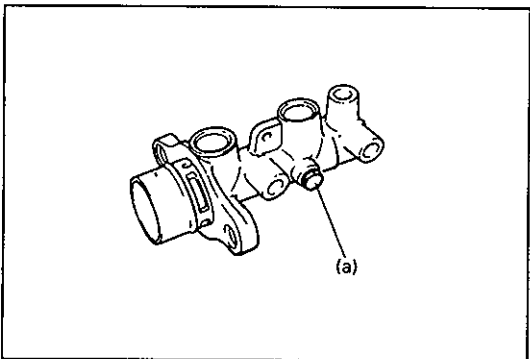
- See NOTE at the beginning of this section.
- Before assembling, wash each part in fluid recommended to use for that vehicle.

- 1) Assemble secondary piston as shown on previous page.
- 2) Install secondary piston assembly into cylinder.
- 3) Install primary piston in cylinder.

64B40-5-52-1



64B40-5-52-2



- 4) Depress, and install circlip.

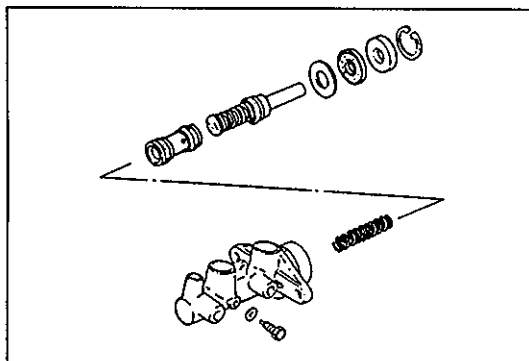
- 5) Install piston stopper bolt with pistons pushed in all the way and tighten it to specified torque.

Tightening Torque

(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

- 6) For installation on vehicle, refer to INSTALLATION on page 5-38.

85F00-5-40-3



85F00-5-41-1

MASTER CYLINDER INSPECTION

1. INSPECT MASTER CYLINDER

Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTE:

- Wash disassembled parts with brake fluid.
- Do not reuse piston cups.

Inspect master cylinder bore for scoring or corrosion. It is best to replace corroded cylinder.

Corrosion can be identified as pits or excessive roughness.

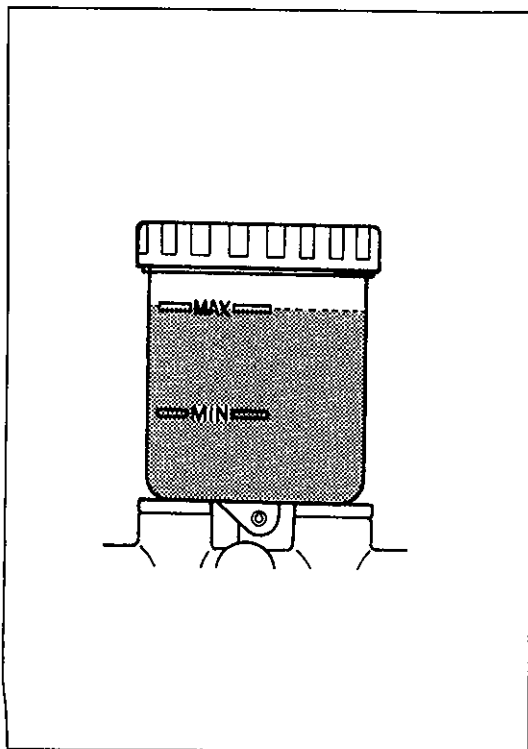
NOTE:

Polishing bore or master cylinder with cast aluminum body with anything abrasive is prohibited, as damage to cylinder bore may occur.

60A40-5-61-2

Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept from cylinder bore surfaces.

60A40-5-61-3



60A40-5-61-4

2. FILL RESERVOIR

CAUTION:

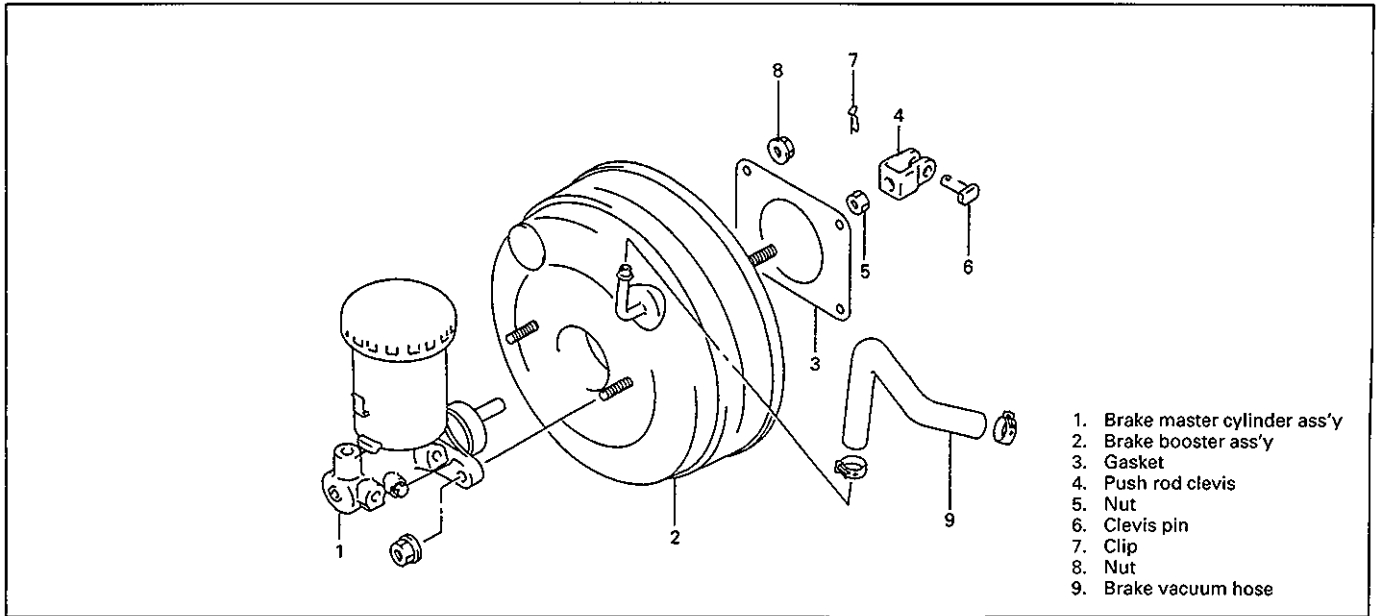
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use container which has been used for mineral oil or which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water will mix with brake fluid, lowering fluid boiling point. Keep all fluid containers capped to prevent contamination.

Fluid to fill reservoir with is indicated on reservoir cap of that vehicle with embossed letters or in owner's manual supplied with it.

Add fluid up to MAX line.

BRAKE BOOSTER R & I

1. REMOVE AND INSTALL BOOSTER

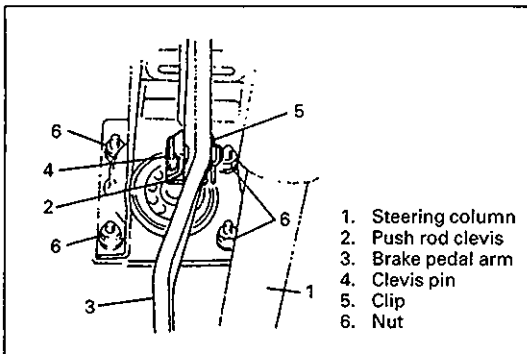


85F00-5-42-1

REMOVAL

- 1) Remove master cylinder assembly, referring to steps 1) to 6) of its REMOVAL on page 5-37.
- 2) Disconnect brake vacuum hose from brake booster.

85F00-5-42-3

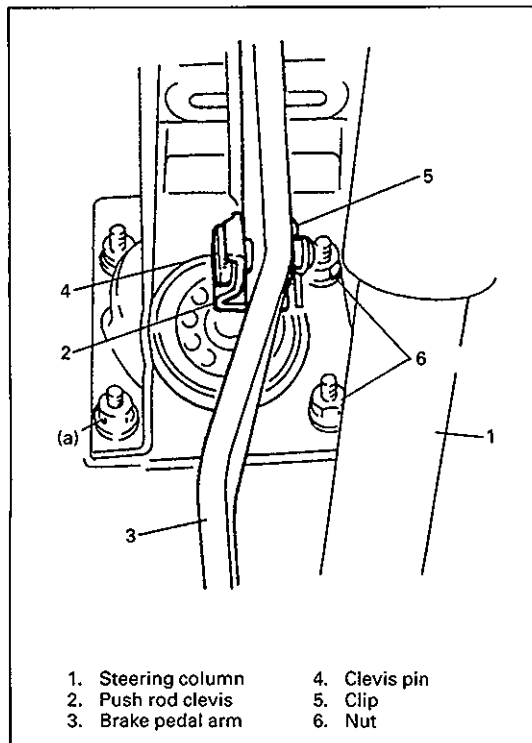


85F00-5-42-4

- 3) Disconnect push rod clevis from brake pedal arm.
- 4) Remove attaching nuts and then booster as shown.

WARNING:

Never disassemble booster assembly. If it is found faulty, replace it with new assembly.



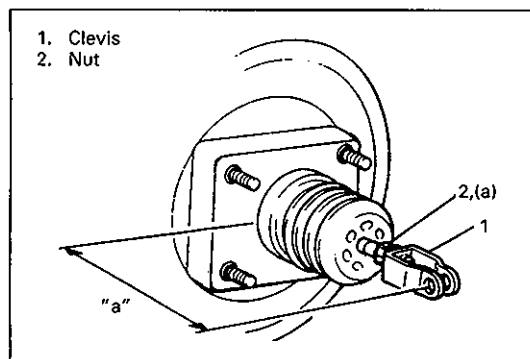
85F00-5-43-1

INSTALLATION

NOTE:

- See NOTE at the beginning of this section.
- Check length of push rod clevis. (Refer to BRAKE BOOSTER INSPECTION AND ADJUSTMENT)
- Before installing master cylinder, adjust booster piston rod. (Refer to CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON ADJUSTMENT of this section).
- Apply silicone grease to master cylinder piston.

- 1) Install booster to dash panel as shown. Then connect booster push rod clevis to pedal arm with clevis pin and clip.
- 2) Install booster attaching nuts temporarily.
- 3) Connect brake vacuum hose to brake booster.
- 4) Install master cylinder, referring to steps 1) to 8) of its INSTALLATION of this section.
- 5) After installing, check pedal height and play. (See pages 5-16, 5-17.)



85F00-5-43-4

BRAKE BOOSTER INSPECTION AND ADJUSTMENT

1. BOOSTER PUSH ROD CLEVIS ADJUSTMENT

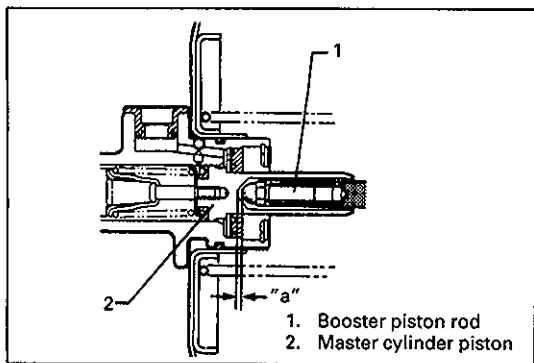
Install push rod clevis so that measurement "A" is obtained and torque nut to specification.

Tightening Torque

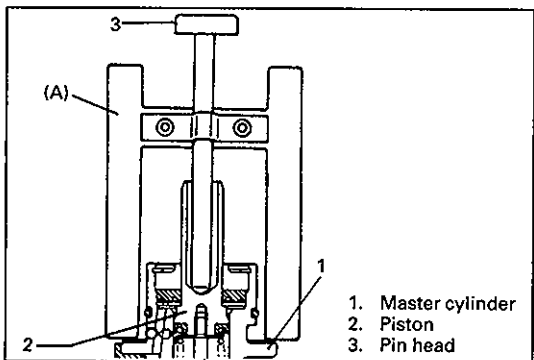
(a): 26 N·m (2.6 kg-m, 19.0 lb-ft)

Length

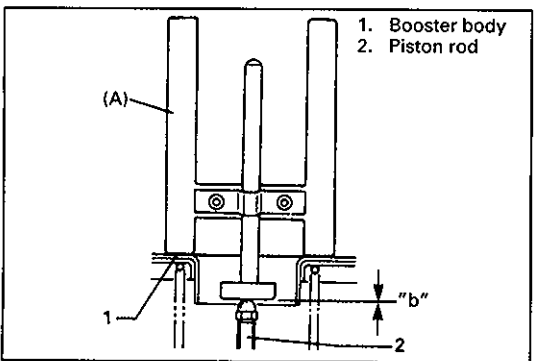
"a": 126.1 – 127.1 mm (4.96 – 5.00 in.)



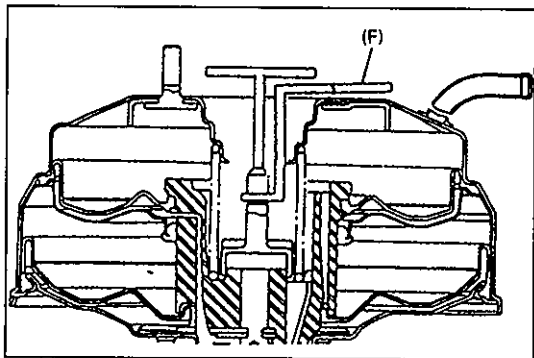
85F00-5-44-1



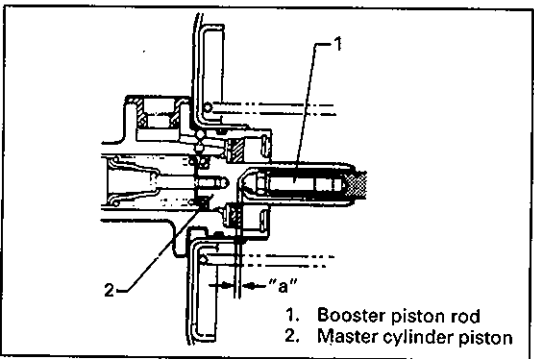
85F00-5-44-2



85F00-5-44-3



85F00-5-44-4



85F00-5-44-5

2. CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON ADJUSTMENT

The length of booster piston rod is adjusted to provide specified clearance "a" between piston rod end and master cylinder piston.

- Before measuring clearance, push piston rod several times so as to make sure reaction disc is in place.
- Keep inside of booster at atmospheric pressure for measurement.

- 1) Set special tool (A) on master cylinder and push pin until contacts piston.

Special Tool

(A): 09950-96010

- 2) Turn special tool upside down and place it on booster. Adjust booster piston rod length until rod end contacts pin head.

Special Tool

(A): 09950-96010

Clearance "b": 0 mm (0 in.)

- 3) Adjust clearance by turning adjusting screw of piston rod.

Special Tool

(F): 09952-16010

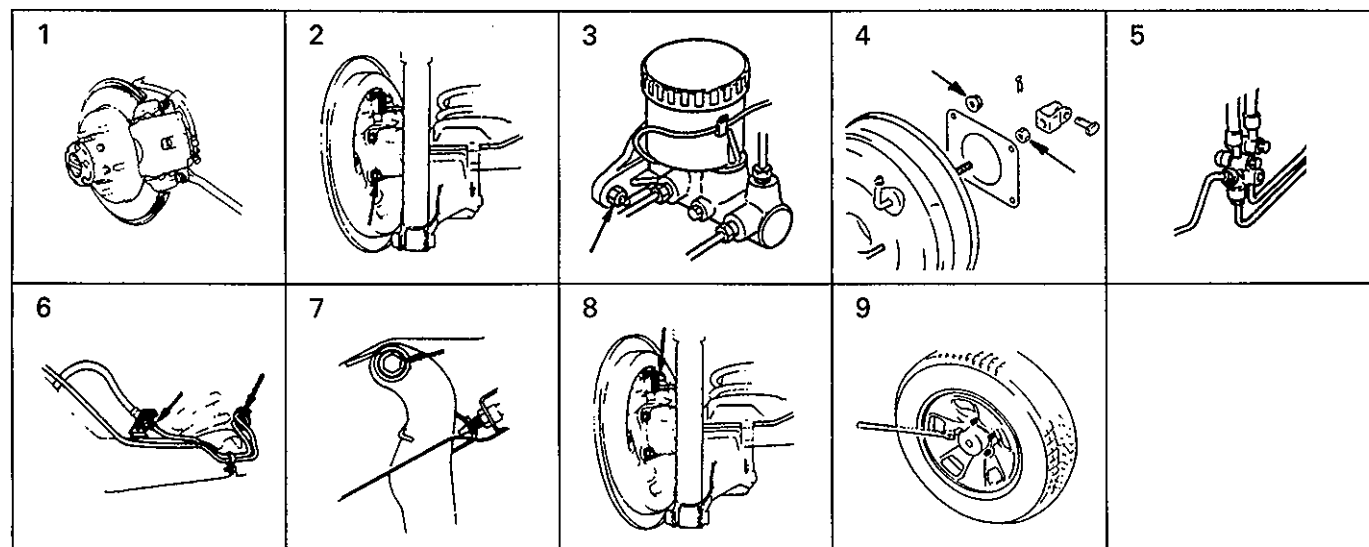
Reference

When adjusted as above, if negative pressure is applied to booster with engine at idle, piston to piston rod clearance "a" should become 0.14 – 0.35 mm (0.006 – 0.014 in.).

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts		Tightening torque		
		N·m	kg·m	lb·ft
1. Brake caliper pin bolt	10 mm thread diameter	50	5.0	36.5
	12 mm thread diameter	85	8.5	61.5
2. Rear brake nut (Brake back plate nut)		23	2.3	17.0
3. Master cylinder nut		13	1.3	9.5
4.	Booster nut	13	1.3	9.5
	Clevis nut	26	2.6	19.0
5. Brake pipe 5-way joint bolt		10	1.0	7.5
6. Brake pipe flare nut		16	1.6	12.0
7. Brake pedal shaft nut		23	2.3	17.0
8. Brake bleeder plug	Front caliper	8.0	0.8	6.0
	Rear cylinder	8.0	0.8	6.0
	LSPV	8.0	0.8	6.0
9. Wheel nut		95	9.5	69.0

85F00-5-45-1



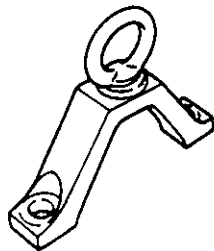
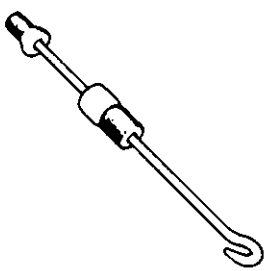
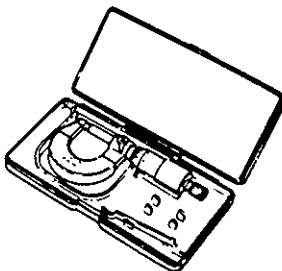
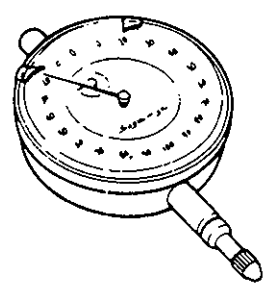
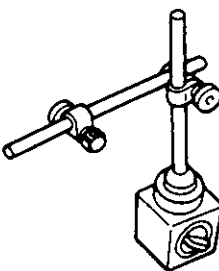
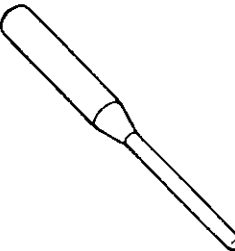
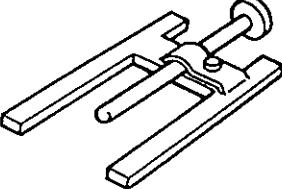
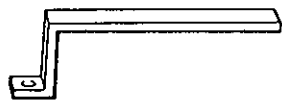
85F00-5-45-2

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir cap or described in owner's manual of vehicle	• To fill master cylinder reservoir. • To clean and apply to inner parts of master cylinder caliper and wheel cylinder when they are disassembled.
Water tight sealant	SEALING COMPOUND 366E 99000-31090	• To apply to mating surfaces of brake back plate and rear wheel cylinder.
Sealant	SUZUKI BOND NO. 1215 99000-31110	• To apply to mating surfaces of brake back plate and rear axle housing. • To apply mating surfaces of brake back plate and rear wheel bearing retainer.

85F00-5-46-1

SPECIAL TOOLS

 09943-35511 Brake drum remover (Front wheel hub remover)	 09942-15510 Sliding hammer	 09950-78210 Flare nut wrench (10 mm)	 09900-20205 Micrometer (0 - 25 mm)
 09900-20602 Dial gauge (1/1000 mm)	 09900-20701 Magnetic stand	 09922-85811 Connector pin remover	 09950-96010 Booster piston rod gauge
 09952-16010 Booster piston rod adjuster			

85F00-5-46-2

SECTION 6

ENGINE

CONTENTS

GENERAL INFORMATION	6-1	ENGINE IGNITION SYSTEM	6F-1
ENGINE DIAGNOSIS	6-5	ENGINE CRANKING SYSTEM	6G-1
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ENGINE COOLING	6B-1	ENGINE EMISSION CONTROLS	6J-1
ENGINE FUEL	6C-1	ENGINE EXHAUST	6K-1
ENGINE ELECTRONIC FUEL INJECTION SYSTEM	6E2-1		

85F00-6-1-1

GENERAL INFORMATION

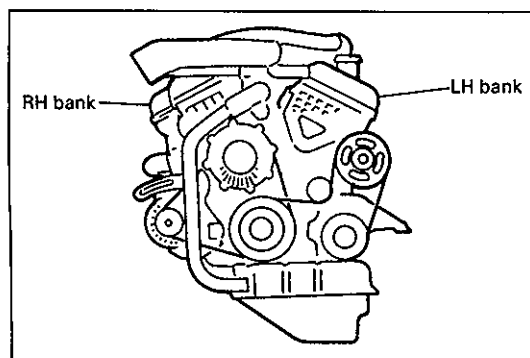
6

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.

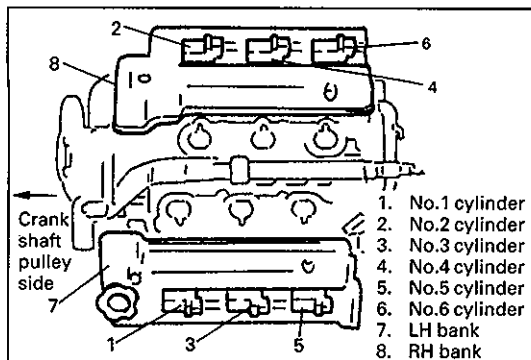
- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should 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.

60A40-6-1-2



85F00-6-1-5

- Throughout this manual, this engine has 2 banks named by LH bank and RH bank as shown left figure. Engine in the figure is viewed from the crankshaft pulley side.



85F00-6-2-1

- Throughout this manual, the 6 cylinders of the engine are identified by numbers; No.1, No.2, No.3, No.4, No.5 and No.6 as counted from crankshaft pulley side to flywheel side.
- Figure at the left shows engine with intake manifold removed and viewed from the top.
LH bank consists of No.1, No.3 and No.5 cylinders.
RH bank consists of No.2, No.4 and No.6 cylinders.

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.

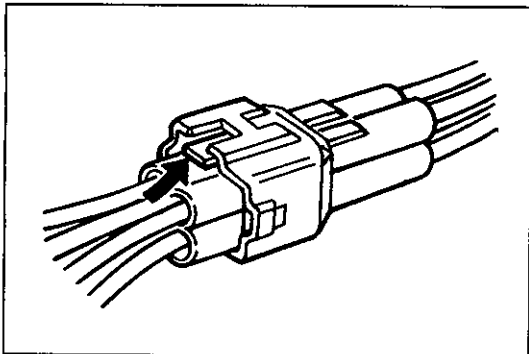
- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, 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.

60A20-6-2-1

- Any time the air cleaner, air intake case, 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.

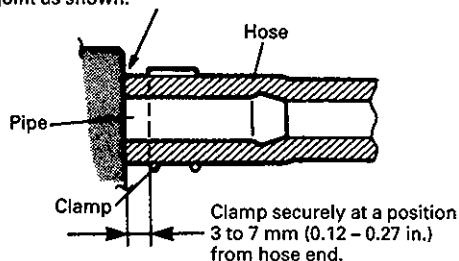
60A40-6-2-3



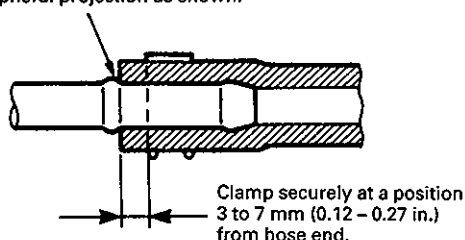
60A40-6-2-4

- 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.

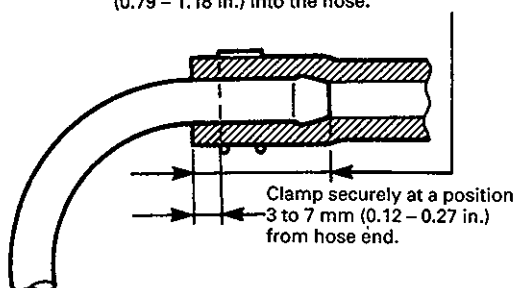
With short pipe, fit hose as far as it reaches pipe joint as shown.



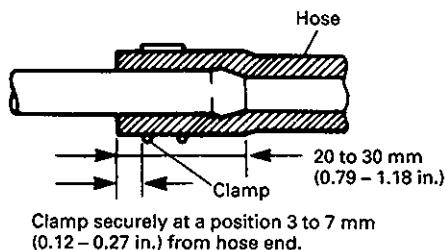
With following type pipe, fit hose as far as its peripheral projection as shown.



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.



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 filter union bolt or plug bolt on union bolt, always use new gasket and tighten it to specified torque. See Section 6C for specified torque.
 - When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O ring with spindle oil or gasoline.
 - When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.

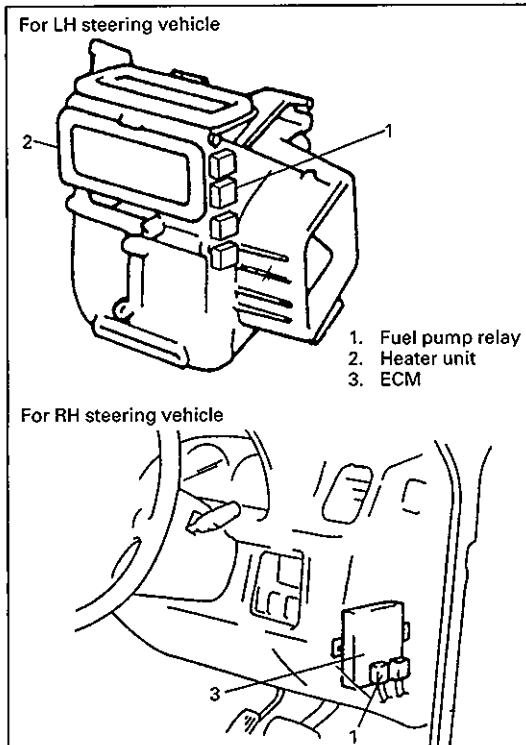
FUEL PRESSURE RELIEF PROCEDURE**CAUTION:**

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) Disconnect coupler from fuel pump relay.
- 3) Remove fuel filter 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, connect coupler to fuel pump relay.

85F00-6-4-1



85F00-6-4-2

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 ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF.
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.

60A20-6-4-4

60A20-6-4-5

ENGINE DIAGNOSIS

Condition	Possible Cause	Correction
Hard starting (Engine cranks OK)	Ignition system out of order. ● Blown fuse ● Faulty spark plug ● Loose connection or disconnection of lead wires ● Faulty ignition coil ● Faulty noise suppressor ● Faulty camshaft position sensor ● Faulty igniter (power unit) ● Improper ignition timing ● Faulty ECM Fuel system out of order. ● Lack of fuel in fuel tank ● Dirty fuel filter ● Dirty or clogged fuel hose or pipe ● Malfunctioning fuel pump ● Air inhaling from intake manifold gasket or throttle body gasket Electronic Fuel Injection system out of order. Low compression. ● Poor spark plug tightening or faulty gasket ● Faulty hydraulic valve lash adjuster ● Compression leak from valve seat ● Sticky valve stem ● Weak or damaged valve springs ● Compression leak at cylinder head gasket ● Sticking or damaged piston ring ● Worn piston, ring or cylinder Others ● Malfunctioning PCV valve ● Loose connection or disconnection of vacuum hoses	Repair or replace. Clean and adjust plug gap or replace. Repair or replace. Replace. Replace. Replace. Replace. Adjust. Replace. Refill. Replace. Clean. Replace. Replace. Refer to SECTION 6E2. Tighten to specified torque or replace gasket. Replace. Remove cylinder head and lap valves. Correct or replace valve and valve guide. Replace valve springs. Repair or replace. Replace piston rings. Replace ring and piston. Rebore or replace cylinder. Replace. Connect securely.

Condition	Possible Cause	Correction
Engine has no power	Low compression. Ignition system out of order. • Incorrect ignition timing • Defective spark plug • Faulty ignition coil Fuel system out of order. • Clogged fuel hose or pipe. • Dirty or clogged fuel filter. • Clogged air cleaner element • Air inhaling from intake manifold gasket or throttle body gasket Electronic Fuel Injection system out of order. Others • Loose connection or disconnection of vacuum hoses • Malfunctioning EGR valve • Dragging brakes • Slipping clutch	Previously outlined. Adjust. Adjust or replace. Replace. Clean. Replace. Clean or replace. Replace gasket. Refer to SECTION 6E2. Connect securely. Check and replace as necessary. Repair or replace. Adjust or replace.
Improper engine idling or engine fails to idle	Ignition system out of order. • Faulty spark plug • Faulty ignition coil • Improper ignition timing Fuel system out of order. • Shortage of fuel in fuel tank • Clogged air cleaner element • Leaky manifold, throttle body, or cylinder head gasket Engine overheating. Electronic Fuel Injection system out of order. Low compression Others • Loose connection or disconnection of vacuum hoses • Malfunctioning EGR valve • Malfunctioning PCV valve	Adjust or replace. Replace. Adjust. Refill Clean or replace. Replace. Refer to "Overheating" section. Refer to SECTION 6E2. Previously outlined. Connect. Check and replace as necessary. Check and replace as necessary.

Condition	Possible Cause	Correction
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. ● Improper ignition timing ● Spark plug faulty or plug gap as out of adjustment Fuel system out of order. ● Clogged air cleaner element ● Clogged fuel filter hose or pipe ● Leaky manifold or throttle body gasket Engine overheating Electronic Fuel Injection system out of order. Low compression Others ● Malfunctioning EGR valve	Adjust. Replace or adjust gap. Clean or replace. Clean or replace. Replace. Refer to "Overheating" section. Refer to SECTION 6E2. Previously outlined. Check and replace as necessary.
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. ● Improper ignition timing ● Defective spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.) Fuel system out of order. ● Clogged fuel filter ● Kinky or damaged fuel hose and lines ● Leaky manifold or throttle body gasket Electronic Fuel Injection system out of order. Others ● Leaky vacuum hoses ● Malfunctioning EGR valve	Adjust. Check and clean, adjust or replace. Replace. Check and replace as necessary. Replace. Refer to SECTION 6E2. Repair or replace. Check and replace as necessary.
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	Engine overheating Ignition system out of order. ● Faulty spark plug ● Improper ignition timing	Refer to the section "Overheating". Replace. Adjust.

Condition	Possible Cause	Correction
	Fuel system out of order. ● Clogged fuel filter and fuel lines ● Air inhaling from intake manifold or throttle body gasket Electronic Fuel Injection system out of order. Others ● Excessive combustion chamber deposits ● Malfunctioning EGR valve	Replace or clean. Replace. Refer to SECTION 6E2. Remove carbon. Check and replace as necessary.
Overheating	● Insufficient coolant ● Loose water pump belt ● Inoperative thermostat ● Poor water pump performance ● Improper ignition timing ● Clogged or leaky radiator ● Improper engine oil grade ● Clogged oil filter or oil strainer ● Not enough oil ● Poor oil pump performance ● Oil leakage ● Dragging brakes ● Slipping clutch ● Blown cylinder head gasket	Replenish. Adjust. Replace. Replace. Adjust. Flush, repair or replace. Replace with proper grade oil. Replace or clean (oil strainer). Replenish. Repair or replace. Repair. Repair or replace. Adjust or replace. Replace.
Poor gasoline mileage.	Fuel system out of order. ● Fuel leakage from fuel tank and lines ● Clogged air cleaner element Ignition system out of order. ● Improper ignition timing ● Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc..) Electronic Fuel Injection system out of order.	Repair or replace. Clean or replace. Adjust. Clean, adjust or replace. Refer to SECTION 6E2.

Condition	Possible Cause	Correction
	Low compression Others • Poor valve seating • Dragging brakes • Slipping clutch • Thermostat out of order • Improper tire pressure • Malfunctioning EGR valve	Previously outlined. Repair or replace. Repair or replace. Adjust or replace. Replace. Adjust. Check and replace as necessary.
Excessive engine oil consumption	Oil leakage • Loose oil drain plug • Loose oil pan bolts • Deteriorated or broken oil pan sealant • Leaky crankshaft oil seal (flywheel side) • Leaky cylinder head cover gasket • Improper tightening of oil filter • Loose oil pressure switch • Blown cylinder head gasket • Leaky crankshaft pulley oil seal • Deteriorated or broken timing chain cover sealant Oil entering combustion chamber • Sticky piston ring • Worn piston and cylinder • Worn piston ring groove and ring • Improper location of piston ring gap • Worn or damaged valve stem seal • Worn valve stem	Tighten. Tighten. Replace sealant. Replace. Replace. Tighten. Tighten. Replace. Replace. Replace sealant. Remove carbon and replace rings. Replace or rebores cylinder, and replace piston. Replace piston and ring. Reposition ring gap. Replace. Replace.
Low oil pressure	• Improper oil viscosity • Malfunctioning oil pressure switch • Not enough oil • Clogged oil strainer • Functional deterioration of oil pump • Worn oil pump relief valve • Excessive clearance in various sliding parts	Use oil of proper viscosity. Replace. Replenish. Clean. Replace. Replace. Replace worn parts.

Condition	Possible Cause	Correction
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 ● Faulty hydraulic valve lash adjuster ● Worn valve stem and guide ● Weak or broken valve spring ● Warped or bent valve ● Loose camshaft housing bolts Piston, ring and cylinder noise ● Worn piston, ring and cylinder bore Connecting rod noise ● Worn crank pin bearing ● Worn crank pin ● Loose connecting rod nuts ● Low oil pressure Crankshaft noise ● Low oil pressure ● Worn crankshaft journal bearing ● Worn crankshaft journal ● Loose bearing cap bolts ● Excessive crankshaft thrust play	Replace. Replace. Replace. Replace. Tighten to specification. Rebore or replace cylinder. Replace piston and ring. Replace. Repair by grinding or replace crankshaft. Tighten nuts to specification. Previously outlined. Previously outlined. Replace. Repair by grinding, or replace crankshaft. Tighten bolts to specification. Replace thrust bearing.

SECTION 6A2

ENGINE MECHANICAL

CONTENTS

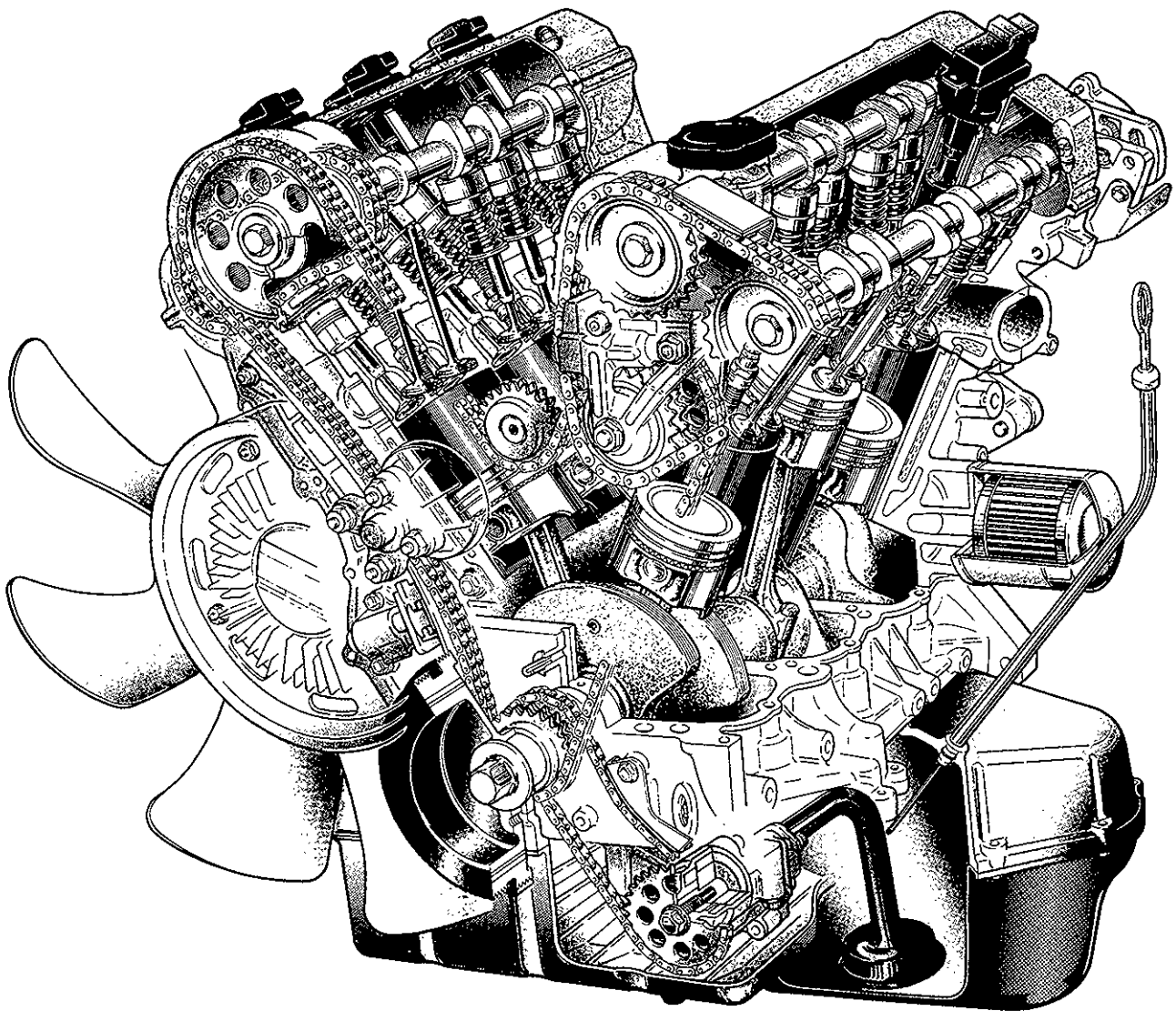
GENERAL DESCRIPTION	6A2- 2
ON VEHICLE SERVICE	6A2- 6
Compression Check	6A2- 6
Engine Vacuum Check	6A2- 7
Oil Pressure Check	6A2- 8
Air Cleaner Element	6A2- 9
Throttle Body and Intake Manifold	6A2-10
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GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, 60°V 6 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for "V" type valve configuration.

The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chains, and no push rods are provided in the valve train system.



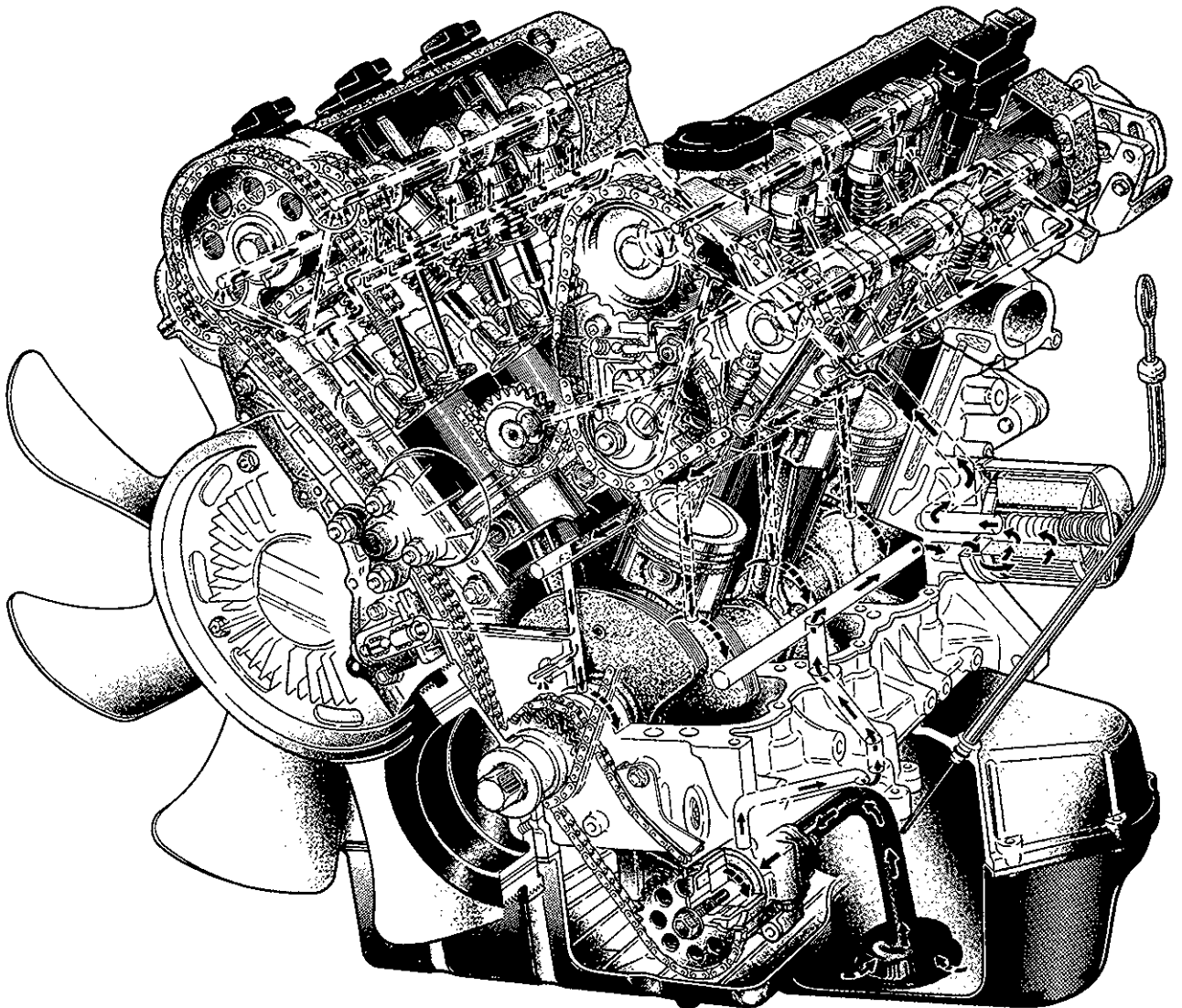
ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted under the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter.

The filtered oil flows into 3 paths in cylinder block. In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of connecting rod to lubricate piston, rings, and cylinder wall.

In other paths oil goes up to the cylinder heads and lubricates valves and camshafts, etc., after passing through the internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 430 kPa (4.3 kg/cm², 61.1 psi).

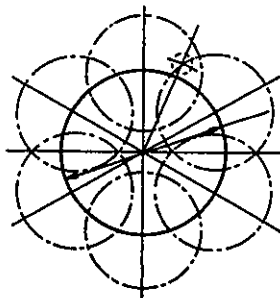


CYLINDER BLOCK

The cylinder block is made of cast aluminum alloy and has 6 cylinders arranged in "60° V" shape. A cylindrical cast iron sleeve is installed in each cylinder.

CRANKSHAFT AND MAIN BEARINGS

A monoblock crankshaft made of forged steel is supported by 4 main bearings which are of precision insert type. 6 crank pins on the crankshaft are positioned as shown below.



Crank pins position

PISTONS, RINGS, PISTON PINS AND CONNECTING RODS

The piston is cast aluminum alloy, and has two compression rings (top and 2nd rings), and one oil ring.

The outer surface of the top ring is treated with nitriding and the 2nd ring is plated with hard chromium for improvement in abrasion resistance.

The oil ring consists of two rails and one spacer. Pins, made of chromium steel, have a floating fit in the pistons and connecting rods. The connecting rods are made of forged steel, and the rod bearings are of precision insert type.

CYLINDER HEADS, VALVE TRAIN AND HYDRAULIC VALVE LASH ADJUSTERS

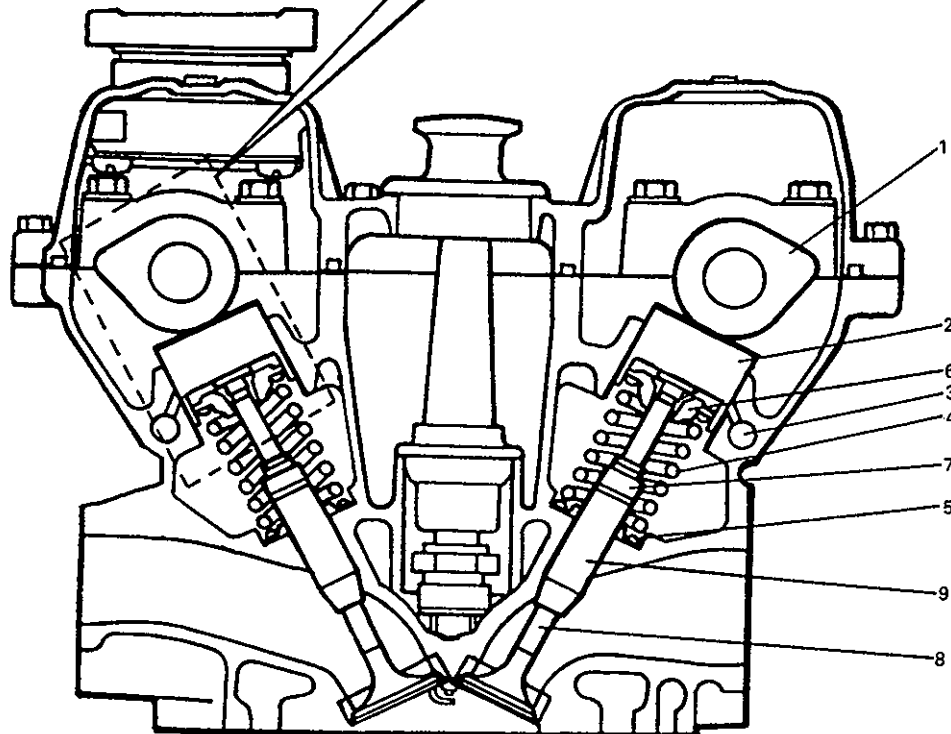
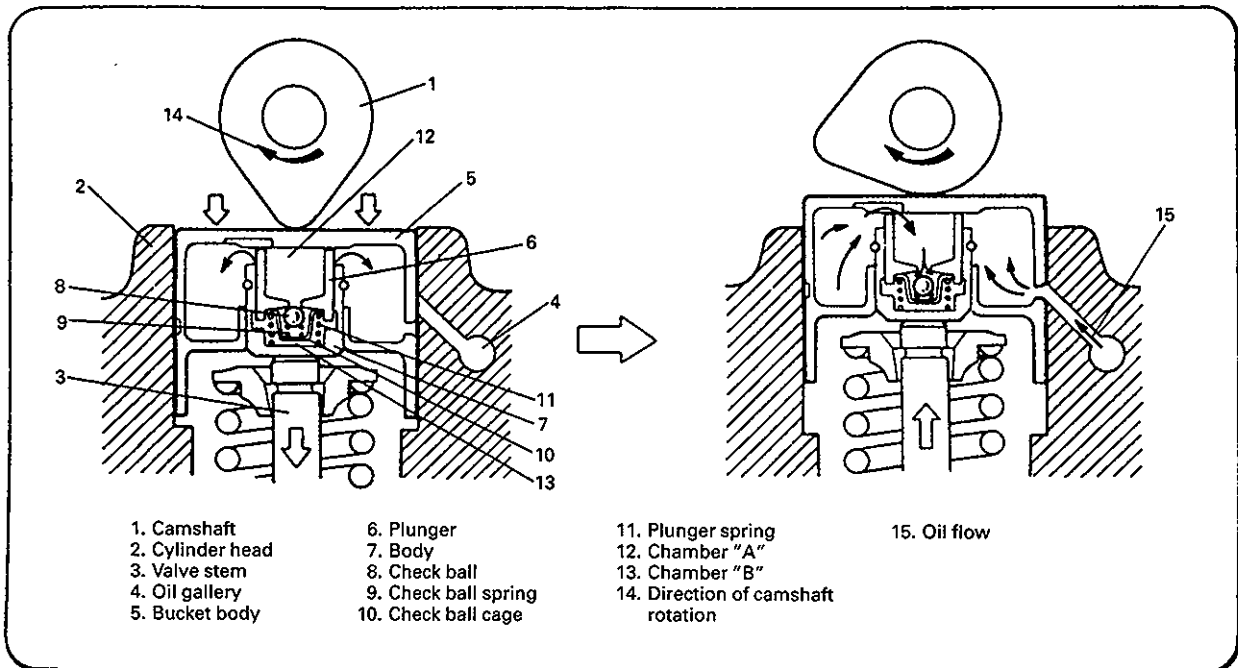
Cylinder heads are made of cast aluminum alloy and one cylinder head has 3 combustion chambers arranged in-line. The combustion chamber is pentarof type (its section is trapezoid but the surface has five faces and is shaped like a roof) and a spark plug is positioned in the center of combustion chamber and between intake ports and exhaust ports.

The double overhead camshafts (intake and exhaust) driven by the crankshaft through the timing chains are mounted on the cylinder heads. Each of them has 6 cams and they operate the intake valves and exhaust valves respectively via the hydraulic valve lash adjusters.

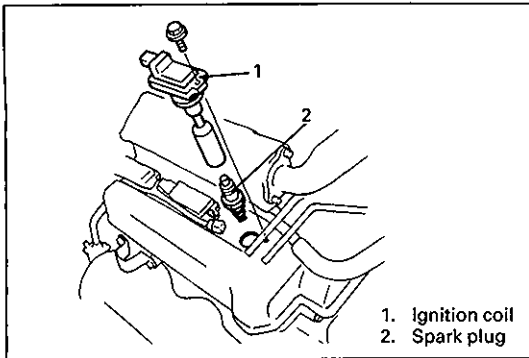
OPERATION OF HYDRAULIC VALVE LASH ADJUSTER

The hydraulic valve lash adjuster, located between the camshaft and valve stem, is direct acting type. With the engine oil delivered into it from the oil pump, the adjuster operates as follows so as to adjust the valve lash (clearance) to "0" automatically at all time.

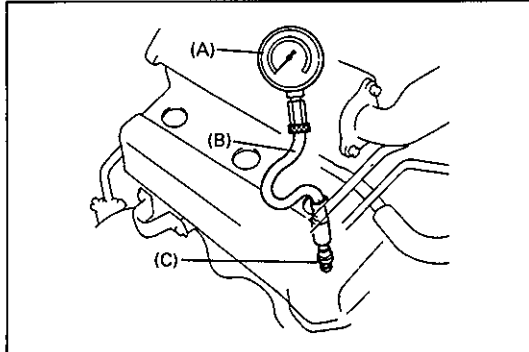
1. When the camshaft doesn't push the bucket body, the bucket body is pushed against the cam and the body against the stem by the plunger spring force. In this state, the valve lash is kept to "0". (At "0" valve lash, the oil pressure becomes equal in the chambers "A" and "B", and the check ball closes the passage between these two chambers.)
2. When the cam crest of the camshaft starts pushing the bucket body, the bucket body and plunger are pushed downward and at the same time the body is pushed upward by the counter force from the valve stem. As a result, the chamber "B" is compressed and the pressure rises high. Then the oil in the chamber "B" leaks through the slight clearance between the body and plunger. However, as the compression time is very short, the volume hardly changed and thus the bucket body, plunger and body, substantially as one unit, push down the valve stem to open the valve.
3. When the push of the cam crest of the camshaft against the bucket body is over, the operation as described in above 1 starts again. As the oil pressure in the chamber "B" is lower than that in "A" (for the oil in the chamber "B" under high pressure has leaked gradually in above 2), the oil pressure in the chamber "A" pushes the check ball open to allow the oil to flow from the chamber "A" to chamber "B" till the oil pressure becomes equal between the two chambers.



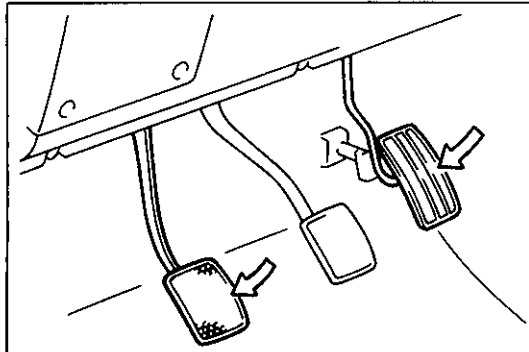
1. Camshaft (EX)
2. Valve lash adjuster
3. Oil gallery
4. Valve spring
5. Valve spring seat
6. Valve spring retainer
7. Valve stem seal
8. Valve stem (EX)
9. Valve guide



85F00-6A2-6-1



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60A20-6A2-6-3

ON VEHICLE SERVICE

COMPRESSION CHECK

Check compression pressure on all 6 cylinders as follows:

- 1) Warm up engine.
- 2) Stop engine after warming up.
- 3) Disconnect ignition coil harness connectors
- 4) Remove ignition coils, and ignition coil cover.
- 5) Remove all spark plugs.
- 6) Disconnect fuel pump relay coupler.
- 7) Install special tool (Compression gauge) into spark plug hole.

Special Tool

(A): 09915-64510

(B): 09915-64530

(C): 09915-67010

- 8) Disengage clutch (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal all the way to make throttle fully open.

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

NOTE:

For measuring compression pressure, crank engine at least 400 r/min. by using fully charged battery.

Compression pressure

Standard: 14.0 kg/cm² (199.0 psi, 1400 kPa)

Limit: 11.0 kg/cm² (156.0 psi, 1100 kPa)

Max. difference between any two cylinders:

1.0 kg/cm² (14.2 psi, 100 kPa)

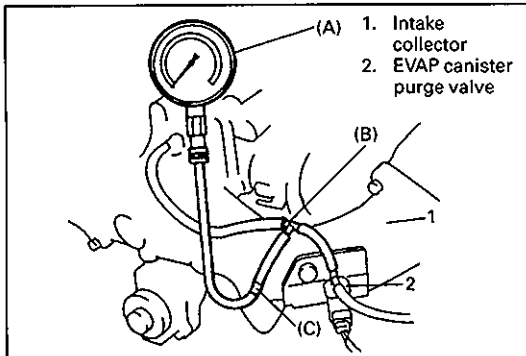
- 10) Carry out steps 7), 8) and 9) on each cylinder to obtain 6 readings.

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 and make sure that engine idle speed is within specification.

77500-6A2-7-1



85F00-6A2-7-2

- 2) Stop engine and disconnect vacuum hoses from intake collector to EVAP canister purge valve.
- 3) Connect special tools (Vacuum gauge and hose joint) to vacuum hose of intake manifold side.

Special Tool

(A): 09915-67310

(B): T joint

(C): 09918-08210

- 4) Start engine and run engine at specified idle speed, and read vacuum gauge. Vacuum should be within specification.

Vacuum specification: 40 – 50 cm Hg
(sea level) (15.7 – 19.7 in.Hg)
at 800 r/min

85F00-6A2-7-3

- 5) After checking, remove vacuum gauge and hose joint.
- 6) Connect vacuum hoses to intake collector and EVAP canister purge valve.

85F00-6A2-7-4

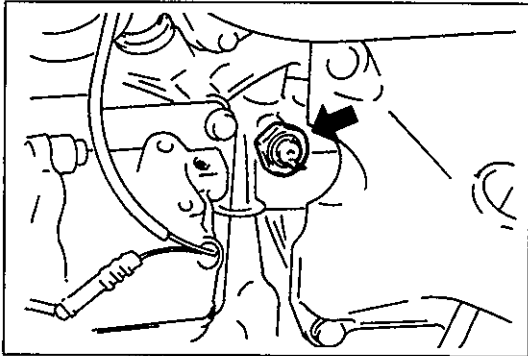
OIL PRESSURE CHECK

NOTE:

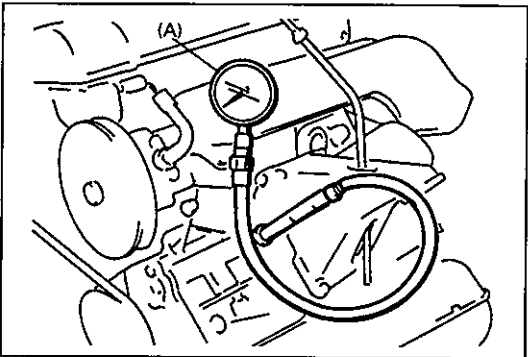
Prior to checking oil pressure, check the followings.

- Oil level in oil pan.
If oil level is low, add oil up to Full level hole on oil level gauge.
- Oil quality.
If oil is discolored, or deteriorated, change it.
For particular oil to be used, refer to Section 0B.
- Oil leaks.
If leak is found, repair it.

85F00-6A2-8-1



85F00-6A2-8-2



85F00-6A2-8-3

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

Oil pressure specification:

390 – 470 kPa (3.9 – 4.7 kg/cm², 55.5 – 66.8 psi) at
4,000 r/min (rpm)

- 5) After checking oil pressure, 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.

Tightening Torque

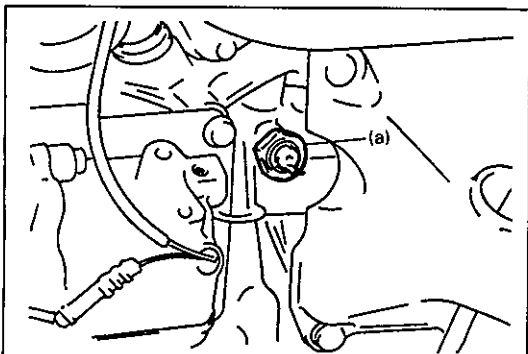
(a): 14 N·m (1.4 kg-m, 10.0 lb-ft)

NOTE:

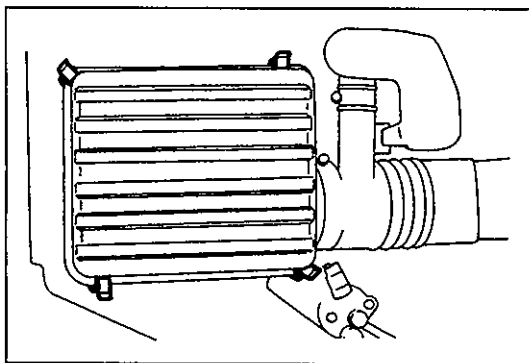
If sealing tape edge is bulged out from screw threads of switch, cut it off.

- 7) Start engine and check oil pressure switch for oil leakage.

85F00-6A2-8-4



85F00-6A2-8-5



85F00-6A2-9-1

AIR CLEANER ELEMENT

This air cleaner element is of dry type. Note that it needs cleaning according to the following method.

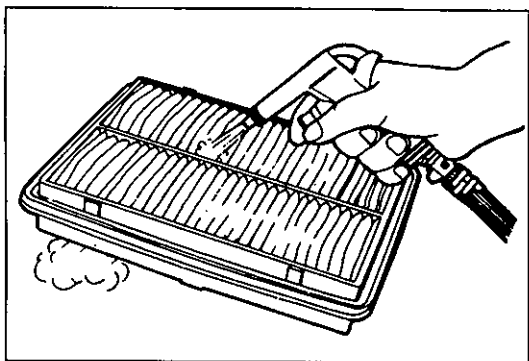
REMOVAL

- 1) Remove air cleaner cap.
- 2) Remove air cleaner element.

INSPECT

Check element for dirt.

60A20-6A2-11-2



60A20-6A2-11-3

CLEAN

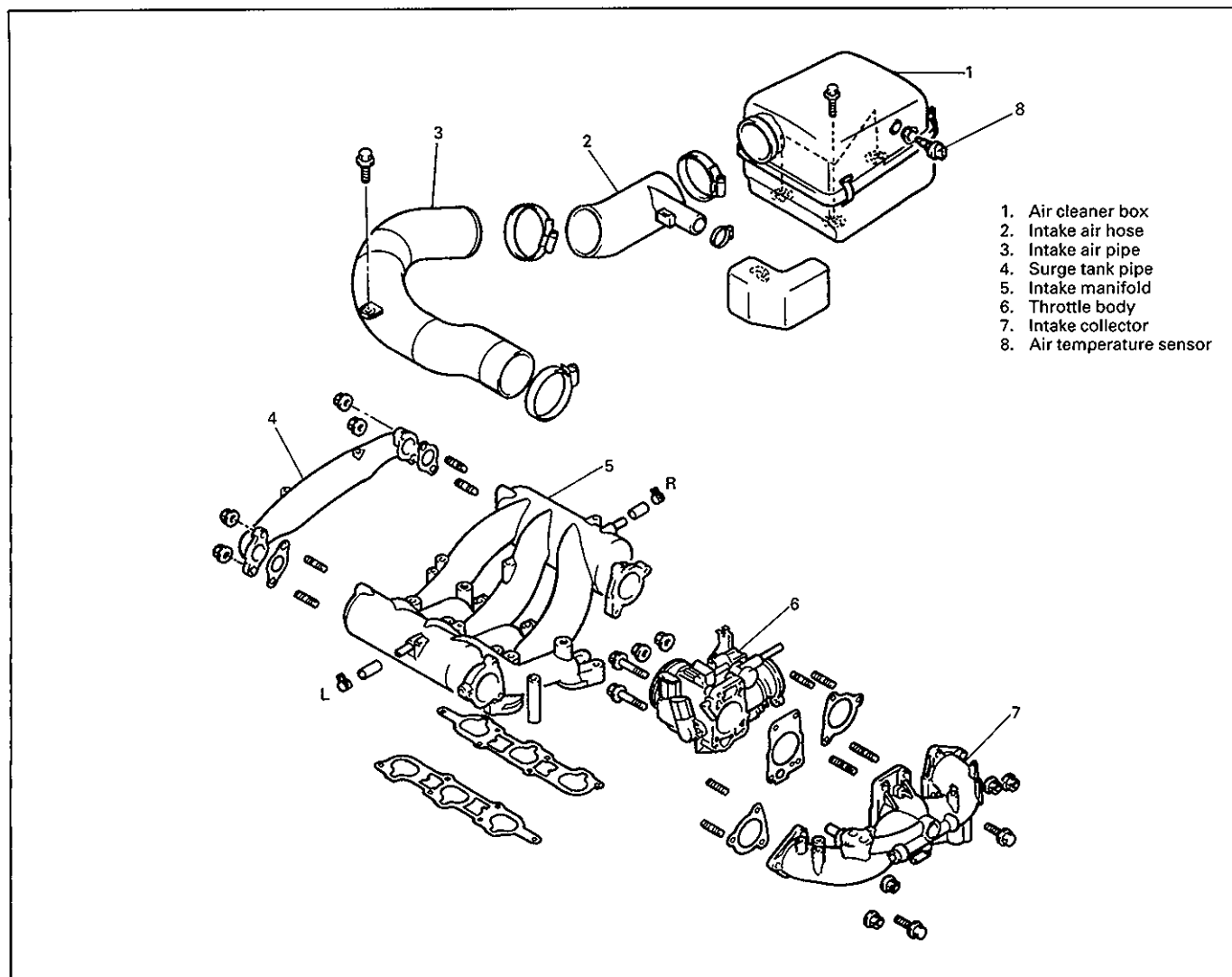
Blow off dust by blowing compressed air from air outlet side of element (i.e., the side facing up when installed in air cleaner case).

INSTALLATION

- 1) Install element to air cleaner box.
- 2) Install air cleaner cap.

60A20-6A2-11-4

THROTTLE BODY AND INTAKE MANIFOLD



85F00-6A2-10-1

REMOVAL

- 1) Release fuel pressure in fuel feed line by referring to Section 6.

CAUTION:

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

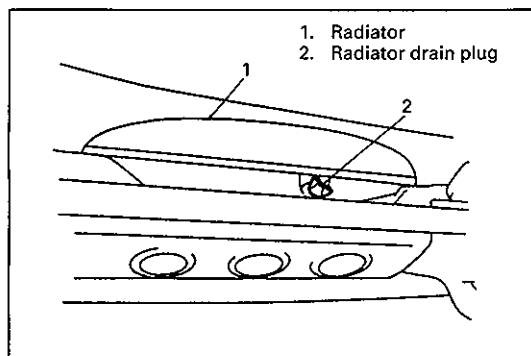
- 2) Disconnect negative cable at battery.
- 3) Drain coolant.

WARNING:

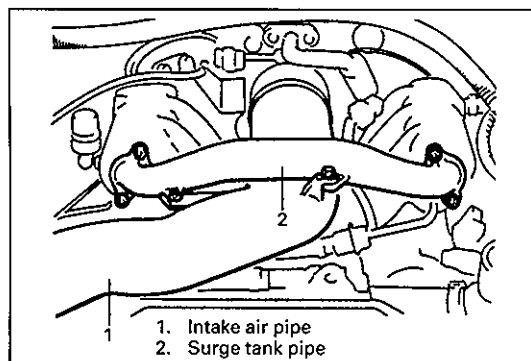
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.

- 4) Remove strut tower bar.
- 5) Remove air temperature sensor.

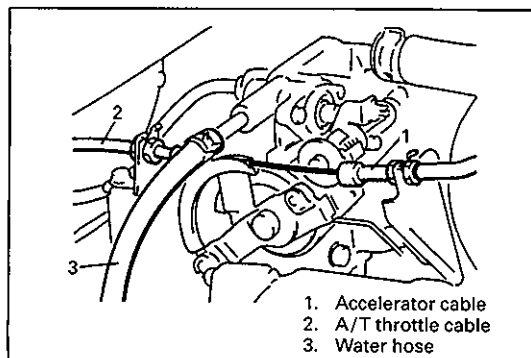
60A20-6A2-13-3



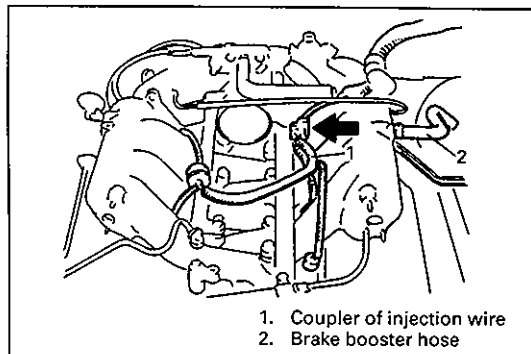
85F00-6A2-10-5



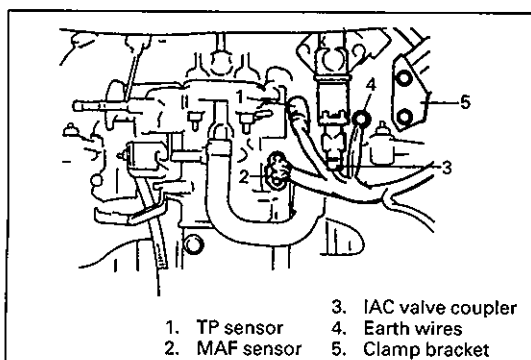
85F00-6A2-11-1



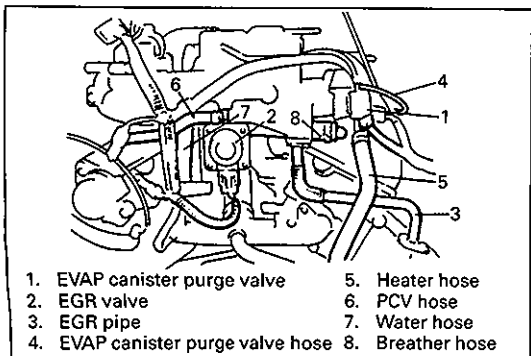
85F00-6A2-11-2



85F00-6A2-11-3



85F00-6A2-11-4



85F00-6A2-11-5

6) Remove air cleaner upper case, intake air hose, intake air pipe and surge tank pipe as one component. Do not disassemble them, when removing and reinstalling.

7) Disconnect accelerator cable and A/T throttle cable (For A/T vehicle) from throttle body.

8) Disconnect water hoses from throttle body.

9) Disconnect couplers of injector wire.

10) Disconnect brake booster hose from intake manifold.

11) Disconnect couplers of TP sensor, MAF sensor and IAC valve.

12) Disconnect earth terminal from intake collector.

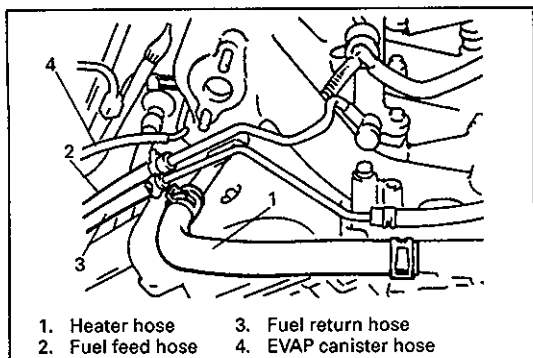
13) Remove clamp from intake collector.

14) Disconnect couplers of EVAP canister purge valve and EGR valve.

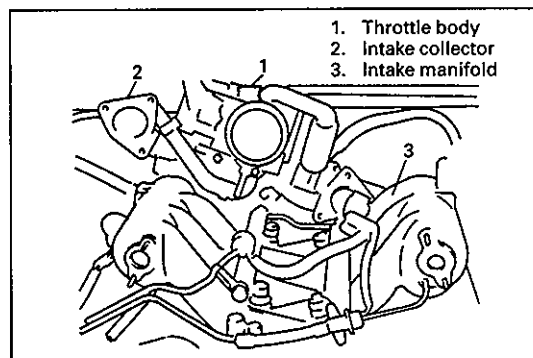
15) Disconnect PCV hose of from cylinder head cover. Disconnect breather hoses from throttle body or cylinder head cover.

16) Disconnect hoses of EVAP canister purge valve and heater.

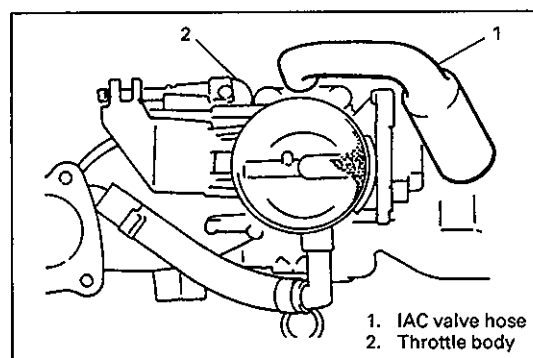
17) Remove EGR pipe.



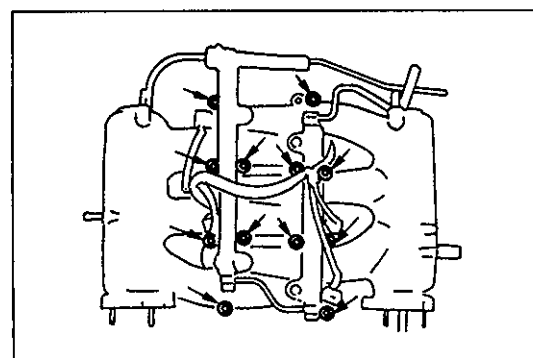
85F00-6A2-12-1



85F00-6A2-12-2



85F00-6A2-12-3



85F00-6A2-12-4

18) Disconnect hoses of heater, EVAP canister, fuel feed and fuel return.

19) Remove throttle body and intake collector from intake manifold.

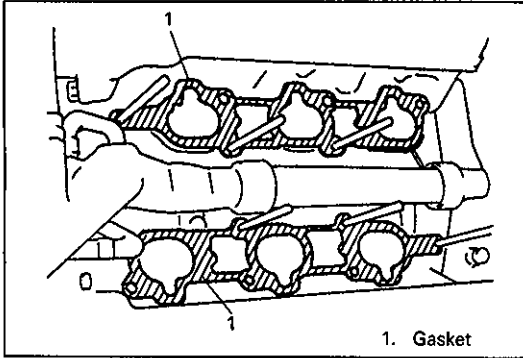
20) Disconnect hoses of IAC valve and EVAP canister purge valve from intake collector.

21) Remove throttle body from intake collector.

22) Remove IAC valve, EGR valve and EVAP canister purge valve from intake collector.

23) Remove intake manifold bolts (6 pc.) and nuts (6 pc.).

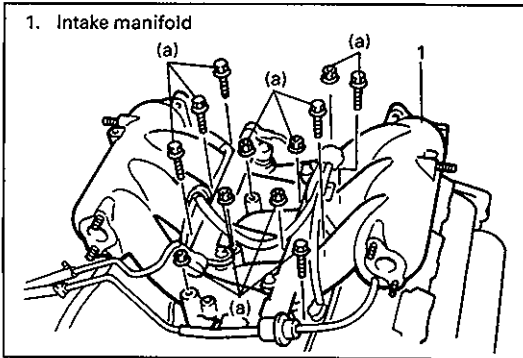
24) Remove intake manifold.



85F00-6A2-13-1

INSTALLATION

- 1) Install new intake manifold gaskets to cylinder heads.
 - Use new gaskets.

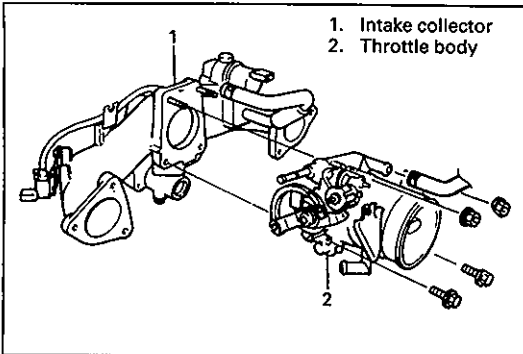


85F00-6A2-13-2

- 2) Install intake manifold.
Tighten bolts and nuts to specified torque.

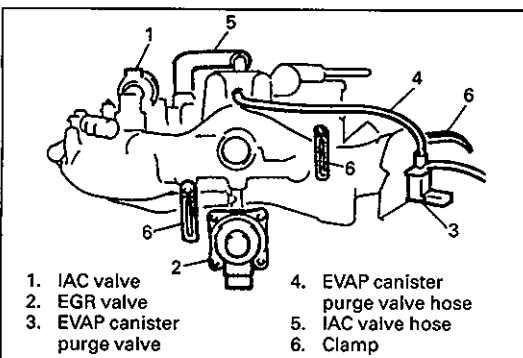
Tightening Torque

(a): 23.0 N·m (2.3 kg-m, 16.5 lb-ft)



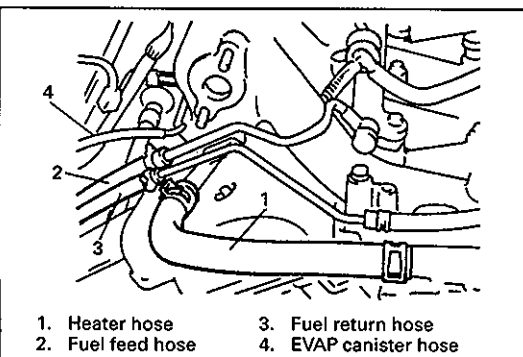
85F00-6A2-13-3

- 3) Install throttle body to intake collector with new throttle body gasket.
Tighten bolts and nuts to specified torque.



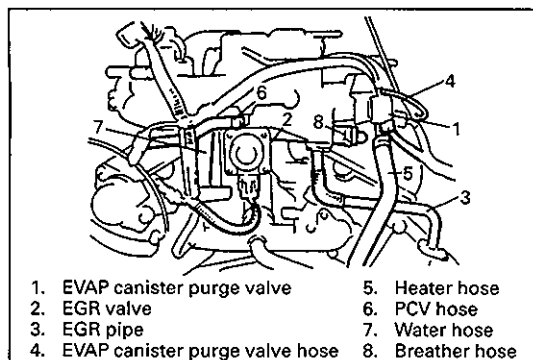
85F00-6A2-13-4

- 4) Install IAC valve, EGR valve, EVAP canister purge valve, clamps and each hoses to intake collector and throttle body.
 - Use new gasket, if equipped.
- 5) Install throttle body and intake collector to intake manifold with intake collector gaskets.

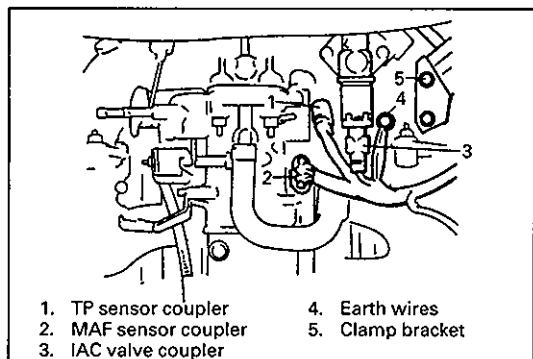


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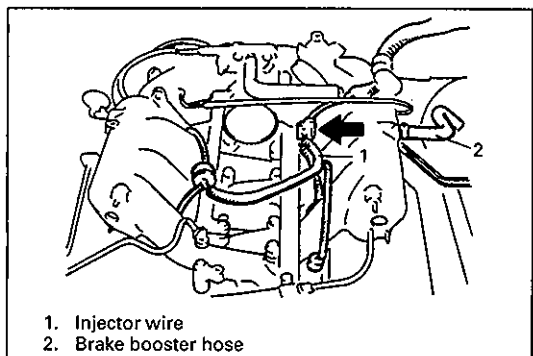
- 6) Connect hoses of heater, EVAP canister, fuel feed and fuel return.



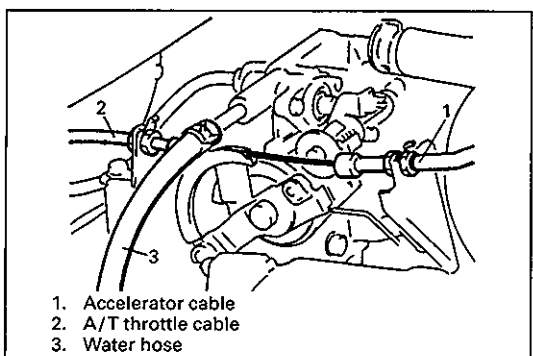
85F00-6A2-14-1



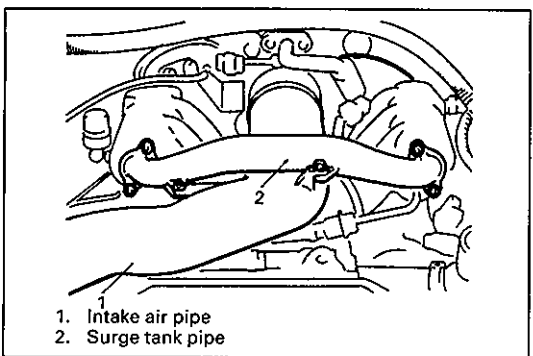
85F00-6A2-14-2



85F00-6A2-14-3



85F00-6A2-14-4



85F00-6A2-14-5

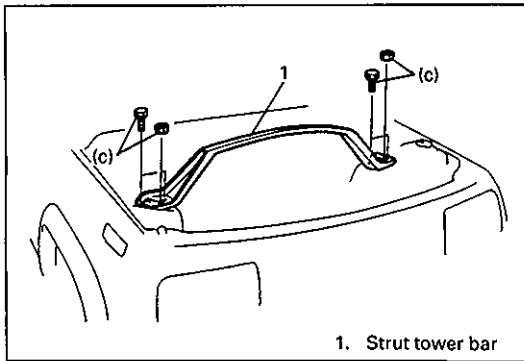
- 7) Install EGR pipe with new gaskets.
 - 8) Connect hoses of EVAP canister purge valve and heater.
 - 9) Connect hoses of PCV, breather and water.
 - 10) Connect couplers of EVAP canister purge valve and EGR valve.
- Fix wire harness with clamps.

- 11) Install clamp to intake collector.
- 12) Connect earth terminal to intake collector.
- 13) Connect couplers of TP sensor, MAF sensor and IAC valve.

- 14) Connect brake booster hose to intake manifold.
- 15) Connect couplers of injector wire.

- 16) Connect water hoses to throttle body.
- 17) Connect accelerator cable and A/T throttle cable (For A/T vehicle) to throttle body.

- 18) Install surge tank pipe to intake manifold with new gaskets and intake air pipe to throttle body.



85F00-6A2-15-1

- 19) Install air cleaner upper case
- 20) Install air temperature sensor (ATS) to air cleaner box.
- 21) Install strut tower bar.
Tighten bolts and nuts to specified torque.

Tightening Torque**(c): 25 N·m (2.5 kg-m, 18.0 lb-ft)**

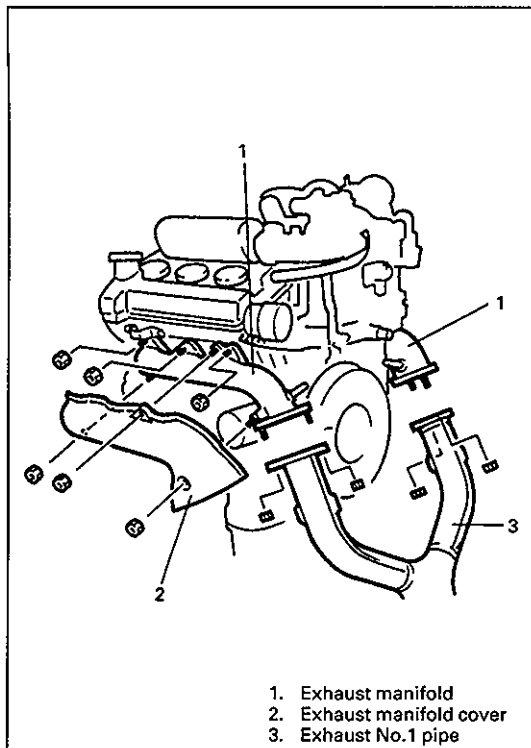
- 22) Check to ensure that all removed parts are back in place.
Reinstall any necessary parts which have not been reinstalled.
- 23) Refill cooling system, referring to Section 6B.
- 24) Connect negative cable at battery.
- 25) Upon completion of installation, verify that there is no fuel leakage at each connection according to procedure described in p. 6-3.

85F00-6A2-15-2

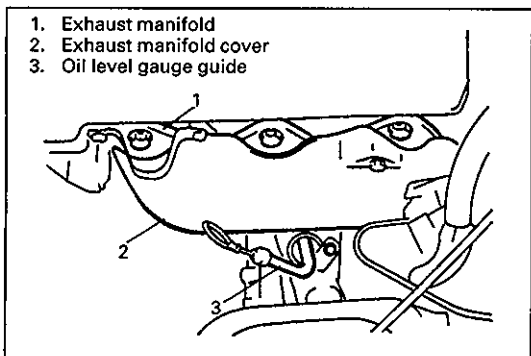
EXHAUST MANIFOLD

WARNING:

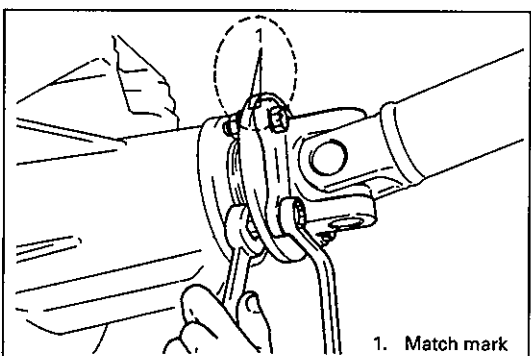
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system has cooled off.



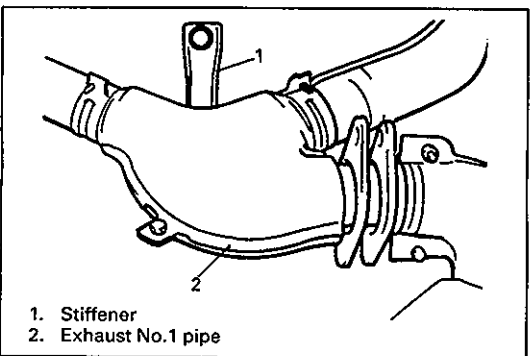
85F00-6A2-16-1



85F00-6A2-16-3



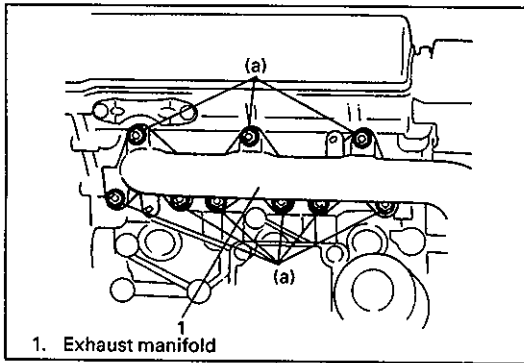
85F00-6A2-16-4



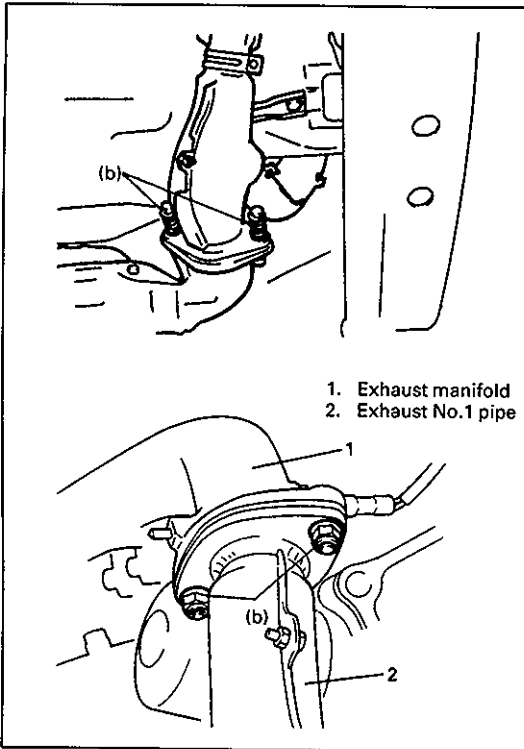
85F00-6A2-16-5

REMOVAL

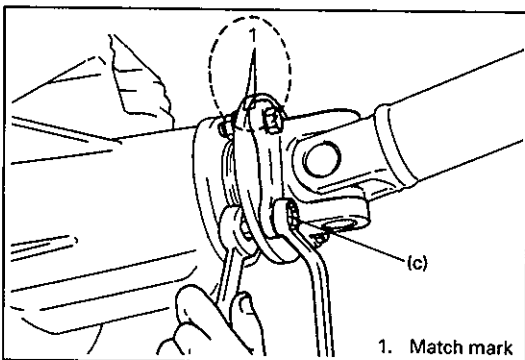
- 1) Disconnect negative cable at battery.
- 2) Disconnect oxygen sensor lead wires at couplers.
- 3) Remove oil level gauge guide.
- 4) Disconnect EGR pipe from RH bank exhaust manifold.
- 5) Remove exhaust manifold covers from exhaust manifolds.
- 6) Hoist vehicle.
- 7) Before disconnecting propeller shaft, put match mark on joint flange and propeller shaft to facilitate their installation as shown in figure.
- 8) Disconnect propeller shaft from front differential.
- 9) Remove exhaust No.1 pipe nuts and stiffener bolt.
- 10) Remove exhaust manifolds and their gaskets from cylinder heads.



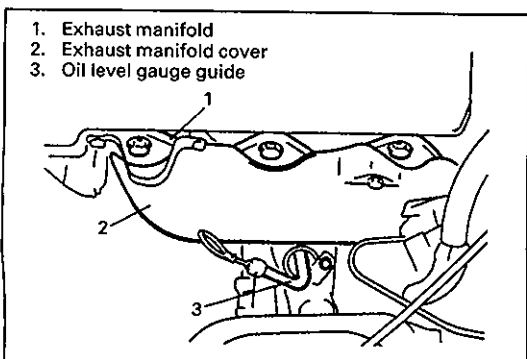
85F00-6A2-17-1



85F00-6A2-17-2



85F00-6A2-17-4



85F00-6A2-17-5

INSTALLATION

- 1) Install manifold gaskets to cylinder heads and No.1 pipe gasket to exhaust No.1 pipe.
 - Use new gaskets.
- 2) Install exhaust manifolds.

Tighten manifold nuts to specified torque.

Tightening Torque

(a): 30 N·m (3.0 kg-m, 21.5 lb-ft)

- 3) Install exhaust No.1 pipe.

Tighten exhaust No.1 pipe bolts and nuts to specified torque.

Tightening Torque

(b): 50 N·m (5.0 kg-m, 36.0 lb-ft)

- 4) Reverse removal procedure to install propeller shaft.
 - When installing propeller shaft, align match mark.
 - Use following specification to torque universal joint flange.

Tightening Torque

(c): 55 N·m (5.5 kg-m, 40.0 lb-ft)

- 5) Connect EGR pipe to RH bank exhaust manifold.
- 6) Install exhaust manifold covers.
- 7) Install oil level gauge guide.
 - Use new O-ring.
- 8) Connect oxygen sensor lead wire couplers.

Be sure to clamp its lead wires.
- 9) Connect negative cable to battery.

Upon completion of installation, start engine and check that no exhaust gas leakage exists.

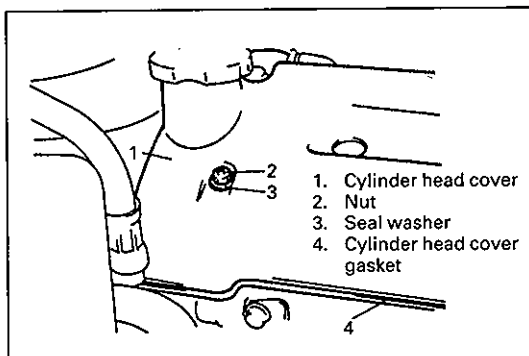
CYLINDER HEAD COVERS

REMOVAL

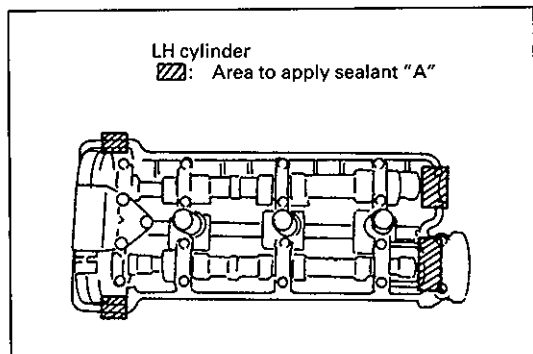
- 1) Remove throttle body and intake manifold.
Refer to item "THROTTLE BODY AND INTAKE MANIFOLD" in this section for removal.
- 2) Remove ignition coil covers.
- 3) Disconnect ignition coil couplers and remove ignition coils.

- 4) Remove cylinder head covers.

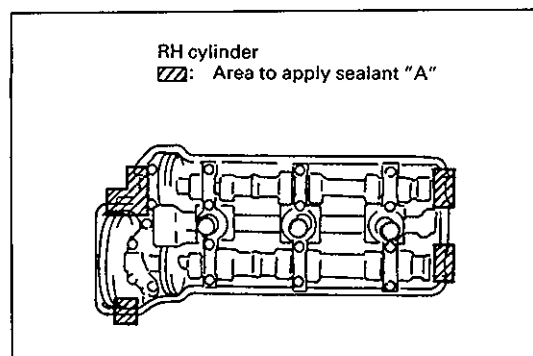
85F00-6A2-18-1



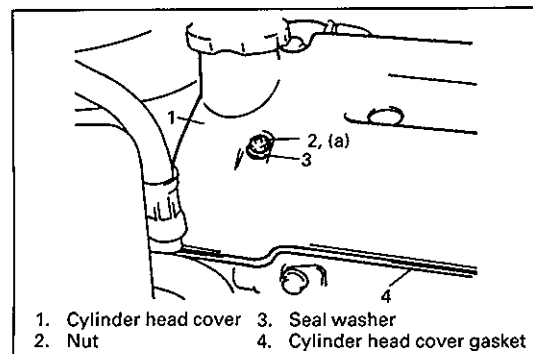
85F00-6A2-18-2



85F00-6A2-18-3



85F00-6A2-18-4



85F00-6A2-18-5

INSTALLATION

- 1) Clean sealing surfaces on cylinder heads and covers.
- 2) Remove oil, old sealant, and dust from sealing surfaces. After cleaning, apply sealant "A" to cylinder heads sealing surface area as shown in figure.

"A": Sealant 99000-31150

- 3) Install cylinder head cover gaskets to head covers.
 - Use new gaskets.
- 4) Install cylinder head covers to cylinder heads.

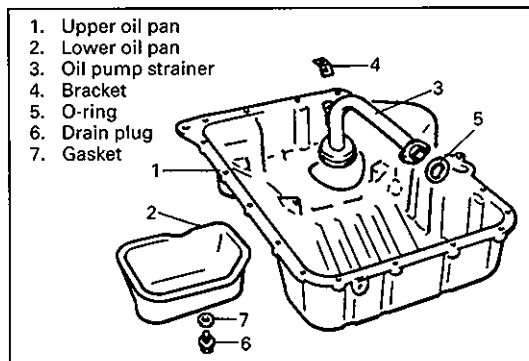
- 5) Tighten nuts to specified torque.
 - Use new seal washers.

Tightening Torque

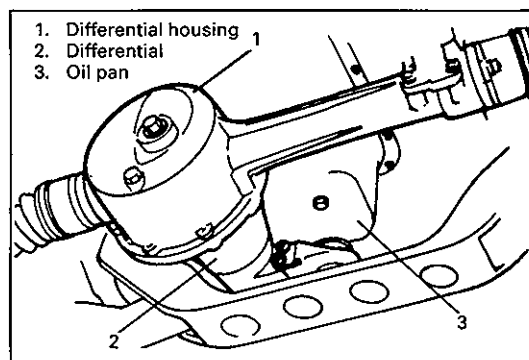
(a): 10.5 N·m (1.1 kg-m, 7.5 lb-ft)

- 6) Install ignition coils and connect ignition coil couplers.
- 7) Install ignition coil covers.
- 8) Install throttle body and intake manifold.
Refer to item "THROTTLE BODY AND INTAKE MANIFOLD" in this section for installation.

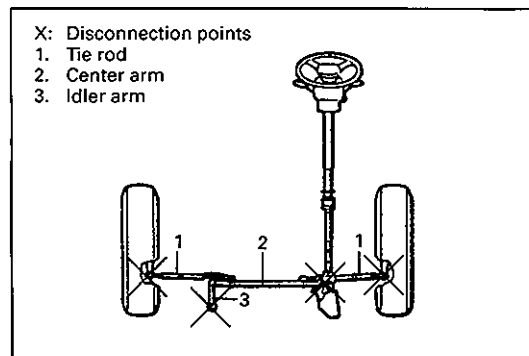
OIL PAN AND OIL PUMP STRAINER



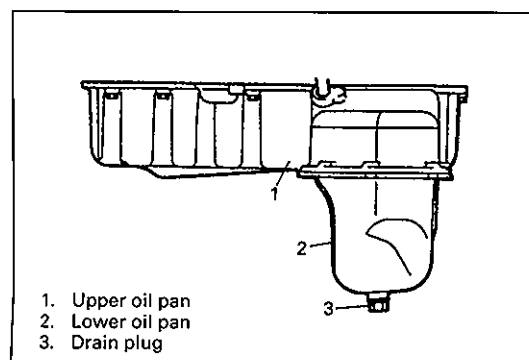
85F00-6A2-19-1



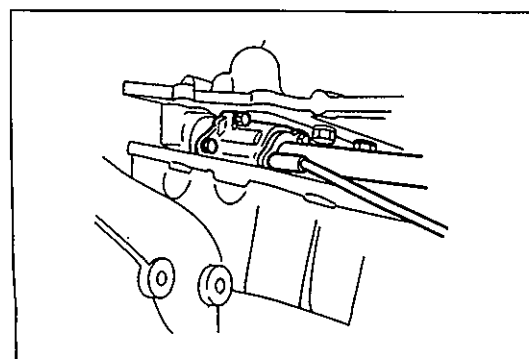
85F00-6A2-19-2



85F00-6A2-19-3



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85F00-6A2-19-5

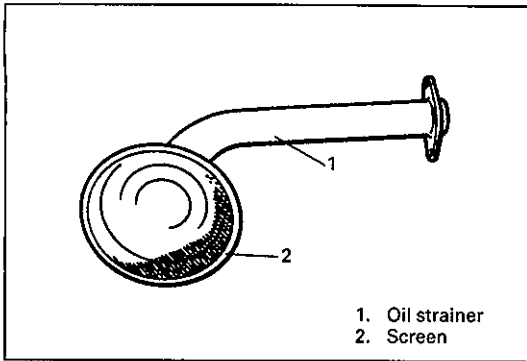
REMOVAL

- 1) Raise vehicle and remove both front wheels.
- 2) Remove front differential housing with differential from chassis. Refer to Section 7E for removal.

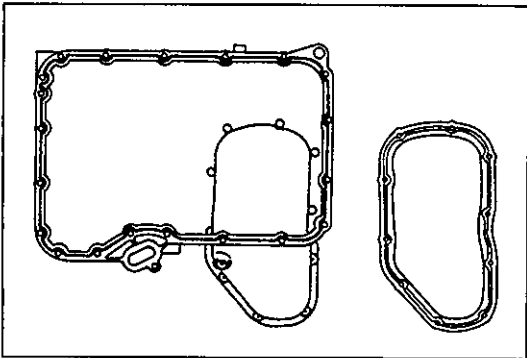
- 3) Remove tie rod, center arm and idler arm.
Refer to Section 3B2 of service manual mentioned in the FOREWORD of this manual for removal.
Disconnection points are marked with X in figure.

- 4) Drain engine oil by removing drain plug.
- 5) Remove lower oil pan from upper oil pan.
- 6) Remove oil strainer bracket.
- 7) Remove radiator outlet pipe from upper oil pan.

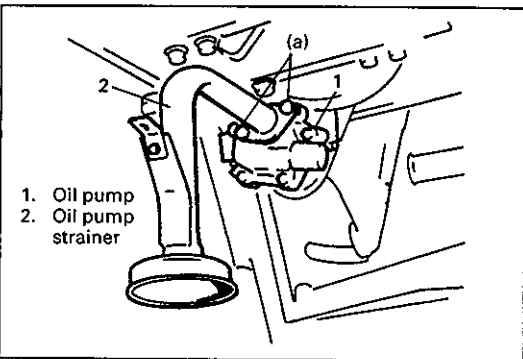
- 8) Remove upper oil pan according to following procedure.
Lower upper oil pan until it stops by way of cross member and oil pump strainer and keep it at that position temporarily.
With wrench inserted between upper oil pan and crank case, and oil pump strainer mounting bolt removed, remove oil pump strainer.
Then remove upper oil pan from temporarily supported position.



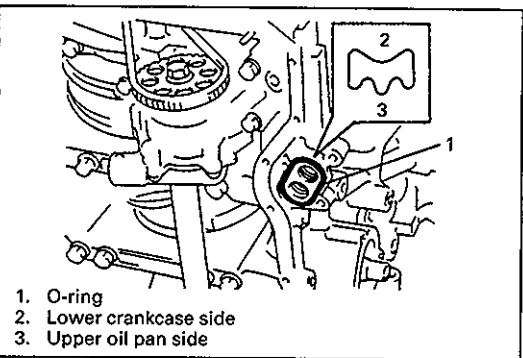
85F00-6A2-20-1



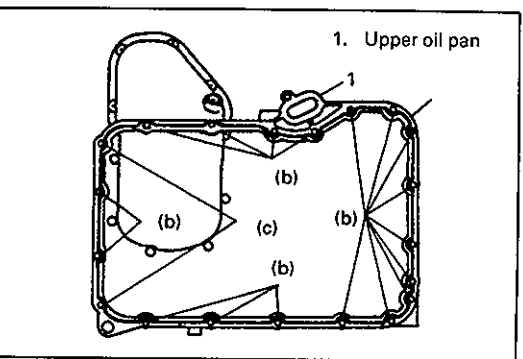
85F00-6A2-20-2



85F00-6A2-20-3



85F00-6A2-20-4



85F00-6A2-20-5

CLEAN

- 1) Inside of oil pan and oil pump strainer screen.

- 2) Clean sealing surface on upper oil pan, lower oil pan and crank case.

Remove oil, old sealant, and dust from sealing surface.

INSTALLATION

- 1) Install oil pump strainer to oil pump with new O-ring.

Tightening Torque

(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

- 2) Install new O-ring to lower crankcase as shown in figure.

- 3) Apply sealant "A" to upper oil pan sealing surface area as shown in figure.

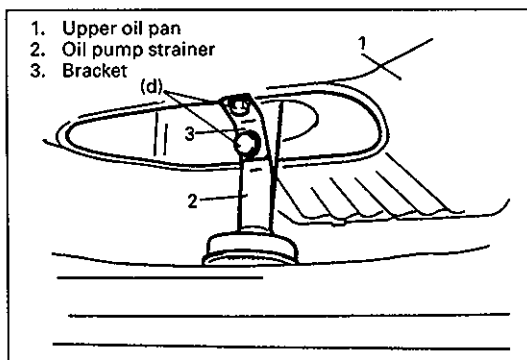
"A": Sealant 99000-31150

- 4) Install upper oil pan to crank case.

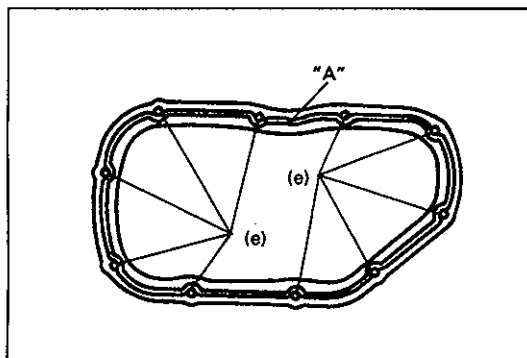
Tightening Torque

(b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

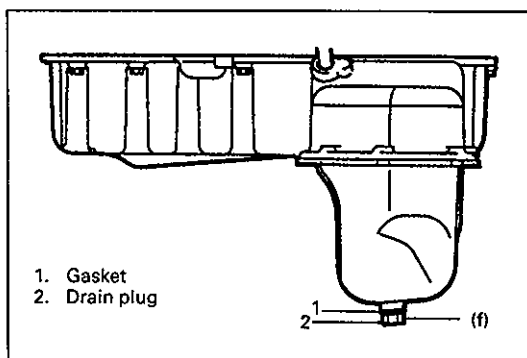
(c): 23.0 N·m (2.3 kg-m, 16.5 lb-ft)



85F00-6A2-21-1



85F00-6A2-21-2



85F00-6A2-21-3

- 5) Install bracket to oil pump strainer and upper oil pan.

Tightening Torque

(d): 11 N·m (1.1 kg-m, 8.0 lb-ft)

- 6) Apply sealant "A" to lower oil pan sealing surface area as shown in figure.

"A": Sealant 99000-31150

- 7) Install lower oil pan to upper oil pan.

Tightening Torque

(e): 11 N·m (1.1 kg-m, 8.0 lb-ft)

- 8) Install gasket and drain plug to oil pan.

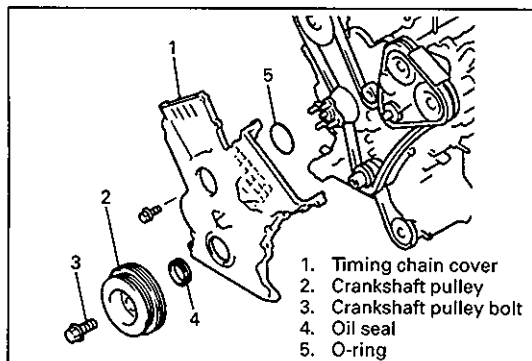
Tightening Torque

(f): 34.0 N·m (3.4 kg-m, 24.5 lb-ft)

- 9) Install radiator outlet pipe to upper oil pan.

- 10) Install tie rod, center arm and idler arm.
Refer to Section 3B2 of service manual mentioned in FOREWORD of this manual for installation.
- 11) Install front differential housing according to installation procedure described in Section 7E.
- 12) Refill front differential housing with gear oil, referring to Section 7E.
- 13) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
- 14) Check wheel alignment, referring to SECTION 3.

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TIMING CHAIN COVER

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove throttle body and intake manifold.
Refer to item "THROTTLE BODY AND INTAKE MANIFOLD" in this section for removal.

- 5) Remove cylinder head covers.
Refer to item "CYLINDER HEAD COVER" in this section for removal.
- 6) Remove cooling fan, fan clutch and water pump pulley.
Refer to Section 6B for removal.
- 7) Remove radiator.
Refer to Section 6B for removal.
- 8) Remove thermostat cap.
Refer to Section 6B for removal.

- 9) Remove P/S pump (A/C compressor) drive belt.
Refer to Section 6B for removal.
- 10) Remove water pump drive belt.
Refer to Section 6B for removal.
- 11) Remove P/S pump and P/S pump bracket.
Refer to Section 3B3 for removal.
- 12) Raise vehicle.
- 13) Remove oil pan.
Refer to item "OIL PAN AND OIL PUMP STRAINER" in this section for removal.

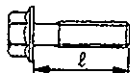
- 14) Remove crankshaft pulley bolt.
To lock crankshaft pulley, use special tool (camshaft pulley holder) with it as shown in figure

Special Tool

(A): 09917-68221

CAUTION:

Be sure to use the following bolt for fixing special tool to crankshaft pulley.



Bolt size: M8, P1.25 $\ell = 45$ mm
Strength: 7T

- 15) Remove crankshaft pulley.
To remove crankshaft pulley, use special tools (Steering wheel remover, Bearing puller attachment) with it as shown in figure.

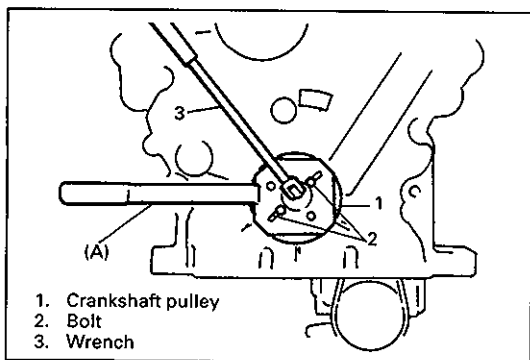
Special Tool

(B): 09944-36011

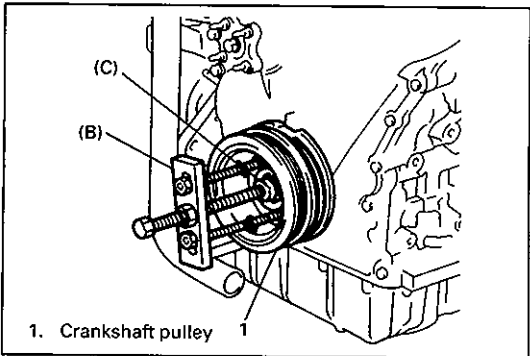
(C): 09926-58010

- 16) Remove timing chain cover.

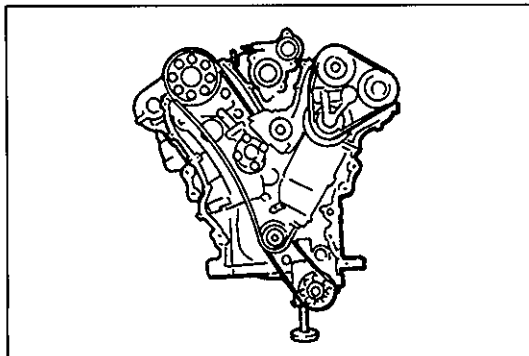
85F00-6A2-22-3



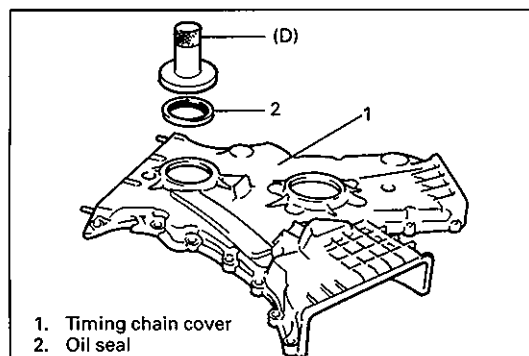
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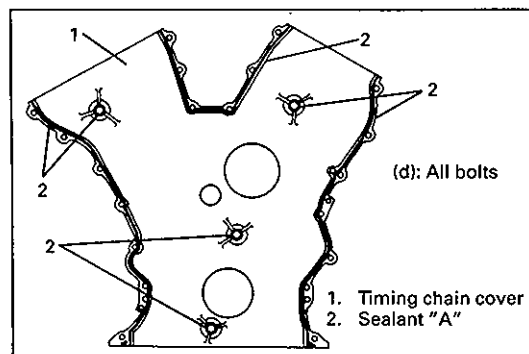
85F00-6A2-22-5



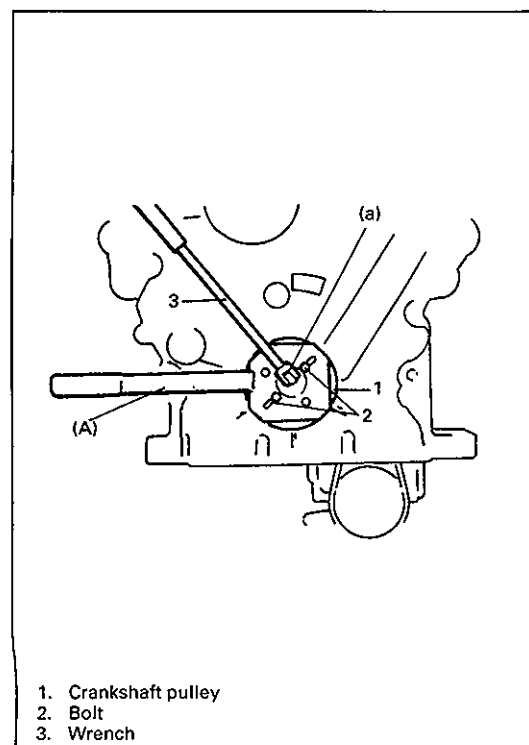
85F00-6A2-23-1



85F00-6A2-23-2



85F00-6A2-23-3



85F00-6A2-23-4

CLEAN

- Clean sealing surface on timing chain cover, crank case, cylinder block and cylinder heads.
Remove oil, old sealant, and dust from sealing surface.

INSPECTION

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

NOTE:

When installing new oil seal, top it in until its surface is flush with edge of timing chain cover.

To install oil seal, use special tool (bearing installer).

Special Tool

(D): 09913-75510

INSTALLATION

Reverse removal sequence to install timing chain cover noting following points.

- 1) Apply sealant "A" to timing chain cover sealing surface area as shown in figure.

"A": Sealant 99000-31150

- 2) Apply engine oil to oil seal lip and water pump O-ring, then install timing chain cover.

Tightening Torque

(d): 11.0 N·m (1.1 kg-m, 7.5 lb-ft)

- 3) Install crankshaft pulley.

To lock crankshaft pulley, use special tool (camshaft pulley holder) with it at shown in figure.

Special Tool

(A): 09917-68221

CAUTION:

Be sure to use the following bolt for fixing special tool to crank pulley.



Bolt size: M8, P1.25 $\ell = 45$ mm

Strength: 7T

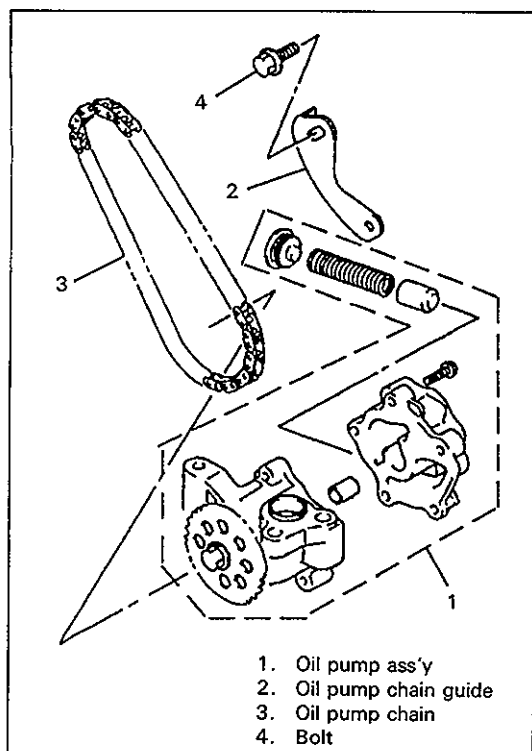
Tightening Torque

(a): 150 N·m (15 kg-m, 108.5 lb-ft)

OIL PUMP

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove oil pan, oil pump strainer and timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section.
- 5) Loosen oil pump chain guide bolts.

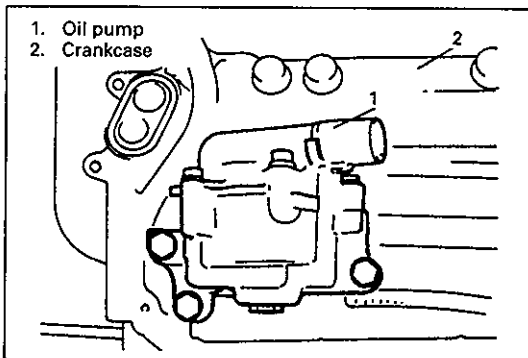


85F00-6A2-24-1

- 6) Remove oil pump from crank case.

CAUTION:

Do not remove oil pump sprocket or bolt.
Otherwise, oil pump sprocket and/or oil pump rotor shaft might be damaged.



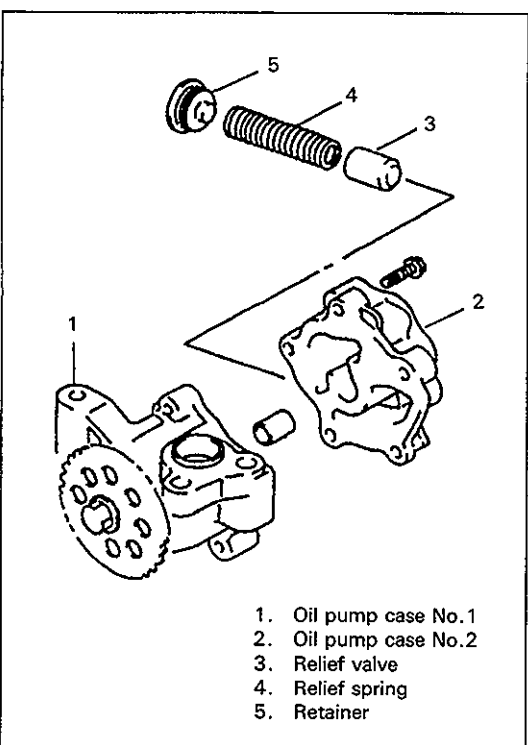
85F00-6A2-24-3

DISASSEMBLY

- Disassemble oil pump as shown in figure.

CAUTION:

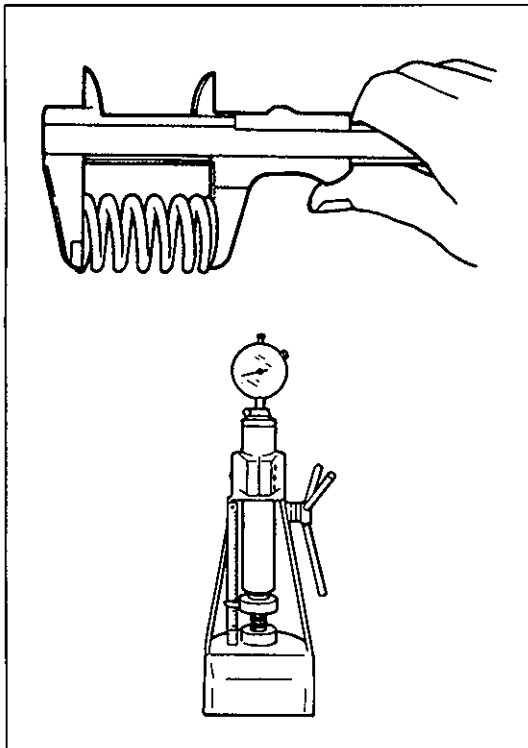
Do not remove oil pump sprocket or bolt.
Otherwise, oil pump sprocket and/or oil pump rotor shaft might be damaged.



INSPECTION

- Check outer rotor, inner rotor and oil pump cases for excessive wear or damage.
- Check relief valve for excessive wear or damage.

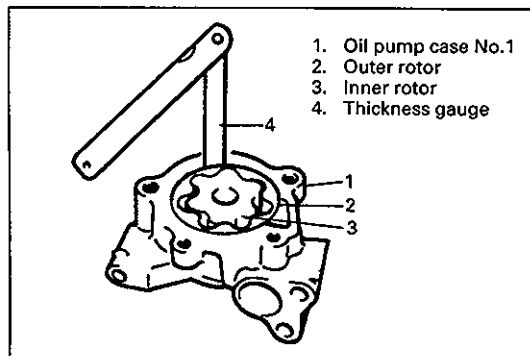
85F00-6A2-24-4



85F00-6A2-25-1

- Measure free length and tension of oil relief spring.

Item	Standard
Spring free length	63.5 mm (2.5 in.)
Spring preload	(86.0 N for 52.0 mm 8.6 kg for 52.0 mm 62.2 lb/ 2.05 in.)



85F00-6A2-25-3

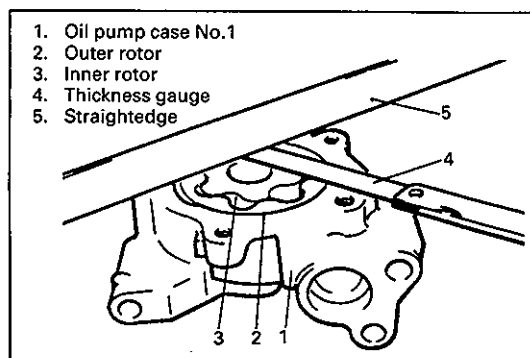
- Measure clearance of oil pump rotor and oil pump case.

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: 0.15 mm (0.0059 in.)**



85F00-6A2-25-4

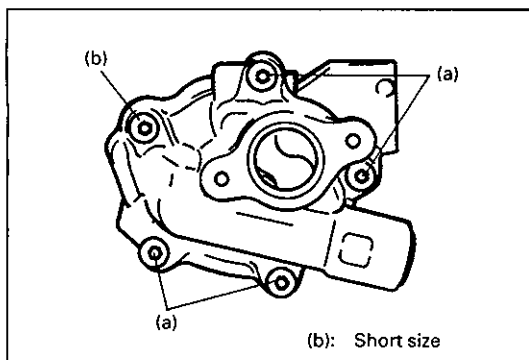
Side Clearance

Using straightedge and thickness gauge, measure side clearance.

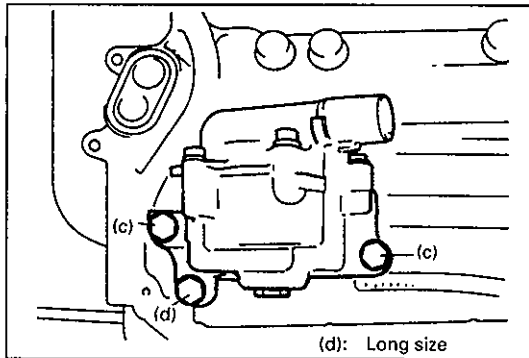
Limit on side clearance: 0.11 mm (0.0043 in.)

ASSEMBLY

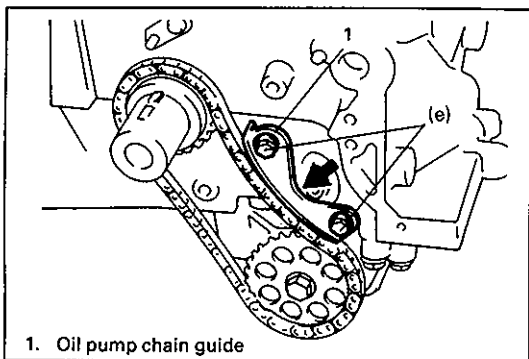
- 1) Wash, clean and then dry all disassembled parts.
- 2) Apply thin coat of engine oil to inner and outer rotors, and inside surfaces of oil pump case.



85F00-6A2-26-1



85F00-6A2-26-2



85F00-6A2-26-3

- 3) Install oil pump. After installing oil pump check to be sure that rotor turns smoothly by hand.

Tightening Torque

(a), (b): 12.0 N·m (1.2 kg-m, 8.5 lb-ft)

INSTALLATION

- 1) Install oil pump to crank case.

Tightening Torque

(c), (d): 23.0 N·m (2.3 kg-m, 16.5 lb-ft)

- 2) Hand-tighten oil pump chain guide bolts.
- 3) To take up slack of oil pump chain, push center of oil pump chain guide with a force of 0.5 to 0.6 N (50–60 g, 0.11–0.13 lb) then tighten oil pump chain guide bolts to specified torque.

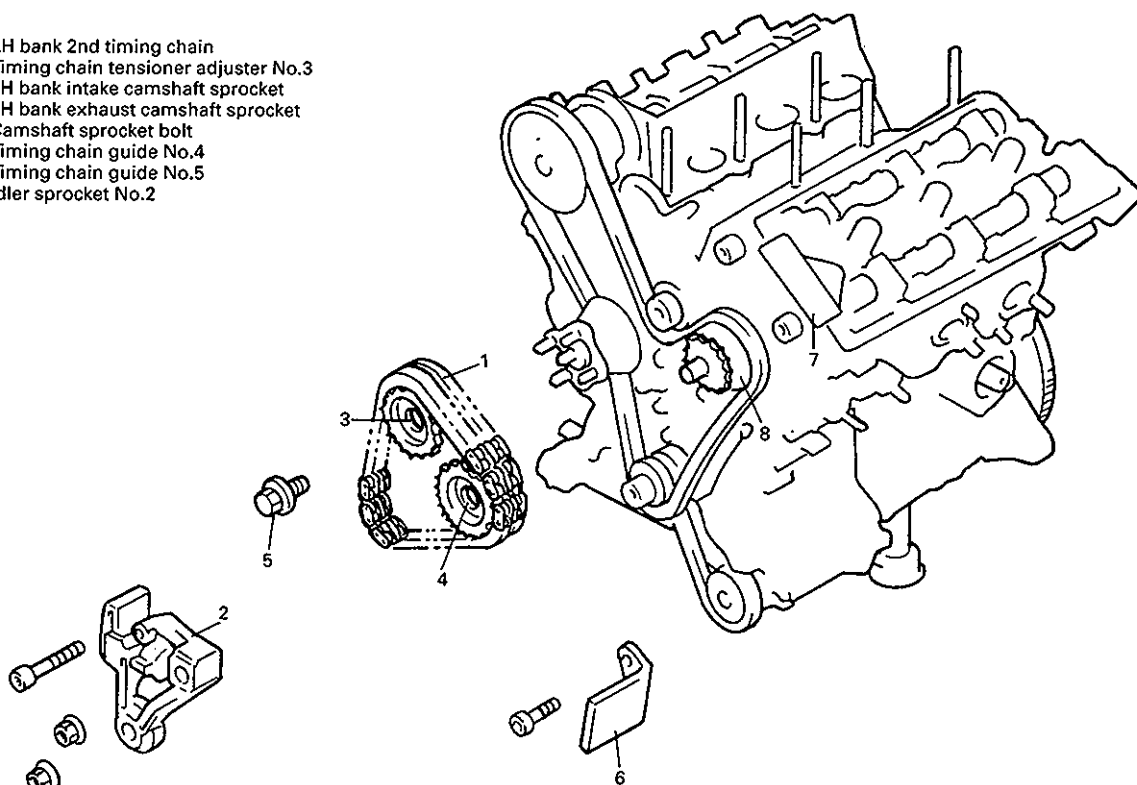
Tightening Torque

(e): 11 N·m (1.1 kg-m, 7.5 lb-ft)

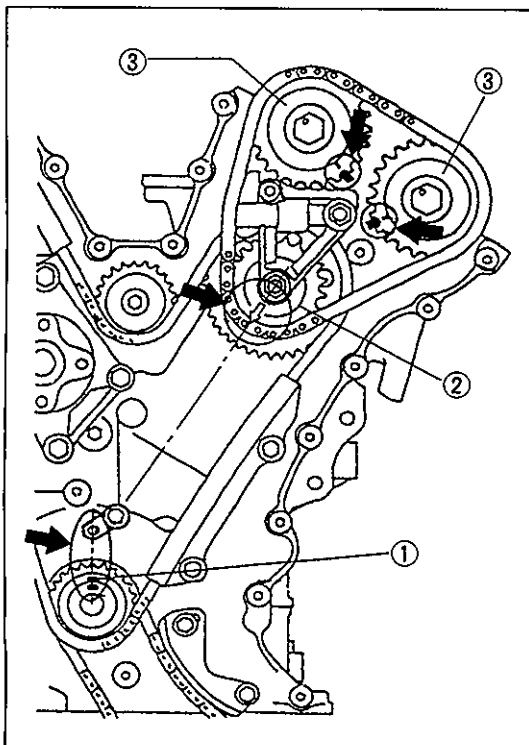
- 4) Install timing chain cover, oil pump strainer and oil pan. Refer to item "TIMING CHAIN COVER" in this section.

LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER

1. LH bank 2nd timing chain
2. Timing chain tensioner adjuster No.3
3. LH bank intake camshaft sprocket
4. LH bank exhaust camshaft sprocket
5. Camshaft sprocket bolt
6. Timing chain guide No.4
7. Timing chain guide No.5
8. Idler sprocket No.2



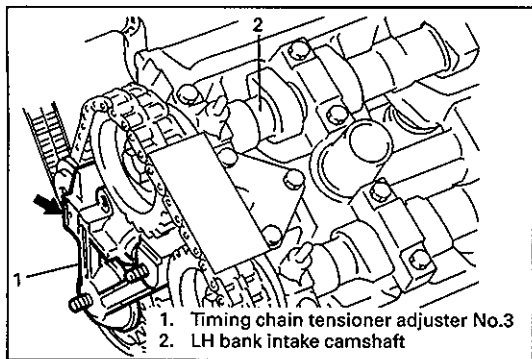
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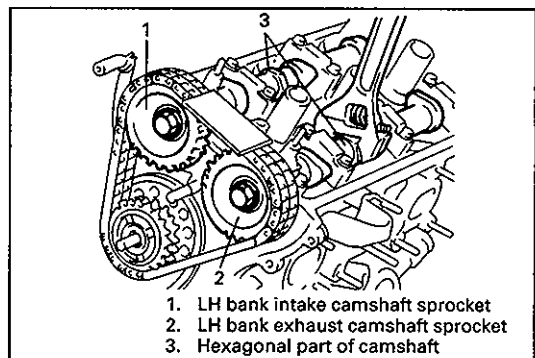
85F00-6A2-27-4

REMOVAL

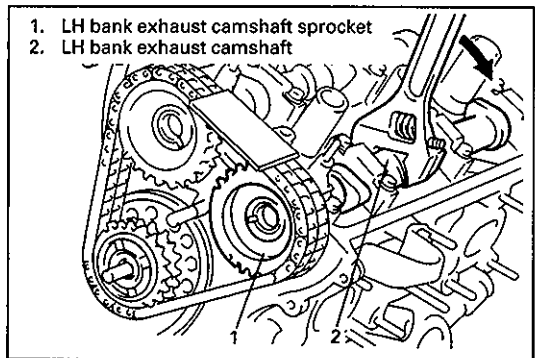
- 1) Disconnect negative cable at battery.
 - 2) Drain engine oil.
 - 3) Drain coolant.
 - 4) Remove timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for removal.
 - 5) Turn crankshaft to meet following condition.
 - Key ① on crankshaft positions as shown.
 - Arrow mark on idler sprocket No. 2 ② points the center of crankshaft.
 - The marks on sprockets ③ match with marks on cylinder head.
- Note that this step must be followed for reinstallation of timing chain.



85F00-6A2-28-1



85F00-6A2-28-2



85F00-6A2-28-3

85F00-6A2-28-4

85F00-6A2-28-5

6) Remove timing chain tensioner adjuster No.3.

To remove it, slacken LH bank 2nd timing chain by turning intake camshaft counterclockwise a little while pushing back pad.

7) Remove LH bank intake and exhaust camshaft sprocket bolts.

To remove it, fit a spanner to hexagonal part at the center of camshaft to hold it stationary.

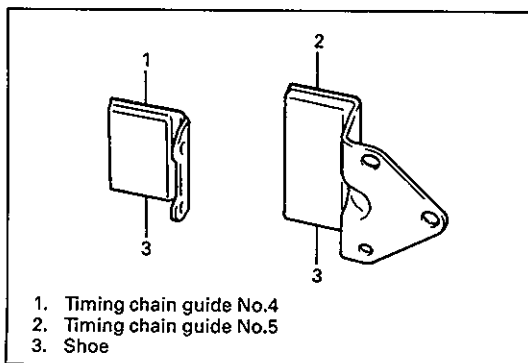
8) Remove LH bank exhaust camshaft sprocket.

CAUTION:

- Removing sprocket from camshaft may cause cam to turn, resulting in damage to valve and piston. To prevent this, when removing sprocket, hold camshaft stationary by using a spanner at its hexagonal part.

9) Remove LH bank intake camshaft sprocket.

10) Remove LH bank 2nd timing chain.

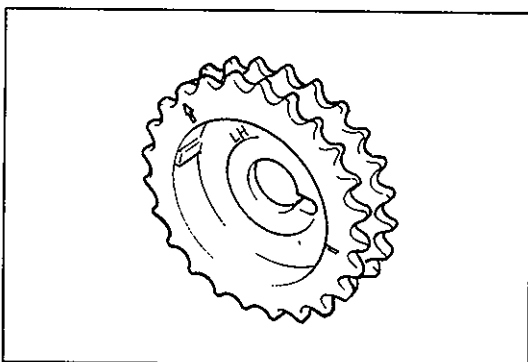


85F00-6A2-29-1

INSPECTION

Timing chain guide No.4 and No.5

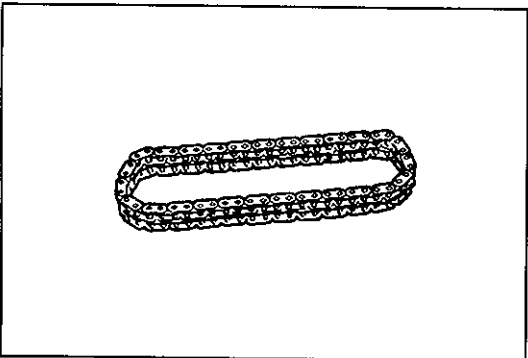
- Check shoe for wear or damage.



85F00-6A2-29-2

Camshaft sprocket

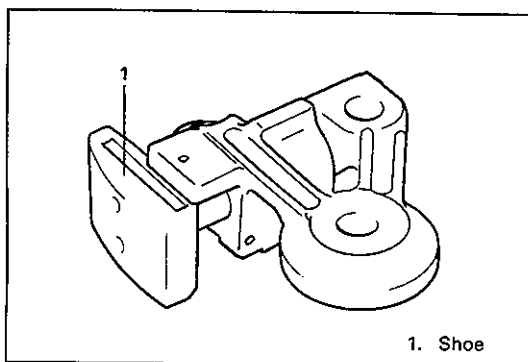
- Check teeth of sprocket for wear or damage.



85F00-6A2-29-3

Timing chain

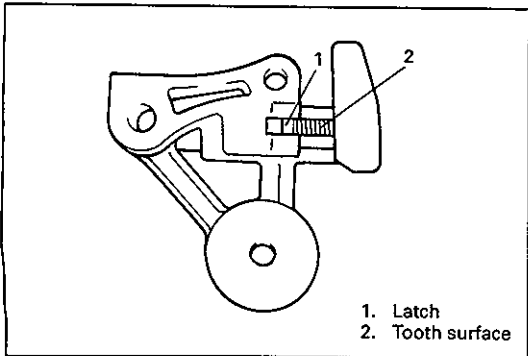
- Check timing chain for wear or damage.



85F00-6A2-29-4

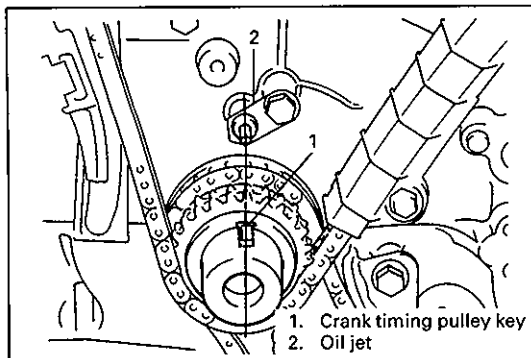
Tensioner adjuster No.3

- Check shoe for wear or damage.

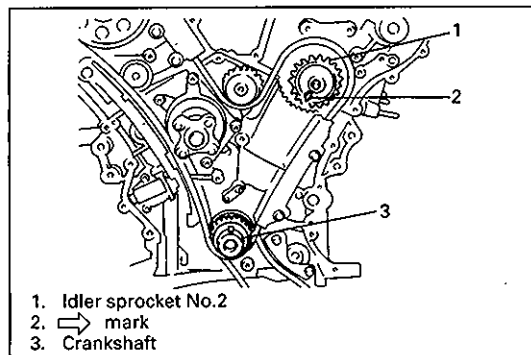


85F00-6A2-29-5

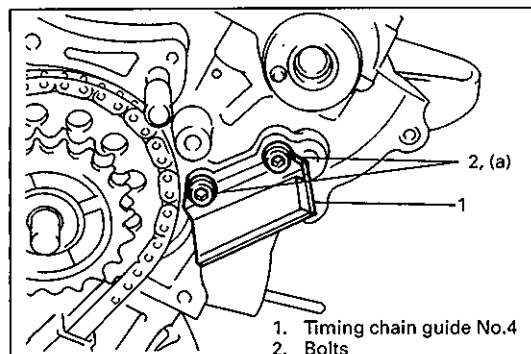
- Check that latch and tooth surface are free from damage and latch functions properly.



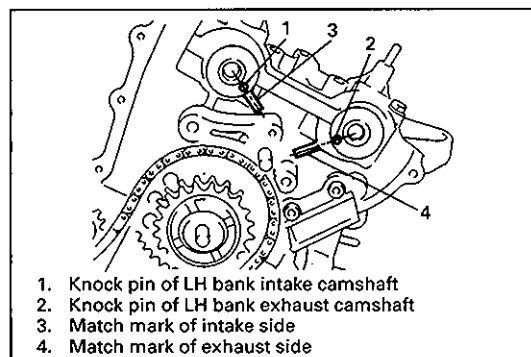
85F00-6A2-30-1



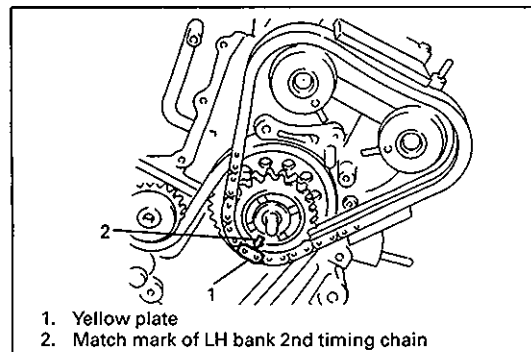
85F00-6A2-30-2



85F00-6A2-30-3



85F00-6A2-30-4



85F00-6A2-30-5

INSTALLATION

1) Check timing mark on crankshaft as shown in figure.

2) Check timing mark on idler sprocket No.2 as shown in figure.

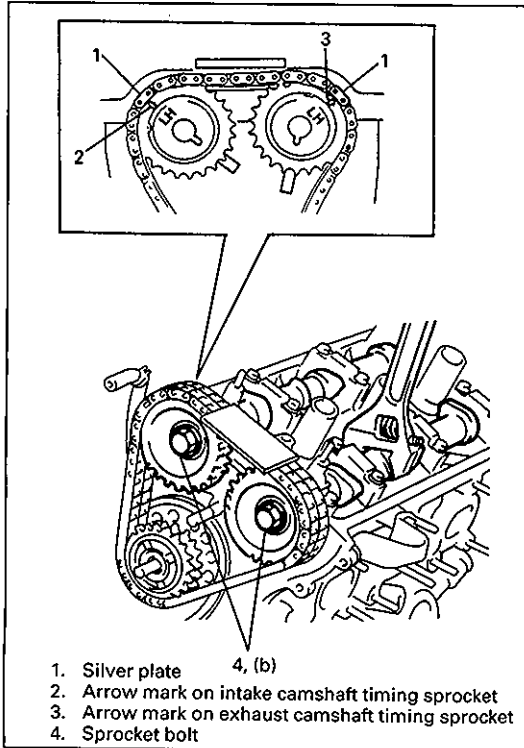
3) Install timing chain guide No.4.

Tightening Torque

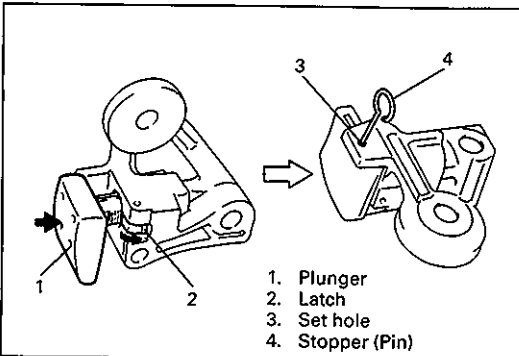
(a): 11 N·m (1.1 kg-m, 7.5 lb-ft)

4) Check that knock-pins of intake and exhaust camshafts are aligned with match marks on cylinder head as shown in figure.

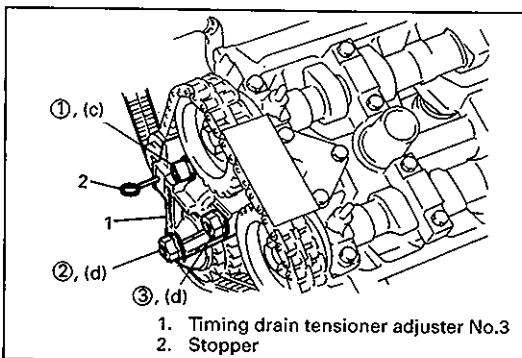
5) Install by aligning match marks on yellow plate of LH bank 2nd timing chain and idler sprocket No.2.



85F00-6A2-31-1



85F00-6A2-31-3



85F00-6A2-31-4

- 6) Install sprockets to intake and exhaust camshafts by aligning silver plate of LH bank 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

CAUTION:

Do not turn camshaft more than necessary.

If turned excessively, valve and piston may get damaged.

- 7) Install LH bank intake and exhaust camshaft timing sprockets.

To install it, fit a spanner to hexagonal part at the center of camshaft to hold stationary.

Tightening Torque

(b): 80 N·m (8.0 kg-m, 57.5 lb-ft)

- 8) With latch of tensioner adjuster No.3 returned and plunger pushed back into body, insert stopper (pin) into set hole.

After inserting it, check to make sure that plunger will not come out.

- 9) Install timing chain tensioner adjuster No.3

Tightening Torque

(c): 25 N·m (2.5 kg-m, 18.0 lb-ft)

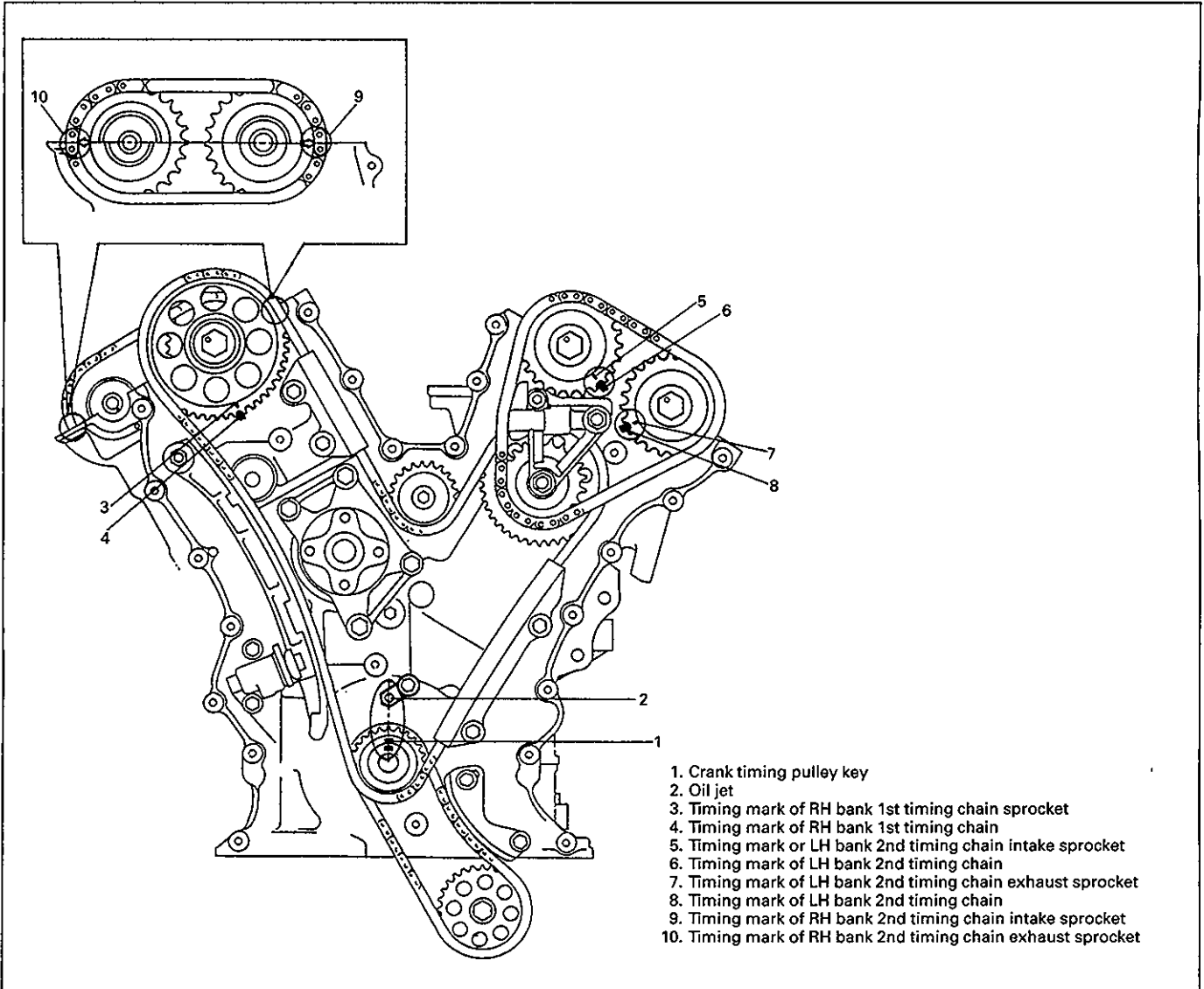
(d): 45 N·m (4.5 kg-m, 32.5 lb-ft)

Tightening order: ① → ② → ③

- 10) Pull out stopper (pin) from set hole.

- 11) Turn crankshaft two rotations clockwise then align timing mark on crankshaft and timing mark on cylinder block as shown in figure.
Check each other timing marks that align them shown in figure.

85F00-6A2-32-1

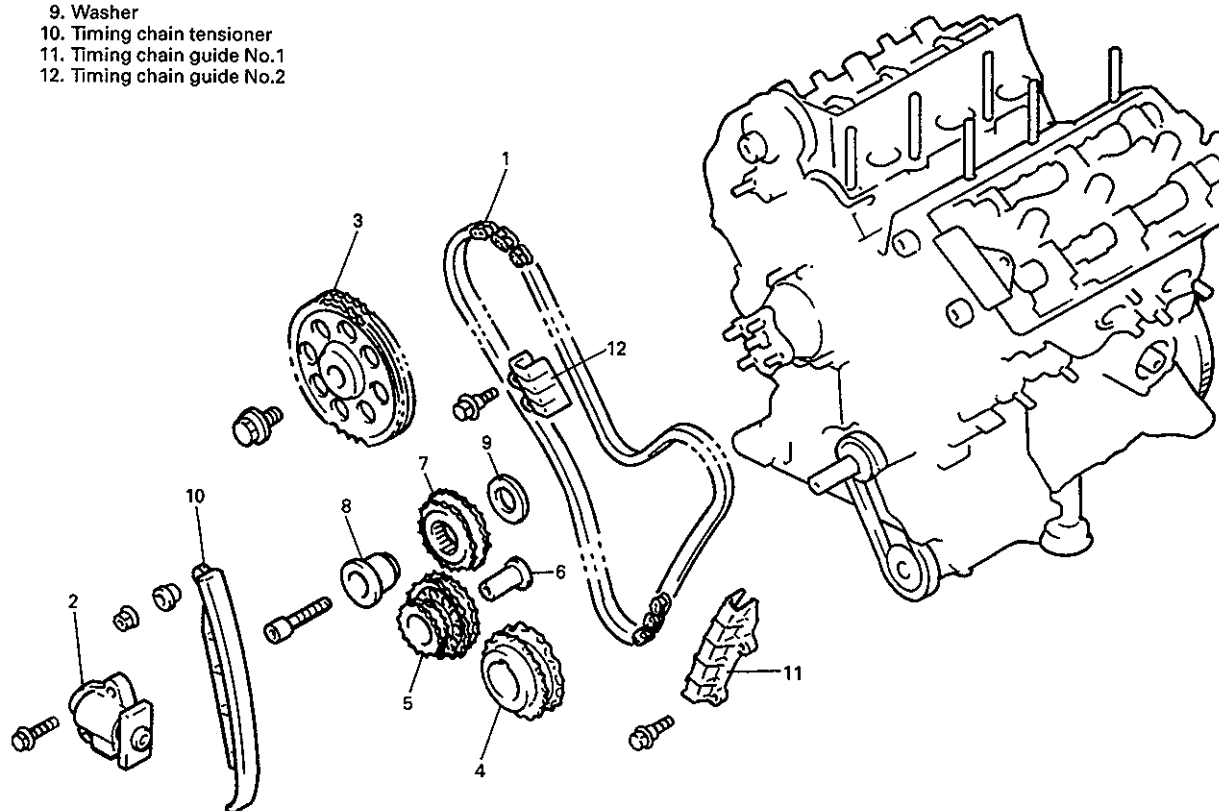


85F00-6A2-32-2

- 12) Apply oil to timing chains, tensioner adjusters sprockets, and guides.
13) Install timing chain cover, oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
14) Refill cooling system, P/S system, front differential and engine with each oil/fluid.
15) Check wheel alignment, referring to SECTION 3.
16) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

1ST TIMING CHAIN AND CHAIN TENSIONER

1. 1st timing chain
2. Timing chain tensioner adjuster No.1
3. RH bank 1st timing chain intake camshaft sprocket
4. 1st timing chain crankshaft sprocket
5. Idler sprocket No.2
6. Shaft
7. Idler sprocket No.1
8. Shaft
9. Washer
10. Timing chain tensioner
11. Timing chain guide No.1
12. Timing chain guide No.2



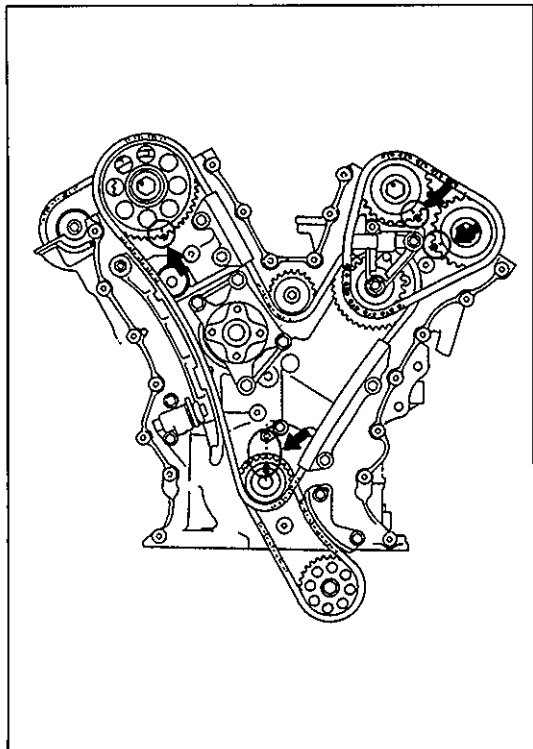
85F00-6A2-33-1

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove timing chain cover.

Refer to item "TIMING CHAIN COVER" in this section for removal.

85F00-6A2-33-5



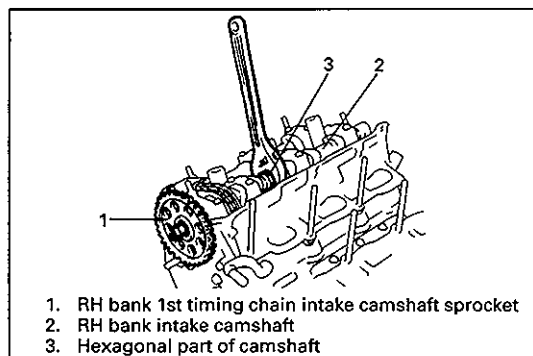
85F00-6A2-34-1

5) For reinstallation of timing chain, align 8 timing marks as shown in figure by turning crankshaft.

6) Remove LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.

- 7) Remove timing chain guide No.1.
- 8) Remove timing chain guide No.2.
- 9) Remove timing chain tensioner adjuster No.1.
- 10) Remove idler sprocket No.1 and 1st timing chain.
- 11) Remove idler sprocket No.2 and sprocket shaft.
- 12) Remove timing chain tensioner.

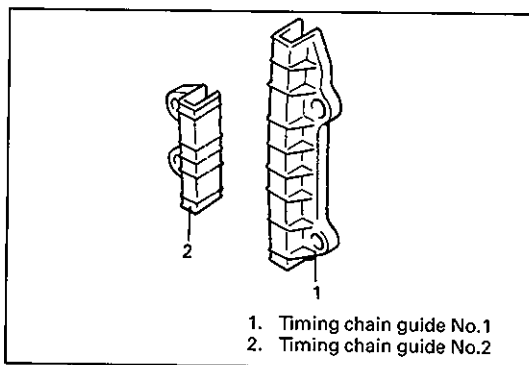
85F00-6A2-34-2



85F00-6A2-34-4

- 13) Remove RH bank 1st timing chain intake camshaft sprocket bolt. To remove it, fit a spanner to hexagonal part at the center of camshaft to hold it stationary.
- 14) Remove RH bank 1st timing chain intake camshaft sprocket.

15) Remove 1st timing chain crankshaft sprocket.

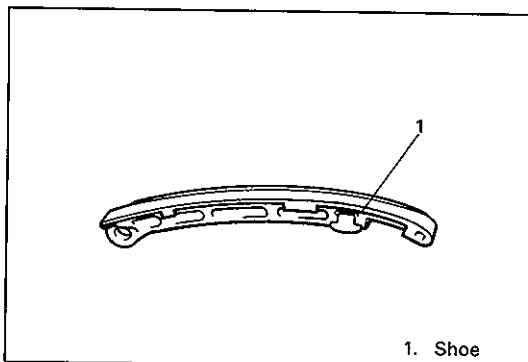


85F00-6A2-35-1

INSPECTION

Timing chain guides No.1 and No.2.

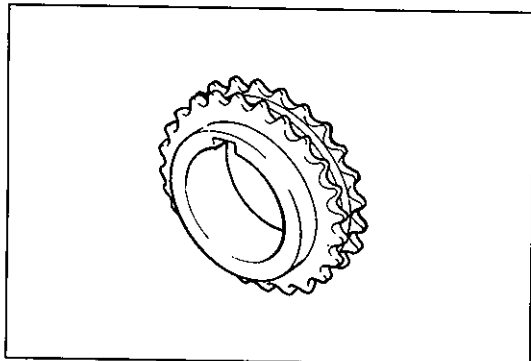
- Check shoe for wear or damage.



85F00-6A2-35-2

Timing chain tensioner.

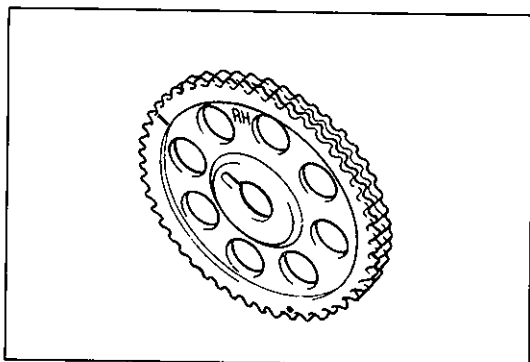
- Check shoe for wear or damage.



85F00-6A2-35-3

1st timing chain crankshaft sprocket.

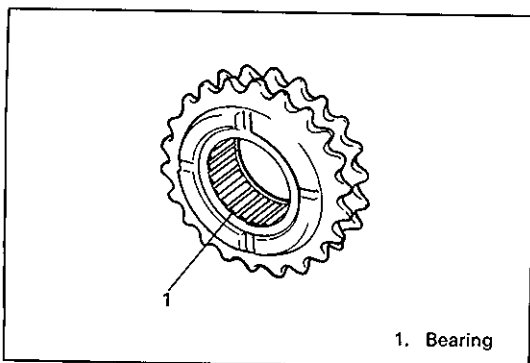
- Check teeth of sprocket for wear or damage.



85F00-6A2-35-4

RH bank 1st timing chain intake camshaft sprocket.

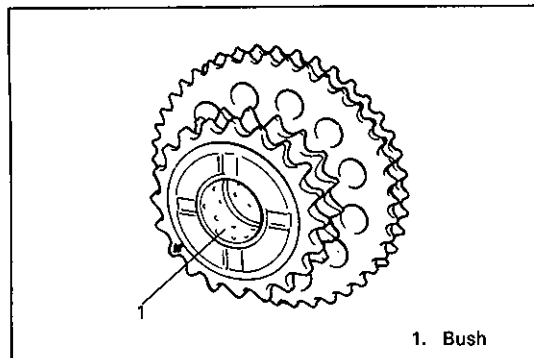
- Check teeth of sprocket for wear or damage.



85F00-6A2-35-5

Idler sprocket No.1

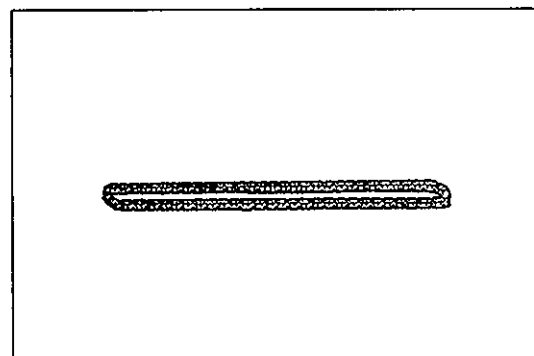
- Check teeth of sprocket for wear or damage.



85F00-6A2-36-1

Idler sprocket No.2

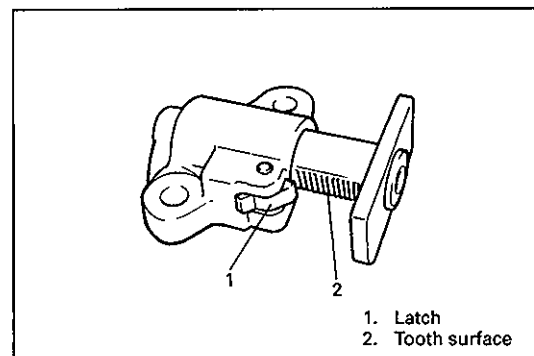
- Check teeth of sprocket for wear or damage.



85F00-6A2-36-2

1st timing chain

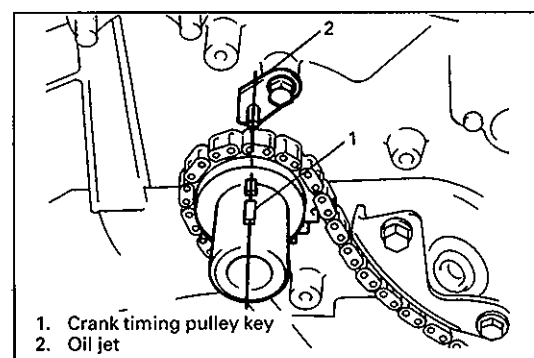
- Check timing chain for wear or damage.



85F00-6A2-36-3

Timing chain tensioner adjuster No.1

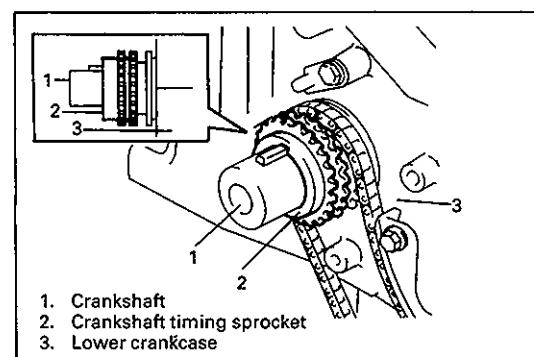
- Check that latch and tooth surface are free from damage and latch functions properly.



85F00-6A2-36-4

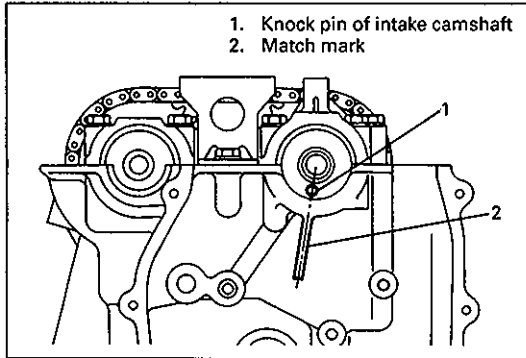
INSTALLATION

- 1) Check timing mark on crankshaft as shown in figure.

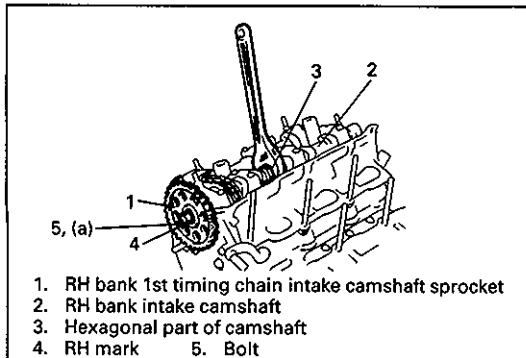


85F00-6A2-36-5

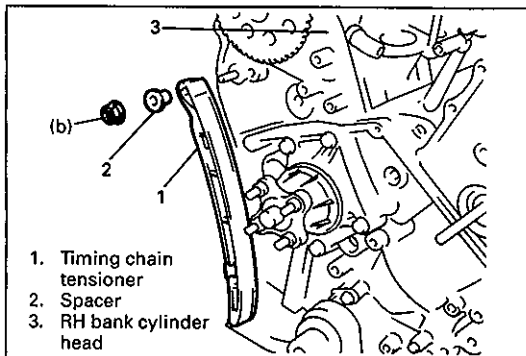
- 2) Install 1st timing chain crankshaft sprocket as shown in figure.



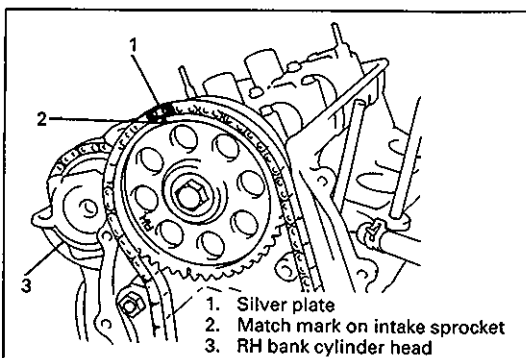
85F00-6A2-37-1



85F00-6A2-37-2



85F00-6A2-37-3



85F00-6A2-37-4

3) Check timing mark on RH bank intake camshaft as shown in figure.

4) Install RH bank 1st timing chain intake camshaft sprocket noting following points.

- The sprocket should be set in such way that its RH mark can be seen.
- Camshaft should be held stationary by using a spanner at its hexagonal parts as shown in figure.

Tightening Torque

(a): 80 N·m (8.0 kg-m, 57.5 lb-ft)

5) Install timing chain tensioner as shown in figure.

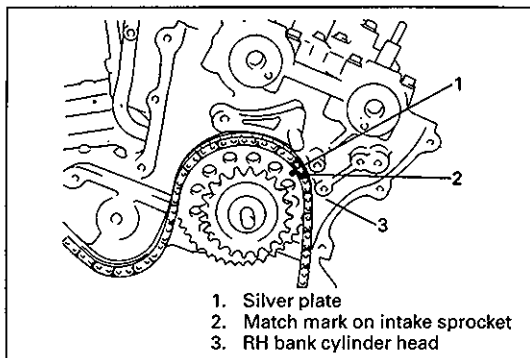
Tightening Torque

(b): 23 N·m (2.3 kg-m, 16.5 lb-ft)

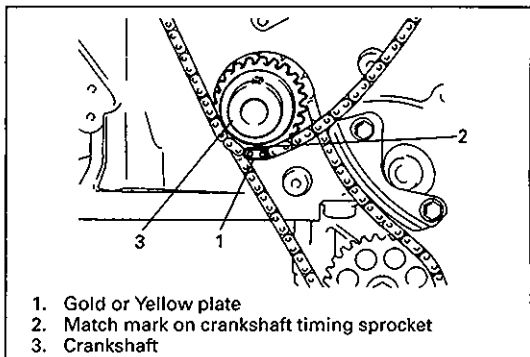
6) Install 1st timing chain by aligning match marks on RH silver plate of 1st timing chain and RH bank 1st timing chain intake camshaft sprocket.

7) Apply oil to bush of idler sprocket No.2.

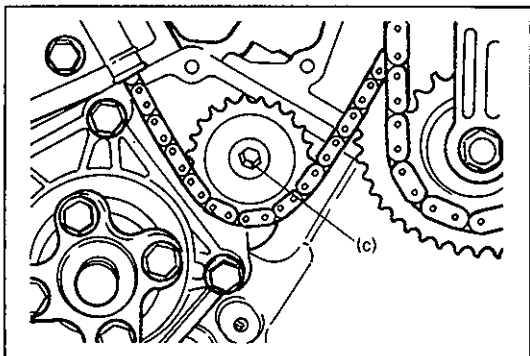
8) Install idler sprocket No.2 and sprocket shaft.



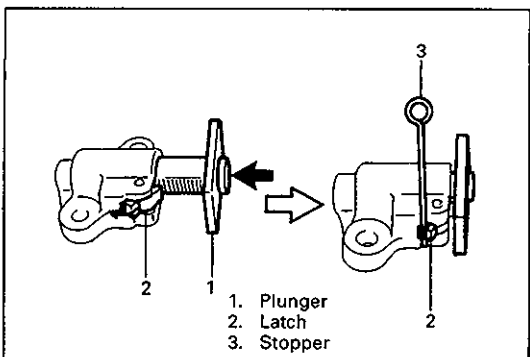
85F00-6A2-38-1



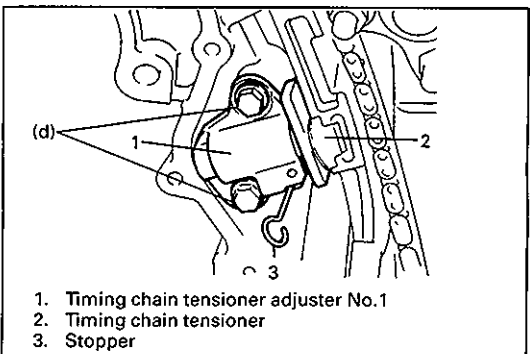
85F00-6A2-38-2



85F00-6A2-38-3



85F00-6A2-38-4



85F00-6A2-38-5

- 9) Install idler sprocket No.2 by aligning match marks on LH silver plate of 1st timing chain.

- 10) Install crankshaft sprocket by aligning match marks on gold or yellow plate of 1st timing chain and crankshaft timing sprocket.

To install it, fit a spanner to hexagonal part at the center of RH bank intake camshaft to turn a little.

CAUTION:

Do not turn camshaft more than necessary.

If turned excessively, valve and piston may get damaged.

- 11) Apply oil to bearing of idler sprocket No.1.
12) Install idler sprocket No.1.

Tightening Torque

(c): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- 13) With latch of tensioner adjuster No.1 returned and plunger pushed back into body, insert stopper into latch and body.

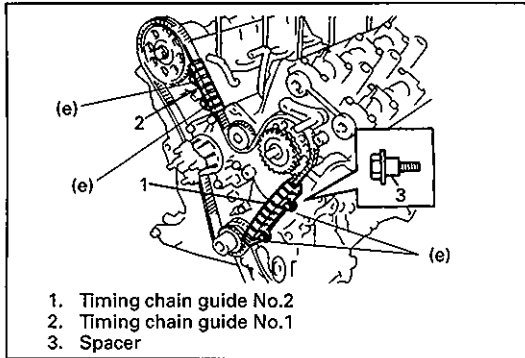
After inserting it, check to make sure that plunger will not come out.

- 14) Install timing chain tensioner adjuster No.1.

Tightening Torque

(d): 11 N·m (1.1 kg-m, 7.5 lb-ft)

- 15) Pull out stopper from adjuster No.1.



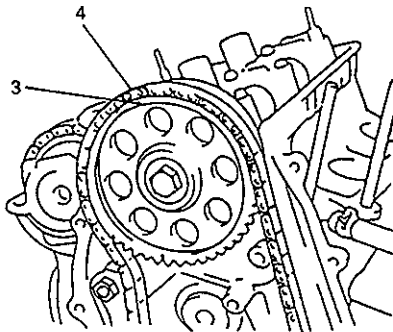
85F00-6A2-39-1

16) Install timing chain guide No.1 and No.2.

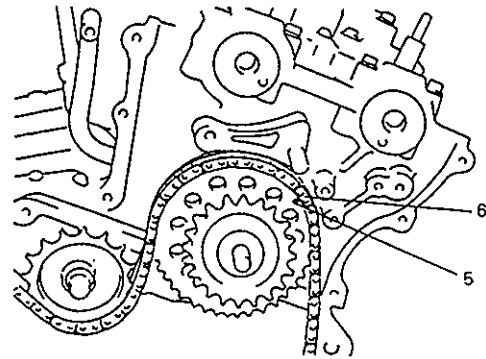
Tightening Torque

(e): 11 N·m (1.1 kg·m, 7.5 lb·ft)

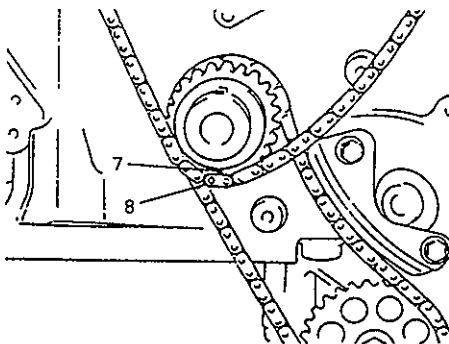
17) Check each aligned timing marks as shown in figure.



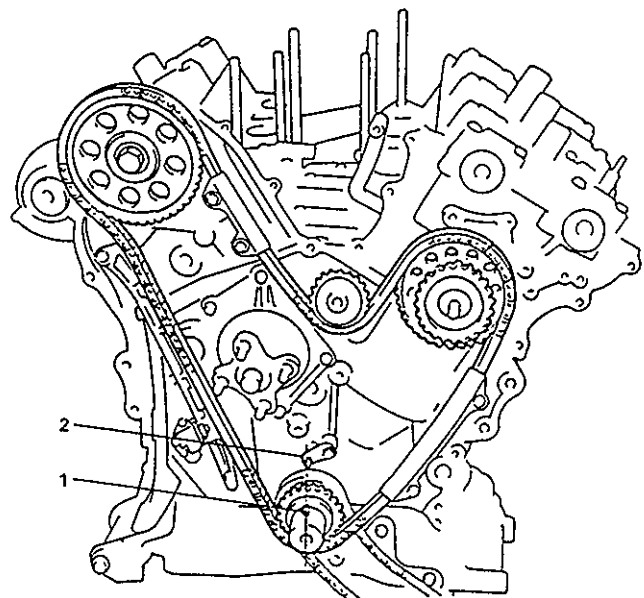
3. Match mark of RH bank 1st timing chain sprocket
4. Silver plate (LH) of 1st timing chain



5. Match mark of idler sprocket No.2
6. Silver plate (RH) of 1st timing chain



7. Match mark of crankshaft timing sprocket
8. Gold or Yellow plate of 1st timing chain.



1. Crank timing pulley key
2. Oil jet

85F00-6A2-39-2

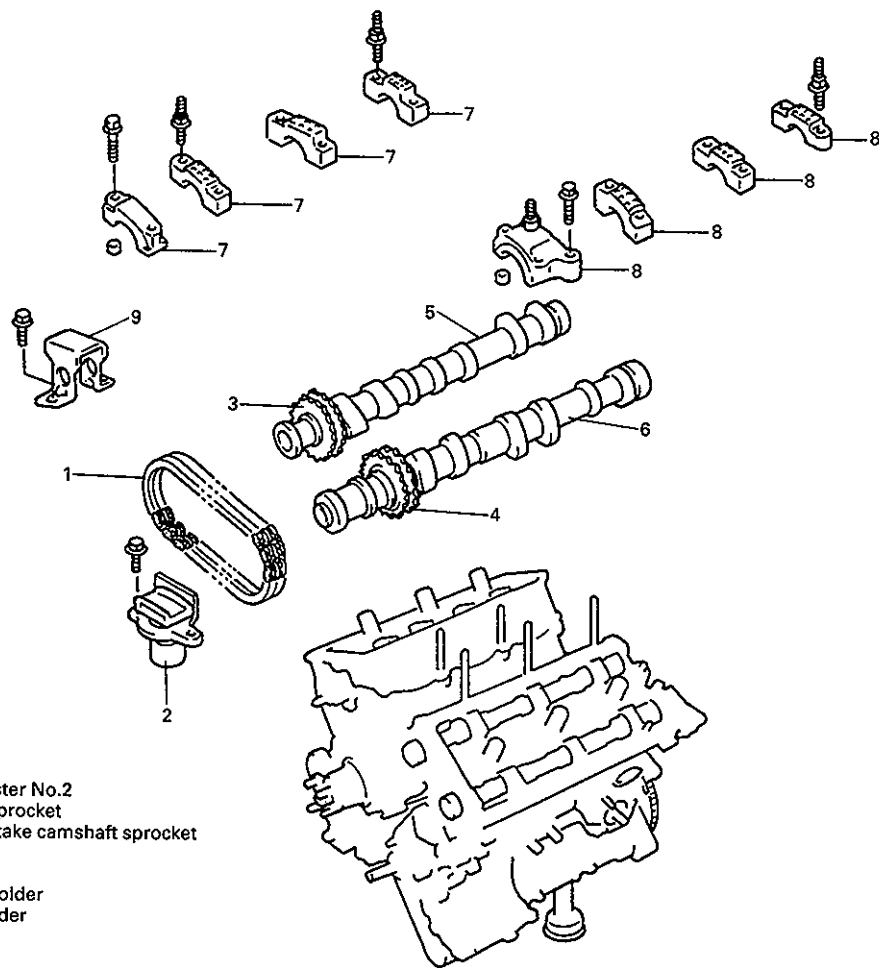
- 18) Install LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND TENSIONER" in this section for installation.

85F00-6A2-40-1

- 19) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
- 20) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
- 21) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
- 22) Check wheel alignment referring to SECTION 3.
- 23) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

85F00-6A2-40-2

RH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER

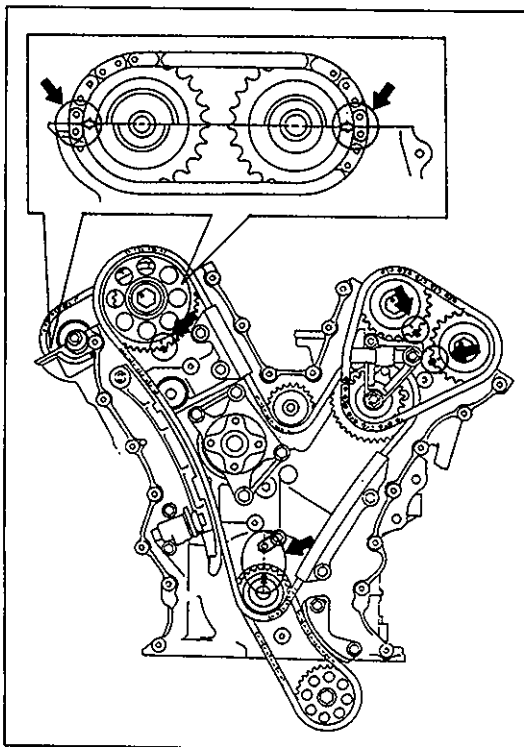


1. RH bank 2nd timing chain
2. Timing chain tensioner adjuster No.2
3. RH bank exhaust camshaft sprocket
4. RH bank 2nd timing chain intake camshaft sprocket
5. RH bank exhaust camshaft
6. RH bank intake camshaft
7. RH bank exhaust camshaft holder
8. RH bank intake camshaft holder
9. Timing chain guide No.3

85F00-6A2-41-1

REMOVAL

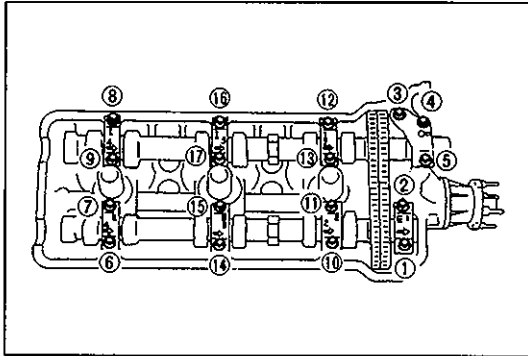
- 1) For reinstallation of timing chain, align 12 timing marks as shown in figure by turning crankshaft.



85F00-6A2-41-4

- 2) Remove LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 3) Remove 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 4) Remove timing chain guide No.3.

85F00-6A2-42-1



85F00-6A2-42-2

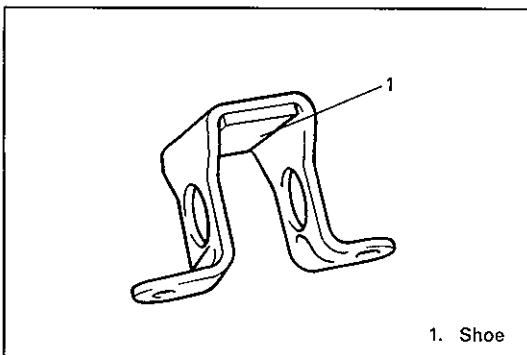
- 5) Loosen camshaft housing bolts in such order as indicated in figure and remove them.
- 6) Remove camshaft housings.

- 7) Remove RH bank intake camshaft, RH bank exhaust camshaft, and RH bank 2nd timing chain as a set.

85F00-6A2-42-3

- 8) Remove timing chain tensioner adjuster No.2.

85F00-6A2-42-4



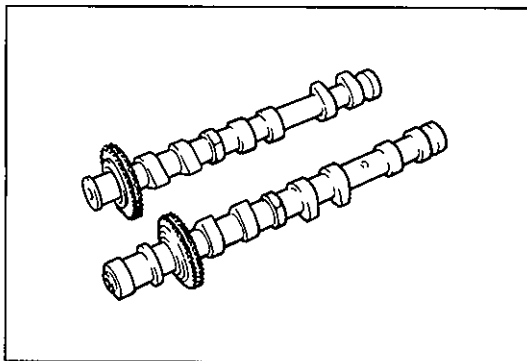
1. Shoe

85F00-6A2-42-5

INSPECTION

Timing chain guide No.3.

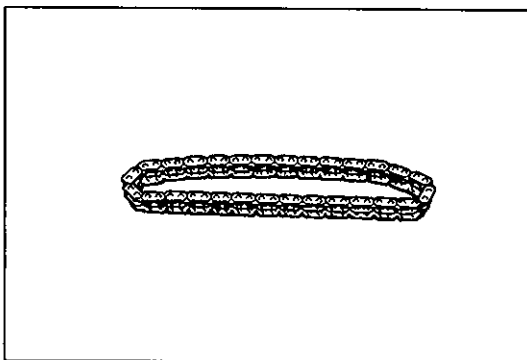
- Check shoe for wear or damage.



85F00-6A2-43-1

RH bank 2nd timing chain sprockets

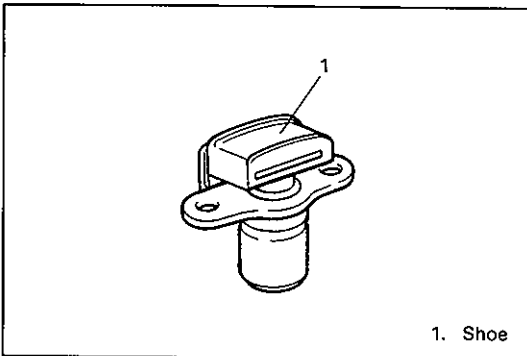
- Check teeth of sprocket for wear or damage.



85F00-6A2-43-2

RH bank 2nd timing chain.

- Check timing chain for wear or damage.

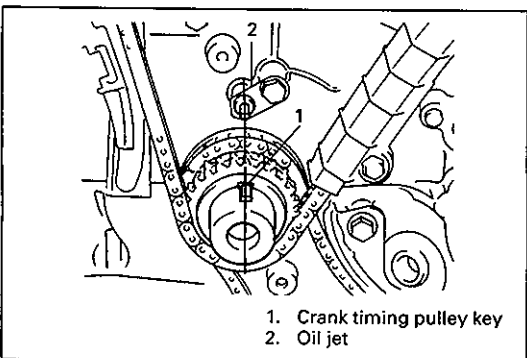


85F00-6A2-43-3

Timing chain tensioner adjuster No.2.

- Check shoe for wear or damage.
- Check that plunger slides smoothly.

1. Shoe

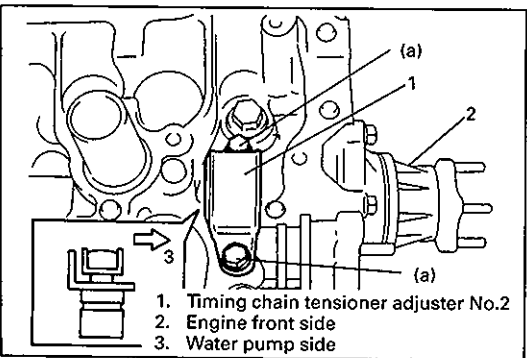


85F00-6A2-43-4

1. Crank timing pulley key
2. Oil jet

INSTALLATION

- 1) Check timing mark on crankshaft as shown in figure.



85F00-6A2-43-5

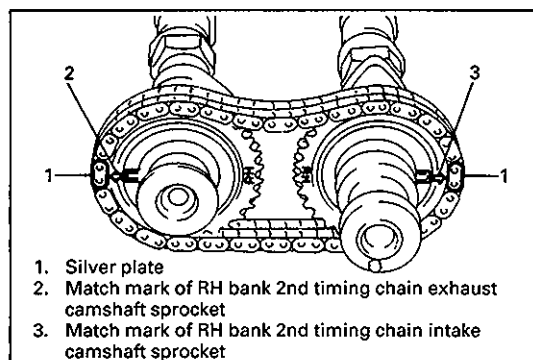
- 2) Apply oil to timing chain tensioner adjuster No.2.
- 3) Install timing chain tensioner adjuster No.2.

Tightening Torque

(a): 11 N·m (1.1 kg-m, 7.5 lb-ft)

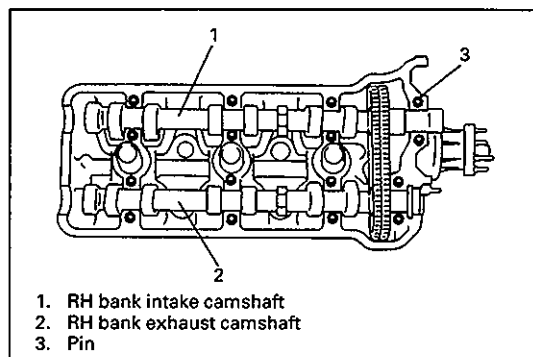
- 4) Apply oil to sliding surface of each camshafts and camshaft journals.

85F00-6A2-44-1



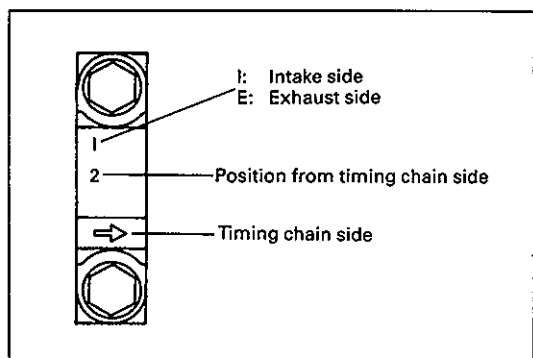
- 5) Install RH bank 2nd timing chain by aligning match marks on silver plates of RH bank 2nd timing chain, RH bank 2nd timing chain intake camshaft sprocket and RH bank 2nd timing chain exhaust camshaft sprocket as shown in figure.

85F00-6A2-44-2



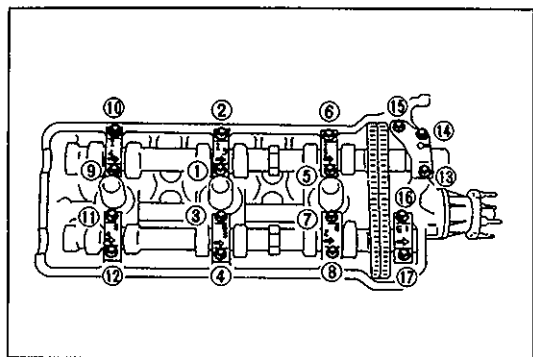
- 6) Install camshaft housing pins as shown in figure.

85F00-6A2-44-3



- 7) Check position of camshaft housings. Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.

85F00-6A2-44-4

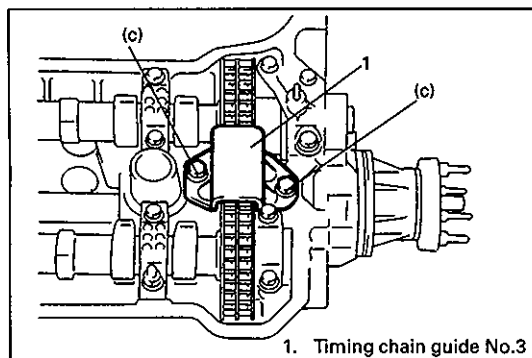


- 8) After applying oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque below.

Tightening Torque

12 N·m (1.2 kg-m, 8.5 lb-ft)

85F00-6A2-44-5



85F00-6A2-45-1

9) Install timing chain guide No.3.

Tightening Torque

(c): 11 N·m (1.1 kg-m, 7.5 lb-ft)

10) Install 1st timing chain.

Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.

11) Install LH bank 2nd timing chain.

Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.

12) Install timing chain cover.

Refer to item "TIMING CHAIN COVER" for installation.

13) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.

14) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.

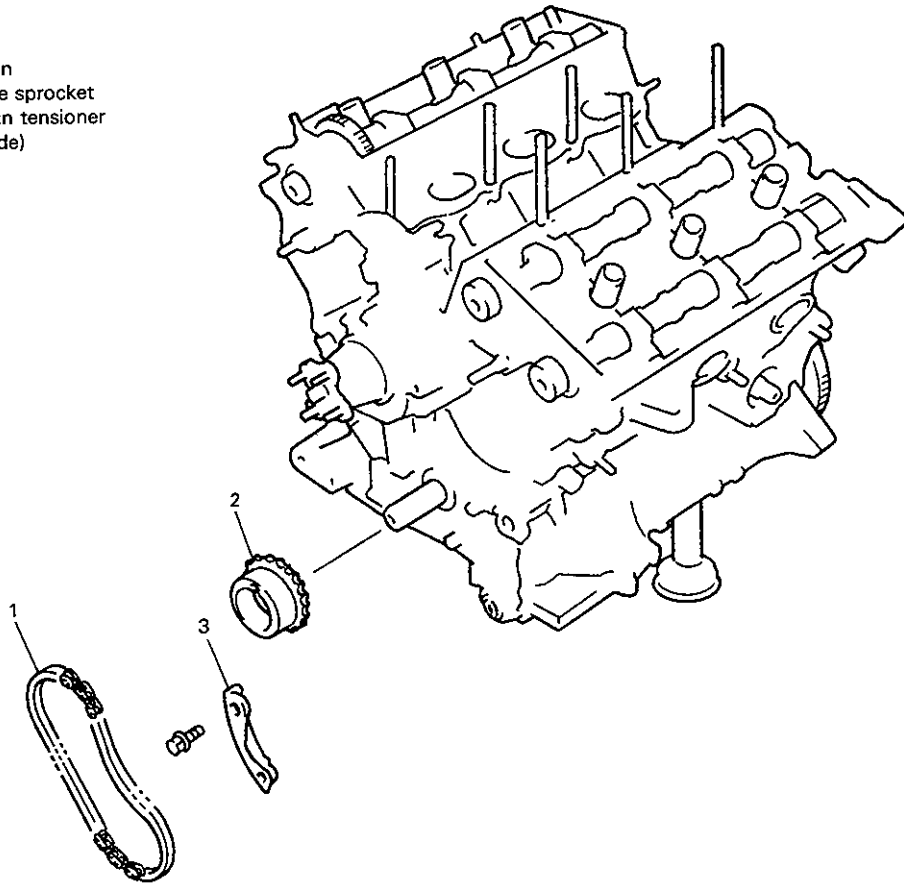
15) Check wheel alignment referring to SECTION 3.

16) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

85F00-6A2-45-2

OIL PUMP CHAIN

1. Oil pump chain
2. Oil pump drive sprocket
3. Oil pump chain tensioner
(oil pump guide)



85F00-6A2-46-1

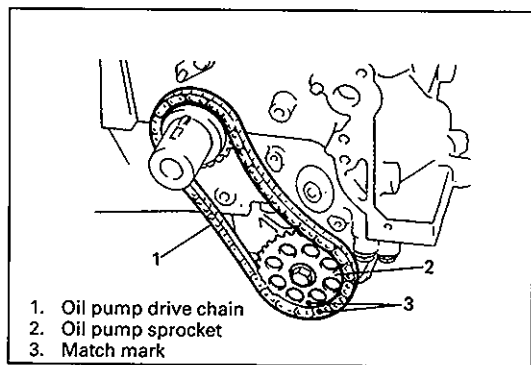
REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for removal.

85F00-6A2-46-4

- 5) Remove LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 6) Remove 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.

85F00-6A2-46-5



85F00-6A2-47-1

7) Put match marks to oil pump chain and oil pump sprocket.

8) Remove oil pump chain guide.

85F00-6A2-47-2

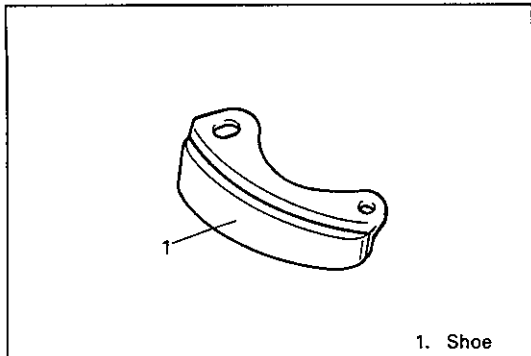
9) Remove oil pump chain.

85F00-6A2-47-3

10) Remove oil pump drive sprocket.

85F00-6A2-47-4

85F00-6A2-47-5

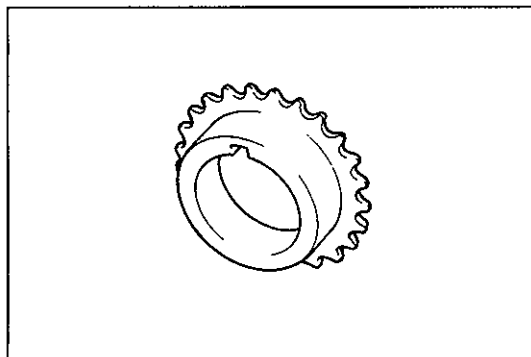


85F00-6A2-48-1

INSPECTION

Oil pump chain guide.

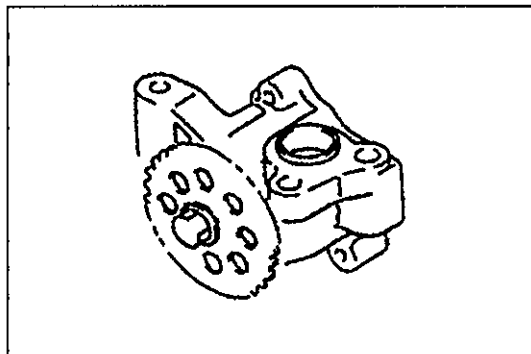
- Check shoe for wear or damage.



85F00-6A2-48-2

Oil pump drive sprocket.

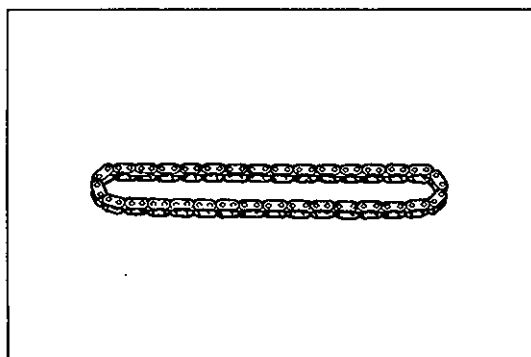
- Check teeth of sprocket for wear or damage.



85F00-6A2-48-3

Oil pump sprocket

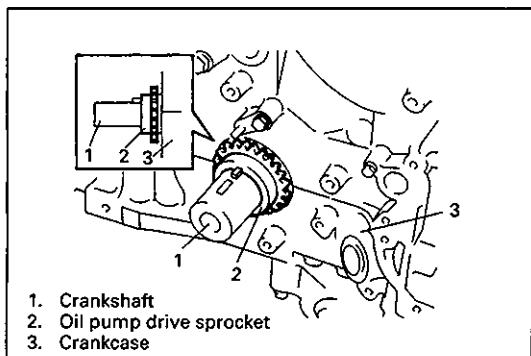
- Check teeth of sprocket for wear or damage.



85F00-6A2-48-4

Oil pump chain

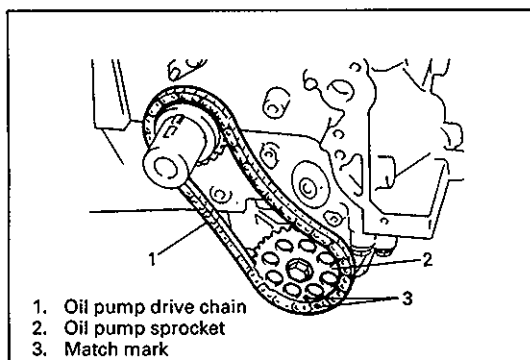
- Check oil pump chain for wear or damage.



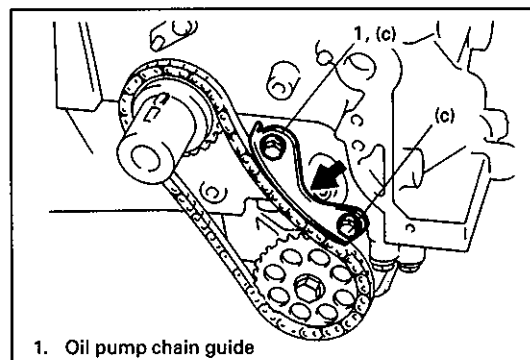
85F00-6A2-48-5

INSTALLATION

- 1) Install oil pump drive sprocket as shown in figure.



85F00-6A2-49-1



85F00-6A2-49-2

- 2) Install by aligning match marks on oil pump chain and oil pump sprocket.

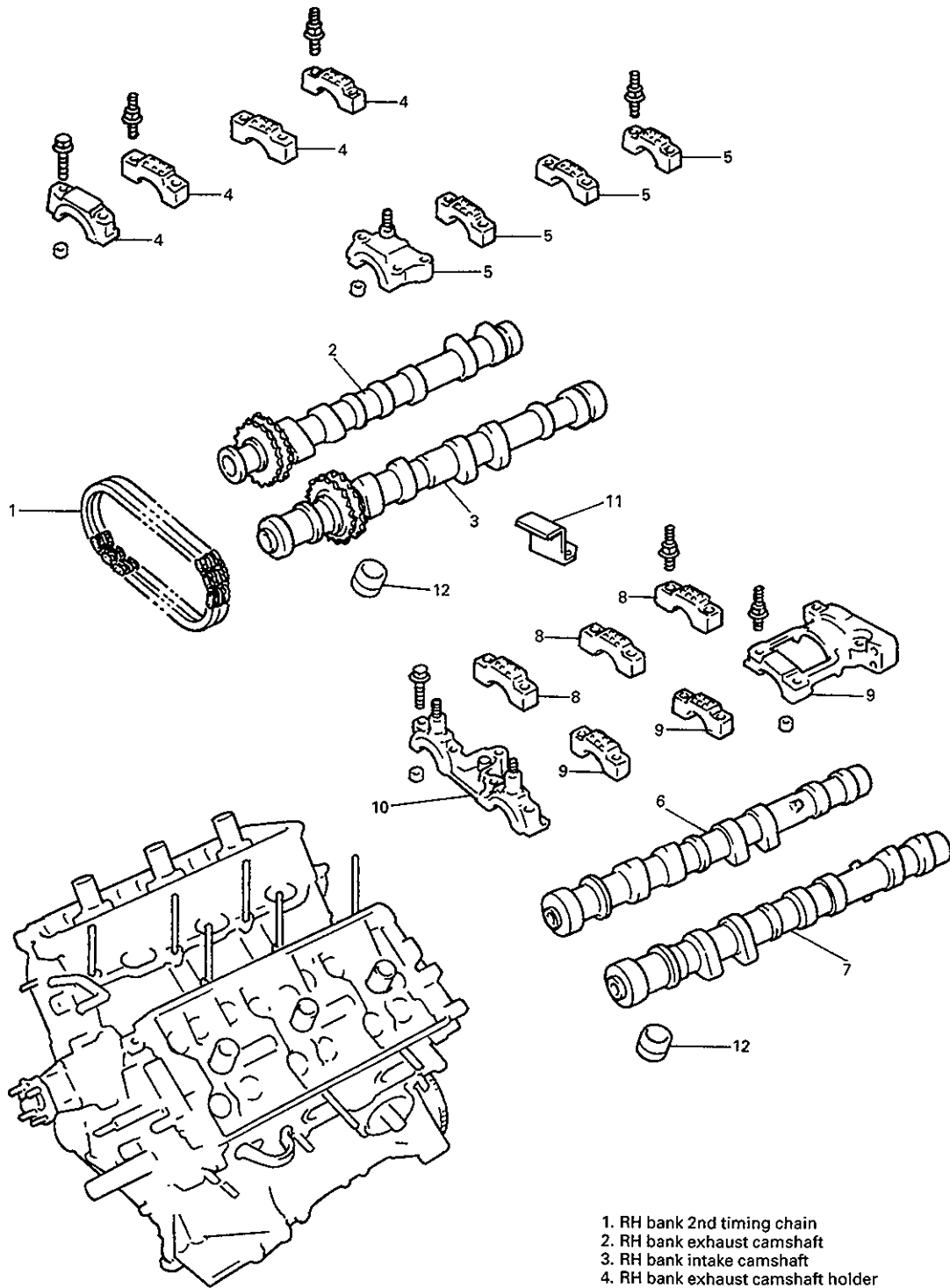
- 3) Install oil pump chain guide and hand-tighten oil pump chain guide bolts.
- 4) To take up slack of oil pump chain, push center of oil pump chain guide with a force of 0.5 to 0.6 N (50–60 g, 0.11–0.13 lb) then tighten oil pump chain guide bolts to specified torque.

Tightening Torque

(c): 11 N·m (1.1 kg-m, 7.5 lb-ft)

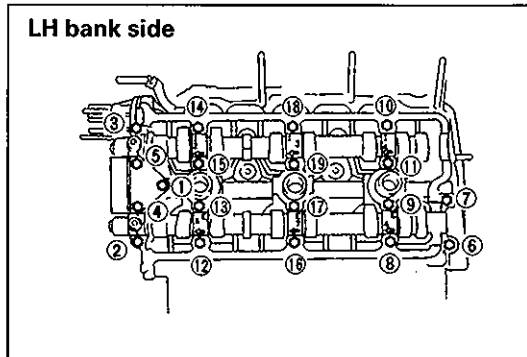
- 5) Install 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 6) Install LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 7) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
- 8) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
- 9) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
- 10) Check wheel alignment referring to SECTION 3.
- 11) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

CAMSHAFT AND VALVE LASH ADJUSTER

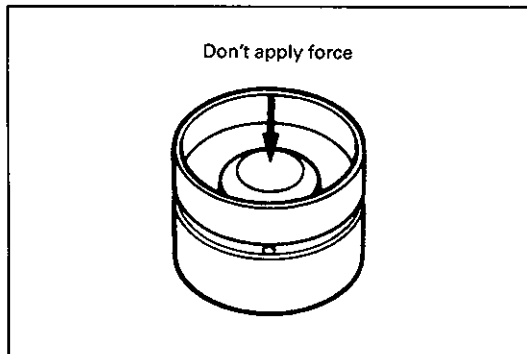


1. RH bank 2nd timing chain
2. RH bank exhaust camshaft
3. RH bank intake camshaft
4. RH bank exhaust camshaft holder
5. RH bank intake camshaft holder
6. LH bank intake camshaft
7. LH bank exhaust camshaft
8. LH bank intake camshaft holder
9. LH bank exhaust camshaft holder
10. LH bank camshaft holder
11. Timing chain guide No.5
12. Valve lash adjuster

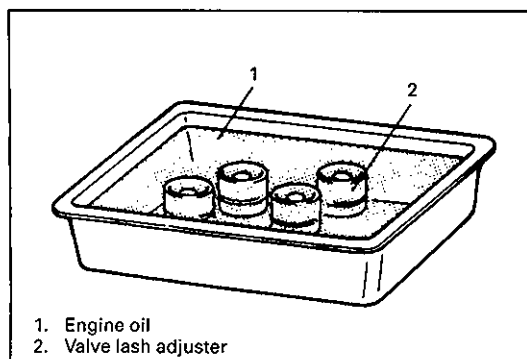
85F00-6A2-51-1



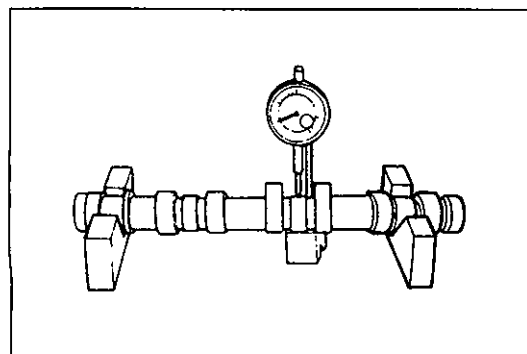
85F00-6A2-51-2



85F00-6A2-51-3



85F00-6A2-51-4



85F00-6A2-51-5

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for removal.
- 5) Remove LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 6) Remove 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 7) Remove RH bank camshafts.
Refer to item "RH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for removal.
- 8) Loosen LH bank camshaft housing bolts in such order as indicated in figure and remove them.
- 9) Remove LH bank camshaft housings.
- 10) Remove LH bank camshafts.
- 11) Remove valve lash adjuster.

NOTE:

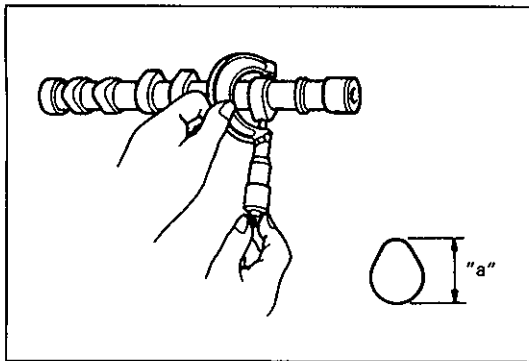
- Never disassemble hydraulic valve lash adjuster.
- Don't apply force to body of adjuster, oil in high pressure chamber in adjuster will leak.
- Immerse removed adjuster in clean engine oil and keep it there till reinstalling it so as to prevent oil leakage. If it is left in air, place it with its bucket body facing down. Don't place on its side or with bucket body facing up.

INSPECTION

Cam Wear

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

Cam height	Standard	Limit
Intake cam	39.445 – 39.605 mm (1.5530 – 1.5593 in.)	39.400 mm (1.5512 in.)
Exhaust cam	39.428 – 39.588 mm (1.5523 – 1.5586 in.)	39.400 mm (1.5512 in.)



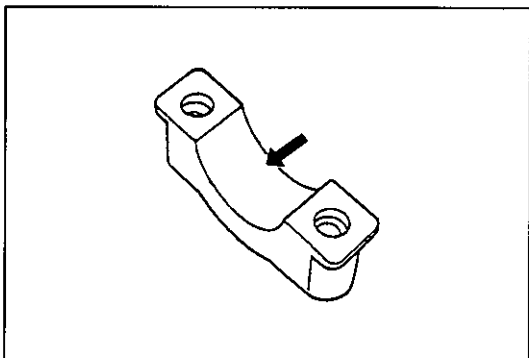
85F00-6A2-52-1

Camshaft Runout

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

If measured runout exceeds below specified limit, replace camshaft.

Runout limit	0.10 mm (0.0039 in.)
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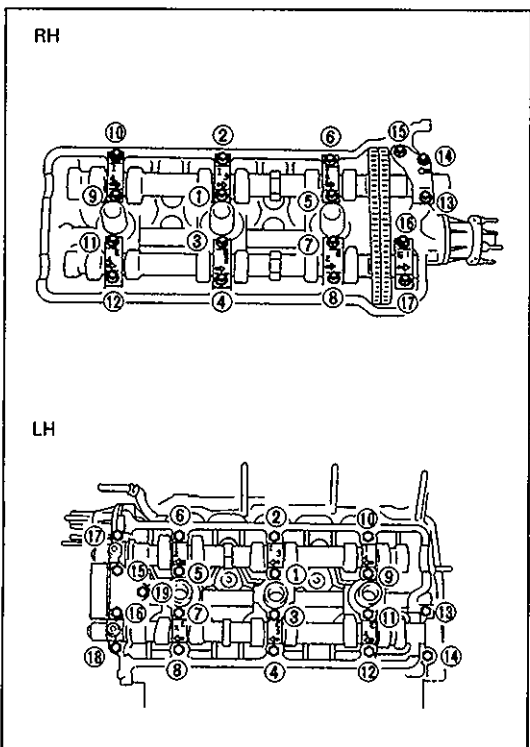


85F00-6A2-52-2

Camshaft Journal Wear

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

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



85F00-6A2-52-3

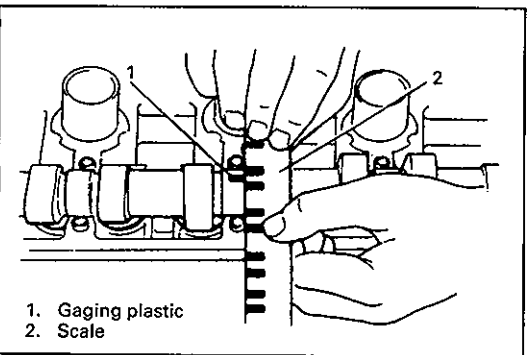
Check clearance by using gaging plastic. The procedure is as follows.

- 1) Clean housings and camshaft journals.
- 2) Make sure that all valve lash adjusters are removed and 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.

- 5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

NOTE:

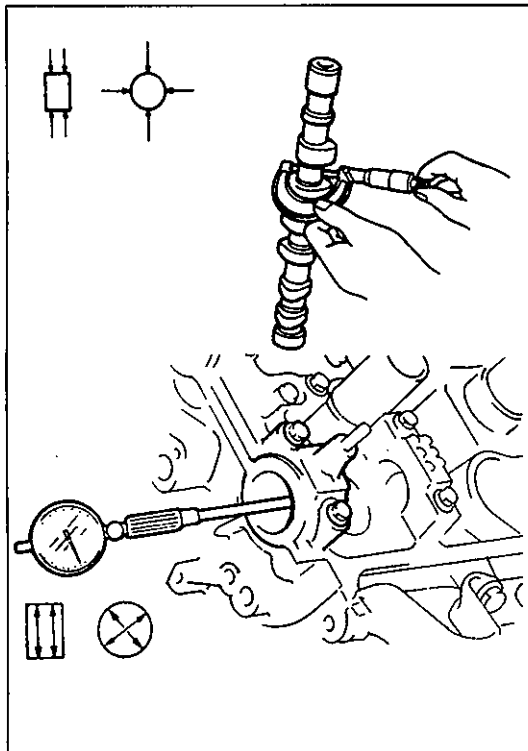
Do not rotate camshaft while gaging plastic is installed.



85F00-6A2-52-5

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

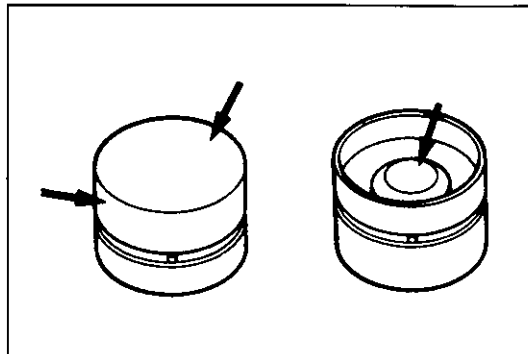
	Standard	Limit
Journal clearance	0.020 – 0.074 mm (0.0008 – 0.0029 in.)	0.12 mm (0.0047 in.)



85F00-6A2-53-1

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.

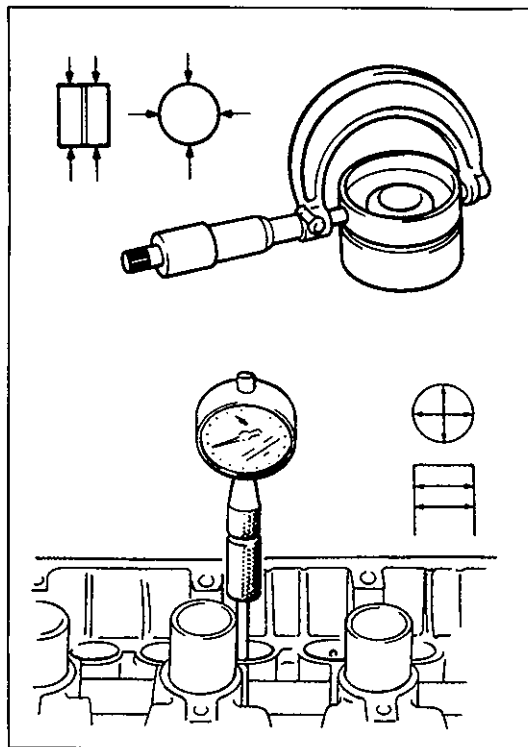
	Standard
Camshaft journal bore dia. (IN & EX)	26.000 – 26.033 mm (1.0236 – 1.0249 in.)
Camshaft journal O.D. (IN & EX)	25.959 – 25.980 mm (1.0220 – 1.0228 in.)



85F00-6A2-53-3

Wear of Hydraulic Valve Lash Adjuster

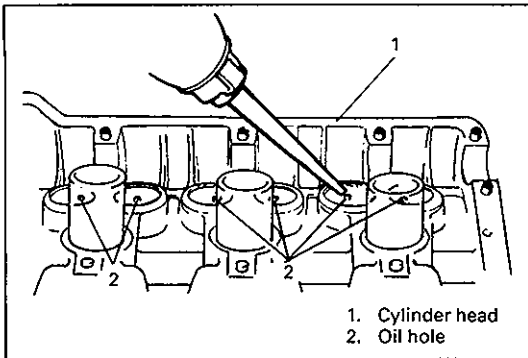
Check adjuster for pitting, scratches, or damage. If any malcondition is found, replace.



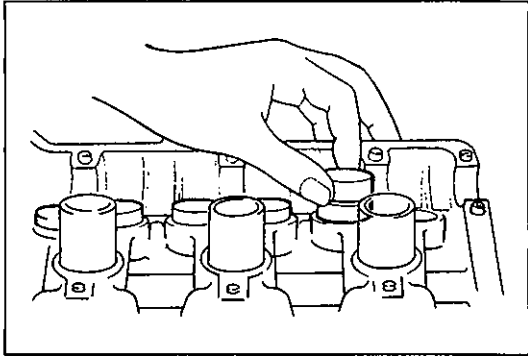
85F00-6A2-53-4

Measure cylinder head bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head.

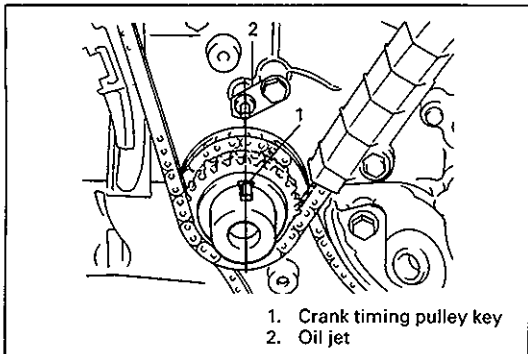
Item	Standard	Limit
Hydraulic valve lash adjuster O.D.	30.959 – 30.975 mm (1.2188 – 1.2194 in.)	–
Cylinder head bore	31.000 – 31.025 mm (1.2205 – 1.2214 in.)	–
Cylinder head to adjuster clearance	0.025 – 0.066 mm (0.0010 – 0.0025 in.)	0.15 mm (0.0059 in.)



85F00-6A2-54-1



85F00-6A2-54-2



85F00-6A2-54-3

INSTALLATION

- 1) Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head with engine oil according to following procedure.

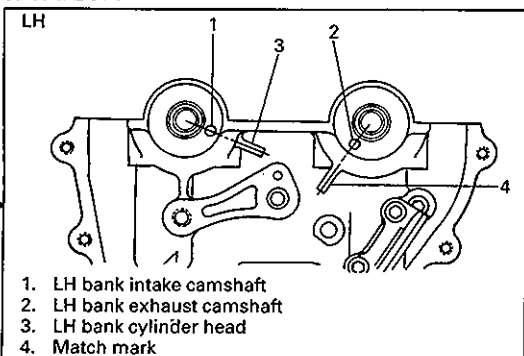
Pour engine oil through oil holes and check that oil comes out from oil holes in sliding part of valve lash adjuster. Perform this check on both intake and exhaust sides.

- 2) Valve lash adjuster to cylinder head.
Apply engine oil around valve lash adjuster and then install it to cylinder head.

- 3) Check timing mark on crankshaft as shown in figure.

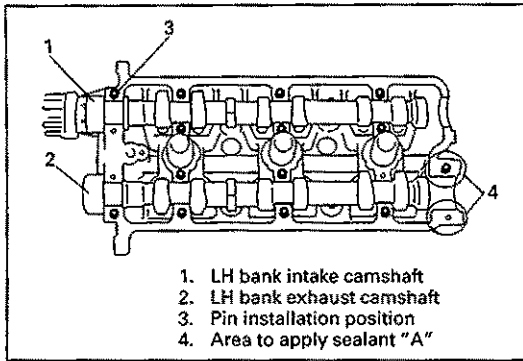
- 4) Install RH bank camshafts, referring to item "RH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.

85F00-6A2-54-4

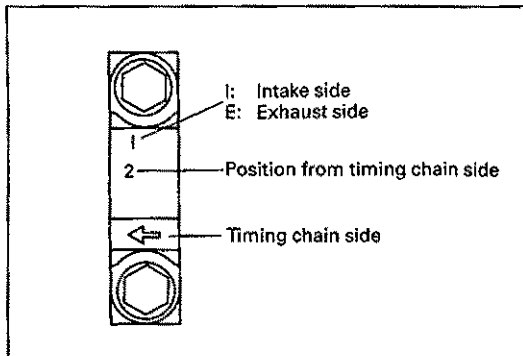


85F00-6A2-54-5

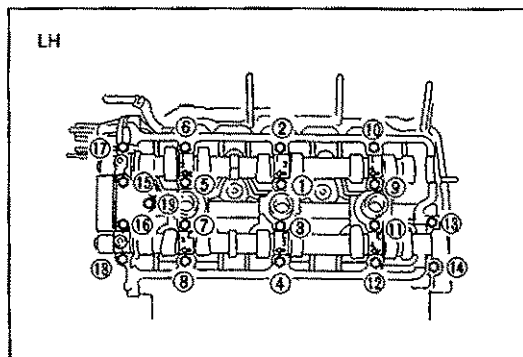
- 5) Install LH bank camshafts.
Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks on cylinder head and LH bank camshafts as shown in figure.



85F00-6A2-55-1



85F00-6A2-55-2



85F00-6A2-55-3

- 6) Install LH bank camshaft housing pins as shown in figure.
- 7) Apply sealant "A" to LH bank exhaust camshaft housing No.5 sealing surface area as shown in figure.

"A": Sealant 99000-31150

- 8) Check position of LH bank camshaft housings.
Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.

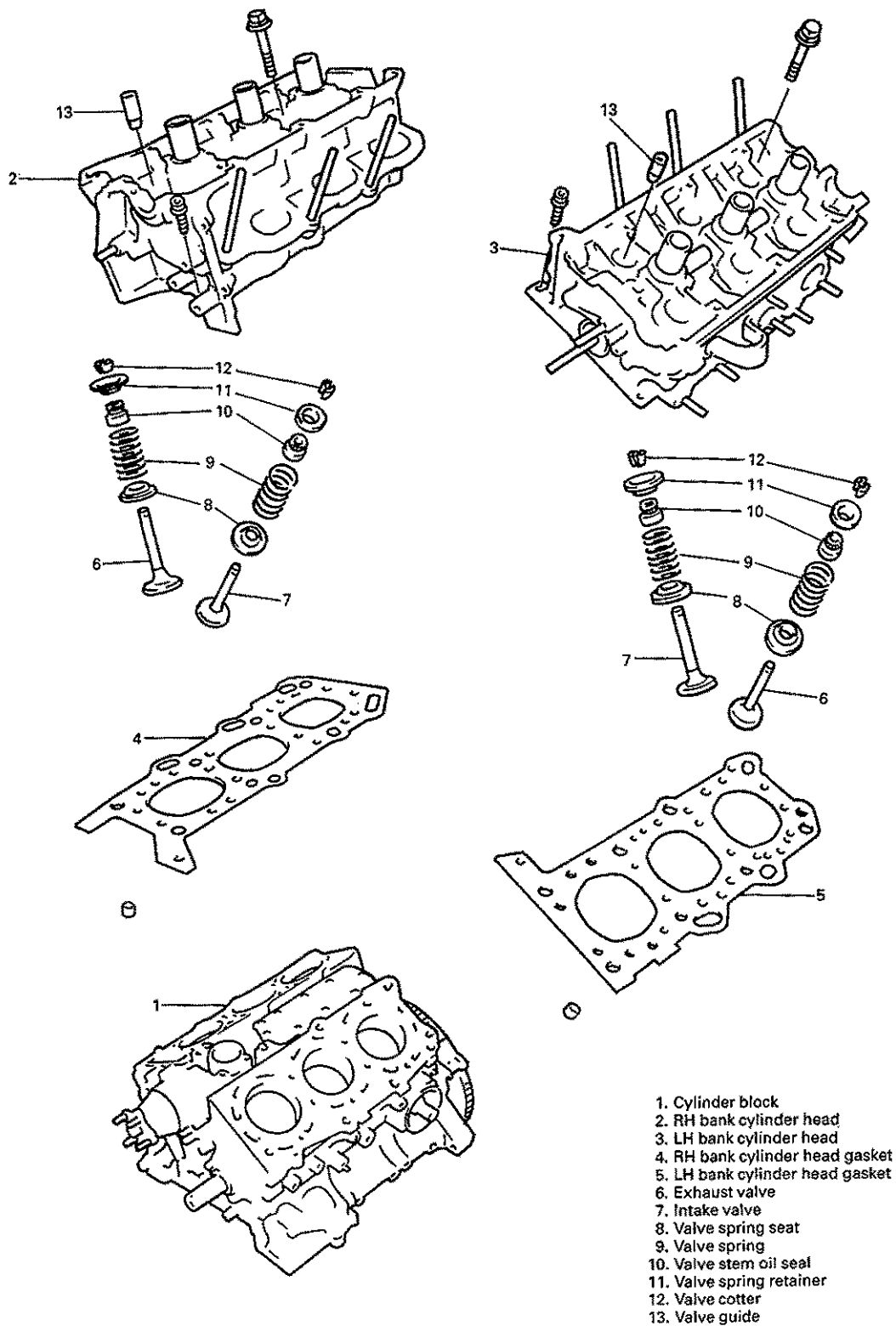
- 9) After applying oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque below.

Tightening Torque

12 N·m (1.2 kg-m, 8.5 lb-ft)

- 10) Install 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 11) Install LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 12) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
- 13) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
- 14) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
- 15) Check wheel alignment referring to SECTION 3.
- 16) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

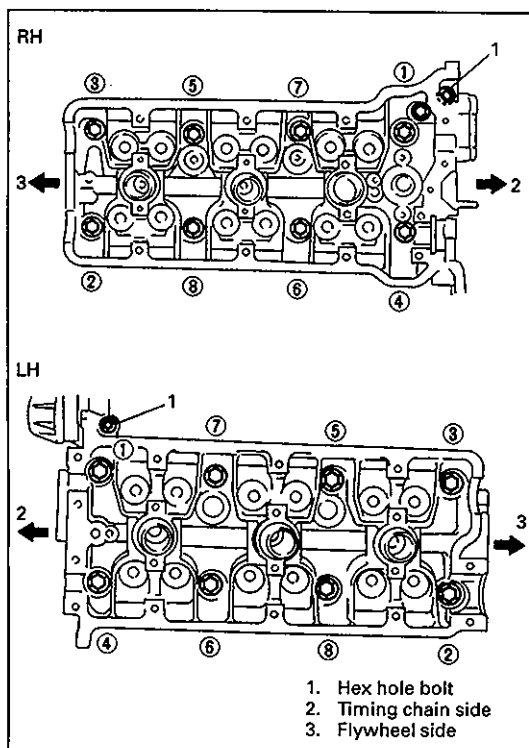
VALVES AND CYLINDER HEADS



REMOVAL

- 1) Relieve fuel pressure according to procedure described in Section 6.
- 2) Disconnect negative cable at battery.
- 3) Drain engine oil.
- 4) Drain coolant.
- 5) Remove CMP sensor, camshaft and valve lash adjuster.
Refer to Section 6F2 for CMP sensor removal and item "CAMSHAFT AND VALVE LASH ADJUSTER" in this section for camshaft and valve lash adjuster removal.
- 6) Remove exhaust manifold.
Refer to item "EXHAUST MANIFOLD" in this section for removal.
- 7) Remove water outlet cap.

85F00-6A2-57-1



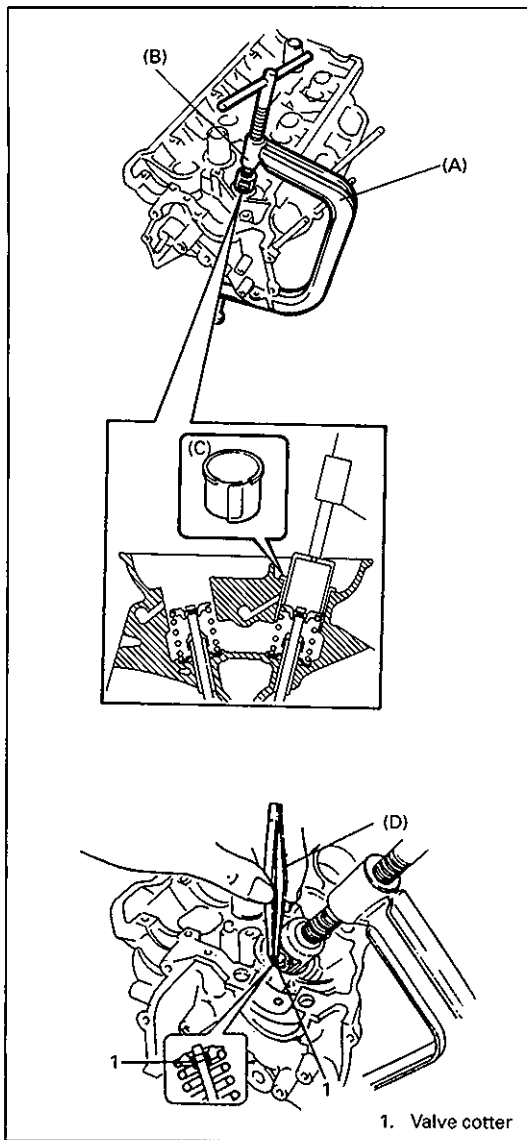
85F00-6A2-57-3

- 8) Loosen cylinder head bolts in such order as indicated in figure and remove them.

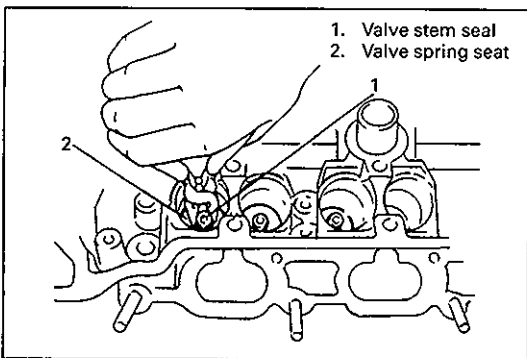
NOTE:

Don't forget to remove two bolts as shown in figure.

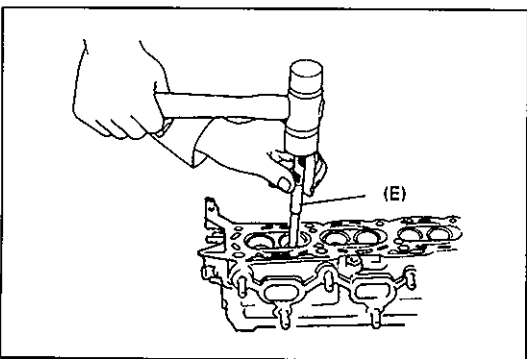
- 9) Remove cylinder heads.



85F00-6A2-58-1



85F00-6A2-58-4



85F00-6A2-58-5

DISASSEMBLY

- 1) Using special tools (A), (B) & (C), compress valve springs and then remove valve cotters by using special tool (D).

Special Tool

(A): 09916-14510

(B): 09916-14910

(C): 09919-28610

(D): 09916-84510

- 2) Release special tool, and remove spring retainer and valve spring.
- 3) Remove valve from combustion chamber side.

- 4) Remove valve stem seal from valve guide, and then valve spring seat.

NOTE:

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

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

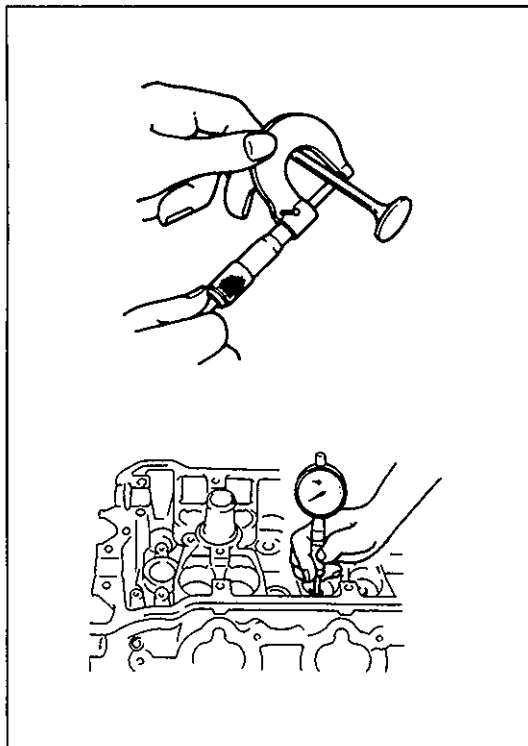
Special Tool

(E): 09916-44910

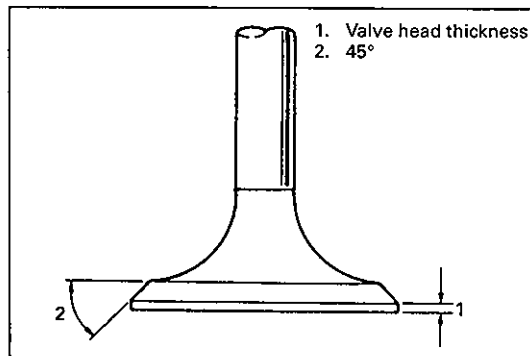
NOTE:

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

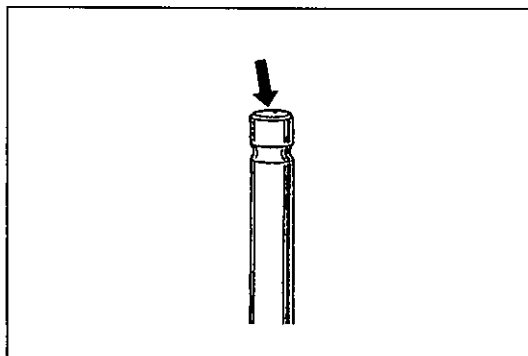
- 6) Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original positions.



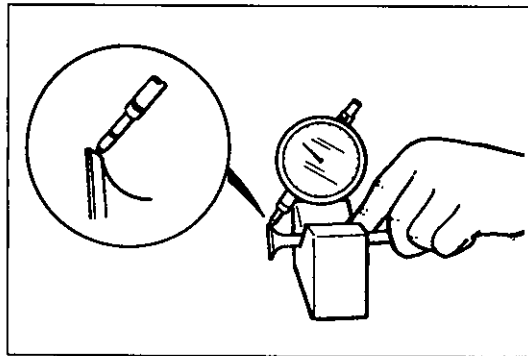
85F00-6A2-59-1



85F00-6A2-59-3



60A50-6A21-52-1S



60A50-6A21-52-2S

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	5.965 – 5.980 mm (0.2348 – 0.2354 in.)	–
	Ex	5.940 – 5.955 mm (0.2339 – 0.2344 in.)	–
Valve guide I.D.	In & Ex	6.000 – 6.012 mm (0.2362 – 0.2367 in.)	–
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.)

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.

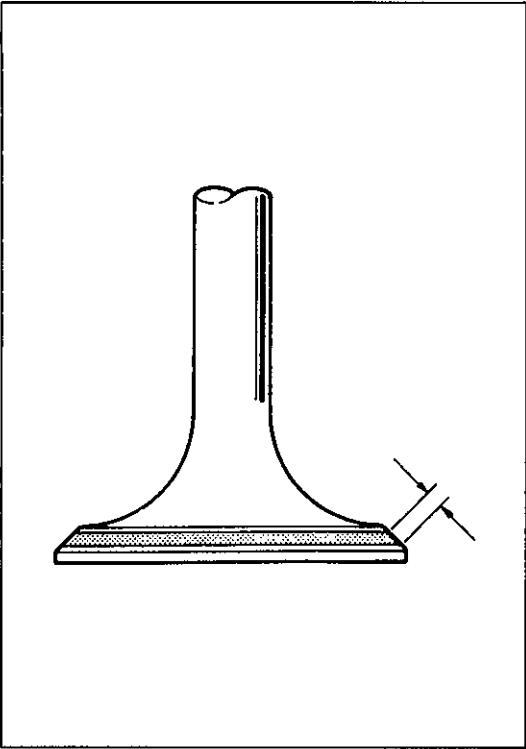
Item	Standard	Limit
In	1.0 mm (0.039 in.)	0.6 mm (0.023 in.)
Ex	1.2 mm (0.047 in.)	0.7 mm (0.027 in.)

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

- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

Limit on valve head radial runout:

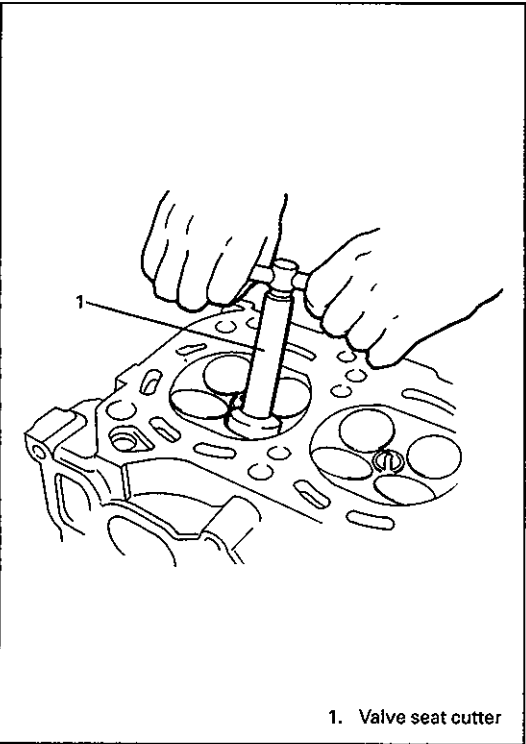
0.08 mm (0.003 in.)



60A50-6A21-52-3S

- **Seating contact width:**
Create contact pattern one 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	



85F00-6A2-60-3

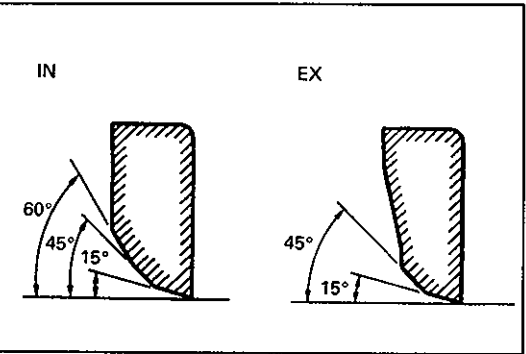
- **Valve seat repair:**
A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.
1) **VALVE SEAT:** Use valve seat cutters to make two cuts as illustrated 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 valve seat:
1.1 – 1.3 mm (0.0433 – 0.0512 in.)

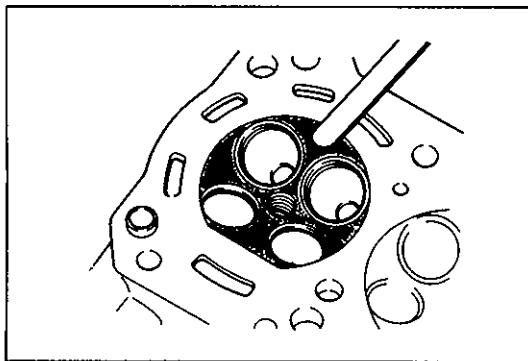
- 2) **INTAKE VALVE SEAT:** Use valve seat cutters to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 15° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

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.



85F00-6A2-60-5



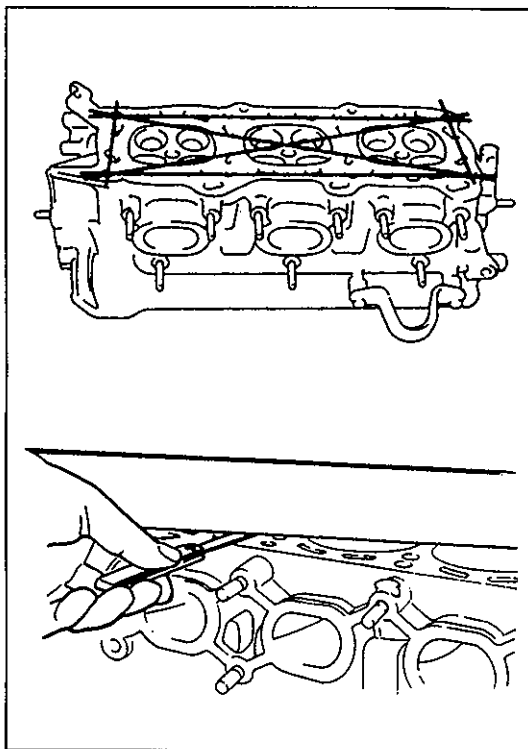
60A50-6A21-53-4S

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.

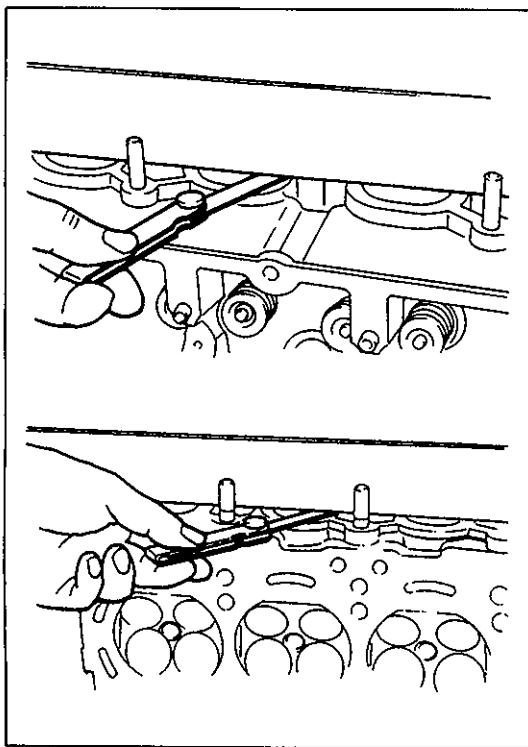


60A50-6A21-54-1S

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

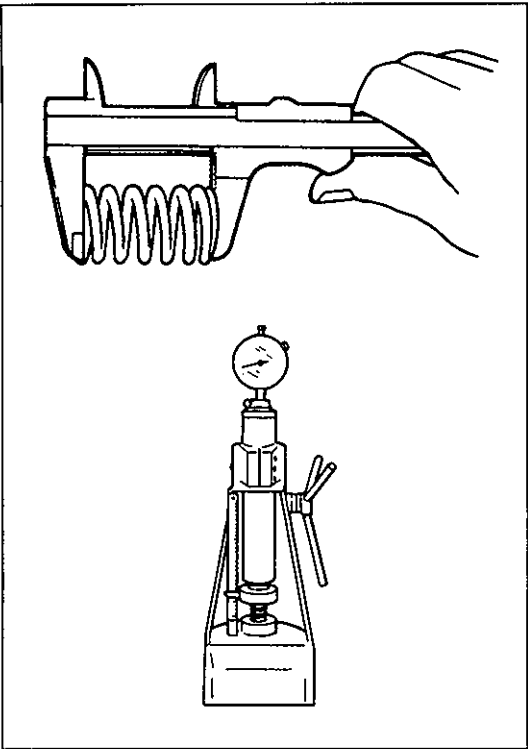
Limit of distortion: 0.05 mm (0.002 in.)



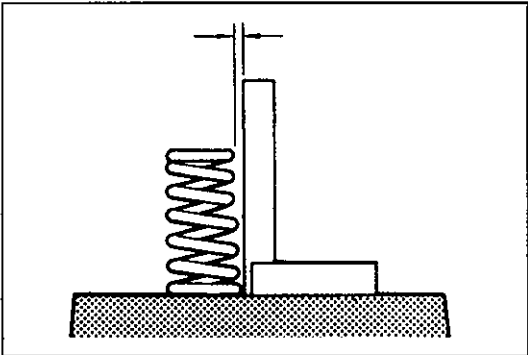
60A50-6A21-54-3S

- 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.)



85F00-6A2-62-1



60A50-6A21-55-3S

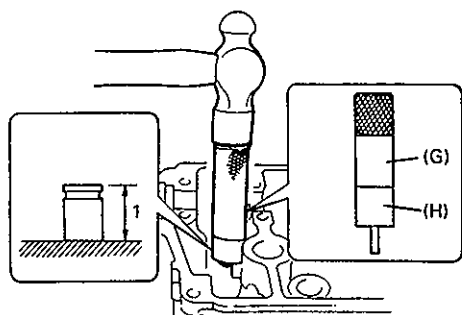
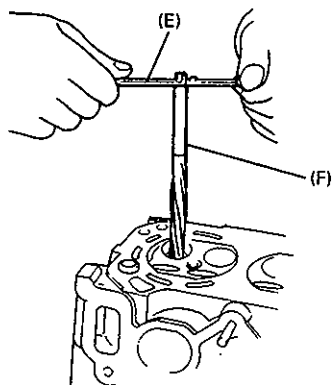
Valve Springs

- 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	42.65 mm (1.6791 in.)	41.50 mm (1.6339 in.)
Valve spring preload	22.3–25.7 kg for 32.6 mm (49.2–56.7 lb/ 1.28 in.)	21.2 kg for 32.6 mm (46.7 lb/ 1.28 in.)

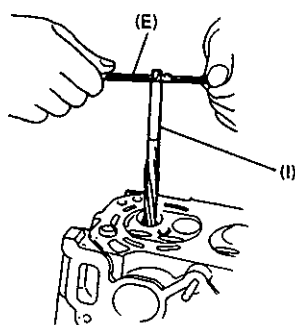
- Spring squareness:
Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

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



1. Valve guide protrusion (11.5 mm)

85F00-6A2-63-1



85F00-6A2-63-4

ASSEMBLY

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

Special Tool

(E): 09916-34542

(F): 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

(G): 09916-58210

(H): 09917-87810

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): 13.5 mm (0.53 in.)

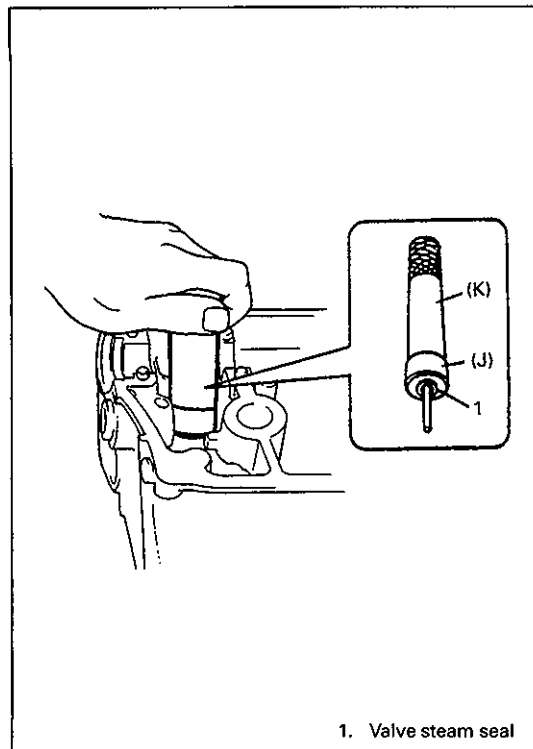
- 3) Ream valve guide bore with special tool (6.0 mm reamer). After reaming, clean bore.

Special Tool

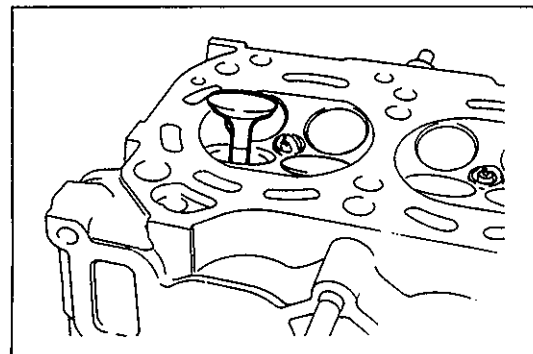
(E): 09916-34542

(I): 09916-37810

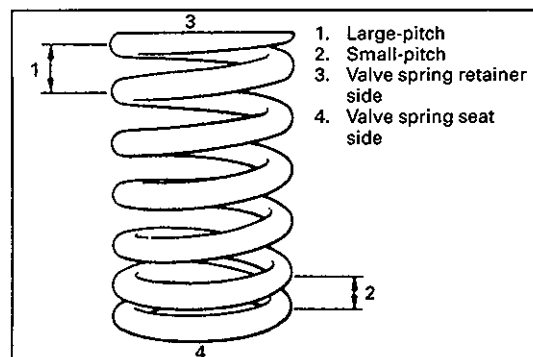
- 4) Install valve spring seat to cylinder head.



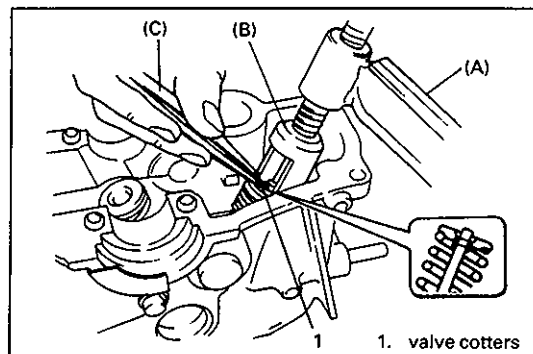
85F00-6A2-64-1



85F00-6A2-64-3



85F00-6A2-64-4



85F00-6A2-64-5

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

(J): 09917-98221

(K): 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.

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).

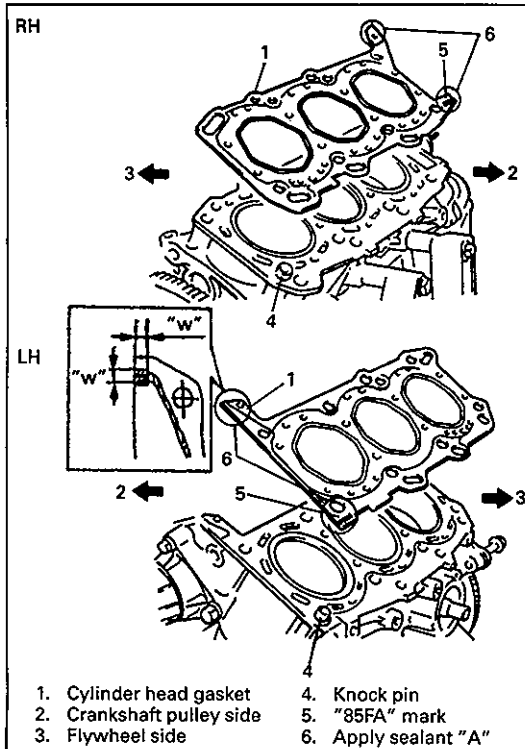
8) Using special tool (Valve lifter), compress valve spring and fit two valve cotter pins into groove in valve stem.

Special Tool

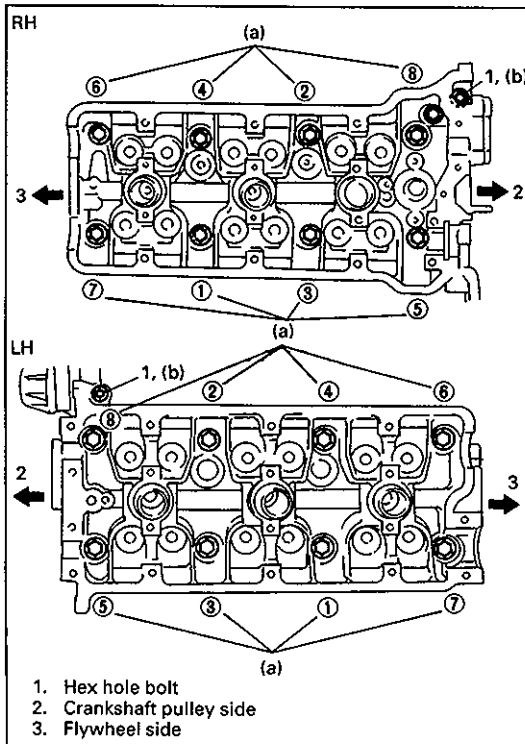
(A): 09916-14510

(B): 09916-14910

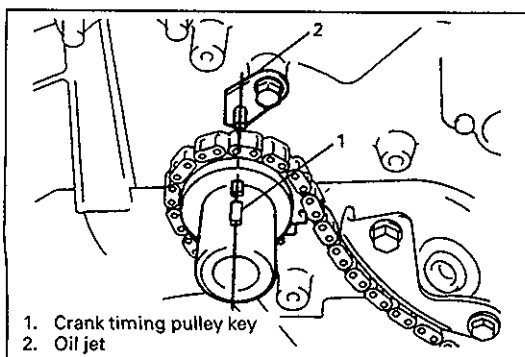
(C): 09916-84510



85F00-6A2-65-1



85F00-6A2-65-3



85F00-6A2-65-5

INSTALLATION

- 1) Clean mating surface on cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.
- 2) Install knock pin to cylinder block.
- 3) Apply sealant "A" to cylinder head gasket as shown in figure.

"A": Sealant 99000-31150

Width "w": Min. 4 mm (0.158 in.)

- 4) Install new cylinder head gasket to cylinder block as shown in figure. "85FA" mark on cylinder head gasket should face up (toward cylinder head side).

- 5) Install cylinder head to block.

After applying oil to cylinder head bolts, tighten then gradually with a torque wrench, following sequence given in figure. Finally tighten bolts to specified torque.

Tightening Torque

(a): 105 N·m (10.5 kg-m, 76.0 lb-ft)

(b): 11 N·m (1.1 kg-m, 7.5 lb-ft)

NOTE:

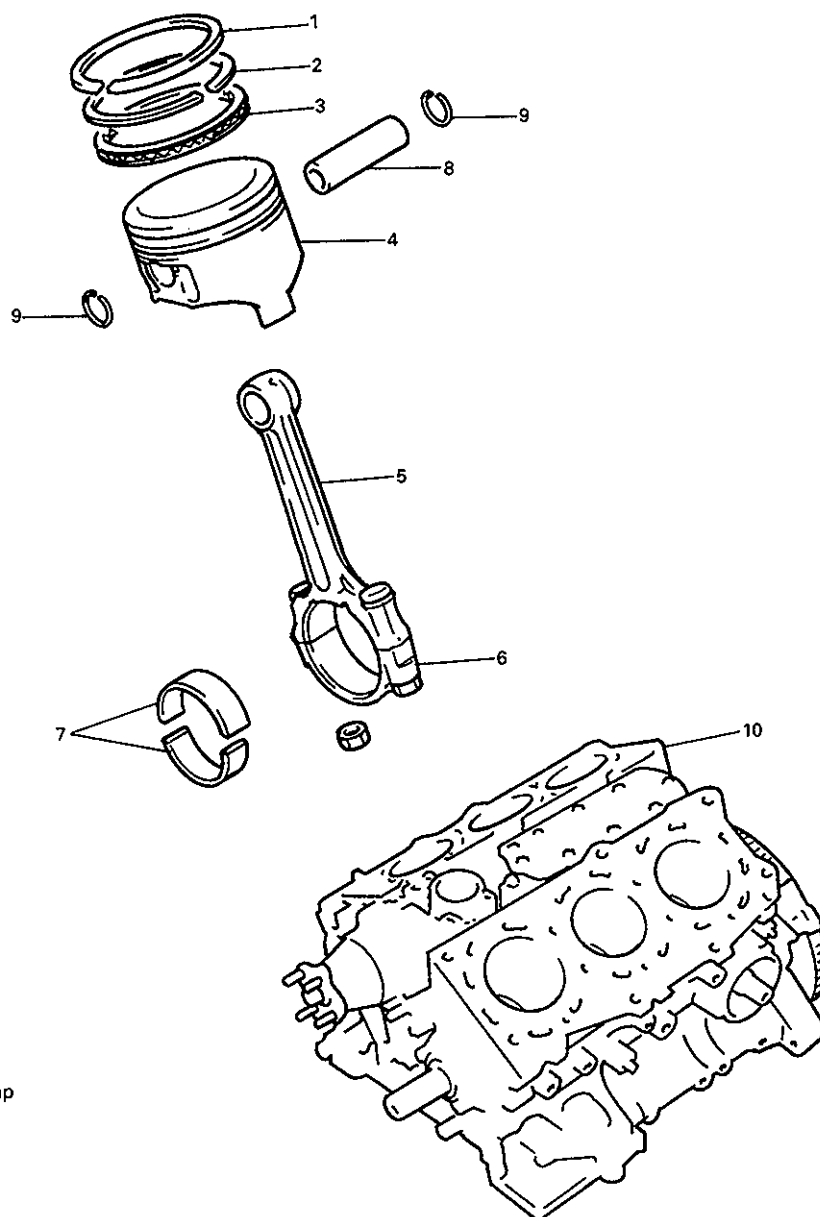
Don't forget to install (b) bolts as shown in figure.

- 6) Install water outlet cap.

- 7) Check timing mark on crankshaft as shown in figure.

- 8) Install valve lash adjuster, camshaft, CMP sensor and RH bank 2nd timing chain.
Refer to item "CAMSHAFT AND VALVE LASH ADJUSTER" and "RH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section. For CMP sensor refer to Section 6F2 for installation.
- 9) Install 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 10) Install LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 11) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
- 12) Install oil pan and oil pump strainer.
Refer to item "OIL PAN AND OIL PUMP STRAINER" in this section for installation.
- 13) Install cylinder head cover.
Refer to item "CYLINDER HEAD COVER" in this section for installation.
- 14) Install exhaust manifold.
Refer to item "EXHAUST MANIFOLD" in this section for installation.
- 15) Install radiator outlet pipe radiator, cooling fan and water hose.
Refer to Section 6B installation.
- 16) Install throttle body and intake manifold.
Refer to item "THROTTLE BODY AND INTAKE MANIFOLD" in this section for installation.
- 17) Adjust water pump drive belt tension.
Refer to Section 6B for adjusting procedure.
- 18) Adjust power steering pump drive belt tension.
Refer to Section 3B3-4 for adjusting procedure.
- 19) Adjust accelerator cable play and A/T throttle cable play.
Refer to Section 6E2.
- 20) Check to ensure that all removed parts are back in place.
Reinstall any necessary parts which have not been reinstalled.
- 21) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
- 22) Refill cooling system referring to Section 6B.
- 23) Refill front differential housing with gear oil, referring to "DIFFERENTIAL" section.
- 24) Connect negative cable at battery.
- 25) Check ignition timing and adjust as necessary, referring to Section 6F2.
- 26) Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each connection.
- 27) Check wheel alignment, referring to SECTION 3.

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS

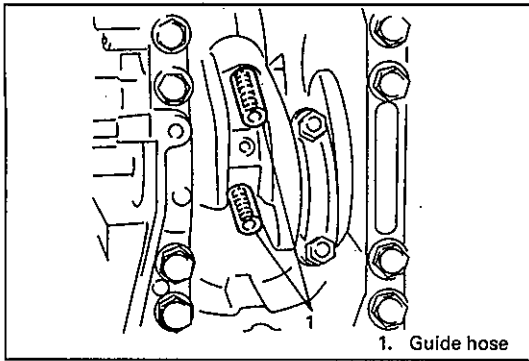


1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip
10. Cylinder block

85F00-6A2-67-1

REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove cylinder heads.
Refer to item "VALVES AND CYLINDER HEADS" in this section for removal.
- 5) Remove oil pump.
Refer to item "OIL PUMP" in this section for removal.



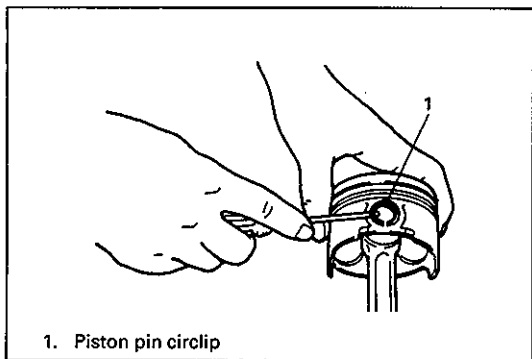
85F00-6A2-68-1

- 6) Mark cylinder number on all pistons, connecting rods and connecting rod caps.
- 7) Remove rod bearing caps.
- 8) Install guide hose over threads of rod bolts.
This prevents damage to bearing journal and rod bolt threads when removing connecting rod.
- 9) Clean carbon from top of cylinder bore before removing piston from cylinder.
- 10) Push piston and connecting rod assembly out through the top of cylinder bore.

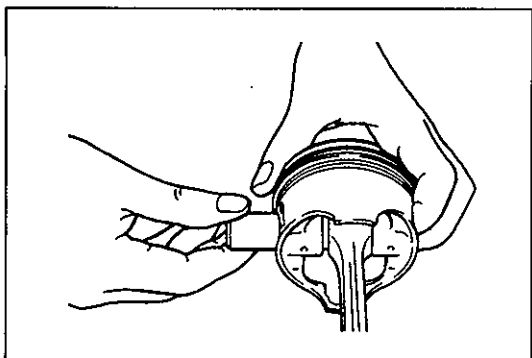
DISASSEMBLY

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

60A50-6A21-61-1S



60A50-6A21-61-2S



60A50-6A21-61-3S

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

- Force piston pin out.

CLEANING

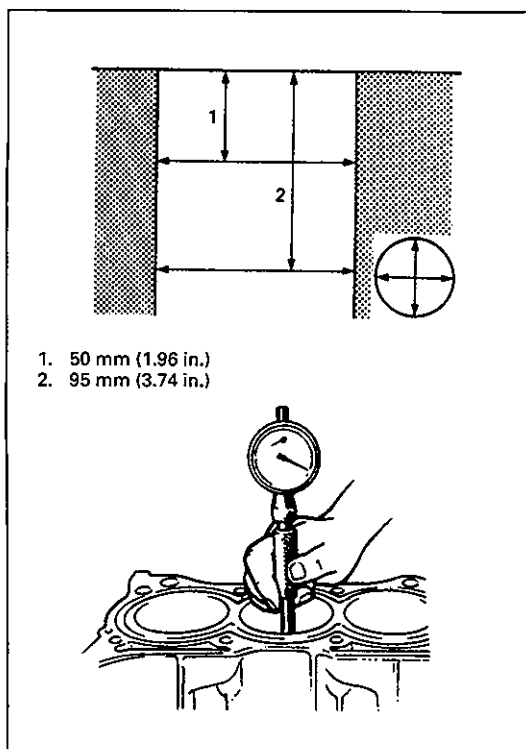
Clean carbon from piston head and ring grooves, using a suitable tool.

INSPECTION

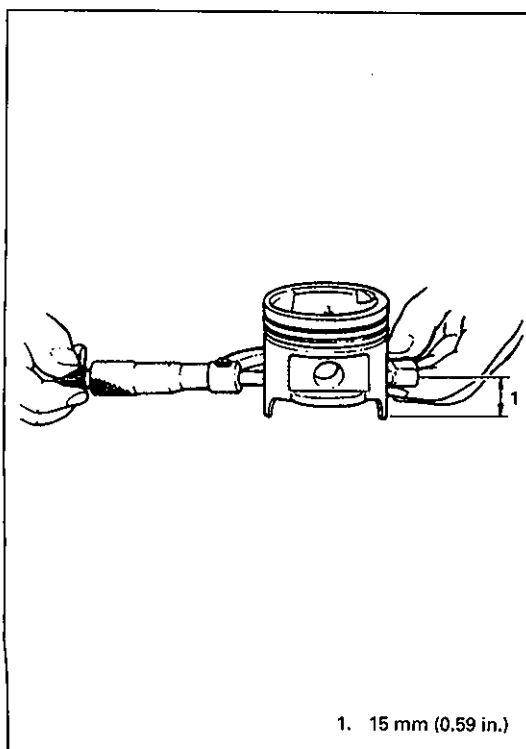
Cylinders

- 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 over size piston.

60A50-6A21-62-1S



85F00-6A2-69-2



85F00-6A2-69-4

- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure. If any of the 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: 78.050 mm (3.0728 in.)

Taper and out-of-round limit: 0.10 mm (0.004 in.)

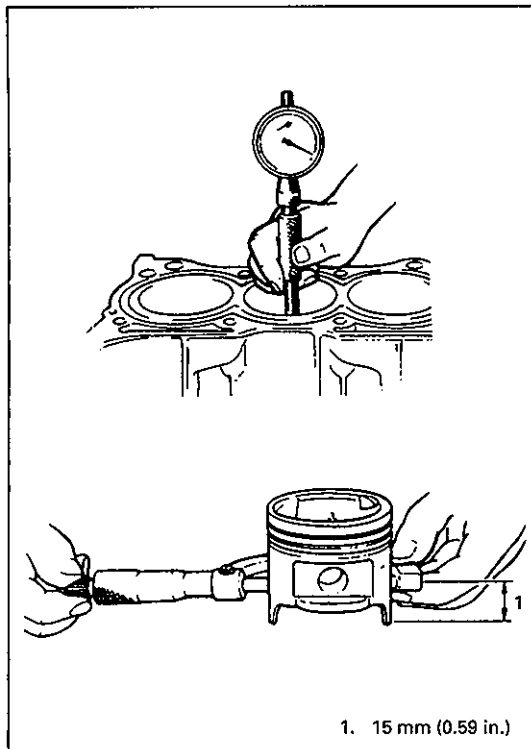
NOTE:

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

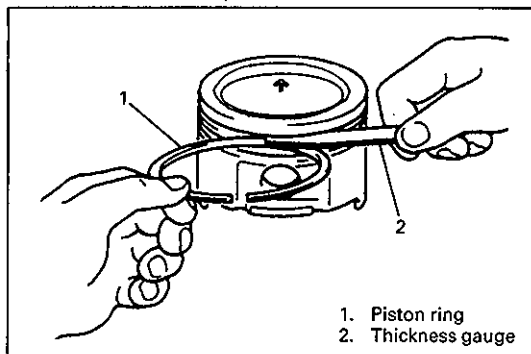
Pistons

- Inspect piston for faults, cracks or other damages. Damaged or faulty piston should be replaced.
- Piston diameter:
As indicated in figure, piston diameter should be measured at a position 15 mm (0.59 in.) from piston skirt end in the direction perpendicular to piston pin.

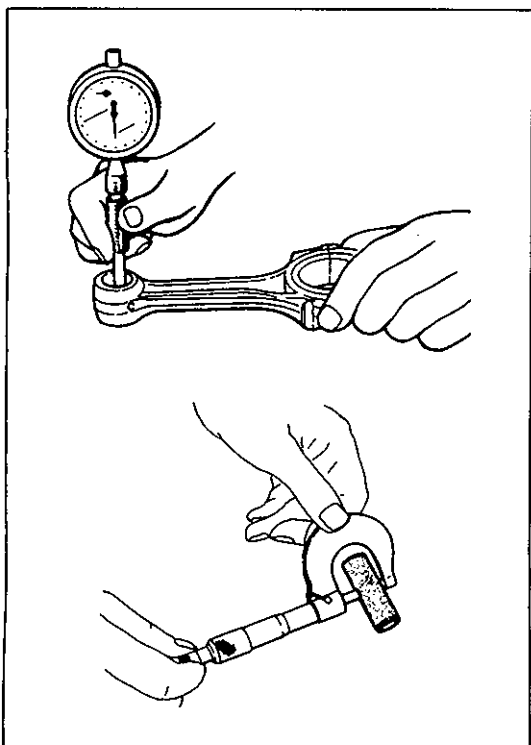
Piston diameter	Standard	77.970 – 77.990 mm (3.0697 – 3.0704 in.)
	Oversize: 0.25 mm (0.0098 in.)	78.22 – 78.24 mm (3.0795 – 3.0803 in.)
	0.50 mm (0.0196 in.)	78.47 – 78.49 mm (3.0894 – 3.0901 in.)



60A50-6A21-63-1S



85F00-6A2-70-3



85F00-6A2-70-4

- **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, rebore 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.

- **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.)

Oil: 0.06 – 0.15 mm (0.0023 – 0.0059 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.

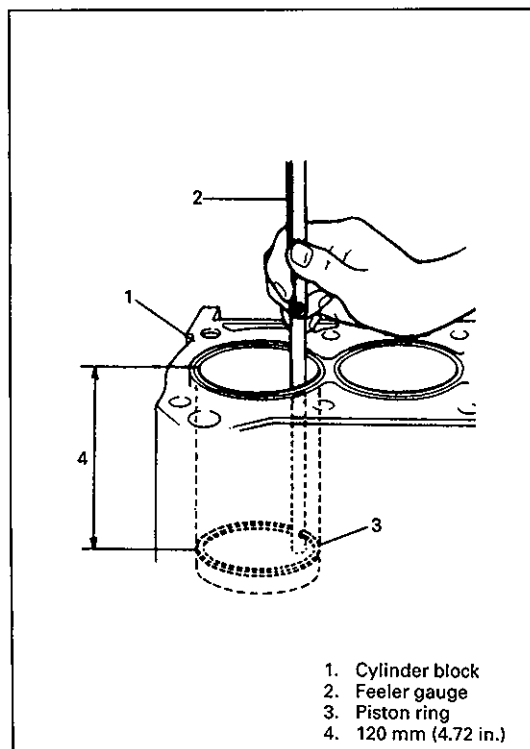
Item	Standard
Piston clearance in small end	0.003 – 0.014 mm (0.0001 – 0.0005 in.)

Small-end bore:

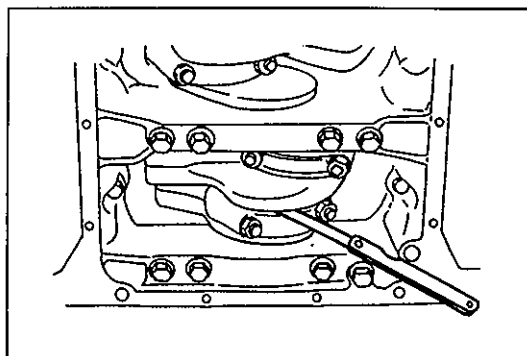
20.003 – 20.011 mm (0.7875 – 0.7878 in.)

Piston pin dia.:

19.997 – 20.000 mm (0.7873 – 0.7874 in.)



85F00-6A2-71-1



85F00-6A2-71-3

Piston Rings

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

NOTE:

Clean carbon and any other dirt from 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 (0.0276 in.)
	2nd ring	0.35 – 0.50 mm (0.0138 – 0.0196 in.)	0.7 mm (0.0276 in.)
	Oil ring	0.2 ~ 0.7 mm (0.0079 – 0.0275 in.)	1.8 mm (0.0709 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	0.25 – 0.35 mm (0.0099 – 0.0137 in.)	0.40 mm (0.0157 in.)

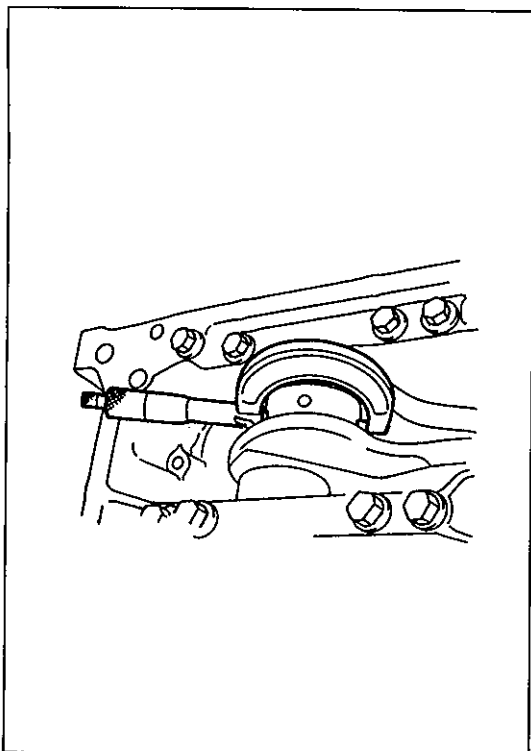
● Connecting rod alignment:

Mount connecting rod on aligner to check it for bow and twist. If limit is exceeded, replace it.

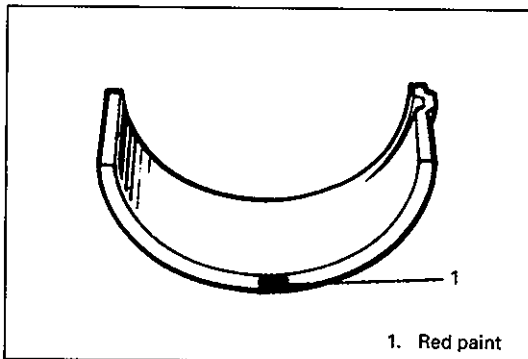
Limit on bow: 0.05 mm (0.0020 in.)

Limit on twist: 0.10 mm (0.0039 in.)

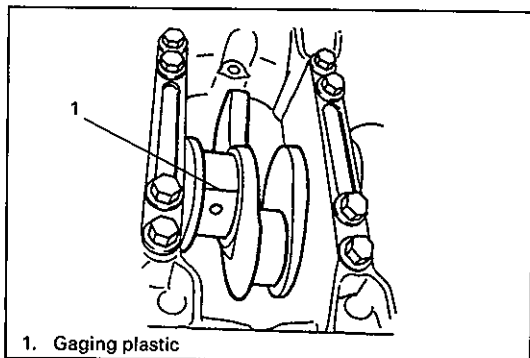
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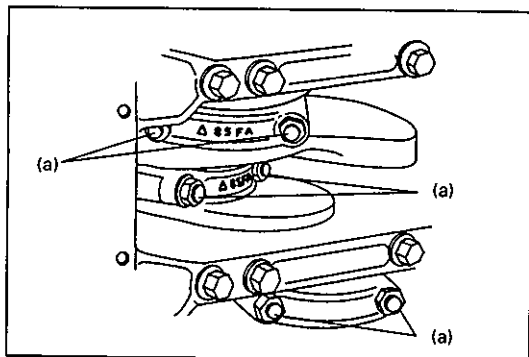
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85F00-6A2-72-4



85F00-6A2-72-5

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 to undersize and use undersize bearing.

Connecting rod bearing size	Crank pin diameter
Standard	49.982 – 50.000 mm (1.9678 – 1.9685 in.)
0.25 mm (0.0098 in.) undersize	49.732 – 49.750 mm (1.9580 – 1.9586 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. For identification of undersize bearing, it is painted red at the position as indicated in figure, undersize bearing thickness is 1.605 – 1.615 mm (0.0632 – 0.0635 in.) at the center of it.

Rod bearing clearance:

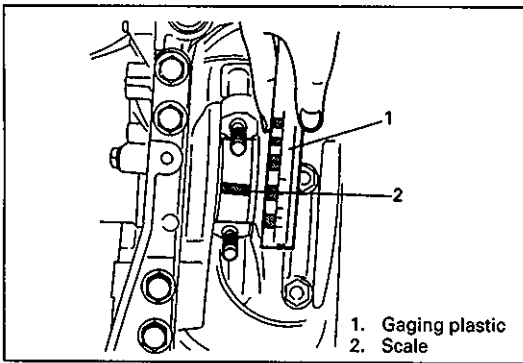
- Before checking bearing clearance, clean bearing and crank pin.
- Install bearing in connecting rod and bearing cap.
- Place a piece of gaging plastic to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.

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): 45 N·m (4.5 kg-m, 32.5 lb-ft)



85F00-6A2-73-1

5. Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance).

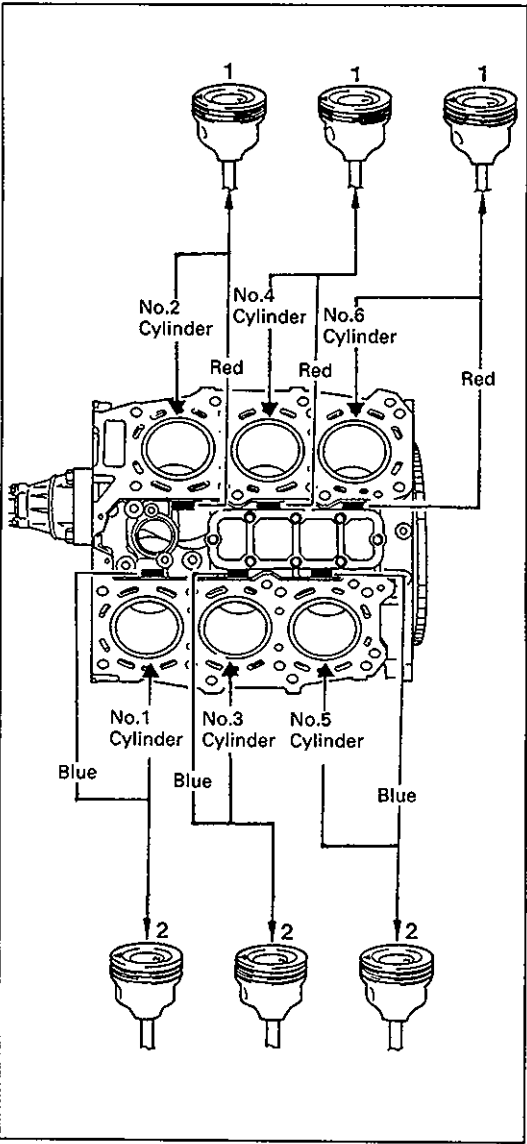
If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.039 – 0.057 mm (0.0016 – 0.0022 in.)	0.08 mm (0.0031 in.)

6. If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crankpin to undersize and use 0.25 mm undersize bearing.

Item	Standard	Limit
Bearing clearance	0.035 – 0.08 mm (0.0014 – 0.0031 in.)	0.09 mm (0.0036 in.)

BLANK



85F00-6A2-75-1

ASSEMBLY

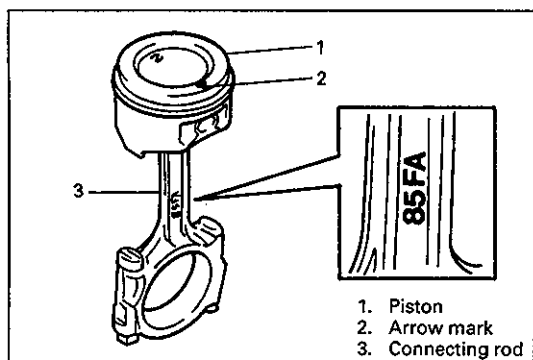
NOTE:

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.

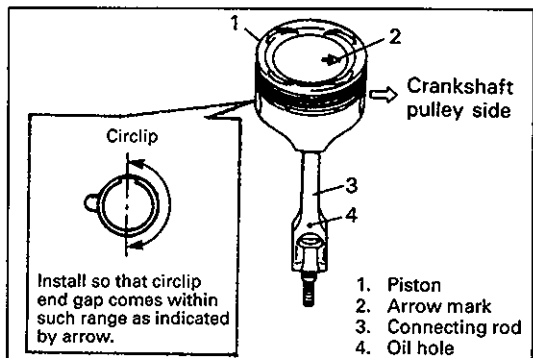
- a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
- b) There are also stamped numbers of 1 and 2 on the cylinder block as shown.
- c) Stamped number on piston and stamped mark on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with mark blue and a number 1 piston to cylinder with mark red.

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Mark	Bore diameter	
1	77.98 – 77.99 mm (3.0701 – 3.0704 in.)	Red	78.01 – 78.02 mm (3.0713 – 3.0716 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	77.97 – 77.98 mm (3.0697 – 3.0700 in.)	Blue	78.00 – 78.01 mm (3.0709 – 3.0712 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

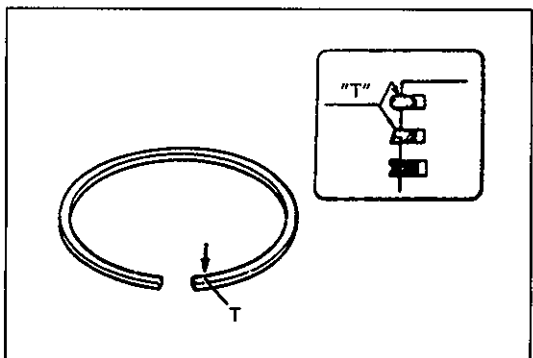
Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.



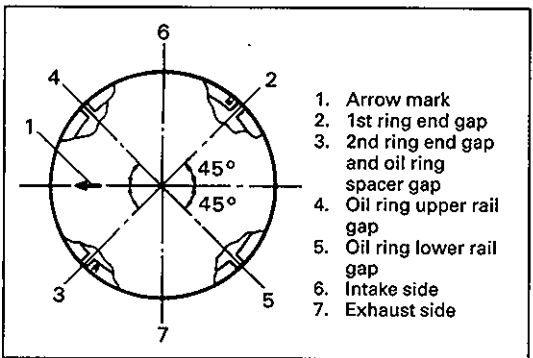
85F00-6A2-76-1



85F00-6A2-76-2



85F00-6A2-76-3



85F00-6A2-76-4

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:

- The "85FA" mark on connecting rod should come on crankshaft pulley side.
- 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 "T" mark. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st rings 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.

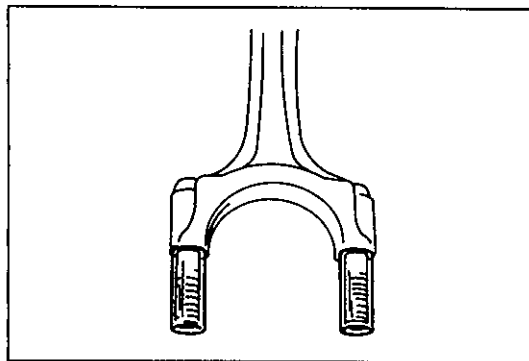
INSTALLATION

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

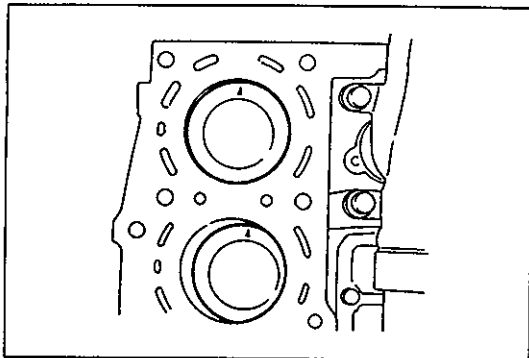
NOTE:

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

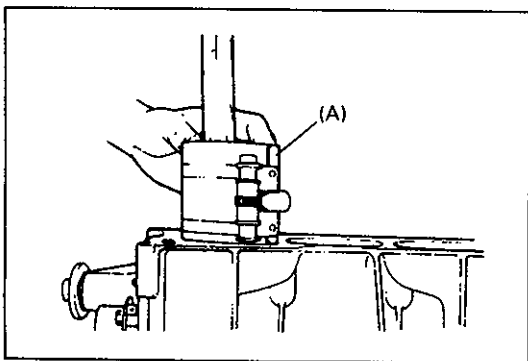
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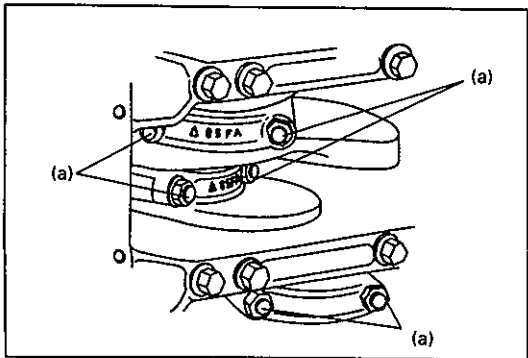
60A50-6A2-68-2S



85F00-6A2-77-3



60A50-6A2-68-4S



85F00-6A2-77-5

- 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): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- 6) Install cylinder heads and oil pump to cylinder block.
Refer to item "VALVES AND CYLINDER HEADS" and "OIL PUMP" in this section.
- 7) Install valve lash adjusters, camshafts and RH bank 2nd timing chain.
Refer to item "CAMSHAFT AND VALVE LASH ADJUSTER" and "RH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 8) Install 1st timing chain.
Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 9) Install LH bank 2nd timing chain.
Refer to item "LH BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
- 10) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
- 11) Install oil pan and pump strainer.
Refer to item "OIL PAN AND OIL PUMP STRAINER" in this section for installation.
- 12) Install cylinder head cover.
Refer to item "CYLINDER HEAD COVER" in this section for installation.
- 13) Install exhaust manifold.
Refer to item "EXHAUST MANIFOLD" in this section for installation.
- 14) Install radiator outlet pipe, radiator, cooling fan and water hose.
Refer to Section 6B for installation.
- 15) Install throttle body and intake manifold.
Refer to item "THROTTLE BODY AND INTAKE MANIFOLD" in this section for installation.
- 16) Adjust water pump drive belt tension.
Refer to Section 6B for adjusting procedure.
- 17) Adjust power steering pump drive belt tension.
Refer to Section 3B3-4 for adjusting procedure.
- 18) Adjust accelerator cable play and A/T throttle cable play.
Refer to Section 6E2.
- 19) Check to ensure that all removed parts are back in place.
Reinstall any necessary parts which have not been reinstalled.
- 20) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
- 21) Refill cooling system referring to Section 6B.
- 22) Refill front differential housing with gear oil, referring to "DIFFERENTIAL" section.
- 23) Connect negative cable at battery.
- 24) Check ignition timing and adjust as necessary, referring to Section 6F2.
- 25) Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each connection.
- 26) Check wheel alignment, referring to SECTION 3.

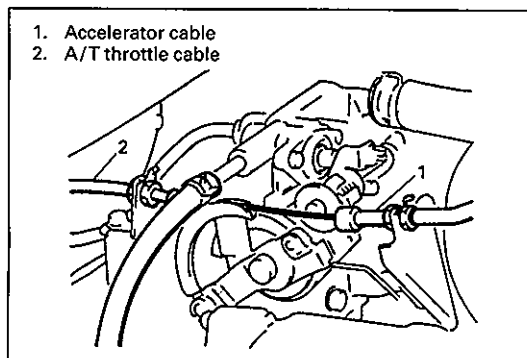
UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

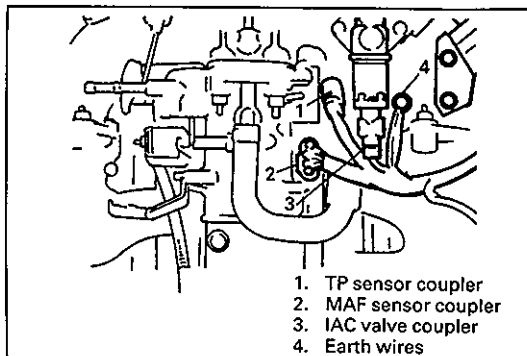
REMOVAL

- 1) Release fuel pressure in fuel feed line.
Refer to Section 6.
- 2) Disconnect negative cable at battery.
- 3) Remove engine hood.
- 4) Drain oil.
- 5) Drain coolant.
- 6) Remove radiator, radiator fan shroud, cooling fan and radiator reservoir. Refer to Section 6B for removal.
- 7) Disconnect accelerator cable and A/T throttle cable (for A/T vehicle) from throttle body.
- 8) Remove strut tower bar.
- 9) Remove air cleaner upper case, intake air hose, intake air pipe and surge tank pipe as a component.
- 10) Remove engine oil level gauge guide and A/T fluid level gauge guide (For A/T vehicle)

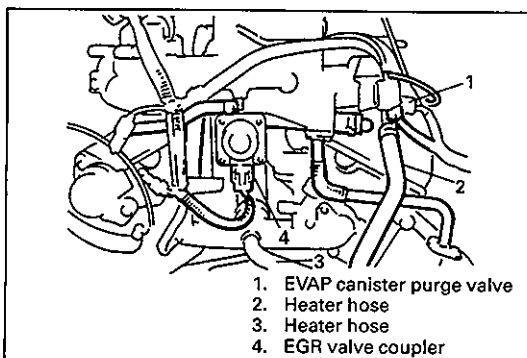
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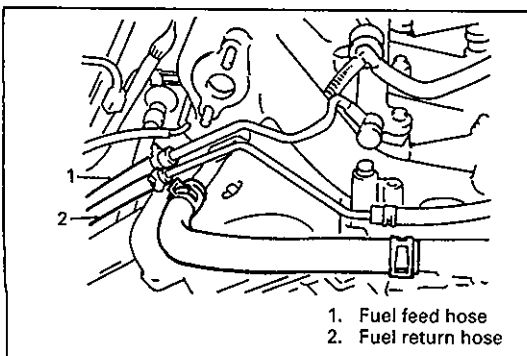
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85F00-6A2-79-5

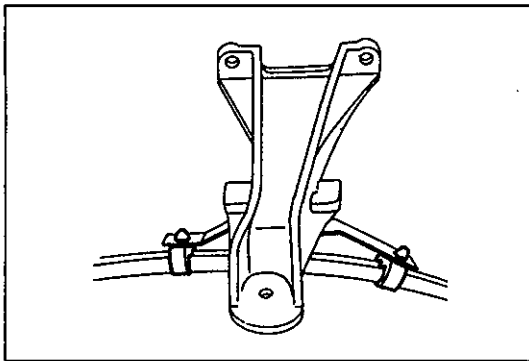
11) Disconnect following electric lead wires:

- Injector wire
- CMP sensor coupler
- Ignition coil wire
- TP sensor coupler
- MAF sensor coupler
- IAC valve coupler
- Earth wire from intake collector
- EVAP canister purge valve coupler
- EGR valve coupler
- Oxygen sensor wires
- Coolant temperature sensor coupler
- Coolant temperature switch coupler
- Generator wires
- Startor wires
- Oil pressure wire
- PS pump wire
- Earth wire from generator bracket

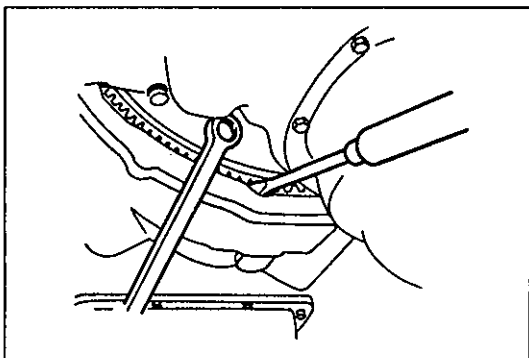
12) Disconnect following hoses:

- Fuel feed hose from fuel feed pipe
- Fuel return hose from fuel return pipe
- Heater hose from heater water pipe
- Heater hose from water outlet cap
- EVAP canister hose from canister pipe
- Brake booster vacuum hose

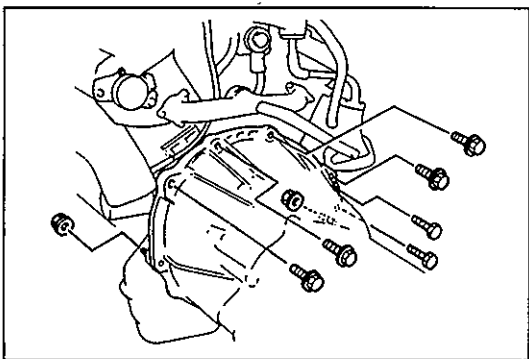
13) Remove EVAP canister.



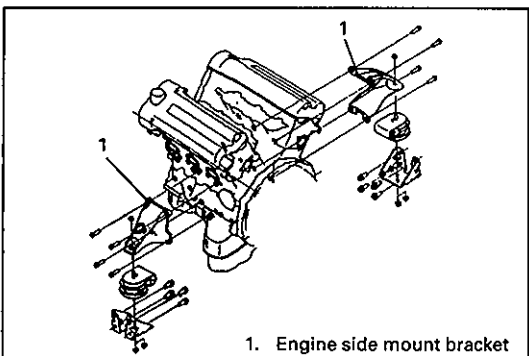
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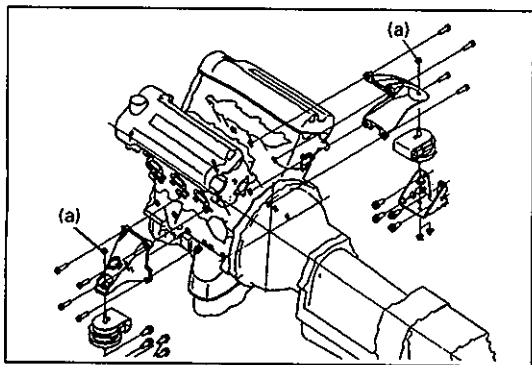
- 14) Raise vehicle
- 15) Remove front differential housing with differential from chassis. Refer to Section 7E for removal.
- 16) Remove exhaust No.1 pipe. Refer to item "EXHAUST MANIFOLD" in this section for removal.
- 17) Remove A/T fluid hose clamps from engine mounting bracket. (for A/T vehicle)

- 18) Remove clutch housing lower plate.
- 19) Remove torque converter bolts. (for A/T vehicle)
- 20) Remove starter motor.
- 21) Lower vehicle.

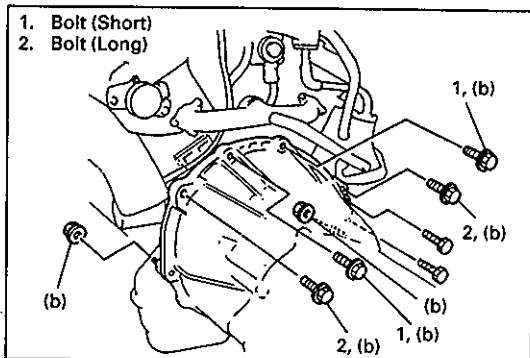
- 22) Support transmission. For A/T vehicle, don't jack under A/T oil pan to support transmission.
- 23) Remove bolts and nuts fastening cylinder block and transmission.

- 24) Install lifting device.
- 25) Disconnect engine side mounting brackets to engine mountings.

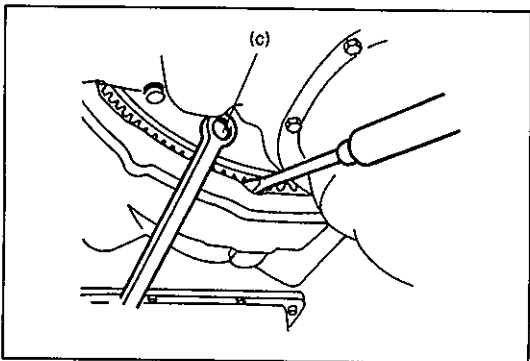
- 26) Before lifting engine, check to ensure all hoses, wires and cables are disconnected from engine.
- 27) Remove engine assembly from chassis and transmission by sliding toward front, and then, carefully hoist engine assembly.



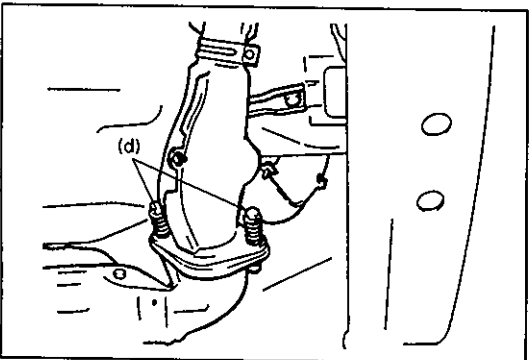
85F00-6A2-81-1



85F00-6A2-81-2



85F00-6A2-81-3



85F00-6A2-81-4

INSTALLATION

Reverse removal procedure for installation, noting following points.

- 1) Lower engine assembly into engine compartment. Connect engine to transmission and engine side mounting brackets to engine mountings.
- 2) Tighten nuts fastening engine side mounting brackets and engine mountings.

Tightening Torque

(a): 50 N·m (5.0 kg-m, 36.0 lb-ft)

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

Tightening Torque

(b): 80 N·m (8.0 kg-m, 58.0 lb-ft)

- 4) Remove lifting device

- 5) Tighten torque converter bolts to specified torque. (for A/T vehicle)

Tightening Torque

(c): 65 N·m (6.5 kg-m, 47.0 lb-ft)

- 6) Tighten bolts and nuts of exhaust No.1 pipe to specified torque

Tightening Torque

(d): 50 N·m (5.0 kg-m, 36.0 lb-ft)

- 7) Install front differential housing with differential to chassis. Refer to Section 7E for installation.

- 8) Reverse disconnected hoses, cables and electric wires for connection.

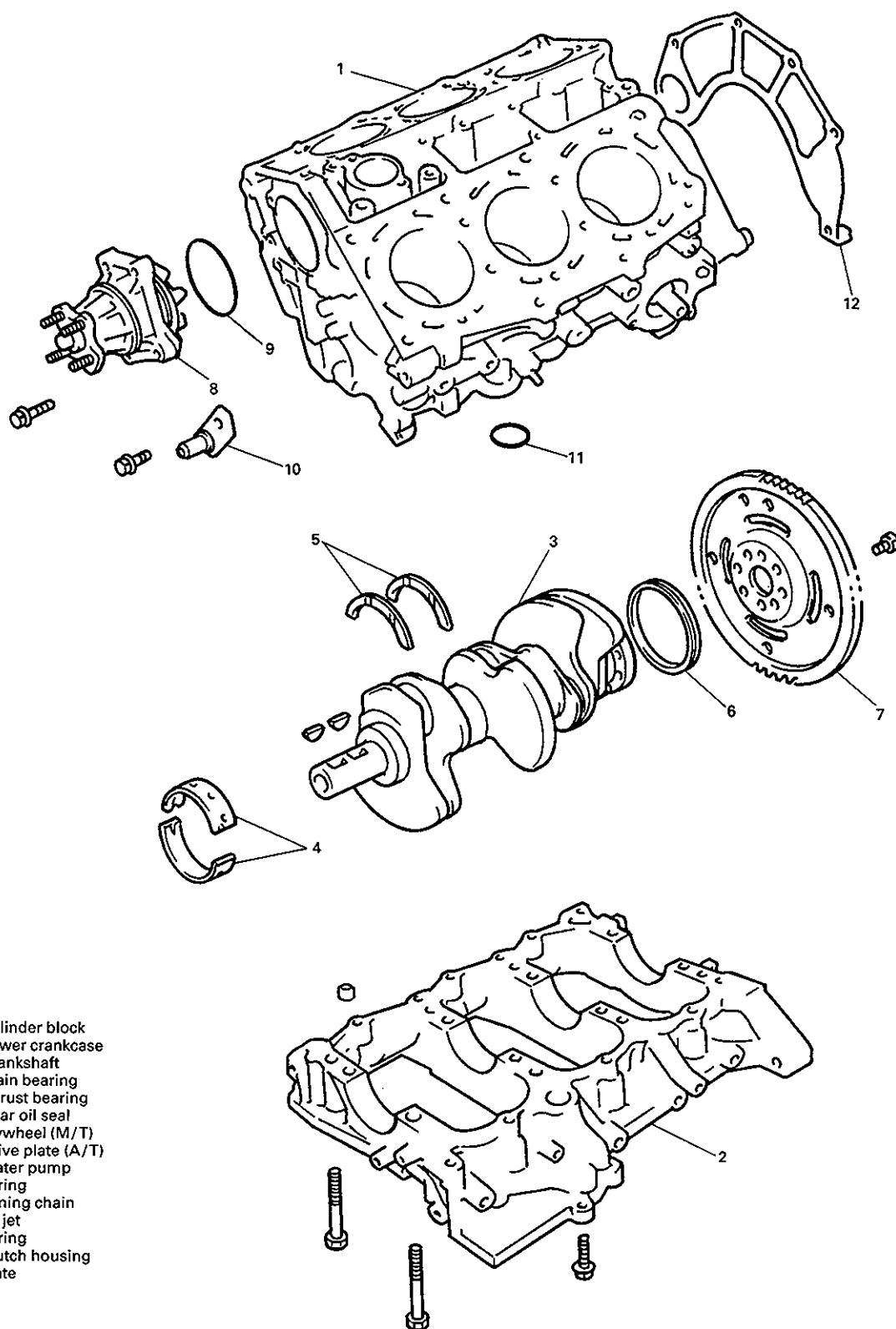
- 9) Adjust accelerator cable and A/T throttle cable (for A/T vehicle) according to procedure described in Section 6E2.
- 10) Refill engine with engine oil referring to item "ENGINE OIL CHANGE" in Section 0B.
- 11) Refill cooling system, referring to Section 6B.
- 12) Check to ensure that all fasteners and clamps are tightened.

85F00-6A2-82-1

- 13) Upon completion of installation, verify that there is no fuel leakage, coolant leakage or exhaust gas leakage at each connection.

85F00-6A2-82-2

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



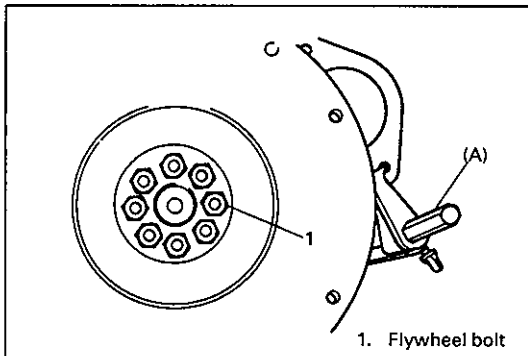
1. Cylinder block
2. Lower crankcase
3. Crankshaft
4. Main bearing
5. Thrust bearing
6. Rear oil seal
7. Flywheel (M/T)
Drive plate (A/T)
8. Water pump
9. O-ring
10. Timing chain
oil jet
11. O-ring
12. Clutch housing
plate

REMOVAL

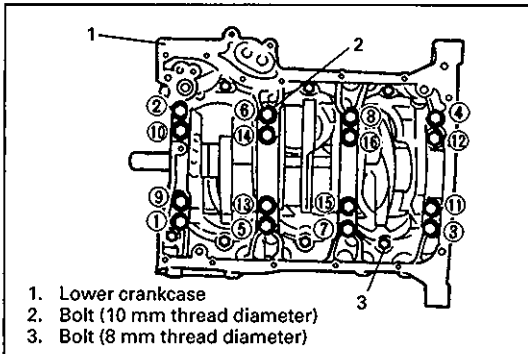
- 1) Remove engine assembly from vehicle as previously outlined.
- 2) Remove clutch and flywheel (for M/T vehicle) or drive plate (for A/T vehicle). For clutch removal, refer to Section 7C1.
- 3) Remove throttle body, intake manifold, exhaust manifolds.
- 4) Remove oil pans (lower and upper) and oil pump strainer. Refer to item "OIL PAN AND OIL PUMP STRAINER" in this section for removal.
- 5) Remove cylinder head cover.
- 6) Remove timing chain cover. Refer to item "TIMING CHAIN COVER" in this section for removal.
- 7) Remove timing chains and chain tensioners, LH Bank 2nd timing chain, 1st timing chain and RH Bank 2nd timing chain.
- 8) Remove cylinder head assembly.
- 9) Remove pistons and connecting rods.
- 10) Remove oil pump and oil pump chain.
- 11) Using special tool (flywheel holder), remove flywheel (M/T vehicle) or drive plate (A/T vehicle).

Special Tool**(A): 09924-17810**

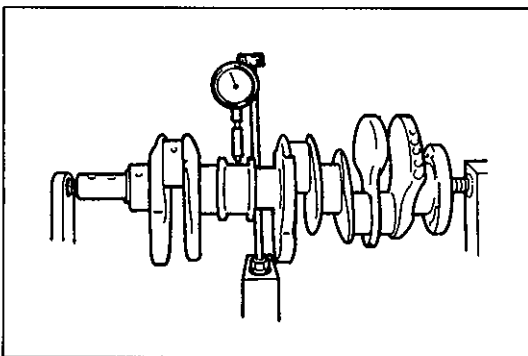
- 12) Loosen crankcase bolts, following sequence in figure and remove them.
- 13) Remove crankshaft from cylinder block.



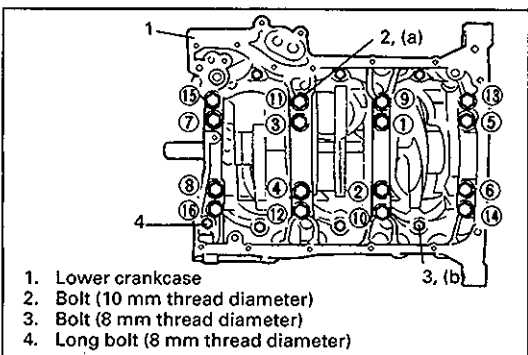
85F00-6A2-84-2



85F00-6A2-84-3



85F00-6A2-84-4



85F00-6A2-84-5

INSPECTION**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.)

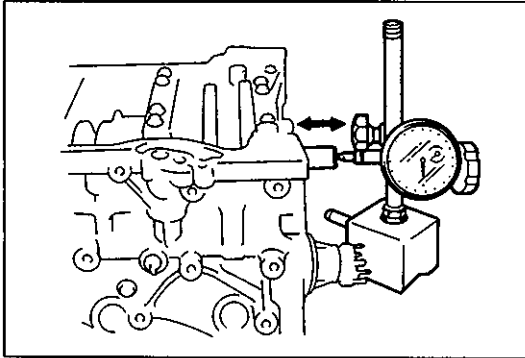
Crankshaft thrust play

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed. Tighten crankcase bolts to specified torque in such order as indicated in figure.

Tightening Torque

(a): 58 N·m (5.8 kg-m, 42.0 lb-ft)

(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



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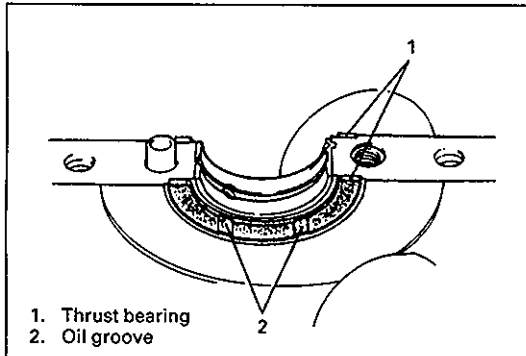
Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.

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

Crankshaft Thrust Play

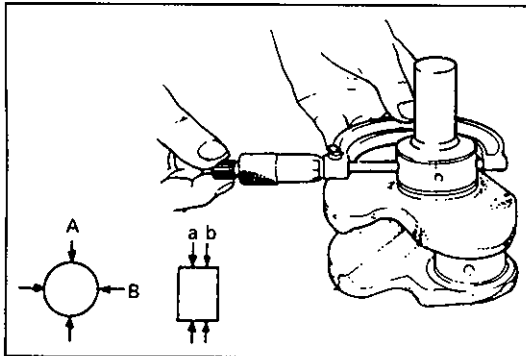
Standard: 0.11 – 0.31 mm (0.0044 – 0.0122 in.)

Limit: 0.38 mm (0.0149 in.)



85F00-6A2-85-2

Thickenss of crankshaft thrust bearing	Standard	2.500 mm (0.984 in.)
	Oversize: 0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)



85F00-6A2-85-3

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

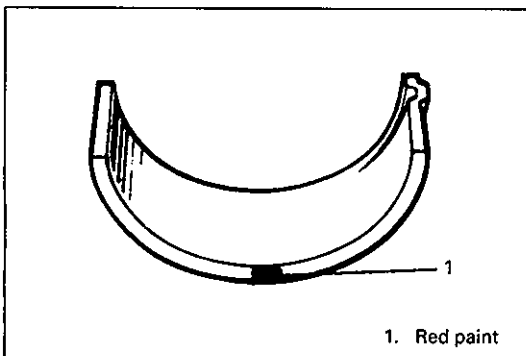
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

Diameter of journal: 57.982 – 58.000 mm (2.2828 – 2.2834 in.)

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

Out-of-round: A – B

Taper: a – b



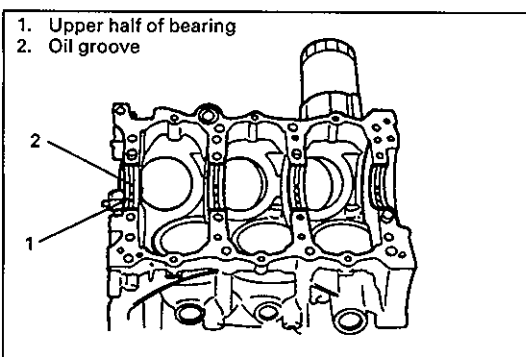
85F00-6A2-85-4

Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and standard size has 5 kinds of bearings differing in tolerance.

To distinguish undersize bearing, it is painted red at the position as indicated in figure. Undersize bearing thickness is 2.124 – 2.128 mm (0.0836 – 0.0837 in.) at the center of bearing.



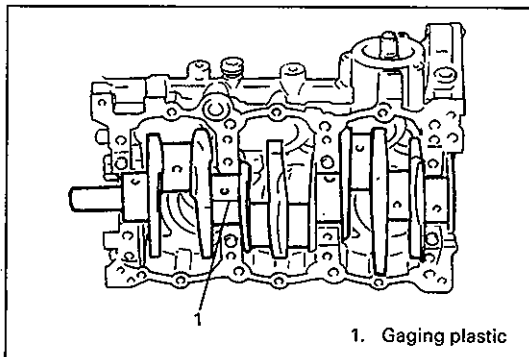
85F00-6A2-85-5

- Upper half of bearing has oil groove as shown in figure. Install this half with oil groove toward cylinder block.
- Lower half of bearing does not have oil groove.

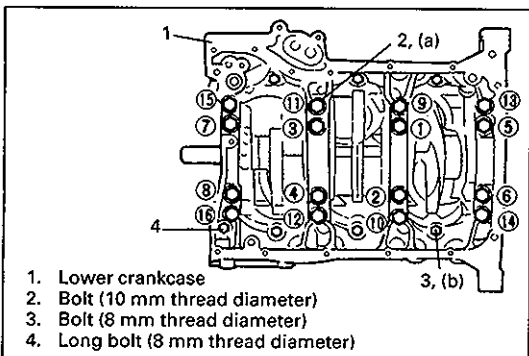
Inspect

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

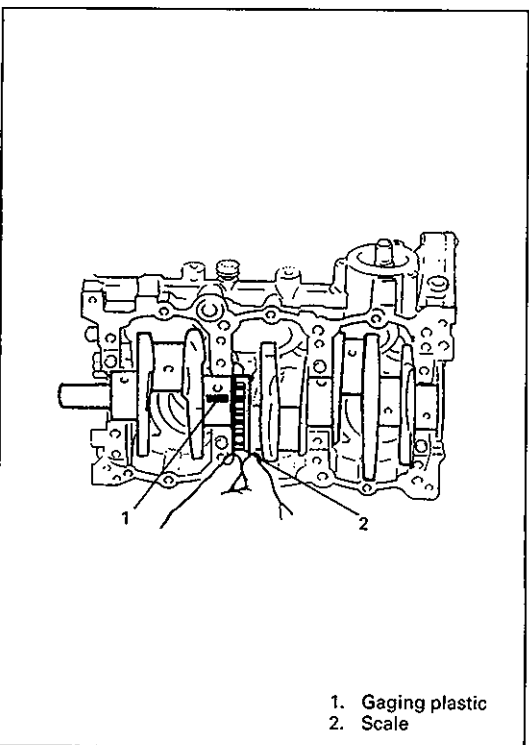
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85F00-6A2-86-3

**Main bearing clearance**

Check clearance by using gaging plastic according to following procedure.

1. Remove crankcase.
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 crankcase to cylinder block.
Tighten crankcase bolts, following sequence in figure.
Tighten crankcase bolts to specified torque.

Tightening Torque

(a): 58 N·m (5.8 kg-m, 42.0 lb-ft)

(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

NOTE:

Do not rotate crankshaft while gaging plastic is installed.

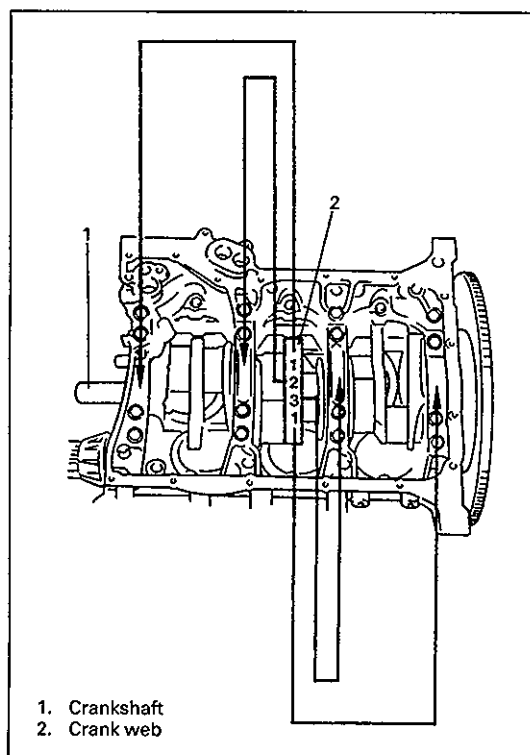
5. Remove crankcase and using scale on gaging plastic envelop, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance. If not, it will be necessary to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

Bearing Clearance

Standard: 0.026 – 0.046 mm (0.0010 – 0.0018 in.)

Limit: 0.060 mm (0.0023 in.)

85F00-6A2-86-4



85F00-6A2-87-1

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.

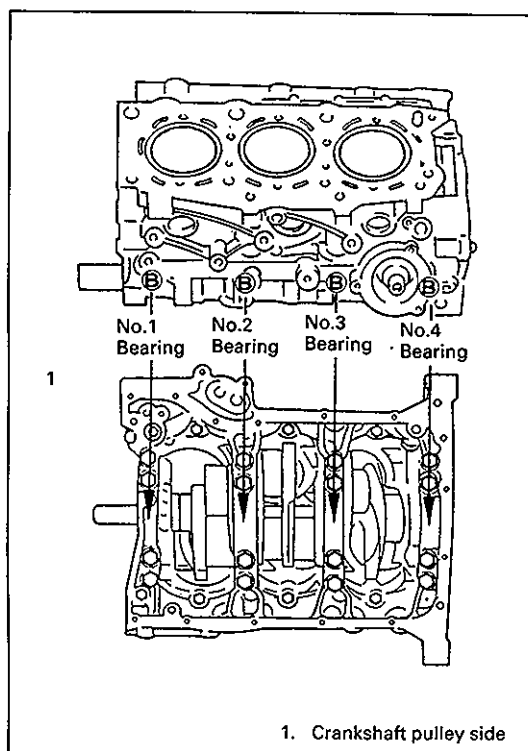
1. First check journal diameter. As shown in figure, crank web has stamped numbers and alphabet at the center. Three kinds of numbers ("1", "2" and "3") represent following journal diameters.

Stamped numbers	Journal diameter
1	57.994 – 58.000 mm (2.2833 – 2.2834 in.)
2	57.988 – 57.994 mm (2.2830 – 2.2832 in.)
3	57.982 – 57.988 mm (2.2827 – 2.2829 in.)

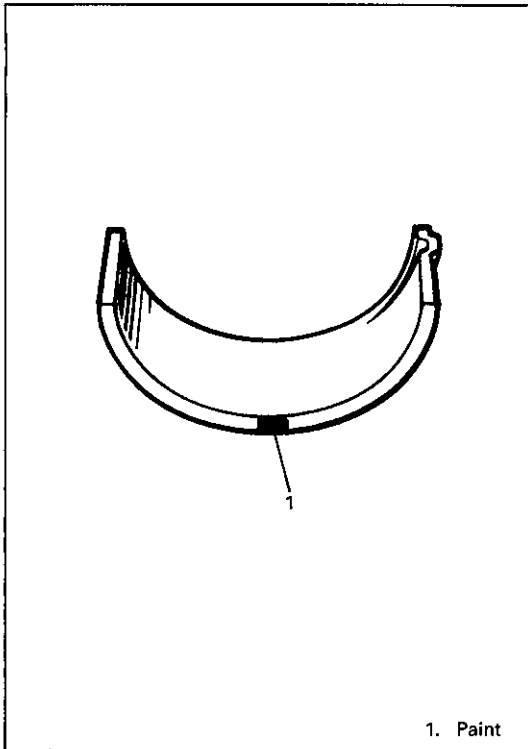
2. Next, check crankcase (bearing cap) bore diameter without bearing. On mating surface of crankcase lower-side 4 alphabets are stamped as shown in figure.

Three kinds of alphabets (A, B and C) represent following cap bore diameters.

Stamped alphabet	Bearing cap bore diameter (without bearing)
A	62.000 – 62.006 mm (2.4410 – 2.4411 in.)
B	62.006 – 62.012 mm (2.4412 – 2.4414 in.)
C	62.012 – 62.018 mm (2.4415 – 2.4416 in.)



85F00-6A2-87-3



85F00-6A2-88-1

3. There are five kinds of 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	1.993 – 1.997 mm (0.0785 – 0.0786 in.)
Black	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Colorless (no paint)	1.999 – 2.003 mm (0.0787 – 0.0788 in.)
Yellow	2.002 – 2.006 mm (0.0788 – 0.0789 in.)
Blue	2.005 – 2.009 mm (0.0789 – 0.0790 in.)

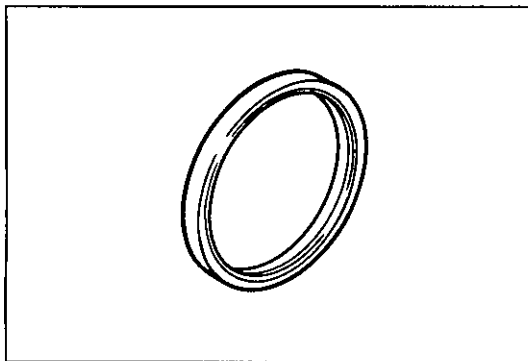
4. From number stamped on crank webs at its center and alphabets stamped on crankcase lower side, determine new standard bearing to be installed to journal, by referring to table shown below.

For example, if number stamped on crank webs is "1" and alphabet stamped on crankcase is "B", install a new standard bearing painted in "Black" to its journal.

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

85F00-6A2-88-3

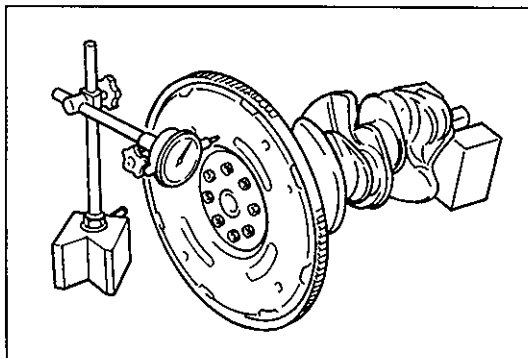
5. Using gaging plastic, check bearing clearance with newly selected standard bearing.
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6. When replacing crankshaft or cylinder block and crank case due to any reason, select new standard bearings to be installed by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



85F00-6A2-89-1

Rear Oil Seal

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

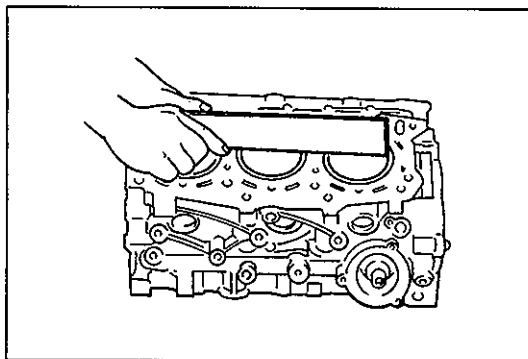


85F00-6A2-89-2

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 a dial gauge. If runout exceeds its limit, replace flywheel.

Limit on runout: 0.2 mm (0.0078 in.)



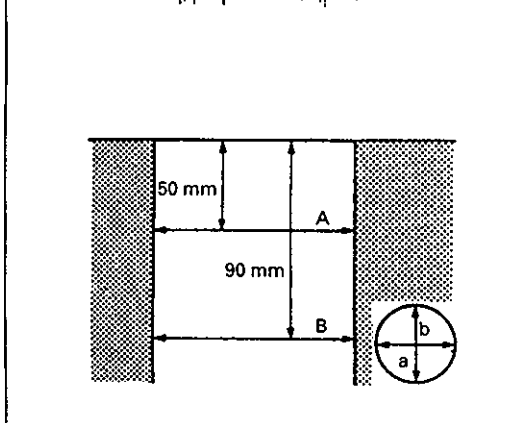
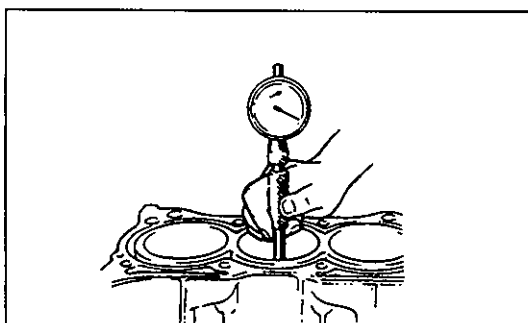
85F00-6A2-89-3

Cylinder Block

Distortion of gasketed surface

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

Flatness Limit: 0.06 mm (0.0024 in.)



85F00-6A2-89-4

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
STD	77.970 – 77.990 mm (3.0997 – 3.0704 in.)
O/S 0.25	78.220 – 78.230 mm (3.0796 – 3.0799 in.)
O/S 0.50	78.470 – 78.480 mm (3.0894 – 3.0897 in.)

3. Using micrometer, measure piston diameter.
4. Calculate cylinder bore diameter to be rebored as follows.

$$D = A + B - C$$

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.)

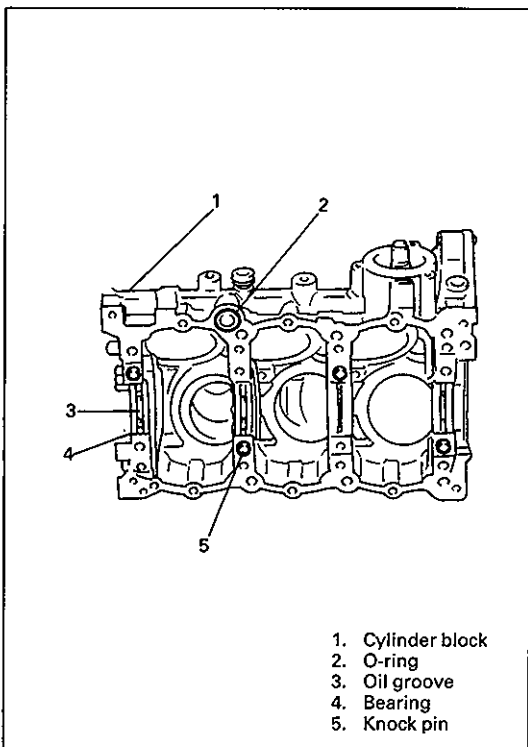
5. Rebore and hone cylinder to calculated dimension.

NOTE:

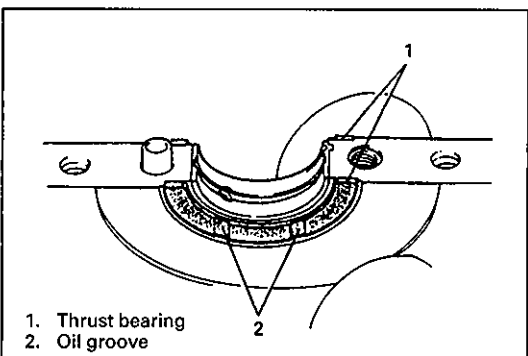
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6. Measure piston clearance after honing.

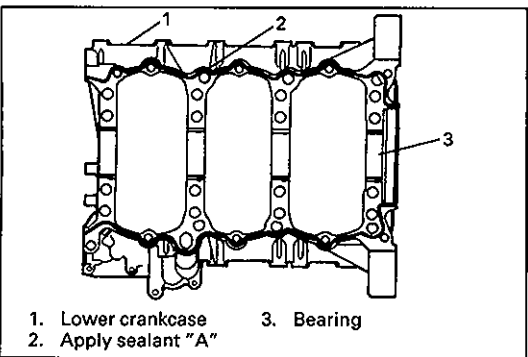
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85F00-6A2-90-4

**INSTALLATION****NOTE:**

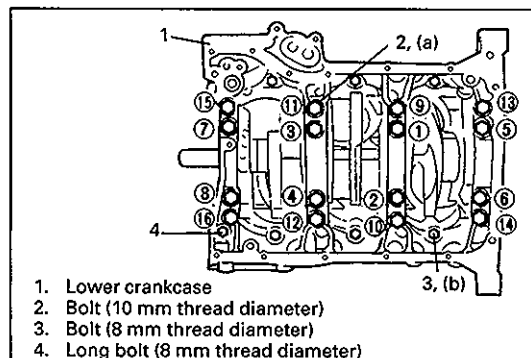
- All parts to be installed must be perfectly clean.
- Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.
- Journal bearings, crankcase (bearings caps), connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb combination and try to see that each part goes back to where it came from, when installing.
- Clean mating surface of cylinder block and crankcase, remove oil, old sealant and dust from mating surface.

1. Fit main bearings to cylinder block.
One of two halves of main bearing, has oil groove. Install this half with oil groove to cylinder block, and another half without oil groove to crankcase.
Make sure that two halves are painted in the same color.
2. Install O-ring to cylinder block.
3. Fit thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.
4. Put crankshaft to cylinder block.

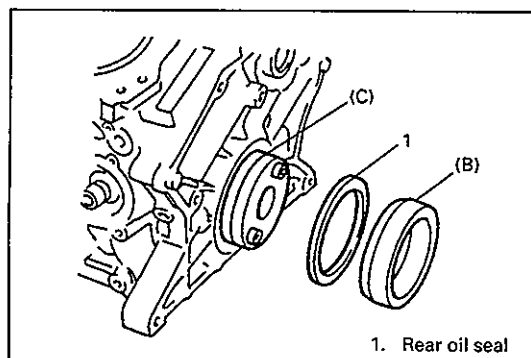
5. Apply sealant "A" to crankcase mating surface area as shown in figure.

"A": Sealant 99000-31150

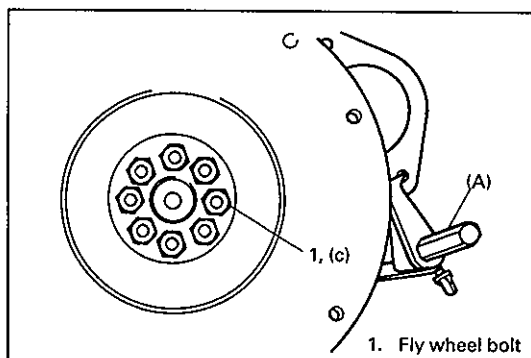
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85F00-6A2-91-1



85F00-6A2-91-2



85F00-6A2-91-3

6. Install crankcase to cylinder block. Apply oil to crankcase bolts before installing them. Tighten crankcase bolts, following sequence in figure. Tighten crankcase bolts to specified torque.

Tightening Torque

(a): 58 N·m (5.8 kg-m, 42.0 lb-ft)

(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

NOTE:

After tightening crankcase bolts, check to be sure that crankshaft rotates smoothly when turned by hand.

7. Using special tools (Oil seal installer and oil seal guide), install rear oil seal.

Special Tool

(B): 09911-97810

(C): 09911-97710

8. Install flywheel (M/T vehicle) or drive plate (A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specification.

Special Tool

(A): 09924-17810

Tightening Torque

(c): 70 N·m (7.0 kg-m, 50.5 lb-ft)

9. Install oil pump, pistons and connecting rods as previously outlined.
10. Install oil pump strainer and oil pan.
11. Install cylinder heads assembly to cylinder block.

NOTE:

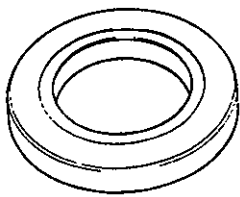
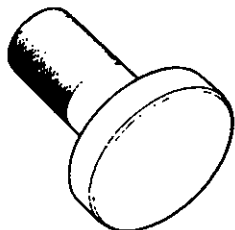
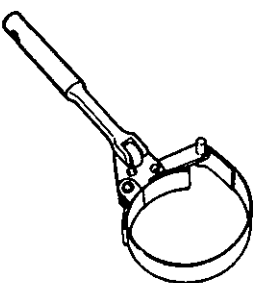
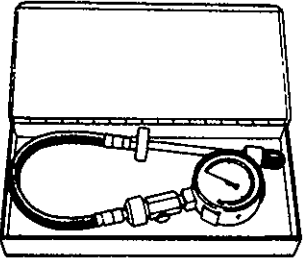
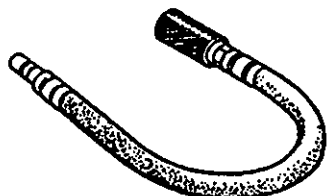
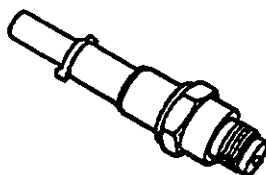
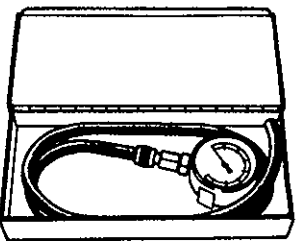
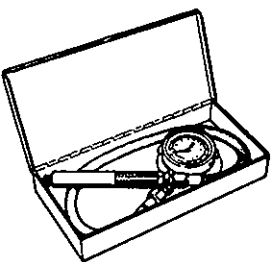
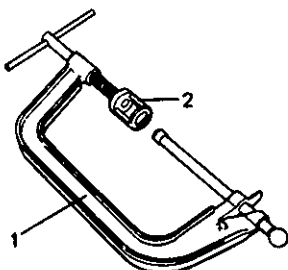
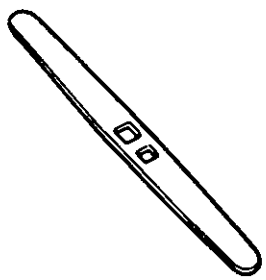
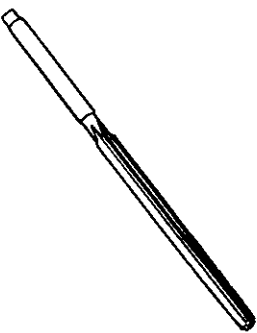
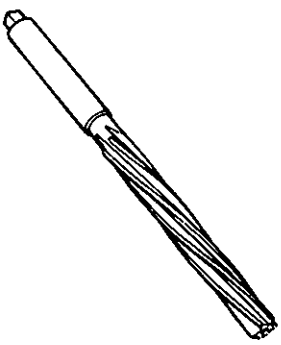
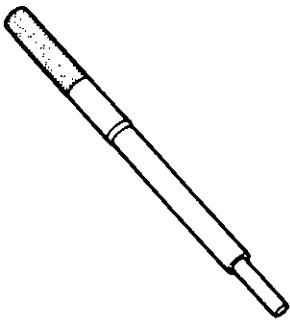
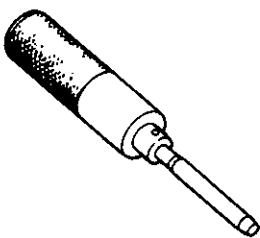
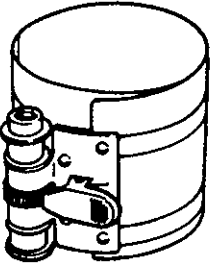
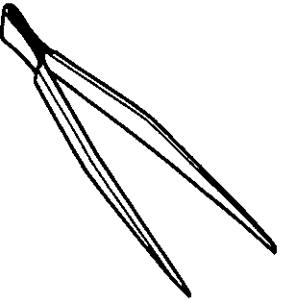
Tighten cylinder head bolts to specified torque as previously outlined.

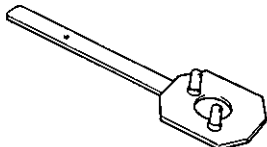
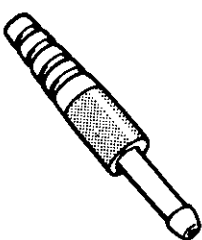
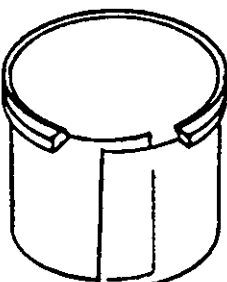
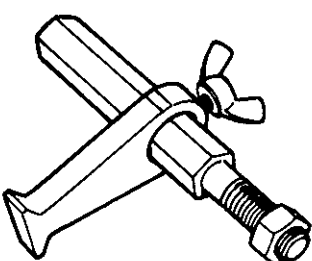
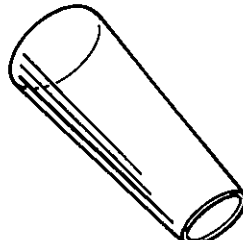
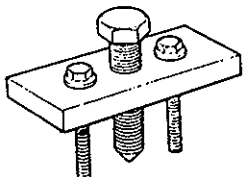
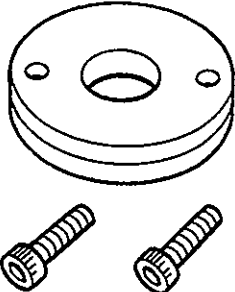
Whenever installing cylinder head to new cylinder block, use following procedure to tighten cylinder head bolts.

- **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.**

12. Install crankshaft oil pump sprocket, timing chain sprocket, oil pump chain, timing chain, timing chain cover, crankshaft pulley, water pump pulley, etc., as previously outlined.
13. Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to Section 7C1.
14. Install engine assembly to vehicle as previously outlined.

SPECIAL TOOLS

 09911-97810 Oil seal installer	 09913-75510 Bearing installer	 09915-47310 Oil filter wrench	 09915-64510 Compression gauge
 09915-64530 Compression gauge hose	 09915-67010 Compression gauge attachment (c)	 09915-67310 Vacuum gauge	 09915-77310 Oil pressure gauge
 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment	 09916-34541 Reamer handle	 09916-37810 Reamer (6 mm)	 09916-38210 Reamer (11 mm)
 09916-44910 Valve guide remover	 09916-58210 Valve guide installer handle	 09916-77310 Piston ring compressor	 09916-84510 Forceps

			
09917-68221 Camshaft lock holder	09917-87810 Valve guide installer	09917-98221 Valve stem seal installer	09918-08210 Vacuum gauge hose joint
			
09919-28610 Protective sleeve	09924-17810 Flywheel holder	09926-18210 Oil seal guide (Vinyl resin)	09926-58010 Bearing puller attachment
			
09944-36011 Steering wheel remover	09911-97710 Oil seal guide		

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REQUIRED SERVICE MATERIAL

RECOMMENDED SUZUKI PRODUCT	USE
Sealant 1207C 99000-31150	• To apply to mating surfaces of cylinder block and oil pan. • To apply to mating surfaces of cylinder block and timing chain cover.

85F00-6A2-93-2

SECTION 6B**ENGINE COOLING****CONTENTS**

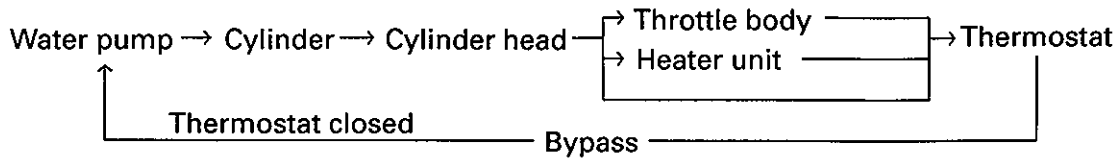
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GENERAL DESCRIPTION

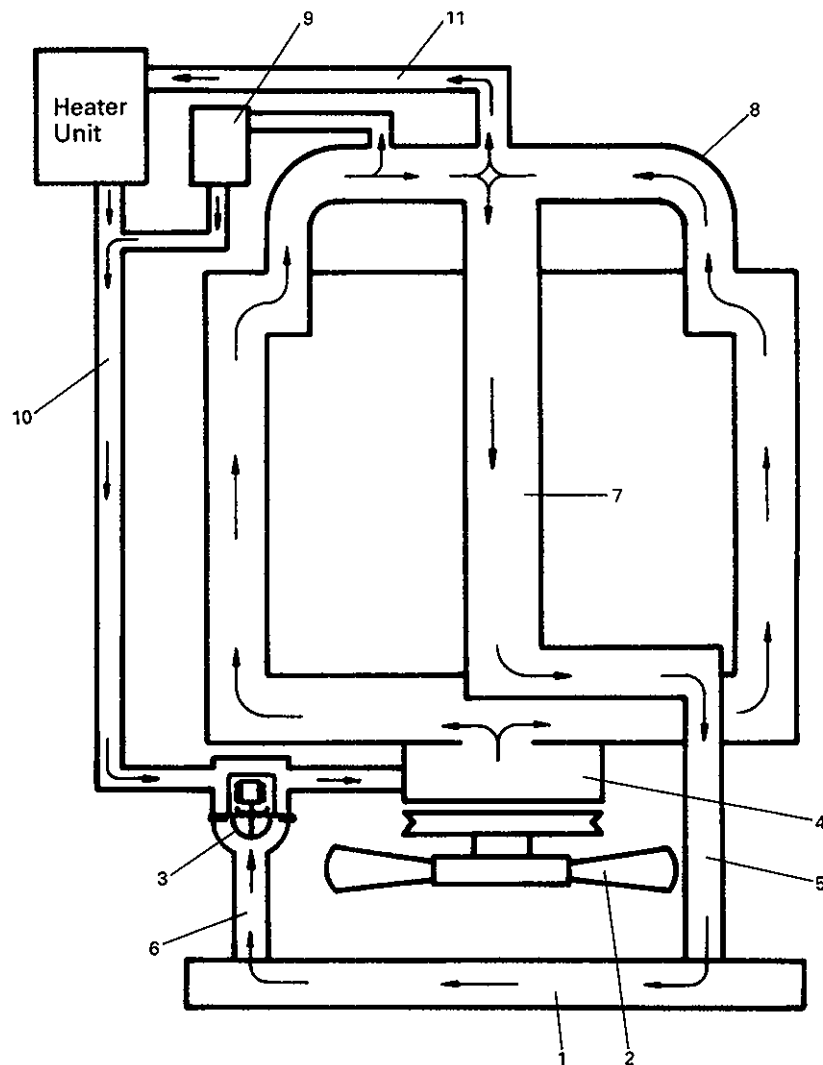
The cooling system consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan, and thermostat. The radiator is of tube-and-fin type.

COOLING SYSTEM CIRCULATION

1) While the engine is warmed up (thermostat closed), coolant circulates as follows.

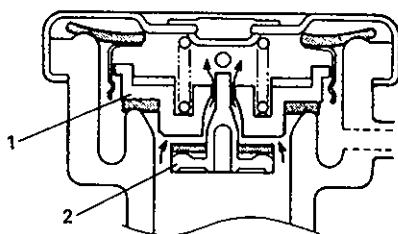


2) When coolant is warmed up to normal temperature and the thermostat opens, coolant passes through the radiator core to be cooled as well as the above flow circuit.

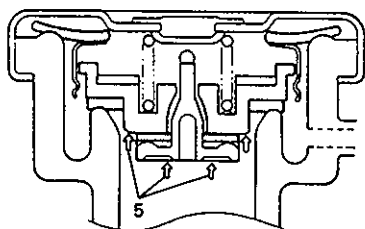


1. Radiator
2. Cooling fan
3. Thermostat
4. Water pump
5. Radiator inlet way
6. Radiator outlet way
7. Outlet pipe
8. Outlet cap
9. Throttle body
10. Heater outlet way
11. Heater inlet way

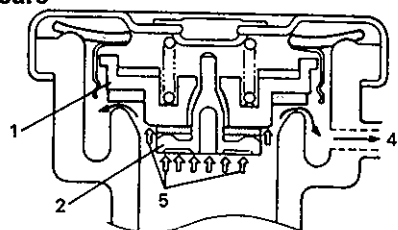
At air bleed



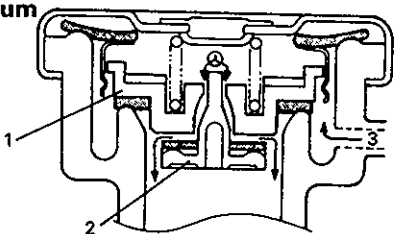
At valves closed



At pressure relief



At vacuum relief



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

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RADIATOR CAP

A pressure-vent cap is used on the radiator. The cap contains a pressure valve and ventilation valve.

The pressure valve is held against its seat by a spring of predetermined strength which protects the cooling system by relieving the pressure if the pressure in cooling system rises by 90 kPa (0.9 kg/cm², 12.8 psi).

The ventilation valve operates as follows.

- It opens to let the air out of the radiator when the temperature and the pressure in the radiator are lower than ventilation valve weight.
- It closes when the engine has warmed up and the pressure in the radiator has risen.
- It opens when the engine has cooled after being warmed up once and vacuum has occurred in the radiator so as to prevent the coolant level in the radiator from falling and the radiator from being collapsed due to the vacuum in it.

NOTE:

Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir. Coolant should be added only to reservoir 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 of causing a serious fire.

COOLANT RESERVOIR

A "see-through" plastic reservoir is connected to the radiator by a hose. As the vehicle is driven, the coolant is heated and expands. The portion of the coolant displaced by this expansion flows from the radiator into the reservoir.

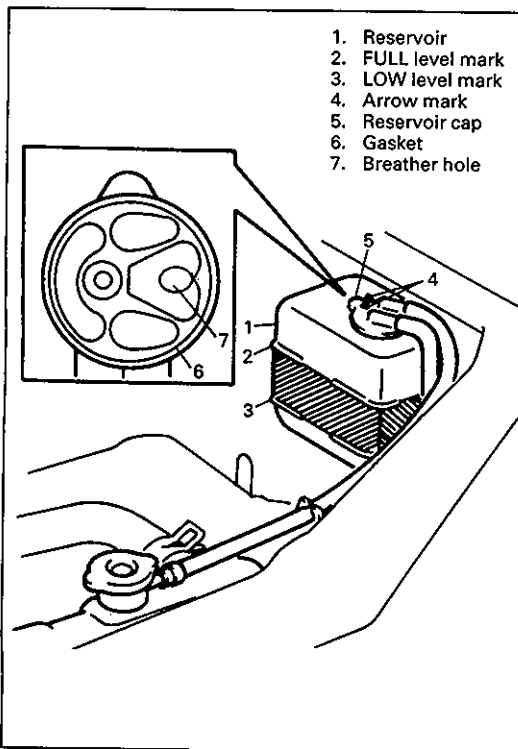
When the vehicle is stopped and the coolant cools and contracts, the displaced coolant is drawn back into the radiator by vacuum.

Thus, the radiator is kept filled with coolant to the desired level at all times, resulting in increased cooling efficiency. Coolant level should be between "FULL" and "LOW" marks on the reservoir.

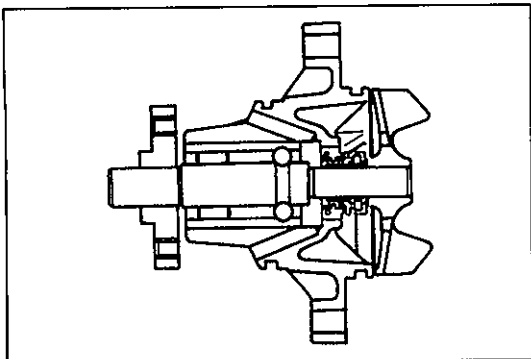
Coolant should be added only to the reservoir as necessary.

NOTE:

- Be sure to check cap gasket is located as shown figure and breather hole is not plugged.
- When installing reservoir cap, align arrow marks on the reservoir and cap.



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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.

THERMOSTAT

A wax pellet type thermostat is used in the coolant outlet passage to control the flow of engine coolant, to provide fast engine warm up and to regulate coolant temperatures.

A wax pellet element is hermetically contained in a metal case, and expands when heated and contracts when cooled.

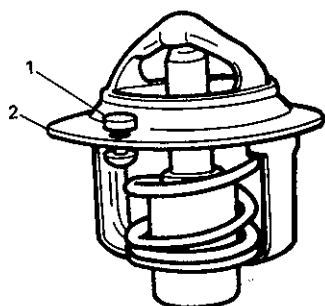
When the pellet is heated and expands, the metal case pushes down the valve to open it.

As the pellet is cooled, the contraction allows the spring to close the valve.

Thus, the valve remains closed while the coolant is cold, preventing circulation of coolant through the radiator.

At this point, coolant is allowed to circulate only throughout the engine to warm it quickly and evenly.

As the engine warms, the pellet expands and the thermostat valve opens, permitting coolant to flow through the radiator. 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.



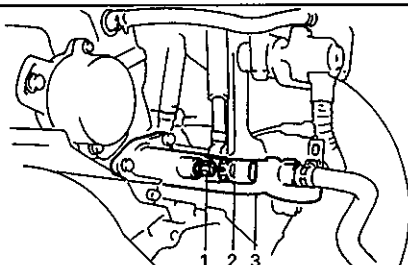
- 1. Air bleed valve
- 2. Thermostat seal

Thermostat functional spec. $\pm 1.5^{\circ}\text{C}$ (2.7°F)	
Temp. at which valve begins to open	82°C (179°F)
Temp. at which valve becomes fully open	95°C (203°F)
Valve lift	More than 8 mm at 95°C

COOLANT (WATER) TEMP. SENSOR

The ECT sensor is located at water outlet cap. This gauge activates a temp. meter gauge in the instrument cluster.

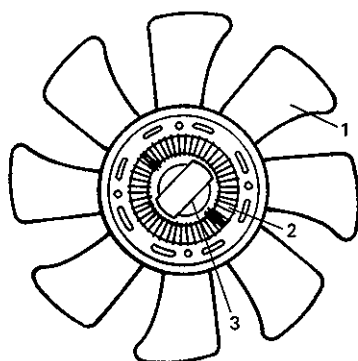
When installing, wind sealing tape on gauge thread and tighten it.



- 1. Coolant temperature switch (for A/C)
- 2. Engine coolant temperature sensor (ECT sensor)
- 3. Water outlet cap

85F00-6B-4-2

85F00-6B-4-5



- 1. Cooling fan
- 2. Fan clutch
- 3. Bimetal

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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.

The clutch is installed to the water pump shaft, so that the cooling fan operates at approximately the same speed as the water pump shaft regardless of the air temperature at the front of the clutch when the water pump shaft turns at low speed (when the engine running at idle speed).

The relation between the temperature detected by the fan clutch and operation of the fan clutch is as follows.

While the fan clutch detects a temperature lower than 50°C, it remains OFF and the fan revolution speed is constant (500 to 800 r/min.(rpm)) regardless of the engine speed. As the temperature reaches 50°C to 70°C, the fan clutch turns ON gradually and the fan revolution speed increases.

A temperature exceeding 70°C causes the fan clutch to turn ON and the fan revolution speed to increase in proportion with the engine speed.

Once the engine speed exceeds 4,000 r/min.(rpm), however, the fan revolution speed becomes constant (2,250 to 2,550 r/min.(rpm)).

NOTE:

Do not disassemble fan clutch.

DIAGNOSIS

Condition	Possible Cause	Correction
Engine overheats	● Loose or broken water pump belt ● Not enough coolant ● Faulty thermostat ● Faulty water pump ● Dirty or bent radiator fins ● Coolant leakage on cooling system ● Defective cooling fan clutch or thermo switch ● Plugged radiator ● Faulty radiator cap	Adjust or replace Check coolant level and add as necessary. Replace. Replace. Clean or remedy. Repair. Check and replace as necessary. Check and replace radiator as necessary. Replace.

85F00-6B-5-2

ANTI-FREEZE PROPORTIONING CHART

Freezing temperature	°C	-16	-36
	°F	3	-33
Antifreeze/Anti-corrosion coolant concentration	%	30	50
Ratio of compound to cooling water	ltr.	2.4/5.6	4.0/4.0
	US pt.	5.1/11.8	8.5/8.5
	Imp. pt.	4.2/9.9	7.1/7.1

COOLANT CAPACITY

Engine, radiator and heater	7.1 liters (15.0/12.5 US/Imp pt.)
Reservoir	0.9 liters (1.9/1.6 US/Imp pt.)
Total	8.0 liters (16.9/14.1 US/Imp pt.)

MAINTENANCE

COOLANT

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir.

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 a 50/50 mixture of water and ethylene glycol antifreeze.

This 50/50 mixture coolant solution provides freezing protection to -36°C (-33°F).

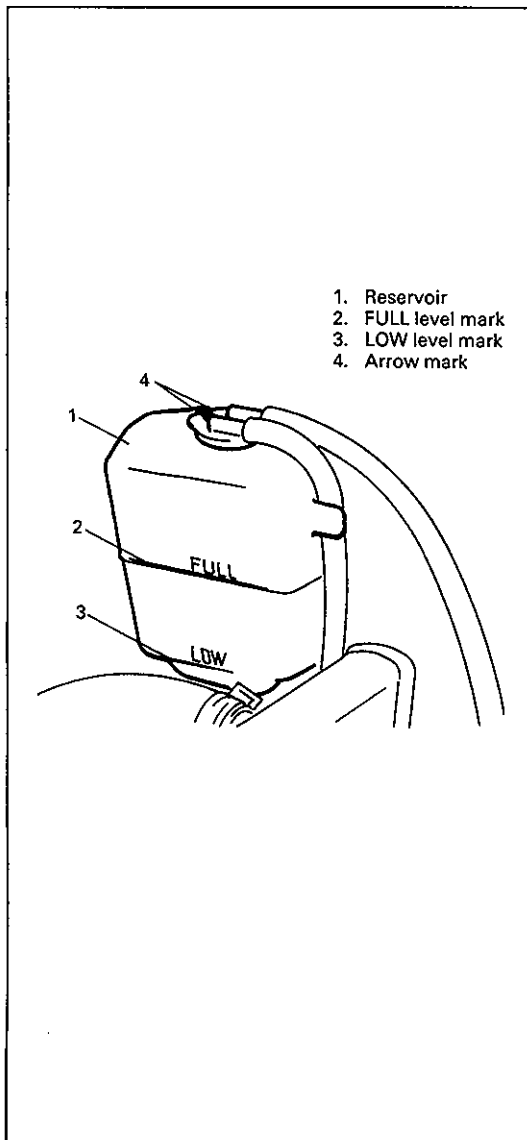
- Maintain cooling system freeze protection at -36°C (-33°F) to ensure protection against corrosion and loss of coolant from boiling.

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).

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.



85F00-6B-7-1

COOLANT LEVEL

To check level, lift hood and look at "see-through" coolant reservoir.

It is not necessary to remove radiator cap to check coolant level.

WARNING:

To help avoid danger of being burned:

- Do not remove reservoir 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.

A normal coolant level should be between "FULL" and "LOW" marks on reservoir.

If coolant level is below "LOW" mark, remove reservoir cap and add proper coolant to reservoir 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, and are unnecessary expense.

- When installing reservoir cap, align arrow marks on reservoir and cap.

COOLING SYSTEM SERVICE

WARNING:

To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot.

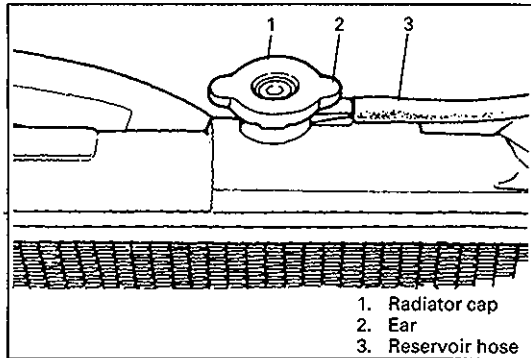
Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

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 90 kPa (0.9 kg/cm², 12.8 psi). If replacement of cap is required, use proper cap specified for this vehicle.

85F00-6B-8-1



85F00-6B-8-2

NOTE:

After installing radiator cap to radiator, make sure that its ear is aligned with reservoir 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.

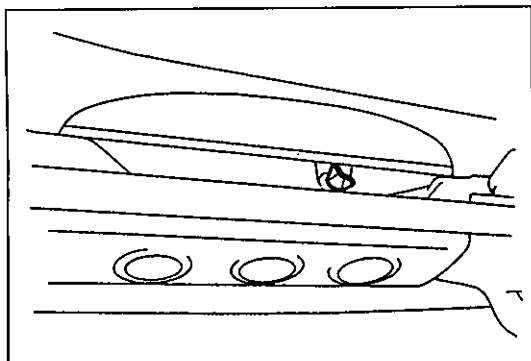
COOLING SYSTEM FLUSH AND REFILL

- 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.

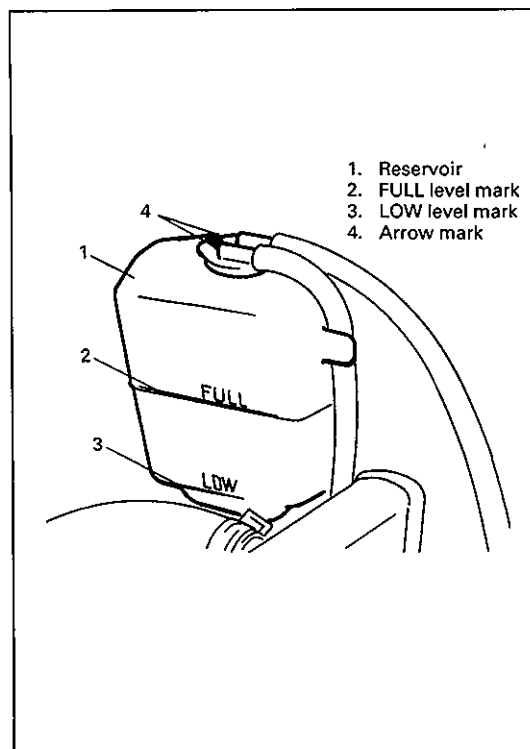
WARNING:

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).



85F00-6B-9-1



85F00-6B-9-2

- 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.

- 7) Disconnect hose from reservoir. Remove reservoir and pour out any fluid. Scrub and clean inside of reservoir with soap and water. Flush it well with clean water and drain. Reinstall reservoir and hose.
- 8) Add 50/50 mixture of good quality ethylene glycol anti-freeze and water to radiator and tank. Fill radiator to the base of radiator filler neck and reservoir to "FULL" level mark. Reinstall reservoir cap, aligning the arrow marks on the reservoir and cap.

- 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 hose.

85F00-6B-9-4

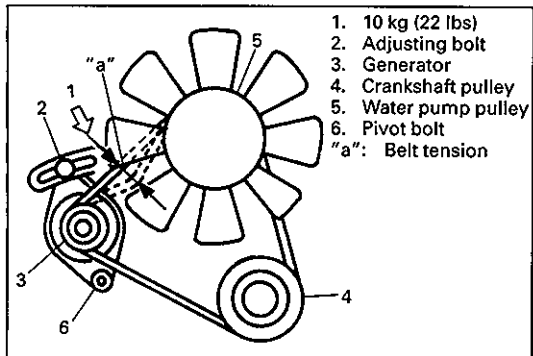
WATER PUMP BELT TENSION

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-13 for procedure.

85F00-6B-10-1



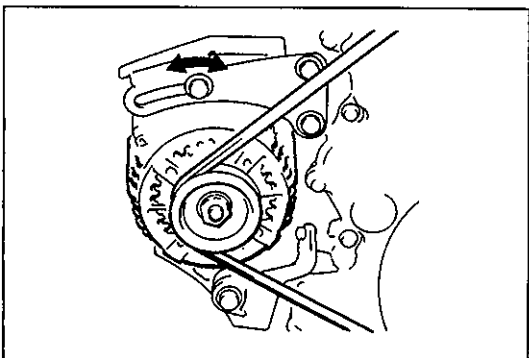
- 2) Check belt for tension. Belt is in proper tension when it deflects 6 to 8 mm (0.24 – 0.32 in.) under thumb pressure (about 10 kg or 22 lb.).

**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.).

85F00-6B-10-2



- 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.

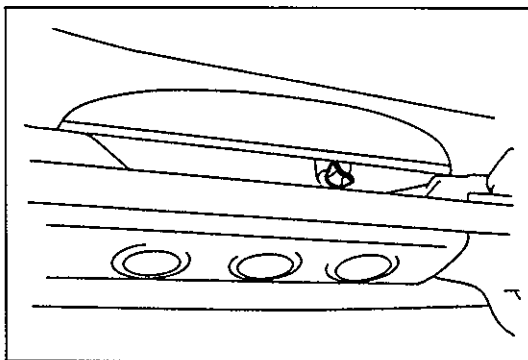
85F00-6B-10-3

ON VEHICLE SERVICE

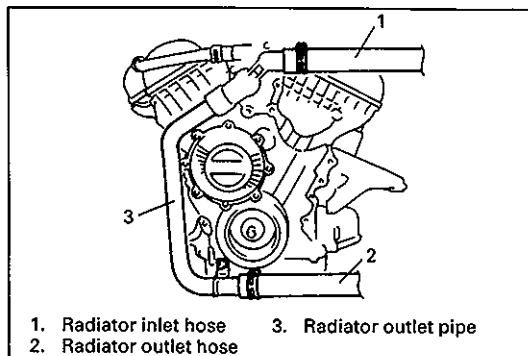
WARNING:

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

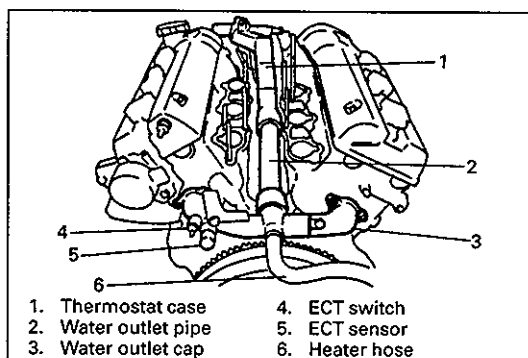
85F00-6B-11-1



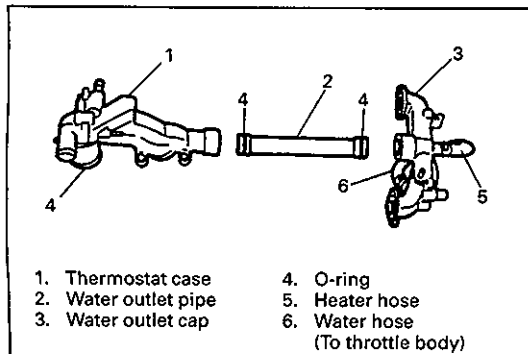
85F00-6B-11-2



85F00-6B-11-3



85F00-6B-11-4



85F00-6B-11-5

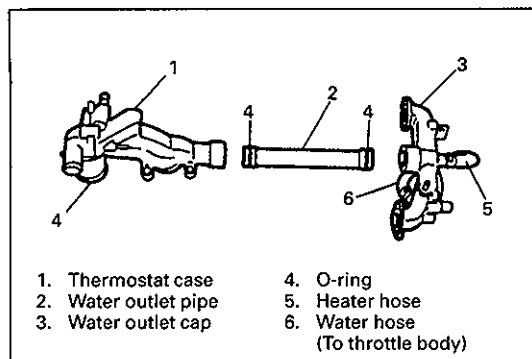
COOLANT DRAINING

- 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 page 6B-6, 6B-7)

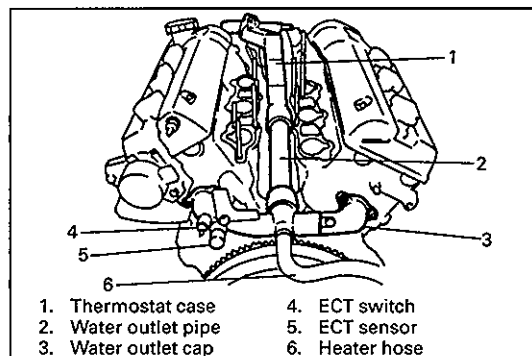
COOLING WATER PIPES AND HOSES

REMOVAL

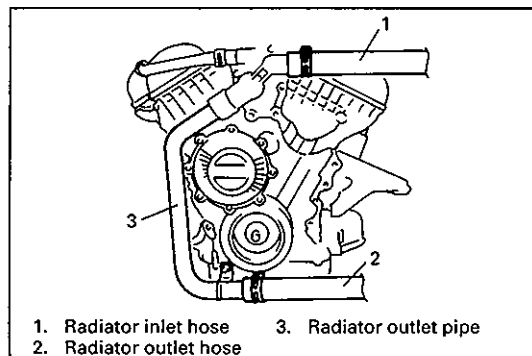
- 1) Disconnect negative cable at battery.
- 2) Drain coolant.
- 3) Remove radiator inlet, outlet hoses and radiator outlet pipe.
- 4) Remove throttle body and intake manifold.
Refer to Section 6A2 for removal.
- 5) Disconnect coolant temperature sensor (ECT sensor) coupler and coolant temperature switch (ECT switch) coupler.
- 6) Disconnect heater inlet hose from water outlet cap.
- 7) Remove water outlet cap from cylinder heads.
- 8) Remove water outlet pipe from thermostat case.
- 9) Remove thermostat case from cylinder block.



85F00-6B-12-1



85F00-6B-12-2



85F00-6B-12-3

INSTALLATION

Install removed parts in reverse order of removal procedure, noting the following.

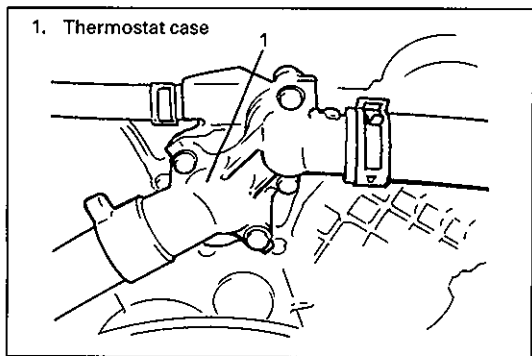
- 1) Install thermostat case to cylinder block with new O-ring.
- 2) Install water outlet pipe to thermostat case with new O-rings.
- 3) Install water outlet cap to cylinder heads with new gaskets.
- 4) Connect heater hose to water outlet cap.
- 5) Connect ECT sensor coupler and ECT switch coupler.

- 6) Install throttle body and intake manifold.
Refer to Section 6A2 for installation.
- 7) Install radiator outlet pipe to thermostat case with new O-ring.
- 8) Install radiator inlet and outlet hoses.
- 9) Refill cooling system with proper coolant, referring to description on COOLANT on page 6B-6 and 6B-7.

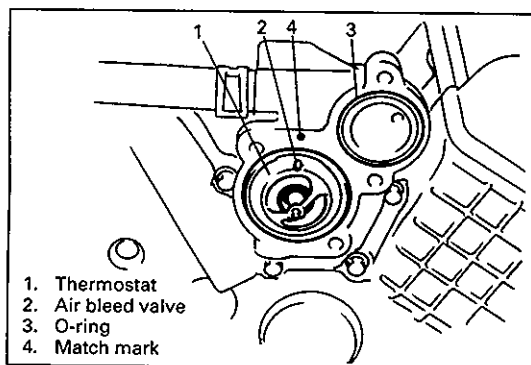
THERMOSTAT

REMOVAL

- 1) Drain coolant and tighten drain plug.
- 2) Remove cooling water pipes and hoses.
- 3) Remove thermostat case.

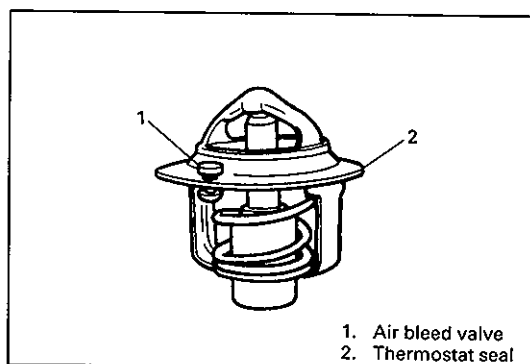


85F00-6B-12-5



85F00-6B-13-1

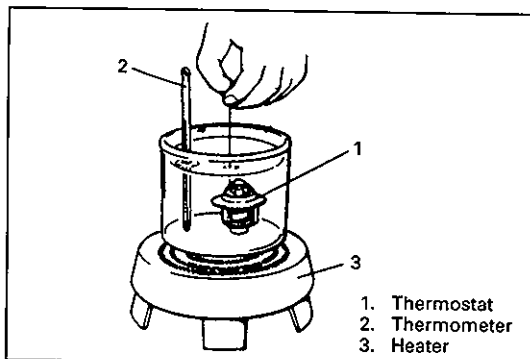
4) Remove thermostat.



85F00-6B-13-2

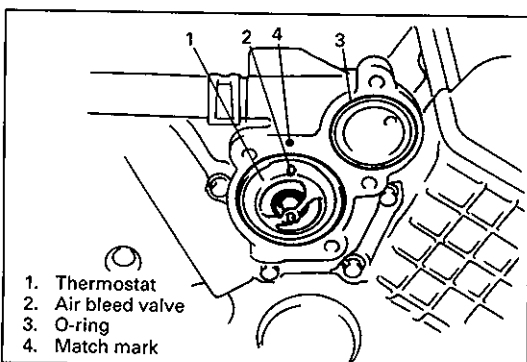
INSPECTION

- 1) Make sure that air bleed valve of thermostat is clean. Should this valve be clogged, engine would tend to over-heat.
- 2) Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.
- 3) Check thermostat seal and O-ring for breakage, deterioration or any other damage.



50G00-6B-11-5

- 4) Check thermostatic movement of wax pellet as follows:
 - ① Immerse thermostat in water, and heat water gradually.
 - ② Check that valve starts to open at specific temperature.
 - ③ If valve starts to open at a temperature substantially below or above specific temperature, thermostat unit should be replaced with a new one. Such a unit, if reused, will bring about overcooling or overheating tendency.

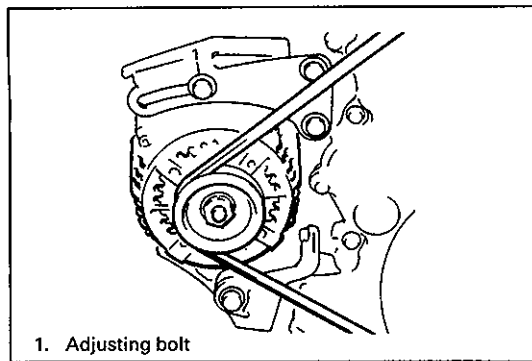


85F00-6B-13-4

INSTALLATION

- 1) When positioning thermostat and O-ring on thermostat case, be sure to position it so that air bleed valve comes at match mark and into the recession of thermostat case.
- 2) Install thermostat cap to thermostat case.
- 3) Connect cooling water pipes and hoses.

- 4) Fill cooling system (Refer to page 6B-6, 6B-7).
- 5) Connect negative cable at battery.
- 6) After installation, check each part for leakage.



85F00-6B-14-1

WATER PUMP BELT

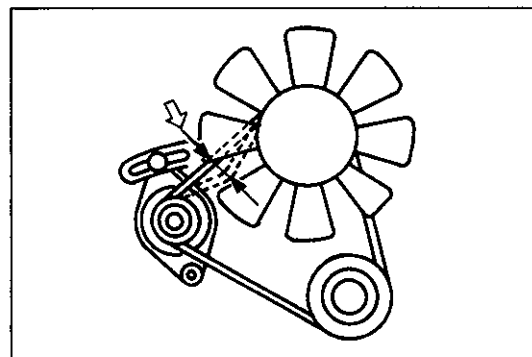
REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Loosen P/S pump drive belt adjusting bolt and then remove P/S pump belt.
- 3) Loosen adjusting bolt and pivot bolts.
- 4) Slacken belt by displacing generator and then remove it.

INSTALLATION

- 1) Install belt to water pump pulley, crankshaft pulley and generator pulley. Install P/S pump drive belt.
- 2) Adjust belt tension as specified.
For Adjustment of P/S pump drive belt tension, refer to Section 0B of this manual.
- 3) Tighten adjusting bolt and pivot bolts.
- 4) Connect negative cable at battery.

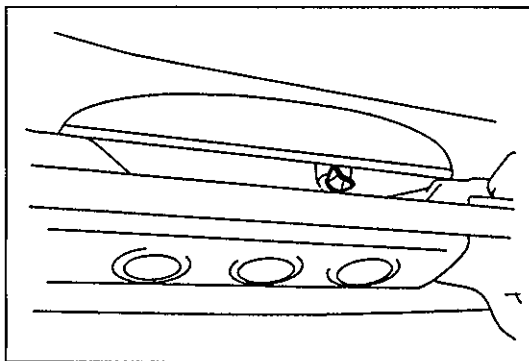
85F00-6B-14-2



85F00-6B-14-3

WATER PUMP BELT TENSION INSPECTION

- 1) Check belt tension. It should be within specification. Refer to page 6B-10.
- 2) If tension is out of specification, adjust it.
For its adjustment, refer to WATER PUMP BELT TENSION on page 6B-10.
After adjustment, be sure to tighten bolts.

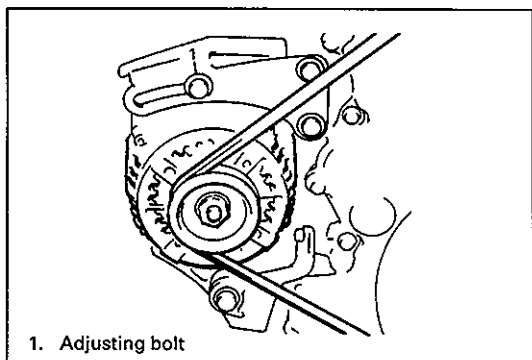


85F00-6B-15-1

COOLING FAN, FAN CLUTCH AND WATER PUMP PULLEY

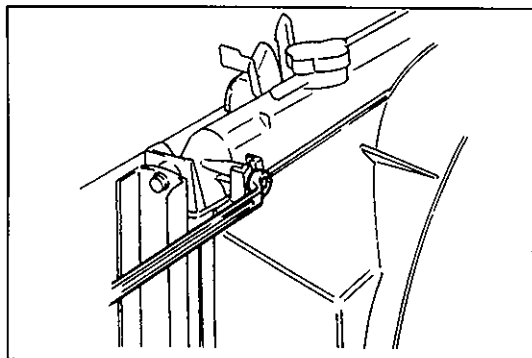
REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain coolant.
- 3) Disconnect radiator inlet hose from radiator.
- 4) Loosen cooling fan/clutch nuts.



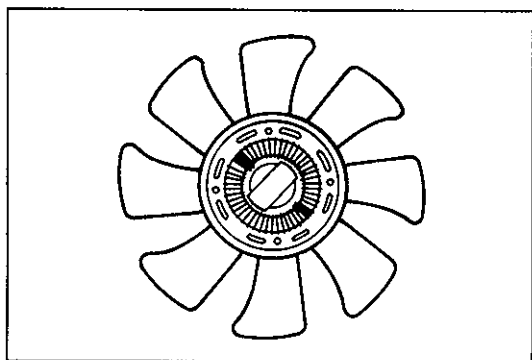
85F00-6B-15-2

- 5) Loosen water pump drive belt tension.
- 6) Remove P/S oil tank.



85F00-6B-15-3

- 7) Remove radiator shroud securing bolts.
- 8) Then remove cooling fan/clutch, water pump pulley and radiator shroud.



85F00-6B-15-4

INSPECTION

Inspect fluid coupling for oil leakage.

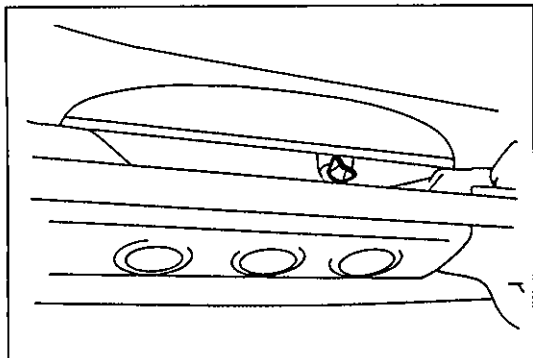
If necessary, replace fan clutch assembly. Do not disassemble clutch assembly.

INSTALLATION

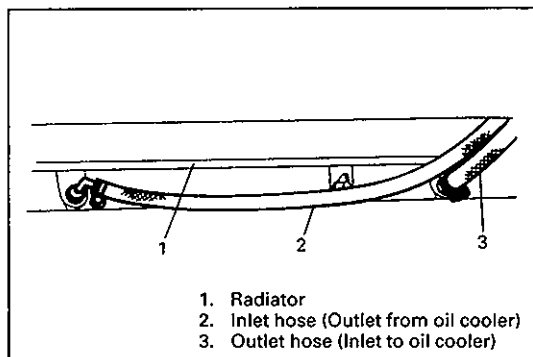
Install removed parts in reverse order of removal procedure. After installation, adjust belt tension for specification and tighten each bolt and nut securely.

NOTE:

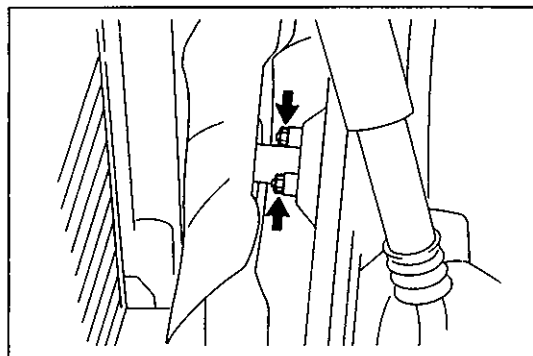
- Refill cooling system with proper coolant referring to COOL-ANT section.
- After installation, check each joint for leakage.



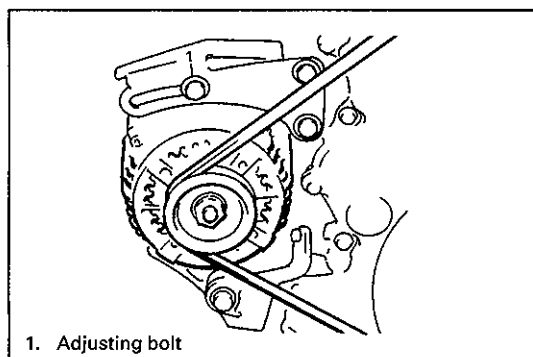
85F00-6B-16-1



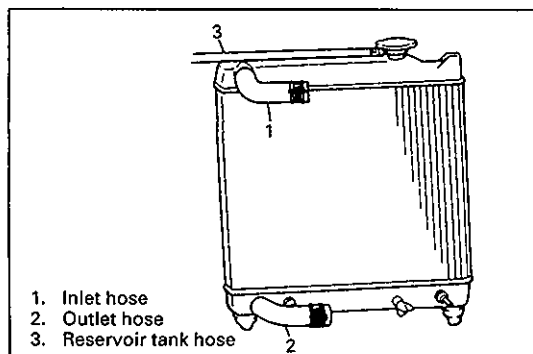
85F00-6B-16-2



85F00-6B-16-3



85F00-6B-16-4



85F00-6B-16-5

RADIATOR

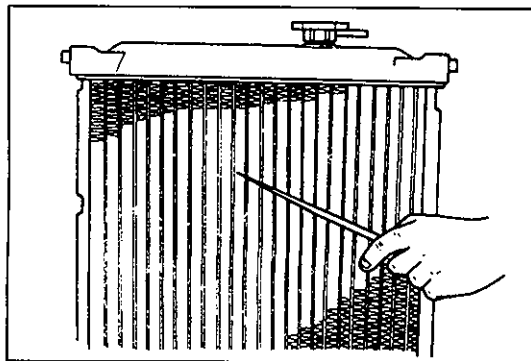
REMOVAL

- 1) Disconnect negative cable at battery.
- 2) Drain cooling system by loosening drain plug of radiator.
- 3) When servicing vehicle equipped with A/T (Automatic Transmission), place oil pan under radiator and disconnect A/T fluid hoses from radiator.
- 4) Loosen cooling fan/clutch nuts.
- 5) Loosen water pump drive belt tension.
- 6) Remove P/S oil tank.
- 7) Disconnect water hoses and reservoir hose from radiator.
- 8) Remove cooling fan/clutch and radiator shroud.
- 9) Remove radiator.

INSPECTION

Check radiator for leakage or damage. Straighten bent fins, if any.

60A20-6B-17-1



60A20-6B-17-2

CLEAN

Clean frontal area of radiator cores.

INSTALLATION

Reverse removal procedures.

NOTE:

- Refill cooling system with proper coolant referring to COOLANT section on pages 6B-6 and 6B-7.
- Adjust water pump belt tension to specification. (For specified tension, refer to page 6B-10.)
- After installation, check each joint for leakage.

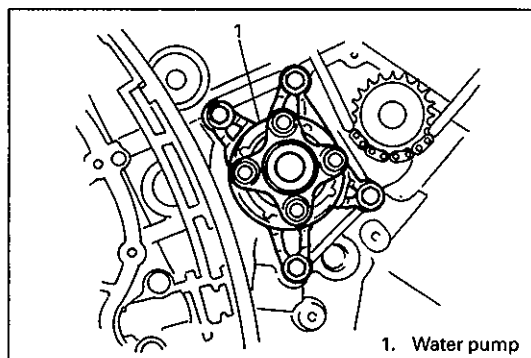
85F00-6B-17-3

WATER PUMP

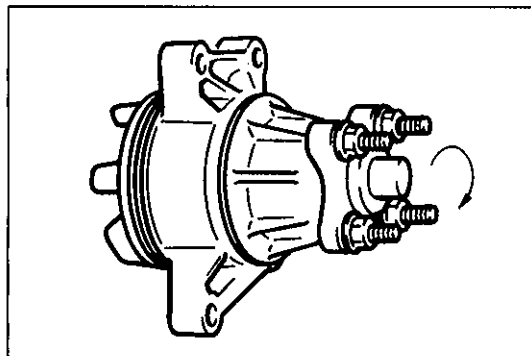
- 1) Disconnect negative cable at battery.
- 2) Drain engine oil.
- 3) Drain coolant.
- 4) Remove timing chain cover.
Refer to Section 6A2 for removal.

- 5) Remove water pump assembly.

85F00-6B-18-1



85F00-6B-18-2



INSPECTION

NOTE:

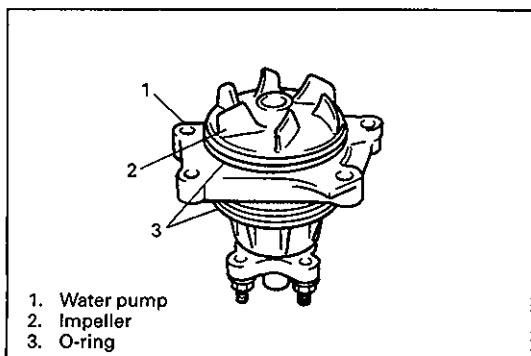
Do not disassemble water pump.

If any repair is required on pump, replace it as assembly.

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

- 2) Inspect water pump impeller for damage.
Replace as necessary.

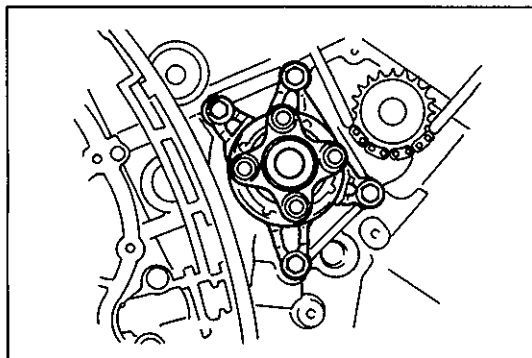
85F00-6B-18-3



85F00-6B-18-4

INSTALLATION

- 1) Install new O-rings to water pump.



85F00-6B-19-1

2) Install water pump to cylinder block.

3) Install timing chain cover.
Refer to SECTION 6A2 for installation.

85F00-6B-19-2

REQUIRED SERVICE MATERIALS

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

60B40-6B-15-5

SECTION 6C

ENGINE FUEL

CONTENTS

GENERAL DESCRIPTION	6C-1	ON VEHICLE SERVICE	6C-3
Fuel System	6C-1	Fuel Pump	Refer to SECTION 6E2
Fuel Tank	6C-2	Fuel Filter	6C-4
Fuel Pump	Refer to SECTION 6E2	Fuel Lines	6C-5
Fuel Filter	6C-2	Fuel Filler Cap	6C-6
Fuel Filler Cap	6C-2	Fuel Tank	6C-6
		TIGHTENING TORQUE	
		SPECIFICATION	6C-9

60A20-6C-1-1

CAUTION:

THE ENGINE OF THIS VEHICLE REQUIRES THE USE OF UNLEADED FUEL ONLY. USE OF LEADED AND / OR LOW LEAD FUEL CAN RESULT IN ENGINE DAMAGE AND REDUCE THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEMS.

60A20-6C-1-2

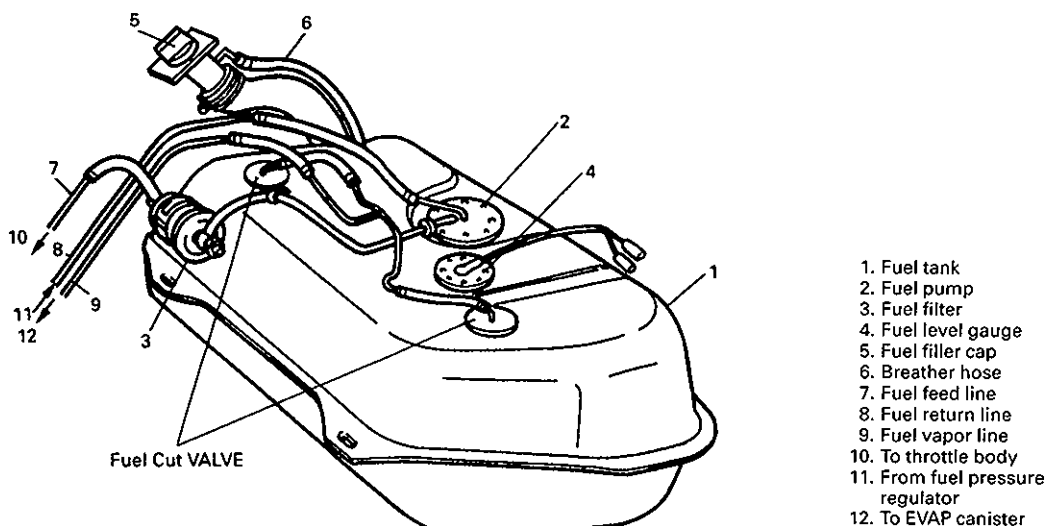
GENERAL DESCRIPTION

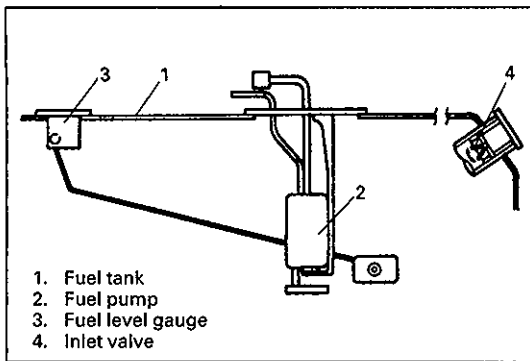
6C

FUEL SYSTEM

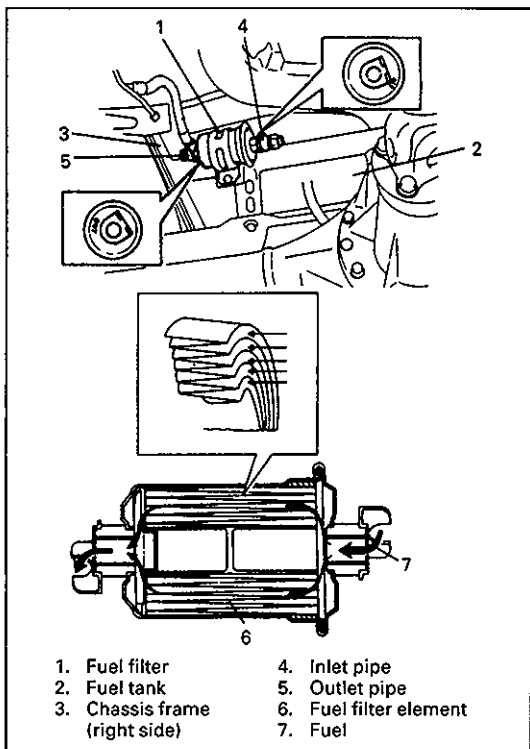
The main components of the fuel system are fuel tank, fuel pump, fuel filter and fuel level gauge and it includes three lines, fuel feed line, fuel return line and fuel vapor line.

For the details of fuel flow and fuel vapor flow, refer to SECTION 6E2 "ELECTRONIC FUEL INJECTION SYSTEM".

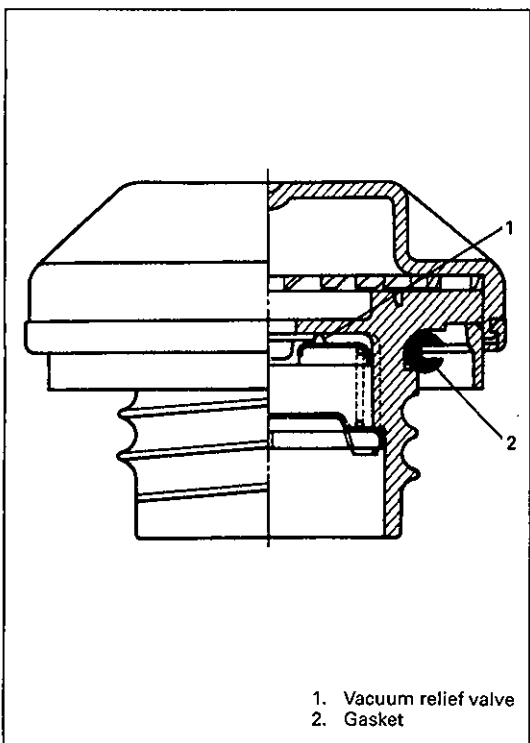




85F00-6C-2-1



60A20-6C-2-2



60A20-6C-2-4

FUEL TANK

The fuel tank is located under the rear of the vehicle. The fuel pump and fuel level gauge are installed on the upper part of the fuel tank.

Also, the fuel tank has the inlet valve at the inlet port.

FUEL FILTER

The fuel filter is installed on the chassis frame and filters the fuel sent under pressure from the fuel pump.

As it can't be disassembled, it should be replaced as an assembly. Note that letters indicating the fuel inlet and outlet ports are stamped on the fuel filter. Refer to them for proper hose connection.

FUEL FILLER CAP

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would prevent sealing fuel vapors.

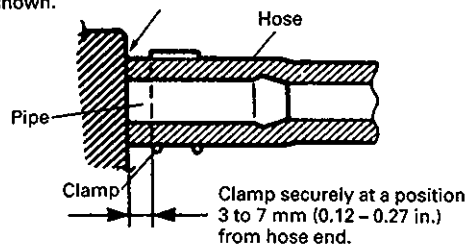
After the gasket on fuel filler cap and the filler neck flange contact, the ratchet produces a loud clicking noise, indicating the seal has been set.

This cap has a vacuum relief valve inside.

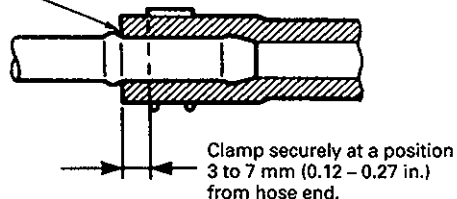
When the pressure in the fuel tank becomes negative (vacuum), the vacuum is usually relieved by the TPC valve which is included in the fuel vapor line. Only when the vacuum becomes high especially the vacuum relief valve opens.

ON VEHICLE SERVICE

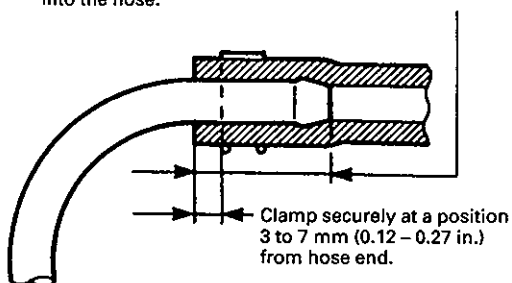
With short pipe, fit hose as far as it reaches pipe joint as shown.



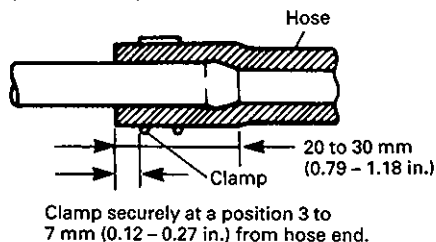
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far 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.



WARNING:

Before attempting service of any type on fuel system, following cautions should be always observed.

- Disconnect negative cable at battery.
- DO NOT smoke, and place "NO SMOKING" signs near work area.
- Be sure to have CO₂ fire extinguisher handy.
- Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).
- Wear safety glasses.
- To release fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.
- As fuel feed line 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 procedure described on p. 6-4.
- 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.

- Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the following.

FUEL FILTER

REMOVAL

1. Relieve fuel pressure in fuel feed line referring to p. 6-4.

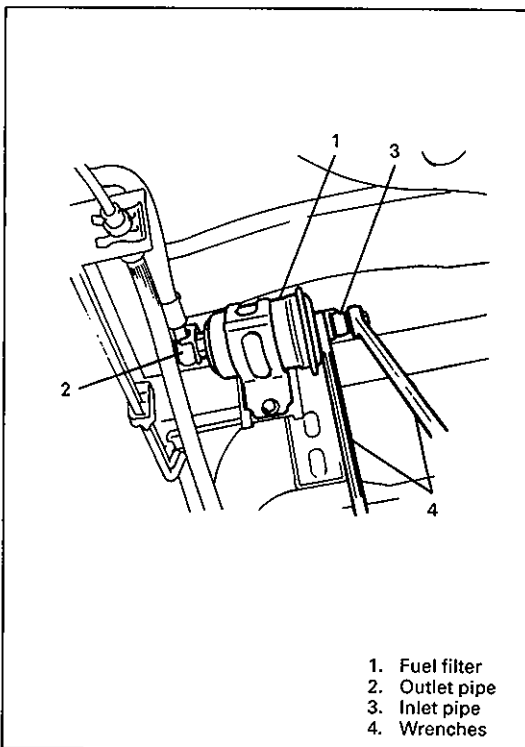
CAUTION:

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

60A20-6C-4-1

2. Disconnect negative cable at battery.
3. Hoist vehicle.

60A20-6C-4-2



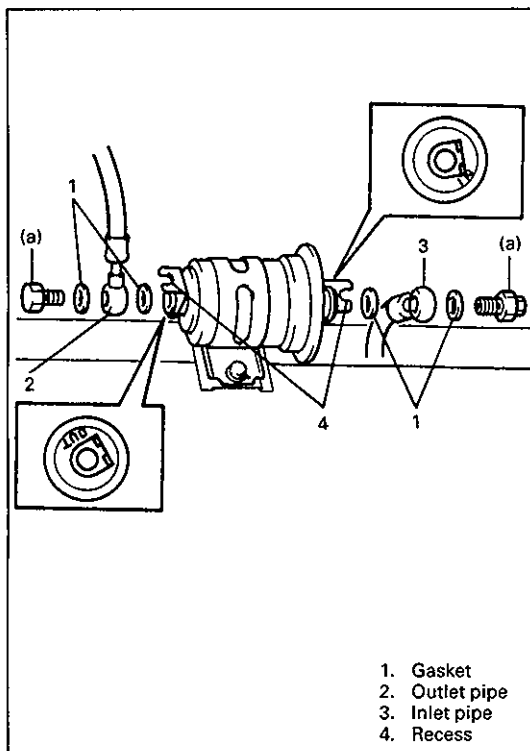
4. Disconnect inlet and outlet pipes from fuel filter by using two wrenches.

WARNING:

A small amount of fuel may be released after fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

5. Remove fuel filter from chassis frame.

60A20-6C-4-3



60A20-6C-5-1

INSTALLATION

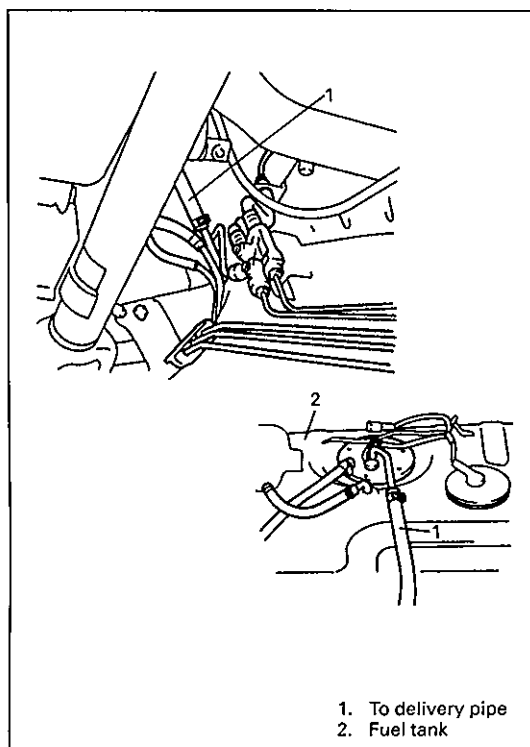
Reverse removal procedure noting the following.

- Use new gaskets.
- Make sure that gasketed surfaces are free from any damage.
- Inlet and outlet pipes should come into recess of plate as shown.
- Tighten union bolts to specified torque.

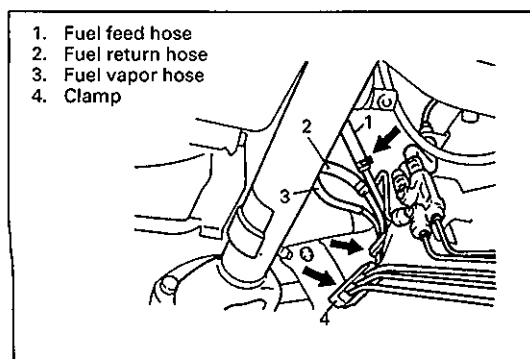
Tightening Torque

(a): 35 N·m (3.5 kg-m, 25.0 lb-ft)

- Upon completion of installation, verify that there is no fuel leakage at each connection according to procedure described in p. 6-4.



85F00-6C-5-3



85F00-6C-5-5

FUEL LINES

Due to the fact that fuel feed line is under high pressure, this system requires special consideration for service.

The feed pipe uses screw couplings and hose clamps.

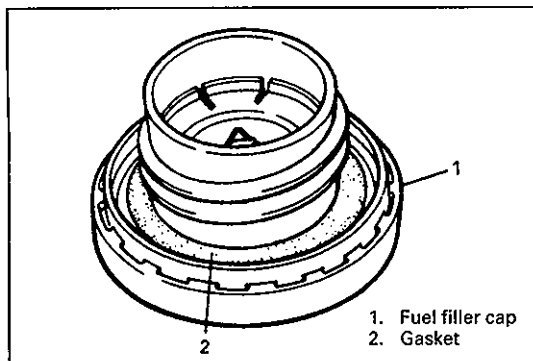
Any time these fittings are loosened to service or replace components, ensure that:

- Backup wrench is used while loosening and tightening fitting.

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose cracking and deterioration, or damage. Make sure all clamps are secure.

Replace parts as needed.



60A20-6C-6-1

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 serious malfunction of the system.

FUEL TANK

REMOVAL

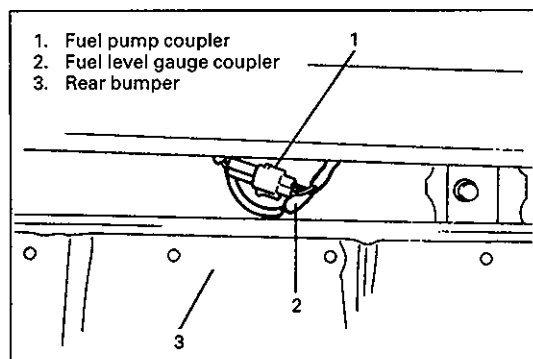
1. Relieve fuel pressure in fuel feed line referring to p. 6-4.

CAUTION:

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

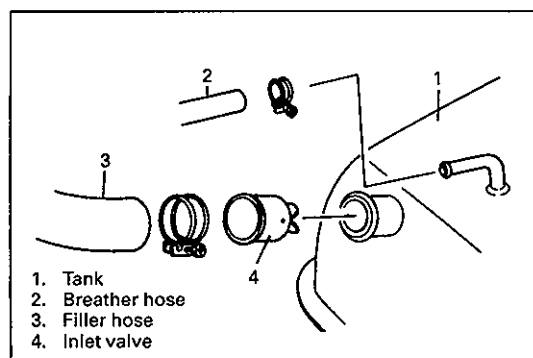
2. Disconnect negative cable at battery.

60A20-6C-6-2



60A20-6C-6-3

3. Disconnect fuel level gauge and fuel pump lead wire couplers after removing rear bumper cover.



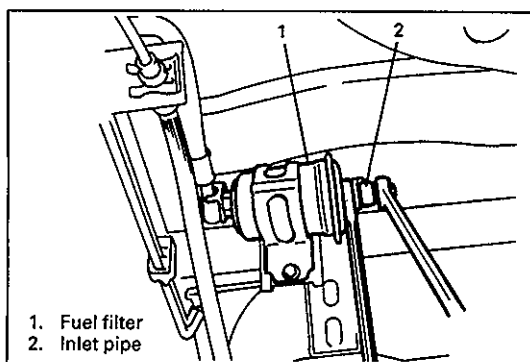
60A20-6C-6-4

4. Remove fuel tank filler hose cover. Then disconnect filler hose and breather hose from fuel tank.
5. Remove fuel tank inlet valve.

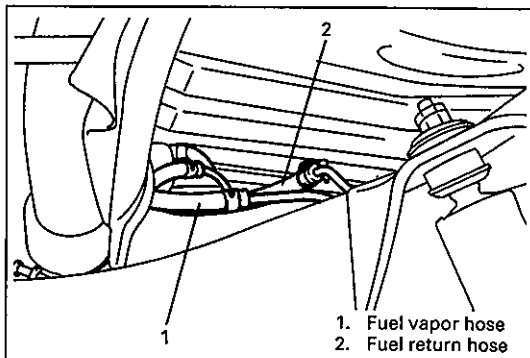
6. Due to absence of fuel tank drain plug, drain fuel tank by pumping fuel out through fuel tank filler. Use hand operated pump device to drain fuel tank.

CAUTION:

Never drain or store fuel in an open container due to possibility of fire or explosion.



60A20-6C-7-1



60A20-6C-7-2

7. Disconnect fuel filter inlet pipe from filter.

8. Disconnect fuel vapor hose and return hose from pipes.

9. Remove fuel tank and protector from vehicle.

INSPECTION

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump and level gauge gaskets for leaks, visually inspect fuel tank for leaks and damage. Replace any damaged or malfunctioned parts.

60A20-6C-7-3

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.

60A20-6C-8-1

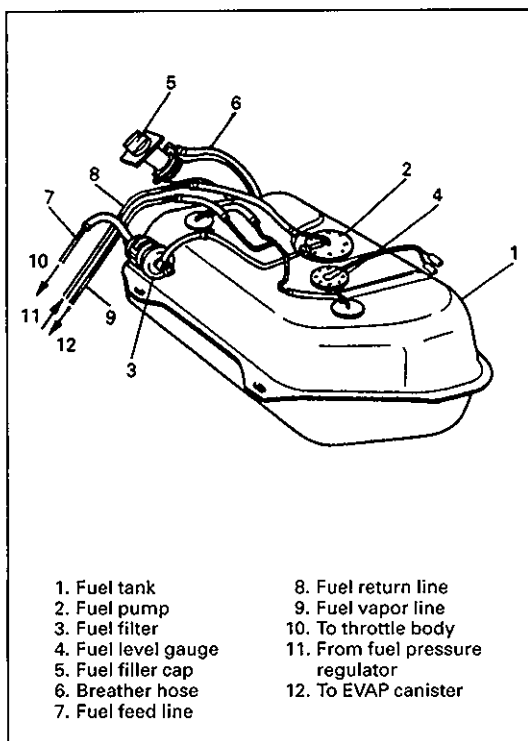
The following procedure is used for purging the fuel tank.

1. After removing fuel tank, remove all hoses, fuel pump and fuel level gauge from fuel tank.
2. Drain all remaining fuel from tank.
3. Move tank to flushing area.

60A40-6C-8-2

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.

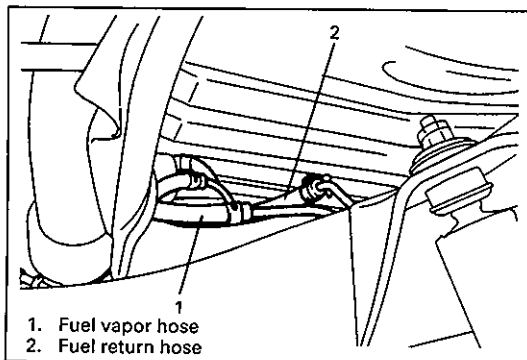
60A20-6C-8-3

**INSTALLATION**

1. Install fuel pump and fuel level gauge to fuel tank. Use new gaskets.
2. Install fuel separator, inlet valve and tank pressure control valve to fuel tank.
3. Connect fuel hoses to fuel tank, fuel pump.
After connecting, clamp hoses securely, Refer to p. 6C-3.

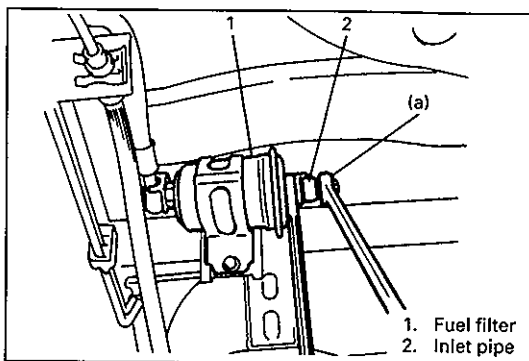
4. Install fuel tank and cover to vehicle.
5. Connect fuel filler hose and breather hose to fuel filler neck. Clamp them securely.
6. Install fuel filler hose cover.

60A20-6C-9-1



7. Connect fuel vapor hose and return hose to fuel pipe. Clamp them securely.

60A20-6C-9-2



8. Connect fuel filter inlet pipe to fuel filter. Use new gaskets and tighten union bolt to specification.

Tightening Torque

(a): 35 N·m (3.5 kg-m, 25.0 lb-ft)

85F00-6C-9-3

9. Connect fuel pump and level gauge couplers.
10. Install fuel rear bumper cover.
11. Connect negative cable to battery.
12. Upon completion of installation, check fuel system for leakage.

60A20-6C-9-4

TIGHTENING TORQUE SPECIFICATION

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Fuel filter union bolt	35	3.5	25.0

SECTION 6E2

ELECTRONIC FUEL INJECTION SYSTEM

(SEQUENTIAL MULTIPOINT FUEL INJECTION
FOR H20A TYPE ENGINE)

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GENERAL DESCRIPTION

The Electronic Fuel Injection System in this vehicle supplies the combustion chambers with air/fuel mixture of optimized ratio under widely varying driving conditions.

It uses the sequential multiport fuel injection system which injects fuel into each intake port of the cylinder head.

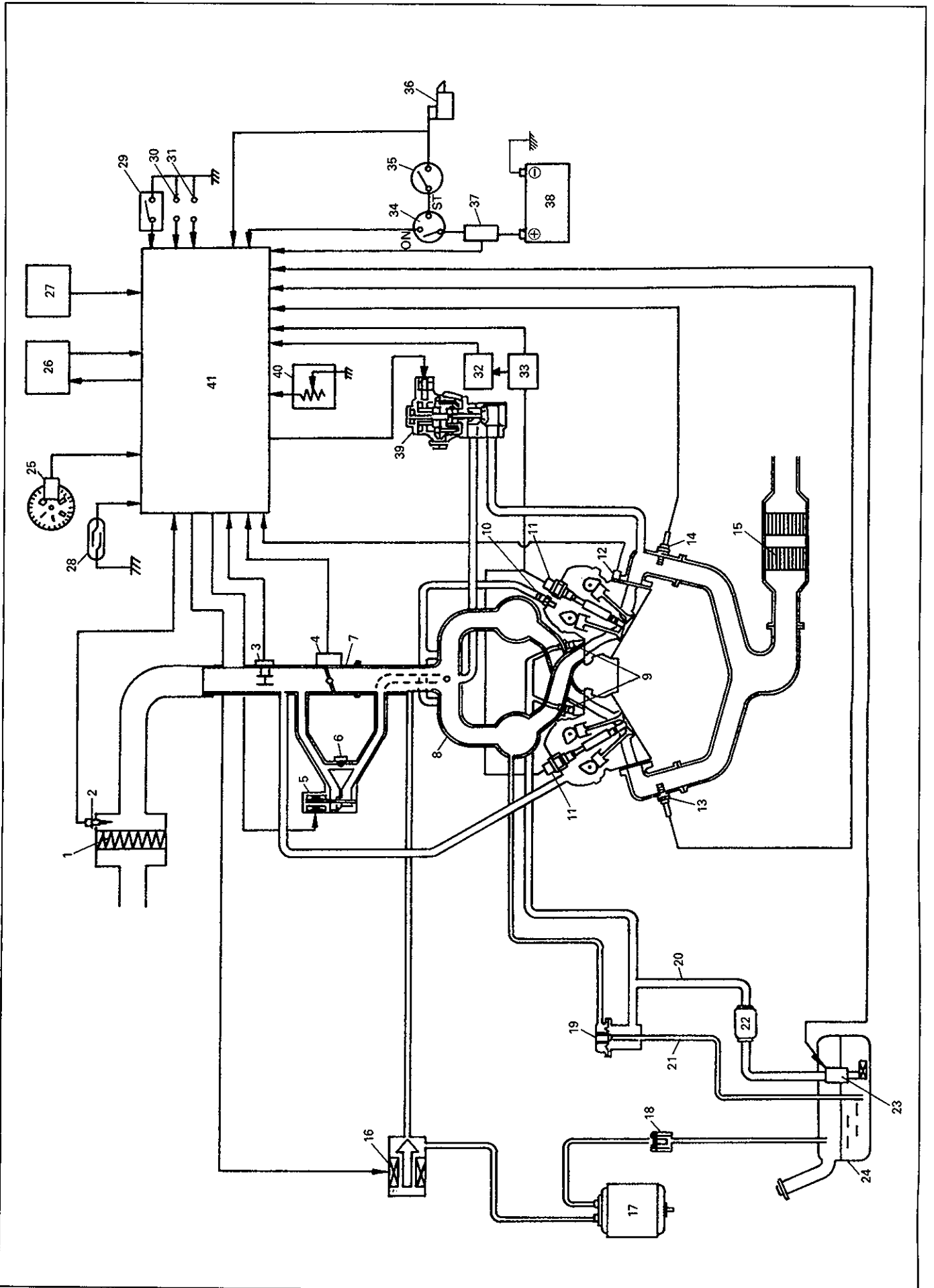
This system has 3 major sub-systems: air intake system, fuel delivery system and electronic control system.

Air intake system includes air cleaner, mass air flow sensor, throttle body, fast idle control system, idle air control valve and intake manifold. Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, etc.

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

This section explains the system related to the electronic fuel injection as well as such functions of ECM as listed below.

- EGR system. (if equipped)
- Evaporative emission control system.
- Throttle valve opening signal and coolant temp. signal outputs for TCM (A/T vehicle only).
- IC (Ignition Control) system.



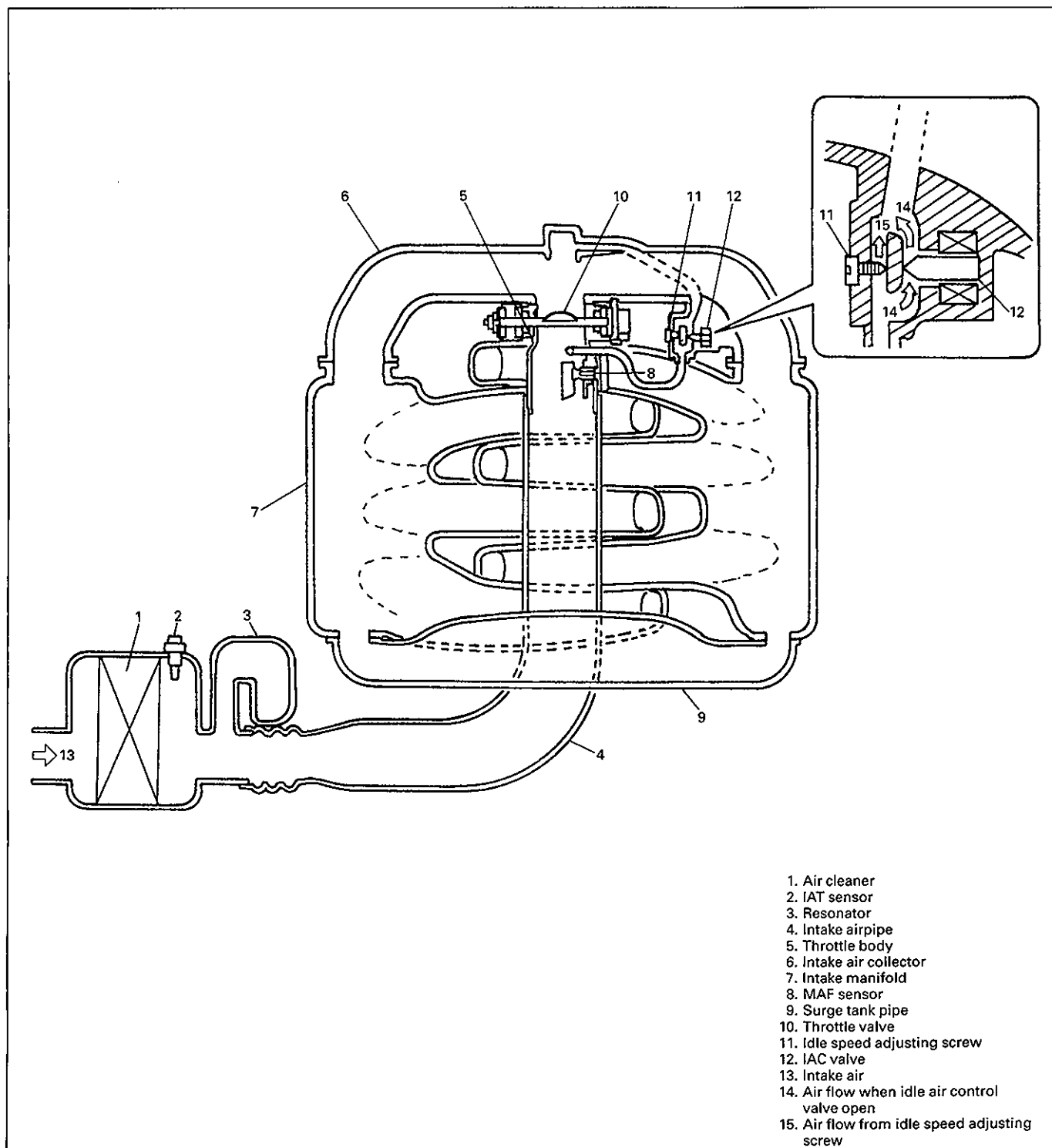
- | | | |
|--|---|--|
| 1. Air cleaner | | |
| 2. IAT sensor | | |
| 3. MAF sensor | | |
| 4. TP sensor | | |
| 5. IAC valve | | |
| 6. Idle speed adjusting screw | | |
| 7. Throttle body | | |
| 8. Intake manifold | | |
| 9. Fuel injector | | |
| 10. PCV valve | | |
| 11. Ignition coil | | |
| 12. ECT sensor | | |
| 13. Heated oxygen sensor
(Right bank : bank 2), if equipped | | |
| | 14. Heated oxygen sensor
(Left bank : bank 1), if equipped | 28. Vehicle speed sensor |
| | 15. Three way catalytic converter
(vehicle with heated oxygen sensor only) | 29. Power steering pressure switch |
| | 16. EVAP canister purge valve | 30. Diagnosis switch terminal |
| | 17. EVAP canister | 31. Test switch terminal |
| | 18. Tank pressure control valve | 32. Noise suppressor
(for ignition fail safe signal) |
| | 19. Fuel pressure regulator | 33. Ignitor |
| | 20. Fuel feed line | 34. Ignition switch |
| | 21. Fuel return line | 35. Transmission range switch
(A / T vehicle only) |
| | 22. Fuel filter | 36. Starter magnetic switch |
| | 23. Fuel pump | 37. Main fuse |
| | 24. Fuel tank | 38. Battery |
| | 25. CMP sensor | 39. EGR valve (if equipped) |
| | 26. Transmission control module | 40. CO adjusting resistor
(vehicle without heated oxygen sensor only) |
| | 27. A / C amplifier | 41. ECM |

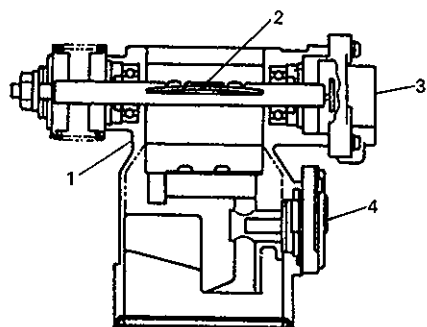
AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, resonator, air intake pipe, throttle body (including mass air flow sensor) 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 engine is idling, when it is cold or when the idle air control valve is opened according to the signal from ECM, the air bypasses the throttle valve through bypass passage which varies in each case and is finally drawn into the intake manifold.





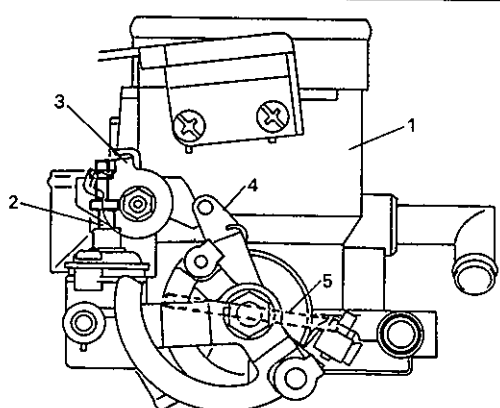
1. Throttle body
2. Throttle valve
3. TP sensor
4. MAF sensor

85F00-6E2-7-1

THROTTLE BODY

The throttle body consists of the main bore, air bypass passage, and the following parts.

- Throttle valve which is interlocked with the accelerator pedal and controls the amount of the intake air
- MAF sensor which detects the mass flow of the air drawn into the engine and sends a signal to ECM.
- TP sensor which detects the throttle valve opening and sends a signal to ECM.
- Fast idle air control system which opens the throttle valve when engine is cold



1. Throttle body
2. Plunger
3. Fast idle control cam
4. Cam follow lever
5. Throttle valve

1. Plunger
2. Thermo wax
3. Seal rubber

85F00-6E2-7-4

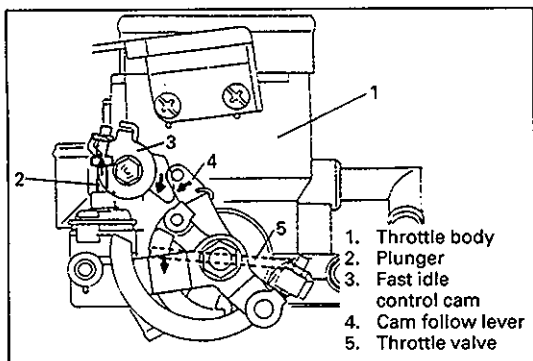
FAST IDLE CONTROL SYSTEM

The fast idle control system consists of thermo-wax, seal rubber, plunger, fast idle control cam and throttle lever.

When the engine is cold, the fast idle control system increases the engine speed by opening the throttle valve to send the air to the intake manifold, and thus the engine is warmed up.

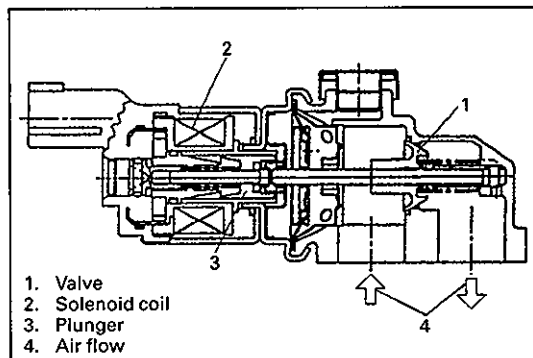
OPERATION

When the engine is cold (or engine coolant temp, is lower than 60°C (140°F)), the thermo-wax is contracts. In this state, as the cam follow lever is on the crest of the fast idle control cam, the throttle valve is kept at a little wider open positions compared with when the engine has been warmed up. Thus, in spite that the throttle valve is closed, the volume of the intake air to the engine is larger in the fast idle state than when the engine has been warmed up.



85F00-6E2-8-1

As the engine gets warmer, the thermowax expands gradually and pushes the fast idle cam upward. Then, the cam follow lever goes over the crest of the fast idle cam about the point when the engine coolant temperature exceeds 60°C (140°F). As a result, the throttle valve returns to the throttle lever linked to it contacts the stop screw and the engine idle speed reduces to the normal idle speed after the engine being warmed up.



85F00-6E2-8-2

IDLE AIR CONTROL VALVE (IAC VALVE)

The IAC valve controls opening of the bypass air passage (i.e., bypass air flow). The opening increase and decreases according to the electric current flow to the IAC valve which is controlled by ECM.

FUEL DELIVERY SYSTEM

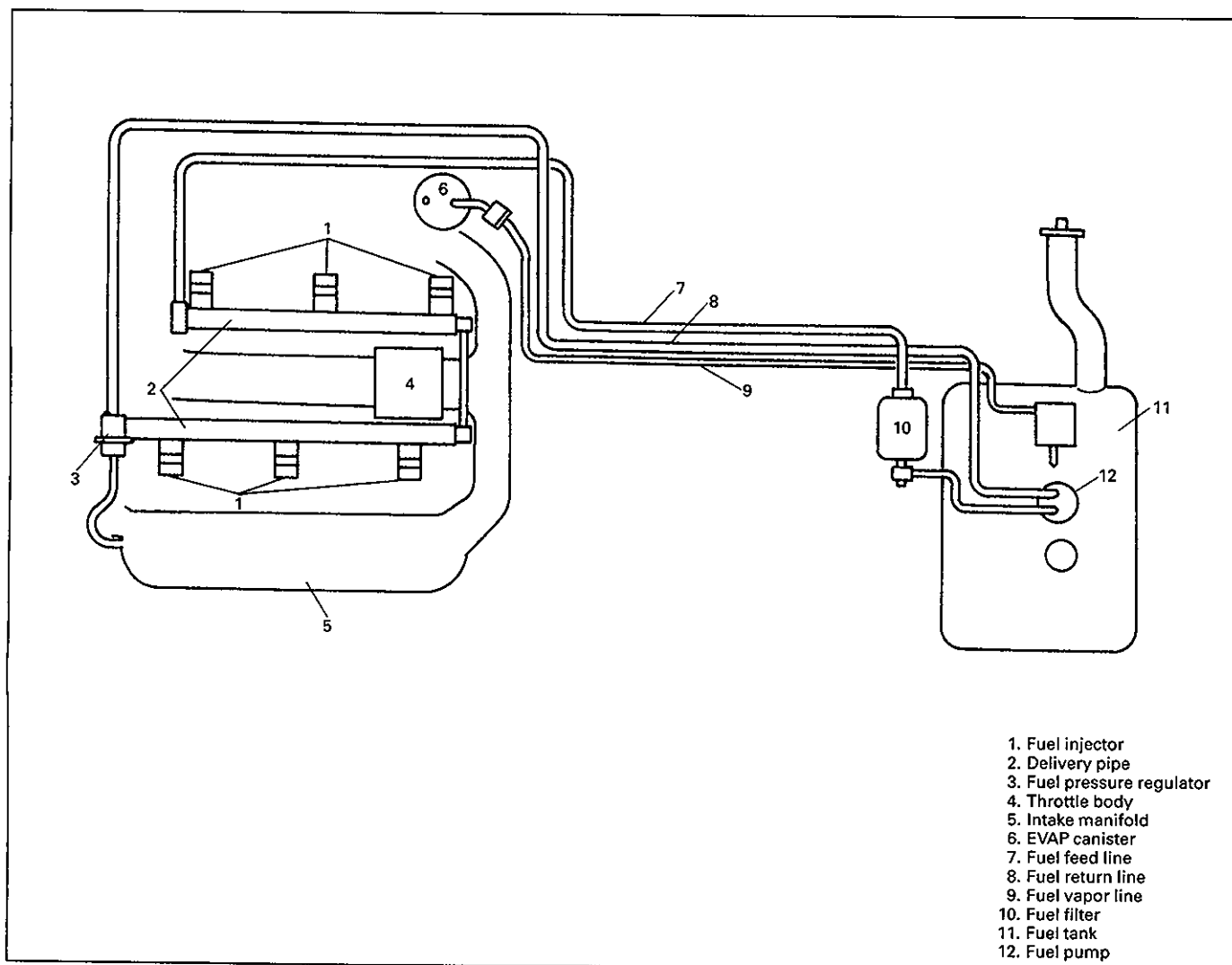
The fuel delivery system consists of the fuel tank, fuel pump, fuel filter, fuel pressure regulator, delivery pipes, and fuel injectors.

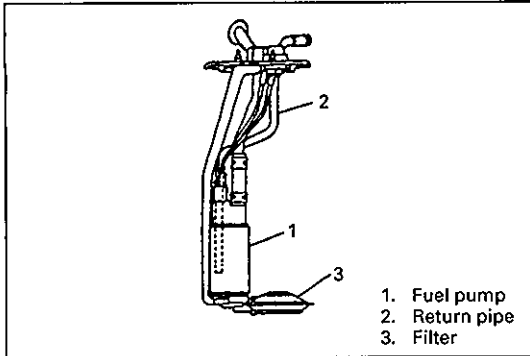
The fuel in the fuel tank is pressurized by the fuel pump, filtered by the fuel filter and fed under pressure to each injector through the delivery pipes. As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in 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.

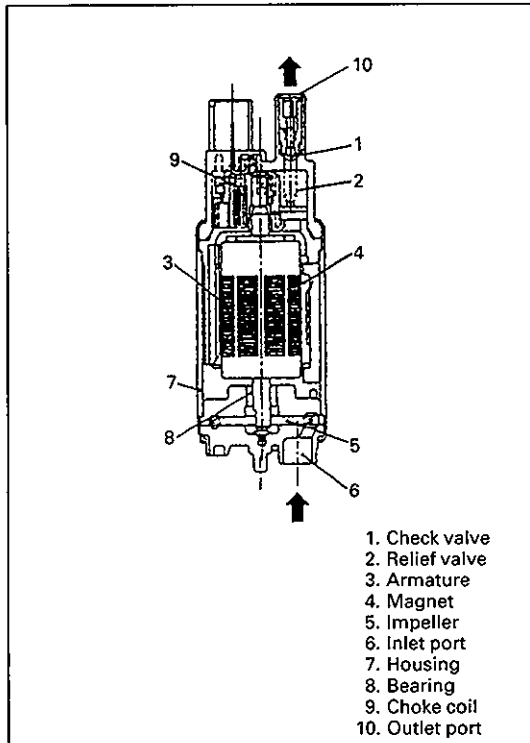
The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.

For the structure and operation of the fuel tank and filter, refer to SECTION 6C "ENGINE FUEL".

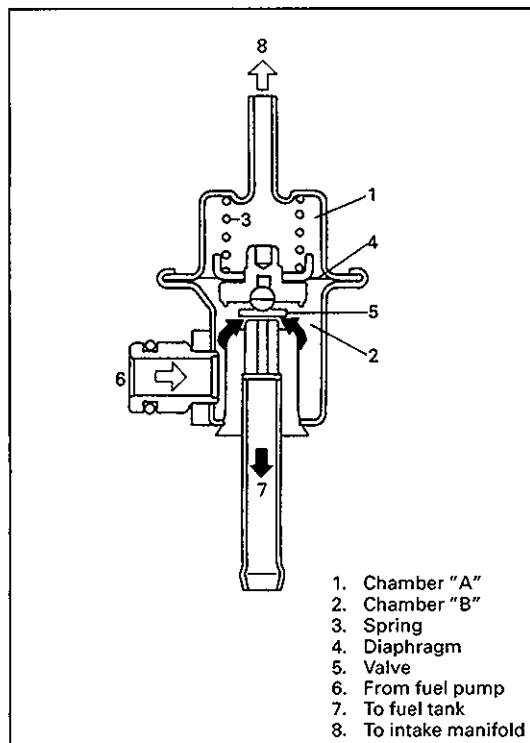




85F00-6E2-10-1



85F00-6E2-10-2



85F00-6E2-10-4

FUEL PUMP

The electric fuel pump located in the fuel tank consists of armature, magnet, impeller, brush, check valve, etc.. The ECM controls its ON/OFF operation as described under "Fuel Pump Control System" included in later part of this section.

Operation

When power is supplied to the fuel pump, the motor in the pump runs and so does the impeller.

This causes a pressure difference to occur between both sides of the impeller as there are many grooves around it. Then the fuel is drawn through the inlet port, and with its pressure increased it is discharged through the outlet port.

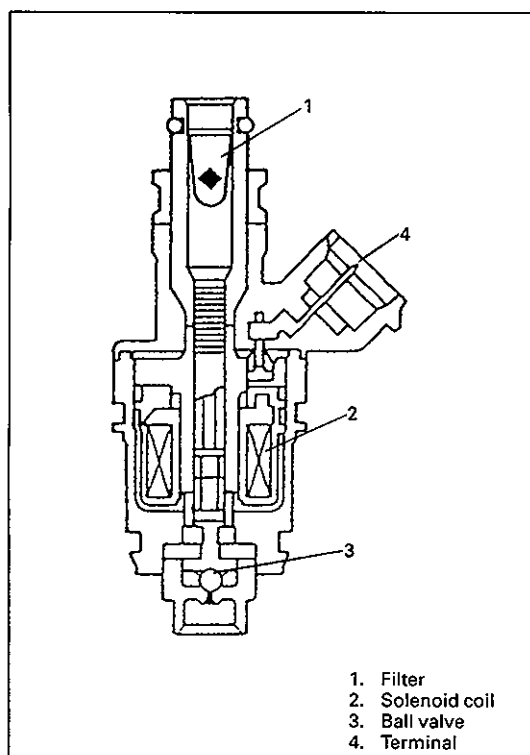
The fuel pump also has a relief valve to prevent excessive rise of the discharge pressure and a check valve to keep some pressure in the fuel feed line even when the fuel pump is stopped.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is diaphragm-operated relief valve consisting of diaphragm, spring and valve. It keeps the fuel pressure applied to the injector 2.9 kg/cm^2 (290 kPa, 41.2 psi) higher than that in the intake manifold at all times.

The pressure applied to the chamber "A" of fuel pressure regulator is intake manifold pressure and that to the chamber "B" is fuel pressure.

When the fuel pressure rises more than 2.9 kg/cm^2 (290 kPa, 41.2 psi) higher than the intake manifold pressure, the fuel pushes the valve in the regulator open and excess fuel returns to the fuel tank via the return line.



85F00-6E2-11-1

FUEL INJECTOR

There are 6 injectors (one for each cylinder), each of which is installed between the intake manifold and delivery pipe. It is an electromagnetic type injection nozzle which injects fuel into the intake port of the cylinder head according to the signal from ECM.

Operation

When the solenoid coil of the injector is energized by ECM, it becomes an electromagnet and attracts the plunger. At the same time, the needle valve which is incorporated with the plunger opens and the injector which is under the fuel pressure injects fuel. As the lift stroke of the ball valve of the injector is set constant, the amount of fuel injected at one time is determined by the length of time during which the solenoid coil is energized (injection time).

ELECTRONIC CONTROL SYSTEM

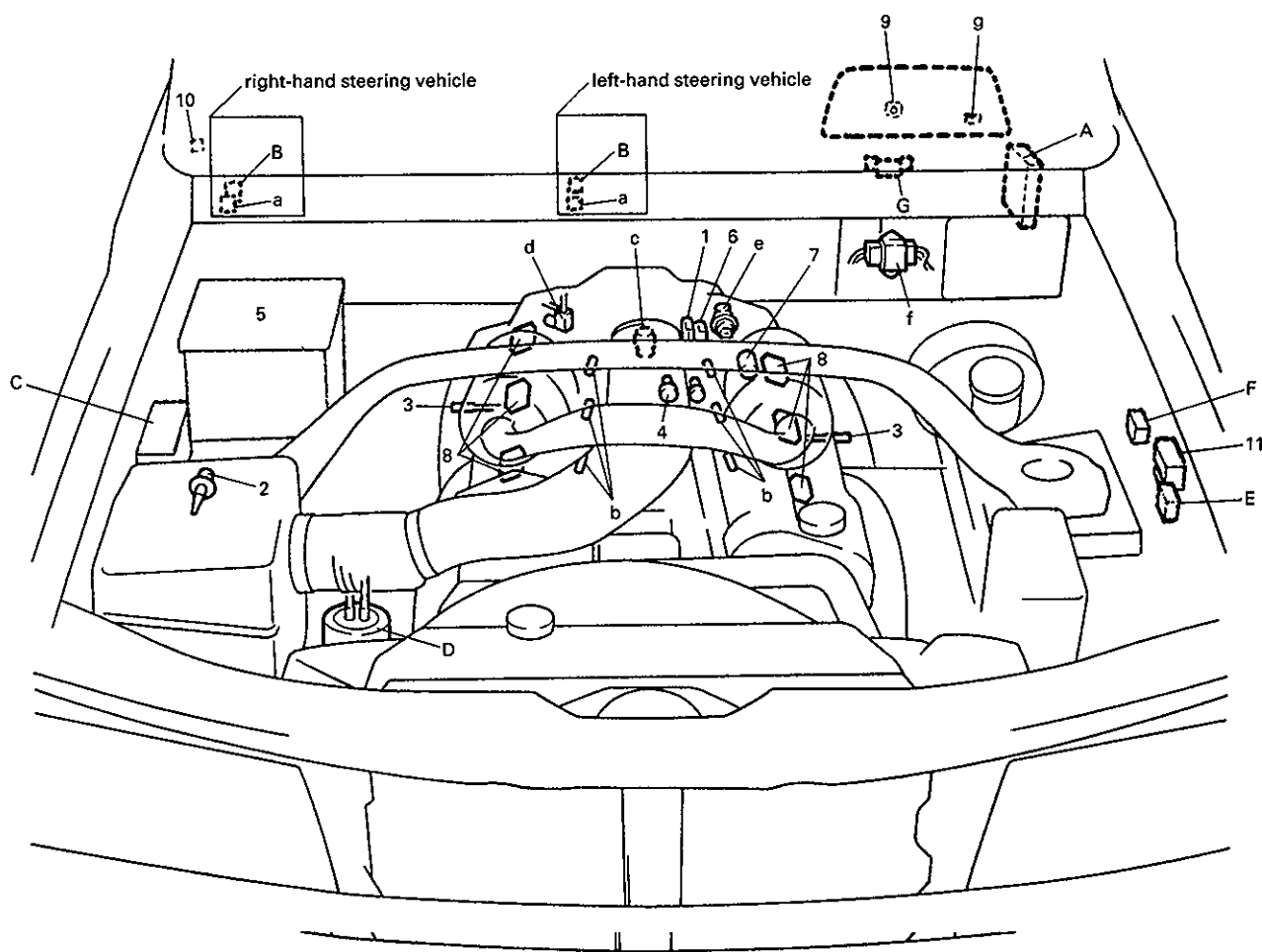
The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Heated oxygen sensor heater control system

- Idle air control system
- Fuel pump control system
- Evaporative emission control system
- ESA (Electronic Spark Advance) system
- EGR system

Also, with 4 A/T model, ECM sends throttle valve opening signal and coolant temp. signal to transmission control module to control A/T.



NOTE:

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

INFORMATION SENSORS

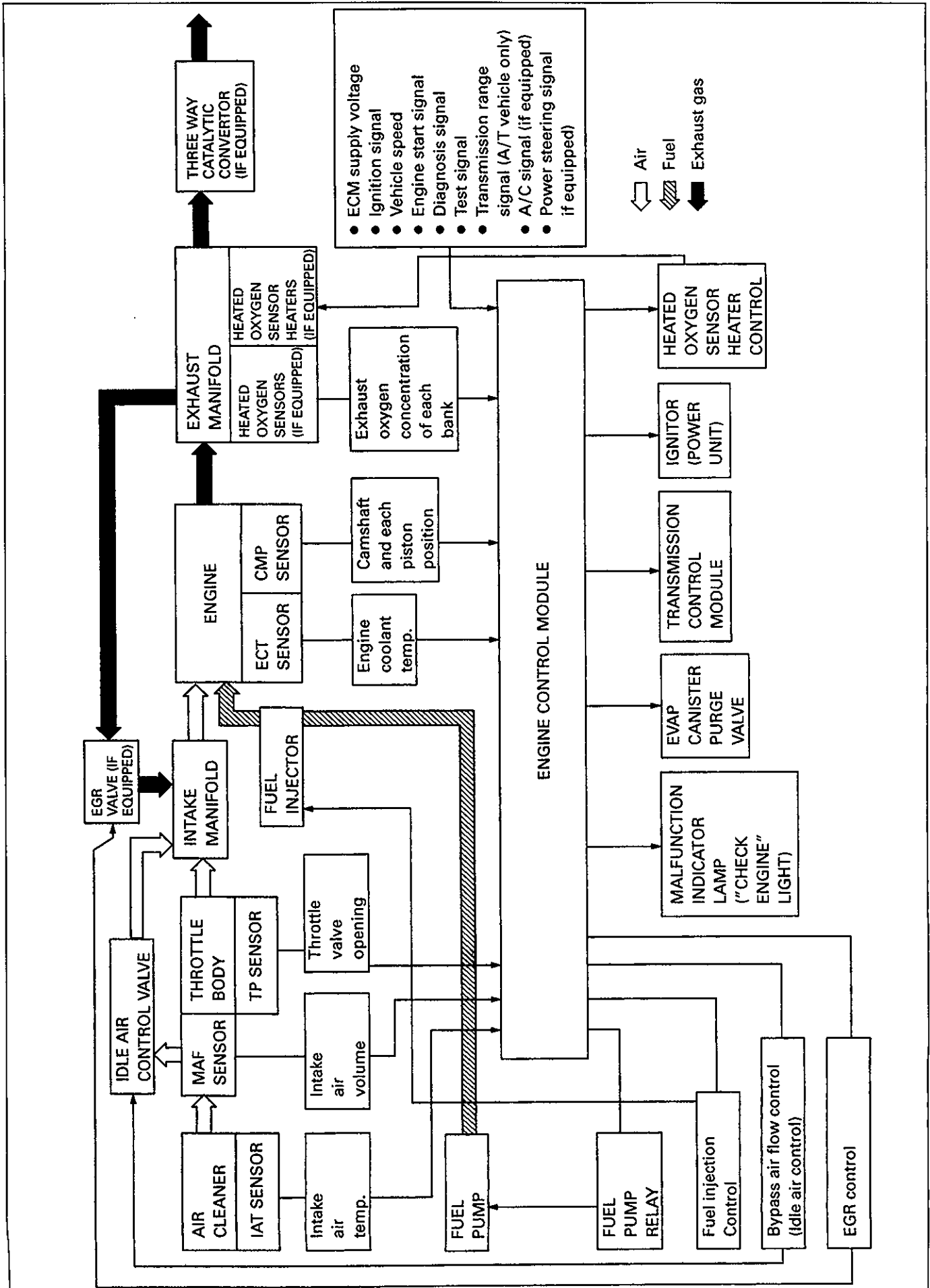
1. MAF sensor
2. IAT sensor
3. Heated oxygen sensor (if equipped)
4. ECT sensor
5. Battery
6. TP sensor
7. Camshaft position sensor (CMP sensor)
8. Ignition coil
9. VSS (in speedometer) (*)
10. CO adjusting resistor (*) (vehicle without heated oxygen sensor only)
11. Noise suppressor (*)

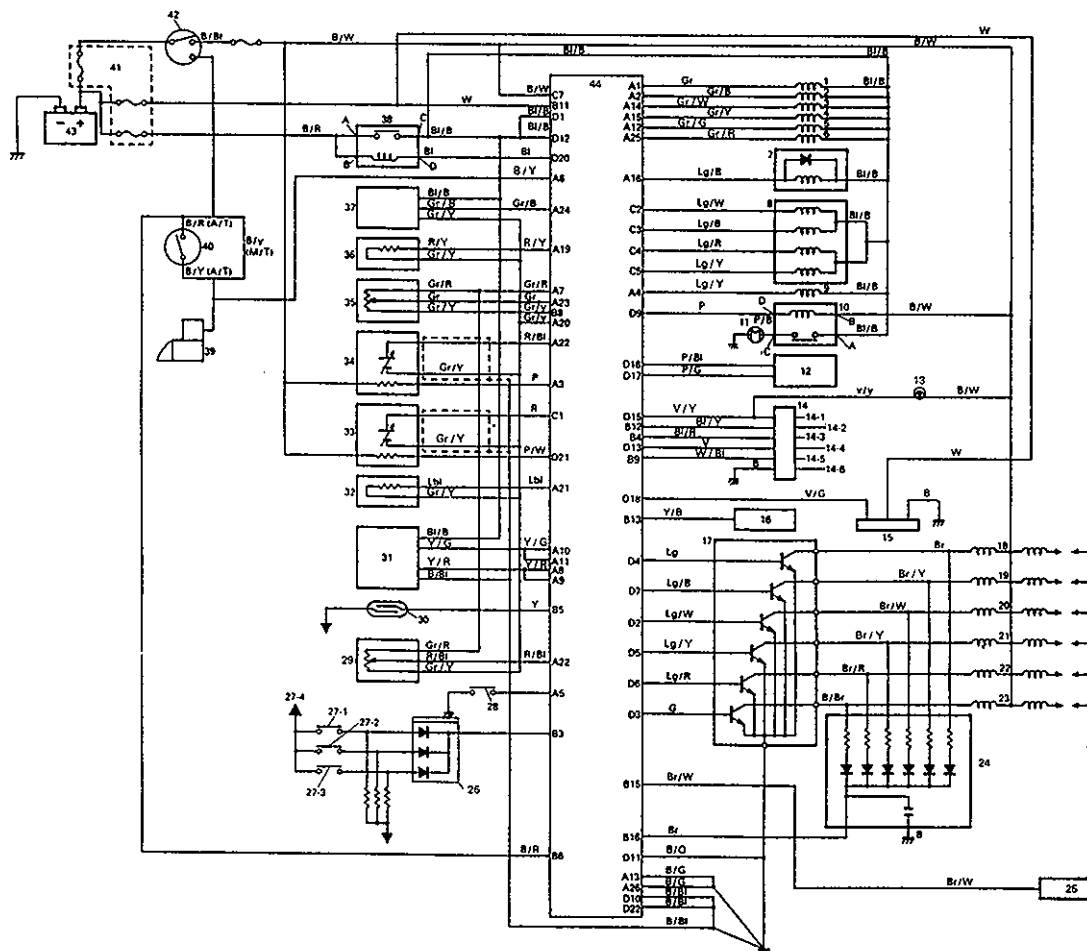
CONTROLLED DEVICES

- a: Fuel pump relay
- b: Injector
- c: EGR valve (if equipped)
- d: EVAP canister purge valve
- e: Idle air control valve
- f: Ignitor
- g: Malfunction indicator lamp (*) ("CHECK ENGINE" light)

OTHERS

- A: ECM (*)
- B: Main relay
- C: Fuse box (*)
- D: EVAP canister
- E: Monitor coupler (Engine) (*)
- F: Monitor coupler (A/T) (*)
- G: Data link connector (*) (Assembly line diag. link)

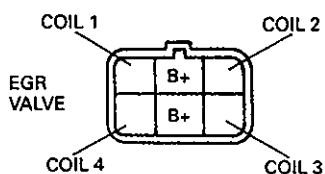
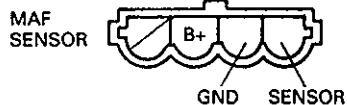
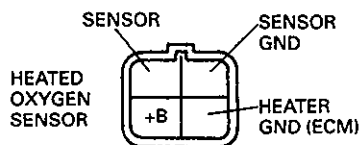
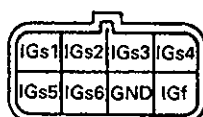
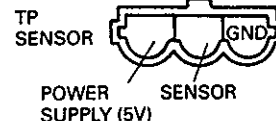
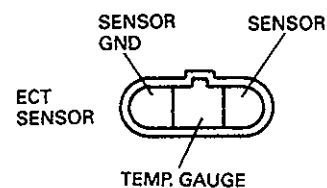
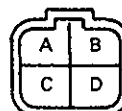




TERMINAL ARRANGEMENT OF EACH
COUPLER (VIEWED FROM HARNESS SIDE)

ECM

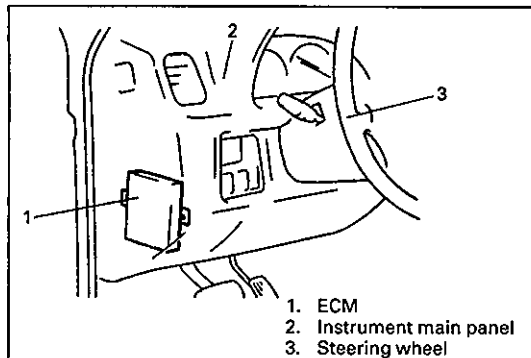
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	B9	B10	B11	B12	B13	B14	B15	B16	C7	C8	C9	C10	C11	C12	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22

NOISE
SUPPRESSORFUEL PUMP
AND MAIN
RELAY

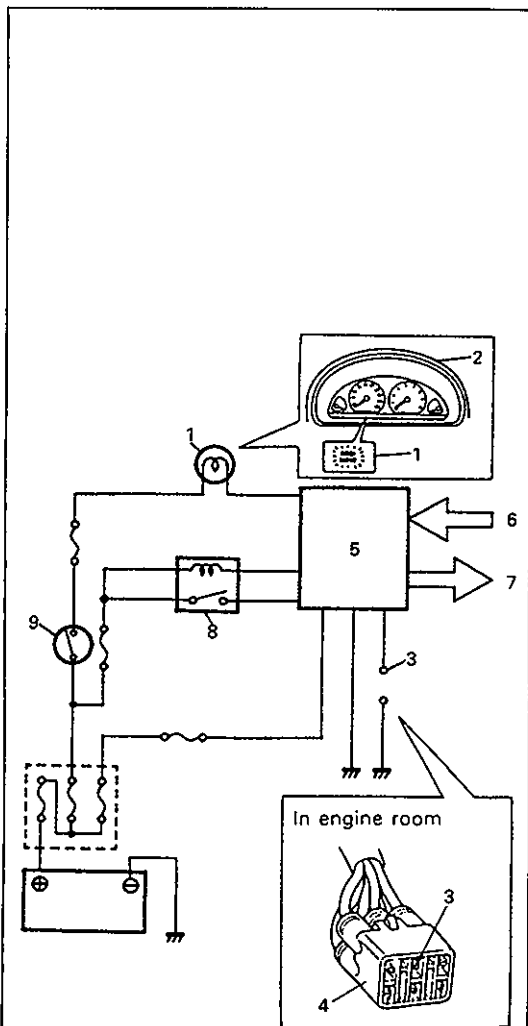
IGt: Ignition trigger signal
IGs: Ignition signal
IGf: Ignition fail safe signal

1. No.1 injector
2. No.2 injector
3. No.3 injector
4. No.4 injector
5. No.5 injector
6. No.6 injector
7. IAC valve
8. EGR valve (stepper motor)
(if equipped)
9. EVAP canister purge valve
10. Fuel pump relay
11. Fuel pump
12. Transmission control module
(A/T vehicle only)
13. Malfunction indicator lamp
("CHECK ENGINE" light)
14. Monitor compler
- 14-1. Diagnosis output terminal
- 14-2. Diagnosis switch terminal
- 14-3. Test switch terminal
- 14-4. Duty output terminal
- 14-5. A/F duty (Right bank, B2)
output terminal
- 14-6. Ground terminal
15. Data link connector
16. A/C amplifier
17. Ignitor
18. No.1 ignition coil
19. No.2 ignition coil
20. No.3 ignition coil
21. No.4 ignition coil
22. No.5 ignition coil
23. No.6 ignition coil
24. Noise suppressor
25. Tachometer
26. Electric load signal diodes
- 27-1. Small light switch
- 27-2. Heater fan motor switch
- 27-3. Rear defogger switch
- 27-4. From battery
28. Power steering pressure switch
29. CO adjusting resistor (if equipped)
30. Vehicle speed sensor
(Reed switch in speedometer)
31. CMP sensor
32. IAT sensor
33. Right bank heated oxygen
sensor (if equipped)
34. Left bank heated oxygen
sensor (if equipped)
35. Throttle position sensor
36. ECT sensor
37. MAF sensor
38. Main relay
39. Starter magnetic switch
40. Transmission range switch
(A/T vehicle only)
41. Main fuse
42. Main switch
43. Battery
44. ECM

TER-MINAL	CIRCUIT	TER-MINAL	CIRCUIT
A1	No.1 injector	C1	Right bank heated oxygen sensor (Bank 2 HO2S), if equipped
A2	No.2 injector	C2	EGR valve (stepper motor coil 1), if equipped
A3	Left bank heated oxygen sensor heater (Bank 1 HO2S heater), if equipped	C3	EGR valve (stepper motor coil 2), if equipped
A4	EVAP canister purge valve	C4	EGR valve (stepper motor coil 3), if equipped
A5	Power steering pressure switch	C5	EGR valve (stepper motor coil 4), if equipped
A6	Engine start switch	C6	Blank
A7	Power source (for sensors)	C7	Ignition switch
A8	CMP sensor (REF signal)	C8	Blank
A9	CMP sensor (POS signal)	C9	
A10		C10	
A11	No.5 injector	C11	
A12	No.3 injector	C12	Blank
A13	No.4 injector	D1	
A14	IAC valve	D2	
A15	Blank	D3	
A16	Blank	D4	Power source
A17	ECT sensor	D5	Ignitor (No.3 cylinder)
A18	Sensor ground	D6	Ignitor (No.6 cylinder)
A19	IAT sensor	D7	Ignitor (No.1 cylinder)
A20	Left bank heated oxygen sensor (Bank 1 HO2S) or CO adjusting resistor	D8	Ignitor (No.4 cylinder)
A21	Throttle position sensor	D9	Ignitor (No.5 cylinder)
A22	MAF sensor	D10	Ignitor (No.2 cylinder)
A23	No.6 injector	D11	Blank
A24	Ground	D12	Fuel pump relay
B1	Blank	D13	Ground
		D14	Power source
B2	Blank	D15	Duty output terminal
B3	Electric load signal diodes	D16	Blank
B4	Test switch terminal	D17	Diagnosis output terminal and MIL ("CHECK ENGINE" light)
B5	Vehicle speed sensor	D18	Throttle valve opening signal to TCM (A/T vehicle only)
B6	Transmission range switch	D19	Engine coolant signal to TCM (A/T vehicle only)
B7	Blank	D20	Data link connector
B8	Sensor ground	D21	Blank
B9	A/F duty (Right bank, B2) output terminal	D22	Main relay
B10	Blank		Right bank heated oxygen sensor heater (Bank 2 HO2S heater), if equipped
B11	Power source for back-up		Ground
B12	Diagnosis switch terminal		
B13	A/C amplifier (if equipped)		
B14	Blank		
B15	Tachometer		
B16	Noise suppressor (ignition fail safe signal)		



85F00-6E2-16-1



1. Malfunction indicator lamp ("CHECK ENGINE" light)
2. Cluster
3. Diagnosis switch terminal
4. Monitor coupler
5. ECM
6. Sensed information
7. Output
8. Main relay
9. Ignition switch

85F00-6E2-16-2

Engine Control Module (ECM)

ECM is installed to the underside of the instrument panel at the driver's seat side.

ECM is a precision unit consisting of microcomputer, A/D (Analog/Digital) converter, I/O (Input/Output) unit, etc..

It is an essential part of the electronic control system, for its functions include not only such a major function as to control fuel injector, idle air control valve, fuel pump relay, etc. but also on-board diagnostic system (self-diagnosis function) and fail-safe function as described in the following section.

On-board diagnostic system (Self-diagnosis function)

ECM diagnoses troubles which may occur in the areas including the following parts when the ignition switch is ON or the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp ("CHECK ENGINE" light).

- Heated oxygen sensors (Left and right bank, if equipped)
- Intake air temp. sensor
- Engine coolant temp. sensor
- Throttle position sensor
- Vehicle speed sensor
- Mass air flow sensor
- Ignition fail-safe signal
- EGR stepper motor (if equipped)
- Fuel system (vehicle with heated oxygen sensor)
- CPU (Central Processing Unit) of ECM

ECM and malfunction indicator lamp ("CHECK ENGINE" light) operate as follows.

- Malfunction indicator lamp ("CHECK ENGINE" light) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Electronic Fuel Injection system. This is only to check the malfunction indicator lamp ("CHECK ENGINE" light) bulb and its circuit.
- If the above areas of Electronic Fuel Injection system 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 above 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.

(The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for 2 minutes or longer.) ECM also indicates trouble area in memory by means of flashing of malfunction indicator lamp ("CHECK ENGINE" light) at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned ON).

NOTE:

- Only ignition circuit trouble (code No.41) among the above areas is not stored in back-up memory of ECM. (In other words, even if ECM has detected a trouble in ignition circuit, once ignition switch is turned OFF, code No.41 will not be indicated even when diagnosis switch terminal is grounded and ignition switch is turned ON). Therefore, to check diagnostic trouble code when engine fails to start, crank engine and then ground diagnostic switch terminal with ignition switch ON.
- Even when a trouble occurs in CMP sensor circuit (circuit open), ECM does not indicate it (or activate malfunction indicator lamp ("CHECK ENGINE" light)).

And when that troubled circuit regains good condition, the memory of defective area will be erased automatically even if the power circuit to ECM is not opened as described above.

85F00-6E2-17-1

Fail-safe function

Even when a trouble has occurred in such areas of Electronic Fuel Injection system that include the following parts and a failure signal is sent to ECM, control over the injector, idle air control valve and other is maintained on the basis of the standard signals and/or back-up program prestored in the ECM while ignoring that failure signal and/or CPU. This function is called "fail-safe function". Thus, with this function, a certain level of engine performance is available even when some failure occurs in such areas so that disability in running is avoided.

- Engine coolant temp. sensor
- Intake air temp. sensor
- Throttle position sensor
- Mass air flow sensor
- EGR stepper motor (if equipped)
- CPU in ECM

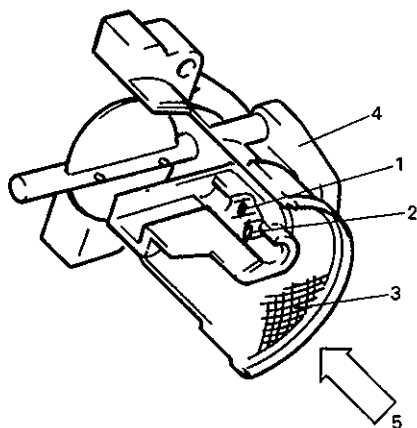
85F00-6E2-17-3

Mass Air Flow Sensor (MAF Sensor)

The MAF sensor is incorporated with throttle body and consists of heat resistor, metering duct, straightening net, body, control circuit, etc.

It detects the mass flow of the air drawn into the engine and sends that information to ECM as a current signal.

ECM uses the signal as one of the signals to control various devices.

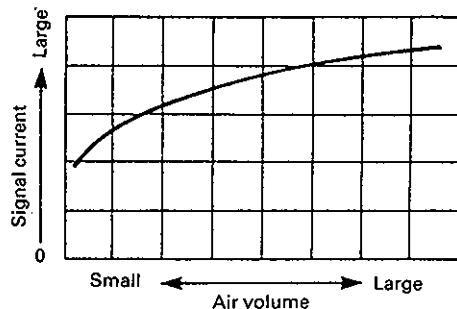
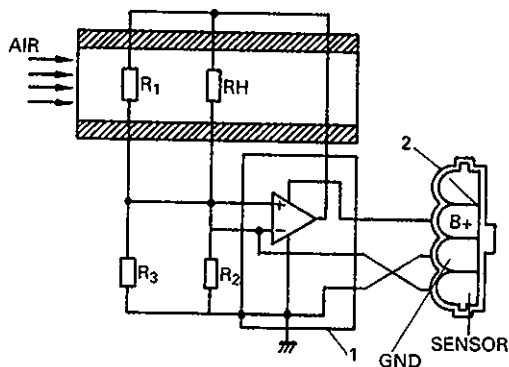


1. Heat-resistor
2. Metering duct
3. Straightening net
4. Control circuit
5. Air from air cleaner

85F00-6E2-18-1

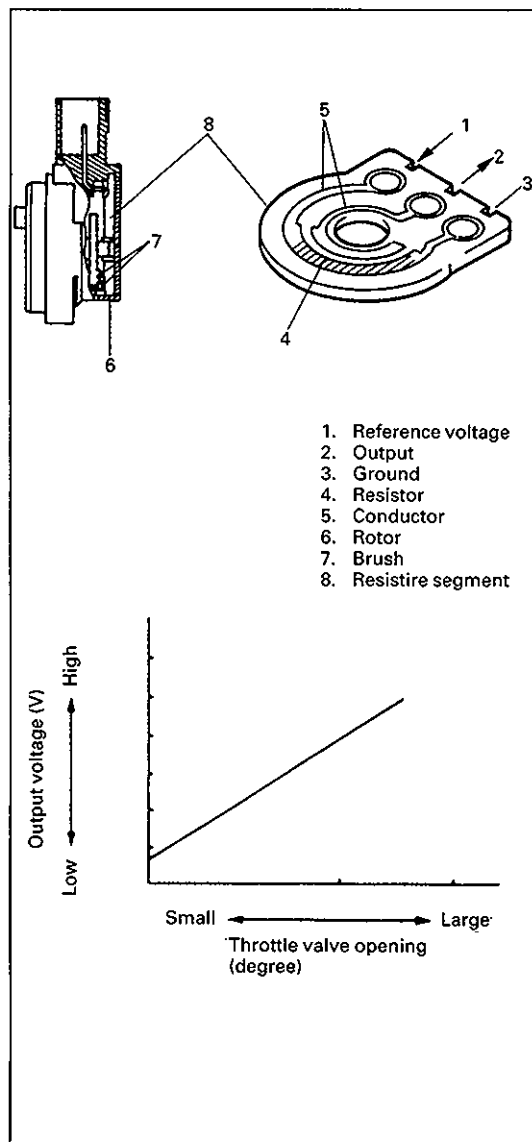
This MAF sensor is a thermal control type including a heat-resistor and a control circuit.

The heat resistor is cooled off by the intake air and the control circuit controls the heat-resistor temperature (the amount of electric current flowing to the heat-resistor) so as to keep it within a certain difference range from the ambient temperature. Then this control value is output as a current signal.



1. Control circuit
2. Coupler
- RH: Heat-resistor
- R: Resistor

85F00-6E2-18-3



85F00-6E2-19-1

Throttle Position Sensor (TP Sensor)

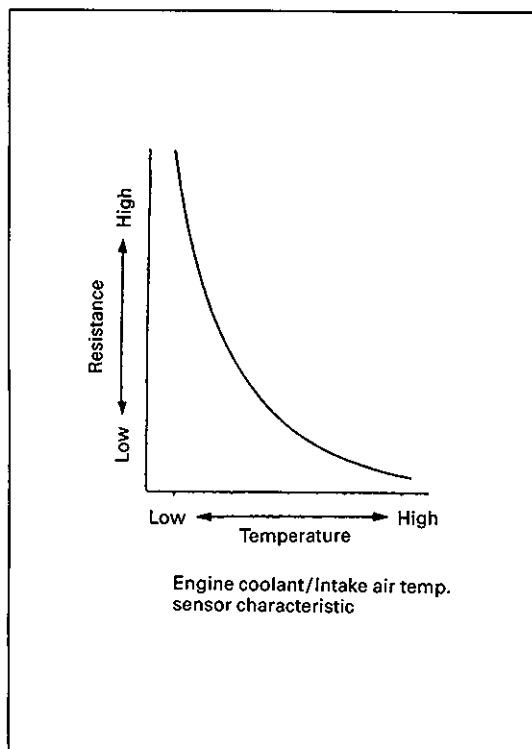
The throttle position sensor consisting of a potentiometer is installed on the throttle body, and detects the throttle valve opening.

A 5-volt reference voltage is applied to the sensor from ECM and as its brush moves over the print resistance according to the throttle valve opening, the output voltage varies accordingly.

By monitoring the sensor output voltage, ECM detects the throttle valve opening.

ECM uses the signal from TP sensor as one of the signals to control fuel injector, idle air control valve, ignition timing, EVAP canister purge valve and EGR valve (if equipped).

Also for A/T model, ECM converts the voltage signal from TP sensor into ON/OFF signal and sends it to transmission control module, where it is used as one of the signals to control the automatic transmission.



85F00-6E2-19-4

Engine Coolant Temperature Sensor (ECT Sensor)

Incorporated with engine coolant temp. gauge and located at the water outlet pipe, this sensor measures the temperature of the engine coolant and converts its change into that in resistance through the thermister.

By monitoring the resistance of the coolant temperature sensor, ECM detects the engine coolant temperature and that affects most systems under the control of ECM.

Also for A/T model, ECM converts the voltage signal from ECT sensor into ON/OFF signal and sends it to transmission control module, where it is used as one of the signals to control the automatic transmission.

Intake Air Temperature Sensor (IAT Sensor)

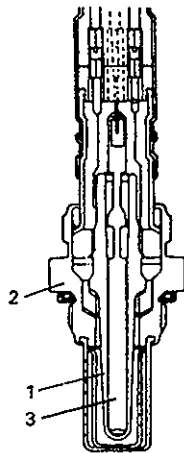
Located on the air cleaner, this sensor measures the temperature of the intake air and converts its change into that in resistance through the thermister like the ECT sensor.

By monitoring the resistance of the IAT sensor, ECM detects the intake air temperature and use it as one of the signals to control fuel injectors, ignition timing and EGR valve.

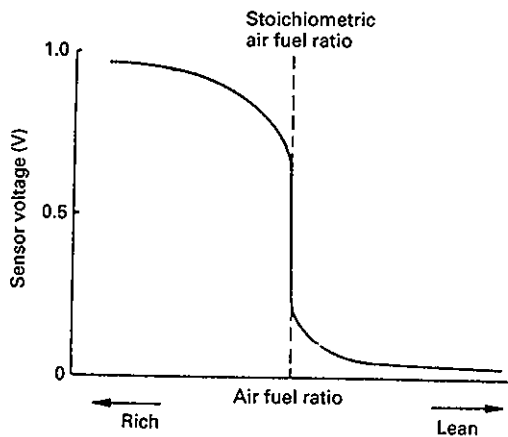
Heated Oxygen Sensor (HO2S) (if equipped)

The heated oxygen sensors are installed on the each exhaust manifold to detect the concentration of oxygen in the exhaust gases.

The oxygen sensor heater promotes activation of the oxygen sensor.



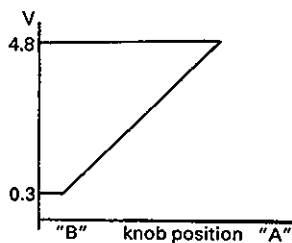
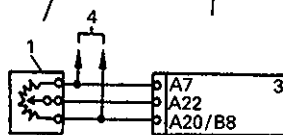
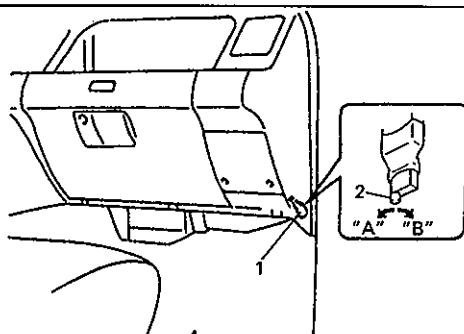
1. Element
2. Housing
3. Heater



85F00-6E2-20-1

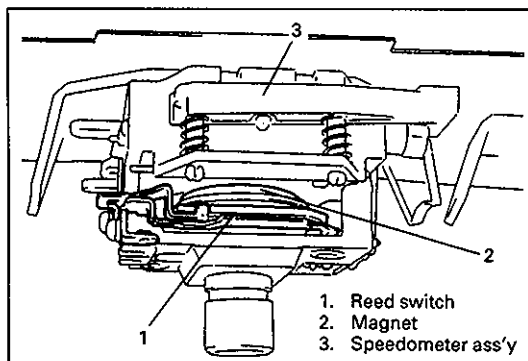
CO Adjusting Resistor. (Vehicle without heated oxygen sensor only)

Variation of the base air/fuel ratio due to such factors of the engine as aging can be adjusted by turning the knob of CO adjusting resistor. Turning the CO adjusting resistor knob to "A" increases CO% (A/F mixture becomes rich) and turning it to "B" decreases CO% (A/F mixture becomes lean).



1. CO adjusting resistor
2. Knob
3. ECM
4. To sensors

85F00-6E2-20-4



85F00-6E2-21-1

Vehicle Speed Sensor (VSS)

The speed sensor consisting of the reed switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the reed switch to turn ON and OFF. Such ON/OFF frequency increases or decreases in proportion with the vehicle speed and is sent to ECM as pulse signals.

ECM uses it as one of the signals to control various devices.

Camshaft Position Sensor (CMP sensor)

The CMP sensor located on the rearward of left side cylinder head consists of the signal generator (photo transistors) and signal rotor (slits plate).

The signal generator generates REF signal and POS signal through two types of slits in the slit plate which turns together with the camshaft.

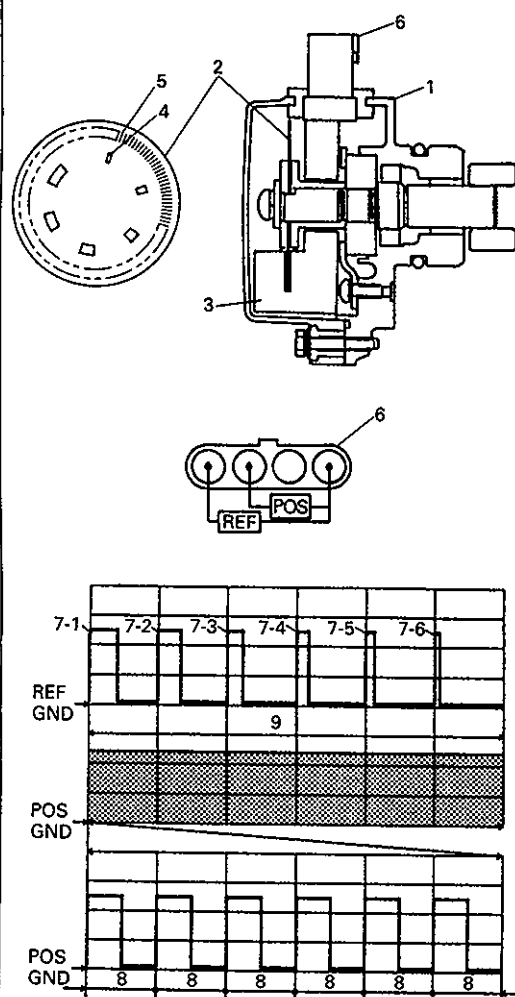
REF signal

The CMP sensor generates 6 pulses of signals each of which has a different wave form while the camshaft makes one full rotation.

Based on these signals, ECM judges which cylinder piston is at the ignition BTDC 110°.

POS signal

The CMP sensor generates 360 pulses of signals while the camshaft makes one full rotation (i.e., 1 pulse per 1° movement of the camshaft). Based on these signals, ECM judges the size of REF signal, the engine speed and piston position.



85F00-6E2-21-2

Ignition Fail-Safe Signal

This signal is sent from the noise suppressor.

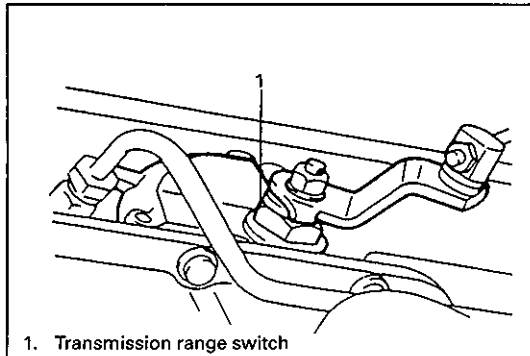
ECM uses it as one of the signals for controlling fuel injectors.

Engine Start Signal

This signal is sent from the engine starter circuit.

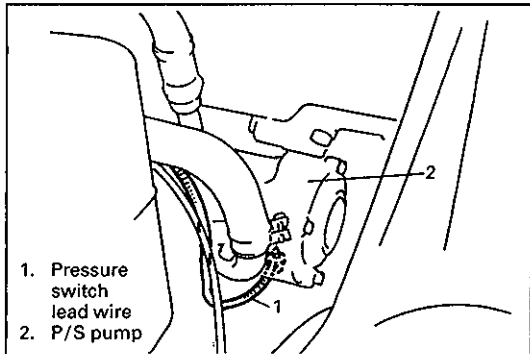
Receiving it, ECM judges whether the engine is cranking or not and uses it as one of the signals to control the fuel injector and fuel pump relay.

85F00-6E2-22-1

**Transmission Range Switch. (A/T only) ("R", "D", "2" or "L" range signal)**

Located on the transmission, it turns ON when the select lever is in the park or neutral position. ECM detects whether the transmission is in the parking or neutral state or in any other state through this ON/OFF signal and uses it as one of the signals to control fuel injectors and idle air control valve.

85F00-6E2-22-2

**Power Steering Signal (For vehicle with power steering)**

This signal is sent from the power steering pressure switch. The power steering pressure switch is installed on the power steering pump body.

The switch turns ON when the oil pressure is higher than 2.2 – 2.8 MPa (22 – 28 kg/cm², 313 – 398 psi).

The turning of the steering wheel causes increased oil pressure.

ECM uses it as one of the signals for controlling idle air control valve operation.

85F00-6E2-22-3

Air Conditioning Signal (For vehicle with A/C)

This signal is sent from the A/C circuit.

ECM detects whether the A/C is operating or not through the signal and uses it as one of the signals for controlling idle air control valve operation.

Electric Load Signal

This signal is sent from each circuit of head & small (or clearance) lights, heater fan, and rear window defogger. ECM uses it as one of the factors for controlling idle air control valve.

85F00-6E2-22-4

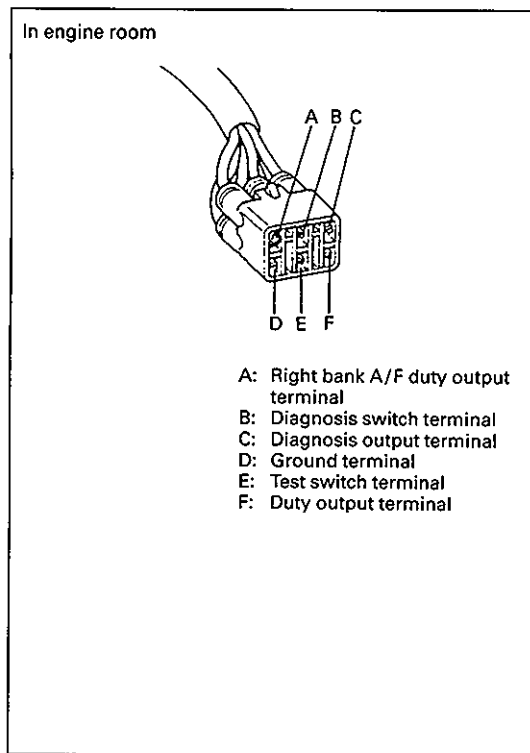
Battery Voltage

The fuel injector is driven by its solenoid coil based upon the ECM output signal.

There is some delay called as "Ineffective injection time", which doesn't provide fuel, between ECM signal and valve action.

As the ineffective injection time depends on the battery voltage, ECM takes voltage information to compensate it in fuel injection time.

85F00-6E2-22-5



85F00-6E2-23-1

Diagnosis Switch Terminal

The diagnosis switch terminal is included in the monitor coupler in the engine room. When this terminal is grounded, a diagnosis signal is fed to ECM which then outputs diagnostic trouble code (self-diagnosis code) and at the same time outputs idle air control (IAC) duty through duty output terminal.

Test Switch Terminal

The test switch terminal is included in the engine-room monitor coupler. When this terminal is grounded, ECM sets the ignition timing to the initial ignition timing.

For vehicle with heated oxygen sensor, when both test switch terminal and diagnosis switch terminal are grounded, ECM outputs left bank A/F duty through the duty output terminal and right bank A/F duty through the right bank A/F duty output terminal.

FUEL INJECTION CONTROL SYSTEM

In this system, ECM controls the time (amount) and timing of the fuel injection from the fuel injector into the cylinder head intake port according to the signals from the various sensors so that suitable air/fuel mixture is supplied to the engine in each driving condition.

Injection Timing

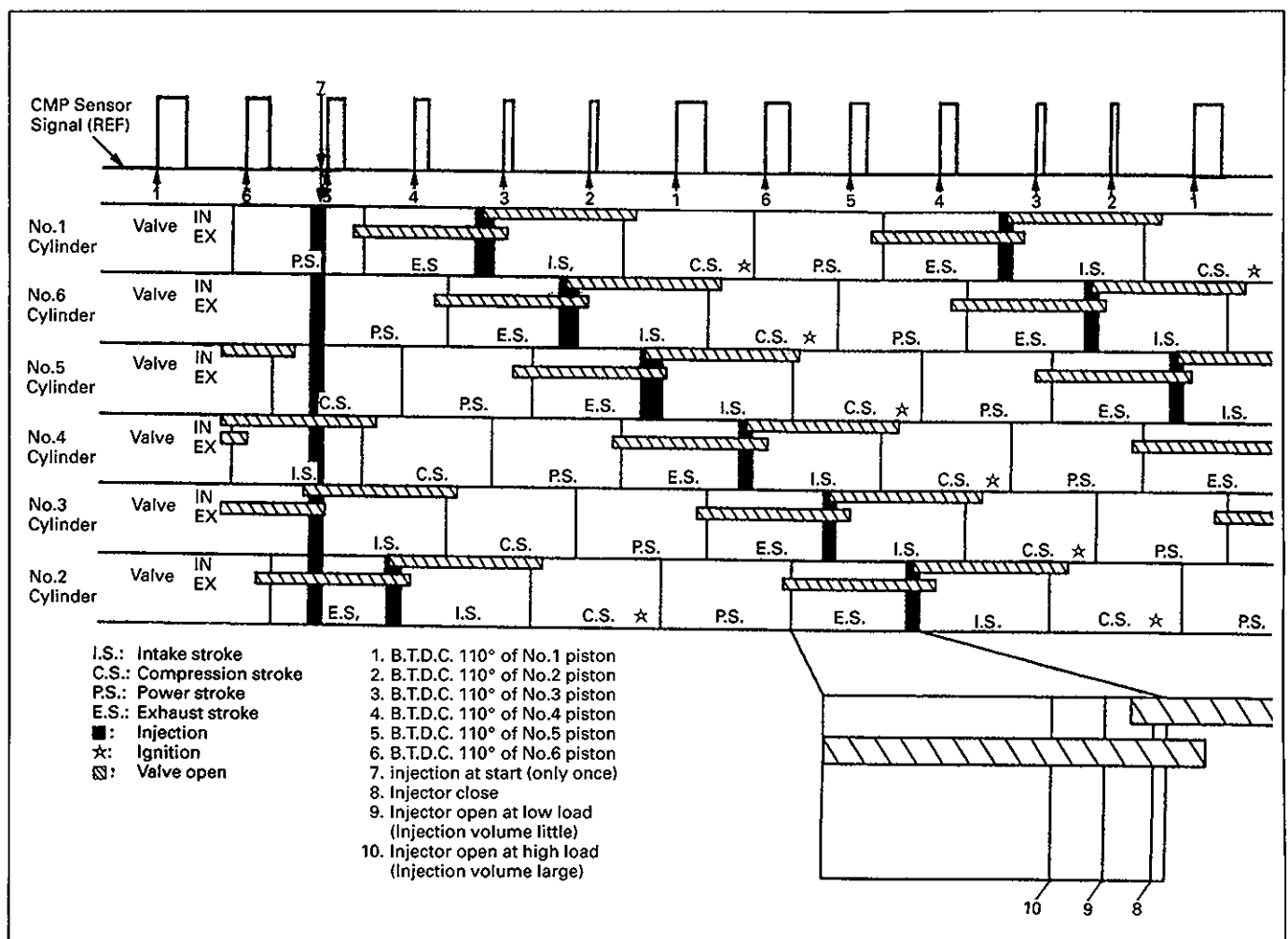
ECM controls the fuel injection as follows.

As soon as ECM detects 2 pulses of CMP sensor signal (REF signal) at the engine start, all injectors inject fuels.

Then sequential injection starts and goes on till the engine stops.

In sequential injection, injection takes place immediately before the intake valve of each cylinder opens based on CMP sensor signals (REF signal and POS signal).

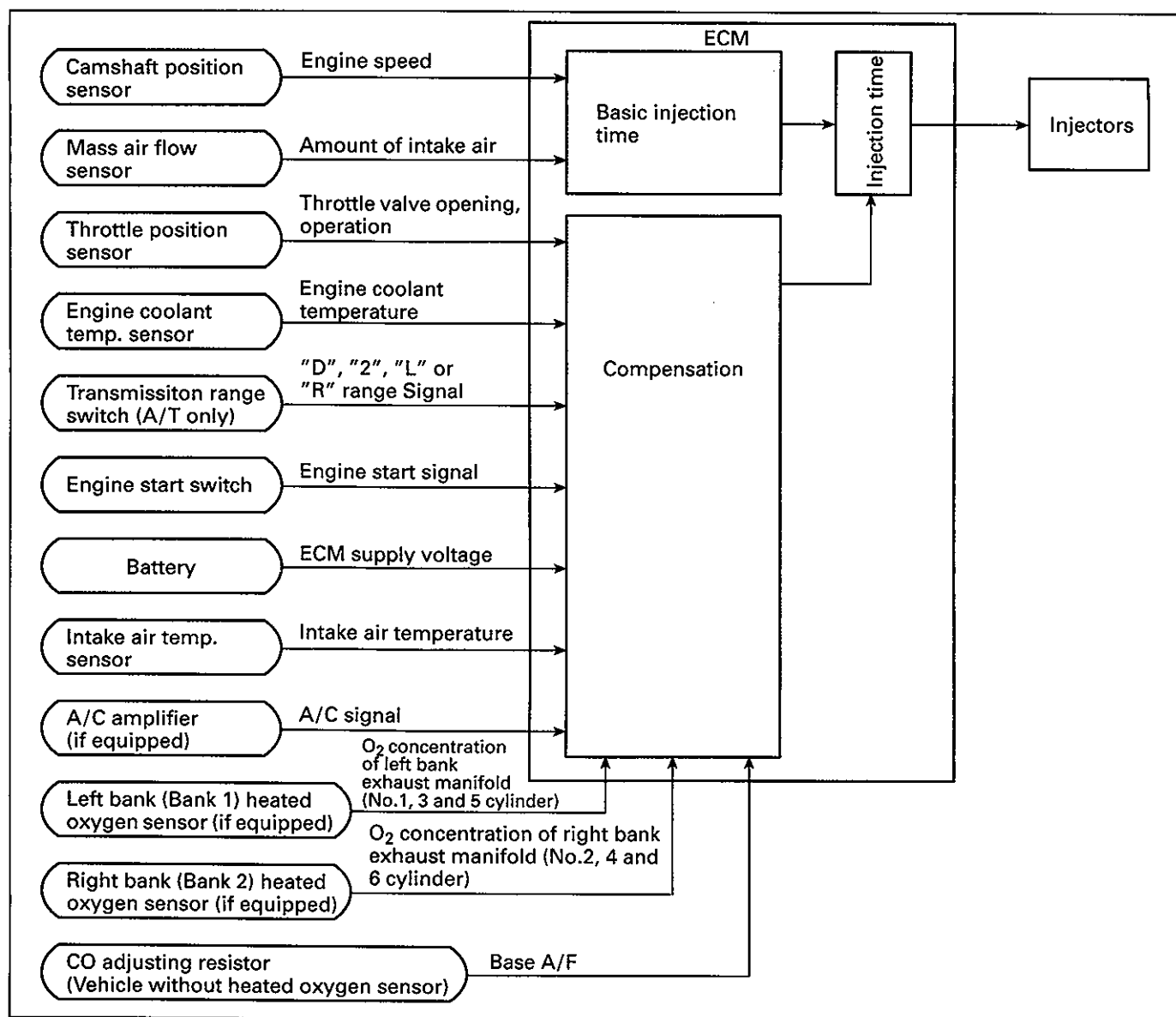
Also, ECM controls the injection time (injection volume) during sequential injection by varying the timing at which the injector starts to open.



Injection time (amount of injection)

The factors to determine the injection time are the basic injection time which is calculated on the basis of the engine speed and the amount of the intake air and various compensations which are

determined according to the signals from various sensors that detect the state of the engine and driving conditions.



85F00-6E2-25-1

Enriching compensation while engine starting

In order to improve starting performance, enriching compensation at start is carried out.

Enriching compensation after engine start

For a certain time after the engine is started, air/fuel mixture enriching compensation is made so as to stabilize the engine speed. The amount of compensation varies depending on the engine coolant temperature and it is the largest immediately after the engine start and after that, it reduces gradually.

85F00-6E2-25-2

Enriching compensation while warming up

When the engine is cold, enriching compensation is made to ensure good driveability till the engine coolant temperature reaches the specified level. The amount to enrich the air/fuel mixture is decreased as the temperature rises.

Power enriching compensation

To ensure smooth acceleration and good driveability under the high load driving condition, enriching compensation is carried out when the throttle valve opening is larger than specification.

Enriching compensation when accelerating

When the accelerator pedal is depressed, the enriching compensation takes place to obtain smooth acceleration performance. The amount of increase for compensation depends on the engine coolant temperature.

Battery voltage compensation

A power voltage drop delays the mechanical operation of the injector. Then the actual injection time becomes shorter for the time that electricity is supplied to the injector. To compensate this, the electricity supply time is made longer when the voltage is lower.

Base air/fuel ratio compensation (Vehicle with heated oxygen sensors only)

The air/fuel ratio may vary due to such factors as variation in each engine itself and aging. To compensate such variation, feed back compensation is used and base air/fuel mixture ratio is adjusted to a proper level for feed back compensation.

Fuel cut

Fuel injection stops (with operation of the injector prevented) when decelerating, so that unburned gas will not be exhausted and it starts again when above conditions for fuel recovery are fulfilled.

The fuel injection also stops when the engine speed exceeds 6,800 r/min to prevent over-run which affects the engine adversely and it starts again when the engine speed reduces to less than 6,500 r/min.

Closed loop system (Air/fuel ratio feed back compensation) (Vehicle with Heated oxygen sensor only)

It is necessary to keep the air/fuel mixture close to the theoretical air/fuel ratio (14.7) to obtain efficient performance of the three way catalytic converter and high clarification rate of CO, HC and NOx in the exhaust gas. For that purpose, ECM operates as follows. First, ECM compares two signals from the heated oxygen sensor which is installed to each exhaust manifold (right and left) and the specified reference voltage.

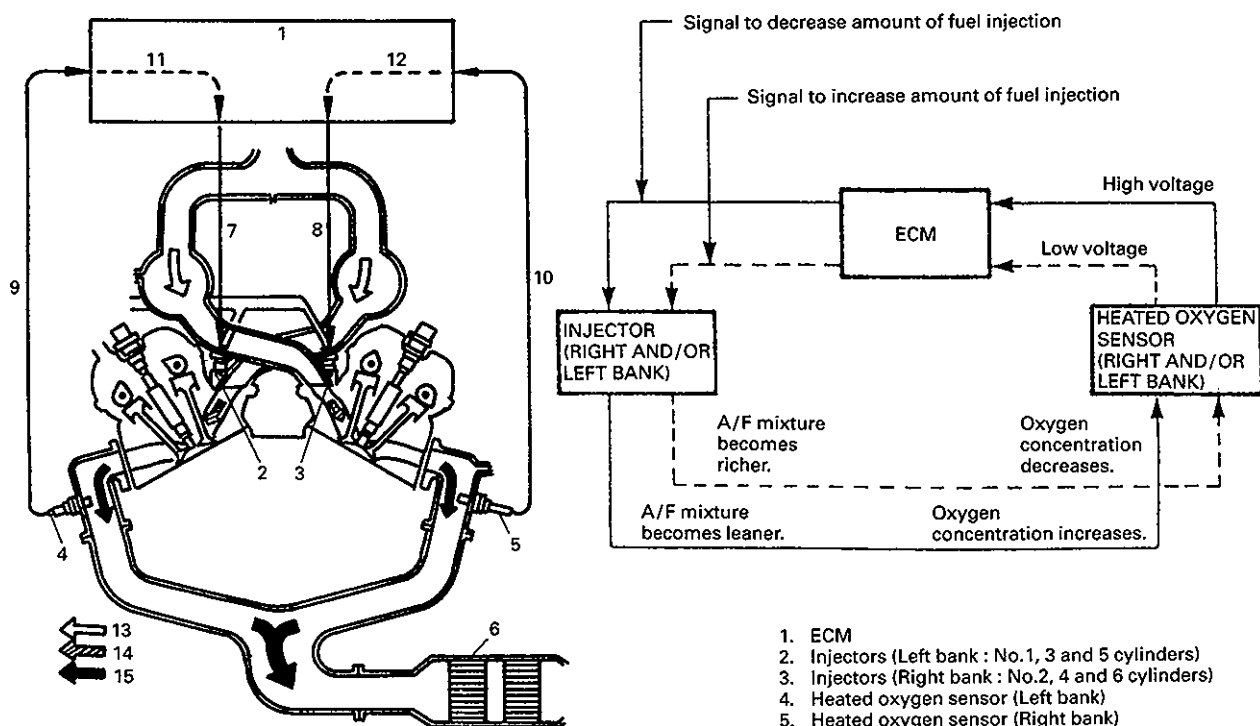
If the signal from either one (or both) of the heated oxygen sensor is higher than the specified reference voltage, ECM judges that the air/fuel ratio on the bank to which the heated oxygen sensor is installed is richer than the theoretical air/fuel ratio and reduces the fuel injection time (volume) for injectors on that side. On the other hand, if the signal from either one (or both) of the heated oxygen sensor is lower than the specified reference voltage, ECM judges that the air/fuel ratio on the bank to which that heated oxygen sensor is installed is leaner than the theoretical air/fuel ratio and increases the fuel injection time (volume) for injectors on that side. By repeating these operations,

ECM compensates injection on each bank (right and left) so that the air/fuel ratio becomes closer to the theoretical value.

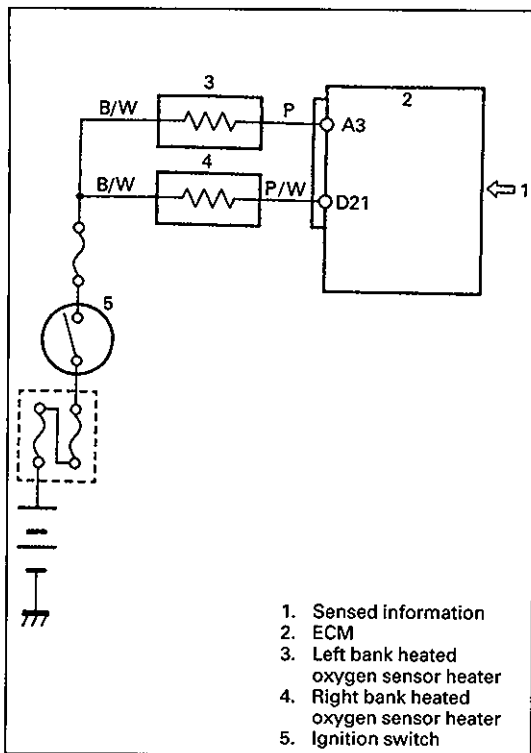
- 1) When oxygen concentration in the exhaust gas is low, that is, when the air/fuel ratio is smaller than the theoretical air/fuel ratio (fuel is richer), electromotive force of the oxygen sensor increases and a rich signal is sent to ECM.
- 2) Upon receipt of the rich signal, ECM decreases the amount of fuel injection, which causes oxygen concentration in the exhaust gas to increase and electromotive force of the oxygen sensor to decrease. Then a lean signal is sent to ECM.
- 3) As ECM increases the amount of fuel injection according to the lean signal, oxygen concentration in the exhaust gas decreases and the situation is back to above 1).

This control process, however, will not take place under any of the following conditions.

- When engine coolant temperature is low
- During fuel cut
- When heated oxygen sensor is cold



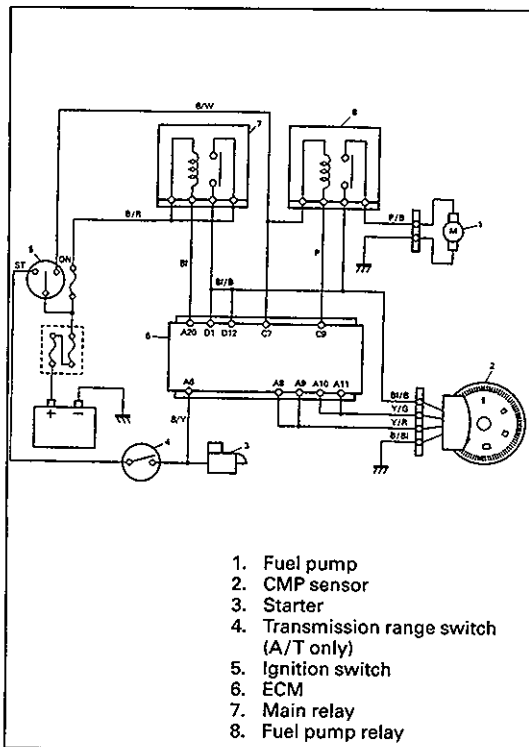
1. ECM
2. Injectors (Left bank : No.1, 3 and 5 cylinders)
3. Injectors (Right bank : No.2, 4 and 6 cylinders)
4. Heated oxygen sensor (Left bank)
5. Heated oxygen sensor (Right bank)
6. Three way catalytic converter
7. Injection signal (Left bank)
8. Injection signal (Right bank)
9. Heated oxygen sensor voltage signal (Left bank)
10. Heated oxygen sensor voltage signal (Right bank)
11. Compensation (Left bank injection time)
12. Compensation (Right bank injection time)
13. Air
14. Air fuel mixture
15. Exhaust gas



85F00-6E2-28-1

HEATED OXYGEN SENSOR HEATER CONTROL SYSTEM (VEHICLE WITH HEATED OXYGEN SENSOR ONLY)

This system controls operation (ON/OFF) of the heater which assists activation of the oxygen sensor. ECM turns the oxygen sensor heater ON (to allow the electric current to flow to the oxygen sensor heater) when the engine is running without high-load and high-speed condition.



85F00-6E2-28-3

FUEL PUMP CONTROL SYSTEM

ECM controls ON/OFF operation of the fuel pump by turning it ON via the fuel pump relay under one of the following conditions.

- For 3 seconds after ignition switch ON.
- While engine start signal is inputted to ECM.
- While CMP sensor signal is inputted to ECM.

IDLE AIR CONTROL SYSTEM

This system controls the bypass air flow by means of ECM and idle air control valve (IAC valve) for the following four purposes.

- To keep the engine idle speed as specified at all times.

The engine idle speed can vary due to following reasons.

- * Load applied to engine (when electric load is applied, automatic transmission is shifted to "R", "D", "2" or "L" range, A/C is turned ON, etc.)
- * Variation in atmospheric pressure
- * Change in engine itself with passage of time
- * Other factors causing idle speed to change
- To improve starting performance of engine
- To compensate air/fuel mixture ratio when decelerating (Dash-pot effect)
- To improve driveability when while engine is warmed up.

Operation

IAC valve opens the bypass passage when it is turned ON by ECM and closes when turned OFF.

ECM detects the engine condition by using signals from various sensors and switches and while repeating ON and OFF cycle of IAC valve at a certain rate (320 times a second), it controls bypass air flow (IAC valve opening) by increasing and decreasing its ON time within a cycle.

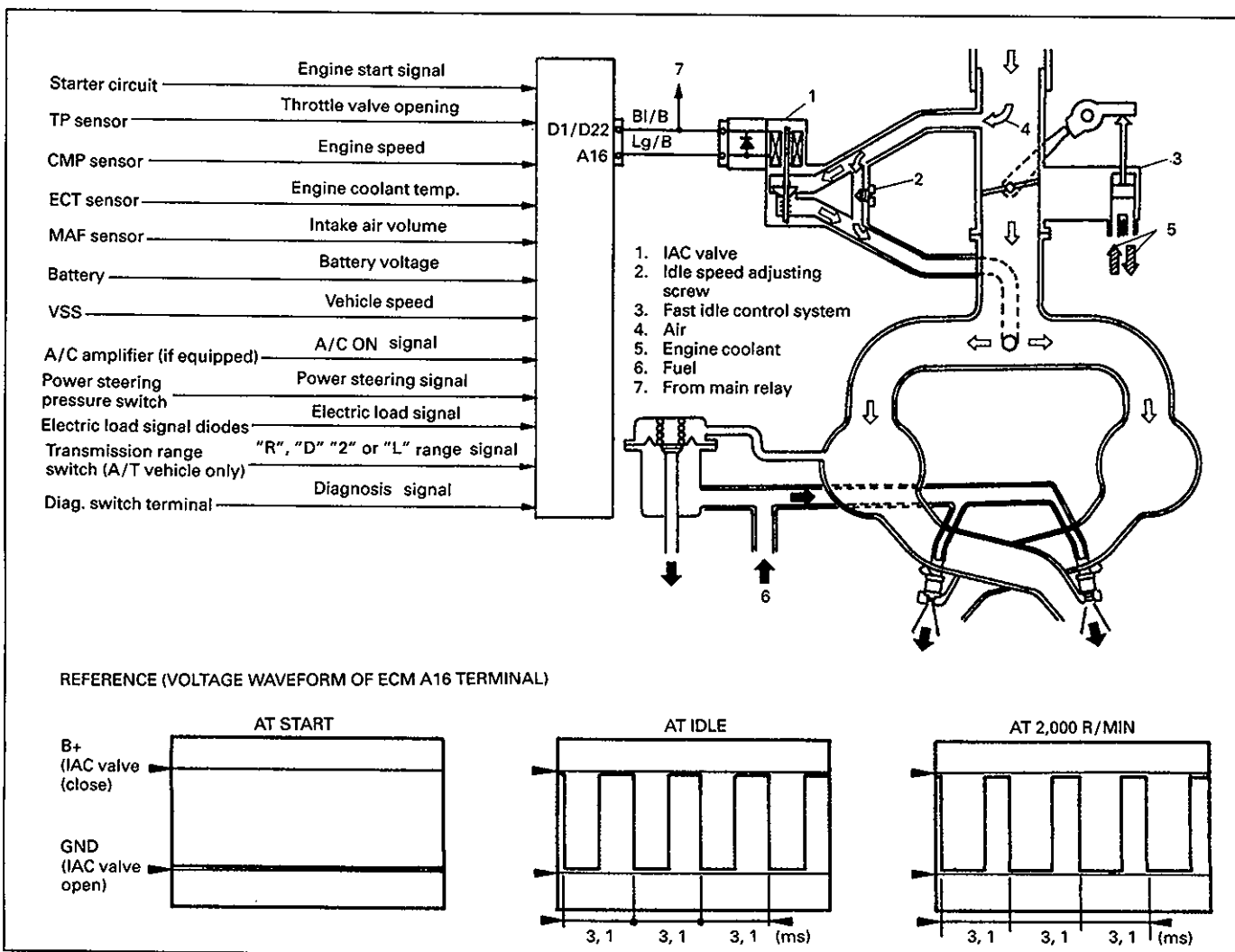
When the vehicle is at a stop, the throttle valve is at the idle position and the engine is running, the engine speed is kept at a specified idle speed.

M/T vehicle

	A/C OFF	A/C ON
Engine idle speed specification	750 ± 50 r/min.	850 ± 50 r/min.

A/T vehicle

	A/C OFF	A/C ON	
Engine idle speed specification	"P" or "N" range	800 ± 50 r/min.	900 ± 50 r/min.
	"R", "D" "2" or "L" range	750 ± 50 r/min.	750 ± 50 r/min.



EXHAUST GAS RECIRCULATION (EGR) SYSTEM (IF EQUIPPED)

This system controls the formation of NO_x emission by recirculating the exhaust gas into the combustion chamber through the intake manifold. The EGR system consists EGR valve and piping for exhaust gas.

The EGR valve is controlled by ECM according to the signals from CMP sensor, ECT sensor, MAF sensor and VSS.

The EGR valve consists of a stepper motor, rods, valve, etc.

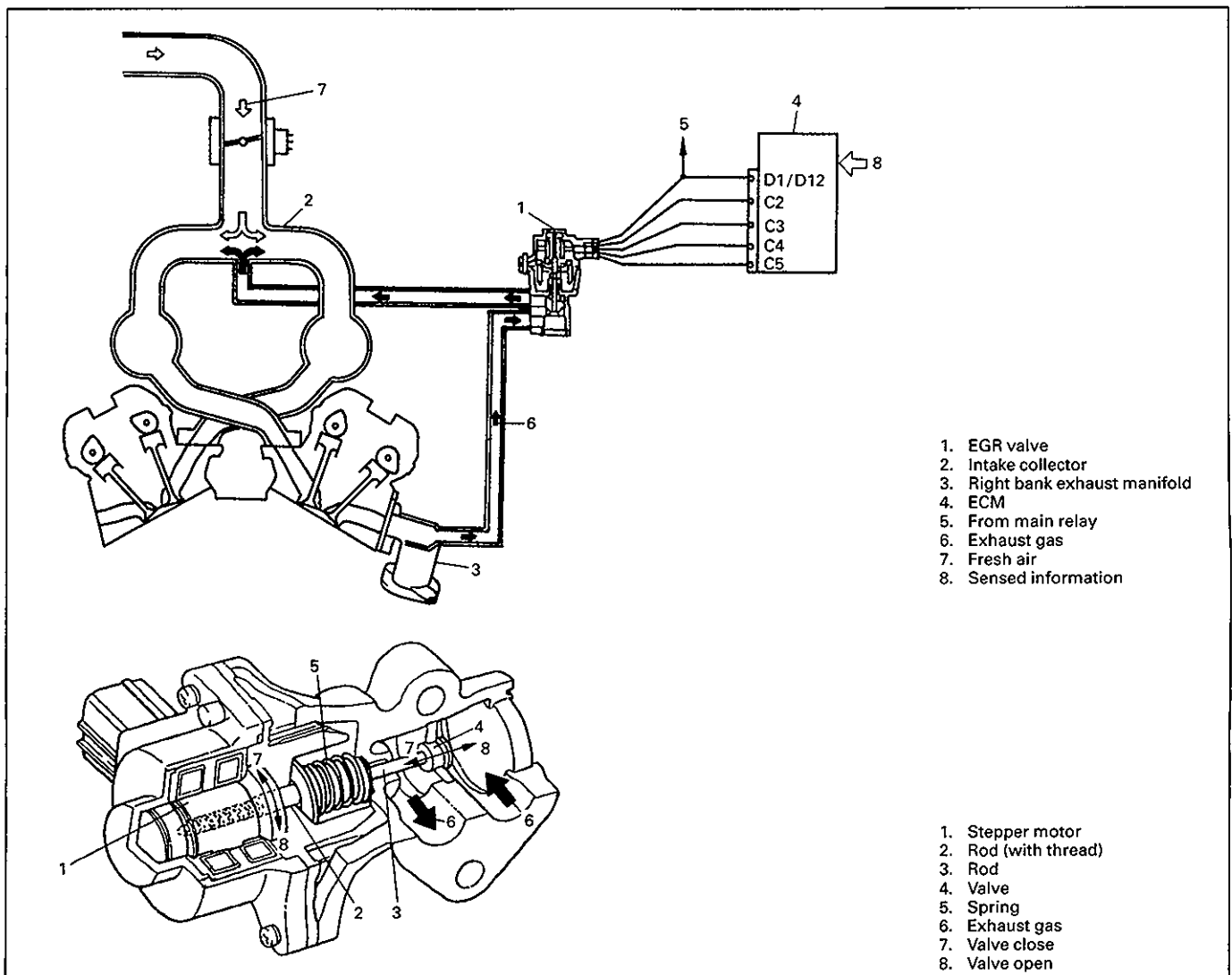
When the EGR valve stepper motor receives "open" signal from ECM, it turns in the "open" direction according to the number of steps and pushes out the rod which is in mesh with the worm of the stepper motor. As the rod installed to the EGR valve is pushed by this rod, the EGR valve opens by the amount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

To close the EGR valve, the stepper motor turns in the "close" direction according to the number of steps of the "close" signal from ECM and pulls up the rod. In this way, the valve is closed by the spring force.

And in this state, the exhaust gas is not allowed to flow to the air intake system or the combustion chamber.

Under any one of the following conditions, ECM closes the EGR valve.

- When engine coolant temperature is low
- When throttle valve opening is less than specification.
- When engine is running under high load
- When vehicle is stopped.



EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

An evaporative emission control system is used to prevent emission of fuel vapor.

The vapor generated in the fuel tank while driving or the engine at a stop passes through a tank pressure control valve and enters the EVAP canister where the charcoal absorbs and stores the fuel vapor.

The EVAP canister purge valve (C) is controlled by ECM according to signals from various sensors.

When none of the following conditions exists, ECM controls ON/OFF (open/close) switching of the canister purge valve at a constant rate (10 times per second) and its opening (amount of purge air) by increasing and decreasing its ON time.

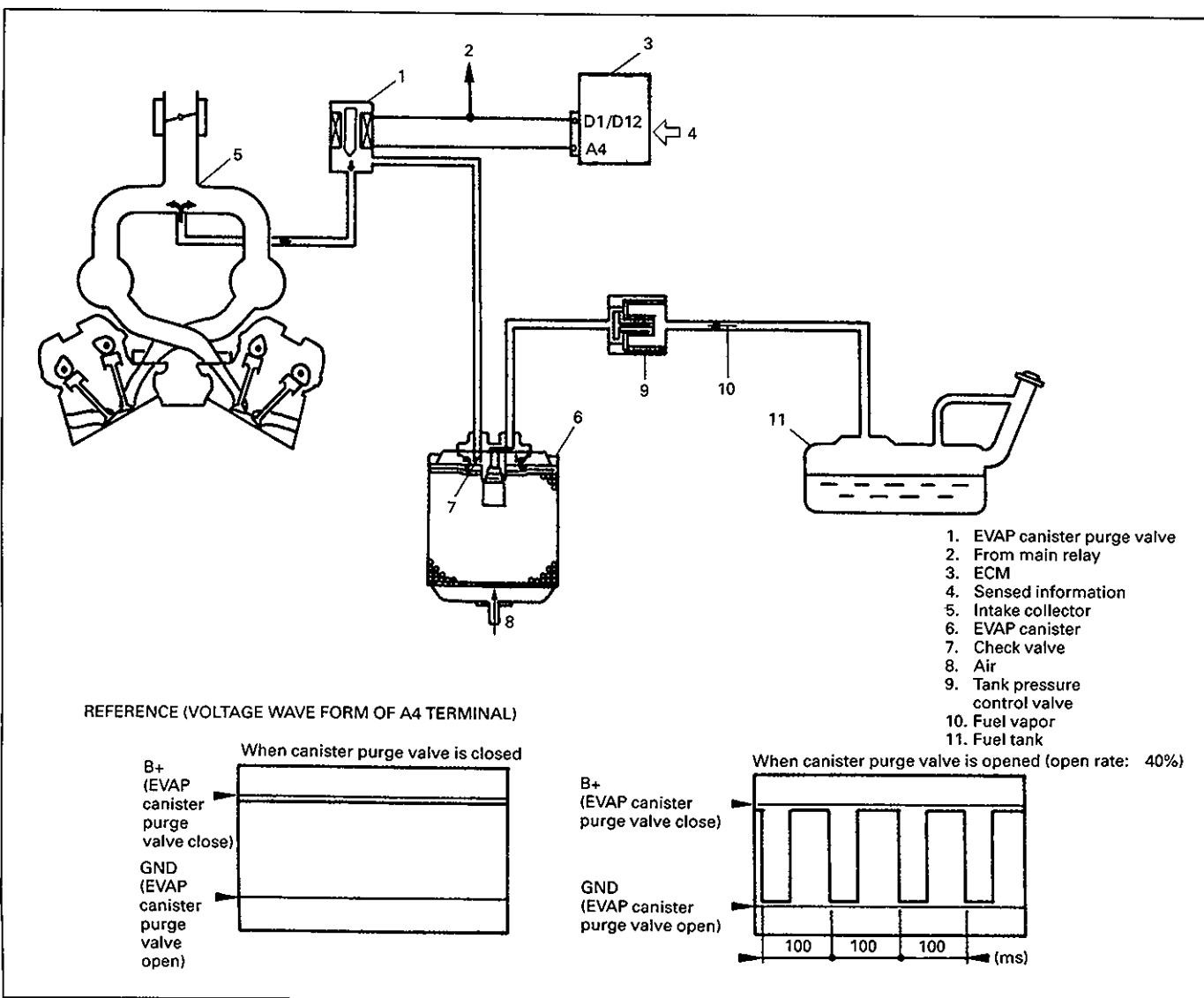
- When idle switch is ON.
- When engine coolant temp. is low.
- When engine speed is low.
- When vehicle is stopped.

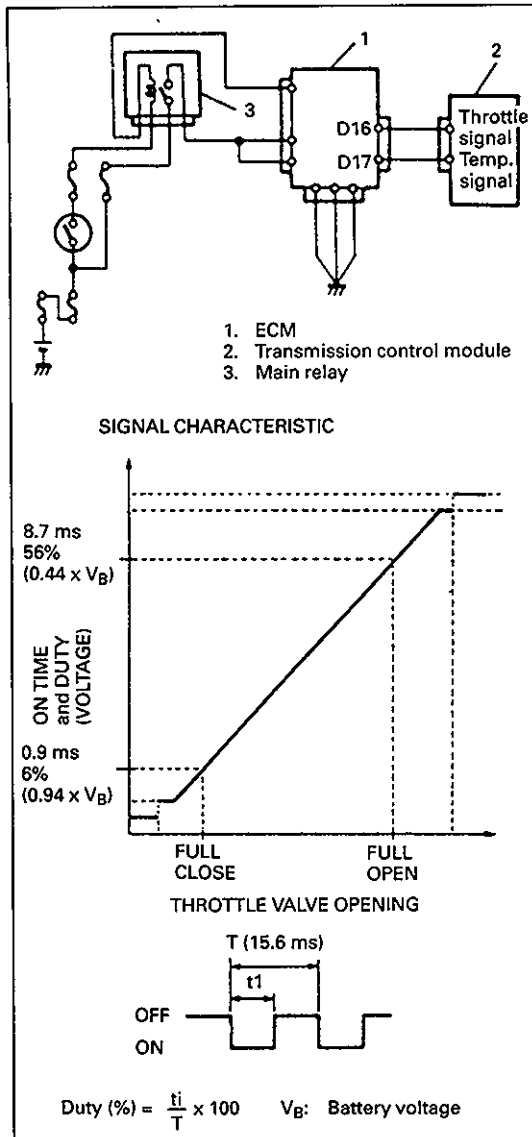
The higher the engine speed rises and the more fuel mixture is drawn in, the larger amount of air is purged.

When the solenoid valve opens, fuel vapor in the canister is sucked into intake manifold.

In this state, the canister is purged or cleaned by air drawn through the filter at the bottom of the canister.

The tank pressure control valve is provided to keep the pressure in the fuel tank constant. When the pressure in the fuel tank becomes positive and reaches its specified value, it opens the valve to let the vapor flow into the EVAP canister. On the other hand, when the pressure in the fuel tank becomes negative and reaches its specified value, it opens the valve to let the air flow into the fuel tank.

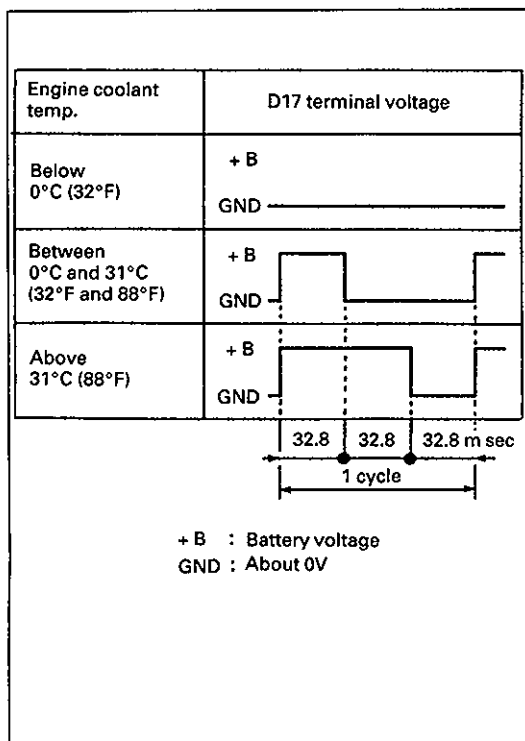




85F00-6E2-32-1

ENGINE COOLANT TEMP. SIGNAL OUTPUT FOR TCM (A/T VEHICLE ONLY)

ECM transmits the engine coolant temperature signal to TCM by grounding D17 terminal which receives battery voltage from TCM. TCM uses this signal as one of the factors to control shift to the 4th (O/D) gear and lock-up.



85F00-6E2-32-4

IC (IGNITION CONTROL) SYSTEM

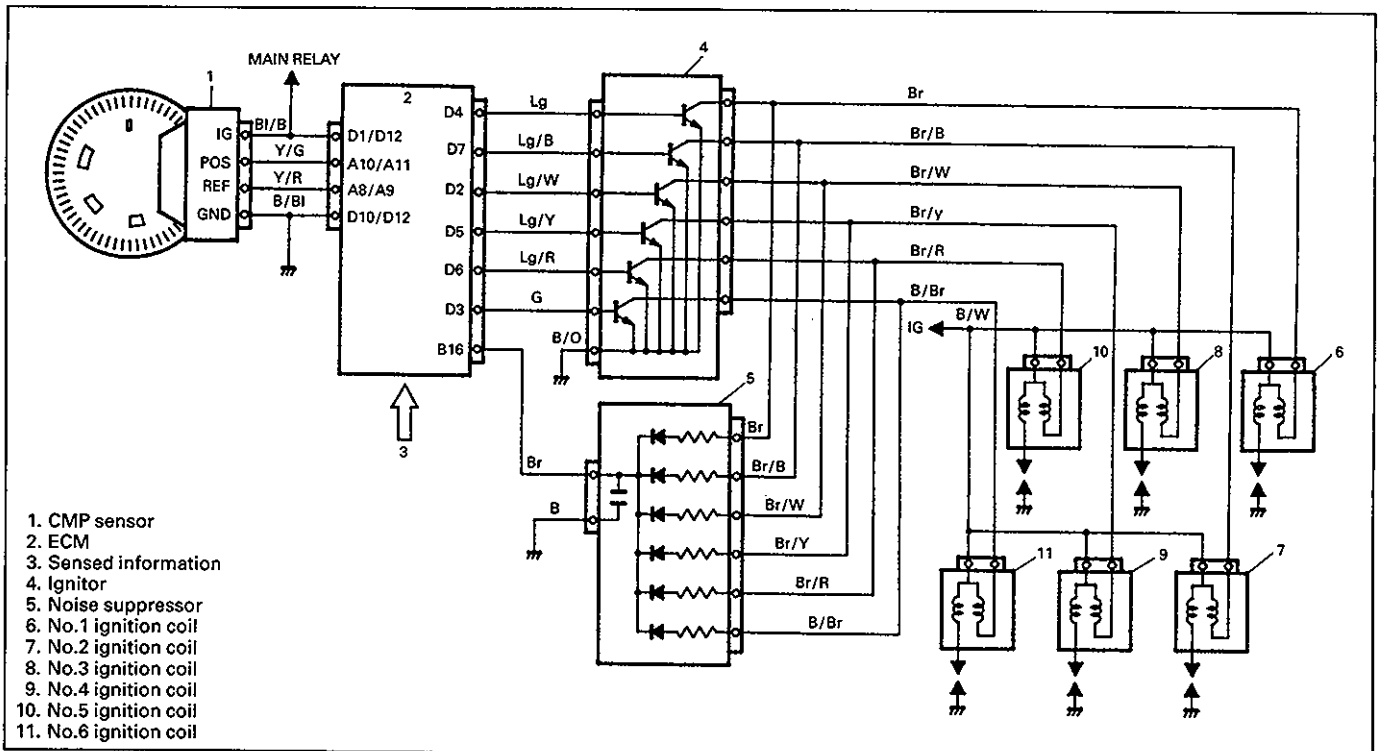
This system controls electronically the time of electric current flow to ignition primary coils as well as ignition timing.

ECM judges the engine condition by using signals from various sensors, selects the most suitable electric current flow time and ignition timing for that engine condition from among those pre-stored in its memory and sends an ignition signal to the igniter.

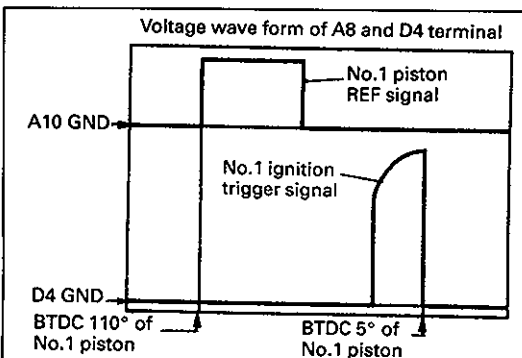
The igniter turns ON and OFF the primary current of the ignition coils according to the signal from ECM.

Control of the system includes three different types as follows.

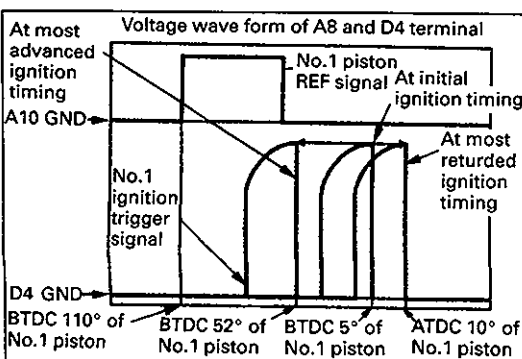
- Ignition timing control at engine start
- Ignition timing control after engine start
- Electric current flow time control



85F00-6E2-33-1



85F00-6E2-33-4



85F00-6E2-33-5

Ignition Timing Control at Engine Start

To obtain better starting performance of the engine at the engine start, IC system sets the ignition timing to the initial ignition timing (5° BTDC).

Ignition Timing Control After Engine Start

The ignition timing after the engine start is determined as follows so that the spark occurs at the most suitable timing for each engine condition.

Ignition timing	=	Initial ignition timing	+	Basic ignition advance	+	Various compensating advance
-----------------	---	-------------------------	---	------------------------	---	------------------------------

When the idle switch is ON, the ignition timing is determined by adding basic ignition advance and coolant temperature compensating advance stability to the initial ignition timing.

When the idle switch is OFF, the ignition timing is determined by adding basic ignition advance which varies according to the engine speed and fuel injection time and coolant temperature compensating advance to the initial ignition timing.

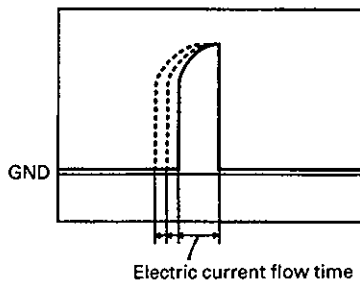
85F00-6E2-34-1

- **Coolant temperature compensating advance**

This compensation is added according to the signal from the coolant temperature sensor which detects the engine coolant temperature. The amount of compensation is larger when the engine coolant temperature is lower and smaller when higher.

85F00-6E2-34-2

Voltage wave form of D4, D7, D2, D5, D6, or D3 terminal



85F00-6E2-34-3

Electric Current Flow Time Control

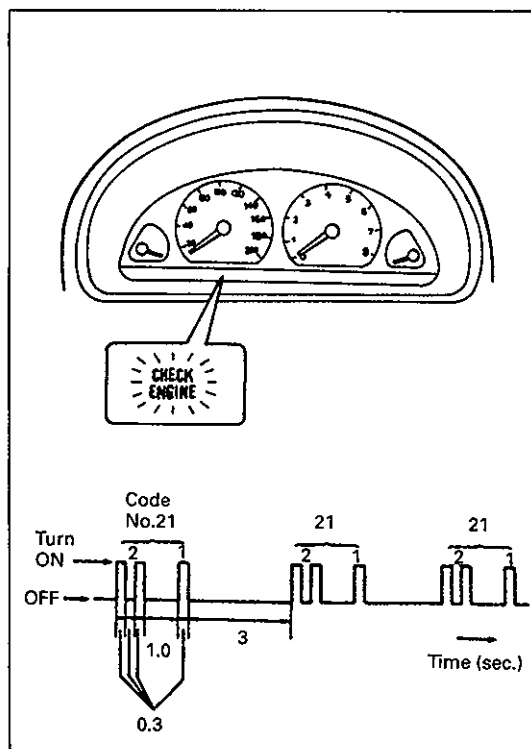
To stabilize the secondary voltage generated in the ignition coil to a proper level, IC system controls the time of primary current flow to the ignition coil.

DIAGNOSIS

ECM has on-board diagnostic system (a system self-diagnosis function) as described previously (p. 6E2-16).

Investigate where the trouble is by referring to "DIAGNOSTIC FLOW CHART" and "DIAGNOSTIC TROUBLE CODE TABLE" on later pages.

85F00-6E2-35-1



60A80-6E2-34-2S

PRECAUTIONS IN DIAGNOSING TROUBLES

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE]

- Before identifying diagnostic trouble code indicated by malfunction indicator lamp ("CHECK ENGINE" light), 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
- 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.

[INTERMITTENT TROUBLES]

- There are cases where malfunction indicator lamp ("CHECK ENGINE" light) indicates a diagnostic trouble code representing a trouble which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such an accident, be sure to follow instructions given below when checking by using "Diagnostic Flow Chart".

* When trouble can be identified, it is not an intermittent one:

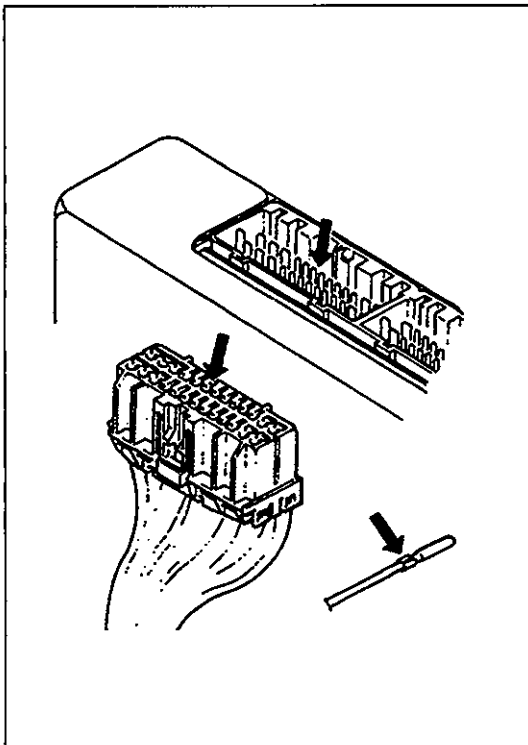
Check sensor (actuator), wires and each connection and if they are all in good condition, substitute a known-good ECM and recheck.

- * When trouble can not be identified but malfunction indicator lamp ("CHECK ENGINE" light) indicates a trouble code:

Diagnose trouble by using that code No. and if sensor (actuator), wires and each connection are all in good condition, erase diagnostic trouble code in ECM memory. Then conduct a test run and check what malfunction indicator lamp ("CHECK ENGINE" light) indicates. Only when it indicates trouble code again, substitute a known-good ECM and check again.

If it indicates not trouble code but normal code No.12, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.

60A80-6E2-35-1S



60A70-6E2-35-3S

[NOTES ON SYSTEM CIRCUIT INSPECTION]

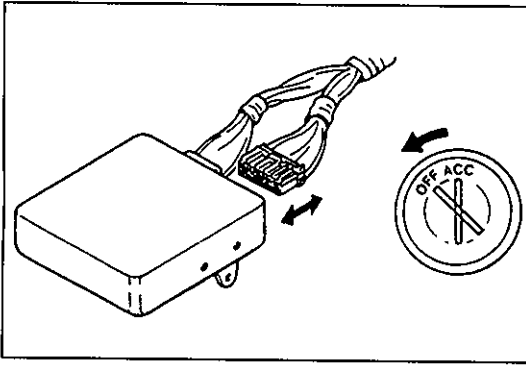
- Intermittent troubles

Most intermittent problems are caused by faulty electrical connections or wiring.

Perform careful check of suspect circuits for:

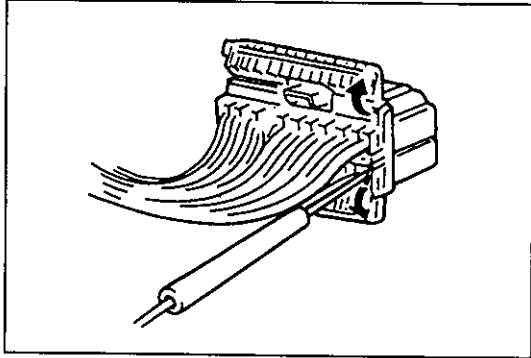
- Poor mating of coupler halves, or terminals not fully seated in coupler body (backed out).
- Improperly formed or damaged terminals. All coupler terminals in problem circuit should be carefully reformed to increase contact tension.
- Poor terminal to wire connection.
- When there is a question "Are couplers connected properly?" in FLOW CHART, check male half of terminal for bend and female half for excessive opening, terminal for poor locking (looseness), corrosion, dust, etc.

- Never connect any tester (voltmeter, ohmmeter, or whatever) to ECM when its coupler is disconnected. Attempting to do it may cause damage to ECM.
- Never connect an ohmmeter to ECM with its coupler connected to it. Attempting to do it may cause damage to ECM and sensors.
- Be sure to use a voltmeter with high impedance (MQ/V minimum) or a digital type voltmeter. Any other voltmeter should not be used because accurate measurements are not obtained.



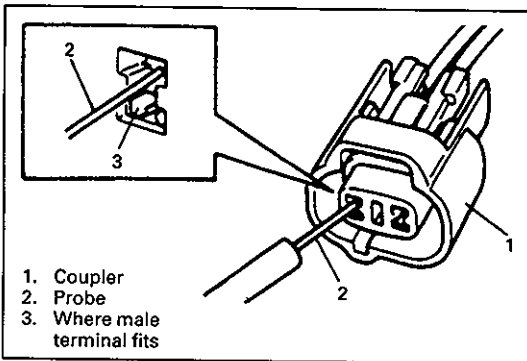
60A70-6E2-36-1S

- When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or ECM may get damaged.



60A50-6E2-36-2S

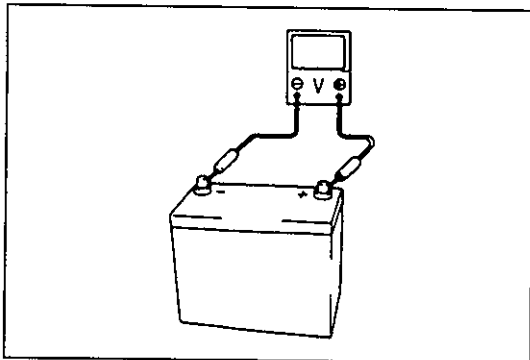
- When connecting a probe of ohmmeter, voltmeter, etc. to coupler terminal, be sure to connect it from wire harness side of coupler.



60A50-6E2-36-3S

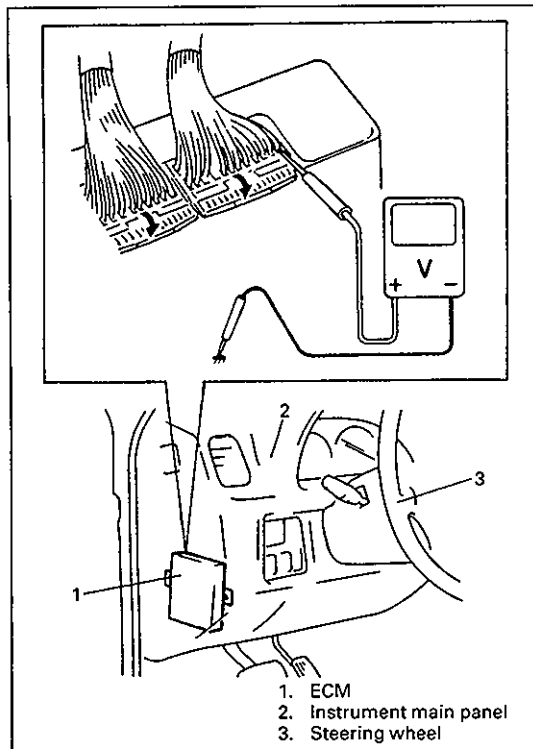
- When connecting meter probe from terminal side of coupler because it can't be connected from harness side, use extra care not to bend male terminal of coupler or force its female terminal open for connection.

In case of such coupler as shown at the left, connect probe as shown to avoid opening female terminal. Never connect probe where male terminal is supposed to fit.



60A50-6E2-36-4S

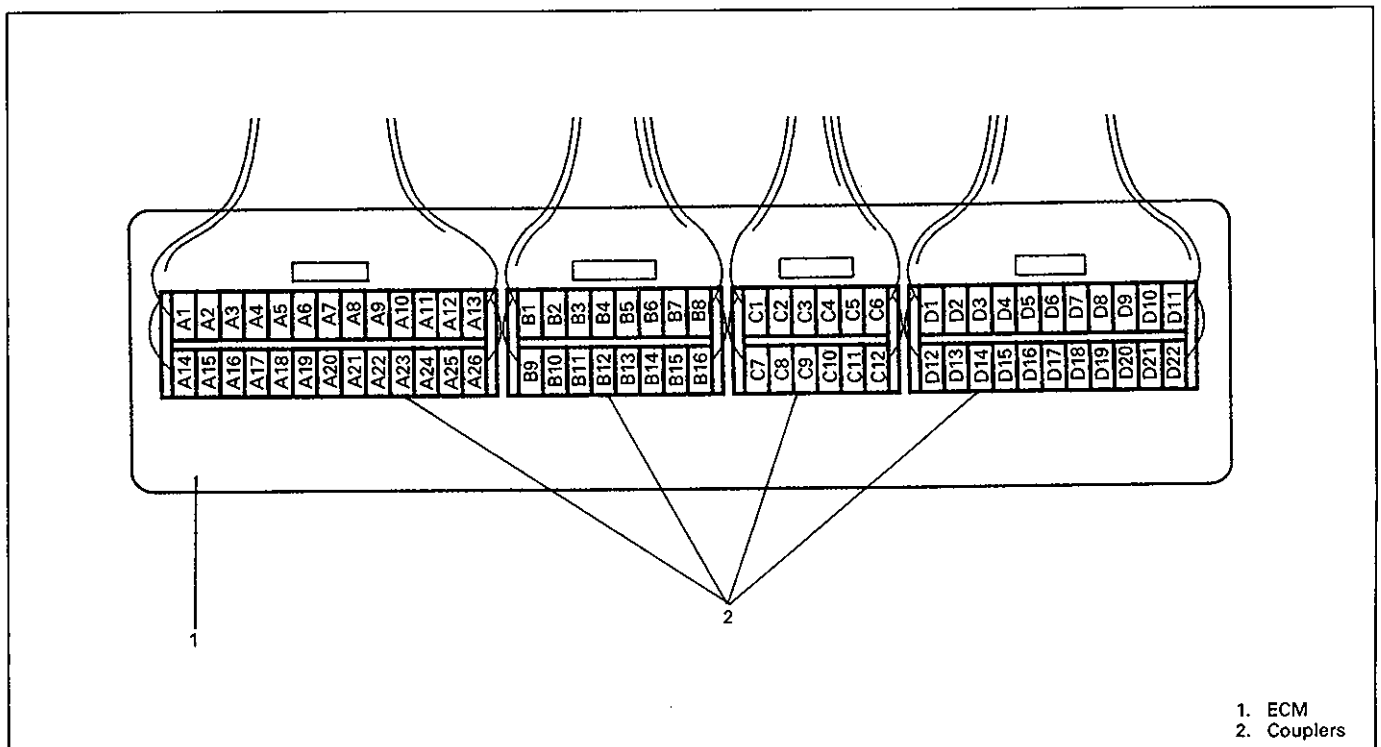
- Before measuring voltage at each terminal, check to make sure that battery voltage is 11V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.



- When checking voltage at each terminal of the coupler which is connected to ECM, be sure to connect negative probe to body ground. Any other way is prohibited even by accident.

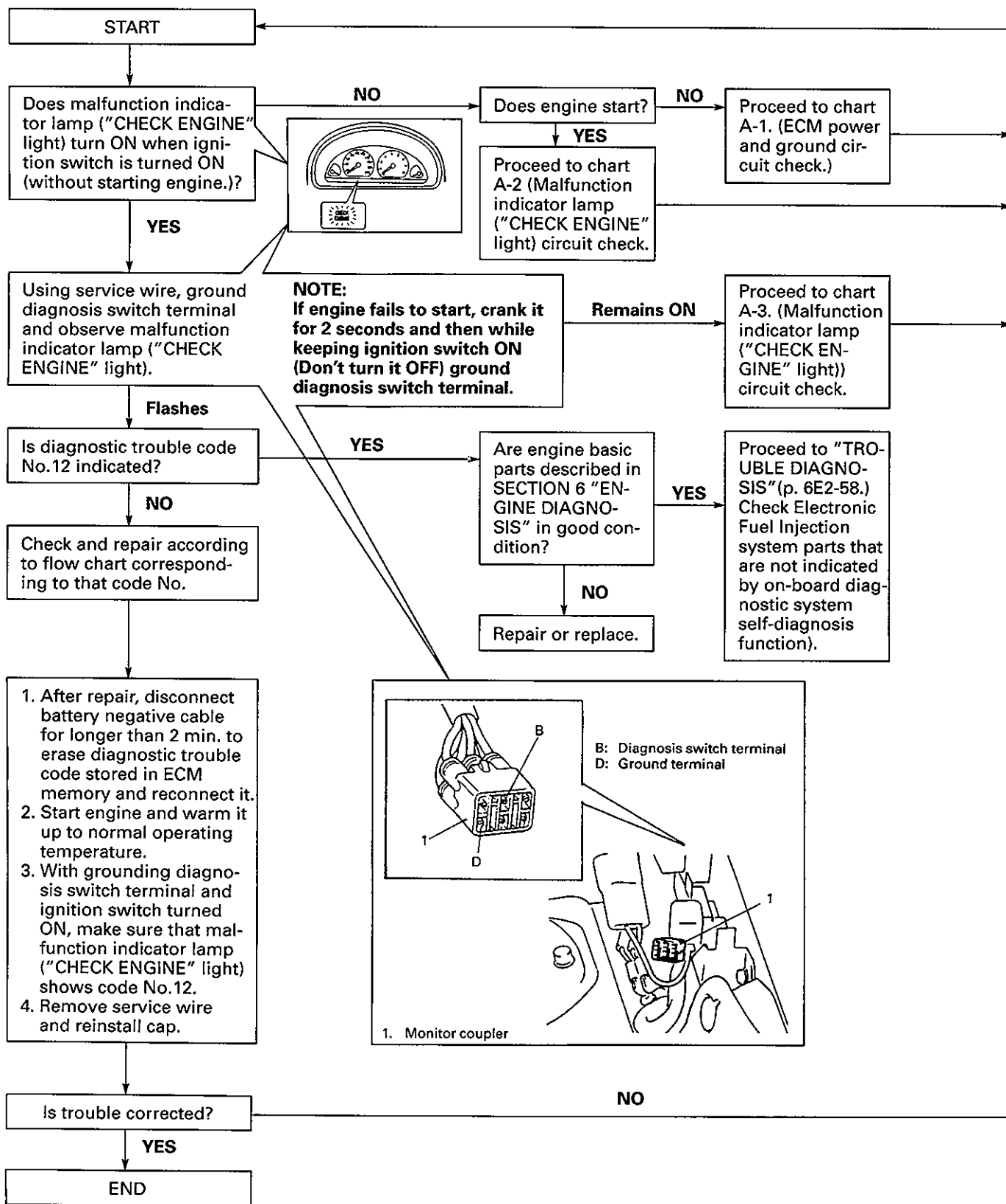
Applying it improperly may cause the sensor or ECM to be shorted and damaged.

85F00-6E2-38-1



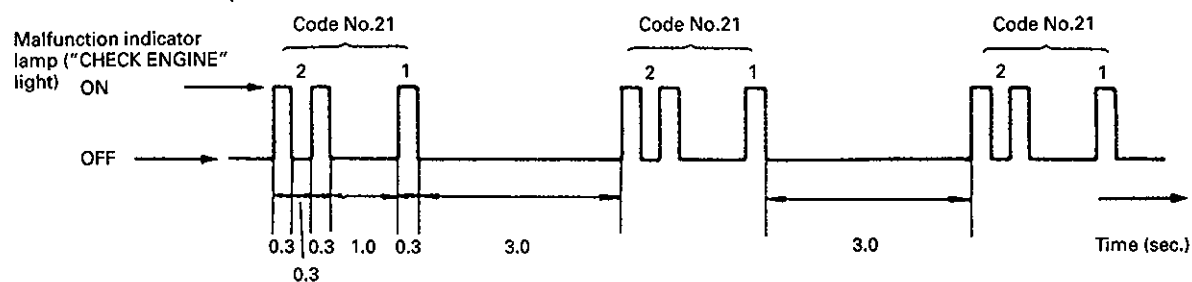
85F00-6E2-38-3

DIAGNOSTIC FLOW CHART



DIAGNOSTIC TROUBLE CODE TABLE

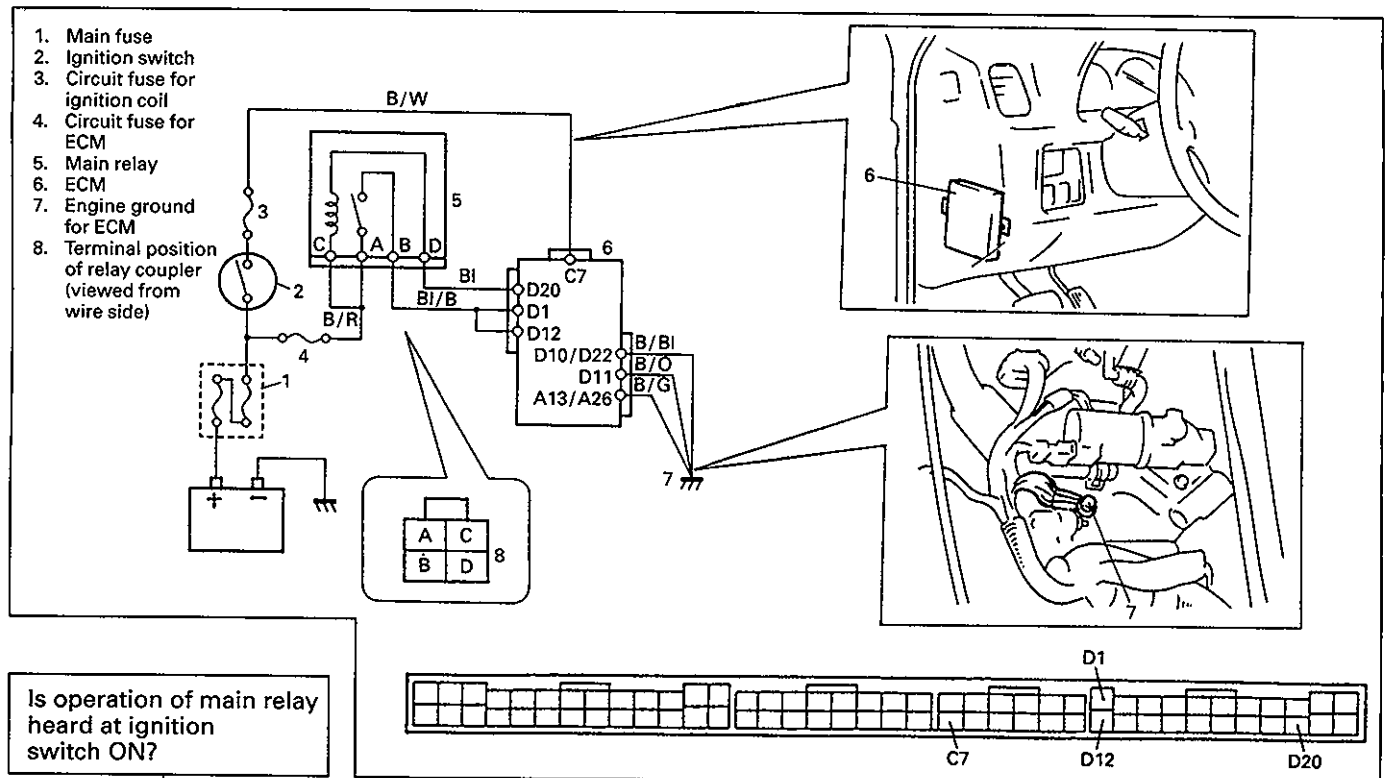
EXAMPLE : When throttle position sensor is defective (Code No. 21)



DIAGNOSTIC TROUBLE CODE NO.	MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) FLASHING PATTERN	DIAGNOSTIC ITEM	DIAGNOSIS
13		Left bank heated oxygen sensor (if equipped)	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No.
26		Right bank heated oxygen sensor (if equipped)	
14		Engine coolant temperature sensor	
15			
21		Throttle position sensor	
22			
23		Intake air temperature sensor	
25			
24		Vehicle speed sensor	
33		Mass air flow sensor	
34			
41		Ignition fail-safe signal	
42		Camshaft position sensor	
51		EGR valve (stepper motor, if equipped)	
52		Fuel system (vehicle with heated oxygen sensor only)	
ON		ECM	ECM failure.
12		Normal	This code appears when none of the other codes (above codes) are identified.

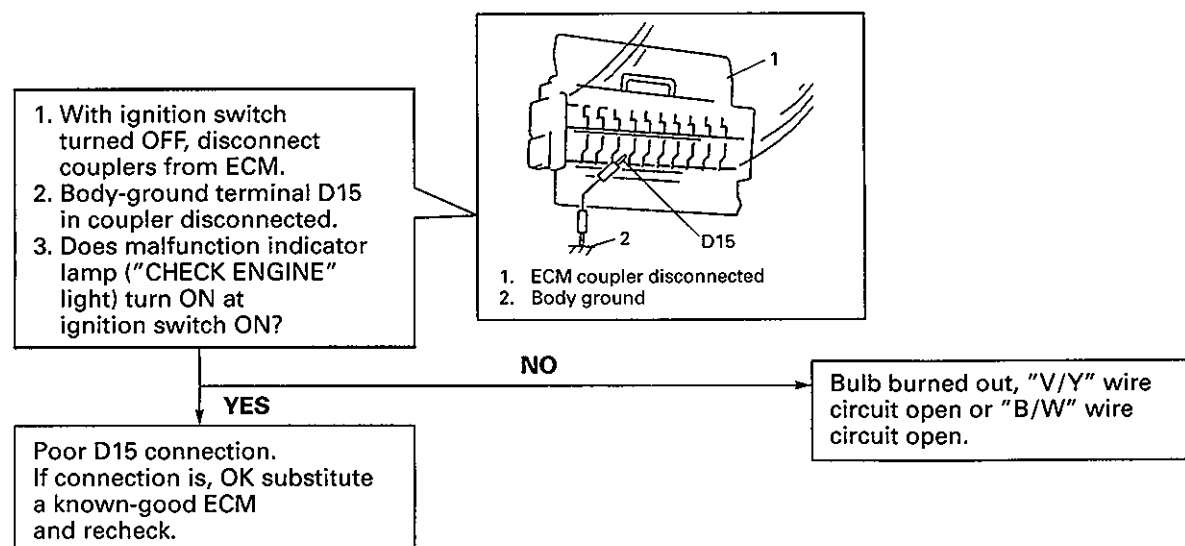
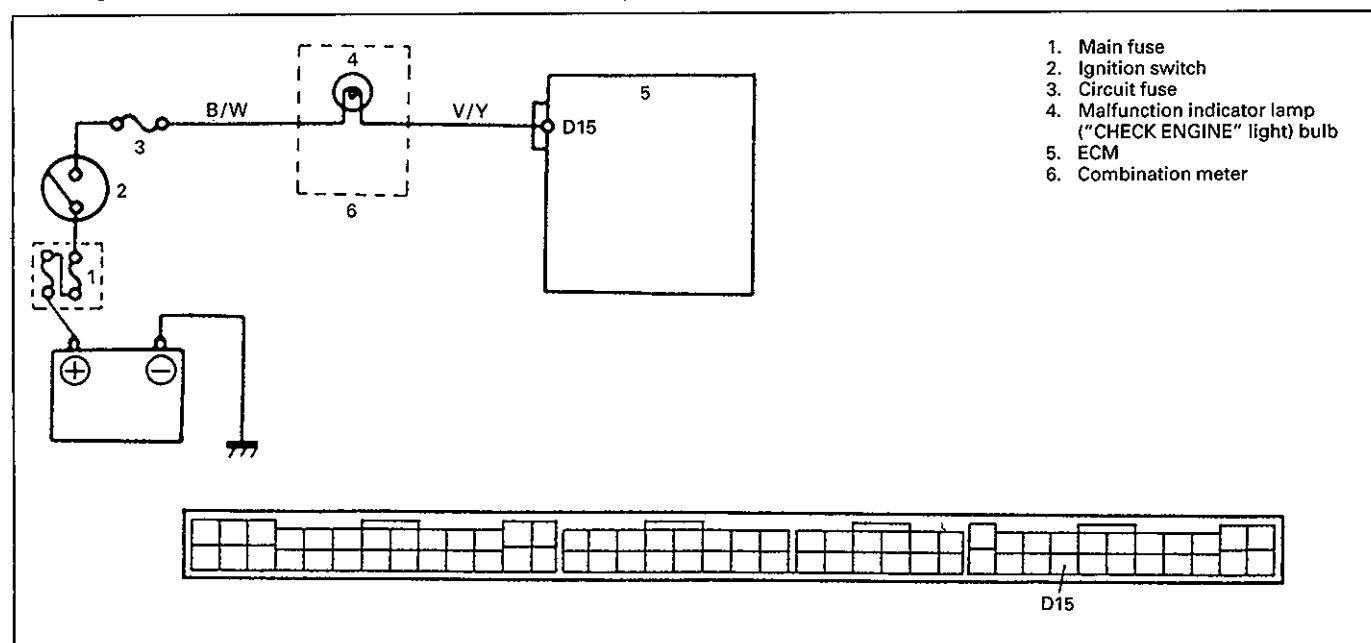
A-1 ECM POWER AND GROUND CIRCUIT CHECK

(MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.)



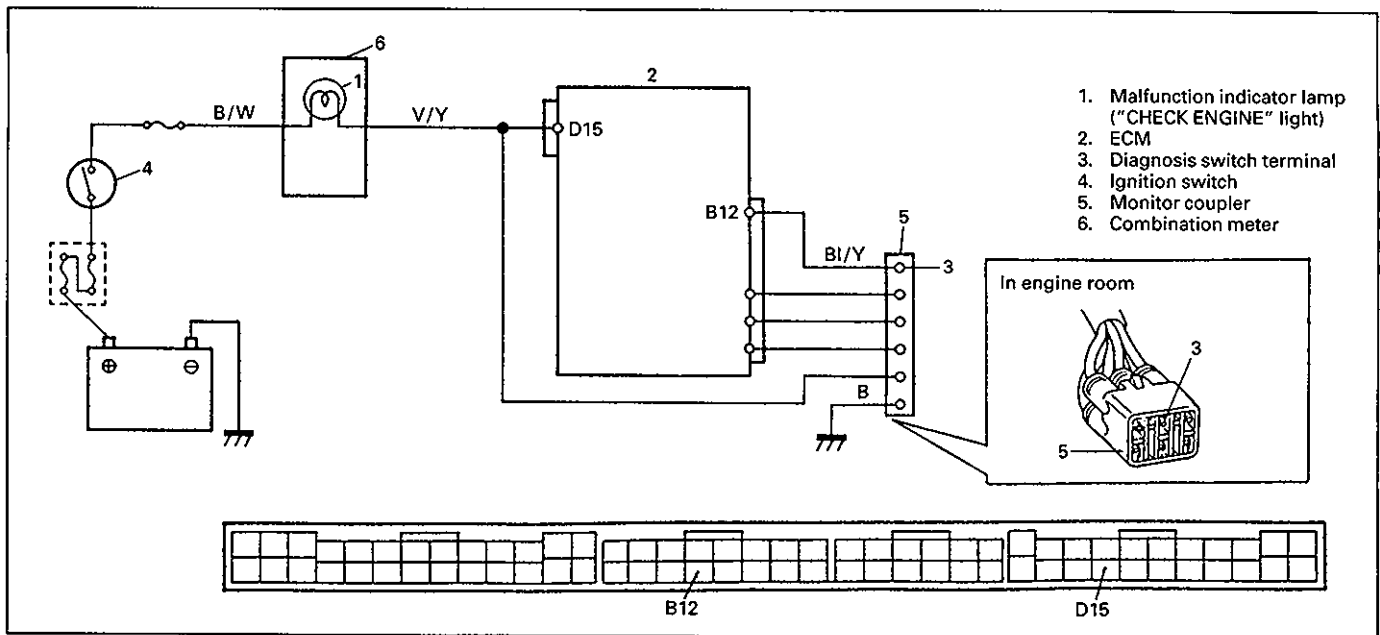
A-2 MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) CIRCUIT CHECK

(MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T LIGHT AT IGNITION SWITCH ON THOUGH ENGINE STARTS.)



A-3 MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) CIRCUIT CHECK

(MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LIGHT) DOESN'T FLASH OR JUST REMAINS ON EVEN WITH GROUNDING DIAGNOSIS SWITCH TERMINAL.)



1. Disconnect ECM couplers with ignition switch turned OFF.
2. Does malfunction indicator lamp ("CHECK ENGINE" light) turn ON at ignition switch ON?

YES

"V/Y" wire circuit shorted to ground.

NO

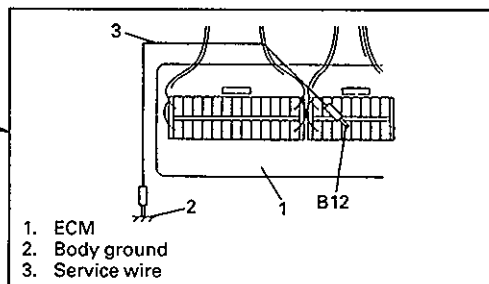
Is coupler (terminal B12) connected to ECM properly?

NO

Poor connection.

YES

1. Using service wire, ground terminal B12 with couplers connected to ECM.
2. Does malfunction indicator lamp ("CHECK ENGINE" light) flash at ignition switch ON?



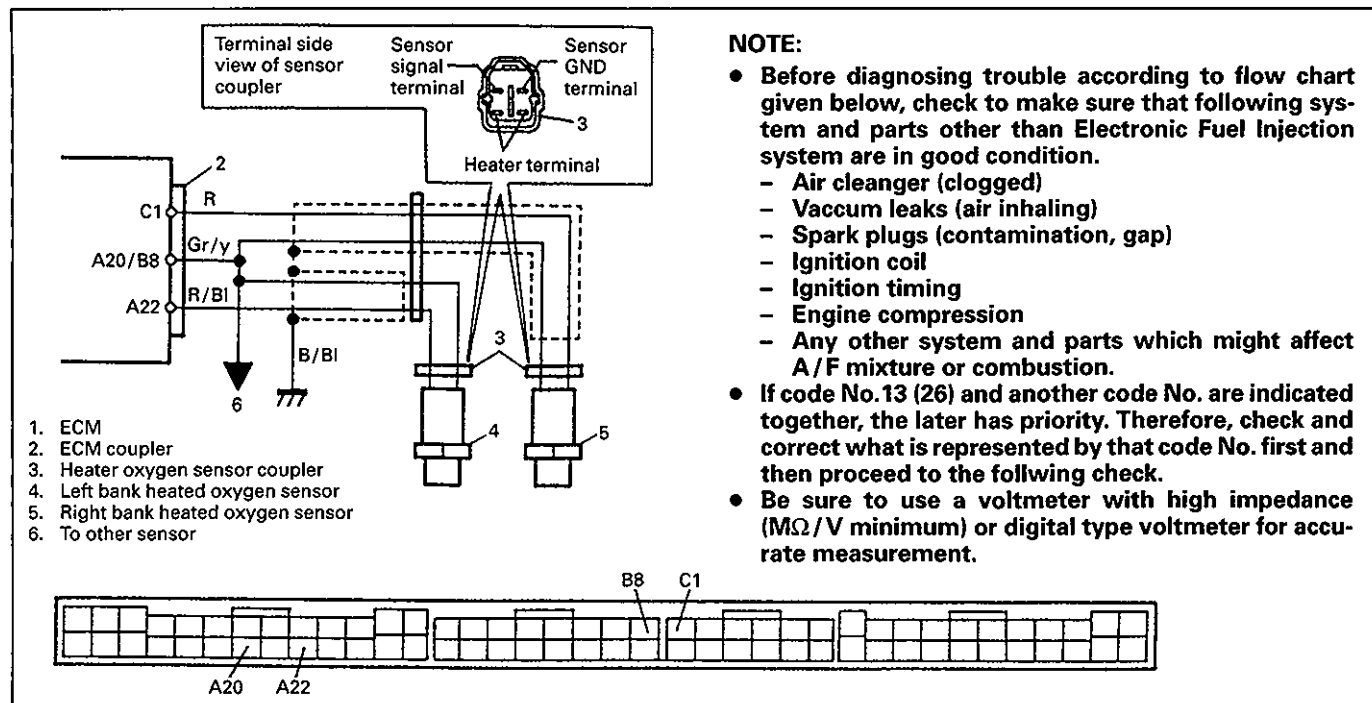
YES

Poor grounding, "BI/Y" wire circuit open or "B" wire open.

NO

Substitute a known-good ECM and recheck.

**CODE NO.13 LEFT BANK HEATED OXYGEN SENSOR CIRCUIT AND/OR
CODE NO.26 RIGHT BANK HEATED OXYGEN SENSOR CIRCUIT (IF EQUIPPED)**



1. Remove ECM and connect couplers to ECM.
2. Warm up engine to normal operating temperature.
3. Connect voltmeter between A22 (left bank, code No.13) or C1 (right bank, code No.26) of ECM coupler and body ground.
4. Maintain engine speed at 2,000 r/min. After 60 seconds, check voltmeter.

Remains unchanged at below 0.45 V.

1. Maintain engine speed at 2,000 r/min for 60 sec.
2. Check voltmeter while repeating racing engine. Does it indicate 0.45 V or more even once?

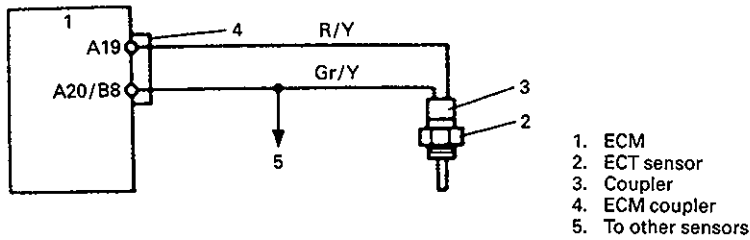
Replace heated oxygen sensor and recheck.

Poor A22 or C1 connection of ECM coupler or lean A/F mixture.
Check MAF sensor, ECT sensor, fuel pressure, injectors and their circuit.
If all above are OK, check ECM and its circuit referring to p. 6E2-71.

Deflects between above and below 0.45 V repeatedly

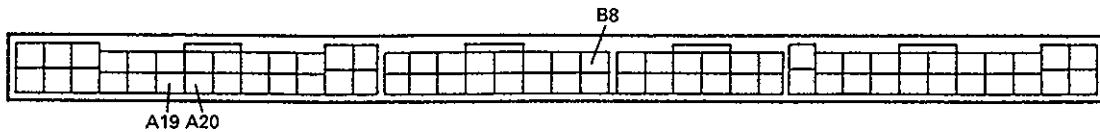
Heated oxygen sensor and its circuit (closea roop system, Air/fuel ratio feed back system) are in good condition.
Intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on p. 6E2-35.

CODE NO.14 ECT SENSOR (ENGINE COOLANT TEMP. SENSOR) CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)

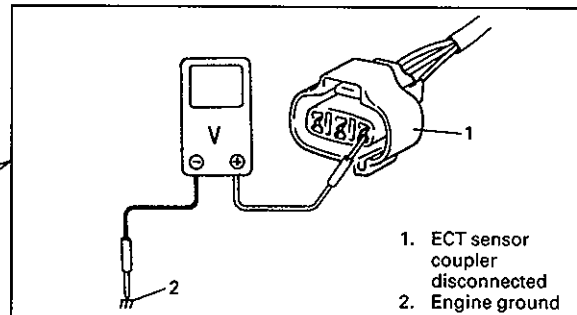


NOTE:

When Code Nos. 13, 14, 21, 23, 26 and 33 are indicated together, it is possible that "Gr/Y" wire is open or B8 and A20 terminal connection is poor.



1. Disconnect ECT sensor coupler with ignition switch OFF.
2. With ignition switch ON, check voltage at "R/Y" wire terminals of ECT sensor coupler. Is it about 4 – 5 V?

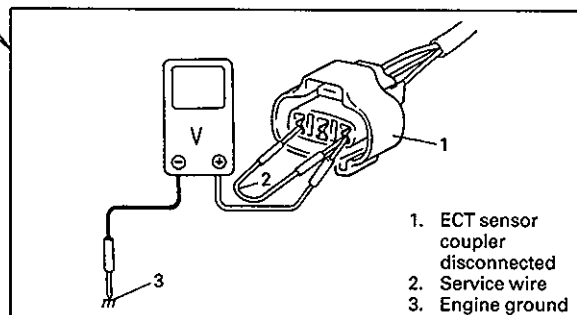


YES

NO

1. Using service wire, connect ECT sensor coupler terminals.
2. Check voltage at "R/Y" wire terminal of ECT sensor coupler with ignition switch ON. Is it below 0.15V?

"R/Y" wire open, poor A19 connection or "R/Y" wire shorted to power circuit. If wire and connection are OK, substitute a known-good ECM and recheck.

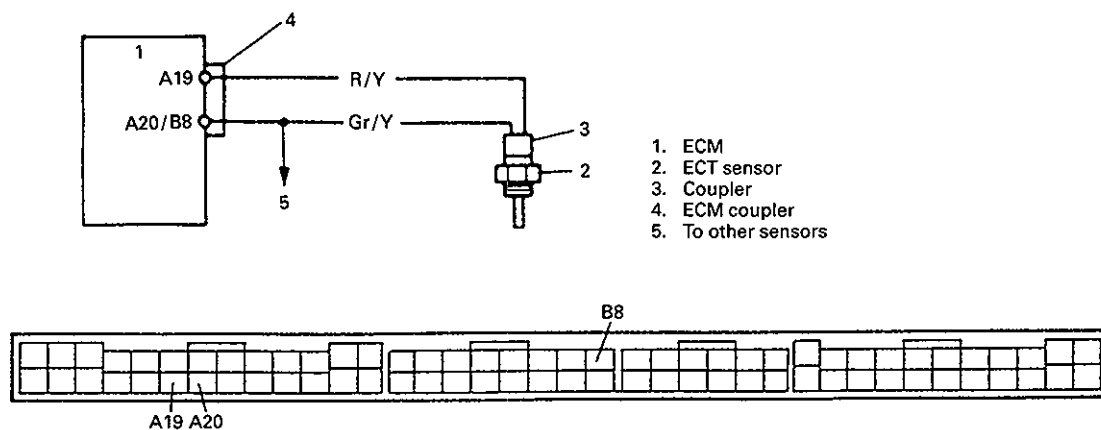


NO

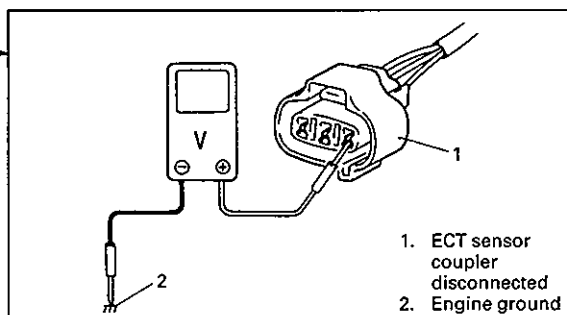
YES

"Gr/Y" wire open or poor A20/B8 connection. If wire and connection are OK, faulty ECM. Substitute a known-good ECM and recheck.

Poor ECT sensor-to-coupler connection of faulty ECT sensor. If connection and ECT sensor are OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble" on p. 6E2-35.

**CODE NO.15 ECT SENSOR (ENGINE COOLANT
TEMP. SENSOR) CIRCUIT****(HIGH TEMPERATURE INDICATED, SIGNAL
CIRCUIT VOLTAGE LOW)**

1. Disconnect ECT sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "R/Y" wire terminal of ECT sensor coupler 4V or more?

**YES**

Check ECT sensor referring to p. 6E2-101. Is it in good condition?

YES

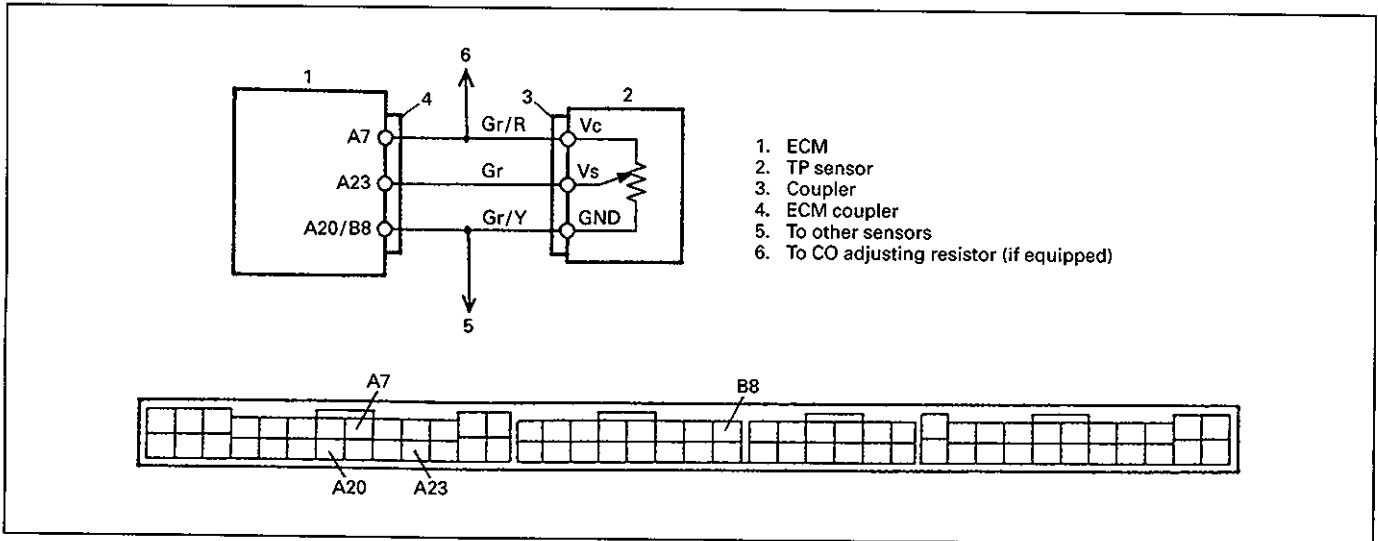
Intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on p. 6E2-35.

NO

"R/Y" wire shorted to "Gr/Y" wire or ground circuit.
If wire is OK, substitute a known-good ECM and recheck.

NO

Faulty ECT sensor.

CODE NO.21 TP SENSOR (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE HIGH)

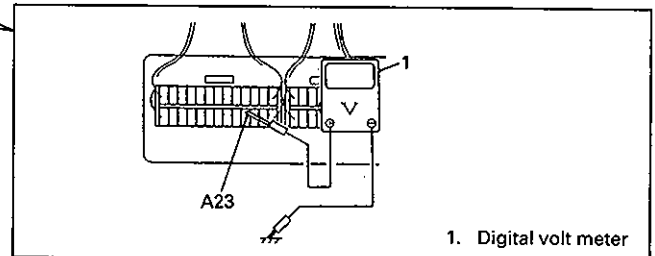
1. Disconnect TP sensor coupler with ignition switch OFF.
2. Check voltage between "Gr/R" wire terminal and "Gr/Y" wire terminal of disconnected TP sensor coupler with ignition switch ON.
3. Is is about 4 – 5 V?

YES

1. Connect TP sensor coupler with ignition switch OFF.
2. Remove ECM and connect ECM couplers with ignition switch OFF.
3. Check voltage between A23 terminal and body ground with ignition switch ON.

NO

"Gr/Y" with open, poor A20 and B8 connections, or "Gr/R" wire shorted to power circuit.



A23 terminal voltage is:
 0.50 ± 0.15 V at throttle valve is fully close
 4.0 ± 0.5 V at throttle valve is fully open.

Poor A23 connection.
 If connection is OK, substitute a known good ECM and recheck.

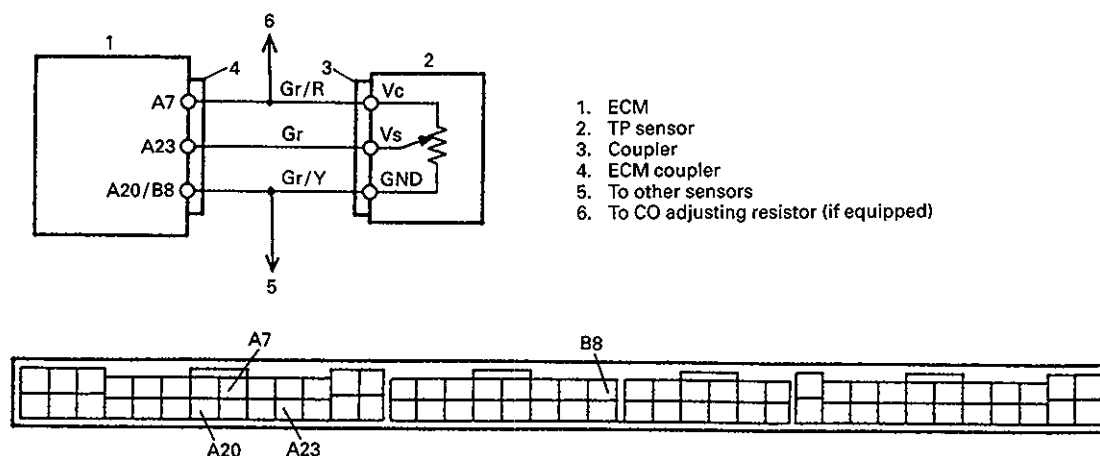
A23 terminal voltage is about
 4 – 5 V.

"Gr" wire open or shorted to
 "Gr/R" wire circuit or poor
 TP sensor coupler connection.

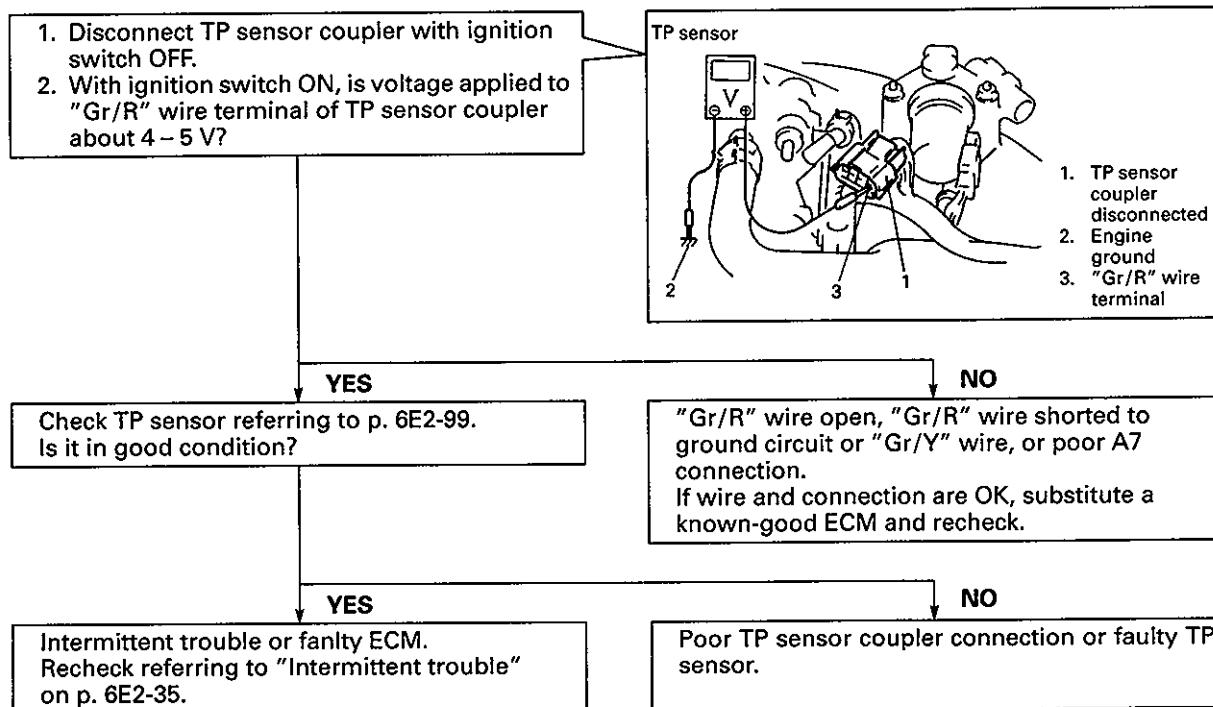
Other

Maladjusted TP sensor or
 faulty TP sensor.

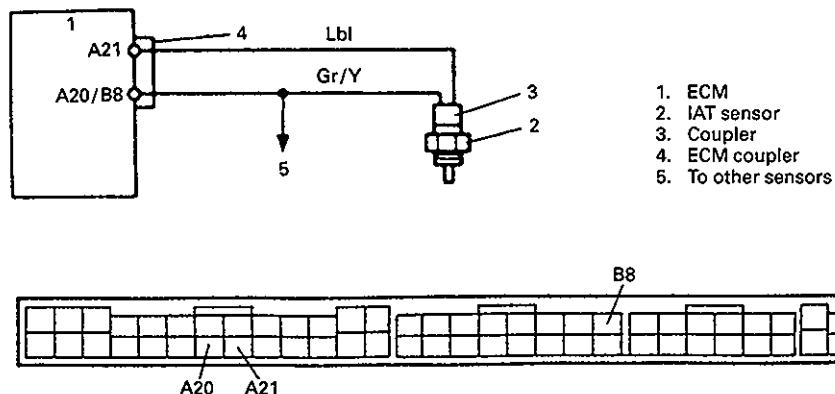
CODE NO.22 TP SENSOR (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE LOW)



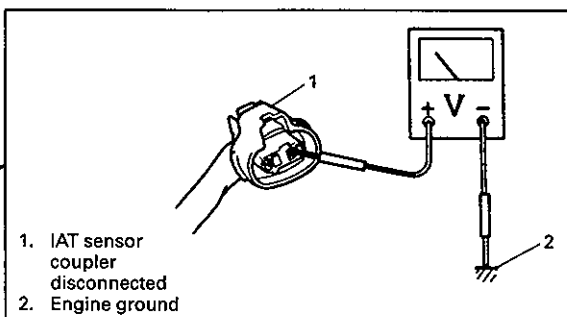
1. ECM
2. TP sensor
3. Coupler
4. ECM coupler
5. To other sensors
6. To CO adjusting resistor (if equipped)



CODE NO.23 IAT (INTAKE AIR TEMP.) SENSOR CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)



1. Disconnect IAT sensor coupler with ignition switch OFF.
2. With ignition switch ON, check voltage at "LbI" wire terminal of IAT sensor coupler. Is it about 4 - 5 V?

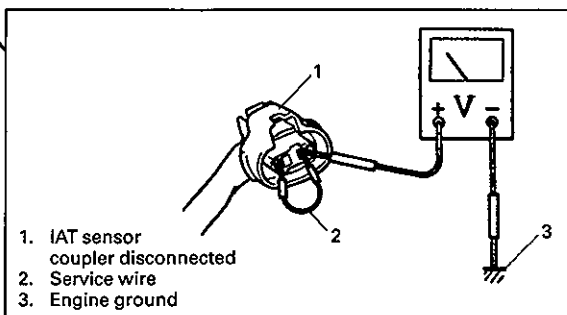


YES

NO

1. Using service wire, connect IAT sensor coupler terminals.
2. Check voltage at "LbI" wire terminal of IAT sensor coupler with ignition switch ON. Is it below 0.15V?

"LbI" wire open, poor A21 connection or "LbI" wire shorted to power circuit.
If wire and connection are OK, substitute a known-good ECM and recheck.



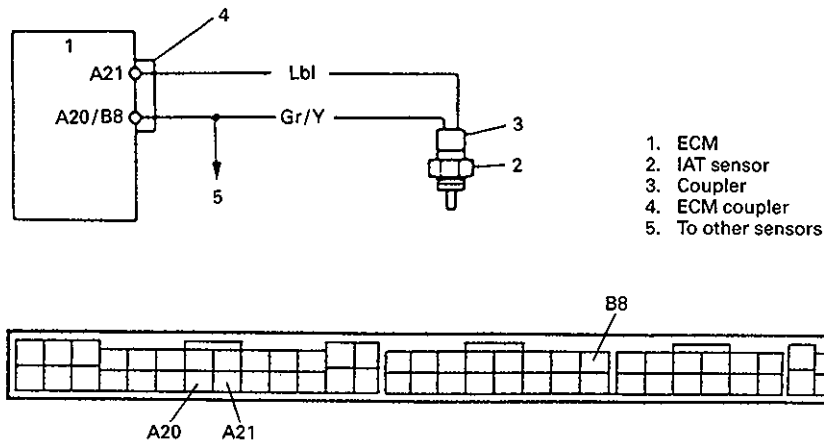
NO

YES

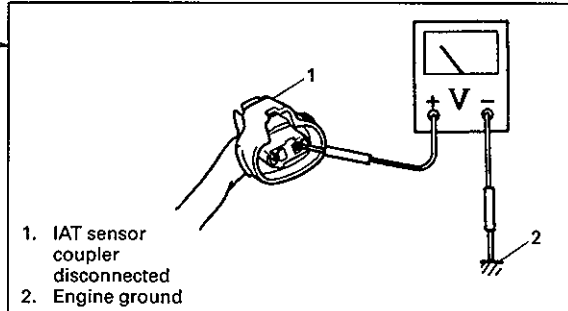
"Gr/Y" wire open or poor A20/B8 connection.
If wire and connection are OK, faulty ECM.
Substitute a known-good ECM and recheck.

Poor coupler connection of IAT sensor or faulty IAT sensor.
If connection and IAT sensor are OK, intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble" on p. 6E2-35.

CODE NO.25 IAT (INTAKE AIR TEMP.) SENSOR CIRCUIT (HIGH TEMPERATURE INDICATED, SIGNAL VOLTAGE LOW)



1. Disconnect IAT sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "R/B" wire terminal of IAT sensor coupler 4V or more?



YES

Check IAT sensor referring to p. 6E2-98.
Is it in good condition?

YES

Intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on
p. 6E2-35.

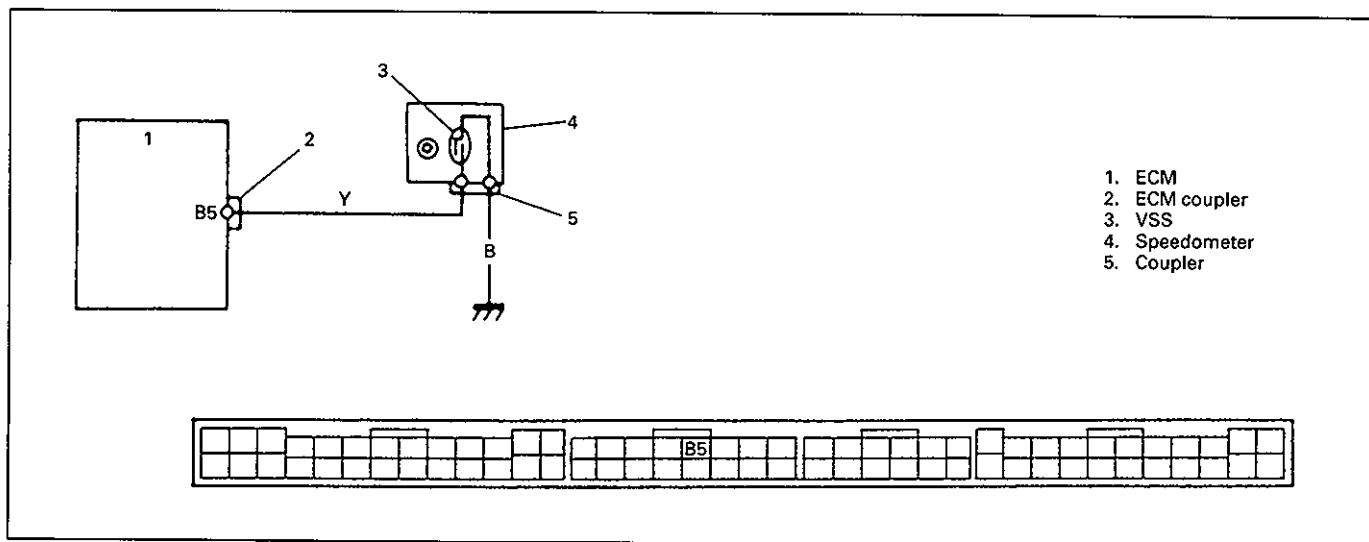
NO

"Lbl" wire shorted to "Gr/Y" wire or ground
circuit.
If wire is OK, substitute a known-good ECM and
recheck.

NO

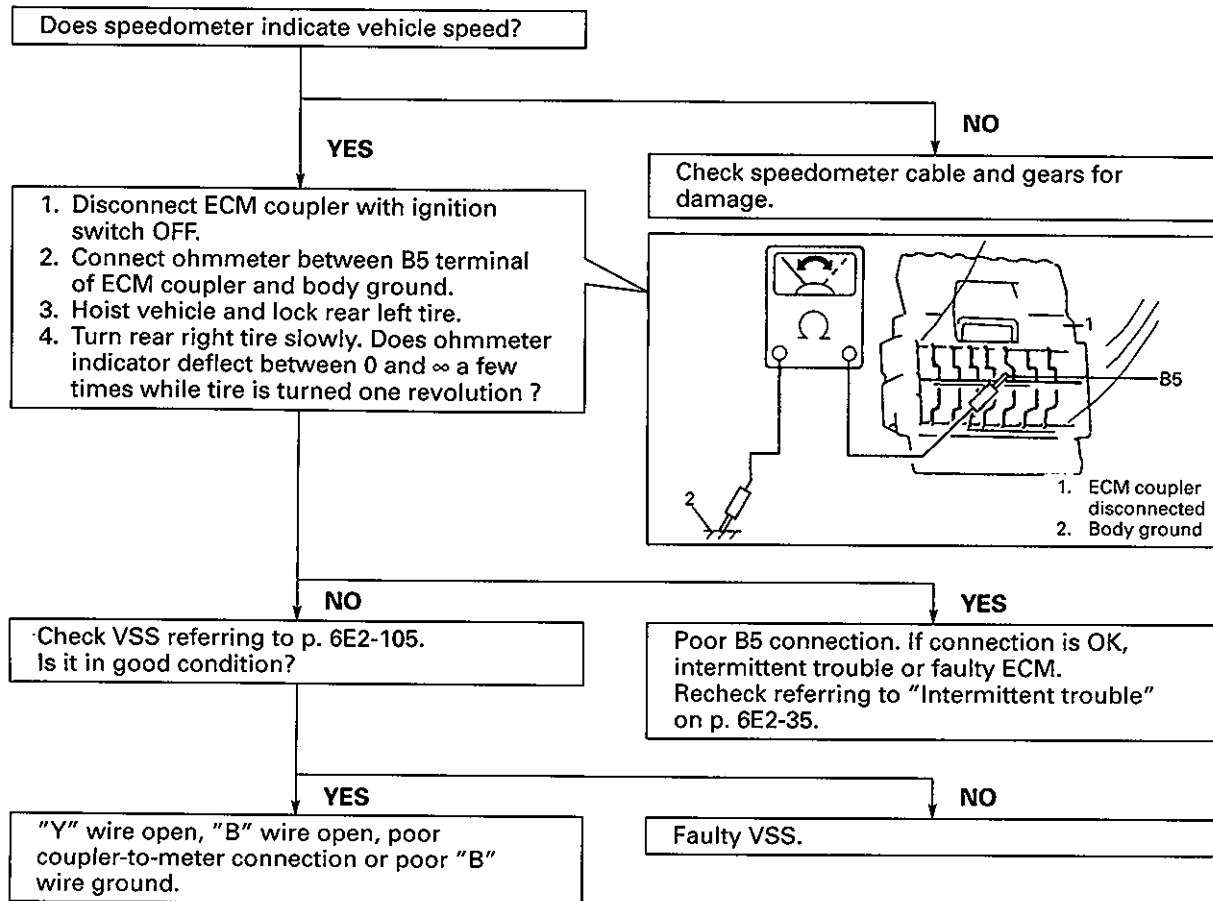
Faulty IAT
sensor.

CODE NO. 24 VSS (VEHICLE SPEED SENSOR) CIRCUIT (VEHICLE SPEED SIGNAL NOT INPUTTED ALTHOUGH FUEL IS KEPT CUT FOR LONGER THAN 5 SECONDS)

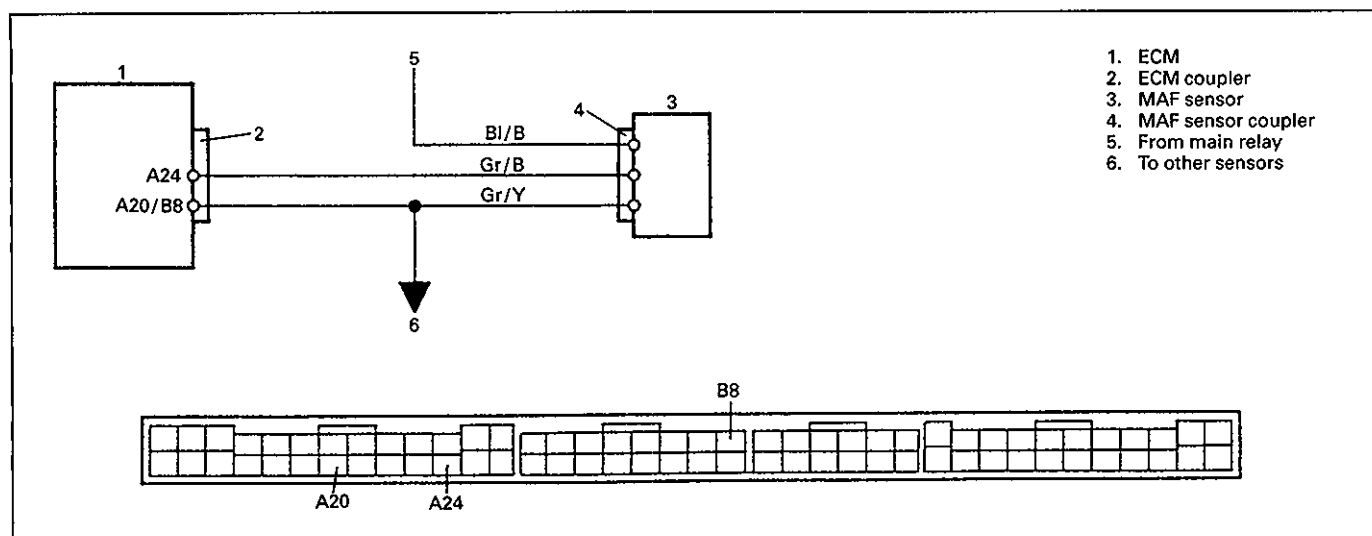


NOTE:

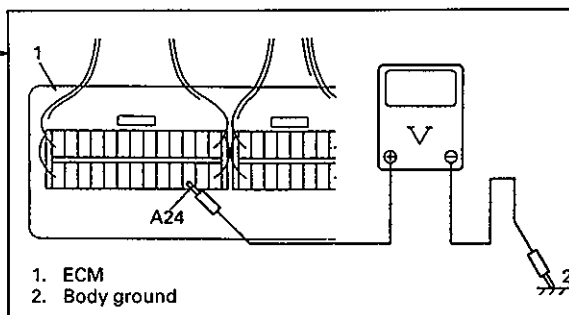
Be sure to turn OFF ignition switch for this check.



CODE NO. 33 MAF SENSOR (MASS AIR FLOW SENSOR) (LARGE SIGNAL CURRENT FLOW, SIGNAL VOLTAGE HIGH)



Turn ignition switch ON and check voltage at A24 terminal.
Is it within 0.5 – 1.0 V?



YES

Start engine and check voltage at A24 terminal.
Does voltage rise within 5V range when engine speed is increased?

YES

Poor A24 connection. If connection is OK, intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on p. 6E2-35.

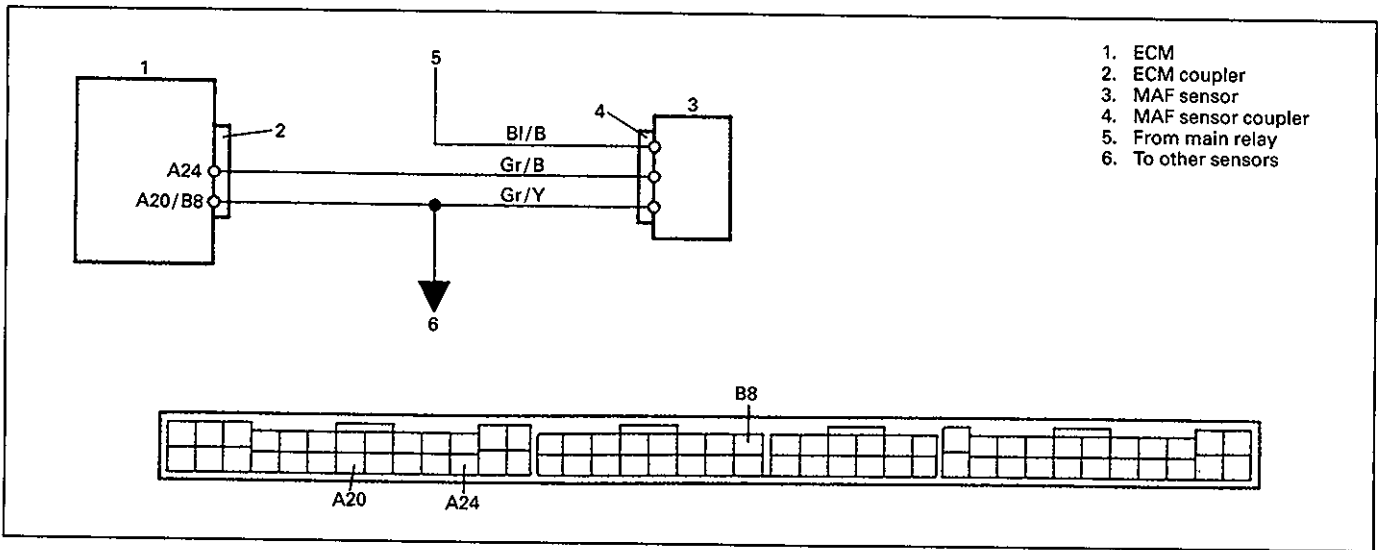
NO

"Gr/Y" wire open or "Gr/B" wire shorted to power circuit.
If wires are OK, substitute a known-good MAF sensor and recheck.

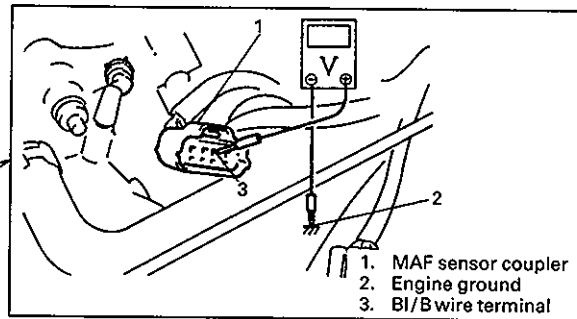
NO

Substitute a known-good MAF sensor and recheck.

CODE NO. 34 MAF SENSOR (MASS AIR FLOW SENSOR) (SMALL SIGNAL CURRENT FLOW, SIGNAL VOLTAGE LOW)



1. Disconnect MAF sensor coupler with ignition switch OFF.
2. With ignition switch ON, is voltage applied to "BI/B" wire terminal of MAF sensor coupler about 10 – 14V?

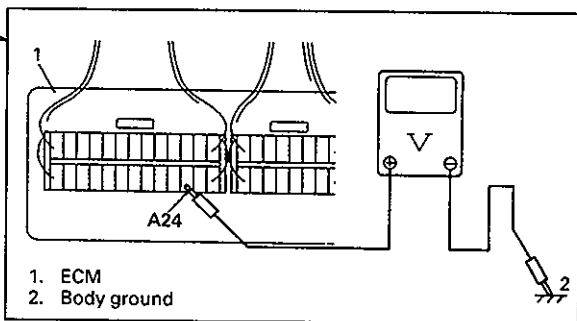


YES

NO

1. Connect MAF sensor coupler with ignition switch OFF.
2. Turn ignition switch ON and check voltage at A24 terminal. Is it within 0.5 – 1.0V?

"BI/B" wire open.



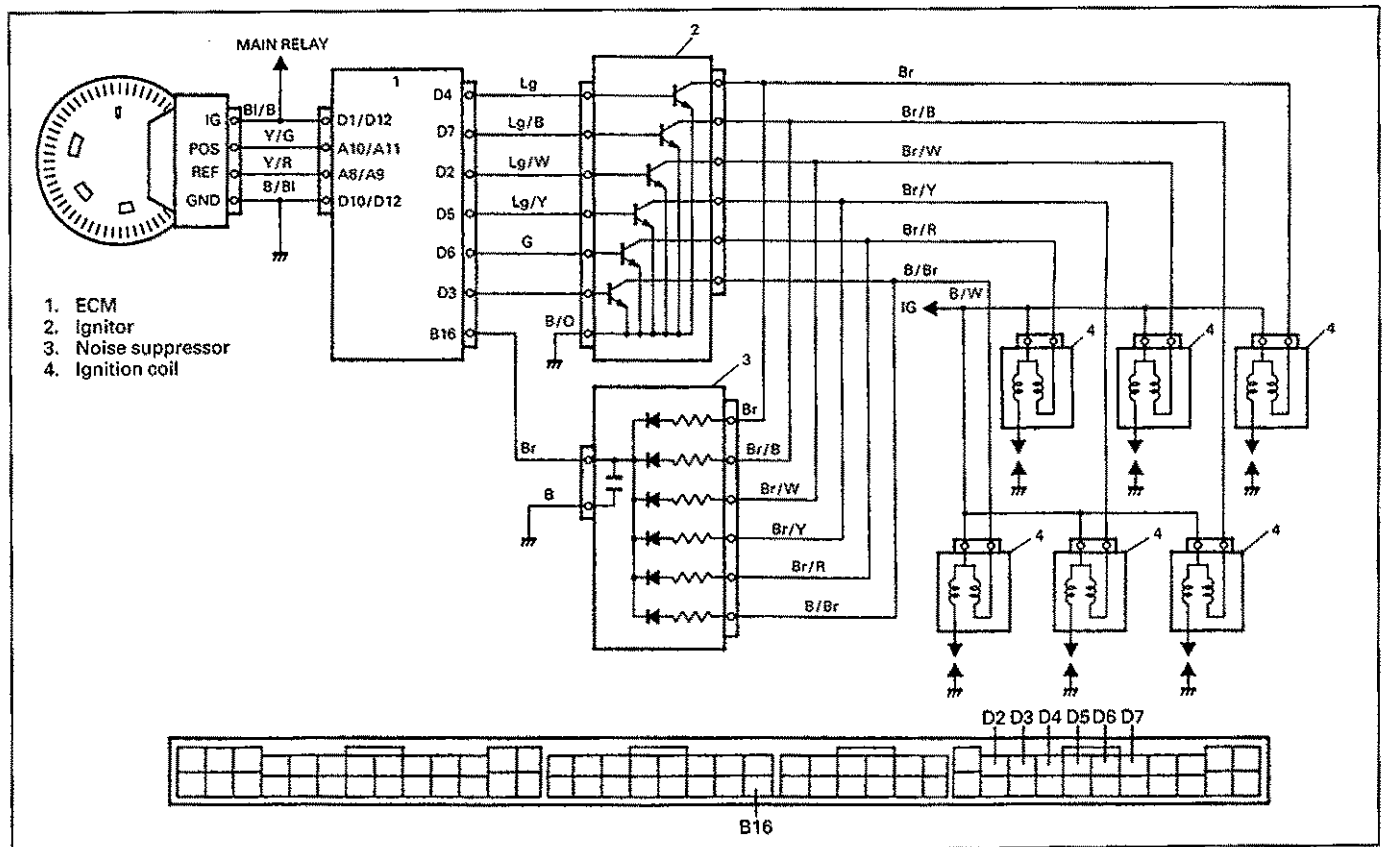
YES

NO

Intermittent trouble or faulty ECM. Recheck referring to "Intermittent trouble" on p. 6E2-35.

Poor A24 connection, "Gr/B" wire open, or poor MAF sensor-to-coupler connection. If wire and connection are OK, substitute a known-good MAF sensor and recheck.

CODE NO. 41 IGNITION FAIL-SAFE SIGNAL (60 IGNITION FAIL SAFE SIGNALS NOT INPUTTED WHILE 240 IGNITIONS) CIRCUIT



Check ignition spark referring to SECTION 6F2.
Is it in good condition?

YES

NO

Is battery voltage applied to B16 terminal at
ignition switch ON?

Faulty ignition system.

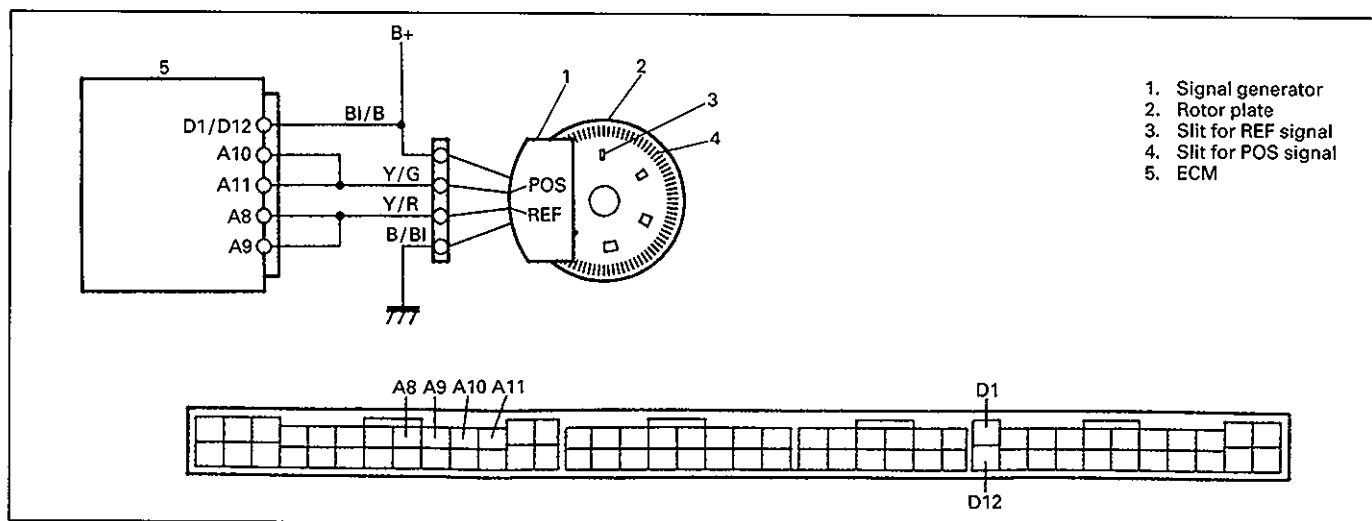
YES

NO

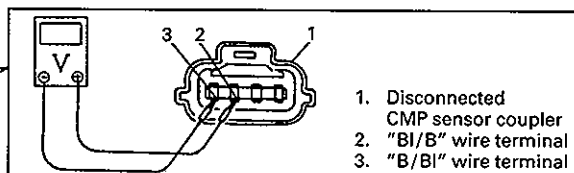
Poor B16 connection.
If connection is OK, substitute a known- good
ECM and recheck.

Faulty noise suppressor or open circuit
between noise suppressor and B16 terminal.

CODE NO. 42 CMP SENSOR (CAMSHAFT POSITION SENSOR) CIRCUIT (REF SIGNAL NOT INPUTTED FOR 3 SECONDS AT ENGINE CRANKING AND/OR POS SIGNAL NOT INPUTTED AT ENGINE RUNNING)



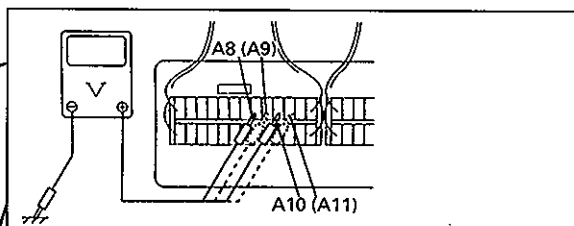
Disconnect CMP sensor coupler with ignition switch OFF and Check voltage between "BI/B" wire terminal and "B/BI" wire terminal of disconnected CMP sensor coupler with ignition switch ON.
Is it battery voltage?



YES

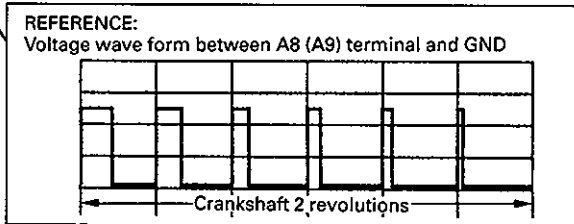
Check voltage between A8 (A9) terminal of ECM coupler and body ground with ignition switch ON and crankshaft turned slowly. Does voltmeter indicator deflect between 0 - 1 V and 4 - 6 V 6 times while crankshaft turned two revolutions?

NO
BI/B wire open, B/BI wire open or poor B/BI wire ground.



YES

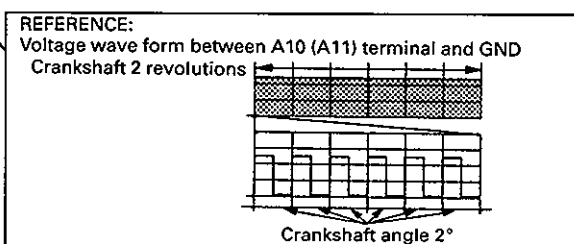
Check voltage between A10 (A11) terminal of ECM coupler and body ground with ignition switch ON and crankshaft turned slowly. Does voltmeter indicator deflect between 0 - 1 V and 4 - 6 V?



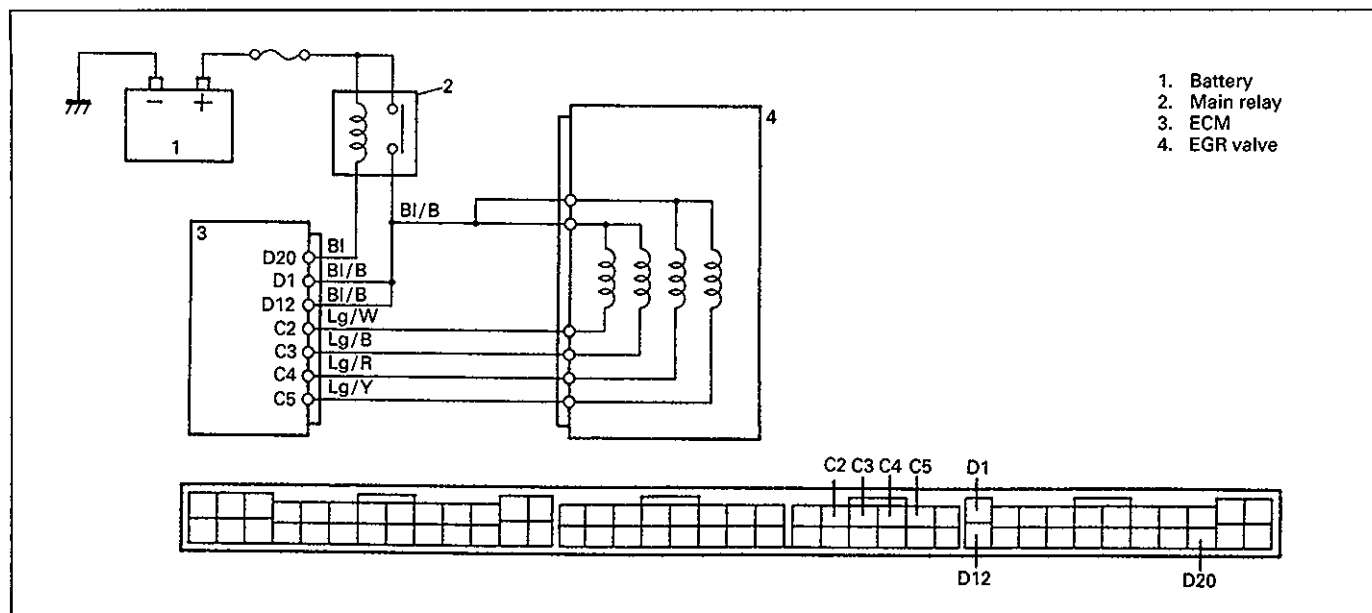
NO
CMP sensor faulty or "Y/R" wire open or short.

YES

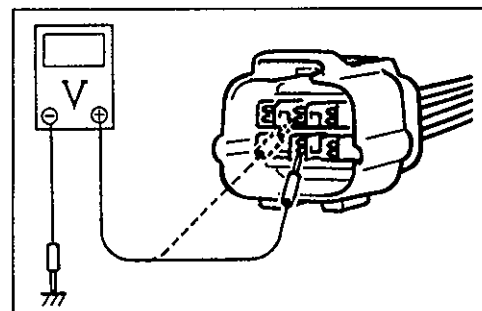
Poor A8 and A9 connection or A10 and A11 connection of ECM coupler.
If connections are OK, substitute a known-good ECM and recheck.



NO
CMP sensor faulty or "Y/G" wire open or short.

CODE NO. 51 EGR VALVE (STEPPER MOTOR OR ITS CIRCUIT OPEN OR SHORT) (IF EQUIPPED)

Does EGR stepper motor operate for 1 second after ignition switch ON?



NO

1. Disconnect EGR valve coupler with ignition switch OFF.
2. Check voltage between "BI/B" wire terminals and body ground.
3. Are they about 10 – 14 V?

NO

"BI/B" wire open.

YES

YES

Check voltage between C2, C3, C4 and C5 terminals of ECM coupler for 0.6 second after ignition switch ON. Is each measured voltage 4 – 8.4 V?

YES

Intermittent trouble or faulty ECM. Recheck referring to intermittent trouble.

YES

"Lg/W", "Lg/B", "Lg/R" or "Lg/Y" wire open or poor C2, C3, C4 or C5 connection of ECM coupler. If wire harness and connections are OK, intermittent trouble or faulty ECM. Recheck referring to intermittent trouble.

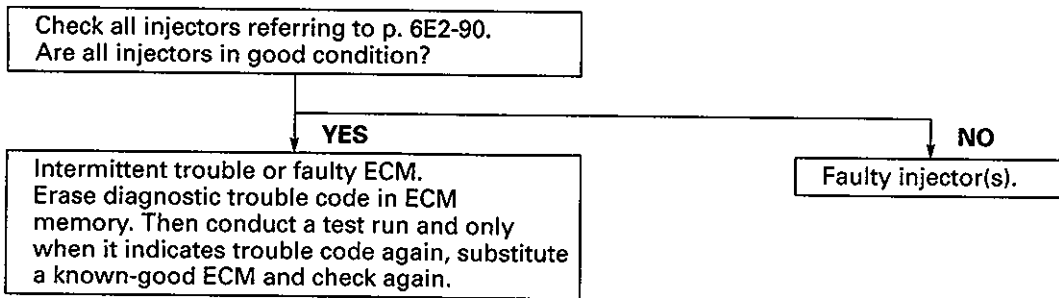
NO

Check EGR valve referring to P. 6E2-102. Is it OK?

NO

Faulty EGR valve.

CODE NO. 52 FUEL SYSTEM (FUEL LEAKAGE FROM FUEL INJECTOR, OXYGEN SENSOR OUTPUT VOLTAGE DOES NOT REDUCE WHEN FUEL IS CUT)
(VEHICLE WITH HEATED OXYGEN SENSOR ONLY)



TROUBLE DIAGNOSIS

This section describes trouble diagnosis of Electronic Fuel Injection system parts whose trouble is not indicated by the on-board diagnostic system (self-diagnosis function).

When diagnostic trouble code No. 12 is indicated by the on-board diagnostic system (self-diagnosis function) and assuredly those engine basic parts as described in "ENGINE DIAGNOSIS" are all in good condition, check Electronic Fuel Injection system parts which may be a possible cause for each symptom of the engine.

85F00-6E2-58-1

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Hard or no starting (Engine cranks OK)	• Shortage of fuel in fuel tank • Vacuum leaks (or air inhaled) in air intake system • Faulty fuel pump or its circuit open • Fuel injector circuit faulty • Fuel pressure out of specification • Poor performance of ECT sensor or MAF sensor • Faulty CMP sensor (No POS signal) • Faulty ECM	Check if fuel pressure is felt at fuel return hose for 3 seconds after ignition switch ON. If not, advance to Diagnostic Flow Chart B-1. Diagnostic Flow Chart B-2. Diagnostic Flow Chart B-3. See p. 6E2-101 or 6E2-96. Diagnostic Flow Chart of code No.42. See p. 6E2-71.
NOTE: If engine is warm and hard to start but starts easily with accelerator pedal depressed, check idle air control valve and its circuit first.		
Engine fails to idle	• Shortage of fuel in fuel tank • Vacuum leaks (or air inhaled) in air intake system • Maladjusted idle speed adjusting screw • Faulty idle air control valve or its circuit • Faulty fast idle control system • Faulty EGR system • Fuel pressure out of specification • Faulty injector(s) • Poor performance of ECT sensor or MAF sensor • Faulty ECM	See page 6E2-78 Check idle air control valve or its circuit See p. 6E2-86 Diagnostic Flow Chart B-5 Diagnostic Flow Chart B-3 See p. 6E2-90 See p. 6E2-101 or 6E2-96 See p. 6E2-71

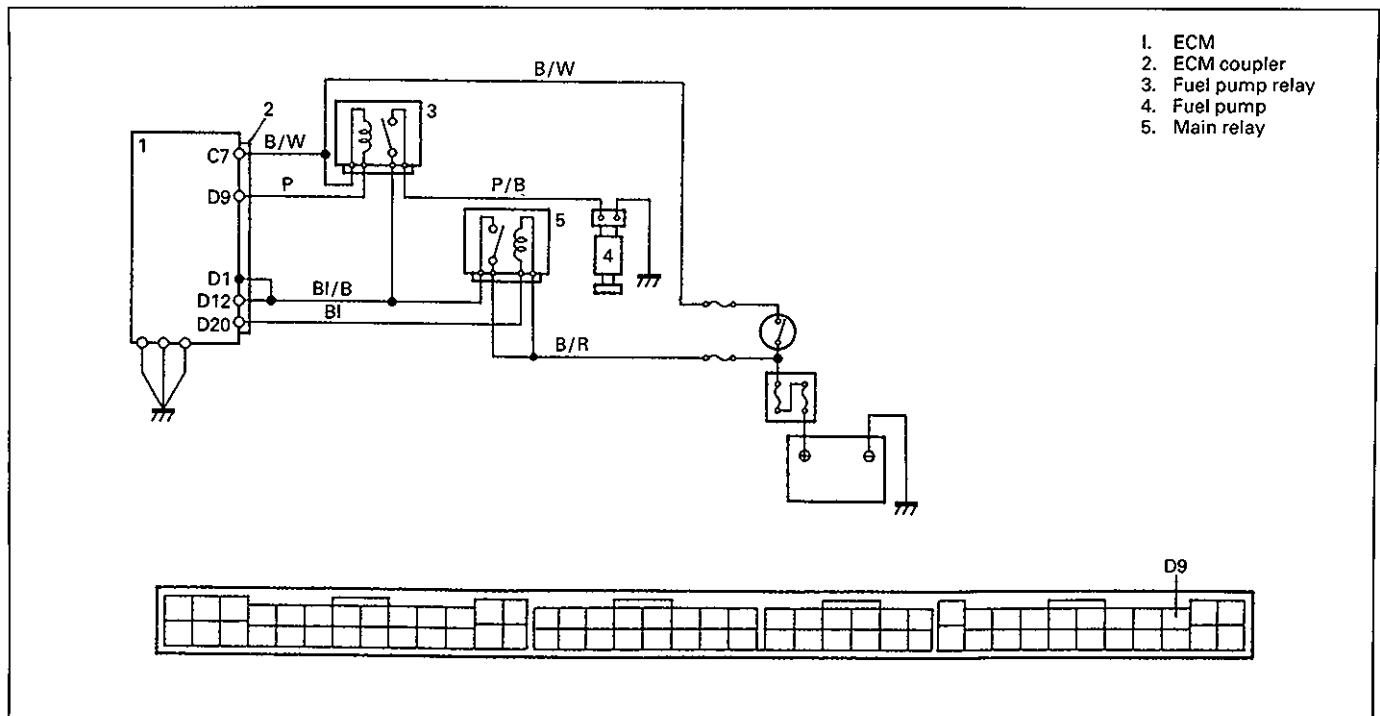
85F00-6E2-58-2

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Improper engine idle speed	● Maladjusted accelerator cable play ● Vacuum leaks (or air inhaled) in air intake system ● Maladjusted idle speed adjusting screw ● Faulty TP sensor ● Faulty idle air control system ● Faulty fast idle control system ● Fuel pressure out of specification ● Faulty injector(s) ● Poor performance of ECT sensor, TP sensor or MAF sensor ● Faulty ECM	See p. 6E2-77 See p. 6E2-78 See p. 6E2-99 Diagnostic Flow Chart B-4 See p. 6E2-86 Diagnostic Flow Chart B-3 See p. 6E2-90 See p. 6E2-101, 6E2-99 or 6E2-96 See p. 6E2-71
NOTE: ● With engine warmed up, if engine idle speed is high even when idle speed adjusting screw is tightened fully (in other words, if engine idle speed cannot be adjusted as specified with idle speed adjusting screw), check accelerator cable play, idle air control system and fast idle control system in that order. ● If engine idle speed lowers below specification only when electric load is applied (e.g. headlight ON), check idle air control system first. ● With A/T model, if engine idle speed lowers below specification only when shifted to "R", "D", "2" or "L" range, check if "R", "D", "2" or "L" signal is inputted to ECM first.		
Engine has no or poor power	● Maladjusted accelerator cable play ● Vacuum leaks (or air inhaled) in air intake system ● Maladjusted installation angle of TP sensor ● Faulty EGR system ● Fuel pressure out of specification ● Faulty injector(s) ● Poor performance of TP sensor, ECT sensor or MAF sensor ● Faulty ECM	Check if throttle valve opens fully when accelerator pedal is depressed fully. See p. 6E2-99 Diagnostic Flow Chart B-5 Diagnostic Flow Chart B-3 See p. 6E2-90 See p. 6E2-99, 6E2-101 or 6E2-96 See p. 6E2-71
Engine hesitates when accelerating	● Vacuum leaks (or air inhaled) in air intake system ● Faulty TP sensor ● Faulty EGR system ● Fuel pressure out of specification ● Faulty injector(s) ● Poor performance of TP sensor, ECT sensor or MAF sensor ● Faulty ECM	See p. 6E2-99 Diagnostic Flow Chart B-5 Diagnostic Flow Chart B-3 See p. 6E2-90 See p. 6E2-99, 6E2-101 or 6E2-96 See p. 6E2-71

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Surges (Variation in vehicle speed is felt although accelerator pedal is not operated)	● Faulty EGR system ● Variable fuel pressure (clogged fuel filter, faulty fuel pressure regulator, etc.) ● Poor performance of MAF sensor ● Faulty injector(s) ● Faulty ECM	Diagnostic Flow Chart B-5 Diagnostic Flow Chart B-3 See p. 6E2-96 See p. 6E2-90 See p. 6E2-71
Poor gasoline mileage	● High idle speed ● Fuel pressure out of specification or fuel leakage ● Poor performance of TP sensor, ECT sensor or MAF sensor ● Faulty EGR system ● Faulty injector(s) ● Faulty ECM	Refer to item "Improper engine idle speed" previously outlined. Diagnostic Flow Chart B-3 See p. 6E2-99, 6E2-101 or 6E2-96 Diagnostic Flow Chart B-5 See p. 6E2-90 See p. 6E2-71
Excessive hydrocarbon (HC) emission	● Engine not at normal operating temperature ● Clogged air cleaner ● Faulty ignition system ● Low compression ● Lead contamination of three way catalytic converter ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Poor performance of MAF sensor, TP sensor or ECT sensor ● Faulty injector(s) ● Faulty ECM	See Section 6F2 See Section 6 Check for absence of filler neck restrictor. Diagnostic Flow Chart B-3 See p. 6E2-96, 6E2-99 or 6E2-101 See p. 6E2-90 See p. 6E2-71
Excessive carbon monoxide (CO)	● Engine not at normal operating temperature ● Clogged air cleaner ● Faulty ignition system ● Low compression ● Lead contamination of three way catalytic converter ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Poor performance of MAF sensor, TP sensor or ECT sensor ● Faulty injector(s) ● Faulty ECM	See Section 6F2 See Section 6 Check for absence of filler neck restrictor Diagnostic Flow Chart B-3 See p. 6E2-96, 6E2-99 or 6E2-101 See p. 6E2-90 See p. 6E2-71

SYMPTOM	POSSIBLE CAUSE	INSPECTION
Excessive nitrogen oxides (NOx) emission	● Vacuum leaks (or air inhaled) in air intake system ● Improper ignition timing ● Lead contamination of three way catalytic converter ● Faulty EGR system ● Fuel pressure out of specification ● Closed loop system (A/F feed back compensation) fails – Poor performance of MAF sensor, TP sensor or ECT sensor ● Faulty injector(s) ● Faulty ECM	See Section 6F2 Check for absence of fiiler neck restrictor Diagnostic Flow Chart B-5 Diagnostic Flow Chart B-3 See p. 6E2-96, 6E2-99 or 6E2-101 See p. 6E2-90 See p. 6E2-71

B-1 FUEL PUMP CIRCUIT CHECK



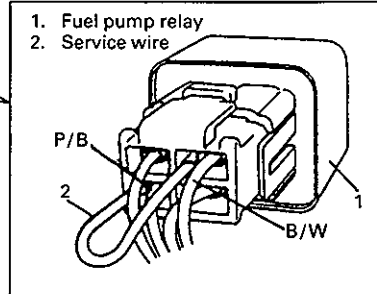
Is fuel pump heard to operate for 3 sec. after ignition switch ON?

NO

1. Turn OFF ignition switch.
2. Using service wire, connect "P/B" and "B/W" wire terminals.
3. Is fuel pump heard to operate at ignition switch ON?

YES

Fuel pump circuit in good condition.



YES

Check fuel pump relay referring to p. 6E2-107. Is it in good condition?

NO

"P/B" wire open, poor fuel pump coupler connection or faulty fuel pump.

YES

Poor relay coupler connection, "P" wire open or poor D9 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

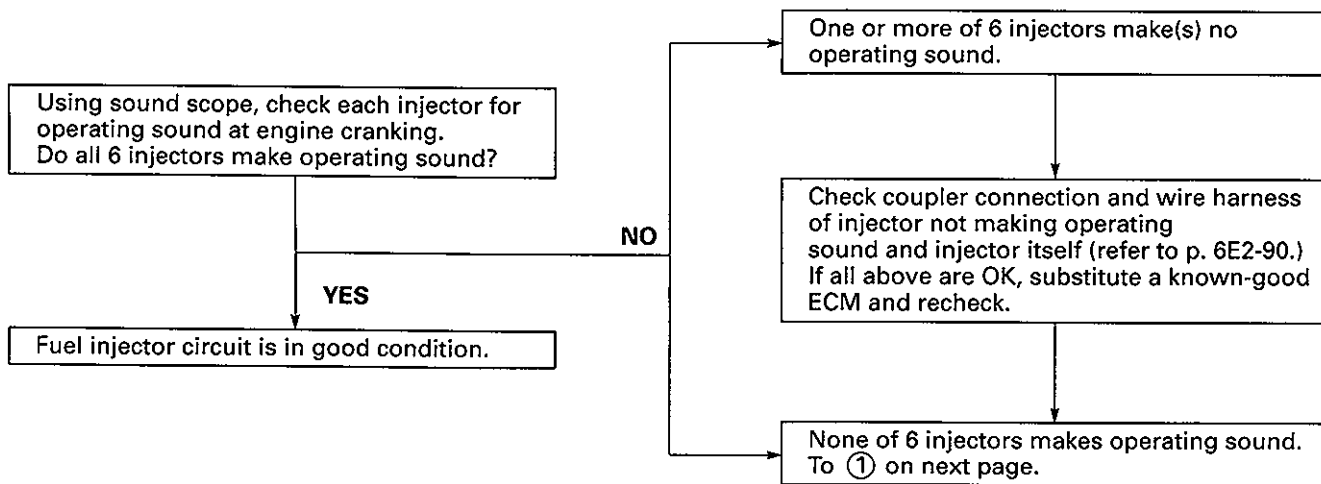
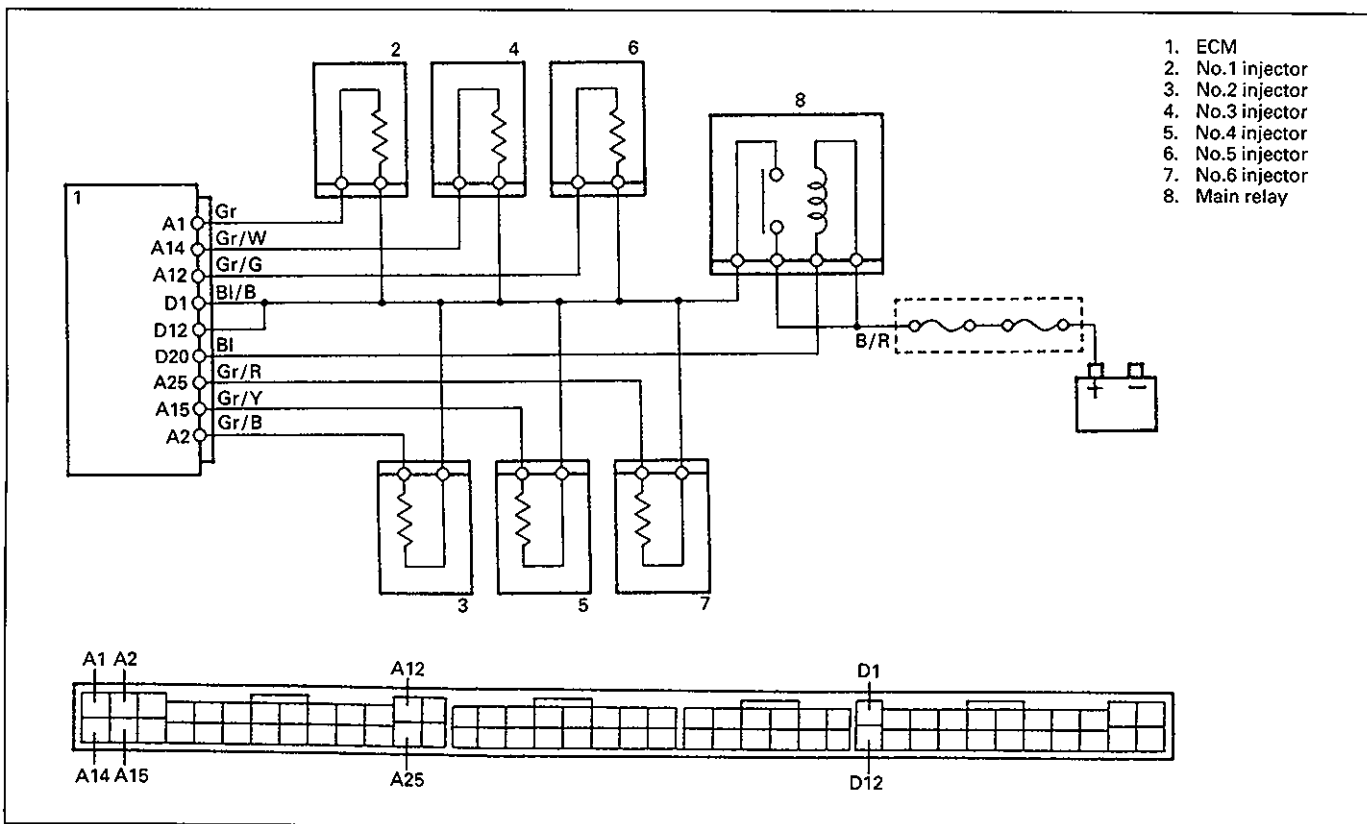
NOTE:

Before substituting a known-good ECM, check to make sure that resistance of coil in relay is as specified.

NO

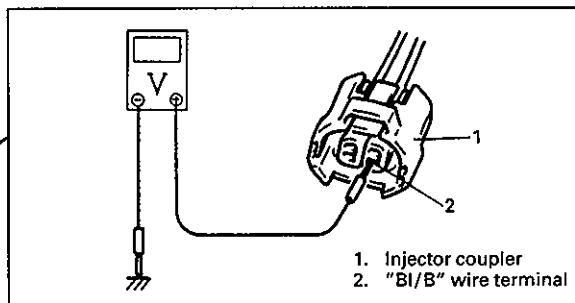
Faulty fuel pump relay.

B-2 FUEL INJECTOR CIRCUIT CHECK



None of 6 injectors makes operating sound.

1. Disconnect coupler from No. 1 injector with ignition switch OFF.
2. Check voltage at "BI/B" wire terminal with ignition switch ON. Is it battery voltage?

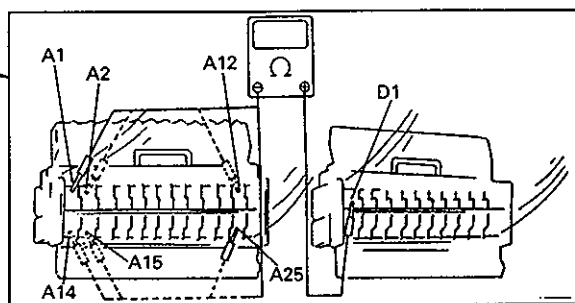


YES

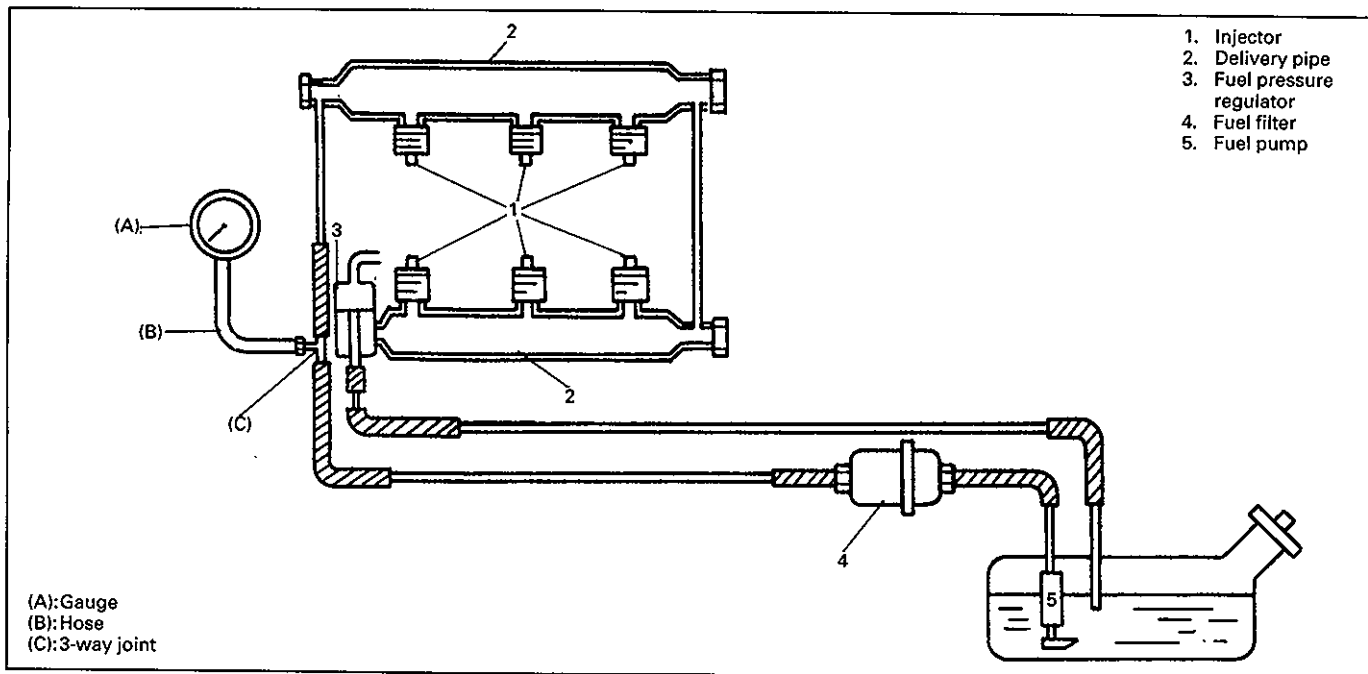
NO

Power circuit open.

Check all 6 injectors for resistance respectively.
If resistance is OK, substitute a known-good ECM and recheck.

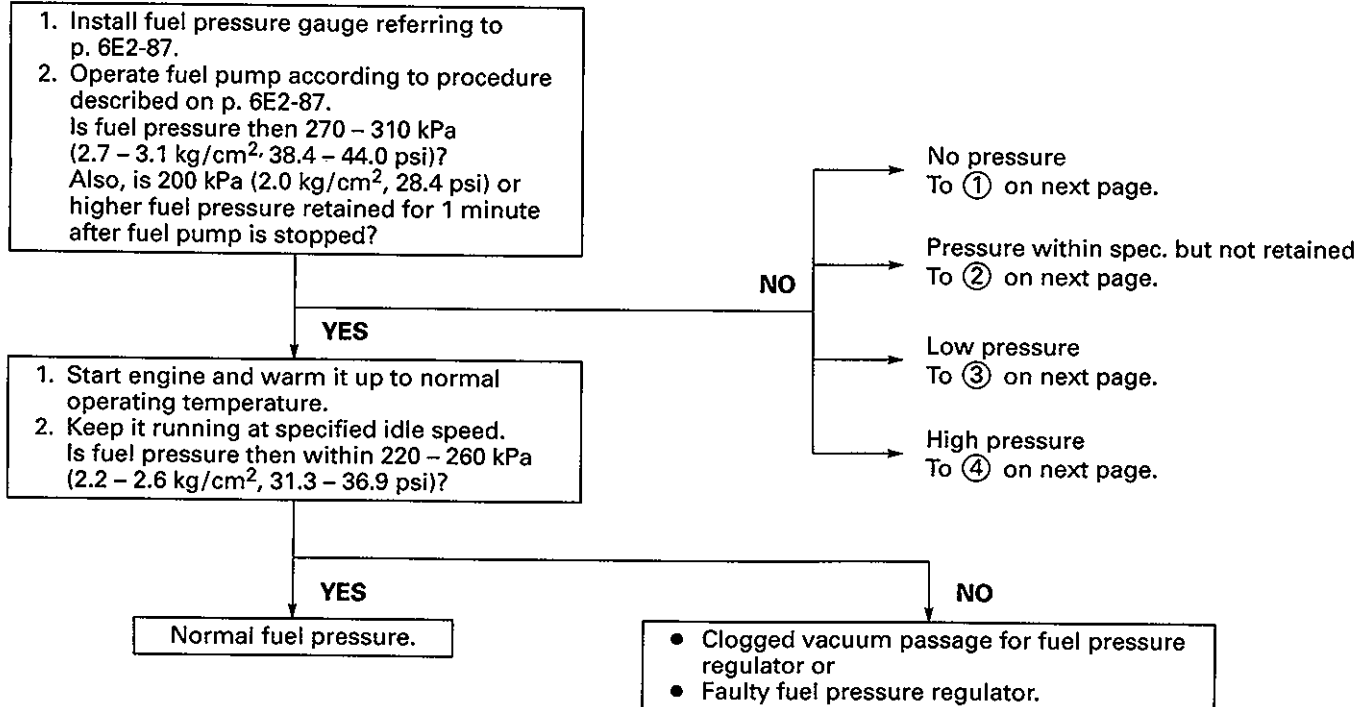


B-3 FUEL PRESSURE CHECK



NOTE:

Before using following flow chart, 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.



B-3 FUEL PRESSURE CHECK (continued)**① NO PRESSURE**

With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?

NO

Shortage of fuel or fuel pump or its circuit defective (Refer to "Diagnostic Flow Chart B-1").

YES

Faulty fuel pressure regulator

③ LOW PRESSURE

1. Operate fuel pump.
2. With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm², 64.0 psi) or more?

NO

- Clogged fuel filter,
- Restricted fuel feed hose or pipe,
- Faulty fuel pump or
- Fuel leakage from hose connection in fuel tank.

YES

Faulty fuel pressure regulator

② PRESSURE WITHIN SPEC. BUT NOT RETAINED

Is there fuel leakage from fuel feed line hose, pipe or their joint?

NO

1. Disconnect fuel return hose from fuel pipe and connect new return hose to it.
2. Put the other end of new return hose into approved gasoline container.
3. Check again if specified pressure is retained. While doing so, does fuel come out of return hose?

YES

Fuel leakage from hose, pipe or joint.

NO

- Fuel leakage from injector,
- Faulty fuel pump (faulty check valve in fuel pump) or
- Fuel leakage from fuel pressure regulator diaphragm.

YES

Faulty fuel pressure regulator

④ HIGH PRESSURE

1. Disconnect fuel return hose from fuel pipe and connect new return hose to it.
2. Put the other end of new return hose into approved gasoline container.
3. Operate fuel pump. Is specified fuel pressure obtained then?

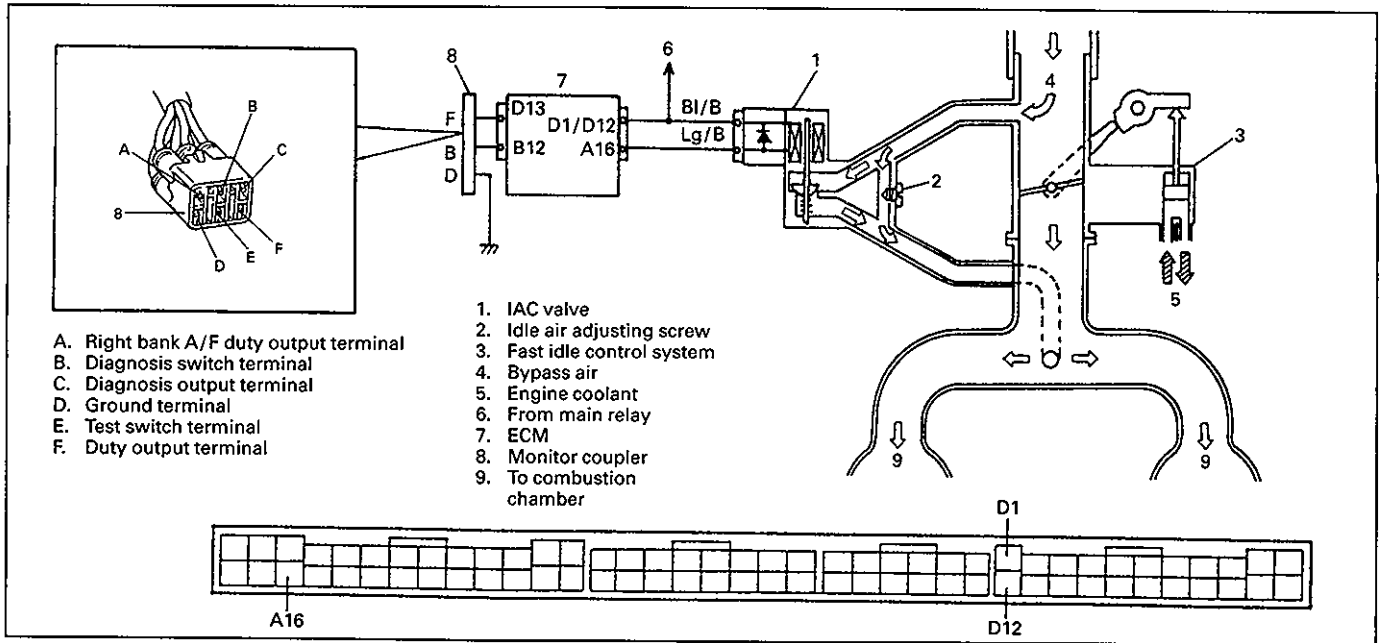
NO

Faulty fuel pressure regulator.

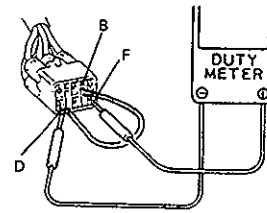
YES

Restricted fuel return hose or pipe.

B-4 IDLE AIR CONTROL SYSTEM CHECK



- B. Diag switch terminal
D. Ground terminal
F. Duty output terminal



1. Warm up engine to normal operating temperature and keep it idling.
2. Using service wire, ground diagnosis switch terminal.
3. Is diagnostic trouble code No. 12 indicated?

YES

NO

Check idle air control duty (IAC duty) and idle speed referring to p. 6E2-78. Are they within specification?

Go back to "Diagnostic Flow Chart" on p. 6E2-39.

YES

NO

High idle speed
To ① on next page

Low idle speed
To ② on next page.

Idle speed is within specification but duty is not.
1. Adjust IAC duty to specification referring to p. 6E2-78.
2. Proceed to next step.

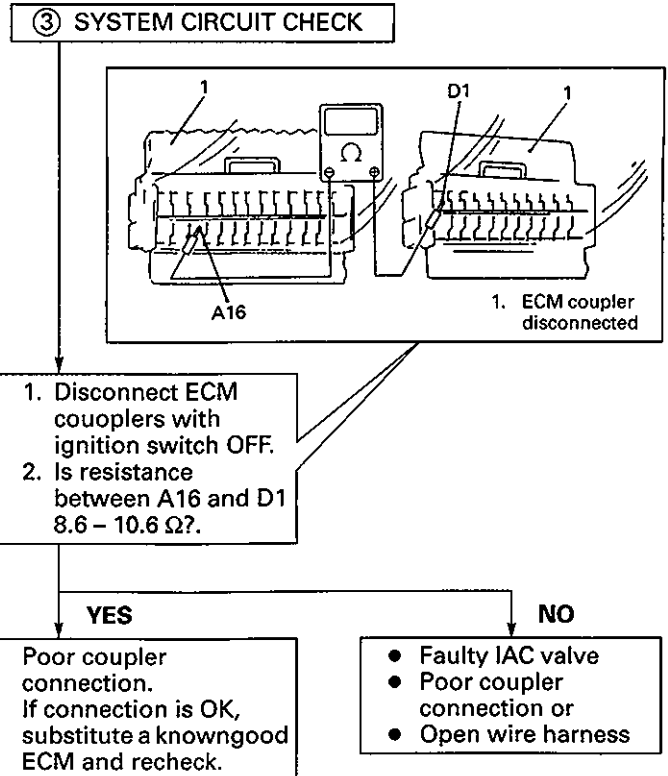
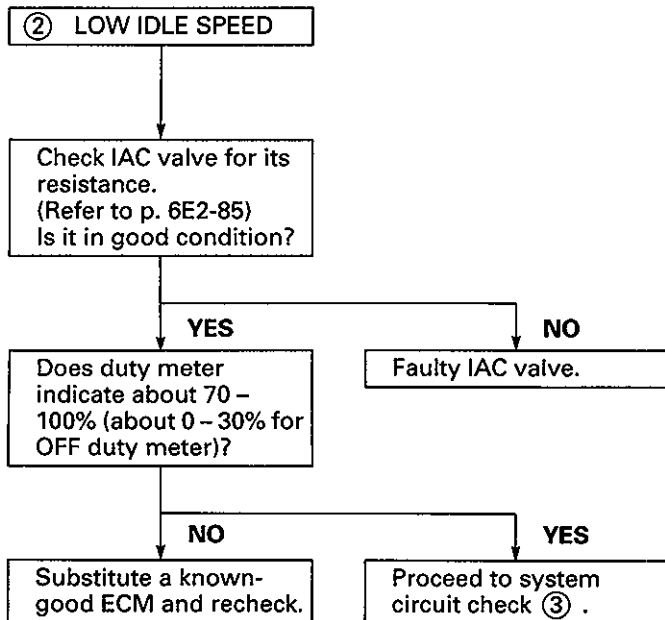
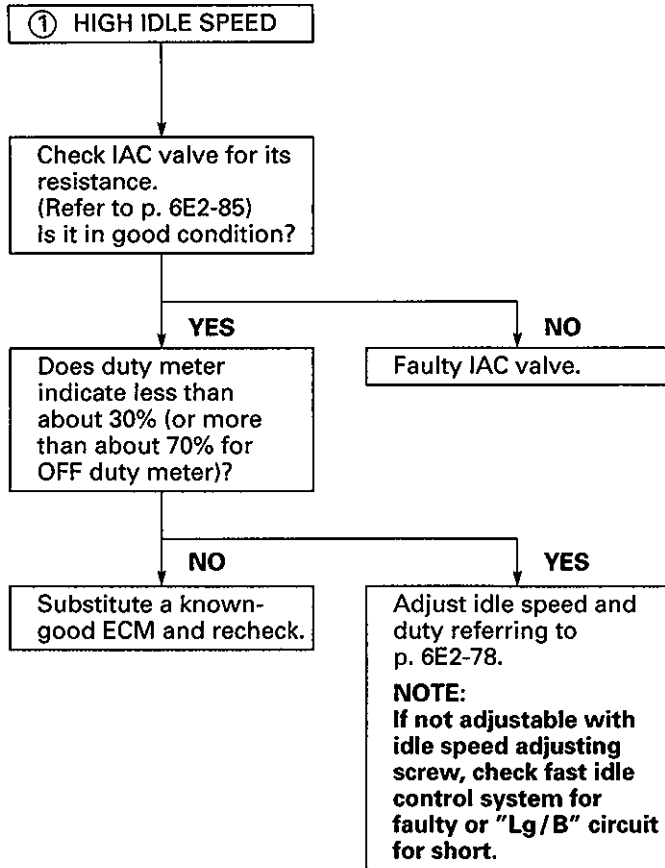
Is engine idle speed kept specified speed (refer to p. 6E2-29) even with headlights turned ON.

YES

NO

System is in good condition.

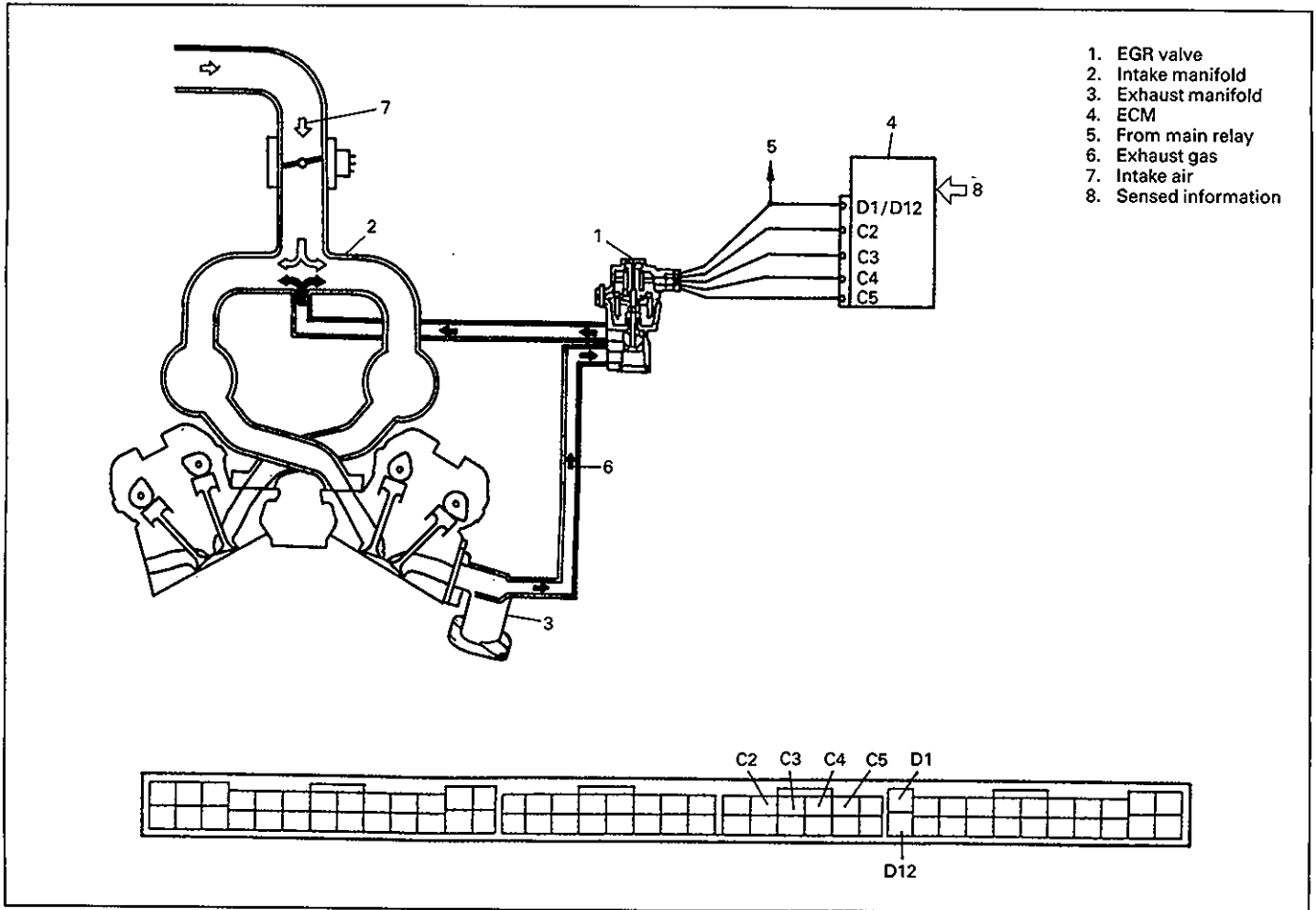
Proceed to system circuit check ③ on next page.

B-4 IDLE AIR CONTROL SYSTEM CHECK (continued)**NOTE:**

IAC duty can be checked by using analog type voltmeter with high impedance ($M\Omega/V$ minimum), although not accurate. IAC duty to voltage relation is as follows.

ON DUTY METER INDICATION	OFF DUTY METER INDICATION	VOLTMETER INDICATION
0 (%)	100 (%)	0 (V)
30	70	$0.3 \times V_B$
70	30	$0.7 \times V_B$
100	0	V_B

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

B-5 EGR SYSTEM CHECK (IF EQUIPPED)

1. Warm up engine to normal operating temperature.
2. Using service wire, ground diag. switch terminal in monitor coupler
3. Is diagnostic trouble code No. 12?

YES

Check EGR system by using tech-1. referring to p. 6E2-102.
Is it good condition?

YES

EGR system is in good condition.

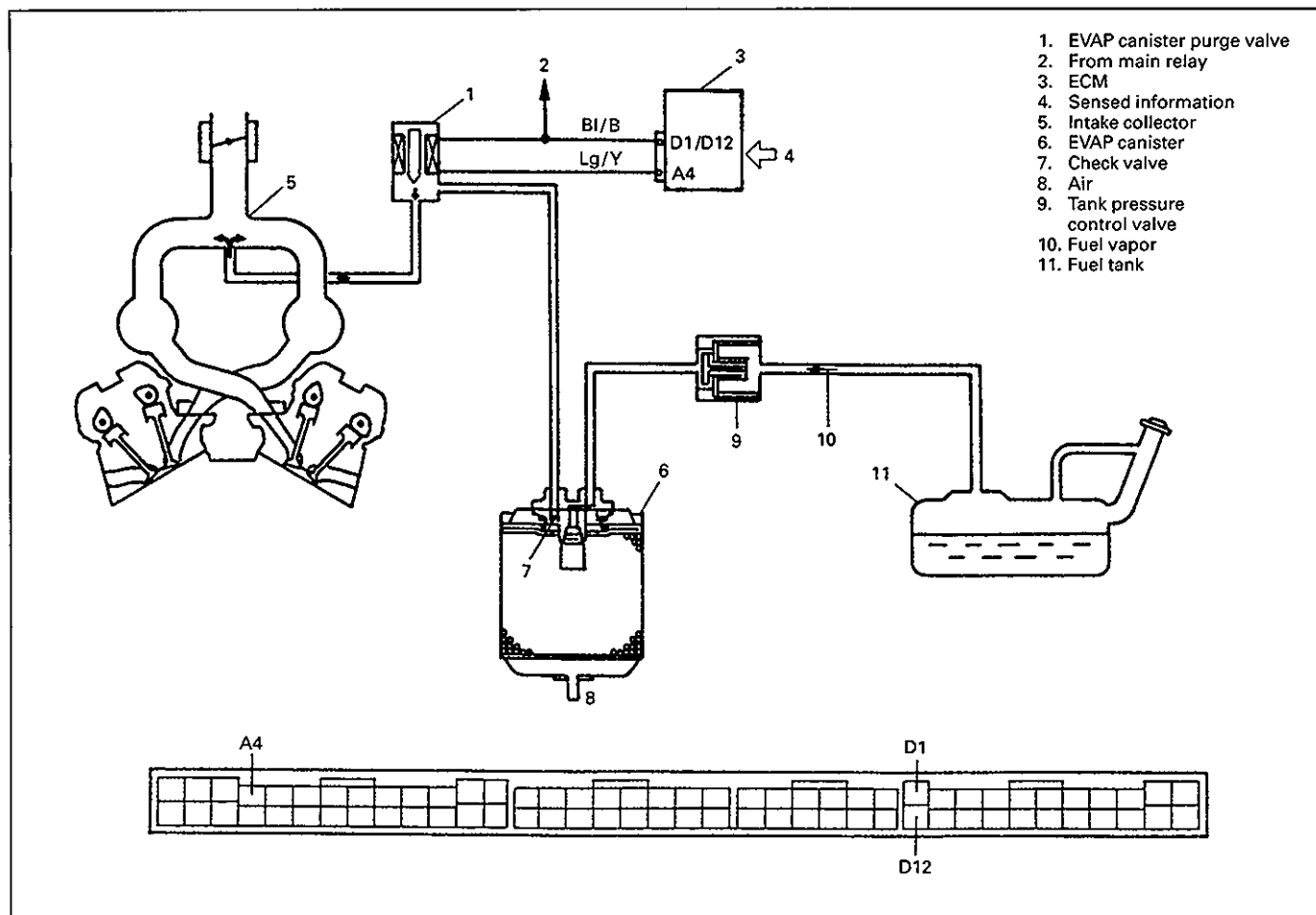
NO

Go back to "Diagnostic Flow Chart" on p. 6E2-39.

NO

Clogged EGR pipe, stuck or faulty EGR valve or poor performance of ECT sensor, TP sensor.

B-6 EVAPORATIVE EMISSION CONTROL SYSTEM CHECK



Check canister purge system for operation referring to p. 6E2-107.
 Is it in good condition?

NO

Check vacuum passage, hoses and EVAP canister purge valve referring to p. 6E2-108.
 Are they in good condition?

YES

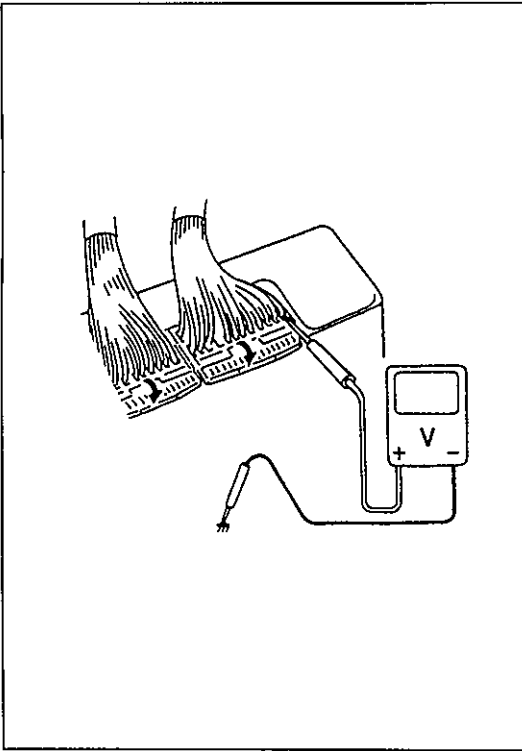
- "Lg/Y" wire open,
 - "Lg/Y" wire shorted to ground,
 - Poor canister purge valve coupler connection,
 - Poor A4 connection or
 - Poor performance of ECT sensor
- If wire, connection and sensor are OK, substitute a known-good ECM and recheck.

YES

- Canister purge system in good condition check EVAP canister, tank pressure control valve and fuel filler cap.

NO

- Vacuum passage clogged,
- Vacuum leakage or
- Faulty EVAP canister purge valve



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.

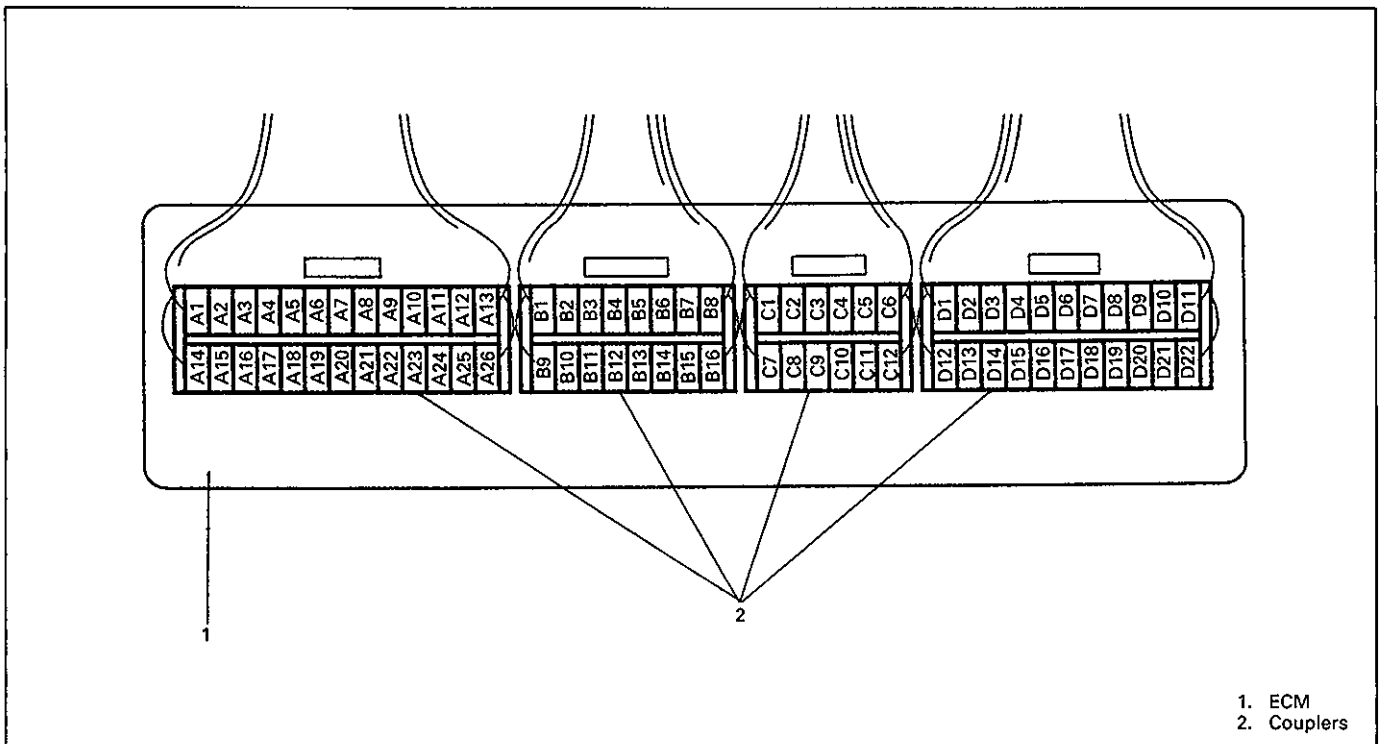
Voltage Check

- 1) Remove ECM from body referring to p. 6E2-95.
- 2) Connect ECM couplers to ECM.
- 3) Check voltage at each terminal of couplers connected.

NOTE:

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

85F00-6E2-71-1



85F00-6E2-71-3

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
A1	No. 1 injector	10 – 14 V	Ignition switch ON
A2	No. 2 injector	10 – 14 V	Ignition switch ON
A3	Left bank heated oxygen sensor heater (if equipped)	10 – 14 V	Ignition switch ON
		0 – 2 V	At specified idle speed after engine warmed up.
A4	EVAP canister purge valve	10 – 14 V	Ignition switch ON
A5	Power steering pressure switch	4.75 – 5.25 V	Ignition switch ON
		0 – 0.8 V	Engine running at idle speed and steering wheel turned to the right and left as far as it stops.
A6	Engine start switch (Engine start signal)	0 – 1 V	Ignition switch ON
		6 – 14 V	While engine cranking
A7	Power source (for sensors)	4.75 – 5.25 V	Ignition switch ON
A8 A9	CMP sensor signal (REF signal)	Indicator deflection between 0 – 1 V and 4 – 6 V	Ignition switch ON Crank shaft turned slowly
A10 A11	CMP sensor signal (POS signal)	Indicator deflection between 0 – 1 V and 4 – 6 V	Ignition switch ON Crank shaft turned slowly
A12	No.5 injector	10 – 14 V	Ignition switch ON
A13	Ground	—	—
A14	No.3 injector	10 – 14 V	Ignition switch ON
A15	No.5 injector	10 – 14 V	Ignition switch ON
A16	IAC valve	6.2 – 8.7 V { (62% : ON DUTY) }	At specified idle speed after engine warmed up.
A17 A18	Blank	—	—
A19	ECT sensor	About 0.8 V	Ignition switch ON Engine coolant temp.: 80 °C (176 °F)
A20	Sensor ground	—	—
A21	IAT sensor	About 3.0 V	Ignition switch ON sensor ambient temp.: 20 °C (68 °F)
A22	Left bank heated oxygen sensor (if equipped)	Indicator deflection repeated between over and under 0.31 V	While engine running at 2,000 r/min for 1 minute or longer after warmed up.
	CO adjusting resistor (vehicle without heated oxygen sensor only)	Ignition switch ON Voltage varies as specified in graph in p. 6E2-20 while CO adjusting resistor knob turned.	
A23	TP sensor	0.35 – 0.65 V	Ignition switch ON after engine warmed up. Throttle valve at idle position.
		3.6 – 4.5 V	Ignition switch ON Throttle valve at full open position.
A24	MAF sensor	0.5 – 1.0 V	Ignition switch ON
		1.5 – 1.8 V	With engine running at idle speed
A25	No.6 injector	10 – 14 V	Ignition switch ON.
A26	Ground	—	—

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	B9	B10	B11	B12	B13	B14	B15	B16	C7	C8	C9	C10	C11	C12	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22

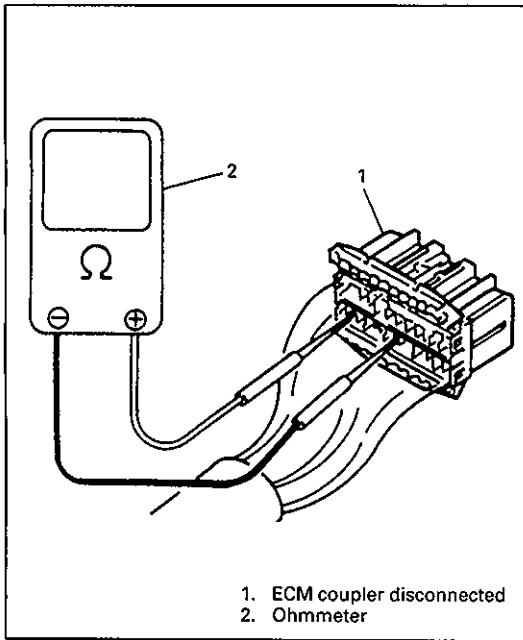
TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
B1 B2	Blank	—	—
B3	Electric load signal diode	0 – 1 V	Ignition switch ON. Small light, heater fan and rear defogger all turned OFF.
		10 – 14 V	Ignition switch ON. Small light, heater fan and rear defogger turned ON
B4	Test switch terminal	4.75 – 5.25 V	Ignition switch ON
		0 – 0.8 V	Ignition switch ON Test switch terminal grounded
B5	Vehicle speed sensor	Indicator deflection repeated between 0 – 1 and 4 – 5 V	Ignition switch ON Rear left tire turned slowly with rear right tire locked.
B6	Transmission range switch	0 – 0.8 V	Ignition switch ON Selector lever in "P" or "N" range
		4.75 – 5.25 V	Ignition switch ON Selector lever in "R", "D", "2" or "L" range
B7	Blank	—	—
B8	Sensor ground	—	—
B9	A/F duty (Right bank) output terminal	4.75 – 5.25 V	Ignition switch ON
B10	Blank	—	—
B11	Power source for back-up	10 – 14 V	Ignition switch ON and OFF
B12	Diagnosis switch terminal	4.75 – 5.25 V	Ignition switch ON
		0 – 0.8 V	Ignition switch ON Diagnosis switch terminal grounded
B13	A/C amplifier (if equipped)	4.75 – 5.25 V	Ignition switch ON
		0 – 1.5 V	A/C ON
B14	Blank	—	—
B15	Tachometer	0 – 0.8 V	Ignition switch ON
B16	Noise suppressor	10 – 14 V	Ignition switch ON

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
C1	Right bank heated oxygen sensor (if equipped)	Indicator deflection repeated between over and under 0.31 V	While engine running at 2,000 r/min for 1 minute or longer after engine warmed up
C2	EGR valve (stepper motor coil 1), if equipped	10 – 14 V	More than 3 seconds after ignition switch ON
		0 – 3.5 V	After engine start (At fast idle)
C3	EGR valve (stepper motor coil 2), if equipped	0 – 3.5 V	More than 3 seconds after ignition switch ON
		10 – 14 V	After engine start (At fast idle)
C4	EGR valve (stepper motor coil 3) if equipped	0 – 3.5 V	More than 3 seconds after ignition switch ON
		10 – 14 V	After engine start (At fast idle)
C5	EGR valve (stepper motor coil 4), if equipped	10 – 14 V	More than 3 seconds after ignition switch ON
		0 – 3.5 V	After engine start (At fast idle)
C7	Ignition switch	10 – 14 V	Ignition switch ON
		0 – 0.8 V	Ignition switch OFF

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
D1	Power source	10 – 14 V	Ignition switch ON
D2	Ignitor (No. 3 ignition coil)	—	—
D3	Ignitor (No. 6 ignition coil)	—	—
D4	Ignitor (No. 1 ignition coil)	—	—
D5	Ignitor (No. 4 ignition coil)	—	—
D6	Ignitor (No. 5 ignition coil)	—	—
D7	Ignitor (No. 2 ignition coil)	—	—
D8	Blank	—	—
D9	Fuel pump relay	0 – 2.5 V	For 3 seconds after ignition switch ON
		10 – 14 V	After the above time
D10 D11	Ground	—	—
D12	Power source	10 – 14 V	Ignition switch ON
D13	Duty output terminal	10 – 14 V	Ignition switch ON
D14	Blank	—	—
D15	Diagnosis output terminal and malfunction indicator lamp ("CHECK ENGINE" light)	0 – 2.5 V	Ignition switch ON
		10 – 14 V	Engine running
D16 (A/T only)	Transmission control module (throttle valve opening signal)	Ignition switch ON Voltage varies as specified in graph in p. 6E2-32 while throttle valve is opened gradually.	
D17 (A/T only)	Transmission control module (engine coolant temp. signal)	0 – 1 V (0% ON duty)	Ignition switch ON Engine coolant temp. = below 0 °C (32 °F)
		3.4 – 4.6 V (33% ON duty)	Ignition switch ON Engine coolant temp. = between 0 °C (32 °F) and 31 °C (88 °F)
		6.7 – 9.3 V (67% ON duty)	Ignition switch ON Engine coolant temp. = over 31 °C (88 °F)
D18	Data link connector	4 – 5 V	Ignition switch ON
D19	Blank	—	—
D20	Main relay	0 – 2.0 V	Ignition switch ON
		10 – 14 V	Ignition switch OFF
D21	Right bank heated oxygen sensor heater (if equipped)	10 – 14 V	Ignition switch ON
		0 – 2.0 V	At specified idle speed after engine warmed up
D22	Ground	—	—

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	B9	B10	B11	B12	B13	B14	B15	B16	C7	C8	C9	C10	C11	C12	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22

**Resistance Check**

- 1) Disconnect ECM couplers from ECM with ignition switch OFF.

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.

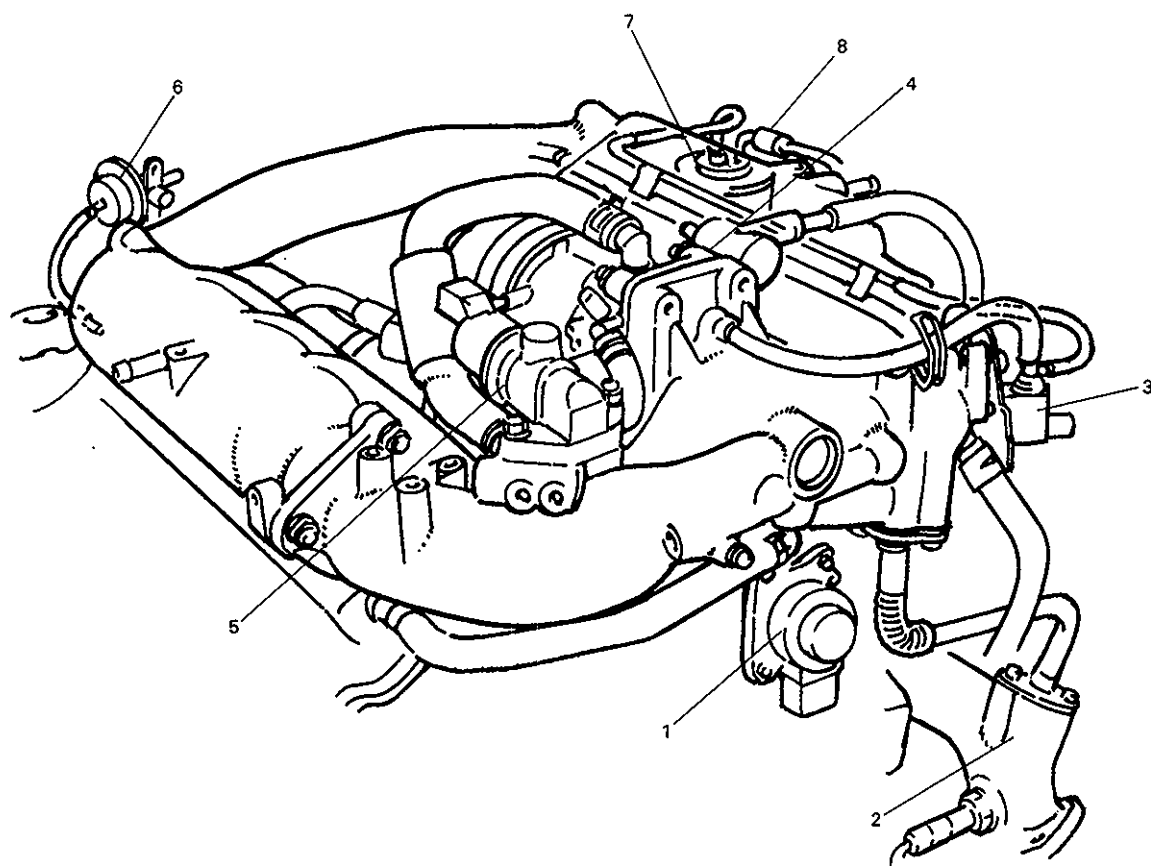
CAUTION:

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

60A50-6B-16-1S

TERMINAL	CIRCUIT	STANDARD RESISTANCE	CONDITION
A1 - D1	No. 1 injector	10.8 - 13.2 Ω	—
A2 - D1	No. 2 injector	10.8 - 13.2 Ω	—
A3 - C7	Left bank HOX2S heater (if equipped)	5.5 - 6.5 Ω	—
A4 - D1	EVAP canister purge valve	28 - 36 Ω	—
A12 - D1	No.5 injector	10.8 - 13.2 Ω	—
A14 - D1	No.3 injector	10.8 - 13.2 Ω	—
A15 - D1	No.4 injector	10.8 - 13.2 Ω	—
A16 - D1	IAC valve	8.7 - 10.5 Ω	—
A19 - B8	ECT sensor	305 - 324 Ω	Engine coolant temp. : 80 °C (176 °F)
A21 - B8	IAT sensor	2.21 - 2.69 k Ω	Intake air temp. : 20 °C (68 °F)
A22 - A7	CO adjusting resistor (if equipped)	0 ~ 50 k Ω	—
A25 - D1	No. 6 injector	10.8 - 13.2 Ω	—
B5 - Body ground	Vehicle speed sesor	Ohmmetes indicator deflects between 0 and ∞	Rear left wheel turned slowly with rear right wheel locked.
B6 - Bady ground	Transmission range switch	Continuity	Selector lever in "P" or "N" range
		Infrity	Selector lever in "R", "D", "2" or "L" range
C2 - D1	EGR valve	21 - 23 Ω	—
C3 - D1	EGR valve	21 - 23 Ω	—
C4 - D1	EGR valve	21 - 23 Ω	—
C5 - D1	EGR valve	21 - 23 Ω	—
D9 - C7	Fuel pump relay	61 - 73 Ω	—
D20 - B11	Main relay	61 - 73 Ω	—
D21 - C7	Right bank HOX2S heater (if equipped)	5.5 - 6.5 Ω	—

ON VEHICLE SERVICE

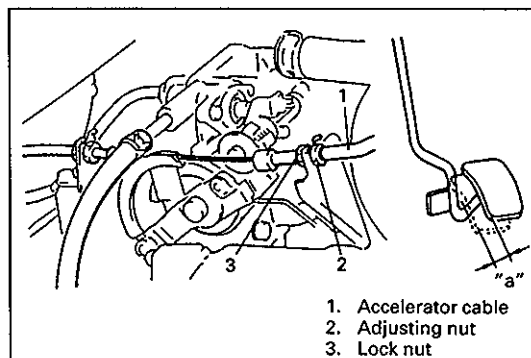


1. EGR valve
2. Exhaust manifold (right bank)
3. EVAP canister purge valve
4. Throttle body
5. IAC valve
6. Fuel pressure regulator
7. EVAP canister
8. Tank pressure control valve

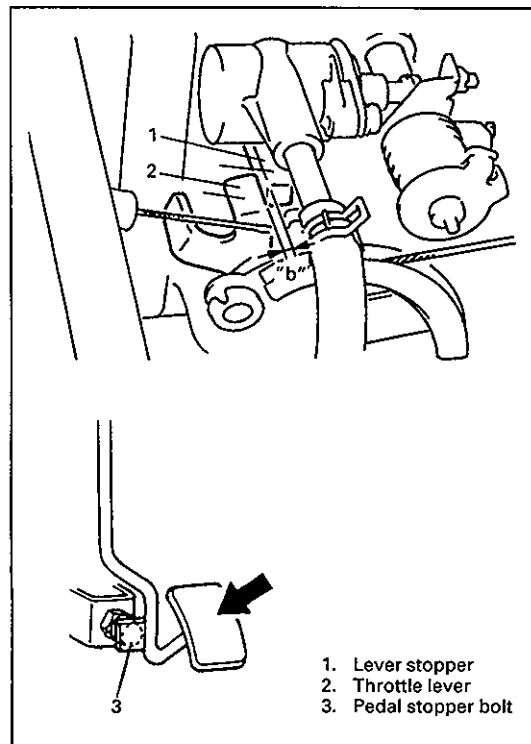
GENERAL

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.

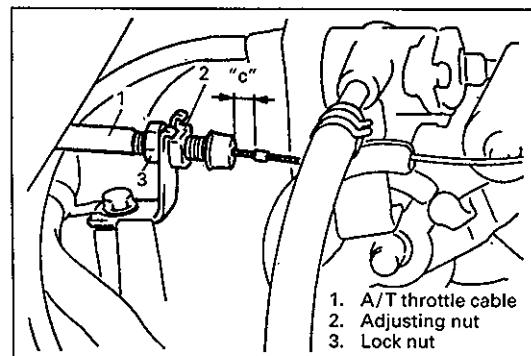
85F00-6E2-77-1



85F00-6E2-77-2



85F00-6E2-77-3



85F00-6E2-77-5

ACCELERATOR CABLE ADJUSTMENT

- 1) Warm up engine to normal operating temperature. And check to make sure that fast idle control cam is off cam follower lever, if not check fast idle control system referring to p. 6E2-86.

- 2) 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.

- 3) 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.

A/T THROTTLE CABLE ADJUSTMENT (A/T vehicle only)

- 1) Make sure that accelerator cable is adjusted as specified.
- 2) Check clearance "c". If it is out of specification, adjust it by turning cable adjusting nut.

Clearance "c": 0.8 – 1.5 mm (0.03 – 0.06 in.)

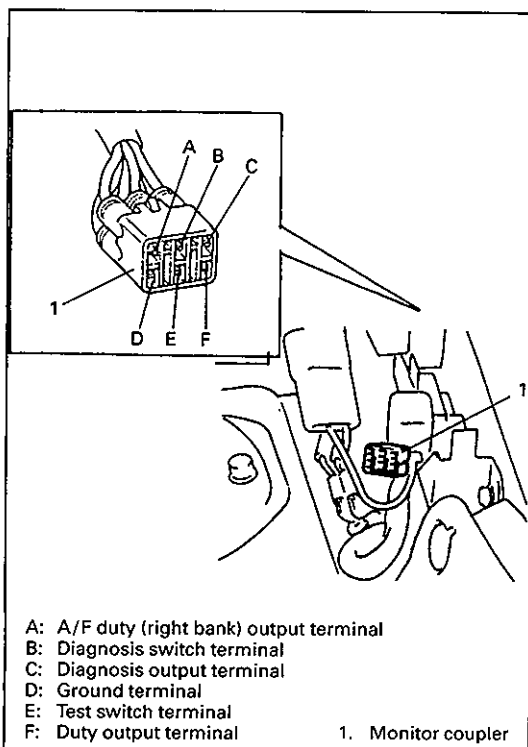
- 3) Tighten lock nut securely.

IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY ADJUSTMENT

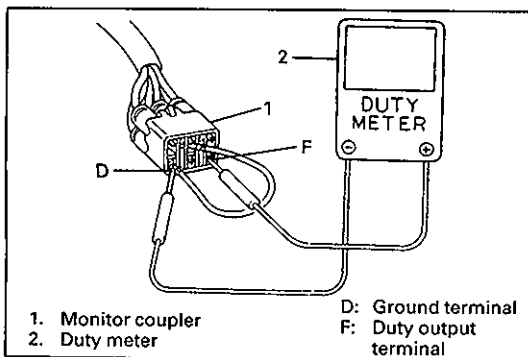
Before idle speed/IAC duty check and adjustment, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- 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.

85F00-6E2-78-1



85F00-6E2-78-3



85F00-6E2-78-5

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

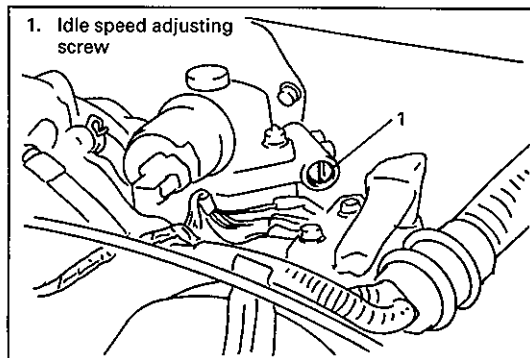
NOTE:

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.

- 1) Warm up engine to normal operating temperature.
- 2) Using service wire, ground diagnosis switch terminal in monitor coupler and make sure that malfunction indicator lamp ("CHECK ENGINE" light) indicate diagnostic trouble code No. 12.

The monitor coupler is located beside washer tank.

- 3) Stop engine and connect duty meter between duty output terminal and ground terminal of monitor coupler.
- 4) Set tachometer.



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- 5) Start engine and warm it up completely.
- 6) Check IAC duty and idle speed. If duty and/or idle speed is out of specifications, adjust it by turning idle speed adjusting screw.

Engine idle speed	M/T	750 ± 50 r/min
	A/T	800 ± 50 r/min
IAC duty at specified idle speed		50 % (7 V when battery voltage is 14 V)

NOTE:

IAC duty can be checked by using analog type 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	$0.5 \times V_B$
100	0	V_B

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

If duty remains unchanged or is not outputted even when adjusting screw is turned, check duty output terminal circuit, A/C signal circuit, PSP switch signal circuit, "D" range signal circuit (A/T) and ECT sensor performance.

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- 7) Remove service wire from monitor coupler.
- 8) Install cap to monitor coupler.
- 9) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
Refer to p. 6E2-29 for specified idle speed.
If not, check A/C ON signal circuit and IAC valve.

85F00-6E2-79-4

IDLE MIXTURE ADJUSTMENT**(For vehicle without heated oxygen sensor)**

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

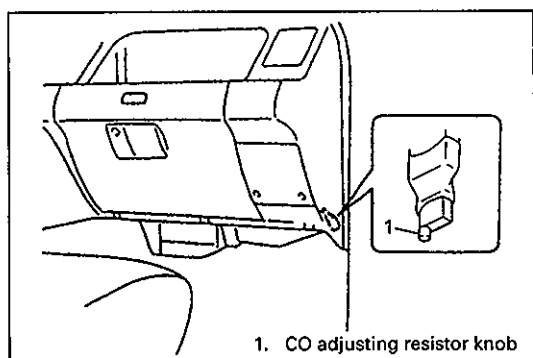
Engine idle mixture CO%	0.8 – 1.3
Engine idle speed (r/min)	refer to p. 6E2-28
IAC duty at specified idle speed	50%

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.

85F00-6E2-80-1



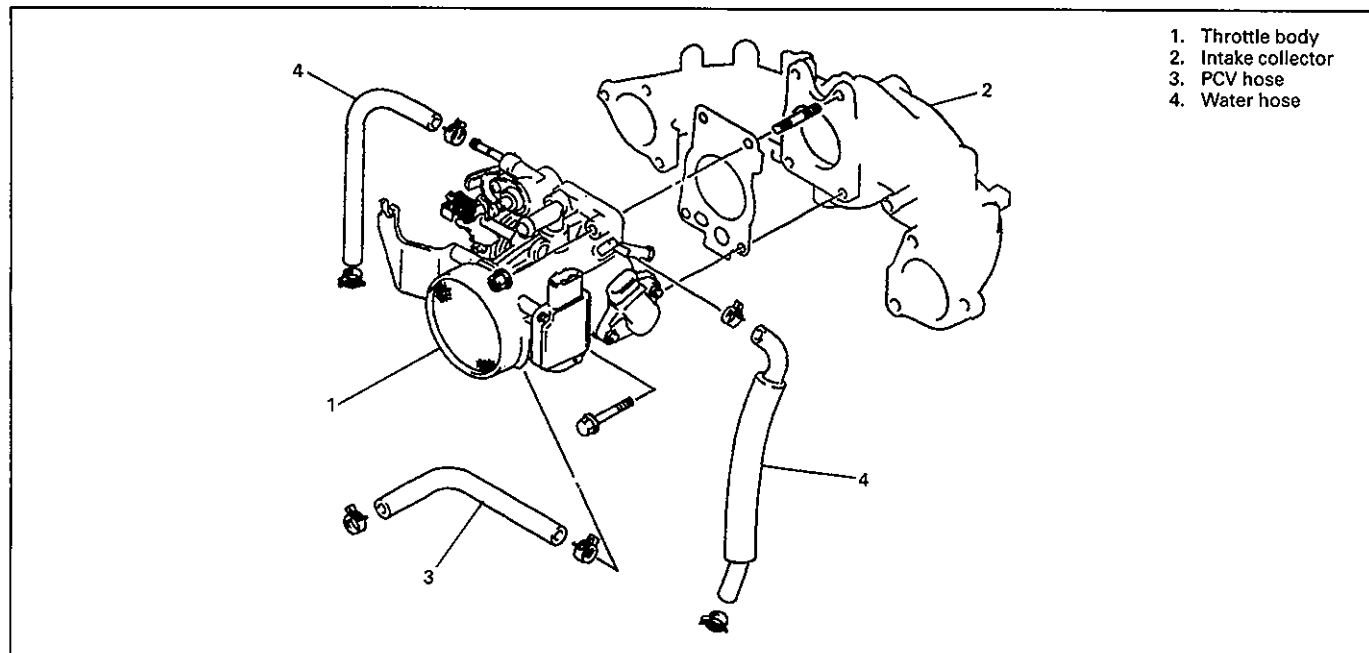
85F00-6E2-80-3

- 1) Check and adjust idle speed according to "IDLE SPEED ADJUSTMENT" described above.
- 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, readjust idle speed and IAC duty.
- 4) Repeat Step 2 and 3) to adjust idle mixture and idle speed as specified.

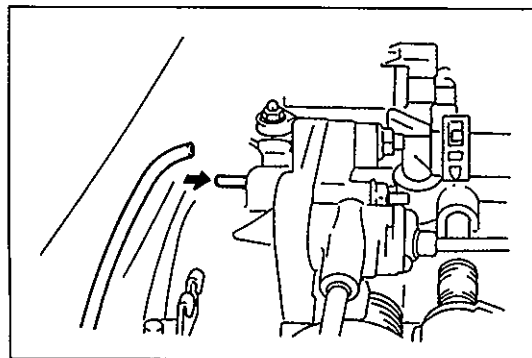
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AIR INTAKE SYSTEM

THROTTLE BODY



85F00-6E2-81-1

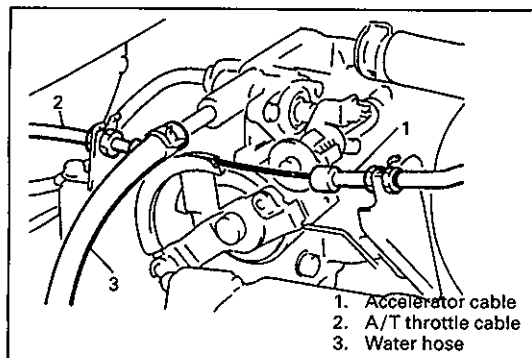


85F00-6E2-81-3

On Vehicle Inspection

- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.

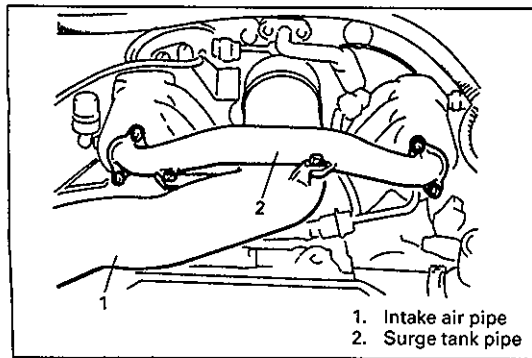
With finger placed against vacuum nozzle, start engine and check that vacuum is applied.



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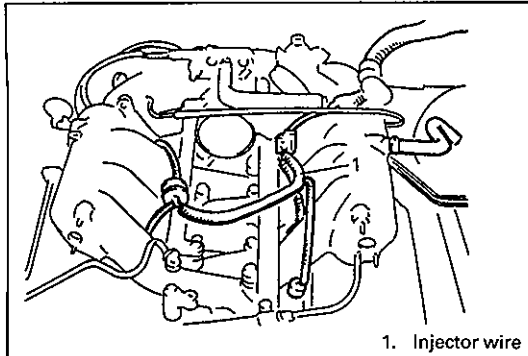
Removal

- 1) Disconnect negative cable at battery.
- 2) Drain cooling system.
- 3) Remove strut tower bar.
- 4) Disconnect accelerator cable and or A/T throttle cable from throttle body.
- 5) Disconnect water hoses from throttle body.

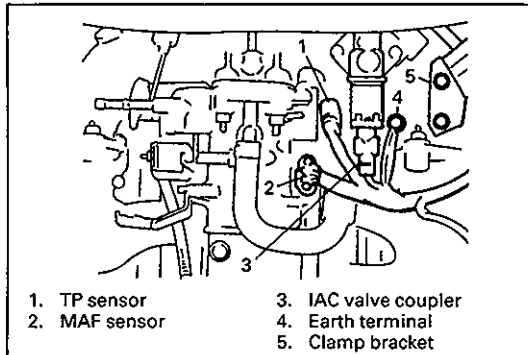


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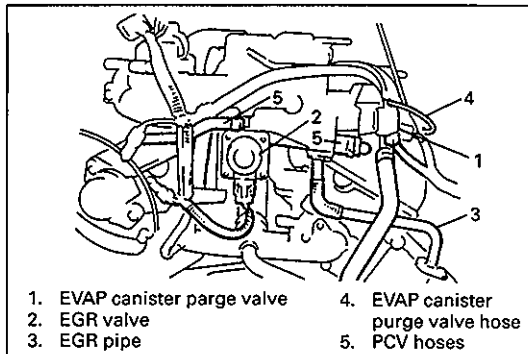
- 6) Remove intake air pipe and surge tank pipe.



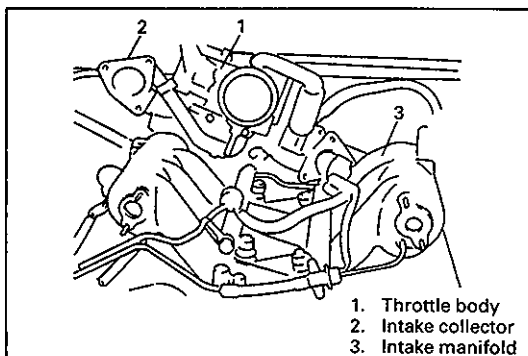
85F00-6E2-82-1



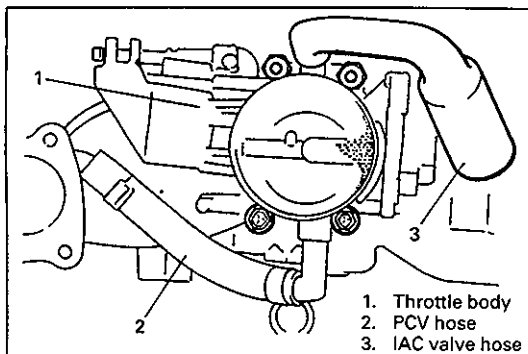
85F00-6E2-82-2



85F00-6E2-82-3



85F00-6E2-82-4



85F00-6E2-82-5

7) Disconnect coupler of injector wire.

8) Disconnect couplers of TP sensor, MAF sensor and IAC valve.

9) Disconnect earth terminal from intake collector.

10) Remove clamp bracket from intake collector.

11) Disconnect couplers of EVAP canister purge valve and EGR valve.

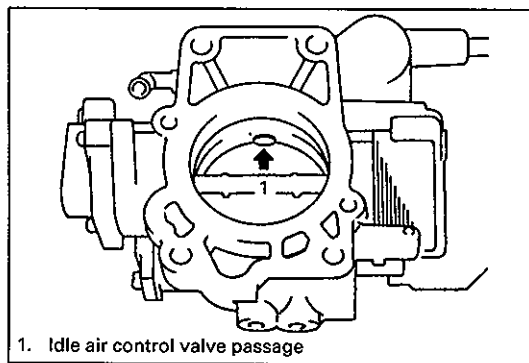
12) Disconnect PCV hoses and EVAP canister purge valve hose.

13) Remove EGR pipe.

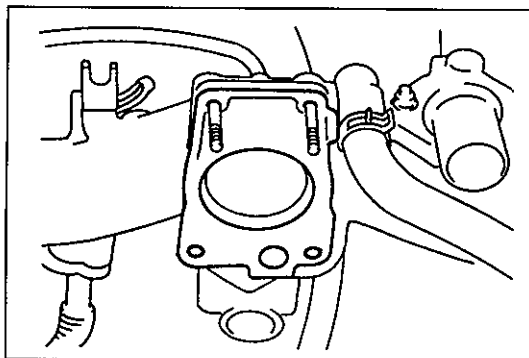
14) Remove throttle body and intake collector from intake manifold.

15) Disconnect hoses of IAC valve and PCV from throttle body.

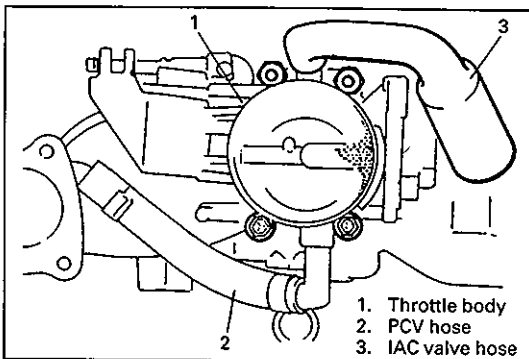
16) Remove throttle body from intake collector.



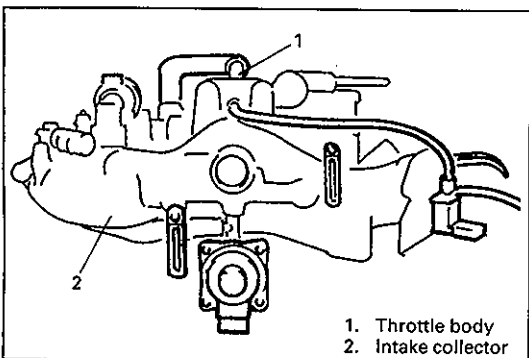
85F00-6E2-83-1



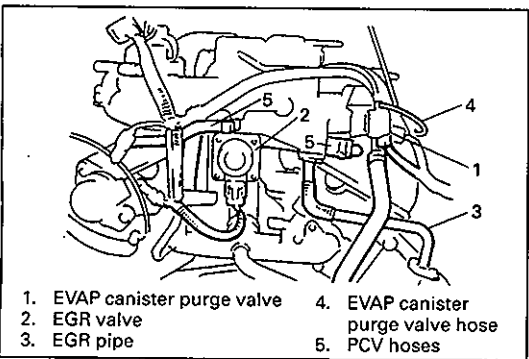
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Cleaning

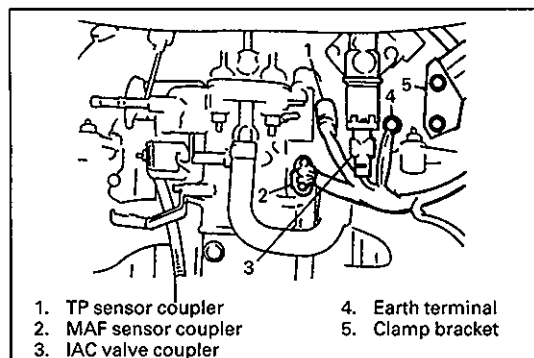
Clean passages by blowing compressed air.

NOTE:

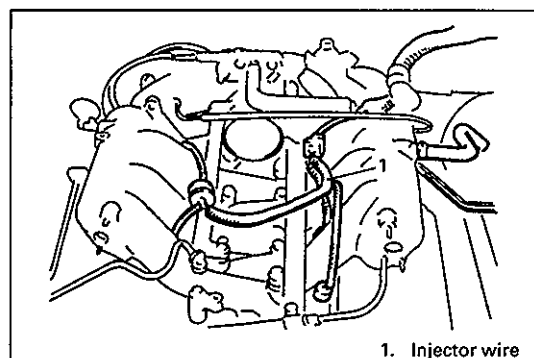
- MAF sensor, TP sensor, or other components containing rubber must not be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or get distorted.
- Don't put drills or wires into passages for cleaning. It causes damages in passages.

Installation

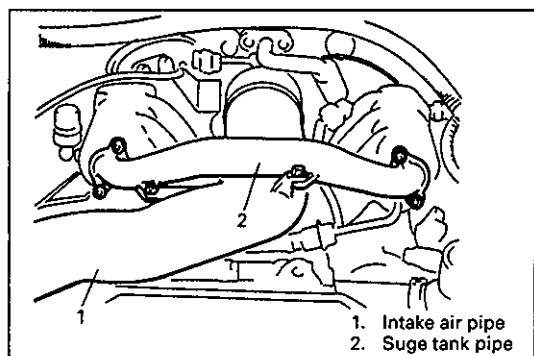
- 1) Clean mating surfaces and install throttle body gasket to intake collector.
Use new gasket.
- 2) Install throttle body to intake collector and tighten bolts.
- 3) Connect IAC valve hose and PCV hose.
- 4) Install throttle body and intake collector to intake manifold with new intake collector gaskets.
- 5) Install EGR pipe with new gaskets.
- 6) Connect PCV hoses and EVAP canister purge valve hose.
- 7) Connect couplers of EVAP canister purge valve and EGR valve.
Fix wire harness with clamps.



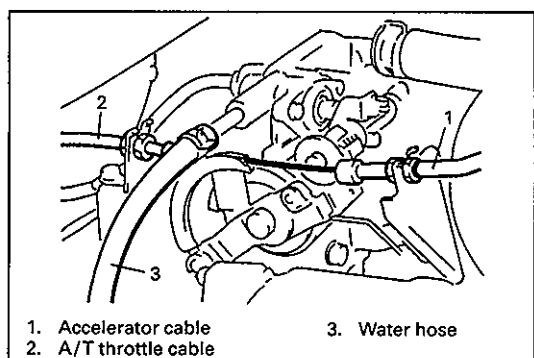
85F00-6E2-84-1



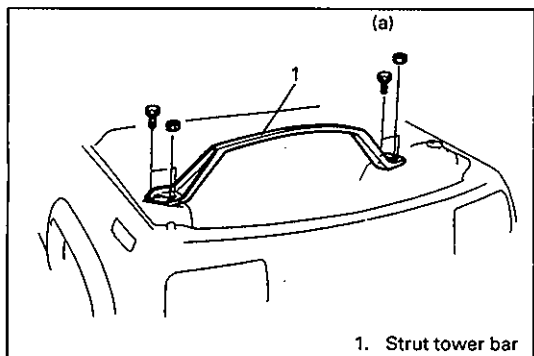
85F00-6E2-84-2



85F00-6E2-84-3



85F00-6E2-84-4



85F00-6E2-84-5

- 8) Install clamp bracket to intake collector.
- 9) Connect ground terminal to intake collector.
- 10) Connect couplers of TP sensor, MAF sensor and IAC valve.

- 11) Connect coupler of injector wire.

- 12) Install surge tank pipe to intake manifold with new gaskets and intake air pipe to throttle body.
- 13) Install air cleaner upper case.
- 14) Install intake air temperature sensor (IAT sensor) to air cleaner box.

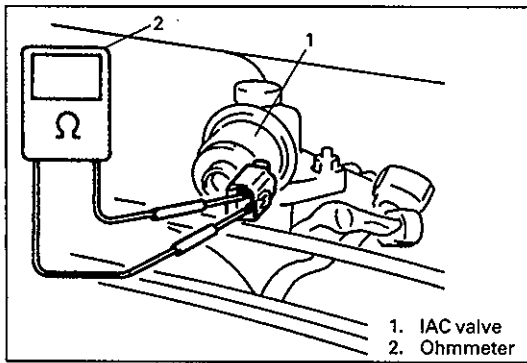
- 15) Connect engine coolant hoses to throttle body.
- 16) Connect accelerator cable and A/T throttle cable (A/T), and adjust each cable play to specification.

- 17) Install strut tower bar and tighten bolts and nuts to specified torque.

Tightening Torque

(a): 90 N·m (9.0 kg-m, 65.5 lb-ft)

- 18) Refill cooling system.
- 19) Connect negative cable at battery.



85F00-6E2-85-1

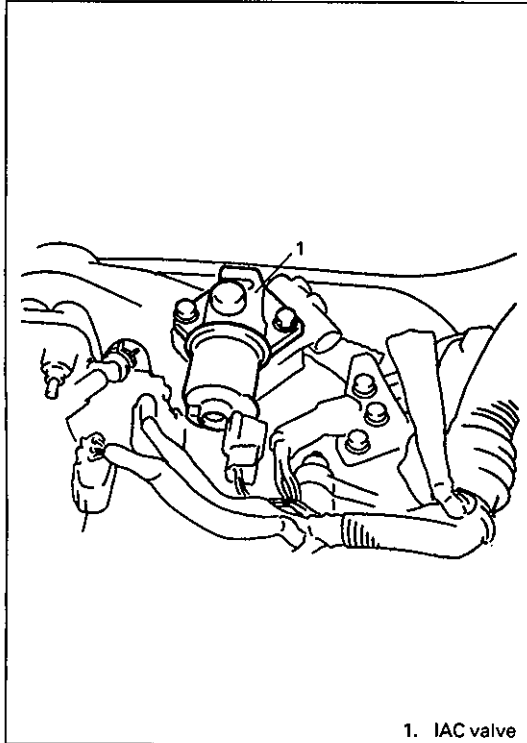
IDLE AIR CONTROL VALVE (IAC VALVE)

On Vehicle Inspection

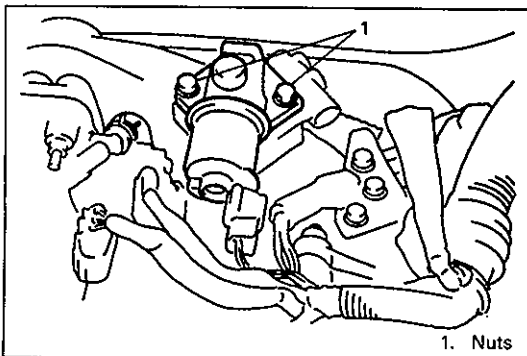
- 1) With ignition switch "OFF", disconnect IAC valve coupler.
- 2) Check resistance between each terminal of IAC valve as shown figure. Standard resistance : $8.7 - 10.5 \Omega$ at 20°C , 68°F

Removal

- 1) Disconnect battery negative cable at battery.
- 2) Disconnect air hose from IAC valve.
- 3) Disconnect IAC valve coupler.
- 4) Remove IAC valve and idle speed adjusting screw assy from intake collector.



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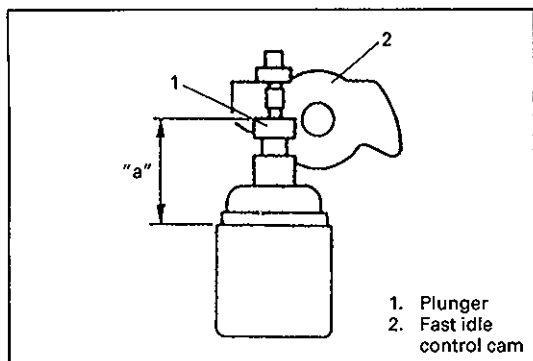


85F00-6E2-85-4

Installation

For installation, reverse removal procedure and note following precautions.

- Use new gaskets.
- Tighten IAC valve nuts to specified torque.



85F00-6E2-86-1

FAST IDLE CONTROL SYSTEM

On Vehicle Inspection

1) Measure plunger protrusion "a" at engine coolant temp. is 25 °C (77 °F).

"a" = 26.6 – 27.4 mm (1.048 – 1.078 in.)

2) Warm up engine and check to make sure that fast control cam is off cam follower lever at engine coolant temp. is 52 – 68 °C (126 – 154 °F)

85F00-6E2-86-2

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

- 1) Relieve fuel pressure in fuel feed line referring to p. 6-4.
- 2) Disconnect fuel feed hose from delivery fuel feed pipe.

CAUTION:

A small amount of fuel may be released when fuel feed hose is removed. Place container under the fuel feed hose or fuel feed pipe with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.

- 3) Connect special tools and hose between fuel feed hose and fuel feed pipe as shown in figure, and clamp hose securely to ensure no leaks occur during checking.

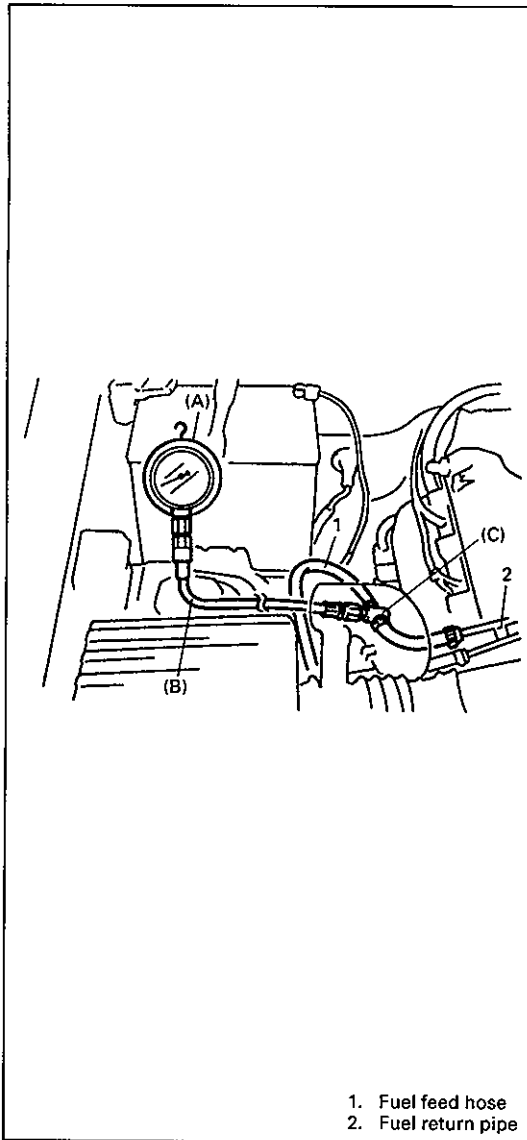
Special Tool

(A): 09912-58441

(B): 09912-58431

(C): 09912-58490

- 4) Check that battery voltage is above 11V.

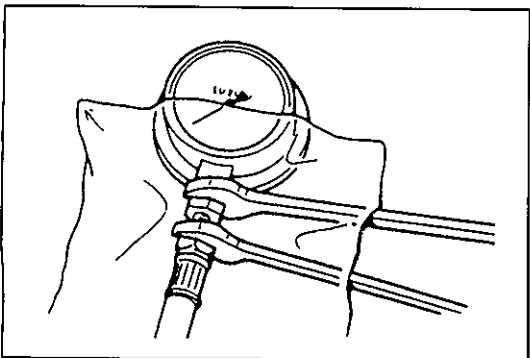


1. Fuel feed hose
2. Fuel return pipe

85F00-6E2-87-2

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	220 – 260 kPa 2.2 – 2.6 kg/cm ² 31.3 – 36.9 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

85F00-6E2-87-4



85F00-6E2-87-5

- 5) Turn ignition switch ON to operate fuel pump and after 3 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.

- 6) Start engine.

- 7) Measure fuel pressure at idling.

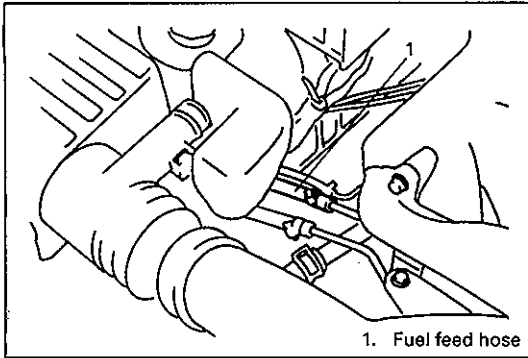
If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Chart B-3" and check each possibly defective part. Replace if found defective.

- 8) 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.



85F00-6E2-88-1

- 9) Remove fuel pressure gauge, hose and 3-way joint.
- 10) Connect fuel feed hose and clamp it securely.
- 11) With engine "OFF" and ignition switch "ON", check for fuel leaks.

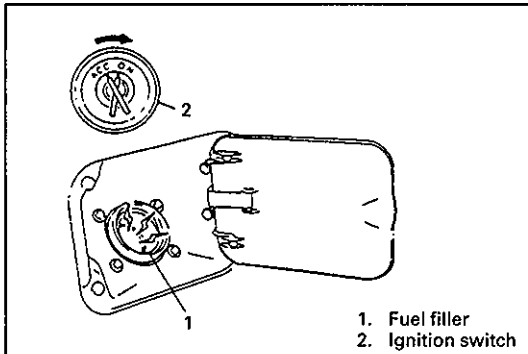
FUEL PUMP

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.

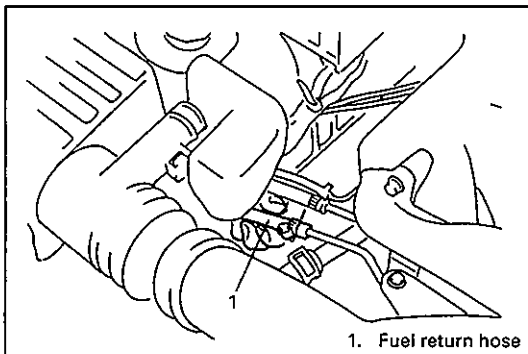
85F00-6E2-88-2



85F00-6E2-88-3

- 1) Remove filler cap and turn ON ignition switch. Then fuel pump operating sound should be heard from fuel filler for about 3 seconds and stop. Be sure to reinstall fuel filler cap after checking.

If above check result is not satisfactory, advance to "Diagnostic Flow Chart B-1".



85F00-6E2-88-4

- 2) Fuel pressure should be felt at fuel return hose for 3 seconds after ignition switch ON.

If fuel pressure is not felt, advance to "Diagnostic Flow Chart B-3".

Removal

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

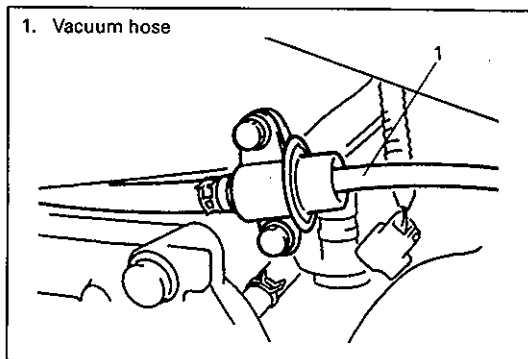
Inspection

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

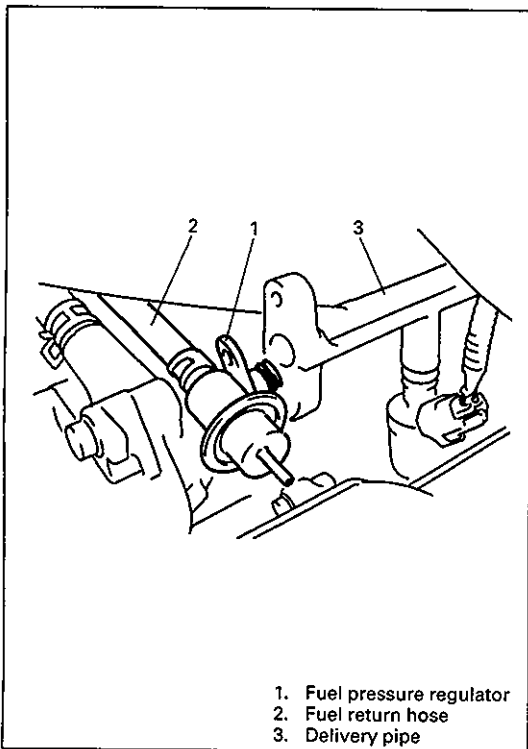
Installation

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

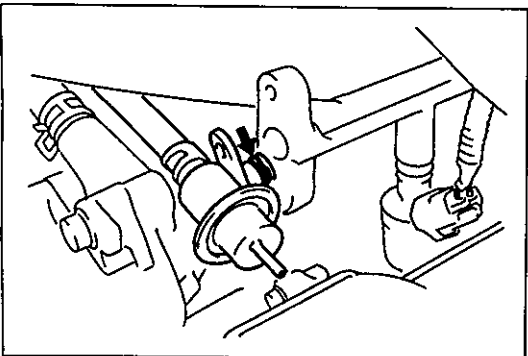
60A90-6E1-92-1S



85F00-6E2-89-2



85F00-6E2-89-4



85F00-6E2-89-5

FUEL PRESSURE REGULATOR**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 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 pressure regulator.

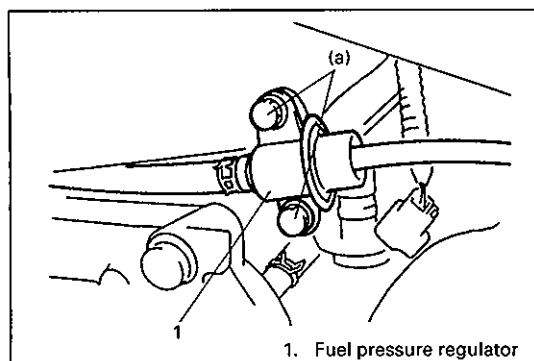
CAUTION:

A small amount of fuel may be released when hose is disconnected. Cover hose to be disconnected with a shop cloth.

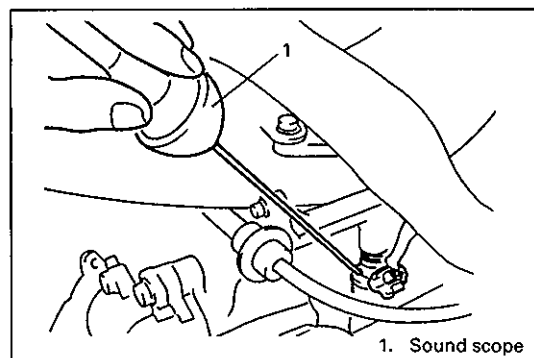
Installation

For installation, reverse removal procedure and note following precaution.

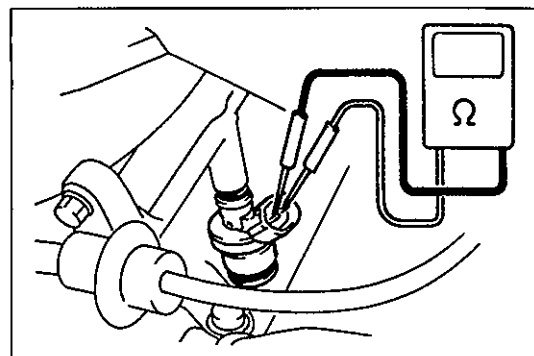
- Apply thin coat of spindle oil or gasoline to O ring to facilitate installation.



85F00-6E2-90-1



85F00-6E2-90-2



85F00-6E2-90-3

- 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 ignition switch "ON", 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, check injector circuit (wire or coupler) or injector.

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

Resistance of injector: 10.8 – 13.2 Ω

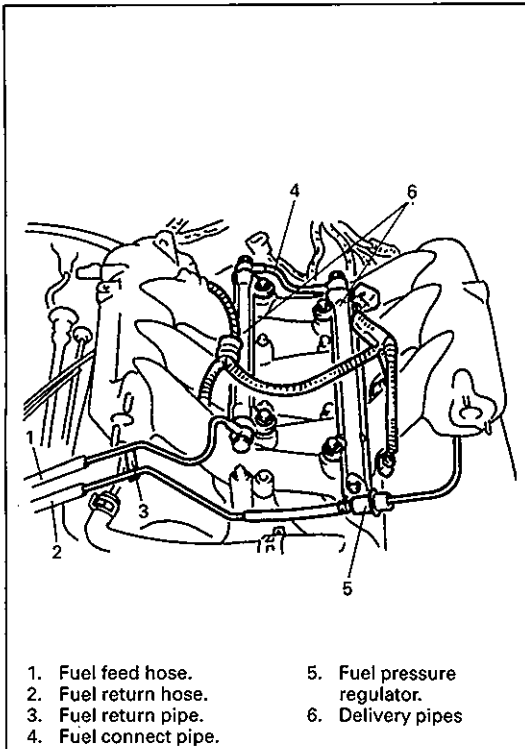
If resistance is out of specification, replace.

- 3) Connect coupler to injector securely.

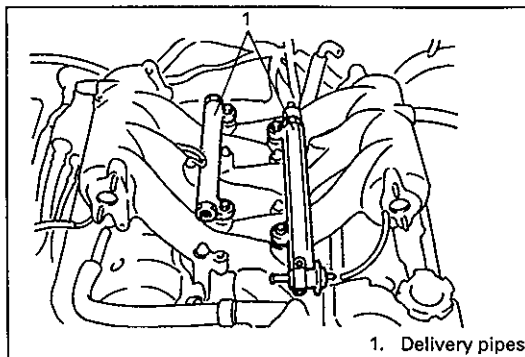
Removal

- 1) Relieve fuel pressure according to procedure described on p. 6-4.
- 2) Remove throttle body and intake collector, refer to steps 1) to 13) of THROTTLE BODY REMOVAL on page 6E2-81.

85F00-6E2-90-4



85F00-6E2-91-1



85F00-6E2-91-2

- 3) Disconnect fuel feed hose and fuel return hose.
- 4) Disconnect vacuum hose and fuel return hose from fuel pressure regulator.
- 5) Remove fuel return pipe and fuel connect pipe from delivery pipes (right and left).

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.

- 6) Disconnect coupler from each injector.

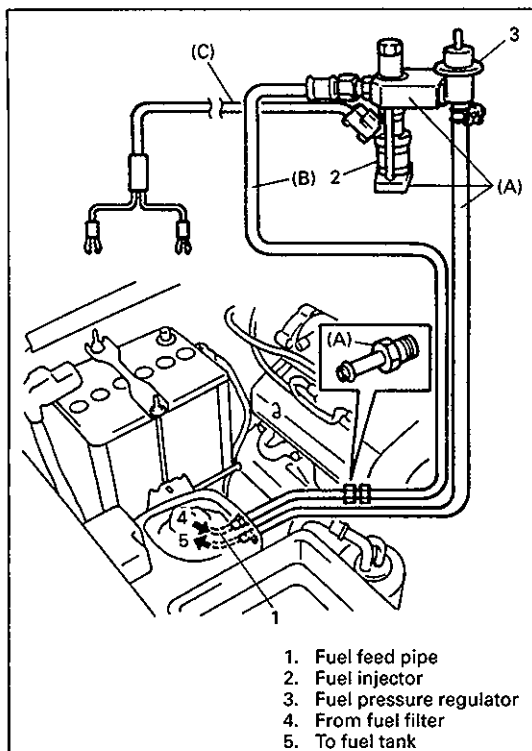
- 7) Remove delivery pipes (right and left) from intake manifold.
- 8) Remove fuel injector(s).

Inspection**WARNING:**

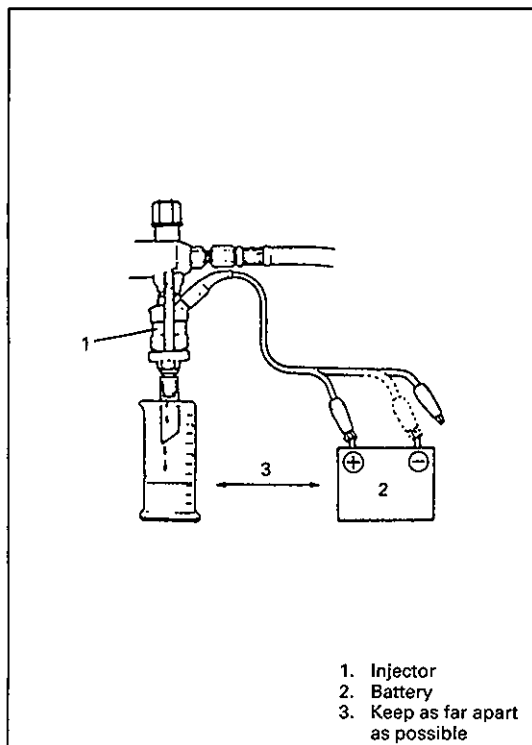
As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.

Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.

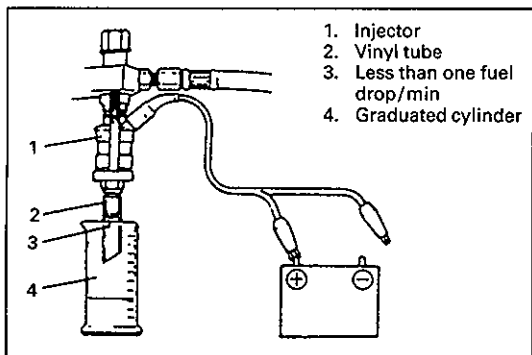
85F00-6E2-91-3



85F00-6E2-92-1



85F00-6E2-92-4



85F00-6E2-92-5

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

NOTE:

Remove grommet from injector, then install injector to special tool and tighten bolts by hand.

Special Tool

(A): 09912-58421

- 2) Connect special tools (hoses and attachment) to pipes of vehicle.

Special Tool

(B): 09912-58431

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

Special Tool

(C): 09930-88521

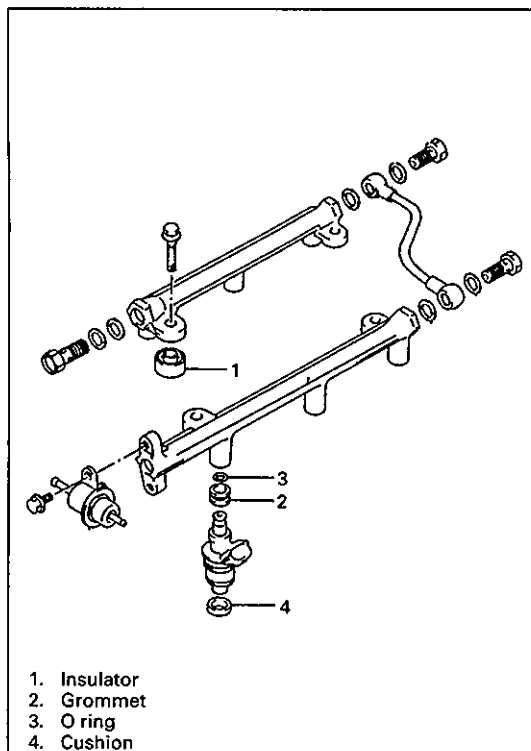
- 4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
- 5) Put graduated cylinder under injector as shown.
- 6) Disconnect coupler from fuel pump relay.
- 7) To operate fuel pump and apply fuel pressure to injector, using wire harness as thick as the one used for fuel pump circuit, connect Blue/Black and Pink/Black wire harness terminals of fuel pump relay coupler.
- 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:

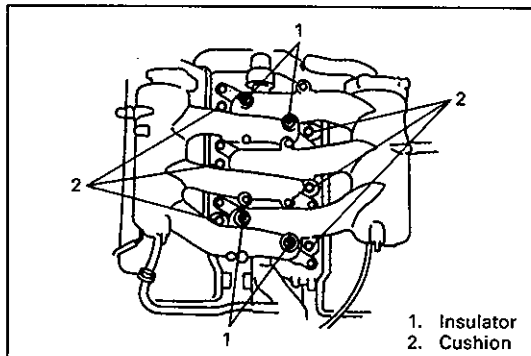
About 48.3 cc/15 sec. (1.63/1.70 US/Imp. oz./15 sec.)

- 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.

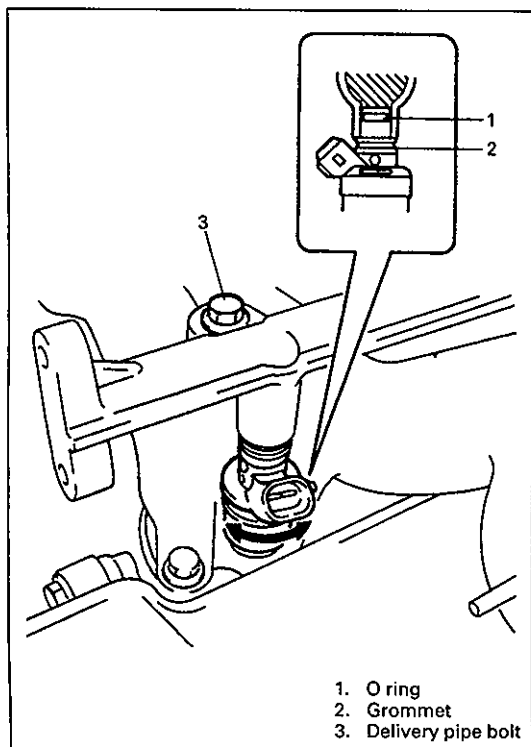
Fuel leakage: Less than 1 drop/min.



85F00-6E2-93-1



85F00-6E2-93-3



85F00-6E2-93-4

Installation

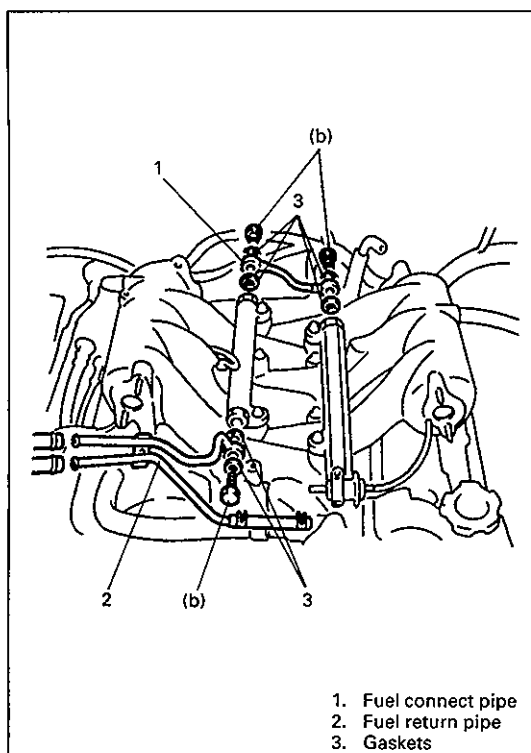
1) Replace injector O ring with new one using care not to damage it. Install grommet to injector.

2) Check if insulator is scored or damaged. If it is, replace with new one.

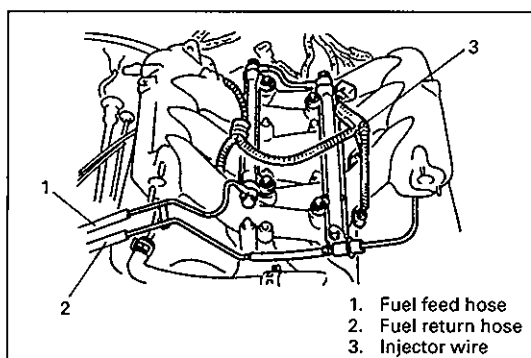
Install insulators and cushions to intake manifold.

3) Apply thin coat of fuel to O rings and then install injectors into delivery pipes (right and left) 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.



85F00-6E2-94-1



85F00-6E2-94-3

- 5) Install fuel connect pipe and tighten union bolts to specified torque.

Use new gaskets

Tightening Torque

(b): 30 N·m (3.0 kg-m, 22.0 lb-ft)

- 6) Install fuel return pipe and tighten unionbolt to specified torque.

Use new gaskets

Tightening Torque

(b): 30 N·m (3.0 kg-m, 22.0 lb-ft)

- 7) Connect vacuum hose and fuel return hose to fuel pressure regulator.

- 8) Connect fuel feed hose and fuel return hose.

- 9) Connect couplers to injectors securely and clamp injector wire.

- 10) Install throttle body and intake collector, refer to steps 4) to 19) of THROTTLE BODY INSTALLATION on page 6E2-83.

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

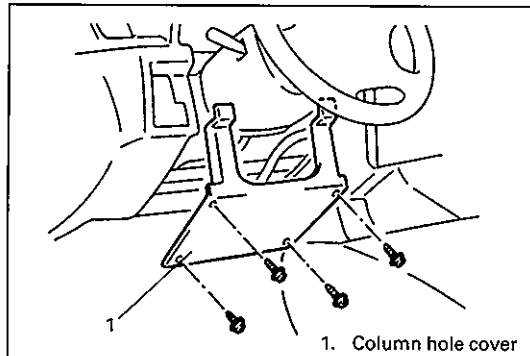
ELECTRONIC CONTROL SYSTEM

ENGINE CONTROL MODULE (ECM)

CAUTION:

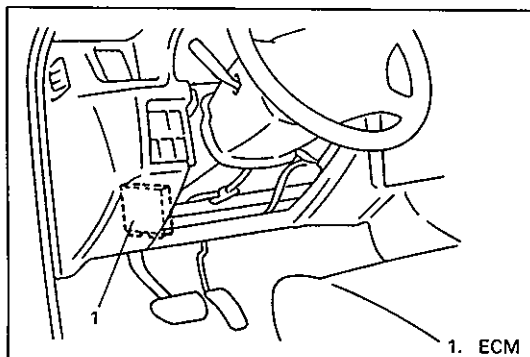
As ECM consists of precision parts, be careful not to expose it to excessive shock.

85F00-6E2-95-1

**Removal**

- 1) Disconnect battery negative cable from battery.
- 2) Remove steering column hole cover.

85F00-6E2-95-2



- 3) Disconnect couplers from ECM, and remove ECM from its bracket.

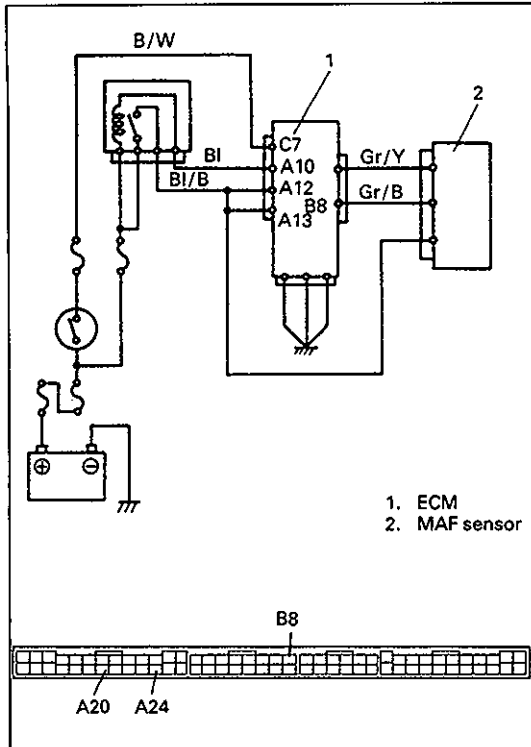
85F00-6E2-95-3

Installation

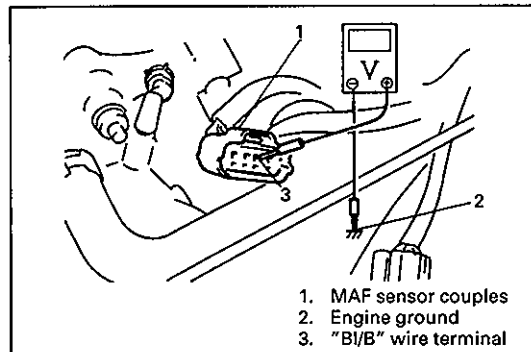
Reverse removal procedure noting the following.

- Connect couplers to ECM securely.

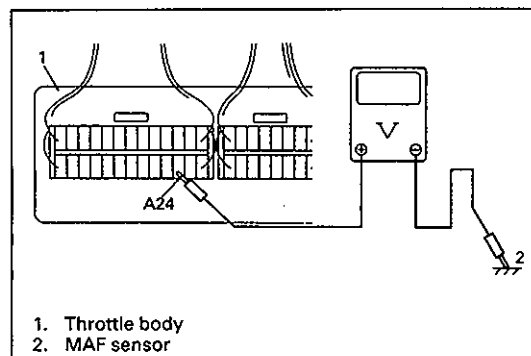
85F00-6E2-95-4



85F00-6E2-96-1



85F00-6E2-96-3



85F00-6E2-96-4

MASS AIR FLOW SENSOR (MAF SENSOR)

Inspection

NOTE:

Use voltmeter with high-impedance (10 k Ω /V minimum) or digital type voltmeter.

- 1) Remove ECM with bracket, relays, fuse box and wire harness previously outlined.
- 2) Connect couplers to ECM.

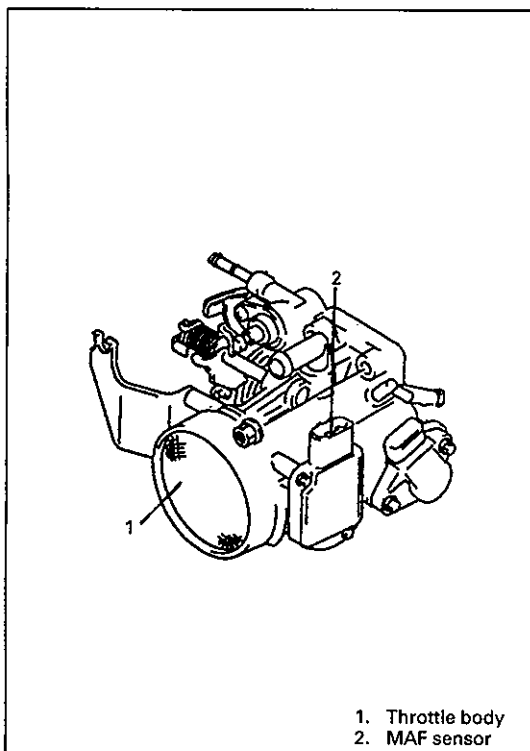
- 3) Connect voltmeter to "BI/B" wire terminal of MAF sensor coupler disconnected and ground.
- 4) Turn ignition switch ON and check that voltage is battery voltage.
If not, check if wire harness is open or connection is poor.

- 5) Turn ignition switch OFF and connect MAF sensor coupler to MAF sensor.
- 6) Turn ignition switch ON and check voltage at "A24" terminal.

Standard voltage: 0.5 – 1.0 V

- 7) Start engine and check that voltage is lower than 5V and it rises as engine speed increases.
(Reference data: 1.5 – 1.8 V at specified idle speed)

If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF sensor or ECM.



85F00-6E2-97-1

Removal

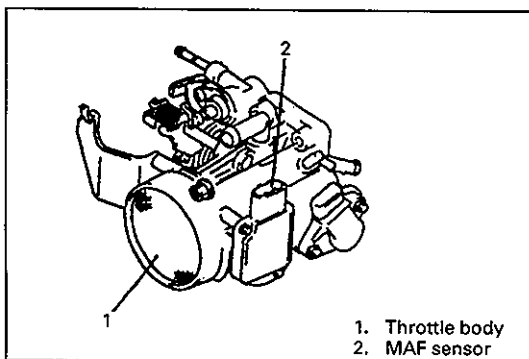
- 1) Disconnect negative cable at battery and coupler from MAF sensor.
- 2) Remove throttle body, refer to steps 2) to 15) of THROTTLE BODY REMOVAL on page 6E2-81.

NOTE:

Don't remove MAF sensor.

CAUTION:

- Do not expose MAF sensor (throttle body) to any shock.
- Do not put finger or any other object into MAF sensor and keep away from net. Malfunction may occur.



85F00-6E2-97-2

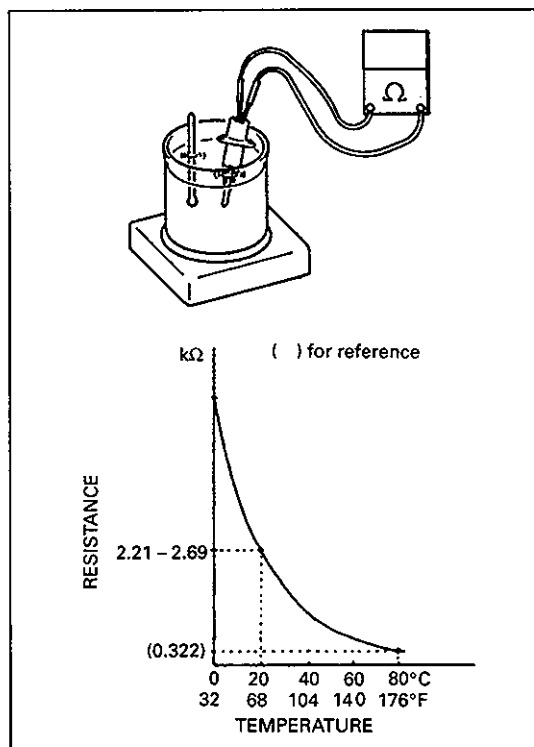
Installation

- 1) Install throttle body, refer to steps 1) to 19) of THROTTLE BODY INSTALLATION on page 6E2-83.

INTAKE AIR TEMPERATURE (IAT) SENSOR**Removal**

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

60A90-6E2-101-1S



85F00-6E2-98-2

Inspection

Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.

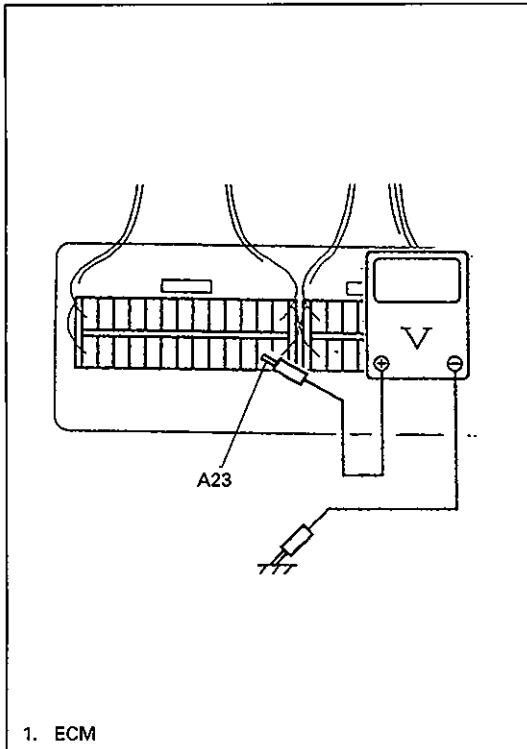
If measured resistance doesn't show such characteristic as shown in figure, replace IAT sensor.

Installation

Reverse removal procedure noting the following.

- Clean mating surface of sensor and air cleaner.
- Install IAT sensor to air cleaner case securely.
- Connect sensor coupler securely.

85F00-6E2-98-4



85F00-6E2-99-1

THROTTLE POSITION SENSOR (TP SENSOR)

Inspection

- 1) Remove ECM as previously outlined.
- 2) Warm up engine and stop it when its temperature has reached normal operating temperature (Check to make sure that they have some clearance between fast idle cam and cam follow lever.).
- 3) Using voltmeter, check voltage at "A23" terminal under following each condition.

When throttle is fully close : 0.50 ± 0.15

When throttle is fully open : 4.0 ± 0.5

If measured voltage is out of above specified range, diagnose trouble by referring to "Diagnostic Flow Chart for Diag. Trouble Code No. 21 or 22".

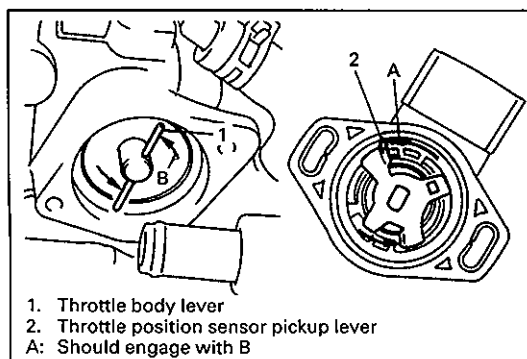
Also, check that voltage varies according to throttle valve opening linearly. If not, it is possible that TP sensor has failed. Replace.

- 4) Upon completion of checking, install ECM.

Removal

- 1) Disconnect battery negative cable at battery.
- 2) Disconnect coupler from TP sensor.
- 3) Remove TP sensor from throttle body.

85F00-6E2-99-3



85F00-6E2-99-4

Installation

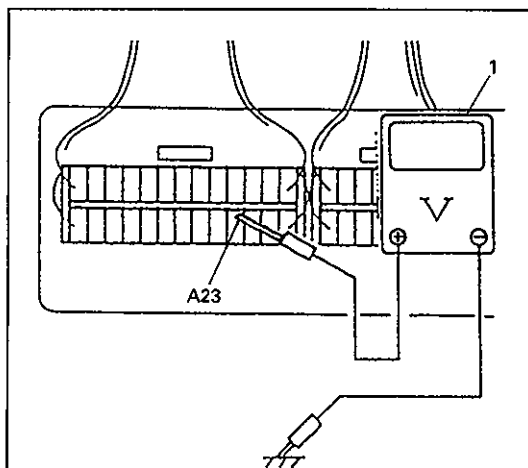
- 1) To install sensor, place it onto throttle body so that sensor pickup lever can engage with throttle body lever.
- 2) Hand-tighten TP sensor screws.

- 3) Connect coupler to TP sensor securely.
- 4) Connect battery negative cable to battery.
- 5) Adjust installation angle of TP sensor according to procedure described in item "Adjustment".

Adjustment

- 1) Warm up engine to normal operating temperature.
- 2) Check to make sure that fast idle cam and cam follower lever are not in contact with each other. If they are, check fast idle control system.

85F00-6E2-100-1



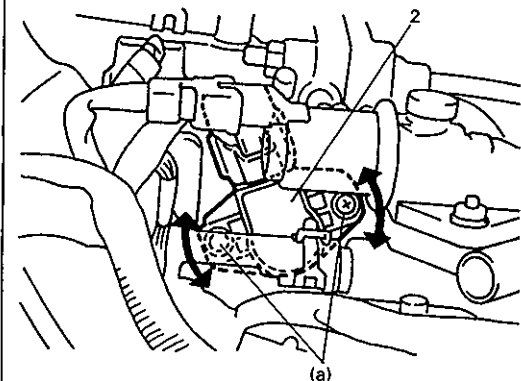
1. Digital type voltmeter

Voltmeter



Tech 1

IDLE SWITCH
ON
THROT POS SENSOR
* 0.50 V



2. TP sensor

- 3) Loosen TP sensor screws.
- 4) Remove ECM as previously outlined and with couplers connected to ECM, connect digital type voltmeter as shown.
- 5) Turn TP sensor clockwise or counterclockwise and tighten TP sensor screw at a position where voltage as specified below is obtained at coupler terminal A23.

NOTE:

If tech 1 and cartridge are available, it is not necessary to remove ECM. Make an adjustment by using tech 1 while observing TP sensor voltage.

TP sensor voltage when throttle is fully close : 0.50 ± 0.15

Tightening Torque

(a): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

- 6) Check to make sure that when throttle is fully open TP sensor voltage is as shown below.

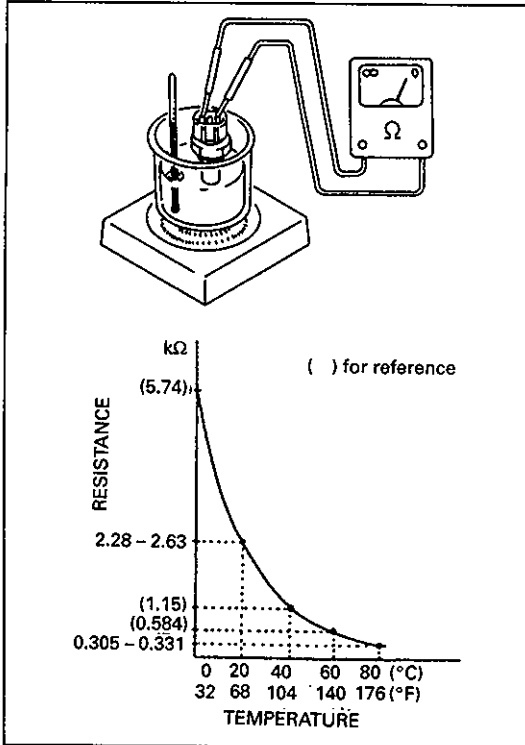
TP sensor voltage when throttle is fully open : 4.0 ± 0.5 V

- 7) Install ECM.
- 8) Warm up engine completely.
- 9) Turn OFF ignition switch when engine is at idle and shift lever is in Neutral (or Parking) position.

ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)**Removal**

- 1) Disconnect negative cable from battery.
- 2) Drain cooling system.
- 3) Disconnect coupler from ECT sensor.
- 4) Remove ECT sensor from water outlet pipe.

99529-6E2-101-1



85F00-6E2-101-2

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 show such characteristic as shown, replace ECT sensor.

Installation

Reverse removal procedure noting the following.

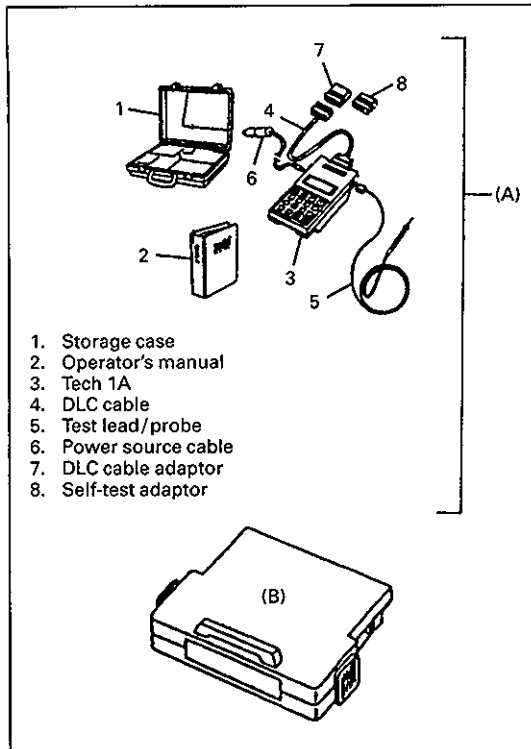
- Clean mating surfaces of sensor and water outlet pipe.
- Tighten ECT sensor to specified torque.

ECT Sensor Tightening Torque

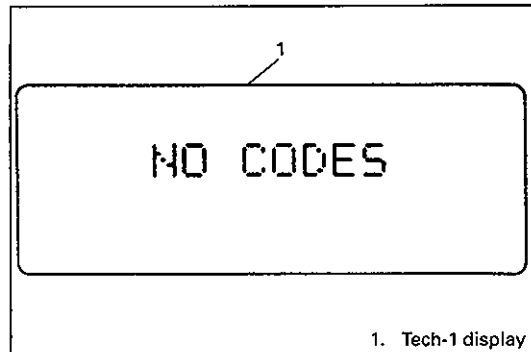
15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect coupler to sensor securely.
- Refill cooling system.

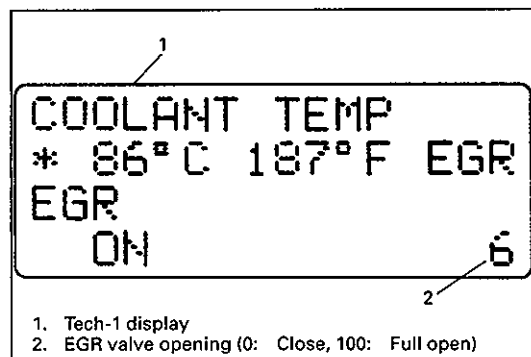
85F00-6E2-101-4



85F00-6E2-102-1



85F00-6E2-102-3



85F00-6E2-102-4

EGR SYSTEM (IF EQUIPPED)

System Inspection

- 1) Connect scan tool (Tech-1) and cartridge to data link connector with ignition switch OFF.

Special tool

(A): 09931-76011 (Tech-1)

(B): '95 ECM cartridge

NOTE:

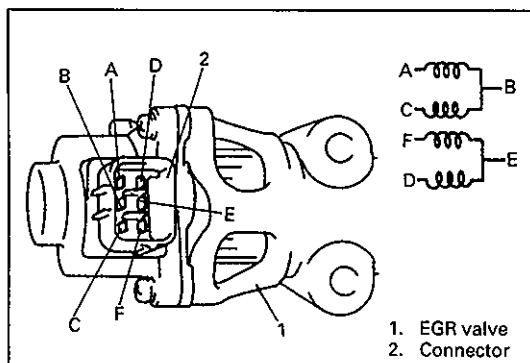
For operation procedure of Tech-1, refer to tech-1 operator's manual.

- 2) Start engine and warm up engine to normal operating temperature (70 – 100°C, 158 – 212°F)
- 3) Check diagnostic trouble code by using Tech-1 (TROUBLE CODE mode).
If tech 1 indicates trouble code, go back to "Diagnostic Flow Chart" on p.6E2-39.

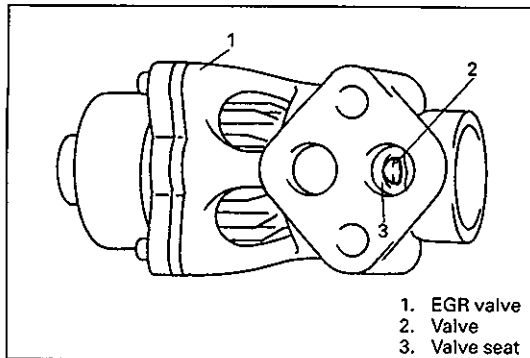
- 4) With engine idling (without depressing accelerator pedal), open EGR valve by using tech-1 (MISC TEST mode).
In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve, poor performance of ECT sensor or TP sensor.

Removal

- 1) Disconnect negative cable at battery.
- 2) Disconnect EGR valve coupler.
- 3) Remove EGR valve and gasket from intake collector.



85F00-6E2-103-1



85F00-6E2-103-2

Inspection

- 1) Check resistance between following terminals of EGR valve in each pair.

Terminal	Standard resistance
A - B	20 - 24 Ω
C - B	
F - E	
D - E	

If found faulty, replace EGR valve ass'y

- 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.

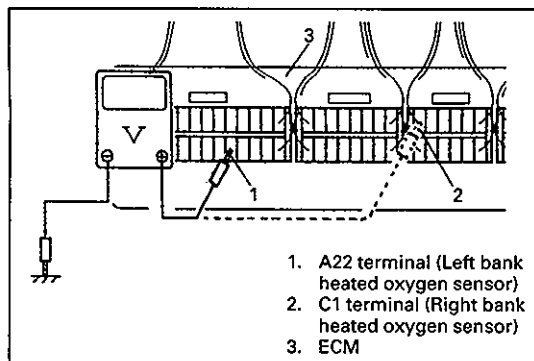
If found faulty, replace EGR valve ass'y.

Installation

Reverse removal procedure noting following.

- Clean mating surface of valve and intake collector.
- Use new gasket

85F00-6E2-103-3



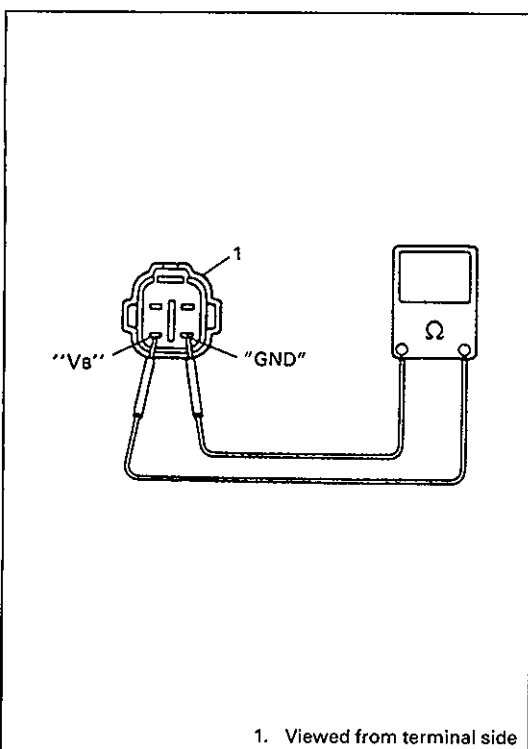
85F00-6E2-104-1

HEATED OXYGEN SENSOR (if equipped)**Sensor Inspection**

- 1) Remove ECM.
- 2) Warm up engine to normal operating temperature.
- 3) Connect voltmeter between A22 (for left bank : C1 for right bank) and body ground.
- 4) Maintain engine speed at 2,000 r/min. After 60 seconds, check voltmeter.

Voltmeter Indication	Possible Cause	Correction
About 0 V	Heated oxygen sensor wire shorted to ground (circuit)	Repair or replace
About 0.3 V	Heated oxygen sensor wire or sensor ground wire open	Repair or replace
0.35 ~ 0.45 V	- Faulty heated oxygen sensor itself - Lean A/F mixture - Faulty fuel injector (s)	Replace heated oxygen sensor Inspect ECM and its circuit Replace fuel injector(s)
Deflect between above and below 0.45 V repeatedly	Heated oxygen sensor and its circuit is in good condition	—
Remains unchanged at above 0.45 V	Rich A/F mixture	Inspect ECM and its circuit

85F00-6E2-104-2

**Oxygen Sensor Heater Inspection**

- 1) Disconnect 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.

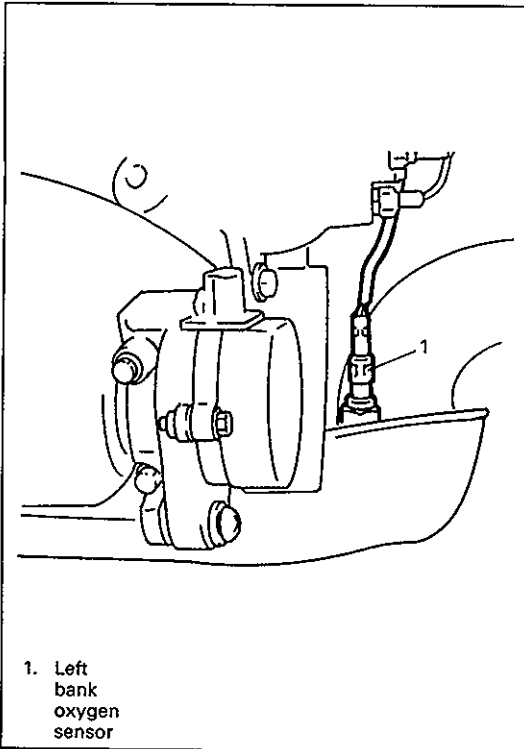
Resistance of oxygen sensor heater:

5.5 – 6.5 Ω at 20°C, 68°F

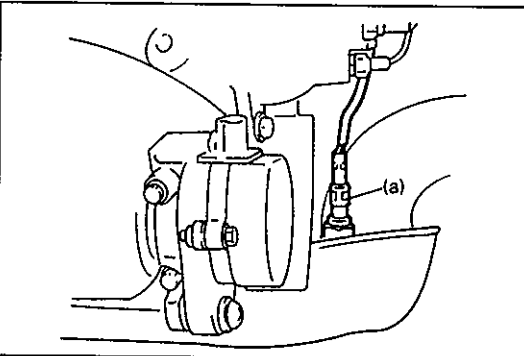
If found faulty, replace oxygen sensor.

- 3) Connect sensor coupler securely.

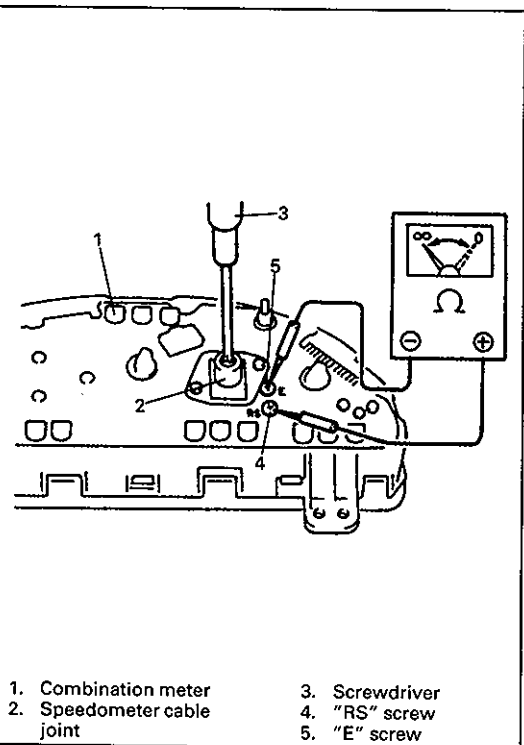
85F00-6E2-104-5



85F00-6E2-105-1



85F00-6E2-105-3



85F00-6E2-105-5

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) Disconnect coupler of oxygen sensor (s).
- 3) Remove oxygen sensor (s) from exhaust manifold (s).

NOTE:

Be careful not to expose it to excessive shock.

Installation

Reverse removal procedure noting the followings.

- Tighten oxygen sensor (s) to specified torque.

Tightening Torque

(a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- Connect coupler of oxygen sensor (s) and clamp wire harness securely.
- After installing oxygen sensor (s), start engine and check that no exhaust gas leakage exists.

VEHICLE SPEED SENSOR (VSS)

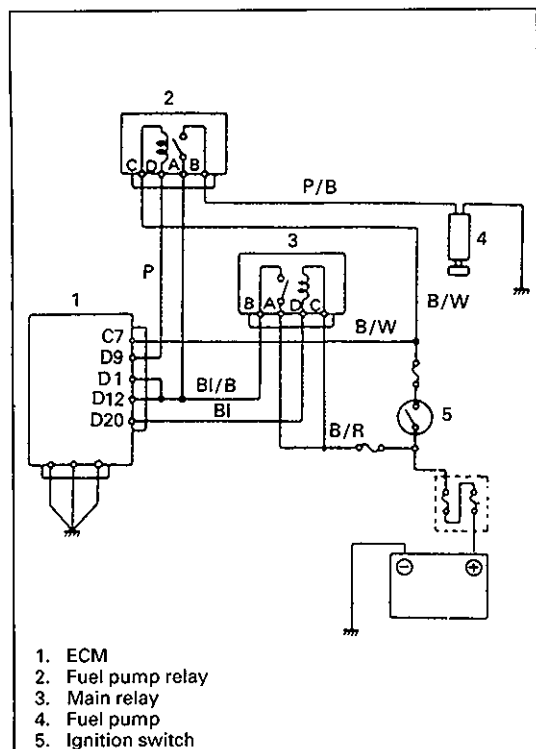
Inspection

- 1) Disconnect negative cable at battery.
- 2) Remove combination meter from instrument panel.
- 3) Connect ohmmeter between "RS" screw (VSS signal terminal) and "E" screw (ground terminal) of combination meter and turn cable joint of speedometer with a screwdriver.

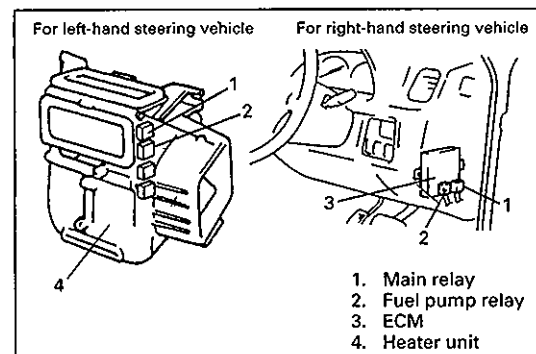
Ohmmeter indicator should move back and forth between 0 (zero) and ∞ (infinity) 4 times while cable joint is turned one full revolution.

Replace speedometer if check result is not satisfactory.

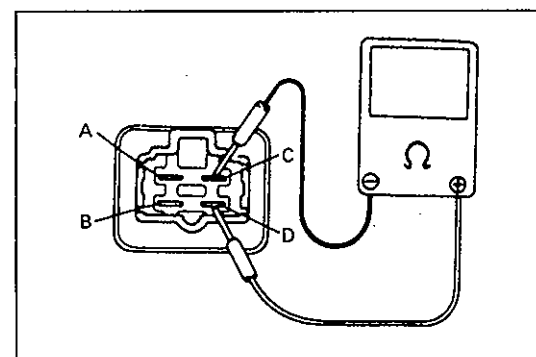
- 4) Install combination meter to instrument panel.
- 5) Connect negative cable to battery.



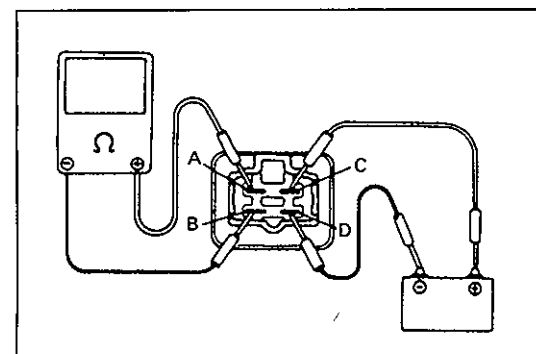
85F00-6E2-106-1



85F00-6E2-106-3



85F00-6E2-106-4



85F00-6E2-106-5

MAIN RELAY

NOTE:

- For left-hand steering vehicle, main relay and fuel pump relay are installed in front of heater unit.
- For right hand steering vehicle, main relay and fuel pump relay are installed side of ECM.
- Distinguish between main relay and fuel pump relay by wire colors.

Inspection

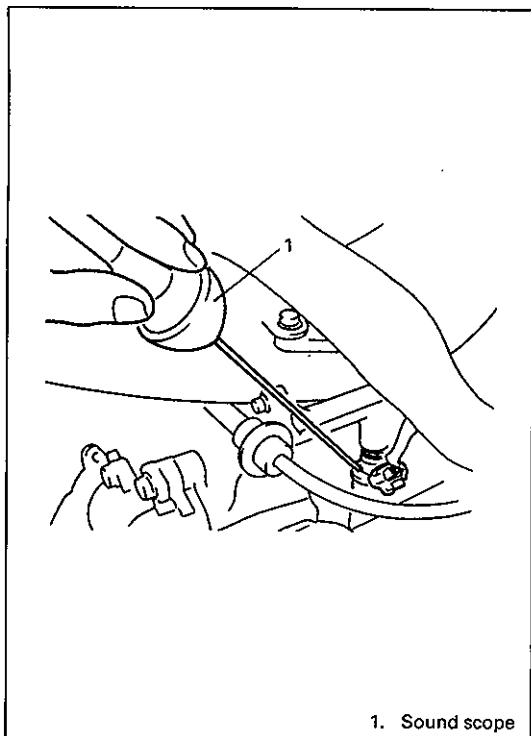
- 1) Disconnect negative cable at battery.
 - 2) Remove main relay from its bracket after disconnecting its coupler.
 - 3) Check resistance between each two terminals as in table below.
If check results are as specified, proceed to next operation check. If not, replace.
- | TERMINALS | RESISTANCE |
|-----------------|---------------------------------|
| Between A and B | ∞ (infinity) |
| Between C and D | 61 – 73 Ω at 20°C (68°F) |
- 4) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".
If found defective, replace.
 - 5) Install relay and connect its coupler securely.

FUEL PUMP RELAY

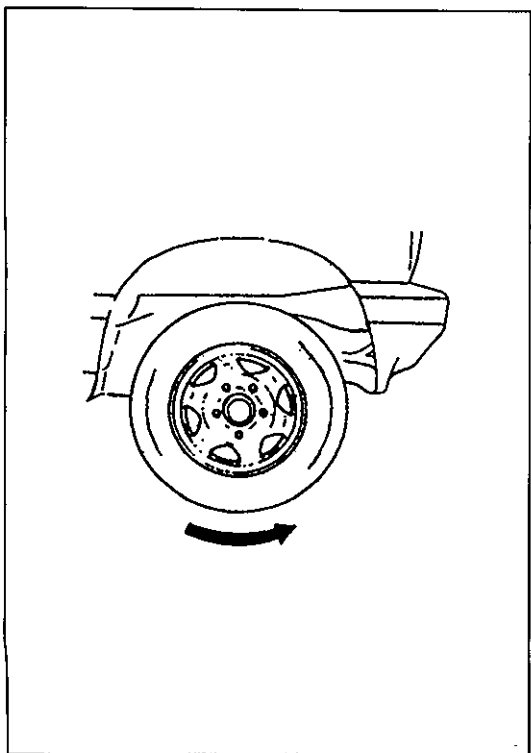
Inspection

- 1) Remove fuel pump relay in the same way as main relay.
 - 2) 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 found defective, replace.

85F00-6E2-107-1



85F00-6E2-107-2



85F00-6E2-107-4

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.

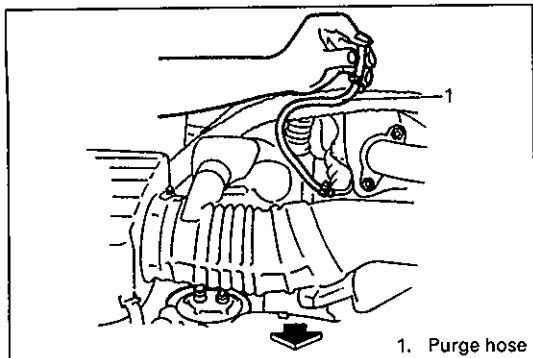
EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP Canister Purge Inspection

- 1) Warm up engine to normal operating temperature.
- 2) Stop engine and hoist vehicle so that rear wheels rotate freely.
- 3) Start engine release parking brake lever, set M/T in "2nd" or A/T in "L" and transfer in "2H".

WARNING:

Make sure that transfer is set to "2H" range position for this check. If it is set to "4H" or "4L" position, front wheel turn at high speed and very dangerous situation may occur.

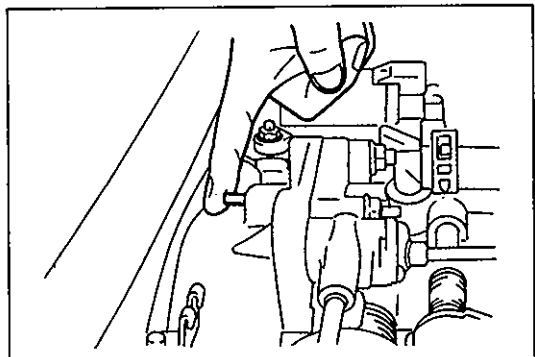


85F00-6E2-108-1

- 4) Disconnect purge hose from EVAP canister.
 - 5) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
 - 6) Also check that vacuum is felt when engine speed is increased to higher than about 2,000 r/min.
- If check result is not satisfactory, check vacuum passage, hoses, EVAP solenoid purge valve, wire harness and ECM.

Vacuum Passage Inspection

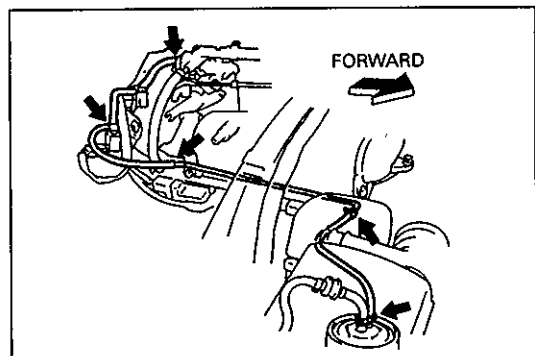
Start engine and run it at idle speed. With finger placed against vacuum nozzle, check that vacuum is applied. If it is not applied, clean vacuum passage by blowing compressed air.



85F00-6E2-108-2

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.



85F00-6E2-108-3

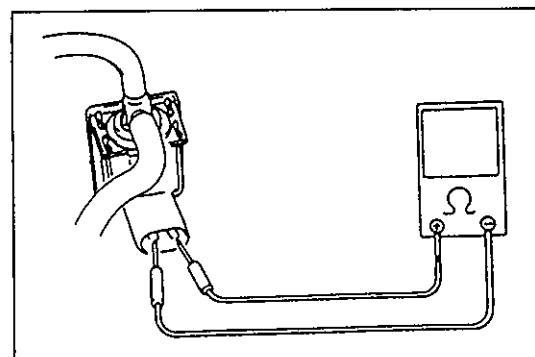
Inspection of EVAP Canister Purge Valve

- 1) With ignition switch OFF, disconnect coupler from canister purge valve.
- 2) Check resistance between two terminals of canister purge valve.

Resistance of canister purge valve:

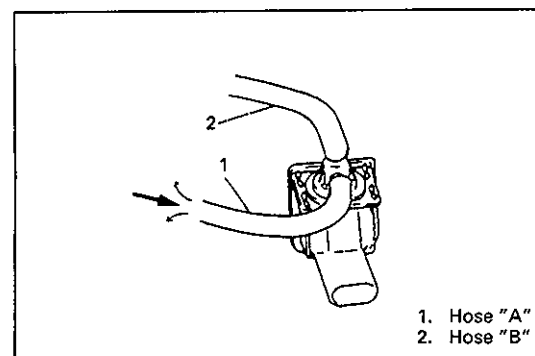
28 – 36 Ω at 20°C (68°F)

If resistance is as specified, proceed to next operation check. If not, replace.

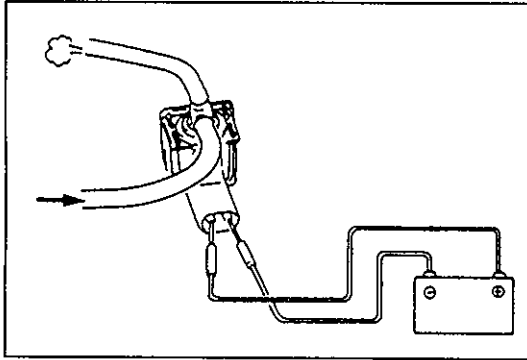


85F00-6E2-108-4

- 3) Disconnect vacuum hoses from intake manifold and EVAP canister.
- 4) With coupler disconnected, blow into hose "A". Air should not come out of hose "B".



60A90-6E1-113-2S



85F00-6E2-109-1

- 5) Connect 12V-battery to canister purge valve terminals.
In this state, blow hose "A".
Air should come out of hose "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 canister purge valve coupler securely.

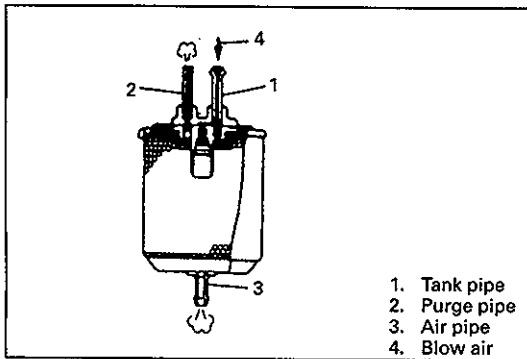
85F00-6E2-109-2

EVAP Canister Inspection**WARNING:**

DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

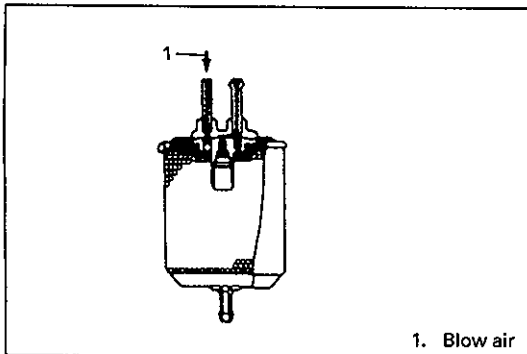
- 1) Disconnect vacuum hoses from EVAP canister.

60A90-6E1-111-5S



85F00-6E2-109-4

- 2) When air is blown into tank pipe, there should be no restriction of flow through purge pipe and air pipe.

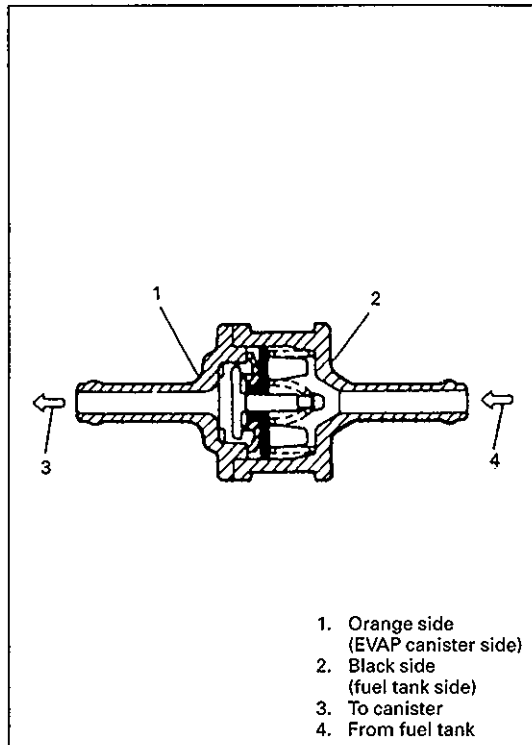


85F00-6E2-109-5

- 3) When air is blown into purge pipe, air should not pass through either tank pipe or air pipe.

- 4) If operation differs from above description, EVAP canister must be replaced.
- 5) Connect hoses to canister.

85F00-6E2-110-1



85F00-6E2-110-2

Tank Pressure Control Valve Inspection

- 1) Remove TPC valve installed above EVAP canister.
- 2) Air should pass through valve smoothly from fuel tank side (black side of TPC valve) to orange side when blown hard.
- 3) From orange side, even when blown softly, air should come out of black side.
- 4) If air doesn't pass through valve in step 2) or hard blow is required in step 3), replace TPC valve.

WARNING:

DO NOT SUCK air through TPC valve. Fuel vapor inside the valve is harmful.

- 5) Install TPC valve.

NOTE:

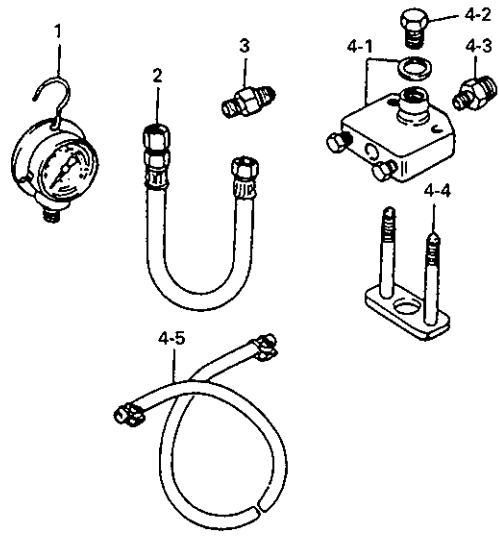
When connecting TPC valve between hoses, refer to figure at the left for installing direction.

TIGHTENING TORQUE SPECIFICATIONS

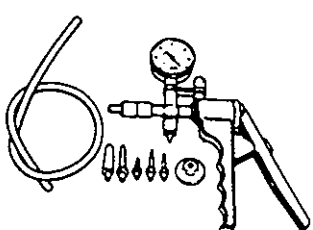
Fastening parts	Tightening torque		
	N·m	kg·m	lb·ft
Strut tower ber bolts and nuts	90	9.0	65.0
Heated oxygen sensor	45	4.5	32.5
Fuel pressure regulator bolts	10	1.0	7.5
Fuel pipe union bolts	30	3.0	22.0
Engine coolant temp. sensor	15	1.5	11.0

85F00-6E2-111-1

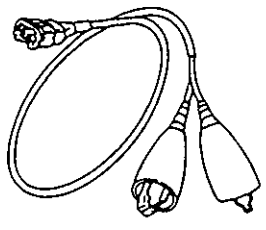
SPECIAL TOOLS



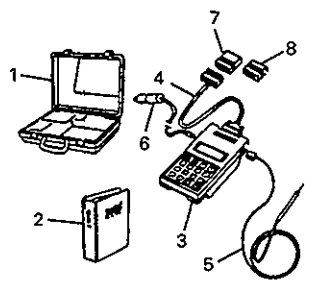
1. Pressure gauge
09912-58441
2. Pressure hose
09912-58431
3. Attachment
09919-46010
4. Checking tool set
09912-58421
 - 4-1. Tool body & washer
 - 4-2. Body plug
 - 4-3. Body attachment
 - 4-4. Holder
- 4-5. Return hose & clamp



09917-47910
Vacuum pump gauge

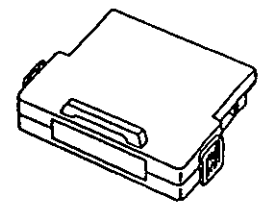


09930-88521
Injector test lead



09931-76011
Tech 1 (scan tool) kit

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



Tech 1 cartridge for '95 ECM

85F00-6E2-111-2

SECTION 6F2

IGNITION SYSTEM

(DIRECT IGNITION TYPE)

CONTENTS

GENERAL DESCRIPTION	6F2- 2
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Components	6F2- 3
DIAGNOSIS	6F2- 4
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Spark Plugs	6F2- 7
Ignition Coil	6F2- 8
Igniter (Power Unit)	6F2- 9
Noise Suppressor	6F2-10
CMP Sensor (Camshaft Position Sensor)	6F2-11
Ignition Timing	6F2-12
TIGHTENING TORQUE SPECIFICATIONS	6F2-13
SPECIAL TOOLS	6F2-13

85F00-6F2-1-1

The components of this system are as follows.

- 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 (power unit).

- Janiter (Power unit)

It turns ON and OFF the primary current of the ignition coil according to the signal from ECM.

- Ignition coils

When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding. One ignition coil is in charge of ignition of one cylinder only.

- **CMP sensor(Camshaft Position Sensor)**

Being photoelectrically operated, this system converts timing and time by and during which the light is received at the light receiving part in the CMP sensor into the electric signals. It also outputs the engine speed (POS) signal and the cylinder identification (REF) signal to ECM.

- Spark plugs and noise suppressor.

- TP sensor, ECT sensor and MAF sensor

For their details, refer to Section 6E2.

The direct ignition system does not have a distributor or high tension cords but each cylinder has an ignition coil and the secondary voltage which occurred in the ignition coil is sent to the spark plug directly. Also, the engine speed (POS) signal and cylinder identification (REF) signal are sent from the CMP sensor to ECM so as to control each ignition coil independently through the igniter.

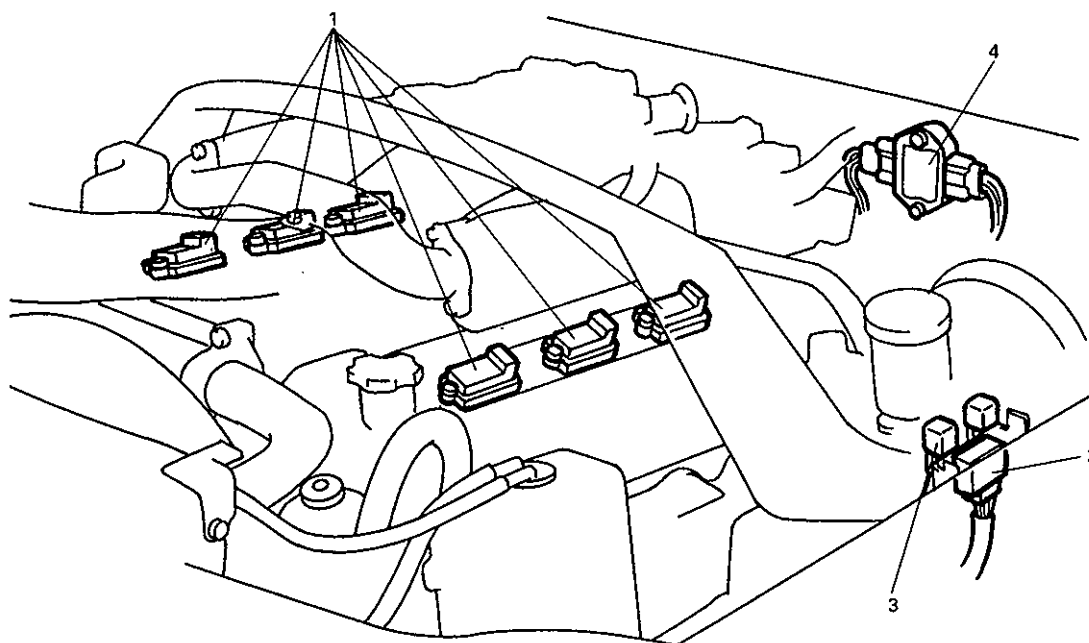
In ESA (Electronic Spark Advance) system, the ECM is programmed for the best ignition timing under every engine condition. Receiving signals which indicate the engine condition from the sensors, e.g., engine revolution, intake air volume, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the igniter (power unit). Thus ignition timing is controlled to yield the best engine performance.

SYSTEM WIRING

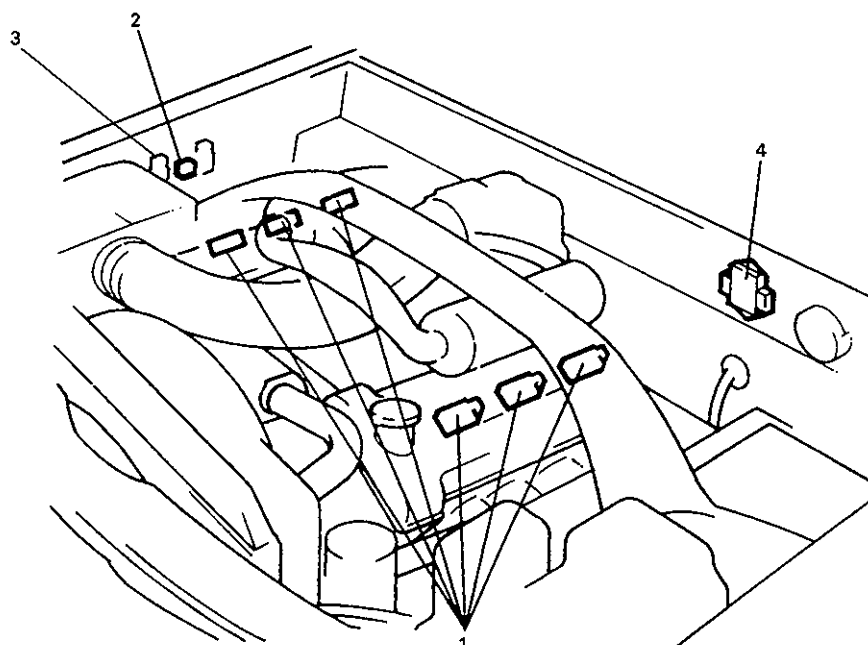


COMPONENTS

FOR LEFT HAND STEERING VEHICLE



FOR RIGHT HAND STEERING VEHICLE



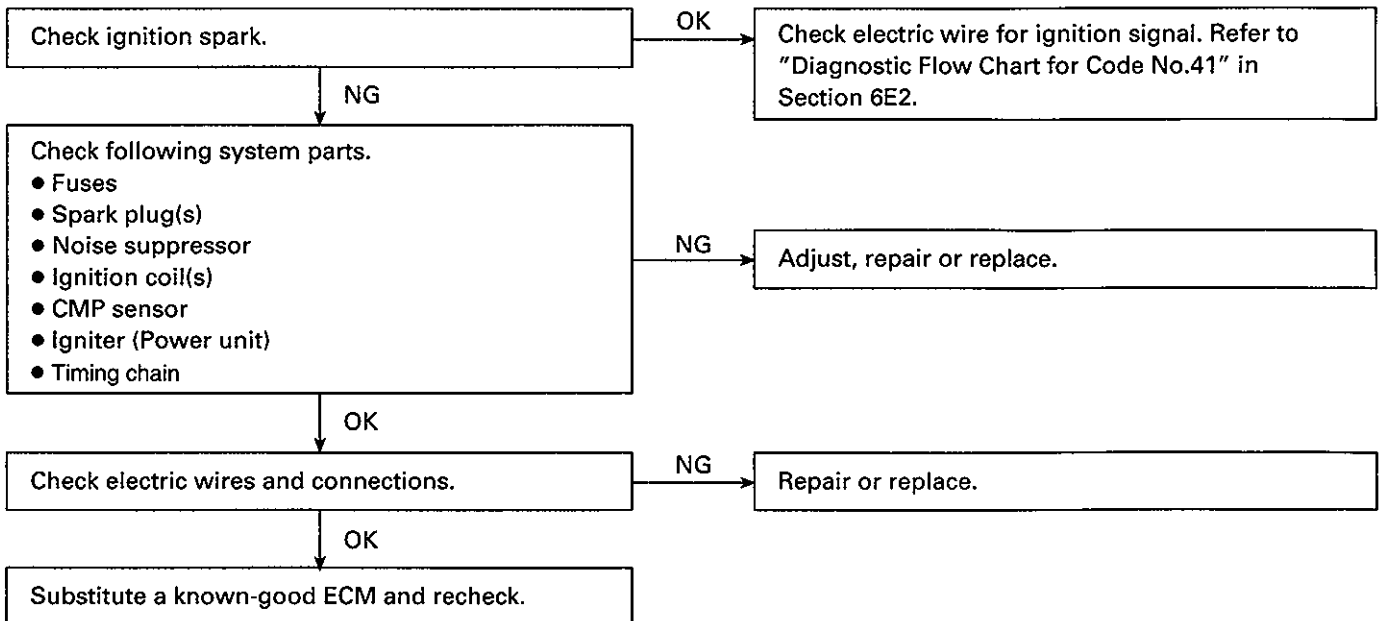
1. Ignition coil
2. Noise suppressor
3. Monitor coupler
(6 terminals)
4. Igniter (power unit)

DIAGNOSIS

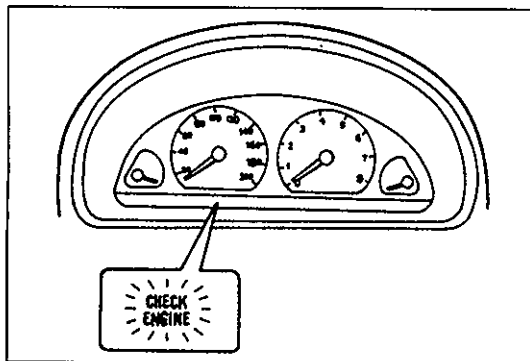
Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	No spark • Blown fuse for ignition coil • Loose connection or disconnection of lead wire • Faulty spark plug(s) • Faulty ignition coil(s) • Faulty noise suppressor • Faulty CMP sensor • Faulty igniter • Faulty ECM Maladjusted ignition timing	Replace Connect securely Adjust, clean or replace Replace Replace Replace Replace Replace Adjust
Poor fuel economy or engine performance	• Incorrect ignition timing • Faulty spark plug(s) • Faulty ignition coil(s) • Faulty noise suppressor • Faulty CMP sensor • Faulty igniter • Faulty ECM	Adjust Adjust, clean or replace Replace Replace Replace Replace Replace

85F00-6F2-4-1

DIAGNOSTIC FLOW CHART (When engine does not start though it is cranked up)



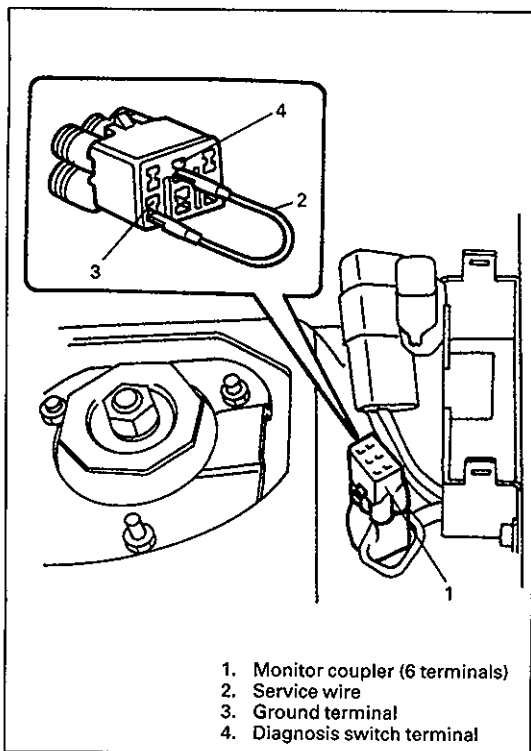
85F00-6F2-4-2



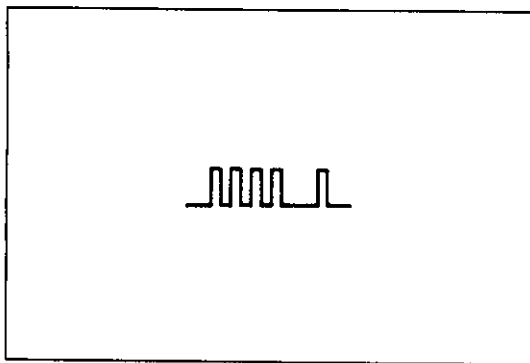
85F00-6F2-5-1

ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS)

1. To insure correct diagnosis, check to confirm that battery voltage is within standard value when engine is standstill.
2. Turn on ignition switch and make sure that malfunction indicator lamp ("CHECK ENGINE" light) lights.
3. If engine will not start but cranking is possible, crank it for more than 3 seconds.
4. While ignition switch is ON, ground diagnosis switch terminal in monitor coupler (6 terminals) and then read diagnostic trouble code (observe malfunction indicator lamp ("CHECK ENGINE" light)).



85F00-6F2-5-2

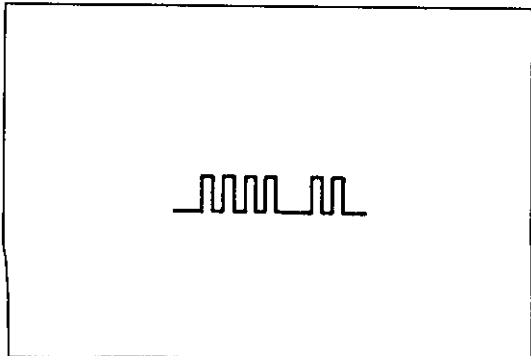


85F00-6F2-5-4

DIAGNOSTIC TROUBLE CODE NO.41

ECM indicates that no ignition signal is inputted while engine is running or being cranked.

Diagnose trouble according to "Diagnostic Flow Chart for Code No.41" in Section 6E2.

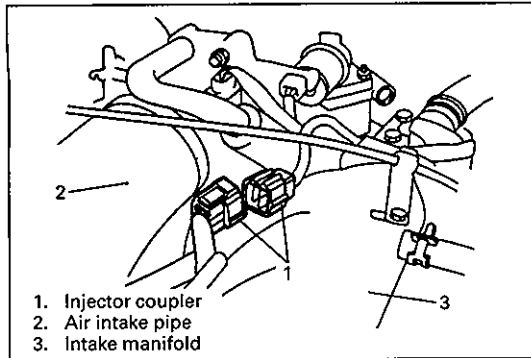


85F00-6F2-5-5

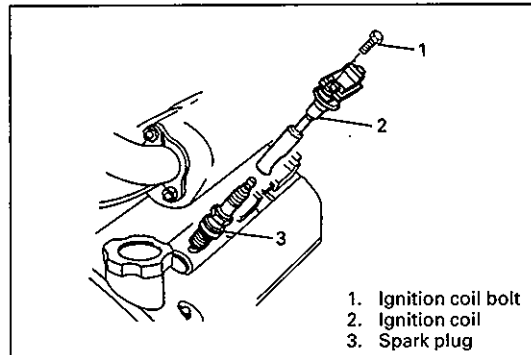
DIAGNOSTIC TROUBLE CODE NO.42

ECM memory indicates that no CMP sensor signal has been experienced for more that 2 seconds while engine is being cranked.

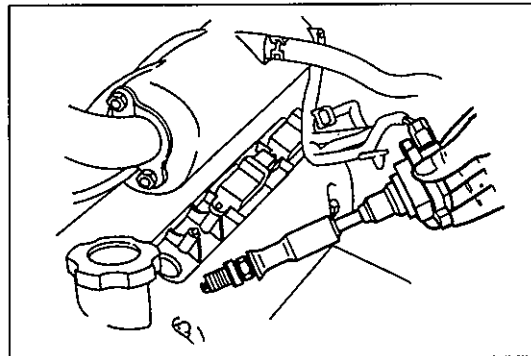
Diagnose trouble according to "Diagnostic Flow Chart for Code No.42" in Section 6E2.



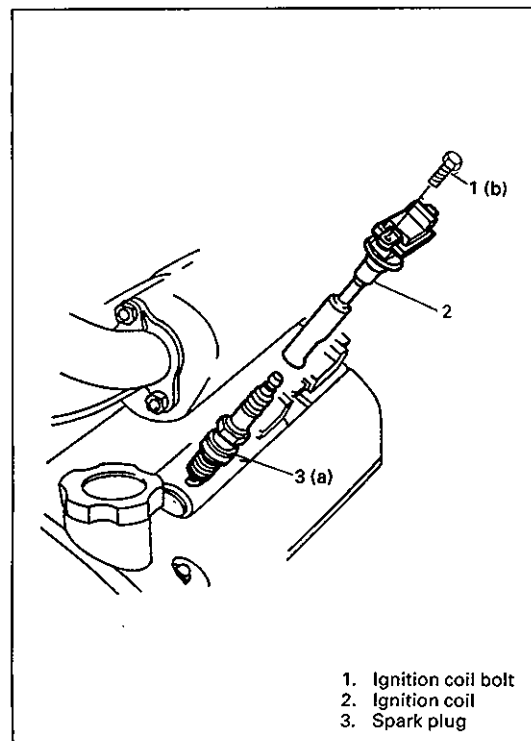
85F00-6F2-6-1



85F00-6F2-6-2



85F00-6F2-6-3



85F00-6F2-6-4

ON VEHICLE SERVICE

IGNITION SPARK TEST

REMOVAL

- 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 ignition coil cover(s).
- 3) Disconnect ignition coil coupler(s).
- 4) Remove ignition coil bolt(s), and then pull out ignition coil(s).
- 5) Remove spark plug(s).

INSPECTION

- 1) Connect ignition coil coupler to ignition coil and connect spark plug to ignition coil.
- 2) Ground them as shown in left figure.
- 3) Crank engine and check if each spark plug sparks.
If no spark is emitted, inspect spark plugs, ignition coils, igniter, etc..

INSTALLATION

- 1) Install spark plug(s) and tighten them to specified torque.

Tightening Torque for Spark Plug

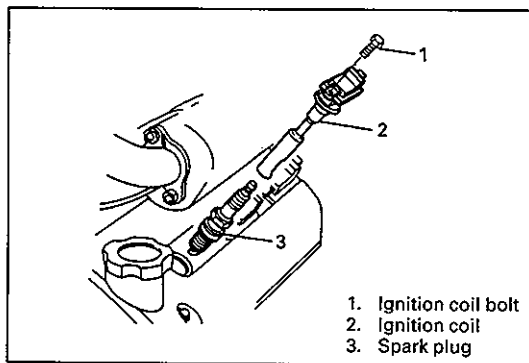
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

- 2) Install ignition coil(s) securely.
- 3) Tighten ignition coil bolt(s), and then connect ignition coil coupler(s).

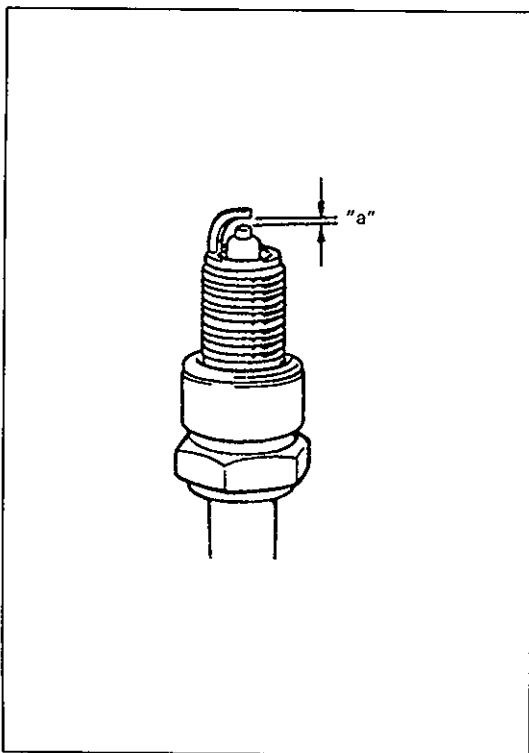
Tightening Torque

(b): 3 N·m (0.3 kg-m, 2.5 lb-ft)

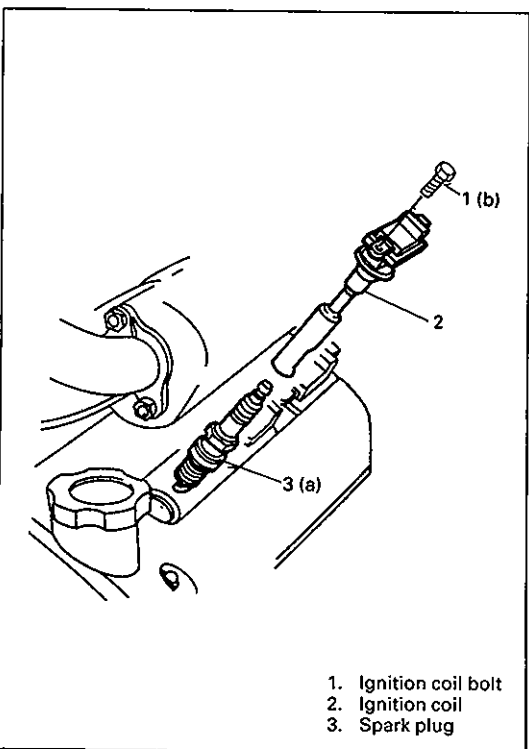
- 4) Install ignition coil cover(s).
- 5) Connect injector coupler.



85F00-6F2-7-1



85F00-6F2-7-2



85F00-6F2-7-4

SPARK PLUG

REMOVAL

- 1) Remove ignition coil cover(s).
- 2) Disconnect ignition coil coupler(s).
- 3) Remove ignition coil bolt(s), and then pull out ignition coil(s).
- 4) Remove spark plug(s).

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 plugs.

Spark plug type:	NGK	BKR6E
	NIPPONDENSO	K20PR-U
Spark plug air gap "a":	0.7 – 0.8 mm (0.028 – 0.031 in.)	

INSTALLATION

- 1) Install spark plug(s) and tighten them to specified torque.

Tightening Torque for Spark Plug

(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

- 2) Install ignition coil(s) securely.
- 3) Tighten ignition coil bolt(s), and then connect ignition coil coupler(s).

Tightening Torque

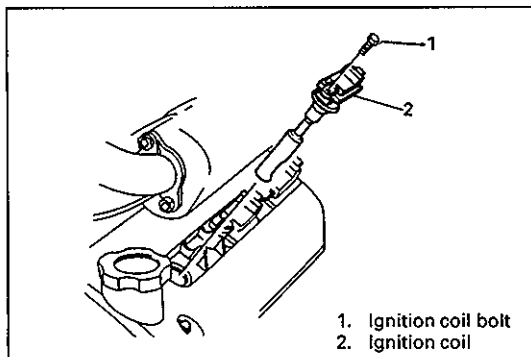
(b): 3 N·m (0.3 kg-m, 2.5 lb-ft)

- 4) Install ignition coil cover(s).

IGNITION COIL

REMOVAL

- 1) Remove ignition coil cover(s).
- 2) Disconnect ignition coil coupler(s).
- 3) Remove ignition coil bolt(s), and then pull out ignition coil(s).



85F00-6F2-8-1

INSPECTION

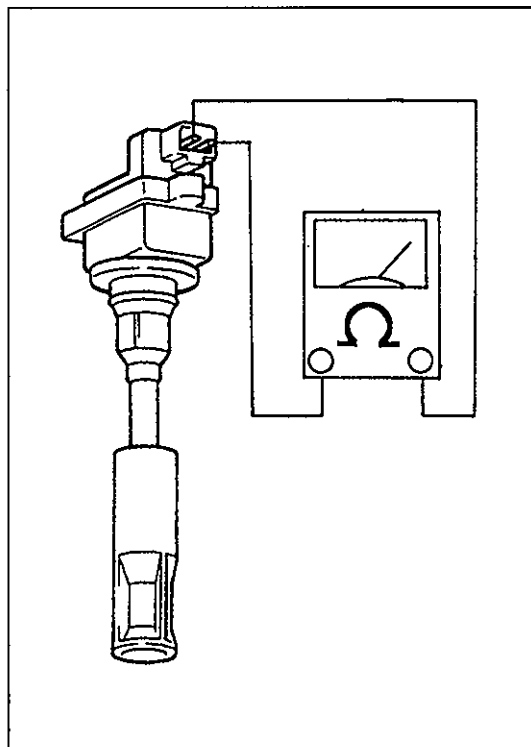
Before this check, prepare 12 volts vehicle battery, an ohmmeter and a digital ammeter.

PRIMARY COIL

Measure primary coil resistance.

Primary coil resistance (at 20 °C (68 °F))
0.61 ~ 0.73 (Ω)

If resistance is out of specification, replace coil with new.



85F00-6F2-8-2

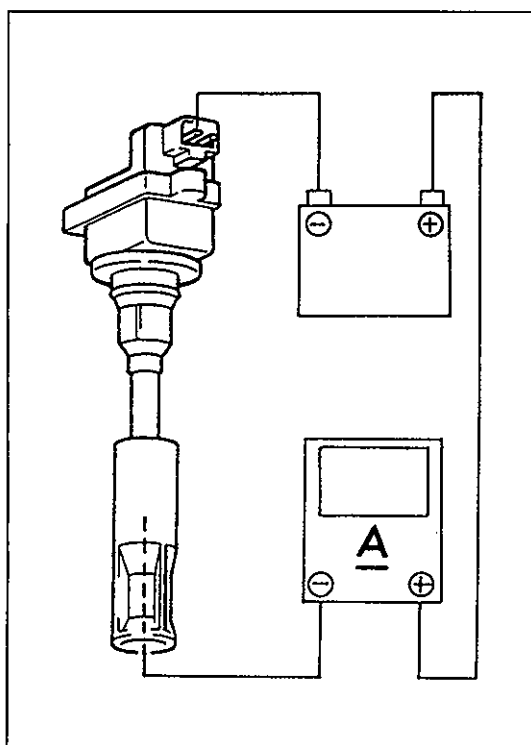
SECONDARY COIL

- 1) Connect 12 V vehicle battery and digital ammeter and measure current value as shown in left figure.

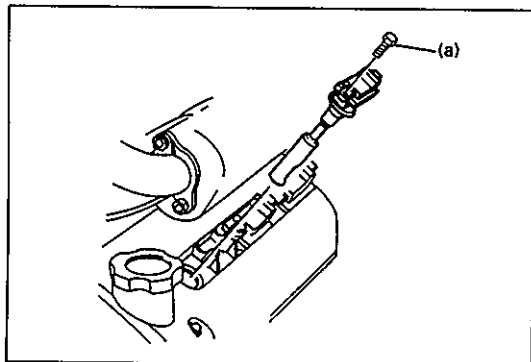
Specified current: 0.3 ~ 1.4 mA

- 2) Reverse polarities and check that current does not flow.

If check result is not satisfactory, replace ignition coil.



85F00-6F2-8-4



85F00-6F2-9-1

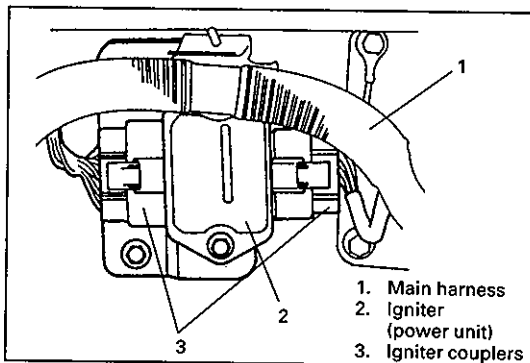
INSTALLATION

- 1) Install ignition coil(s) securely.
- 2) Tighten ignition coil bolt(s), and then connect ignition coil coupler(s).

Tightening Torque

(a): 3 N·m (0.3 kg-m, 2.5 lb-ft)

- 3) Install ignition coil cover(s).



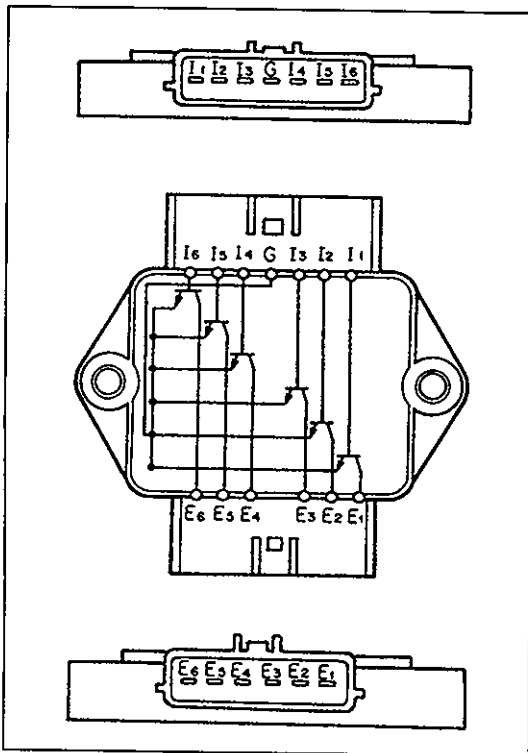
85F00-6F2-9-2

IGNITER (POWER UNIT)

Before this check, prepare digital ohmmeter.

REMOVAL

- 1) Disconnect igniter couplers.
- 2) Remove igniter.



85F00-6F2-9-3

INSPECTION

- Check resistance between terminals of corresponding numbers for values in table below.

Tester Terminal		Resistance (Ω)
Positive ⊕	Negative ⊖	
"E"	"I"	Neither 0 nor ∞
"E"	"G"	
"I"	"G"	

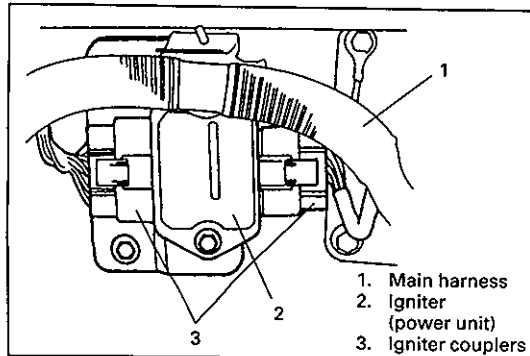
- Measure resistance with polarities of tester reversed and according to table below.

Tester Terminal		Resistance (Ω)
Positive ⊕	negative ⊖	
"I"	"E"	∞
"G"	"E"	
"G"	"I"	Neither 0 nor ∞

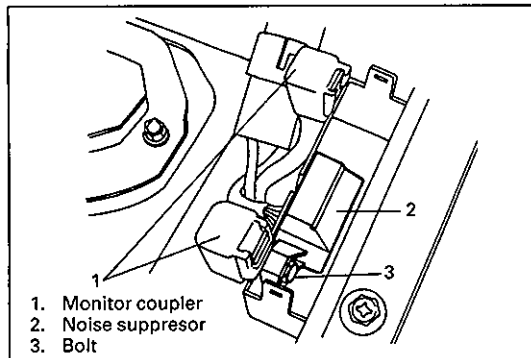
Take measurement at each circuit from "1" to "6".
If check result is not satisfactory, replace igniter.

INSTALLATION

- 1) Install igniter.
- 2) Connect igniter couplers.



85F00-6F2-9-5



85F00-6F2-10-1

NOISE SUPPRESSOR

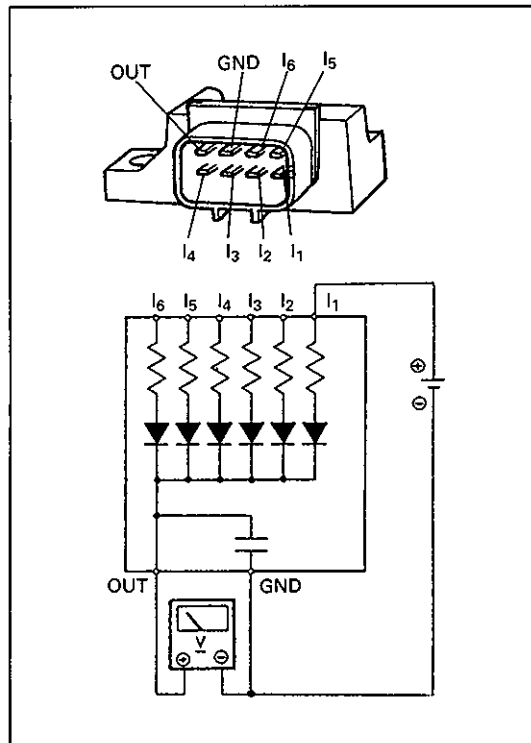
REMOVAL

- 1) Remove noise suppressor.
- 2) Disconnect coupler of noise suppressor.

INSPECTION

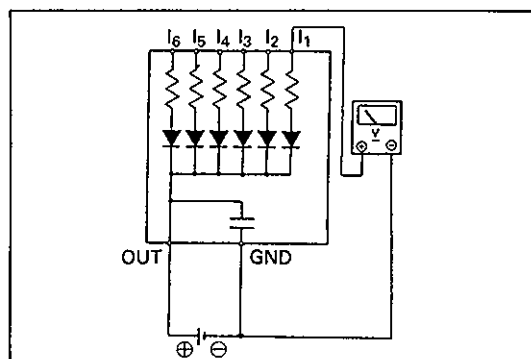
Before this check, prepare a new 1.5 V battery, a voltmeter and ohmmeter.

- 1) Connect as shown in left figure so that about 1.5 V voltage is applied between "I" and "GND" terminals.
With voltmeter connected between "OUT" and "GND" terminals, check that 0 V is not indicated.
Take measurement at each terminal from "I₁" to "I₆".



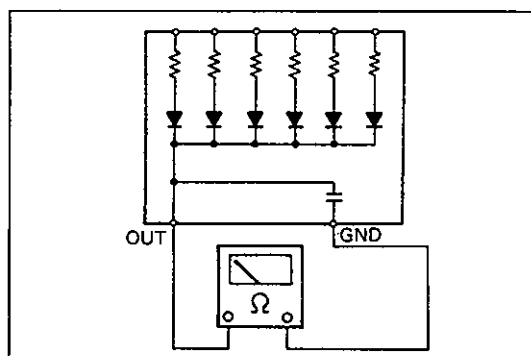
85F00-6F2-10-2

- 2) Connect as shown in left figure so that about 1.5 V voltage is applied between "OUT" and "GND" terminals. With voltmeter connected between "I" and "GND" terminals, check that voltage is 0 V.
Take measurement at each terminal from "I₁" to "I₆".

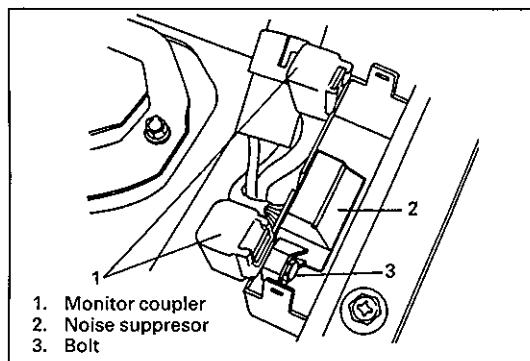


85F00-6F2-10-4

- 3) Check to continuity (infinity) between "OUT" and "GND" terminals.
If check result is not satisfactory, replace noise suppressor.



85F00-6F2-10-5



85F00-6F2-11-1

INSTALLATION

- 1) Connect coupler of noise suppressor.
- 2) Install noise suppressor.

CMP (CAMSHAFT POSITION) SENSOR**CAUTION**

Disassembly is prohibited. If anything faulty is found, replace as an assembly unit.

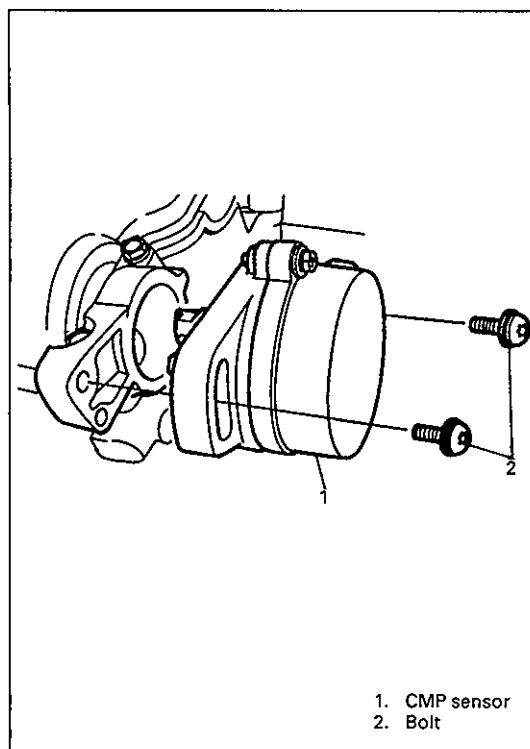
REMOVAL

- 1) Disconnect CMP sensor coupler.
- 2) Remove CMP sensor.
- 3) Remove O-ring from CMP sensor.

INSPECTION

For check, refer to SECTION 6E2.

If check result is not satisfactory, replace CMP sensor.

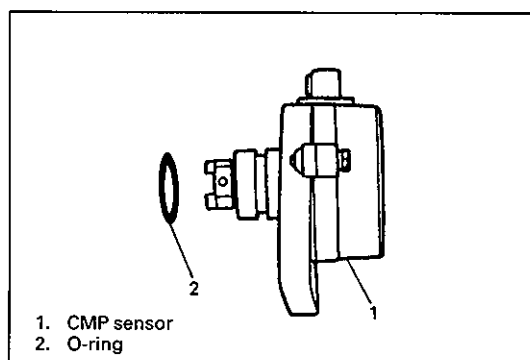


85F00-6F2-11-2

INSTALLATION**NOTE:**

After installing CMP sensor, adjust ignition timing.
(Refer to "IGNITION TIMING" in this section)

- 1) Install a new O-ring to CMP sensor.



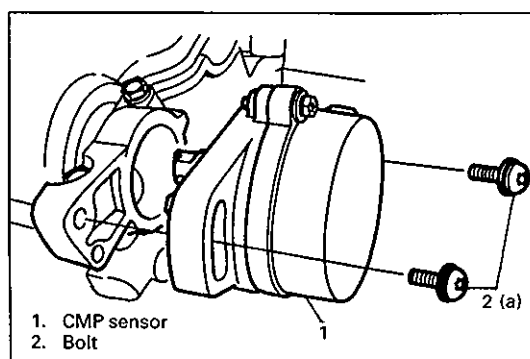
85F00-6F2-11-4

- 2) Install CMP sensor.

Tightening Torque

(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- 3) Connect CMP sensor coupler.



85F00-6F2-11-5

IGNITION TIMING

INSPECTION AND ADJUSTMENT

NOTE:

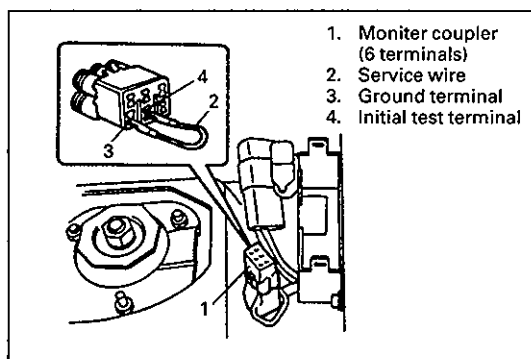
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

- 1) Start engine and warm it up to normal operating temperature.
- 2) Make sure that all of electrical loads except ignition are switched off.
- 3) Check to be sure that idle speed is within specification.

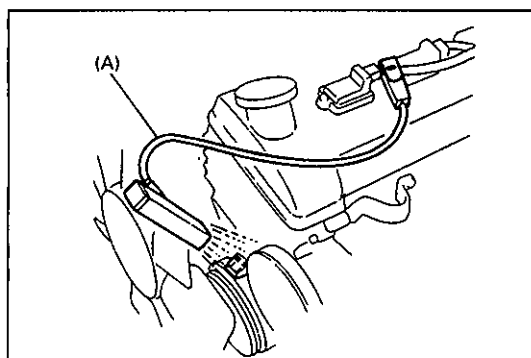
Idle speed:

750 ± 50 (rpm) (for MT model)

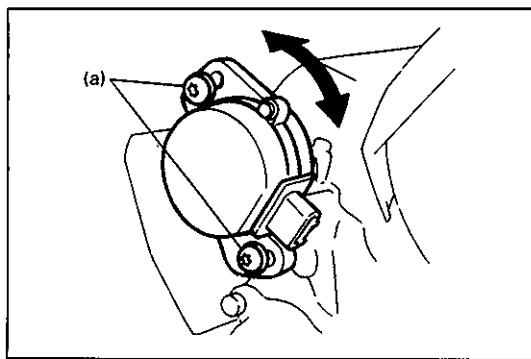
800 ± 50 (rpm) (for AT model)



85F00-6F2-12-3



85F00-6F2-12-4



85F00-6F2-12-5

- 4) Remove monitor coupler cap.
- 5) Ground initial test terminal in monitor coupler (6 terminals) by using service wire so that ignition timing is fixed on initial one.

- 6) Set timing light to No.1 ignition harness.
- 7) Using timing light, check that timing is within specification.

Initial ignition timing (Test switch terminal grounded):

5 ± 1 ° BTDC (at idle speed)

Ignition order: 1-6-5-4-3-2

Special Tool

(A): 09930-76420

- 8) If ignition timing is out of specification, loosen flange bolts, adjust timing by turning CMP sensor while engine is running, and then tighten bolts.

Tightening Torque

(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- 9) After tightening bolts, recheck that ignition timing is within specification.

- 10) 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.

85F00-6F2-13-1

- 11) With engine idling (test switch terminal ungrounded, idle switch ON and vehicle stopped), check that ignition timing is 8° – 12° BTDC.

Also, check that increasing engine speed advances ignition timing.

If above check results are not satisfactory, check TP sensor (idle switch), test switch terminal circuit and ECM.

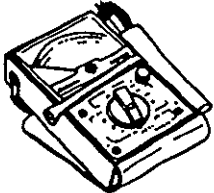
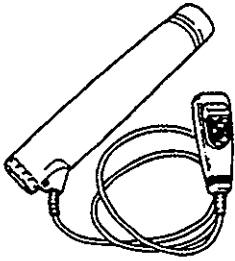
85F00-6F2-13-2

TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening Torque		
	N·m	kg-m	lb-ft
1. Spark Plug	25	2.5	18.0
2. Ignition coil bolt	3	0.3	2.5
3. CMP sensor bolts	15	1.5	11.0

85F00-6F2-13-3

SPECIAL TOOLS

 09900-25002 Pocket tester	 09930-76420 Timing light (Dry cell type)		
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85F00-6F2-13-4

SECTION 6G

CRANKING SYSTEM

(1.2 kW and 1.4 kW Reduction Type)

Discrimination:

Vehicle specification	M/T model	A/T model
Starting motor type	1.2 kW Reduction	1.4 kW Reduction

85F00-6G-1-1

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REQUIRED SERVICE MATERIAL	6G-18
SPECIAL TOOL	6G-18

85F00-6G-1-2

GENERAL DESCRIPTION

CRANKING CIRCUIT

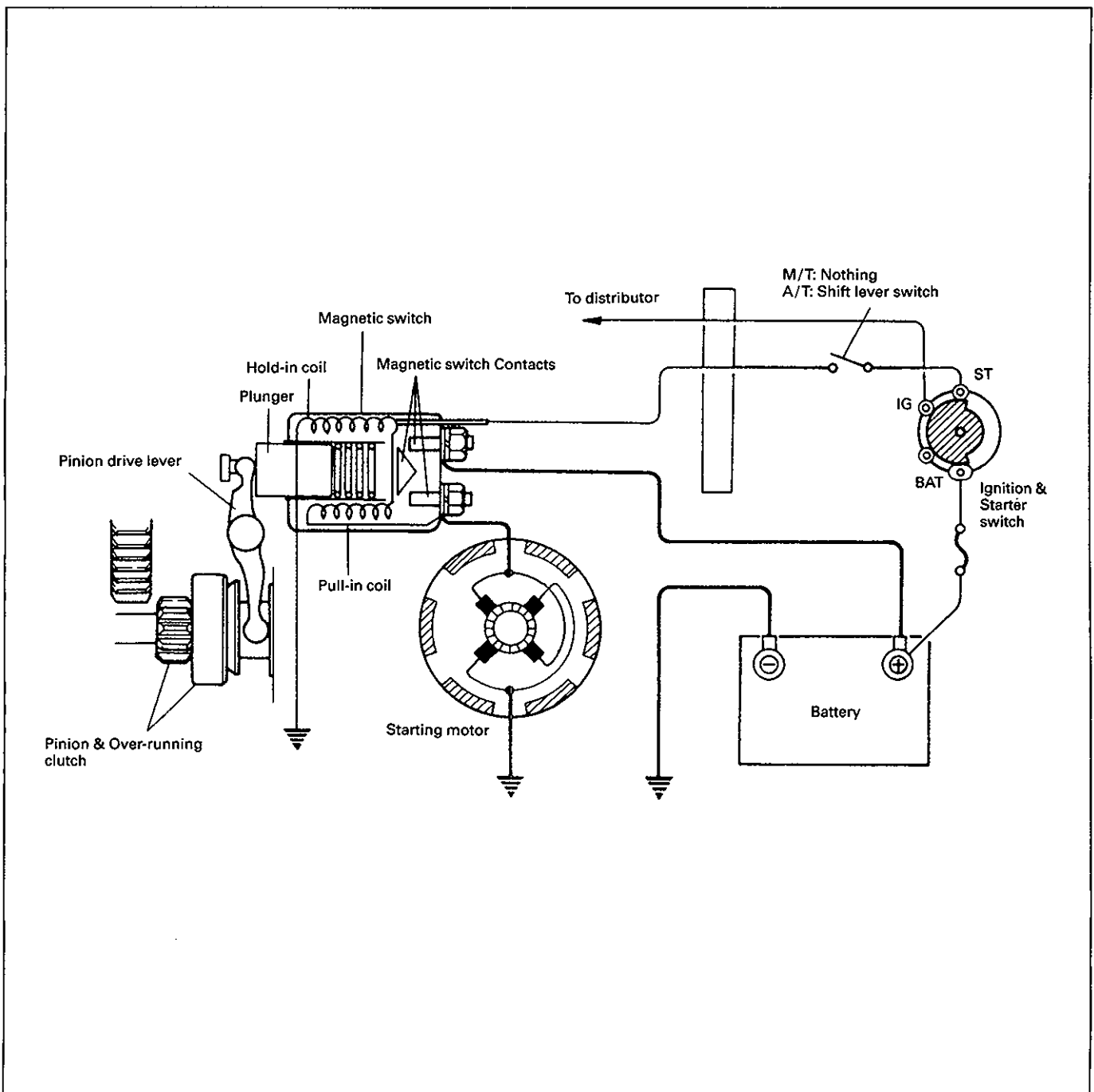
The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically.

Only the starting motor will be covered in this section.

60G00-6G2-2-1

STARTING MOTOR CIRCUIT

- The magnetic 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 over-running clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.



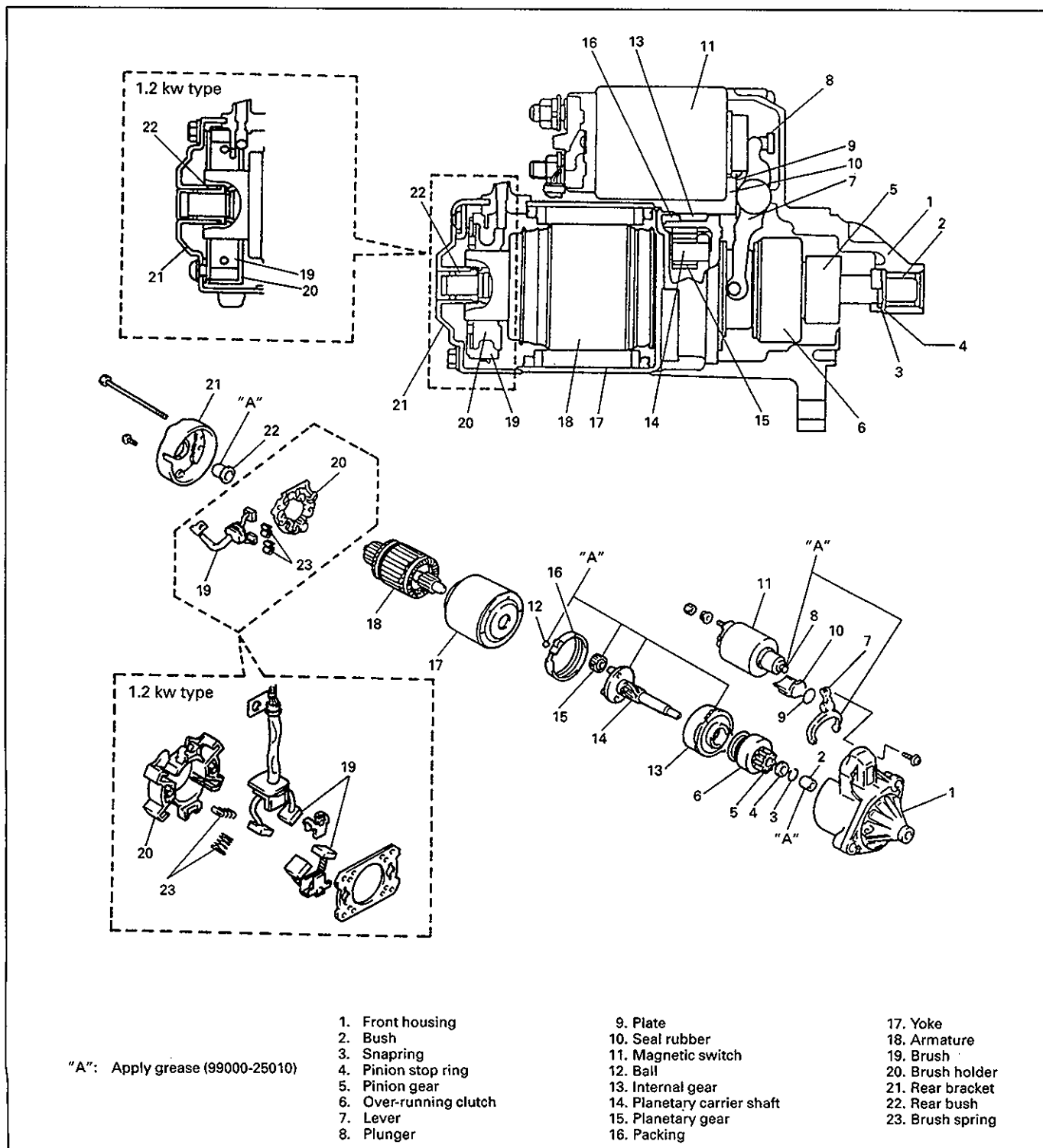
STARTING MOTOR

The starting motor consists of parts shown in below and has permanent magnets 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.

NOTE:

- Make sure to apply grease before assembly where so indicated "A" in the figure below.
- Spare parts have been lubricated.
- 1.2 kw starting motor differs from 1.4 kw starting motor in brush, brush holder and brush spring only. For 1.2 kw starting motor, only those different parts are shown in the figure below.



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 starting motor 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 1. Shift lever switch is not in P or N, or not adjusted (A/T) 2. Battery run down 3. Battery voltage too low due to battery deterioration 4. Poor contact in battery terminal connection 5. Loose grounding cable connection 6. Fuse set loose or blown off 7. Poor contacting action of ignition switch and magnetic switch 8. Lead wire coupler loose in place 9. Open-circuit between ignition switch and magnetic switch 10. Open-circuit in pull-in coil 11. Brushes are seating poorly or worn down 12. Poor sliding or plunger and/or pinion	Shift in P or N, or adjust switch. Recharge battery. Replace battery. Retighten or replace. Retighten. Tighten or replace. Replace. Retighten. Repair. Replace magnetic switch. Repair or replace. Repair.
	Operating sound of magnetic switch heard 1. Battery run down 2. Battery voltage too low due to battery deterioration 3. Loose battery cable connections 4. Burnt main contact point, or poor contacting action of magnetic switch 5. Brushes are seating poorly or worn down 6. Weakened brush spring	Recharge battery. Replace battery. Retighten. Replace magnetic switch Repair or replace. Replace.

Condition	Possible Cause	Correction
Motor not running	7. Burnt commutator 8. Layer short-circuit of armature 9. Crankshaft rotation obstructed.	Replace armature. Replace. Repair.
Starting motor running but too slow (small torque)	If battery and wiring are satisfactory, inspect starting motor 1. Insufficient contact of magnetic switch main contacts 2. Layer short-circuit of armature 3. Disconnected, burnt or worn commutator 4. Worn brushes 5. Weakened brush springs 6. Burnt or abnormally worn end bush	Replace magnetic switch. Replace. Repair commutator or replace armature. Replace brush. Replace spring. Replace bush.
Starting motor running, but not cranking engine	1. Worn pinion tip 2. Poor sliding of over-running clutch 3. Over-running clutch slipping 4. Worn teeth of ring gear	Replace over-running clutch. Repair. Replace over-running clutch. Replace flywheel.
Noise	1. Abnormally worn bush 2. Worn pinion or worn teeth of ring gear 3. Poor sliding of pinion (failure in return movement) 4. Worn internal or planetary gear teeth 5. Lack of oil in each part	Replace bush. Replace pinion or flywheel. Repair or replace. Replace. Lubricate.
Starting motor does not stop running	1. Fused contact points of magnetic switch 2. Short-circuit between turns of magnetic switch coil (layer short-circuit) 3. Failure of returning action in ignition switch	Replace magnetic switch. Replace magnetic switch. Replace.

UNIT REPAIR OVERHAUL

DISMOUNTING

NOTE:

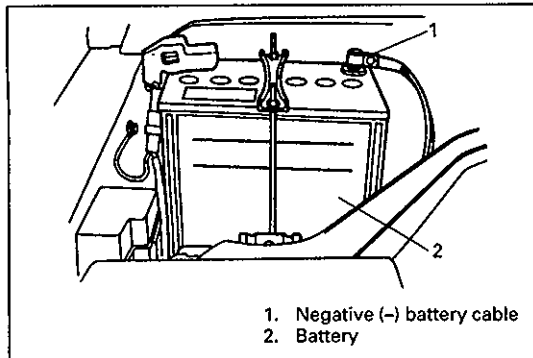
Service procedures are the same for all 1.2 and 1.4 kw starting motors except where noted.

1) Disconnect negative (-) battery cable.

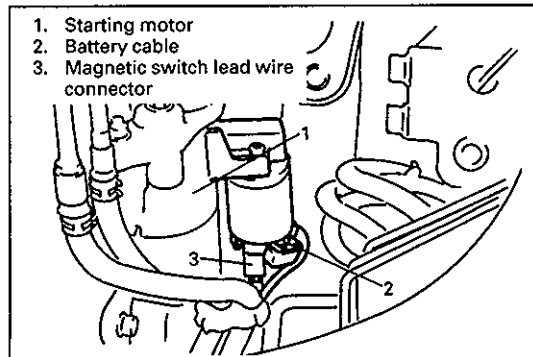
2) Disconnect magnetic switch lead wire and battery cable from starting motor terminals.

3) Remove starting motor mount bolts.

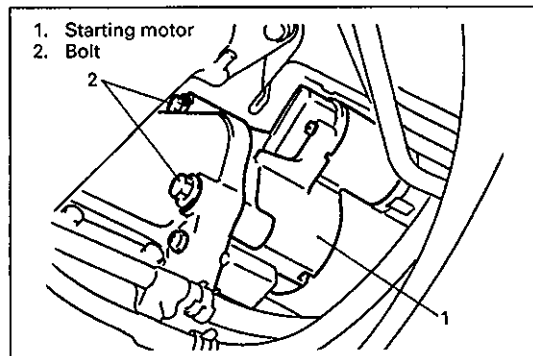
4) Remove starting motor.



85F00-6G-6-1



85F00-6G-6-2

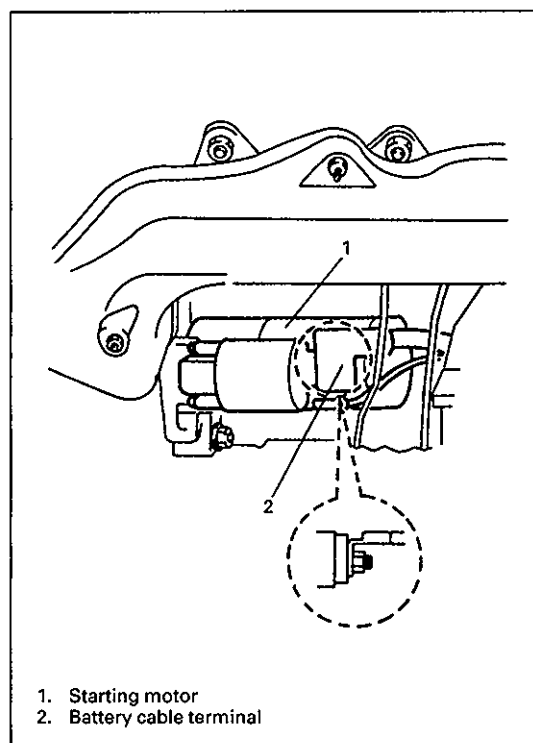


85F00-6G-6-3

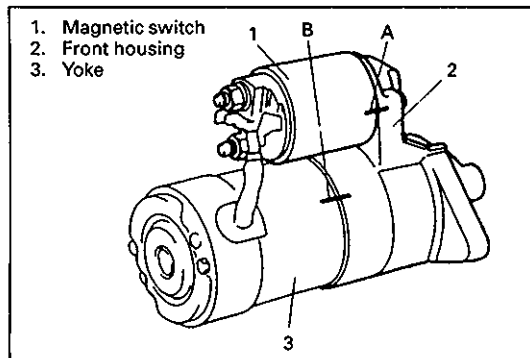
REMOUNTING

Remounting in reverse order of DISMOUNTING, noting the following.

- Set battery cable terminal as shown in left figure.



85F00-6G-6-4

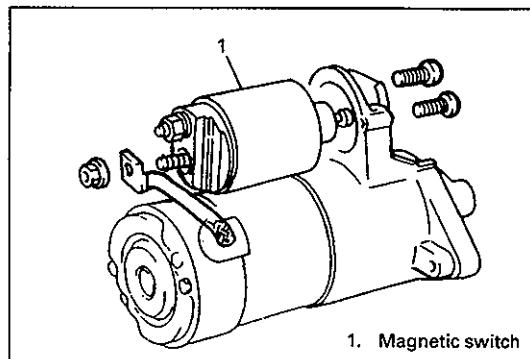


85F00-6G-7-1

DISASSEMBLY

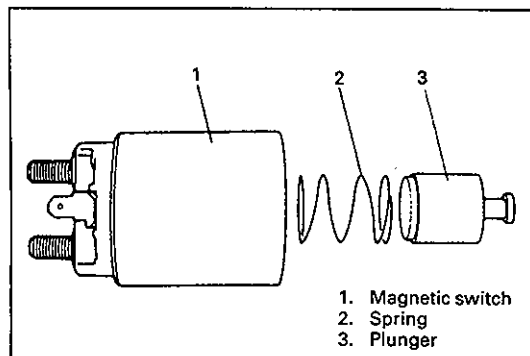
NOTE:

- Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in figure left so that any possible mistake can be avoided.
- Do not clamp yoke in a vise or strike it with a hammer during repair operations.



85F00-6G-7-2

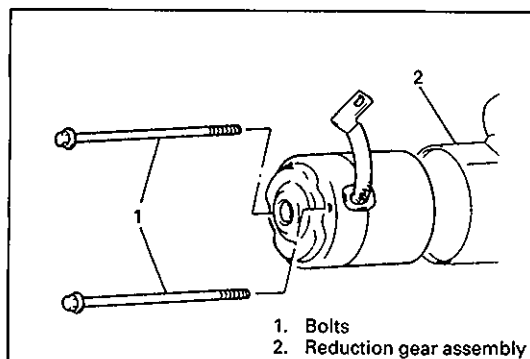
- 1) Remove magnetic switch.



60G00-6G2-7-3

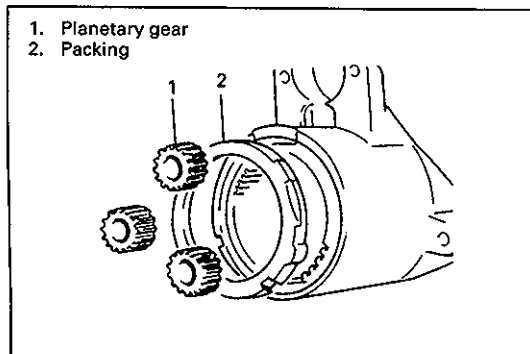
NOTE:

Don't disassemble this switch. If defective, replace as a complete assembly.



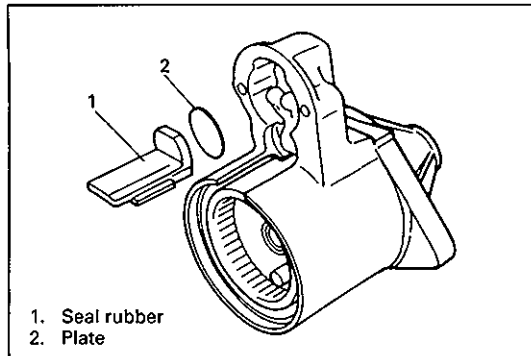
85F00-6G-7-4

- 2) Remove bolts shown in left figure, then separate reduction gear assembly from starting motor assembly.



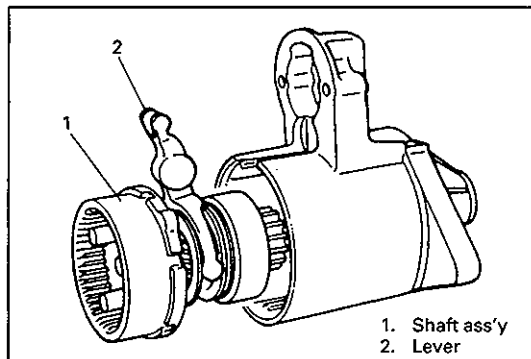
85F00-6G-7-5

- 3) To overhaul reduction gear assembly, remove packing and planetary gear.



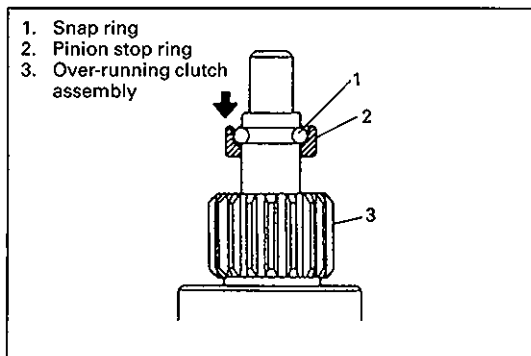
85F00-6G-8-1

4) Remove seal rubber and plate.



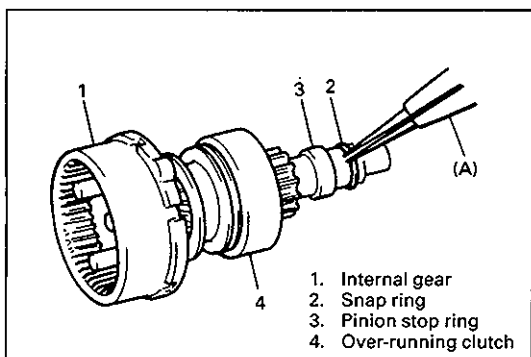
85F00-6G-8-2

5) Remove shaft assembly with lever.



85F00-6G-8-3

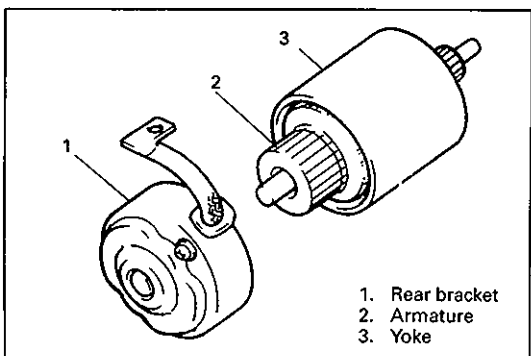
6) Loosen pinion stop ring fixed by snap ring.



85F00-6G-8-4

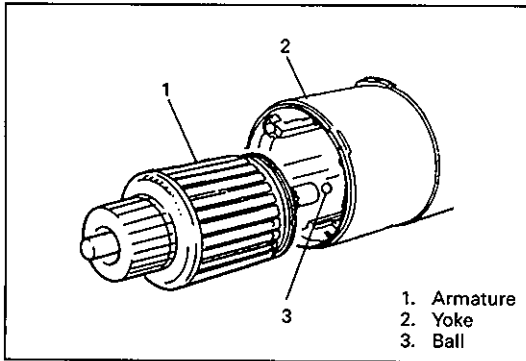
7) Remove snap ring, then pull out pinion stop ring and over-running clutch and internal gear.

Special Tool
(A): 09900-06107



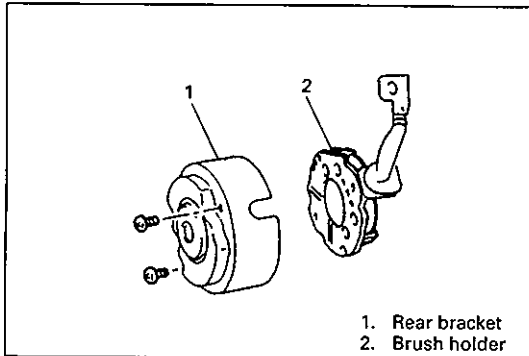
85F00-6G-8-5

8) Remove rear bracket and brush holder.



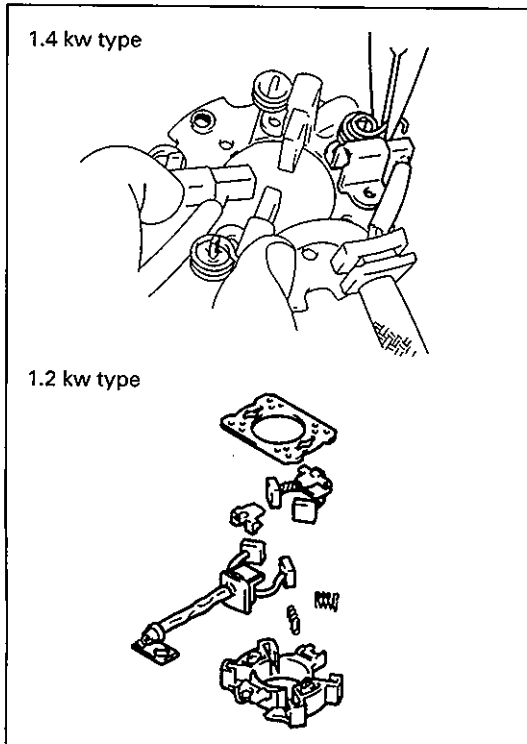
85F00-6G-9-1

9) Remove armature from yoke.



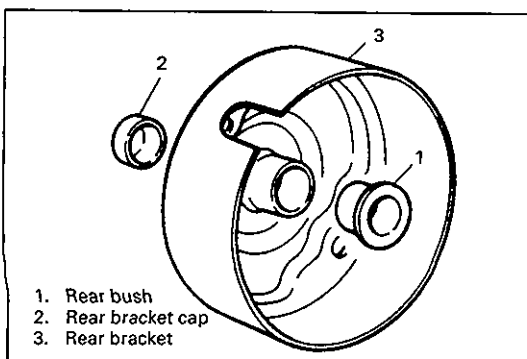
85F00-6G-9-2

10) Remove brush holder from rear bracket.



85F00-6G-9-3

11) Remove brush spring and brush.



85F00-6G-9-5

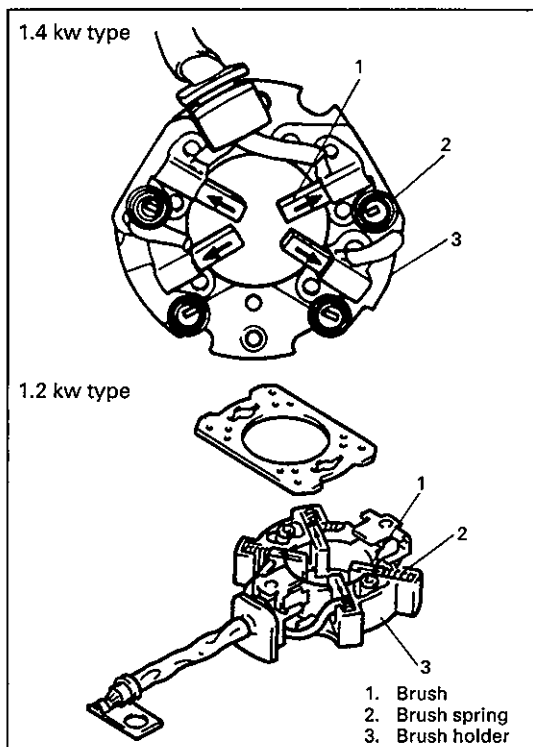
12) Remove rear bracket cap, and then remove rear bush, as required.

REASSEMBLY

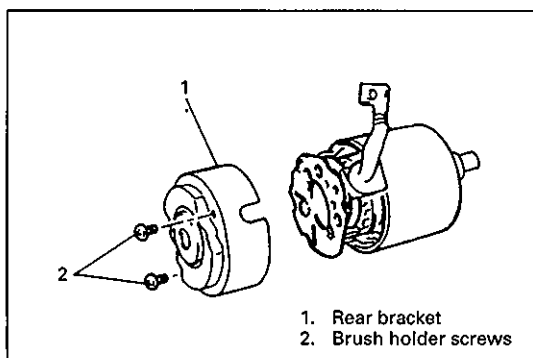
CAUTION:

- Washing, adjusting and disassembling of shock absorber (clutch plate) are not allowed.
- New oilless bearing have been lubricated when they are supplied as spare parts. **DO NOT** wash with grease dissolving solvent nor lubricate them with other lubricant.

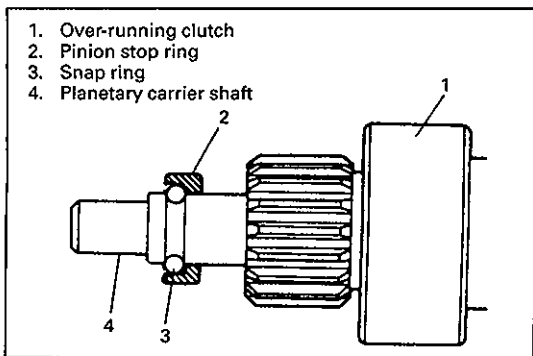
- 1) Inspect component parts (Refer to page 6G-12) and replace with new ones as necessary.
- 2) Apply grease (Refer to page 6G-3).
- 3) Install armature to yoke.
- 4) Install brushes and brush springs to brush holder.
- 5) Install brush holder to armature while pushing 4 brushes outward.



85F00-6G-10-3



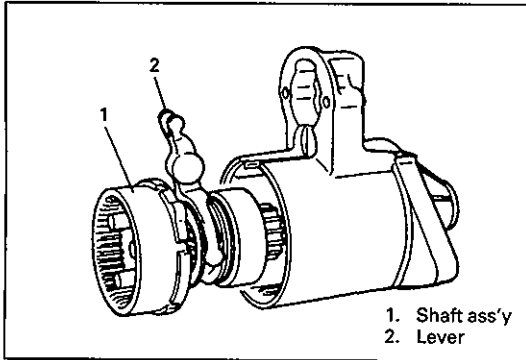
85F00-6G-10-4



85F00-6G-10-5

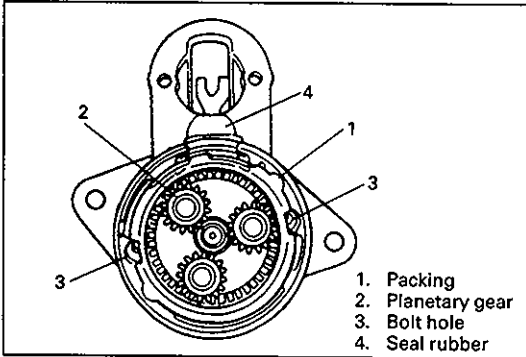
- 6) Install rear bush and then rear bracket cap.
- 7) Install rear bracket.
- 8) Tighten brush holder screws.

- 9) Install over-running clutch assembly to planetary carrier shaft, using care for installing direction of pinion stop ring.



85F00-6G-11-1

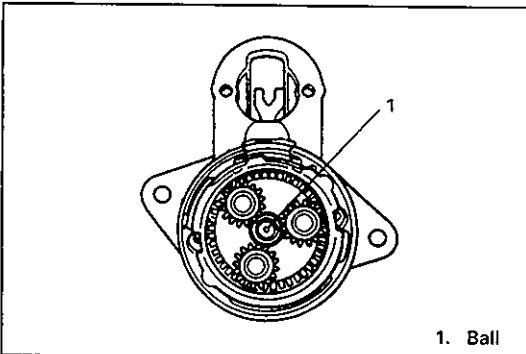
10) Insert shaft ass'y into front housing with lever positioned as shown left figure.



85F00-6G-11-2

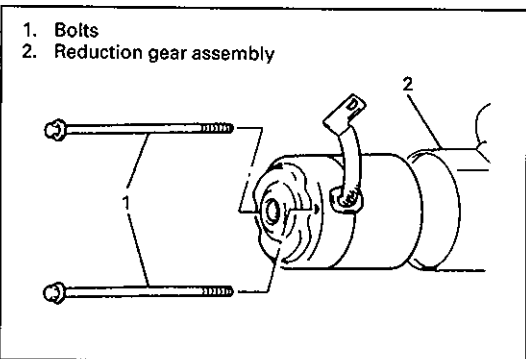
11) Install packing so that cuts in packing align with holes for through bolt in front housing.

12) Install plate and seal rubber to front housing.



85F00-6G-11-3

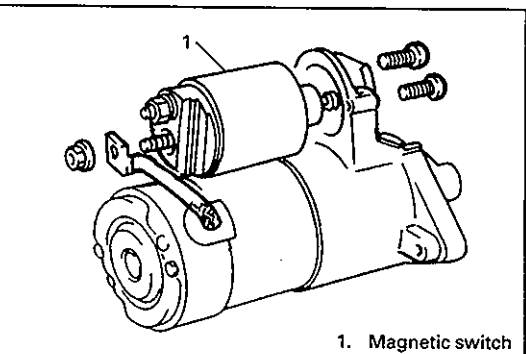
13) Apply grease to ball and install ball into shaft hole.



85F00-6G-11-4

14) Install yoke, armature, brush holder and rear bracket to front housing by aligning match marks provided before removal.

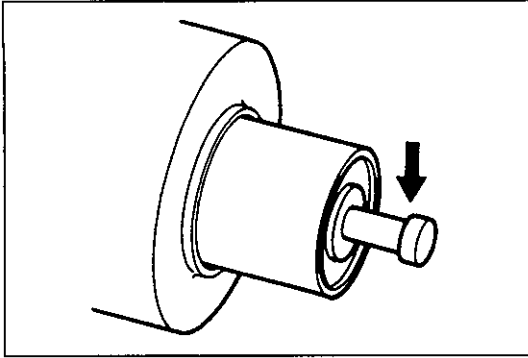
15) Tighten housing bolts.



85F00-6G-11-5

16) Install magnetic switch assembly and connect wire (switch to motor) to switch terminal.

17) Upon completion of assembly, carry out PERFORMANCE TEST. (Refer to page 6G-16.)

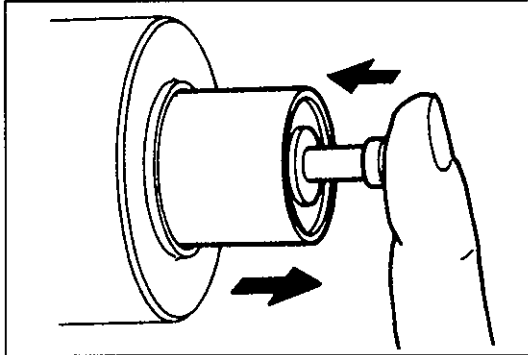


85F00-6G-12-1

INSPECTION

1. PLUNGER

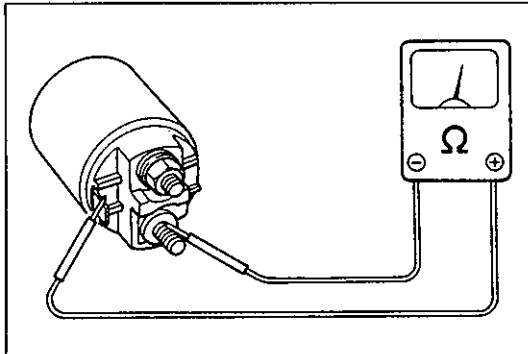
Inspect plunger for wear. Replace if necessary.



60G00-6G2-12-2

2. MAGNETIC SWITCH

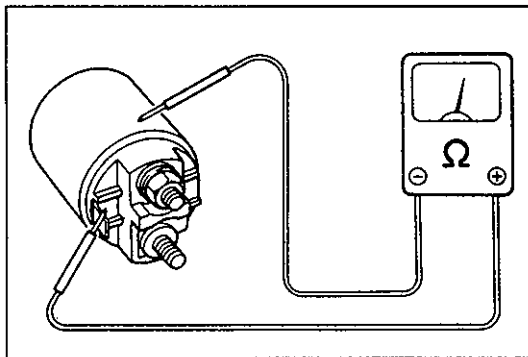
Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.



60G00-6G2-12-3

- **Pull-In Coil Open Circuit Test**

Check for continuity across magnetic switch 'S' terminal 'M' terminal. If no continuity exists, coil is open and should be replaced.



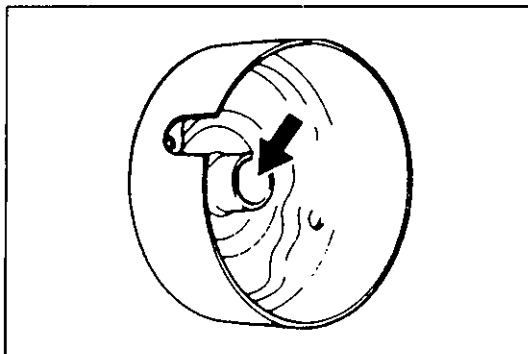
60G00-6G2-12-4

- **Hold-In Coil Open Circuit Test**

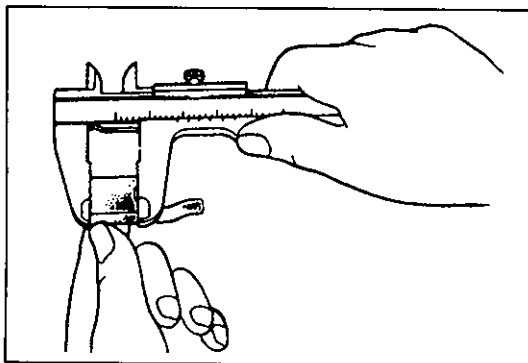
Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.

3. ARMATURE SHAFT BUSH

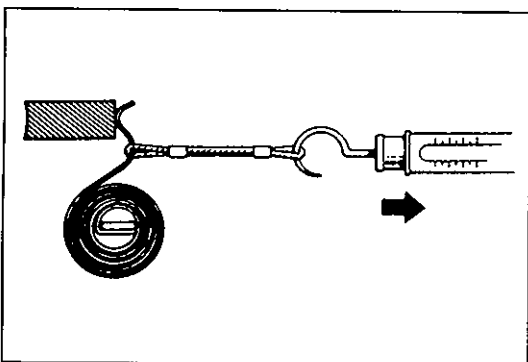
Inspect bush for wear or damage. Replace if necessary.



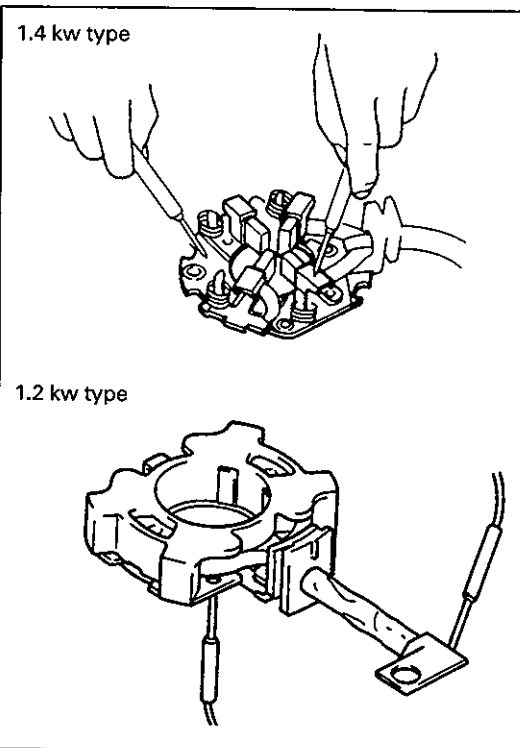
85F00-6G-12-5



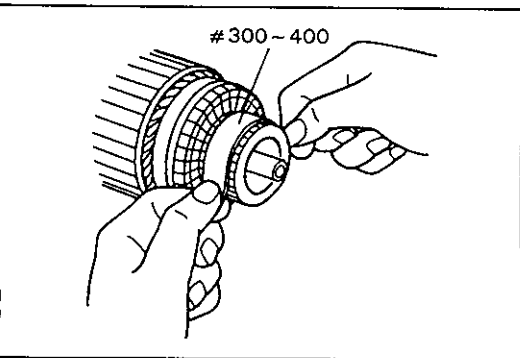
85F00-6G-13-1



85F00-6G-13-2



85F00-6G-13-3



85F00-6G-13-5

4. BRUSH

- Check brushes for wear. Measure length of brushes and if below limit, replace brush.

Brush length

	1.4 kw	1.2 kw
Standard	16.5 mm (0.65 in.)	12.3 mm (0.44 in.)
Limit	9 mm (0.35 in.)	7 mm (0.28 in.)

- Install brushes to each brush holder and check for smooth movement.

5. SPRING

Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension

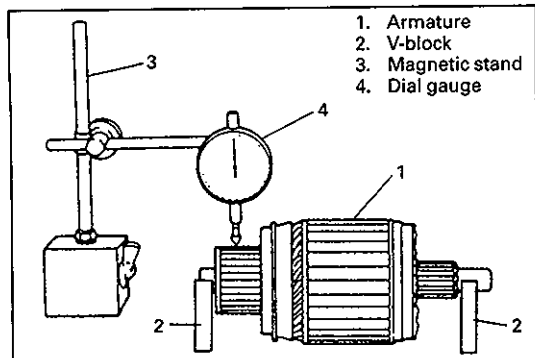
	1.4 kw	1.2 kw
Standard	2.1 kg (4.63 lb)	1.8 kg (3.97 lb)
Limit	0.7 kg (1.54 lb)	0.6 kg (1.32 lb)

6. BRUSH HOLDER

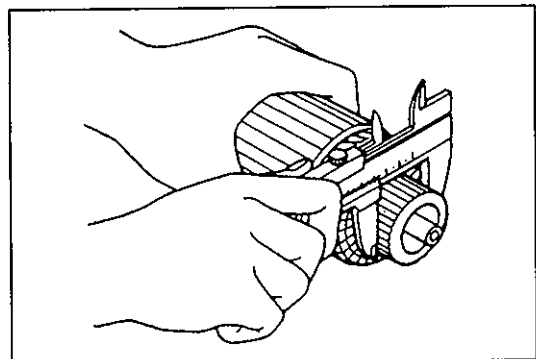
- Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination. Clean or correct as necessary.
- 1.4 kw type**
Check for continuity across insulated brush holder (positive side) and grounded brush holder (negative side). If continuity exists, brush holder is grounded due to defective insulation and should be replaced.
- 1.2 kw type**
Check for continuity across brush positive terminal and grounded brush holder. If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

7. ARMATURE

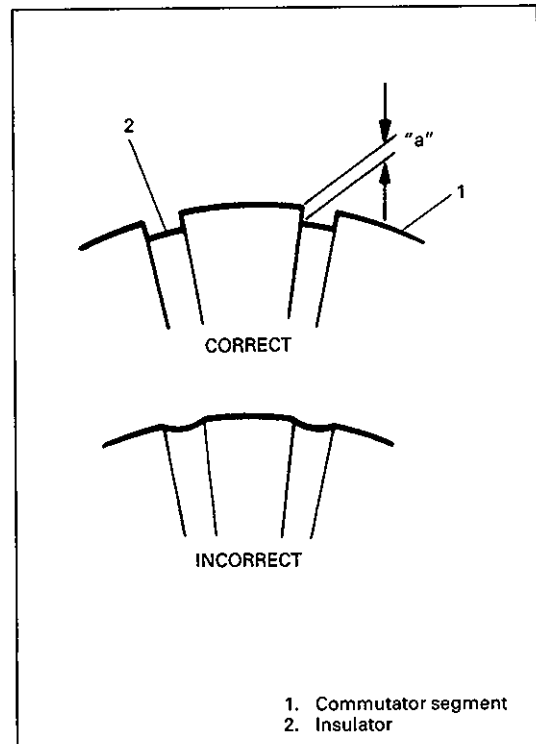
- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



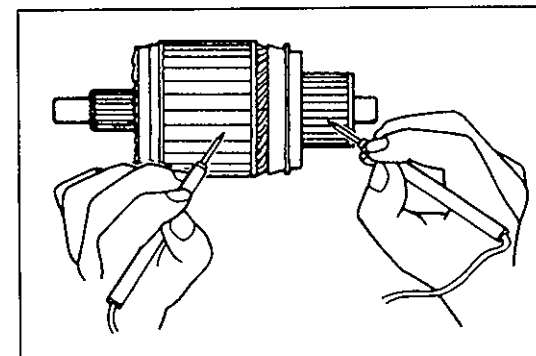
60G00-6G2-13-5



60G00-6G2-14-1



60G00-6G2-14-2



60G00-6G2-14-4

- Check commutator for uneven wear with armature supported on V-blocks. 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 of round

Standard : 0.05 mm (0.002 in.) or less

Limit : 0.4 mm (0.015 in.)

- Inspect commutator for wear. If diameter is below limit, replace armature.

Commutator outside diameter

Standard : 29.4 mm (1.16 in.)

Limit : 28.8 mm (1.13 in.)

- Inspect commutator for insulator depth. Correct or replace if below limit.

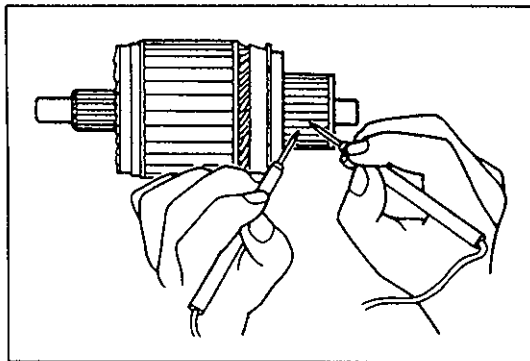
Commutator insulator depth "a"

Standard : 0.4 – 0.6 mm (0.015 – 0.023 in.)

Limit : 0.2 mm (0.008 in.)

● Ground Test

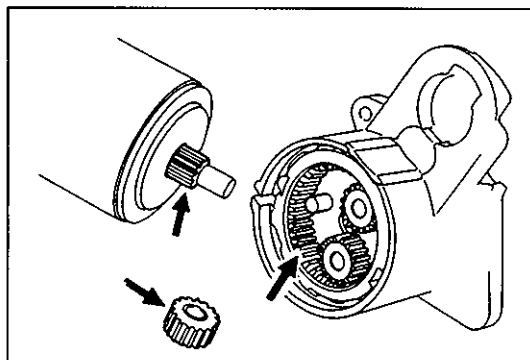
Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.



60G00-6G2-14-5

- **Open Circuit Test**

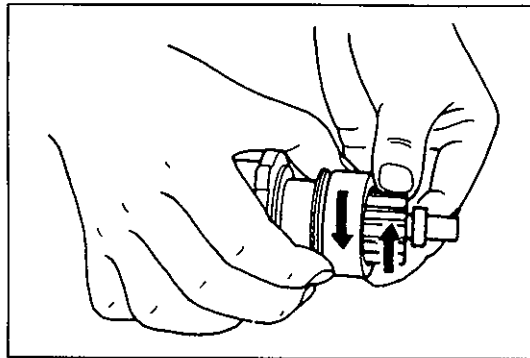
Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.



85F00-6G-15-2

8. GEARS

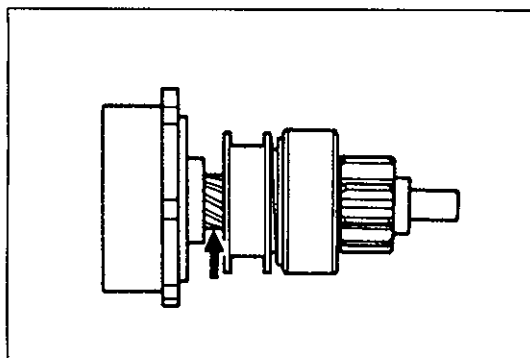
Inspect internal gear and planetary gears for wear, damage or other abnormal conditions. Replace if necessary.



60G00-6G2-15-2

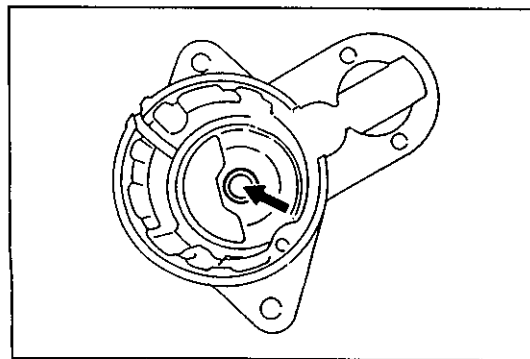
9. PINION AND OVER-RUNNING CLUTCH

- 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.



60G00-6G2-15-3

- Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.



85F00-6G-15-5

10.FRONT HOUSING BUSH

Inspect bush for wear or damage. Replace if necessary.

PERFORMANCE TEST

CAUTION:

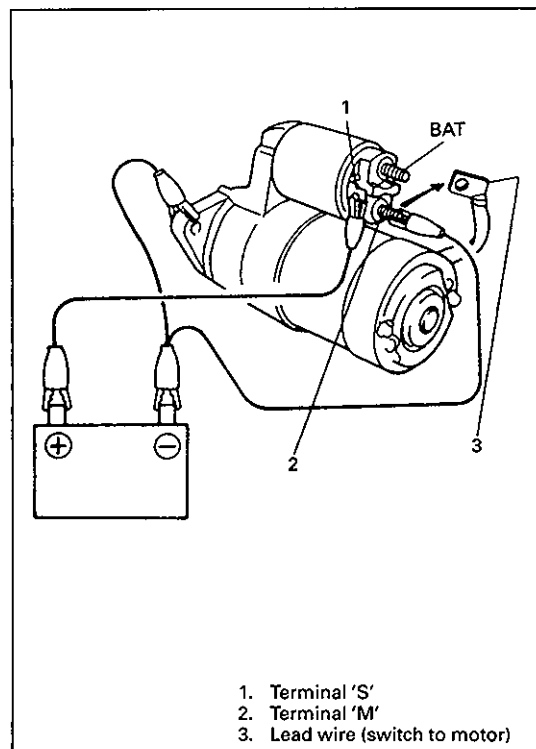
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

1) Pull-In Test

Connect battery to magnetic switch as shown. Check that plunger and pinion move outward. If plunger and pinion don't move, replace magnetic switch.

NOTE:

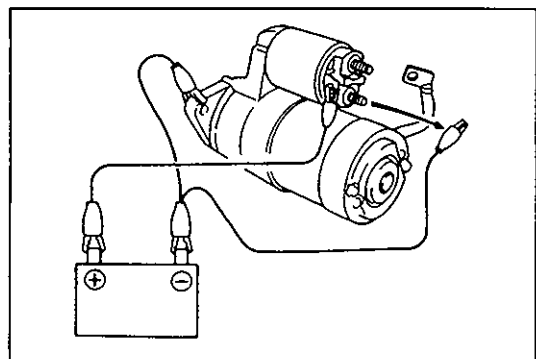
Before testing, disconnect lead wire from terminal M.



60G00-6G-16-1

2) Hold-In Test

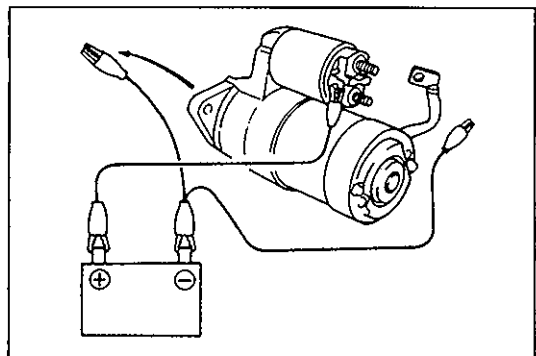
While connected as above with plunger out, disconnect negative lead from terminal 'M'. Check that plunger and pinion remain out. If plunger and pinion return inward, replace magnetic switch.



60G00-6G-16-3

3) Plunger and Pinion Return Test

Disconnect negative lead from switch body. Check that plunger and pinion return inward. If plunger and pinion don't return, replace magnetic switch.

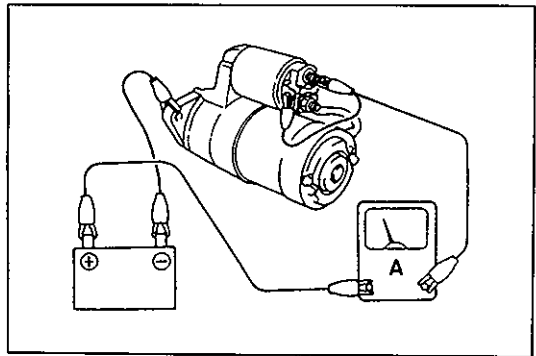


60G00-6G-16-4

4) No-Load Performance Test

- Connect battery and ammeter to starter as shown.
- Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current: 90A MAX. at 11V



60G00-6G-16-5

SPECIFICATIONS

1.4 kw type

Voltage		12 volts	
Output		1.4 kW	
Rating		30 seconds	
Direction of rotation		Clockwise as viewed from pinion side	
Brush length		16.5 mm (0.65 in.)	
Number of pinion teeth		8	
Performance		Condition	Guarantee
Around at 20 °C (68 °F)	No load characteristic	11.0 V	90 A maximum 3,000 rpm minimum
	Load characteristic	7.7 V 300 A	9.81 N·m (0.98 kg-m, 7.0 lb-ft) minimum 1000 rpm minimum
	Locked rotor current	4.0 V	980 A maximum 23 N·m (2.3 kg-m, 16.5 lb-ft) minimum
	Magnetic switch operating voltage		8 volts maximum

85F00-6G-17-1

1.2 kw type

Voltage		12 volts	
Output		1.2 kW	
Rating		30 seconds	
Direction of rotation		Clockwise as viewed from pinion side	
Brush length		12.3 mm (0.44 in.)	
Number of pinion teeth		8	
Performance		Condition	Guarantee
Around at 20 °C (68 °F)	No load characteristic	11.0 V	90 A maximum 3,000 rpm minimum
	Load characteristic	7.7 V 300 A	9.1 N·m (0.91 kg-m, 6.5 lb-ft) minimum 850 rpm minimum
	Locked rotor current	4.0 V	780 A maximum 17.7 N·m (1.77 kg-m, 13.0 lb-ft) minimum
	Magnetic switch operating voltage		8 volts maximum

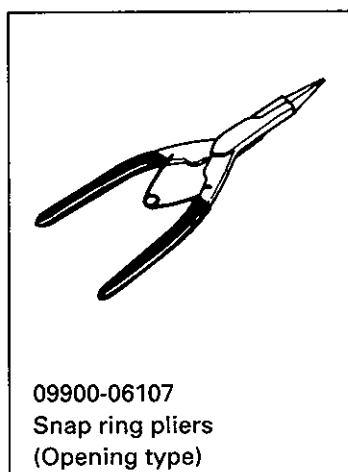
85F00-6G-17-2

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Front and rear bush. ● Plunger. ● Pinion drive lever. ● Internal gear. ● Planetary carrier shaft. ● Planetary gear ● Ball

85F00-6G-18-1

SPECIAL TOOL



60G00-6G2-17-3

SECTION 6H

CHARGING SYSTEM

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 Disassembly 6H-14

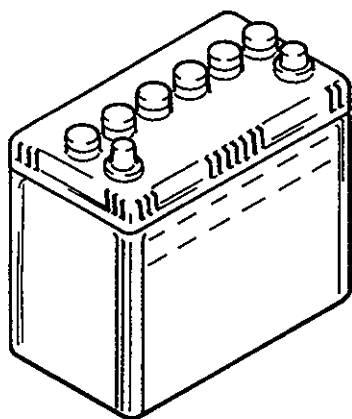
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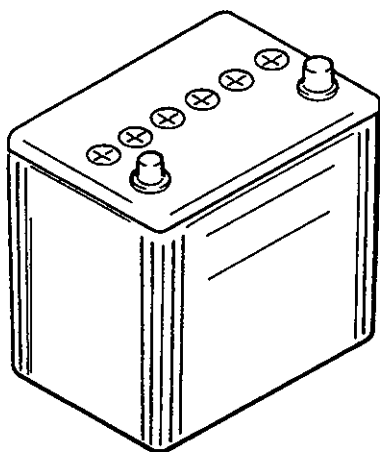
SPECIFICATIONS 6H-22

TIGHTENING TORQUE SPECIFICATIONS 6H-22

55B24L (S) TYPE



55D23L TYPE



85F00-6H-2-1

BATTERY

GENERAL DESCRIPTION

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.

The battery mounted in each vehicle is one of the following two types, depending on specification.

55B24L(S) 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)

55D23L TYPE

Rated capacity	48 AH/5HR, 12 Volts
Electrolyte	3.9 L (8.24/6.86 US/Imp pt)
Electrolyte S.G.	1.28 when fully charged at 20 °C (68 °F)

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.

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85F00-6H-2-5

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.

85F00-6H-3-1

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.

85F00-6H-3-2

- 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.

85F00-6H-3-5

- 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.

DIAGNOSIS

VISUAL INSPECTION

Check for obvious damage, such as cracked or broken case or cover, that could 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.

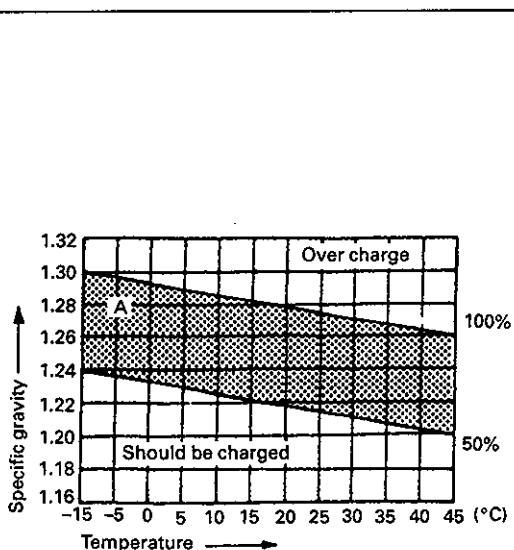
For the manner of correction, refer to the graph showing the relation between S.G. value and temperature at the left.

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.



ON VEHICLE SERVICE

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.

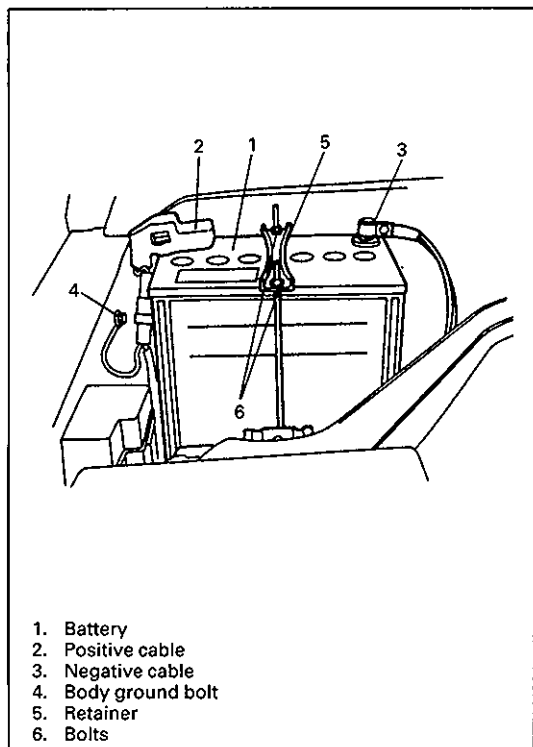
5. Start engine of vehicle with booster battery and turn off electrical accessories. Then Start engine of the vehicle with discharged battery.
6. Disconnect jumper cables in the exact reverse order.

WITH CHARGING EQUIPMENT

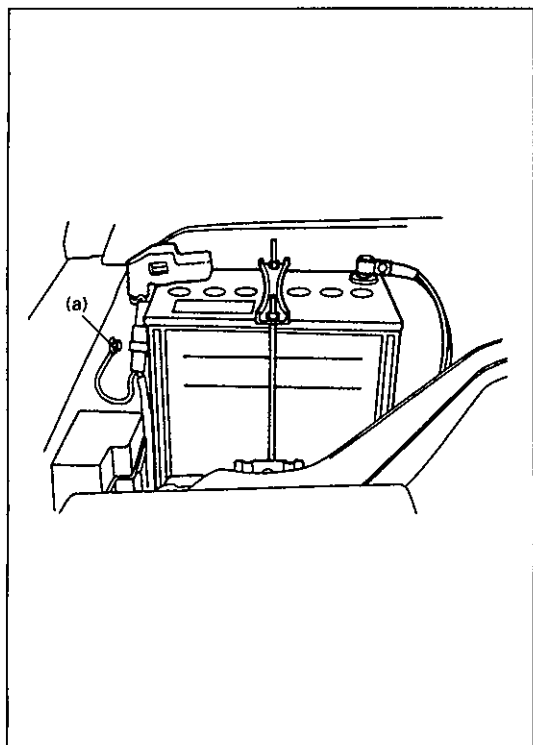
CAUTION:

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.

85F00-6H-6-1



85F00-6H-6-2



85F00-6H-6-4

OFF VEHICLE SERVICE

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)

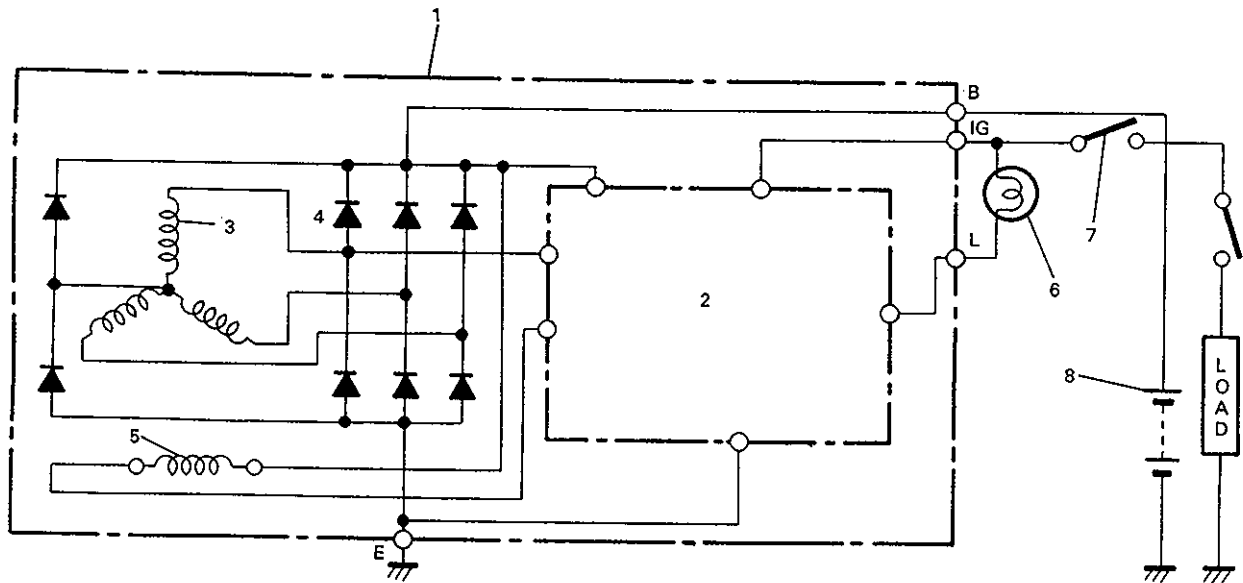
GENERATOR

GENERAL DESCRIPTION

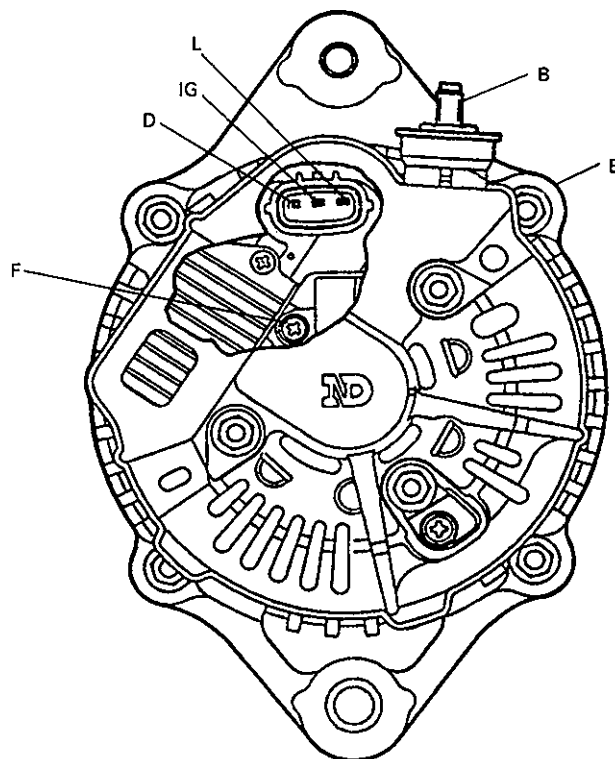
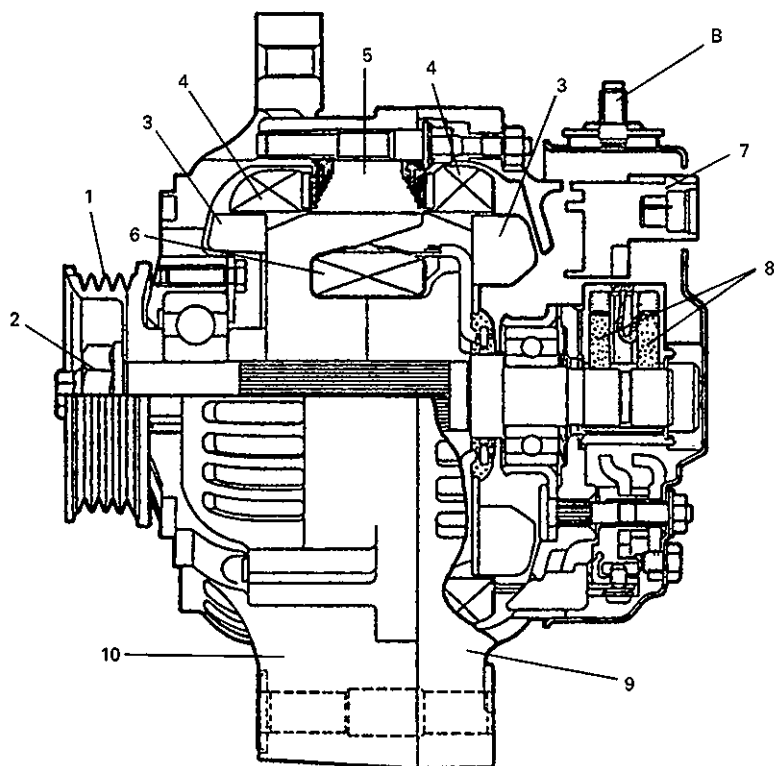
The generator is a small and high performance type with an IC regulator incorporated. The internal components are connected electrically as shown below figure.

The generator features are as follows:

- Solid state regulator is mounted inside the generator.
- All regulator components are enclosed into a solid mold.
- 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



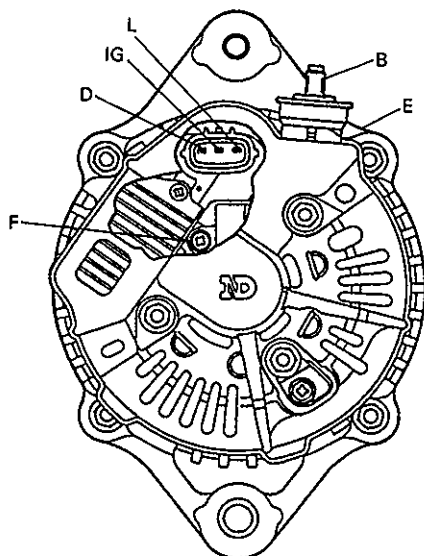
1. Pulley
2. Pulley nut
3. Rotor fan
4. Stator coil
5. Stator core
6. Field coil
7. Regulator
8. Brush
9. Rear end frame
10. Drive end frame

- B : Generator output (Battery terminal)
 D : Dummy terminal
 E : Ground
 F : Field coil terminal
 IG : Ignition terminal

DIAGNOSIS

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.



B : Generator output (Battery terminal)
 D : Dummy terminal
 E : Ground
 F : Field coil terminal
 IG : Ignition terminal

85F00-6H-9-1

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.

60G00-6H-9-2

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.

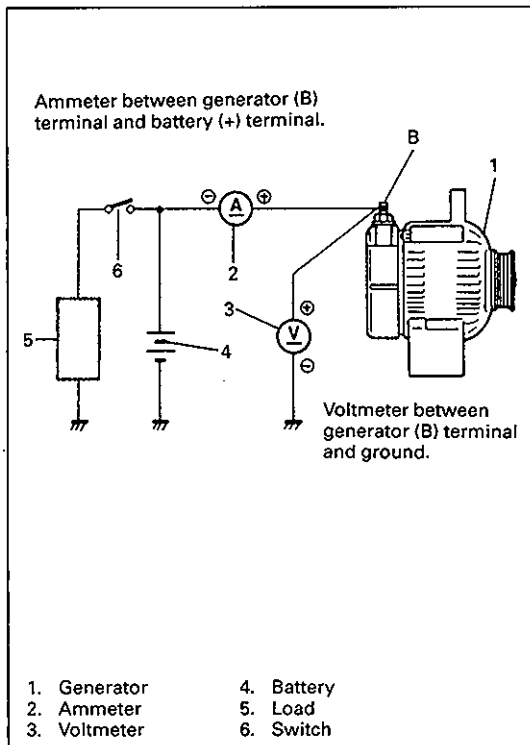
Ammeter

Set between generator B terminal and battery (+) terminal.

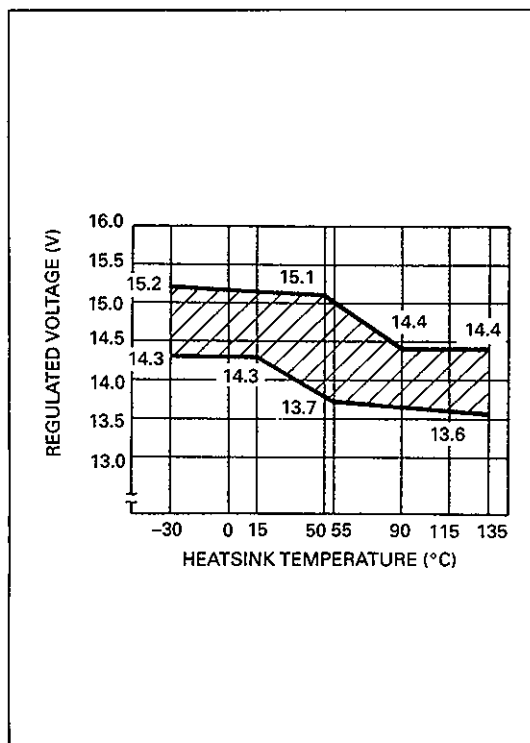
NOTE:

Use fully charged battery.

60G00-6H-10-1



85F00-6H-10-2



85F00-6H-10-3

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	14.2 – 15.1 v at 25 °C (77 °F)

NOTE:

Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in left figure.

Higher Voltage

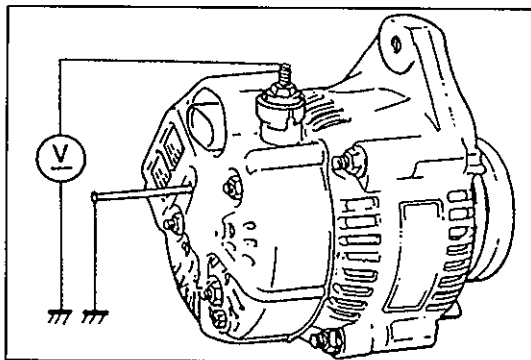
If voltage is higher than standard value, check ground of brush.

If brush ground is correct, replace IC regulator.

Lower Voltage

If voltage is lower than standard value, proceed to following check.

60G00-6H-11-1



85F00-6H-11-2

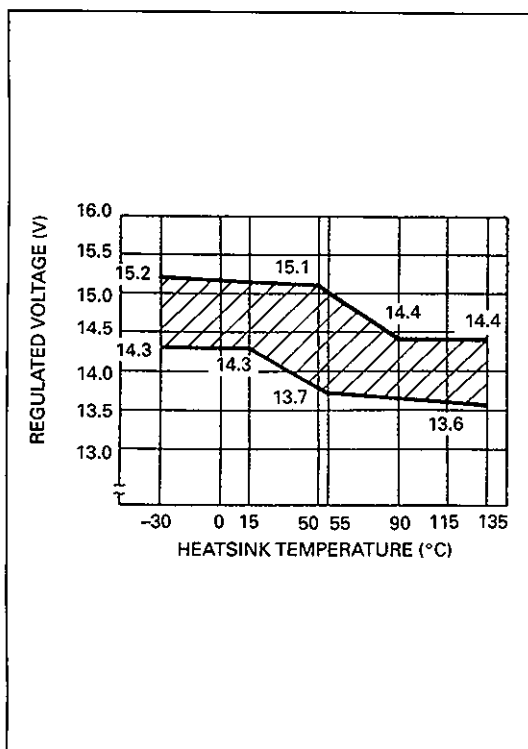
- 2) Ground F terminal and start engine, then measure voltage at B terminal as shown in left figure.

- 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 30 A repair or replace generator.

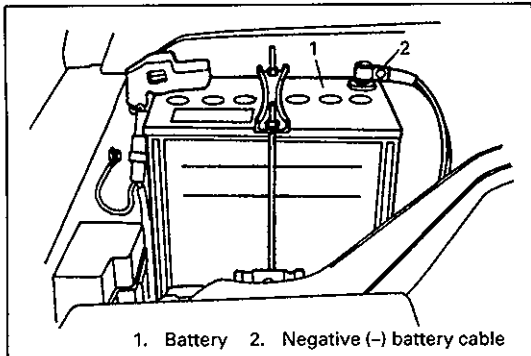
85F00-6H-11-3



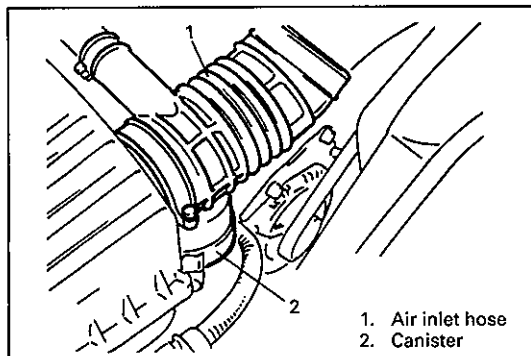
60G00-6H-11-4

OVERCHARGED BATTERY

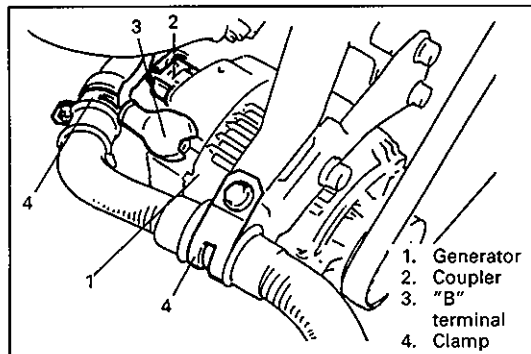
- 1) To determine battery condition, refer to Battery section.
- 2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, proceed to disassembly section of generator service and check field windings for grounds and shorts. If problem exists, replace rotor.
- 3) With engine running at 2,000 rpm, measure voltage.
- 4) If measured voltage is out of standard value, check brush ground or IC regulator.



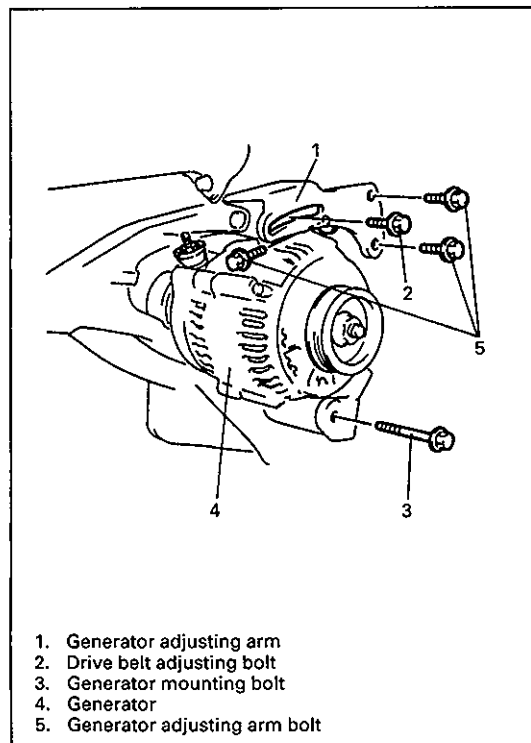
85F00-6H-12-1



85F00-6H-12-2



85F00-6H-12-3

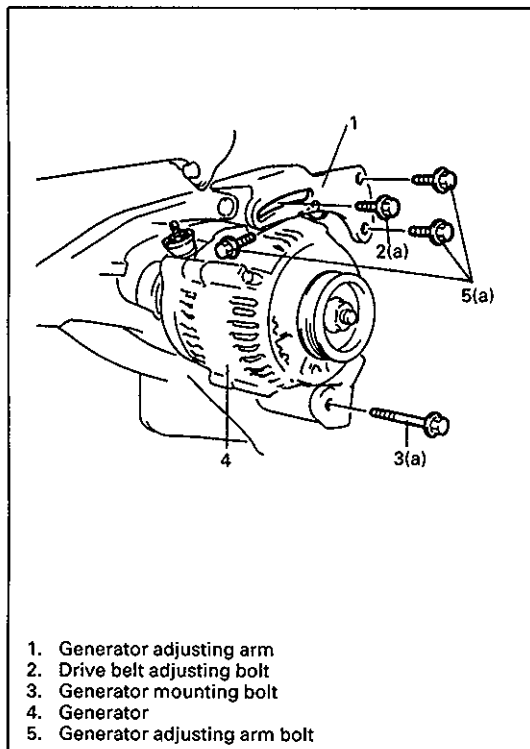


85F00-6H-12-4

UNIT REPAIR OVERHAUL

DISMOUNTING

- 1) Disconnect negative (-) cable at battery.
- 2) Remove air inlet hose.
- 3) Remove canister with canister mounting bracket from body.
- 4) Remove clamps from generator mounting bracket and engine mounting bracket.
- 5) Disconnect "B" terminal wire and coupler from generator.
- 6) Remove generator drive belt adjusting bolt and loosen generator mounting bolt.
- 7) Remove generator adjusting arm.
- 8) Remove generator.



85F00-6H-13-1

REMountING

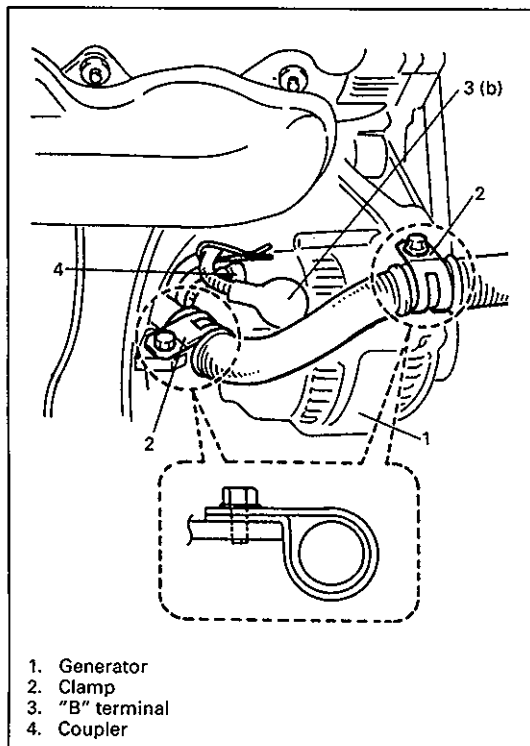
- 1) Mount generator on the generator bracket with the generator mounting bolt. Do not tighten the bolt yet.
- 2) Install generator adjusting arm.
- 3) Tighten adjusting bolt giving specified tension to drive belt, and then tighten generator mounting bolt.

NOTE:

For belt tension refer to SECTION 6B.

Tightening Torque

(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)



85F00-6H-13-3

- 4) Connect "B" terminal wire and coupler to generator.

Tightening Torque

(b): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

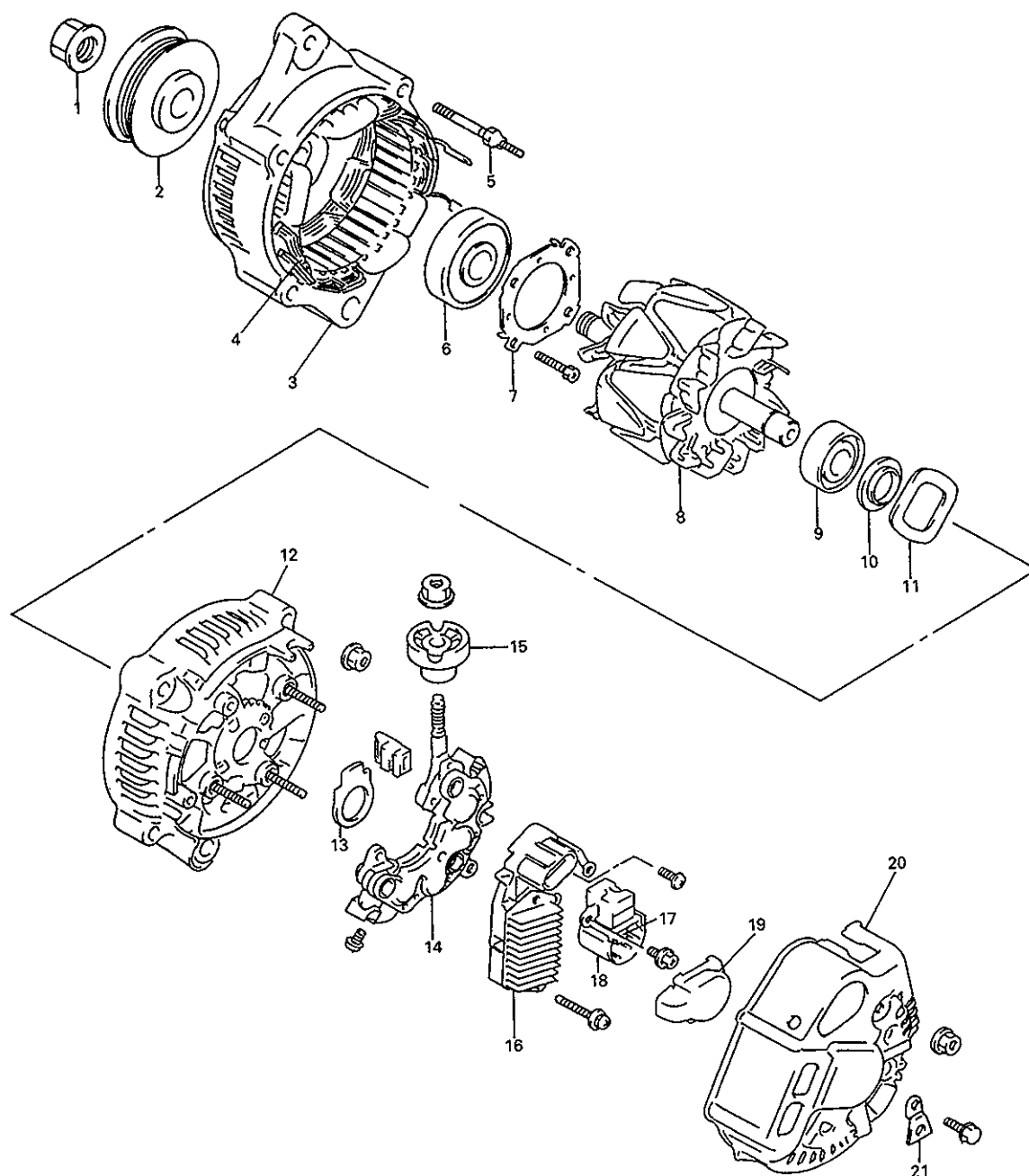
- 5) Install clamps to generator mounting bracket and engine mounting bracket.

NOTE:

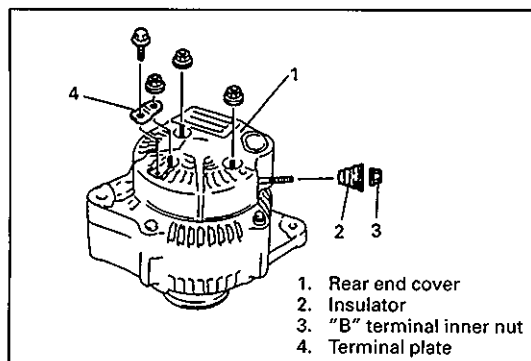
Set clamps as shown in left figure.

- 6) Install canister.
- 7) Install air inlet hose.
- 8) Connect negative (–) cable at battery.

DISASSEMBLY

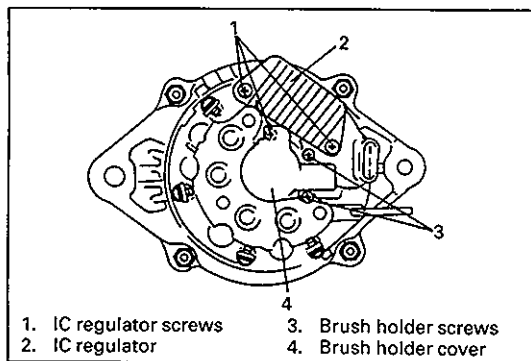


- | | |
|------------------------|------------------------|
| 1. Pulley nut | 12. Rear end frame |
| 2. Pulley | 13. Seal plate |
| 3. Drive end frame | 14. Rectifier |
| 4. Stator | 15. Insulator |
| 5. Stud bolt | 16. Regulator |
| 6. Drive end bearing | 17. Brush |
| 7. Bearing retainer | 18. Brush holder |
| 8. Rotor | 19. Brush holder cover |
| 9. End housing bearing | 20. Rear end cover |
| 10. Bearing cover | 21. Terminal plate |
| 11. Wave washer | |



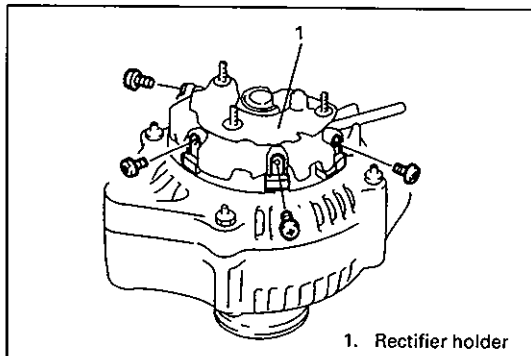
85F00-6H-15-1

- 1) Remove "B" terminal inner nut and insulator.
- 2) Remove terminal plate and rear end cover.



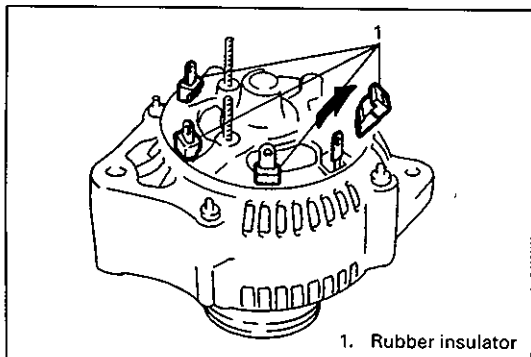
85F00-6H-15-2

- 3) Remove 2 screws and pull out brush holder assembly and remove brush holder seat.
- 4) Remove 3 screws and IC regulator.
- 5) Remove brush holder cover from brush holder.



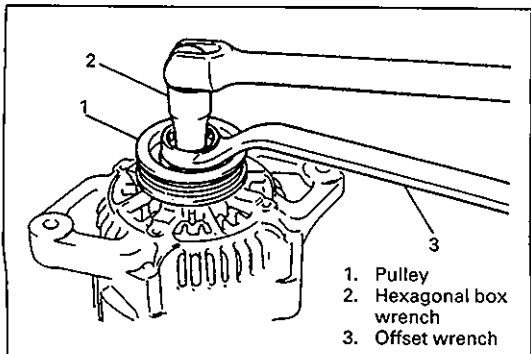
60G00-6H-15-3

- 6) Remove rectifier holder.



60G00-6H-15-4

- 7) Remove 4 rubber insulators.

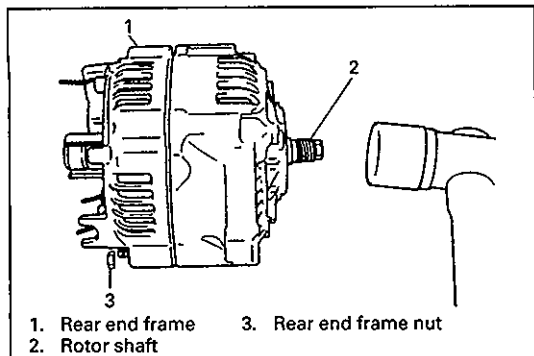


60G00-6H-15-5

- 8) Hold shaft by using hexagonal box wrench and remove pulley nut, and then pull out pulley.

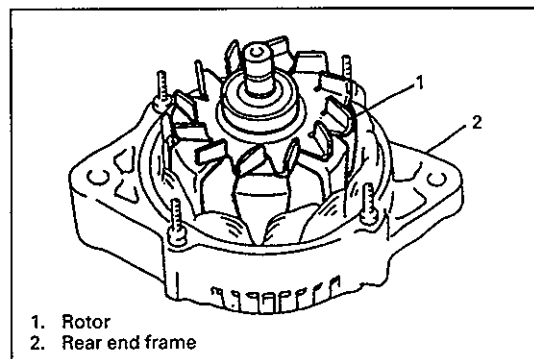
CAUTION:

- 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.



60G00-6H-16-1

- 9) Remove 4 rear end frame nuts.
- 10) Drive out rear end frame with rotor tapping shaft lightly by using plastic hammer.

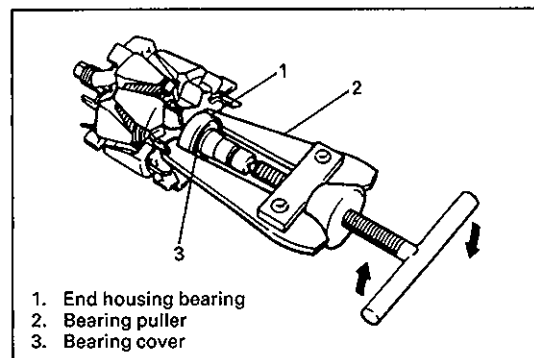


60G00-6H-16-2

- 11) 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.

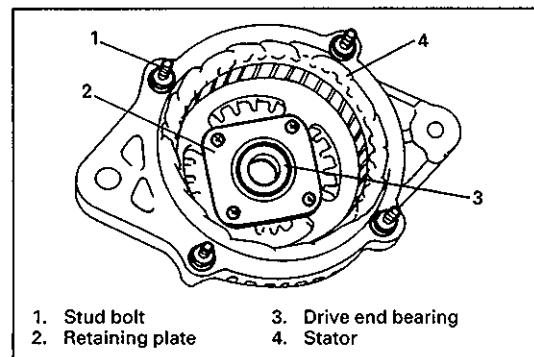


60G00-6H-16-3

- 12) 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.



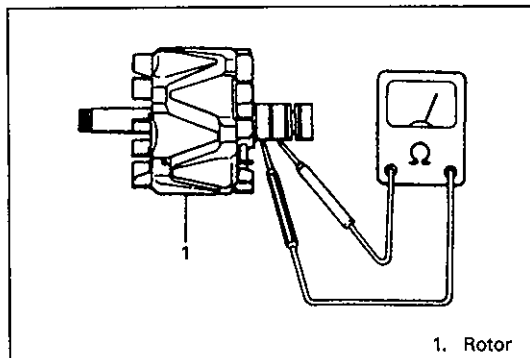
60G00-6H-16-4

- 13) If required, remove 4 screws, retainer plate and then drive out drive end bearing.

- 14) If required, remove stud bolts and then pull out stator.

NOTE:

Heating drive end frame may facilitate removal of stator.



60G00-6H-17-1

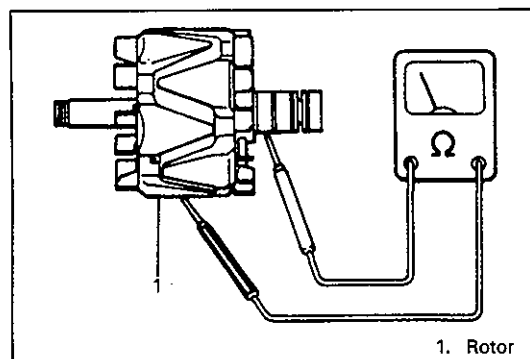
INSPECTION

1. ROTOR

Open Circuit

Using ohmmeter, check for continuity between slip rings of rotor. If there is no continuity, replace rotor.

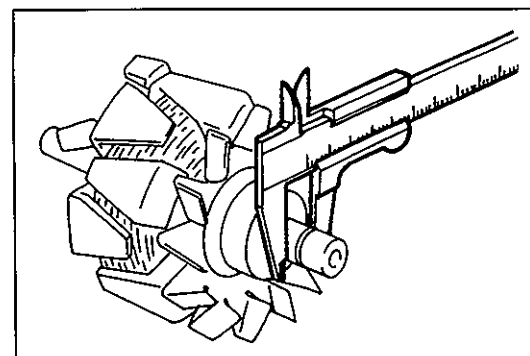
Standard resistance: About 2.9 Ω (at 20 °C (68 °F))



60G00-6H-17-2

Ground

Using ohmmeter, check that there is no continuity between slip ring and rotor. If there is continuity, replace rotor.



85F00-6H-17-3

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: 14.2 – 14.4 mm
(0.559 – 0.567 in.)**

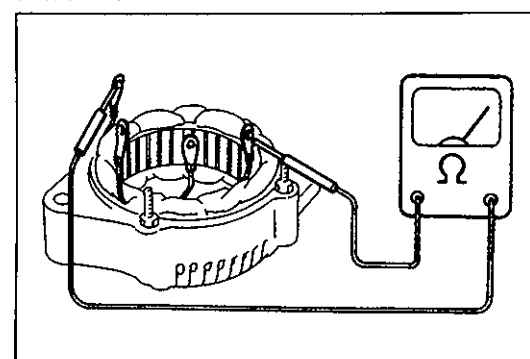
Minimum diameter: 12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.

2. STATOR

Open Circuit

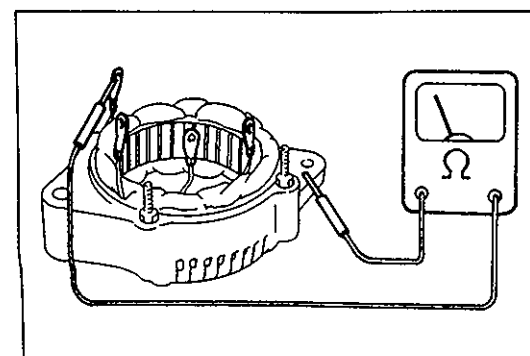
Using ohmmeter, check all leads for continuity. If there is no continuity, replace stator.



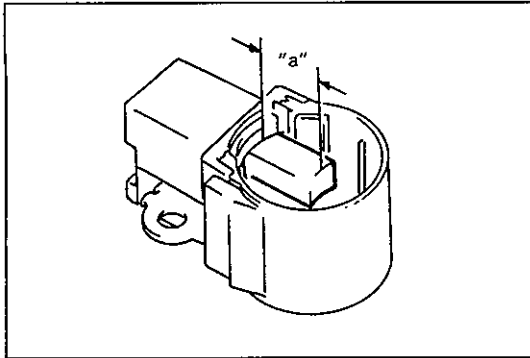
60G00-6H-17-4

Ground

Using ohmmeter, check that there is no continuity between coil leads and stator core. If there is continuity, replace stator.



60G00-6H-17-5



85F00-6H-18-1

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.

Exposed brush length "a"

Standard: 10.5 mm (0.413 in.)

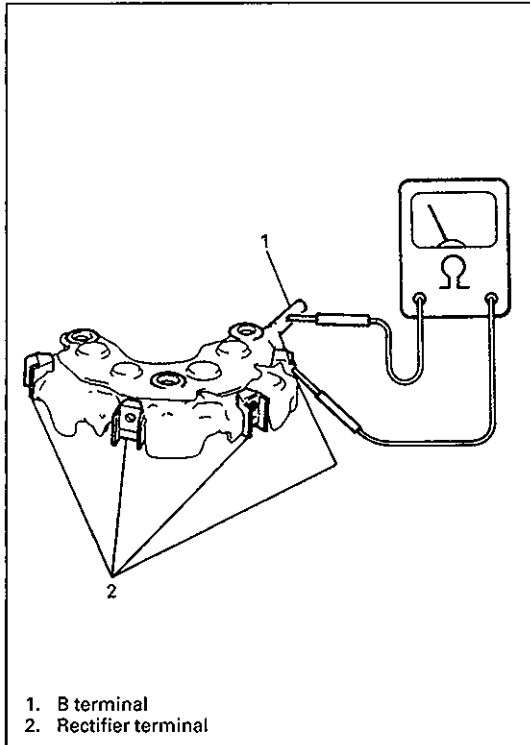
Limit: 9 mm (0.354 in.)

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.



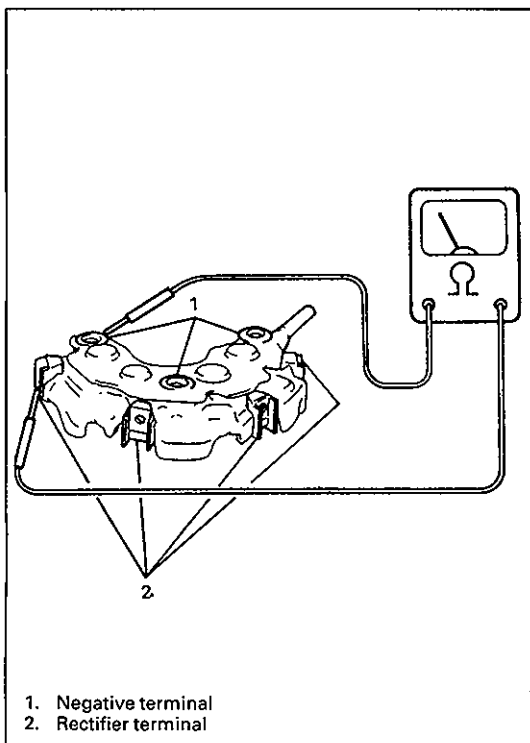
1. B terminal
2. Rectifier terminal

60G00-6H-18-2

Negative Rectifier

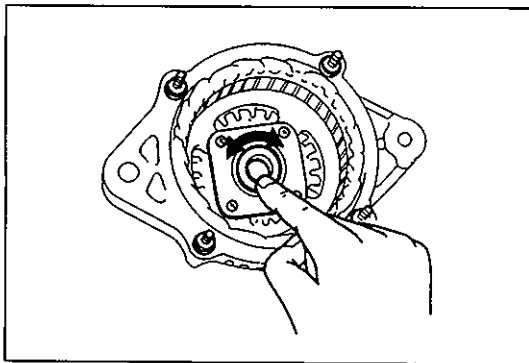
- 1) Using an ohmmeter, connect one tester probe to each negative terminal and the other to each rectifier terminal.
- 2) Reverse the polarity of the tester probes and repeat step 1).
- 3) Check that one shows continuity and the other shows no continuity.

If there is continuity, replace the rectifier holder.



1. Negative terminal
2. Rectifier terminal

60G00-6H-18-4

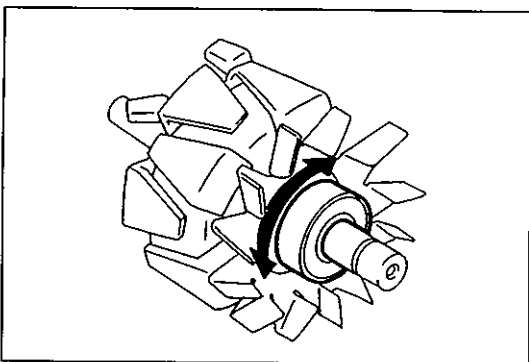


60G00-6H-19-1

5. BEARING

Drive End Bearing

Check that the bearing is not rough or worn.

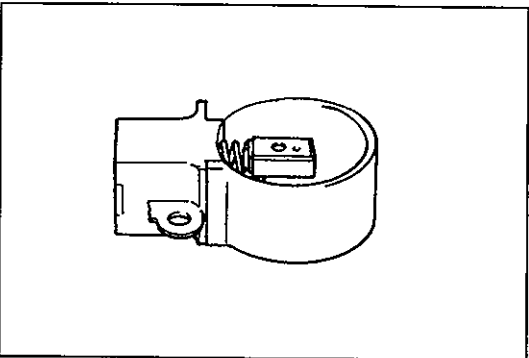


60G00-6H-19-2

End Housing Bearing.

Check that the bearing is not rough or worn.

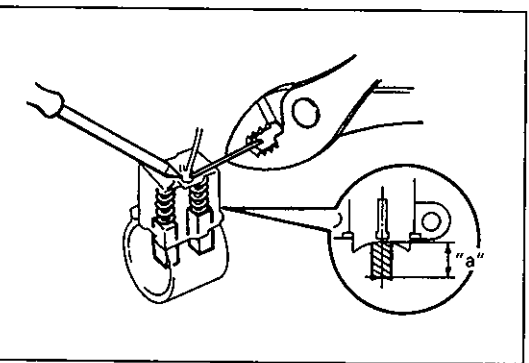
When removal is necessary, refer to 6H-16.



85F00-6H-19-3

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.

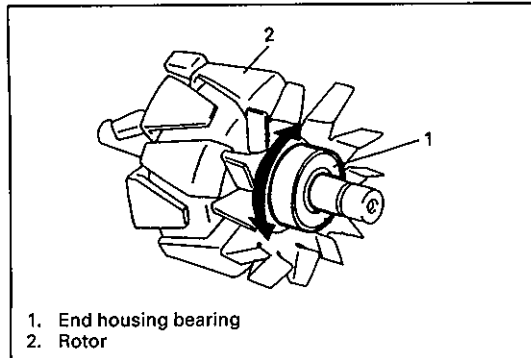


85F00-6H-19-4

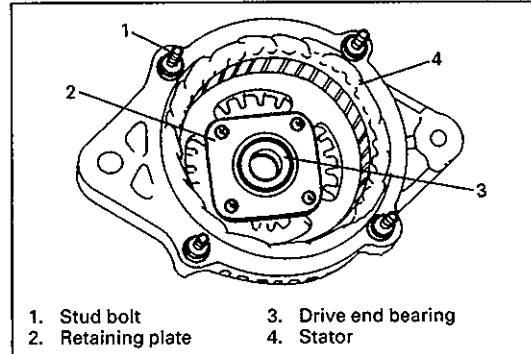
- 3) Solder the brush wire to the brush holder at specified exposed length.

Exposed length "a": 10.5 mm (0.413 in.)

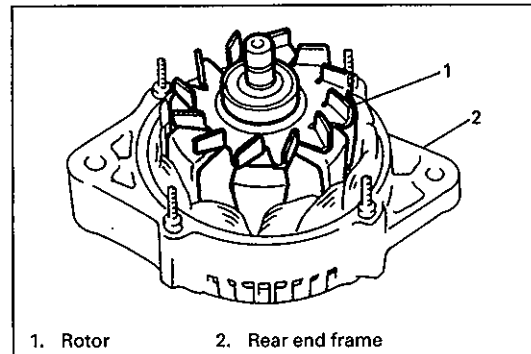
- 4) Check that the brush moves smoothly in the brush holder.
- 5) Cut off the excess wire.
- 6) Apply insulation paint to the soldered area.



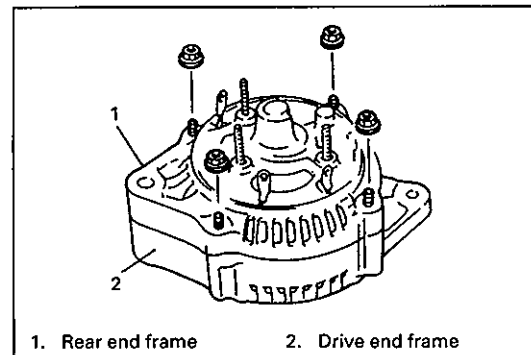
60G00-6H-20-1



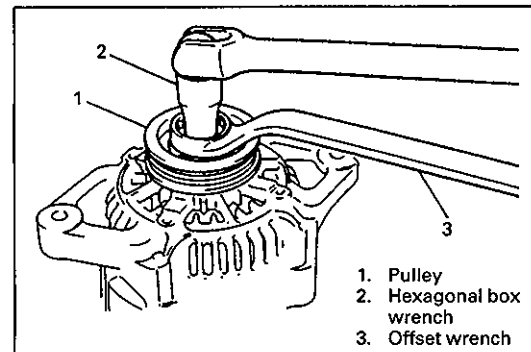
60G00-6H-20-2



60G00-6H-20-3



60G00-6H-20-4



85F00-6H-20-5

REASSEMBLY

- 1) If end housing bearing is removed, install it.
- 2) Check end housing bearing turns smoothly.

- 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.

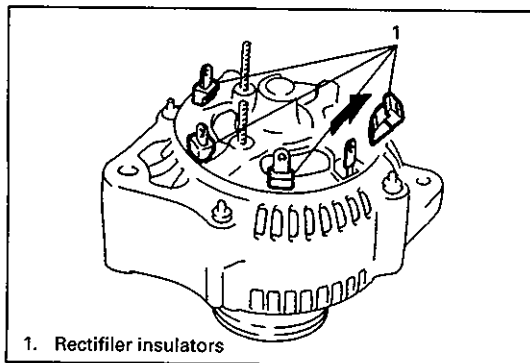
- 6) Place drive end frame on pulley, and then install rotor to drive end frame.

- 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)

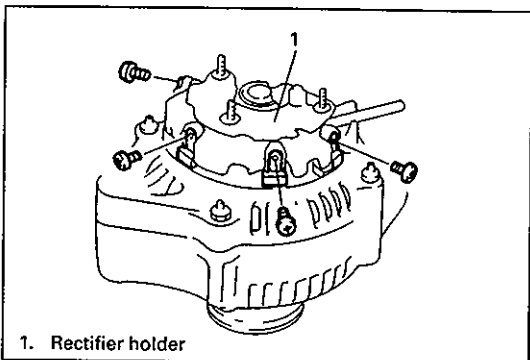
- 9) Install pulley and tighten pull nut with holding shaft by using hexagonal box wrench to specified torque.

Tightening Torque
111 N·m (11.1 kg-m, 80.5 lb-ft)



60G00-6H-21-1

10) Install 4 rubber insulators.

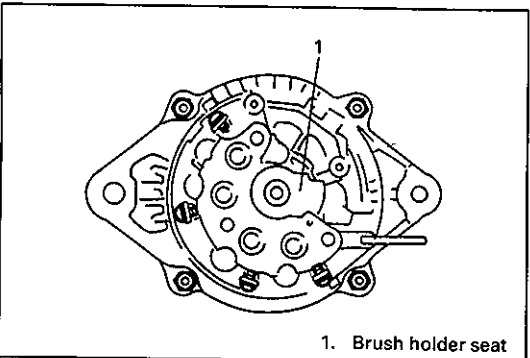


60G00-6H-21-2

11) Install rectifier holder.

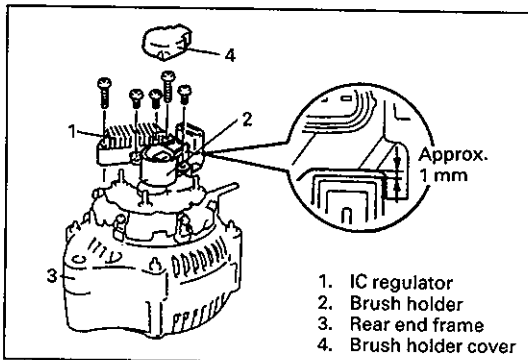
CAUTION:

When installing rectifier, check to confirm that stator leads have enough clearance with cooling fan blades.



85F00-6H-21-3

12) Install brush holder seat.

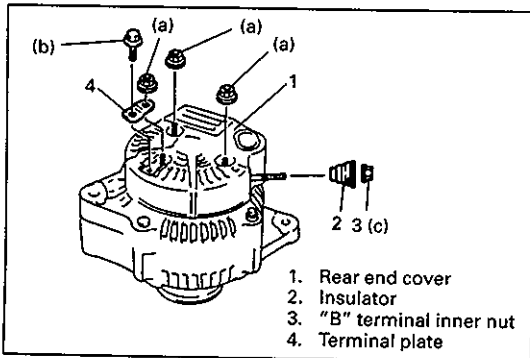


85F00-6H-21-4

13) Place the IC regulator together with the brush holder horizontally on the rear end frame.

14) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.

15) Install brush holder cover.



85F00-6H-21-5

16) Install rear end cover and terminal plate.

Tightening Torque

(a): 4.5 N·m (0.45 kg-m, 3.5 lb-ft)

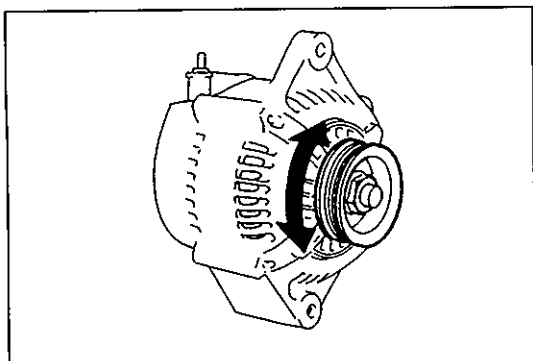
(b): 3.8 N·m (0.38 kg-m, 3.0 lb-ft)

17) Install insulator and tighten B terminal inner nut to specified torque.

Tightening Torque

(c): 4.0 N·m (0.4 kg-m, 3.0 lb-ft)

18) Make sure that rotor turns smoothly.



85F00-6H-22-1

SPECIFICATIONS

Rated voltage	12 V	Permissible ambient temperature	– 30 to 90 °C (– 22 to 194 °F)
Maximum output	85 A		
Permissible max. speed	18,000 rpm	Polarity	Negative ground
No-load speed	950 rpm	Rotation	Clockwise viewed from pulley side
Setting voltage	13.6 to 14.4 V		

85F00-6H-22-2

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg·m	lb·ft
1. Body ground bolt	8.0	0.8	6.0
2. Generator drive belt adjusting bolt	23	2.3	16.5
3. Generator mounting bolts and nut			
4. Generator bracket bolt			
5. "B" terminal inner nut	4.0	0.4	3.0
6. "B" terminal outer nut	8.0	0.8	6.0
7. Pulley nut	111	11.1	80.5
8. Rear end frame nuts	4.5	0.45	3.5
9. Rear end cover nuts	4.5	0.45	3.5
10. Terminal plate screw	3.8	0.38	3.0

85F00-6H-22-3

SECTION 6J

EMISSION CONTROLS

CONTENTS

GENERAL DESCRIPTION 6J-2

 Positive Crankcase Ventilation (PCV) System 6J-2

 Three Way Catalytic converter 6J-2

 Exhaust Gas Recirculation (EGR) System Refer to SECTION 6E2.

 Evaporative Emission Control System Refer to SECTION 6E2.

DIAGNOSIS Refer to SECTION 6 and SECTION 6E2.

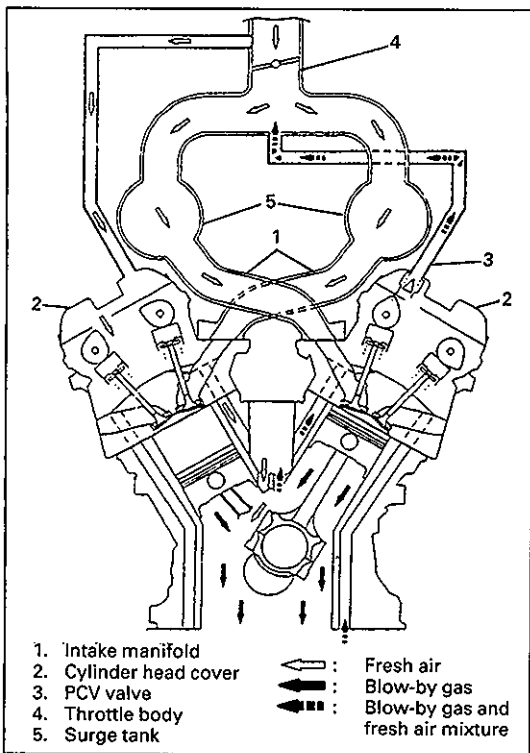
ON VEHICLE SERVICE 6J-3

 General 6J-3

 PCV System 6J-3

 EGR System Refer to SECTION 6E2.

 Evaporative Emission Control System Refer to SECTION 6E2.



85F00-6J-2-1

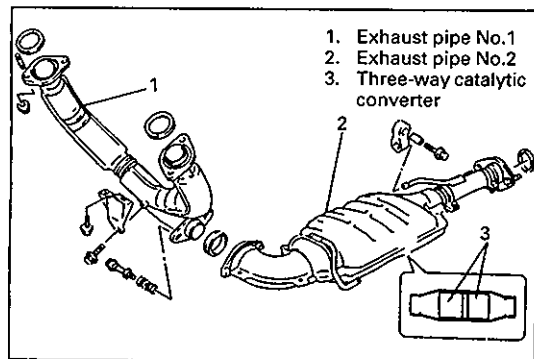
GENERAL DESCRIPTION

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

The term "blow-by gas" stands for the compressed gas and exploded gas which blow through cylinder-to-piston clearance, which contain a large amount of unburned gases such as CO and HC. The PCV (Positive Crankcase Ventilation) system is provided to prevent the blow-by gas from being emitted into atmosphere and it operates as follows.

When the vacuum in the intake manifold is low (throttle valve open), the PCV valve is wide open due to its spring force. Thus a large amount of the blow-by gas is drawn into the intake manifold.

On the other hand, when the vacuum in the manifold is high, the PCV valve opening is limited due to the high vacuum. Thus the amount of the blow-by gas drawn into the intake manifold is small.



85F00-6J-2-3

THREE WAY CATALYTIC CONVERTER

The three way catalytic converter is provided in the exhaust system (exhaust center pipe). The function of the catalyst is to reduce the emission of CO, HC and NO_x in the exhaust gas by oxidizing or converting them into CO₂, H₂O and N₂ respectively.

ON VEHICLE SERVICE

GENERAL

When the emission control hoses are disconnected and the system's component is removed for service, reinstall the component properly, and route and connect hoses correctly after service. Refer to SECTION 6E2 for proper routing of hoses.

85F00-6J-3-1

PCV SYSTEM

NOTE:

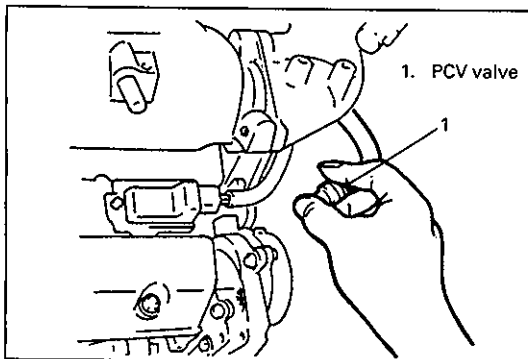
Be sure to check that there is no obstruction in PCV valve or its hoses before adjusting engine idle speed. For obstructed PCV valve or hose hampers its accurate adjustment.

60A20-6J-3-2

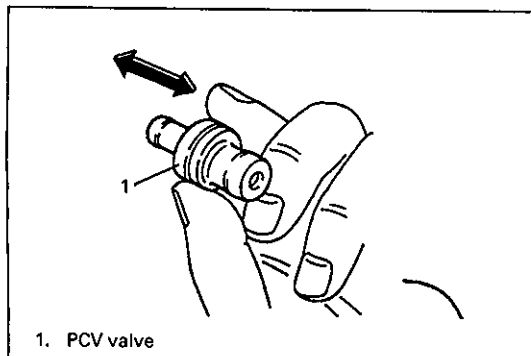
PCV HOSE

Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.

60A20-6J-3-3



85F00-6J-3-4



85F00-6J-3-5

PCV VALVE

- 1) Disconnect PCV valve, from left bank cylinder head cover.
- 2) Run engine at idle.
- 3) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve or hose. Replace as necessary.
- 4) After checking vacuum, stop engine and check PCV valve for sticking. Disconnect PCV valve from PCV hose. Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.
- 5) Connect PCV valve and PCV hose securely.

SECTION 6K

EXHAUST SYSTEM

CONTENTS

GENERAL DESCRIPTION 6K-1

MAINTENANCE 6K-2

ON VEHICLE SERVICE 6K-3

60A20-6K-1-1

GENERAL DESCRIPTION

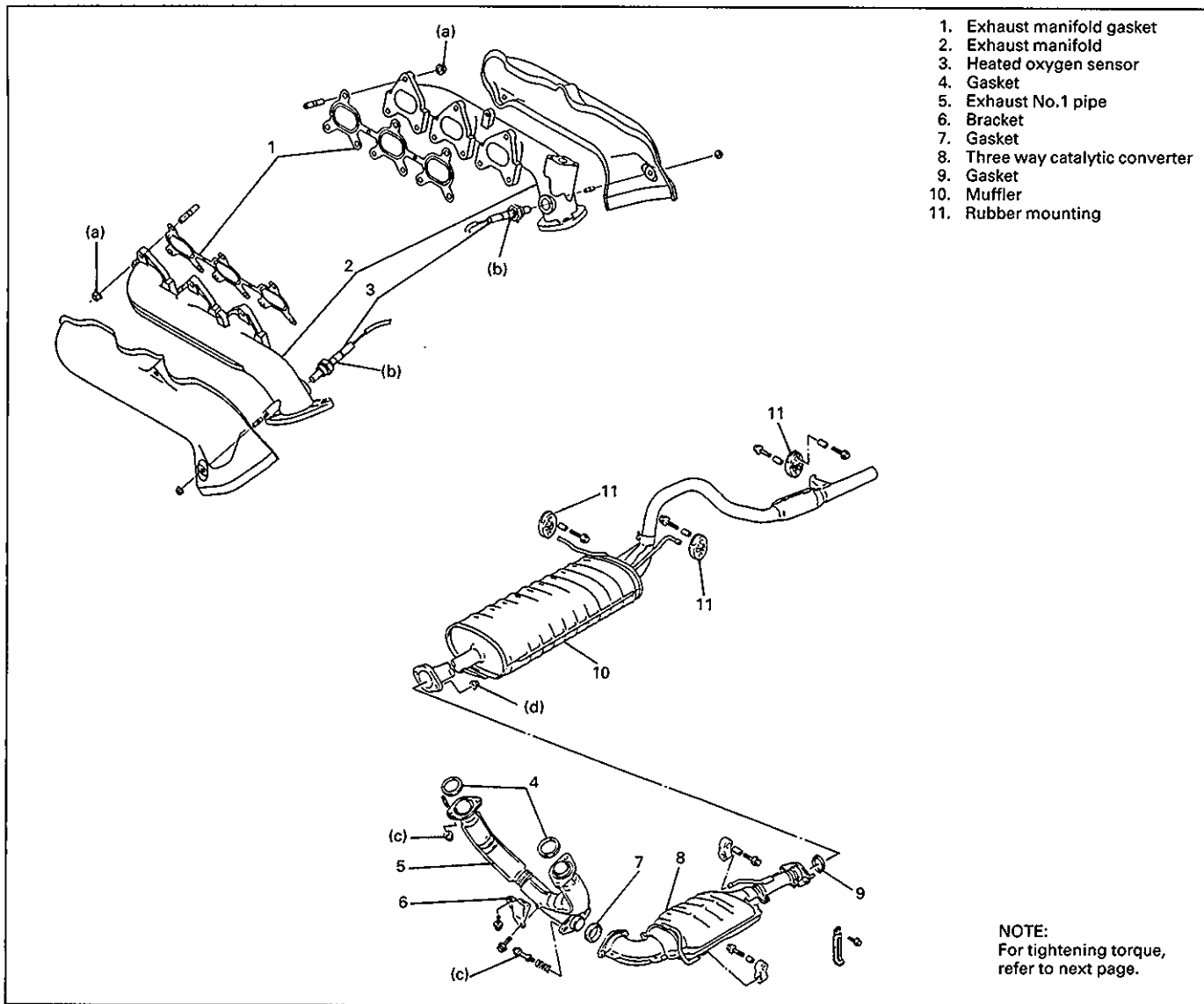
The exhaust system consists of an exhaust manifold, an exhaust No. 1 pipe a three way catalytic converter, a muffler, a tail pipe, and seals and gaskets etc.

The three way catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon

85F00-6K1-2

Monoxide (CO), and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

THE CATALYTIC CONVERTER REQUIRES USE OF UNLEADED FUEL ONLY.



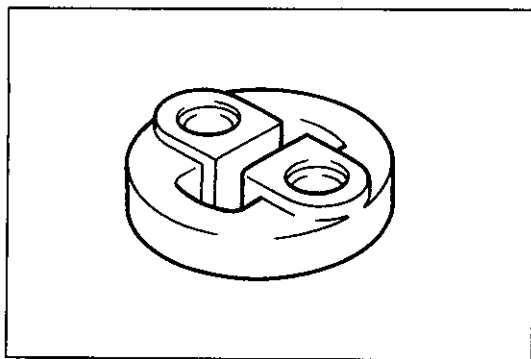
85F00-6K-2-1

MAINTENANCE

WARNING:

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

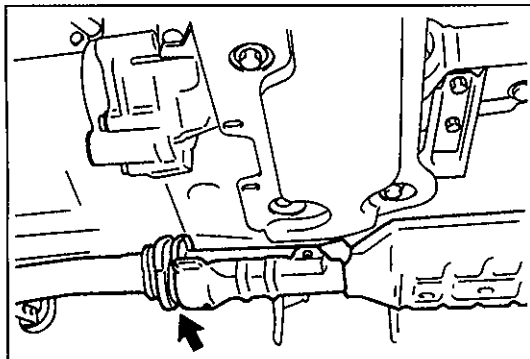
60A20-6K-2-1



At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage, deterioration, and out of position.

86F00-6K-2-5



85F00-6K-3-1

- Check exhaust system for leakage, loose connection, dent and damage.
If bolts or nuts are loosened, tighten them to specified torque.
Refer to "ON VEHICLE SERVICE" for torque data.

- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

60A20-6K-2-4

ON VEHICLE SERVICE

WARNING:

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

Tightening Torque

- (a): 30 N·m (3.0 kg-m, 21.5 lb-ft)
- (b): 45 N·m (4.5 kg-m, 32.5 lb-ft)
- (c): 50 N·m (5.0 kg-m, 36.0 lb-ft)
- (d): 60 N·m (6.0 kg-m, 43.0 lb-ft)

85F00-6K-3-3

EXHAUST MANIFOLD

Refer to Section 6A2 for removal and installation procedures. Before installation, check gasket and seal for deterioration or damage. Replace them as necessary.

60A20-6K-3-4

MUFFLER

CAUTION:

As muffler center pipe has three way catalytic converter in it, it should not be exposed to any impulse. Be careful not to drop it or hit it against something.

Refer to figure of previous page for removal and installation.

60A20-6K-3-5

SECTION 7A

MANUAL TRANSMISSION

NOTE:
For the descriptions (items) not found in this section of this manual, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

85F00-7A-1-1

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Engine Rear Mounting	7A-2
UNIT REPAIR OVERHAUL	7A-3
Dismounting of Trans. Unit	7A-3
Remounting	7A-6

85F00-7A-1-2

ON VEHICLE SERVICE

ENGINE REAR MOUNTING

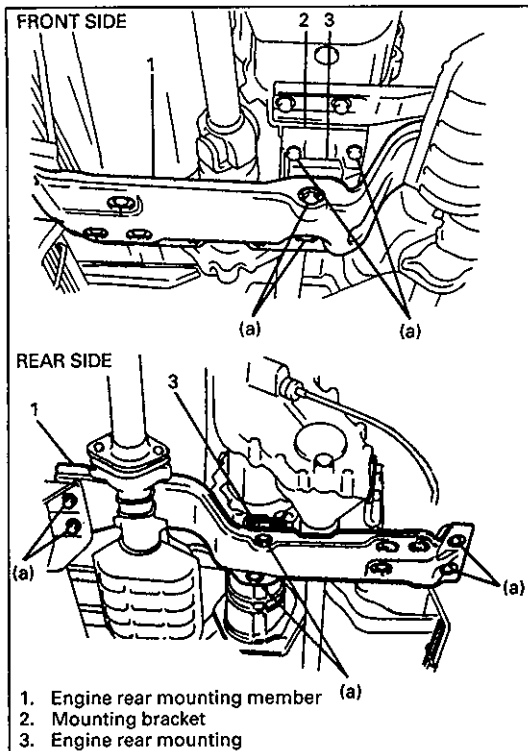
1. When replacement of mounting parts are necessary, torque bolts and nut as specified below.

NOTE:

Install torque stopper loosely first, remove any tension, twist motion and rubber to rubber contact, and then tighten it.

Tightening Torque

(a): 50 N·m (5.0 kg-m, 36.0 lb-ft)



85F00-7A-2-1

UNIT REPAIR OVERHAUL

DISMOUNTING OF TRANS. UNIT

IN CABIN

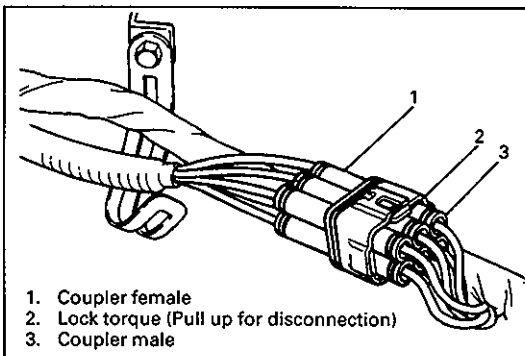
Remove transmission shift control lever (refer to page 7A-7) and transfer shift control lever knob.

85F00-7A-3-1

IN ENGINE ROOM

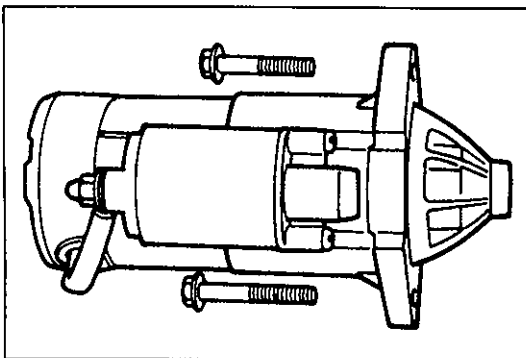
1. Disconnect negative cable at battery.
2. Remove breather hose from clamp.

85F00-7A-3-2



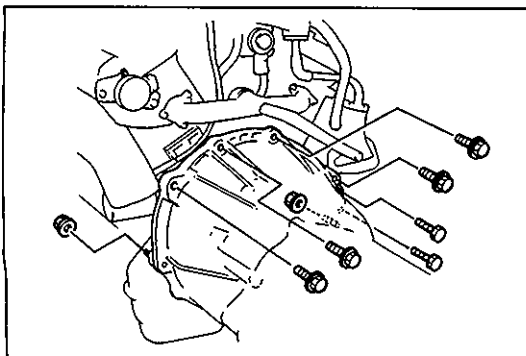
3. Disconnect wiring harness coupler.

85F00-7A-3-3



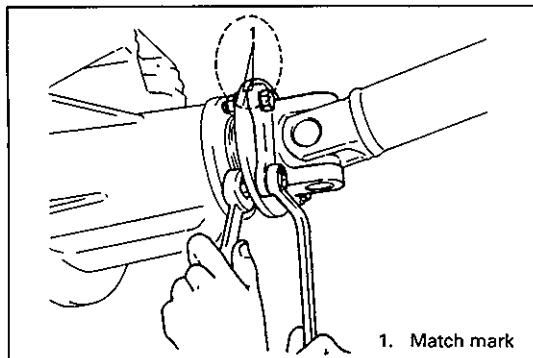
4. Remove starter motor fixing nuts and remove starter.

85F00-7A-3-4



5. Remove transmission fastening bolts.

85F00-7A-3-5



86F00-7A-4-1

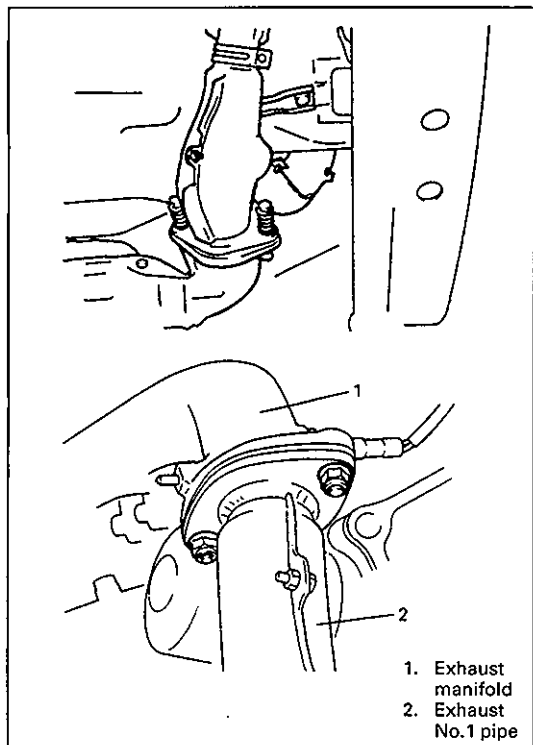
ON LIFT

1. Drain oil from transmission and transfer.
2. Give match marks on joint flange and propeller shaft as shown in figure. (front and rear)
3. Remove flange bolts of rear propeller shaft universal joint and pull out propeller shaft.
4. Remove flange bolts of front propeller shaft universal joint and pull out propeller shaft.

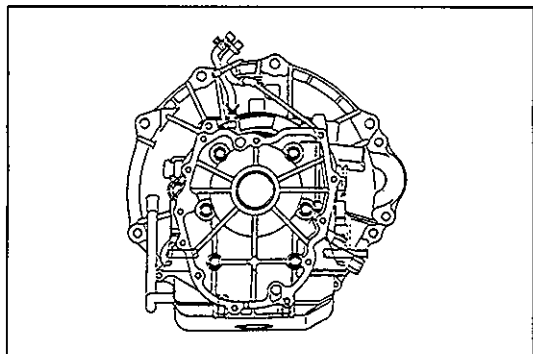
NOTE:

- It is not necessary to drain transmission oil when dismounting transmission and transfer for clutch maintenance only.
- Work without draining transfer oil is possible if front propeller shaft is dismantled together with transmission and transfer.

5. Drain clutch fluid. Refer to Section 7C.
6. Disconnect clutch hose at clutch operating cylinder. Refer to Section 7C.
7. Remove clutch housing lower plate.
8. Take off exhaust No.1 pipe.

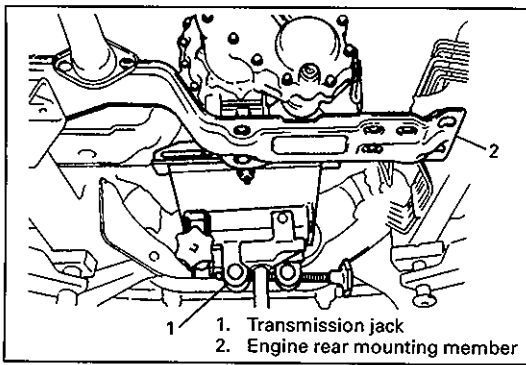


85F00-7A-4-3



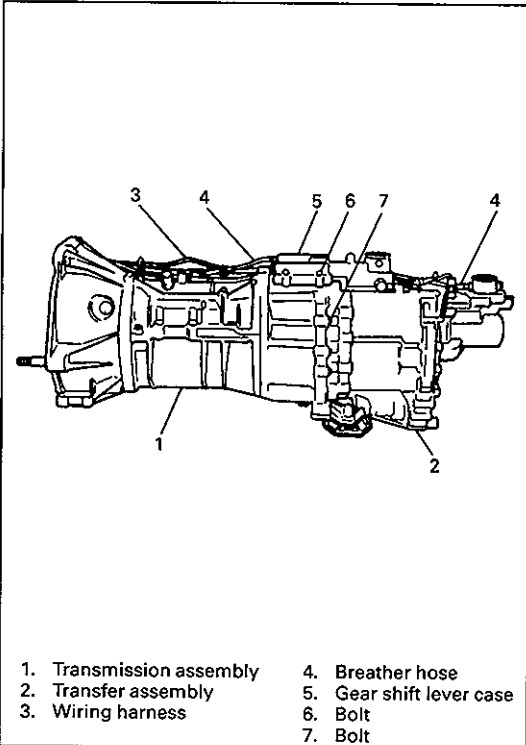
85F00-7A-4-5

9. Remove nuts from joint with engine.
10. Remove nut where meter cable is connected and disengage cable from transfer.



85F00-7A-5-1

10. Apply transmission jack and remove engine rear mounting member by taking off its bolts.
11. After removing mounting member, move rearward transmission and transfer assemblies placed on jack and then lower them.



60A40-7A-15-2

12. Remove wiring harness and breather hose.
13. Separate gear shift lever case and transfer assembly from transmission.

REMountING

For remounting, reverse dismounting procedure.
Use specified torques as given below.

Tightening Torque

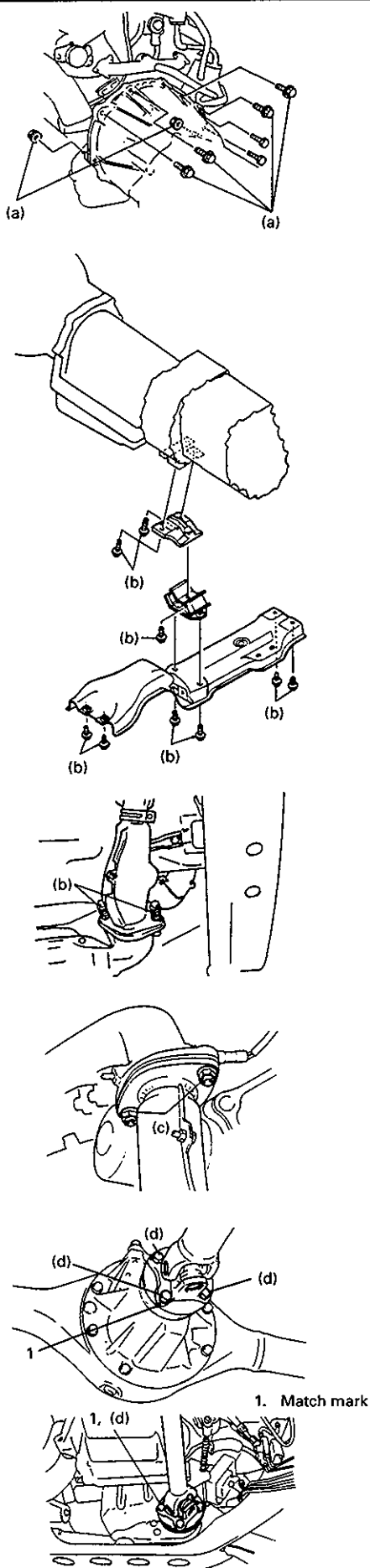
(a): 80 N·m (8.0 kg-m, 58.0 lb-ft)

(b): 50 N·m (5.0 kg-m, 36.0 lb-ft)

(c): 60 N·m (6.0 kg-m, 43.0 lb-ft)

(d): 55 N·m (5.5 kg-m, 40.0 lb-ft)

- Set each clamp for wiring, hose and cable securely.
- Set clamp for shift control lever boots securely.



SECTION 7B1

AUTOMATIC TRANSMISSION (4 A/T)

NOTE:

For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

85F00-7B1-1-1

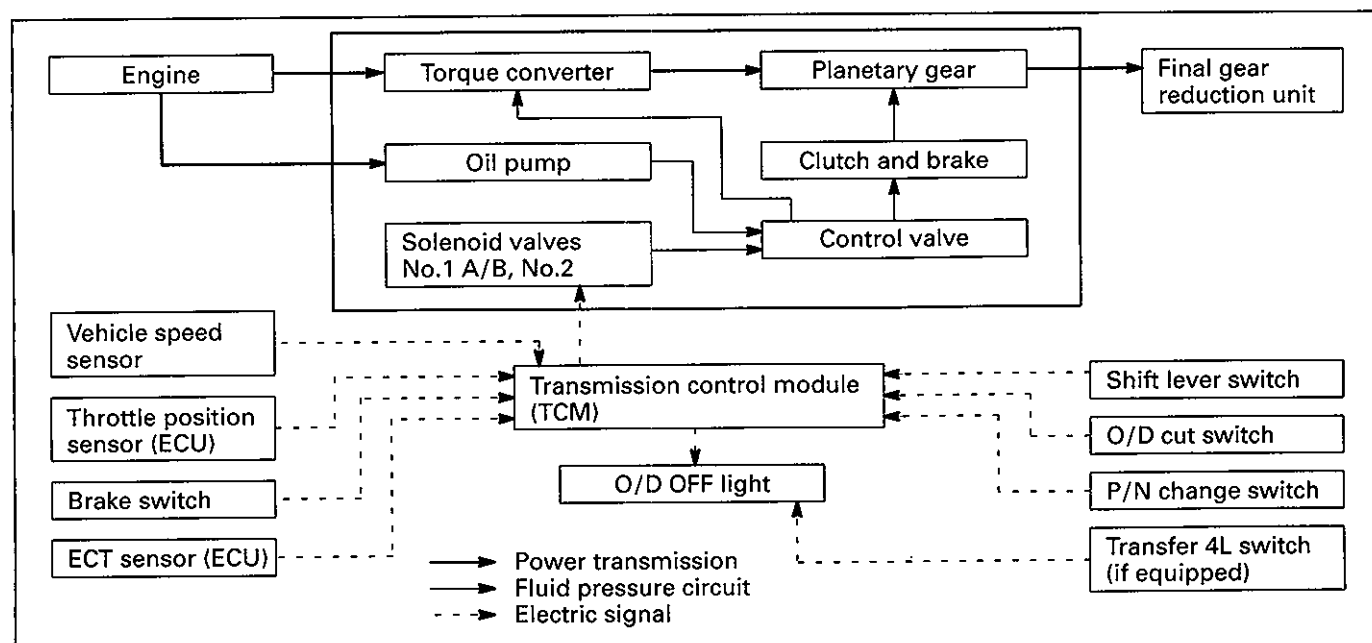
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GENERAL DESCRIPTION

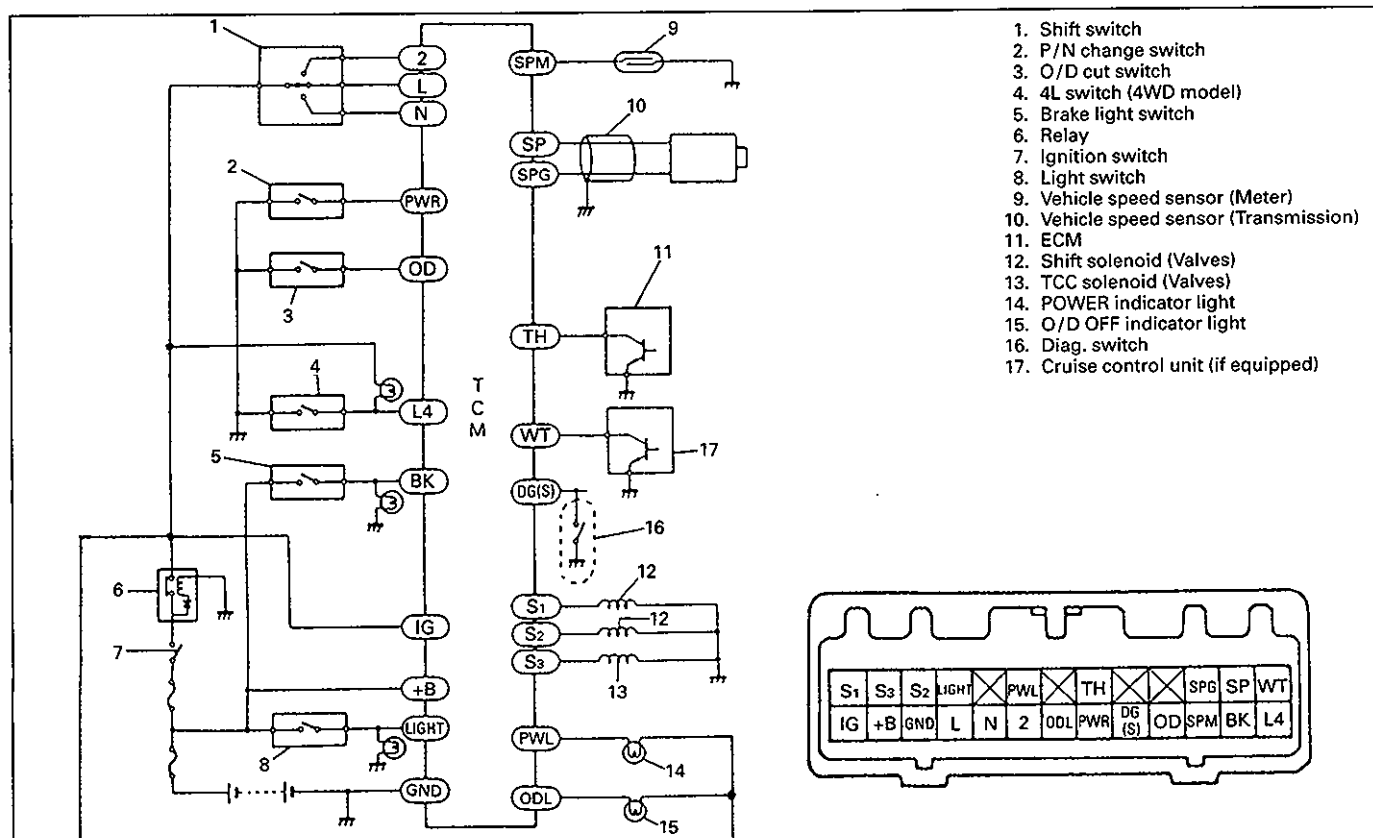
ELECTRONIC SHIFT CONTROL SYSTEM



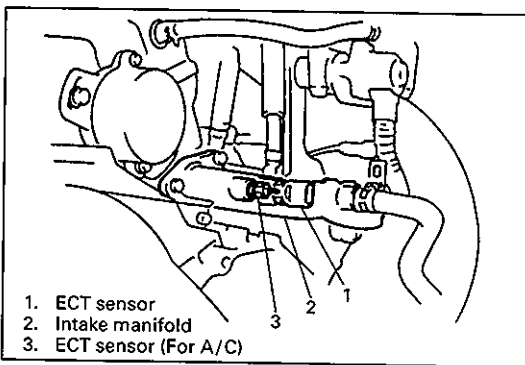
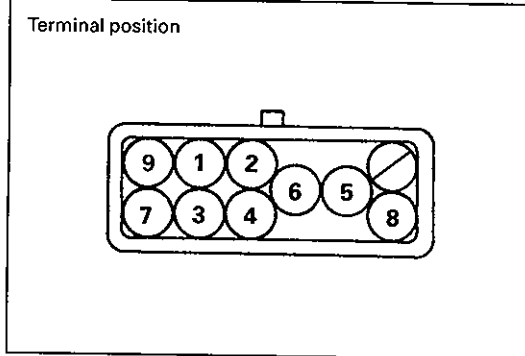
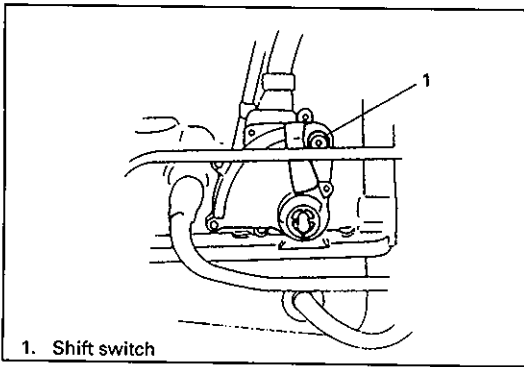
85F00-7B1-2-1

TRANSMISSION CONTROL MODULE (TCM)

The TCM is an electronic circuit component that controls gear shift and idle-up according to the signal from each sensor. It is a microcomputer consisting of an IC, transistor, diode, etc. It is installed at the right side of the steering column on LH steering vehicle and at the left side of the steering column on RH steering vehicle.



85F00-7B1-2-2



Shift Switch

A shift switch is provided so that the engine can be started only when the shift lever is in the "P" or "N" position.

Terminal position	6	5	9	8	4	7	3	2	1
P	○	○	○	○					
R			○	○	○				
N	○	○	○	○		○			
D			○	○			○		
2			○	○				○	
L			○	○					○

Engine Coolant Temperature Sensor (ECT Sensor)

The coolant temperature sensor of the electronic fuel injection system is used and it prevents gear change to the O/D gear and lock-up when the engine coolant temperature is 30°C (86°F) or lower.

AUTOMATIC GEAR SHIFT DIAGRAM

Automatic shift schedule as a result of shift control is shown below. In case that select lever shifted to L at a speed higher than 55 km/h (34 mile/h), 2nd gear operates first and then down shifts to 1st at a speed lower than that. No up shift is available in L.

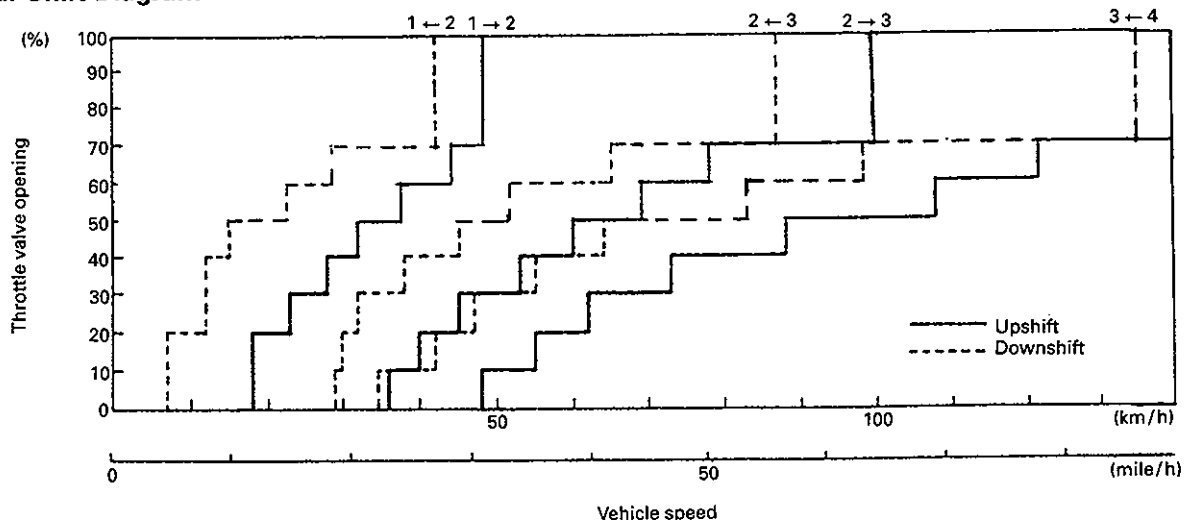
The same as, the select lever shifted to 2 at a speed higher than 105 km/h (66 mile/h), 3rd gear operates first and then down shifts to 2nd at a speed lower than that. No up shift is available in 2.

Power Mode

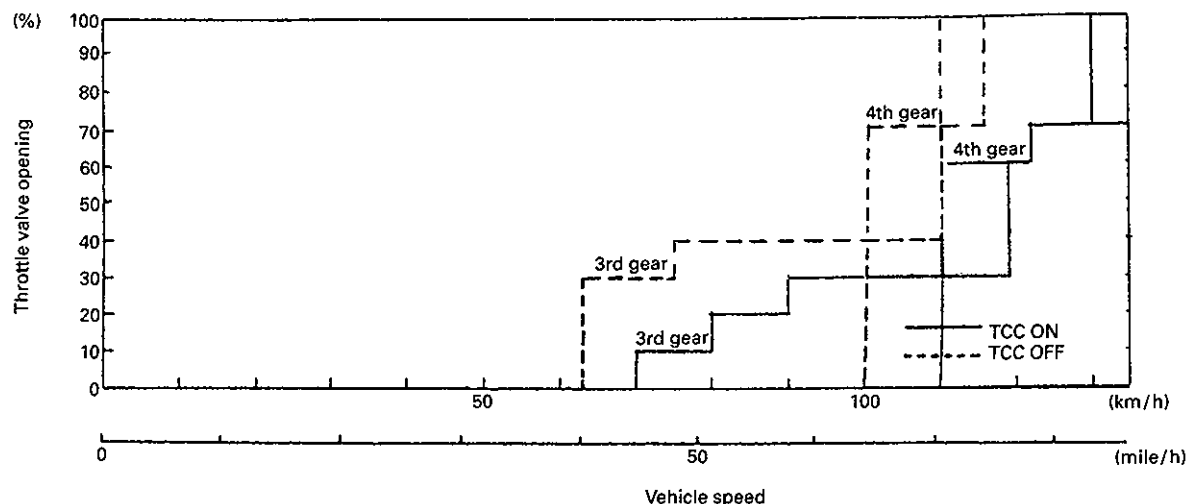
Unit: km/h
(mile/h)

Shift Throttle opening	1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
Full throttle	48 (30)	100 (63)	— —	135 (84)	88 (55)	43 (27)
Closed throttle	18 (11)	36 (23)	48 (30)	35 (22)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram

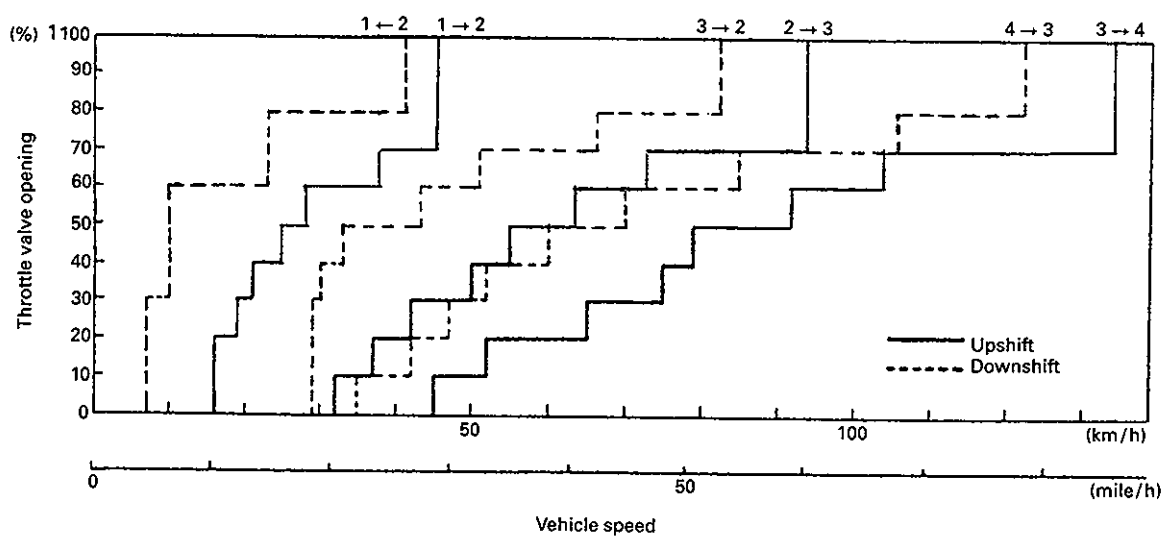


Normal Mode

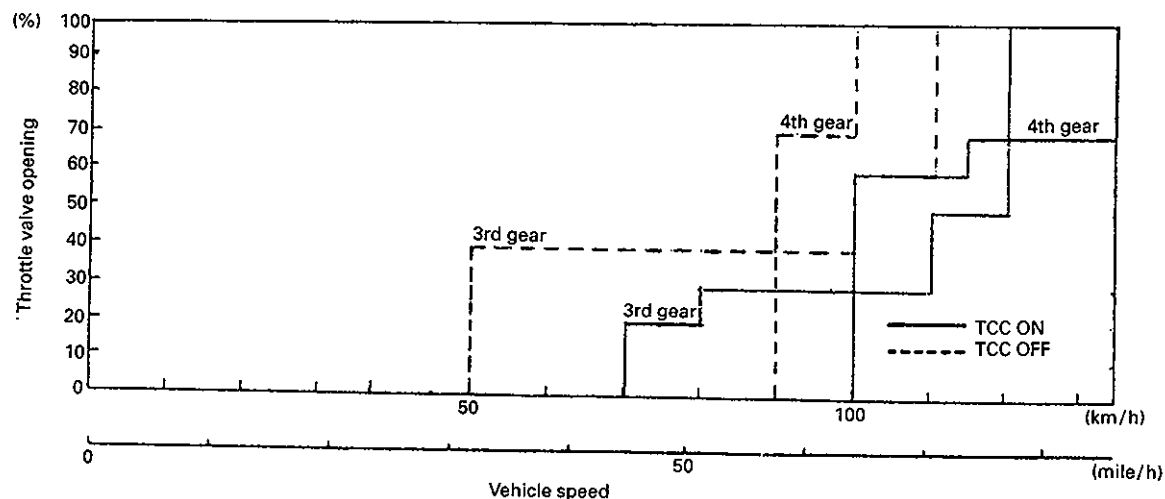
Unit: km/h
(mile/h)

Shift \ Throttle opening	1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
Full throttle	46 (29)	94 (59)	135 (84)	123 (77)	82 (51)	41 (26)
Closed throttle	16 (10)	32 (20)	45 (28)	35 (22)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram



DIAGNOSIS

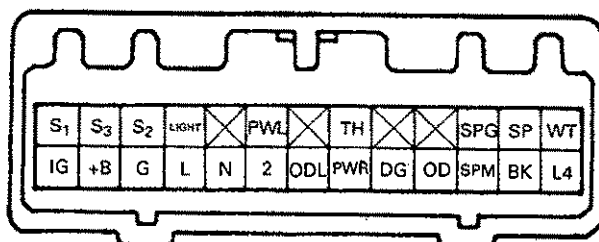
ELECTRONIC SHIFT CONTROL SYSTEM

Diagnostic Trouble Code Table

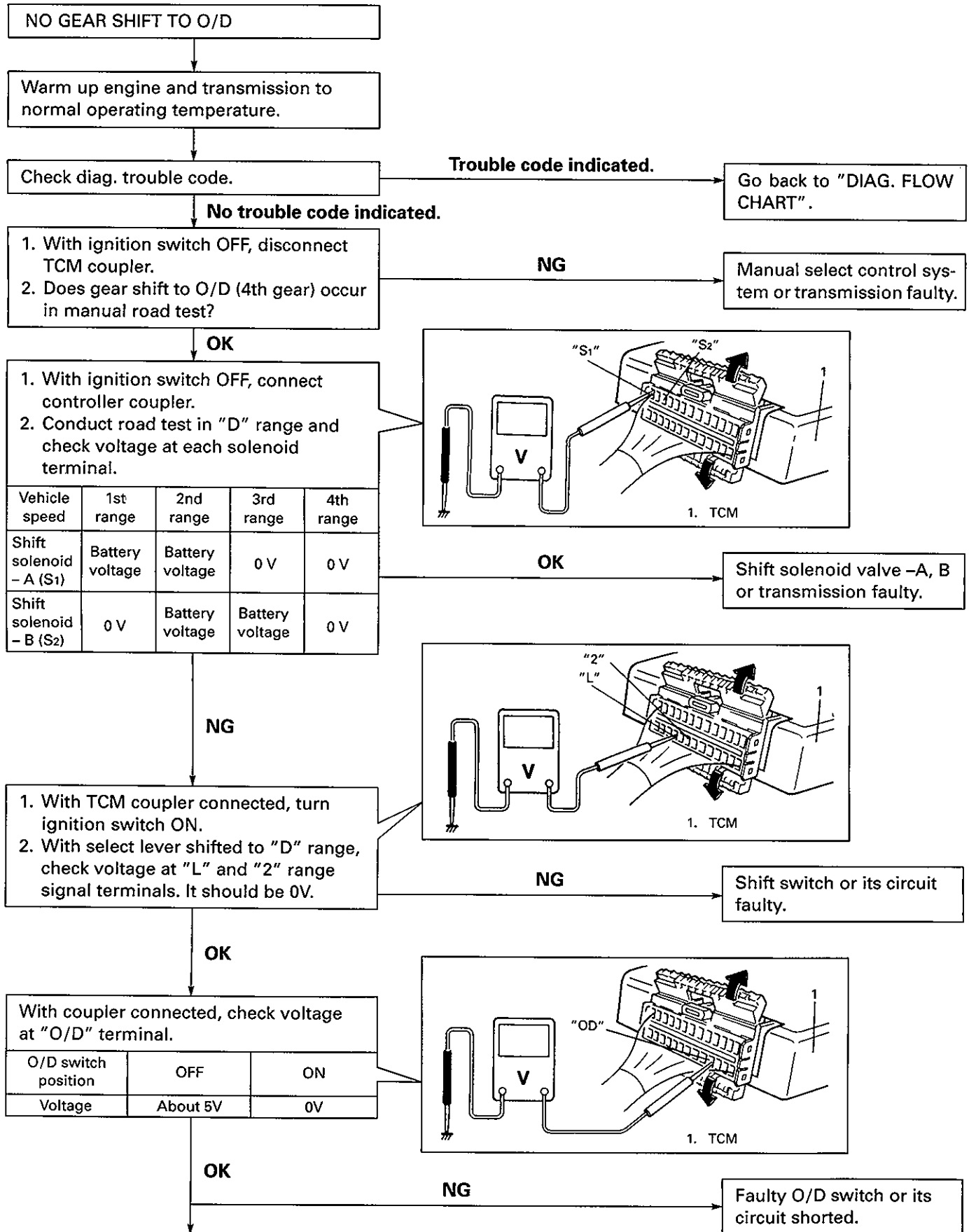
Code No.	Diagnostic Area	Diagnosis	Fail-Safe Function
12	—	Normal	—
21	Solenoid valve No.1 – A (Shift solenoid valve – A)	Shift solenoid – A opened	Shift solenoid valve – B 1st, 2nd and 3rd gears ON, 4th (O/D) gear OFF. For shift position, refer to same section of Service Manual mentioned in FORE- WORD of this manual.
22		Shift solenoid – A short-circuit	
23	Solenoid valve No.1 – B (Shift solenoid valve – B)	Shift solenoid – B opened	Shift solenoid valve – A 1st gear ON, 2nd, 3rd and 4th gears OFF. For shift position, refer to same section of Service Manual mentioned in FORE- WORD of this manual.
24		Shift solenoid – B short-circuit	
25	Solenoid valve No.2 (TCC solenoid valve)	TCC solenoid opened	TCC solenoid valve OFF.
26		TCC solenoid short- circuit	
31	Vehicle speed sensor	Defective sensor (sig- nal from A/T discon- nected) or short-circuit	Signal from speedometer sensor is used.
36		Defective both sensors (signal from A/T and speedometer discon- nected or short-circuit)	—
32	Throttle position sensor	Defective sensor, short- circuit or defective en- gine control module	Throttle opening is controlled as closed.
33		Defective sensor, open circuit or defective engine control module	
34	Shift switch	Defective switch (more than two shift switches of "N, 2 and L" turned ON simultaneously) or short-circuit	Priority order is "L, 2 and N".
51	Wire of ECM to A/T controller	Open circuit of ECM to A/T controller	4th (O/D) gear OFF.

85F00-7B1-6-1

Terminal Positions

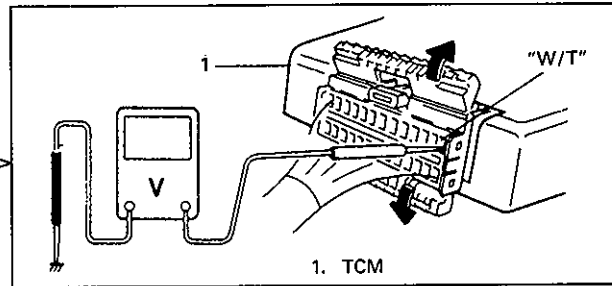


85F00-7B1-6-2

DIAGNOSTIC FLOW CHART C

Continued

With coupler connected, check voltage at "W/T" terminal.			
Engine coolant temp.	Below 0°C (32°F)	Below 25°C (77°F) Above 0°C (32°F)	Above 30°C (86°F)
Voltage	0 V	About 4 V	About 8 V



NG

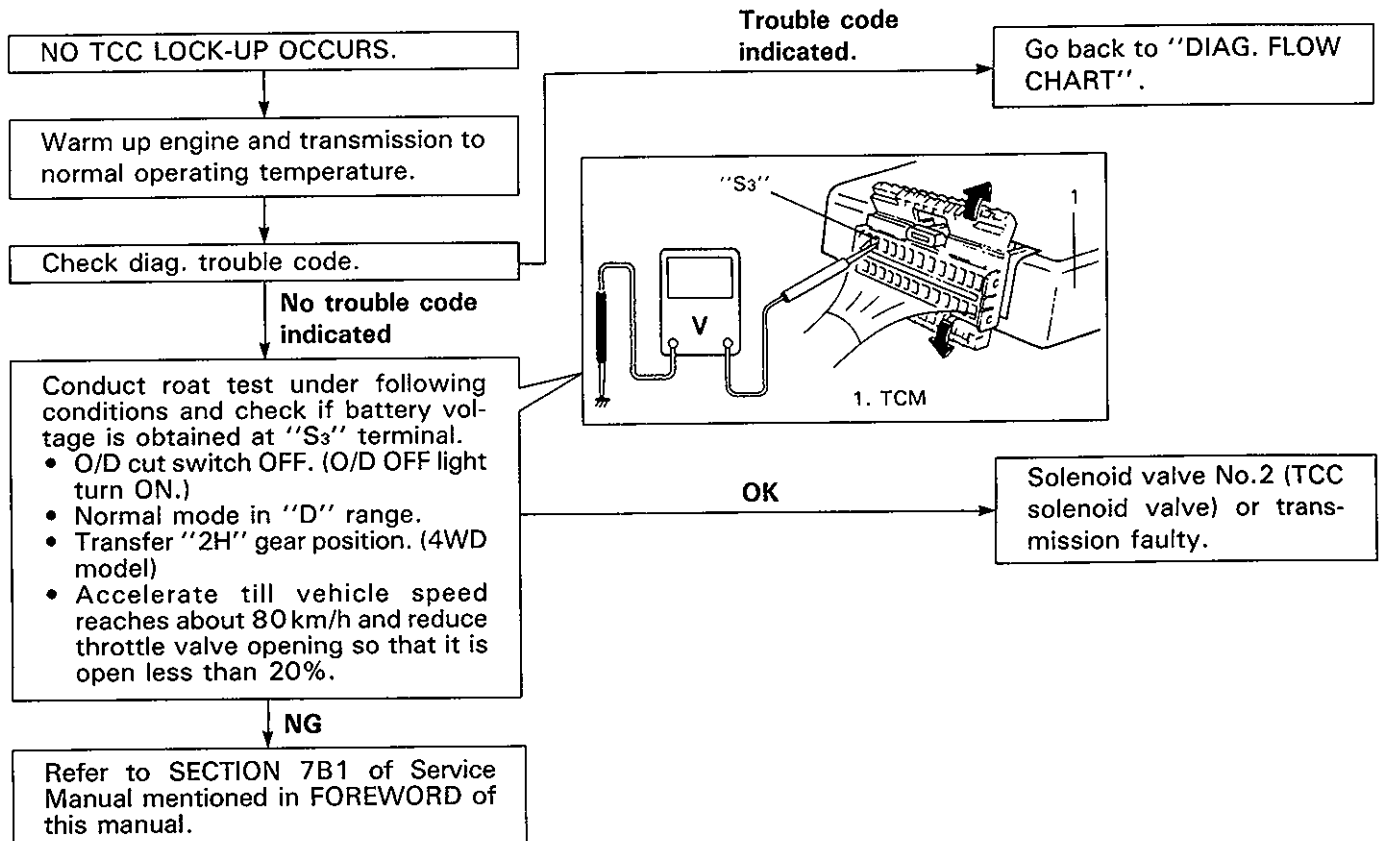
ECT sensor or engine control module faulty or its circuit shorted.

OK

Recheck TCM and recheck.

85F00-7B1-8-1

DIAGNOSTIC FLOW CHART D



ON VEHICLE SERVICE

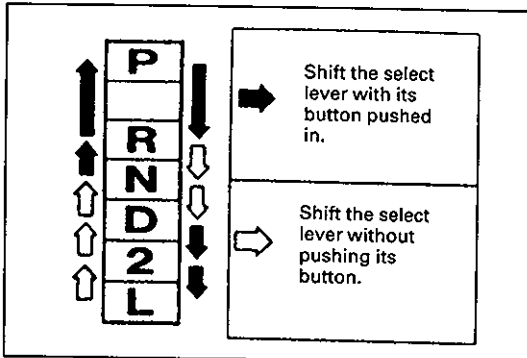
MAINTENANCE SERVICE

FLUID LEVEL

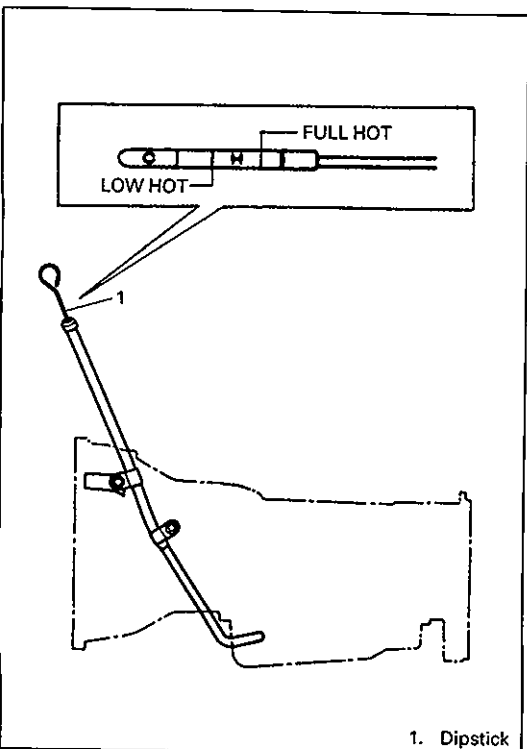
LEVEL CHECK AT NORMAL OPERATING TEMPERATURE

- 1) Stop vehicle and place it level.
- 2) Apply parking brake and place chocks against wheels.
- 3) With selector at P position, start engine.
- 4) Warm up engine till fluid temperature reaches normal operating temperature (70 – 80°C/158 – 176°F). As a guide to check fluid temperature, warm up engine till engine coolant temperature meter indicates around 1 unit above C point.

60A90-7B1-71-1S



85F00-7B1-9-3



1. Dipstick

85F00-7B1-9-4

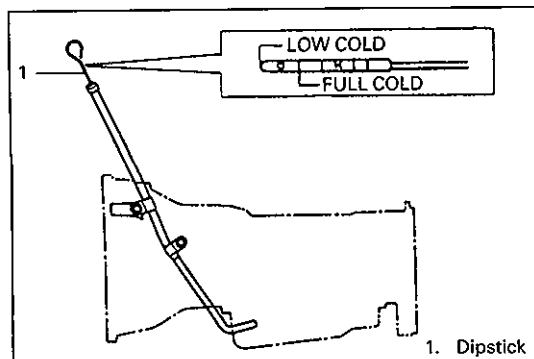
- 5) Keep engine idling and shift selector lever slowly to L and back to P position.
- 6) With engine idling, pull out dipstick, wipe it off with a clean cloth and put it back into place.

- 7) Pull out dipstick again and check fluid level indicated on it. Fluid level should be between FULL HOT and LOW HOT. If it is below LOW HOT, add an equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III up to FULL HOT.

Fluid specification
An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III

NOTE:

- **DO NOT RACE ENGINE** while checking fluid level, even after the engine start.
- **DO NOT OVERFILL.** Overfilling can cause foaming and loss of fluid through breather. Then slippage and transmission failure can result.
- Bringing the level from LOW HOT to FULL HOT requires 0.3 liters (0.64 / 0.53 US / Imp. pt).
- If vehicle was driven under high load such as pulling a trailer, fluid level should be checked about half an hour after the vehicle has stopped.



85F00-7B1-10-1

LEVEL CHECK AT ROOM TEMPERATURE

The fluid level check at room temperature performed after repair or fluid change before test driving is just preparation for level check of normal operating temperature. The checking procedure itself is the same as that described previously. If the fluid level is between FULL COLD and LOW COLD, proceed to test drive. And when the fluid temperature has reached the normal operating temperature, check fluid level again and adjust it as necessary.

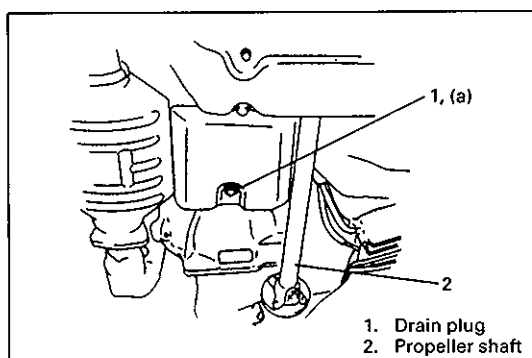
FLUID CHANGE INTERVALS

The transmission operating temperature resulting from the type of driving conditions under which the vehicle is used, is the main consideration in establishing the proper frequency of transmission fluid changes.

Change the transmission fluid every 25,000 km (15,000 miles) or 15 months if the vehicle is usually driven under one or more of the following conditions which are considered severe transmission service.

- 1) In heavy city traffic. Where the outside temperature regularly reaches 32°C (90°F).
- 2) In very hilly or mountainous areas.
- 3) Frequent trailer pulling.
- 4) Commercial use, such as taxi, police vehicle, delivery service, or rent-a-car. If the vehicle is not used under any of these conditions, change the fluid every 166,000 km (100,000 miles).

60A90-7B1-72-2S



85F00-7B1-10-4

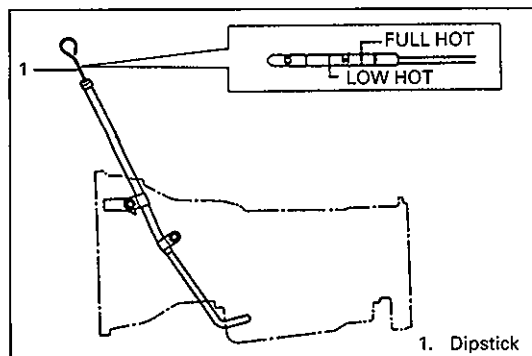
CHANGING FLUID

- 1) Lift up vehicle.
- 2) With engine cool, remove drain plug from oil pan and drain A/T fluid.
- 3) Install drain plug.

Tightening Torque

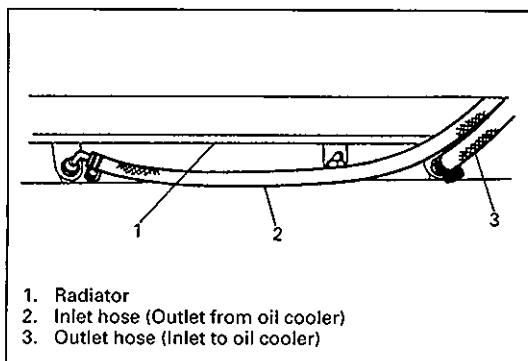
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

- 4) Lower vehicle and fill proper amount of an equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III.
- 5) Check fluid level according to procedure described under LEVEL CHECK AT NORMAL OPERATING TEMPERATURE.

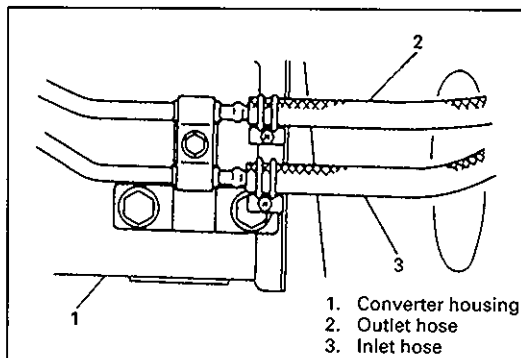


85F00-7B1-10-5

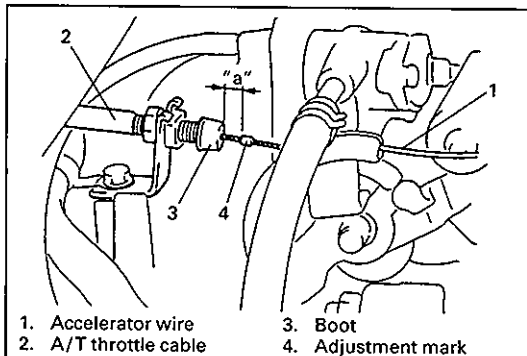
Fluid specification	
An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III	
Fluid capacity	
When draining from drain plug hole	2.5 liters (5.28/4.40 US/Imp.pt.)
When overhauling	6.9 liters (14.58/12.14 US/Imp.pt.)



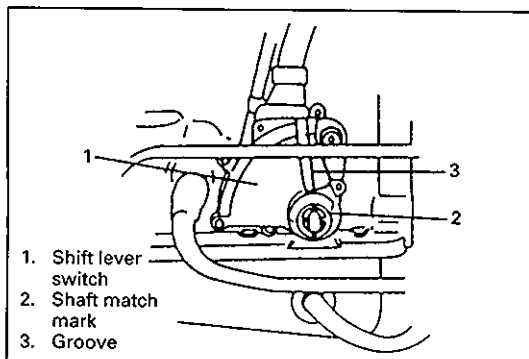
85F00-7B1-11-1



60A50-7B1-73-2S

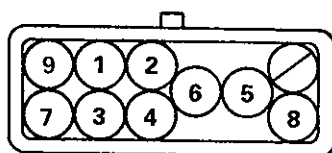


85F00-7B1-11-3



60A90-7B1-75-1S

Terminal position



85F00-7B1-11-5

OIL COOLER HOSES

The rubber hoses for the oil cooler should be replaced every 60,000 km (36,000 miles) or every 3 years. When replacing them, be sure to note the following.

- to replace clamps at the same time
- to insert hose as far as its limit mark
- to tighten clamps to specified torque

Tightening Torque:

1.5 N·m (0.15 kg·m, 1 lb-ft)

A/T THROTTLE CABLE

ADJUSTMENT

- 1) Warm up engine and transmission to normal operating temperature.
- 2) Measure distance between tip end of cable adjustment mark and end of boot (indicated as "a" in figure).

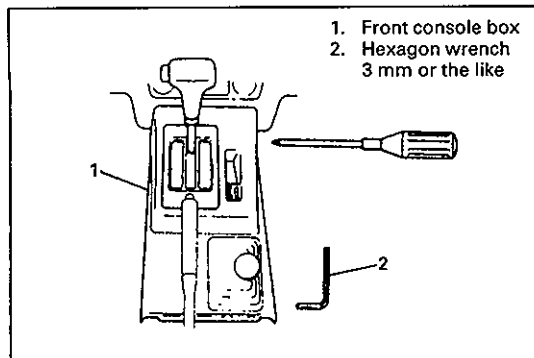
Standard distance "a": 0.8 – 1.5 mm (0.031 – 0.059 in)

SHIFT SWITCH

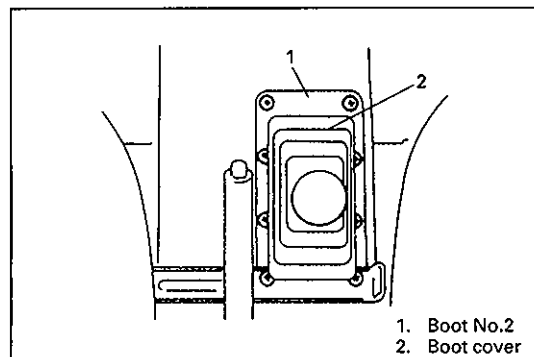
INSPECTION & ADJUSTMENT

- 1) Shift select lever to "N" range.
- 2) Fix shift switch with groove in shift switch and match mark on shaft aligned.
- 3) Check that engine starts in "N" and "P" ranges but it doesn't start in "D", "2", "L" or "R" range. Also, check that back-up lamp lights in "R" range.
- 4) If faulty condition cannot be corrected by adjustment, disconnect shift switch coupler and check that continuity exists as shown below by moving select lever.

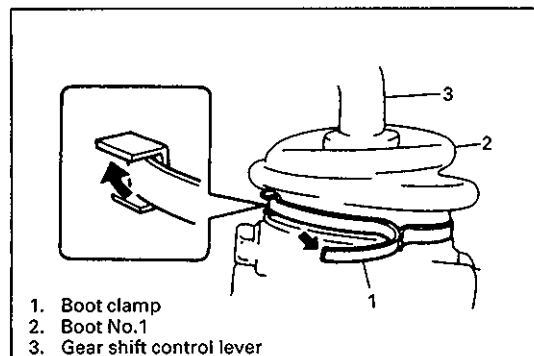
Terminal position	6	5	9	8	4	7	3	2	1
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○



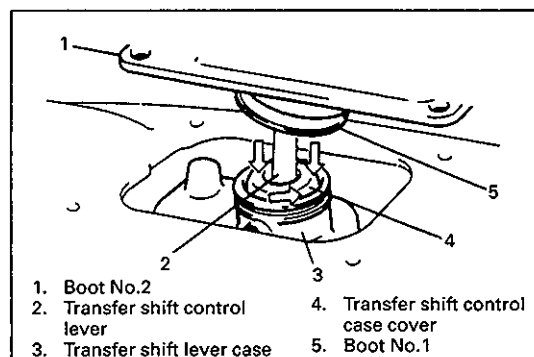
85F00-7B1-12-1



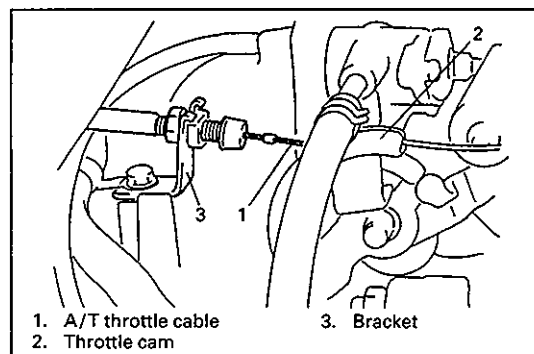
85F00-7B1-12-2



60A90-7B1-80-3S



60A90-7B1-80-4S



85F00-7B1-12-5

TRANSMISSION UNIT REPAIR OVERHAUL

DISMOUNTING OF TRANSMISSION WITH TRANSFER

IN CABIN

- 1) Remove clips at the front of rear console box.

NOTE:

To remove clip, push in its center pin first.

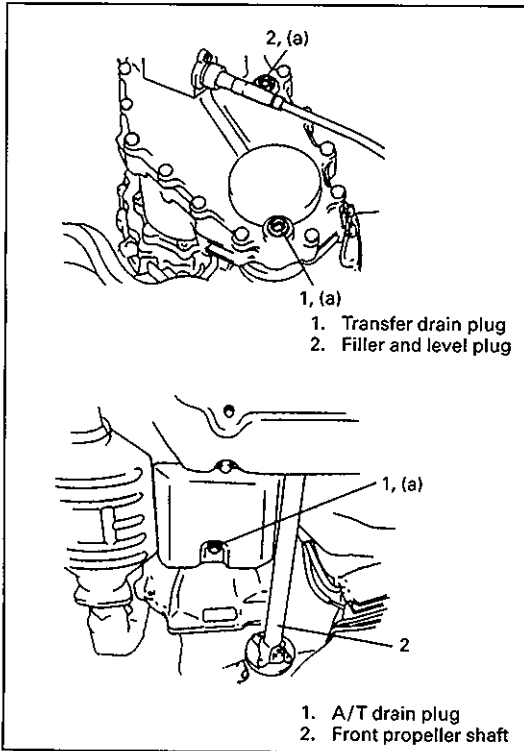
- 2) Remove screws at the front and clips at the rear, and then remove front console box.
- 3) Remove boot cover and boot No.2. (if equipped)

- 4) Remove boot clamp and then remove boot No.1 from transfer gear shift lever case. (if equipped)

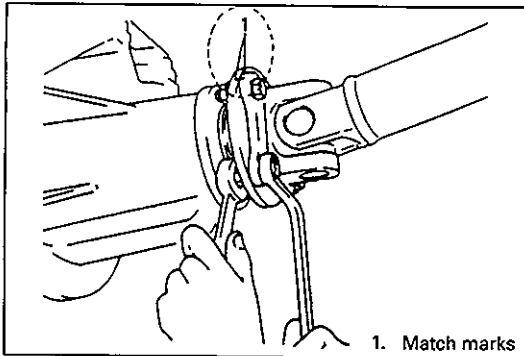
- 5) With transfer shift control case cover pushed down with fingers, turn it to counterclockwise and take out shift control lever. (if equipped)

IN ENGINE ROOM

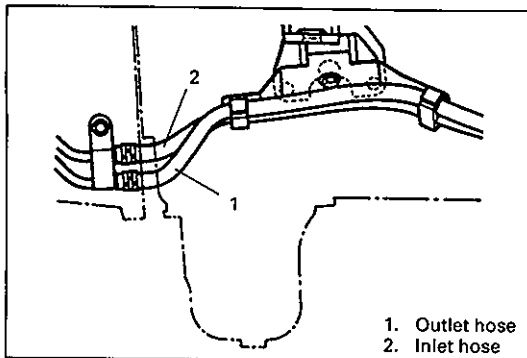
- 1) Disconnect negative cable at battery and remove dipstick and oil filler tube.
- 2) Disconnect A/T throttle cable from throttle cam and bracket.
- 3) Disconnect wiring harness couplers.
- 4) Remove starter motor. But don't disconnect its wiring harness.
- 5) Remove transmission to engine bolts.



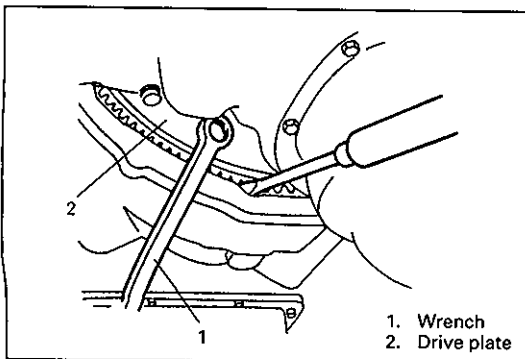
85F00-7B1-13-1



60A90-7B1-81-3S



85F00-7B1-13-4



85F00-7B1-13-5

ON LIFT

- 1) Drain transfer oil.

NOTE:

If automatic transmission is to be overhauled later on, draining A/T fluid at this point will facilitate work.

Tightening Torque

(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)

- 2) Before removing propeller shafts, give match marks on joint flange and propeller shaft as shown in left figure.
- 3) Remove universal joint flange bolts and take out rear propeller shaft.
- 4) Likewise, take out front propeller shaft. (if equipped)
- 5) Remove nut from the end of select cable and E-ring from bracket to set cable free.
- 6) Remove select cable bracket by removing its 2 bolts.
- 7) Remove exhaust pipe No.1 and No.2.

- 8) Loosen clamps and disconnect oil cooler hoses from pipes.

NOTE:

To avoid leakage of transmission fluid, plug open ends of oil cooler pipes and hoses right after they are disconnected.

- 9) Remove torque converter housing lower plate.

- 10) Holding drive plate stationary, remove 4 torque converter mounting bolts with wrench.

- 11) Remove engine to transmission nuts.
- 12) Disconnect ground cable from rear mounting member.
- 13) Remove speedometer cable end nut and disconnect cable.
- 14) Apply transmission jack and take off rear mounting member by removing its bolts.
- 15) With transmission and transfer assemblies held up on jack, move them rearward and lower them including torque converter.

85F00-7B1-14-1S

WARNING:

Transmission and transfer assemblies may tilt rearward on jack. It is recommended to use an auxiliary arm of jack for the purpose of safety.

60A50-7B1-82-2S

AFTER DISMOUNTING

WARNING:

Be sure to keep transmission and transfer assemblies horizontal throughout the work. Should they be tilted, torque converter may fall off and cause personal injury and A/T fluid may flow out.

- 1) Remove wiring harness and breather hoses.
- 2) Remove transfer by removing its 12 bolts.

60A90-7B1-82-3S

REMountING

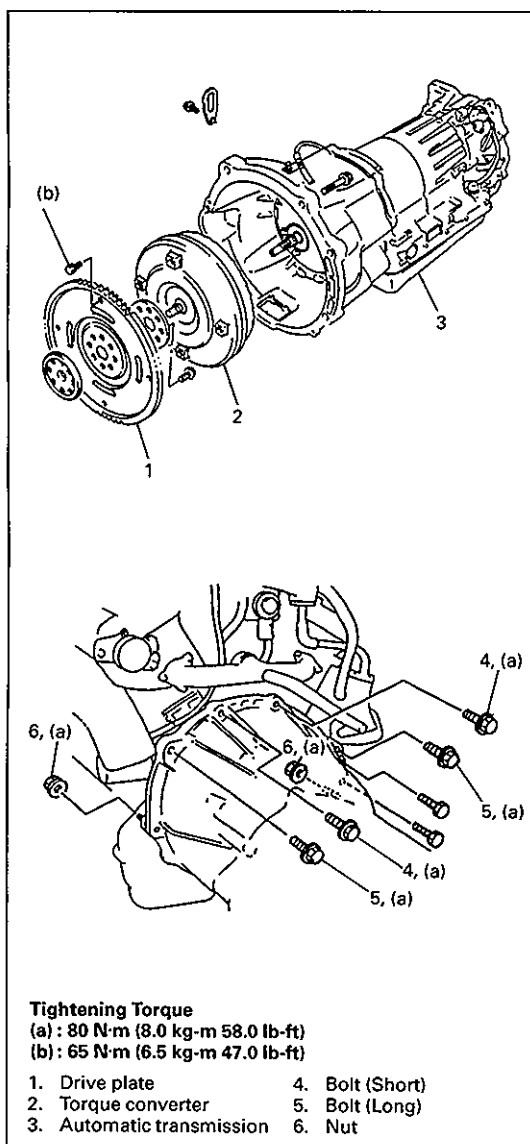
WARNING:

When moving transmission assembly with torque converter equipped in it, be sure to keep it horizontal. Tilting it with its front facing down may allow converter to fall off, whereby an injury may result.

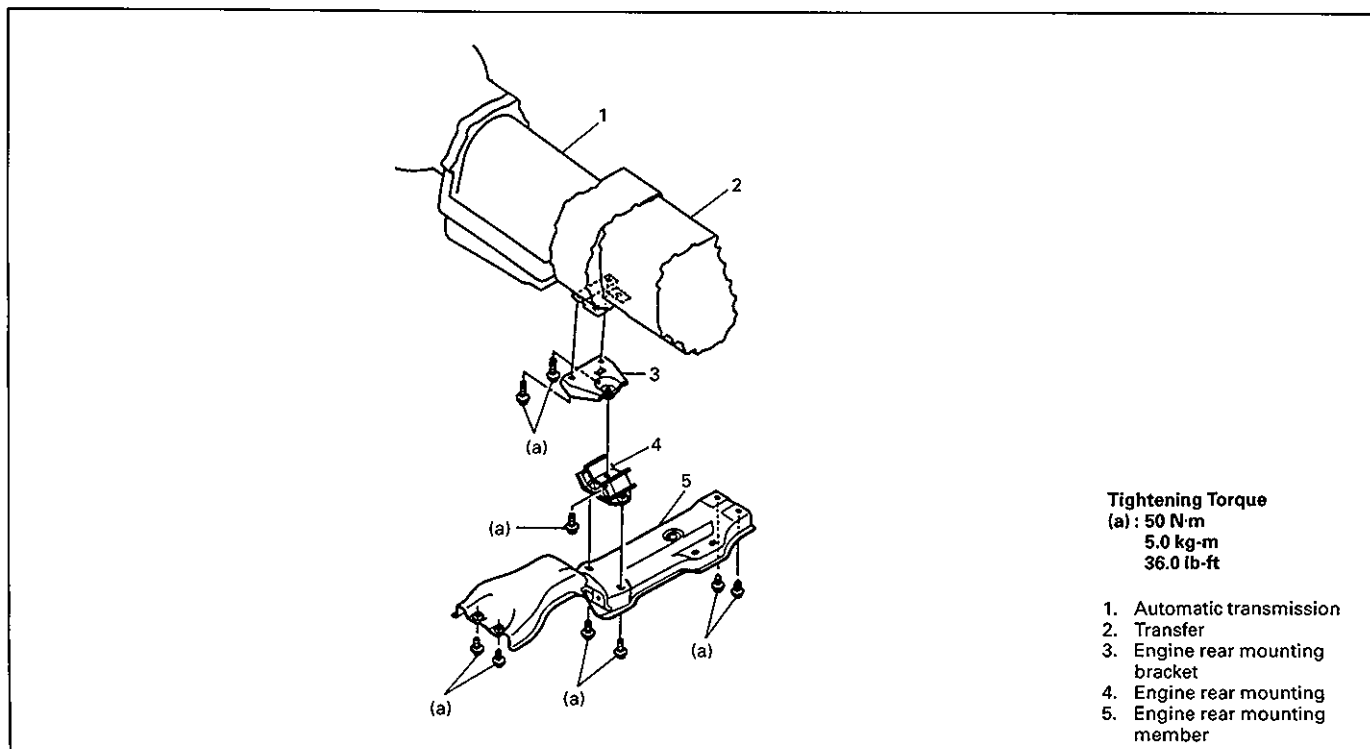
For remounting, reverse dismantling procedure. Use specified torque as given below and left.

Tightening torque	N·m	kg·m	lb·ft
Exhaust pipe No.1 to manifold bolts	50	5.0	36.0
Muffler to exhaust pipe No.2 nuts	60	6.0	43.0
Universal joint flange bolts and nuts	55	5.5	40.0

- Clamp wiring harness and hoses securely.
- When remounting drive plate, use specified bolts.



85F00-7B1-15-1



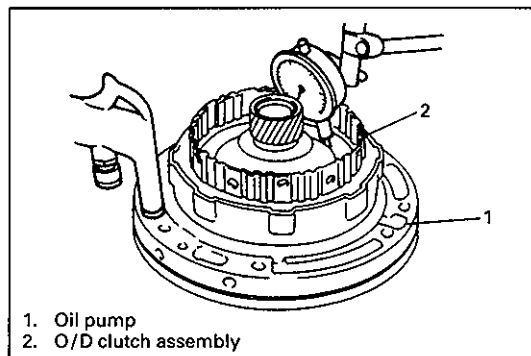
85F00-7B1-15-2

DISASSEMBLY OF SUBASSEMBLY

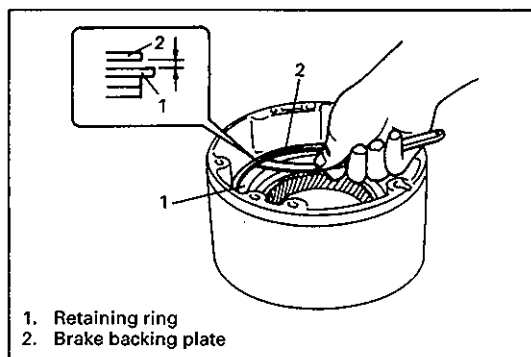
NOTE:

Described here are items including only different standard values as compared with those of VITARA 1.6L model. Therefore, with respect to steps before and after what is described and information not found here, refer to NOTE on the first page of this section.

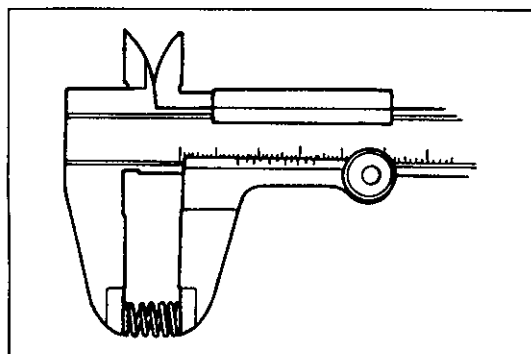
85F00-7B1-16-1



85F00-7B1-16-3



85F00-7B1-16-4



85F00-7B1-16-5

OVERDRIVE (PLANETARY GEAR SIDE)

Disassembly

- 3) With O/D clutch assembly installed to oil pump, apply 4 to 8 kg/cm² air pressure into fluid hole in oil pump and measure stroke of clutch piston. If it is not within standard range, replace cushion clutch plate or clutch disc.

Standard stroke of clutch piston:

1.77 – 2.58 mm (0.070 – 0.101 in)

OVERDRIVE (CASE SIDE)

Disassembly

- 1) Measure clearance between retaining ring and brake backing plate with thickness gauge.

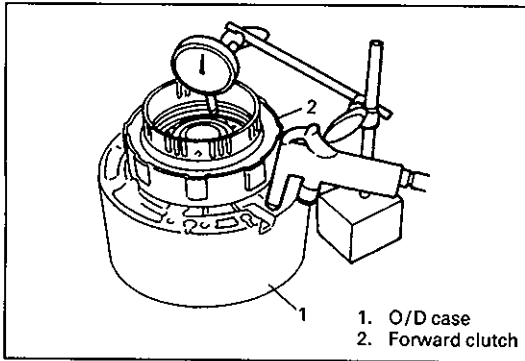
Standard clearance: 0.56 – 1.62 mm (0.022 – 0.063 in)

If it is not within standard range, replace brake disc or brake plate.

Inspection

- Measure free length of piston return spring.

Standard free length: 15.13 mm (0.596 in)



85F00-7B1-17-1

FORWARD CLUTCH

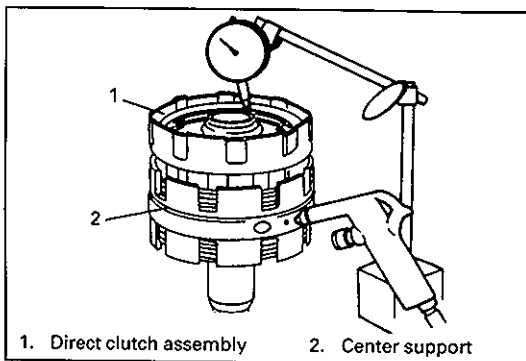
Disassembly

- 4) Install forward clutch to O/D case. Apply 4 to 8 kg/cm² air pressure into fluid hole at the right of cut in O/D case and measure movement of forward clutch piston.

Standard forward clutch piston movement:

1.40 – 1.60 mm (0.056 – 0.063 in)

If measured value is not within standard range, use either 1.8 mm (0.071 in) or 2.0 mm (0.079 in) clutch disc to adjust it to standard value.



85F00-7B1-17-3

DIRECT CLUTCH

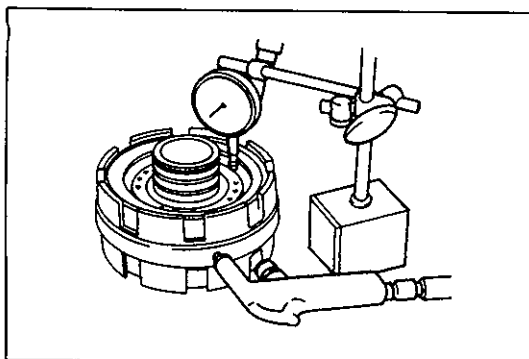
Disassembly

- 1) Install direct clutch assembly to center support and with 4 to 8 kg/cm² air pressure applied to second fluid hole from the left, measure stroke of direct clutch piston as shown in figure.

Standard direct clutch piston stroke:

0.90 – 1.30 mm (0.036 – 0.051 in)

If it is not within standard range, use 3.6 mm, 3.8 mm or 4.0 mm (0.141 in, 0.149 in or 0.157 in) clutch backing plate to adjust it to standard stroke.



85F00-7B1-17-5

CENTER SUPPORT

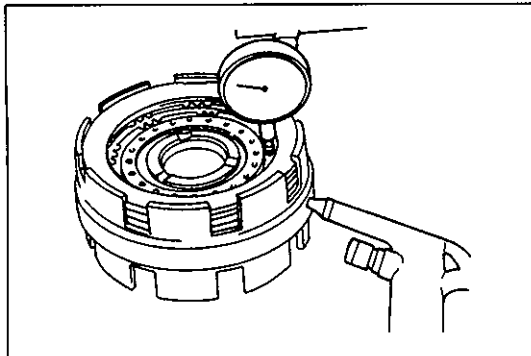
Disassembly

- 3) Apply 4 to 8 kg/cm² air pressure into fluid hole at the extreme left and measure movement of B1 brake (Second coast brake) piston.

Standard B1 brake piston movement:

0.80 – 1.40 mm (0.032 – 0.055 in)

If measured value is not within standard range, replace B1 brake plate or B1 brake disc.



85F00-7B1-18-1

- 10) Apply 4 to 8 kg/cm² air pressure into the second hole from the left and measure stroke of B2 brake (Second brake) piston as shown in figure.

Standard B2 brake piston stroke:

1.03 – 1.65 mm (0.041 – 0.064 in)

If measured value is not within standard range, replace B2 brake plate or B2 brake disc.

Assembly

- After installing each retaining backing plate ring, measure movement of brake piston again.

Standard movement of B1 brake piston:

0.80 – 1.40 mm (0.032 – 0.055 in)

Standard movement of B2 brake piston:

1.03 – 1.65 mm (0.041 – 0.065 in)

If it is not within standard range, it is possible that ring is not installed properly. Then disassemble and reassemble again.

85F00-7B1-18-2

VALVE BODY ASSEMBLY

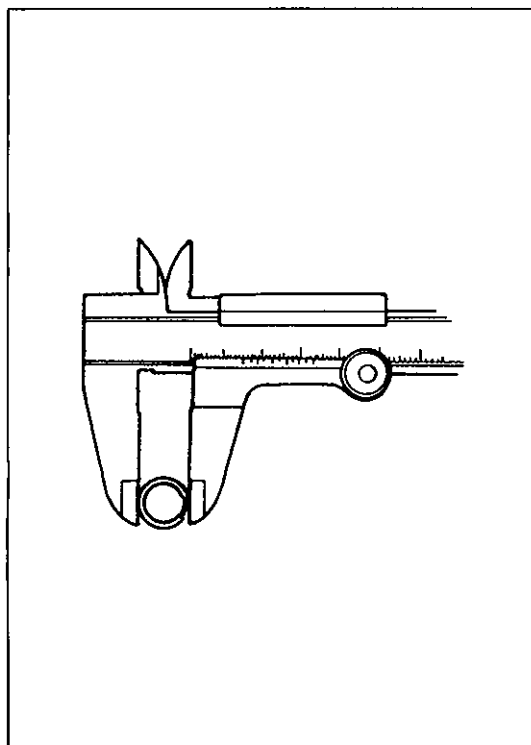
Front Upper Valve Body

Assembly

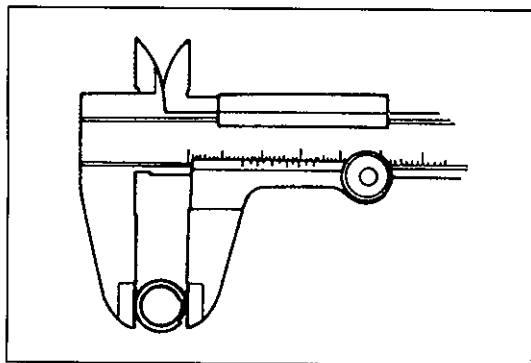
Assemble each component by reversing disassembly procedure and noting following points.

- Coil outer diameter and free length of each valve spring should be as listed below. Be sure to use each one of correct size.

Name of spring	Outer diameter	Free length
Secondary regulator valve spring	17.43 mm (0.681 in)	71.27 mm (2.806 in)
Cut back valve spring	6.85 mm (0.269 in)	23.00 mm (0.905 in)
Secondary valve spring	8.58 mm (0.337 in.)	19.24 mm (0.757 in)
Throttle valve primary spring	10.90 mm (0.429 in)	39.55 mm (1.557 in)



85F00-7B1-18-4



60A50-7B1-130-4S

Lower Valve Body

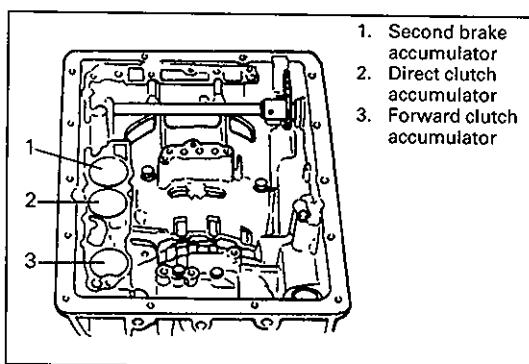
Assembly

Assemble each component by reversing disassembly procedure and noting following points.

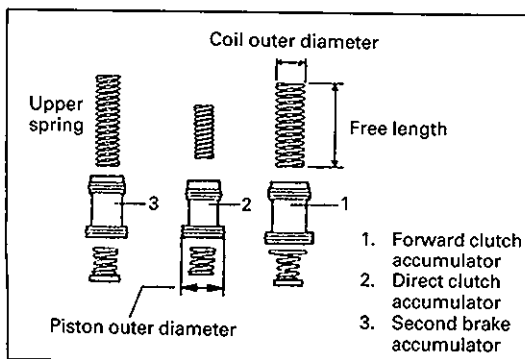
- Coil outer diameter and free length of each valve spring should be as listed below. Be sure to use each one of correct size.

Name of spring	Outer diameter	Free length
Pressure relief valve spring	13.14 mm (0.517 in)	32.14 mm (1.265 in)
TCC (Lock-up) control valve spring	11.40 mm (0.449 in)	32.60 mm (1.283 in)
Valve damping spring	4.97 mm (0.196 in)	20.00 mm (0.787 in)
Low coast modulator valve spring	9.24 mm (0.364 in)	42.35 mm (1.667 in)
Inter coast modulator valve spring	8.80 mm (0.346 in)	35.43 mm (1.395 in)
Ball valve spring	10.50 mm (0.413 in)	13.70 mm (0.539 in)
By pass valve spring	13.80 mm (0.543 in)	28.90 mm (1.138 in)
Primary regulator valve spring	17.02 mm (0.670 in)	50.28 mm (1.980 in)

85F00-7B1-19-2



85F00-7B1-19-4



85F00-7B1-19-5

UNIT ASSEMBLY

- 33) Apply A/T fluid to new O-ring and spring and install them to accumulator piston and install accumulator piston to transmission case.

Used for	Piston outer diameter	Spring free length	
Direct clutch accumulator	31.80 – 31.85 mm (1.252 – 1.254 in)	Upper spring	43.56 mm (1.715 in)
		Lower spring	32.20 mm (1.268 in)
Forward clutch accumulator		Upper spring	57.18 mm (2.251 in)
		Lower spring	30.40 mm (1.197 in)
Second brake accumulator	34.80 – 34.85 mm (1.370 – 1.372 in)	Upper spring	56.16 mm (2.211 in)
		Lower spring	18.50 mm (0.728 in)

NOTE:

The free length data of the spring with a shim includes the shim thickness.

SECTION 7C1

CLUTCH

CONTENTS

GENERAL DESCRIPTION	7C1- 1	Disassembly and Assembly Clutch	
DIAGNOSIS	7C1- 3	Operating Cylinder	7C1-10
Clutch Master Cylinder	7C1- 4	UNIT REPAIR OVERHAUL	7C1-11
Operating Cylinder	7C1- 4	Clutch Cover, Clutch Disc and	
ON VEHICLE SERVICE	7C1- 5	Flywheel	7C1-11
Clutch Pedal Height	7C1- 5	TIGHTENING TORQUE	
Clutch Pedal Free Travel	7C1- 5	SPECIFICATIONS	7C1-15
Clutch Fluid Pipe and Hose	7C1- 5	REQUIRED SERVICE MATERIALS	7C1-15
Clutch Master Cylinder	7C1- 6	SPECIAL TOOLS	7C1-15
Fluid Inspection	7C1- 7		
Disassembly and Assembly			
Clutch Master Cylinder	7C1- 8		
Clutch Operating Cylinder	7C1- 9		

85F00-7C1-1-1

GENERAL DESCRIPTION

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a tapering-finger type, which is a solid ring in the outer diameter part, with a series of tapered fingers pointing inward.

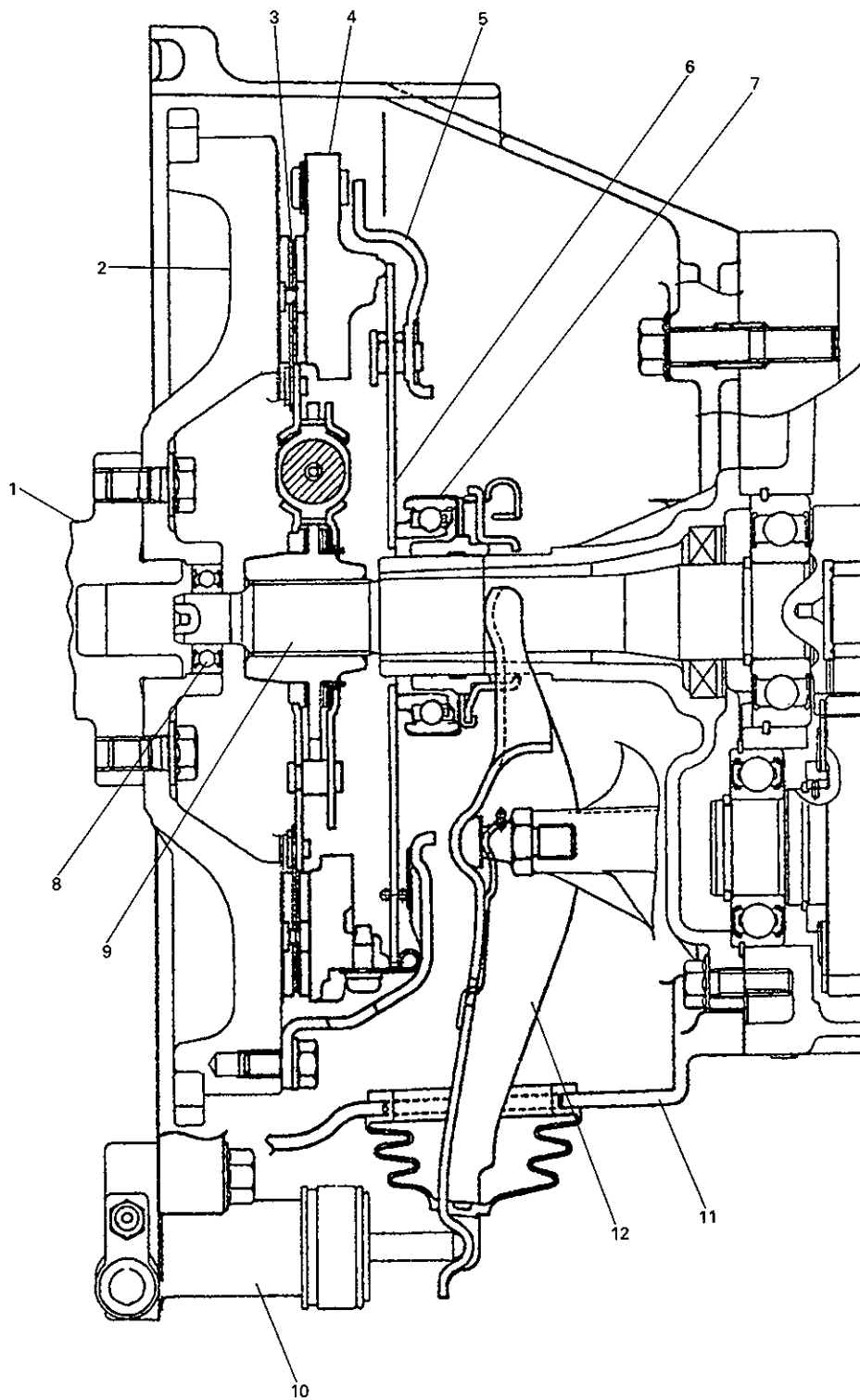
The disc, carrying four torsional coil springs, is positioned on the transmission input shaft with an involute spline fit.

The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back. This is the engaged condition of the clutch.

Depressing the clutch pedal causes the release bearing to advance and pushes on the tips of the tapered fingers of the diaphragm spring. When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.

The clutch pedal position switch is mounted above clutch pedal. This switch is in the electric circuit of starting motor, and operates according to movement of clutch pedal. When starting the engine, the clutch pedal should be fully depressed in order to turn on this switch. If the clutch pedal is released or is not depressed all the way, this switch is OFF and the starting motor will not run even if the ignition key is in the START position.

60A20-7C-1-2



1. Crankshaft
2. Flywheel
3. Clutch disc
4. Pressure plate
5. Clutch cover
6. Diaphragm spring
7. Release bearing
8. Input shaft bearing
9. Input shaft
10. Operating cylinder
11. Clutch housing
12. Release fork

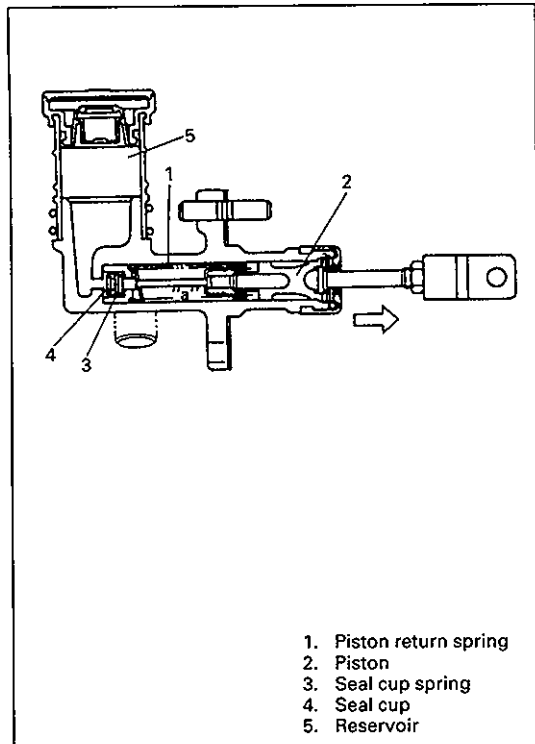
DIAGNOSIS

Condition	Possible Cause	Correction
Slipping	● Improper clutch pedal free travel. ● Worn or oily clutch disc facing. ● Warped disc, pressure plate or flywheel surface. ● Weakened diaphragm spring. ● Master cylinder piston or seal cup not returning.	Replace clutch arm or master cylinder. Replace disc. Replace disc, clutch cover or flywheel. Replace clutch cover. Repair master cylinder.
Dragging clutch	● Improper clutch pedal free travel. ● Weakened diaphragm spring, or worn spring tip. ● Rusted input shaft splines. ● Damaged or worn splines of transmission input shaft. ● Excessively wobbly clutch disc. ● Clutch facings broken or dirty with oil. ● Fluid leakage.	Replace clutch arm or master cylinder. Replace clutch cover. Lubricate. Replace input shaft. Replace disc. Replace disc. Repair or replace.
Clutch vibration	● Glazed (glass-like) clutch facings. ● Clutch facings dirty with oil. ● Release bearing slides unsmoothly on input shaft bearing retainer. ● Wobbly clutch disc, or poor facing contact. ● Weakened torsion springs in clutch disc. ● Clutch disc rivets loose. ● Distorted pressure plate or flywheel surface. ● Weakened or loosened engine mounting bolt or nut.	Repair or replace disc. Replace disc. Lubricate or replace input shaft bearing retainer. Replace disc. Replace disc. Replace disc. Replace clutch cover or flywheel. Retighten or replace mounting.
Noisy clutch	● Worn or broken release bearing. ● Input shaft front bearing worn down. ● Excessive rattle of clutch disc hub. ● Cracked clutch disc. ● Pressure plate and diaphragm spring rattling.	Replace release bearing. Replace input shaft bearing. Replace disc. Replace disc. Replace clutch cover.
Grabbing clutch	● Clutch disc facings soaked with oil. ● Clutch disc facings excessively worn. ● Rivet heads showing out of facing. ● Weakened torsion springs.	Replace disc. Replace disc. Replace disc. Replace disc.

CLUTCH MASTER CYLINDER

WHEN NOT OPERATING

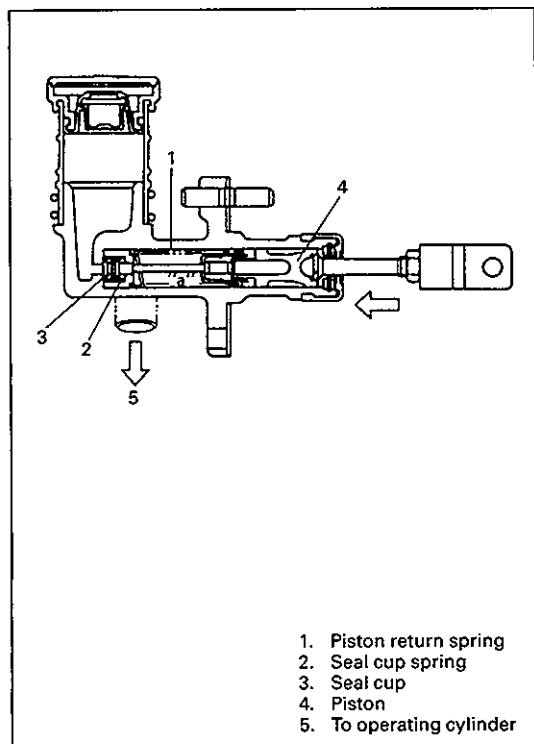
As the piston is pushed to the right shown in the figure by the return spring force, no hydraulic pressure is generated in the chamber "a". The spring force also compresses the seal cup spring, opening the oil passage between the reservoir and the chamber "a".



85F00-7C1-4-1

WHEN OPERATING

Depressing the clutch pedal causes the piston to move to the left as shown in the figure, thereby the piston return spring is compressed. Then the seal cup, by its own spring force, closes the oil passage between the reservoir and the chamber "a". Immediately after this closure, hydraulic pressure is generated in the chamber "a" and it is applied to the operating cylinder on the transmission.

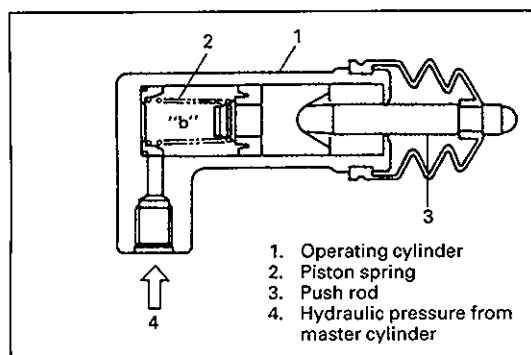


85F00-7C1-4-3

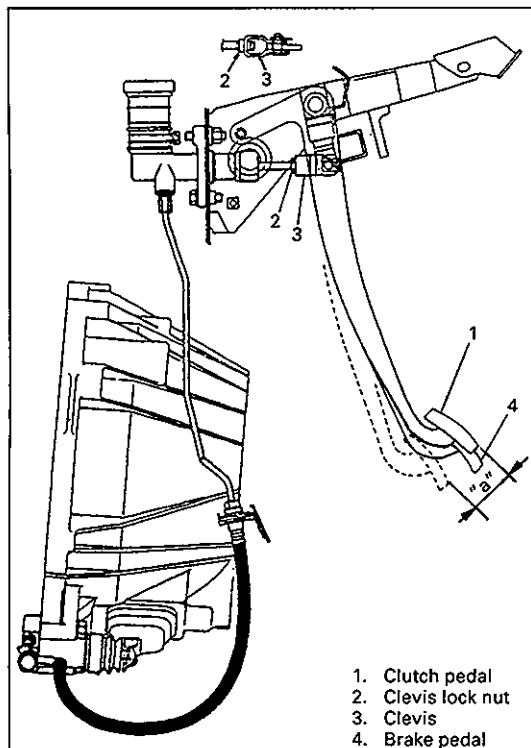
OPERATING CYLINDER

When the operating cylinder is not operating, the push rod is pushed against the release arm only by the piston spring force.

When it is operating, the hydraulic pressure from the clutch master cylinder is applied to the chamber "b". Then the piston pushes the push rod to move the clutch release arm, causing the clutch disc to operate.

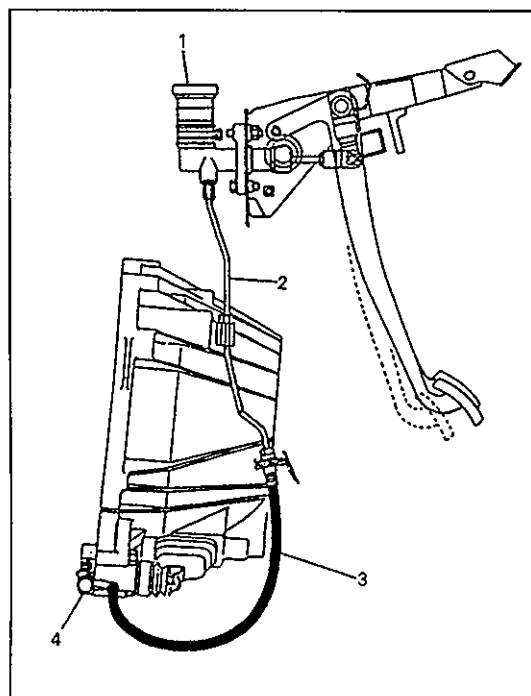


85F00-7C1-4-5

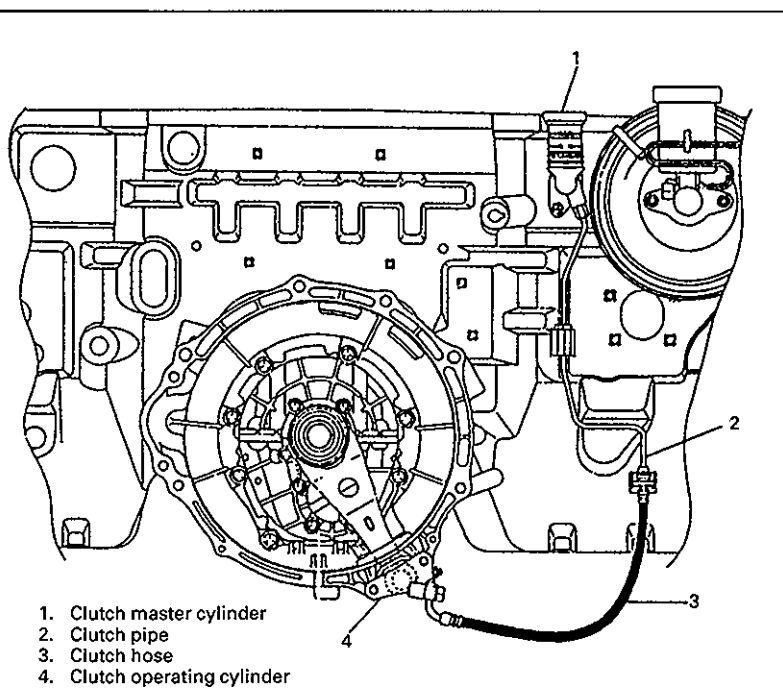


85F00-7C1-5-1

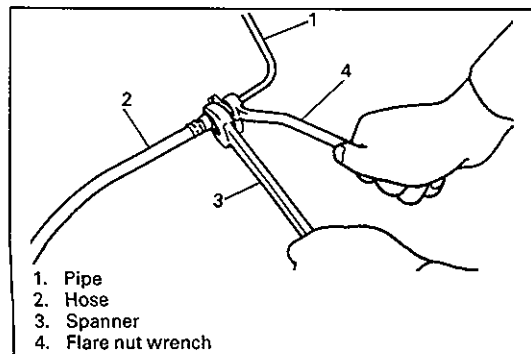
CLUTCH FLUID PIPE AND HOSE



85F00-7C1-5-3



1. Clutch master cylinder
2. Clutch pipe
3. Clutch hose
4. Clutch operating cylinder



85F00-7C1-5-5

ON VEHICLE SERVICE

CLUTCH PEDAL HEIGHT

Adjust clutch pedal height by loosening clevis lock nut and turning push rod as shown.

For RH steering vehicle:

Clutch pedal height is normal if clutch pedal is as high as brake pedal.

For LH steering vehicle:

Clutch pedal height is normal if clutch pedal is as about 10 mm (0.39 in.) higher than brake pedal.

CLUTCH PEDAL FREE TRAVEL

Depress clutch pedal, stop the moment clutch resistance is felt and measure distance (clutch pedal free travel). Free travel should be within following specification.

Pedal free travel "a": 15 – 25 mm (0.6 – 1.1 in.)

REMOVAL

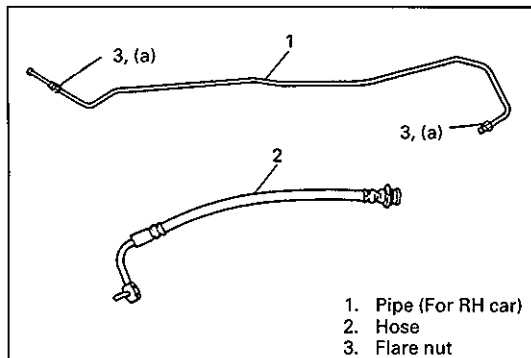
NOTE:

Do not allow fluid to get on painted surface.

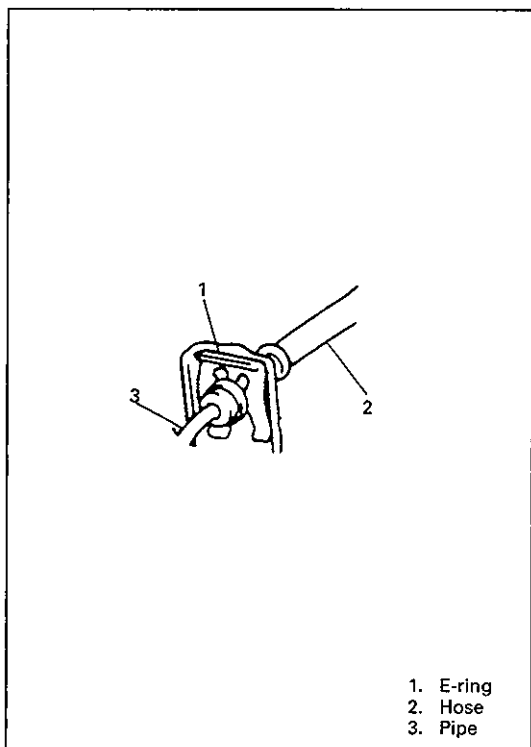
- 1) Remove dust and dirt from each joint of hose and pipe to be disconnected and clean around reservoir cap.
- 2) Take out fluid with syringe or such.
- 3) Disconnect fluid pipe from hose.

NOTE:

To disconnect pipe from hose, separate them by using flare nut wrench and spanner so as not to kink them.



85F00-7C1-6-1



85F00-7C1-6-2

INSPECTION

Check pipe and hose for dent, kink, crack, dirt and dust. Replace if check result is not satisfactory.

INSTALLATION

Reverse removal sequence noting following points.
Tighten flare nuts to specified torque.

Tightening Torque

(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

NOTE:

- For air bleeding of master cylinder alone, it must be removed from vehicle.
(For procedures of removal and installation of master cylinder ass'y and air bleeding, refer to **CLUTCH MASTER CYLINDER** section.)
- Do not allow fluid to get on painted surface.
- Do not allow pipe and hose to contact hard against vehicle or other parts.
- Install each clamp securely.
- Install E-ring securely as shown.
- After installation, check clutch pedal free travel and bleed air from system.
- Check fluid leakage.
- Add fluid close to MAX level of reservoir.

CLUTCH MASTER CYLINDER

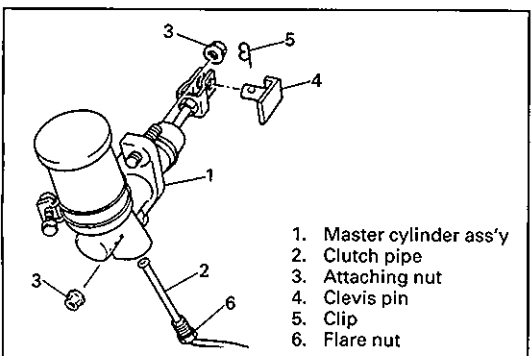
REMOVAL

- 1) Clean around reservoir cap and take out fluid with syringe or such.
- 2) Remove push rod clevis pin.
- 3) Disconnect fluid pipe from master cylinder.

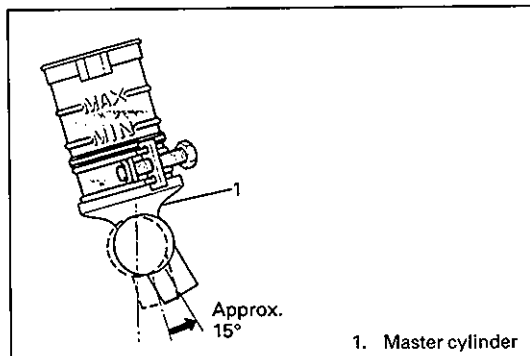
NOTE:

Do not allow fluid to get on painted surfaces.

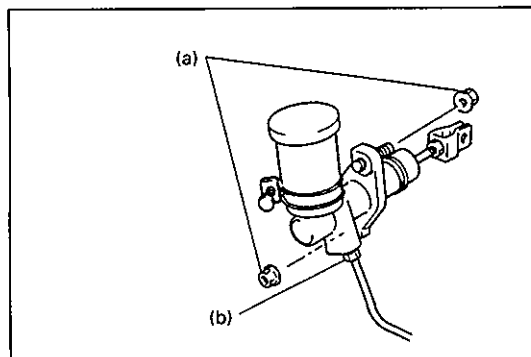
- 4) Remove master cylinder attaching nuts.
- 5) Remove master cylinder ass'y and gasket.



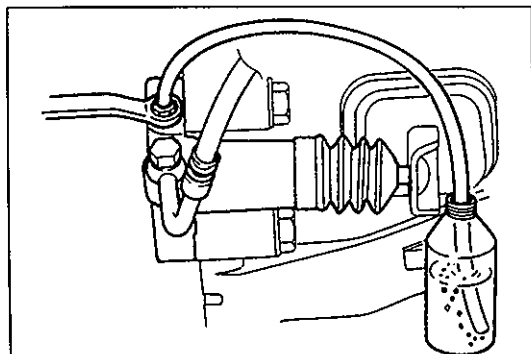
85F00-7C1-6-5



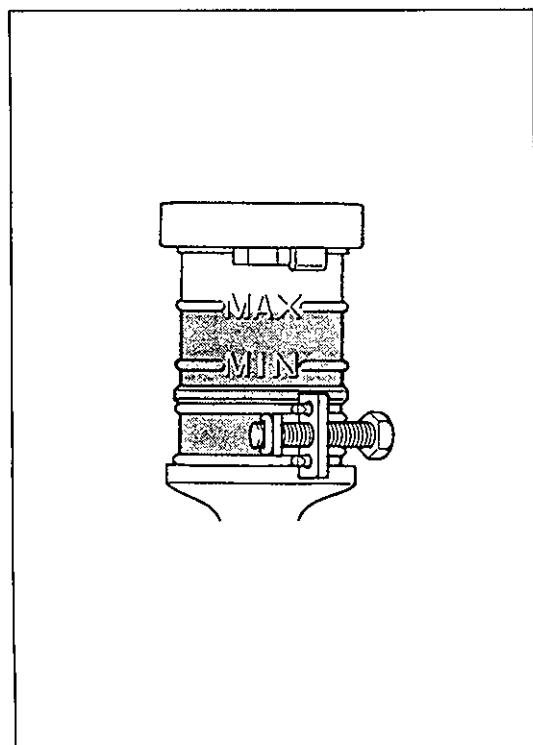
85F00-7C1-7-1



85F00-7C1-7-2



85F00-7C1-7-3



85F00-7C1-7-4

INSTALLATION

- 1) To bleed air from master cylinder itself, tilt it as shown in figure and add fluid into it.

NOTE:

After bleeding air from master cylinder, plug pipe hole in it to prevent fluid from spilling out of it till pipe is connected.

- 2) Install master cylinder ass'y and new gasket to body, attaching nuts and push rod clevis pin.

NOTE:

Do not reuse gasket.

- 3) Torque attaching nuts to specification.
- 4) Connect fluid pipe and torque flare nut to specification.

Tightening Torque

(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

(b): 16 N·m (1.6 kg-m, 11.5 lb-ft)

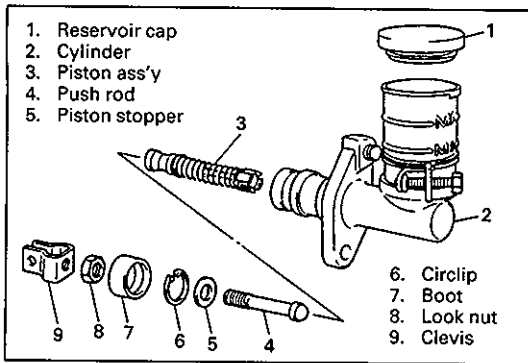
- 5) Install push rod clevis pin.
- 6) Fill reservoir with specified brake fluid and check fluid leakage.
- 7) After installation, bleed air from system and check clutch pedal free travel. Refer to BRAKE section for air bleeding procedure.

FLUID INSPECTION

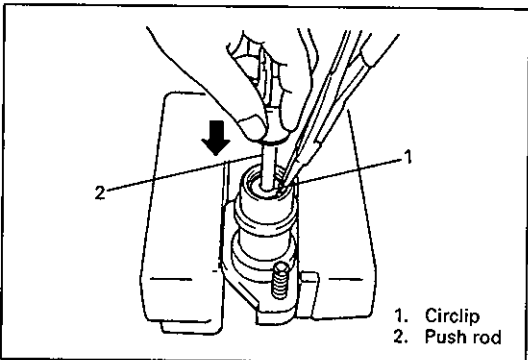
Fluid level should be always between MIN and MAX lines on reservoir. If fluid decreases quickly, check for leakage, repair leaky point, if any, and add fluid up to MAX level.

NOTE:

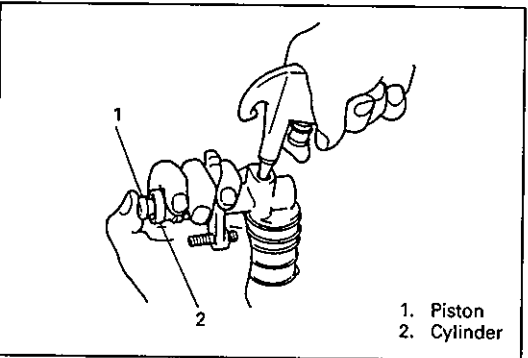
- Brake fluid damages painted surface badly. Should it get on painted surface, remove it immediately and clean surface thoroughly.
- Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use container which has been used for mineral oil or which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic clutch system and water will mix with brake fluid, lowering fluid boiling point. Keep all fluid containers capped to prevent contamination.
- Make sure not to use fluid whose container cap was first opened more than a year ago.



85F00-7C1-8-1



85F00-7C1-8-2



85F00-7C1-8-3

DISASSEMBLY AND ASSEMBLY CLUTCH MASTER CYLINDER

DISASSEMBLY

- 1) Remove boot and then circlip with piston pushed in.
- 2) Blow compressed air gradually into hole for pipe connection to remove piston ass'y, using care to prevent it from jumping out.

INSPECTION

Inspect all disassembled parts for wear or damage and replace parts if necessary.

NOTE:

- Wash disassembled parts with brake fluid.
- Do not reuse piston ass'y and circlip.

Inspect cylinder bore for scoring or corrosion. It is best to replace corroded cylinder. Corrosion can be identified as pits or excessive roughness.

NOTE:

Polishing bore of cylinder with anything abrasive is prohibited, as damage to cylinder bore may occur.

Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept away from cylinder bore surfaces.

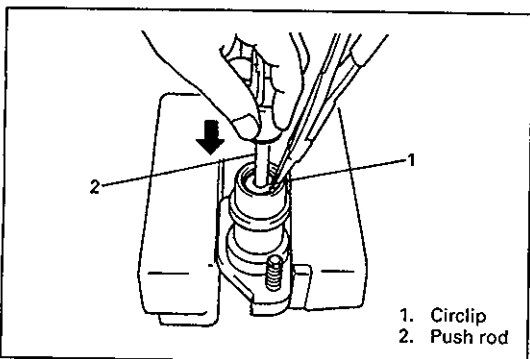
ASSEMBLY

NOTE:

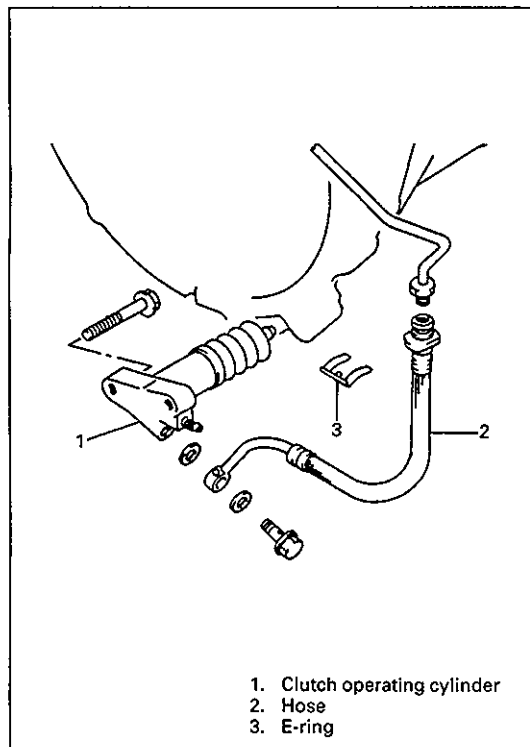
Before installation, wash each part in specified brake fluid.

- 1) Apply brake fluid to inside of piston ass'y and cylinder body.
- 2) Install piston ass'y into cylinder.
- 3) With piston pushed down, install circlip as shown. And install boot.
- 4) For installation of master cylinder to vehicle; refer to INSTALLATION described previously.

85F00-7C1-8-4



85F00-7C1-8-5



85F00-7C1-9-1

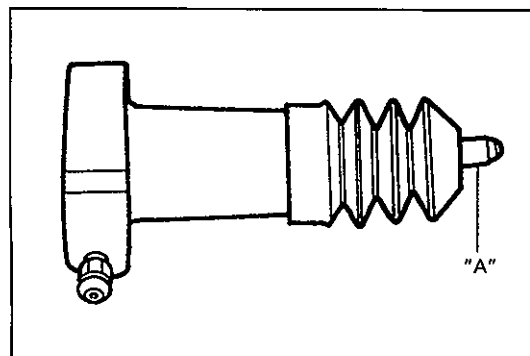
CLUTCH OPERATING CYLINDER

REMOVAL

NOTE:

Do not allow fluid to get on painted surfaces.

- 1) Clean around reservoir cap and take out fluid with syringe or such.
- 2) Disconnect fluid hose from operating cylinder.
- 3) Remove operating cylinder attaching bolts and operating cylinder.



85F00-9C-9-3

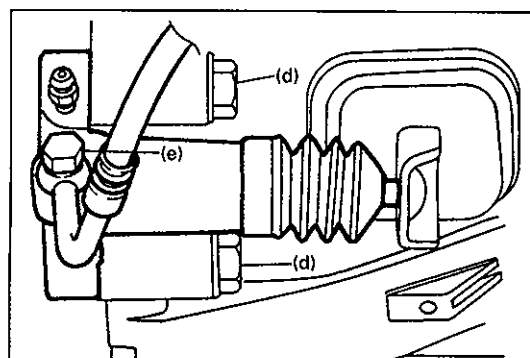
INSTALLATION

- 1) For air bleeding of master cylinder alone, it must be removed from vehicle.
For procedures of removal and installation of master cylinder ass'y and air bleeding, refer to CLUTCH MASTER CYLINDER section.
- 2) Apply small amount of grease to rod tip.

"A": Grease 99000-25010

NOTE:

Don't allow any grease to be on boot.



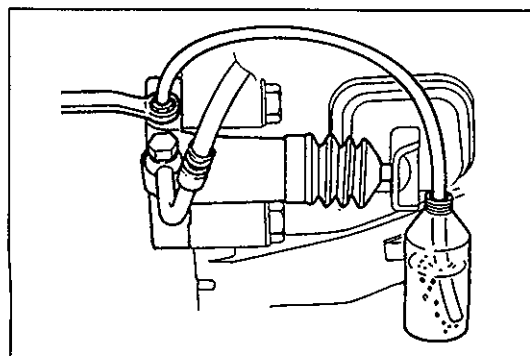
85F00-7C1-9-4

- 3) Install clutch operating cylinder and torque attaching bolts to specification.
- 4) Connect clutch fluid hose and torque union bolt to specification.

Tightening Torque

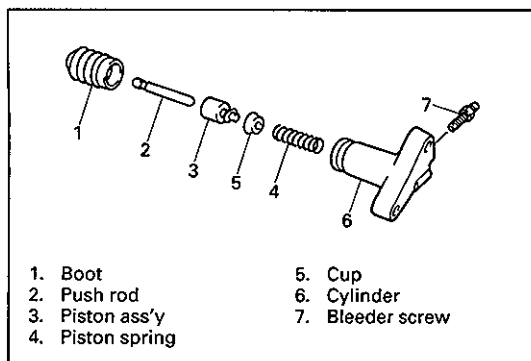
(d): 50 N·m (5.0 kg-m, 36.0 lb-ft)

(e): 23 N·m (2.3 kg-m, 16.5 lb-ft)

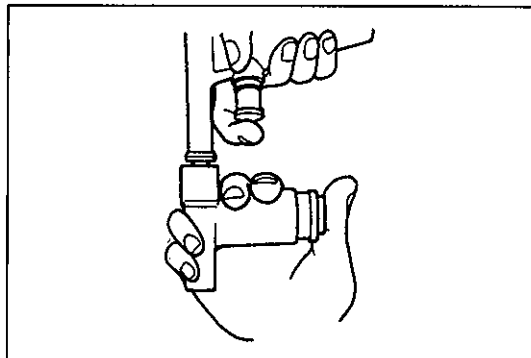


85F00-7C1-9-5

- 5) Fill reservoir with specified brake fluid and check for fluid leakage.
- 6) Bleed air from system and check clutch pedal free travel.
Refer to BRAKE section for air bleeding procedure.



85F00-7C1-10-1



85F00-7C1-10-2

DISASSEMBLY AND ASSEMBLY CLUTCH OPERATING CYLINDER

DISASSEMBLY

- 1) Remove boot and then push rod.
- 2) Remove piston by blowing compressed air into bolt hole where hose was connected, using care to prevent it from jumping out.

INSPECTION

Inspect all disassembled parts for wear or damage, and replace clutch operating cylinder ass'y if necessary.

NOTE:

- Wash disassembled parts with brake fluid.
- Do not reuse piston cups.

Inspect cylinder bore for scoring or corrosion. It is best to replace corroded cylinder. Corrosion can be identified as pits or excessive roughness.

NOTE:

Polishing bore of cylinder with anything abrasive is prohibited, as damage to cylinder bore may occur.

Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept away from cylinder bore surfaces.

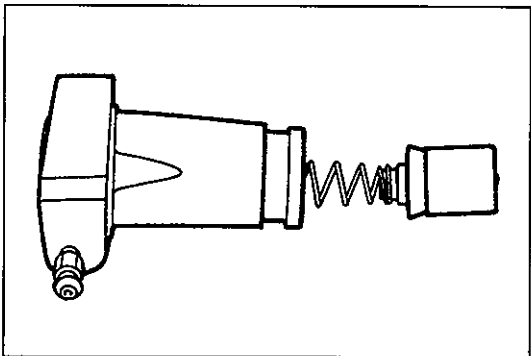
ASSEMBLY

NOTE:

Before installation, wash each part in specified brake fluid.

- 1) Assemble piston.
- 2) Apply brake fluid to piston ass'y and inside of cylinder.
- 3) Install piston ass'y into cylinder. When inserting it, be careful not to cause damage to lip of piston cup.
- 4) Install boot and push rod.
- 5) For installation of operating cylinder to vehicle, refer to CYLINDER INSTALLATION described previously.

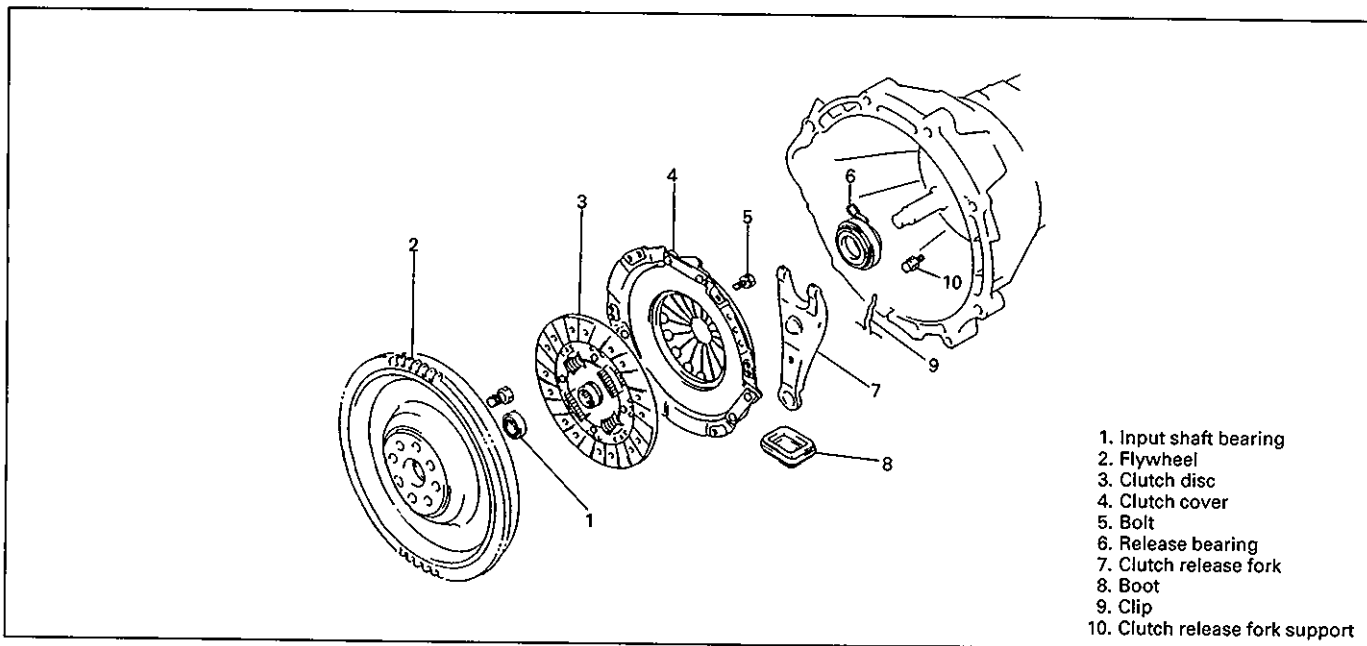
85F00-7C1-10-3



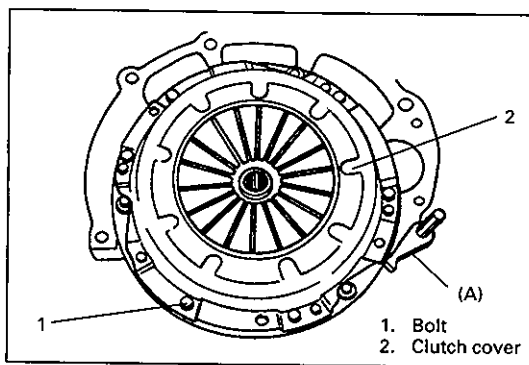
85F00-7C1-10-4

UNIT REPAIR OVERHAUL

CLUTCH COVER, CLUTCH DISC AND FLYWHEEL



85F00-7C1-11-1



85F00-7C1-11-4

DISMOUNTING/REMountING

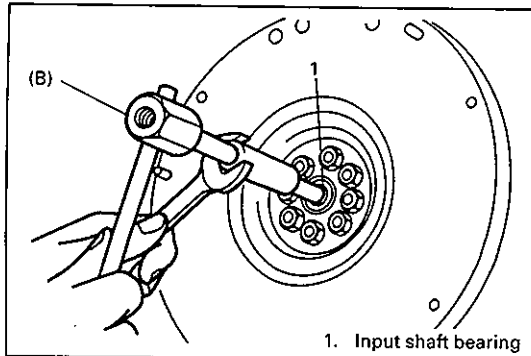
Refer to SECTION 7A of Service Manual mentioned in FOREWORD of this manual.

REMOVAL

1. Hold flywheel stationary with special tool (A) and remove clutch cover bolts, clutch cover and clutch disc.

Special Tool

(A): 09924-17810



85F00-7C1-11-5

2. Pull out input shaft bearing by using special tool (B) and wrench.

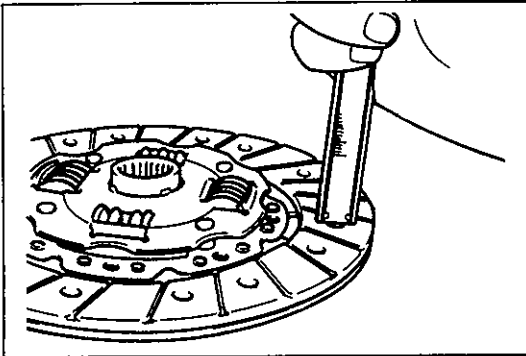
Special Tool

(B): 09923-73210

INSPECTION**Input Shaft Bearing**

Check bearing for smooth rotation and replace it if abnormality is found.

60A20-7C1-8-1



60A40-7C1-8-2

Clutch Disc

Measure depth of rivet head depression, i.e. distance between rivet head and facing surface. If depression is found to have reached service limit at any of holes, replace disc assembly.

Rivet head depth

Standard: 1.6 mm (0.06 in.)

Service limit: 0.5 mm (0.02 in.)

Clutch Cover

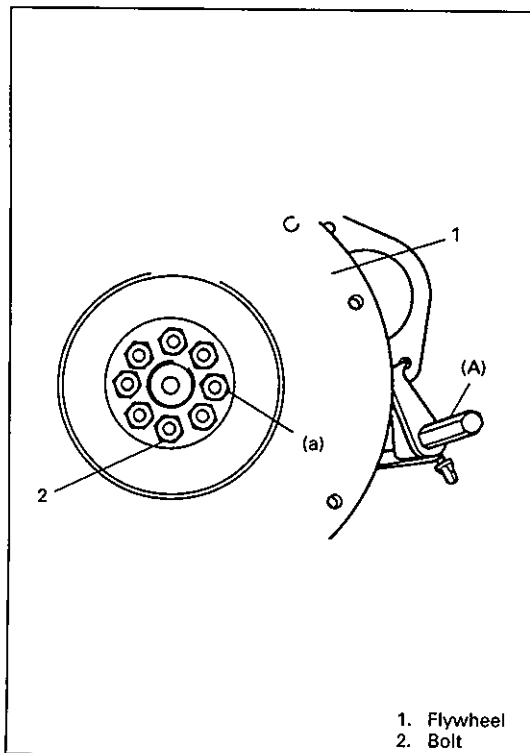
1. Check diaphragm spring for abnormal wear or damage.
2. Inspect pressure plate for wear or heat spots.
3. If abnormality is found, replace it as assembly. Do not disassemble it into diaphragm and pressure plate.

60A20-7C1-8-3

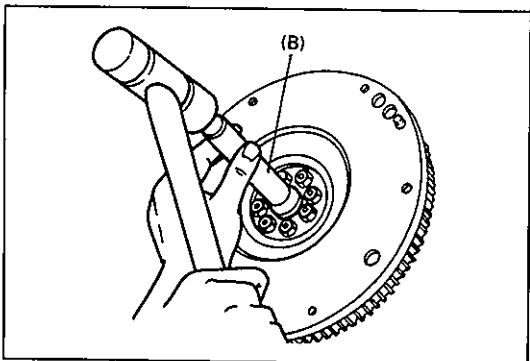
Flywheel

Check surface contacting clutch disc for abnormal wear or heat spots. Replace or repair as required.

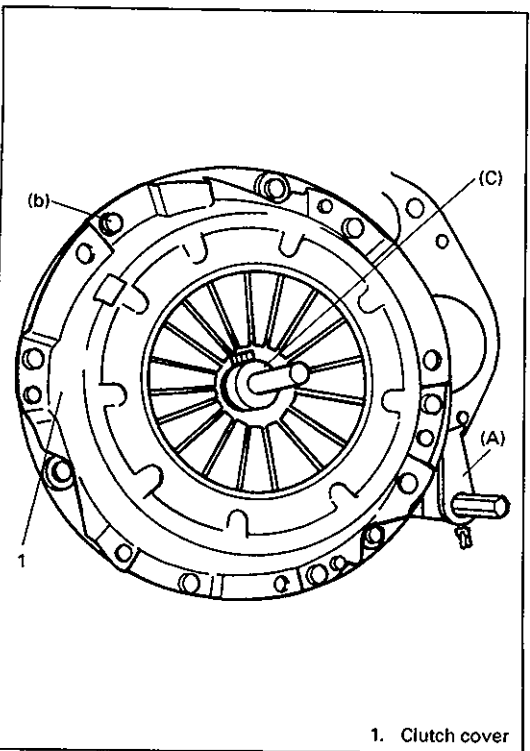
60A20-7C1-8-4



85F00-7C1-13-1



85F00-7C1-13-3



85F00-7C1-13-4

INSTALLATION

NOTE:

Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.

1. Install flywheel to crankshaft and tighten bolts to specification.

Special Tool

(A): 09924-17810

Tightening Torque

(a): 70 N·m (7.0 kg-m, 50.5 lb-ft)

2. Using special tool (B), install input shaft bearing to flywheel.

Special Tool

(B): 09925-98210

3. Aligning clutch disc to flywheel center by using special tool (C), install clutch cover and bolts. Then tighten bolts to specification.

NOTE:

- While tightening clutch cover bolts, compress clutch disc with special tool (C) by hand so that disc centered.
- Tighten cover bolts little by little evenly in diagonal order.

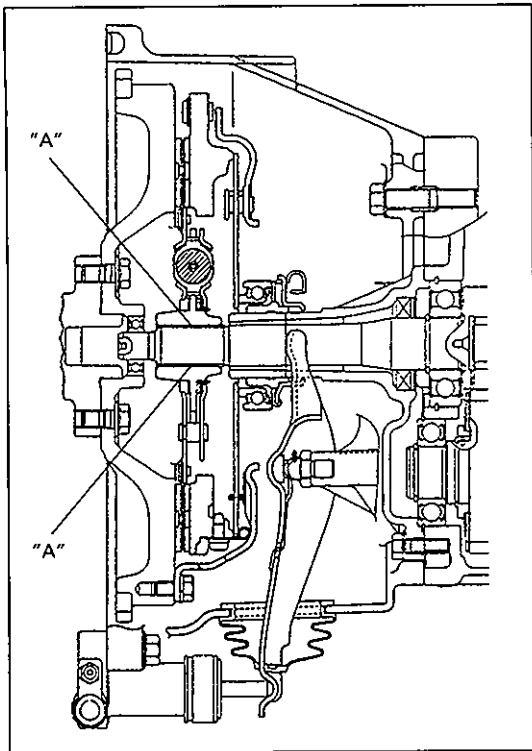
Special Tools

(A): 09924-17810

(C): 09923-36320

Tightening Torque

(b): 23 N·m (2.3 kg-m, 16.5 lb-ft)



4. Slightly apply grease to input shaft, then join transmission transfer assembly with engine. Refer to SECTION 7A of Service Manual mentioned in FOREWORD of this manual for remounting procedure.

NOTE:

Turn crankshaft with wrench from front while inserting transmission input shaft to clutch disc until splines mesh.

"A": Grease 99000-25010

TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
1. Flare nut	16	1.6	11.5
2. Master cylinder nut	13	1.3	9.5
3. Flywheel bolts	70	7.0	50.5
4. Clutch cover bolts	23	2.3	16.5
5. Operating cylinder bolt	50	5.0	36.0
6. Clutch hose union bolt	23	2.3	16.5

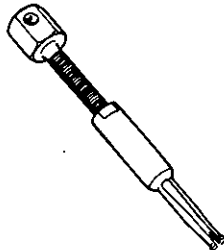
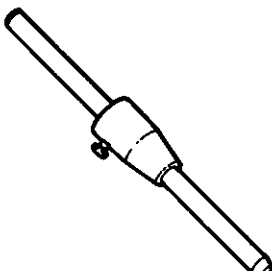
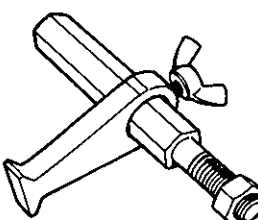
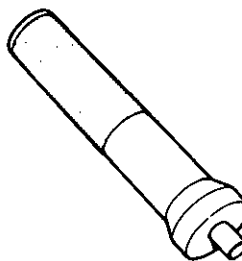
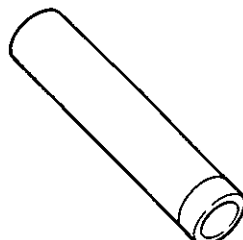
85F00-7C1-15-1

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Clutch master cylinder clevis pin. • Release shaft bushes and seal. • Release shaft arm. • Push rod tip of operating cylinder.
	SUZUKI SUPER GREASE I (99000-25210)	Input shaft spline front end.
Clutch fluid (Brake fluid)	DOT3 or SAE J1703	• Clutch reservoir. • Clutch master cylinder. • Clutch operating cylinder.

85F00-7C1-15-2

SPECIAL TOOLS

 09923-73210 Bearing remover	 09923-36320 Clutch center guide	 09924-17810 Flywheel holder	 09925-98210 Input shaft bearing installer
 09925-98221 Bearing installer			

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SECTION 7E

DIFFERENTIAL (FRONT AND REAR)

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

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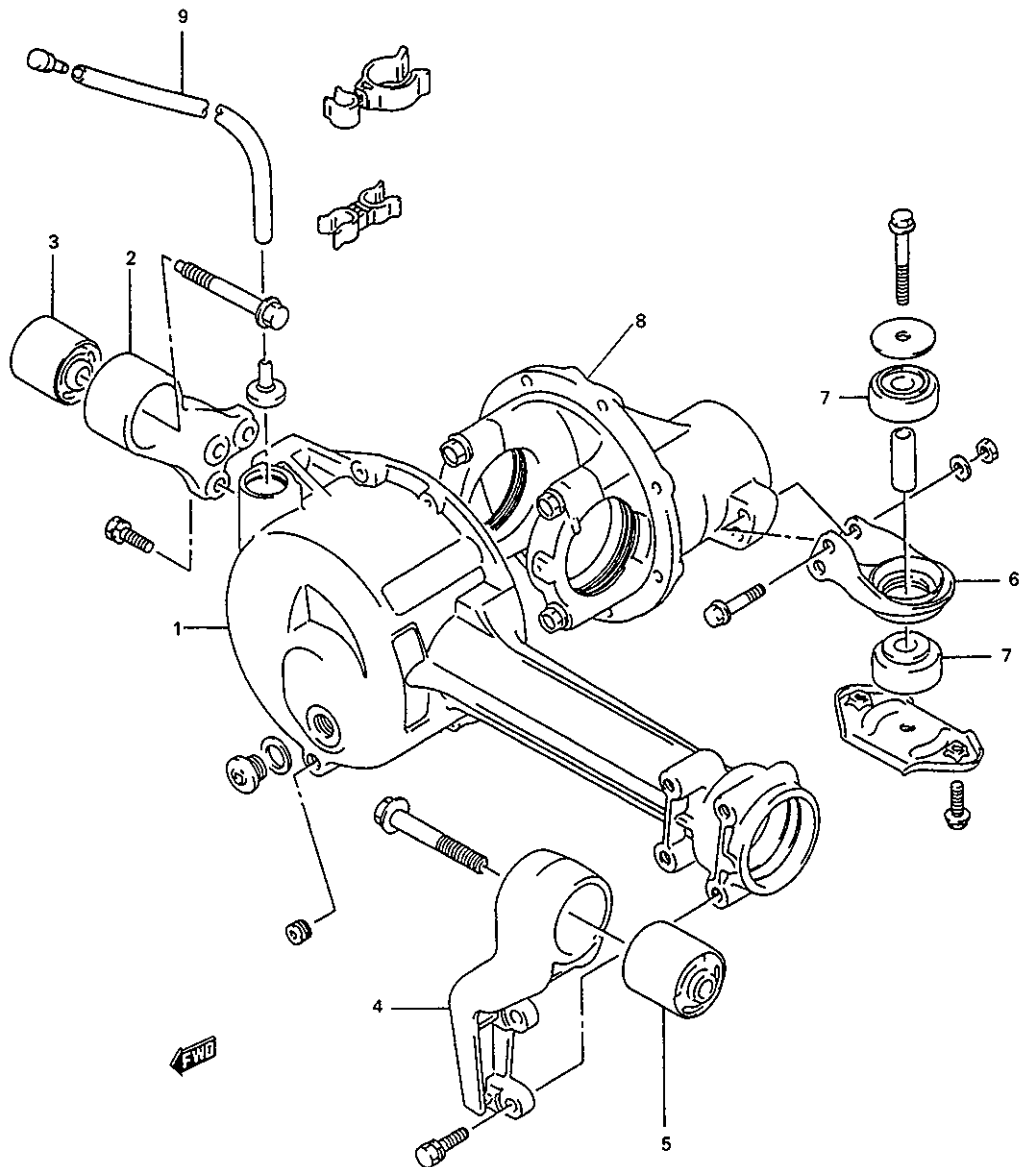
 Front Differential Remounting 7E-7

 Rear Differential Thrust Bolt 7E-8

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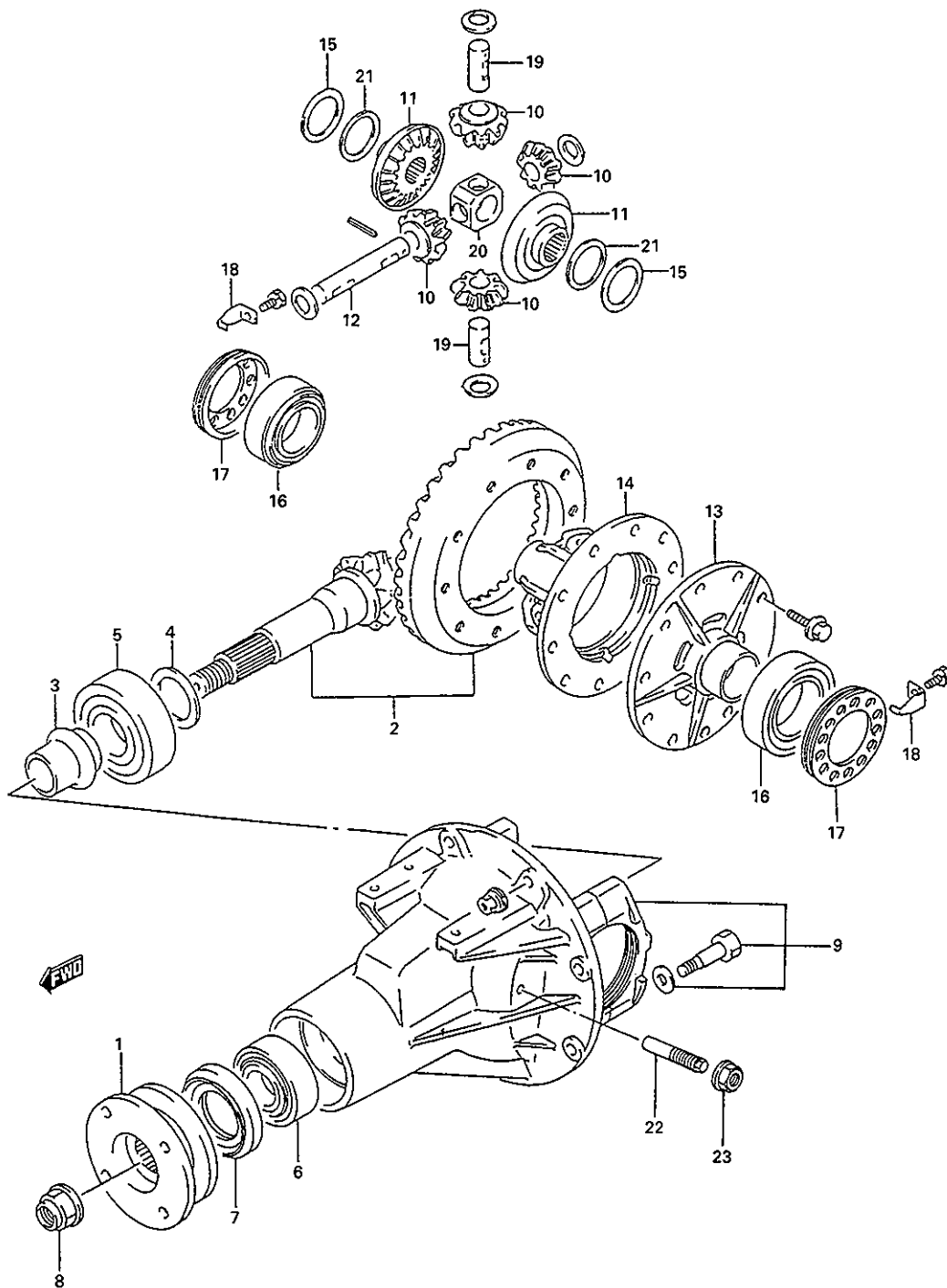
GENERAL DESCRIPTION

Front Differential Exploded view



1. Differential housing
2. Mounting bracket R
3. Bush
4. Mounting bracket L
5. Bush
6. Rear mounting
7. Bush
8. Differential carrier
9. Breather hose

Rear Differential Exploded view



1. Universal joint flange
2. Bevel pinion gear set
3. Bevel pinion spacer
4. Shim
5. Rear bearing
6. Front bearing
7. Oil seal
8. Flange nut

9. Rear diff. carrier ass'y
10. Differential pinion
11. Differential gear
12. Pinion shaft No.1
13. Differential left case
14. Differential right case
15. Thrust washer
16. Differential side bearing

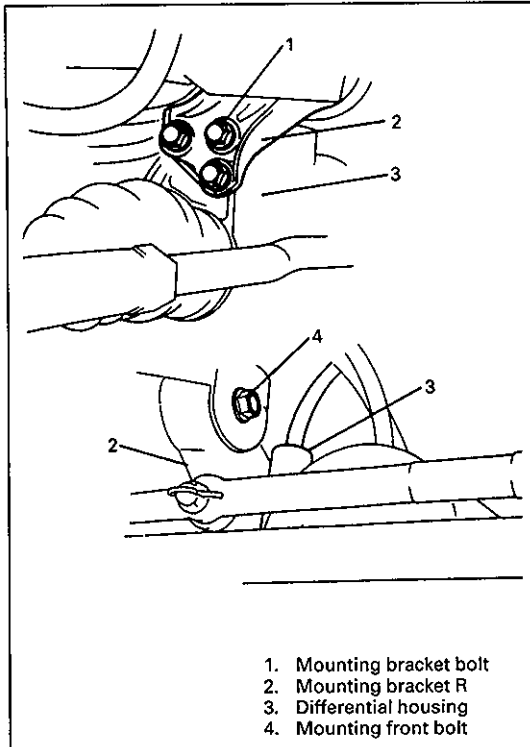
17. Bearing adjuster
18. Lock plate
19. Pinion shaft No.2
20. Pinion joint
21. Spring washer
22. Thrust bolt
23. Thrust nut

ON VEHICLE SERVICE

FRONT DIFFERENTIAL MOUNTING

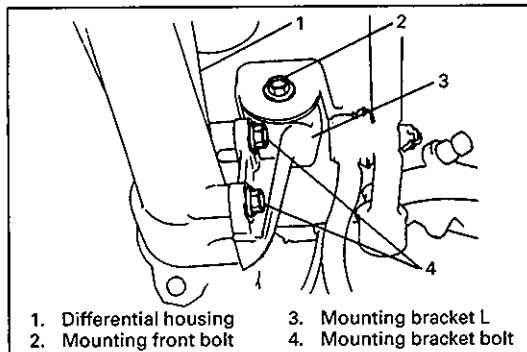
RIGHT AND LEFT MOUNTINGS

1. Lift up vehicle and turn steering wheel all way to the right.
2. Separate mounting bracket R from differential housing by removing 3 bolts from its lower part.
3. Remove mounting bracket R by removing mounting front bolt from its upper part.



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4. Remove mounting bracket L by removing upper and lower fastening bolts.



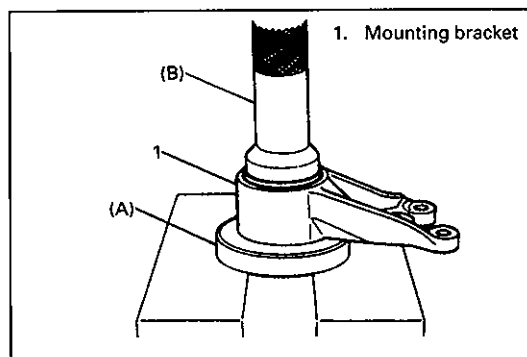
85F00-7E-4-3

5. Check conditions of each bush. If it is damaged or deteriorated, drive it out with special tools and press for replacement.

Special Tool

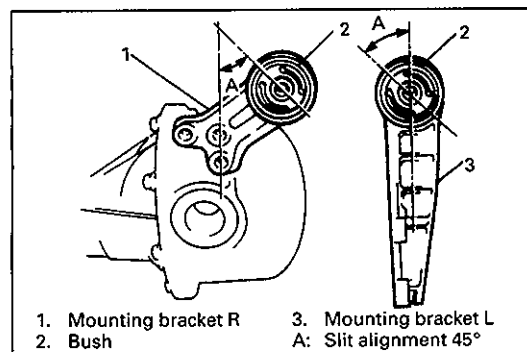
(A): 09951-26010

(B): 09951-16080

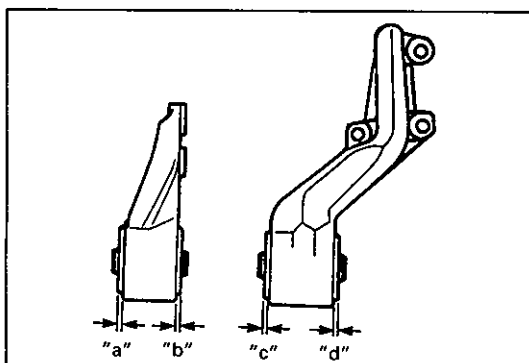


60A20-7E-5-4

6. Position slit in each bush as shown when press-fitting it.



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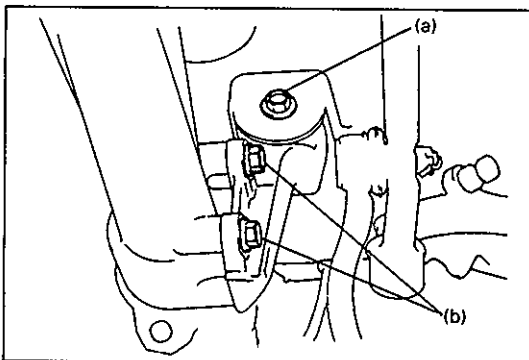
7. Position each bush to bracket as shown.

Length "a": 0.0 mm (0.00 in.)

"b": 0.0 mm (0.00 in.)

"c": 0.0 mm (0.00 in.)

"d": 0.0 mm (0.00 in.)



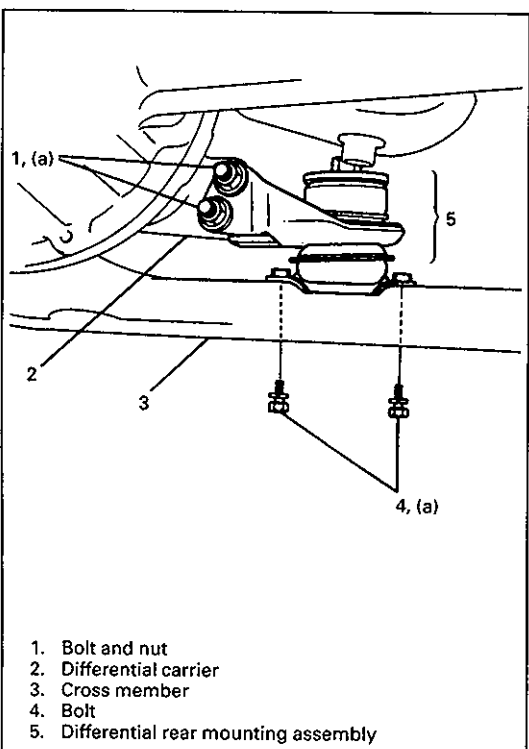
85F00-7E-5-2

8. Use following torque for reinstallation.

Tightening Torque

(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)

(b): 50 N·m (5.0 kg-m, 36.0 lb-ft)



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REAR MOUNTING

(For front differential carrier)

1. Lift up vehicle and remove mounting assembly by removing 2 bolts and nuts from differential carrier side and 2 bolts from cross member side.
2. Check mounting rubber for damage or deterioration and replace as necessary.
3. Use following torque for reinstallation.

Tightening Torque

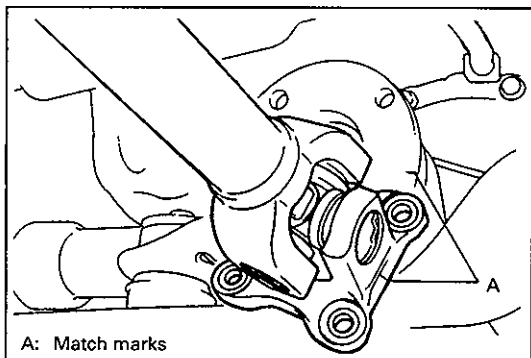
(a): 50 N·m (5.0 kg-m, 36.0 lb-ft)

UNIT REPAIR OVERHAUL

FRONT DIFFERENTIAL DISMOUNTING

1. Lift up vehicle and drain oil.
2. Disconnect breather hose from differential housing.

60A20-7E-7-1

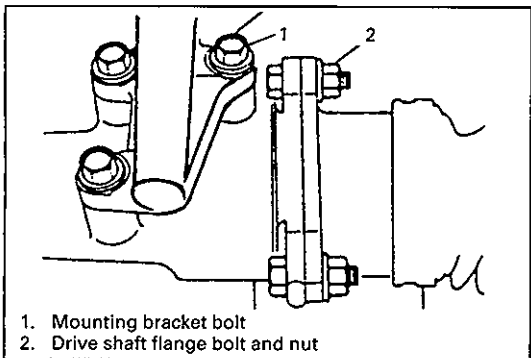


3. Before removing propeller shaft, give match marks on joint flange and propeller shaft as shown.
4. Remove propeller shaft flange by removing its 4 bolts and suspend it with cord or the like.

NOTE:

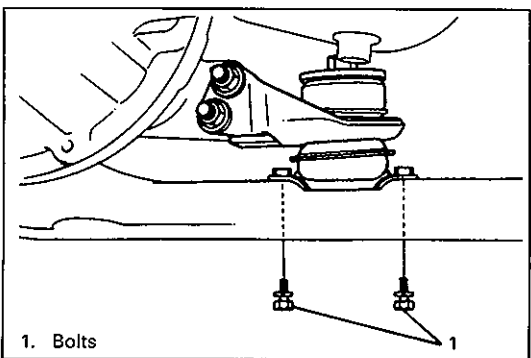
Transfer oil must be drained before pulling out propeller shaft.

60A20-7E-7-2



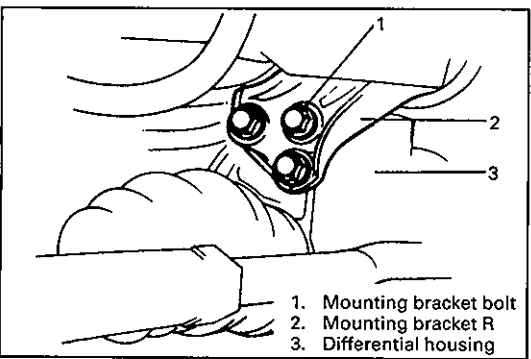
5. Remove 3 bolts for left mounting bracket and 3 bolts for drive shaft flange to set left side of differential free.

85F00-7E-6-3



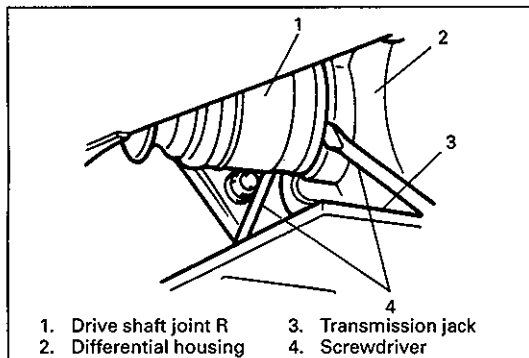
6. Remove differential rear mounting.

60A20-7E-7-4



7. With differential housing assembly held with transmission jack, remove 3 mounting bolts on right end of housing.

60A20-7E-7-5



60A20-7E-8-1

8. Using 2 large screwdrivers as levers, pull out right side drive shaft joint from differential and dismount housing assembly from vehicle.

CAUTION:

During above work, use care not to cause damage to drive shaft boot.

FRONT DIFFERENTIAL REMOUNTING

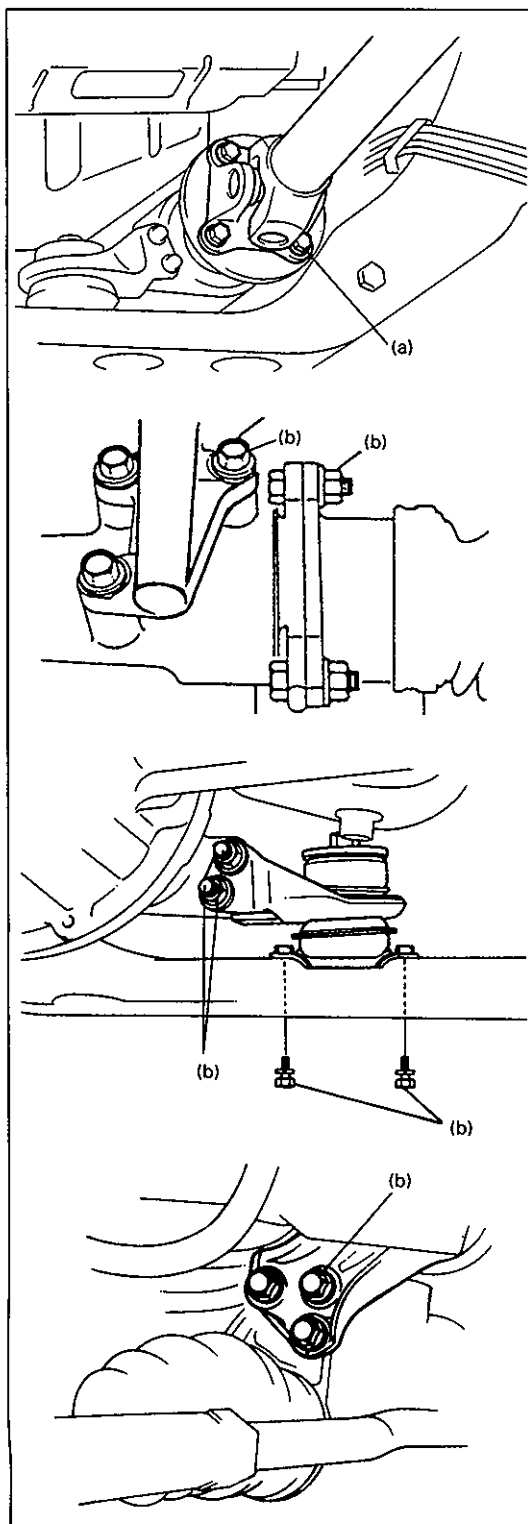
For remounting, reverse dismounting procedure and use following tightening torque.

Tightening Torque

(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

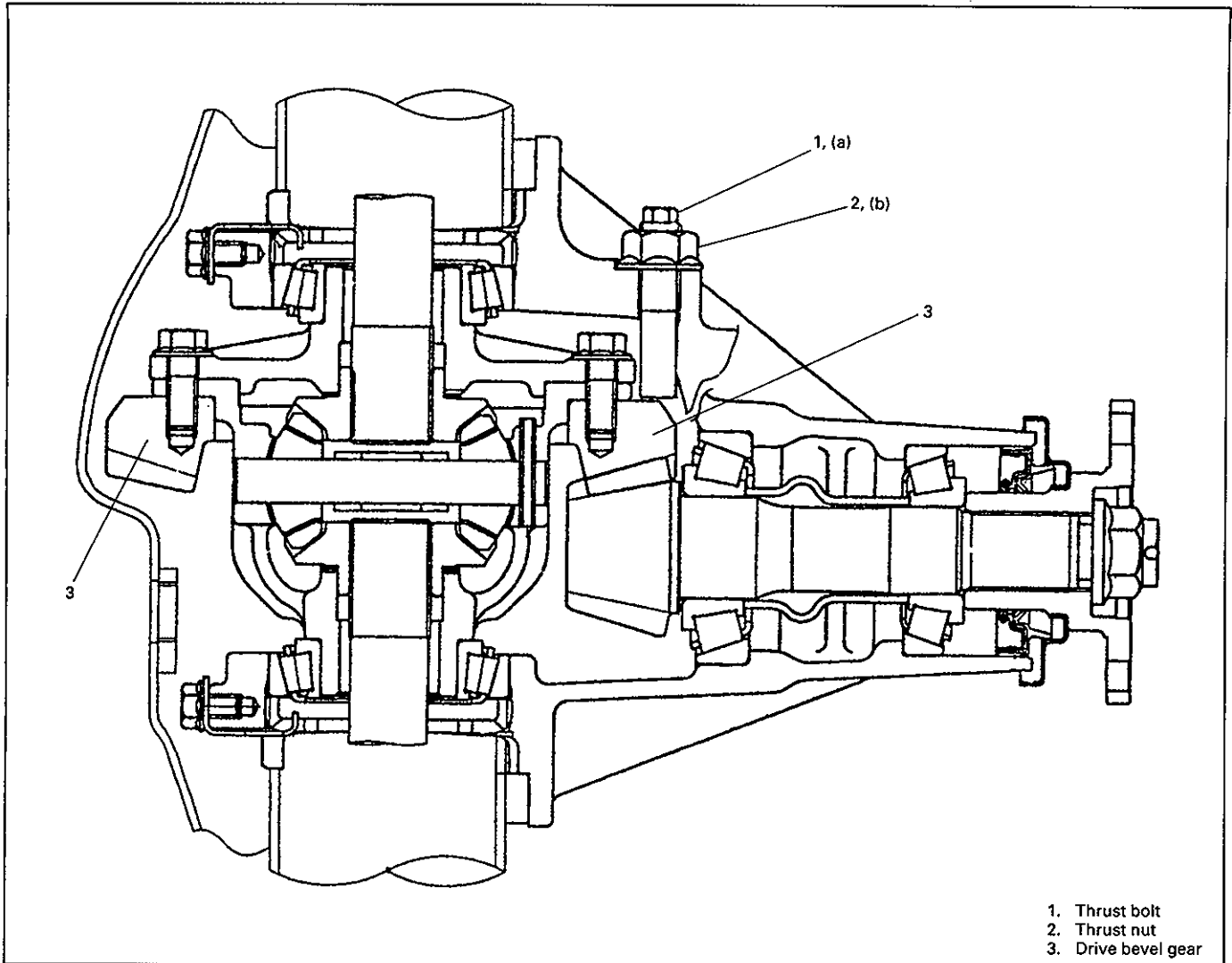
(b): 50 N·m (5.0 kg-m, 36.0 lb-ft)

After tightening all fasteners properly, fill hypoid gear oil as specified and check tightening of plugs with specification.



85F00-7E-7-2

REAR DIFFERENTIAL THRUST BOLT



- 1. Thrust bolt
- 2. Thrust nut
- 3. Drive bevel gear

85F00-7E-8-1

ADJUSTMENT

Thrust bolt, screwed into the differential carrier, is required to take a certain position relative to the bevel gear in place. This position is reached when thrust bolt is first tightened specified torque till its forward end touches the back of the bevel gear and then backed away 1/4 turn.

This position of the bolt introduces the specified clearance (0.2 – 0.4 mm, 0.008 – 0.015 in).

After so positioning the bolt, be sure to secure it by tightening thrust nut to the specified torque value.

Tighting Torque

(a): 2.0 N·m (0.2 kg-m, 1.4 lb-ft)

(b): 85 N·m (8.5 kg-m, 61.5 lb-ft)

SECTION 8

BODY ELECTRICAL SYSTEM

NOTE:

*1 and *2 of system circuit in this section indicate as shown below.

*1; For General & European spec. (Except German spec.)

*2; For German spec.

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Light Remainder Warning Buzzer	8-12
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Headlight Beam Leveling System (If equipped)	8-17
Small, Tail and License Plate Light	8-19
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Stop Lights	8-21
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Rear Window Wiper and Washer (If equipped)	8-29
Rear Window Defogger (Optional)	8-31
Power Door Mirror Control System (If equipped)	8-34
Central Locking System (If equipped)	8-36
Power Window Control System (If equipped)	8-40

85F00-8-1-2

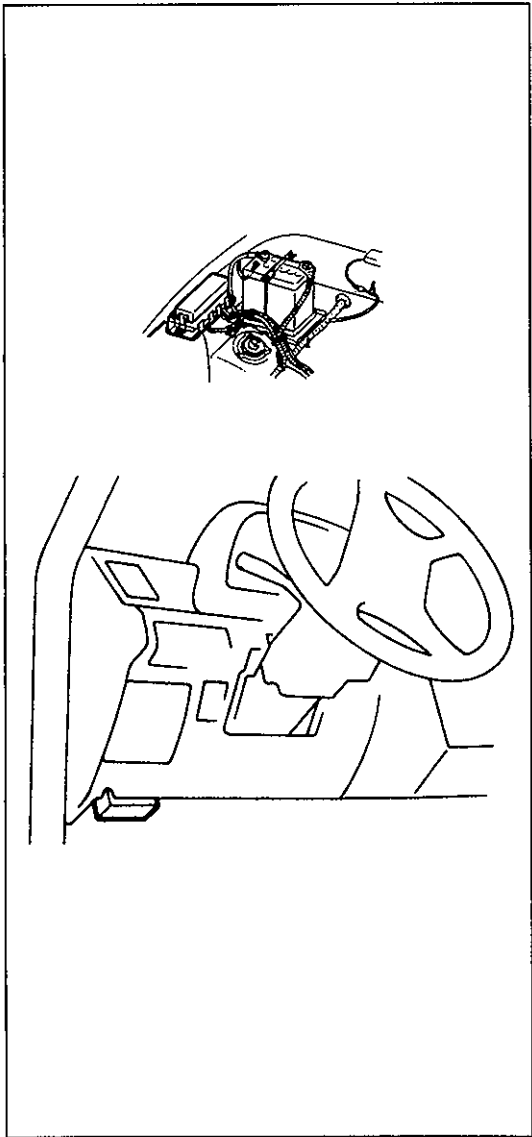
GENERAL DESCRIPTION

The chassis electrical components of this vehicle are designed to operate on 12 volts power supplied by the battery. The electrical system utilizes negative ground polarity.

WIRING

All chassis low voltage wires are insulated. The insulation is color coded for identification of individual chassis circuit.

85F00-8-2-1



85F00-8-2-2

BODY ELECTRICAL SYSTEM

FUSES AND SWITCHES

FUSES AND MAIN SWITCH

The main fuse box is located on the fender apron panel in the engine room and the fuse box is installed to underside of the instrument cover panel. The data and arrangement of each fuse are as shown below.

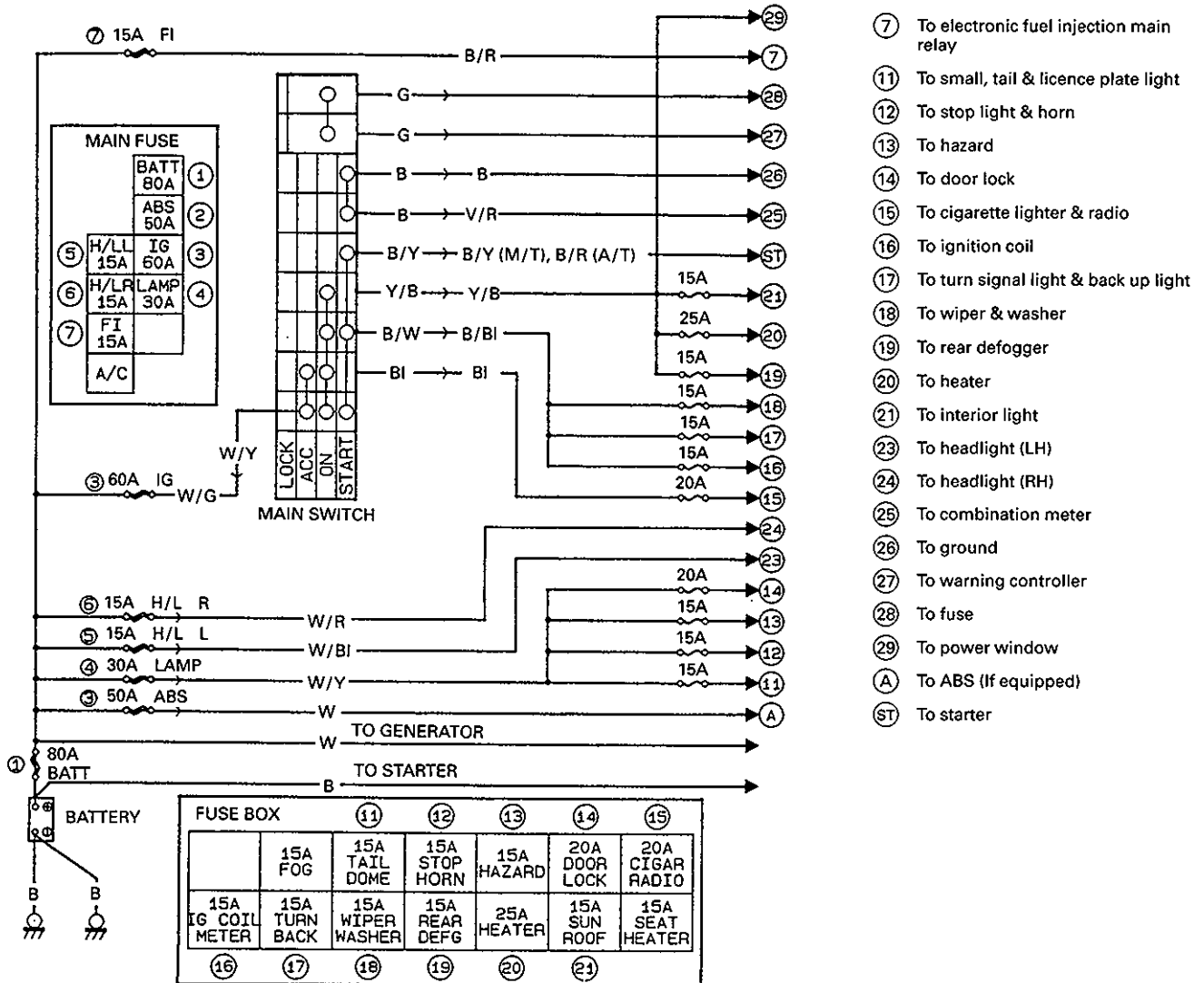
CAUTION:

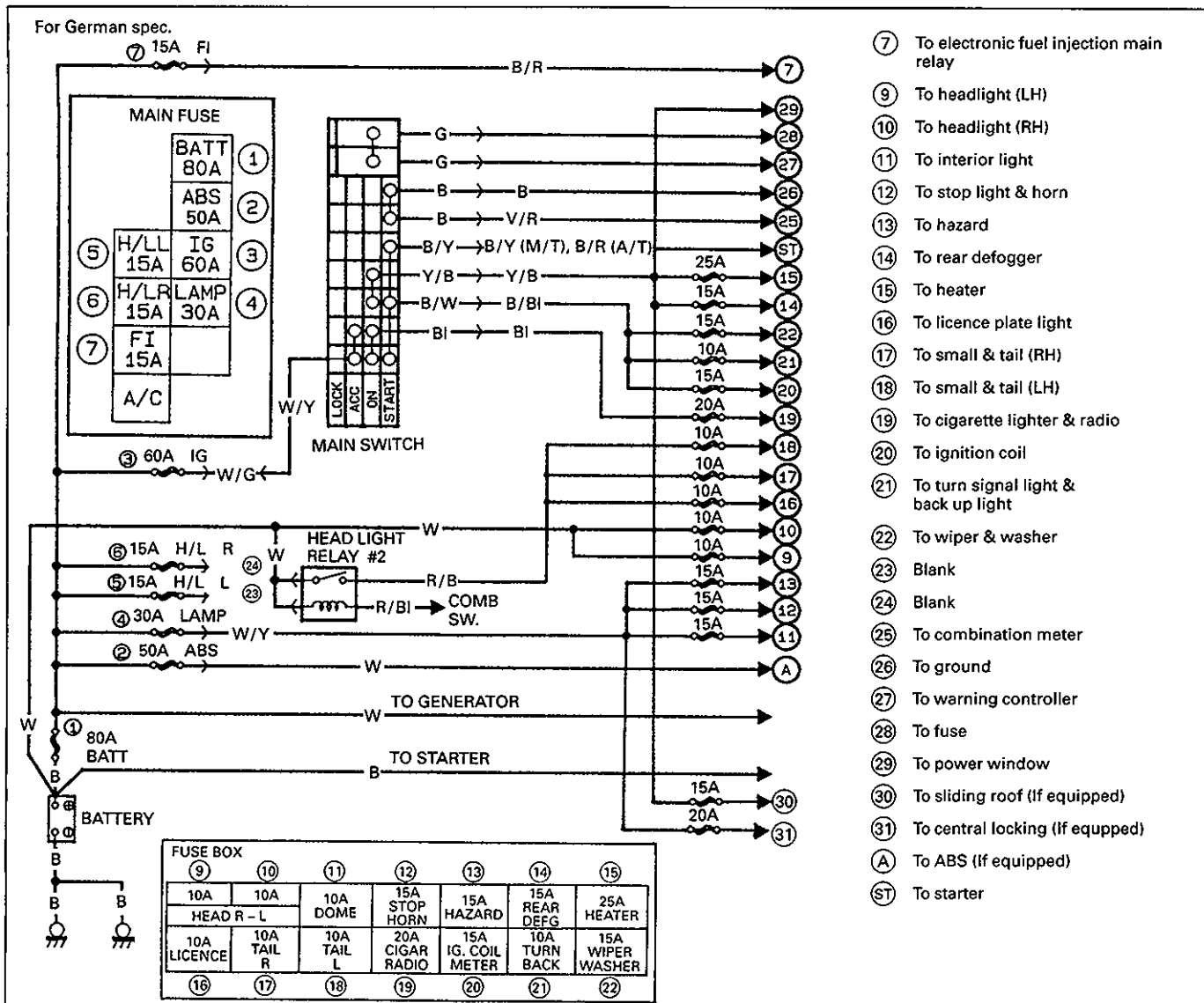
- When replacing a fuse, be sure to use one having a correct rated amperage.
- Before replacing a fuse, turn OFF every switch of electric equipment including main switch.

WIRE COLOR SYMBOLS

B	:Black	Lg	:Light green	W/G	:White/ Green
Bl	:Blue	P/B	:Pink/ Black	W/R	:White/ Red
B/Bl	:Black/ Blue	R	:Red	W/Y	:White/ Yellow
B/R	:Black/ Red	V/R	:Violet/ Red	Y	:Yellow
B/W	:Black/ White	W	:White	Y/B	:Yellow/ Black
B/Y	:Black/ Yellow	W/B	:White/ Black	Y/Bl	:Yellow/ Blue
G	:Green	W/Bl	:White/ Blue	Y/G	:Yellow/ Green

For General & European spec.
(Except German spec.)





85F00-8-4-1

MAIN SWITCH**Inspection**

Remove steering column referring to Steering Section. And then remove steering lock/main switch from steering column referring to Steering Section.

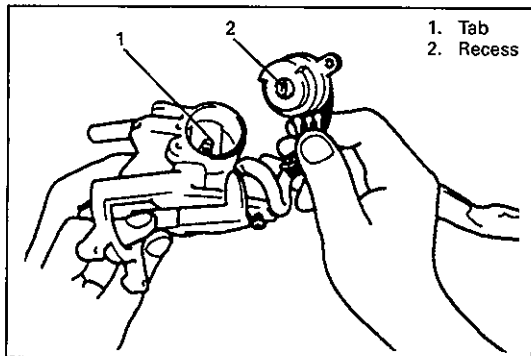
Checking continuity between terminals

Use a circuit tester to check continuity at each switch position.

Wire color		W/Y	BI	B/W	Y/B	B/Y	B	B	G	G
Key	Position									
OUT	LOCK	○								
	ACC	○	○							
	ON	○	○	○	○					
	START	○	○	○	○	○	○	○		

If any continuity is not obtained, replace main switch. Reverse removal procedure to install. At installation, position ignition switch so that its recess is mated with tab on bracket.

85F00-8-4-4



85F00-8-4-5

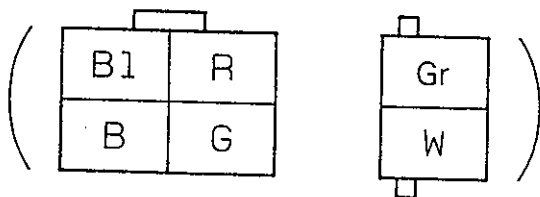
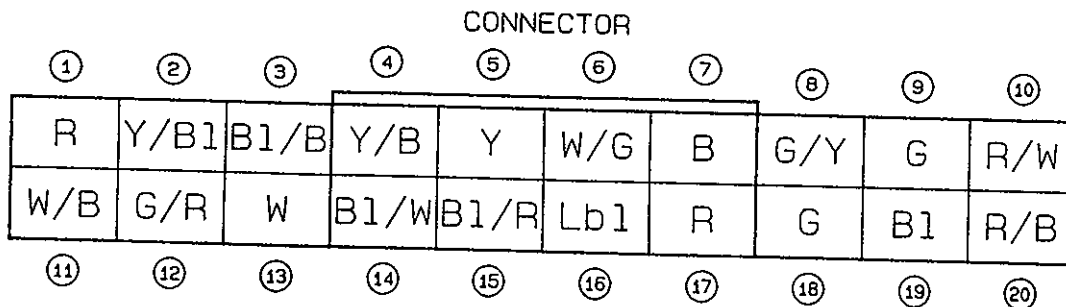
COMBINATION SWITCH

The turn signal/dimmer switch incorporates the turn signal, hazard warning, dimmer and passing light switches.

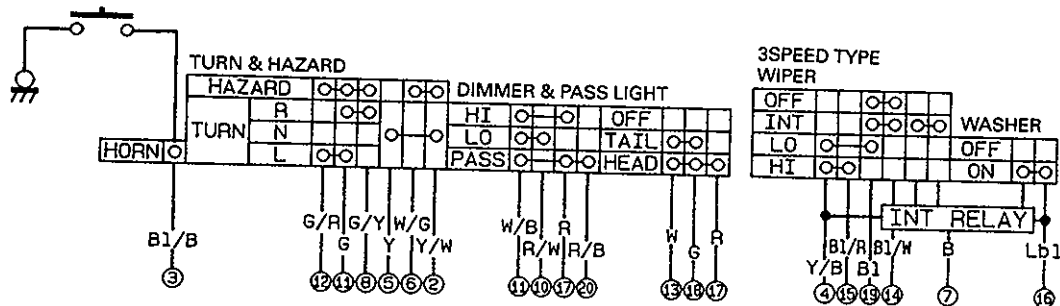
Inspection

1. Disconnect negative cable at battery.
2. Remove lower steering column cover.
3. Disconnect combination switch couplers.

85F00-8-5-1



Continuity between terminals

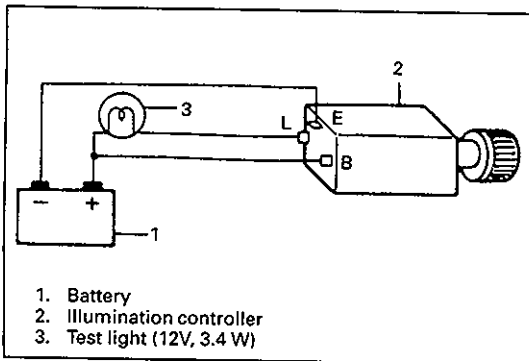


B : Black
 B1 : Blue
 B1/B : Blue/Black
 B1/R : Blue/Red
 B1/W : Blue/White
 G : Green

G/R : Green/Red
 G/Y : Green/Yellow
 R : Red
 R/B : Red/Black
 R/W : Red/White
 W : White

W/B : White/Black
 W/G : White/Green
 Y : Yellow
 Y/B : Yellow/Black
 Y/B1 : Yellow/Blue
 Lb1 : Light blue
 Gr : Gray

85F00-8-5-2



1. Battery
2. Illumination controller
3. Test light (12V, 3.4 W)

85F00-8-5-5

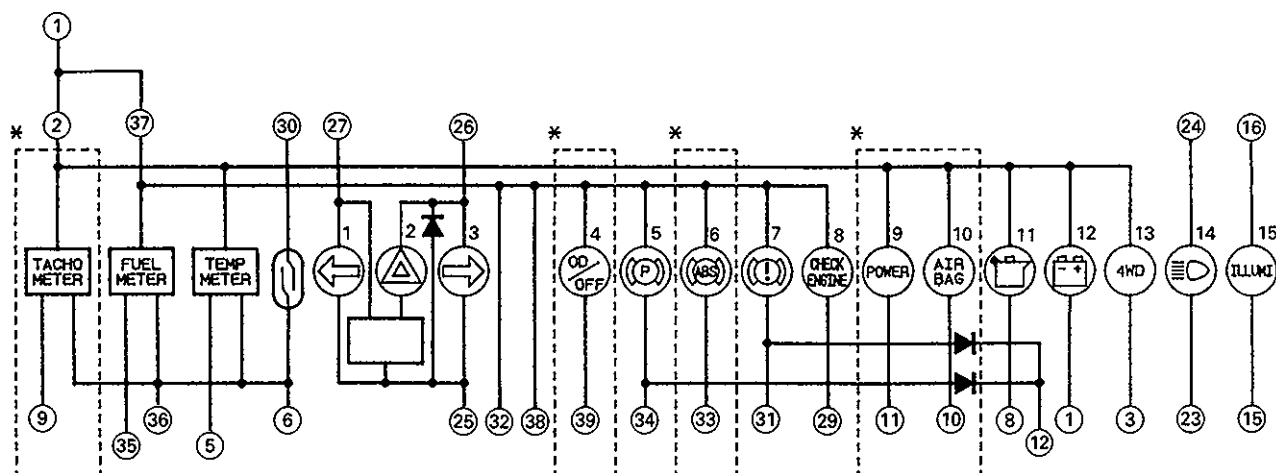
ILLUMINATION CONTROLLER (If equipped)**Inspection**

Use a bulb to wire as illustrated.

Make sure that illumination controller knob is turned clockwise to brighten test light and counterclockwise to darken it.

INSTRUMENTS AND GAUGES

COMBINATION METER WIRING



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
W	B	O		Y			Y	Br	Y		V				R							R	W	B	G		G	V	Y	Y	R	Lg	R	B	Y	B	Y	W	B
R	W	B	W	W	W	B	B	W	G	R	R				Y	Bl						Bl	Bl		Y	R	R	Y	Y	B	Bl	Bl	Y	W	W	R	B		

1. Turn signal pilot light (LH)
2. Hazard pilot light
3. Turn signal pilot light (RH)
4. Over drive off indicator light (A/T)
5. Parking brake warning light
6. "ABS" warning light (if equipped)
7. Brake warning light
8. "CHECK ENGINE" light
9. Power select indicator light (A/T)
10. "AIR BAG" warning light (if equipped)
11. Oil pressure light
12. Charge warning light
13. "4WD" light
14. High beam light
15. Illumination light

- 1 To generator
- 2 To ignition switch
- 3 To 4WD controller
- 5 To coolant temp. sensor
- 6 Blank
- 8 To oil pressure switch
- 9 To ECM
- 10 To AIR BAG controller
- 11 To A/T controller
- 12 To ignition switch
- 15 To illumination controller
- 16 To light relay
- 23 To headlight switch
- 24 To main fuse

- White/Red
Black/White
Orange/Black
Yellow/White

Yellow/Black
Brown/White
Yellow/Green
Pink
Violet/Red
Black
Red/Yellow
Red
White/Blue

- 25 To ground
- 26 To turn signal switch (RH)
- 27 To turn signal switch (LH)
- 29 To ECM
- 30 To ECM
- 31 To brake fluid level switch
- 32 Blank
- 33 To ABS controller
- 34 To parking brake switch
- 35 To fuel level gauge
- 36 To ground
- 37 To ignition switch
- 38 To rear fog light
- 39 To A/T controller

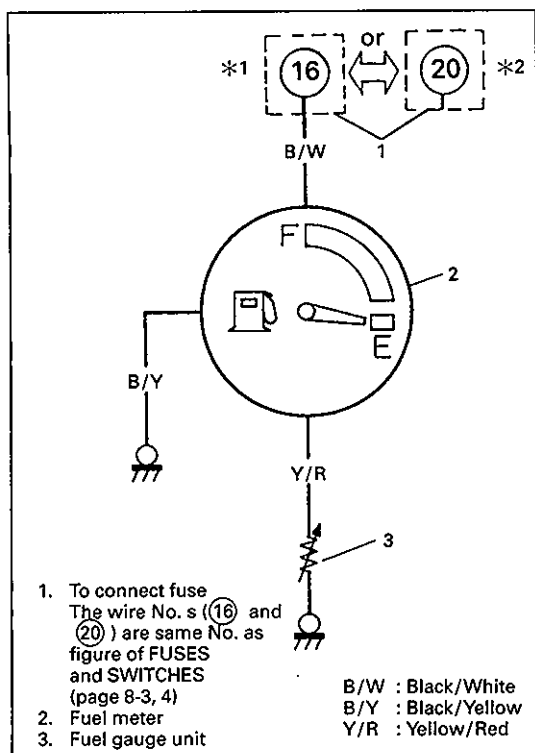
- Black
Green/Yellow
Green/Red
Violet/Yellow
Yellow
Red/Black
Light green/Red
Red/Blue
Black/Red
Yellow/Red
Black/Yellow
Black/White
Yellow/Red
White/Black

NOTE:

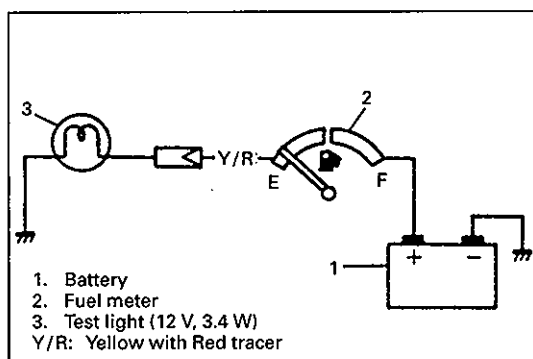
Whether equipped with * marked parts or not depends on vehicle specification.

TROUBLE DIAGNOSIS

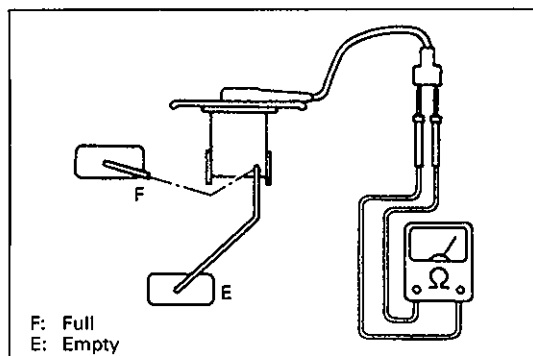
Trouble	Possible cause	Correction
Fuel level meter shows no operation.	• Meter fuse blown • Fuel meter faulty • Fuel level gauge unit faulty • Wiring or grounding faulty	Replace fuse to check for short. Check meter. Check gauge unit. Repair.
Coolant (water) temperature meter shows no operation.	• Meter fuse blown • Coolant (water) temperature meter faulty • Coolant (water) temperature gauge unit faulty • Wiring or grounding faulty	Replace fuse to check for short. Check meter. Check gauge unit. Repair.
Oil pressure light shows no lighting.	• Light fuse blown • Bulb burnt out • Oil pressure switch faulty • Wiring or grounding faulty	Replace fuse to check for short. Replace bulb. Check switch. Repair.
Brake fluid level warning light (parking brake light) shows no lighting.	• Light fuse blown • Bulb burnt out • Brake fluid level switch faulty • Wiring or grounding faulty	Replace fuse to check for short. Replace bulb. Check warning switch. Repair.
Main switch key warning buzzer shows no sounding. (Applicable to vehicle equipped with light / buzzer)	• Buzzer fuse blown • Buzzer faulty • Wiring or grounding faulty	Replace fuse to check for short. Replace buzzer. Repair.



85F00-8-8-1



85F00-8-8-3



85F00-8-8-4

FUEL METER/FUEL GAUGE UNIT

DESCRIPTION OF CIRCUIT

The fuel meter circuit consists of the fuel meter and the fuel gauge unit in the tank. Current flowing through the meter coil is varied to control the movement of the meter pointer.

When the tank is full, the fuel level gauge resistance is decreased allowing more current flow into the meter coil causing the pointer to move to the "F" (FULL) position.

INSPECTION

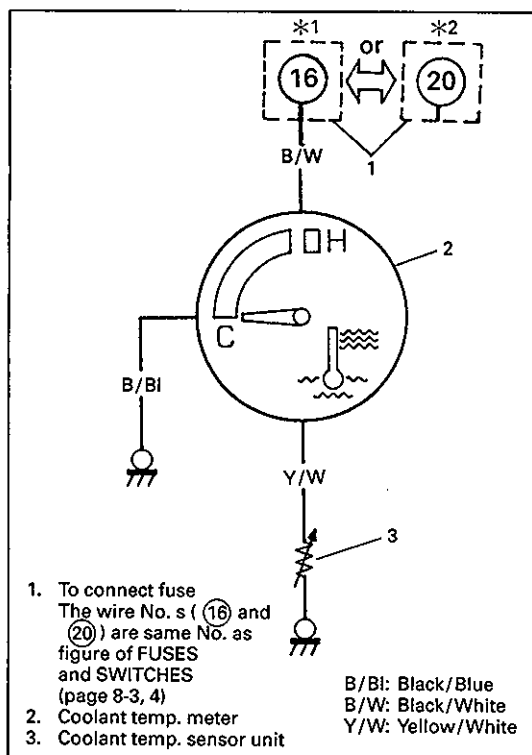
FUEL METER

- 1) Remove rear bumper.
- 2) Disconnect Y/R (Yellow with Red tracer) lead wire going to gauge unit.
- 3) Use bulb (12 V, 3.4 W) in position to ground above lead wire as shown.
- 4) Turn main switch ON.
- 5) Make sure bulb is lighted with meter pointer fluctuating several seconds thereafter.
- 6) If meter is faulty, replace it.

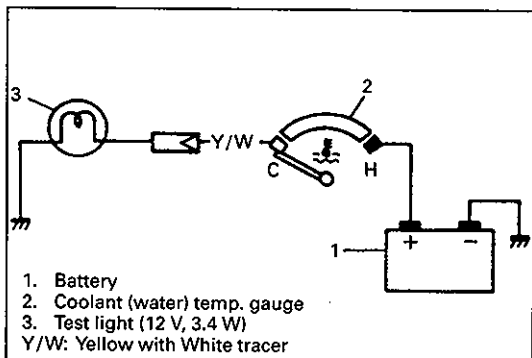
GAUGE UNIT

Use an ohmmeter to confirm that level gauge unit changes in resistance with the change of float position.

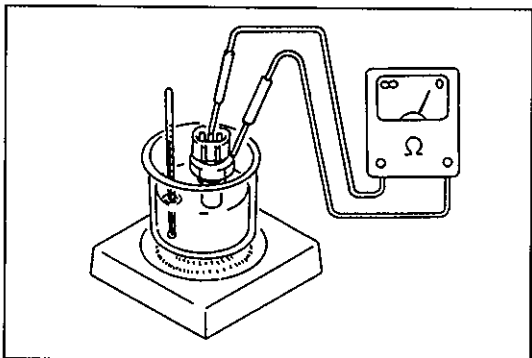
Position	Resistance
E	$120 \pm 8\Omega$
F	$3 \pm 2\Omega$
1/2	$32.5 \pm 4\Omega$



85F00-8-9-1



60A40-8-10-4



85F00-8-9-4

COOLANT (WATER) TEMP. METER/SENSOR UNIT

DESCRIPTION OF CIRCUIT

The coolant (water) temp. gauge circuit consists of coolant (water) temp. meter and the coolant (water) temp. sensor unit on the water outlet cap. The sensor unit shows different resistance values depending on the coolant temp. This causes a current flowing, through the temp. sensor coil to change, controlling the sensor pointer. That is, when the coolant temp. rises, the gauge unit resistance is decreased with more current flowing through the gauge coil, raising the gauge pointer upward from the "C" position.

INSPECTION

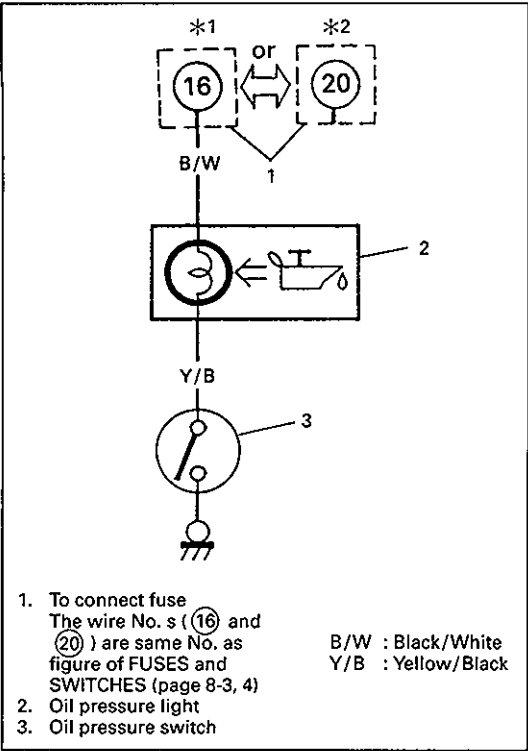
COOLANT (WATER) TEMP. METER

1. Disconnect Y/W lead wire going to gauge unit installed to intake manifold.
2. Use a bulb (12 V, 3.4 W) in position to ground above wire as illustrated.
3. Turn main switch ON. Confirm that bulb is lighted with meter pointer fluctuating several seconds thereafter.
If meter is faulty, replace it.

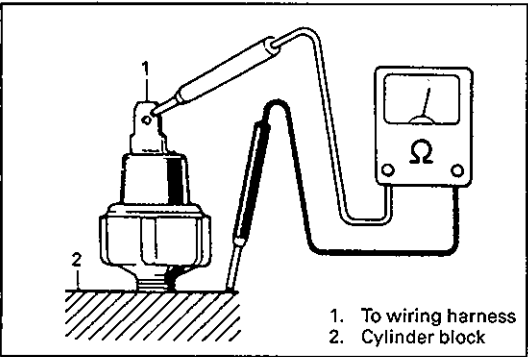
GAUGE UNIT

Warm up gauge unit. Thus make sure its resistance is decreased with increase of its temperature.

Temperature	Resistance
50°C (122°F)	190 – 260 Ω
80°C (176°F)	55 – 65 Ω
100°C (212°F)	25 – 35 Ω



60A20-8-12-1



60A20-8-12-4

OIL PRESSURE LIGHT

DESCRIPTION OF CIRCUIT

The oil pressure circuit consists of the oil pressure switch installed to the cylinder block and the warning light inside the combination meter.

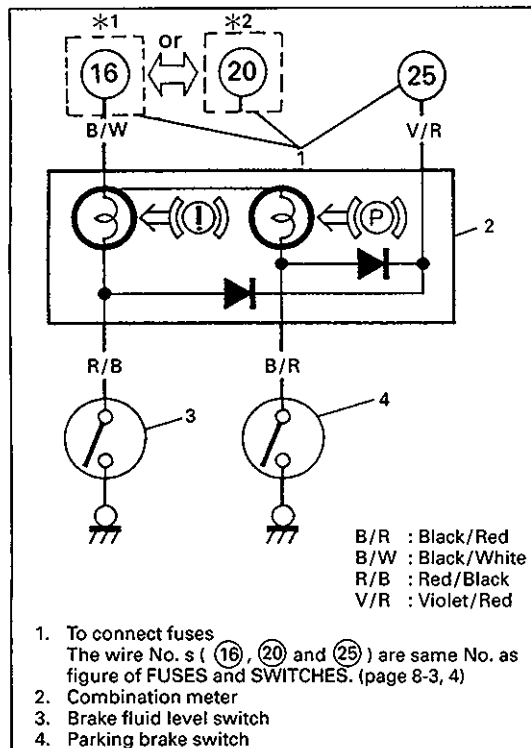
The oil pressure switch operates in such a way that it is switched OFF when oil pressure is produced by the started engine and then fed to switch.

INSPECTION

OIL PRESSURE SWITCH

Use an ohmmeter to check switch continuity.

During engine running	No continuity obtained ($\infty \Omega$)
At engine stop	Continuity obtained (0Ω)



85F00-8-11-1

BRAKE FLUID LEVEL WARNING LIGHT (If equipped)

DESCRIPTION OF CIRCUIT

The brake fluid level warning light circuit consists of a brake fluid level switch installed in the master cylinder reservoir, and the light (brake fluid level warning light) in the gauge cluster. Also, this circuit is additionally provided with the parking brake switch which warns that the parking brake is applied.

OPERATION OF WARNING LIGHT

1. When the engine is stopped the warning light comes on, if the ignition switch is turned ON and the parking brake is applied.
2. For the bulb check, the warning light comes on briefly during engine starting regardless of the brake fluid level position and the parking brake operation.
3. After the engine is started, release the parking brake. If the light goes off, the brake fluid level is adequate.

INSPECTION

● BRAKE FLUID LEVEL SWITCH

Use an ohmmeter to check switch for continuity. If found defective, replace switch.

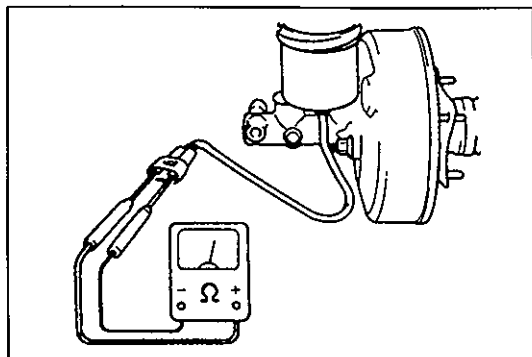
OFF position (float up)	No continuity
ON position (float down)	Continuity

● PARKING BRAKE SWITCH

Use an ohmmeter to check switch for continuity. If found defective, replace switch.

OFF position (release the parking brake)	No continuity
ON position (parking brake lever pulled up)	Continuity

85F00-8-11-3

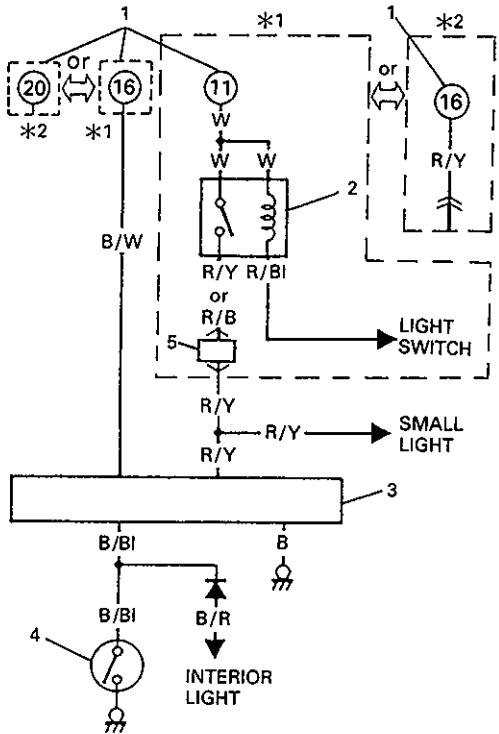


60A20-8-14-3

LIGHT REMAINDER WARNING BUZZER

DESCRIPTION OF CIRCUIT

The light warning buzzer circuit is a system to sound the buzzer when the driver turns OFF the ignition and door switch (driver side) turns ON (i.e. driver side door opens) while the lights are still ON, warning driver to turn off the lights.



1. To connect fuses
The wire No. s (11), (16) and (20) are same No. as figure of FUSES and SWITCHES. (page 8-3, 4)
2. Light relay #2
3. Warning buzzer controller
4. Door switch
5. DRL controller (If equipped)

B : Black
B/BI : Black/Blue
B/W : Black/White
B/R : Black/Red
R/B : Red/Black
R/BI : Red/Blue
R/Y : Red/Yellow

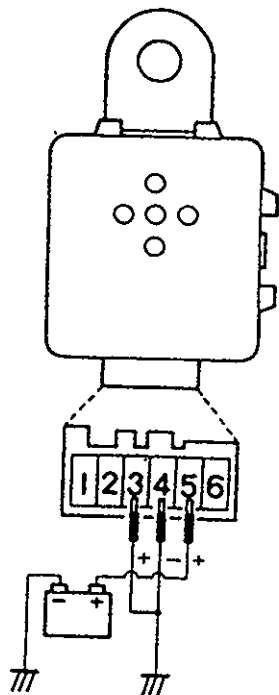
INSPECTION

When the warning buzzer does not make sounding, use the circuit diagram as shown as a reference to check the buzzer, wiring, etc.

INSPECTION OF WARNING CONTROLLER

First, connect positive (+) terminal of battery to terminal ⑤ of controller and negative (-) one to ③ and ④.

If buzzer emits buzzing sound then, controller is in good condition. If not, replace.

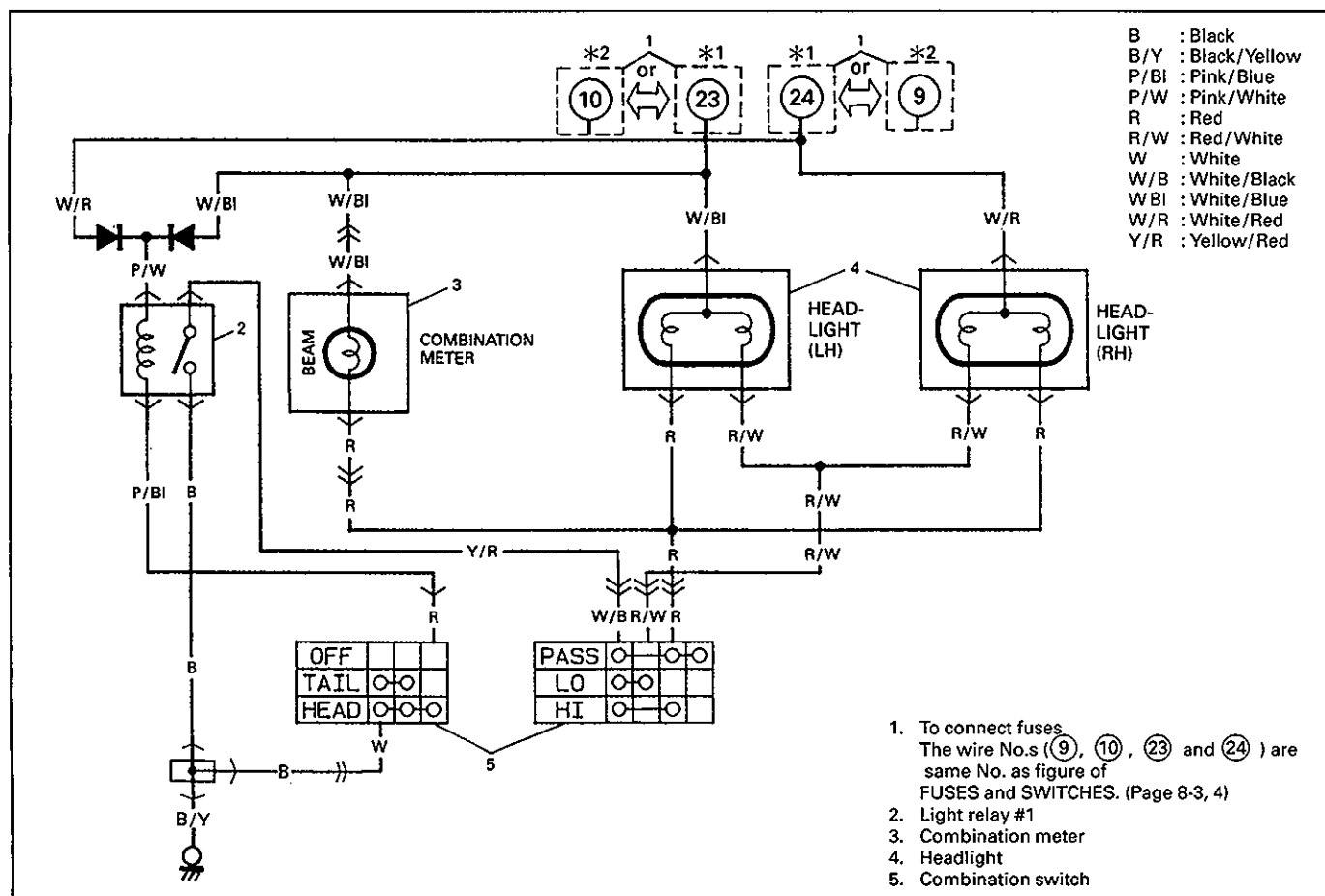


ON VEHICLE SERVICE

LIGHTING SYSTEM

HEADLIGHTS

Wiring Diagram



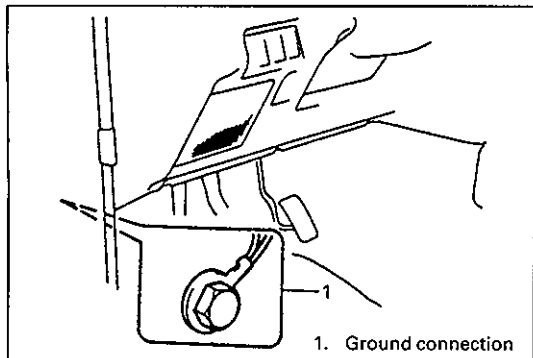
85F00-8-13-1

When the headlights are turned on, so is the small light system. As for the circuit of the small light system, refer to the following pages.

Trouble Diagnosis

Trouble	Possible cause	Correction
Only one light does not light.	- Bulb burnt out - Fuse blown - Socket, wiring or grounding faulty	Replace bulb. Replace fuse. Repair as necessary.
Headlights do not light.	- Main fuse and/or fuses blown - Lighting and dimmer switches faulty - Defective light relay - Defective diode - Wiring or grounding faulty	Replace main fuse and/or fuses to check for short. Check switches. Replace light relay. Replace diode. Repair as necessary.
Only one beam ("Hi" or "Lo") does not light.	- Bulb burn out - Lighting or dimmer switch faulty	Replace bulb. Check switch.

50G00-8-16-1



60A20-8-20-1

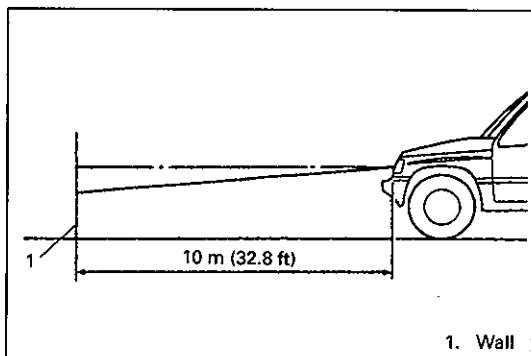
Inspection

- 1) Check lighting and dimmer switches for each terminal-to-terminal continuity.
Refer to the Section "SWITCHES".
- 2) The headlight has ground at cowl dash side panel on each side.

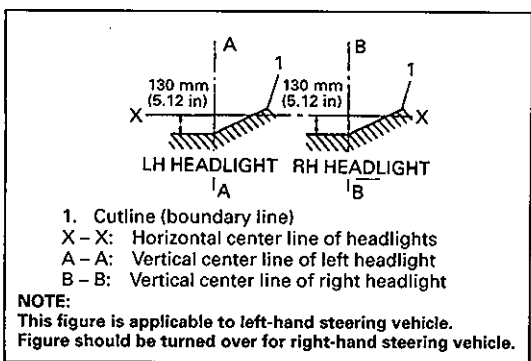
SETTING HEADLIGHT BEAMS**(Standard Procedure)**

Before setting headlight beams, adjust air pressure of each tire as specified respectively. Bounce each corner of vehicle by hand to settle its balance. Then move it over a flat surface. For headlight beam setting, some different methods and instruments are in use now, e.g., screen method using a focusing tester, etc. But method described here does not use such tester.

85F00-8-14-2



85F00-8-14-3



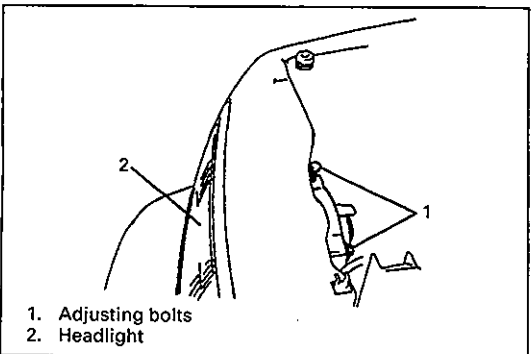
- 2) Light headlights (low beam) and check their beams projected on the wall. They should correspond to shadowed portion in figure.

NOTES:

- The beam adjustment should be carried out with one driver (75 kg or 165 lb) aboard.
- When servicing headlight beam leveling system equipped vehicle, set its leveling switch to "0" with ignition ON.

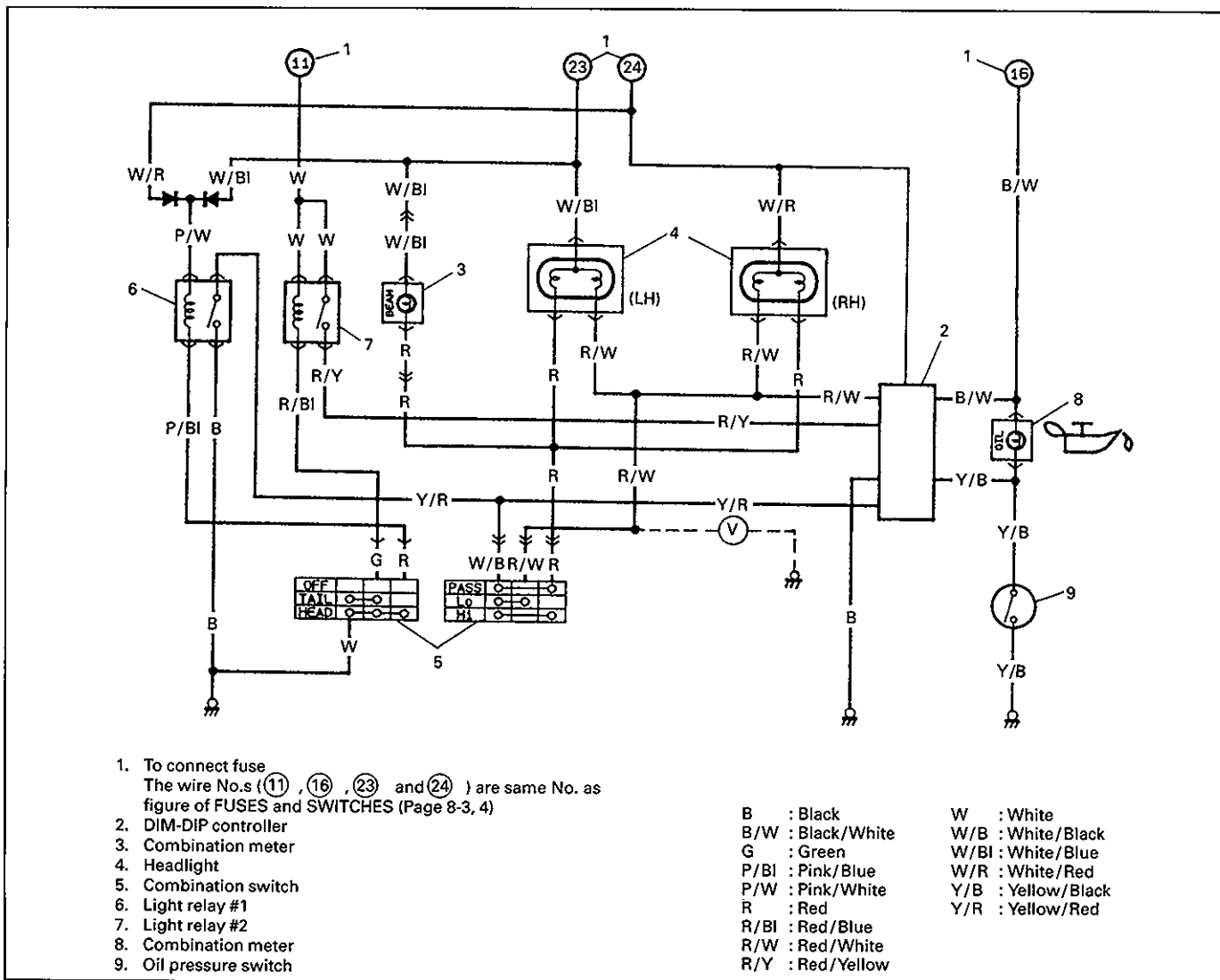
HEADLIGHT ADJUSTMENT

When adjusting headlight beam (vertical and horizontal), turn adjusting bolts.



85F00-8-14-5

DIM-DIP SYSTEM



85F00-8-15-1

Role of this system is to dim out low beam of headlights which light when engine is started and lighting switch is set to small light position.

Should anything go wrong with this system, check controller by measuring D.C. voltage between Red/White lead (headlight low beam side) and ground as shown by broken line in figure above with engine running and lighting switch set to small light position.

If measured voltage is out of specification (about 6V), replace controller.

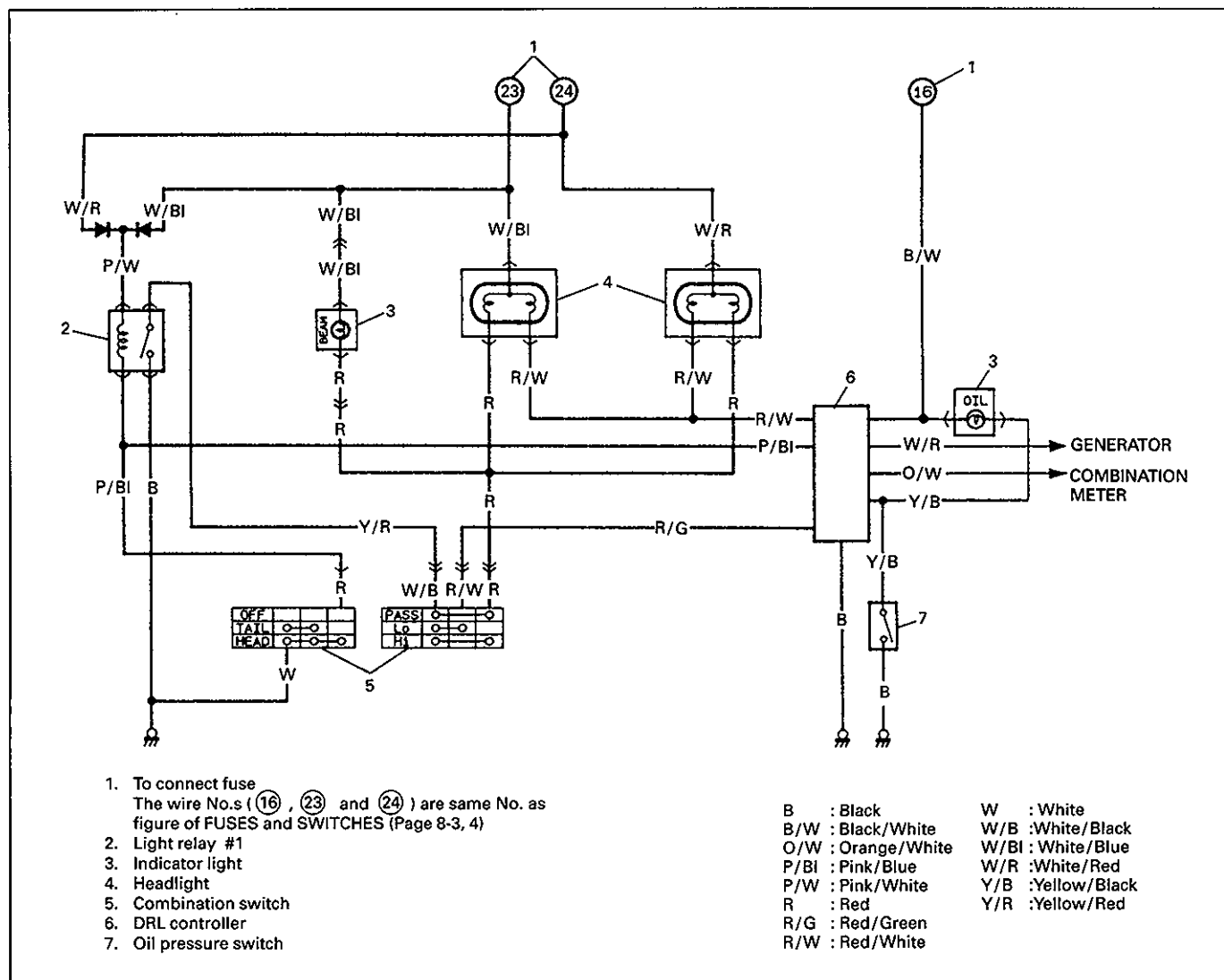
If controller is in good condition (i.e., measured voltage is about 6V), check wiring, etc. while referring to above circuit diagram.

If headlights remain on even when engine is at a stop and lighting switch is turned OFF, replace controller.

NOTE:

Dim-dip controller is located under instrument panel at the right of steering column.

DAYTIME RUNNING LIGHT SYSTEM (If equipped)

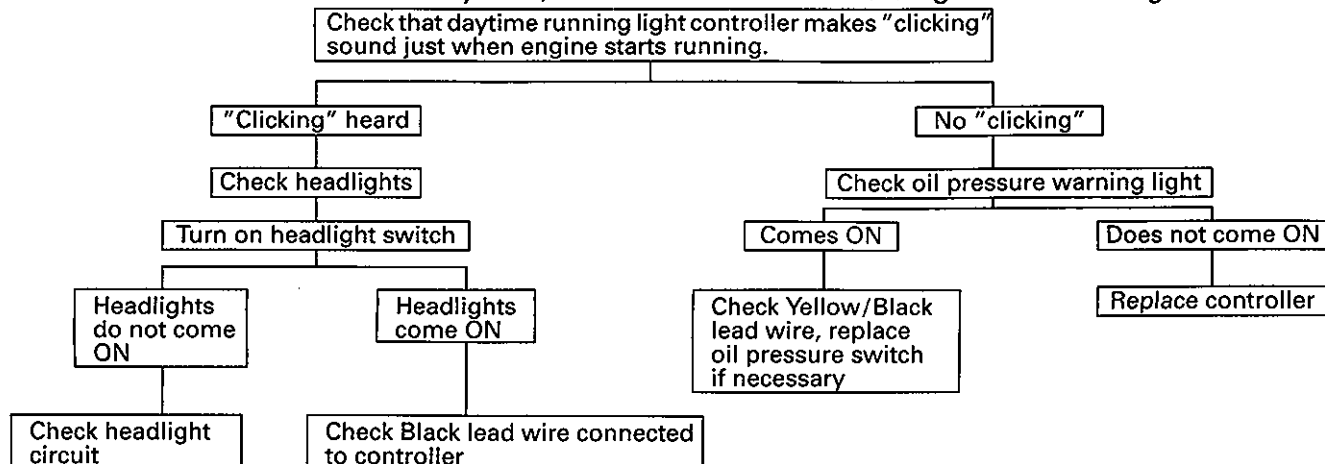


85F00-8-16-1

With this system, low beam of headlights and small lights turn ON when the engine is started and they turn OFF when it is stopped.

This system is so designed that the lighting switch has a priority. That is, when the lighting switch is set to the small light position while the engine is running and this system is at work (headlights and small lights are ON), only small lights remain ON and headlights turn OFF.

When a trouble has occurred in this system, check and correct it according to the following flow chart.

**NOTE:**

Daytime running light controller is located under instrument panel at the right of steering column.

85F00-8-16-4

HEADLIGHT BEAM LEVELING SYSTEM (If equipped)

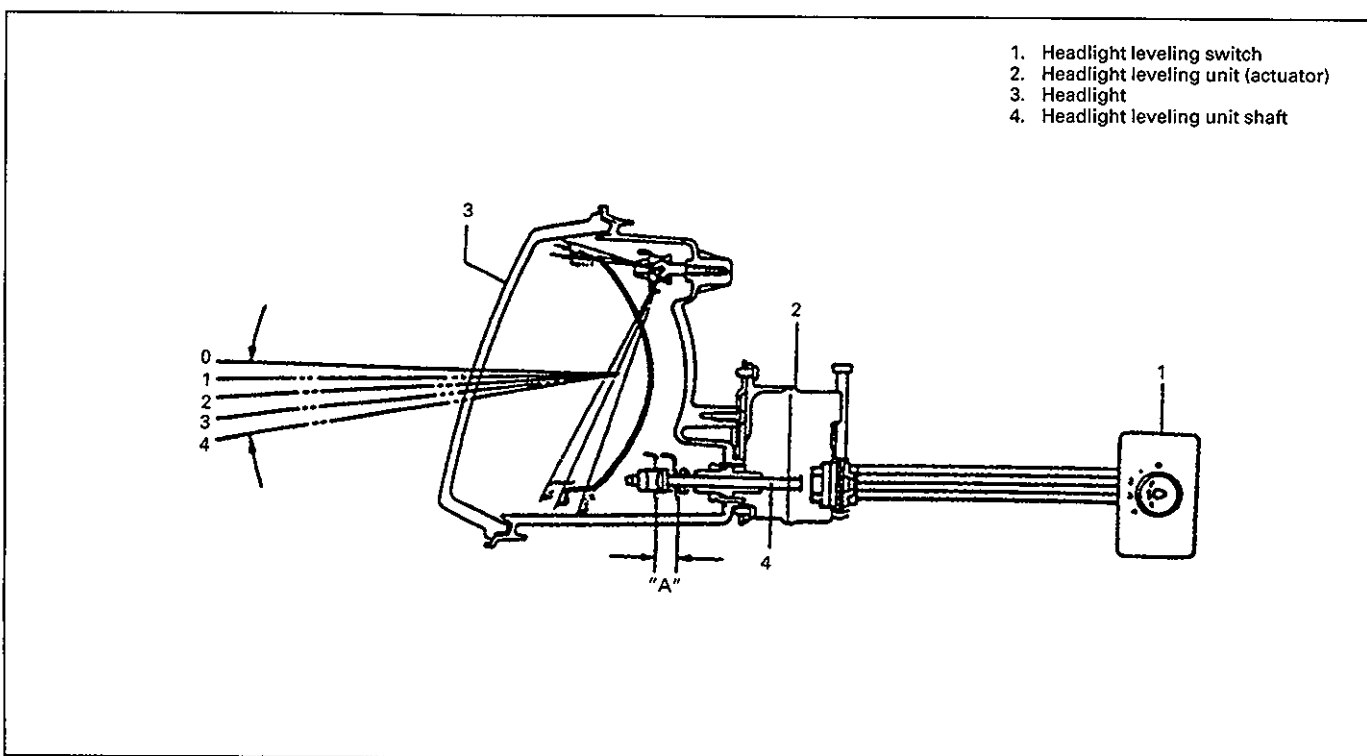
This system consists of the headlight leveling switch and headlight leveling actuator. It is used to lower both headlight aiming angles from the initial setting level by operating the leveling switch on the instrument.

NOTE:

When inspecting and adjusting the headlight beam, make sure to set the leveling switch to the "0" position with the ignition switch "ON", or down stroke from the initial setting level will be reduced.

OPERATION

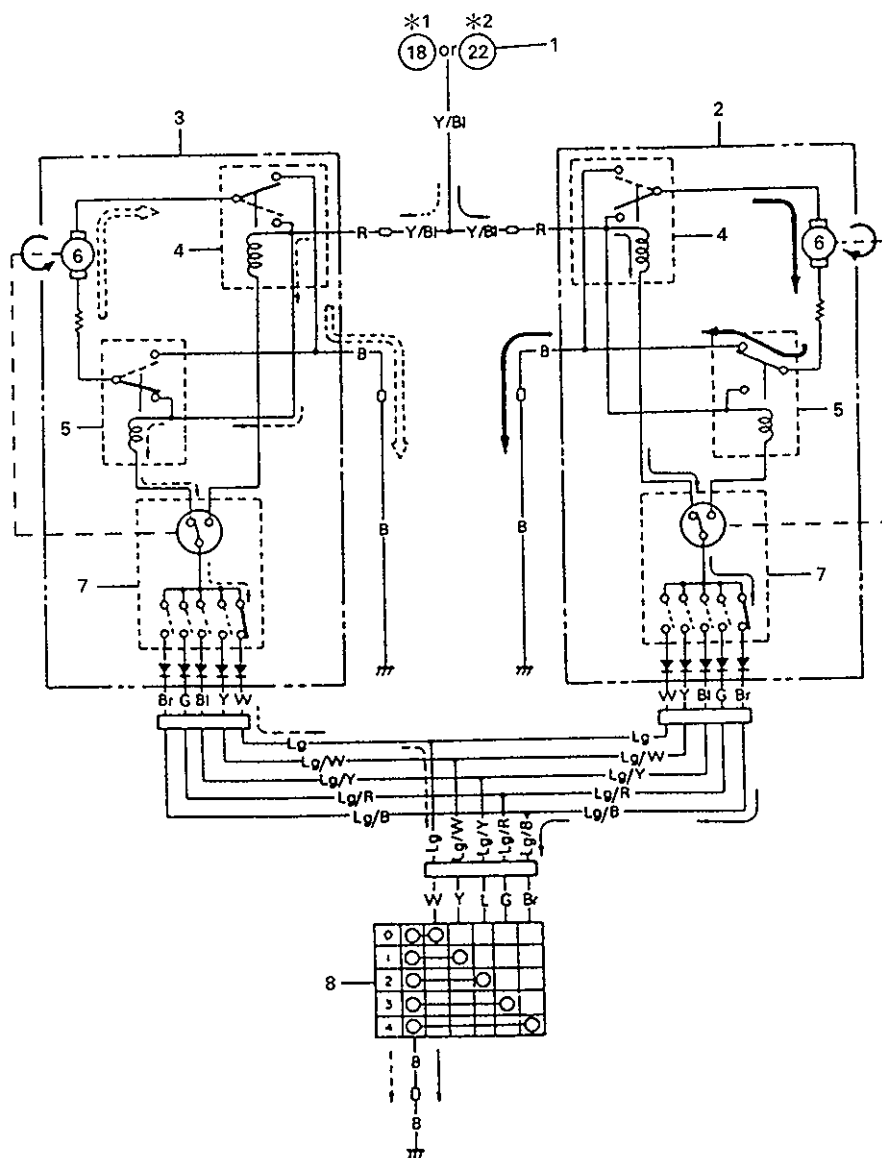
The headlight leveling actuator is mounted behind headlight assembly and connected to the headlight reflector. When the headlight leveling switch knob is turned, the headlight leveling actuator operates and it changes the headlight aiming angle according to the position selected by the leveling switch knob.



Switch position	Headlight beam level	Stroke "A"
0	Initial setting level ↓ Max. down level	_____
1		_____
2		_____
3		_____
4		Max. 3.6 mm (0.14 in)

HEADLIGHT BEAM LEVELING SYSTEM CIRCUIT

The diagram below shows the headlight beam leveling system circuit. The circuit in the area shown as "5" indicates the beam's "down" leveling operation. The circuit in area "6" indicates the beam's "up" leveling operation.



1. To connect fuse
The wire No. (18) or (22)
is same No. as figure of
FUSES and SWITCHES
2. Headlight leveling
actuator (RH)
3. Headlight leveling
actuator (LH)
4. Relay
5. Relay
6. Motor
7. Contact switch
8. Headlight leveling
switch ass'y

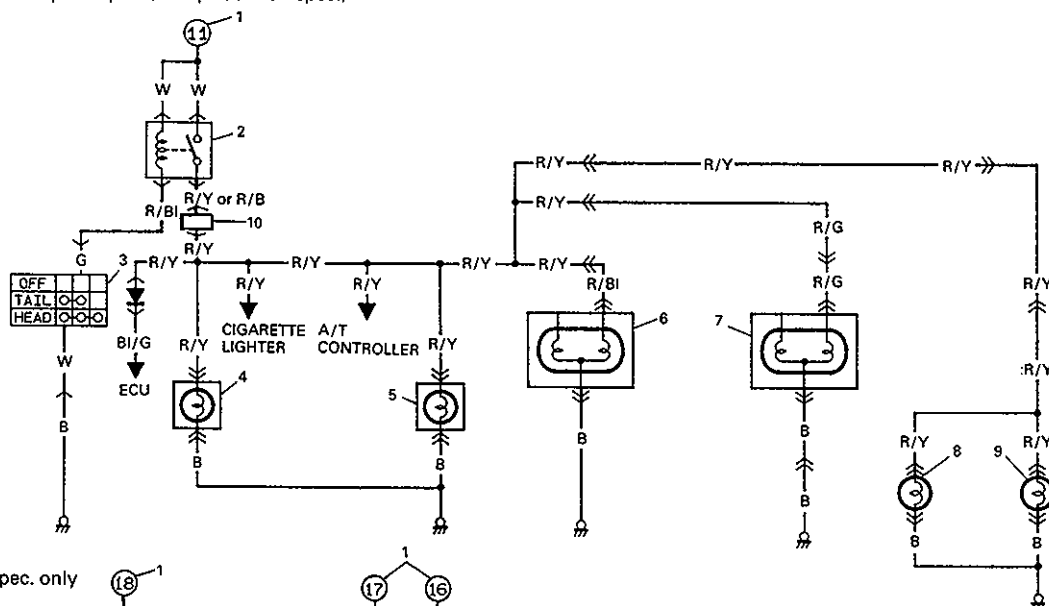
WIRE COLOR

B	:Black
Bl	:Blue
Br	:Brown
G	:Green
Lg	:Light green
R	:Red
W	:White
Y	:Yellow
B/Bl	:Black with Blue tracer
Lg/B	:Light green with Black tracer
Lg/W	:Light green with White tracer
Lg/Y	:Light green with Yellow tracer
W/G	:White with Green tracer
Y/Bl	:Yellow with Blue tracer

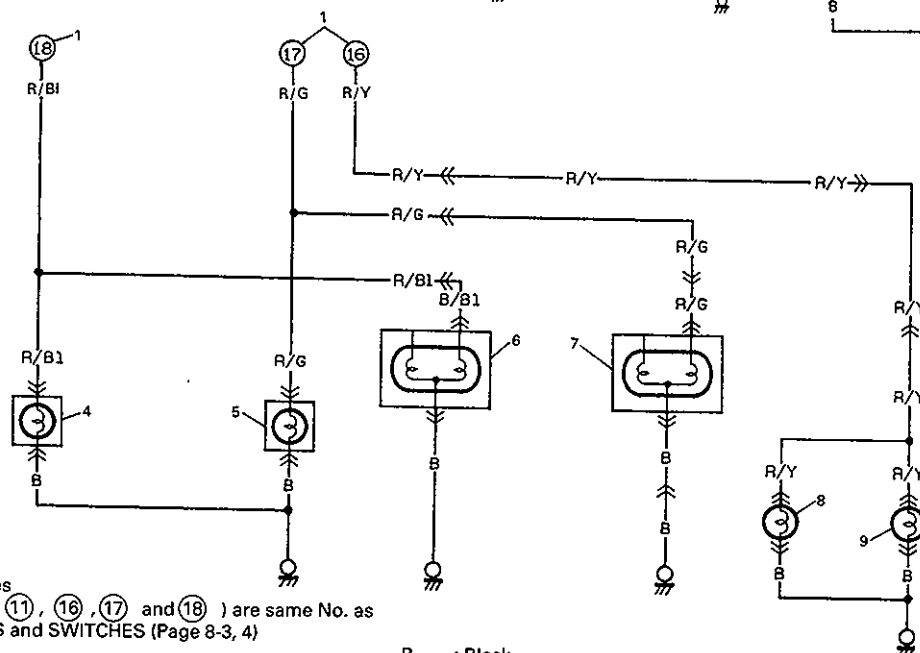
SMALL, TAIL AND LICENSE PLATE LIGHT

WIRING CIRCUIT

For General & European spec. (Except German spec.)



For German spec. only



1. To connect fuses

The wire No.s (11 , 16 , 17 and 18) are same No. as figure of FUSES and SWITCHES (Page 8-3, 4)

2. Light relay #2
3. Combination meter
4. Front small light (LH)
5. Front small light (RH)
6. Rear tail light (LH)
7. Rear tail light (RH)
8. License plate light (LH)
9. License plate light (RH)
10. DRL controller (If equipped)

B : Black
 B/Bl : Black/Blue
 Bl/G : Blue/Green
 G : Green
 R/B : Red/Black
 R/Bl : Red/Blue
 R/G : Red/Green
 R/Y : Red/Yellow
 W : White

85F00-8-19-1

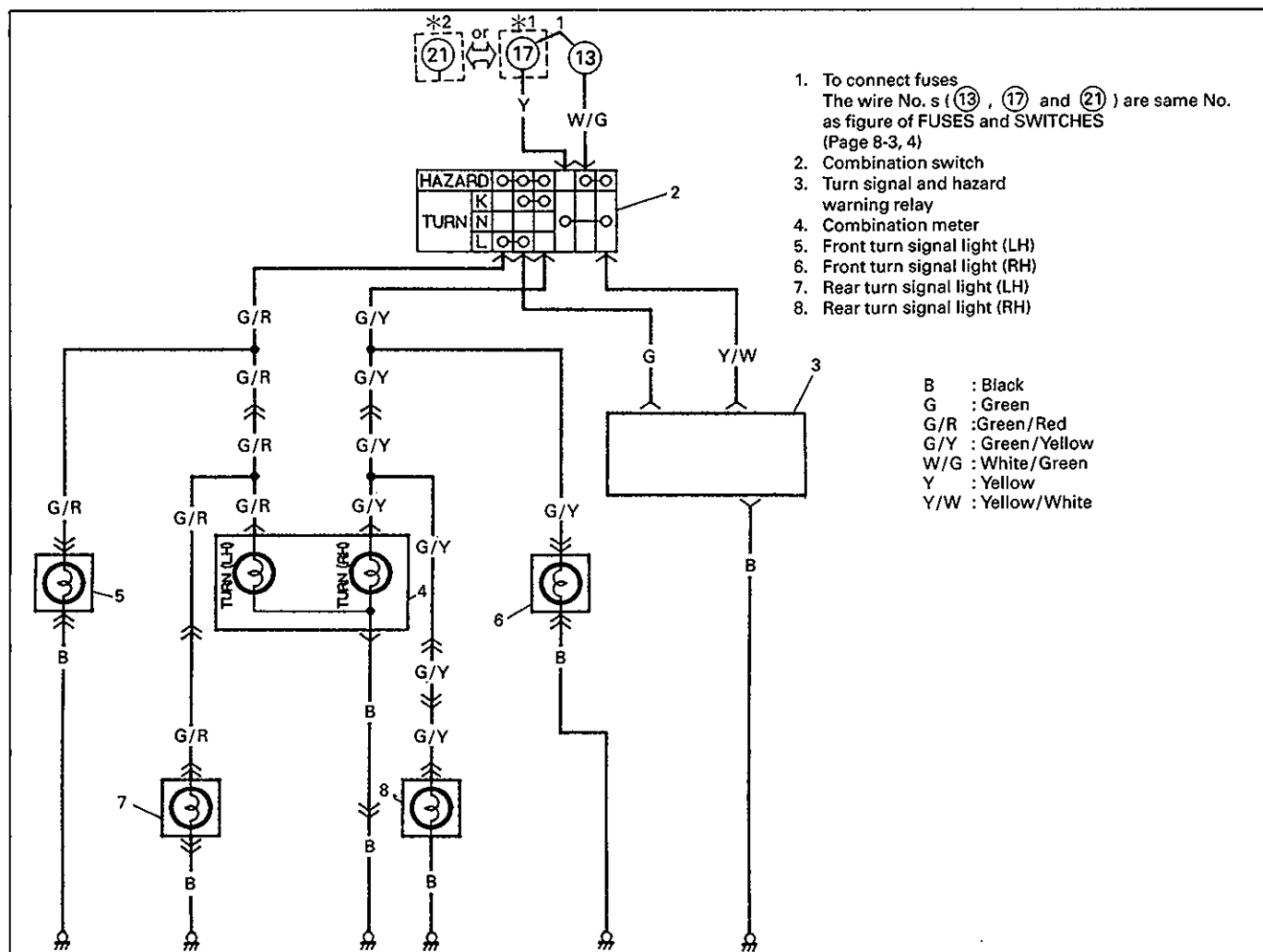
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Lights do not light.	● Main fuse and/or fuses blown ● Light relay faulty ● Lighting switch faulty ● Wiring or grounding faulty	Replace main fuse and/or fuses to check for short. Replace light relay Check switch. Repair as necessary.

85F00-8-19-5

TURN SIGNAL AND HAZARD WARNING LIGHT

WIRING CIRCUIT



85F00-8-20-1

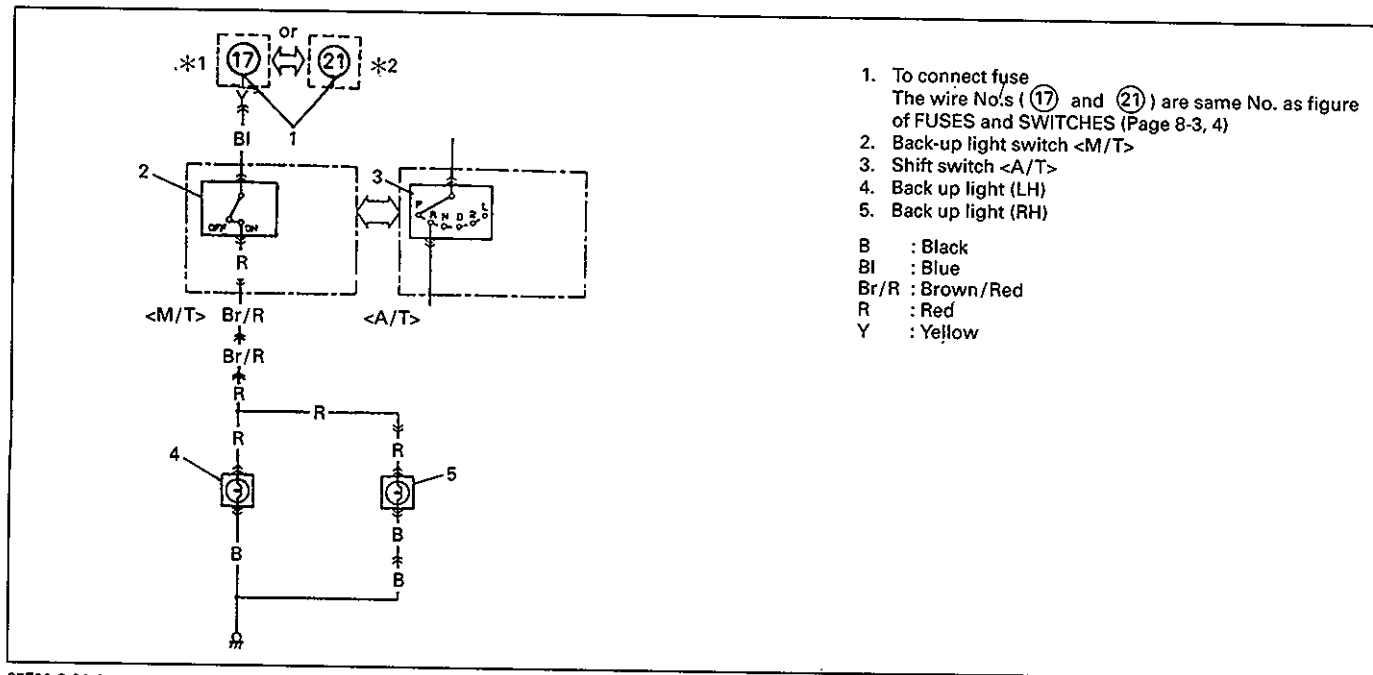
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Flashing rate high or slow, only one side flashes.	• Wiring or grounding faulty	Repair
	• Wrong bulb or setting different wattage bulb	Replace.
	• One of light bulbs burnt out on the right or left side of the front or rear side	Replace.
	• Defective turn signal and hazard warning relay	Replace.
	• Open circuit or high resistance existing between turn signal and hazard warning switch and lights on one side	Repair.
No flashing on either side.	• Blown fuse on turn signal and hazard warning circuit.	Replace.
	• Open circuit or high resistance existing between battery and switch	Repair.
	• Defective relay	Replace.

85F00-8-20-4

BACK UP LIGHTS

WIRING CIRCUIT



85F00-8-21-1

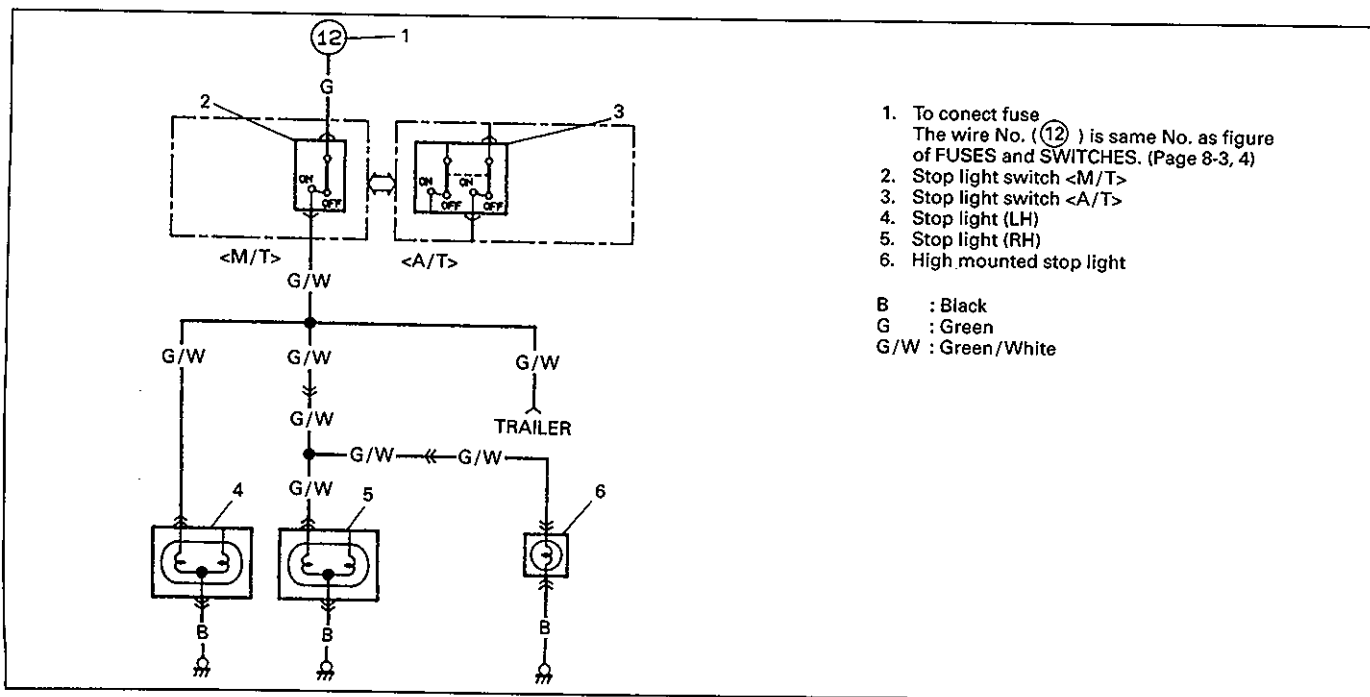
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Back-up lights do not light.	- Fuse blown - Back-up light switch faulty - Wiring or grounding faulty	Replace fuse to check for short. Check switch. Repair as necessary.

85F00-8-21-3

STOP LIGHTS

WIRING CIRCUIT



85F00-8-21-4

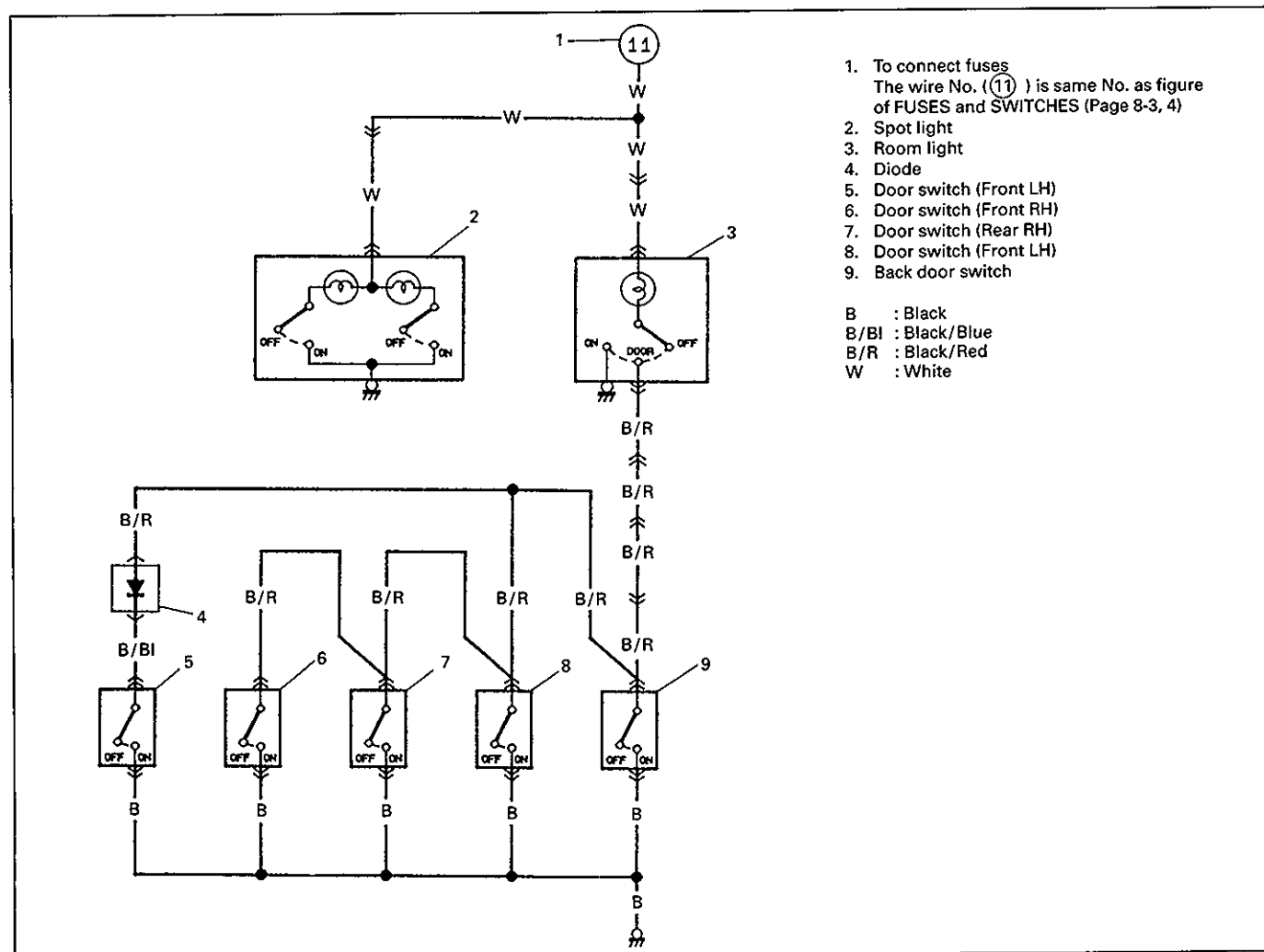
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Stop lights do not light.	- Fuse blown - Stop light switch faulty - Wiring or grounding faulty	Replace fuse to check for short. Adjust or replace switch. Repair as necessary.
Stop lights stay on.	Stop light switch faulty	Adjust or replace switch.

60A20-8-24-1

INTERIOR LIGHTS

WIRING CIRCUIT



85F00-8-22-2

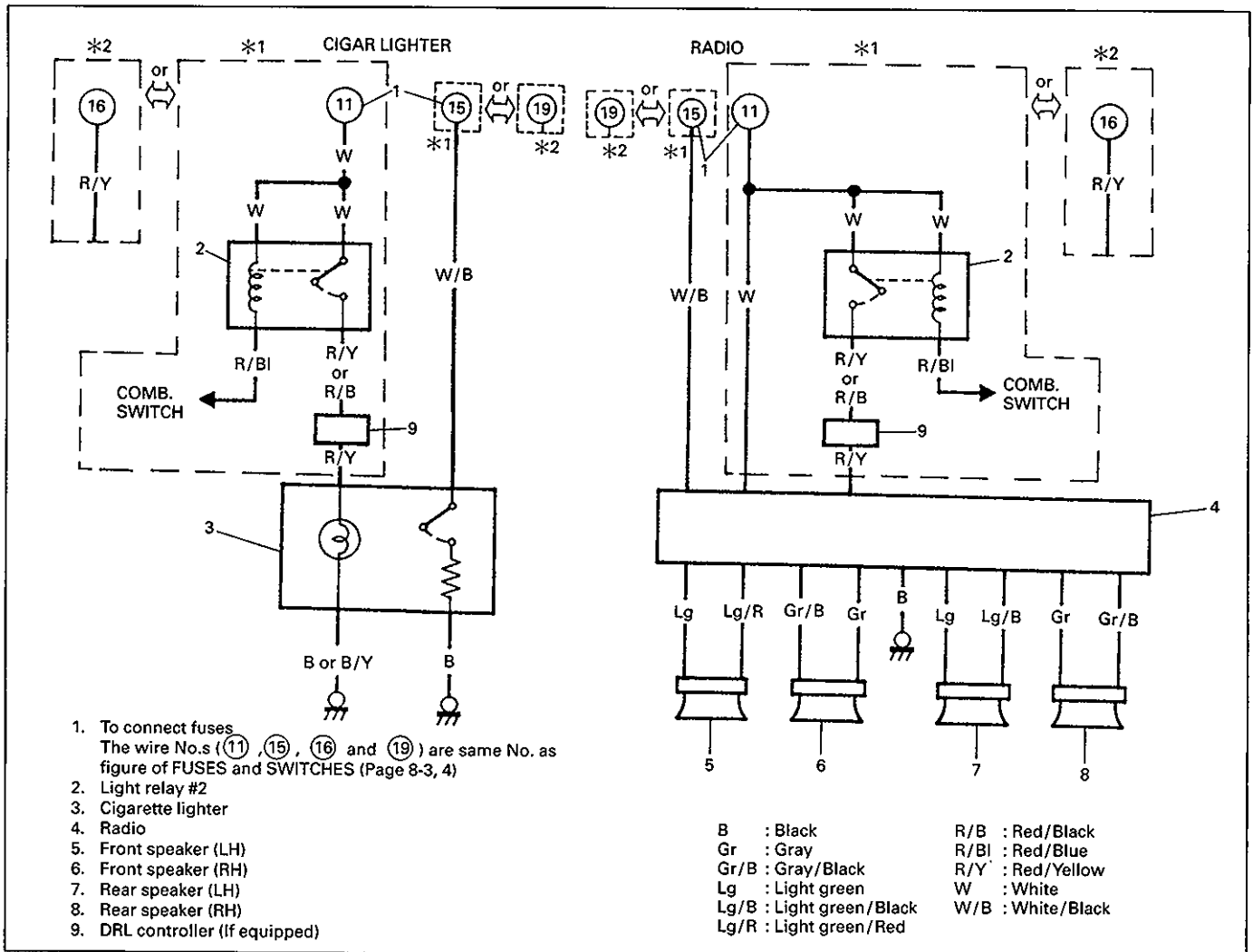
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Interior light does not light.	- Fuse blown - Switch faulty - Wiring or grounding faulty	Replace fuse to check for short. Check switch. Repair as necessary.

60A20-8-25-2

CIGARETTE LIGHTER AND RADIO

WIRING CIRCUIT



85F00-8-23-1

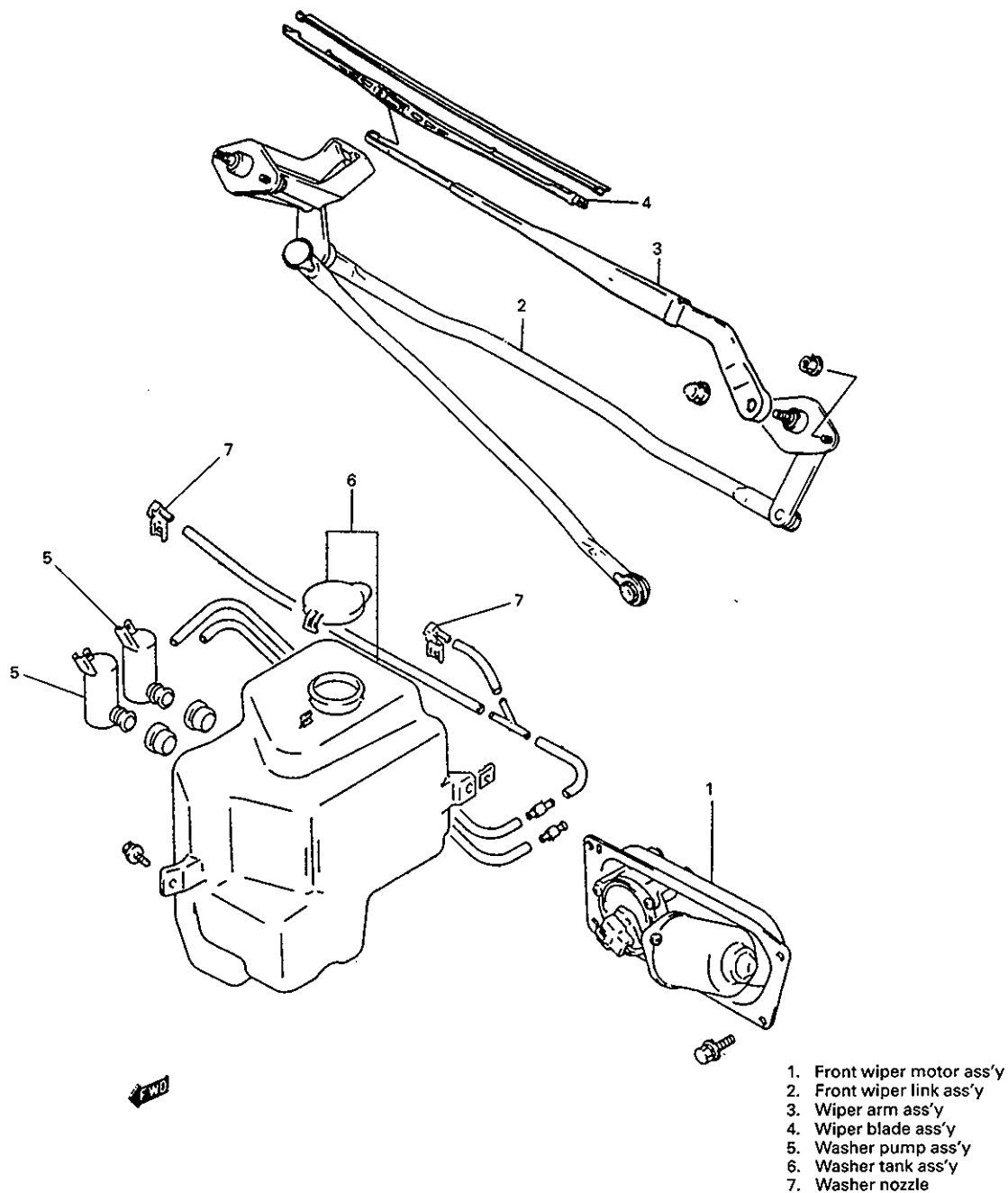
TROUBLE DIAGNOSIS

Trouble	Possible cause	Correction
Cigarette lighter/radio (optional) do not work.	- Fuse blown - Ignition switch faulty - Wiring or grounding faulty	Replace fuse to check for short. Check switch. Repair as necessary.

85F00-8-23-4

WINDSHIELD WIPERS (FRONT WIPER)

The windshield wiper is 3-speed type and the windshield washer is equipped with a separate-type washer pump.



DESCRIPTION OF CIRCUIT

The circuit is designed so that when the wiper switch is turned OFF the wiper blades automatically return to their specified rest positions. In figure below, when the wiper switch is turned ON with the ignition switch ON, current is supplied continuously from the battery (via lead Y/BI-switch-lead BI or BI/R) to the motor, running the motor to move the blades.

The gear-and-linkage mechanism, which converts the rotary movement of the motor to the wiping movement of the blades, has a contact plate on the shaft of its output gear.

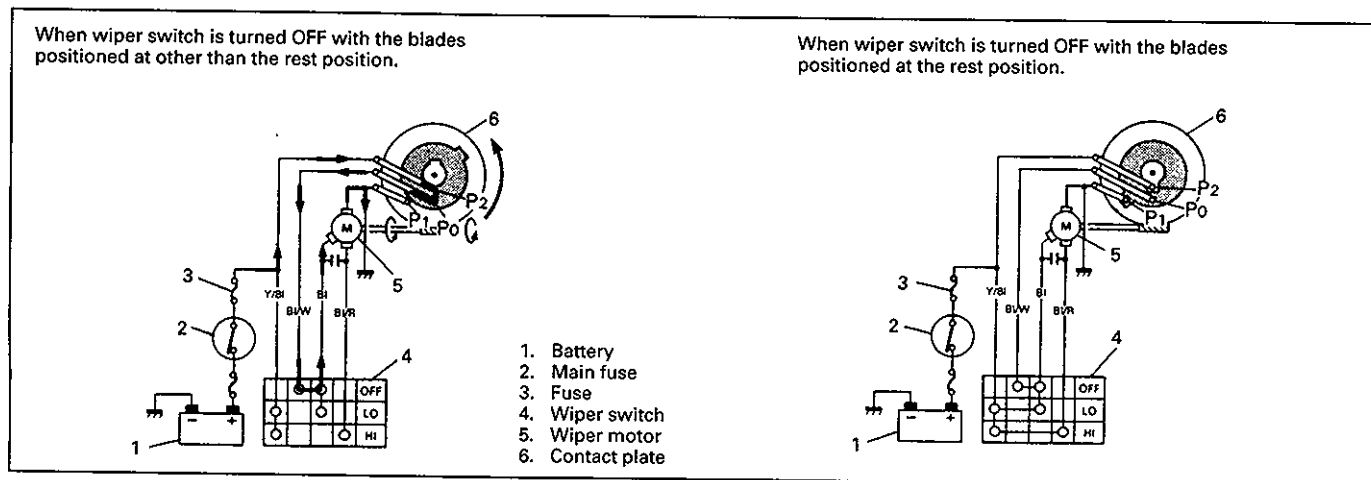
The plate serves to connect the contact P_0 to the contact P_1 . Although the plate thus serves to make and break the circuits containing the contacts P_0 , P_1 and P_2 , the wiper motor makes its rotation completely independent of this plate rotation. When the wiper switch is turned OFF (the switch is set to the OFF position) with the blades positioned at the rest positions, current supply is cut, causing the motor to stop with the blades staying at the same positions.

Even when the wiper switch is turned OFF (the switch is set to the OFF position) with the blades positioned other than at the rest positions, current is still supplied, though intermittently, through a different path from the battery (via lead Y/BI-contact P_2 -contact P_0 -lead BI/W-switch (OFF position)-lead BI) to the motor.

Therefore, the motor can still rotate supplied with this intermittent current, causing the blades to return to the rest positions.

As soon as the blades have returned to their rest positions, the plate connects contact P_0 to contact P_1 , causing current to be shunted around the motor.

When current is no longer supplied to the motor, a counter electromotive force is generated in the motor armature, causing a current to flow through the motor-and-shunt circuit so that the motor is stopped with the blades staying at the specified rest positions.



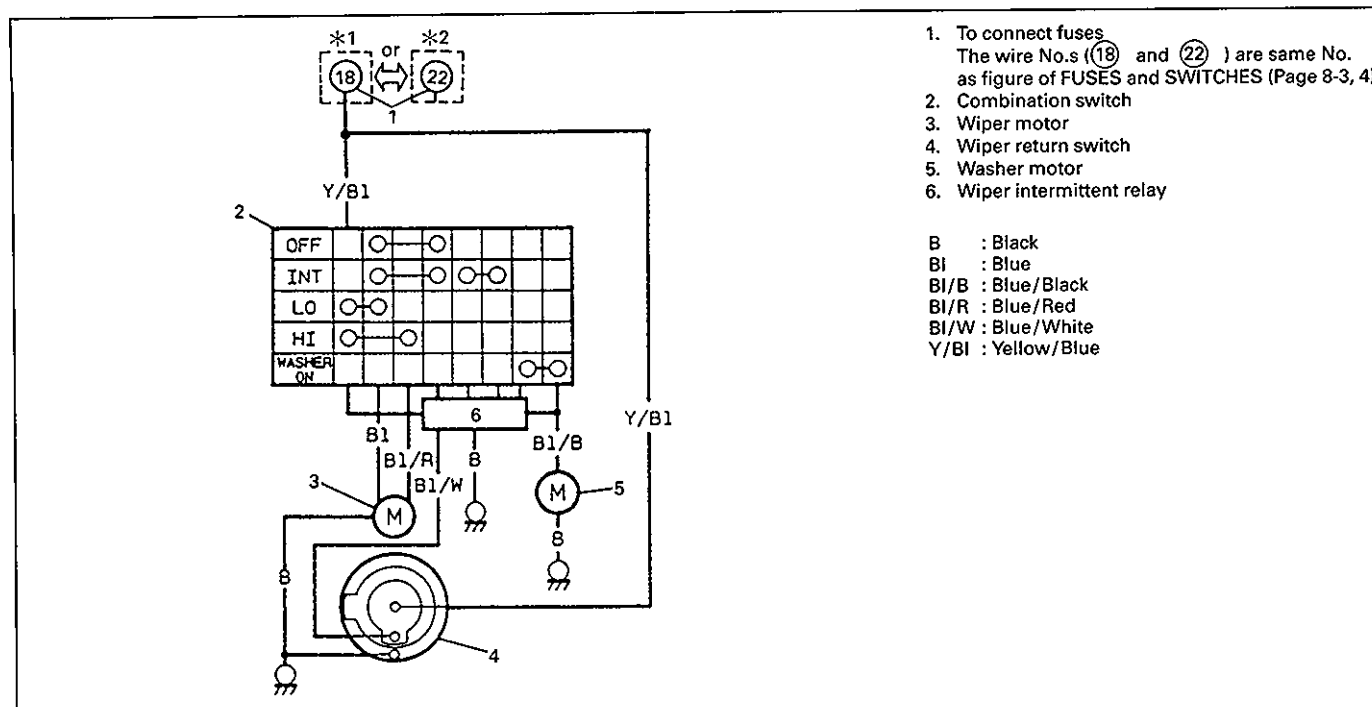
85F00-8-25-1

INTERMITTENT WIPER RELAY CIRCUIT (If equipped)

When the wiper switch is set to the intermittent position with the ignition switch ON (the condenser is charged at this time), current from the battery flows through the Y/BI wire, generates magnetic force in the coil in the relay and causes the switch in the relay to turn ON. Then current is transmitted in the sequence of Y/BI, BI/W, wiper switch and BI, and causes the wiper motor to rotate (meanwhile, the condenser discharges). By the time the wiper motor makes one rotation and the contact plate in the motor comes to the automatic stop position P_1 , the condenser in the relay has finished discharging (no magnetic force in the coil in the relay). Then the switch in the relay turns OFF and the wiper stops. They remain that way until the condenser is fully charged. As soon as the condenser begins discharging after being fully charged, magnetic force generated in the coil in the relay causes the switch to turn ON. As described above, intermittent operation of the wiper motor is controlled by charging and discharging of the condenser.

85F00-8-25-5

WIRING CIRCUIT



85F00-8-26-1

TROUBLE DIAGNOSIS

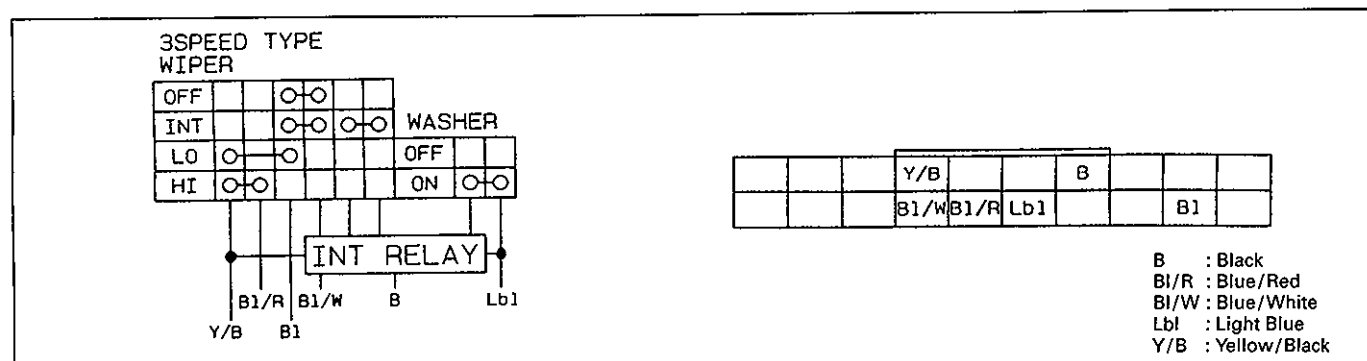
Trouble	Possible cause	Correction
Wiper malfunctions or does not return to original position.	- Wiper fuse blown - Wiper motor faulty - Wiper control switch faulty - Wiring or grounding faulty	Replace blown fuse to check for short. Check motor. Check switch. Repair.
Washer malfunctions.	- Washer hose or nozzle clogged - Washer motor faulty - Wiper control switch faulty - Wiring faulty	Repair. Check motor. Check switch. Repair.

64B40-8-27-1

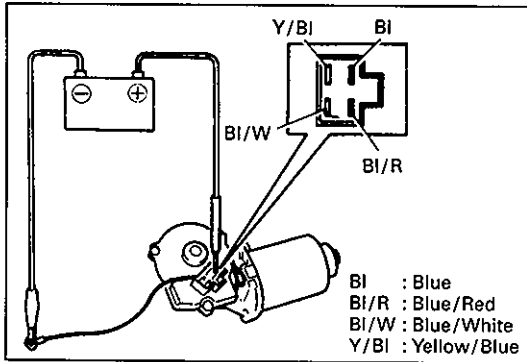
INSPECTION

A. Wiper/washer Switch

Use a circuit tester to check switch for each terminal-to-terminal continuity.

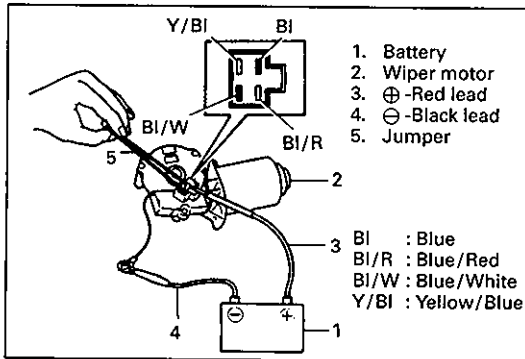


85F00-8-26-5



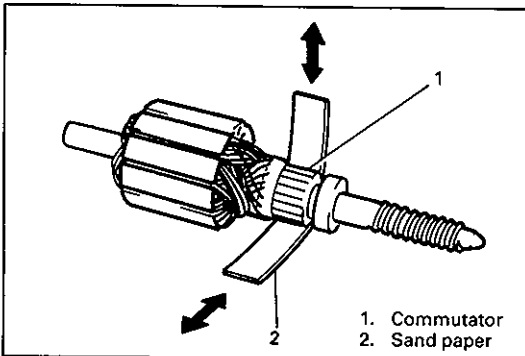
B. Wiper Motor

- 1) As illustrated left, use a 12 V battery to connect its (+) terminal to Blue terminal, and its (-) terminal to Black lead cord. If motor rotates at a low revolution speed of 45 to 55 rpm, it is proper. As for high speed check, connect battery (+) terminal to Blue/Red terminal, and its (-) terminal to Black lead cord. If motor rotates at a high revolution speed of 68 to 78 rpm, it is proper.



- 2) Testing automatic stop action

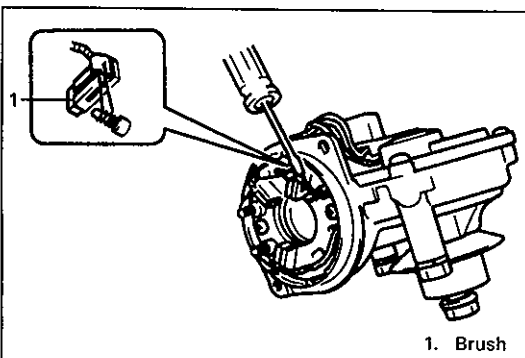
Connect battery (+) terminal to motor Yellow/Blue terminal, and (-) terminal to Black lead cord, respectively. Use a jumper to short Blue/White and Blue terminals to each other to check whether motor shaft stops at a given position. This position must conform to start position. Stop motor again and again with the jumper to confirm that it stops at the same position.



- 3) Checking brush and commutator

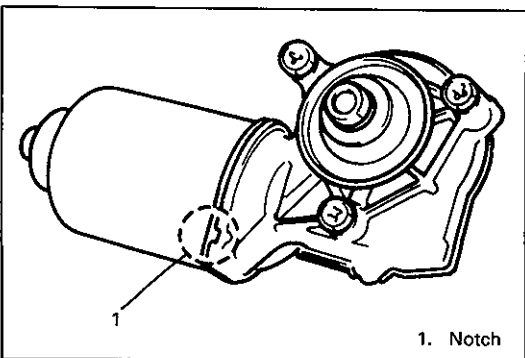
Use a circuit tester to check Blue terminal-to-Black lead cord continuity. If continuity is poor, check brush-to-commutator contact area for proper condition.

When the area is fouled, use a cloth wetted with gasoline to clean the area. When surface of the area is coarse or burnt, use a sandpaper to smooth it.

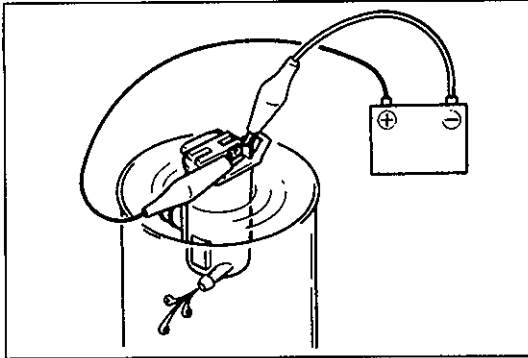


NOTE:

When reinstalling wiper motor, fit brush into each brush holder and hook brush lead wire around holder beforehand. After reinstalling it, release each brush.



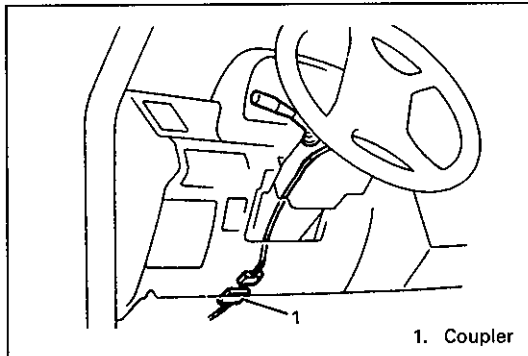
When installing wiper motor cover, be careful of its notch position to assemble it to specified position.



60A20-8-31-1

C. Washer Pump

Connect battery (+) and (-) terminals to pump (+) and (-) terminals respectively to check the pumping rate.

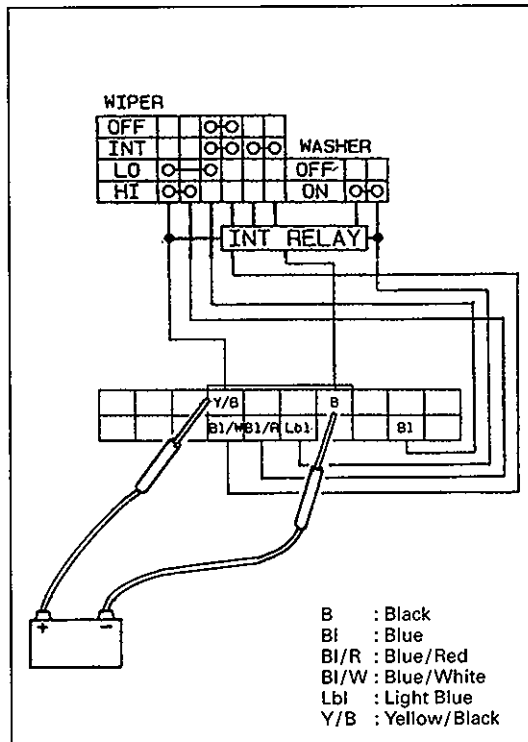


1. Coupler

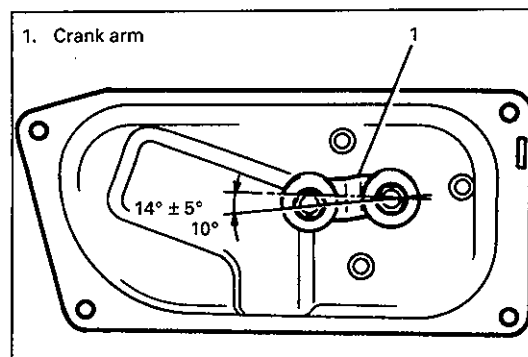
85F00-8-28-2

D. Intermittent Wiper Relay Circuit (If equipped)

1. Disconnect wiper & washer switch coupler.
2. Turn wiper switch to "INT" position.
3. Connect (+) cord and (-) cord of 12 V battery to coupler terminals as shown left. If an operating sound is heard from relay, it is at work properly.



85F00-8-28-3



1. Crank arm

INSTALLATION

Wiper Motor, Linkage and Arms

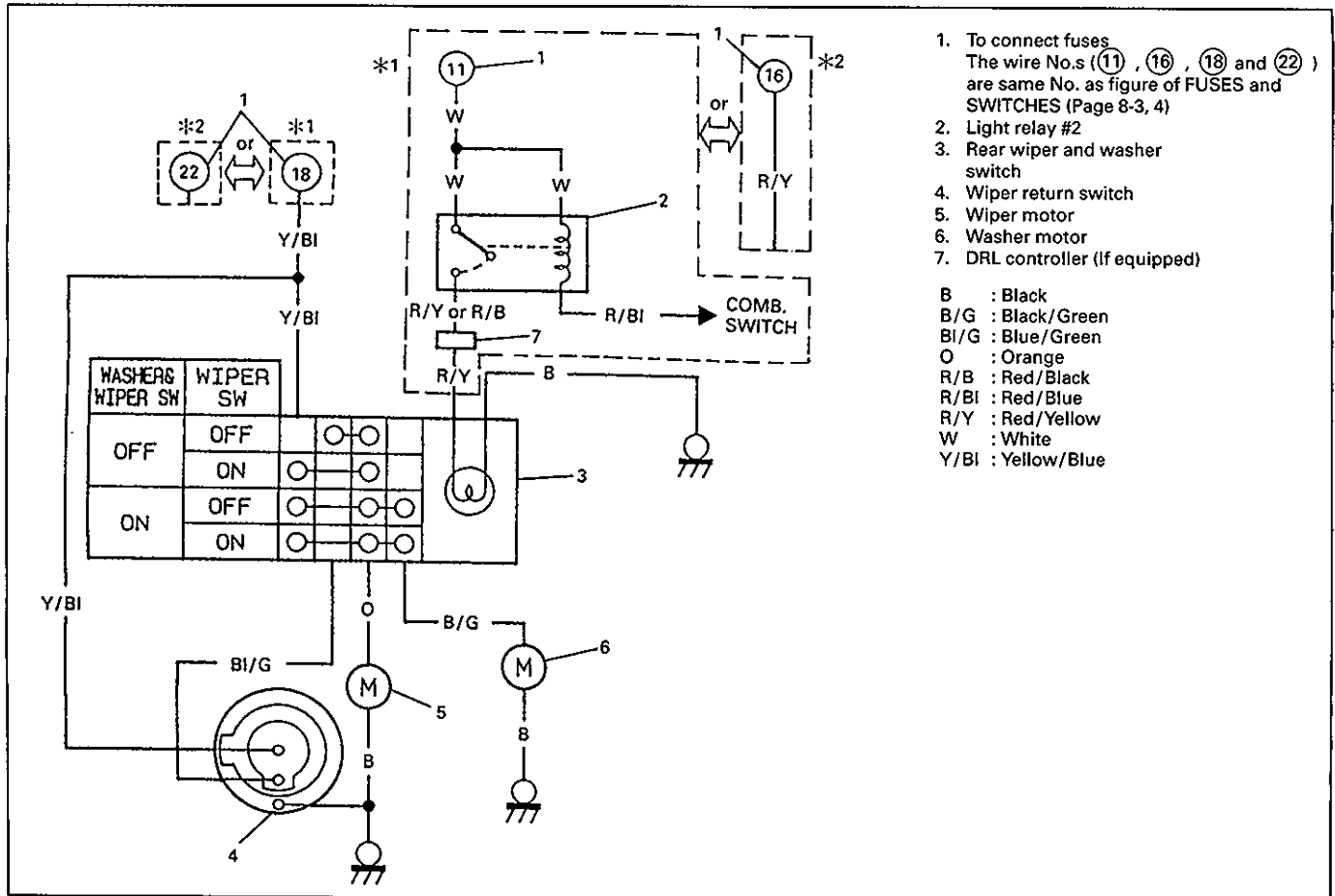
1. Install wiper linkage.
2. Install wiper motor into position.
3. Connect electric connector to motor.
4. Turn ignition switch ON. Set wiper switch to ON position, and then to OFF position.
Thus make sure that crank arm is positioned as shown left.
5. Install wiper arms.

60A20-8-32-2

REAR WINDOW WIPER AND WASHER (If equipped)

The rear window wiper is of the one-speed type, and its washer is equipped with a separate-type washer pump.

WIRING CIRCUIT

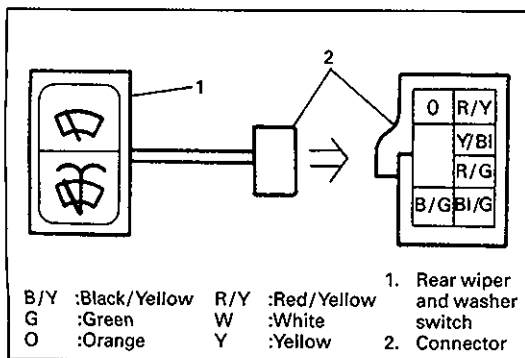


85F00-8-29-1

DESCRIPTION OF CIRCUIT AND TROUBLE DIAGNOSIS

Refer to "WINDSHIELD WIPER" section.

50G00-8-32-4



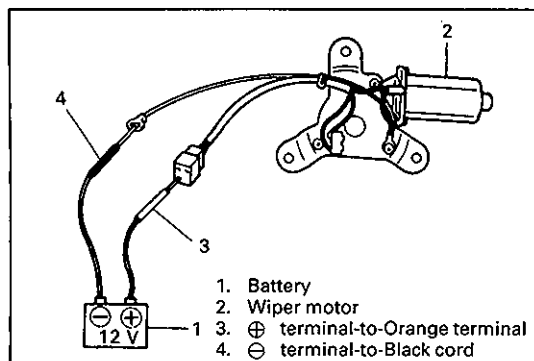
85F00-8-29-5

INSPECTION

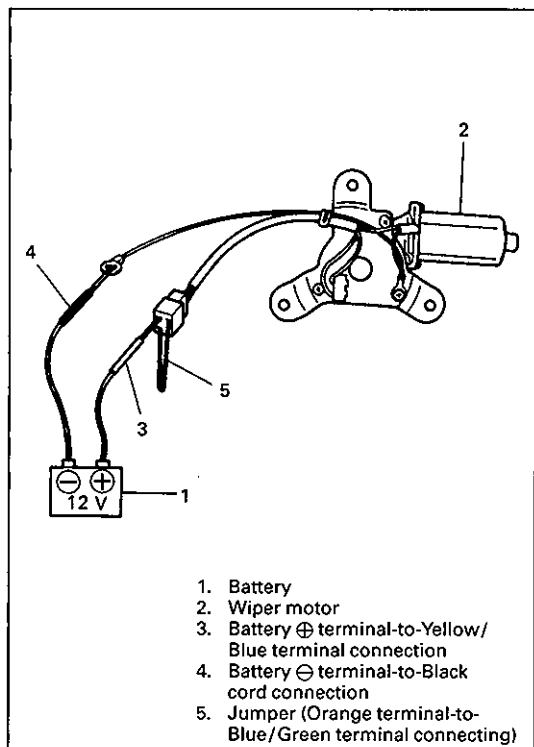
A. Wiper And Washer Switches

Use a circuit tester to check switches for continuity.

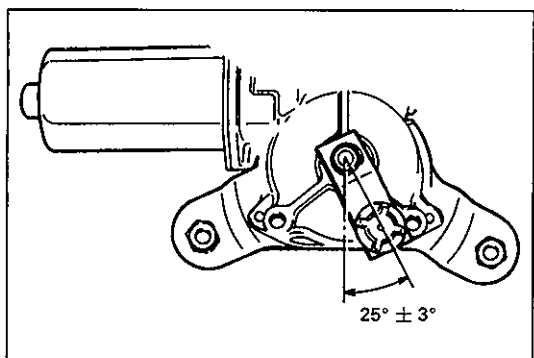
Wahser & Wiper	Wiper	Y/Bl	O	Bl/G	B/G	R/Y	R/G
OFF	OFF		○	○			
	ON	○	○				
ON	OFF	○	○		○		
	ON	○	○		○		



60A20-8-38-1



60A40-8-38-2



60A20-8-38-4

B. Wiper Motor

1) As shown left, use a 12 V battery to connect its (+) and (-) terminals to the Orange terminal and Black lead cord respectively. If motor rotates at a range of 38 to 46 rpm, it is proper.

2) Testing automatic stop action

Connect battery (+) and (-) terminals to motor Yellow/Blue terminal and Black lead cord respectively.

Use a jumper to short Orange and Blue/Green terminals to each other to check whether motor shaft stops at a given position. Use jumper to make sure again and again that shaft stops at the same position.

3) Checking brush and commutator

Use a circuit tester to check Orange terminal-to-Black lead cord continuity. If continuity is poor, check brush-and-commutator area for proper contact condition.

If fouled, clean the area with a cloth wetted with gasoline. If surface of the area is coarse or burnt, smooth it with a sand-paper.

(Refer to "FRONT WIPER MOTOR" Section.)

4) Crank arm position

Make sure that crank arm is positioned as illustrated when switch is set to automatic stop position.

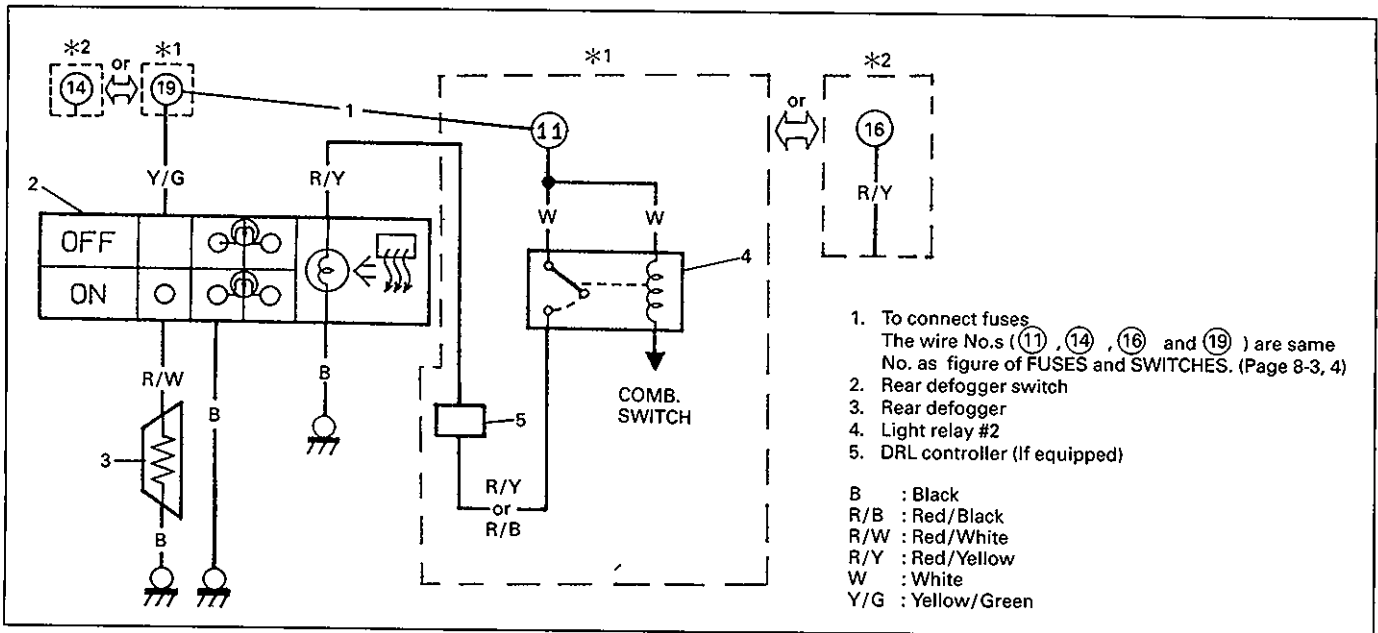
If not, repair wiper motor.

C. Washer Pump

In the same manner as with the windshield washer pump, check the pumping rate.

REAR WINDOW DEFOGGER (OPTIONAL)

The optional rear window defogger system has horizontal ceramic silver compound elements and two vertical bus bar. The system is operated by the defogger switch in the instrument panel.



85F00-8-31-1

TROUBLE DIAGNOSIS

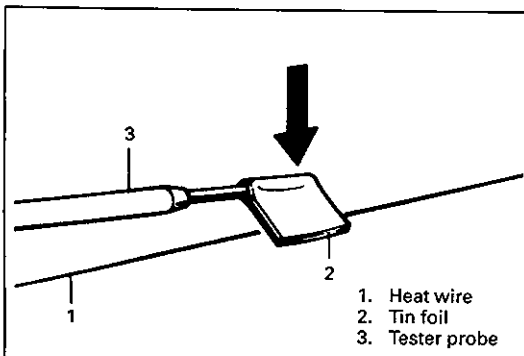
Trouble	Possible cause	Correction
Defogger won't work.	- Defogger switch faulty - Defogger heat wire faulty - Wiring or grounding faulty	Check switch. Check heat wire. Repair as necessary.

60A20-8-32-4

	Y/G	R/W	B	B (R/G)	R/Y
OFF		○	○	○	○
ON	○	○	○	○	○

Y/G :Yellow with Green tracer
 R/W :Red with White tracer
 B :Black
 R/G :Red with Green tracer
 R/Y :Red with Yellow tracer

60A40-8-33-1



60A20-8-33-2

INSPECTION

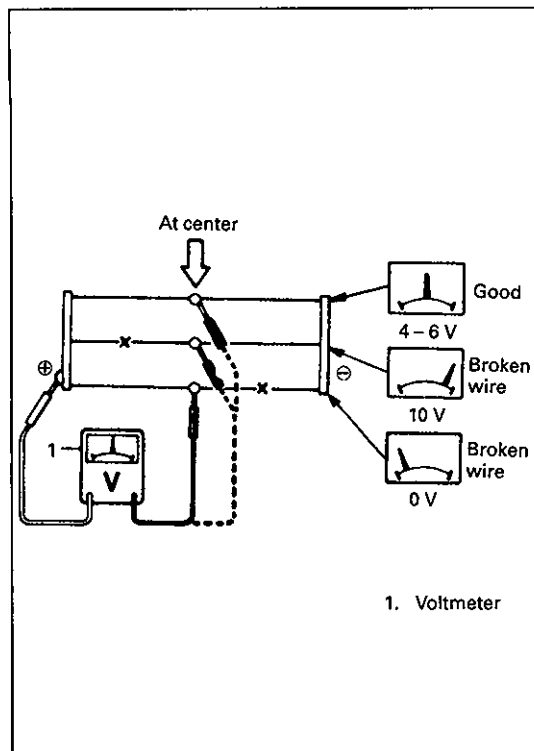
Defogger Switch

Use a circuit tester to check defogger switch for continuity. If switch has no continuity between terminals, replace.

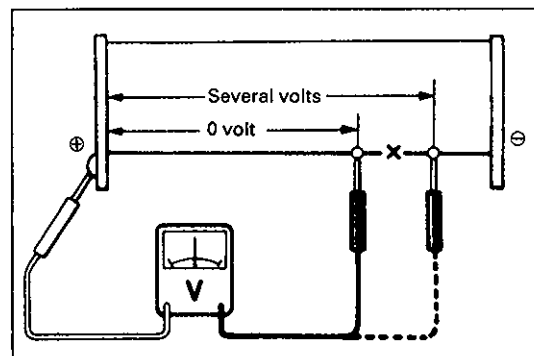
Defogger wire

NOTE:

- When cleaning rear window glass, use a dry cloth to wipe it along wire direction.
- When cleaning glass, do not use detergent or abrasive - containing glass cleaner.
- When measuring wire voltage, use a tester with negative probe wrapped with a tin foil which should be held down on wire by finger pressure.



60A20-8-33-3



60A20-8-33-5

1. Checking wire damage

- Turn main switch ON.
- Turn defogger switch ON.
- Use a voltmeter to check voltage at the center of each heat wire, as shown.

Voltage	Criteria
Approx. 5 V	Good (No break in wire)
Approx. 10 or 0 V	Broken wire

If measured voltage is 10 V, wire must be damaged between its center and positive end. If voltage is zero, wire must be damaged between its center and ground.

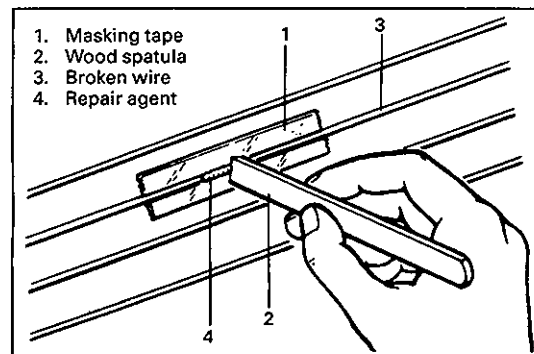
2. Locating damage in wire

- Touch voltmeter positive (+) lead to heat wire positive terminal end.
- Touch voltmeter negative (-) lead with a foil strip to heat wire positive terminal end to then move it along wire to the negative terminal end.
- The place where voltmeter fluctuates from zero to several volts is where there is damage.

NOTE:

If heat wire is free from damage, voltmeter should indicate 12 V at the heat wire positive terminal end and its indication should decrease gradually toward zero at the other terminal (ground).

60A20-8-34-1



60A20-8-34-2

REPAIR

Defogger Circuit

- Use white gasoline for cleaning.
- Apply masking tape at both upper and lower sides of heat wire to be repaired.

3. Apply commercially-available repair agent with a fine-tip brush.
4. Two to three minutes later, remove the masking tapes previously applied.
5. Leave repaired heat wire as it is for at least 24 hours before operating defogger again.

60A20-8-34-3

INSTALLATION

When installing rear window defogger (optional), have following parts available.

- Back window glass
- Defogger switch
- Defogger lead wires (positive and negative wire)

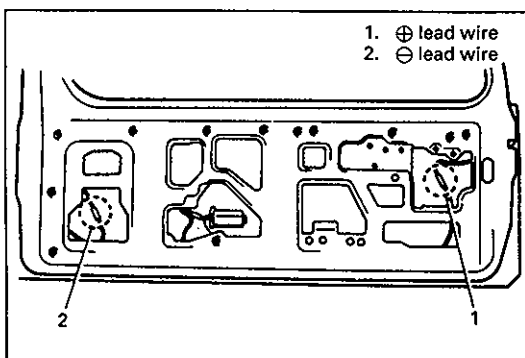
60A20-8-34-4

Removal

Remove following parts:

- Back window glass
(Refer to Body Service section for removal).
- Back door trim, water proof film

60A20-8-34-5



60A20-8-35-1

Installation

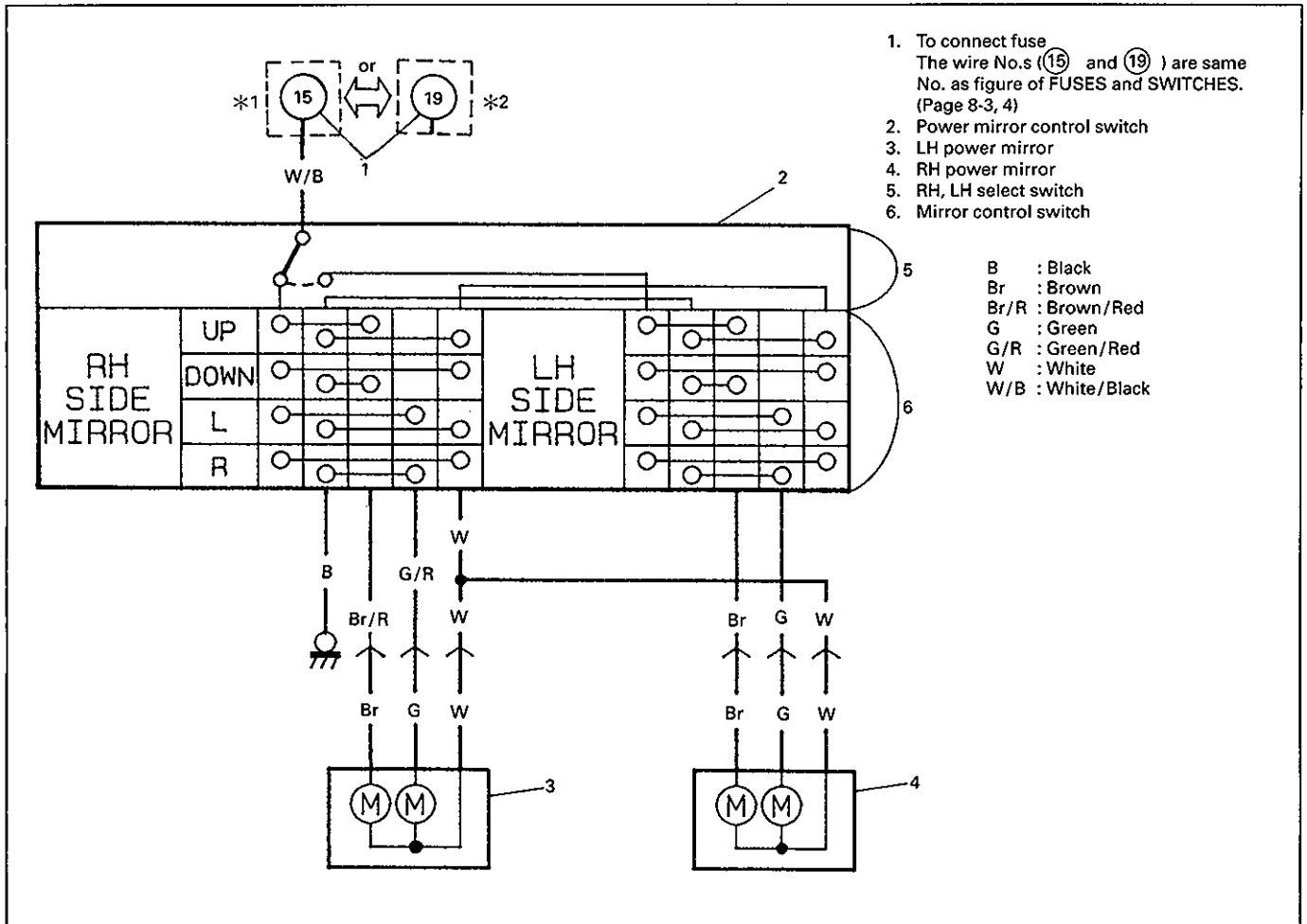
Before installing, disconnect negative cable at battery.

- 1) Install back window glass.
- 2) Connect lead wires to harness connectors.

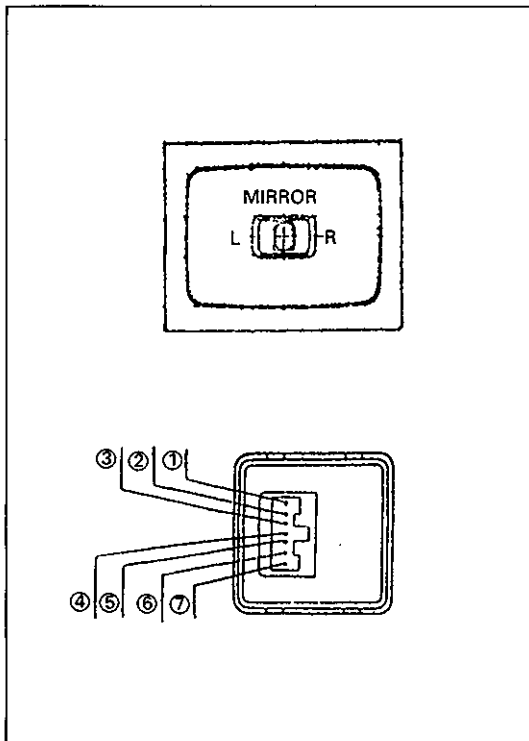
- 3) Install defogger switch on instrument panel and connect switch connector to harness connector.

POWER DOOR MIRROR CONTROL SYSTEM (If equipped)

The power door mirror control system consists of the power door mirror control switch, door mirror actuator and related wiring harness.



85F00-34-1



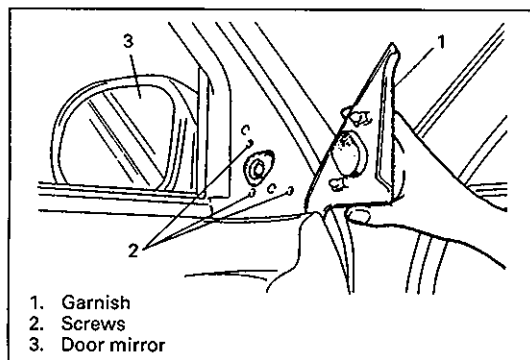
MIRROR SWITCH INSPECTION

- 1) Take out mirror switch from instrument panel.
- 2) Check continuity at each switch position by using a circuit tester.

If any continuity is not obtained, replace mirror switch.

LH	①	②	③	④	⑦
RH				⑤	⑥
UP	○	○	○	○	
DOWN	○	○	○	○	
LEFT	○	○	○		○
RIGHT	○	○	○		○

85F00-8-34-4



64B40-8-42-1

DOOR MIRROR INSPECTION

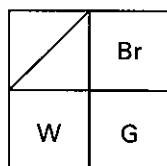
- 1) Remove garnish and screws from door.
- 2) Remove door mirror from door by disconnecting coupler.

- 3) Check that door mirror operates properly when battery voltage is applied to connector terminals.

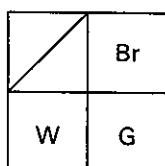
If malfunction is found, correct or replace.

NOTE:

When installing door mirror to door, be careful not to pinch harness between door and door mirror.



left side



right side

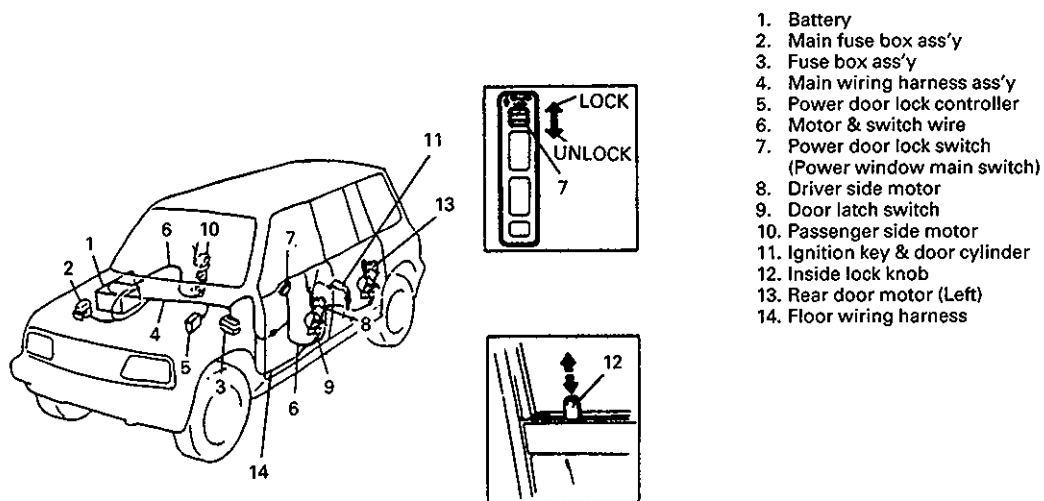
Left side	W	Br	G	Operation
Right side	W	Br	G	
	⊖	⊕		up
	⊕	⊖		down
	⊖		⊕	left
	⊕		⊖	right

Br : Brown
G : Green
W : White

85F00-35-2

CENTRAL LOCKING SYSTEM (If equipped)

The central locking system consists of the power door lock controller, door lock switch, door latch switch, ignition key & door cylinder, motors and related wiring harness.



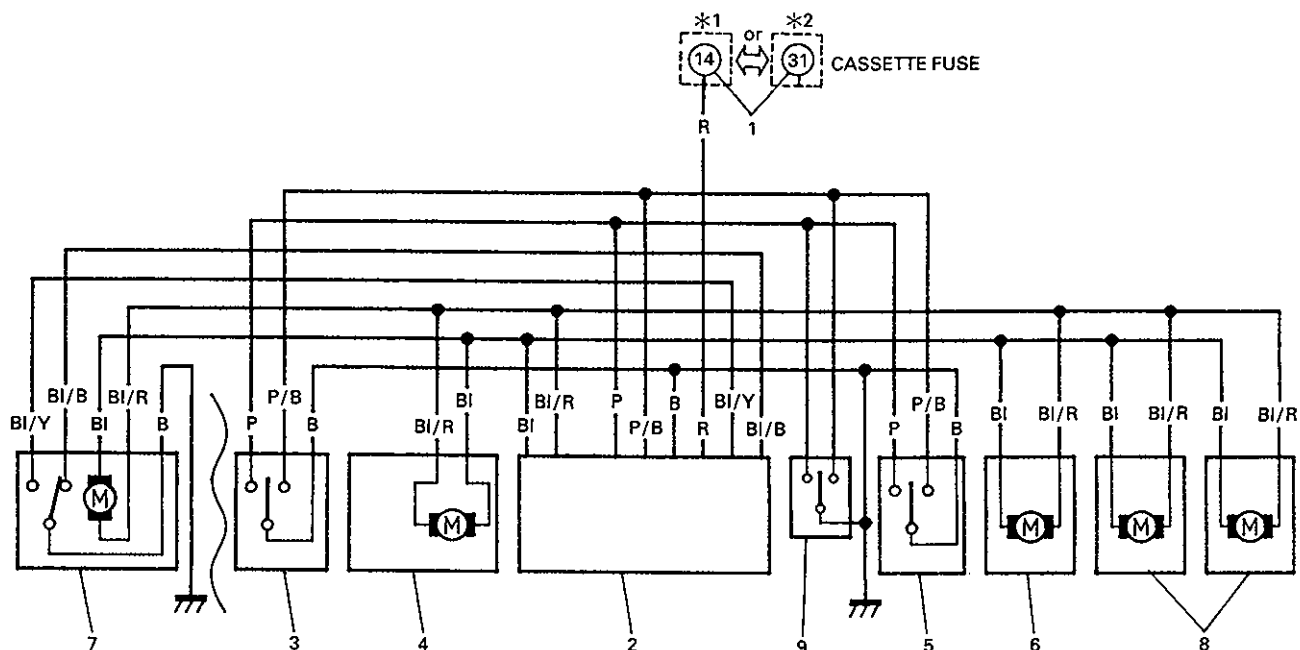
1. Battery
2. Main fuse box ass'y
3. Fuse box ass'y
4. Main wiring harness ass'y
5. Power door lock controller
6. Motor & switch wire
7. Power door lock switch (Power window main switch)
8. Driver side motor
9. Door latch switch
10. Passenger side motor
11. Ignition key & door cylinder
12. Inside lock knob
13. Rear door motor (Left)
14. Floor wiring harness

60A90-8-8-1S

WIRING DIAGRAM

1. To connect fuse
The wire No.s (⑭ and ③①) are same No. as figure of FUSES and SWITCHES. (Page 8-3, 4)
2. Power door lock controller
3. Driver side door latch switch
4. Driver side motor switch
5. Passenger side door latch switch
6. Passenger side motor
7. Back door motor & latch switch
8. Rear door lock motor
9. Power door lock switch

B : Black
 BI : Blue
 BI/B : Blue/Black
 BI/R : Blue/Red
 BI/Y : Blue/Yellow
 P : Pink
 P/B : Pink/Black
 R : Red



CENTRAL LOCKING SYSTEM CIRCUIT AND OPERATION

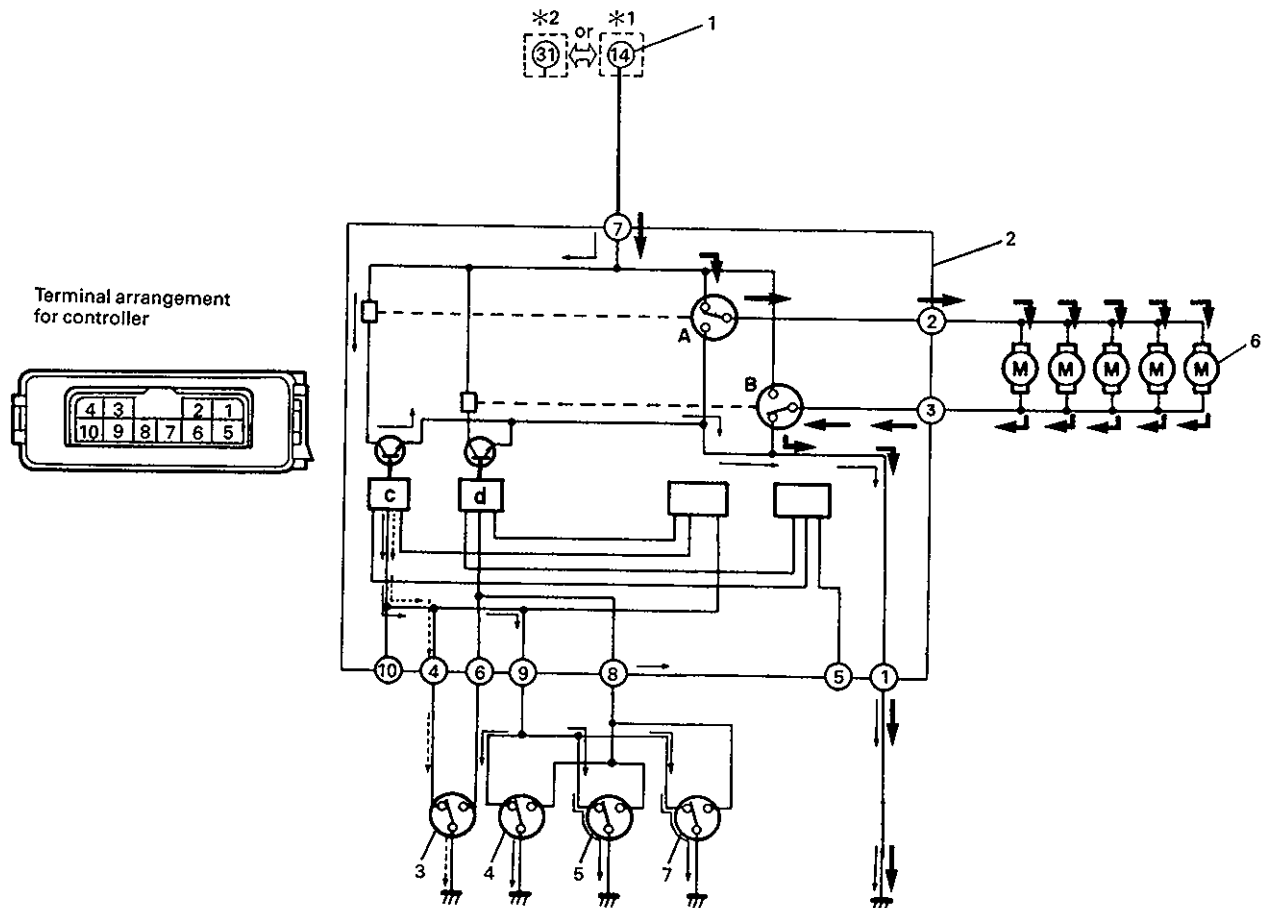
Locking Operation

Figure below shows the central locking system circuit in operation as "LOCK".

1. When the ignition key is used to lock the door or the lock switch is set to the "LOCK" position, the electric current flows as shown by fine arrow ($\rightarrow$).
2. Then the switch A which is built in the power door lock controlled turn ON for their "LOCK" side and the electric current flows as shown by bold arrow ($\rightarrow$) to cause the motor to operate.
3. The arrow (- - $\rightarrow$) shows the electric current flow when the back door lock is set to the lock position.
4. As the electric current flowing to motor is controlled by the timer "c" which is built in the power door lock controller, switch A automatically turn OFF and electric current flow stops.

"LOCK"

1. From battery
2. Power door lock controller
3. Back door switch
4. Driver side door latch switch
5. Passenger side door latch switch
6. Door lock motor
7. Door lock switch
- c. Lock timer
- d. Un-lock timer



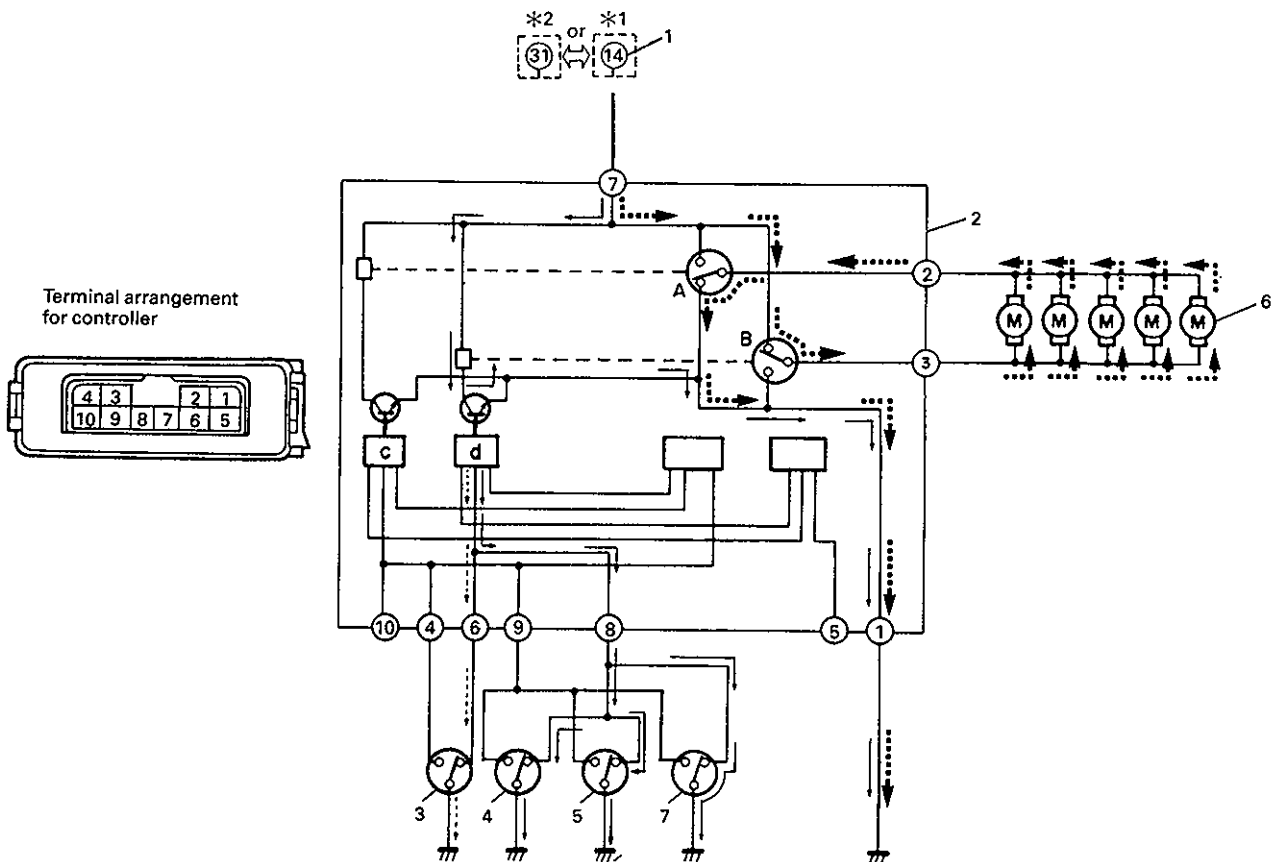
Unlocking Operation

Figure below shows the circuit in operation as "UNLOCK".

1. When the ignition key is used to unlock the door or the door lock switch is set to the "UNLOCK" position, the electric current flows as shown by fine arrow ($\longrightarrow$).
2. Then the switch B which is built in the power door lock controller turn ON for their "UNLOCK" side and the electric current flows as shown by bold broken arrow ($\bullet\bullet\longrightarrow$) to cause the motor to operate.
3. When the back door lock is set to the unlock position, the electric current flows as shown by the arrow ($- - \longrightarrow$) to unlock the door.
4. As the electric current flowing to motor is controlled by the timer "d" the switch B automatically turns OFF and the electric current flow stops.

"UNLOCK"

1. From battery
2. Power door lock controller
3. Back door switch
4. Driver side door latch switch
5. Passenger side door latch switch
6. Door lock motor
7. Door lock switch
- c. Lock timer
- d. Un-lock timer



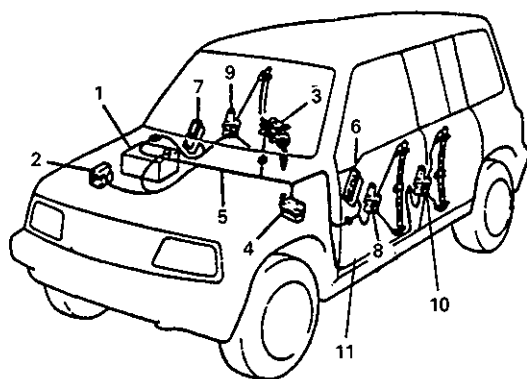
TROUBLE DIAGNOSIS

Condition	Possible cause	Correction
All power door locks do not operate.	● Main fuse and/or fuses blown ● Wiring or grounding faulty ● Power door lock switch, door lock switch, door lock switch or knob switch faulty. ● Controller faulty	Replace main fuse and/or fuses to check for short. Repair as necessary. Replace. Replace.
Only one power door lock does not operate.	● Wiring or socket faulty ● Actuator (door lock motor) faulty	Repair as necessary. Replace.

POWER WINDOW CONTROL SYSTEM (If equipped)

The power window control system is so designed that it electrically controls up & down movement of side door window glass by means of the motor which is installed to the window regulator.

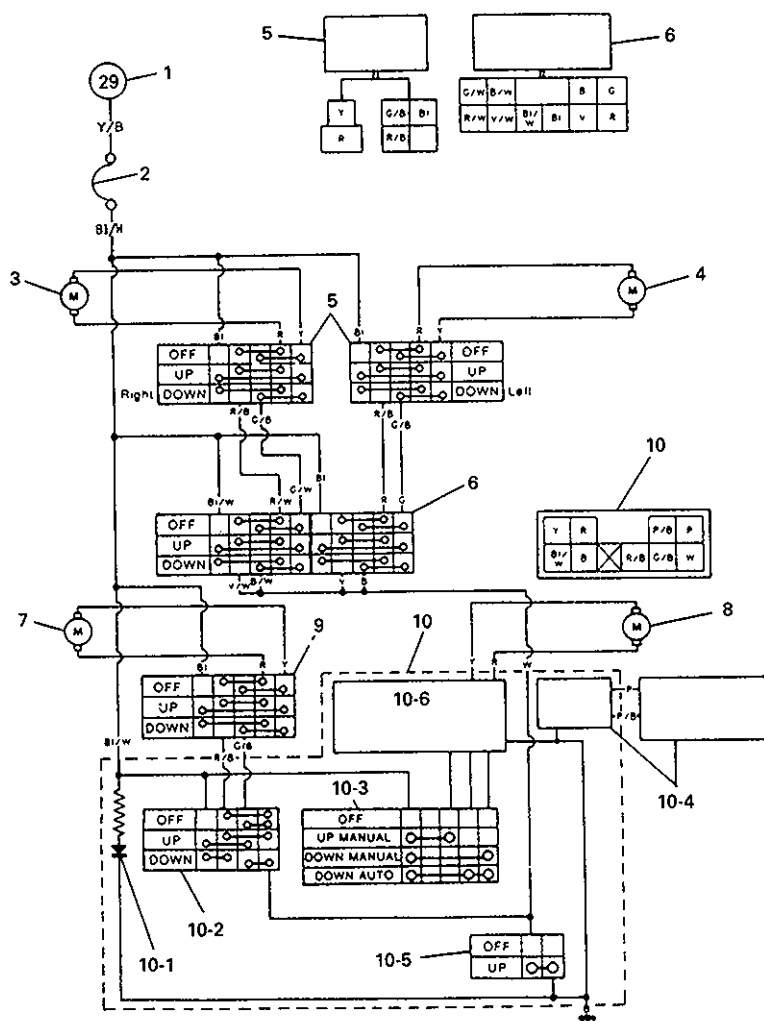
The system consists of the ignition switch, power window switches, window regulator motors and related wiring harness. The figure below shows location of its component parts and wiring diagram.



1. Battery
2. Main fuse box ass'y
3. Ignition switch
4. Fuse box
5. Main wiring harness
6. Power window main switch
7. Power window sub switch
8. Driver side window regulator
9. Passenger side window regulator
10. Rear window regulator (Left)
11. Floor wiring harness

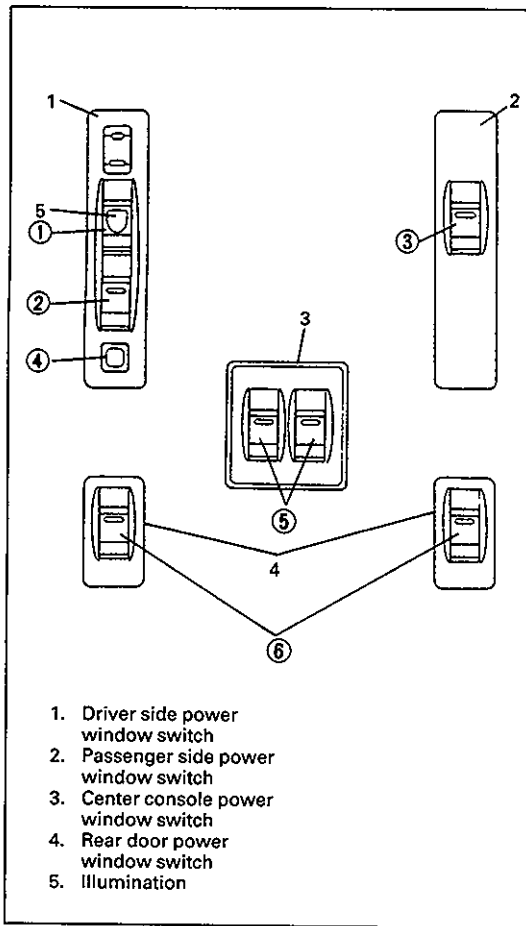
60A90-8-12-1S

WIRING DIAGRAM



1. To connect main switch
The wire No. (29) is same No. as figure of FUSES and SWITCHES (Page 8-3, 4)
2. Circuit breaker
3. Rear right door power window motor
4. Rear left door power window motor
5. Rear door (right and left) and passenger side power window switch
6. Center console power window switch
7. Passenger side power window motor
8. Driver side power window motor
9. Passenger side power window assistant switch
10. Driver side power window switch
- 10-1. Illumination to confirm "POWER ON"
- 10-2. Passenger side power main switch
- 10-3. Power window auto switch
- 10-4. Door lock circuit
- 10-5. Window lock switch
- 10-6. Auto circuit

B : Black
 B/W : Black/White
 BI : Blue
 BI/W : Blue/White
 G : Green
 G/B : Green/Black
 G/W : Green/White
 P : Pink
 P/B : Pink/Black
 R : Red
 R/B : Red/Black
 R/W : Red/White
 V : Violet
 V/W : Violet/White
 W : White
 Y : Yellow
 Y/B : Yellow/Black



85F00-8-41-1

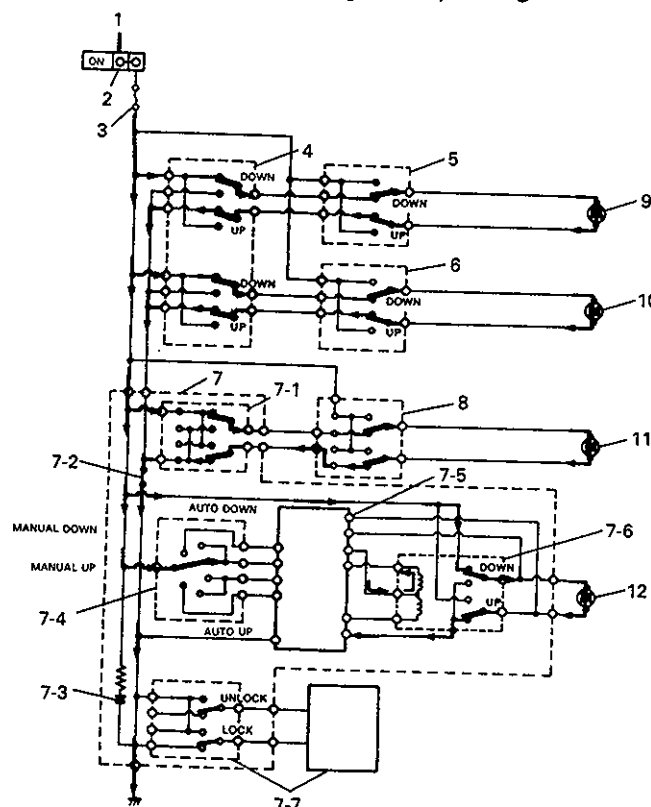
OPERATION OF POWER WINDOW SYSTEM

The power window main switch in the driver side door trim controls up & down movement of both driver side window by switch ① and passenger side window by switch ②. Also, driver side switch has an auto-up function. The sub switch ③ in the passenger side door trim controls the passenger side window only. The window lock switch ④ also in the power window main switch locks passenger side window and rear windows. As long as this switch is depressed (The switch is turned "OFF" in the circuit), the passenger side window does not move even when the passenger side sub switch ③ or driver side passenger switch ② are operated. Rear window regulator, like passenger side regulator, can be controlled by center console switches ⑤ and rear switches ⑥ when window lock switch is not applied. In this system, up & down movement of the window is done as follows.

Setting center console switch for downward operation when ignition switch is ON and window lock switch is not applied will cause electric current to flow in its circuit as shown by an arrow.

When window lock switch is applied, rear window or passenger side window can not be opened or closed by using center console switch or master switch. With ignition OFF, no power window operation is available and the illumination remains OFF.

Downward operation of window glass by using driver side switch and center console switch.



1. From battery
2. Ignition switch
3. Circuit breaker
4. Center console power window switch
5. Rear right door power window switch
6. Rear left door power window switch
7. Driver side power window switch
- 7-1. Passenger side power window main switch
- 7-2. Window lock switch
- 7-3. Illumination to confirm "POWER ON"
- 7-4. Power window auto switch
- 7-5. Auto circuit
- 7-6. Auto relay
- 7-7. Door lock circuit
8. Passenger side power window assistant switch
9. Rear right door power window motor
10. Rear left door power window motor
11. Passenger side power window motor
12. Driver side power window motor

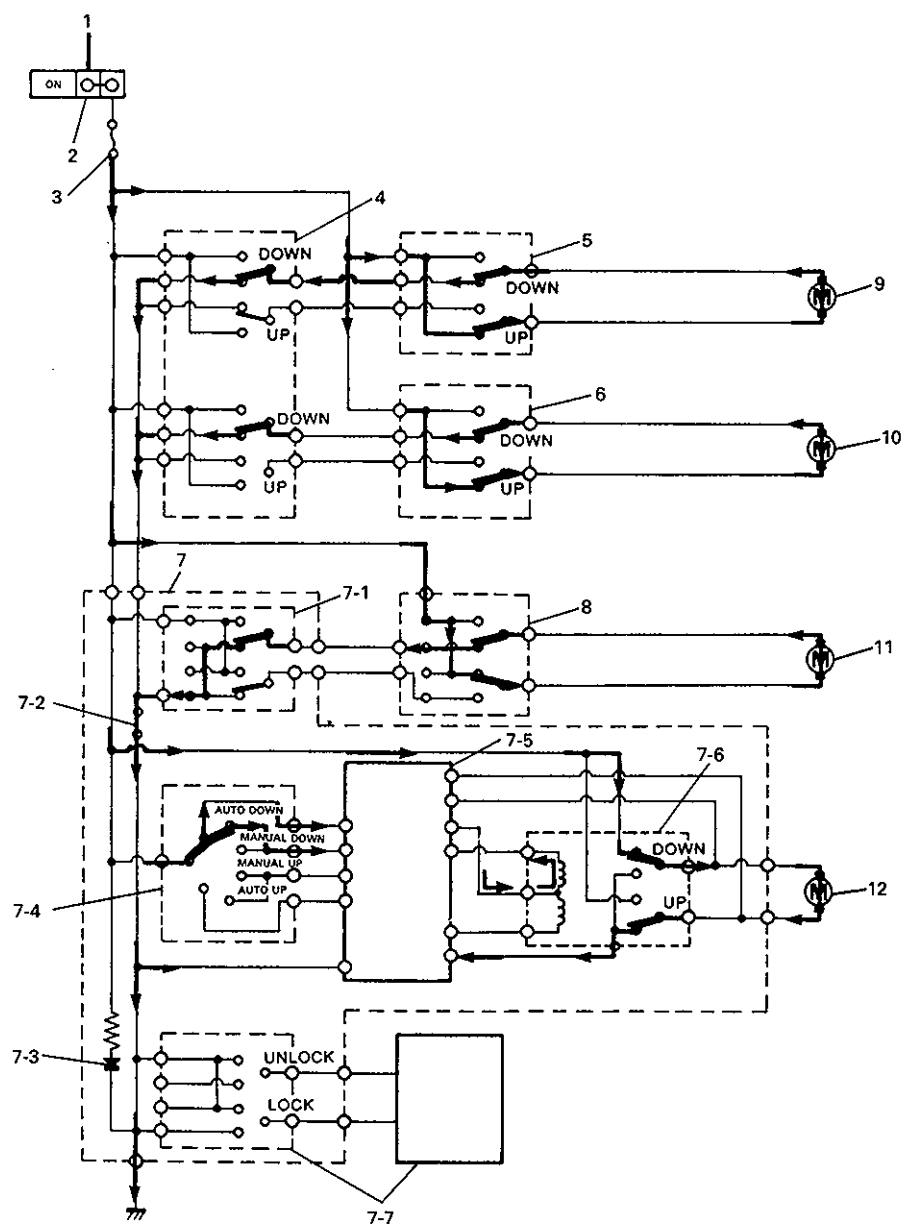
85F00-8-41-3

OPERATION OF POWER WINDOW AUTO SYSTEM

When rear door sub switch or passenger assist switch is set for upward operation and driver side switch for AUTO down operation, electric current flows in circuit as shown below. AUTO function works when driver side regulator switch is tilted at least 7° but if its tilt angle is less than 7° , the operation is in the manual mode. When the window glass reaches its lower end in the automatic operation mode, the load applied to the motor increases and so does the electric current. Thus the electric current flowing to the solenoid stops and relay turns OFF, resulting the motor to stop.

Automatic downward operation of window glass by using driver side automatic switch.

Upward operation of window glass by using passenger side switch and rear door switch.



1. From battery
2. Ignition switch
3. Fuse
4. Center console power window switch
5. Rear right door power window switch
6. Rear left door power window switch
7. Driver side power window switch
- 7-1. Passenger side power window main switch
- 7-2. Window lock switch
- 7-3. Illumination to confirm "POWER ON"
- 7-4. Power window auto switch
- 7-5. Auto circuit
- 7-6. Auto relay
- 7-7. Door lock circuit
8. Passenger side power window assistant switch
9. Rear right door power window motor
10. Rear left door power window motor
11. Passenger side power window motor
12. Driver side power window motor

Trouble Diagnosis

Condition	Possible cause	Correction
All power window motors do not operate.	● Main fuse and/or fuses blown ● Wiring or grounding faulty	Replace main fuse and/or fuses to check for short. Repair as necessary.
Some switches do not operate.	● Wiring or socket faulty ● Window lock switch faulty	Repair as necessary. Replace.
Only one actuator does not function.	● Wiring or socket faulty ● Actuator faulty	Repair as necessary. Replace.

SECTION 9

BODY SERVICE

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

85F00-9-1-1

CONTENTS

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UNDERBODY 9-8

 Underbody Dimensions 9-9

BODY DIMENSIONS 9-11

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METAL REPLACEMENT PARTS FINISHING

The metal service replacement parts (or assemblies) are coated with electro-deposition primer. For the proper adhesion of a paint, the following finish process (refinish steps) becomes necessary.

1. Use wax or grease-removing solvent to clean the part.
2. Use a wet or dry sand-paper (No. 400) to polish the panel lightly. Do not polish it forcibly to produce any scratch. Clean the part again.
3. If factory-applied primer coating is cut through to the bare metal, apply metal conditioner to the bare metal exposed to open air. As for method of use of the metal conditioner, follow directions on the container.
4. Apply primer-surfacer to the part completely dry before starting sand-paper polishing. As for drying time, follow directions advised on the primer-surfacer container.
5. Use a wet or dry sand-paper (No. 400) and water to polish the panel lightly.
6. Wash the part again.
7. Apply color, coating to the part.
8. Different paints demand different drying methods. Hence, follow directions advised on the pertinent paint container.

9. When lacquer coating (quick-drying paint coating) is applied, dry coated surface and polish it with compound.

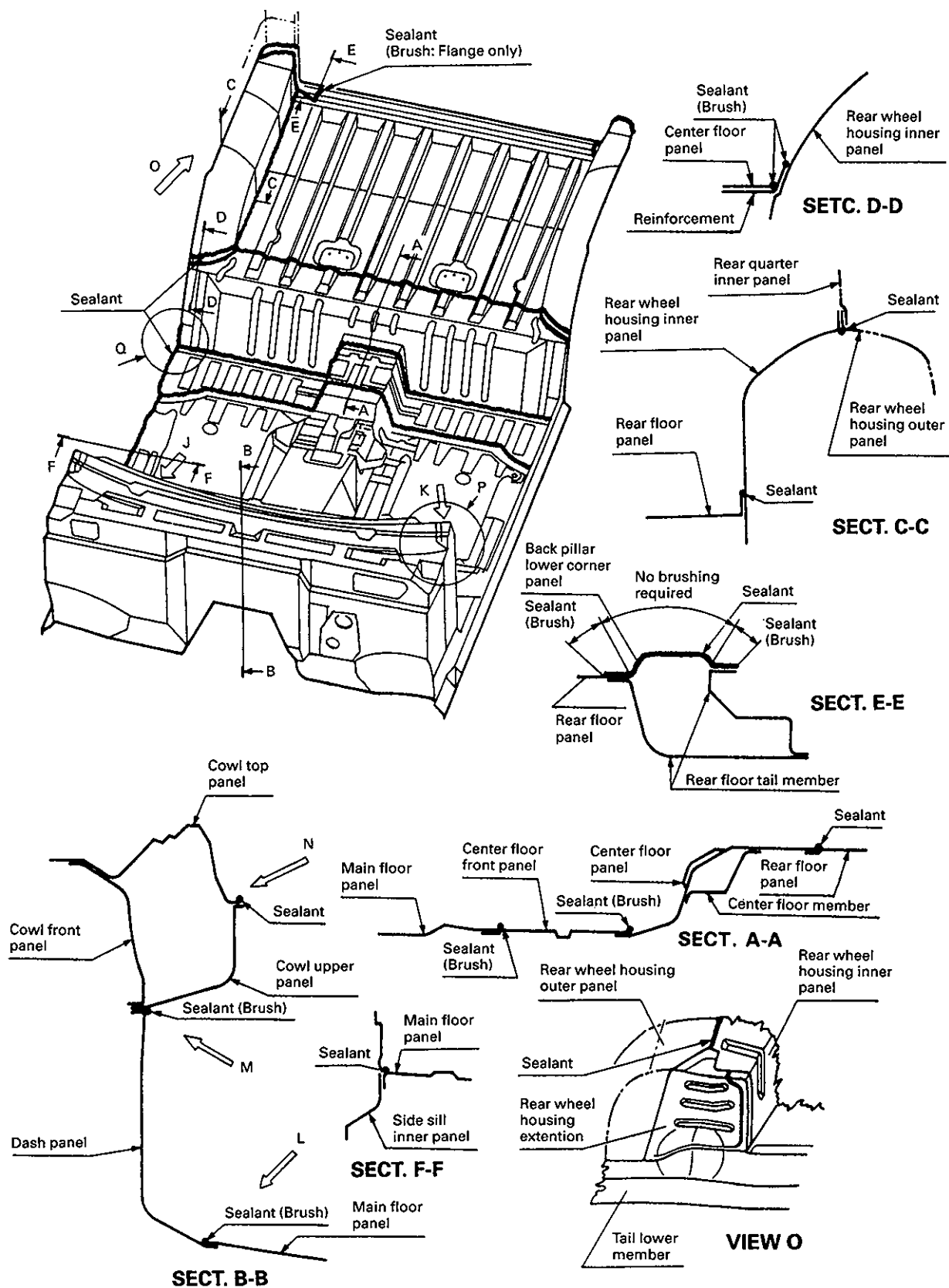
In the case of the melamine or acrylic coating, compound polishing can be omitted after drying.

10. In the case of lacquer coating, wax should not be applied to coated surface until the surface has dried completely (for approx. two months).

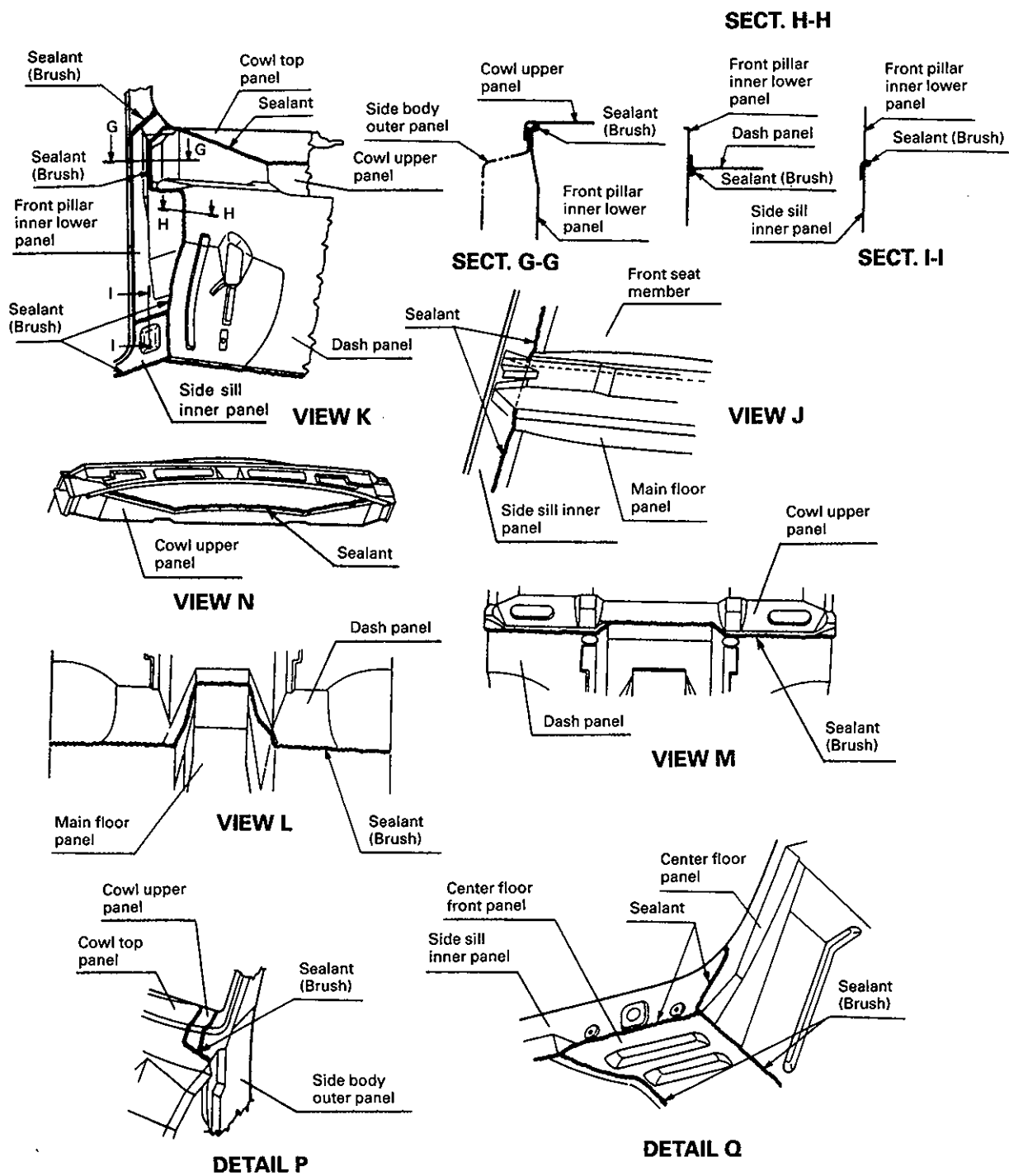
Before replacing exterior parts or assemblies, check paint conditions of all the covered or hidden interior surfaces. If any rust scale is found at these places, proceed as follows:

1. Use a proper wire brush, adhesive or liquid rust removing agent to remove rust. As for the method of use, follow directions advised for respective materials.
2. If necessary, wash part with detergent, rinse, and dry them.
3. Before installing exterior body parts, apply anticorrosive compound to all cleaner surfaces of exterior body parts. Also, apply anticorrosive compound to inner surfaces of exterior body parts to be installed.

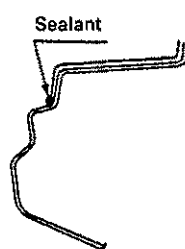
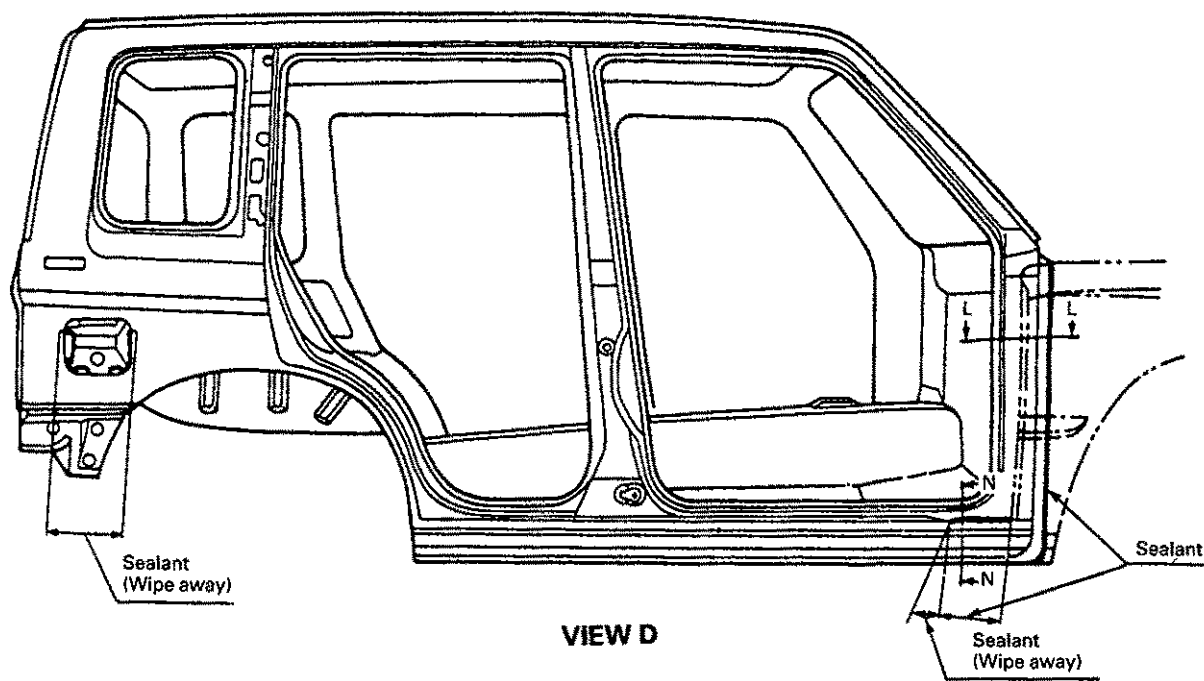
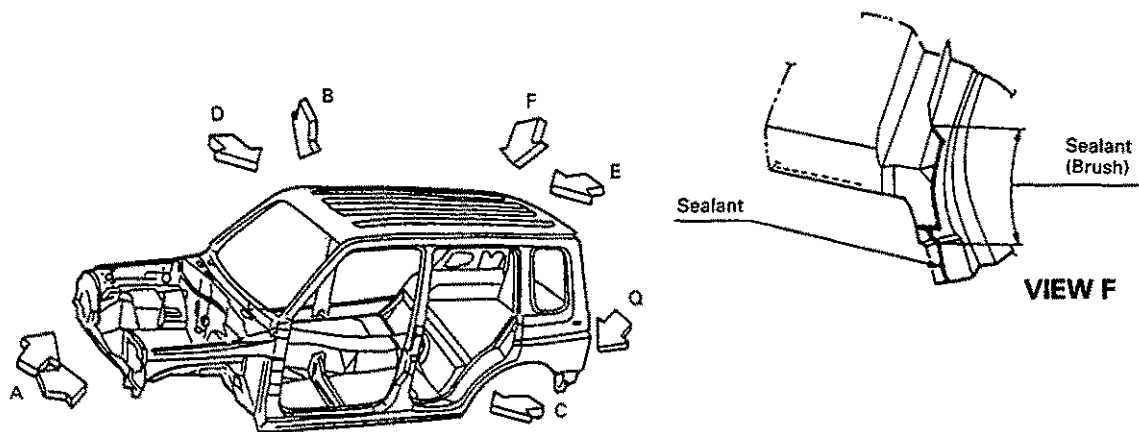
UNDERBODY SEALING No. 1



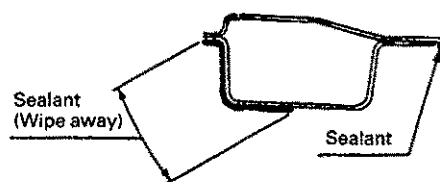
UNDERBODY SEALING No. 2



UNDERBODY SEALING No. 3

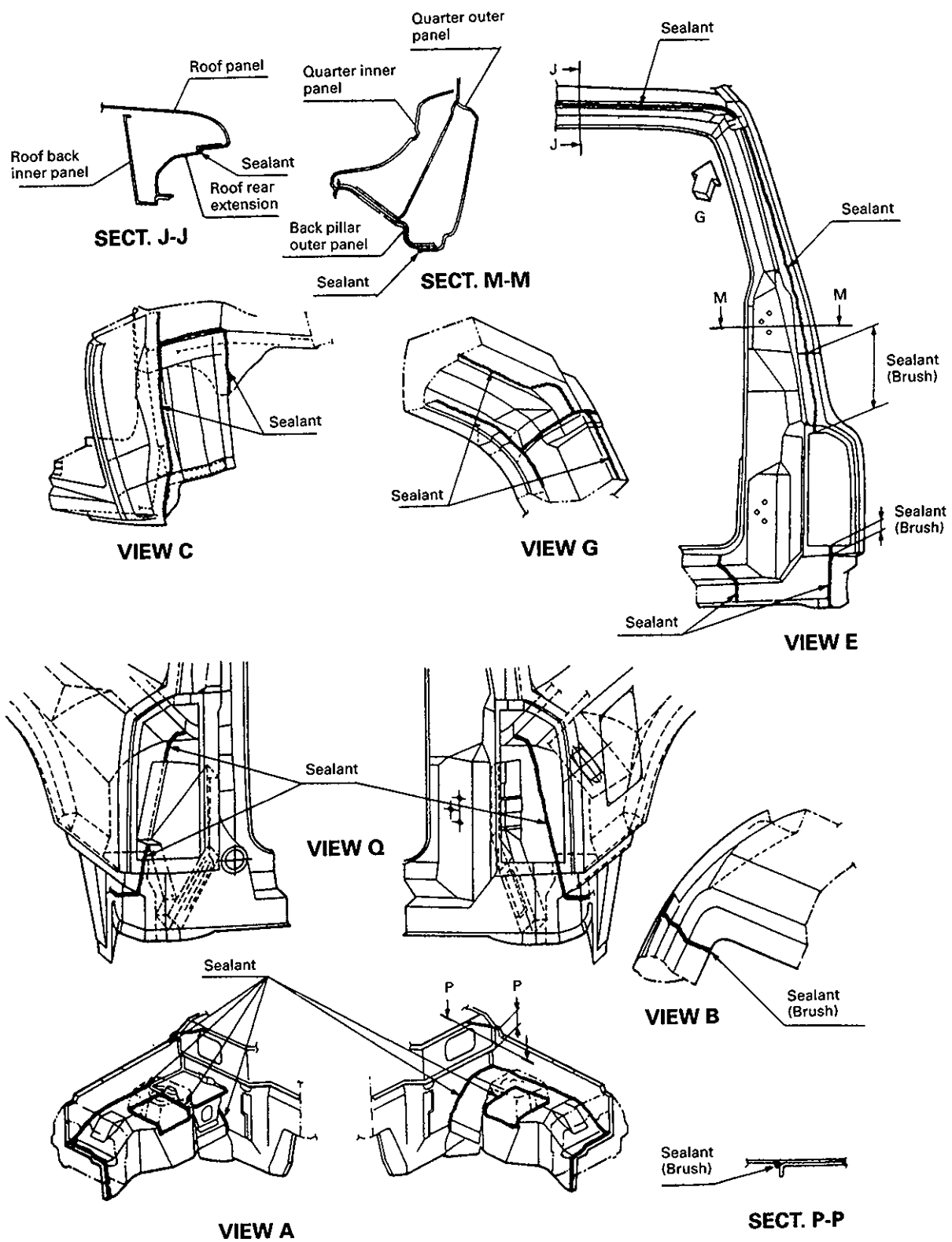


SECT. N-N

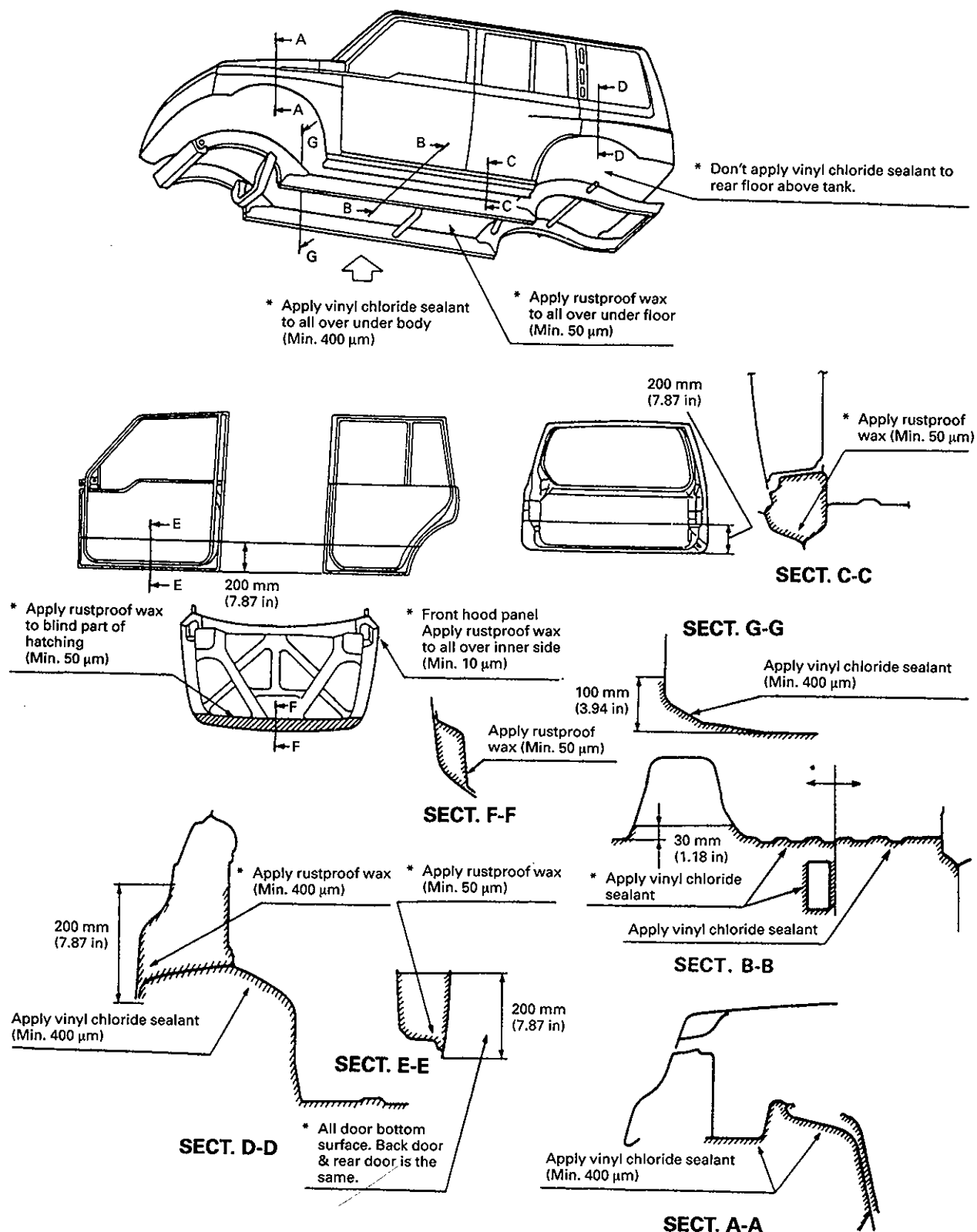


SECT. L-L

UNDERBODY SEALING No. 4



UNDER COATING / ANTI-CORROSION COMPOUND APPLICATION



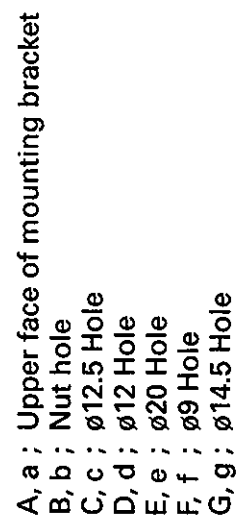
The parts with (*) is provided or not depending on specification.

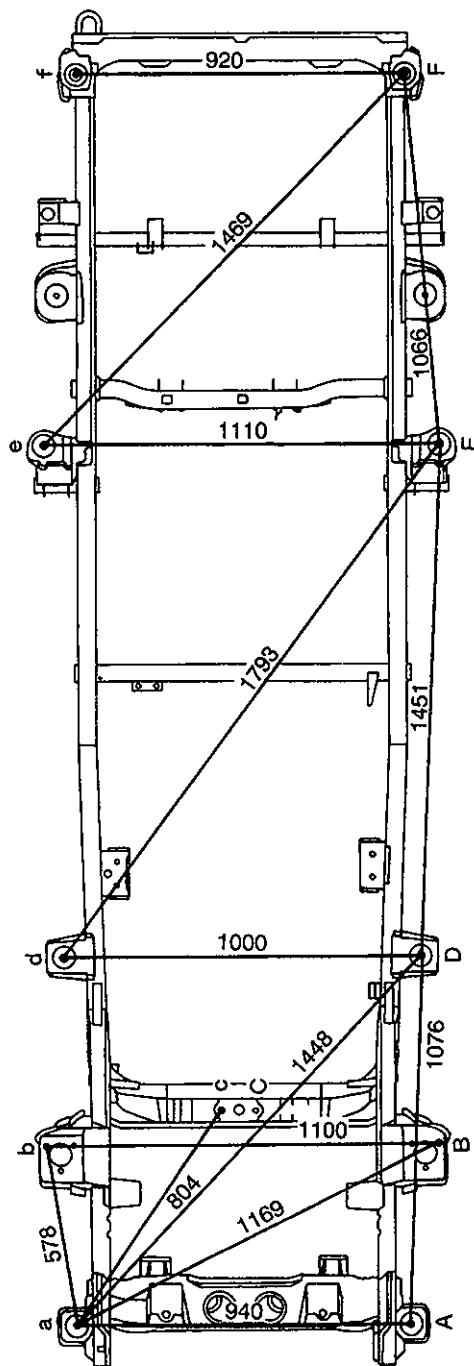
UNDERBODY

Each individual underbody component is not only affecting the strength of the entire unit of a vehicle but also relating to the wheel alignment (toe-in, camber, caster). It is essential, therefore, to properly check the underbody and correctly perform, if necessary, any welding operation connected to its correction or replacement.

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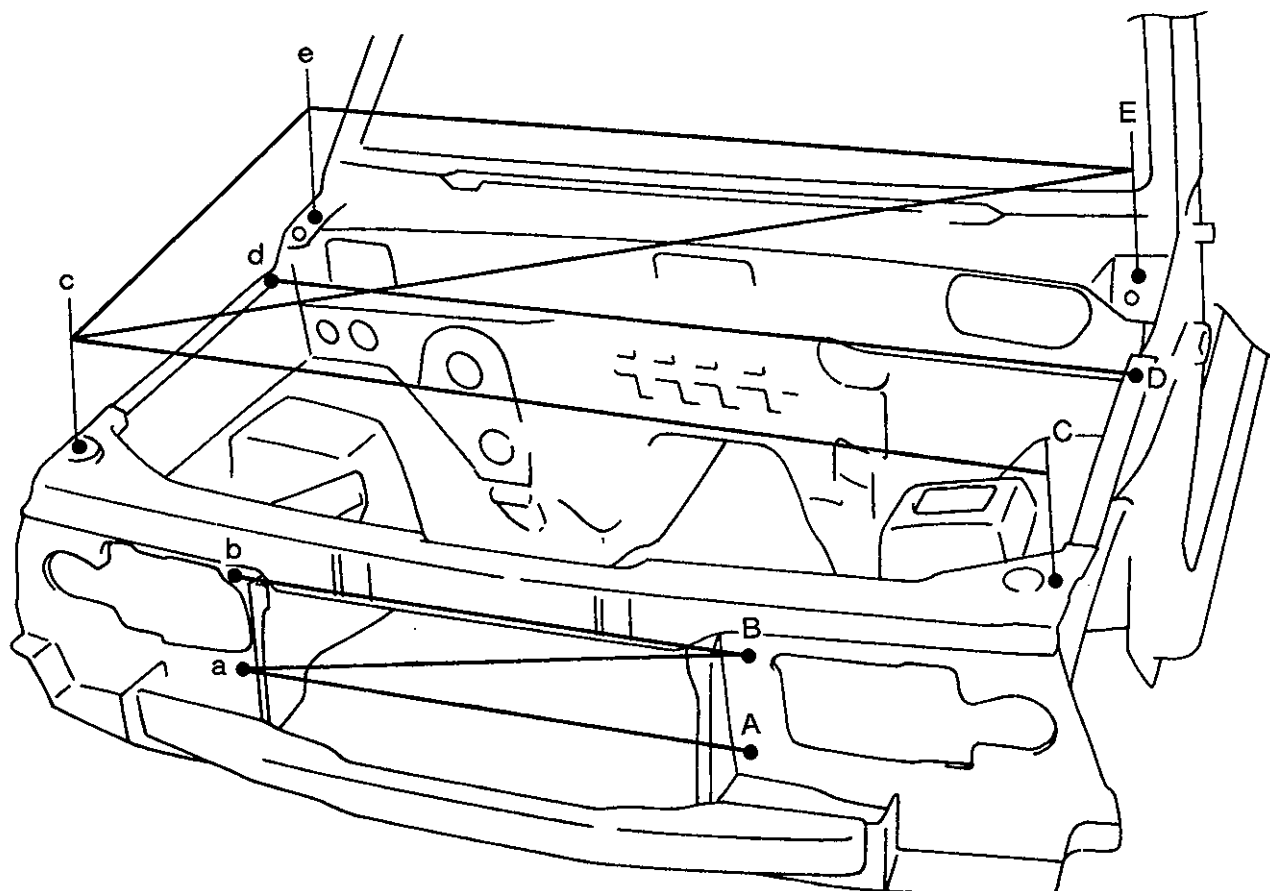
When the underbody is found to have a damaged sealing or rust proof treatment, it is mandatory to apply correct sealing and rust proof treatment. As for the sealing and rust proof treatment, refer to the section "ANTI-CORROSION TREATMENT" of the service manual mentioned in FOREWORD of this manual.





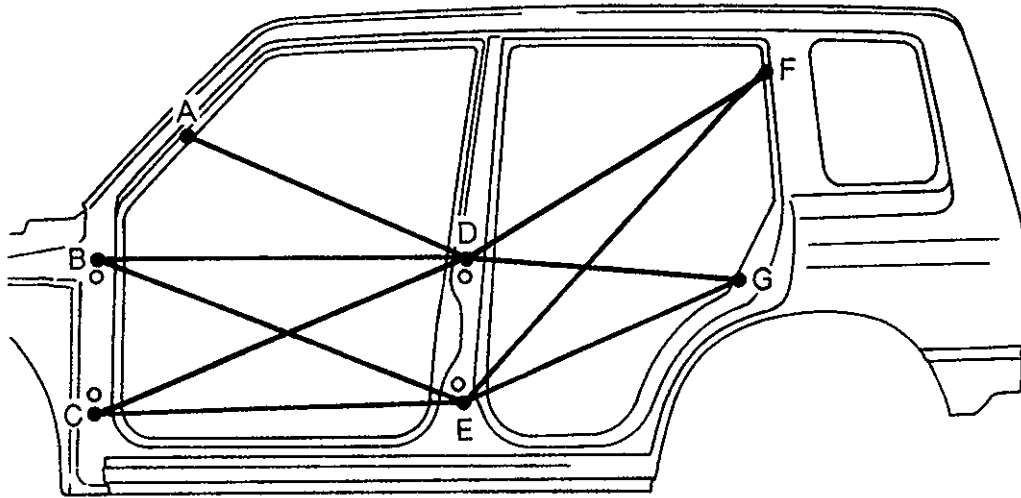
A, a ; $\varnothing 11$ Hole
 B, b ; $\varnothing 9$ Hole
 C, c ; $\varnothing 12$ Hole
 D, d ; $\varnothing 26$ Hole
 E, e ; $\varnothing 26$ Hole
 F, f ; $\varnothing 26$ Hole

BODY DIMENSIONS



MEASUREMENT POSITION	LENGTH: mm (in.)	MEASUREMENT POSITION	LENGTH: mm (in.)
A – a	684 (26.93)	D – d	1351 (53.19)
B – a	717 (28.23)	E – c	1516 (59.69)
B – b	710 (27.95)	E – e	1280 (50.39)
C – c	1351 (53.19)	c – e	754 (29.69)

A, a; $\varnothing 7$ Hole
 B, b; $\varnothing 7$ Hole
 C, c; Nut hole (Front fender panel)
 D, d; Nut hole (Front fender panel)
 E, e; Nut hole (Hood hinge)



MEASUREMENT POSITION	LENGTH: mm (in.)	MEASUREMENT POSITION	LENGTH: mm (in.)
A - D/a - d	872 (34.33)	D - F/d - f	991 (39.02)
B - D/b - d	1029 (40.51)	D - G/d - g	739 (29.09)
B - E/b - e	1093 (43.03)	E - F/e - f	1242 (48.90)
C - D/c - d	1106 (43.54)	E - G/e - g	812 (31.97)
C - E/c - e	1020 (40.16)		

Body width: mm (in.)

A - a : 1238 (48.74)

F - f : 1131 (44.53)

G - g : 1318 (51.89)

NOTE:

Each small letter indicates the same position as the large letter of the same alphabet on the other side.

A, a ; $\varnothing 7$ Hole

B, b ; Nut hole (Front door hinge)

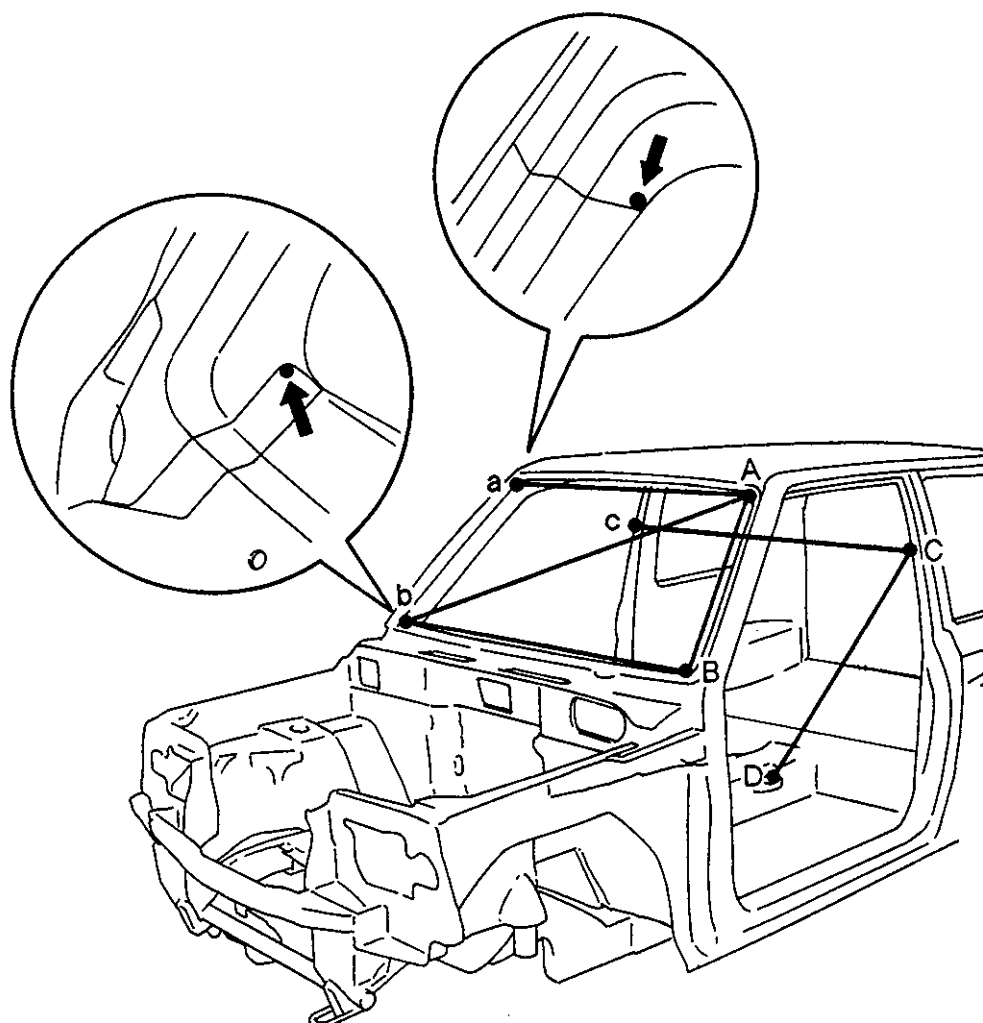
C, c ; Nut hole (Front door hinge)

D, d ; Nut hole (Rear door hinge)

E, e ; Nut hole (Rear door hinge)

F, f ; $\varnothing 7$ Hole

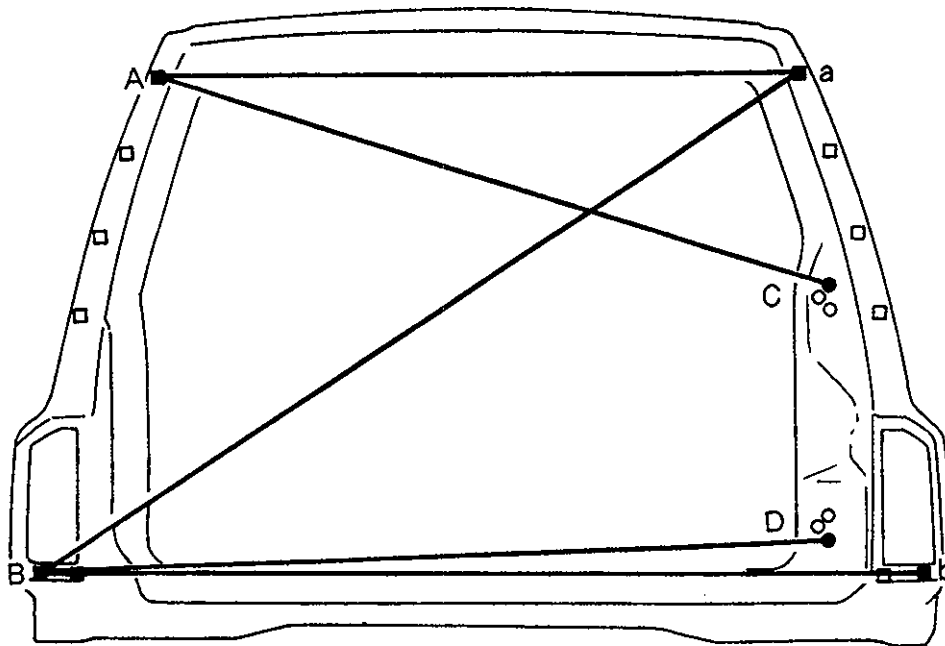
G, g ; $\varnothing 9$ Hole



MEASUREMENT POSITION	LENGTH: mm (in.)	MEASUREMENT POSITION	LENGTH: mm (in.)
A - B	601 (23.66)	B - b	1255 (49.41)
A - a	1019 (40.12)	C - D	970 (38.19)
A - b	1280 (50.39)	C - c	1188 (46.77)

C, c ; $\varnothing 7$ Hole

D, d ; Nut hole (Seat slide adjuster)



MEASUREMENT POSITION	LENGTH: mm (in.)	MEASUREMENT POSITION	LENGTH: mm (in.)
A - C	1191 (46.89)	B - D	1332 (52.44)
A - a	1089 (42.87)	B - b	1480 (58.27)
B - a	1536 (60.47)		

A, a; Square hole

B, b; Square hole

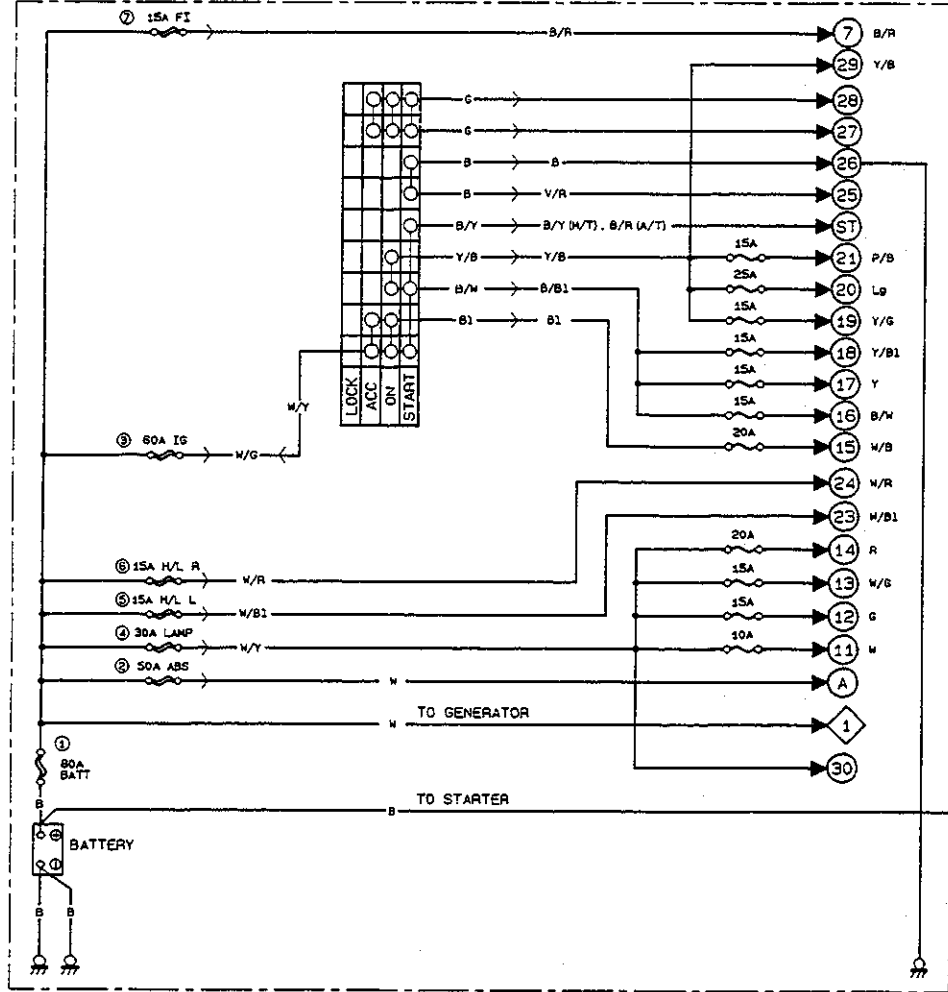
C ; Nut hole (Back door hinge)

D ; Nut hole (Back door hinge)

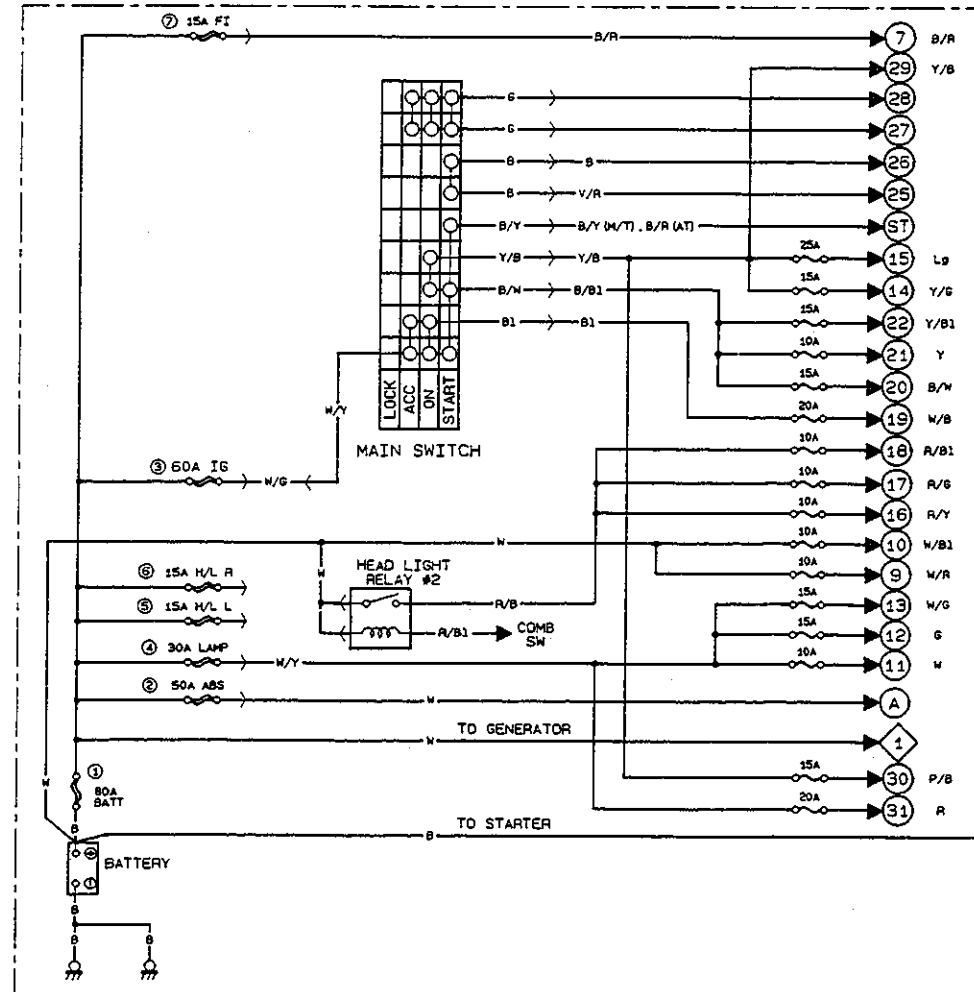
WIRING DIAGRAM

NOTE: #1...FOR GENERAL & EUROPEAN MARKET
#2...FOR GERMAN MARKET ONLY

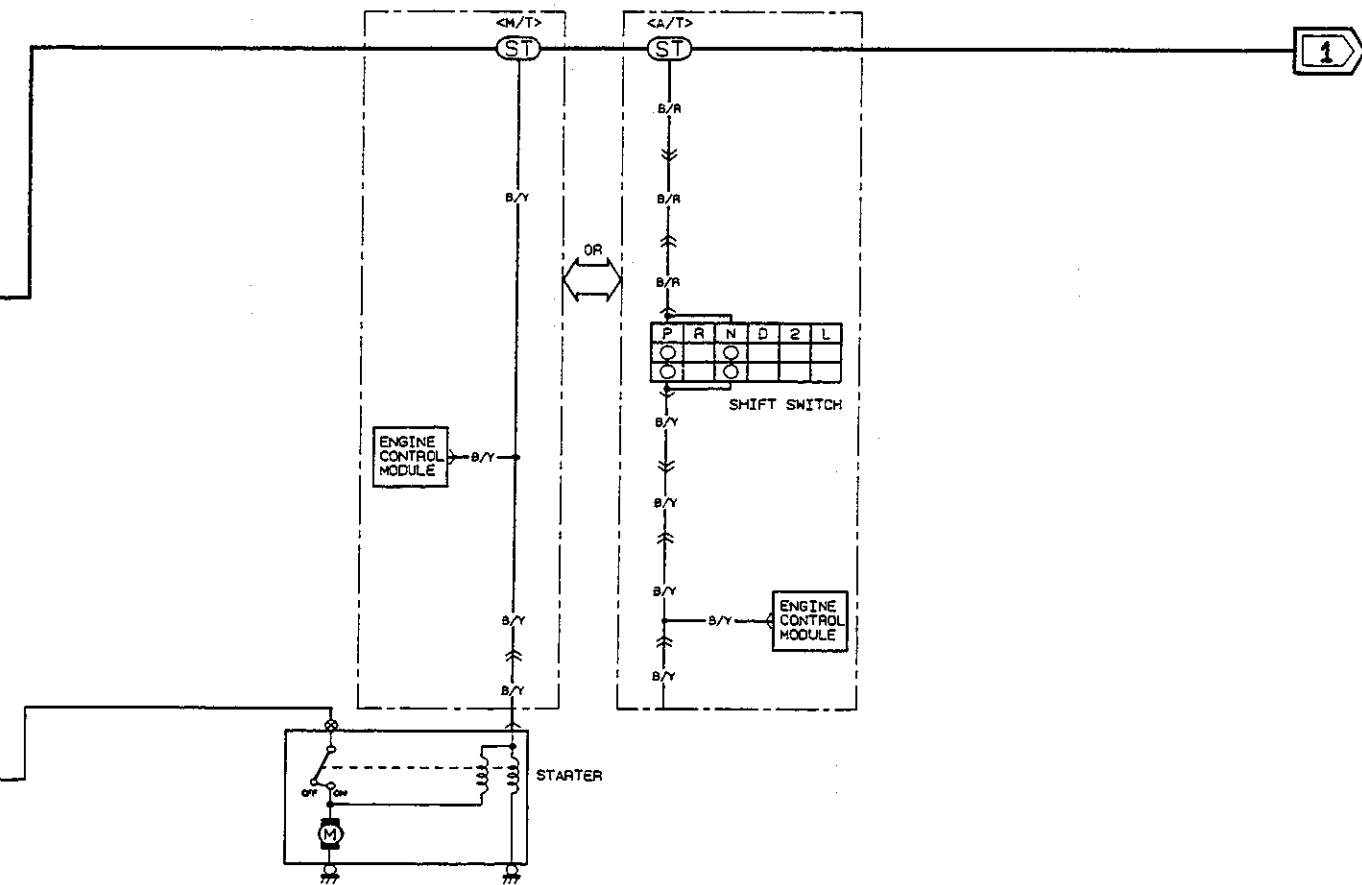
<FOR GENERAL & EUROPEAN MARKET>
XCEPT GERMAN MARKET



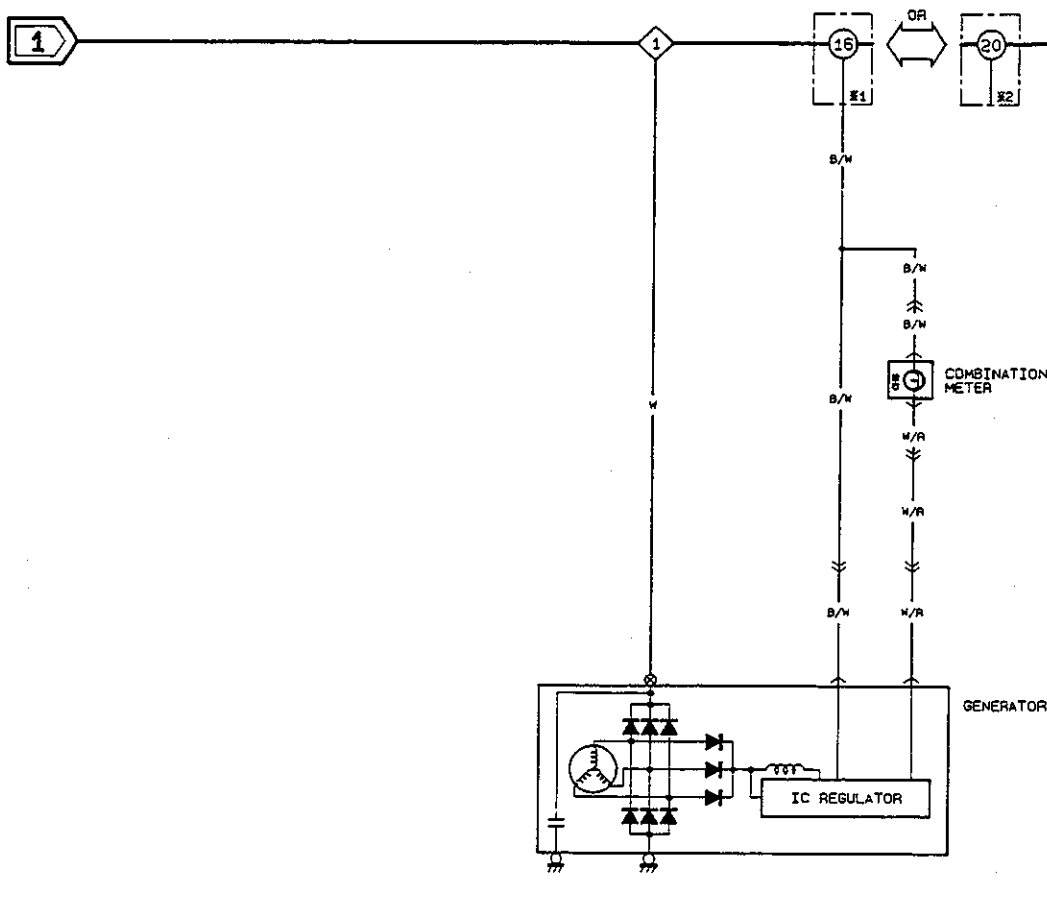
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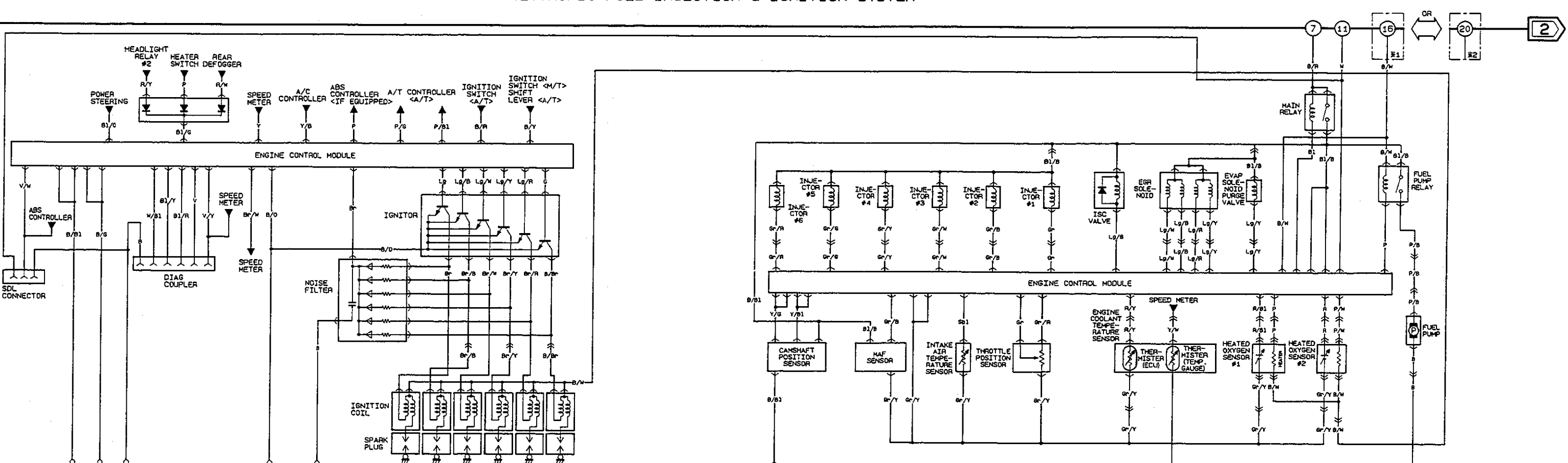
CRANKING SYSTEM



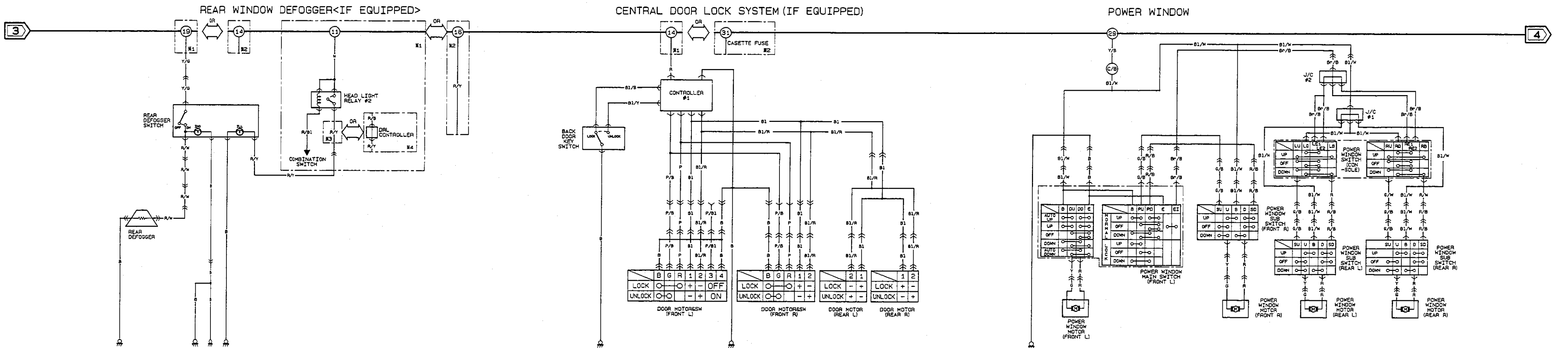
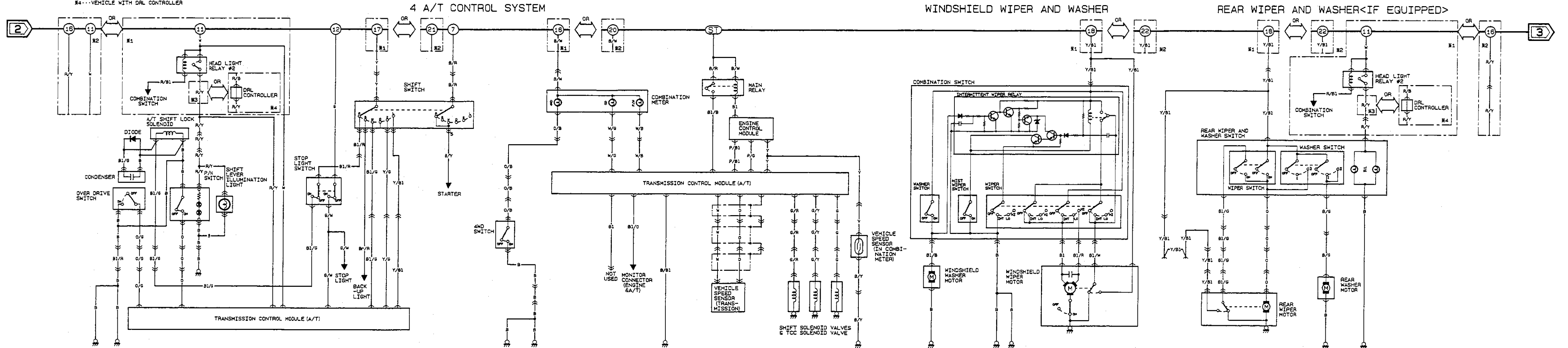
CHARGING SYSTEM

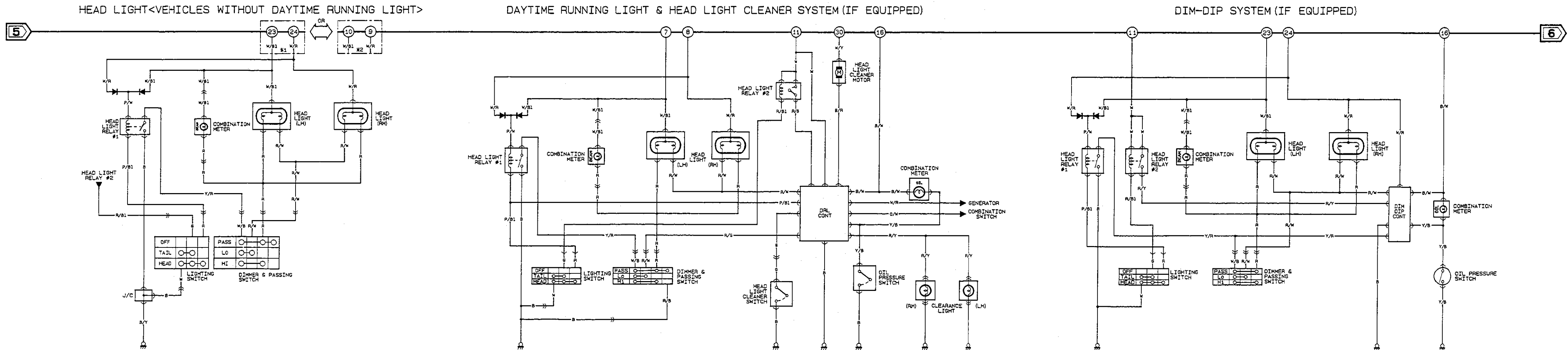
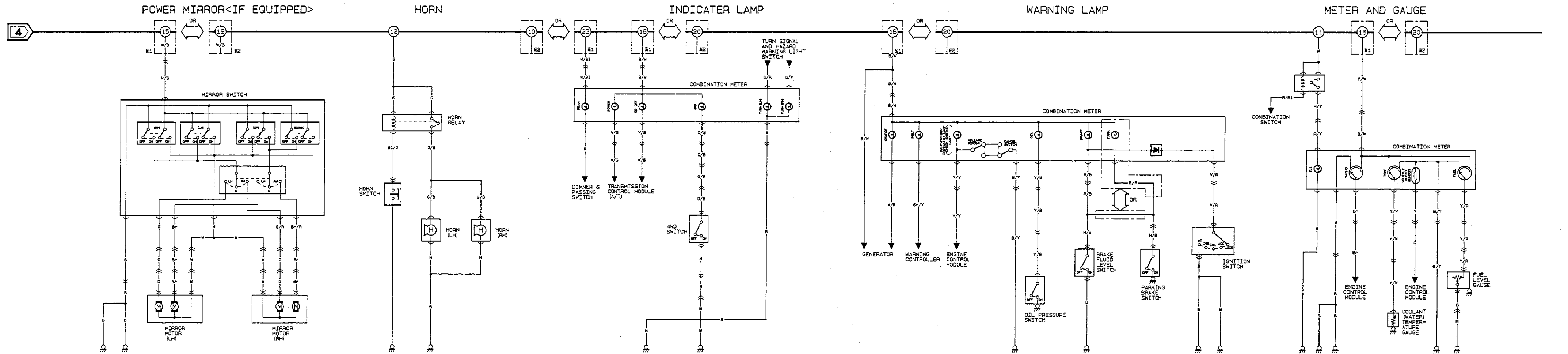


ELECTRONIC FUEL INJECTION & IGNITION SYSTEM



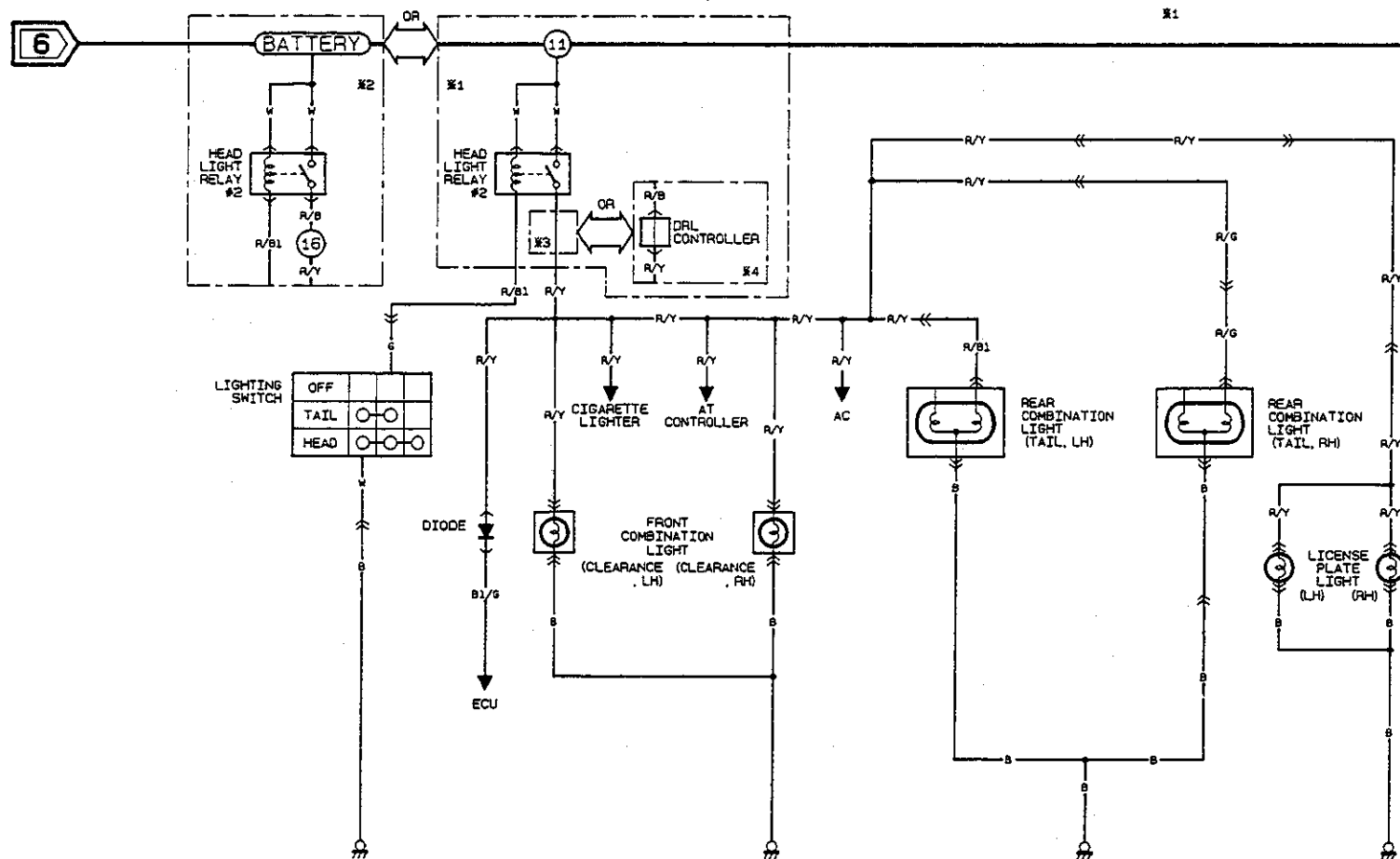
NOTE: #1...FOR GENERAL & EUROPEAN MARKET
 #2...FOR GERMAN MARKET ONLY
 #3...VEHICLE WITHOUT DRL CONTROLLER
 #4...VEHICLE WITH DRL CONTROLLER



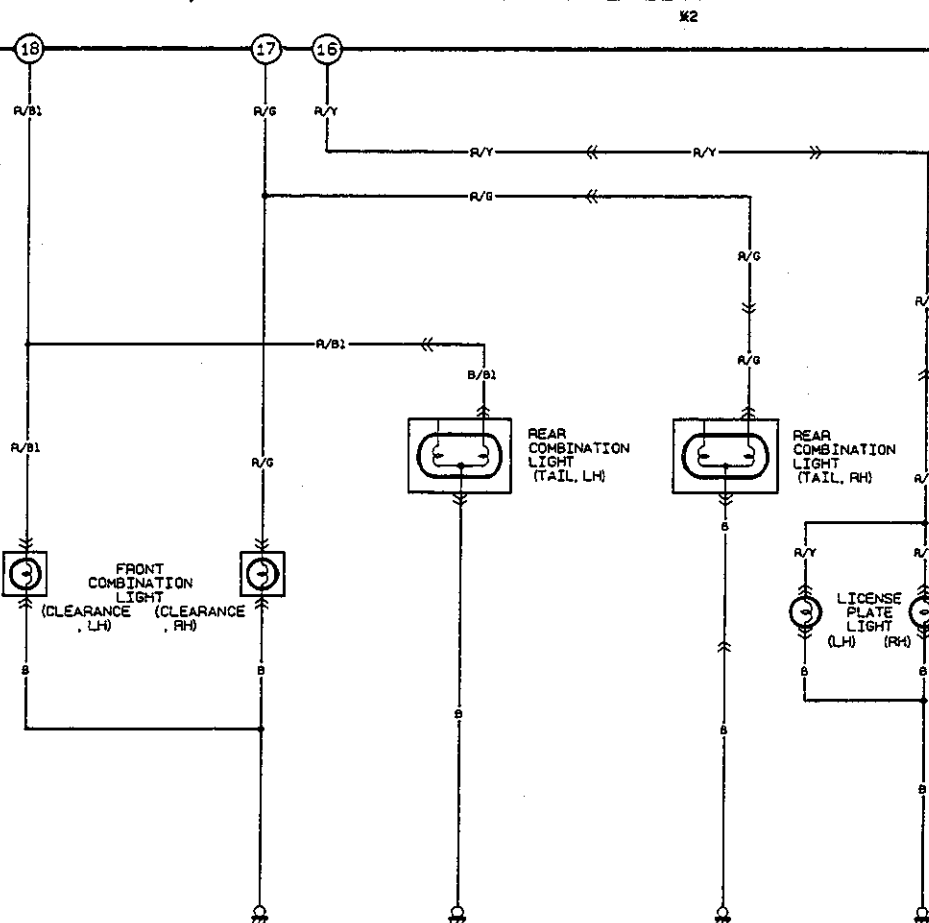


NOTE: #1...FOR GENERAL & EUROPEAN MARKET
 #2...FOR GERMAN MARKET ONLY
 #3...VEHICLE WITHOUT DRL CONTROLLER
 #4...VEHICLE WITH DRL CONTROLLER

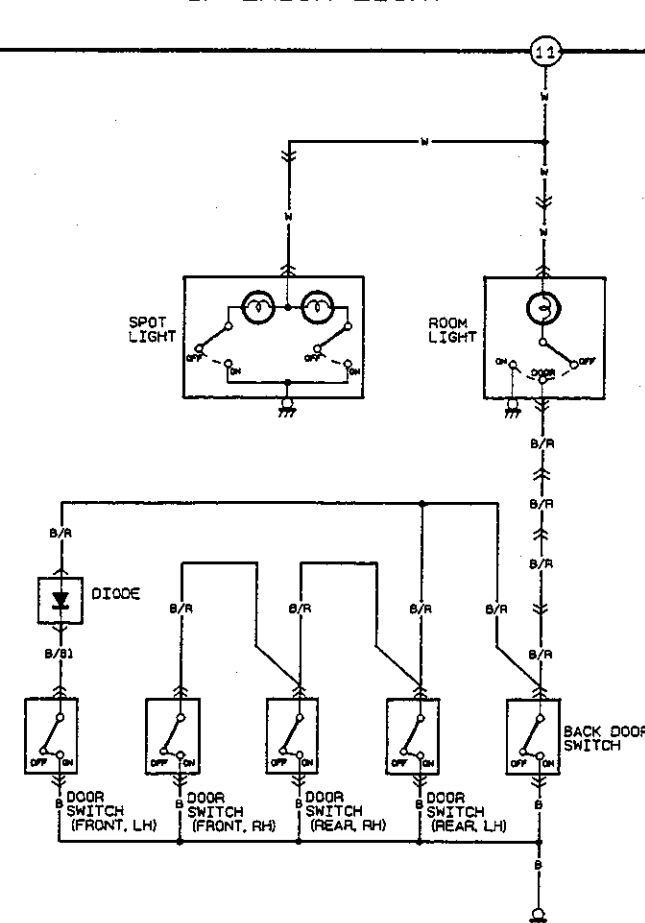
CLEARANCE, TAIL AND LICENSE PLATE LIGHT



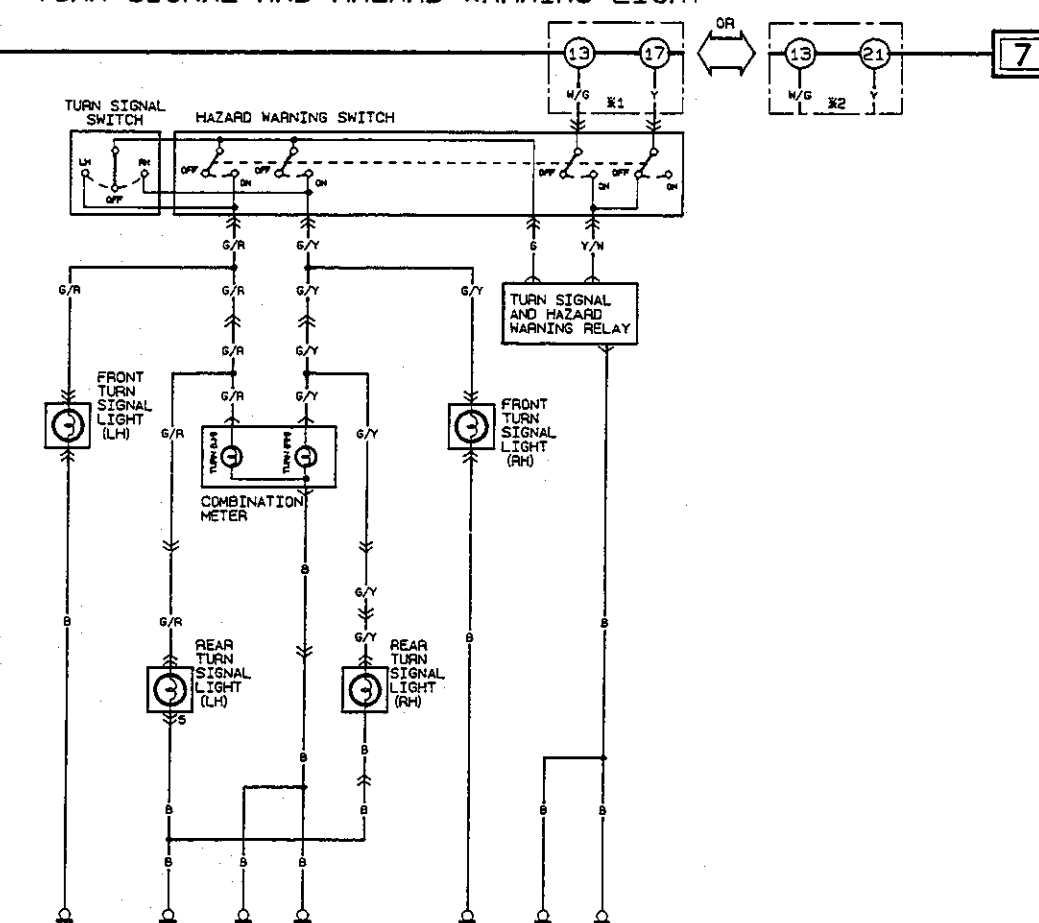
CLEARANCE, TAIL AND LICENSE PLATE LIGHT



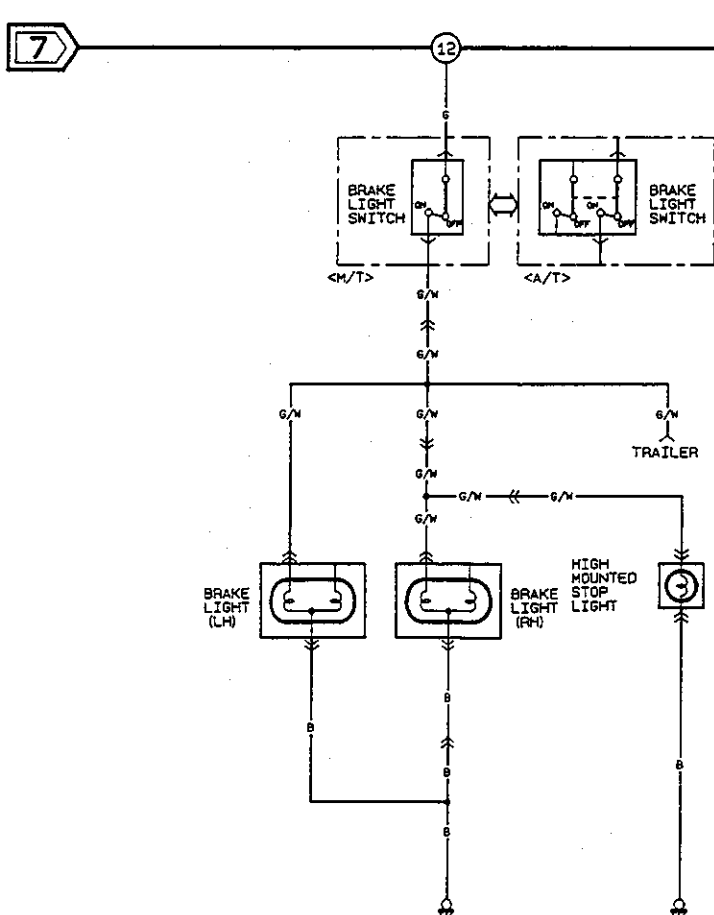
INTERIOR LIGHT



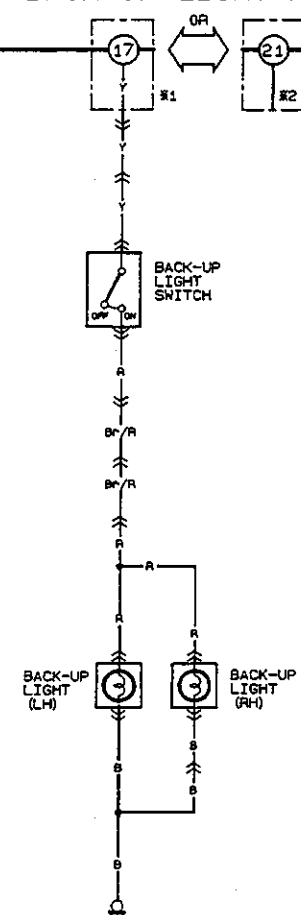
TURN SIGNAL AND HAZARD WARNING LIGHT



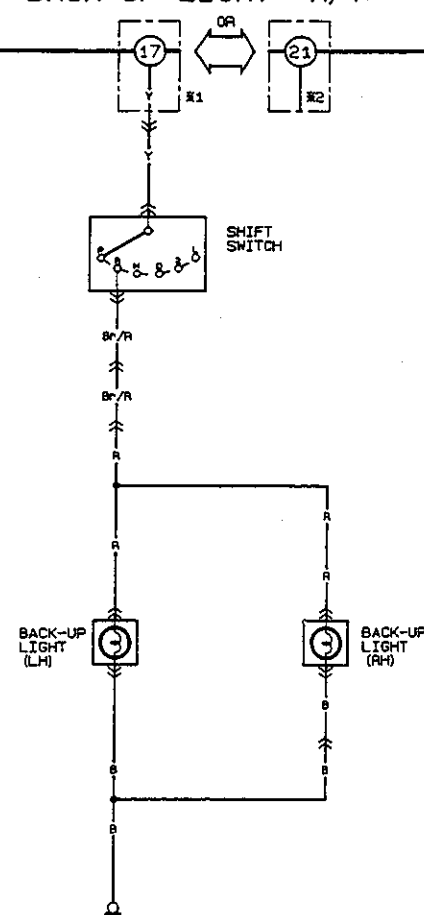
BRAKE LIGHT



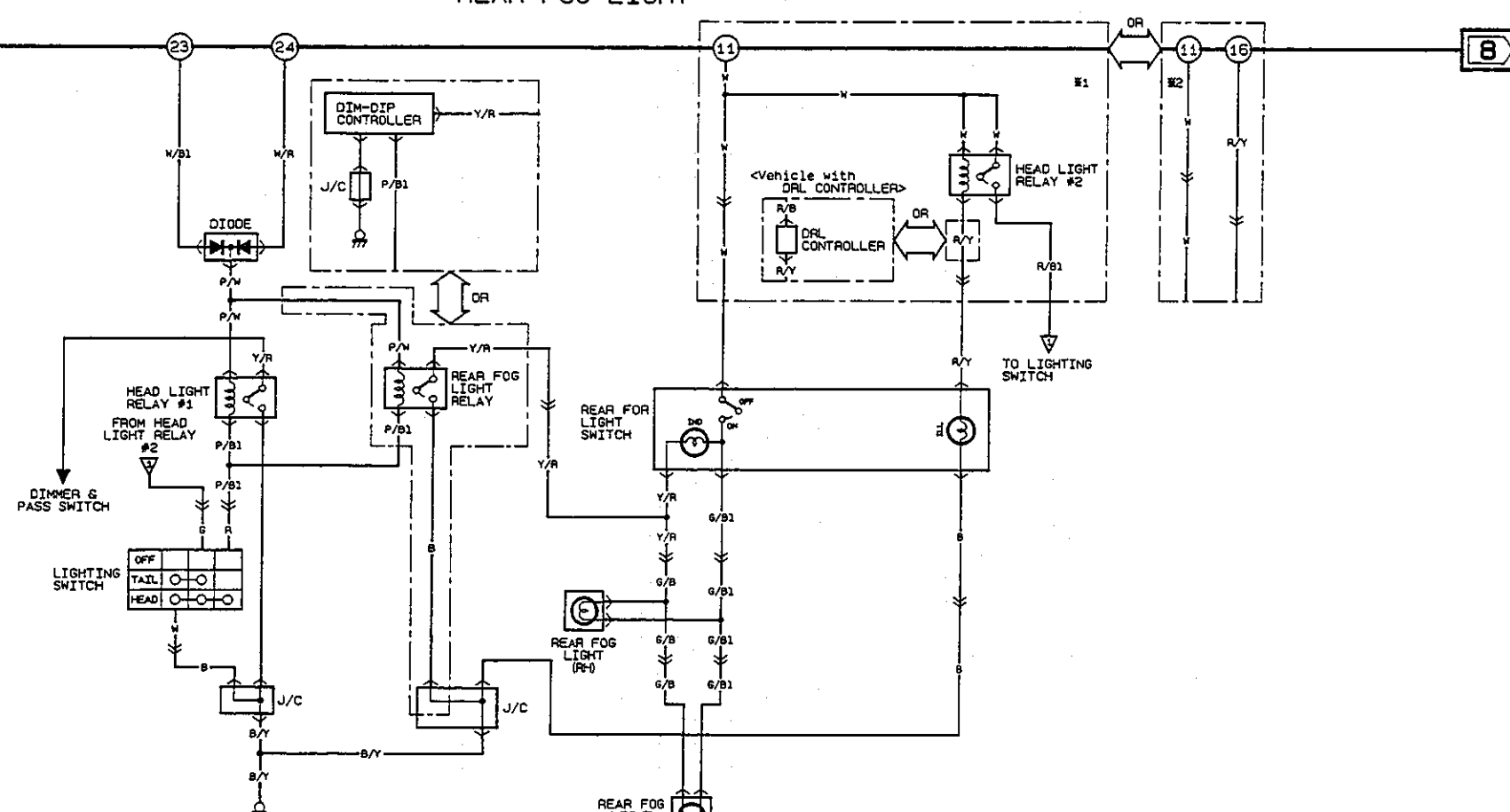
BACK-UP LIGHT <M/T>



BACK-UP LIGHT <A/T>



REAR FOG LIGHT



HEATER

Diagram showing the wiring for the heater system, including the heater control panel illumination light, blower motor, and various relays and switches.

RADIO

Diagram showing the wiring for the radio system, including the radio unit, speakers, and various relays and switches.

DATA LINK CONNECTOR (DLC) / MONITOR CONNECTOR

Diagram showing the wiring for the data link connector (DLC) and monitor connector, including the DLC monitor, monitor unit, and various relays and switches.



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