

SUZUKI **SWIFT** GTi

SUZUKI

SWIFT

SUZUKI MOTOR CO., LTD.

SERVICE MANUAL
1300 GTi

SERVICE MANUAL

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FOREWORD

This manual contains procedures for diagnosis, maintenance adjustments, minor service operations, replacement of components (Service) and for disassembly and assembly of major components (Unit Repair-Overhaul).

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on this page. And on the first page of each individual section is an index of that section.

This manual should be kept in a handy place for ready reference of the service work. Strict observance of the so specified items will enable one to obtain the full performance of the vehicle.

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.

CAUTION:

It is important to note that, during any vehicle maintenance procedures, replacement fasteners must have the same measurements as those removed.

Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possible personal injury.

Therefore, fasteners removed from the vehicle should be saved for re-use whenever possible.

Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

Additional information concerning this subject will be found in the section 0A (METRIC INFORMATION).

SUZUKI MOTOR CO., LTD.

TECHNICAL DEPARTMENT
AUTOMOBILE SERVICE DIVISION

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SECTION 0A

GENERAL INFORMATION

CONTENTS

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GENERAL INFORMATION

VEHICLE IDENTIFICATION

The vehicle identification number is on the left front top of the instrument panel. Refer to Fig. 0A-1 for its location and Fig. 0A-2 for detailed VIN code information.

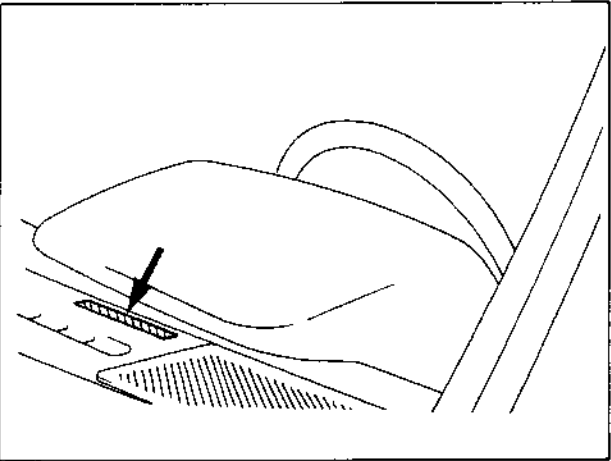


Fig. 0A-1 Vehicle Identification Number Location

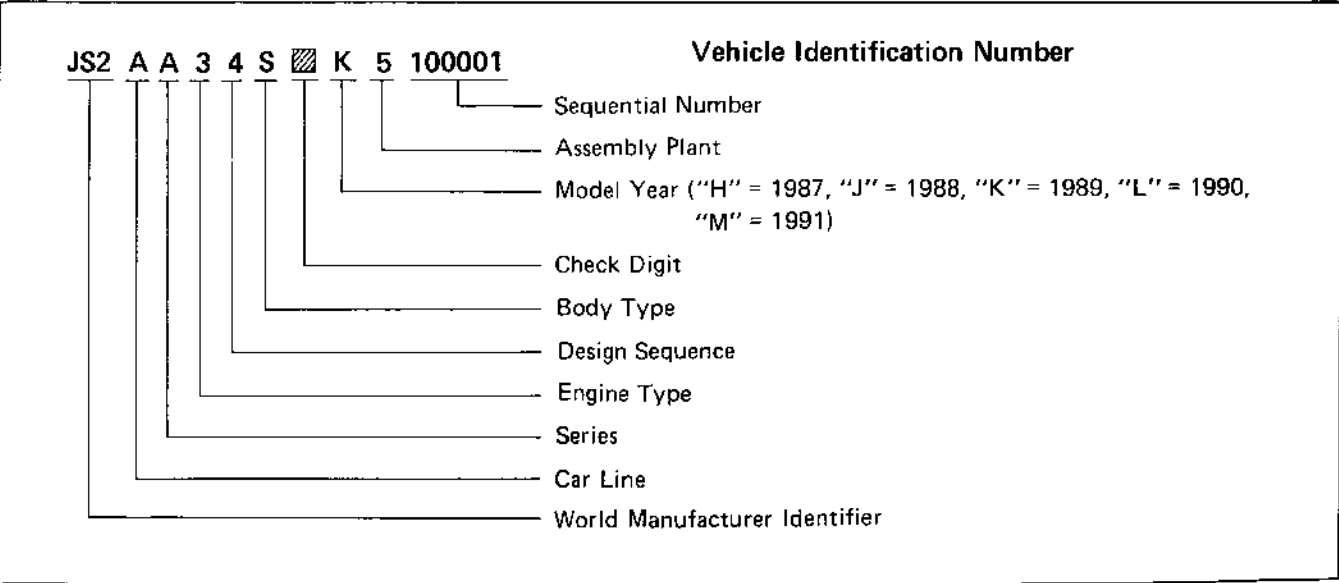


Fig. 0A-2 Vehicle Identification Number

ENGINE AND TRANSMISSION IDENTIFICATION

Refer to Fig. 0A-3 and 0A-4 for engine and transmission identification numbers and their locations.

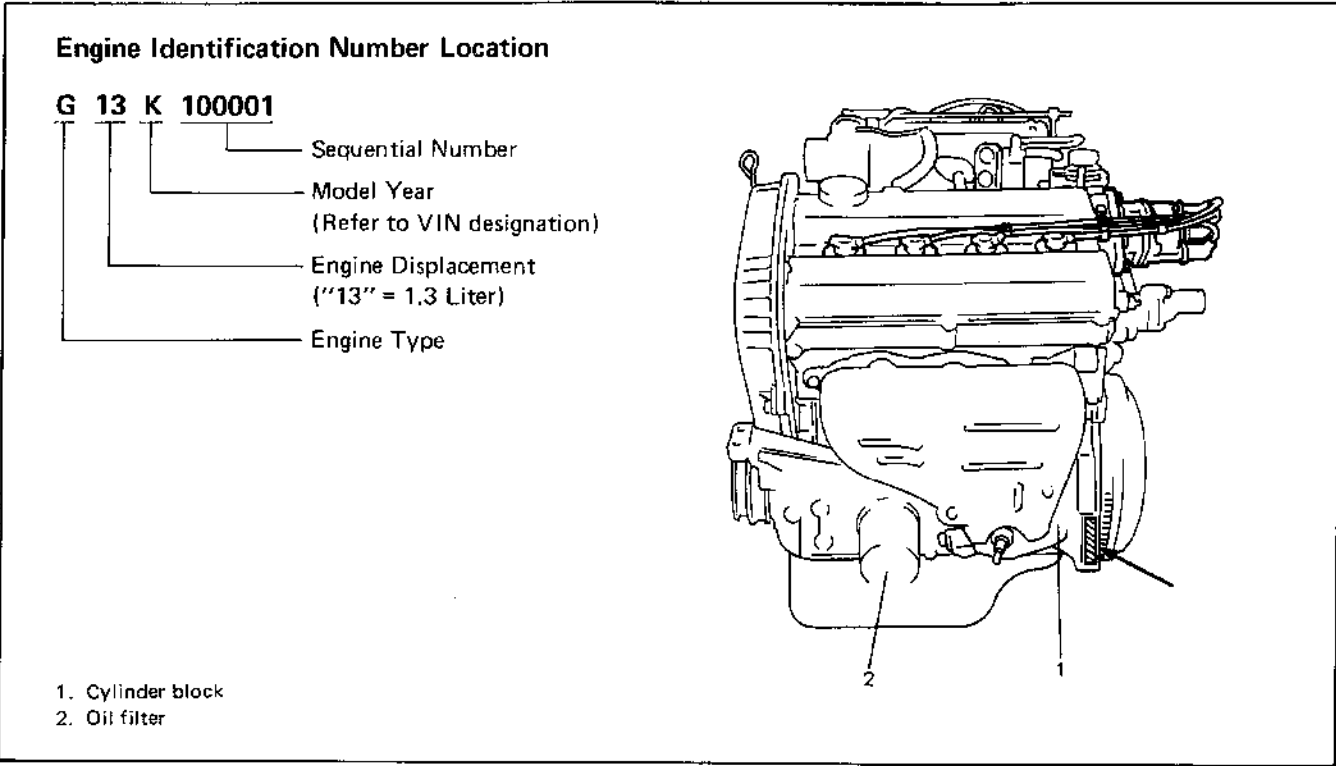


Fig. 0A-3 Engine Identification Number Location

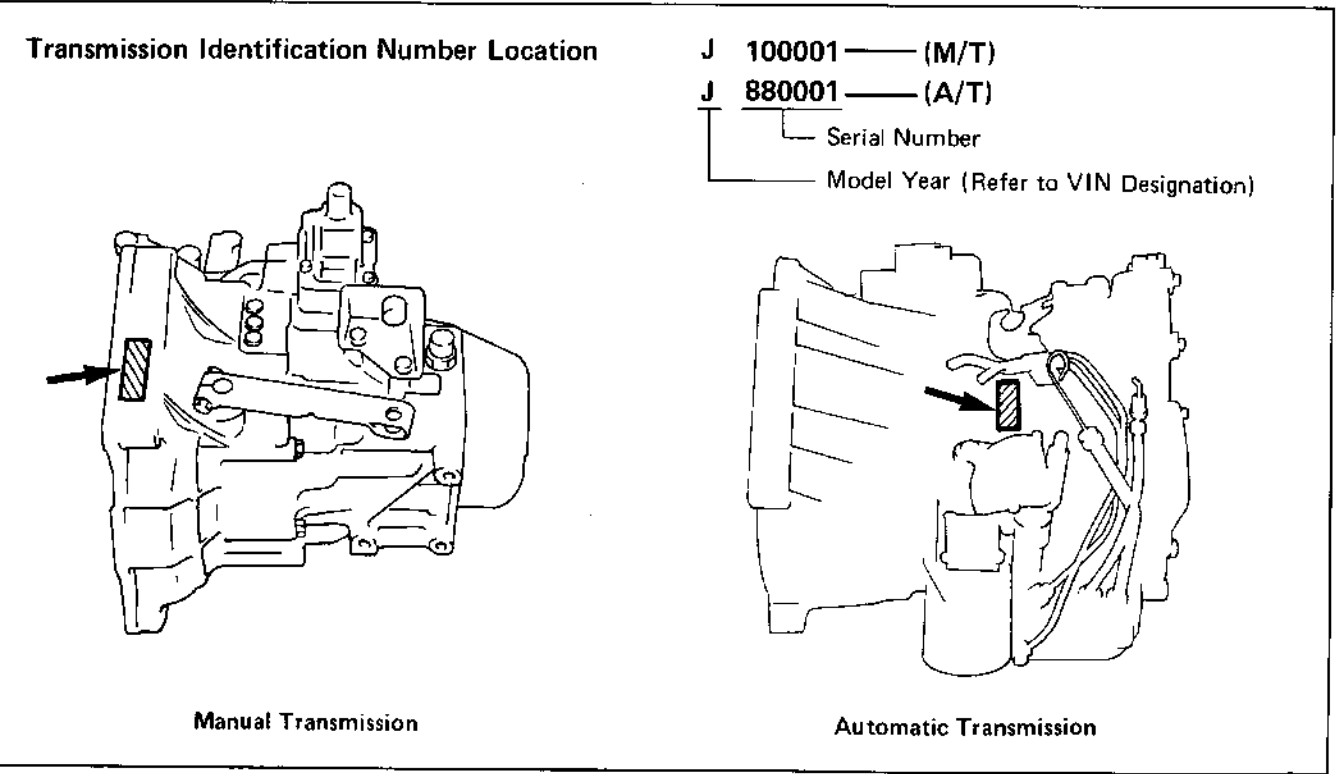


Fig. 0A-4 Transmission Identification Number Location

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.

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. Fig. 0A-5 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.

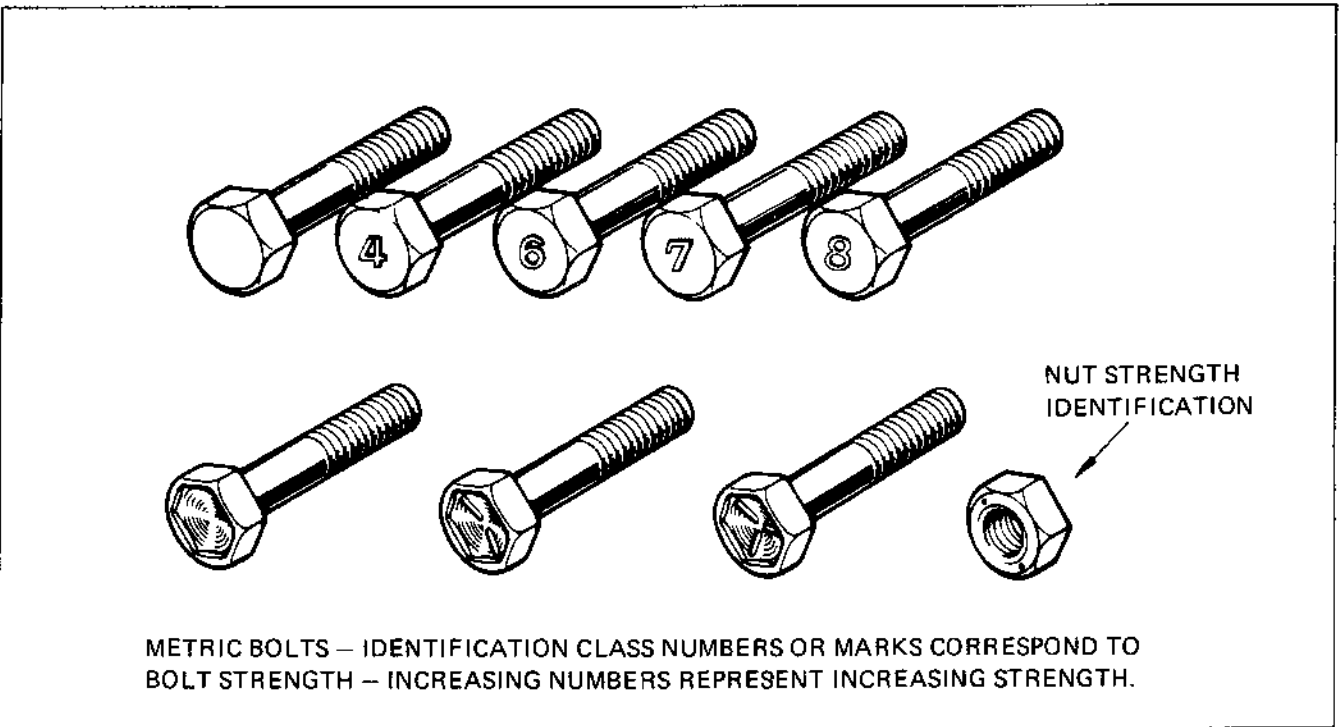


Fig. 0A-5 Bolt Strength Markings

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 below chart.
- The below chart is applicable only where the fastened parts are made of steel or light alloy.

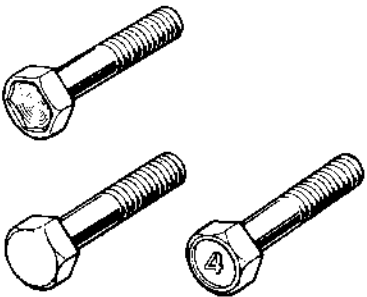
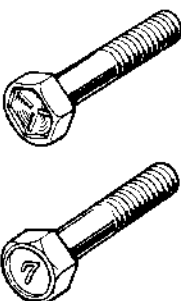
STRENGTH						
	Conventional bolt "4T" bolt			"7T" bolt		
THREAD DIAMETER (mm)	N-m	kg-m	lb-ft	N-m	kg-m	lb-ft
4	1 – 2	0.1 – 0.2	0.7 – 1.5	1.5 – 3.0	0.15 – 0.30	1.0 – 2.2
5	2 – 4	0.2 – 0.4	1.5 – 3.0	3 – 6	0.3 – 0.6	2.0 – 4.5
6	4 – 7	0.4 – 0.7	3.0 – 5.0	8 – 12	0.8 – 1.2	6.0 – 8.5
8	10 – 16	1.0 – 1.6	7.0 – 11.5	18 – 28	1.8 – 2.8	13.0 – 20.0
10	22 – 35	2.2 – 3.5	16.0 – 25.0	40 – 60	4.0 – 6.0	29.0 – 43.5
12	35 – 55	3.5 – 5.5	25.0 – 40.0	70 – 100	7.0 – 10.0	50.5 – 72.5
14	50 – 80	5.0 – 8.0	36.0 – 58.0	110 – 160	11.0 – 16.0	79.5 – 116.0
16	80 – 130	8.0 – 13.0	57.5 – 94.5	170 – 250	17.0 – 25.0	122.5 – 181.0
18	130 – 190	13.0 – 19.0	94.0 – 137.5	200 – 280	20.0 – 28.0	144.5 – 203.0

Fig. 0A-6 Tightening Torque Chart

VEHICLE LIFTING POINTS

Fig. 0A-7 and 0A-8 indicate the methods of lifting the vehicle using a hoist, and Fig. 0A-9 and 0A-10 show additional locations for lifting with a floor jack.

WARNING:

- When using frame contact hoist, apply hoist as shown below (right and left at the same position). Lift up the car till 4 tires are a little off the ground and make sure that the car will not fall off by trying to move car body in both ways. Work can be started only after this confirmation.
- Before applying hoist to underbody, always take car balance throughout service into consideration. Car balance on hoist may change depending of what part to be removed.
- Make absolutely sure to lock hoist after car is hoisted up.
- If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels 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.

PRECAUTION AGAINST TIPPING

On front-wheel drive vehicles, the centerline-of-gravity is further forward than on rear-wheel drive vehicle. Therefore, whenever removing major components from the rear of the vehicle, while supported on a hoist, it is mandatory to support the vehicle in a manner to prevent the possibility of the vehicle tipping forward.

When using frame contact hoist:

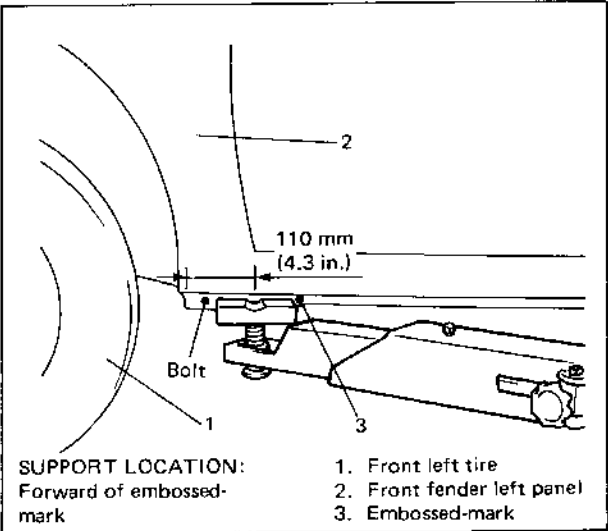


Fig. 0A-7 Front Support Location

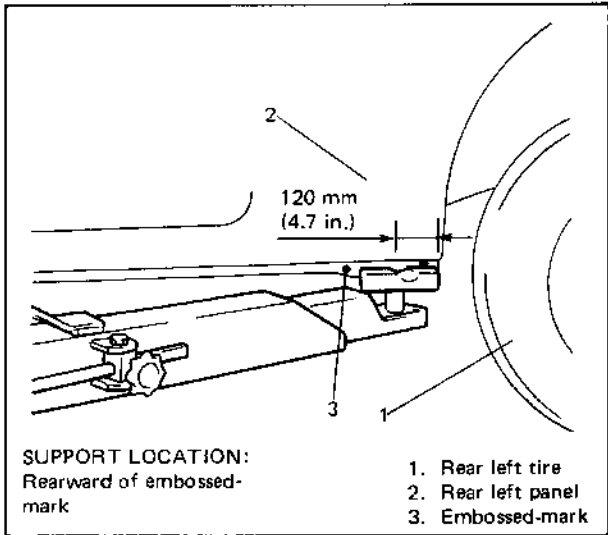


Fig. 0A-8 Rear Support Location

When using floor jack:

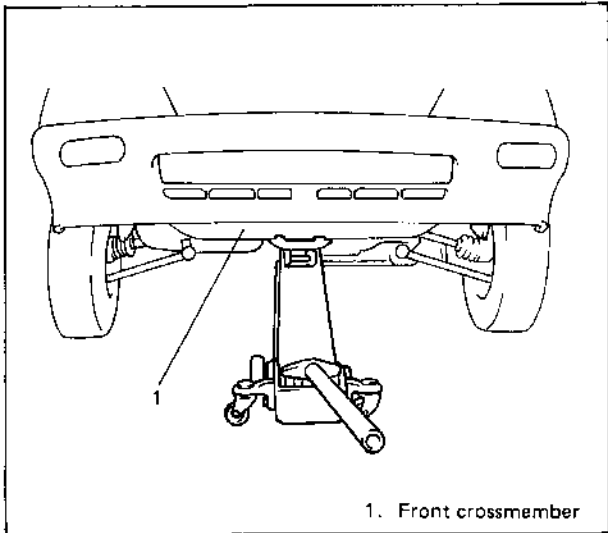


Fig. 0A-9 Front Support Location

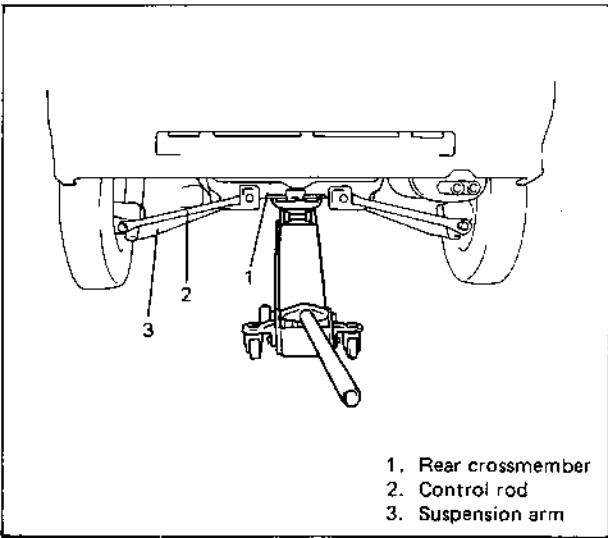


Fig. 0A-10 Rear Support Location

SECTION 0B

MAINTENANCE AND LUBRICATION

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MAINTENANCE SCHEDULE

NORMAL CONDITION SCHEDULE

Interval: This interval should be judged by odometer reading or months, whichever comes first.		This table includes services as scheduled up to 60,000 miles (100,000 km) mileage. Beyond 60,000 miles (100,000 km), carry out the same services at the same intervals respectively.								
		Miles (x 1,000)	7.5	15	22.5	30	37.5	45	52.5	60
		Km (x 1,000)	12.5	25	37.5	50	62.5	75	87.5	100
		Months	7.5	15	22.5	30	37.5	45	52.5	60
1. ENGINE										
1-1. Water pump belt (tension, damage)		—	—	—	I	—	—	—	I	
1-2. & 1-3. Engine oil and Engine oil filter		Replace every 5,000 miles (8,000 km) or 12 months								
1-4. Cooling system, hoses and connections (leakage, damage)		—	*I	—	*I	—	*I	—	I	
1-5. Engine coolant		—	—	—	R	—	—	—	R	
1-6. Exhaust system		—	—	—	I	—	—	—	I	
1-7. Wiring harness and connections		—	—	—	—	—	—	—	I	
2. IGNITION SYSTEM										
2-1. Spark plugs		—	—	—	R	—	—	—	R	
2-2. Ignition wiring		—	—	—	—	—	—	—	R	
3. FUEL SYSTEM										
3-1. Air cleaner filter element	Paved-road	—	—	—	R	—	—	—	R	
3-2. Fuel tank, cap & lines (leakage, damage)		—	*I	—	*I	—	*I	—	I	
4. BRAKE										
4-1. Brake discs and pads (thickness, wear, damage)		I	—	I	—	I	—	I	—	
4-2. Brake hoses and pipes (leakage, damage, clamp)		I	—	I	—	I	—	I	—	
4-3. Brake fluid		—	I	—	I	—	I	—	R	
4-4. Brake lever and cable (damage, stroke, operation)		I	—	I	—	I	—	I	—	
4-5. Brake pedal		—	I	—	I	—	I	—	I	
5. CHASSIS AND BODY										
5-1. Clutch (For manual transmission) pedal free travel		I	I	I	I	I	I	I	I	
5-2. Tires/wheel discs (wear, damage, rotation)		I	I	I	I	I	I	I	I	
5-3. Drive axle boots (breakage, damage)		I	I	I	I	I	I	I	I	
5-4. Suspension system (Tightness, damage, rattle, breakage)		I	I	I	I	I	I	I	I	
5-5. Steering system (tightness, damage, breakage, rattle)		I	I	I	I	I	I	I	I	
5-6. Manual transmission oil (leakage, level)		I	R	I	R	I	R	I	R	
5-7. Automatic transmission	Fluid level	I	I	I	I	I	I	I	I	
	Fluid change	Replace every 100,000 miles (160,000 km)								
	Fluid hose	—	—	—	—	—	R	—	—	
5-8. Door hinges & Gear shift control lever/shaft (operation)		I	I	I	I	I	I	I	I	

NOTES:

"R" : Replace or change

"I" : Inspect and correct or replace if necessary

* This is a recommended maintenance item.

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

Follow this schedule if your car is mainly operated under one or more of the following conditions:

- When most trips are less than 4 miles (6 kilometers).
- When most trips are less than 10 miles (16 kilometers) and outside temperatures remain below freezing.

- Idling and/or low-speed operation in stop-and-go traffic.
 - Operating in dusty areas.
- Schedule should also be followed if the car is used for delivery service, police, taxi or other commercial applications.

Interval: This interval should be judged by odometer reading or months, whichever comes first.		This table includes services as scheduled up to 60,000 miles (100,000 km) mileage. Beyond 60,000 miles (100,000 km), carry out the same services at the same intervals respectively.																									
		Miles (x 1,000)	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60					
		Km (x 1,000)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
		Months	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60					
1. ENGINE																											
1-1. Water pump belt (tension, damage)		—	—	—	—	—	—	—	—	—	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	I
1-2. Engine oil filter		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1-3. Engine oil		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1-4. Cooling system hoses and connections (leakage, damage)		—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	—	—	—	—	—	I
1-5. Engine coolant		—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R
1-6. Exhaust system (leakage, damage, tightness)		—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	—	—	—	—	—	I
1-7. Wiring harness and connections		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	I
2. IGNITION SYSTEM																											
2-1. Spark plugs		—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R
2-2. Ignition wiring		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R
3. FUEL SYSTEM																											
3-1. Air cleaner filter element		I	I	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	R
3-2. Fuel tank, cap & lines (leakage, damage)		—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	—	—	—	—	—	I
4. BRAKE																											
4-1. Brake discs and pads (thickness, wear, damage)		—	I	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	—	—	I
4-2. Brake hoses and pipes (leakage, damage, clamp)		—	I	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	—	—	I
4-3. Brake fluid		—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	R
4-4. Brake lever and cable (damage, stroke, operation)		—	I	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	I
4-5. Brake pedal		—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	I	—	—	—	—	—	I
5. CHASSIS AND BODY																											
5-1. Clutch (For manual transmission) pedal free travel		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
5-2. Tires/Wheel discs (wear, damage, rotation)		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
5-2. Wheel bearings (loose, wear, noise, damage)		—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	—	—	I	—	I
5-3. Drive axle boots (breakage, damage)		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
5-4. Suspension system (tightness, damage, rattle, breakage)		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
5-5. Steering system (tightness, damage, breakage, rattle)		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
5-6. Manual transmission oil (leakage, level)		—	I	—	R	—	I	—	R	—	I	—	R	—	I	—	R	—	I	—	R	—	I	—	R	—	R
5-7. Automatic transmission	Fluid level	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I
	Fluid change	—	—	—	R	—	—	—	R	—	—	—	R	—	—	—	R	—	—	—	R	—	—	—	R	—	R
	Fluid hose	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—	—	—
5-8. Door hinges & Gear shift control lever/shaft		—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I	—	I

NOTES:

"R" : Replace or change "I" : Inspect and correct or replace if necessary

MAINTENANCE SERVICE

ENGINE

1-1

Water Pump Belt Inspection

WARNING:

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

- 1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. Replace, if necessary.
- 2) Check pump belt for tension and adjust it as necessary. Refer to SECTION 6B for its procedure.

1-2 & 1-3

Engine Oil and Filter Change

It is recommended to use engine oil of API grade SF or SF/CC class.

Always change oil and oil filter as soon as possible after driving in a dust storm.

See your Owner's Manual for further details.

NOTE:

For temperature below 32°F (0°C), it is highly recommended to use SAE 5W-30 oil.

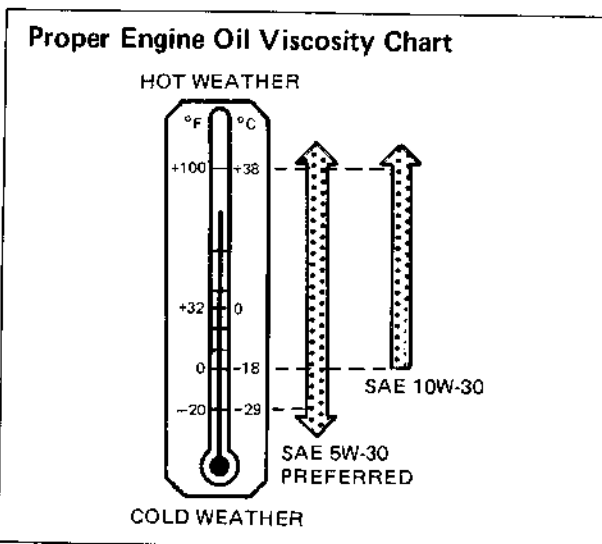


Fig. 0B-1-1

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 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 in figure below.

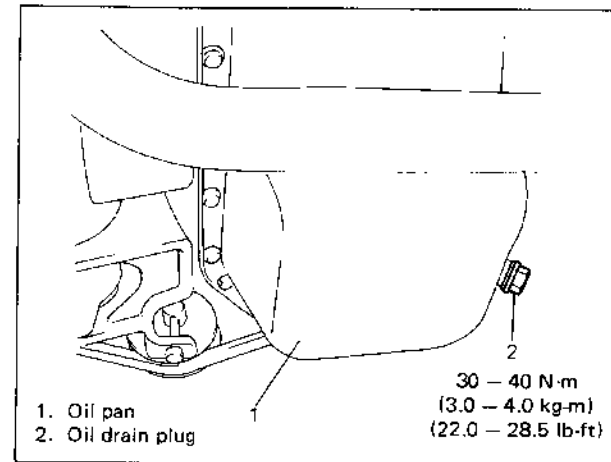


Fig. 0B-1-2

- 3) Loosen oil filter by using oil filter wrench (Special tool).

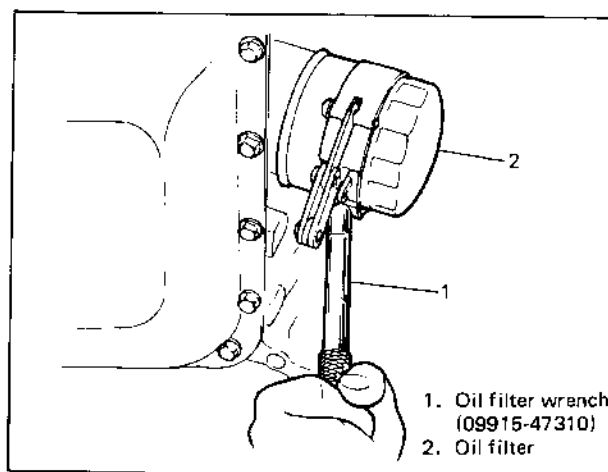


Fig. 0B-1-3

NOTE:

Before fitting new oil filter, be sure to apply engine oil to its "O" ring.

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

CAUTION:

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

- 5) Using oil filter wrench, tighten filter 3/4 turn from contact point described above.

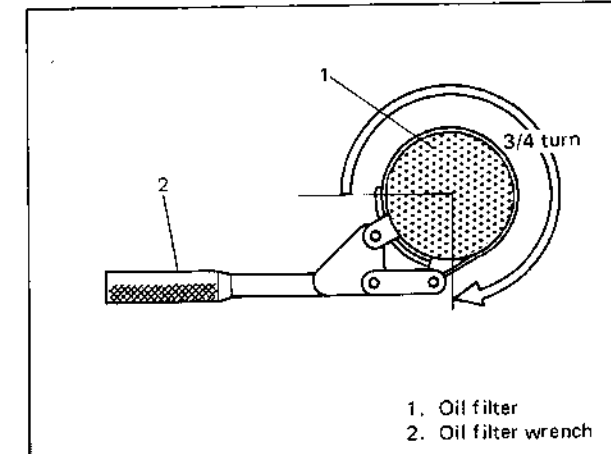


Fig. 0B-1-4

- 6) Replenish oil until oil level is brought to FULL level mark on dipstick. (about 3.3 liters or 6.9/5.8 US/Imp pt.). Filler inlet is at the top of cylinder head cover.
- 7) Start engine and run it for three minutes. Stop it and wait another 3 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dip stick.

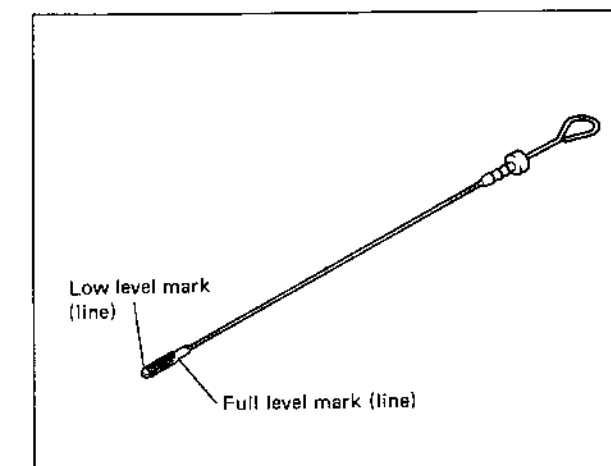


Fig. 0B-1-5

Engine oil capacity

Oil pan capacity	about 3.1 liters (6.5/5.5 US/Imp pt.)
Oil filter capacity	about 0.2 liters (0.4/0.3 US/Imp pt.)
Others	about 0.3 liters (0.6/0.5 US/Imp pt.)
Total	about 3.6 liters (7.5/6.3 US/Imp pt.)

NOTE:

Engine oil capacity is specified as above.

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

- 8) Check oil filter and drain plug for oil leakage.

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.

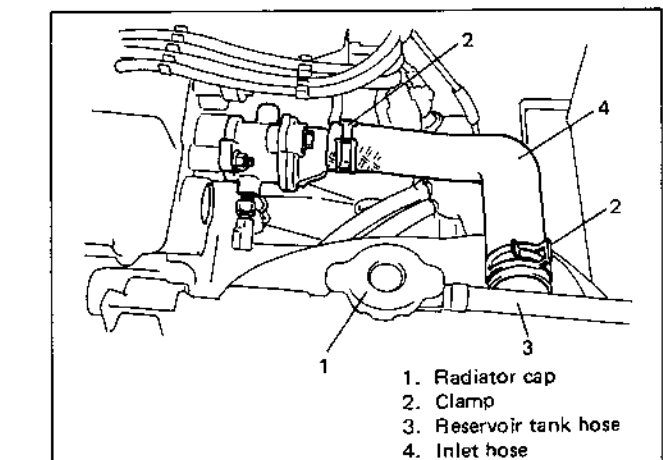


Fig. 0B-1-6

- 2) Replace all hoses which show evidence of leakage, cracks or other damage. Replace all clamps which cannot maintain proper tightness.

- 3) Clean frontal area of radiator core.
- 4) Test system and radiator cap for proper pressure holding capacity, 0.9 kg/cm² (12.8 psi). If replacement cap is needed, use a cap designed for cooling system of this car.
- 5) Check coolant level and concentration. Add if necessary.
Refer to COOLANT LEVEL of SECTION 6B for procedure of level check.

1-5 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.

- 1) Remove radiator cap when engine is cool.
- 2) Loosen radiator drain plug to drain coolant.
- 3) Remove reservoir tank, and drain.
- 4) Tighten plug securely. Also reinstall reservoir tank.

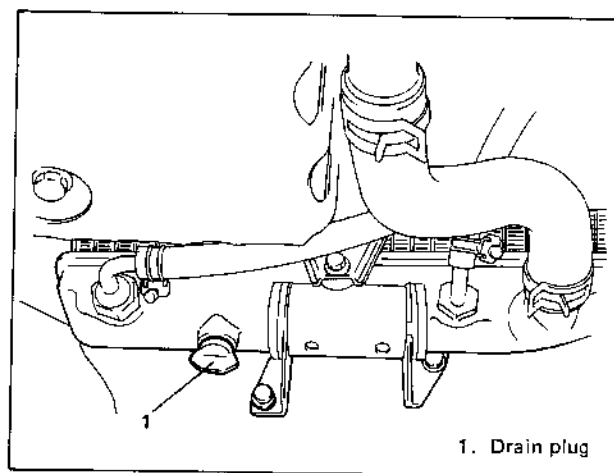


Fig. OB-1-7

- 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 filler throat of radiator. Reinstall radiator cap.

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

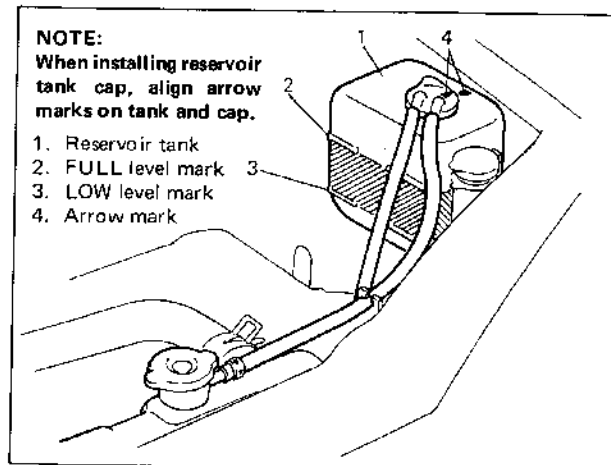


Fig. OB-1-8

CAUTION:

When changing engine coolant, use mixture of 50% water and 50% ethylene-glycol base coolant (Anti-freeze/Anti-corrosion coolant) for the market where ambient temperature falls lower than -16°C (3°F) in winter and mixture of 70% water and 30% ethylene-glycol base 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% ethylene-glycol base coolant should be used for the purpose of corrosion protection and lubrication.

Refer to SECTION 6B of this manual for COOLANT CAPACITY.

1-6

Exhaust system 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 car is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage and deterioration.
- Check muffler pipe for leakage, loose connections, dents, and damages.
If bolts or nuts are loose, tighten them to specification. Refer to SECTION 6K (p. 6K-2) for torque specification of bolts and nuts.
- 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 car.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to floor carpet.
- Any defects should be fixed at once.

1-7

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

IGNITION SYSTEM

2-1

Spark Plugs Replacement

Replace spark plugs as follows:

- 1) Dust off cylinder head around spark plugs.
- 2) Disconnect high tension cords at spark plugs.
To avoid inside damage of cords, DO NOT pull on cords for disconnection. Pull on boots.

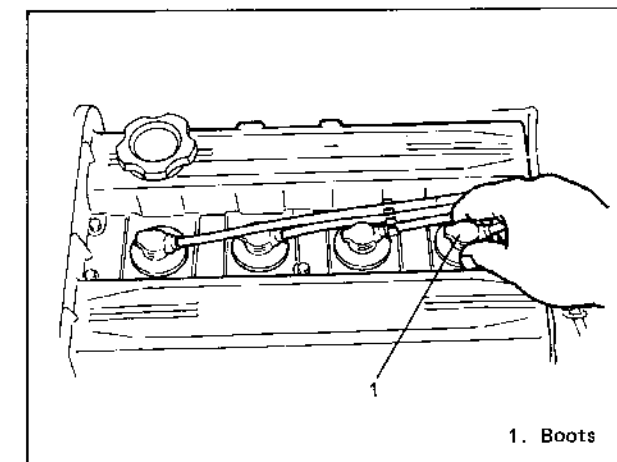


Fig. OB-2-1

- 3) Using a spark plug wrench, remove spark plugs.
- 4) Check plug gaps of new spark plugs, and adjust them to specification as necessary.

Spark Plug Specifications

Plug type	NGK BPR6ES DENSO W20EPR-U
Plug gap	0.7 – 0.8 mm (0.027 – 0.031 in)
Tightening torque	25 – 30 N·m (2.5 – 3.0 kg·m) (18.0 – 21.5 lb·ft)

- 5) Install new spark plugs. Tighten plugs to specification.
- 6) Connect high tension cords to spark plugs. DO NOT push cords for connection. Push boots.

2-2

Ignition Wiring (high-tension cord) Replacement

- 1) Disconnect high tension cords from spark plugs, ignition coil and distributor.
- 2) Connect new high tension cords and clamp them securely. DO NOT push cords for connection. Push boots.
Refer to SECTION 6F for high-tension cords distribution.

FUEL SYSTEM

3-1

Air Cleaner Element Replacement

NOTE:

Replace more often under dusty conditions. Ask your dealer for proper replacement interval for your driving conditions.

Replace air cleaner element with new one according to procedure described in SECTION 6A.

Air Cleaner Element Inspection

- 1) Visually check that air cleaner element is not excessively dirty, damaged or oily.
- 2) Clean element with compressed air from inside of element.

NOTE:

If car is used in dusty area, clean every 5,000 km (3,000 miles) or more frequently.

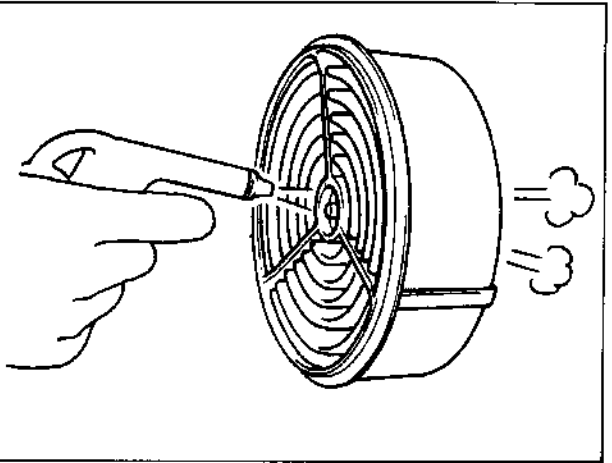


Fig. OB-3-1

3-2

Fuel Tank, Cap Gasket and Fuel Lines Inspection

- Check fuel tank, fuel filler cap and fuel lines for loose connection, deterioration or damage which could cause leakage.
Make sure all clamps are secure.
- Check fuel filler cap gasket for an even filler neck imprint or any damage.
- Replace any damaged or deteriorated parts.
There should be no sign of fuel leakage or moisture at any fuel connection.

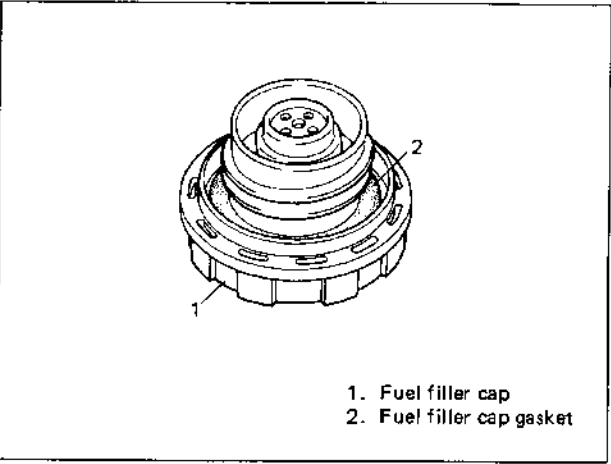


Fig. OB-3-2

BRAKE

4-1

Brake Discs and Pads Inspection

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

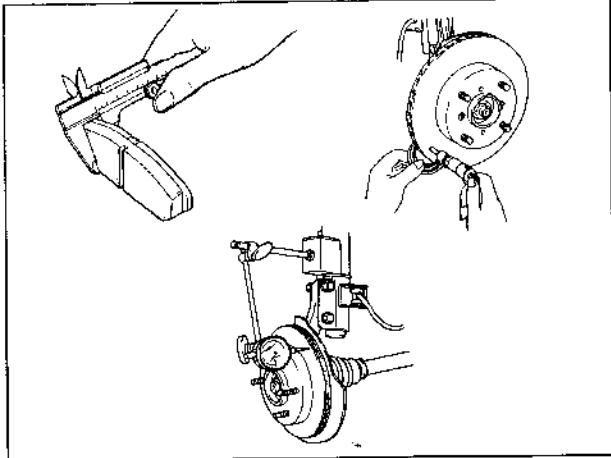


Fig. OB-4-1 Front Brake

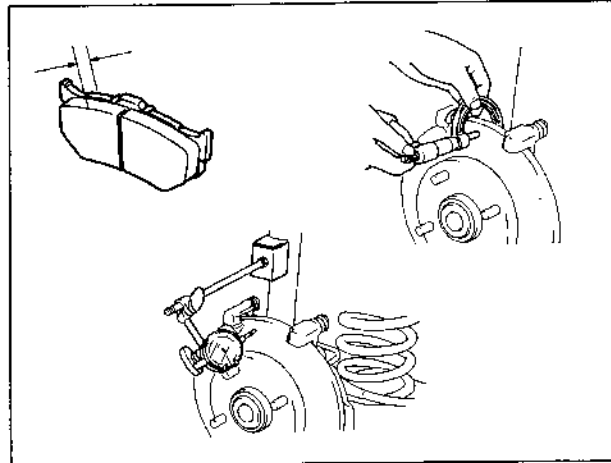


Fig. OB-4-2 Rear Brake

NOTE:

If noise is heard from front brake when brake pedal is depressed, check brake pad lining for wear. If it is worn, both right and left brake pads should be replaced with new ones.

CAUTION:

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

4-2

Brake Hoses and Pipes Inspection

Perform this inspection where there is enough light and use a mirror as necessary.

- Check brake hoses and pipes for proper hook-up, leaks, cracks, chafing, wear, corrosion bends, twists and other damage.
Replace any of these parts as necessary.
- Check all clamps for tightness and connections for leakage.
- Check that hoses and pipes are clear of sharp edges, moving parts.

4-3

Brake 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.

Brake fluid	Specification
	DOT 3

For the details, refer to ON-CAR SERVICE of SECTION 5.

CAUTION:

Since brake system of this car is factory-filled with glycol-base brake fluid, do not use or mix different type of fluid when re-filling; otherwise serious damage will occur. Do not use old or used brake fluid, or 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.

**4-4
Brake Lever and Cable Inspection**

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

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

**4-5
Brake Pedal Inspection**
Check brake pedal travel.
For checking procedure, refer to PEDAL TRAVEL CHECK of SECTION 5.

CHASSIS AND BODY

**5-1
Clutch Pedal Free Travel Inspection**
Check clutch pedal free travel. Refer to SECTION 7C for procedure to check and adjust it.

- 5-2
Tire and Wheel Disc Inspection**
- [Tire inspection]
- Check tire for uneven or excessive wear, or damage. If defective, replace.
 - Check inflating pressure of each tire and adjust pressure to specification as necessary.

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 car.

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

[Tire rotation]
Rotate tires.
For details of above steps, refer to SECTION 3F.

- 5-2'
Wheel Bearing Inspection**
- 1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to FRONT SUSPENSION INSPECTION of SECTION 3D.
 - 2) Check rear wheel bearing for wear, damage abnormal noise or rattle. For details, refer to WHEEL BEARING INSPECTION of SECTION 3E.

**5-3
Drive Axle Boot Inspection**
Check drive axle boots (wheel side and differential side) for leakage, detachment, tear or any other damage.
Replace boot as necessary.

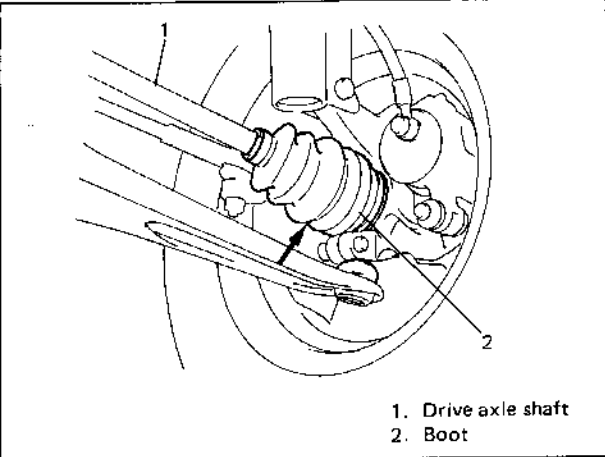


Fig. 0B-5-1

**5-4
Suspension System Inspection**

- Inspect front & rear struts for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration.
Replace defective parts, if any.

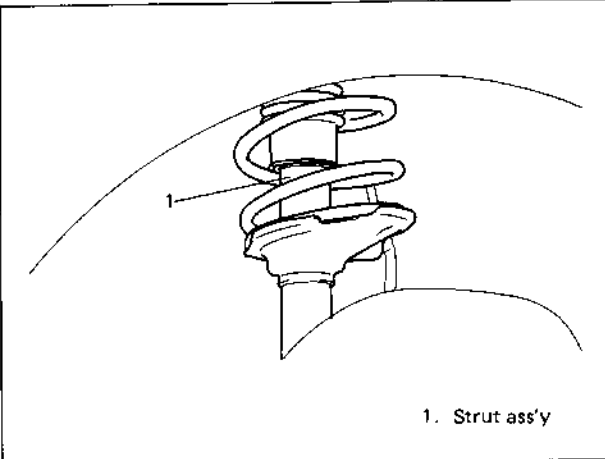


Fig. 0B-5-2

- Check front and rear suspension systems for damaged, loose or missing parts; also for parts showing signs of wear or lack of lubrication.
Repair or replace defective parts, if any.
- Check front suspension arm ball joint stud dust seals for leakage, detachment, tear, or any other damage.
Replace defective boot, if any.

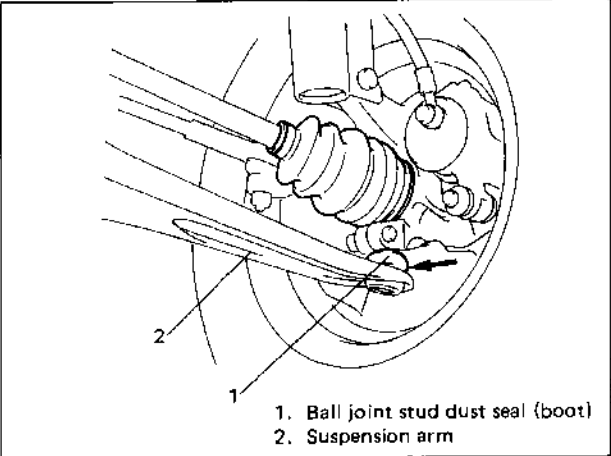


Fig. 0B-5-3

**5-5
Steering System Inspection**

1) Check steering wheel for play and rattle, holding car straight on ground.

Steering wheel play "A"	0 – 30 mm (0 – 1.2 in.)

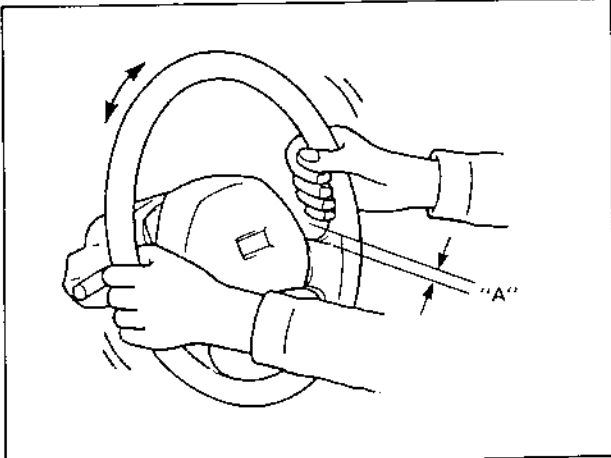


Fig. 0B-5-4

- 2) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
- 3) Check boots of steering linkage and steering gear case for damage (leaks, detachment, tear, etc.). If damage is found, replace defective boot with new one.
- 4) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.

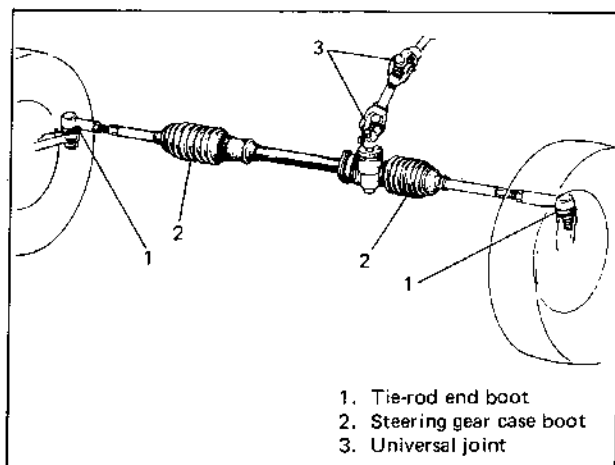


Fig. 0B-5-5

5-6

Manual Transmission Oil Inspection and Change

[Inspection]

- 1) Inspect transmission case for evidence of oil leakage.
Repair leaky point if any.
- 2) Make sure that car is placed level for oil level check.
- 3) Remove level plug of transmission.
- 4) Check oil level.

Oil level can be checked roughly by means of filler/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 oil up to level hole.

For specified oil, refer to description of oil change (p. 7A-7) under ON-CAR SERVICE in SECTION 7A.

[Change]

- 1) Place the car level and drain oil by removing drain plug.

- 2) Apply sealant to drain plug and tighten drain plug to specified torque.
- 3) Pour specified oil up to level hole.
- 4) Tighten filler plug to specified torque.
For recommended oil, its amount and tightening torque data, refer to ON-CAR SERVICE (p. 7A-7) of SECTION 7A.

5-7

Automatic Transmission

[Fluid level inspection]

- 1) Inspect transmission case for evidence of fluid leakage.
Repair leaky point, if any.
- 2) Make sure that car is placed level for fluid level check.
- 3) Check fluid level.
For fluid level checking procedure, refer to ON-CAR SERVICE in SECTION 7B and be sure to perform it under specified conditions. If fluid level is low, replenish specified fluid.

[Fluid change]

- 1) Perform steps 1) and 2) of above Fluid Level inspection.
- 2) Change fluid. For its procedure, refer to ON-CAR SERVICE in SECTION 7B.

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-CAR SERVICE in SECTION 7B.

5-8

Door Hinges, Gear Shift Control Lever and Shaft Inspection

Check that doors and gear shift control lever move smoothly without abnormal noise. If defective, lubricate as follows.

Wipe off dirt of door hinges and apply a thin coat of engine oil. Open and close door several times to insure that oil has worked in effectively. Lubricate lever seat and shaft bushings with water resistant chassis grease.

FINAL INSPECTION

BODY PARTS OPERATION

Hood Latch

Check that hood opens and closes smoothly and properly. Also check that it locks securely when closed.

Doors

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

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.

ROAD TEST

Carry out road test in safe place.

WARNING:

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

Engine Start

Check engine start for readiness.

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.

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 car, also check that shift indicator indicates properly according to which position selector lever is shifted to.

CAUTION:

With automatic transmission equipped car, make sure that car is at complete stop when shifting selector lever to "P" range position.

Brake

[Foot brake]

Check the following when depressing brake pedal while driving;

- that brake works properly,
- that it is free from noise,
- and that braking force is applied equally on all wheels.

[Parking brake]

Check to ensure that parking brake is fully effective when the car is stopped on the slope and brake lever is pulled all the way.

Steering

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

Engine

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

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.

Meters and Gauge

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

Lights

Check that all lights operate properly.

Seat Belt

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

Check that seat belt is securely locked.

WARNING:

For this test, select a safe place without any running car so as to prevent any accident. And again make sure that no man or no other car is seen in front or behind and use great care to the surroundings when carrying out the test.

OWNER INSPECTIONS AND SERVICES

Listed below are items which should be checked and serviced by either the owner himself or a qualified technician daily or periodically to help ensure safety and dependability of each car. Should any problem occur, contact nearby dealer or a qualified technician for proper service advice. For the safety of the driver himself and others, be sure to inspect any safety-related parts that could have been damaged in any accident and take corrective measures for whatever in need of repair before using car again.

BEFORE OPERATING YOUR CAR

[OUTSIDE CAR]

Fluid Leak Check

Check for fuel, coolant, oil, or other fluid leakage by looking at surface beneath car after it has been parked for a while. Water dripping from air conditioning system after use is normal. If gasoline fume of fluid is noted at any time, investigate its cause and correct it at once.

Door Operation

Check that all doors including back door operate smoothly, and that all doors close and all latches lock securely.

Tire, Wheel and Wheel Nut Inspection

- Check pressure as shown on tire placard (including spare tire). Pressure should be checked when tires are "cold".
- Check tire for cuts, damage or excessive wear.
- Check wheel nuts for looseness or for missing nuts. If necessary, tighten them.

[INSIDE CAR]

Seat Adjuster Operation

- Move seat back and forth and check that seat adjuster operates smoothly and locks properly and securely.
- Check that seat back can be reclined smoothly and locked securely at any angle.

Warning Light, Buzzer and Tone Operation

Check all warning lights, buzzers and interior indicator lights for operation. For details, refer to Owner's Manual.

Glass, Mirror, Light and/or Reflector Condition

Check each glass, mirror, light and reflector for breakage, scratch, dirt or any other damage which could reduce driver's view or visibility or cause injury. Replace, clean or repair promptly, if necessary.

Rear View Mirror and Sun Visor Operation

Check that friction joints hold mirrors and sun visors in place.

Seat Belts Condition and Operation

Check belt system including webbing, buckles, latch plates, retractors, guide loops, and anchors for proper operation, damage and/or wear.

Light Operation

Check license plate lights, headlights, small lights, taillights, brake lights, turn signals, back-up lights, instrument panel lights and interior lights, hazard warning flashers and other lights. Have headlight aim checked at once if beams seem improperly aimed.

Clutch Pedal Free Travel Check

- Check free travel and adjust as necessary.
- Check pedal for smooth operation.

Accelerator Pedal Operation

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

Exhaust System Check

Check for leakage, cracks or loose supports.

Brake Pedal Check

- Check pedal for smooth operation.
- Check pedal travel (pedal-to-wall clearance). For checking procedure, refer to PEDAL TRAVEL CHECK of SECTION 5.
- Check brake booster function.

Parking Brake Lever Travel Check

Check that lever has proper travel.

Automatic Transmission Shift Indicator and Park Mechanism Operation

- Move selector lever and check that indicator points to exact gear as chosen.
- Check the lock release button of the selector lever for proper and smooth operation.

[UNDER HOOD]

Engine Hood Latch Operation

Check that hood closes firmly. Check for damaged, loose, or missing parts that might prevent tight latching. Make sure secondary latch keeps hood from opening all the way when primary latch is released.

Engine Oil Level Check

Check engine oil on the dipstick with the engine turned off and add if necessary. See your Owner's Manual.

NOTE:

A large loss in this system may indicate a problem. Have it inspected and repaired at once.

Engine Coolant Level and Condition

When engine is cool, check coolant level in reservoir tank and add if necessary.

Inspect coolant and replace if dirty or rusty.

A normal coolant level should be between "FULL" and "LOW" marks on reservoir tank.

See Owner's Manual.

NOTE:

A large loss in this system may indicate a problem. Have it inspected and repaired at once.

Windshield Washer Fluid Level Check

Check washer fluid level in tank and add if necessary.

Brake Master Cylinder Fluid Level Check

Check reservoir tank fluid level in accordance with Owner's Manual and keep at proper level.

NOTE:

A large loss in this system may indicate a problem. Have it inspected and repaired at once.

Battery Electrolyte Level Check

Check that the electrolyte level of all battery cells is between the upper and lower level lines on the case.

Engine Drive Belt(s) Inspection

Inspect all belts for cracks, fraying and wear. Adjust or replace as needed.

WHILE OPERATING YOUR CAR

Horn Operation

Check to make sure that horn works when its button is pushed at its any part.

Windshield Wiper and Washer Operation

Check wipers and washer for proper operation. Also check spray direction of washer fluid. Check wiper blades for wear or cracks whenever they fail to wipe clean. If necessary, replace.

Windshield Defroster

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

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

Steering System Operation

Be alert for any changes in steering action. An inspection or service is needed when: the steering wheel is harder to turn or has too much free play, or if there are strange sounds when turning.

Brake System Operation

Be alert to abnormal noise, increase in brake pedal travel or repeated pull to one side when braking.

When any of such conditions is noted, check brake system. If brake warning light stays on or keeps flashing, there may be some trouble in brake system.

Also, test parking brake by pulling parking brake lever.

Exhaust System Operation

Be alert for any changes in the sound of the exhaust system or any smell of fumes. These are signs the system may be leaking or overheating. Have it check and/or repaired at once.

Tire and Wheel Operation

Be alert to vibration of the steering wheel or seat at normal highway speeds. This may mean a wheel balance is needed. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or wheel alignment.

IT IS RECOMMENDED TO CHECK FOLLOWING ITEMS AT LEAST ONCE A YEAR

Starter Safety Switch Operation**WARNING:**

Before performing the following safety switch check, be sure to have enough room around the car. Then, firmly apply both the parking brake (see your Owner's Manual for procedure) 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 car could move without warning and possibly cause personal injury or property damage.

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

On manual transmission cars, 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.

Parking Brake and Transmission "Park" Mechanism Operation**WARNING:**

With car 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 car should start to move.

To check holding ability of parking brake, start engine shift gear to neutral position and release regular brake gradually till car is held by parking brake only.

To check automatic transmission "Park" mechanism holding ability, shift selector lever to "Park" position and release all brakes.

Under Body Flushing

At least once a year in spring, flush underbody with water to remove corrosive deposits such as road salt and dirt. Use special care to clean any area where mud and dust can collect easily. Take out dust packed in closed place before flushing.

Engine Cooling System

Check coolant and its anti-freeze property. If it is contaminated or rusty, drain, flush with water and refill new coolant. Maintain coolant at such mixture ratio as specified in Owner's Manual, thereby freezing and corrosion is avoided and engine operating temperature is properly controlled.

Check hoses and replace if cracked, swollen hardened or otherwise deteriorated. Tighten hose clamps. Clean outside of radiator and air conditioning condensor. Wash radiator filler cap and neck.

For coolant change interval, refer to Maintenance Schedule Table.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SF or SF/CC, SAE 5W-30 (Refer to Fig. 0B-1-1)
Engine coolant (long life coolant)	Ethylene-glycol base coolant ("Antifreeze/Anticorrosion coolant" GOLDEN CRUISER 1200)
Brake fluid	DOT3
Manual transmission oil	See oil chart on page 7A-7
Automatic transmission fluid	Automatic transmission fluid DEXRON-II
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

Fig. 0B-6

SECTION 1A

HEATER AND VENTILATION

CONTENTS

GENERAL DESCRIPTION..... 1A-1

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 Heater..... 1A-2

 Heater Control Operation..... 1A-3

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 Heater Blower Motor..... 1A-4

 Heater Blower Motor Resistor..... 1A-5

 Heater Blower Motor Switch..... 1A-6

 Heater Control Cables..... 1A-7

 Heater Unit..... 1A-8

GENERAL DESCRIPTION

BODY VENTILATION

The body ventilation system of this car is equipped with air conditioning that consists of a fresh air intake located at the cowl top panel. Ventilating air is drawn into the interior from the intake grille and drawn out from the ventilator outlet provided at each side of the body outer panel.

HEATER

The heater and ventilation of this car consist of such main components as control levers, blower motor, heater core and air ducts. The blower motor runs on electricity to send air inside. In the heater core, the cooling water warmed by the engine keeps circulating. Each control lever controls the blower motor speed, temperature and operation of the dampers in the air ducts so that the air is delivered where necessary.

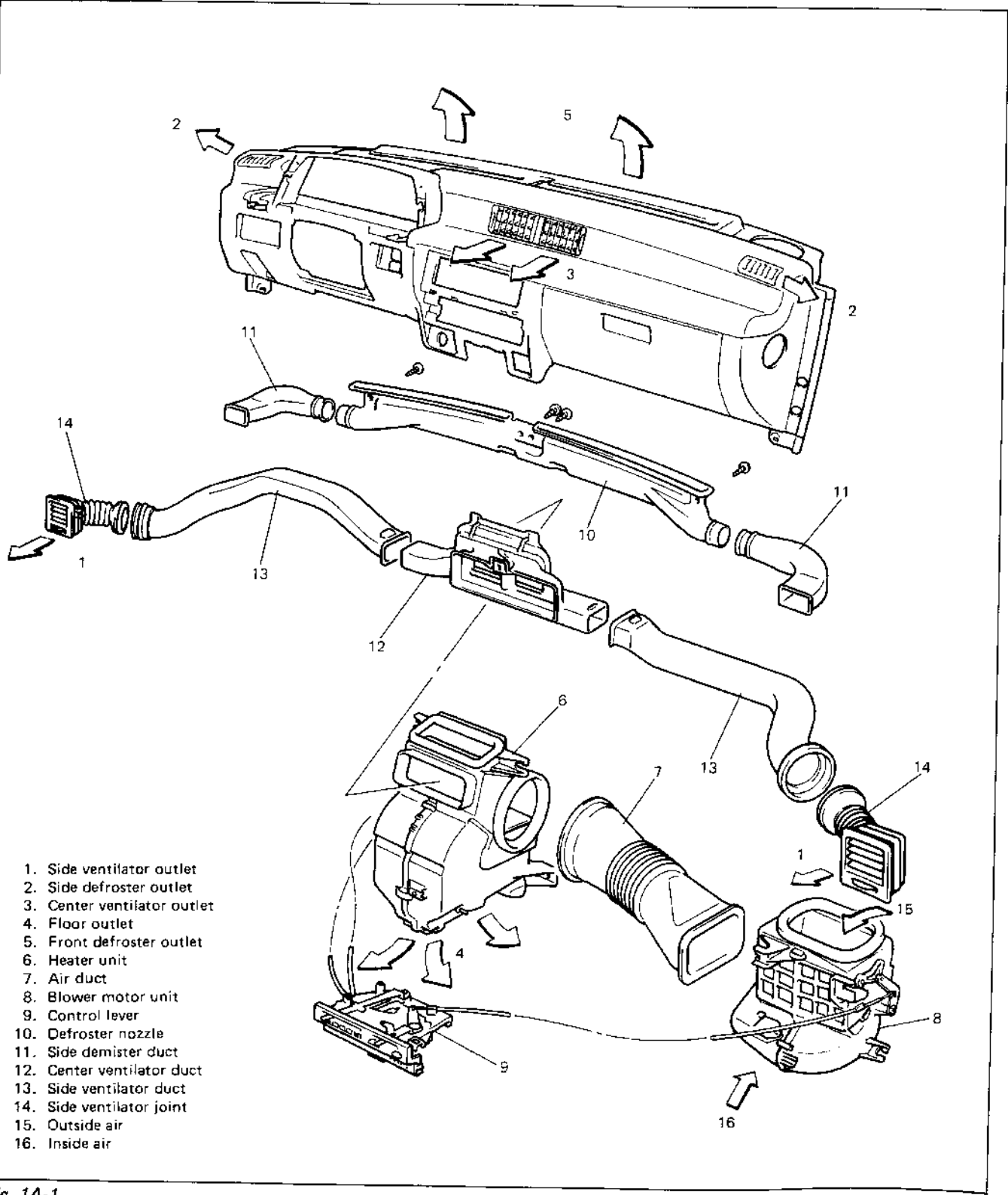


Fig. 1A-1

HEATER CONTROL OPERATION

The heater and ventilation provide temperature control, ventilation and defrosting functions. Their operation is controlled by selecting the positions of the control levers on the instrument panel. Each lever position and function of heater and ventilation are as given below.

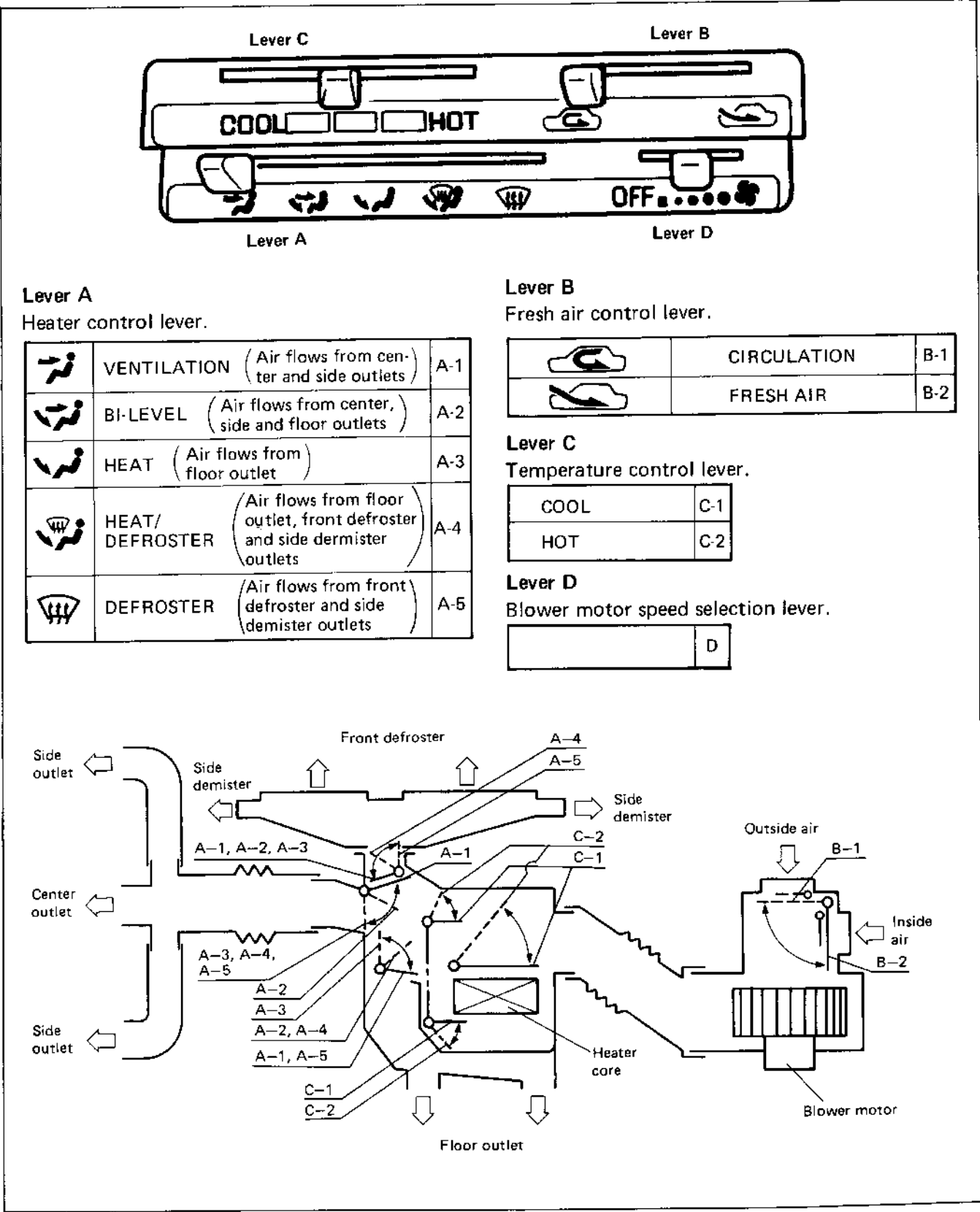


Fig. 1A-2

DIAGNOSIS

Trouble	Possible cause	Remedy
Heater blower won't work even when its switch is ON.	Blower fuse blown	Replace fuse to check for short.
	Blower register faulty	Check continuity.
	Blower motor faulty	Replace motor.
	Wiring or grounding faulty	Repair as necessary.
Incorrect temperature output	Control cables broken or binding	Check cables.
	Air damper broken	Repeir damper.
	Air ducts clogged	Repair air ducts.
	Heater radiator leaking or clogged	Replace radiator.
	Heater hoses leaking or clogged	Replace hoses.

ON-CAR SERVICE

HEATER BLOWER MOTOR

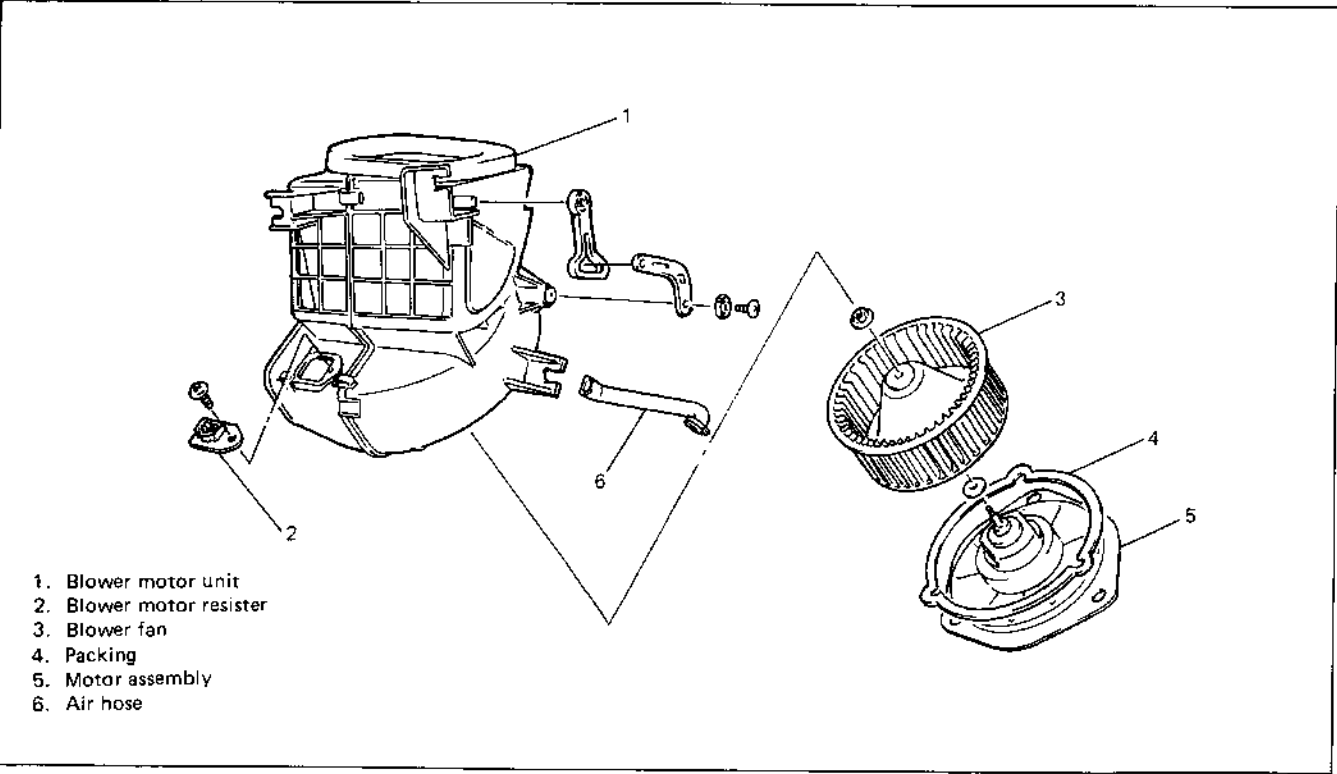


Fig. 1A-3

REMOVAL

- 1) Disconnect battery (—) leadwire.
- 2) Disconnect blower motor and resister leadwires at couplers.
- 3) Disconnect fresh air control cable from motor unit.
- 4) Remove blower motor unit after removing glove box upper panel and bolts as shown below.

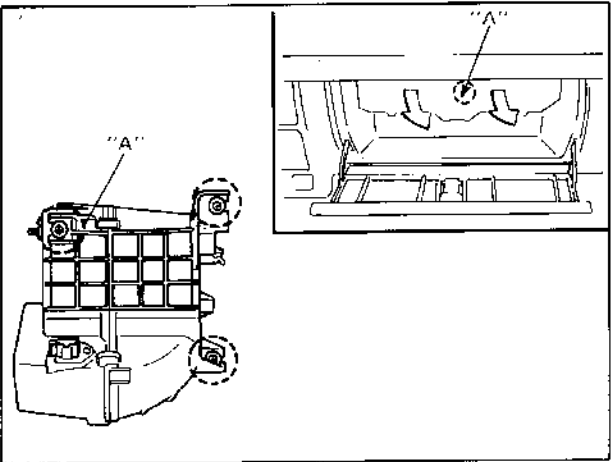


Fig. 1A-4

- 5) Remove blower motor.

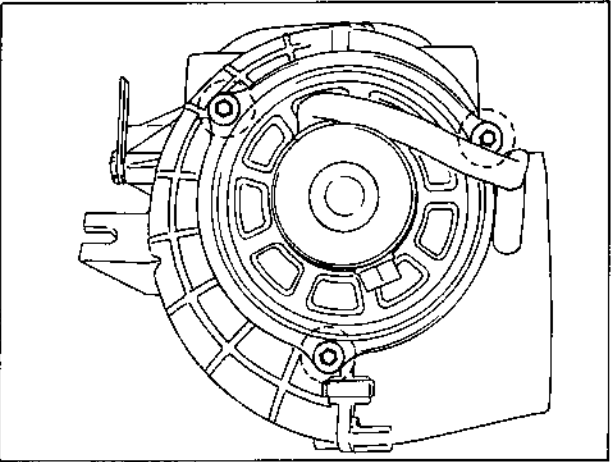


Fig. 1A-5

INSTALLATION

Reverse removal procedure for installation.

HEATER BLOWER MOTOR RESISTOR

REMOVAL

- 1) Remove blower motor unit as previously outlined.
- 2) Remove heater blower motor resistor.

INSPECTION

Check blower motor register for each terminal-to-terminal continuity. If there is no continuity, replace blower motor resistor.

INSTALLATION

Reverse removal procedure for installation.

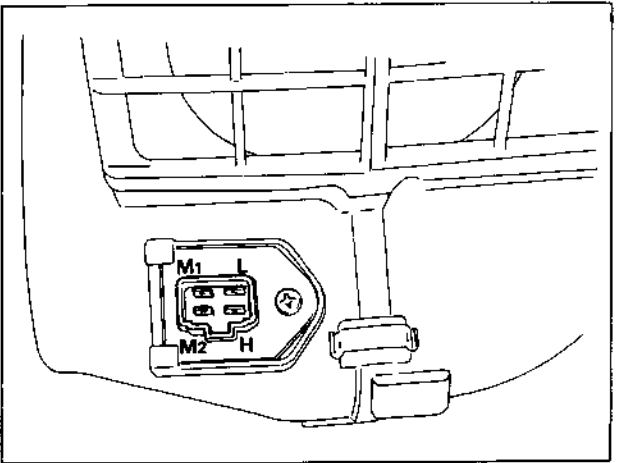


Fig. 1A-6

HEATER BLOWER MOTOR SWITCH

REMOVAL

- 1) Remove console box.
- 2) Remove ashtray and ashtray upper plate.
- 3) Remove cigarette lighter.
- 4) Remove control lever knobs and control panel garnish.
- 5) Remove control panel.
- 6) Disconnect leadwire from blower motor switch at coupler.
- 7) Disconnect control cables from blower motor unit and heater unit.
- 8) Remove control lever ass'y.
- 9) Remove blower motor switch.

INSPECTION

Heater blower motor switch is connected between battery and blower motor, through fuse and resistor as shown below.

Check switch for each terminal-to-terminal continuity. If there is no continuity, replace blower motor switch.

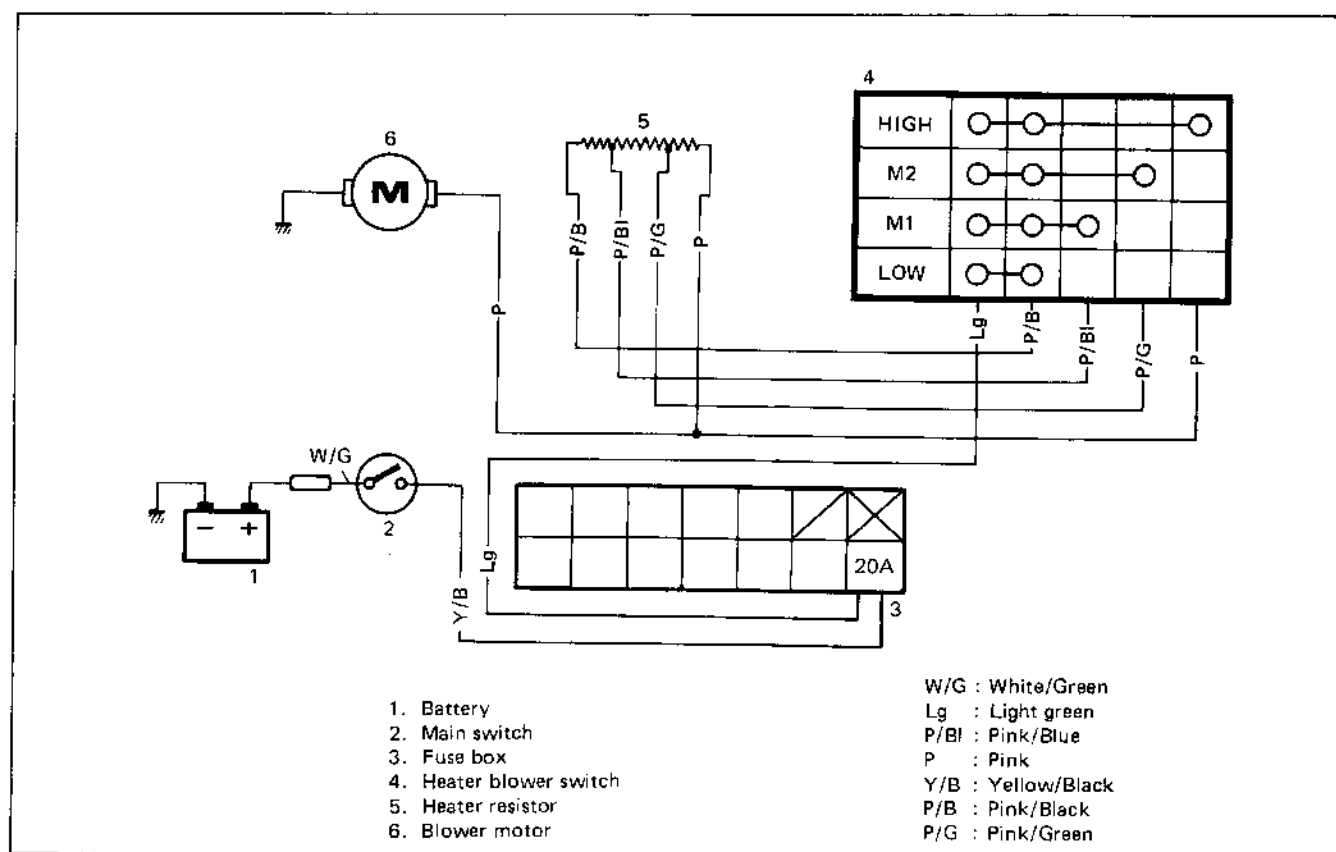


Fig. 1A-7

INSTALLATION

Install in the reverse order of removal.

HEATER CONTROL CABLES

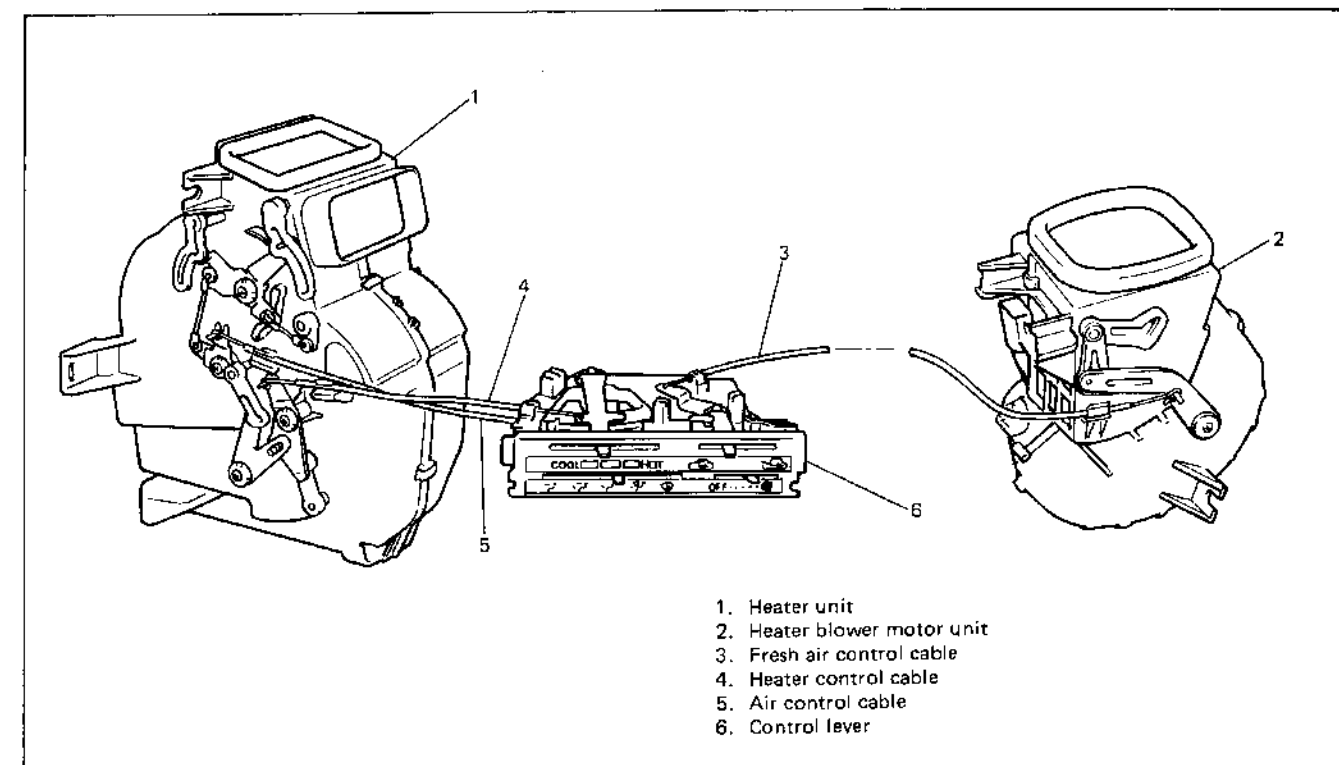


Fig. 1A-8

REMOVAL

- 1) Remove console box.
- 2) Remove ashtray and ashtray upper plate.
- 3) Remove cigarette lighter.
- 4) Remove control lever knobs and control panel garnish.
- 5) Remove control panel.
- 6) Disconnect leadwire from blower motor switch at coupler.
- 7) Disconnect control cables from blower motor unit and heater unit.
- 8) Remove control lever ass'y.
- 9) Disconnect control cables from control lever.

INSTALLATION

Install control cables by reversing removal procedure, noting the following point.

After installing control cables to control levers, move control levers to such position as to pull cables fully, then connect and clamp control cables to heater unit and blower motor unit levers as shown.

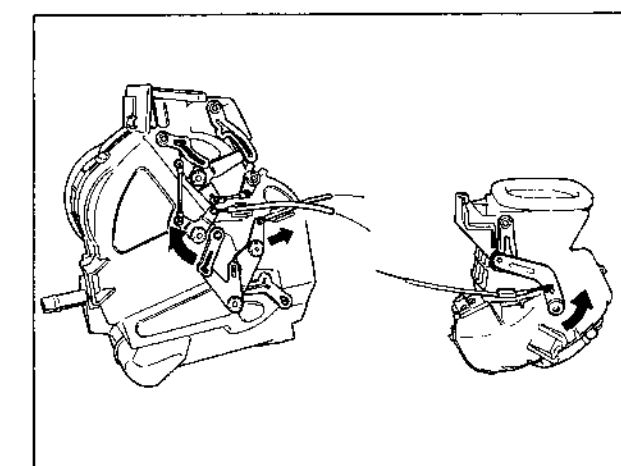


Fig. 1A-9

NOTE:

After installing control cables, be sure that control knobs move smoothly and stop at proper position.

HEATER UNIT

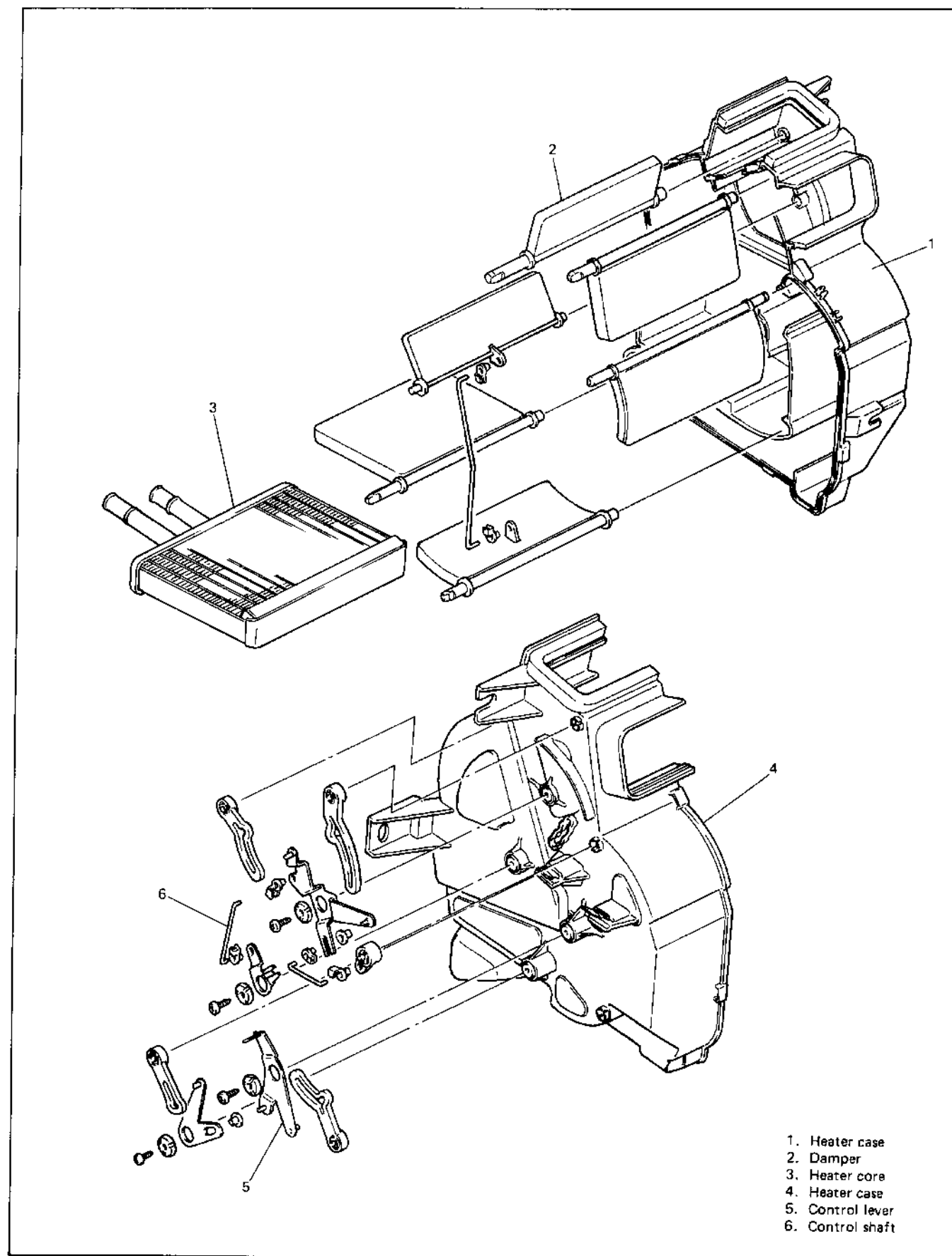


Fig. 1A-10

REMOVAL

- 1) Disconnect battery (—) leadwire, drain coolant and disconnect 2 water hoses from heater unit.
- 2) Remove console box.
- 3) Disconnect wires and cables from heater and blower unit.
- 4) Remove steering wheel, steering column unit and steering joint upper bolt. (Refer to p. 3C-5)
- 5) Disconnect speedometer cable and remove speedometer ass'y.
- 6) Remove speaker garnish (R, L) and center cover.
- 7) Remove instrument panel member mounting bolts.
- 8) Remove instrument panel together with instrument panel member.

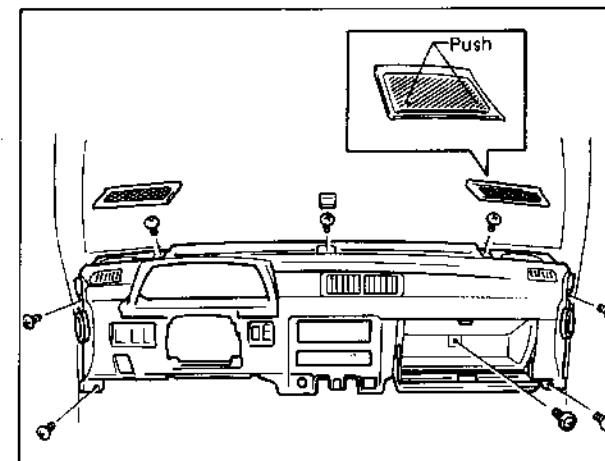


Fig. 1A-11

- 9) Remove heater unit.

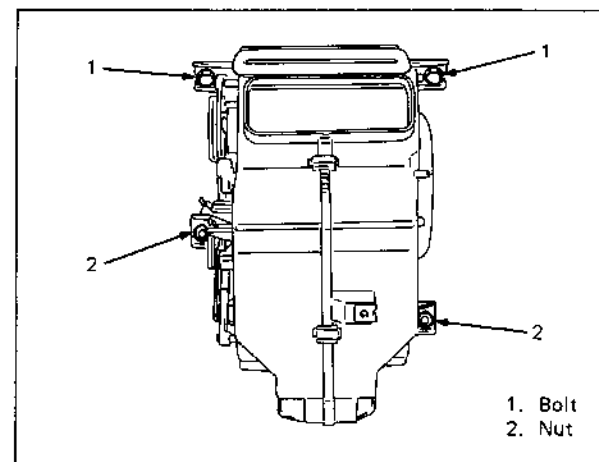


Fig. 1A-12

- 10) Remove heater unit clips and screws to separate heater unit.

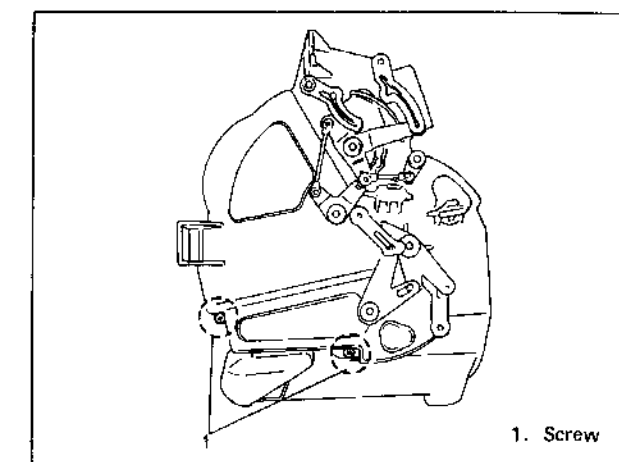


Fig. 1A-13

- 11) Pull out heater core from unit.

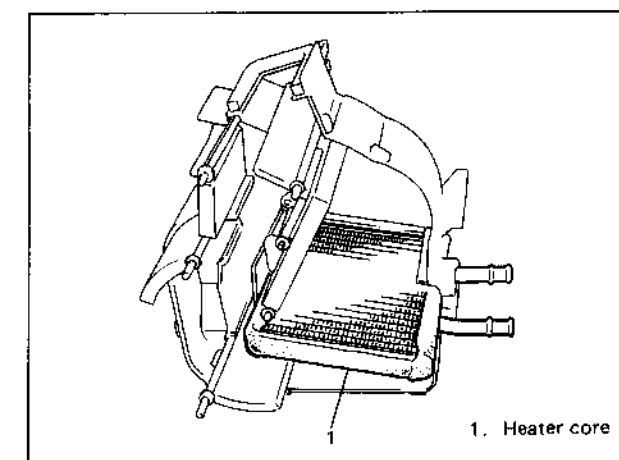


Fig. 1A-14

INSTALLATION

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

- 1) Adjust control cables. (Refer to p. 1A-7)
- 2) Fill coolant to radiator.

NOTE:

- When installing each part, be careful not to catch any cable or wiring harness.
- When installing steering shaft to steering shaft joint, set front wheels (right and left) in the straight ahead state and check to make sure that steering wheel is also in that state.
- When fastening steering column ass'y to car body, start with lower nuts on column and then upper nuts. Be sure to tighten them to specified torque. (Refer to p. 3C-6 for details.)

SECTION 1B

AIR CONDITIONER (OPTIONAL)

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AIR CONDITIONER (OPTIONAL)

The present car can be optionally provided with an air conditioner. This Section covers the description, charging of refrigerant, etc. of the air conditioner.

GENERAL DESCRIPTION

MAJOR COMPONENTS AND REFRIGERANT FLOW OF AIR CONDITIONING SYSTEM

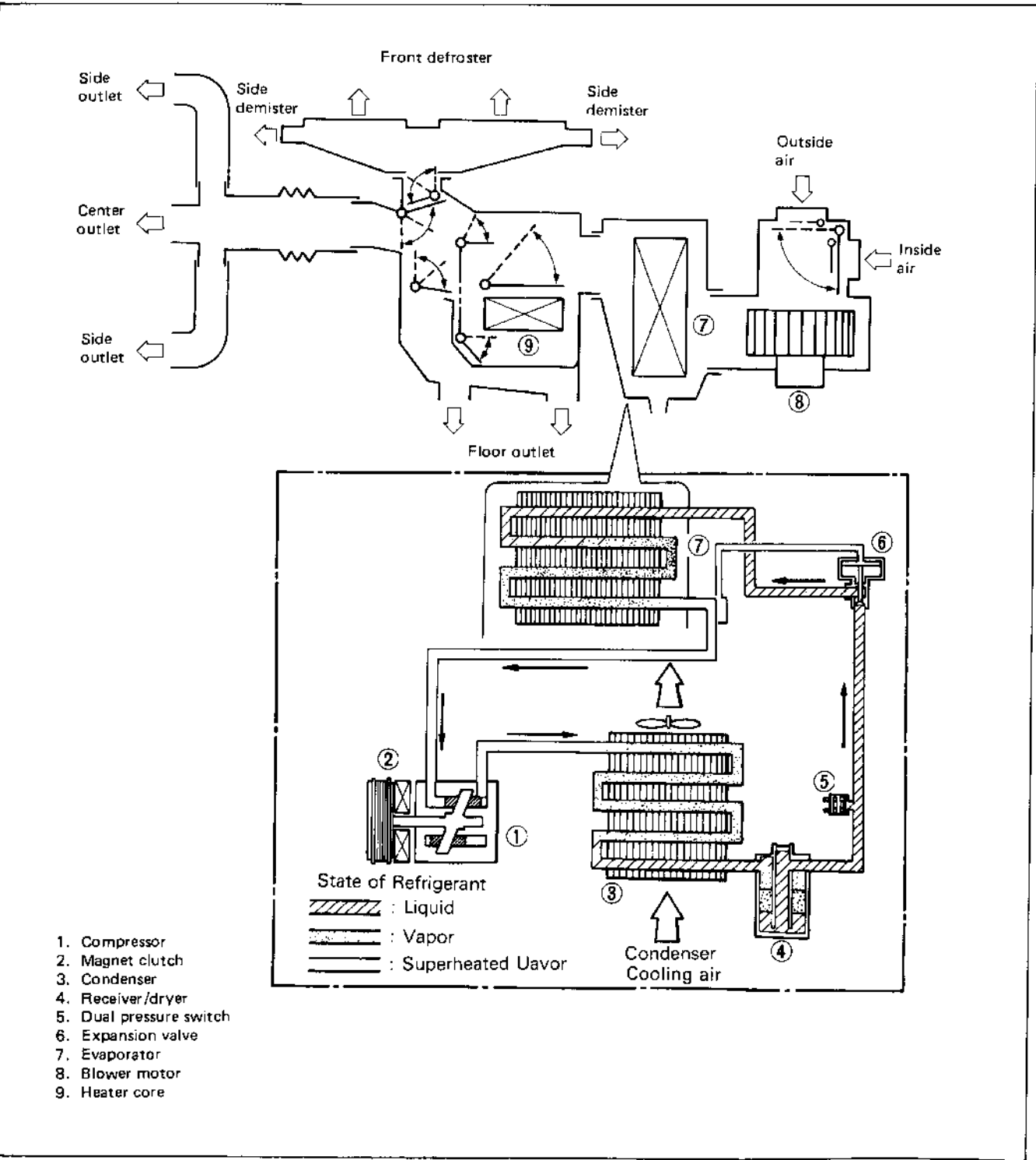


Fig. 1B-1

FUNCTION OF EACH COMPONENT

COMPRESSOR

Compresses the gas vaporized in the evaporator. Thus compressed gas is sent to the condenser where it is changed into liquid refrigerant whose heat of vaporization can be reused. Compressors used for the air conditioning of car include reciprocating-, swash plate-, and wobble plate-types. This model employs the swash plate-type less in vibration and excellent in durability.

MAGNETIC CLUTCH

A device used, with the engine running, for operating the compressor only when the air conditioning is needed and stopping it otherwise. Employs a powerful electromagnet.

CONDENSER

Serves to change the compressor-compressed, high temperature/high pressure-obtained refrigerant into liquid refrigerant by forcibly taking heat therefrom. Constructionally the same as the radiator. Installed at the frontmost of the car for increased heat radiation, and cooled compulsorily by the cooling fan.

RECEIVER/DRYER

The receiver/dryer has the three roles as described below:

- A) The receiver section serves as a temporary storage container of condenser-liquefied refrigerant so that it is possible to supply the evaporator with the condenser-liquefied refrigerant just conforming to the demand of the cooling load.
- B) The dryer section serves to remove the dirt and water mixed in the cycling refrigerant by means of the filter and desiccant sealed therein.
- C) The sight glass, installed atop the receiver, serves to look at thereby the flowing state of the refrigerant.

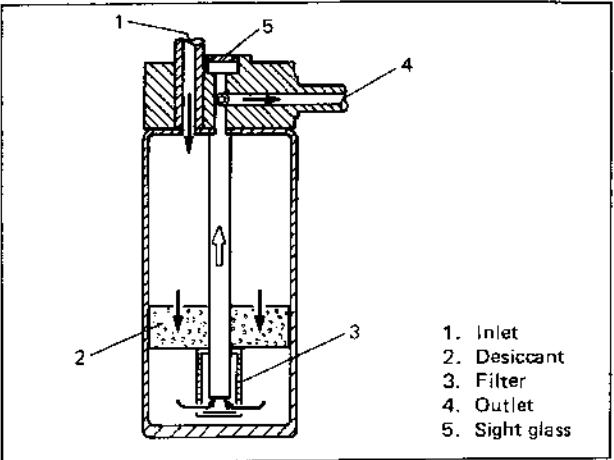


Fig. 1B-2

DUAL PRESSURE SWITCH

A control switch to stop further rotation of the compressor by turning OFF the electric circuits of the magnetic clutch and condenser cooling fan when the cycling refrigerant is abnormally dropped or risen in pressure.

EXPANSION VALVE

A device to eject the receiver/dryer-passed liquid refrigerant from fine holes for sudden expansion to produce atomized refrigerant of low temperature and low pressure.

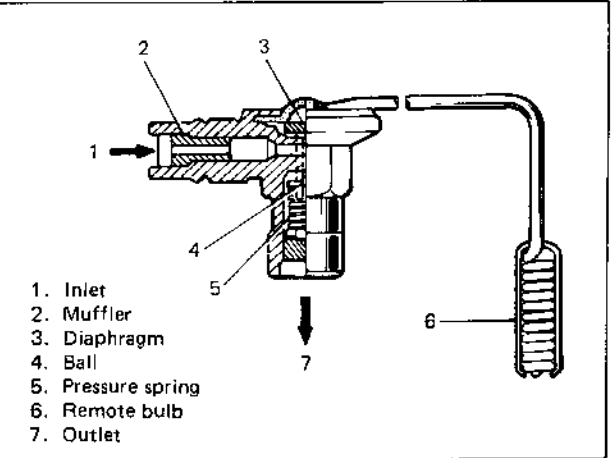


Fig. 1B-3

EVAPORATOR

Passes therethrough the cold atomized refrigerant to lower the ambient temperature. The refrigerant, now changed into hot gas, is sent to the compressor. Functionally, the evaporator acts just inversely to the condenser. (The refrigerant takes a state of liquid when entering the evaporator and a state of gas when leaving therefrom).

WIRING DIAGRAM

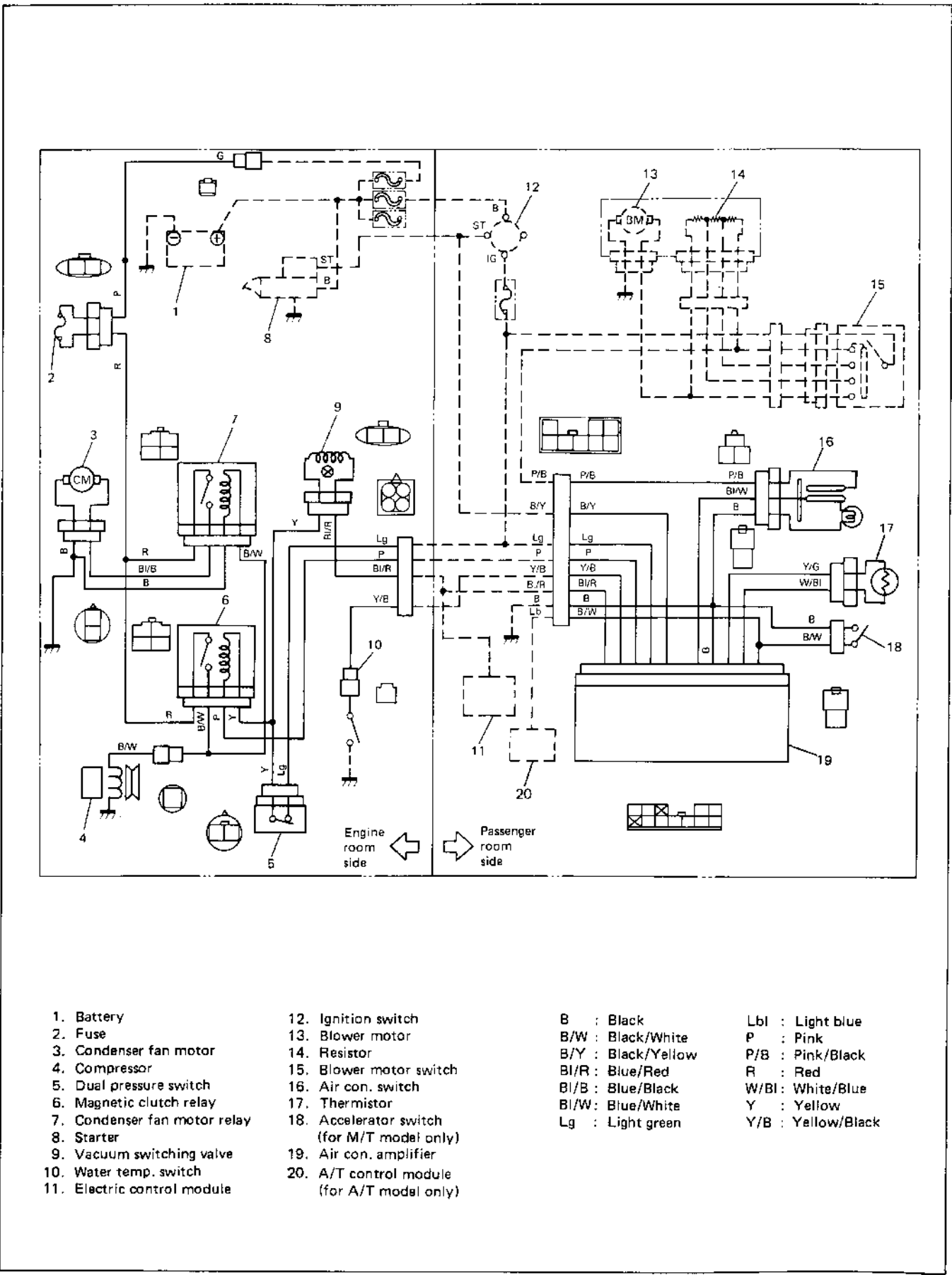


Fig. 1B-4

FUNCTION OF EACH CONTROL COMPONENT

RELAY (condenser fan/magnetic clutch)

A relay to operate the condenser fan motor and magnetic clutch. The motor continues operation as long as the air conditioner (compressor) is under operation.

MAGNETIC CLUTCH

A device used, with the engine running, for operating the air conditioner only when needed, and controlled by the A/C amplifier.

EVAPORATOR THERMISTER

When the evaporative temperature of a refrigerant drops to 1°C (34°F) or below, the evaporator fins get stuck with frost or ice, reducing the airflow, lowering the cooling capacity. The thermister is a sensor which is used to prevent this frosting or icing.

The thermister installed to evaporator converts the evaporative temperature into a resistance value and send it to A/C amplifier.

WATER TEMP SWITCH

A switch to stop compressor operation when the coolant temperature exceeds 108°C (226°F).

DUAL PRESSURE SWITCH

A control switch to stop the compressor operation when the cycling refrigerant is dropped in pressure due to its leakage, lack of refrigerant or has reached too high a level.

The switch is installed in the high pressure line behind the receiver dryer.

VSV (VACUUM SWITCHING VALVE)

At a zone of close-to-idling, low revolution speeds as used while driving through congested urban districts, parking or doing the like, or at the idle speed, the engine output is so small that any attempt to operate the compressor under the above condition applies unreasonable load to the engine, causing its overheating or stalling. VSV is a device to open or shut the air passage to intake manifold.

The VSV opens and closes according to the signal from A/C amplifier. When it opens, the air is supplied to the intake manifold passing through the VSV in addition to air passing through the idle port and the ISC solenoid valve, and the engine speed rises a little higher than the specified idle speed.

AIR-CON AMPLIFIER

Air-con amplifier is installed to the lower evaporator case.

It controls operation of the VSV, compressor magnetic clutch and condenser fan motor according to the signals from the sensors which detect the state of the engine and driving conditions. Main system control functions are as follows (at A/C switch ON).

- Idle speed control (idle-up).
- Magnetic clutch delay control: 0.8 second delay after V.S.V. on.
- Air-con ON – OFF control:

High refrigerant pressure:
above 27 kg/cm² (383 psi) OFF
below 21 kg/cm² (299 psi) ON

Low refrigerant pressure:
below 2.1 kg/cm² (29.9 psi) OFF
above 2.4 kg/cm² (34.1 psi) ON

Coolant water temperature:
above 108°C (226°F) OFF
below 105°C (221°F) ON

While engine cranking with
starter on OFF

Evaporative temperature:
below 1°C (34°F) OFF

While accelerating rapidly:
(when throttle opened 90% within
10 seconds) OFF

INSTALLATION

PREPARATION PRIOR TO INSTALLATION

A. INSPECTION AND ADJUSTMENT OF CAR

Before installing air conditioner, check and adjust following items.

- 1) Engine ignition timing.
- 2) Engine cooling system.
- 3) Battery electrolyte and charging system.
- 4) Passenger compartment sealing.
- 5) Fuel system.
- 6) General car conditions.

B. PREPARATION OF AIR CONDITIONER COMPONENTS

When unpacking parts kit, arrange unpacked parts in the order of installation.

At this time, you have to make sure the kit has no missing or defective parts. And, when installing air conditioner, you have to use covers for protection of fender and seat.

PRECAUTION FOR SERVICING

- 1) Battery negative terminal should be disconnected.
- 2) Engine-installed air conditioner components should be tightened by specified torque using bolts supplied in the kit.
- 3) Air conditioning lines and wire harnesses should, when installed, be routed correctly so as not to interfere with peripheral parts.
- 4) Hoses and tubes should be connected with each other respectively after applying two to three drops of refrigerant to seats of flared nuts.
- 5) Line fittings should be tightened or loosened using two wrenches so that they are supported evenly during such tightening or loosening.
- 6) Flared nuts should be tightened by specified torque.

- 7) Until it becomes possible to connect each component into position, blind plugs of attaching portions should not be removed.

NOTE:

Remove plugs from compressor carefully to allow refrigerant to escape slowly. This is necessary because compressor is shipped out from factory with a slight charge of refrigerant to prevent its seals from corroding.

- 8) When handling refrigerant-12, you should always wear safety goggles and also use care that it will not get on your skin.
- 9) Refrigerant-12 can should be kept at about 40°C (100°F) by putting it in hot water.

INSTALLATION

When installing air conditioner, refer to instruction manual which is packed with air-con parts.

EVACUATION AND CHARGING

EVACUATING SYSTEM

- 1) Whenever opened (exposed to atmospheric air), air conditioning system must be evacuated by using a vacuum pump. The A/C system should be attached with a manifold gauge set, and should be evacuated for approx. 15 minutes.
- 2) Connect high and low charging hoses of manifold gauge set respectively as follows:

High Charging Hose ➡ Compressor Delivery Hose
Low Charging Hose ➡ Compressor Suction Hose

- 3) Attach center charging hose of manifold gauge set to vacuum pump.
- 4) Operate vacuum pump, and then open suction-side valve (Lo) of manifold gauge set. If there is no blockage in the system, there will be an indication on high pressure gauge. When this occurs, open the other-side valve (Hi) of the set.

- 5) Approx. 10 minutes later, low pressure gauge should show a vacuum lower than 760 mmHg providing no leakage exists.

NOTE:

- If the system does not show a vacuum below 760 mmHg, close both valves, stop vacuum pump and watch movement of low pressure gauge.
- Increase in the gauge reading suggests existence of leakage. In this case, repair the system before continuing its evacuation.
- If the gauge shows a stable reading (suggesting no leakage), continue evacuation.

- 6) Evacuation should be carried out for a total of at least 15 minutes.
- 7) Continue evacuation until low pressure gauge indicates a vacuum less than 760 mmHg, and then close both valves.
- 8) Stop vacuum pump. Disconnect center charging hose from pump inlet. Now, the system is ready for charging refrigerant.

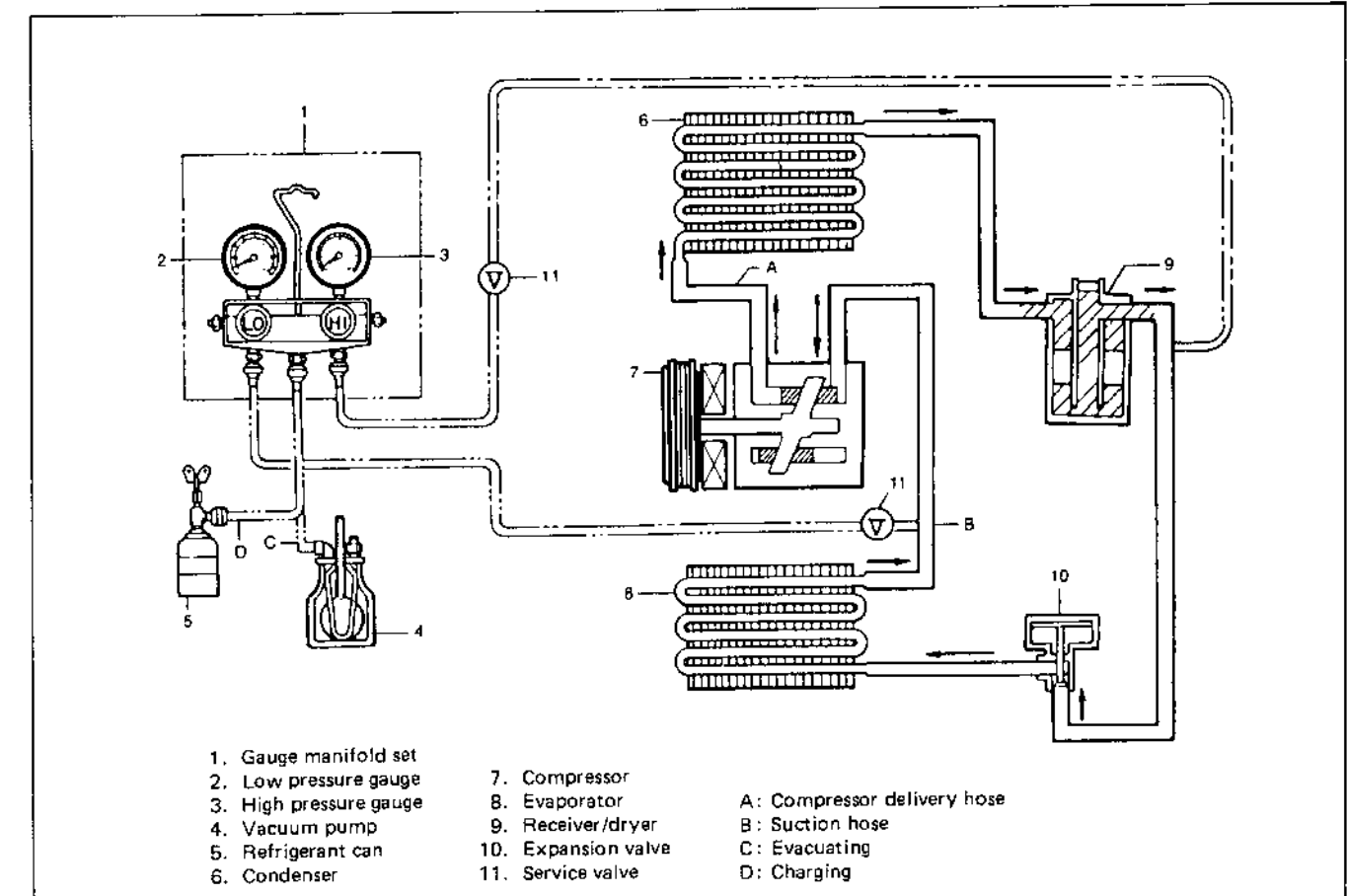


Fig. 1B-5

HANDLING CAN TAP VALVE

- 1) The can tap valve should, before put on a refrigerant can, be turned counterclockwise by its handle until its needle is fully retracted.

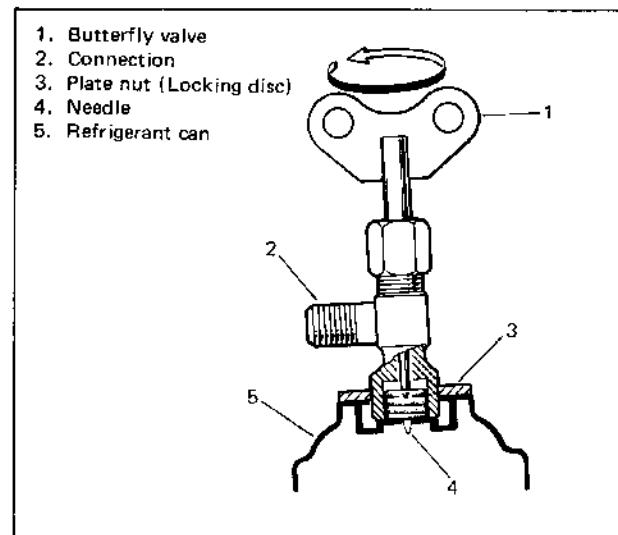


Fig. 1B-6

- 2) Turn plate nut counterclockwise until it reaches its highest position relative to can tap valve. Then screw can tap valve into refrigerant can.
- 3) Turn plate nut clockwise fully to thus install center charging hose to fitting of can tap valve.
- 4) Tighten plate nut sufficiently by hand.
- 5) Charging of refrigerant should be carried out according to following procedure.

CHARGING SYSTEM WITH REFRIGERANT

CAUTION:

- ALWAYS CHARGE THROUGH LOW-SIDE of A/C system.
- NEVER CONNECT ON HIGH-SIDE of A/C system.
- Do not charge while compressor is hot.
- When installing can tap valve to refrigerant can to make a hole therethrough, carefully follow directions given by manufacturer.
- A pressure gauge should always be used before and during charging.

- The refrigerant can should be emptied of refrigerant before discarding it.
- The refrigerant can should not be heated up to 40°C (100°F) or over.
- Refrigerant should not be reversed in direction during charging. Reversing in direction causes liquid refrigerant to enter compressor, causing troubles, such as compression of liquid refrigerant and the like.

- Your eyes should not be exposed to refrigerant (liquid).

Any liquid Refrigerant-12 escaping by accident shows a temperature as low as approx. -6°C (21°F) below freezing point. Should liquid R-12 get into your eyes, it may cause a serious injury.

To protect your eyes against such accident, it is necessary to always wear goggles. Should it occur that R-12 strikes your eye(s), consult a doctor immediately.

- DO NOT USE YOUR HAND TO RUB THE AFFECTED EYE(S). INSTEAD, use quantities of fresh cold water to splash it over the affected area to gradually raise temperature of such area above freezing point.
 - Obtain proper treatment as soon as possible from a doctor or eye specialist.
- Should the R-12 liquid come into contact with your skin, the affected area should be treated in the same manner as when skin is frostbitten or frozen.
 - Refrigerant must not be handled near where welding or steam cleaning is performed.
 - Refrigerant should be kept at a cold and dark place. It should never be stored where a high temperature is anticipated, e.g. where exposed to direct sun light, close to fire or inside car (including trunk room).
 - Avoid breathing fumes produced when R-12 is burned. Such fumes may be hazardous to health.

PROCEDURE OF CHARGING

- 1) Check to make sure that hoses are routed properly after evacuating the system (see Fig. 1B-7).
- 2) Connect the manifold gauge set in position. Thus slacken the handle of the refrigerant can tap valve to purge the charging line. Then open the low pressure-side valve.

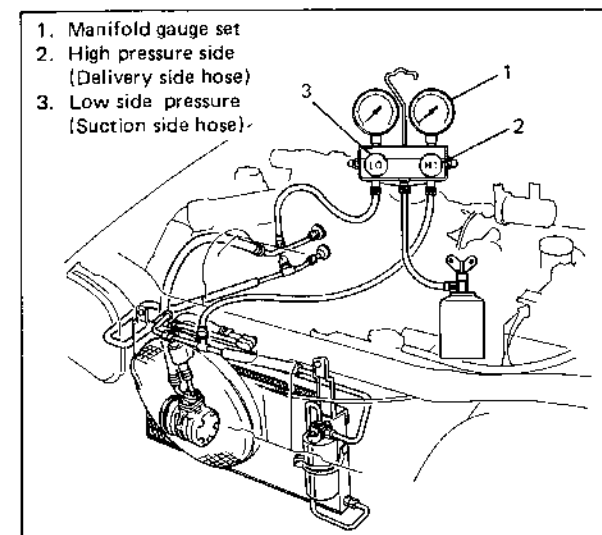


Fig. 1B-7

WARNING:

Make sure that high pressure-side valve is closed securely.

- 3) Start engine and keep engine speed at 1000 r/min. Then, operate air conditioner.
- 4) Charge A/C system with refrigerant in vapor state. At this time, refrigerant can should be held upright.
- 5) When refrigerant can is emptied, use following procedure to replace it with a new refrigerant can.
 - a. Close low pressure valve.
 - b. Retract needle and remove refrigerant can tap valve by loosening its plate nut.

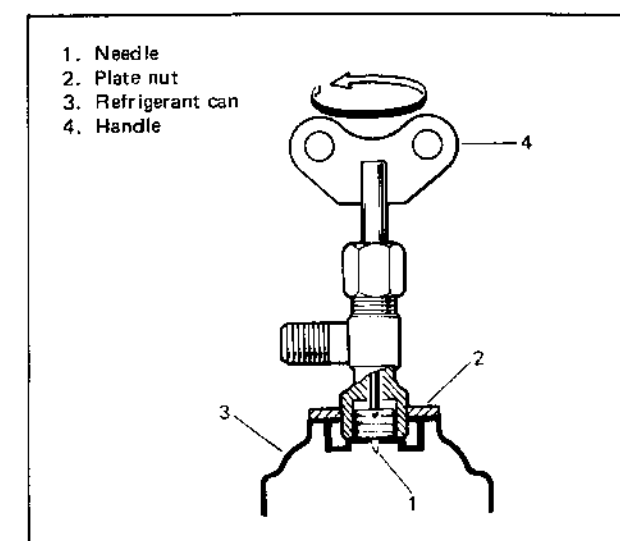


Fig. 1B-8

- c. Install previously-removed refrigerant can tap valve to a new refrigerant can.
- d. Use following procedure to purge any air existing in center charging hose.

- ① Once fully tighten refrigerant can tap valve and then loosen (open) it slightly.
- ② Open low pressure valve of manifold gauge set a little.
- ③ As soon as refrigerant comes out with a "hiss" through a clearance between refrigerant can and refrigerant can tap valve, close refrigerant can tap valve as well as manifold gauge set low pressure valve.

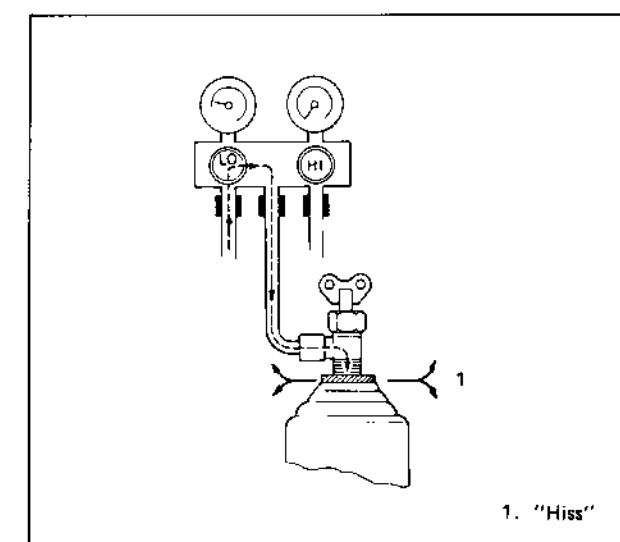


Fig. 1B-9

- ④ Turn handle of can tap valve clockwise so that its needle is screwed into the new can to make a hole for refrigerant flow.
- 6) After the system has been charged with specified amount (500 g or 17.6 oz) of refrigerant or when low and high pressure gauges have indicated about 2 and 15 kg/cm² (28 and 213 psi) respectively, close low pressure side valve of manifold gauge set. At this time, look into the sight glass of receiver/dryer and check that there are no bubbles in it, which means that the system is fully charged.

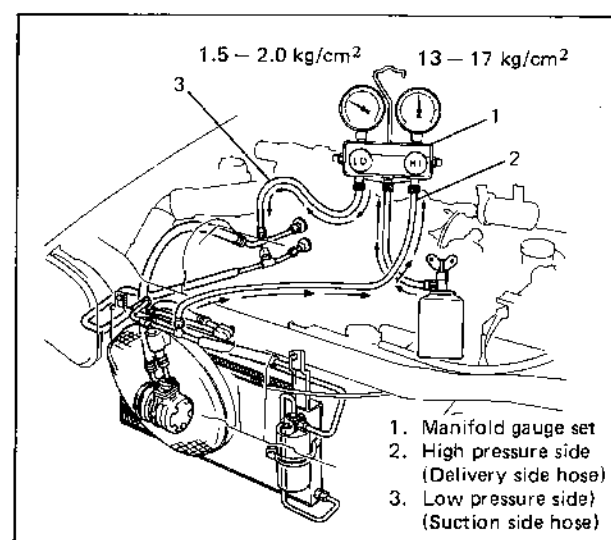


Fig. 1B-10

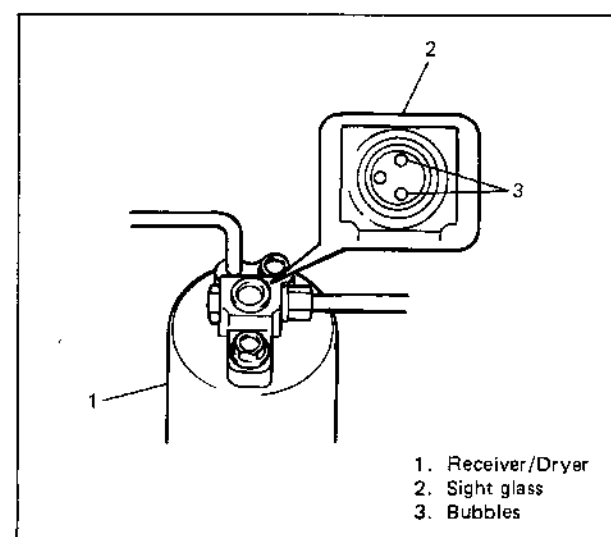


Fig. 1B-11

REMOVING MANIFOLD GAUGE SET

When A/C system has been charged with a specified amount of refrigerant, remove manifold gauge set as follows:

- 1) Close low pressure-side valve of manifold gauge set. (The high pressure-side valve is closed continuously during the process of charging.)
- 2) Fully tighten handle of refrigerant can tap valve.
- 3) Stop engine.
- 4) Using shop rag, remove charging hoses from service valves. This operation must be performed rapidly.
- 5) Put caps on service valves.

WARNING:

High pressure-side is naturally under high pressure. So, care must be used to protect your eyes and skin.

LEAK-TESTING REFRIGERANT SYSTEM

Whenever a refrigerant leak is suspected in the system or any service operation has been performed which may result in disturbing lines or connections, it is advisable to test for leaks. Common sense should be used in performing any refrigerant leak test, since the need and extent of any such test will, in general, depend upon the nature of a complaint and the type of a service performed on the system.

LIQUID LEAK DETECTORS:

There are a number of fittings and places throughout the air conditioning system where a liquid leak detector solution may be used to pinpoint refrigerant leaks.

By merely applying the solution to the area in question with a swab, such as attached to the cap of a vial, bubbles will form within seconds if there is a leak.

For confined areas, such as sections of the evaporator and condenser, an electronic (gas) leak detector is more practical for determining leaks.

SERVICING

TROUBLE DIAGNOSIS

Trouble	Possible cause	Remedy
No cooling or warm air.	Magnetic clutch does not engage properly. a) Fuse blown b) Magnetic clutch faulty c) A/C switch faulty d) Thermister faulty e) Dual pressure switch faulty f) Wiring or grounding faulty g) No refrigerant h) A/C amplifier faulty Compressor is not rotating properly. a) Drive belt loose or broken b. Compressor faulty Blower inoperative Expansion valve faulty Leak in system Receiver/dryer having blown fusible plug or clogged screw	Replace fuse and check for short. Check clutch. Check switch. Check thermister. Check switch. Repair as necessary. Check A/C circuit. Replace A/C amplifier. Tighten or replace drive belt. Check compressor. Check blower. Check expansion valve. Check system for leaks. Check receiver/dryer.
Cool air comes out only intermittently.	Magnetic clutch slipping A/C amplifier faulty Expansion valve faulty Wiring connection faulty Excessive moisture in system	Check magnetic clutch. Replace A/C amplifier. Check expansion valve. Repair as necessary. Evacuate and charge system.
Cool air comes out only at high speeds.	Condenser clogged Drive belt slipping Compressor faulty Insufficient or excessive charge of refrigerant Air in system	Check condenser. Check or replace drive belt. Check compressor. Check charge of refrigerant. Evacuate and charge system.
Insufficient cooling.	Condenser clogged Drive belt slipping Magnetic clutch faulty Compressor faulty Expansion valve faulty Thermister faulty Insufficient or excessive charge of refrigerant Air or excessive compressor oil existing in system Receiver/dryer clogged	Check condenser. Check or replace drive belt. Check magnetic clutch. Check compressor. Check expansion valve. Check thermister. Check charge of refrigerant. Evacuate and charge system. Check receiver/dryer.
Insufficient velocity of cooled air	Evaporator clogged or frosted Air leaking from cooling unit or air duct Air inlet blocked Blower motor faulty	Check evaporator. Repair as necessary. Repair as necessary. Replace blower motor.

ON-CAR SERVICE

NOTE

When servicing air conditioning system, following instructions must be observed.

WIRING:

- 1) Disconnect battery negative terminal to prevent any short circuit.
- 2) Connect wire connectors securely.
- 3) When routing a wire harness through a panel hole, previously insert a rubber bushing into the hole for its protection.
- 4) Use a vinyl tape or original clamps to connect air conditioner wire harness to main wire harness.
- 5) If original harness has been disconnected or removed while servicing, return it to a proper position.
- 6) During their installation, be careful not to pinch original and air conditioner wire harnesses.
- 7) When adding lead wires to wire harness by soldering, use those lead wires which share the same diameter and tape each connection.
- 8) Keep wire harness away from any components moving or subjected to high temperature.
- 9) Keep connecting portions away from fuel lines.
- 10) Make sure that wire harness makes no contact to a sharp edge or corner.

REFRIGERANT LINES:

- 1) Never use heat for bending pipes.
When bending a pipe, try to make a bend as slight as possible.
- 2) Keep internal parts of air conditioner free from moisture and dust.
When disconnecting any line from system, install a blind plug or cap to fitting of such line immediately.
- 3) When connecting hoses and pipes to each other respectively, previously apply a few drops of refrigerating oil to seats of coupling nuts and O-ring.

- 4) When tightening or loosening a fitting, use two wrenches, one for turn and the other for support.
- 5) Receiver/dryer inlet fitting must be connected to the pipe from condenser outlet fitting.
- 6) Tighten flared nuts according to following table of Tightening Torque.

Coupling Nut Used for	Tightening Torque
1/4 inch pipe	10 to 15 N·m (1.0 to 1.5 kg-m) (7.7 to 11.0 lb-ft)
3/8 inch pipe	20 to 30 N·m (2.0 to 3.0 kg-m) (14.5 to 21.5 lb-ft)
1/2 inch pipe	30 to 40 N·m (3.0 to 4.0 kg-m) (21.5 to 29.0 lb-ft)
5/8 inch pipe	40 to 50 N·m (4.0 to 5.0 kg-m) (29.0 to 36.0 lb-ft)

- 7) Route drain hose so that drained water does not make any contact to car components.

HANDLING REFRIGERANT-12:

- 1) When handling refrigerant, always wear goggles to protect your eyes.
- 2) Avoid your direct contact to liquid refrigerant.
- 3) Do not heat refrigerant can higher than 40°C (100°F).
- 4) Do not discharge refrigerant into the enclosed area having open flame.
- 5) Do not allow liquid refrigerant to touch bright metals. Refrigerant combined with moisture is corrosive and will tarnish surfaces of bright metals including chrome.
- 6) When purging refrigerating system, discharge refrigerant very slowly. Otherwise, refrigerating oil will be discharged together with refrigerant.

- 7) When discharging refrigerant from system, cover the end of charging hose with a rag or place such end in a container.

WARNING:

Should Refrigerant-12 strike your eye(s), consult a doctor immediately.

- DO NOT USE YOUR HAND TO RUB AFFECTED EYE(S). Instead, use quantities of fresh cold water to splash it over affected area to thus gradually raise its temperature above the freezing point.
- Obtain proper treatment as soon as possible from a doctor or eye specialist. Should liquid R-12 get on your skin, such affected part should be treated in the same manner as when skin is frost-bitten or frozen.

INSPECTION AND REPAIRING REFRIGERATING SYSTEM

A. CHARGE OF REFRIGERANT

The following procedure can be used for quickly checking whether the A/C system has a proper charge of refrigerant or not.

Run engine at fast idle, and operate air conditioner at its max. cooling capacity for a few minutes. Then, look at the sight glass on receiver/dryer to check charge of refrigerant.

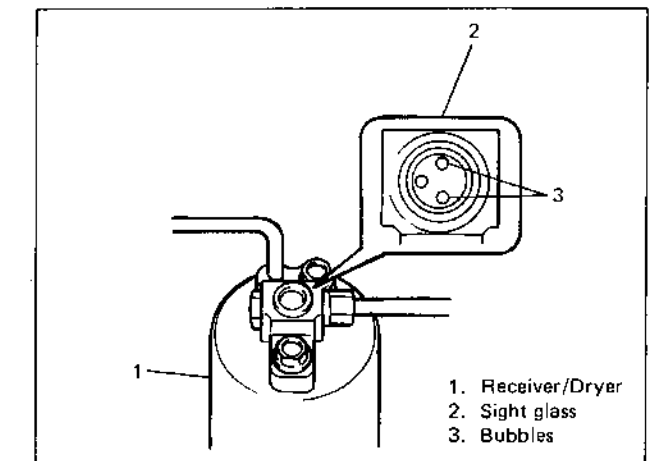


Fig. 1B-12

Use the following table when checking charged state of refrigerant and correct it as necessary.

Item No.	Symptom	Charge of refrigerant	Remedy
1	Bubbles observed in sight glass	Insufficient charge of refrigerant in system	Check system for leaks with a leak tester.
2	No bubbles observed in sight glass	No or insufficient charge of refrigerant in system	Refer to the items 3 and 4.
3	No temperature difference between compressor inlet and outlet	Empty or nearly empty system	Evacuate and charge system and then check it for leaks with a leak tester.
4	Noticeable temperature difference between compressor inlet and outlet	Proper or too much charge of refrigerant in system	Refer to the items 5 and 6.
5	When air conditioner is turned OFF, refrigerant in sight glass clears immediately and remains clear	Too much charge of refrigerant in system	Discharge excess charge of refrigerant to adjust it to a specified charge.
6	When air conditioner is turned OFF, refrigerant in sight glass once produces bubbles and then clears	Proper charge of refrigerant in system	NO CORRECTION NEEDED BECAUSE CHARGE OF REFRIGERANT IS NORMAL.

B. CONDENSER**Inspection**

Check a) condenser fins for blockage, b) condenser fittings for leakage, and c) condenser fins for damage.

Clogged condenser fins should be washed with water, and should be dried with compressed air.

NOTE:

Be careful not to damage condenser fins. If condenser fin is bent, straighten it by using a screwdriver or pair of pliers. If any leakage is found from fitting or tube, repair or replace condenser.

Removal

- 1) Slowly discharge refrigerant from high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant. So, care must be used to avoid any quick discharge.
- 2) Disconnect compressor delivery hose from condenser inlet fittings.
- 3) Disconnect receiver/dryer outlet pipe at above condenser cooling fan.

NOTE:

As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust do not enter condenser.

- 4) Remove hood latch and hood lock member.
- 5) Disconnect fan motor wire at coupler.
- 6) Remove its attaching bolts.
- 7) Remove condenser together with fan and receiver/dryer.

NOTE:

Be careful not to damage fins of condenser and radiator.

- 8) Remove cooling fan and receiver/dryer from condenser.

Installation

- 1) Reverse removal sequence to install condenser.

NOTE:

When replacing condenser, add 20 to 30 cc of refrigerating oil from compressor suction-side.

- 2) Evacuate and charge system according to previously-described procedure.

C. RECEIVER/DRYER**Inspection**

Use a leak tester to check for gas leakage, sight glass, fusible plug and fittings.

Removal

- 1) Slowly discharge refrigerant from high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant. So, care must be used to avoid any quick discharge.
- 2) Disconnect liquid line pipes.
- 3) Remove receiver/dryer from its holder.

Installation

- 1) Reverse removal sequence to install receiver/dryer.

NOTE:

- When replacing receiver/dryer, add 10 cc of refrigerating oil from compressor suction-side.
- Blind plugs of receiver/dryer should not be removed until just before receiver/dryer is installed.

- 2) Evacuate and charge system according to previously-described procedure.

D. EVAPORATOR (COOLING UNIT)**Removal**

- 1) Disconnect the battery (—) terminal.
- 2) Slowly discharge refrigerant from high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant. So, care must be used to avoid any quick discharge.
- 3) Disconnect blower motor and resistor wire couplers.
- 4) Disconnect fresh air control cable from blower motor unit.

- 5) Remove blower motor unit after removing glove box upper panel and bolts as shown below.

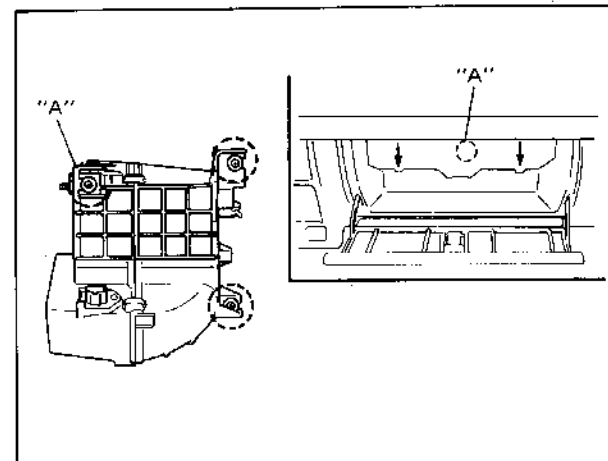


Fig. 1B-13

- 6) Disconnect A/C amplifier and thermister wire couplers.
- 7) Disconnect compressor suction pipe, receiver/dryer outlet pipe and drain hose from evaporator (cooling unit).

NOTE:

As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust may not enter cooling unit.

- 8) Remove evaporator with evaporator case.
- 9) Remove A/C amplifier from lower case.

Disassembly

- 1) Detach clamp to separate evaporator upper and lower cases from each other.

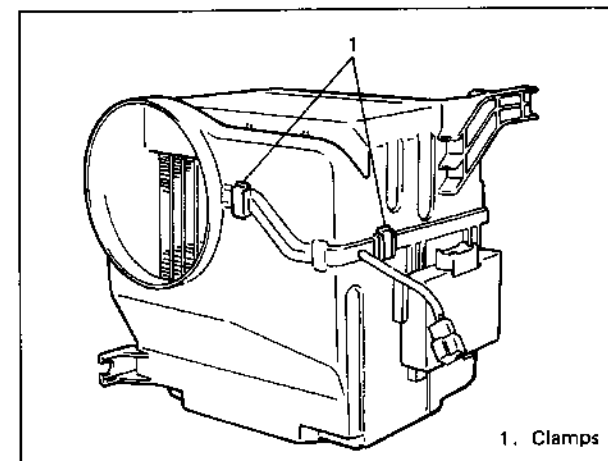


Fig. 1B-14

- 2) Take off case cover and remove evaporator out of position.

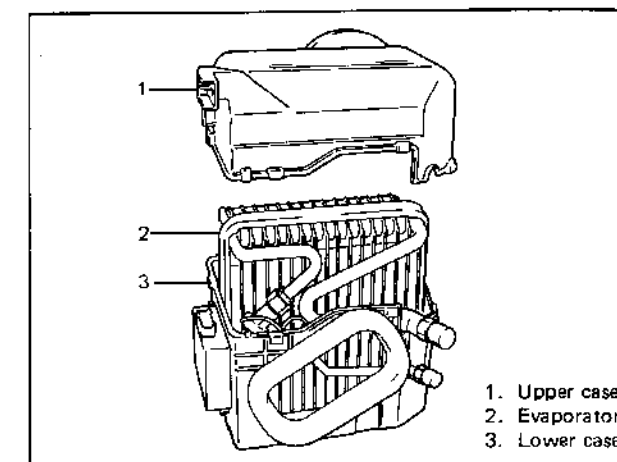


Fig. 1B-15

- 3) Detach following components from evaporator.
 - Expansion valve.
 - Thermister.

Inspection

- 1) Check evaporator fins for blockage. If found clogged, use compressed air to clean the fins.

NOTE:

Do not use water for cleaning of evaporator.

- 2) Check inlet and outlet fittings for crack or scratch. Repair them as required.

E. EXPANSION VALVE

Inspection Prior to Removal

- 1) Connect manifold gauge set to service valves.
- 2) Run engine at 1000 r/min with A/C switched ON.
- 3) Check that low pressure gauge shows a reading of 0.5 to 5.0 kg/cm² (7 to 71 psi) properly. If the reading is too low (below 0.5 kg/cm², 7 psi), check expansion valve and/or receiver/dryer, and replace as necessary. If the reading is too high (above 5.0 kg/cm², 70 psi), tighten remote bulb holder or replace expansion valve.

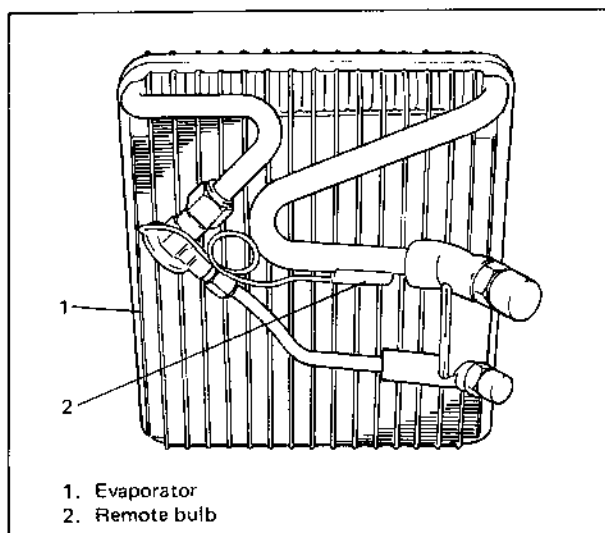


Fig. 1B-16

Removal

Refer to items REMOVAL and DISASSEMBLY in the previous section EVAPORATOR (COOLING UNIT).

Inspection

- 1) Connect manifold gauge set to expansion valve and its charging hose to refrigerant can.

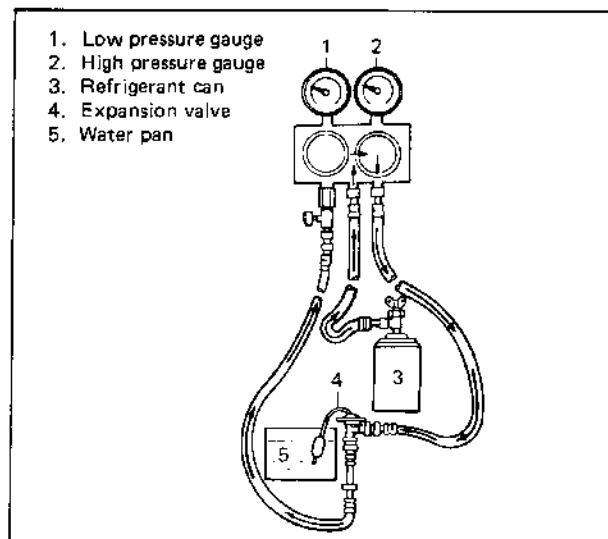


Fig. 1B-17

- 2) Soak remote bulb of expansion valve in water contained in a water pan.
- 3) Previously close both low and high pressure valves.
- 4) Use a can tap valve to pierce refrigerant can to release its pressure.
- 5) Open high pressure valve to adjust pressure to approx. 5 kg/cm² (70 psi).
- 6) Read the pressure indicated on low pressure gauge. At the same time, use a thermometer to measure water temperature.
- 7) Use the Chart as shown below to check whether above measurements fall within shaded acceptable range.

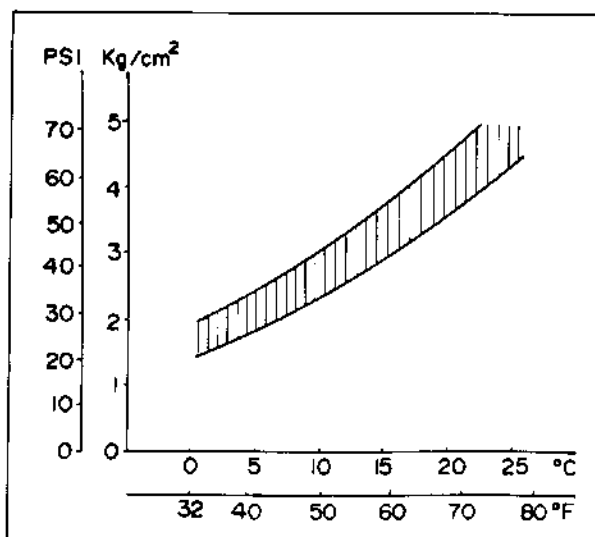


Fig. 1B-18

Installation

- 1) Reverse removal sequence to install expansion valve.
- 2) Evacuate and charge system according to previously-described procedure.

F. EVAPORATOR THERMISTER

A thermister is a temperature sensor to sense the temperature of air discharge from evaporator. The electrical characteristic is shown below.

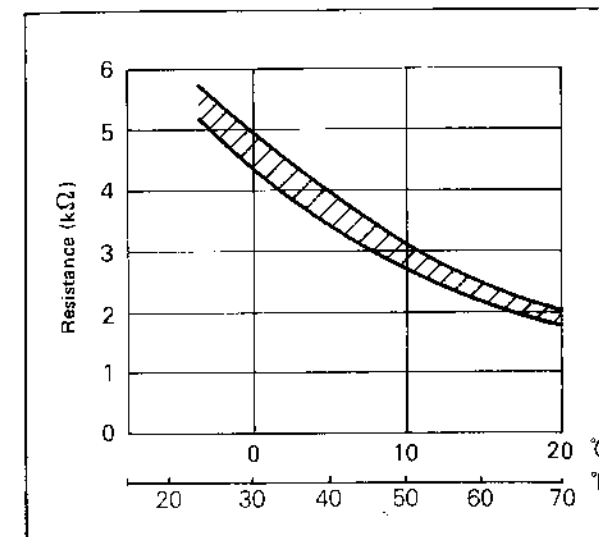


Fig. 1B-19

When temperature is lower than specified, amplifier makes magnetic clutch turn off to prevent evaporator from frosting.

Removal

Refer to items REMOVAL and DISASSEMBLY in the section of EVAPORATOR.

Inspection

Check resistance if it is within the shaded range of above graph.

Installation

- 1) Reverse removal sequence to install thermister.
- 2) Evacuate and charge system according to previously described procedure.

G. WATER TEMP. SWITCH

Inspection

Warm switch and check for continuity. It is in good condition if continuity appears at and above below specified temperature.

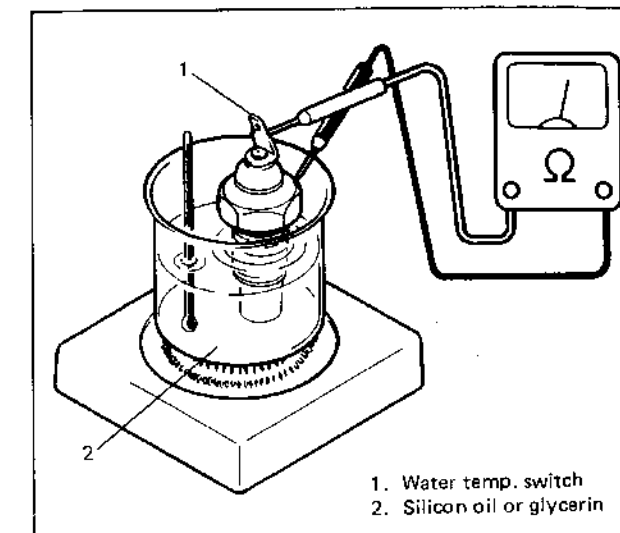


Fig. 1B-20

Continuity should exist at and above

108° C (226° F)

H. REFRIGERANT LINES

Inspection

- 1) Use a leak tester to check hoses and pipes for any gas leakage.
- 2) Check each hose or pipe clamp for tightness. Retighten or replace loose clamp as required, if any.

Removal

- 1) Slowly discharge refrigerant from high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant. So, care must be used to avoid any quick discharge.
- 2) Replace defective hose or pipe.

NOTE:

As soon as the above hose or pipe is disconnected, cap its opened fitting to prevent moisture and dust from entry.

Installation

- 1) Reverse removal procedure to install refrigerant line.
- 2) Evacuate and charge system according to previously-described procedure.

I. ELECTRICAL CIRCUIT**A/C SWITCH****Inspection**

- 1) Disconnect the battery (—) cable.
- 2) Remove heater control knobs and panel.
- 3) Disconnect A/C switch connector to remove A/C switch.
- 4) Use an ohmmeter to check A/C switch for proper continuity between each terminal.

Terminal Position	Pink/Black	Blue	Black
OFF			
ON	○	○	

If A/C switch shows no continuity, replace it.

DUAL PRESSURE SWITCH

This car is equipped with switch which operates according to high or low pressure.

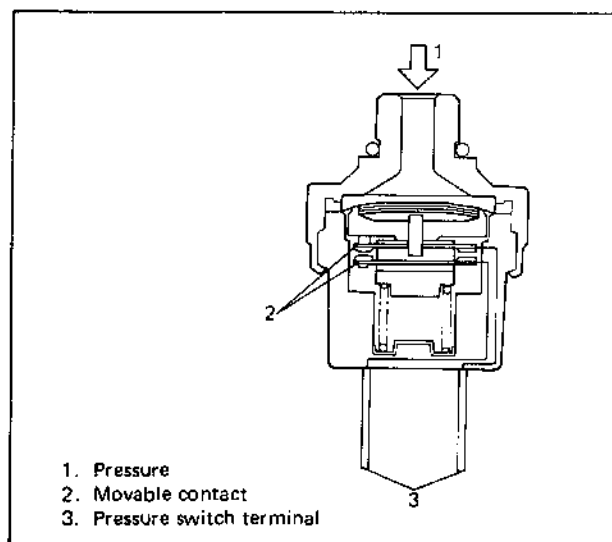


Fig. 1B-21

Inspection

- 1) Check switches for continuity at normal temperature (approx. 25°C, 77°F) when A/C system has a proper charge of refrigerant and when A/C system (compressor) is under operation. In each of these cases, switches should show proper continuity.

- 2) When pressure is 2.11 kg/cm² (30 psi) or below, low pressure switch should show no continuity. When pressure is 27.0 kg/cm² (383 psi) or above, high pressure switch should show no continuity.

VSV (VACUUM SWITCHING VALVE)**Inspection**

- 1) Disconnect vacuum hose and connector from VSV.
- 2) Check VSV for proper vacuum circuit continuity.

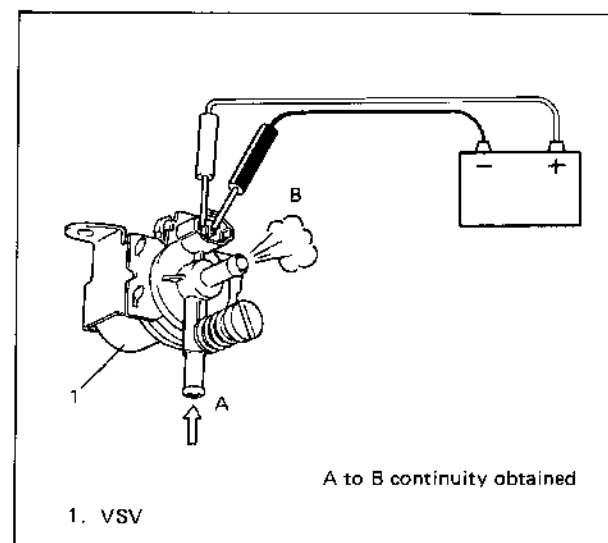


Fig. 1B-22

- 3) Check VSV for short circuit.

No continuity should exist between each terminal and VSV body.

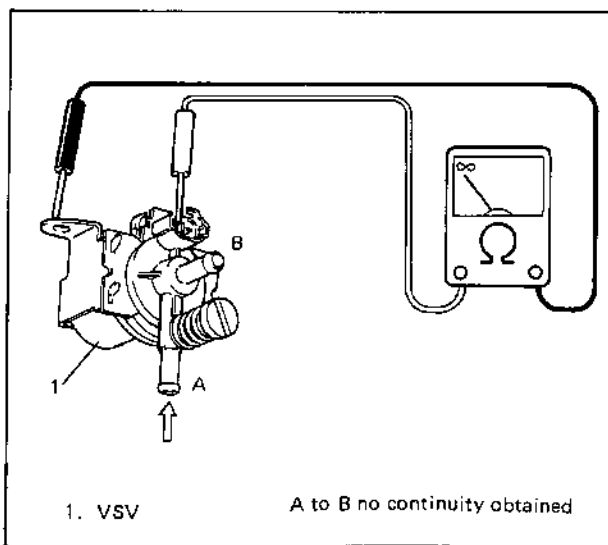


Fig. 1B-23

- 4) Check VSV for open circuit.

Measure resistance between two terminals of VSV.

Specified Resistance	24 to 30 Ω

MAGNETIC CLUTCH**Inspection**

- 1) Check pressure plate and rotor for wear and oil soaked conditions respectively.
- 2) Check clutch bearing for noise, wear, and grease leakage.
- 3) Measure stator coil for resistance at 25°C (77°F).

Standard Resistance	3.2 ± 0.2 Ω

If the measured resistance does not remain within above tolerance, replace coil.

RELAY**Inspection**

- 1) Disconnect the battery (—) cable.
- 2) Disconnect its connector to remove relay out of position.
- 3) Wire as shown below to check whether proper continuity is obtained between terminals 3 and 4.

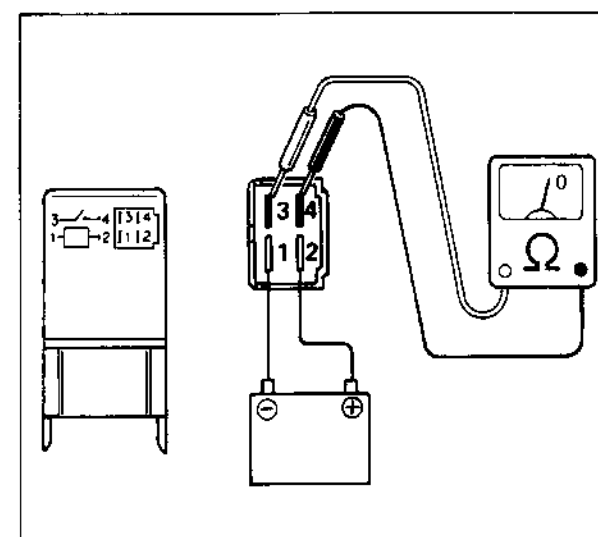


Fig. 1B-24

If found defective with no continuity, replace relay.

J. MISCELLANEOUS**DRIVE BELT****Inspection**

- 1) Check belt tension, and adjust it as necessary.

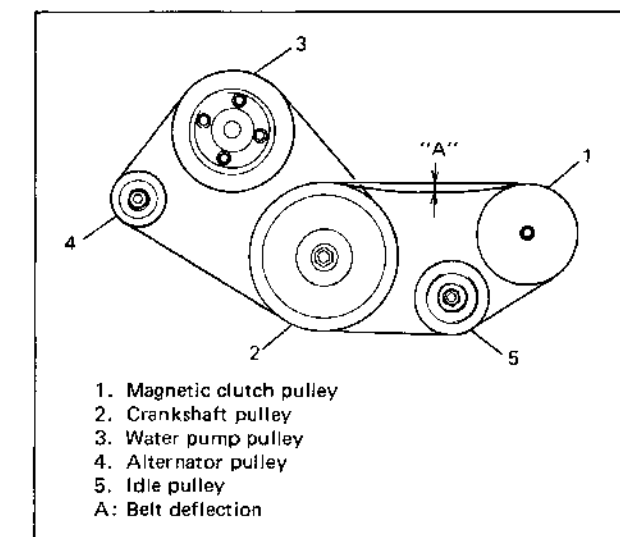


Fig. 1B-25

Belt Tension as Loaded with 10 kg THUMB PRESSURE	5 to 6.5 mm (0.20 – 0.25 in)

- 2) Check belt for wear and crack, and replace it as required.

COMPRESSOR MOUNT**Inspection**

- 1) Check mounting bolt for looseness.
- 2) Check mounting bracket for crack or fracture. When retightening the bolt, use specified torque.

8 mm Bolt		
25 to 30 N·m	2.5 to 3.0 kg·m	10 to 22 lb·ft
10 mm Bolt		
40 to 50 N·m	4.0 to 5.0 kg·m	30 to 40 lb·ft

ADJUSTMENT OF IDLE SPEED WITH AIR-CON ON

Refer to "6E" of E.F.I. section.

PERFORMANCE TEST

After finishing all repairs, make sure to carry out performance test of air conditioning system as follows.

PROCEDURE

- 1) Connect high and low side charging hoses of manifold gauge set to hose fittings of compressor.
- 2) Run engine, and keep compressor speed at 2,000 rpm.
- 3) Operate air conditioner, and set blower switch at "HI", temperature lever at "COOL".
- 4) Keep all windows and doors open.
- 5) Insert a dry bulb thermometer in cool air outlet, and place psychrometer (dry and wet bulb thermometer) close to inlet of cooling unit.

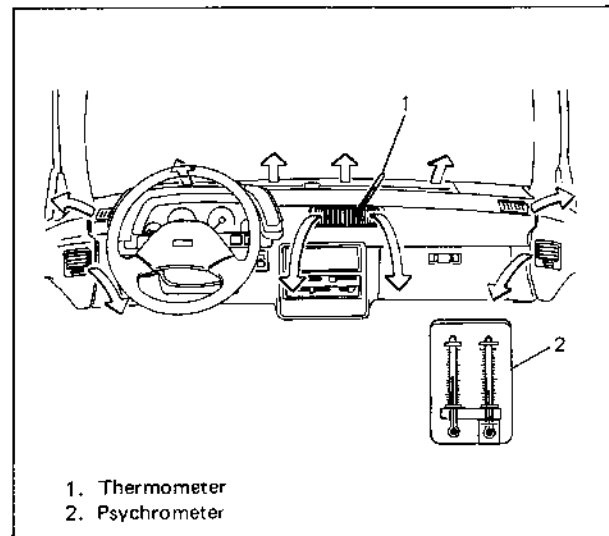


Fig. 1B-26

- 6) The high pressure gauge reading should be within specified pressure range, 14.0 to 15.5 kg/cm² (200 to 220 psi).

NOTE:

If the gauge indicates too high, pour water on condenser or if it is too low, cover front surface of condenser.

- 7) The dry bulb thermometer at air inlet should be within 25 to 35°C (77 to 95°F).

Under above conditions, operate air conditioning system until a stabilized condition on high and low pressure gauges and thermometers has been established.

HOW TO READ THE STANDARD PERFORMANCE CURVE

- 1) Read psychrometer reading at the inlet, and get relative humidity from psychrometric chart. (See Fig. 1B-28 or 1B-29).
- 2) Measure dry bulb temperature at cool air outlet, then find out the difference between inlet and outlet temperatures.

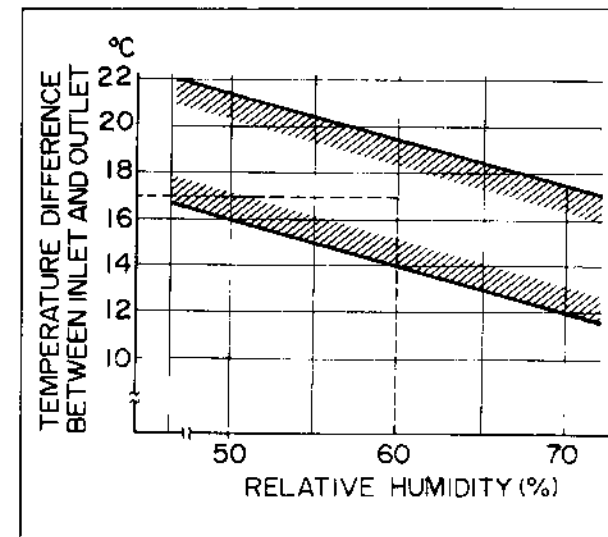


Fig. 1B-27

- 3) Check the relative humidity-to-temperature difference relationship using the above graph. As an example of 17°C (62.6°F) temperature difference and 60% relative humidity shown in it, if their crossing point falls within the area between two lines, cooling performance then is satisfactory and proper.

HOW TO READ RELATIVE HUMIDITY (°F)

Measure wet-bulb temperature and dry-bulb temperature on the psychrometer at the evaporator air inlet, follow lines at those temperatures and read the relative humidity curve at their intersection.

Example:

If dry-bulb temperature is 90°F and wet-bulb temperature is 78°F, the relative humidity is 60%.

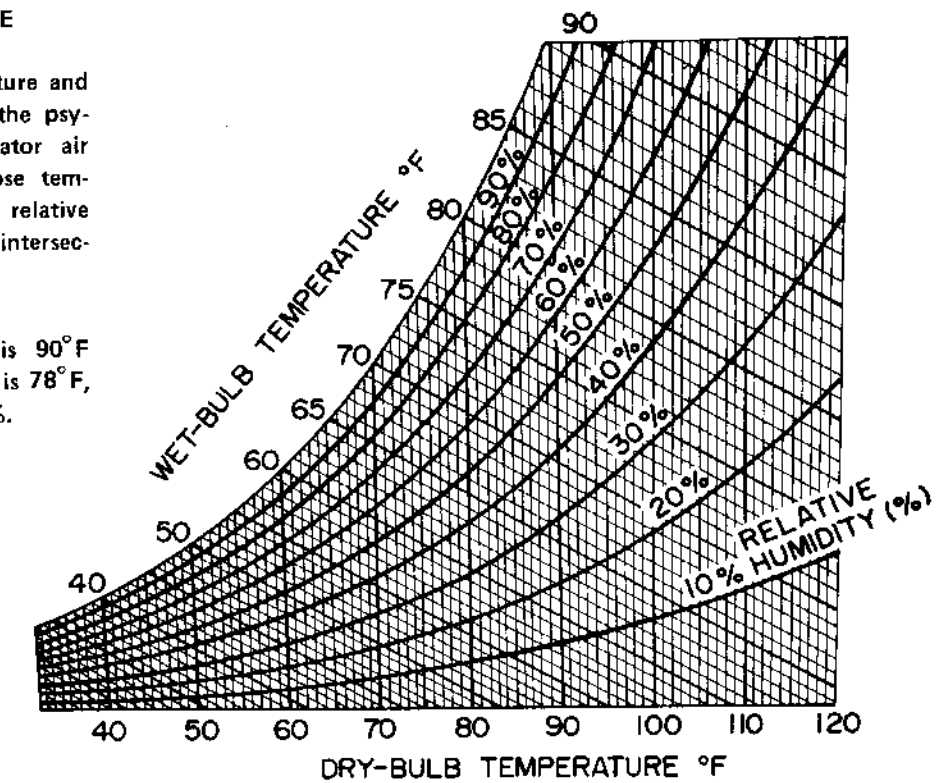


Fig. 1B-28

HOW TO READ RELATIVE HUMIDITY (°C)

Measure wet-bulb temperature and dry-bulb temperature on the psychrometer at the evaporator air inlet, follow lines at those temperatures and read the relative humidity curve at their intersection.

Example:

If dry-bulb temperature is 25°C and wet-bulb temperature is 19.5°C, the relative humidity is 60%.

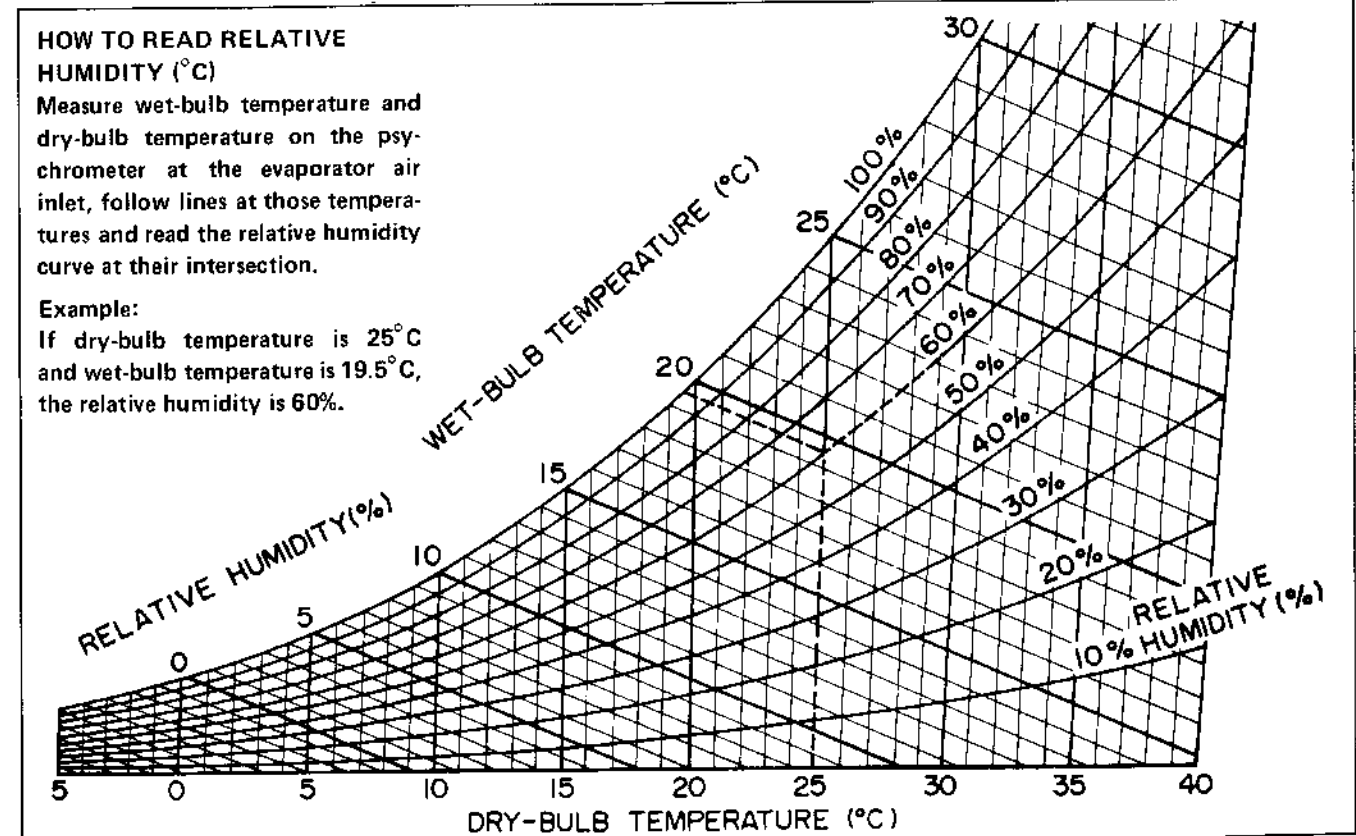


Fig. 1B-29

SECTION 1C

AIR CONDITIONER COMPRESSOR OVERHAUL
(OPTIONAL)

CONTENTS

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REMOVAL OF COMPRESSOR	1C- 2	CLUTCH	1C-14
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DISASSEMBLY OF MAGNETIC		PERFORMANCE TEST OF	
CLUTCH	1C- 3	COMPRESSOR	1C-15
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GENERAL INFORMATION

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connection and the outside of the compressor should be cleaned before any "on-car" repair, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene or equivalent solvent and dried with dry air. Use only lint free cloths to wipe parts.

The operations described below are based on bench overhaul with compressor removed from the car, except as noted. They have been prepared in order of accessibility of the components. When compressor is removed from the car for servicing, the oil remaining in the compressor should be discarded and new refrigerant oil added to the compressor.

Minor repair procedures may be done on the car without discharging the system. Major repair procedures require that the system be discharged of refrigerant.

TROUBLE DIAGNOSIS

Compressor troubles are mainly following three types: gas leakage, noise and insufficient pressure. Compressor gas leakages in most cases develop from the shaft seal. When detecting gas leakage, always use a leak tester. If a small amount of oil seeps out from the shaft seal, there is no necessity of replacing the seal. The shaft seal has been designed to allow a small amount of oil to leak

out for lubricating purpose. Thus, the shaft seal should be replaced only when a large amount of compressor oil is leaking out or when gas leakage is discovered by using gas tester.

In regard to noise and insufficient pressure, repairs should be made only after diagnosing the trouble properly.

ITEM	PROBLEM	POSSIBLE CAUSES	CORRECTION
1	Noise from compressor	1. Defective piston/shoe 2. Defective bearing 3. Defective cylinder and/or shaft	Replace Replace Replace
2	Noise from magnetic clutch	1. Defective bearing 2. Defective clutch face	Replace Replace
3	Insufficient cooling	1. Defective gasket 2. Defective reed valve	Replace Replace
4	Not rotating	1. Locked by item 1-1 to 1-3 and 3-2. 2. Seized magnetic clutch 3. Rotating parts seized due to insufficient oil	Replace Replace or repair Replace or repair
5	Oil and/or gas leakage	1. Defective seal 2. Defective "O" ring	Replace Replace

ON-CAR INSPECTION

1) Install manifold gauge set as shown below.

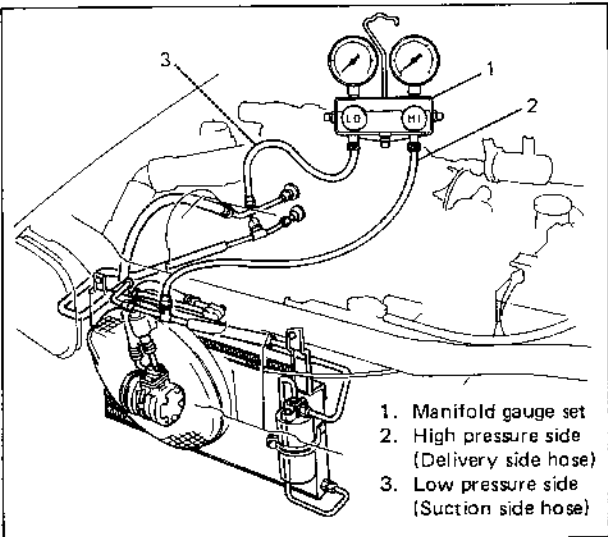


Fig. 1C-1

- 2) Close Hi and Lo hand valves.
3) Run engine at fast idle.
4) Check compressor for following:
- a. High pressure gauge reading is not low and low pressure gauge reading is not higher than normal.
 - b. Metallic sound.
 - c. Leakage from shaft seal.
- If any of the above checks indicates a defect, repair compressor.

5) Check magnetic clutch.

- a. Inspect pressure plate and rotor for signs of oil.
- b. Check clutch bearings for noise and grease leakage.
- c. Using an ohmmeter, measure resistance of stator coil between clutch lead wire and ground at 25° C (77° F).
If resistance is not within specification, replace coil.

Standard resistance	3.2 ± 0.2 ohms

REMOVAL OF COMPRESSOR

- 1) Run engine at idle with air conditioning on for 10 minutes.
- 2) Disconnect battery negative (–) terminal.
- 3) Discharge refrigerant very slowly from refrigeration system.
- 4) Disconnect clutch stator lead wire from A/C wire harness.
- 5) Disconnect suction and discharge flexible hoses from compressor.

6) Remove O rings from hoses.

NOTE:
Cap open fittings immediately to keep moisture out of system.

- 7) Hoist car and remove front fender apron extension (R) and oil filter.
- 8) Loosen compressor drive belt, then remove compressor mounting bolts.
- 9) Remove compressor with clutch ass'y from its mounts.

NOTE:
When removing compressor, be careful not to damage fins of condenser.

INSTALLATION OF COMPRESSOR

- 1) Reverse removal sequence to install compressor ass'y.
- 2) Add engine oil.
- 3) Evacuate and charge system according to previously described procedure.

DISASSEMBLY OF MAGNETIC CLUTCH

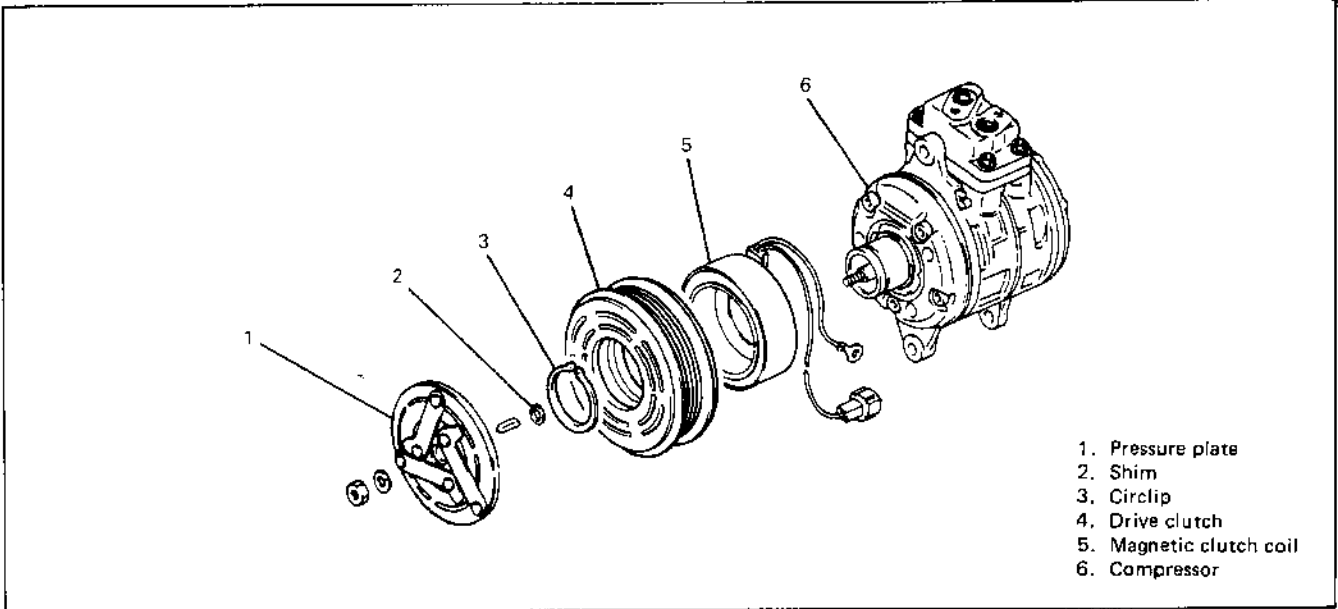


Fig. 1C-2

1) Remove pressure plate nut.

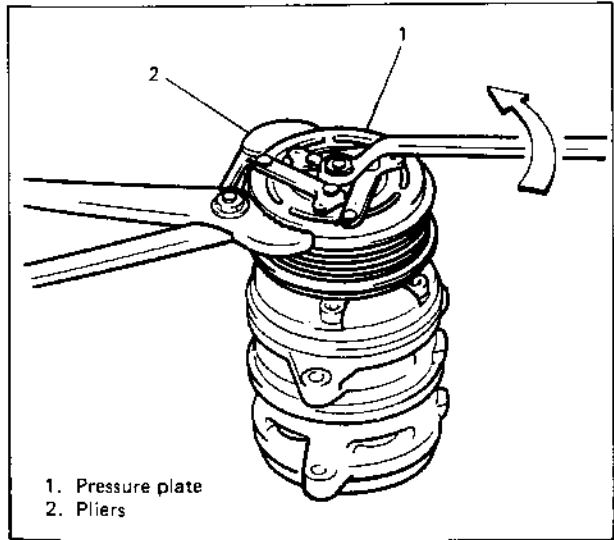


Fig. 1C-3

2) Using pressure plate remover, remove pressure plate.

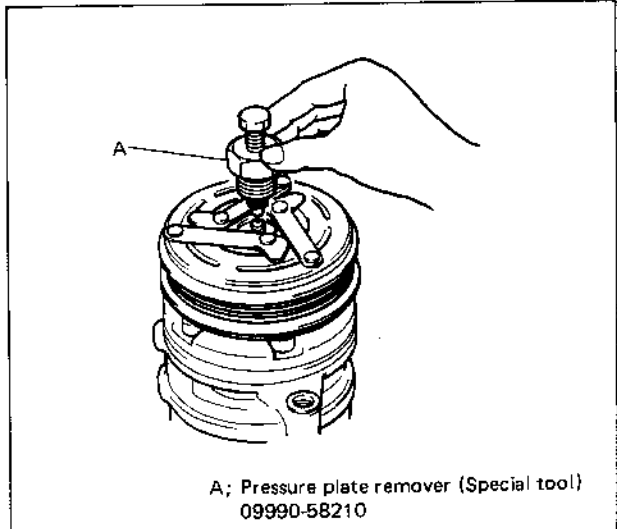


Fig. 1C-4

- 3) Remove shims from shaft.
4) Remove drive clutch.
Using snap ring pliers, remove circlip.

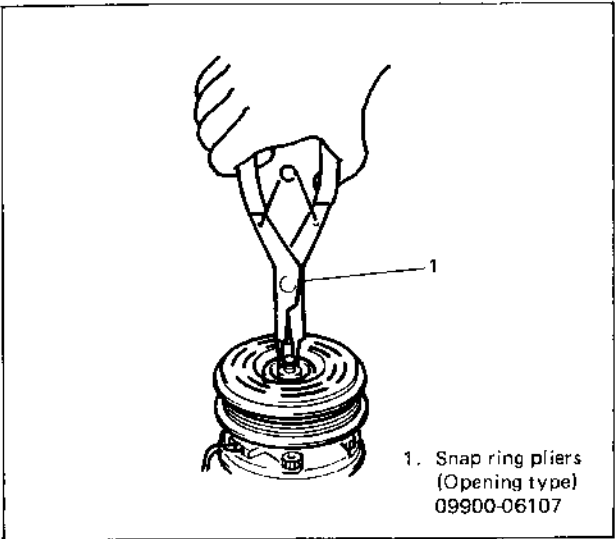
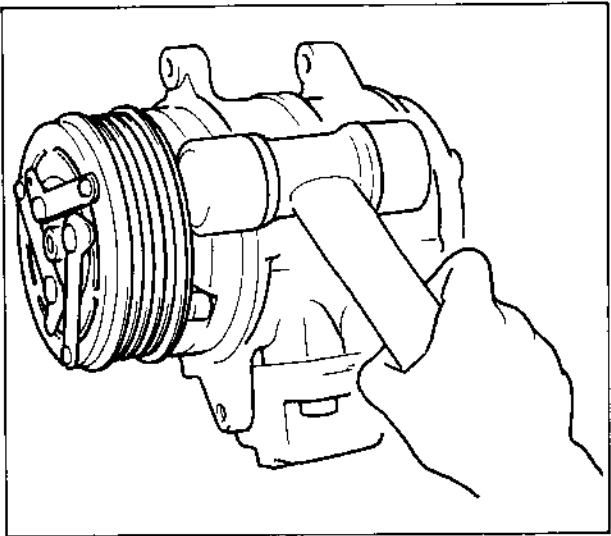


Fig. 1C-5

Using plastic hammer, tap drive clutch off from shaft.



NOTE:
Be careful not to damage pulley when tapping drive clutch.

- 5) Remove clutch coil.
Disconnect coil lead wire from compressor housing. Using snap ring pliers, remove circlip.

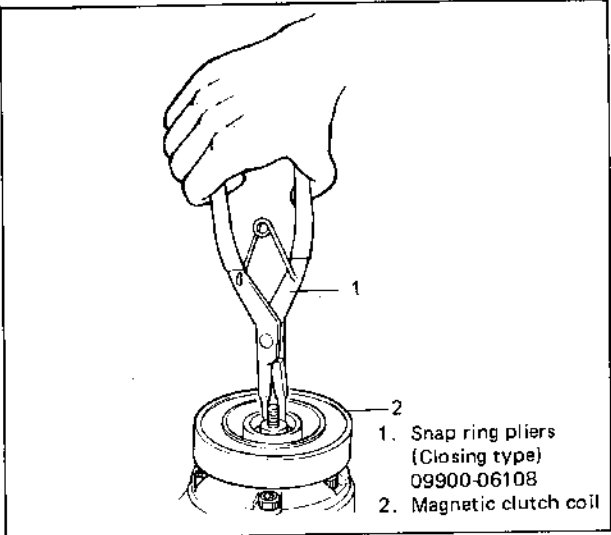


Fig. 1C-7

Remove clutch coil.

- 6) Inspect pressure plate, drive clutch and clutch coil.
- a. Inspect pressure plate and drive clutch surfaces for wear and scoring. Replace if necessary.
 - b. Check drive clutch bearings for wear and leakage of grease. Replace if necessary.
 - c. Check clutch coil for resistance using ohmmeter. Replace if necessary.

Standard resistance	$3.2 \pm 0.2 \Omega$

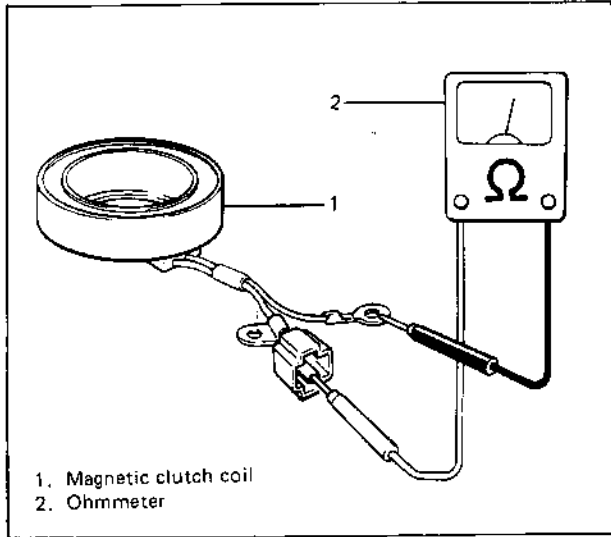
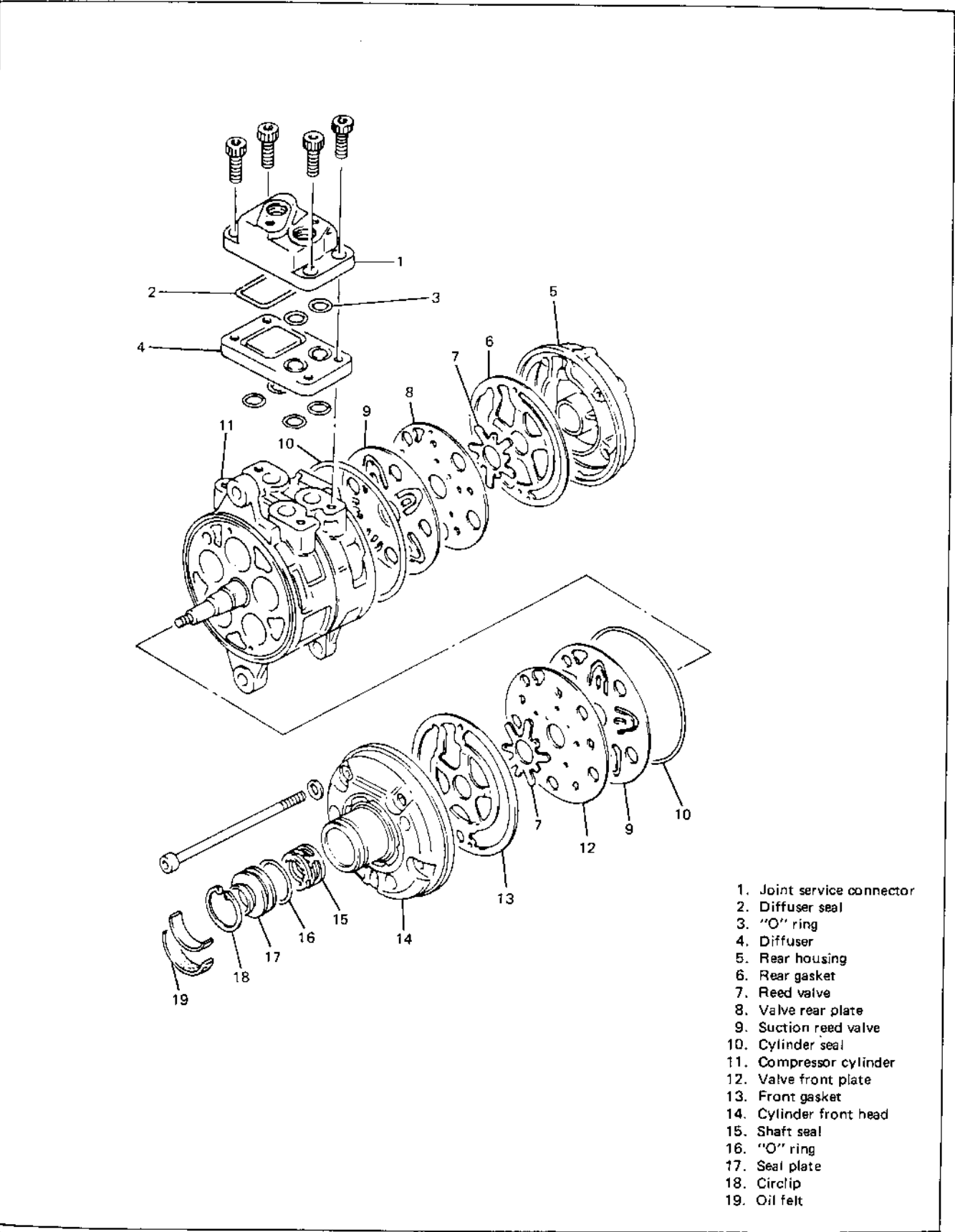


Fig. 1C-8

DISASSEMBLY OF COMPRESSOR



1) Remove oil felt.

Using a screw driver, pry out oil felt.

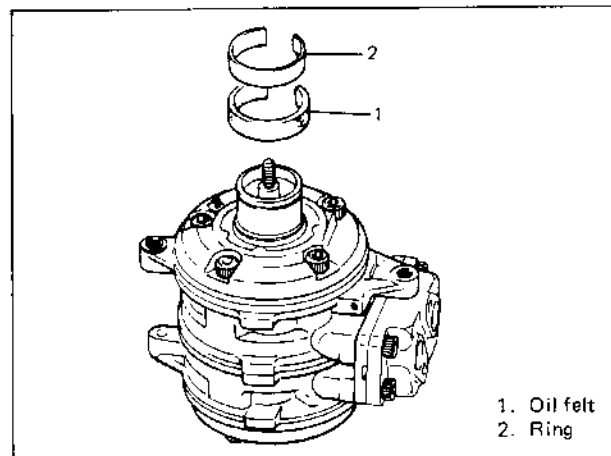


Fig. 1C-10

2) Remove key.

Using a hammer and punch, drive key from shaft.

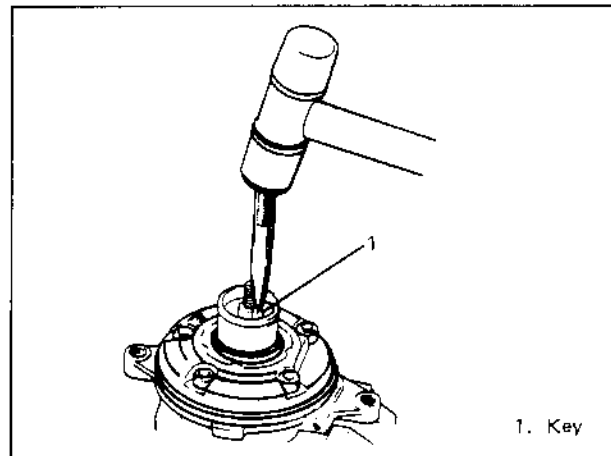


Fig. 1C-11

3) Remove circlip.

Using snap ring pliers, remove circlip.

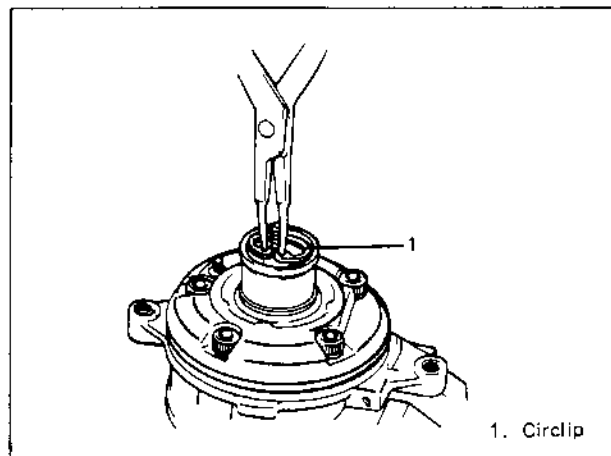


Fig. 1C-12

4) Apply compressor oil to inner bore.

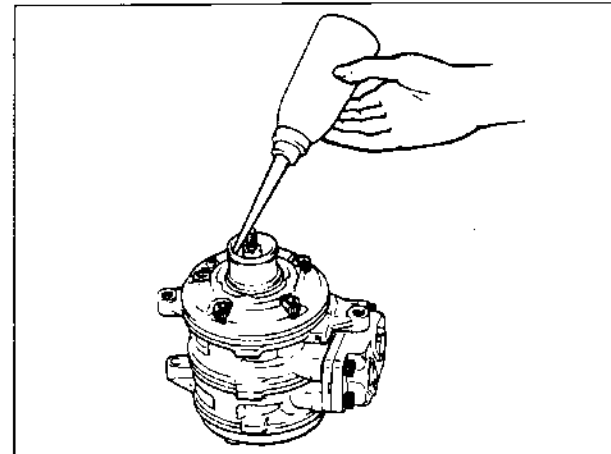


Fig. 1C-13

5) Using seal plate remover (Special tool), remove seal plate.

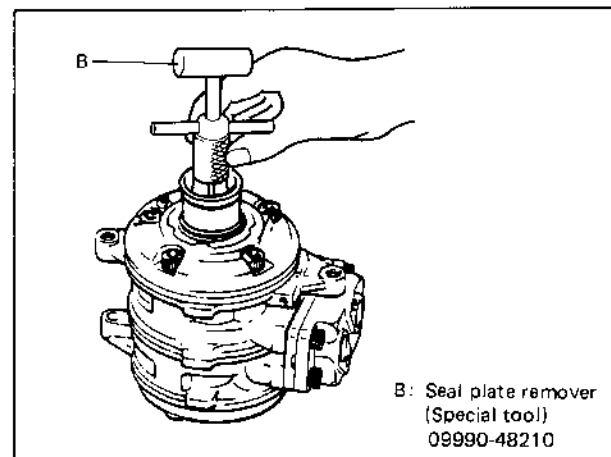


Fig. 1C-14

6) Using shaft seal remover (Special tool), remove shaft seal.

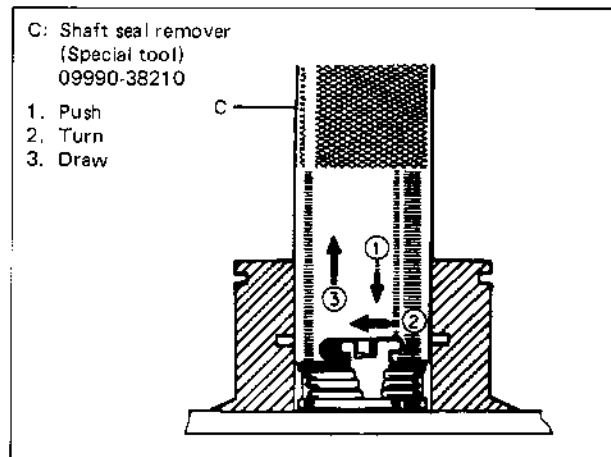


Fig. 1C-15

7) Remove joint service connector.

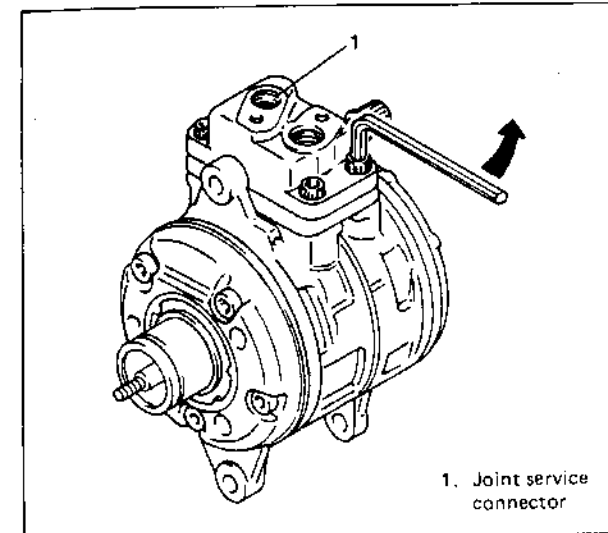


Fig. 1C-16

Remove "O" rings from service valve and discard them.

8) Drain oil into container.

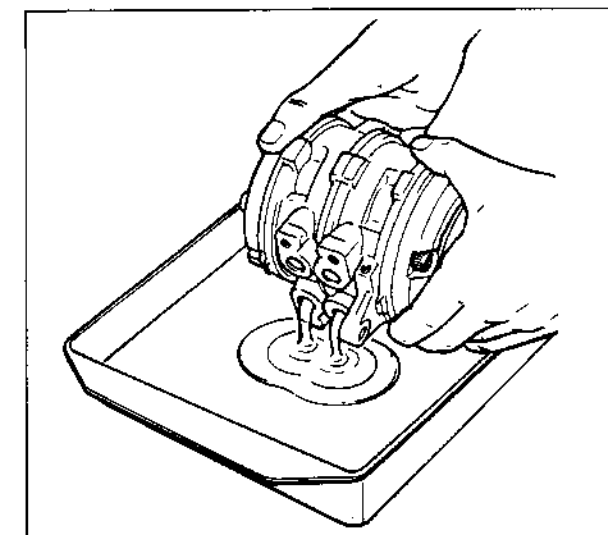


Fig. 1C-17

9) Remove front housing.

NOTE:

Do not reuse five washers.

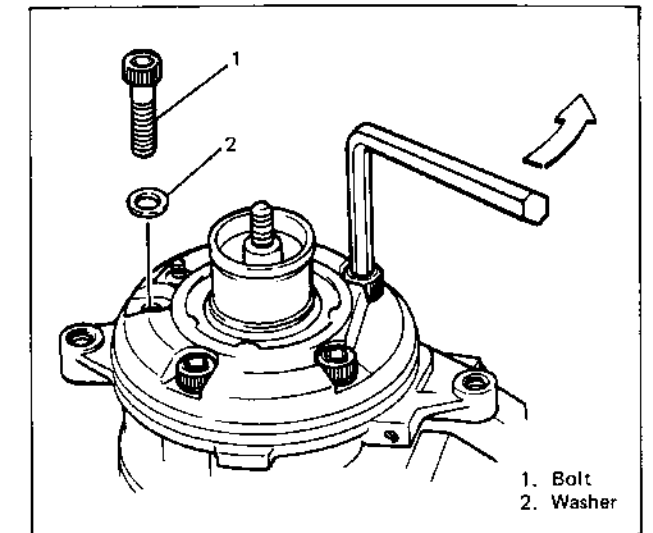


Fig. 1C-18

Remove front housing by prying it at its protrusion.

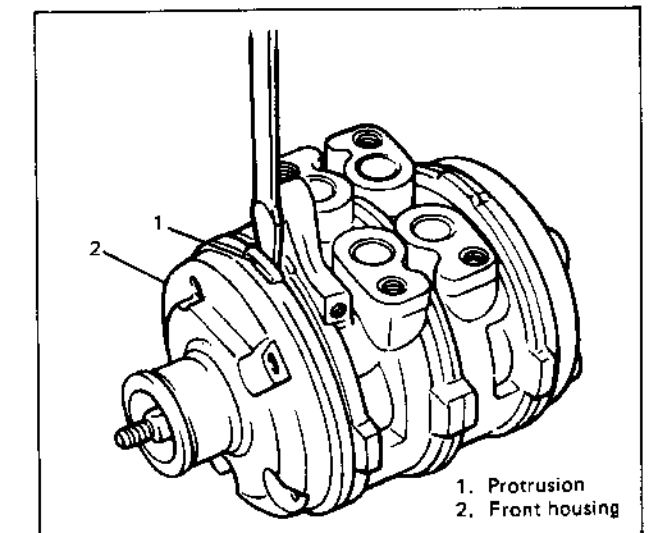


Fig. 1C-19

NOTE:

Be careful not to scratch sealing surface of front housing.

- 10) Remove front valve plate.
Remove two pins from cylinder block.

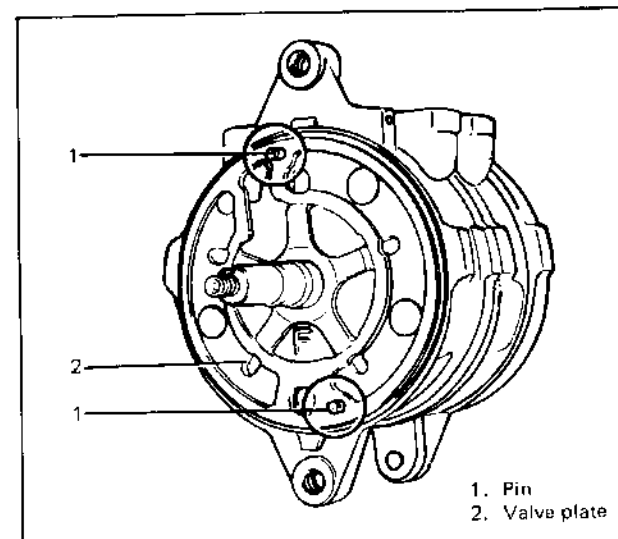


Fig. 1C-20

- 11) Remove rear housing by prying it at its protrusion.

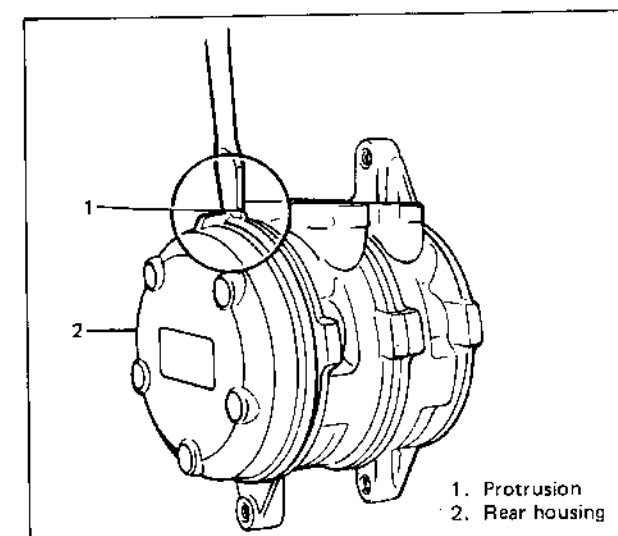


Fig. 1C-21

NOTE:

Be careful not to scratch sealing surface of rear housing.

- 12) Remove rear valve plate.
Remove two pins from rear housing.

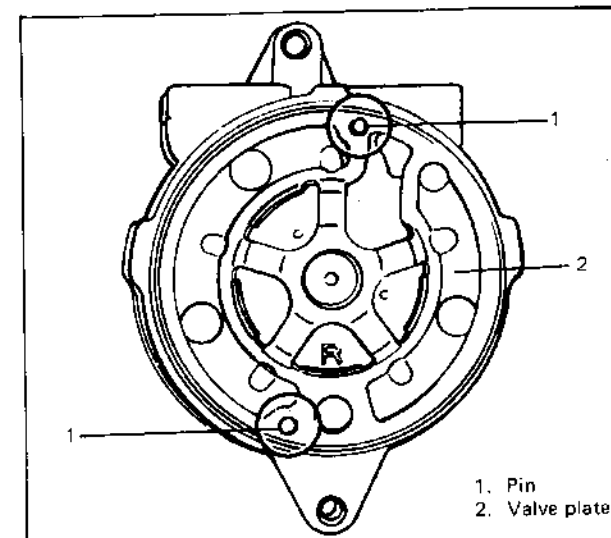


Fig. 1C-22

- 13) Remove front and rear "O" rings from cylinder block and discard them.

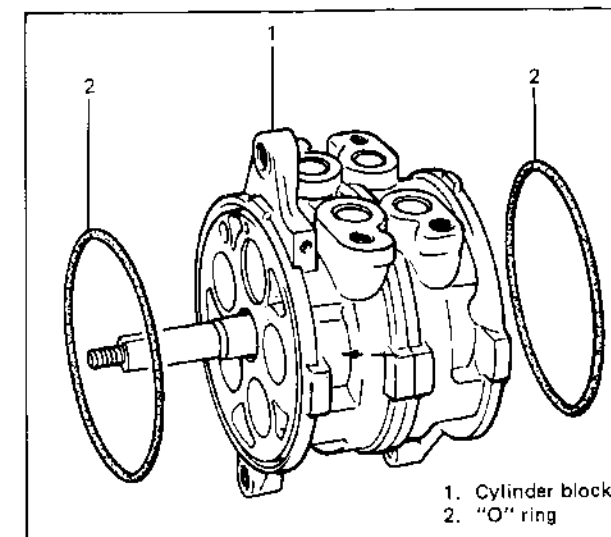


Fig. 1C-23

CHECKING COMPONENTS

Clean all parts with cleaning solvent and apply compressor oil to them.

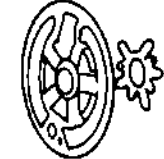
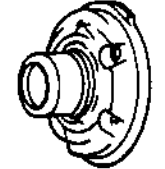
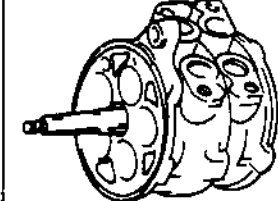
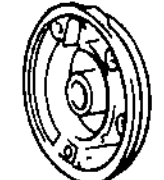
PART NAME	CHECK POINT	REMEDY
Shaft seal 	1. Check lapping surface of carbon disc for cracks and scratches. 2. Check rubber seal for cracks and hardening. 3. Check spring action	Replace Replace Replace
Seal plate 	1. Check sealing surfaces for scratches and corrosion.	Replace
Valve plate 	1. Check both surfaces for scratches and corrosion.	Replace or polish with fine oil stone.
Reed valve 	1. Check reed for cracks, scratches, deformation and corrosion.	Replace
Front housing 	1. Check sealing surface for cracks scratches and deformation.	Replace
Piston cylinder block 	1. Check cylinder bore for scratches and corrosion. 2. Check radial bearings for poor contact, worn-out needle, scoring or pit. 3. Check shaft for excessive axial play. 4. Check piston for excessive axial play.	Replace Replace Replace
Rear housing 	1. Check sealing surface for cracks, scratches and deformation.	Replace

Fig. 1C-24

ASSEMBLY OF COMPRESSOR

NOTE:

- Do not re-use gasket shaft seal, O-rings, or washers. Use overhaul gasket kit.
- Before starting assembly, make sure all parts as well as work-bench are clean.

1) Install rear valve plate on rear cylinder.

- Install two pins in rear cylinder.
- Lubricate new O-ring with compressor oil and install it in rear cylinder.
- Install suction reed valve, rear valve plate, and discharge reed valve to rear cylinder top. For installation locations, refer to figure below.

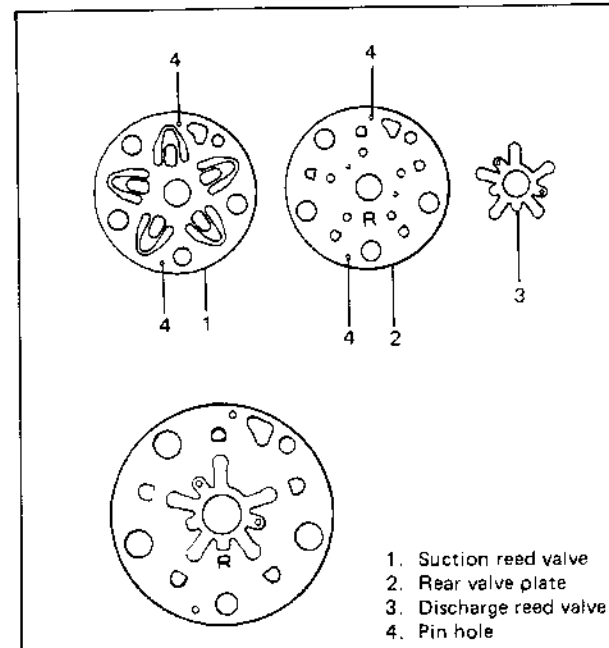


Fig. 1C-25

NOTE:

- Front and rear reed valves (suction and discharge) are the same.
- Rear valve plate is marked "R".

- Lubricate gasket with compressor oil and install it to valve plate.

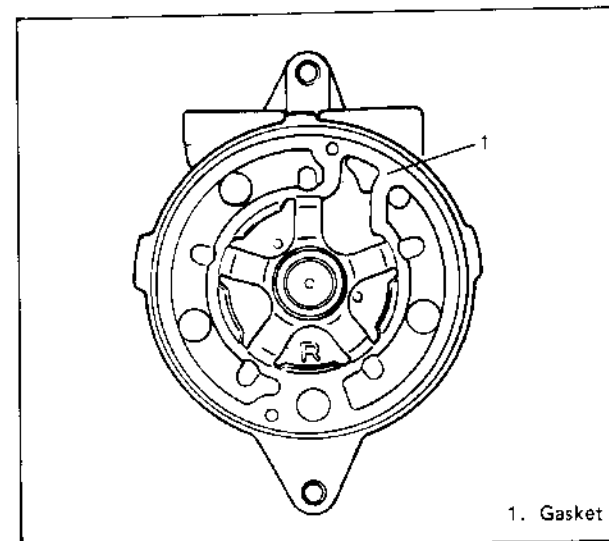


Fig. 1C-26

NOTE:

Front and rear gaskets aren't the same, so do not interchange them.

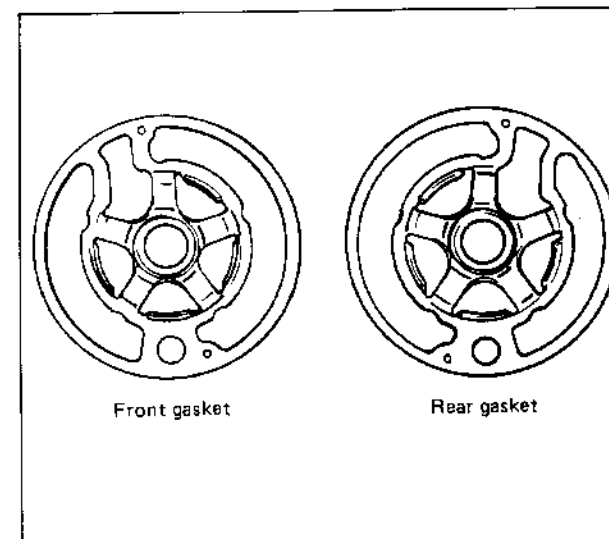


Fig. 1C-27

NOTE:

Assemble gaskets so that their protruded surfaces face upward.

2) Install rear housing to rear cylinder.

Protrusion of housing should come at the top.

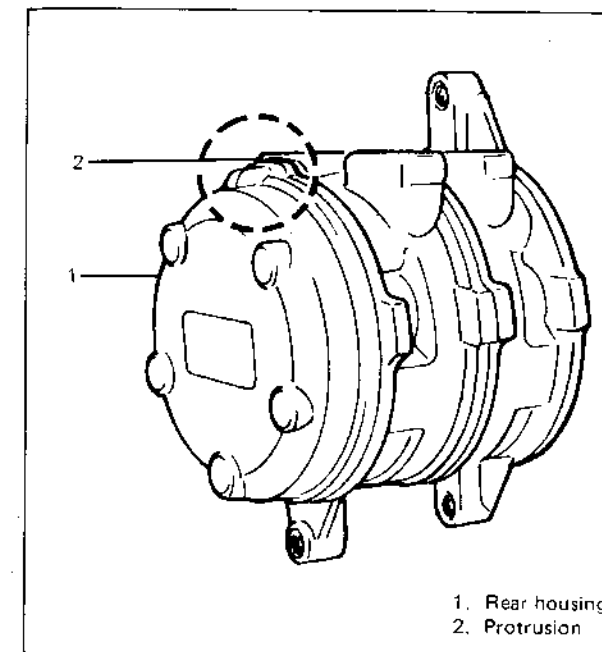


Fig. 1C-28

3) Install front valve plate on front cylinder.

- Install two pins in front cylinder.
- Lubricate new O-ring with compressor oil. Install it in front cylinder.
- Install suction reed valve, front valve plate, and discharge reed valve onto front cylinder top. For installation locations, refer to figure below.

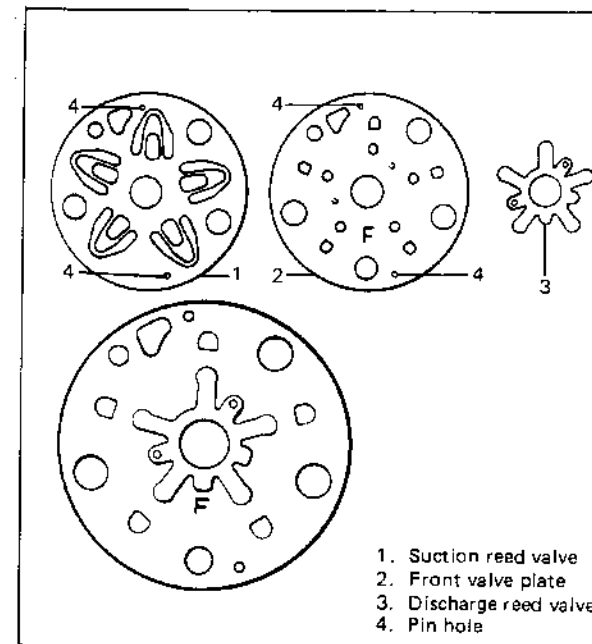


Fig. 1C-29

NOTE:

- Front and rear reed valves (suction and discharge) are the same.
- Front valve plate is marked "F".

- Lubricate gasket with compressor oil and install it to valve plate.

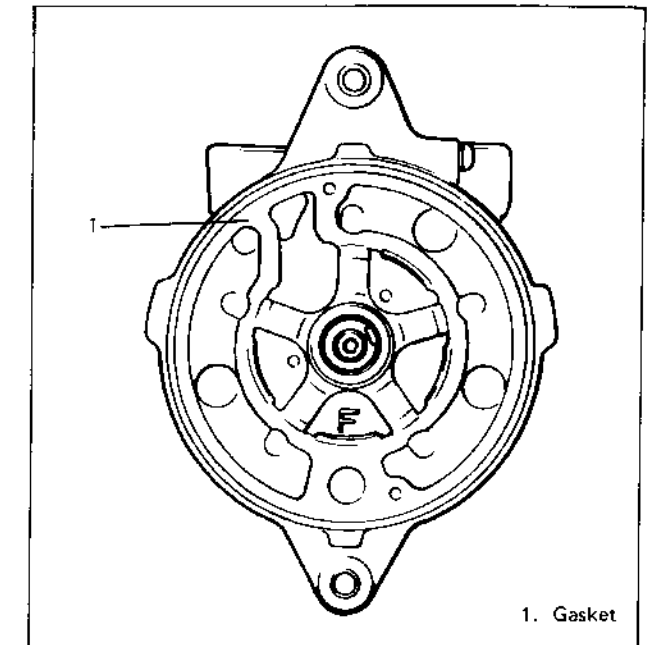


Fig. 1C-30

NOTE:

- Front and rear gaskets aren't the same, so do not interchange them. (To differentiate them, refer to description on rear valve plate.)
- Assemble gaskets so that their protruded surfaces face upward.

4) Install front housing front cylinder and tighten five through bolts.

- Using a torque wrench and hexagon wrench, gradually tighten five through bolts.

	N·m	kg·m	lb·ft
Tightening torque	25 - 27	2.5 - 2.7	18.1 - 19.5

NOTE:
Protrusion of housing should come at the top.

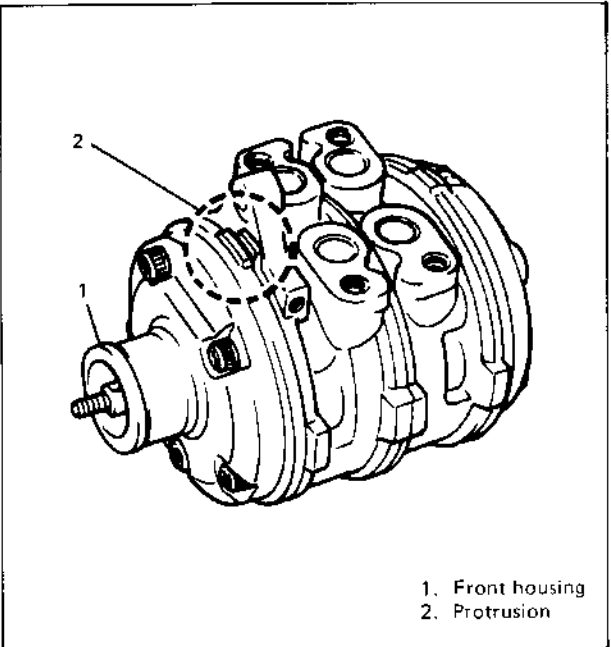


Fig. 1C-31

5) Install shaft seal.
a. Lubricate shaft seal with compressor oil and fit it to shaft seal remover (Special tool).

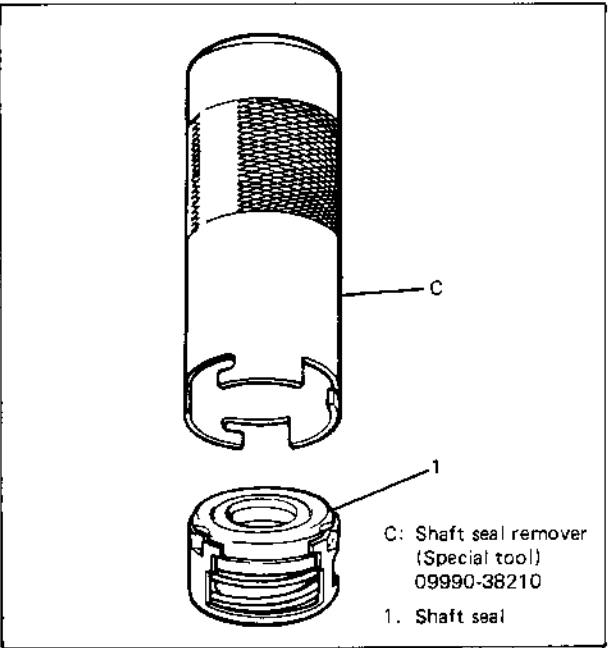


Fig. 1C-32

b. Apply oil to bore.
Insert shaft seal remover, and turn it to the left while lightly pressing. Then pull up shaft seal remover.

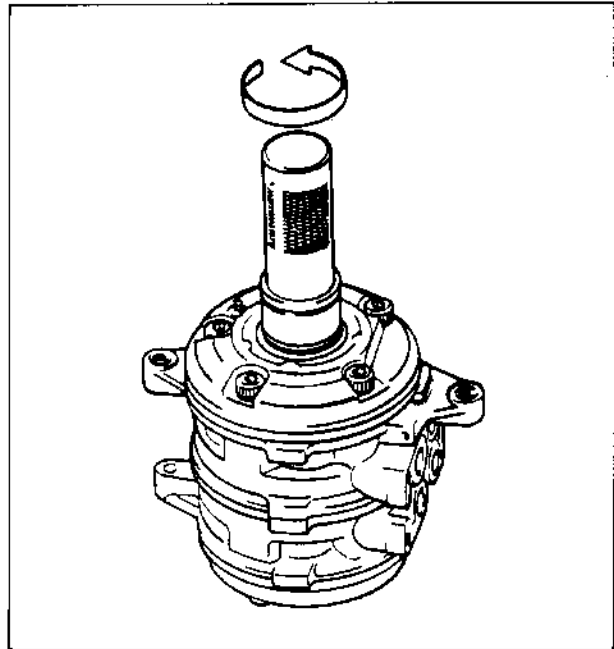


Fig. 1C-33

6) Install seal plate.
a. Lubricate O-ring with compressor oil. Put seal plate.
b. Press seal plate presser by hand.

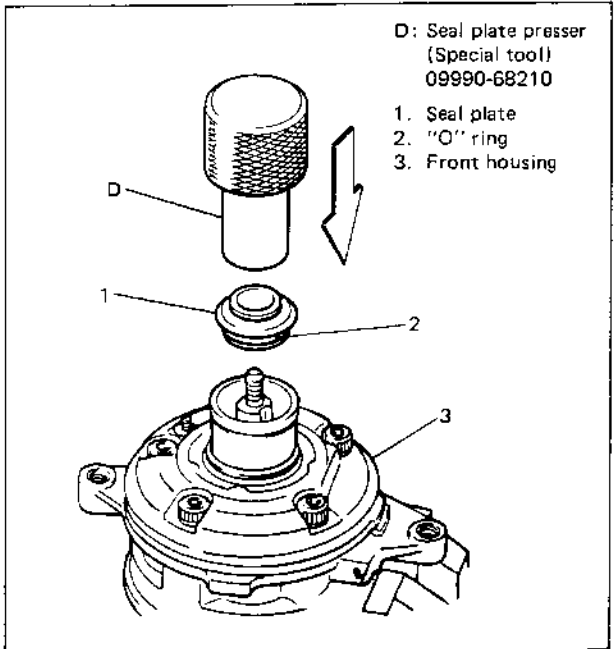


Fig. 1C-34

7) Install circlip.

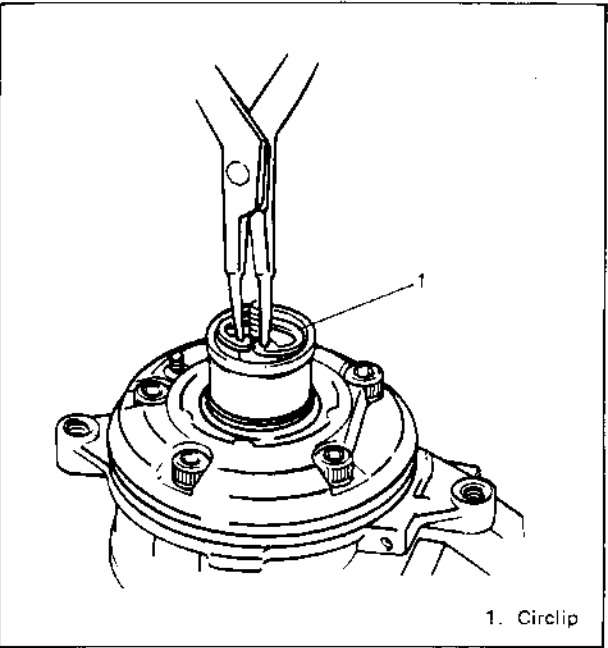


Fig. 1C-35

8) Install key in shaft groove.
a. Using a plastic hammer and key installing tool (Special tool), tap key lightly.

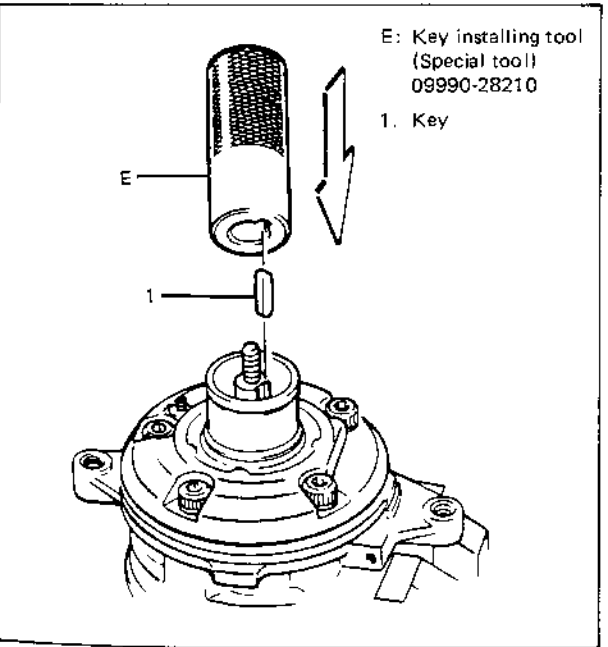


Fig. 1C-36

9) Install oil felt.
a. Put new oil felt to inside of bore.

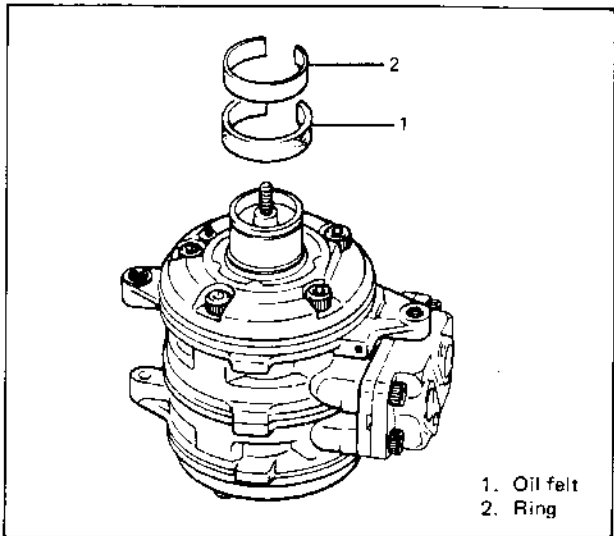


Fig. 1C-37

10) Pour compressor oil into compressor.

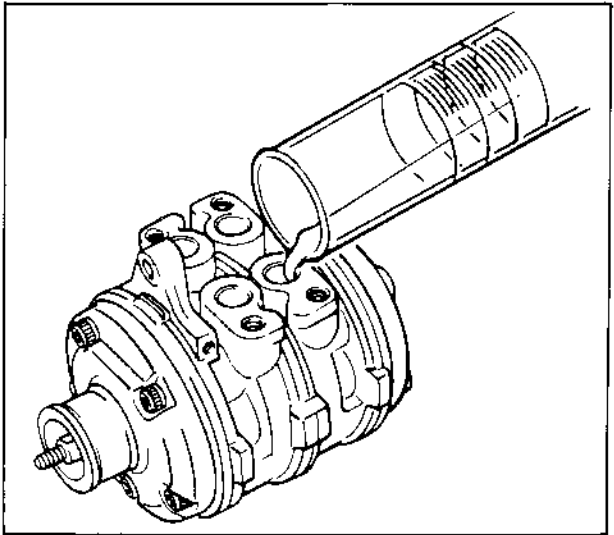


Fig. 1C-38

Additional oil after compressor overhauling	40 cc (2.4 cu. in.)
Oil capacity of air conditioner system	80 ± 20 cc (4.9 ± 0.1 cu. in.)

NOTE:
Compressor ass'y supplied from factory is filled with 80 cc oil. Therefore, when replacing only compressor ass'y with new one, drain 40 cc oil from it.
The rest 40 cc oil remain in other parts than compressor.

11) Install service valves.

- a. Lubricate new O-rings with compressor oil and install them in service connector.
- b. Install service connector to compressor.

	N·m	kg·m	lb·ft
Tightening torque	25 – 27	2.5 – 2.7	18.1 – 19.5

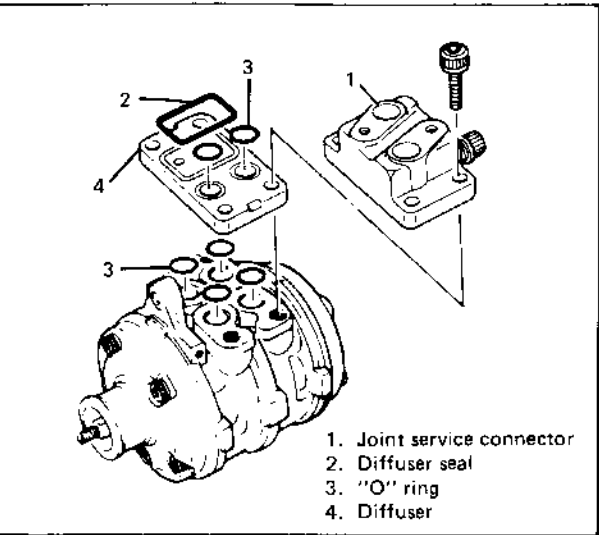


Fig. 1C-39

NOTE:

Suction port has larger internal opening than discharge port.

12) Check shaft rotating torque.

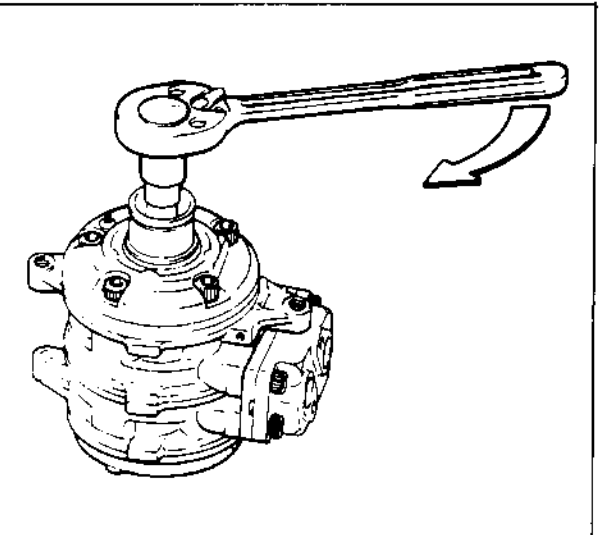


Fig. 1C-40

Starting torque	Less than 30 kg·cm (2.2 lb·ft)

ASSEMBLY OF MAGNETIC CLUTCH

(See Fig. 1C-2)

1) Install magnetic clutch coil.

Install clutch coil to compressor.

2) Install drive clutch.

- a. Install drive clutch on compressor shaft.
- b. Using snap ring pliers, install snap ring.

3) Install pressure plate.

- a. Adjust clearance between pressure plate and drive clutch by putting shims on compressor shaft.

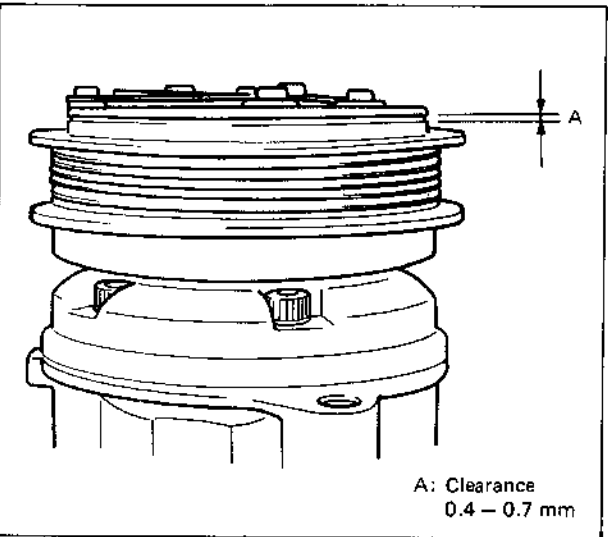


Fig. 1C-41

Standard clearance	0.4 – 0.7 mm (0.016 – 0.028 in)

- b. Tighten pressure plate fixing nut.

	N·m	kg·m	lb·ft
Tightening torque	15 – 17.5	1.5 – 1.75	11.0 – 12.7

FINISH

1) Performance gas leak test.

- a. Put caps on joint service connectors.
*As compressor ass'y supplied from factory has caps, keep and use these caps for this test and storing a repaired compressor.
- b. Charge compressor with refrigerant through charging valve until 3 kg/cm² (45 psi) pressure is obtained.
- c. Using gas leak detector, check compressor for leaks.
If leak is found, check and replace gasket, O-ring or shaft seal.

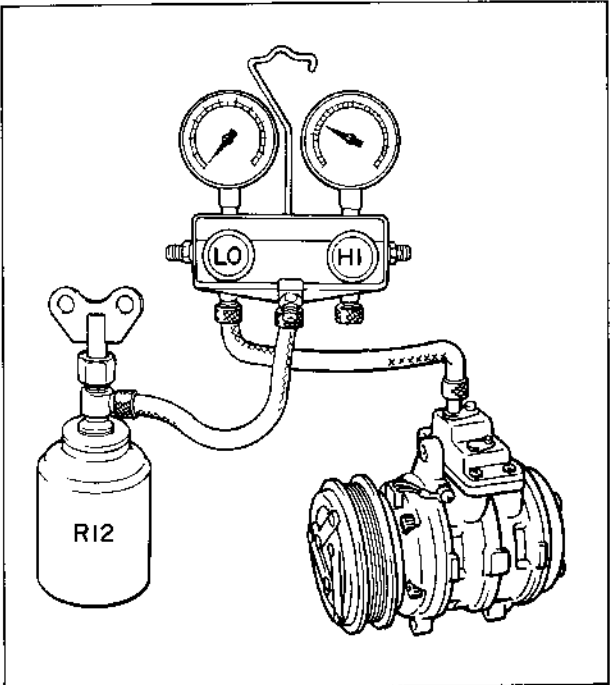


Fig. 1C-42

2) Evacuate compressor and charge with refrigerant

Make sure caps are tight and free from moisture and dust.

PERFORMANCE TEST OF COMPRESSOR

Performance test of repaired compressor is made by installing compressor on car and checking pressure measured with gauge manifold while operating air conditioning system. For mounting method of gauge manifold, refer to evacuating procedure as described previously.

NORMAL OPERATION

Measure pressures with suction port air temperature set at around 30° to 35°C (86° to 95° F), engine speed at 2,000 rpm, and at strongest cooling setting.

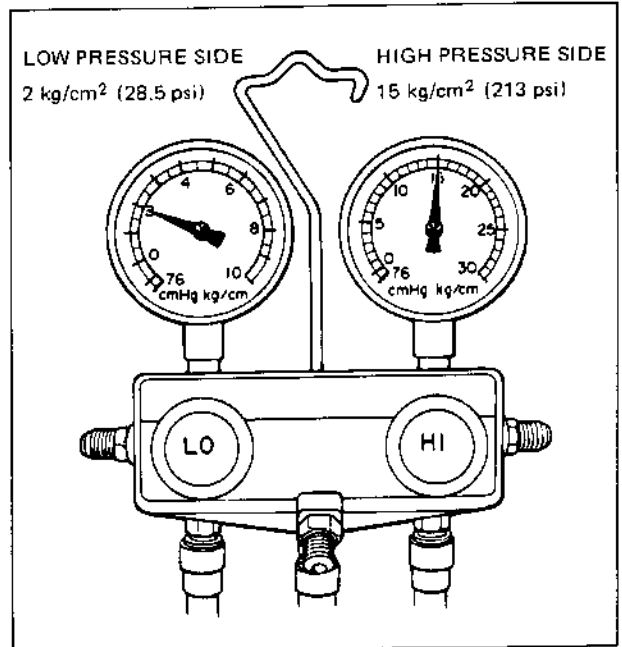


Fig. 1C-43

Standard Pressures	
Low pressure side	1.5 – 2.0 kg/cm ² (21.3 – 28.4 psi)
High pressure side	14.5 – 15 kg/cm ² (206 – 213 psi)

NOTE:
When storing a compressor for an extended period, charge compressor with refrigerant or dry nitrogen gas to prevent corrosion.

If low pressure side reads too high or high pressure side too low, probable cause is leakage from reed valve inside compressor or a broken sliding part (piston, cylinder, or others). In such a case, disassemble compressor and make a recheck.

SPECIAL TOOLS

NO.	TOOL NAME	TOOL NO.	USE
1.	Pressure plate remover	09990-58210	To remove magnetic clutch plate
2.	Seal plate remover	09990-48210	To remove seal plate
3.	Shaft seal remover	09990-38210	To remove/install shaft seal
4.	Seal plate pressor	09990-68210	To install seal plate
5.	Key pressor	09990-28210	To install key
6.	Oil filter wrench	09915-47310	To remove/install oil filter

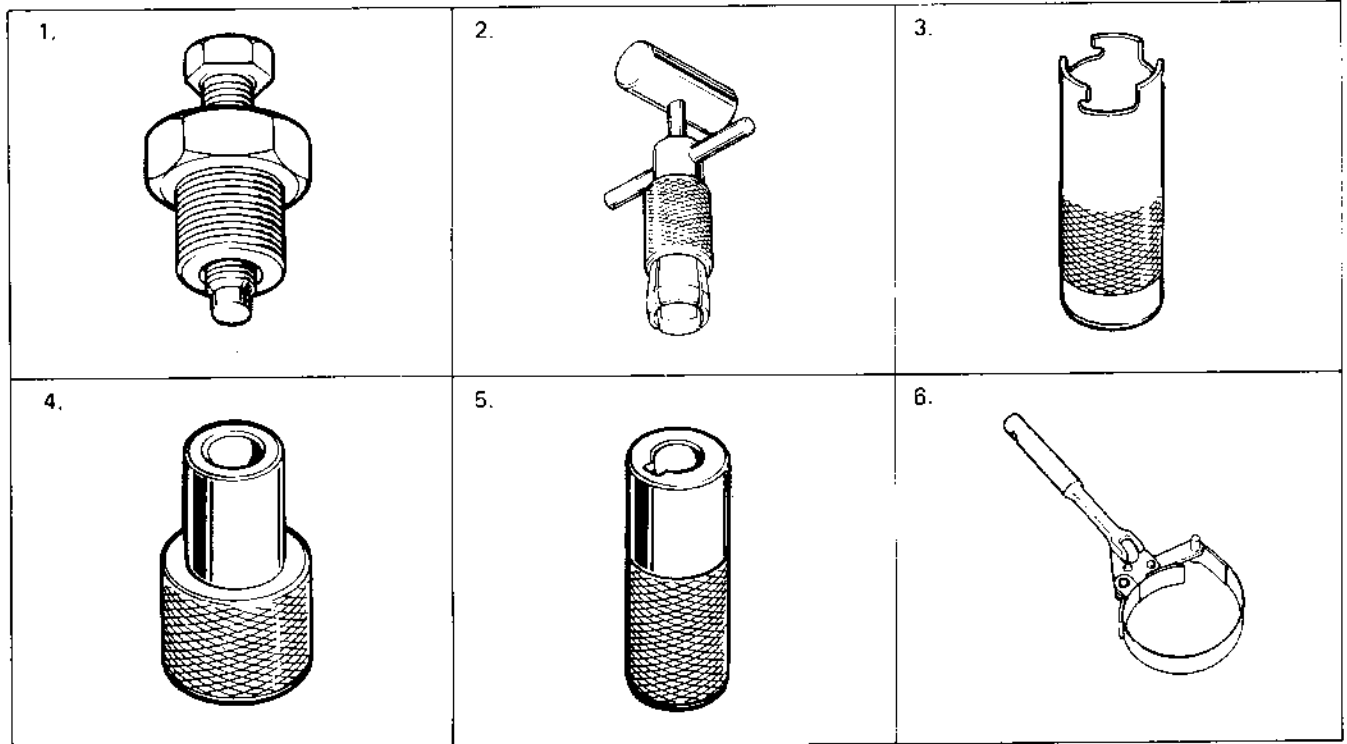


Fig. 1C-44

SECTION 2

BUMPERS AND SHEET METAL

CONTENTS

BUMPERS 2-1

HOOD 2-4

FRONT FENDER 2-5

BUMPERS

NOTE:
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.

FRONT BUMPER

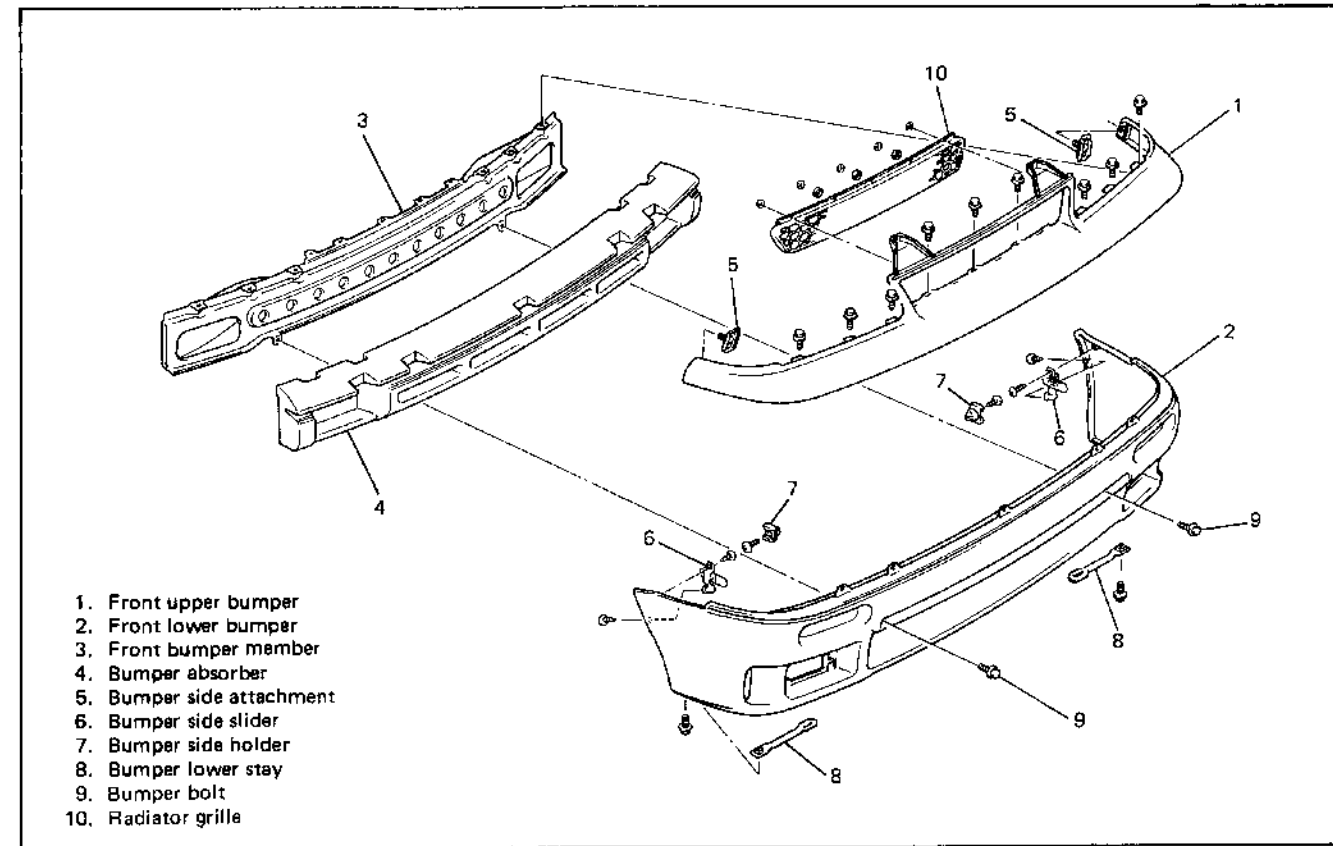


Fig. 2-1

REMOVAL

- 1) Remove front fender lining and disconnect fog light couplers.
- 2) Remove front turn signal lights.
- 3) Remove bumper fitting bolts and nuts shown in Fig. 2-2.

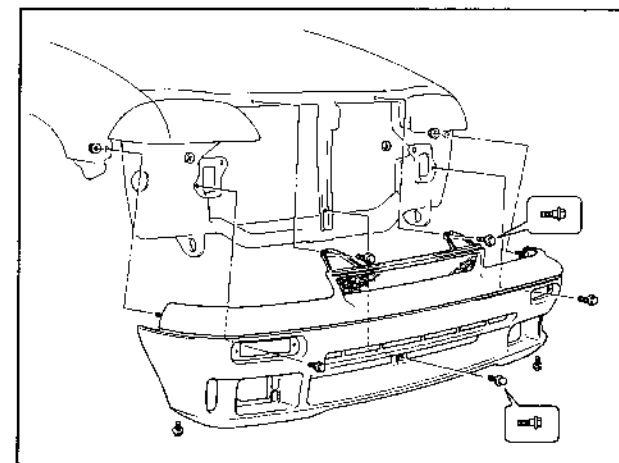


Fig. 2-2

- 4) Slide bumper (with bumper member) forward to remove it.

INSTALLATION

- 1) Connect fog light couplers.
- 2) Slide bumper onto bumper side attachments on both fenders.
- 3) Use bumper bolts and nuts to fix bumper in position.
- 4) Install front turn signal lights.

REAR BUMPER

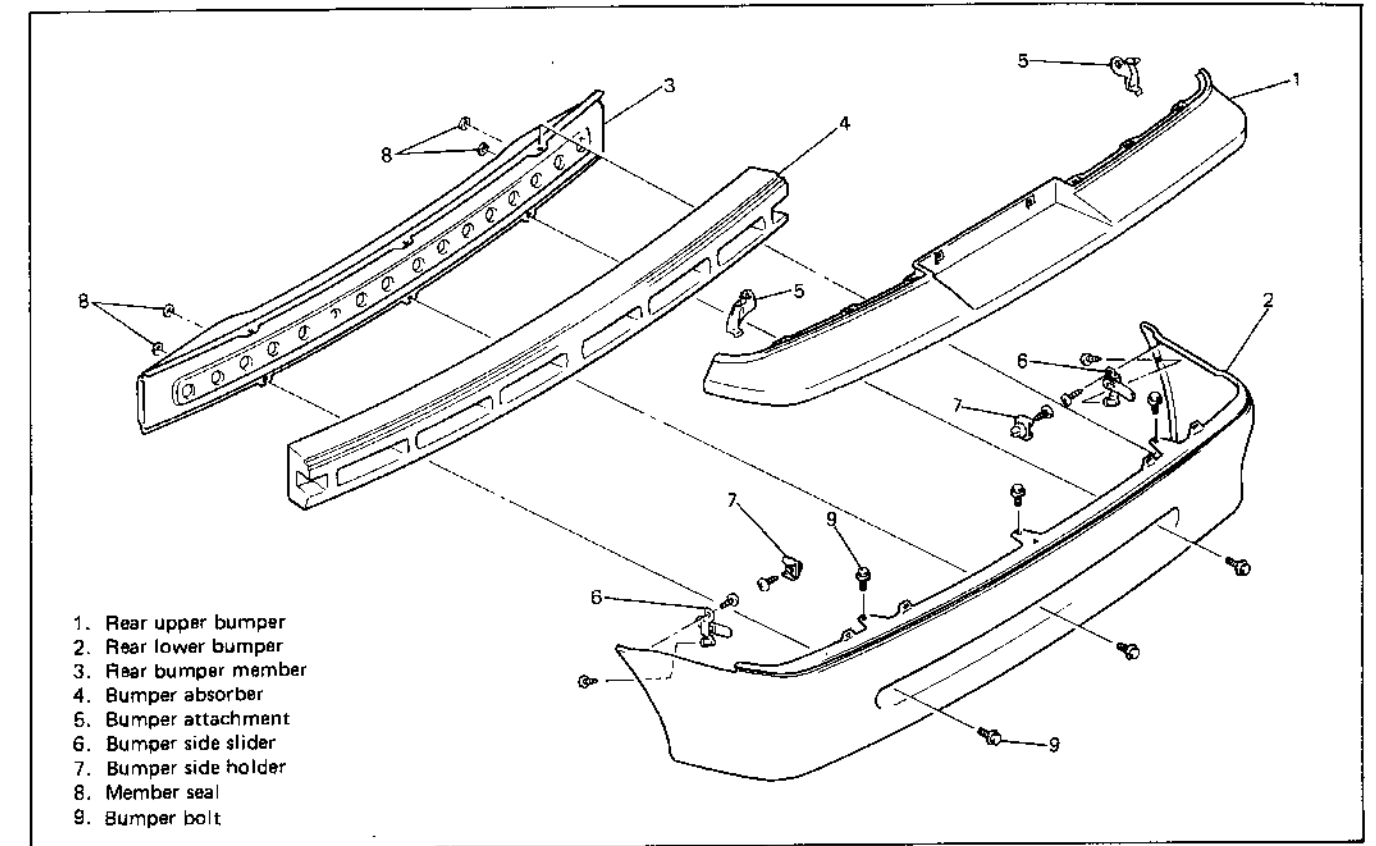


Fig. 2-3

REMOVAL

- 1) Remove rear combination light fitting screws.
- 2) Remove bumper fitting bolts and nuts shown in Fig. 2-4.

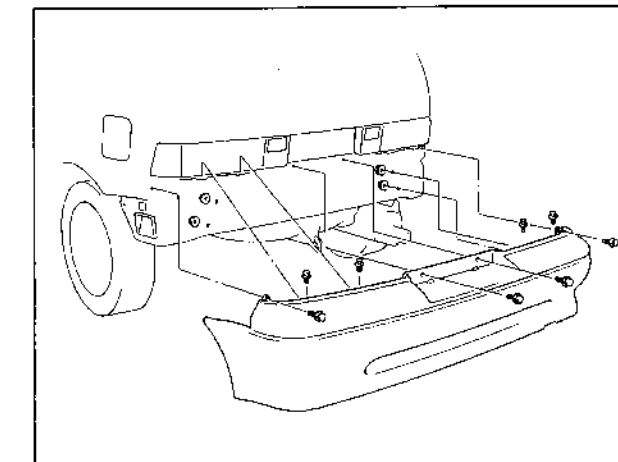


Fig. 2-4

- 3) Temporarily install rear combination lights in position with screws.
- 4) Slide bumper (with bumper member) backward to remove it.

INSTALLATION

- 1) Slide bumper onto side attachments on both fenders.
- 2) Install removed parts in reverse order of removal.

HOOD

REMOVAL

Remove four mounting bolts to detach hood.

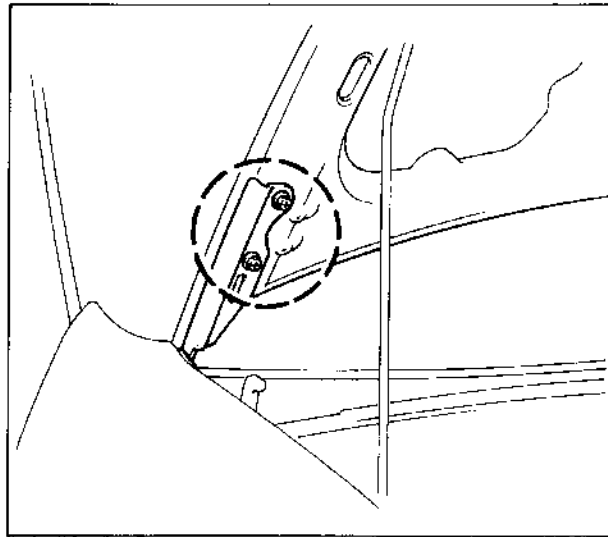


Fig. 2-5 Hood Mounting Bolts (Right Side)

ADJUSTMENT

A. Fore-and-aft and right-and-left adjustment

Slacken four mounting bolts for adjustment.

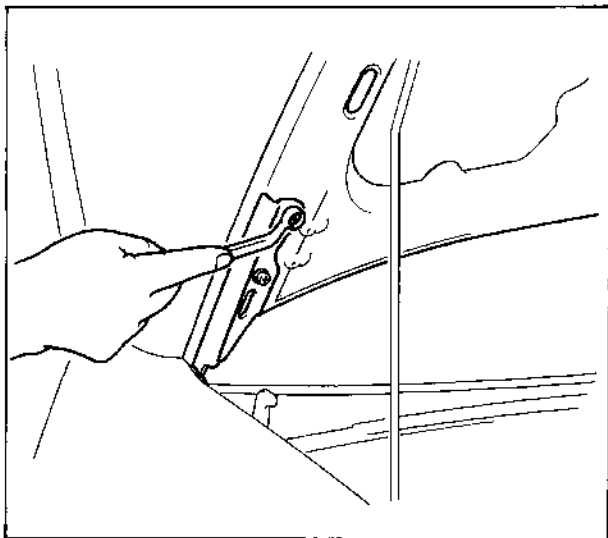


Fig. 2-6 Hood Mounting Bolts (Right Side)

B. Vertical adjustment

If only one side (right or left) of hood is not level with front fender, make it level by tightening or loosening hood cushion.

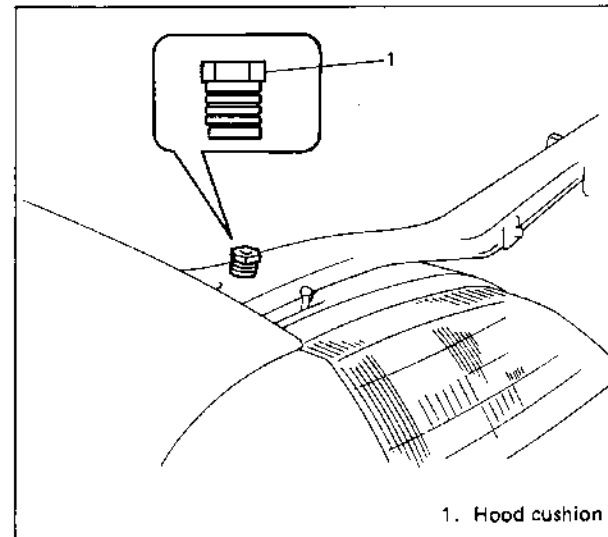


Fig. 2-7 Vertical Hood Adjustment

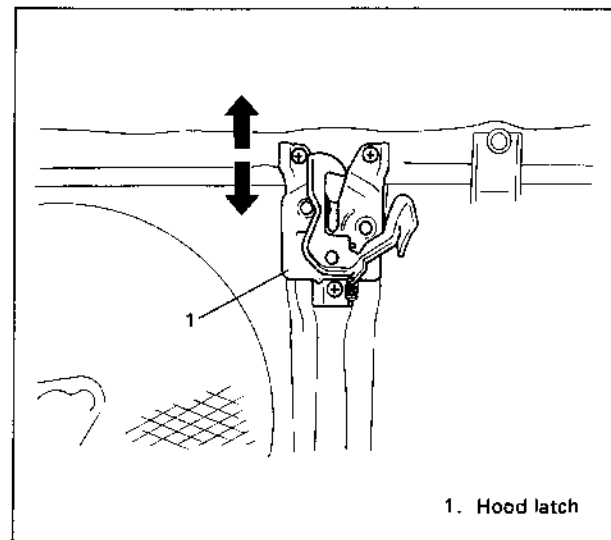


Fig. 2-8 Hood Latch Adjustment

FRONT FENDER

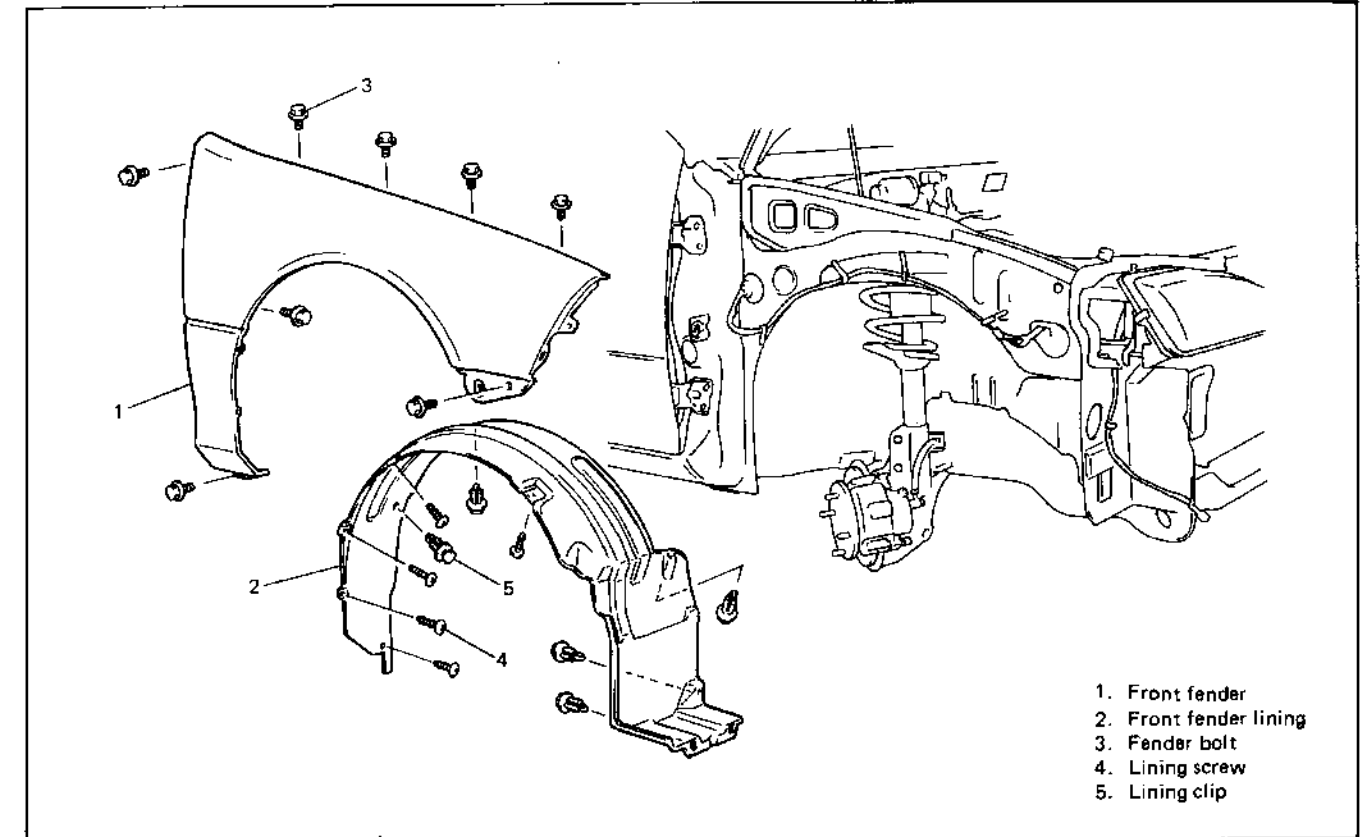


Fig. 2-9

REMOVAL

- 1) Remove front bumper (Refer to p. 2-2).
- 2) Remove clearance lights.

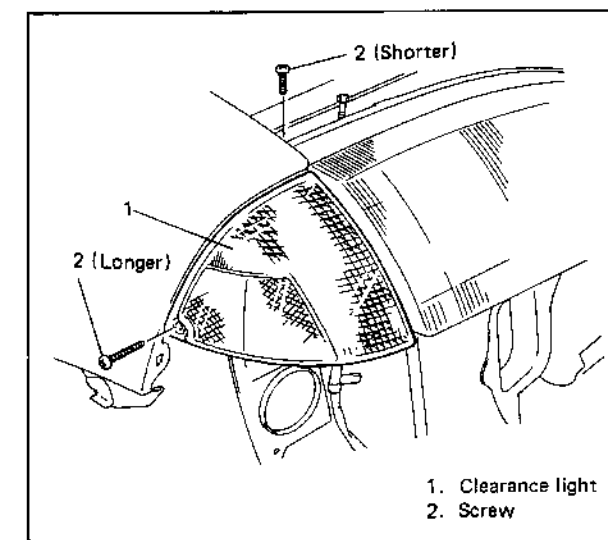


Fig. 2-10 Removing Clearance Light

- 3) Remove front fender.

INSTALLATION

1. Reverse removal procedure for installation.

NOTE:

When replacing front fender, be sure to apply anti-corrosive treatment to replacement fender.

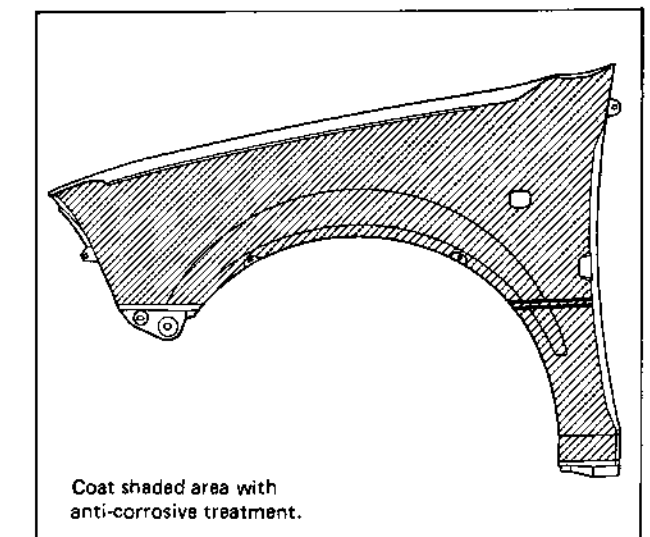


Fig. 2-11 Replacement Fender

SECTION 3

STEERING, SUSPENSION, WHEELS AND TIRES

DIAGNOSIS 3-1

FRONT END ALIGNMENT 3A-1

MANUAL RACK AND PINION 3B-1

STEERING COLUMN 3C-1

FRONT SUSPENSION 3D-1

REAR SUSPENSION 3E-1

WHEELS AND TIRES 3F-1

CONTENTS

GENERAL DIAGNOSIS 3-1	Radial Tire Waddle 3-6
TIRE DIAGNOSIS 3-6	Radial Tire Lead 3-8
Irregular and/or Premature Wear 3-6	VIBRATION DIAGNOSIS 3-8
Wear Indicators 3-6	

GENERAL DESCRIPTION

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To avoid using the wrong symptom, always road test the car first. Proceed with the following preliminary inspections and correct any defects which are found.

- 1) Inspect tires for proper pressure and uneven wear.
- 2) Raise car on a hoist and inspect front and rear suspension and rack and pinion for loose or damaged parts.
- 3) Spin front wheels. Inspect for out-of-round tires, out-of-balance tires, bent rims, loose and/or rough wheel bearings.

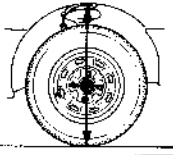
GENERAL DIAGNOSIS CHART A		
Condition	Possible Cause	Correction
Car Pulls (Leads)	1. Mismatched or uneven tires.	Replace tire.
	2. Tires not adequately inflated.	Adjust tire pressure.
	3. Broken or sagging springs.	Replace spring.
	4. Radial tire lateral force.	Replace tire.
	5. Disturbed front end alignment.	Check and adjust front end alignment.
	6. Disturbed rear wheel alignment.	Check and adjust rear wheel alignment.
	7. Brake dragging in one road wheel.	Repair front brake.
	8. Loose, bent or broken front or rear suspension parts.	Tighten or replace suspension parts.

GENERAL DIAGNOSIS CHART B

Condition	Possible cause	Correction
Abnormal or Excessive Tire Wear	1. Sagging or broken spring. 2. Tire out of balance. 3. Disturbed front or rear end alignment. 4. Faulty strut (shock absorber). 5. Hard driving. 6. Overloaded car. 7. Not rotating tire. 8. Worn or loose road wheel bearing. 9. Wobbly wheel or tire. 10. Tires not adequately inflated.	Replace spring. Adjust balance or replace tire. Check and adjust front end alignment. Replace strut. Replace tire. Replace tire. Replace or rotate tire. Replace wheel bearing. Replace wheel or tire. Adjust tire pressure.
Wheel Tramp	1. Blister or bump on tire. 2. Improper strut (shock absorber) action.	Replace tire. Replace strut.
Shimmy, Shake or Vibration	1. Tire or wheel out of balance. 2. Loose wheel bearings. 3. Worn tie rod ends. 4. Worn lower ball joints. 5. Excessive wheel runout. 6. Blister or bump on tire. 7. Excessively loaded radial runout of tire/wheel assembly. 8. Disturbed front end alignment. 9. Loose or worn steering linkage. 10. Loose steering gear case bolts.	Balance wheels or replace tire and/or wheel. Replace wheel bearing. Replace tie rod end. Replace front suspension arm. Repair or replace wheel and/or tire. Replace tire. Replace tire or wheel. Check and adjust front end alignment. Tighten or replace steering linkage. Tighten case bolts.
Hard Steering	1. Bind in tie rod end ball studs or lower ball joints. 2. Disturbed front end alignment. 3. Rack and pinion adjustment. 4. Tire not adequately inflated. 5. Bind in steering column.	Replace tie rod end or front suspension arm. Check and adjust front end alignment. Check and adjust rack & pinion torque. Inflate tires to proper pressure. Repair or replace.

GENERAL DIAGNOSIS CHART C

Condition	Possible Cause	Correction
Too Much Play In Steering	1. Wheel bearings worn. 2. Rack and pinion attachments loose. 3. Rack and pinion adjustments. 4. Worn steering shaft joints. 5. Worn tie rod ends or tie rod inside ball joints. 6. Worn lower ball joints.	Replace. Tighten or repair. Check and adjust rack & pinion torque. Replace joint. Replace tie rod end or tie rod. Replace front suspension control arm.
Poor Returnability	1. Bind in tie rod end ball studs. 2. Bind in ball joints. 3. Bind in steering column. 4. Poorly lubricated rack and pinion. 5. Disturbed front end alignment. 6. Rack and pinion adjustment. 7. Tires not adequately inflated.	Replace tie rod end. Replace. Repair or replace. Check, repair or lubricate rack & pinion. Check and adjust front end alignment. Check and adjust rack & pinion torque. Adjust tire pressure.
Rack and Pinion Noise (Rattle or Chuckle)	1. Rack and pinion attachments loose. 2. Worn rack bush. 3. Rack and pinion adjustment.	Tighten steering gear case mounting bolts. Replace. Check and adjust rack & pinion torque.
Abnormal Noise, Front End	1. Worn, sticky or loose tie rod ends, lower ball joints, tie rod inside ball joints or drive shaft joints. 2. Damaged struts or mountings. 3. Worn suspension arm bushings. 4. Loose stabilizer bar. 5. Loose wheel nuts. 6. Loose suspension bolts or nuts. 7. Broken or otherwise damaged wheel bearings. 8. Broken suspension springs. 9. Poorly lubricated or worn strut bearings. 10. Worn or sticky stabilizer joints.	Replace tie rod end, suspension arm, tie rod or drive shaft joint. Repair or replace. Replace. Tighten bolts or nuts, replace bushes. Tighten wheel nuts. Tighten suspension bolts or nuts. Replace. Replace. Lubricate or replace strut bearing. Replace.

GENERAL DIAGNOSIS CHART D		
Condition	Possible Cause	Correction
Wander Or Poor Steering Stability	1. Mismatched or uneven tires.	Replace or inflate tires to proper pressure.
	2. Loose ball joints and tie rod ends.	Replace suspension arm or tie rod end.
	3. Faulty struts or mounting.	Replace strut or repair mounting.
	4. Loose stabilizer bar.	Tighten or replace stabilizer bar or bush.
	5. Broken or sagging springs.	Replace spring.
	6. Rack and pinion adjustment.	Check and adjust rack and pinion torque.
	7. Front end alignment.	Check and adjust front end alignment.
	8. Loose stabilizer joints.	Replace joint.
Erratic Steering When Braking	1. Worn wheel bearings.	Replace.
	2. Broken or sagging springs.	Replace coil spring.
	3. Wheel tires are inflated unequally.	Inflate tires to proper pressure.
	4. Disturbed front end alignment.	Check and adjust front end alignment.
	5. Brakes not working in unison.	Refer to Section 5.
Low Or Uneven Trim Height Right-to-left trim height (H) difference should be within 15 mm (0.6 in) with curb weight.  * Same with rear side.	1. Broken or sagging springs.	Replace.
	2. Over loaded.	Check loading.
	3. Incorrect springs.	Replace.
Ride Too Soft	1. Faulty struts (shock absorbers).	Replace strut.
Suspension Bottoms	1. Overloaded.	Check loading.
	2. Faulty struts (shock absorbers).	Replace strut.
	3. Incorrect broken or sagging springs.	Replace.

GENERAL DIAGNOSIS CHART E		
Condition	Possible Cause	Correction
Body Leans Or Sways In Corners	1. Loose stabilizer bar.	Tighten stabilizer bar bolts or nuts, or replace bushes or joint.
	2. Faulty struts (shock absorbers) or mounting.	Replace strut or tighten mounting.
	3. Broken or sagging springs.	Replace.
	4. Overloaded.	Check loading.
Cupped Tires	1. Front Struts defective.	Replace.
	2. Worn wheel bearings.	Replace.
	3. Excessive tire or wheel run-out.	Replace tire or wheel disc.
	4. Worn ball joints.	Replace front suspension arm.
	5. Tire out of balance.	Adjust tire balance.

TIRE DIAGNOSIS

IRREGULAR AND/OR PREMATURE WEAR

Irregular and premature wear has many causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.

If the following conditions are noted, rotation is necessary:

1. Front tire wear is different from rear.
2. Uneven wear exists across the tread of any tire.
3. Front tire wear is unequal between the right and left.
4. Rear tire wear is unequal between the right and left.
5. There is cupping, flat spotting, etc.

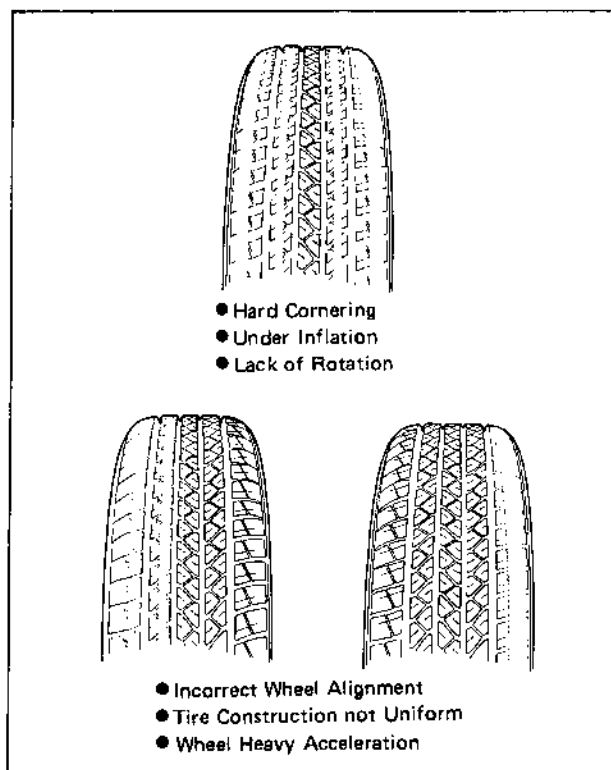


Fig. 3-1 Tire Wear Diagnosis

A wheel alignment check is necessary if following conditions are noted:

1. Front tire wear is unequal between the right and left.
2. Wear is uneven across the tread of any front tire.
3. Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.

WEAR INDICATORS (FIG. 3-2)

Original equipment tires have built-in tread wear indicators to show when they need replacement. These indicators will appear as 12 mm (0.47 inch) wide bands when the tire tread depth becomes 1.6 mm (0.063 inch). When the indicators appear in 3 or more grooves at 6 locations, tire replacement is recommended.

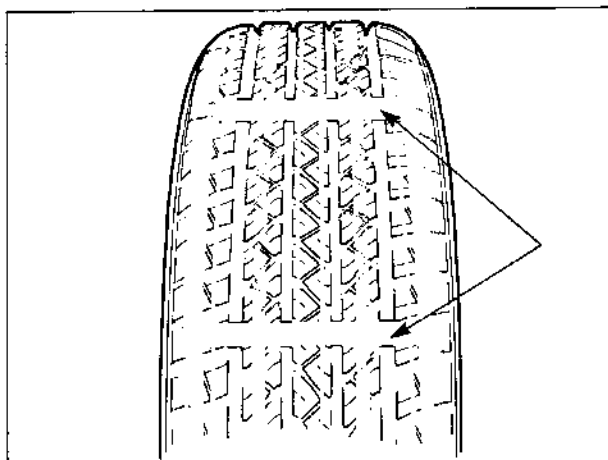


Fig. 3-2 Tire Wear Indicator

RADIAL TIRE WADDLE (FIG. 3-3)

Waddle is side to side movement at the front and/or rear of the car. It is caused by the steel belt not being straight within the tire. It is most noticeable at a low speed, 5 to 30 mph.

It is possible to locate the faulty tire by road testing the car. If it is on the rear, the rear end of the vehicle shakes from side to side or "waddles". To the driver in his seat, it feels as though someone is pushing on the side of the vehicle.

If the faulty tire is on the front, waddling is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in the car.

Waddle can be quickly diagnosed by using Tire Problem Detector (TPD) and following the equipment manufacturer's recommendations.

If TPD is not available, an alternative method of substituting known good tire/wheel assemblies can be used as follows, although it takes a longer time.

1. Ride car to determine whether the front or rear waddles.
2. Install tires and wheels that are known to be good (on similar car) in place of those on waddling end of car. If waddling end cannot be identified, substitute rear ones.
3. Road test again. If improvement is noted, reinstall originals one at a time till waddle causal tire is found. If no improvement is noted, install known good tires in place of all four. Then reinstall originals in the same manner as above.

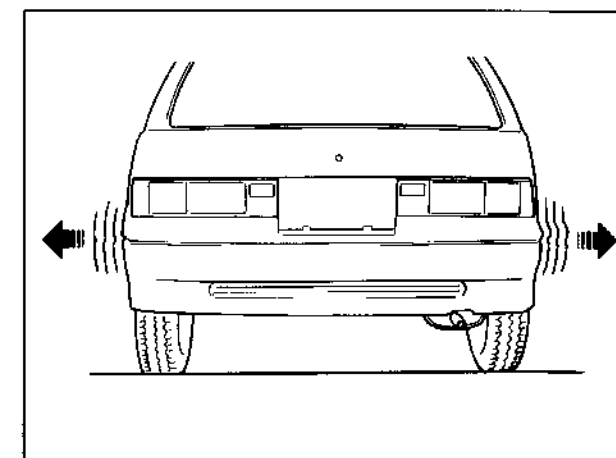


Fig. 3-3 Radial Tire Waddle

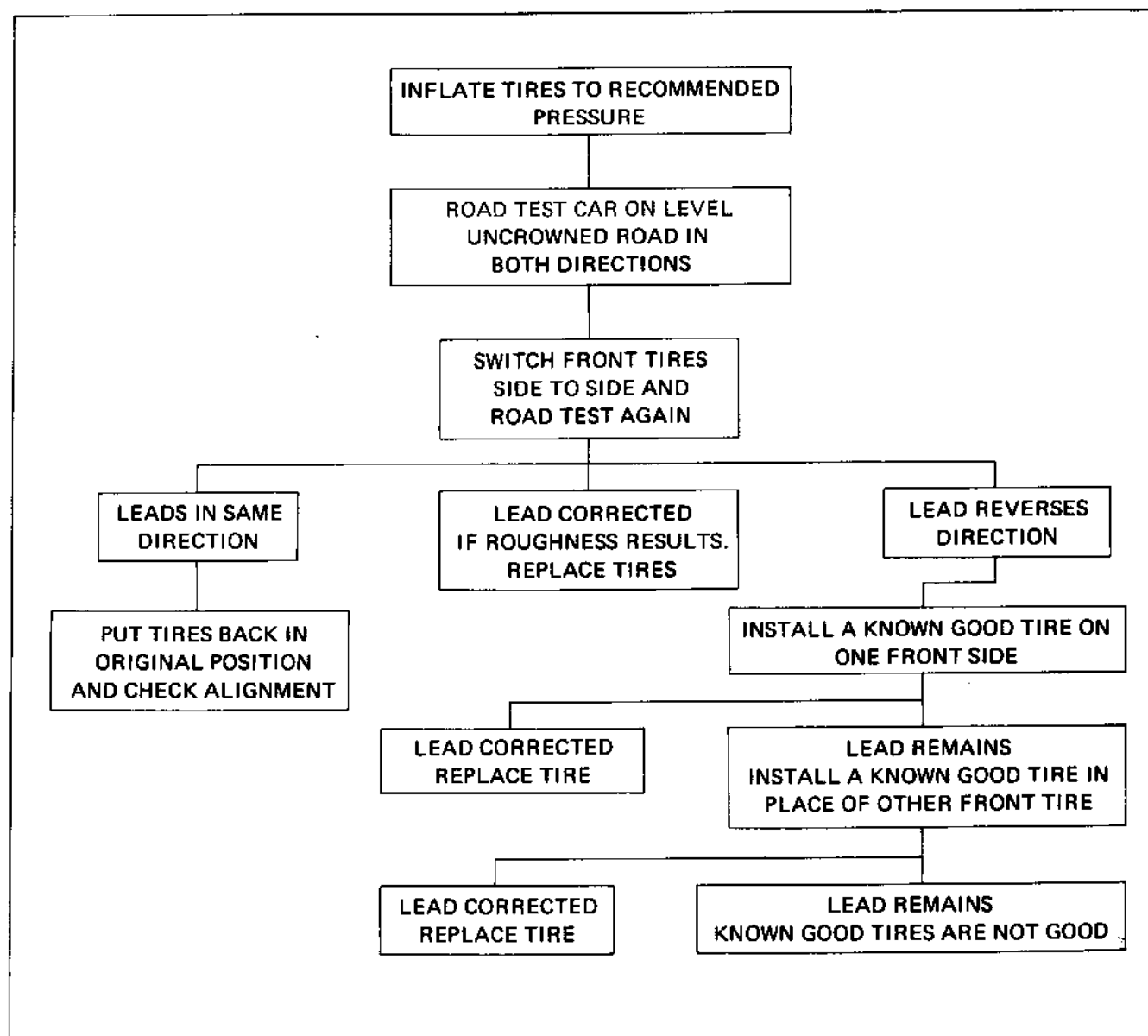


Fig. 3-4 Lead Diagnosis

RADIAL TIRE LEAD

"Lead" is the deviation of the car from a straight path on a level road even with no pressure on the steering wheel.

Lead is usually caused by:

- 1) Incorrect alignment.
- 2) Uneven brake adjustment.
- 3) Tire construction.

The way in which a tire is built can produce lead in a car. An example of this is placement of the belt. Off center belts on radial tires can cause the tire to develop a side force while rolling straight down the road. If one side of the tire has a little larger diameter than the other, the tire will tend to roll to one side. This will develop a side force which can produce car lead. The procedure in Fig. 3-4 should be used to make sure that front alignment is not mistaken for tire lead.

- 1) Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the car, be sure to check that ride roughness has not developed.
- 2) Rear tires will not cause lead.

VIBRATION DIAGNOSIS

Wheel unbalance causes most of the highway speed vibration problems. If a vibration remains after dynamic balancing, its possible causes are as follows.

- 1) Tire runout.
- 2) Wheel runout.
- 3) Tire stiffness variation.

Measuring tire and/or wheel free runout will uncover only part of the problem. All three causes, known as loaded radial runout, must be checked by using a Tire Problem Detector (TPD). If TPD is not available, alternative method of substituting known good tire and wheel assemblies on the problem car can be used, although it takes a longer time.

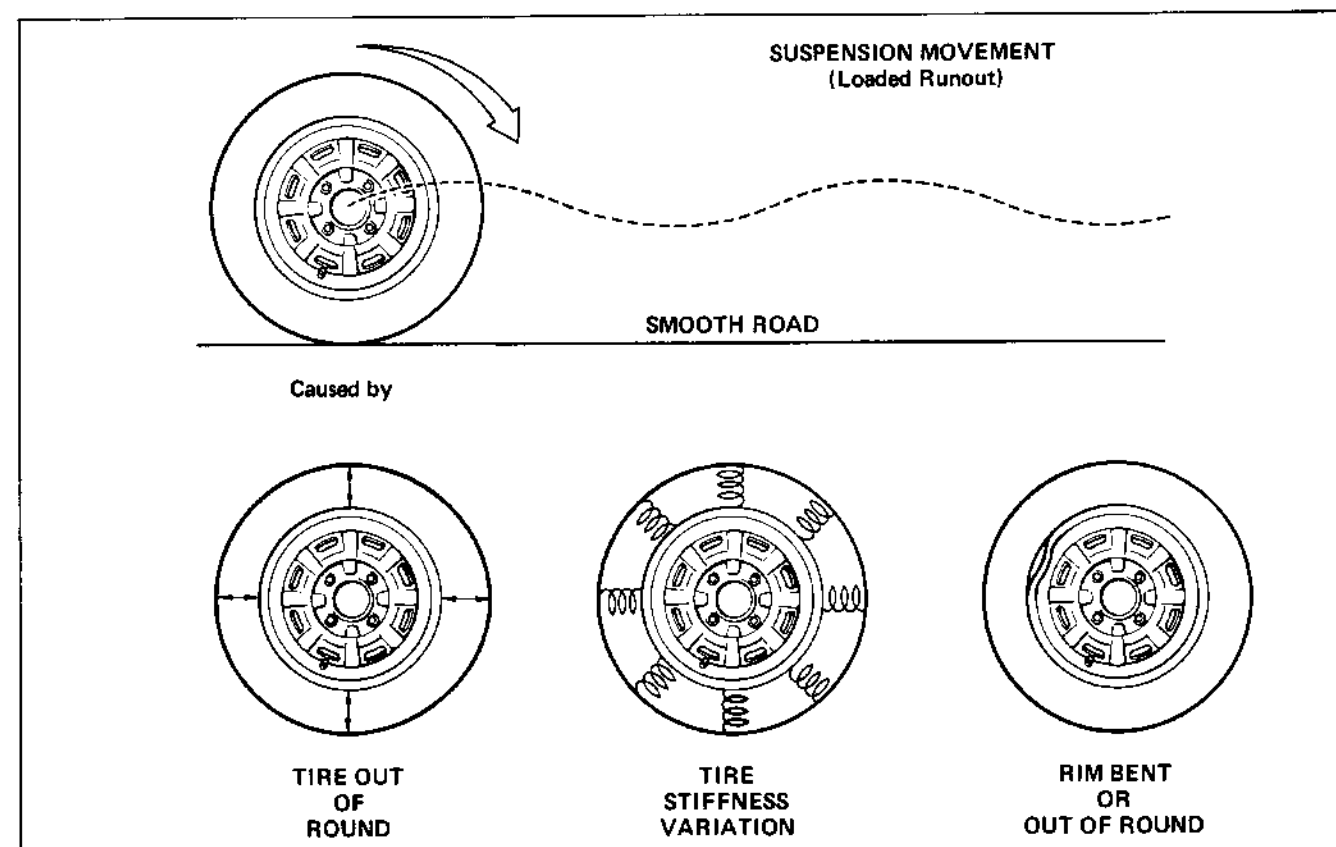


Fig. 3-5 Vibration

SECTION 3A

FRONT END ALIGNMENT

CONTENTS

DIAGNOSIS	3-1
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Toe Setting — Figure 3A-1	3A-1
Camber — Figure 3A-1	3A-1

Preliminary Checks Prior to Adjusting	
Front Alignment	3A-2
Toe Adjustment	3A-2
Camber and Caster Adjustment	3A-2
Steering Angle	3A-3

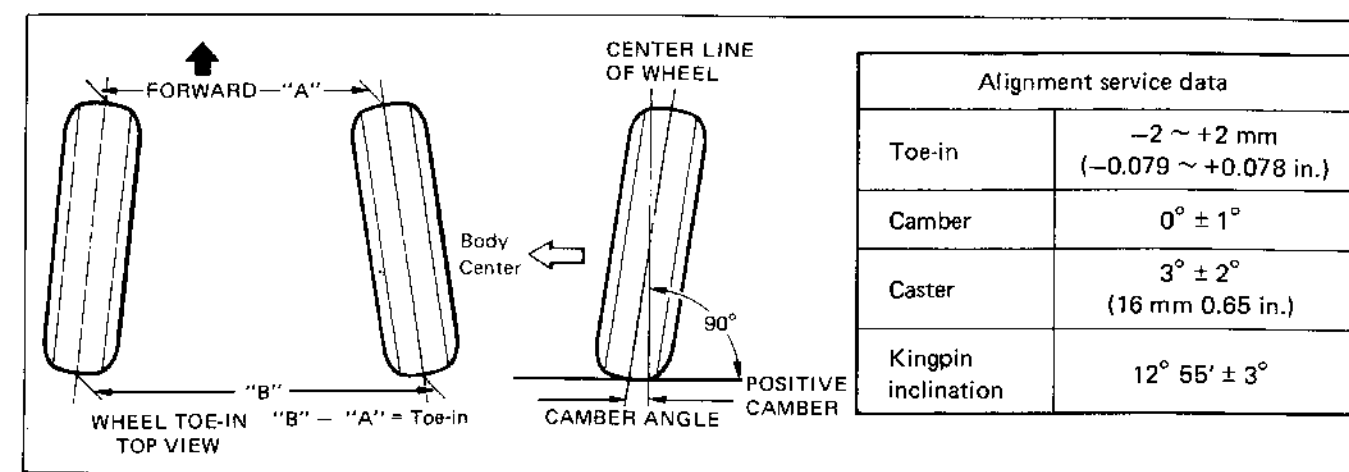
GENERAL DESCRIPTION

Fig. 3A-1 Toe-in and Camber

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 first and damaged body should be repaired or damaged suspension should be replaced.

TOE SETTING-FIGURE 3A-1

Toe is the turning in or out of the front wheels. The purpose of a toe specification is to ensure parallel rolling of the front wheels (Excessive toe-in or toe-out may increase tire wear). Amount of toe can be obtained by subtracting "A" from "B" as shown in Fig. 3A-1 and therefore is given in mm (in.).

CAMBER-FIGURE 3A-1

Camber is the tilting of the front wheels from the vertical, as viewed from the front of the car. When the wheels tilt outward at the top, the camber is positive. When the wheels tilt inward at the top, the camber is negative. The amount of tilt is measured in degrees.

PRELIMINARY CHECKS PRIOR TO ADJUSTING FRONT ALIGNMENT

Steering and vibration complaints are not always the result of improper alignment. An additional item to be checked is possibility of tire lead due to worn or improperly manufactured tires. "Lead" is the deviation of the car from a straight path on a level road without hand pressure on the steering wheel. Section 3 of this manual contains a procedure for determining presence of a tire lead problem.

Before making any adjustment affecting toe setting, following checks and inspections should be made to insure correctness of alignment readings and alignment adjustments:

- 1) Check all tires for proper inflation pressures and approximately the same tread wear.
- 2) Check ball joints for looseness. Check tie rod ends; if excessive looseness is noted, it must be corrected before adjusting.
- 3) Check wheels and tires for run-out.
- 4) Check car trim height. If it is out of limit and correction is necessary, it must be made before adjusting toe (Refer to p. 3-4).
- 5) Check suspension arms for looseness.
- 6) Check for loose or missing stabilizer bar attachment.
- 7) Consideration must be given to excess loads, such as tool boxes. If this excess load is normally carried in car, it should remain there during alignment checks.
- 8) Consider the condition of the equipment being used to check alignment and follow its manufacturer's instructions.
- 9) Whatever equipment is used to check alignment, car must be placed on level surface.

TOE ADJUSTMENT

Toe is adjusted by changing tie rod length. Loosen right and left tie rod end lock nuts first and then rotate right and left tie rods by the same amount to align toe-in to specification. In this adjustment, right and left tie rods should become equal in length ("A" in Fig. 3A-2). Before rotating tie rods, apply grease between tie rods and rack boots so that boots won't be twisted.

After adjustment, tighten lock nuts to specified torque and make sure that rack boots are not twisted.

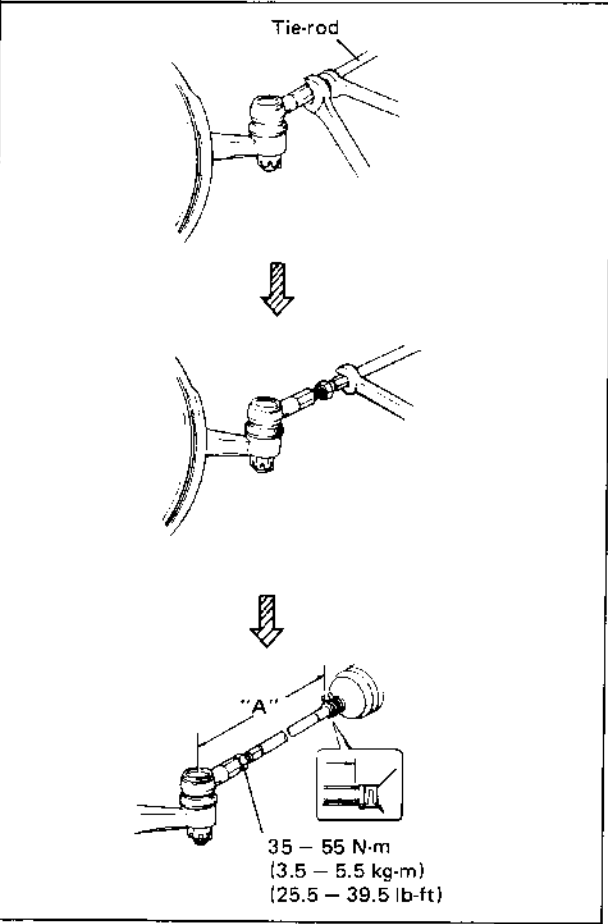


Fig. 3A-2 Toe-Adjustment

CAMBER AND CASTER ADJUSTMENT

Should camber or caster be found out of specifications upon inspection, locate its cause first. If it is in damaged, loose, bent, dented or worn suspension parts, they should be replaced. If it is in car body, repair it so as to attain specifications. To prevent possible incorrect reading of camber or caster, car front end must be moved up and down a few times before inspection.

STEERING ANGLE

Steering angle	inside	38°
	outside	32°

When tie rod or tie rod end was replaced, check toe and then also steering angle with turning radius gauge.

If steering angle is not correct, check if right and left tie rods are equal in length ("A" in Fig. 3A-3).

NOTE:

If tie rod lengths were changed to adjust steering angle, reinspect toe-in.

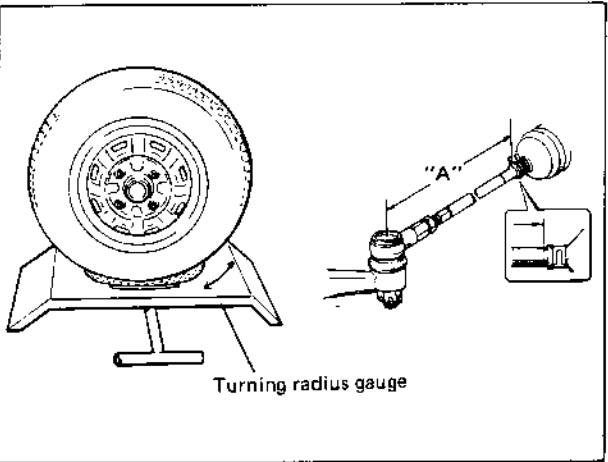


Fig. 3A-3 Steering Angle Inspection

Reference information:

SIDE SLIP:

For inspecting front wheel side slip with side slip tester:

Side slip limit: Less than 3 mm/m
(Less than 0.118 in/3 ft)

If side slip exceeds above limit, toe-in or front wheel alignment may not be correct.

SECTION 3B

MANUAL RACK AND PINION

NOTE:

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.

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2. Remove and Install Manual Rack and Pinion Assembly (Steering Gear Case)	3B- 5	REQUIRED SERVICE MATERIAL ...	3B-16
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GENERAL DESCRIPTION

The rack and pinion steering system consists of two main components, the rack and the pinion. When the steering wheel is turned, the motion is transmitted to the steering shaft, shaft joint and then to the pinion. Since the pinion teeth mesh with teeth on rack, the motion is further transferred to the rack and changed to linear motion. The force is then transmitted through the tie rods to the steering knuckles which turn wheels.

NOTE:

Although the figure below show only the left-hand side steering car, the same work procedure and data apply to the right-hand side steering car.

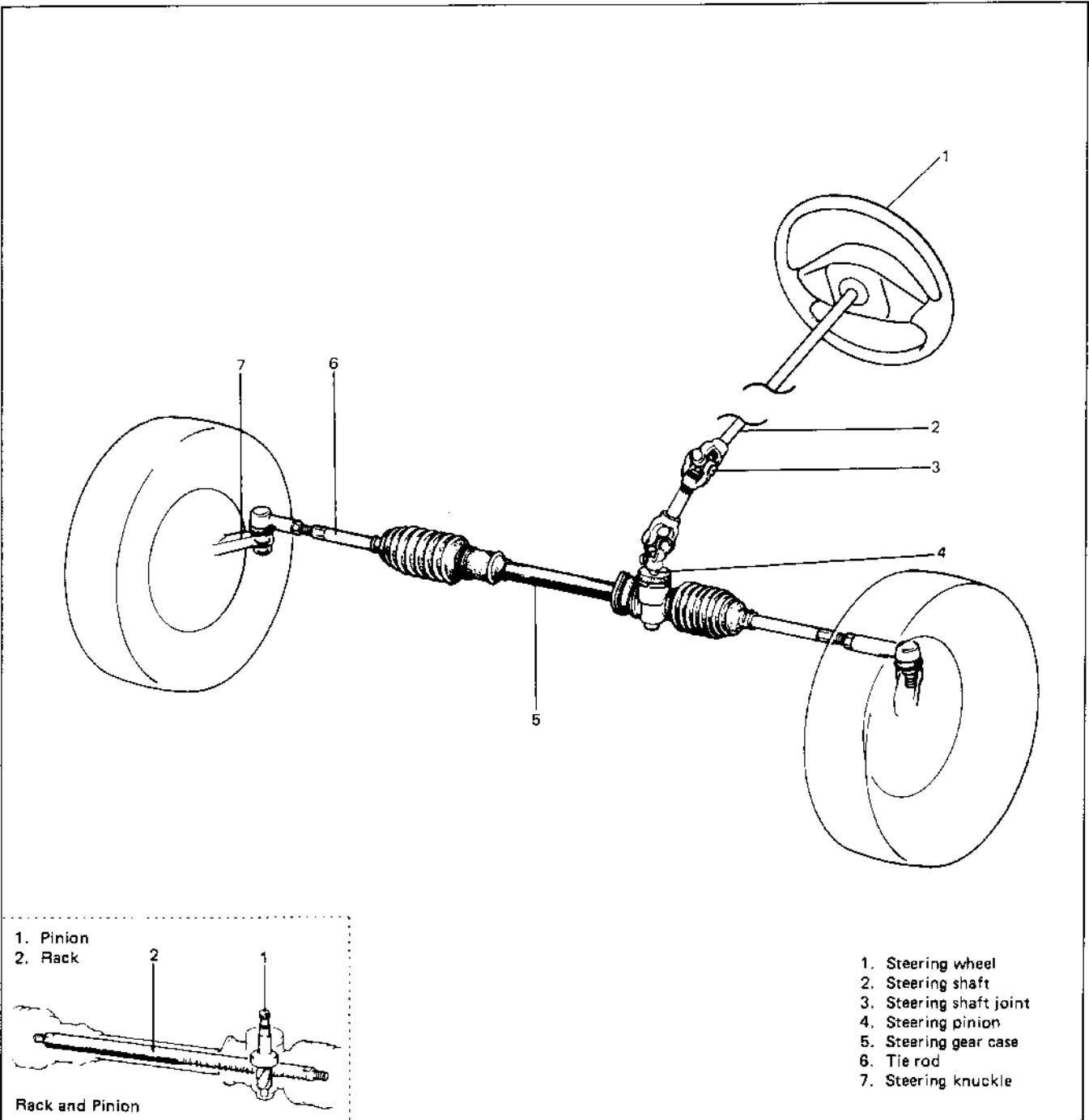


Fig. 3B-1 General Description of Steering System

ON-CAR SERVICE

LUBRICATION

When inner parts of the steering gear case were disassembled, they should be washed clean before reassembly. It is recommended to use the grease as given at the right where grease application is indicated in the text.

*SUZUKI SUPER GREASE (E) 99000-25050, or Lithium grease (applicable for $-40^{\circ}\text{C} \sim 130^{\circ}\text{C}$ or $-40^{\circ}\text{F} \sim 266^{\circ}\text{F}$)

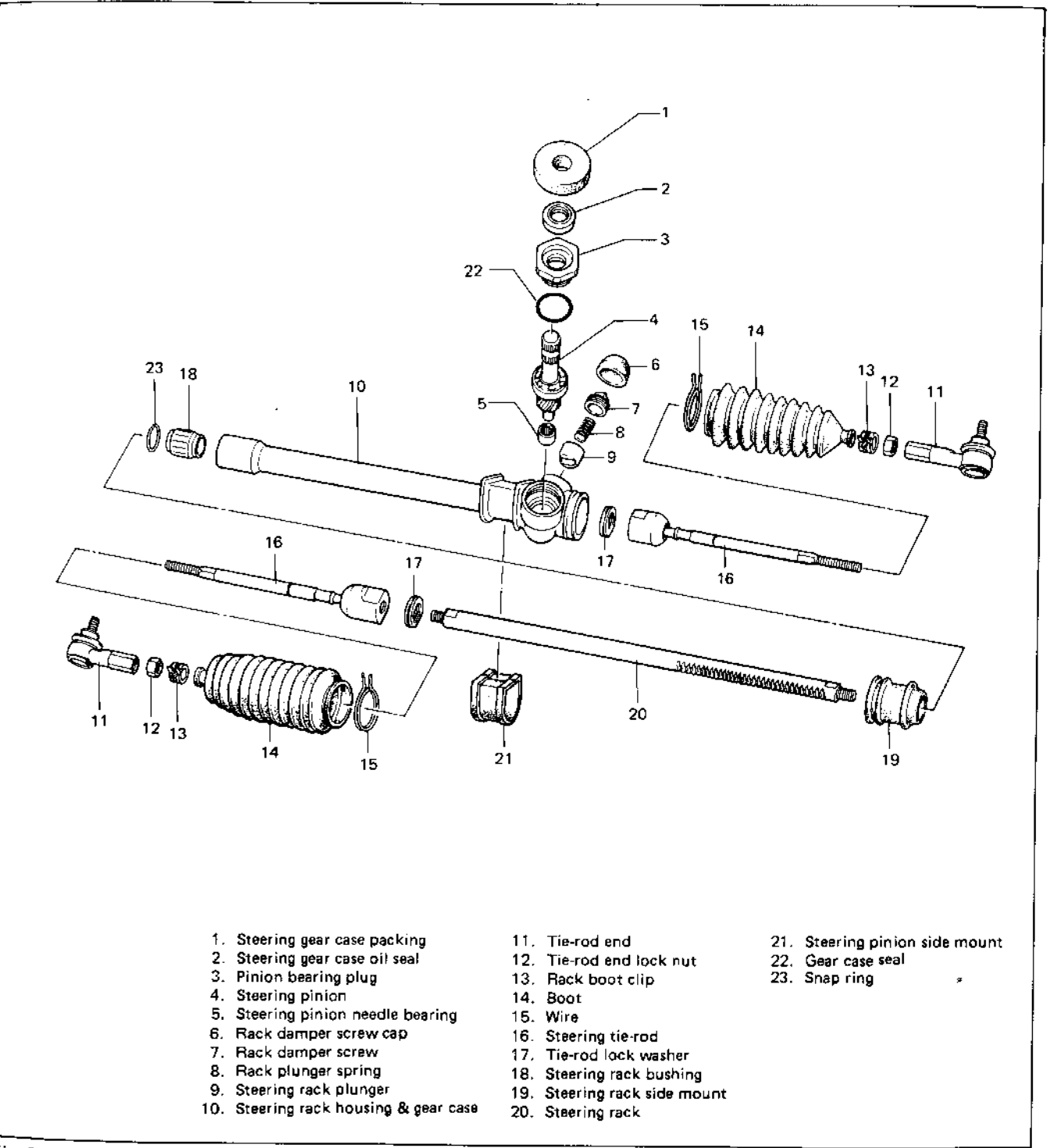


Fig. 3B-2 Exploded View of Manual Rack and Pinion

1. REMOVE AND INSTALL TIE ROD END

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove split pin and tie rod end castle nut from steering knuckle.

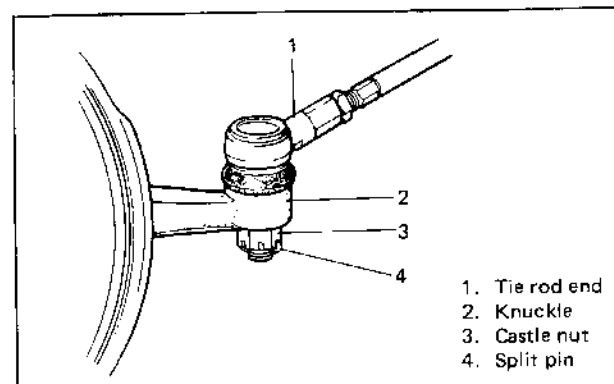


Fig. 3B-3

- 3) Disconnect tie rod end from knuckle, using special tool (A).

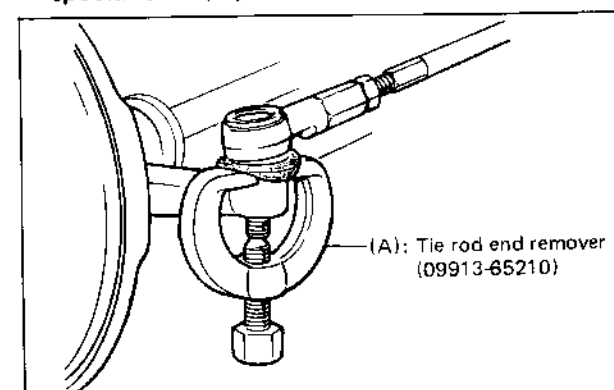


Fig. 3B-4

- 4) For ease of adjustment after installation, make marking of tie rod end lock nut position on tie rod thread. Then loosen lock nut and remove tie rod end from tie rod.

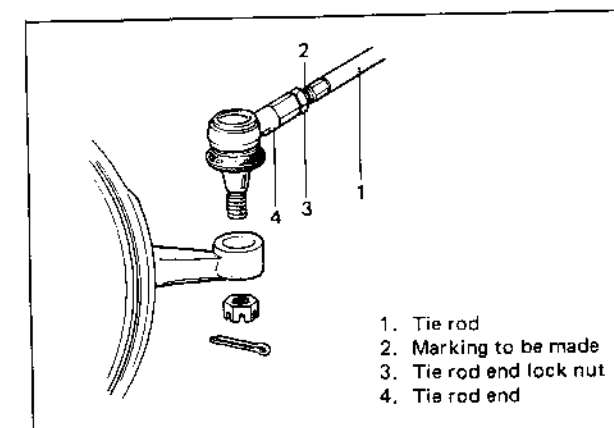


Fig. 3B-5

INSTALLATION

- 1) Install tie rod end lock nut and tie rod end to tie rod. Align lock nut with mark on tie rod thread.
- 2) Connect tie rod end to knuckle. Tighten castle nut until holes for split pin are aligned, but only within specified torque.
- 3) Bend split pin as shown below.
- 4) Inspect for proper toe (Refer to FRONT END ALIGNMENT).
- 5) After confirming proper toe, tighten tie rod end lock nut to specified torque.
- 6) Tighten wheel to specified torque and lower hoist.

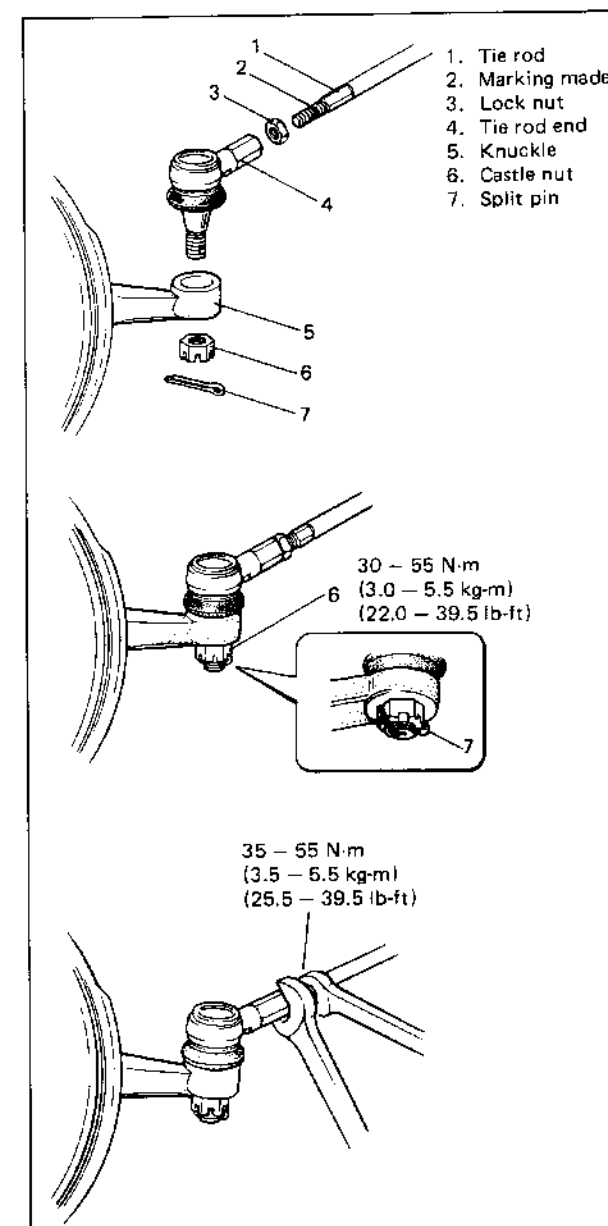


Fig. 3B-6

2. REMOVE AND INSTALL MANUAL RACK AND PINION ASSEMBLY (STEERING GEAR CASE)

REMOVAL

- 1) Slide driver's seat as far back as possible.
- 2) Pull off front part of floor mat on driver's side and remove steering shaft joint cover.
- 3) For ease of installation, loosen steering shaft upper joint bolt but don't remove.
- 4) Remove steering shaft lower joint bolt and disconnect lower joint from pinion.

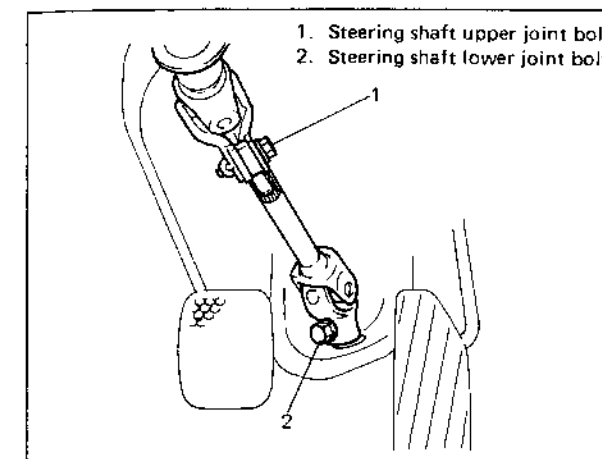


Fig. 3B-7

- 5) Hoist car and remove both wheels.
- 6) Remove split pins and tie rod castle nuts from both knuckles.

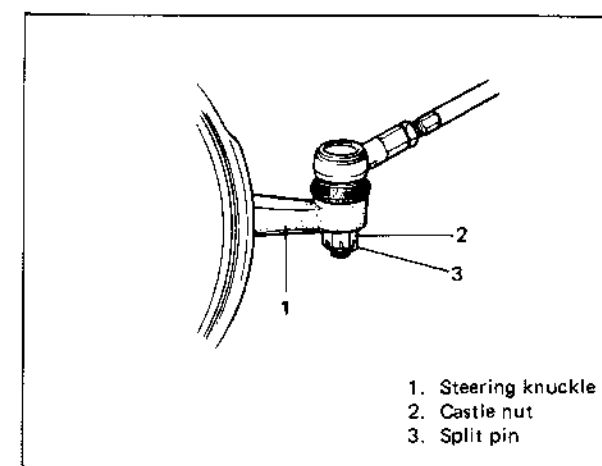


Fig. 3B-8

- 7) Disconnect both tie rod ends from knuckles, using special tool (A).

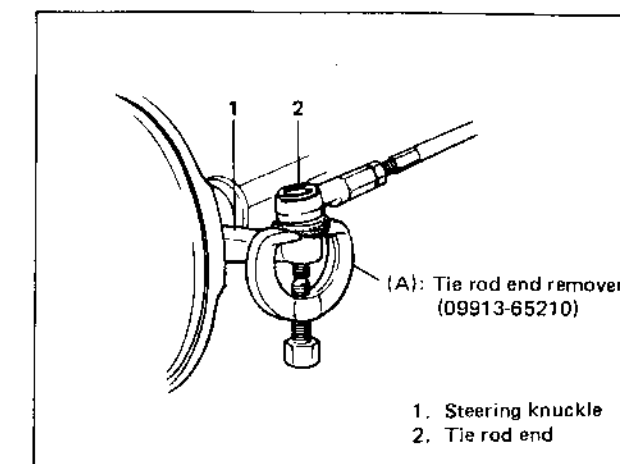


Fig. 3B-9

- 8) Remove steering gear case mount bolts, gear case brackets and then gear case.

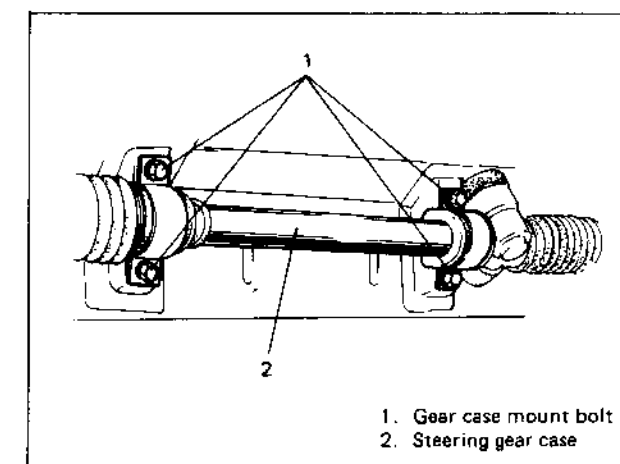


Fig. 3B-10

INSTALLATION

1) Mount steering gear case to body and tighten gear case mount bolts to specified torque.

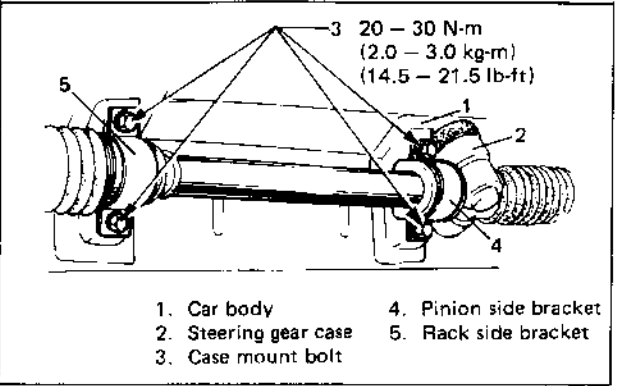


Fig. 3B-11

2) Install tie rod ends to knuckles (R & L). Tighten each castle nut until holes for split pin align but within specified torque and then bend split pin as shown.

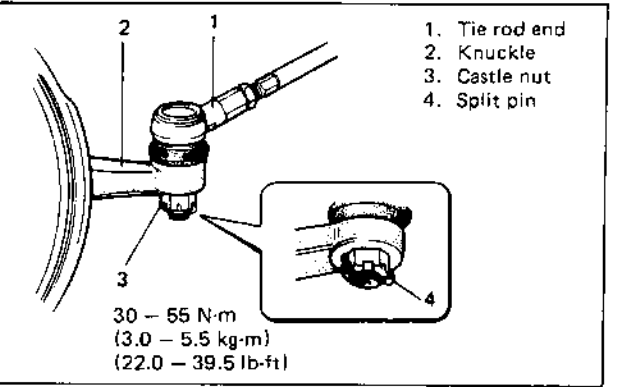


Fig. 3B-12

3) Be sure that steering wheel and brake discs (R & L) are all straightahead driving state and then insert steering lower joint into steering pinion shaft.

4) Tighten steering shaft joint bolts to specified torque (Lower side first and then upper side).

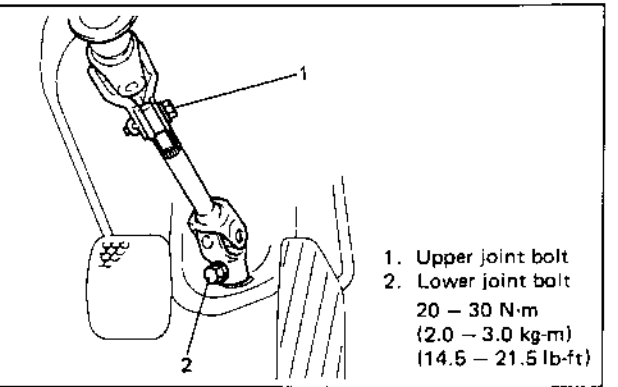


Fig. 3B-13

5) Reinstall cover removed previously to steering shaft joint.

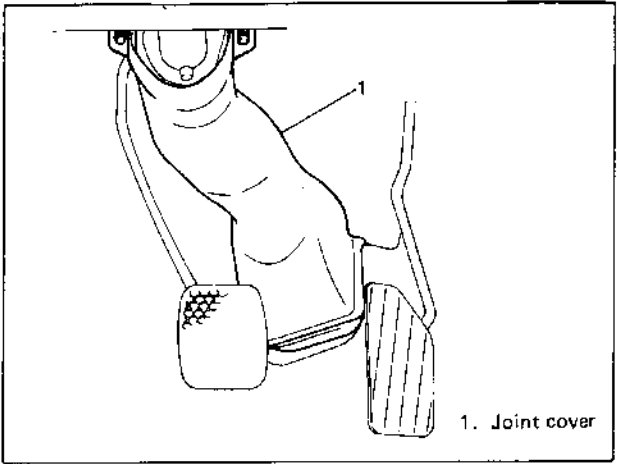


Fig. 3B-14

6) Put back floor mat as it was.
7) Install both wheels and tighten wheel nuts to specified torque.

N·m	kg·m	lb·ft
40 - 70	4.0 - 7.0	29.0 - 50.5

8) Lower hoist.
9) Check toe setting. Adjust as required (Refer FRONT END ALIGNMENT).
10) Tighten both tie rod end lock nuts to specified torque.

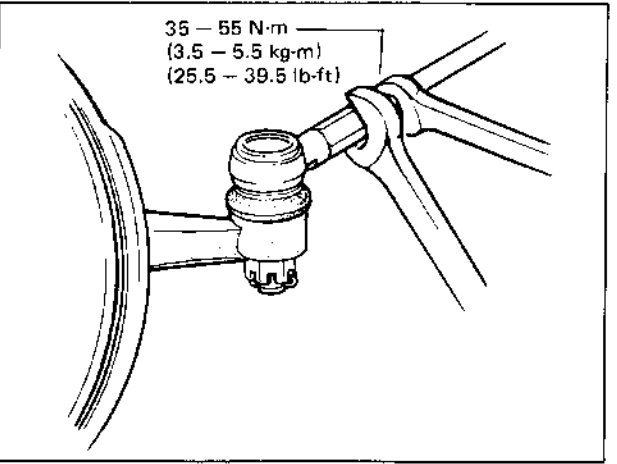


Fig. 3B-15

3. REMOVE AND INSTALL RACK BOOT/TIE ROD

REMOVAL

1) Remove steering gear case by performing Steps 1) - 8) in Item 2 REMOVAL of this section.
2) For ease of adjustment after installation, make marking of tie rod end lock nut position on tie rod thread.

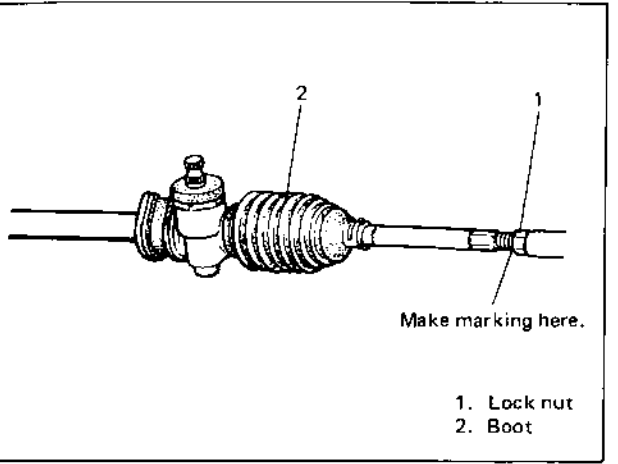


Fig. 3B-16

3) Loosen tie rod end lock nut and remove tie rod end.
4) Remove boot wire and clip.

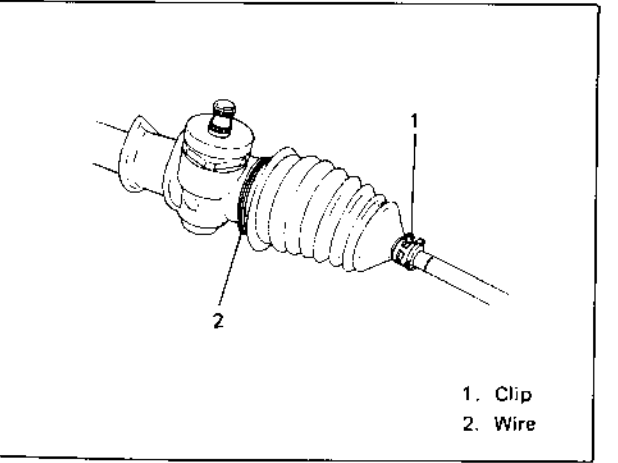


Fig. 3B-17

5) Remove boot from tie rod.
6) Unbend bent part of tie rod lock washer and remove tie rod from rack.

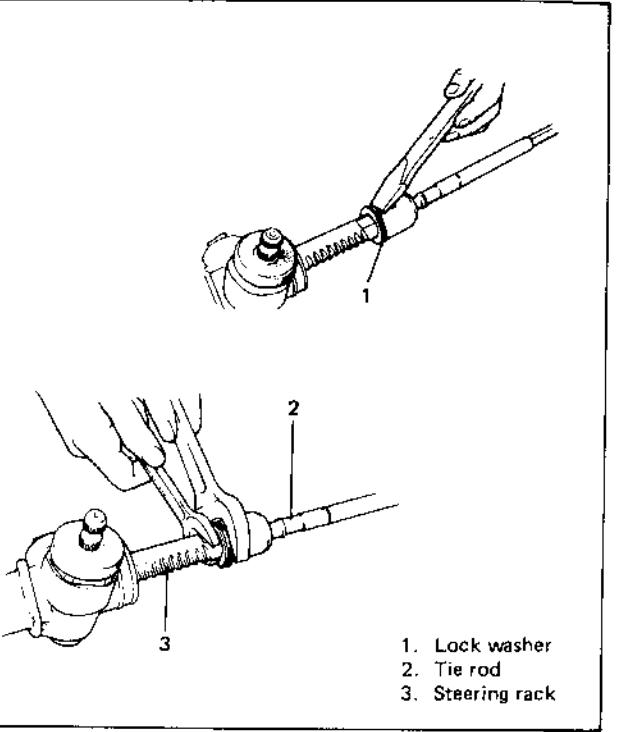


Fig. 3B-18

INSTALLATION

- 1) Install tie rod lock washer and tie rod to rack.
Align straight part "A" of washer with flat part "B" of rack.

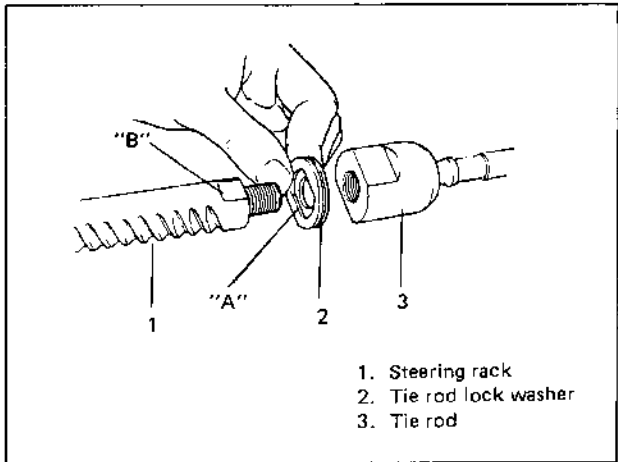


Fig. 3B-19

- 2) Tighten tie rod inside ball nut to specified torque.

N·m	kg-m	lb-ft
70 – 100	7.0 – 10.0	51.0 – 72.0

- 3) Bend lock washer to tie rod side as shown below.

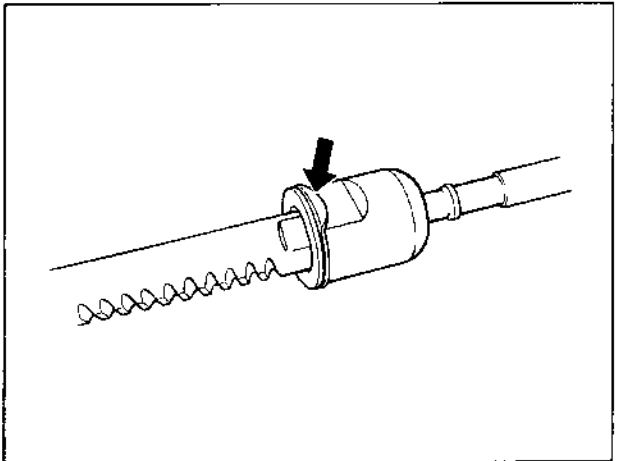


Fig. 3B-20

- 4) Position boot properly in grooves of gear case and tie rod and clamp it with wire and clip. Wire should be new and should go around twice and be tightened with its both ends twisted together. The twisted ends should be bent in the circumferential direction. After this, check to ensure that boot is free from twist and dent.

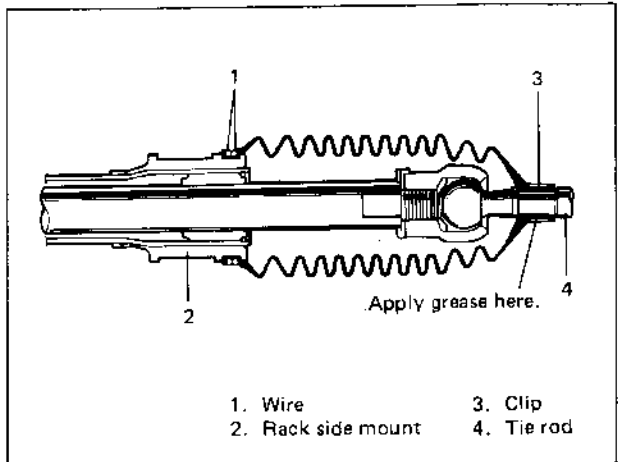


Fig. 3B-21

- 5) Install tie rod end lock nut and tie rod end to tie rod.
Position lock nut to marking made in removal.

NOTE:
When tie rod was replaced, measure length "A" on removed tie rod and use it on new replacement tie rod so as to position lock nut properly.

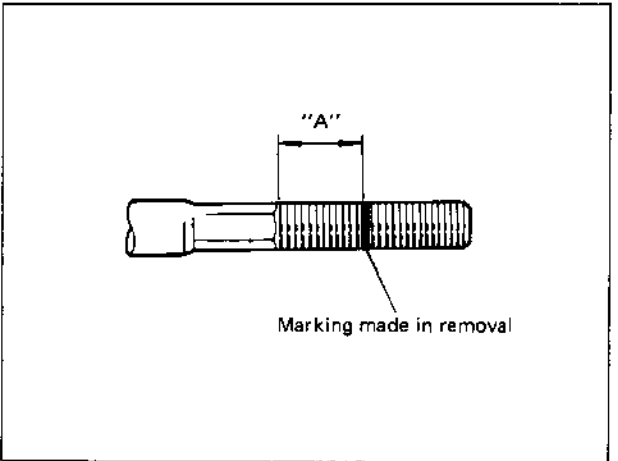


Fig. 3B-22

- 6) For installation procedures following the above, use Steps 1) – 10), INSTALLATION of STEERING GEAR CASE on p. 3B-6.

4. REMOVE AND INSTALL STEERING RACK PLUNGER

REMOVAL

- 1) Remove parts as shown below.

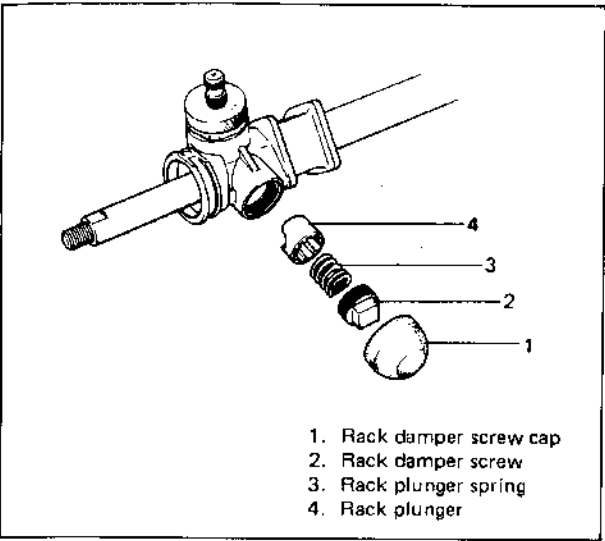


Fig. 3B-23

INSTALLATION

- 1) Apply grease lightly to sliding part of plunger against rack.
2) Install parts as shown.
3) After tightening rack damper screw to the tightest point, turn it back by 0 – 90° and check for rotation torque of pinion.

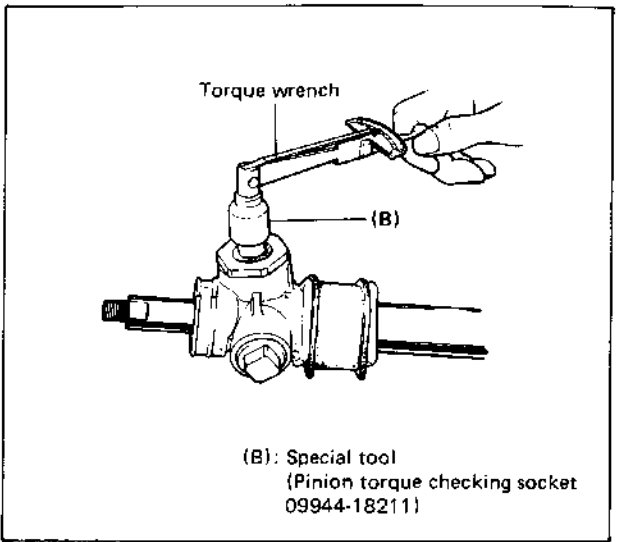


Fig. 3B-24

Also, check if rack as a whole moves smoothly.

Pinion torque:

N·m	kg-m	lb-ft
0.8 – 1.3	0.08 – 0.13	0.58 – 0.94

- 4) After adjustment, put rack damper screw cap as deeply as possible.

5. REMOVE AND INSTALL STEERING PINION

REMOVAL

- 1) Remove rack plunger as shown Item 4.
- 2) Remove gear case packing.
- 3) Remove bearing plug with special tool (C).

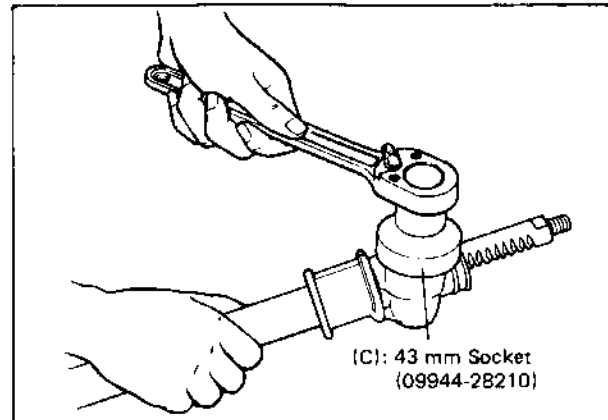


Fig. 3B-25

- 4) Tap on position as shown with plastic hammer to separate pinion assembly from housing.

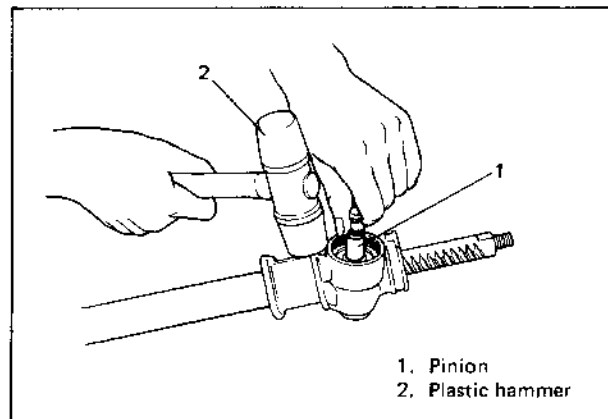


Fig. 3B-26

- 5) Remove pinion assembly.

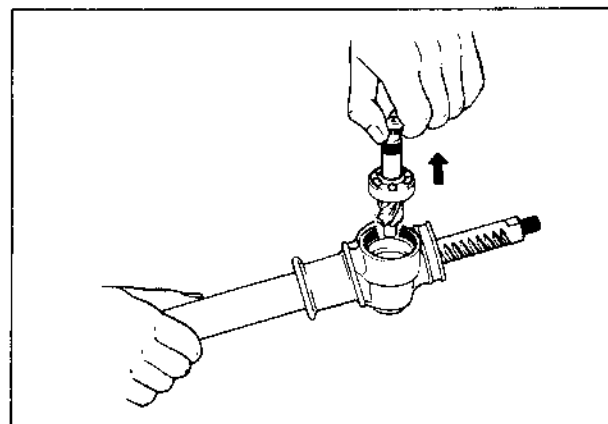


Fig. 3B-27

INSTALLATION

- 1) Apply grease to all around pinion teeth, pinion needle bearing and gear case oil seal lip.

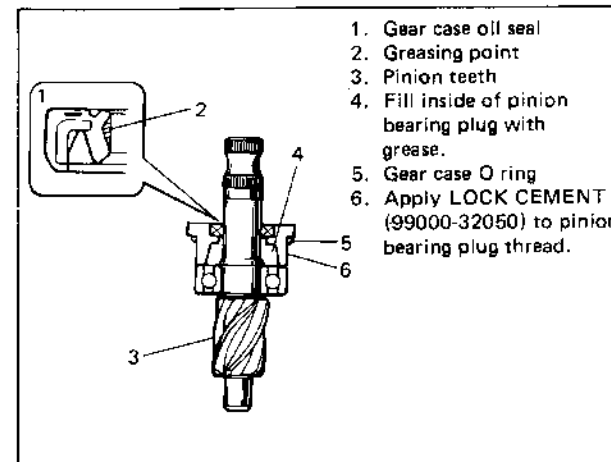


Fig. 3B-28

- 2) Install pinion assembly.
- 3) Tighten pinion bearing plug to specified torque.

N·m	kg-m	lb-ft
80 - 110	8.0 - 11.0	58.0 - 79.5

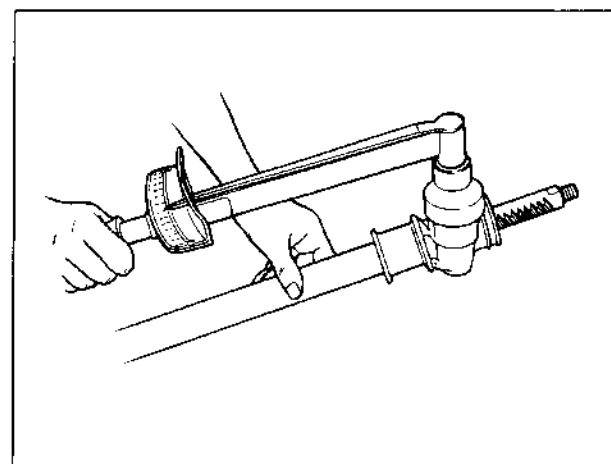


Fig. 3B-29

- 4) Install gear case packing.
- 5) Install rack plunger as described in Item 4.

6. REMOVE AND INSTALL STEERING RACK

REMOVAL

- 1) Remove boot wires and clips.

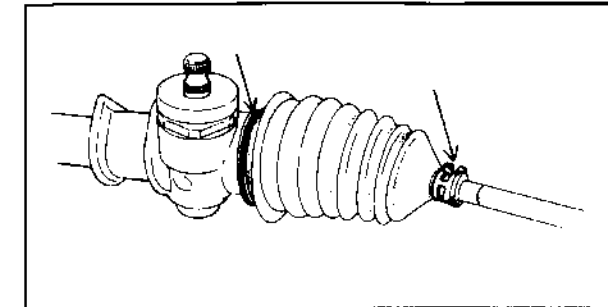


Fig. 3B-30

- 2) Move both boots toward tie rod end.
- 3) Unbend bent part of tie rod lock washers and remove tie rods from right and left sides of steering rack.
- 4) Mark left and right tie rods accordingly.

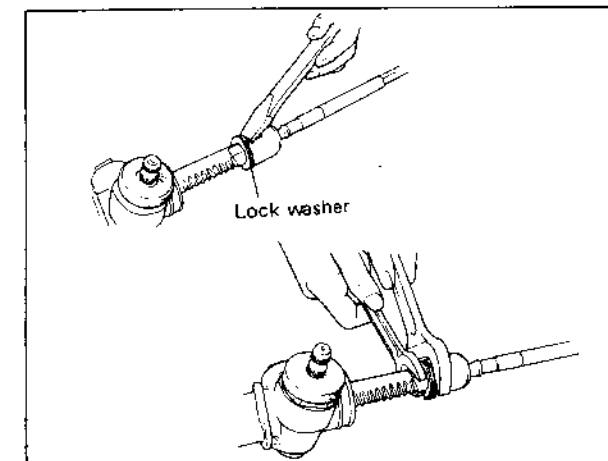


Fig. 3B-31

- 5) Remove rack plunger and pinion assembly from gear case by performing Steps 1) - 5) in Item 5 STEERING PINION REMOVAL of this section.
- 6) Remove rack from gear case. Direction for rack removal is as shown below.

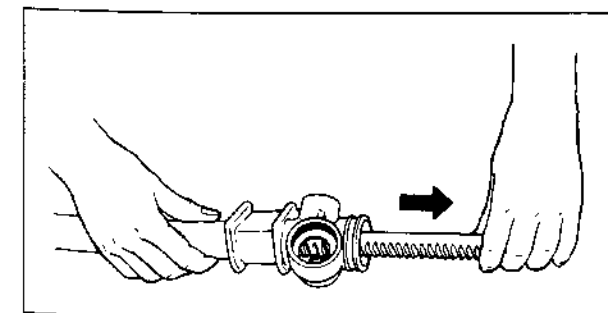


Fig. 3B-32

INSTALLATION

- 1) Apply grease to entire teeth surface of rack and its periphery.
- 2) Slide rack into steering gear case in the direction as shown below.

CAUTION:

Inside of steering rack bushing is coated with special coating. As it is damageable, be very careful not to cause damage to it when inserting rack into steering gear case.

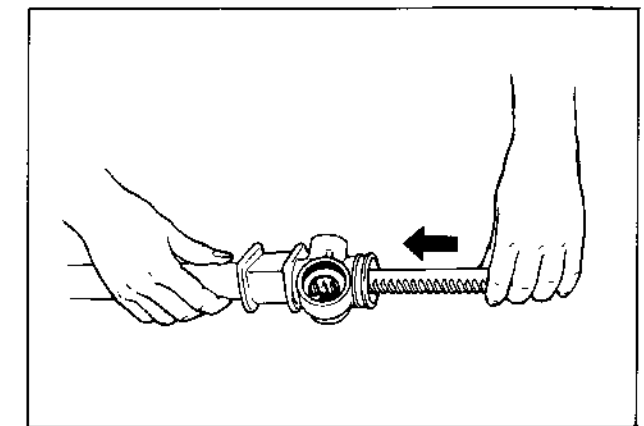


Fig. 3B-33

- 3) Install pinion assembly to gear case by performing Steps 1) - 4) in Item 5 STEERING PINION INSTALLATION of this section.
- 4) Perform Steps 1) - 4) in Item 4 STEERING RACK PLUNGER INSTALLATION of this section.
- 5) Before installing boot to steering rack housing, make sure that rack side mount is positioned as shown below. Install tie rods to rack by performing Steps 1) - 6) in Item 3 RACK BOOT/TIE ROD INSTALLATION of this section.

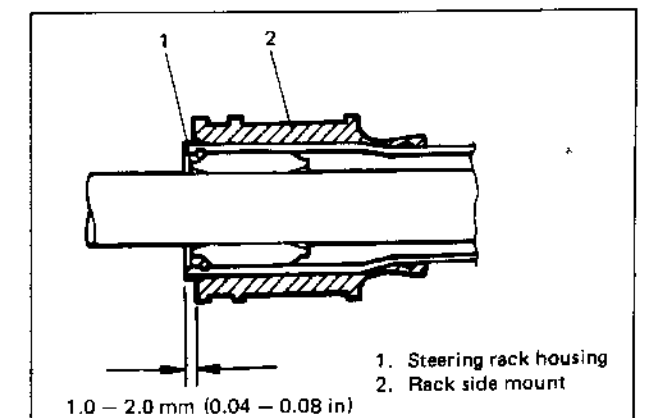


Fig. 3B-34

7. REMOVE AND INSTALL PINION BEARING

REMOVAL

- 1) Remove rack from steering gear case, referring to Item 6 STEERING RACK REMOVAL of this section.
- 2) Pull out pinion bearing from gear case with special tools (D and E) as shown.

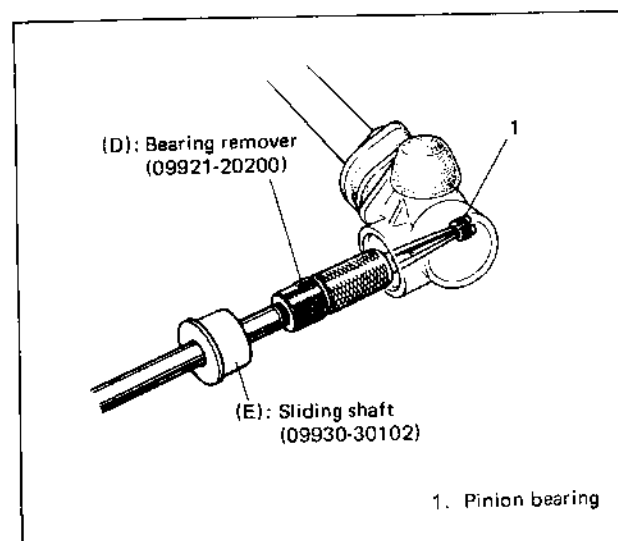


Fig. 3B-35

INSTALLATION

- 1) Apply grease to rollers of pinion bearing.
 - 2) Press-fit pinion bearing into gear case with special tool (F) as shown.
- After press-fitting, make sure that bearing rollers are installed properly.

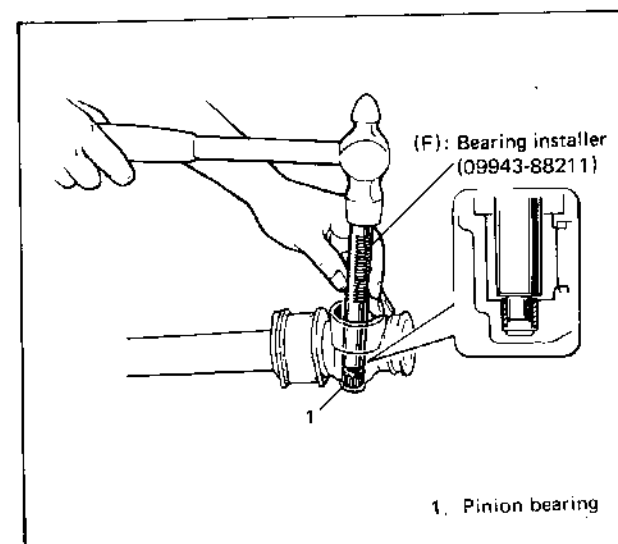


Fig. 3B-36

- 3) Follow Steps 1) – 5) in Item 6 STEERING RACK INSTALLATION of this section to complete installation.

8. REMOVE AND INSTALL RACK BUSHING

REMOVAL

- 1) Remove rack from steering gear case, referring to Item 6 STEERING RACK REMOVAL of this section.

NOTE:

When removing rack bushing, be careful not to pull out bushing by holding gear case in a vise. Or housing (pipe) may come off gear case. For this work, be sure to use the below specified special tool.

- 2) Remove snap ring.

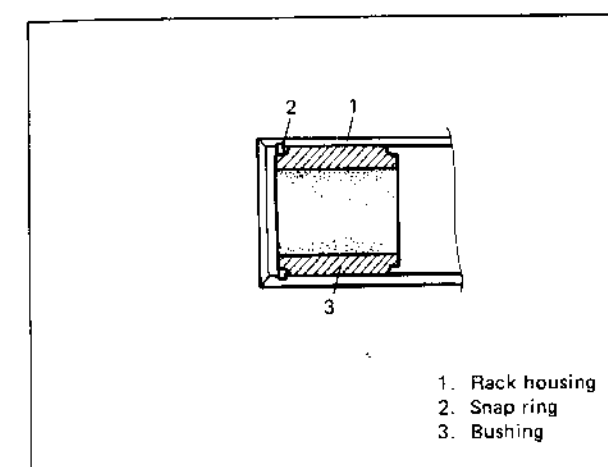


Fig. 3B-37

- 3) Pull out bushing from rack housing with special tool (G) as shown.

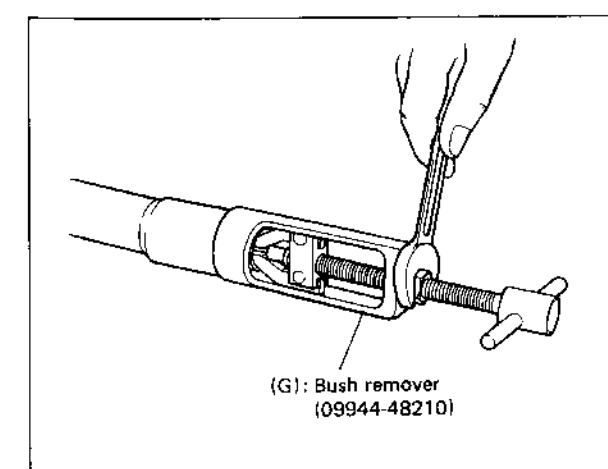


Fig. 3B-38

INSTALLATION

- 1) Apply grease lightly to entire inner surface of bushing.
- 2) Press-fit bushing as far into rack housing as shown below by using special tool (H).

CAUTION:

Inside of bushing is coated with special coating. As it is damageable, be sure to use special tool and special care not to cause damage to inside of bushing when press-fitting it.

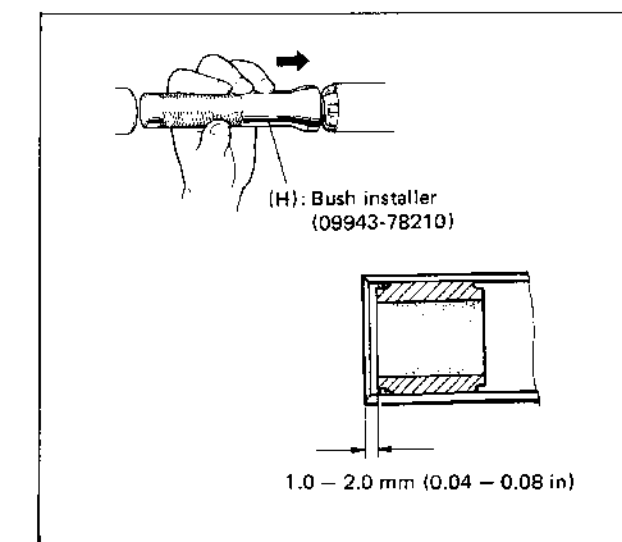


Fig. 3B-39

- 3) Install snap ring.
- 4) Follow Steps 1 – 5) in Item 6 STEERING RACK INSTALLATION of this section to complete installation.

RACK AND PINION INSPECTION

STEERING RACK BOOTS

Hoist car.

Inspect each boot for tear. A torn boot allows entry of dust and water which can cause wear to steering rack and pinion to produce noise as well as rust to result in malfunction of steering system.

If even a small tear is noted, replace with new one.

Boots should be visually inspected for any damage and tear during every periodical inspection at specified intervals and whenever car is hoisted for any other purpose.

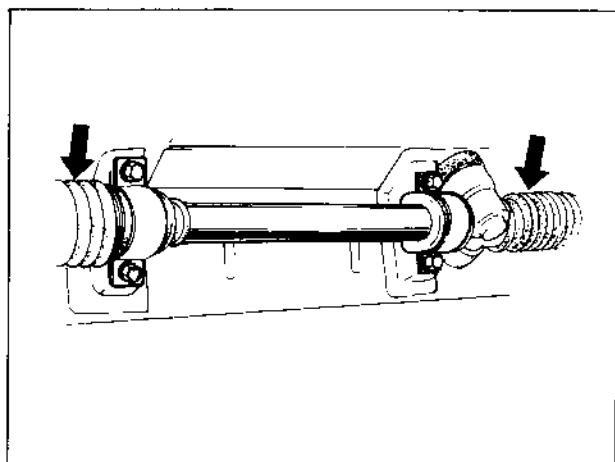


Fig. 3B-40

TIE ROD END BOOTS

Inspect each boot for tear. If even a small tear is noted, replace with new one.

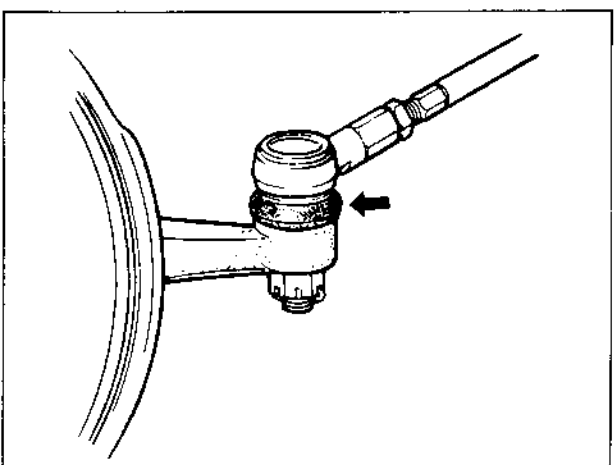


Fig. 3B-41

STEERING SHAFT JOINT

Check shaft joint for wear, breakage and other damage and replace if any defect exists.

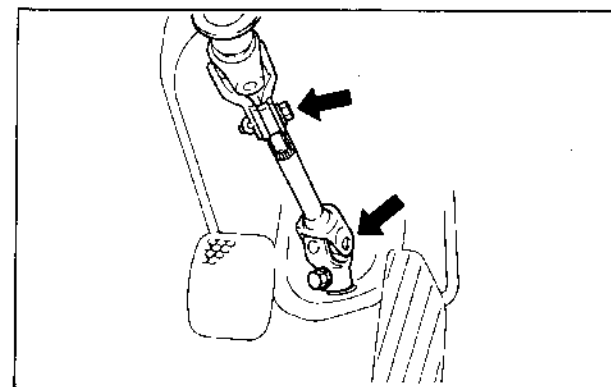


Fig. 3B-42

TIE ROD END

- 1) Inspect for play in ball joint.
 - 2) Inspect for play in rack end ball joint.
- In either case, if found defective, replace.

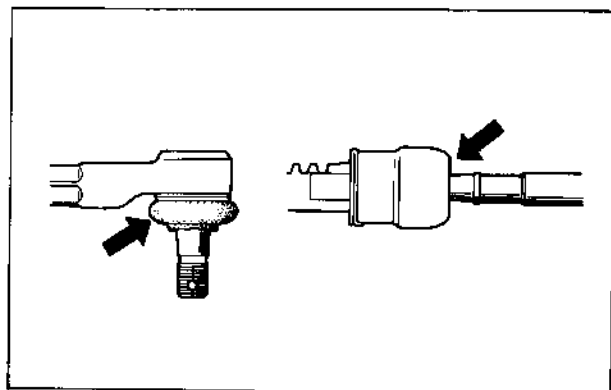


Fig. 3B-43

RACK PLUNGER

- 1) Inspect rack plunger for wear or damage.
 - 2) Inspect rack plunger spring for deterioration.
- In either case, if found defective, replace.

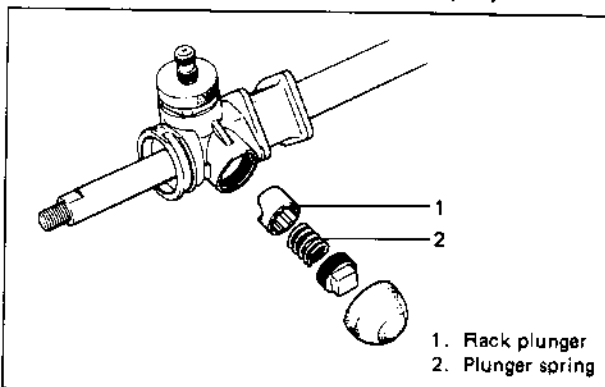


Fig. 3B-44

STEERING PINION

- 1) Inspect pinion teeth surface for wear or damage.
 - 2) Inspect oil seal for damage.
 - 3) Inspect gear case packing for damage.
- Replace any part found defective.

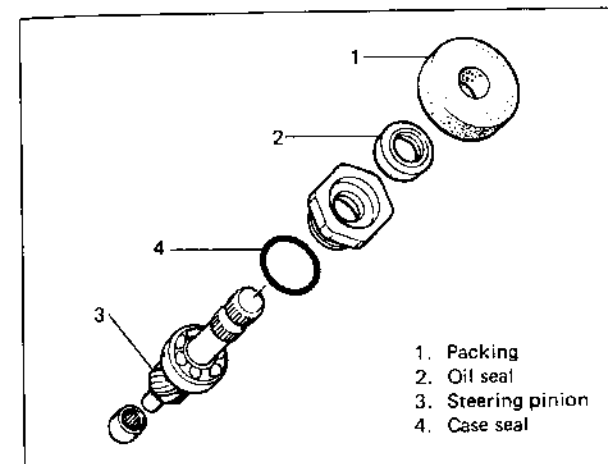


Fig. 3B-45

STEERING PINION BEARING

Check rotation condition of bearing and inspect for wear.
If found defective, replace.

STEERING RACK

Inspect for deflection, teeth wear, or damage, back surface wear or damage.

Limit of rack deflection	0.40 mm (0.016 in)

If deflection exceeds limit, replace rack.

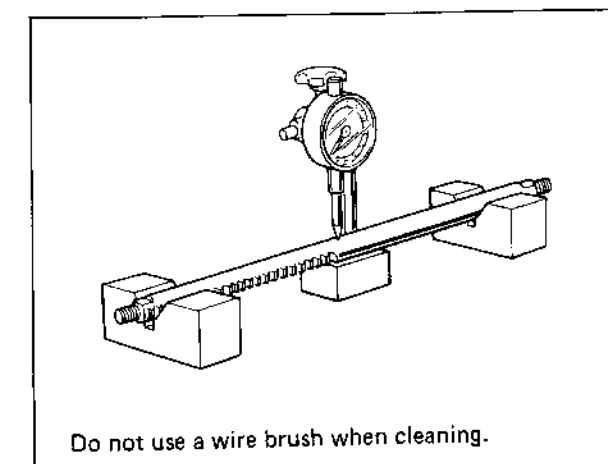


Fig. 3B-46

Do not use a wire brush when cleaning.

STEERING RACK BUSHING

Inspect rack bushing for wear or damage.
If found defective, replace.

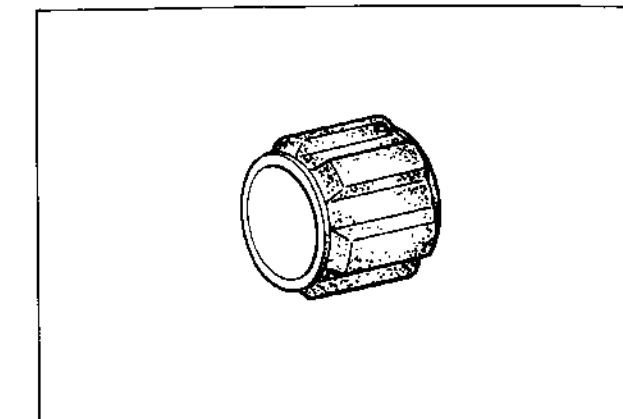


Fig. 3B-47

STEERING WHEEL

Check steering wheel for play and rattle, holding car in straight forward condition on the ground.

Steering wheel play (A)	0 — 30 mm (0 — 1.2 in.)

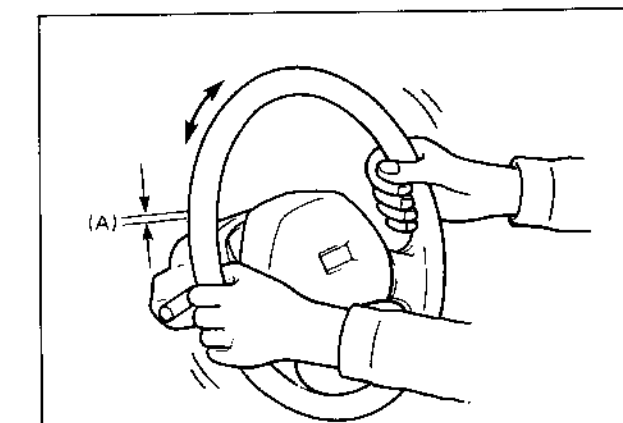


Fig. 3B-48

If steering wheel play is not within specification, inspect as follows and replace if found defective.

- Tie-rod end ball stud for wear (ball stud should move when more than 2 kg-cm torque is applied.)
- Lower ball joint for wear
- Steering shaft joint for wear
- Steering pinion or rack gear for wear or breakage
- Each part for looseness

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N-m	kg-m	lb-ft
1. Steering shaft joint bolts	20 – 30	2.0 – 3.0	14.5 – 21.5
2. Steering gear case bolts	20 – 30	2.0 – 3.0	14.5 – 21.5
3. Tie-rod end castle nuts	30 – 55	3.0 – 5.5	22.0 – 39.5
4. Tie-rod end lack nuts	35 – 55	3.5 – 5.5	25.5 – 39.5
5. Steering pinion bearing plug	80 – 110	0.8 – 11.0	58.0 – 79.5
6. Tie-rod	70 – 100	0.7 – 10.0	51.0 – 72.0
7. Wheel nut	50 – 70	5.0 – 7.0	36.5 – 50.5

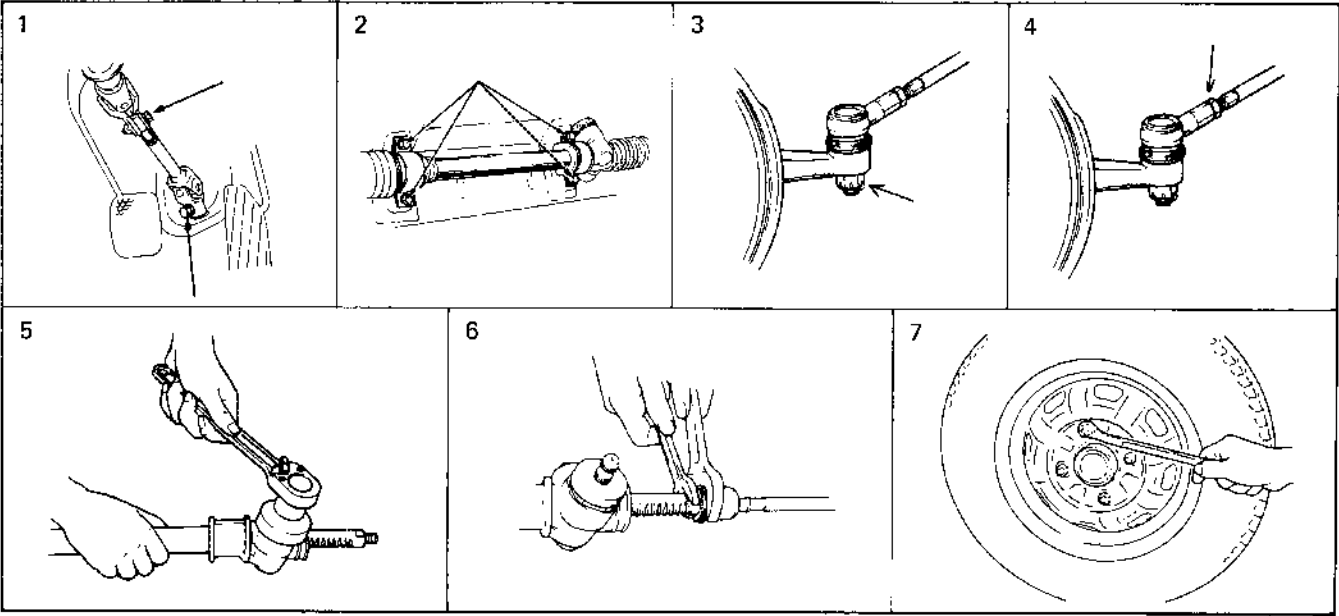


Fig. 3B-49

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium Grease (Should be applicable for -40°C ~ 130°C)	SUZUKI SUPER GREASE (E) (99000-25050)	• Sliding part of rack against steering housing (All around rack plunger, rack bushing and rack) • Sliding part against steering pinion (Oil seal lip, needle bearing) • Steering rack and pinion gear teeth • Filled into pinion bearing cap • Contacting parts of tie-rod and rack side boots • Rack end ball joint

SPECIAL TOOLS

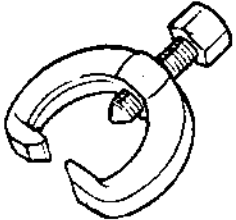
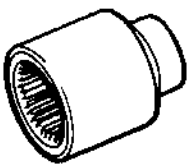
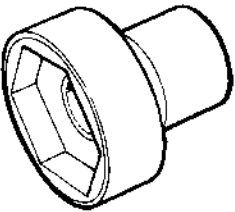
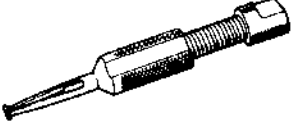
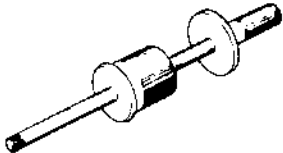
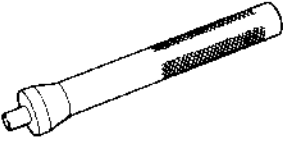
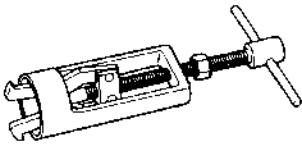
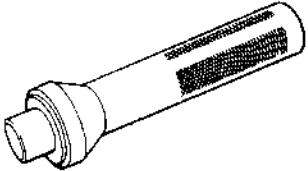
 09913-65210 Tie-rod end remover	 09944-18211 Pinion torque checking socket	 09944-28210 43 mm Socket (Pinion bearing plug remover)	 09921-20200 Pinion bearing remover
 09930-30102 Sliding shaft	 09943-88211 Pinion bearing installer	 09944-48210 Rack bush remover	 09943-78210 Rack bush installer

Fig. 3B-50

SECTION 3C

STEERING WHEEL AND COLUMN

NOTE:

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 of substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

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2. Remove and Install Combination		RECOMMENDED TORQUE	
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Column	3C-5		
4. Remove and Install Steering			
Lock	3C-7		

GENERAL DESCRIPTION

The ball and double tube type steering column includes following 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 an injury to the driver of the car.
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 car.

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

When the column assembly is removed from the car, special care must be taken in handling it. Use of a steering wheel puller other than the one recommended in this manual or a sharp blow on the end of the steering shaft, leaning on the assembly, or dropping the assembly could shear the plastic shear pins which maintain column length.

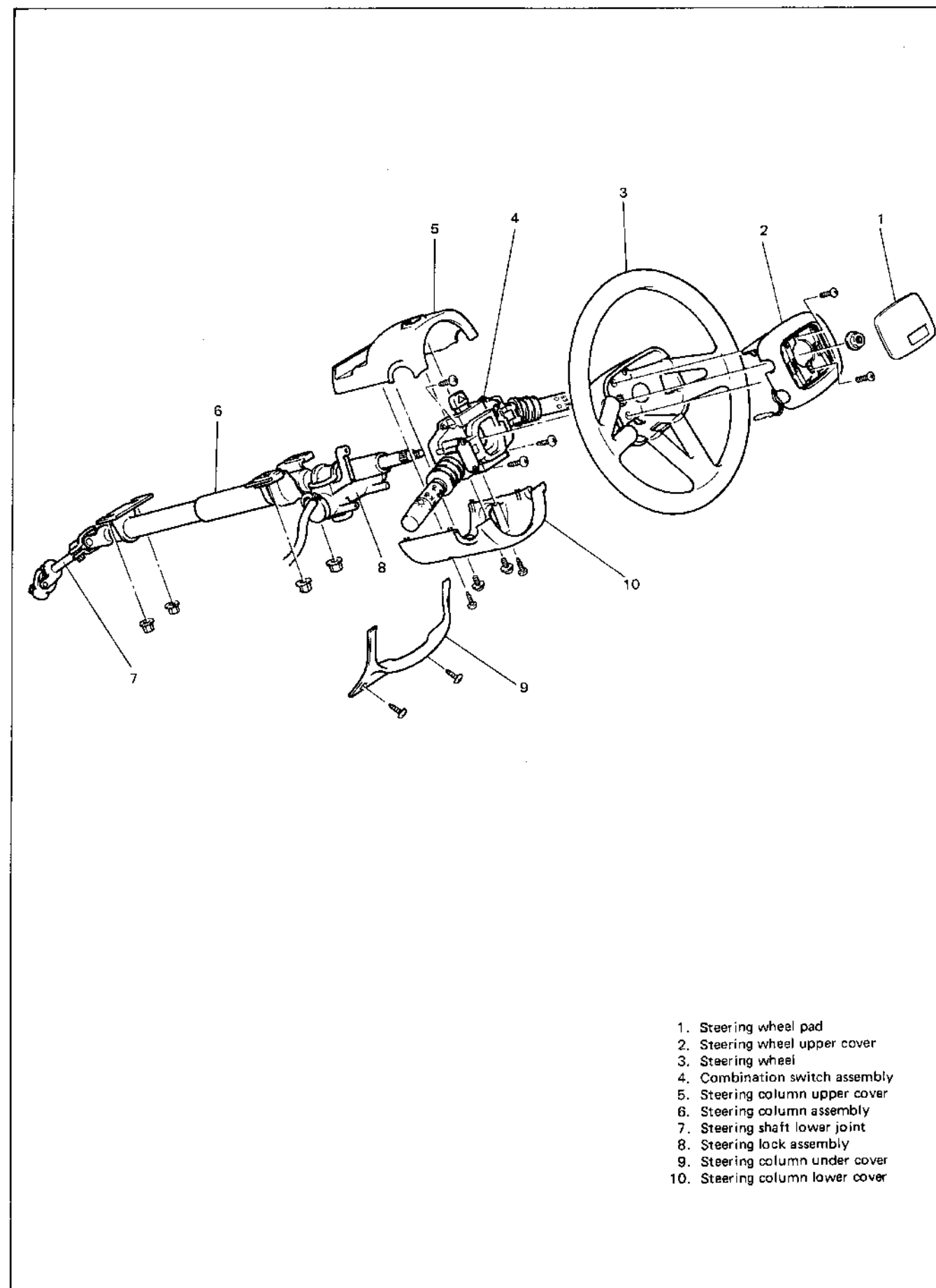


Fig. 3C-1 Steering Wheel and Column

ON-CAR SERVICE

1. REMOVE AND INSTALL STEERING WHEEL

REMOVAL

- 1) Disconnect negative battery cable.
- 2) Remove pad by pulling it upward.
- 3) Remove steering wheel upper cover and steering shaft nut.
- 4) Make alignment marks on steering wheel and shaft for a guide during reinstallation.

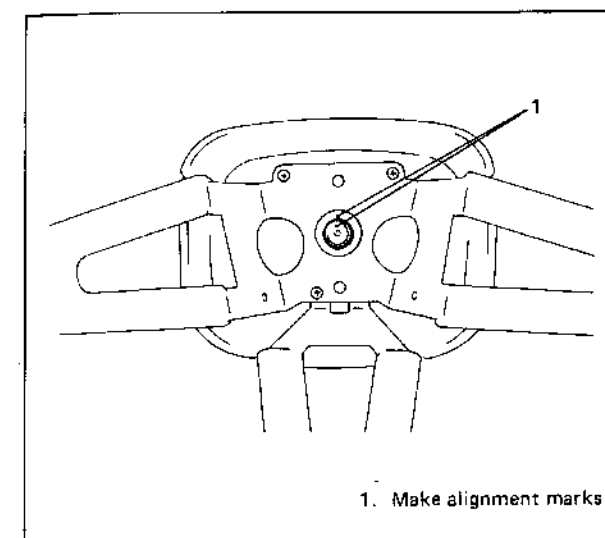


Fig. 3C-2

- 5) Remove steering wheel with special tool (A).

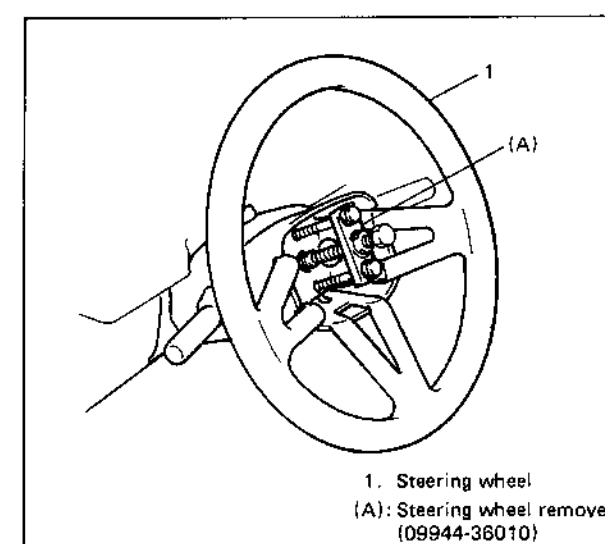


Fig. 3C-3

INSTALLATION

- 1) Install steering wheel onto shaft, aligning alignment marks on them.
- 2) Torque steering shaft nut to specification as given below.
- 3) Connect horn wire to steering wheel and then, install steering wheel upper cover and pad.

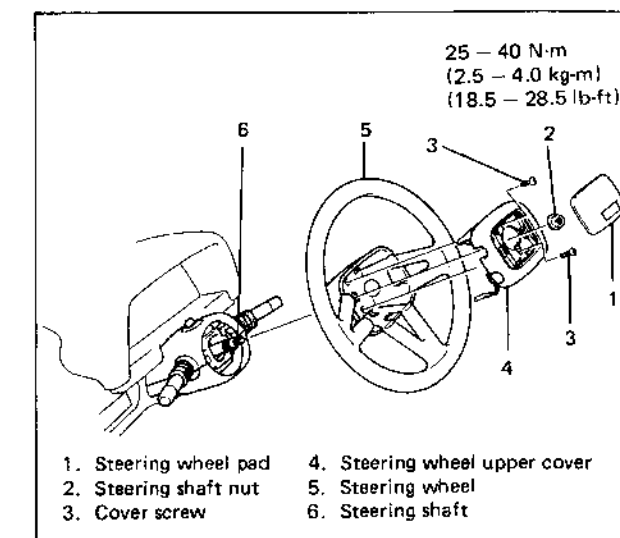


Fig. 3C-4

- 4) Connect negative battery cable.

2. REMOVE AND INSTALL COMBINATION SWITCH

REMOVAL

- 1) Disconnect negative battery cable.
- 2) Before removing this switch, remove steering wheel. Refer to STEERING WHEEL REMOVAL.
- 3) Remove column covers (under and lower).

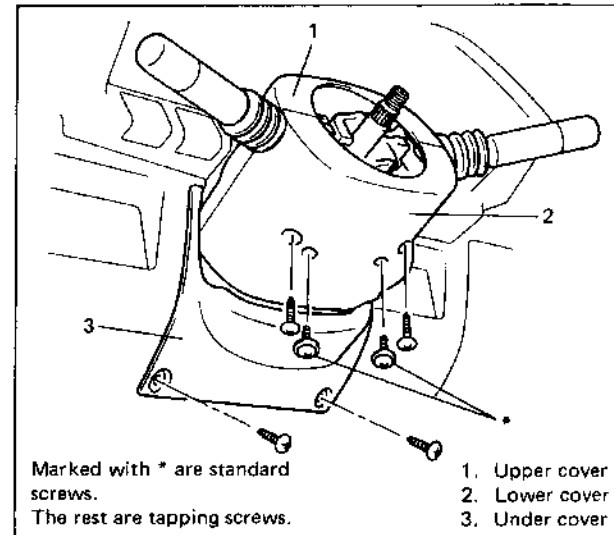


Fig. 3C-5

- 4) Disconnect lead wire from combination switch at coupler.
- 5) Loosen wire bands.
- 6) Remove combination switch assembly from steering column.

INSTALLATION

- 1) Install combination switch.
- 2) Connect lead wire from this switch at coupler.
- 3) Tighten wire bands.
- 4) Install column lower cover and under cover.

NOTE:

When tightening lower cover and upper cover, be careful so that combination switch lead wire is not caught between covers.

- 5) Install steering wheel. Refer to step 1) through 4) under STEERING WHEEL INSTALLATION.

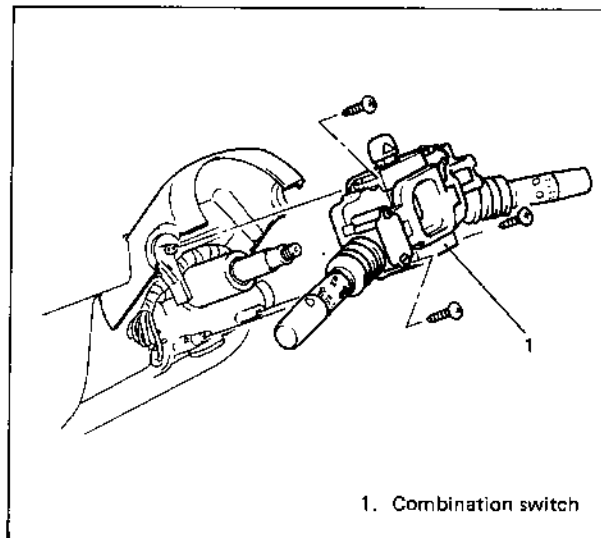


Fig. 3C-6

3. REMOVE AND INSTALL STEERING COLUMN

NOTE:

Once the steering column is removed from the car, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic shear pins which maintain column length. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use steering wheel remover. Under no condition should the end of the shaft be hammered upon as hammering could loosen the plastic shear pins which maintain column length.

REMOVAL

- 1) Disconnect negative battery cable.
- 2) Remove steering wheel. Refer to STEERING WHEEL REMOVAL.
- 3) Remove combination switch. Refer to Steps 3 through 6 under COMBINATION SWITCH REMOVAL.
- 4) Disconnect lead wires from ignition switch and ignition key warning switch at coupler.
- 5) Pull off floor mat at the foot of steering shaft and remove steering joint cover.

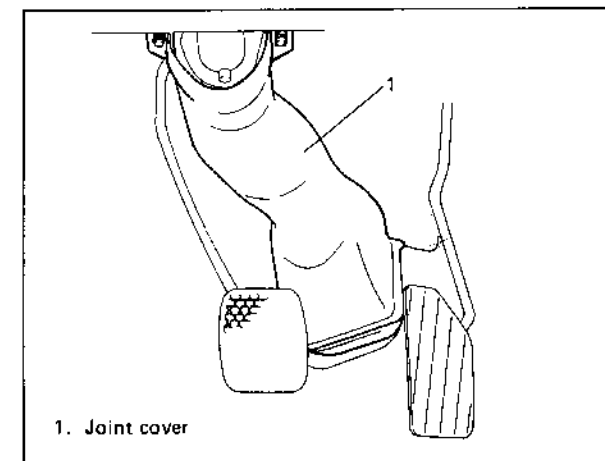


Fig. 3C-7

- 6) Remove steering shaft joint upper side bolt.

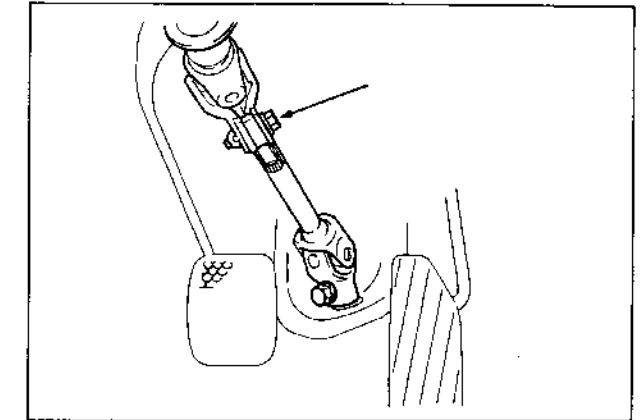


Fig. 3C-8

- 7) Remove steering column mount nuts.

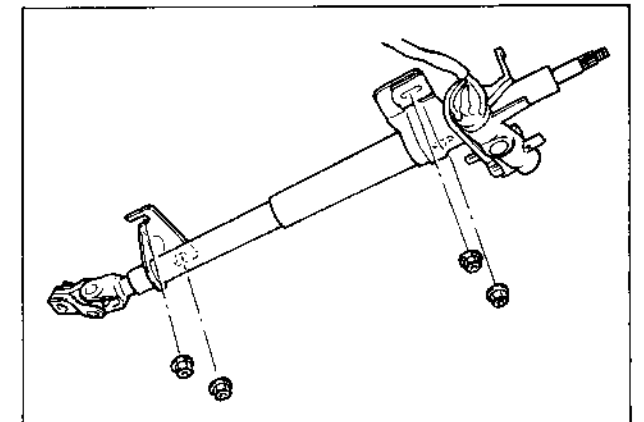


Fig. 3C-9

- 8) When working on car with automatic transmission remove back drive cable from steering column assembly.
- 9) Remove steering column assembly.

NOTE:

Don't disassemble steering column assembly into column and shaft. If steering column or shaft is found defective, replace as an assembly. See p. 3C-9.

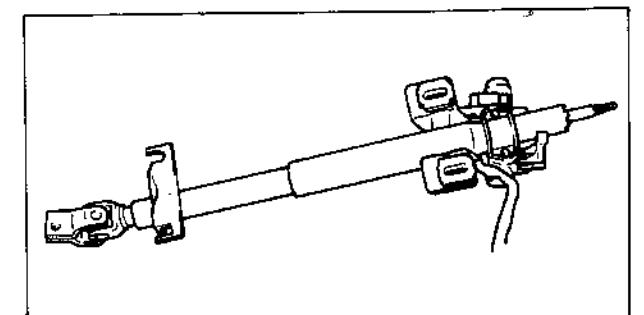


Fig. 3C-10 Steering Column Assembly

INSTALLATION

- 1) When working on car with automatic transmission, install back drive cable to steering column assembly.

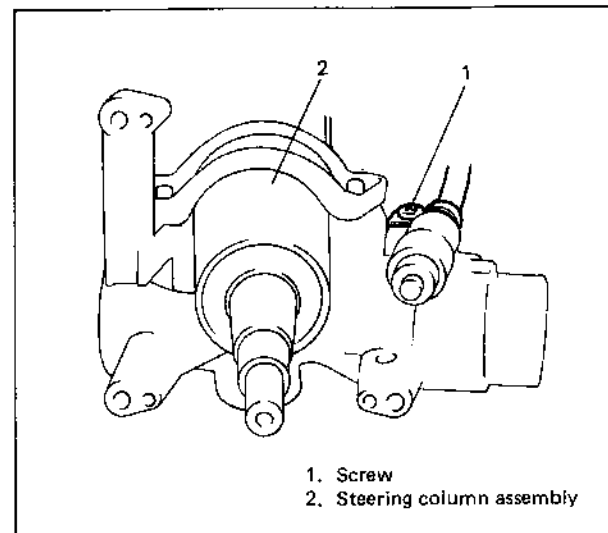


Fig. 3C-10-1

- 2) Align flat part "A" of lower joint shaft with bolt hole "B" of upper side joint as shown. Then insert upper side joint into lower joint shaft.

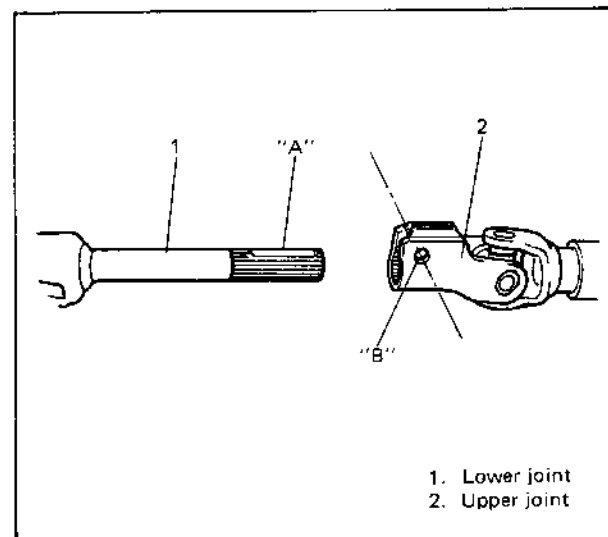


Fig. 3C-11

- 3) Install steering column assembly to lower and upper brackets. Torque steering column nuts to specifications as given below.
- Tighten nuts (a) first to specified torque.
 - Then tighten nuts (b) to specified torque.

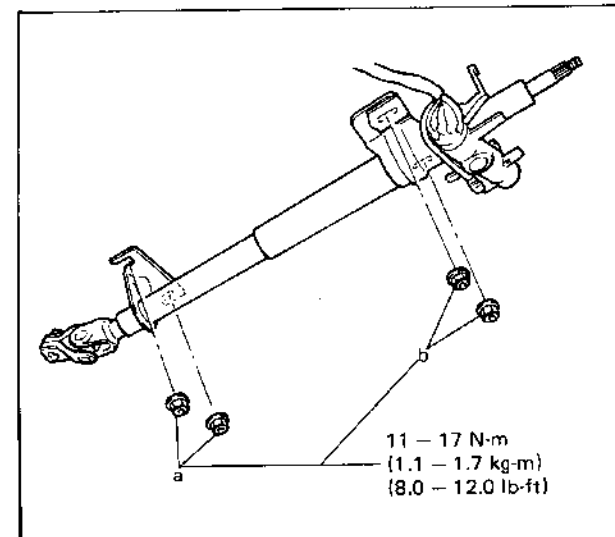


Fig. 3C-12

- 4) Install bolt to steering shaft upper joint and tighten it to specified torque.

NOTE:

After tightening column nuts, bolt 1 should be tightened.

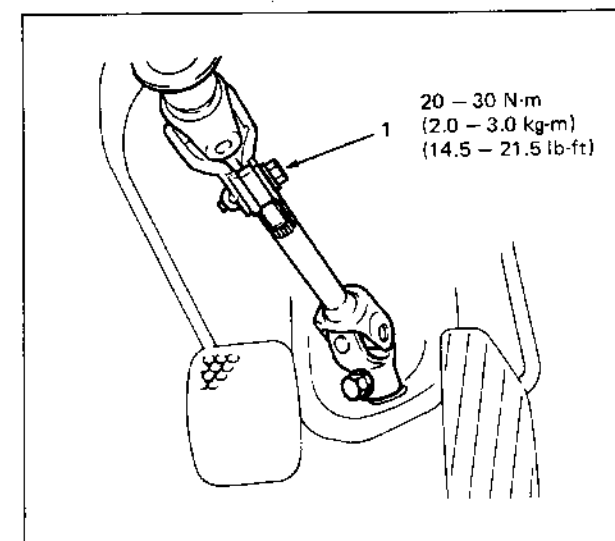


Fig. 3C-13

- 5) Install steering joint cover and put floor mat back as it was originally.
- 6) Connect lead wires from ignition switch and ignition key warning switch at coupler.
- 7) Install combination switch. Refer to Steps 1 through 4 under COMBINATION SWITCH INSTALLATION.
- 8) Install steering wheel. Refer to Steps 1 through 4 under STEERING WHEEL INSTALLATION.

4. REMOVE AND INSTALL STEERING LOCK

(Applicable to car equipped with steering lock.)

REMOVAL

- 1) Remove steering column. Refer to STEERING COLUMN REMOVAL.

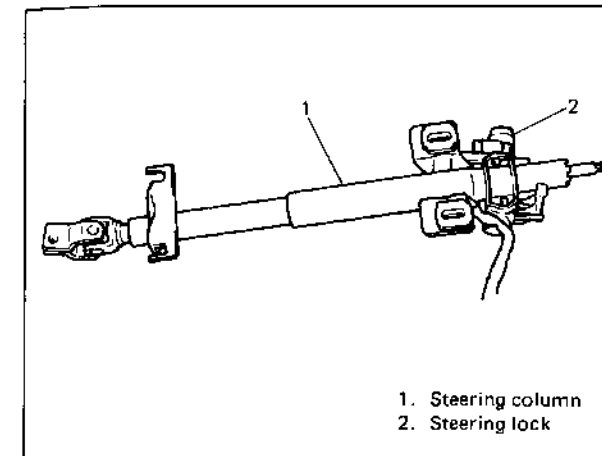


Fig. 3C-14

- 2) Using center punch as shown, loosen and remove steering lock mounting bolts. Use care not to damage aluminum part of steering lock body with center punch.

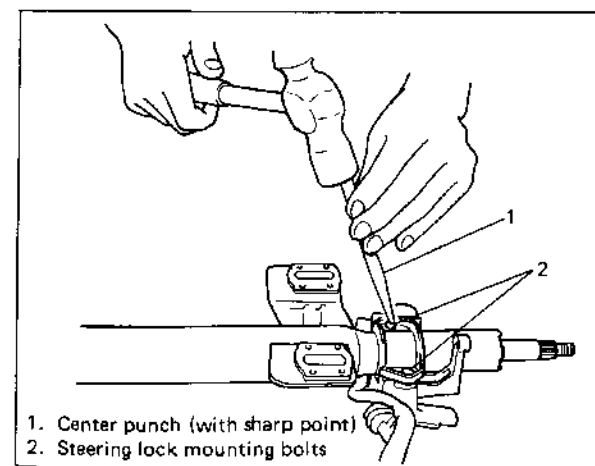


Fig. 3C-15

- 3) Turn ignition key to "ACC" or "ON" position and remove steering lock assembly from steering column.

INSTALLATION

- 1) Position oblong hole of steering shaft in the center of hole in column.

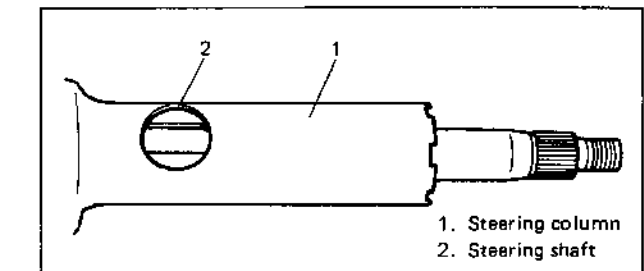


Fig. 3C-16

- 2) Turn ignition key to "ACC" or "ON" position and install steering lock assembly onto column.
- 3) Now turn ignition key to "LOCK" position and pull it out.
- 4) Align hub on lock with oblong hole of steering shaft and rotate shaft to assure that steering shaft is locked.

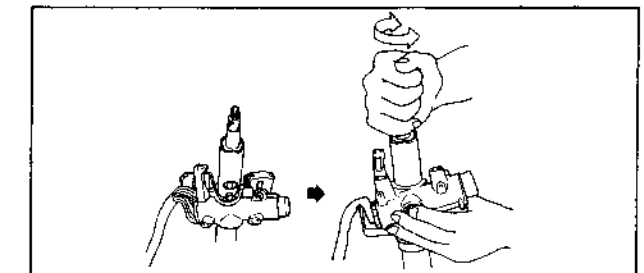


Fig. 3C-17

- 5) Tighten two new bolts until head of each bolt is broken off.

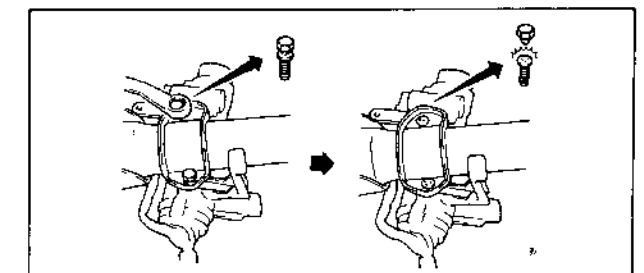


Fig. 3C-18

- 6) Turn ignition key to "ACC" or "ON" position and check to be sure that steering shaft rotates smoothly. Also check for lock operation.
- 7) Install steering column. Refer to Steps 1) through 8) under STEERING COLUMN INSTALLATION.

5. REMOVE AND INSTALL STEERING SHAFT LOWER JOINT

REMOVAL

- 1) Set front wheels in straightforward state and remove steering shaft joint cover.
- 2) Remove steering shaft joint bolts.

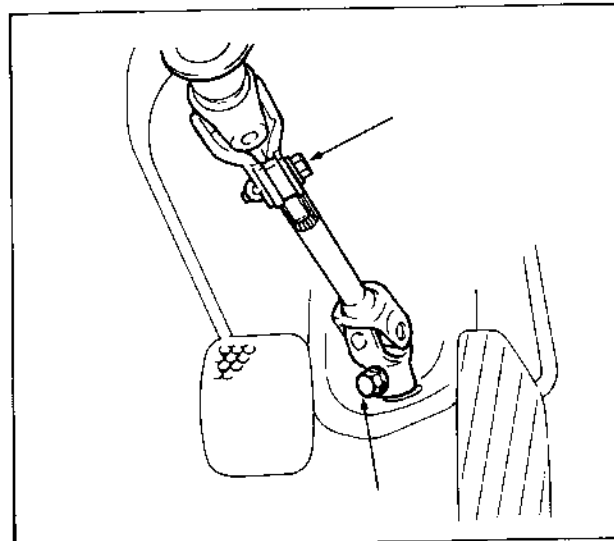


Fig. 3C-19

- 3) Remove steering shaft lower joint. If it's hard to remove, loosen steering column mounting nuts a little.

INSTALLATION

- 1) Align flat part of lower joint shaft with bolt hole of upper joint as shown. Then insert lower joint shaft into upper joint.

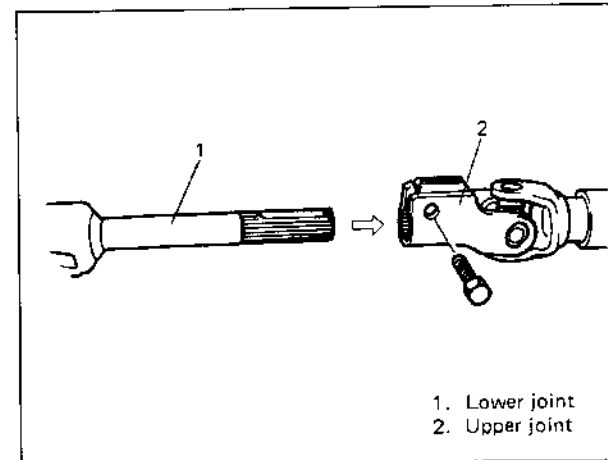


Fig. 3C-20

- 2) Be sure that front wheels and steering wheel are in straightforward state and insert lower joint into steering pinion shaft.
- 3) If steering column nuts were loosened in removal, torque lower bracket nuts to below specification first.

N·m	kg-m	lb-ft
11 - 17	1.1 - 1.7	8.0 - 12.0

And then torque upper bracket nuts to specification.

N·m	kg-m	lb-ft
11 - 17	1.1 - 1.7	8.0 - 12.0

- 4) Torque steering shaft joint bolts to specification.

N·m	kg-m	lb-ft
20 - 30	2.0 - 3.0	14.5 - 21.5

- 5) Install steering shaft joint cover.

6. CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

NOTE:

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

CHECKING PROCEDURE

- 1) Check capsules on steering column bracket; all should be contacting the bottom of slots. If not, steering column assembly should be replaced. Use thickness gauge for convenience.

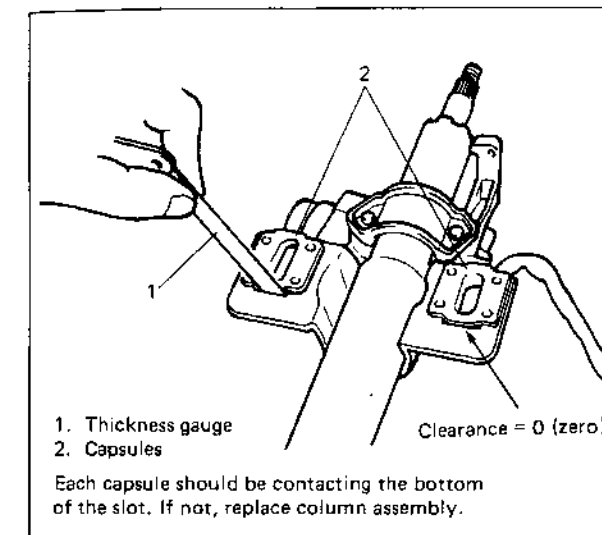


Fig. 3C-21 Checking Steering Column

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

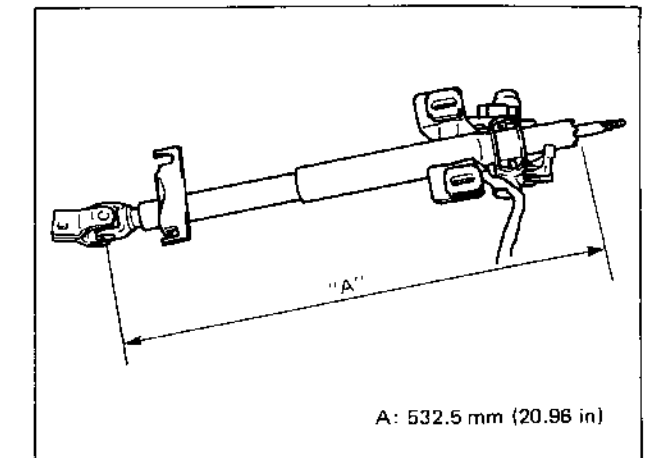


Fig. 3C-22

- 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 joint assembly.

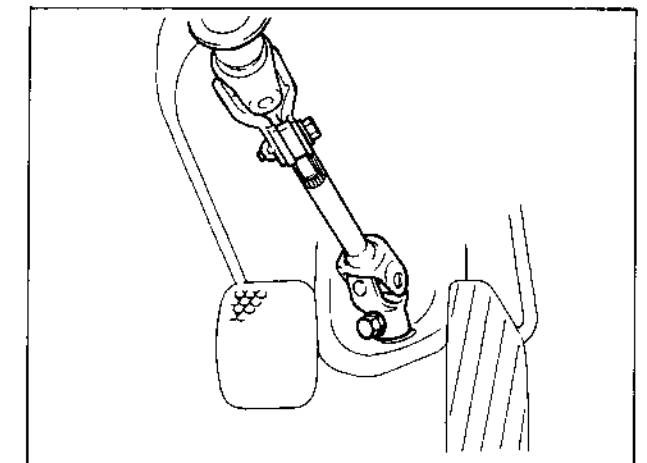


Fig. 3C-23

- 4) Check steering shaft for smooth rotation. If found defective, replace as column assembly.
- 5) Check steering shaft and column for bend, cracks or deformation. If found defective, replace.

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg·m	lb·ft
1. Steering shaft nut	25 – 40	2.5 – 4.0	18.5 – 28.5
2. Steering shaft joint bolts	20 – 30	2.0 – 3.0	14.5 – 21.5
3. Steering column nuts	11 – 17	1.1 – 1.7	8.0 – 12.0

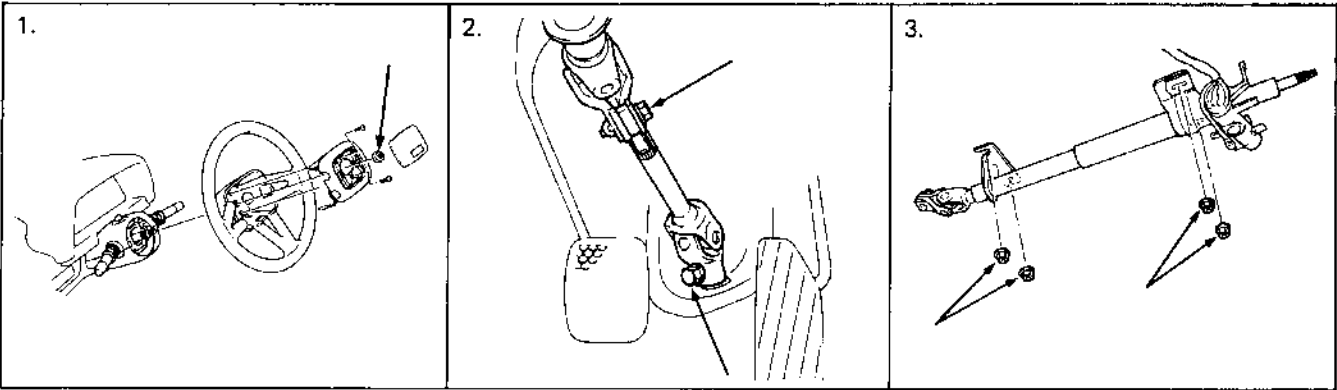


Fig. 3C-24

SPECIAL TOOL

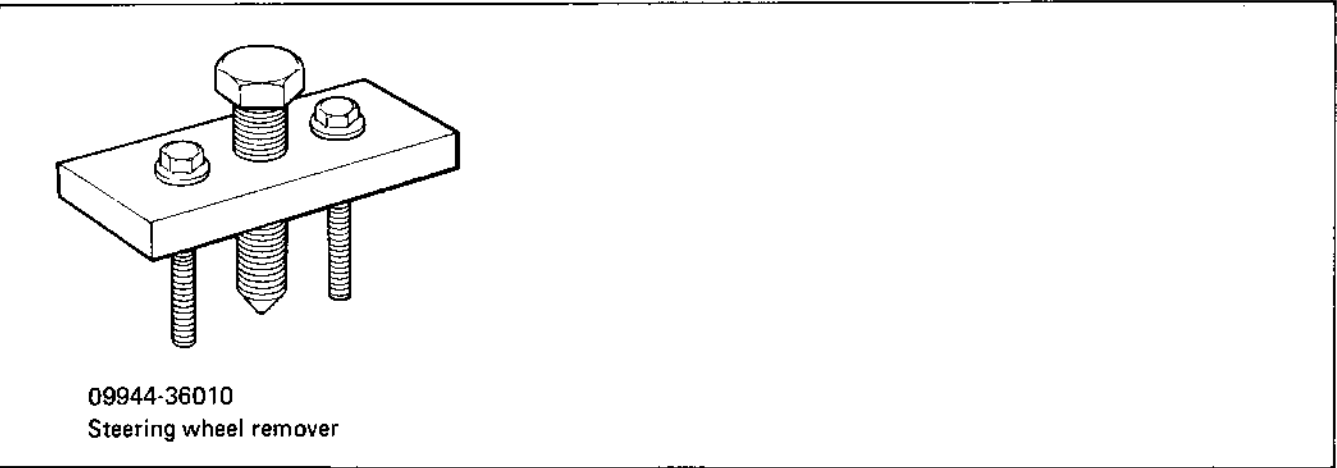


Fig. 3C-25

SECTION 3D

FRONT SUSPENSION

- NOTE:
- 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 front suspension part. Replace it with a new part, or damage to the part may result.

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2. Remove and Install Strut Damper Assembly	3D- 5
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5. Remove and Install Suspension Arm/Bushing	3D-10
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GENERAL DESCRIPTION

The front suspension is the strut type independent suspension. The upper end of a strut is anchored to the car body by a strut support. The strut and strut support are isolated by a rubber mount. A strut bearing is also installed a little lower to the rubber mount.

The lower end of the strut is connected to the upper end of a steering knuckle and lower end of knuckle is attached to the strut of a ball joint which is incorporated in a unit with a suspension control arm. And connected to this steering knuckle is the tie-rod end.

Thus, movement of the steering wheel is transmitted to the tie-rod end and then to the knuckle, eventually causing the wheel-and-tire to move. In this operation, with the movement of the knuckle, the strut also rotates by means of the strut bearing and lower ball joint.

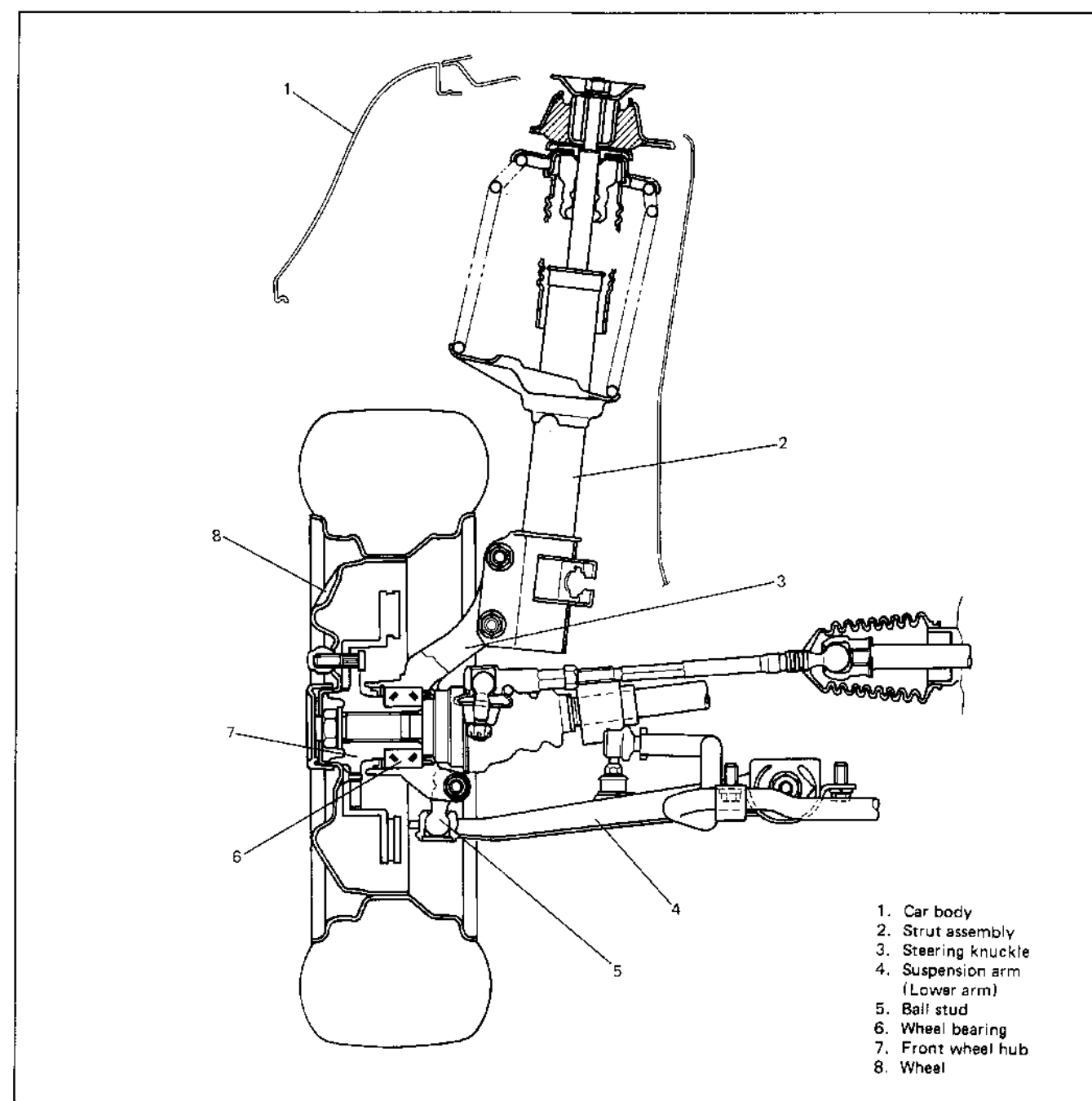


Fig. 3D-1

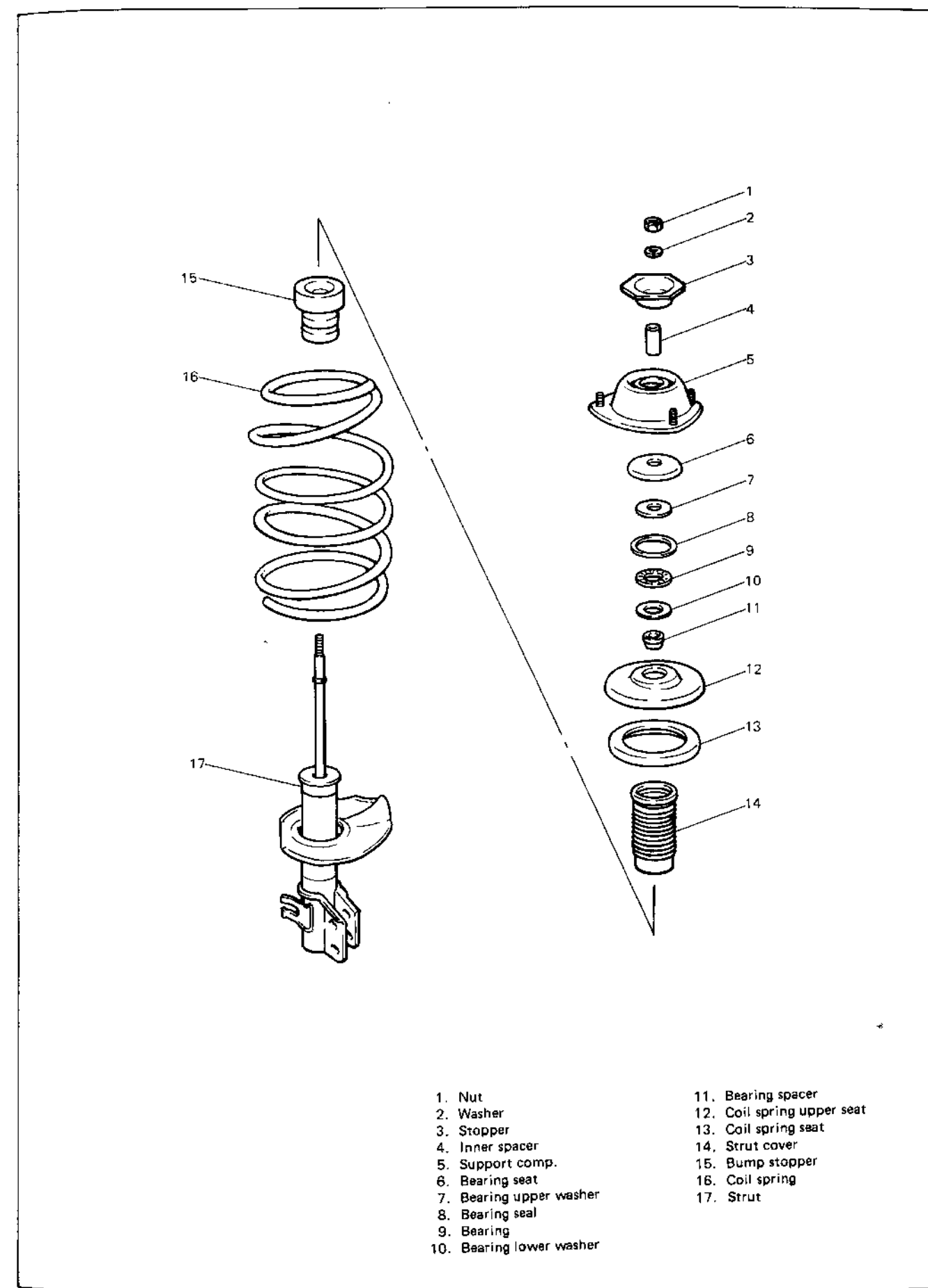


Fig. 3D-2 Front Suspension

ON-CAR SERVICE

1. REMOVE AND INSTALL STABILIZER BAR AND/OR BUSHINGS

REMOVAL

- 1) Remove stabilizer link nuts, washers and cushions.
- 2) Remove stabilizer mount brackets.
- 3) Remove stabilizer.
- 4) Remove stabilizer joints from stabilizer.

INSTALLATION

- 1) When installing stabilizer, loosely assemble all components while insuring that stabilizer is centered, side-to-side. Refer to figure "A" below for its check.
For correct installation in vertical direction, Refer to figure "B".
- 2) Install parts by reversing Steps 1) – 3) of REMOVAL.

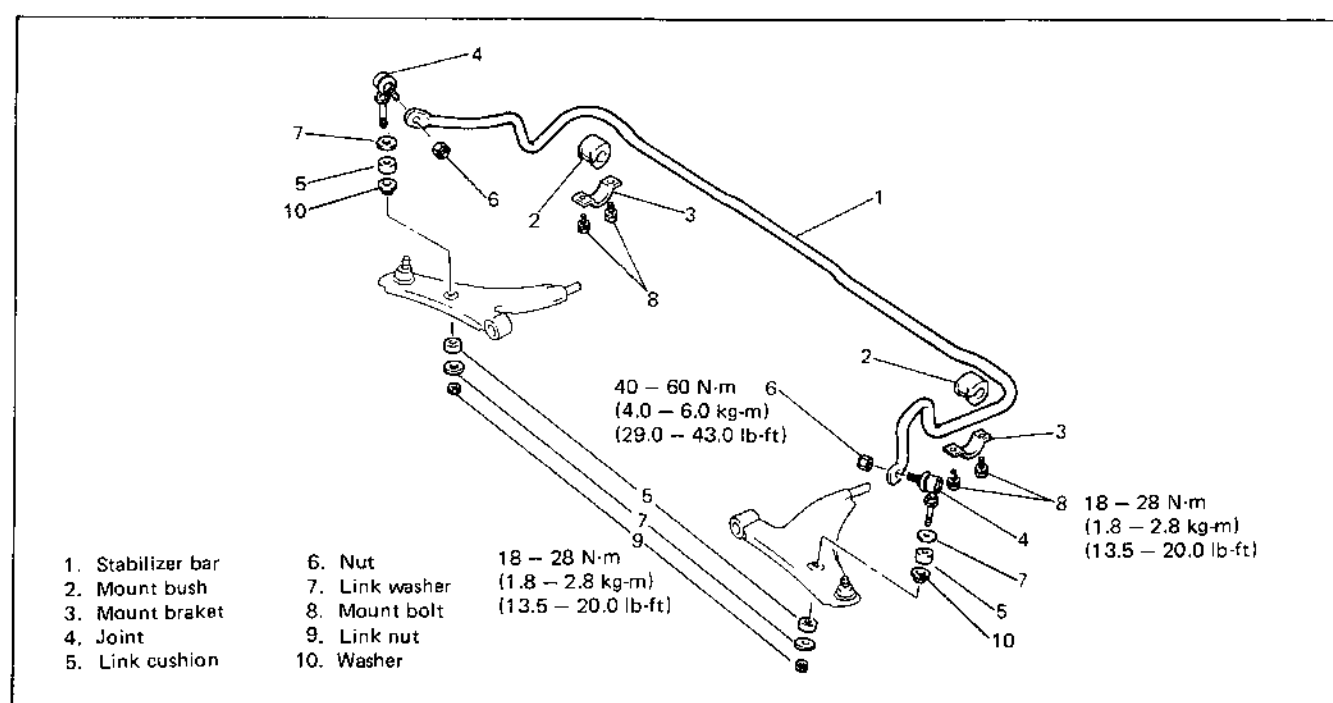


Fig. 3D-1-1

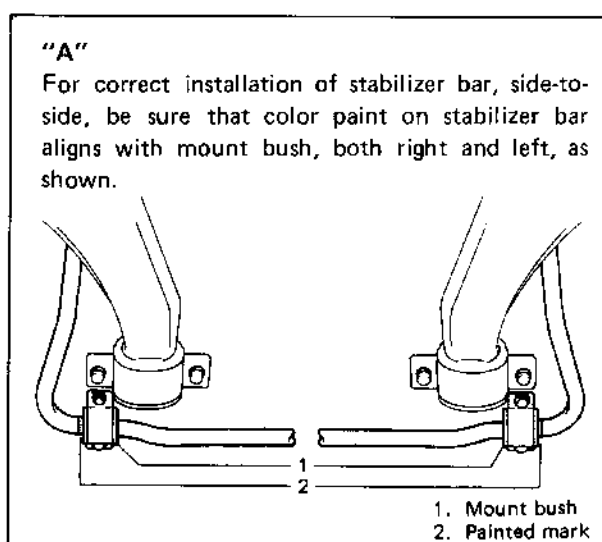


Fig. 3D-1-2

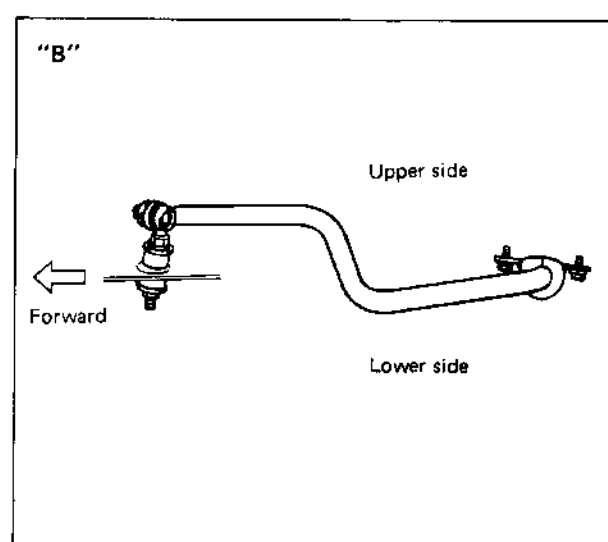


Fig. 3D-1-3

2. REMOVE AND INSTALL STRUT DAMPER ASSEMBLY

REMOVAL

- 1) Hoist car, allowing front suspension to hang free.
- 2) Remove wheel.
- 3) Remove E ring securing brake hose and take brake hose off strut bracket as shown below.

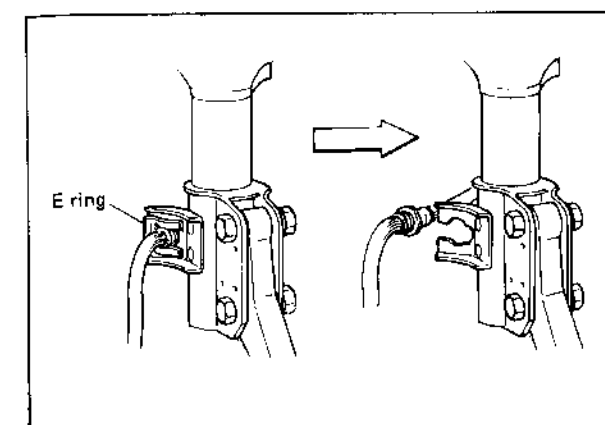


Fig. 3D-2-1

- 4) Remove strut bracket bolts.

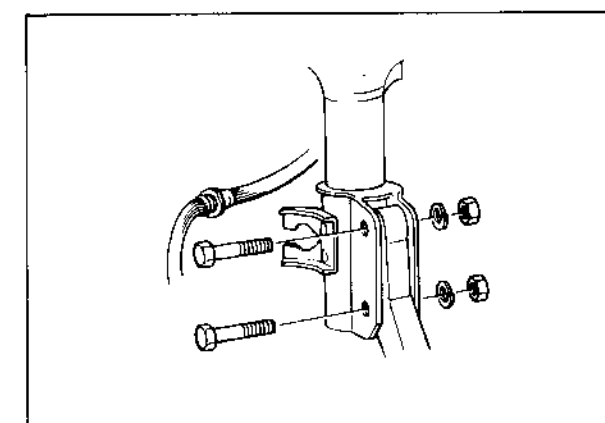


Fig. 3D-2-2

- 5) Remove strut support nuts.
Hold strut by hand so that it will not fall off.

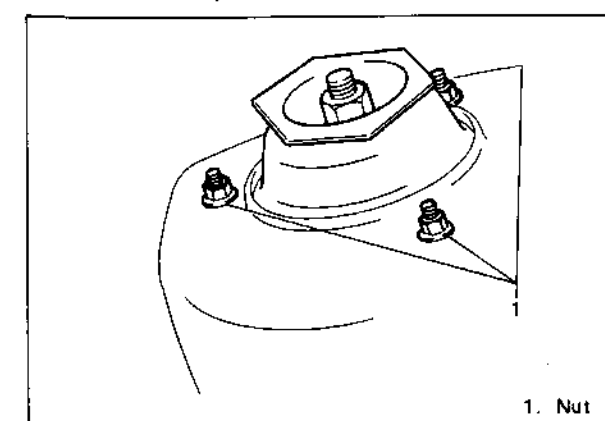


Fig. 3D-2-3

- 6) Remove strut assembly.

INSTALLATION

- 1) Install strut by reversing REMOVAL Steps 1) – 6). Insert bolts in such a direction as shown below.
- 2) Torque all fasteners to specification.

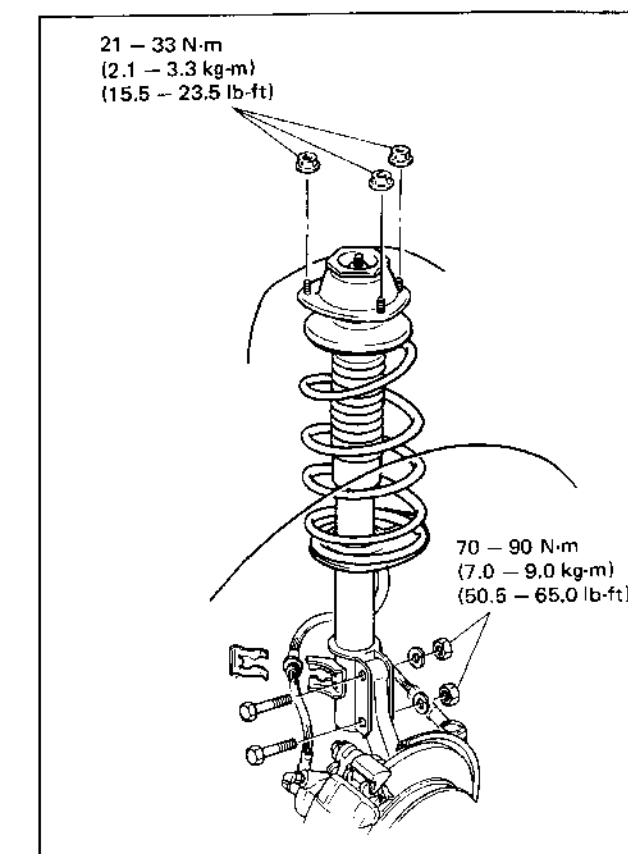


Fig. 3D-2-4

NOTE:
Don't twist brake hose when installing it.
Install E ring as far as it fits to bracket as shown below.

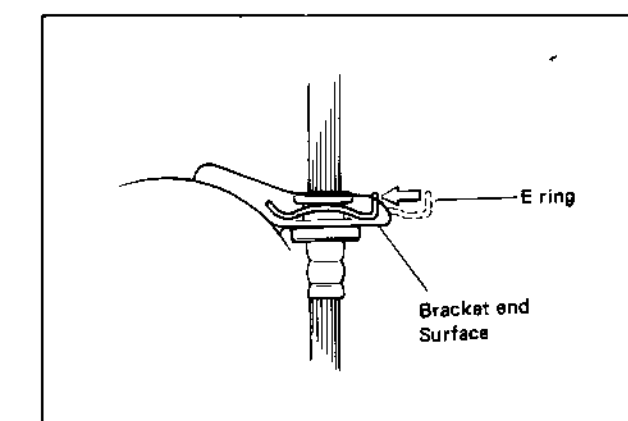


Fig. 3D-2-5

3. DISASSEMBLY AND ASSEMBLY STRUT DAMPER

DISASSEMBLY

- 1) With special tool (A) placed to spring as shown, turn special tool bolts alternately until spring tension is released. Whether it is released or not can be known by whether strut turns lightly while strut spring is held stationary.

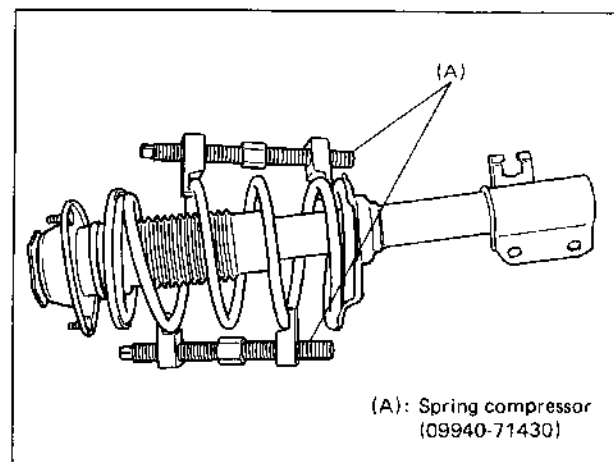


Fig. 3D-3-1

- 2) While keeping spring compressed with special tool as shown above, remove strut nut and then disassemble parts.

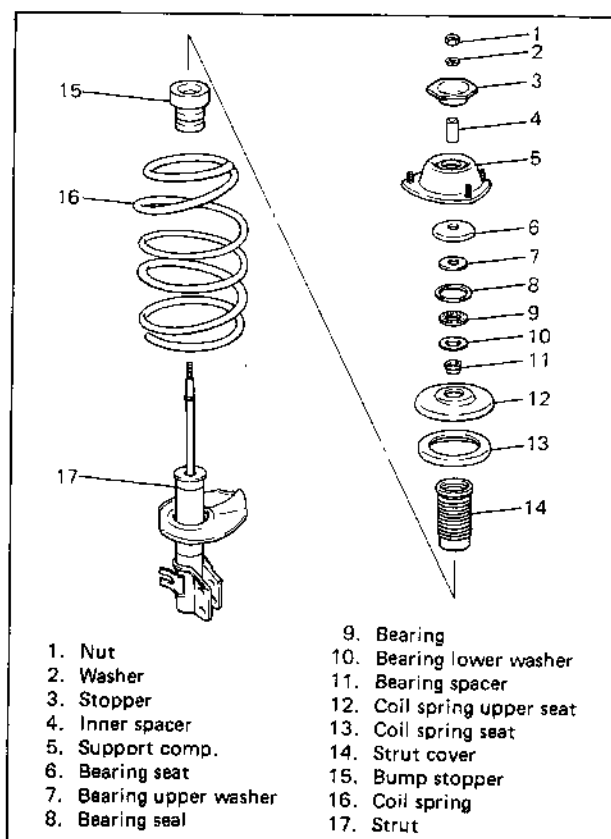


Fig. 3D-3-2

ASSEMBLY

- 1) Compress spring with special tool (A) until total length becomes about 230 mm (9.06 in) as shown.

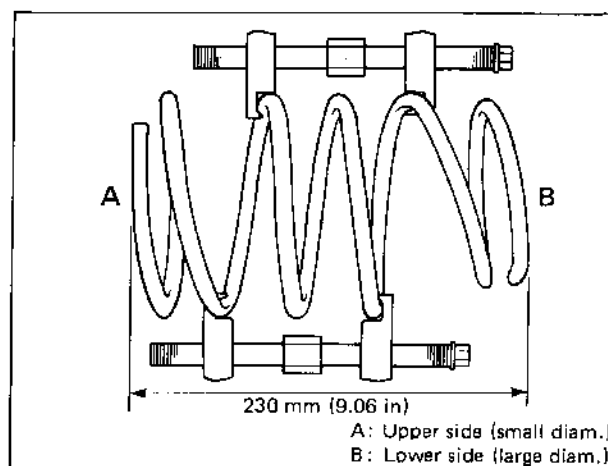


Fig. 3D-3-3

- 2) Mate spring end with stepped part of lower seat as shown.

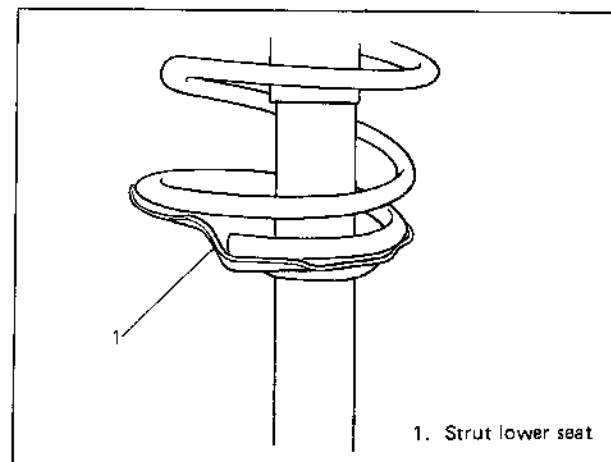


Fig. 3D-3-4

- 3) Install bump stopper onto strut rod. For installing direction, refer to the figure at the left.
- 4) Pull strut rod as far up as possible and use care not to allow it to retract into strut.
- 5) Install spring seat, bearing spacer and strut cover to spring upper seat and then install strut bracket with its center aligned with "A" mark on spring upper seat.

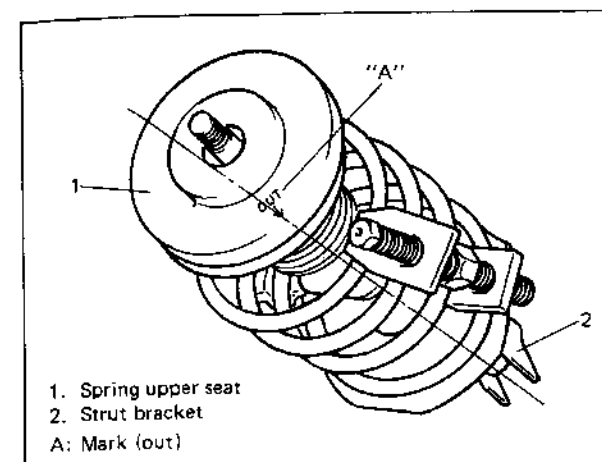


Fig. 3D-3-5

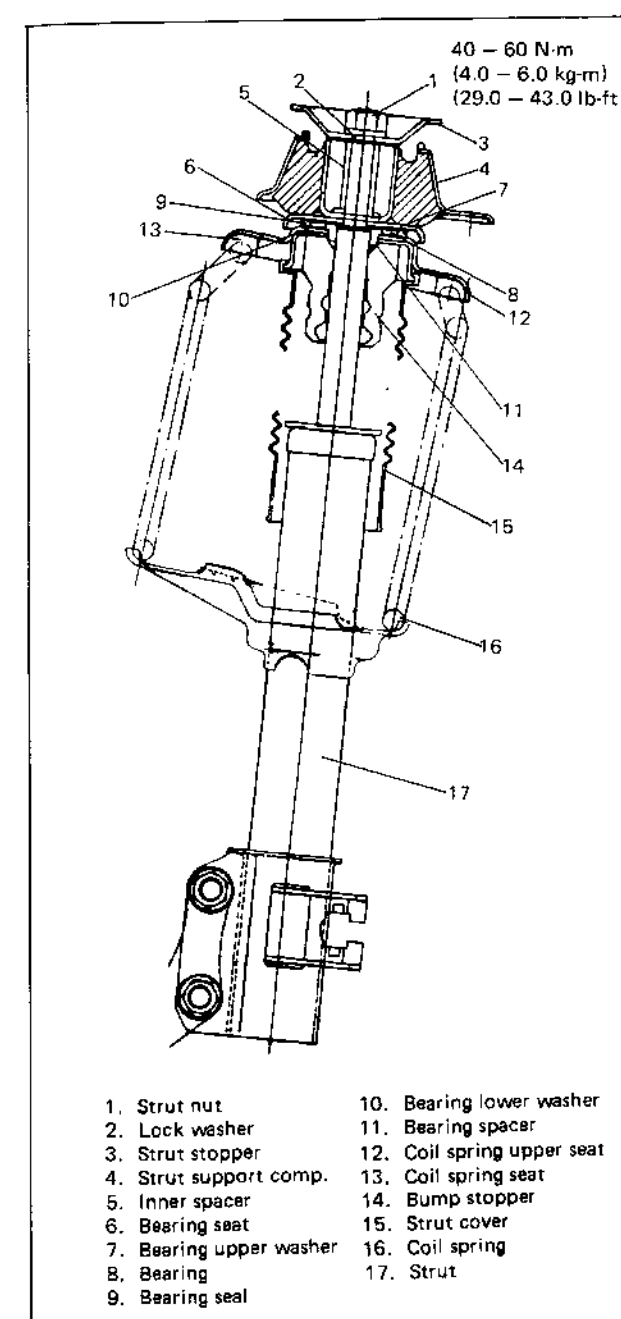


Fig. 3D-3-6

- 6) Wash bearing lower washer and install it.
- 7) Wash strut bearing and apply grease. Install it on bearing lower washer.
- 8) Wash bearing upper washer and install it.
- 9) Install bearing seal, bearing seat, strut support, inner spacer, washer and strut nut in this sequence.
Be careful for installing directions.
Tighten strut nut to specified torque and then apply water-proof coating (paint or lacquer) all around nut and strut rod thread.
- 10) Loosen and remove special tool (A) compressing coil spring. While loosening special tool, recheck that stepped part of spring seat and spring end are in place to each other as described in foregoing Step 2).
- 11) Install strut to car body. Refer to STRUT DAMPER INSTALLATION of this section.

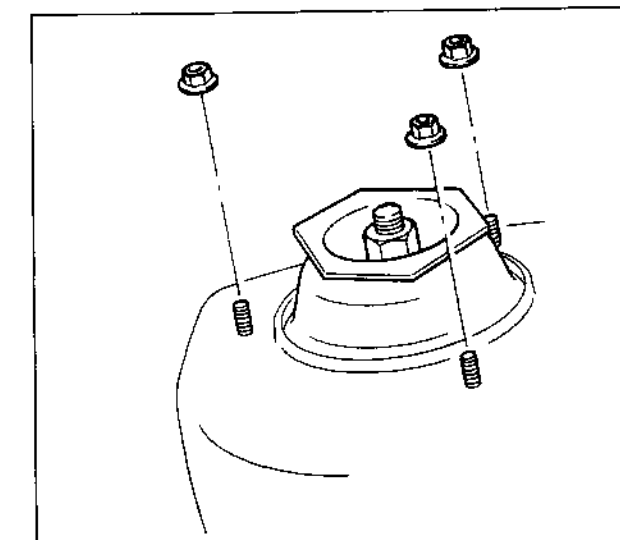


Fig. 3D-3-7

4. REMOVE AND INSTALL WHEEL HUB, WHEEL STUD/WHEEL BEARING OUTSIDE INNER RACE

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Uncalk drive shaft nut.
- 3) Depress foot brake pedal and hold it there.
Remove drive shaft nut.
- 4) Remove caliper carrier bolts.

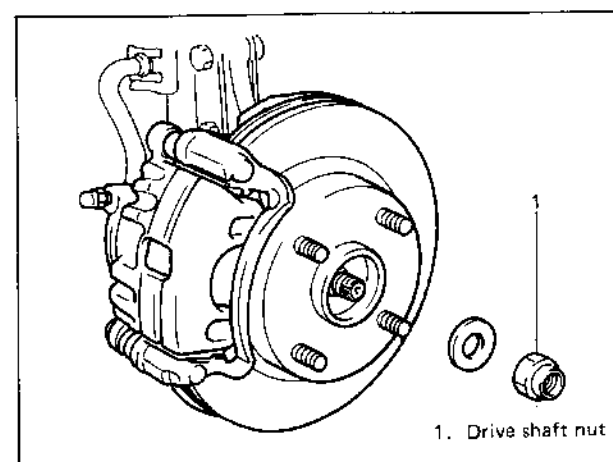


Fig. 3D-4-1

- 5) Remove caliper with carrier.
- 6) Remove disc screws.
- 7) Pull brake disc off by using two 8 mm bolts.

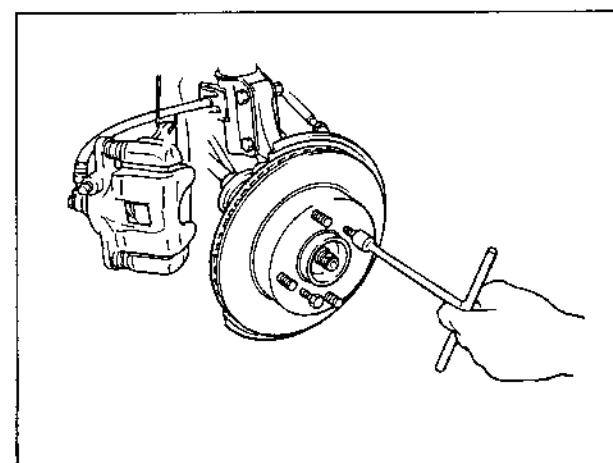


Fig. 3D-4-2

- 8) Pull out wheel hub with special tools (B) and (C).

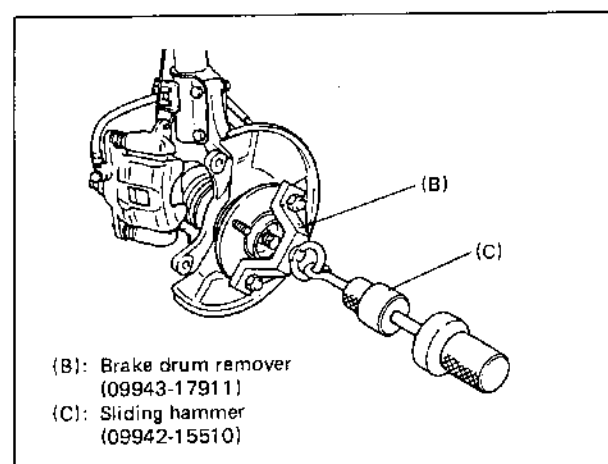


Fig. 3D-4-3

- 9) Remove hub bolts.

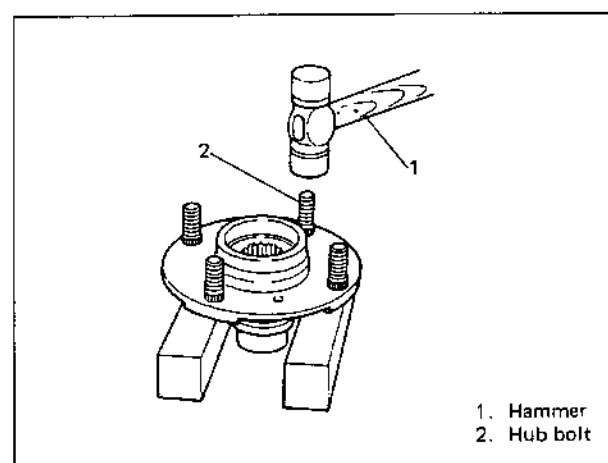


Fig. 3D-4-4

- 10) Remove wheel bearing inner race.

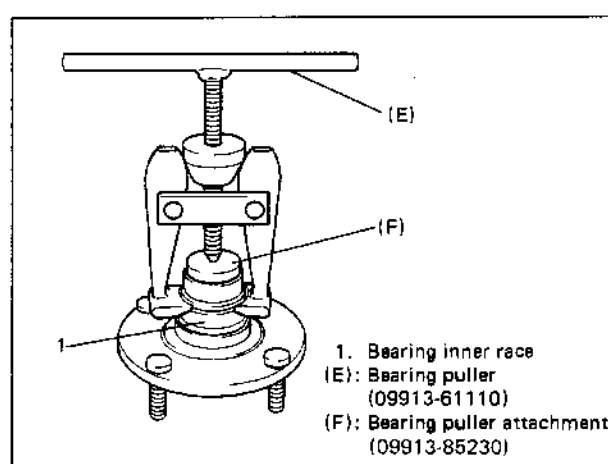


Fig. 3D-4-5

INSTALLATION

Install Hub Bolts

Insert new stud in hub hole. Rotate stud slowly to assure serrations are aligned with those made by original bolt.

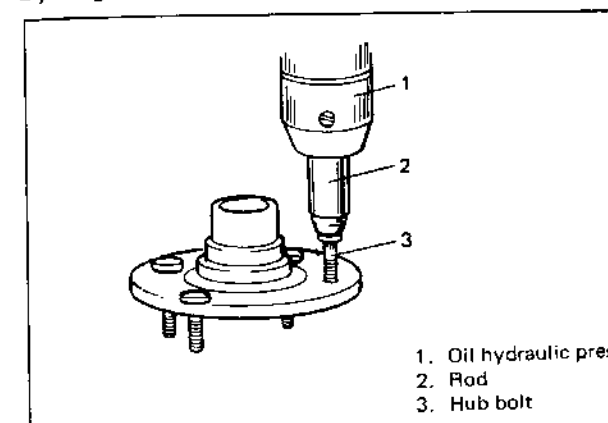


Fig. 3D-4-6

- 1) Install outside inner race to wheel hub using special tool (G). Installing direction is as shown.

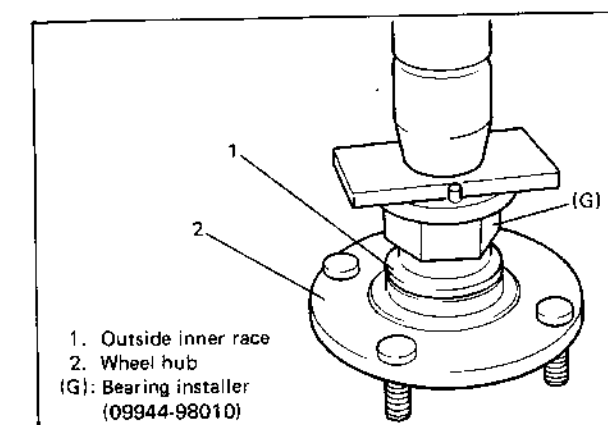


Fig. 3D-4-7

- 2) Apply grease to outside bearing, outside inner race and oil seal lip.

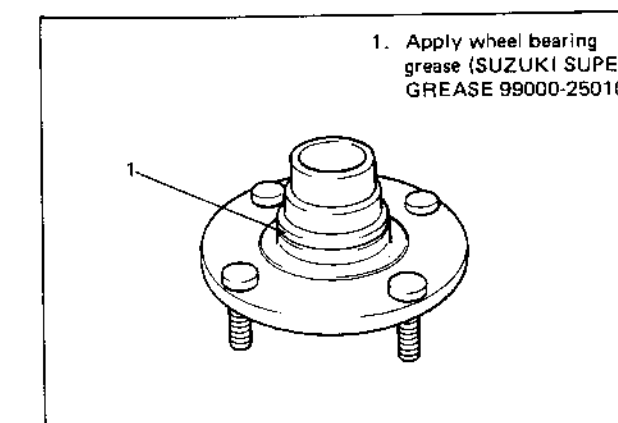


Fig. 3D-4-8

- 3) Install wheel hub to knuckle by tightening drive shaft nut. Don't tap wheel hub.

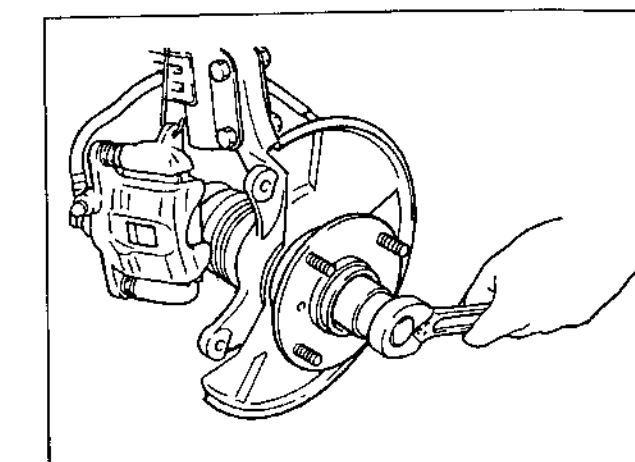


Fig. 3D-4-9

- 4) Install brake disc.
- 5) Install brake caliper/caliper carrier.

- 6) Tighten caliper carrier bolts to specified torque.
- 7) Depress foot brake pedal and hold it there.
Tighten drive shaft nut and brake disc screws to specified torque.
- 8) Calk drive shaft nut as shown below.

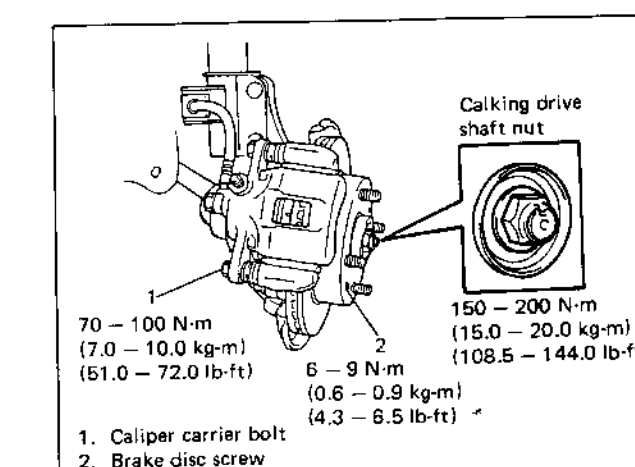


Fig. 3D-4-10

- 9) Install wheel and lower hoist.

5. REMOVE AND INSTALL SUSPENSION ARM/BUSHING

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove stabilizer link nut, washer and cushion.
- 3) Remove ball stud bolt.
- 4) Remove suspension arm bracket nut.
- 5) Remove suspension arm bracket bolts.
- 6) Remove rear bracket and suspension arm.
- 7) Remove rear bushing with hydraulic press as shown.

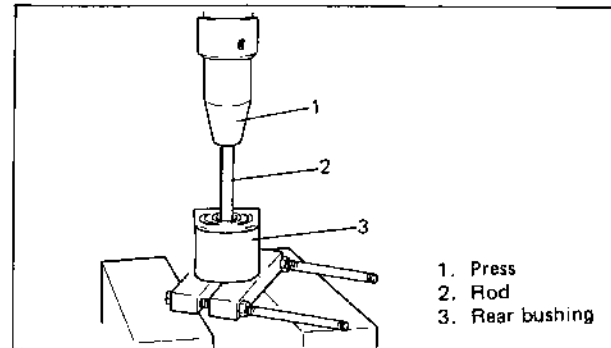


Fig. 3D-5-1

- 8) Cut off flange of front bushing as shown in below figure "A" and then push out front bushing by using hydraulic press as shown in figure "B".

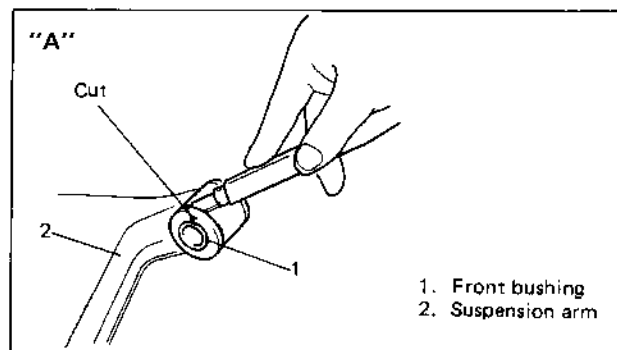


Fig. 3D-5-2

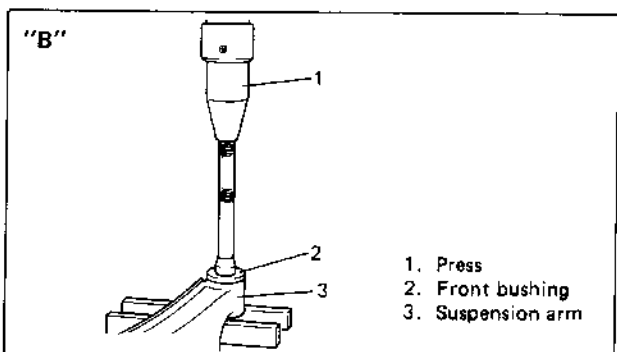


Fig. 3D-5-3

INSTALLATION

- 1) Install front bushing.

Before installing bushing, apply soap water on its circumference to facilitate installation.

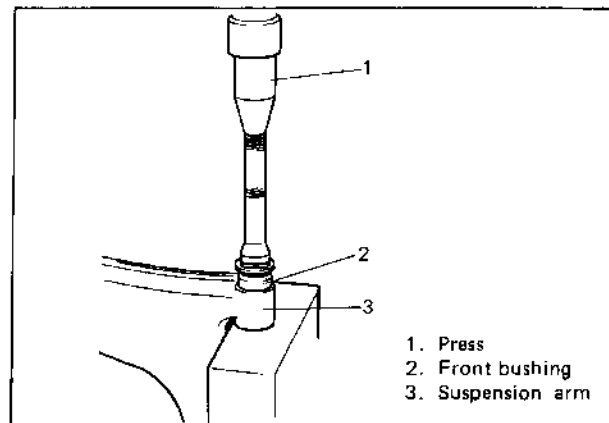


Fig. 3D-5-4

When installed, bush should be equal on the right and left of arm as shown.

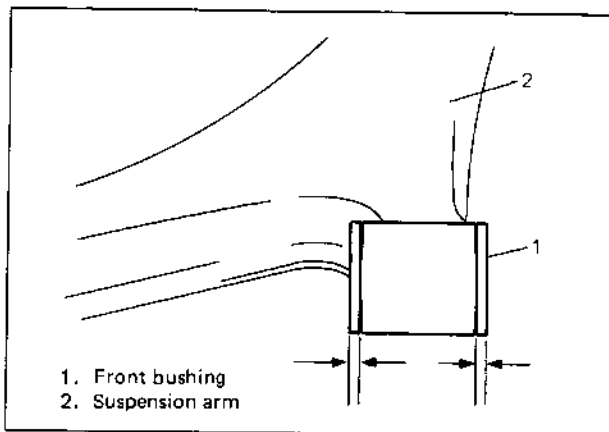


Fig. 3D-5-5

- 2) Install rear bushing to suspension arm as follows. First, push in rear bushing in such direction and angle as shown in below figure "A" and drive it into such position as shown in figure "B".

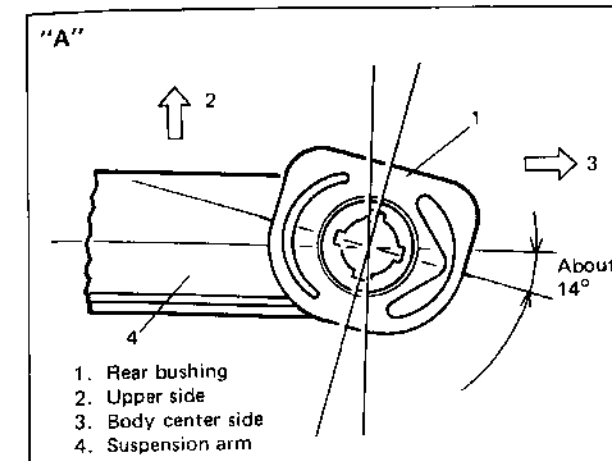


Fig. 3D-5-6

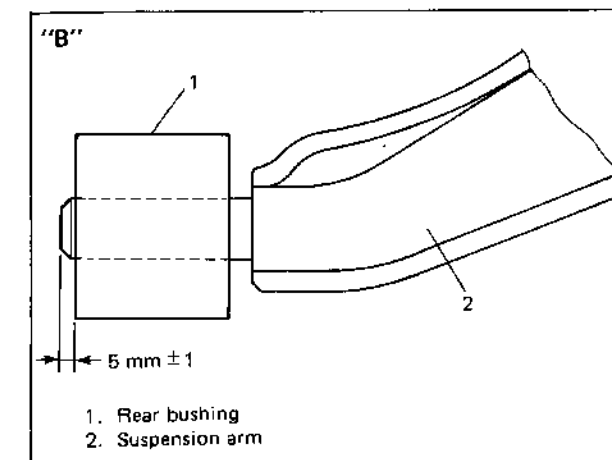


Fig. 3D-5-7

- 3) Fit suspension arm bracket to suspension arm in such direction as shown in Fig. 3D-5-9 and hand-tighten bracket nut lightly and then install suspension arm bracket to car body. At this point, tighten bracket bolt only lightly by hand.

- 4) Install ball stud to knuckle.

Align ball stud groove with knuckle bolt hole as shown in figure. Then drive in ball stud bolt from the direction as shown and install washer and nut.

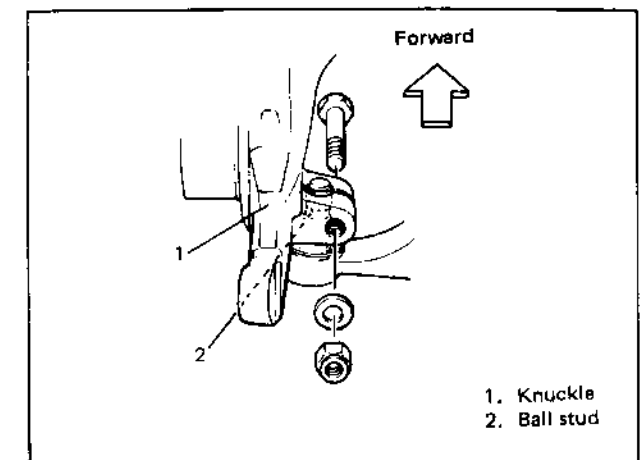


Fig. 3D-5-8

- 5) Install suspension arm rear bracket.

- 6) Install stabilizer cushion, washer and link nut.

Link nut tightening torque:
18–28 N·m (1.8–2.8 kg·m, 13.5–20.0 lb ft)

- 7) Tighten all bolts and nuts in figure to each specified torque.

- 8) Install wheel and lower hoist.

- 9) Check toe seating and adjust as required.

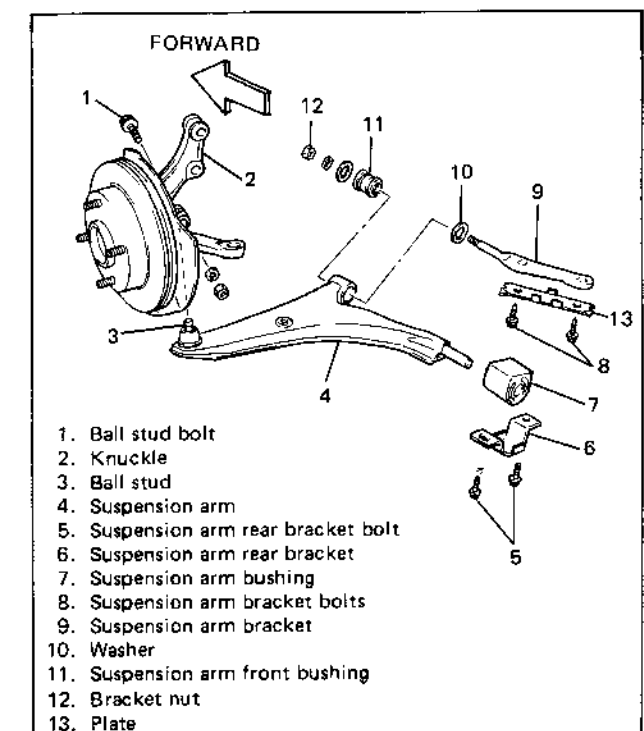


Fig. 3D-5-9

6. REMOVE AND INSTALL KNUCKLE/BEARING

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove wheel hub. Refer to Step 2) – 8) in item 4 of WHEEL HUB REMOVAL of this section.
- 3) Disconnect tie-rod end from knuckle with special tool (H).

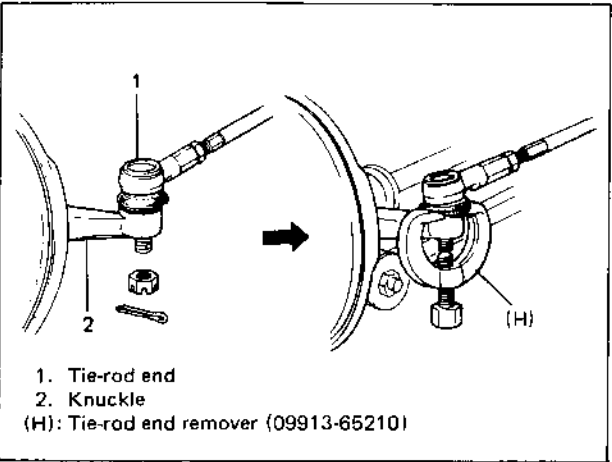


Fig. 3D-6-1

- 4) Remove strut bracket bolts from strut bracket and then ball stud bolt.

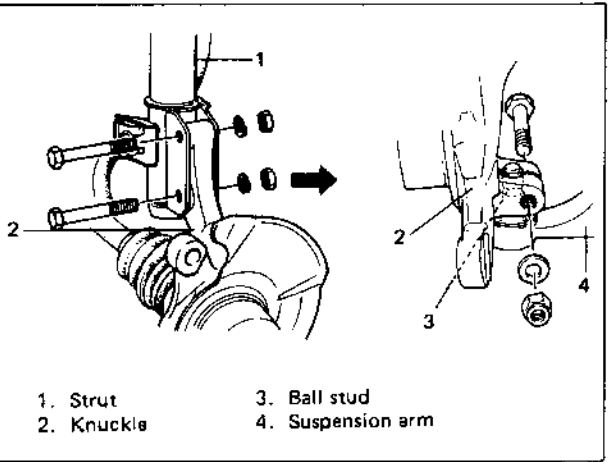


Fig. 3D-6-2

- 5) Remove knuckle.

INSTALLATION

- 1) Install knuckle to ball stud on suspension arm and strut bracket. Installing direction of each bolt is as shown. Align knuckle bolt hole with ball stud groove as shown and install ball stud bolt. Tighten each nuts to specified torque.

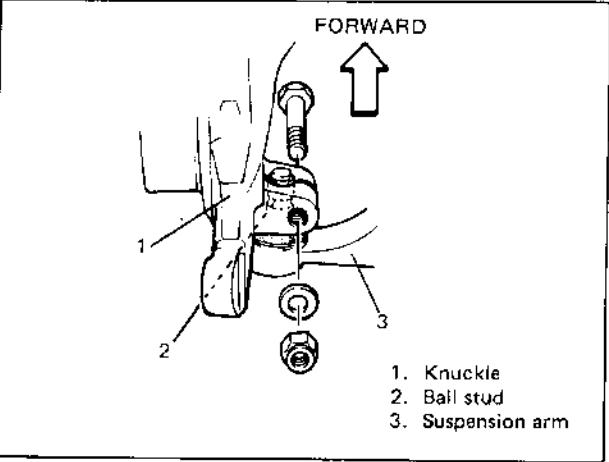


Fig. 3D-6-3

- 2) Connect tie-rod end to knuckle and tighten tie-rod end castle nut to specified torque. Install split pin.

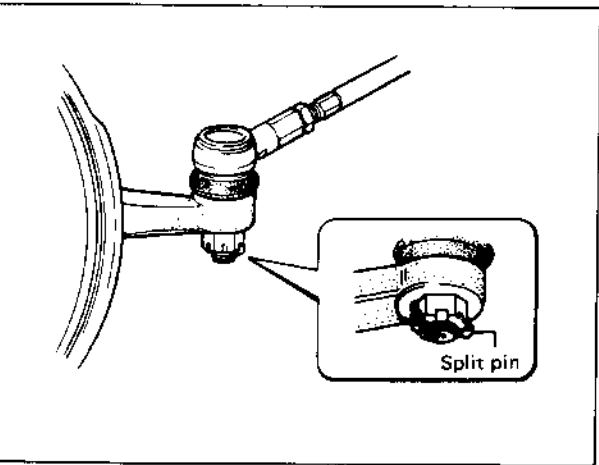


Fig. 3D-6-4

- 3) For installation procedures following the above, refer to Steps 1) – 9) in Item 4, WHEEL HUB INSTALLATION of this section.

For tightening torque, refer to next page.

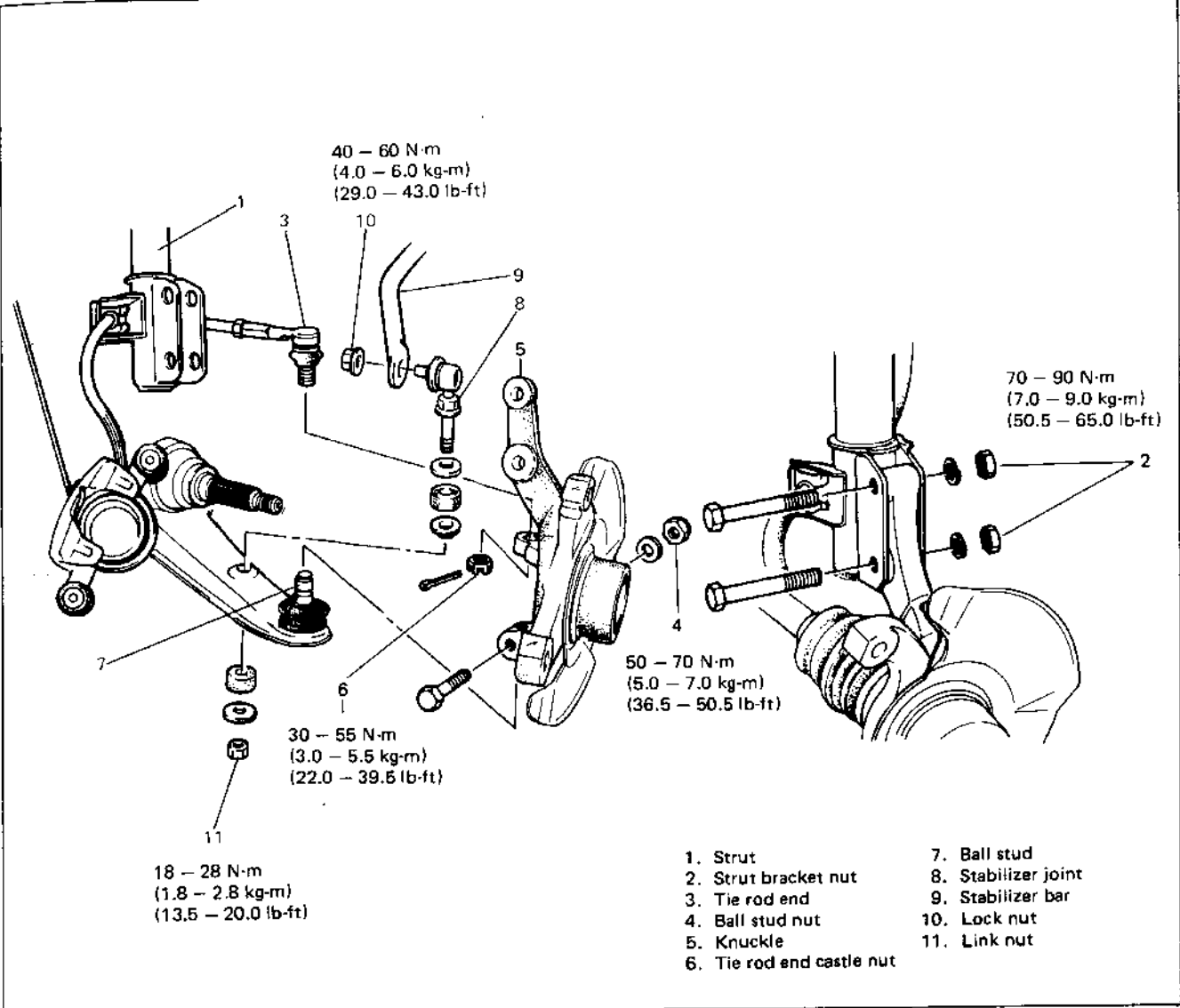


Fig. 3D-6-5

REMOVE OIL SEALS, SNAP RING AND WHEEL BEARING

Once bearing outer race is removed, bearing set (outer race, bearings and inner races) should be replaced with new one.

- Remove outside oil seal, snap ring outside bearing, inside oil seal and inside bearing in that order.

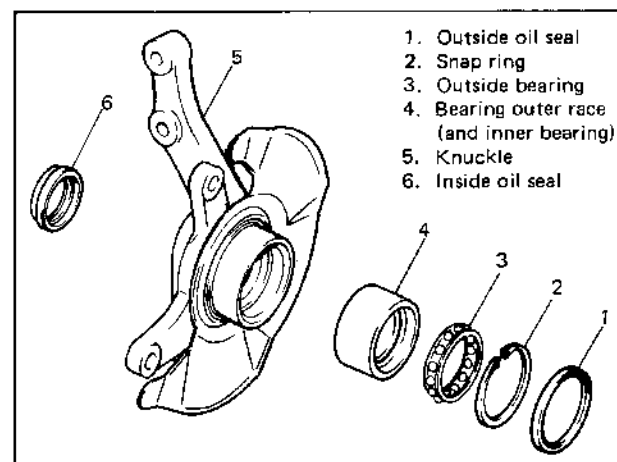


Fig. 3D-6-6

- Remove bearing outer race/inner bearing using special tool (I) and (J), and hydraulic press.

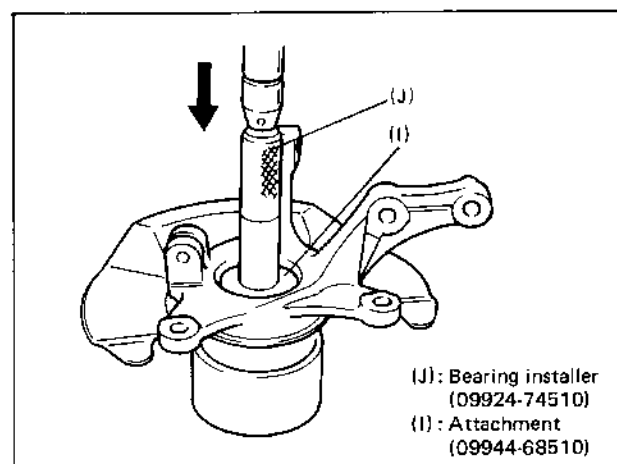


Fig. 3D-6-7

INSTALL OIL SEALS, SNAP RING AND WHEEL BEARING

When replacing bearing, inner bearing or outer bearing, be sure to replace them with new ones as a set.

- Press-fit bearing outer race/inner bearing using special tools (J), (K) and (L).

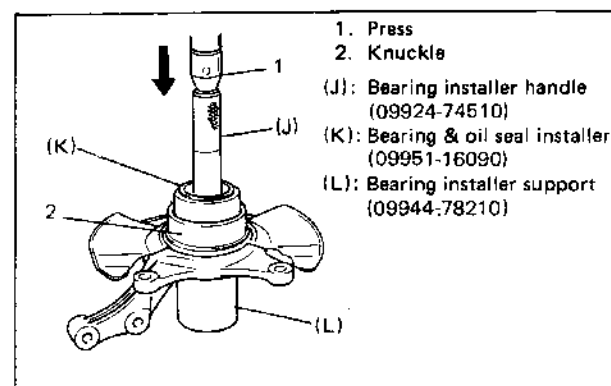


Fig. 3D-6-8

- After greasing (lithic grease) bearing outer race, bearings and oil seal lips, install them.

Inside Oil Seal

Drive in Oil seal until seal is flush with stopped surface of knuckle by using special tool (L).

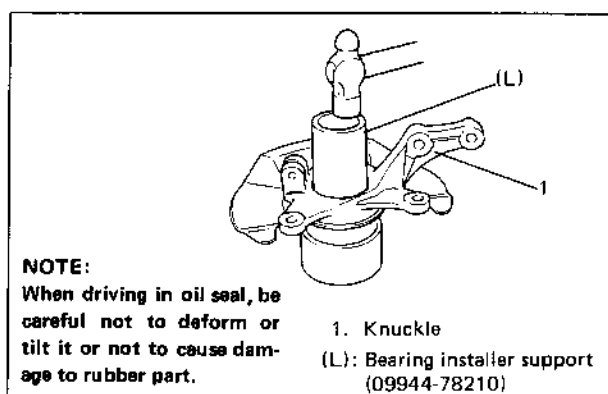


Fig. 3D-6-9

Outside Oil Seal

Drive in oil seal until its end contacts snap ring using special tools (J), (K) and (L). As for its installing direction, refer to Fig. 3D-6-10.

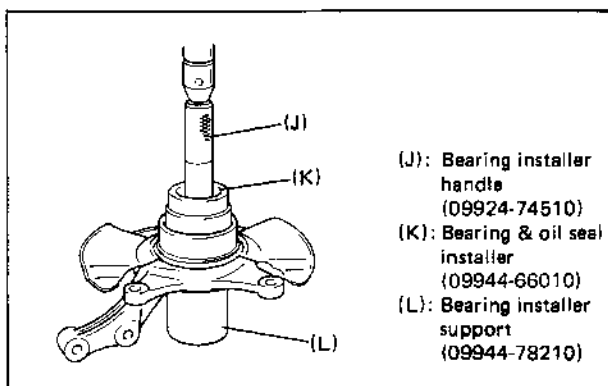


Fig. 3D-6-10

7. FRONT SUSPENSION INSPECTION

STABILIZER BAR AND/OR BUSHING

Bar

Inspect for damage or deformation. If defective, replace.

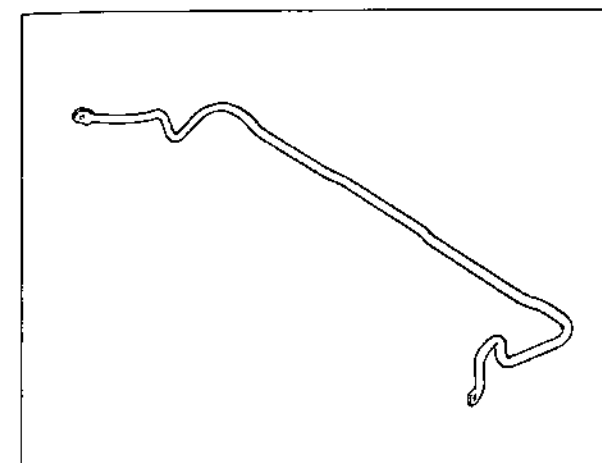


Fig. 3D-7-1

Bushing

Inspect for damage, wear or deterioration. If defective, replace.

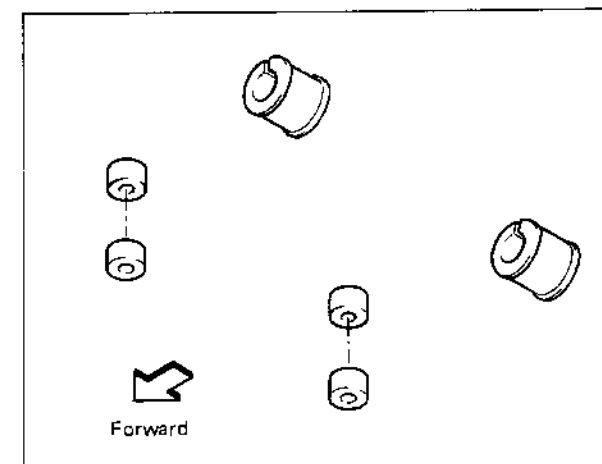


Fig. 3D-7-2

STRUT DAMPER

- 1) Inspect strut for oil leakage. If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.

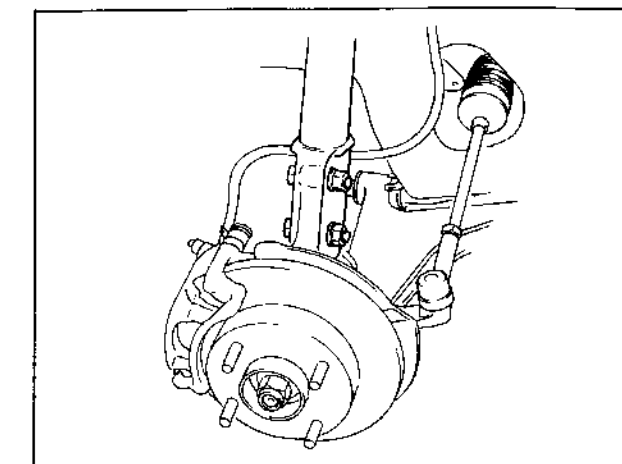


Fig. 3D-7-3

- 2) Strut function check

Check and adjust tire pressures as specified. Bounce car body three or four times continuously by pushing front end on the side with strut to be checked. Apply the same amount of force at each push and note strut resistance both when pushed and rebounding. Also, note how many times car body rebounds before coming to stop after hands are off. Do the same for strut on the other side. Compare strut resistance and number of rebound on the right with those on the left. And they must be equal in both. With proper strut, car body should come to stop the moment hands are off or after only one or two small rebounds. If struts are suspected, compare them with known good car or strut.

- 3) Inspect for damage or deformation.
- 4) Inspect bearing for wear, abnormal noise or gripping.
- 5) Inspect for cracks or deformation in spring seat.
- 6) Inspect for deterioration of bump stopper.
- 7) Inspect rebound stopper and strut mount for wear, cracks or deformation.

Replace any parts found defective in Steps 2) – 7).

**SUSPENSION ARM/ARM BRACKET/
KNUCKLE ARM**
Inspect for cracks, deformation or damage.

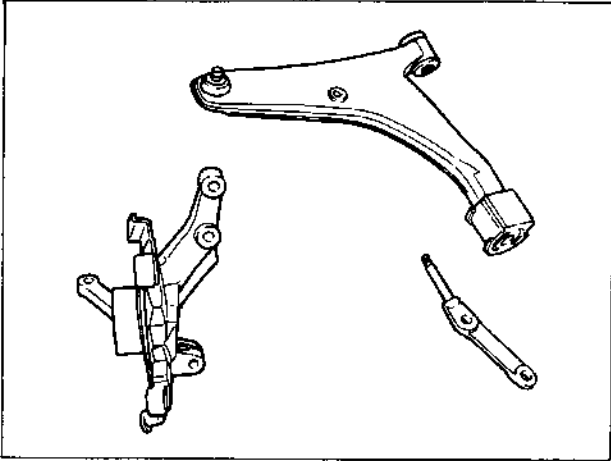


Fig. 3D-7-4

SUSPENSION ARM JOINT
1) Check for smooth rotation.
2) Inspect ball stud for damage.
3) Inspect dust cover for damage.

NOTE:
Suspension arm and arm joint cannot be separated.

If there is any damage to either, control arm assembly must be replaced as a complete unit.

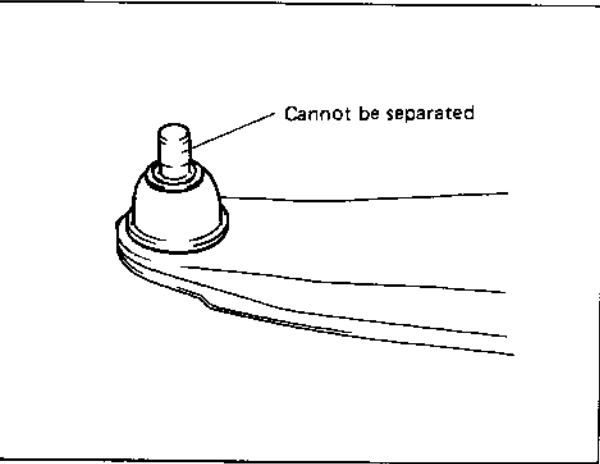


Fig. 3D-7-5

SUSPENSION ARM BUSHING
Inspect for damage, wear or deterioration.

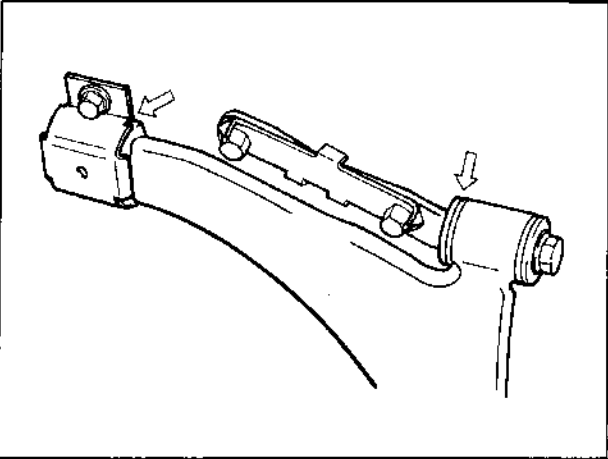


Fig. 3D-7-6

WHEEL DISC, NUT & BEARING
1) Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
2) Check wheel nuts for tightness and, as necessary retighten them to specification.

Tightening torque for wheel nuts	N·m	kg·m	lb·ft
	50 – 70	5.0 – 7.0	36.5 – 50.5

3) Check wheel bearing for wear. When measuring thrust play, apply a dial gauge to wheel hub center after removing wheel center cap from wheel disc.

Thrust play limit	0.4 mm (0.016 in)

When measurement exceeds limit, replace bearing.
4) By rotating wheel actually, check wheel bearing for noise and smooth rotation. If defective, replace bearing.

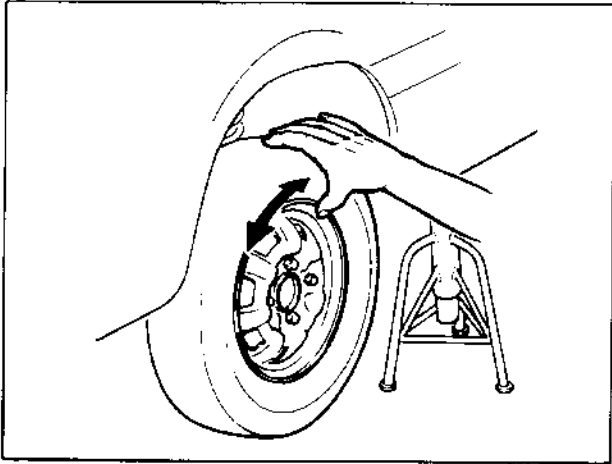


Fig. 3D-7-7

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg·m	lb·ft
1. Strut bracket nut	70 – 90	7.0 – 9.0	50.5 – 65.0
2. Strut nut	40 – 60	4.0 – 6.0	29.0 – 43.0
3. Strut support nut	21 – 33	2.1 – 3.3	15.5 – 23.5
4. Ball stud nut	50 – 70	5.0 – 7.0	36.5 – 50.5
5. Suspension arm rear bracket bolt	30 – 55	3.0 – 5.5	22.0 – 39.5
6. Suspension arm bracket bolt	85 – 100	8.5 – 10.0	61.5 – 72.0
7. Bracket nut	100 – 150	10.0 – 15.0	72.5 – 108.0
8. Stabilizer joint nut	40 – 60	4.0 – 6.0	29.0 – 43.0
9. Stabilizer link nut	18 – 28	1.8 – 2.8	13.5 – 20.0
10. Stabilizer bracket bolt	18 – 28	1.8 – 2.8	13.5 – 20.0
11. Drive shaft nut	150 – 200	15.0 – 20.0	108.5 – 144.0
12. Tie rod end castle nut	30 – 55	3.0 – 5.5	22.0 – 39.0
13. Wheel nut	50 – 70	5.0 – 7.0	36.5 – 50.5

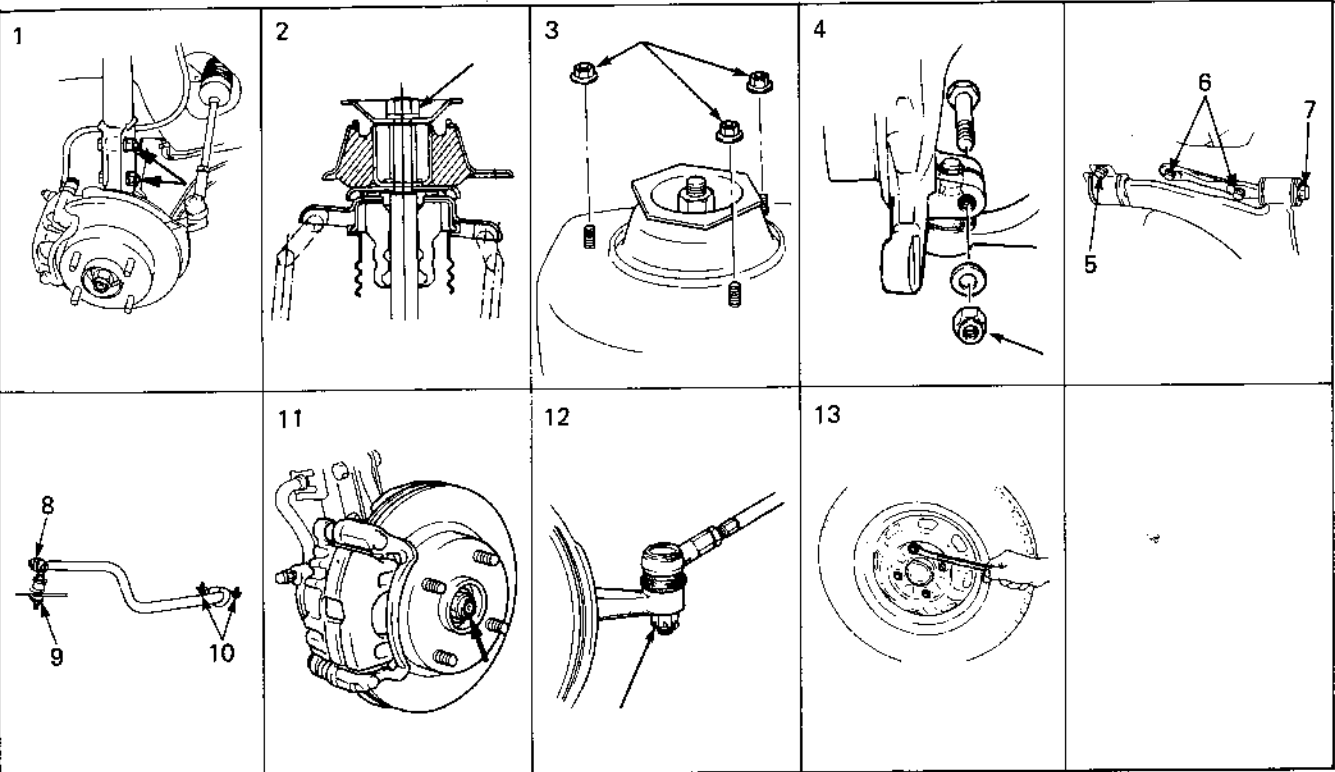


Fig. 3D-7-8

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE (A) (99000-25010)	Strut bearing
Lithic wheel bearing grease	SUZUKI SUPER GREASE (A) (99000-25010)	Wheel bearing, wheel bearing oil seal lip

SPECIAL TOOLS

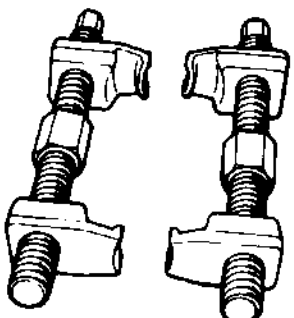
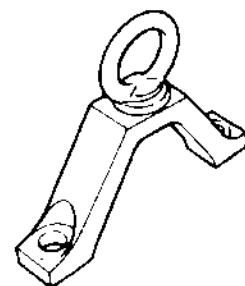
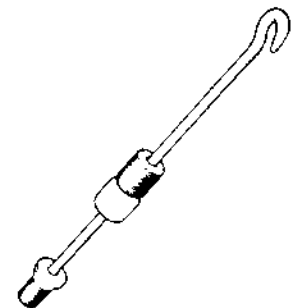
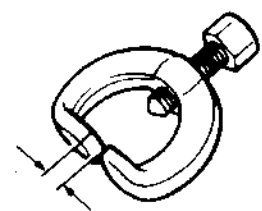
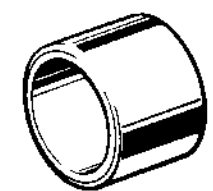
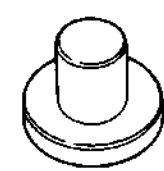
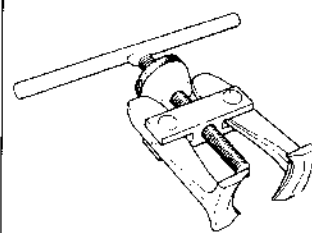
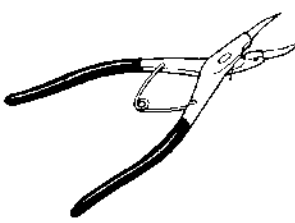
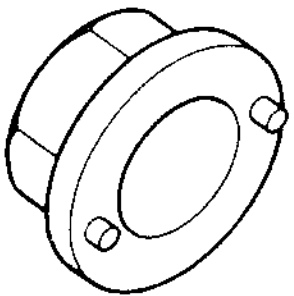
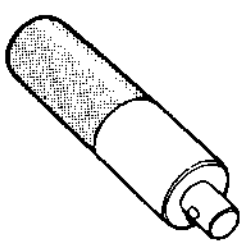
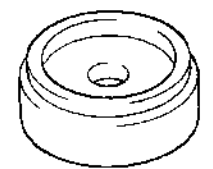
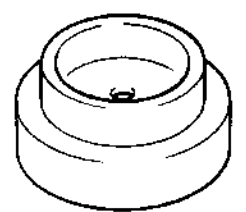
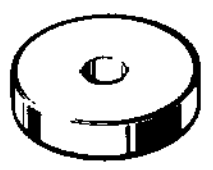
 09940-71430 Spring compressor	 09943-17911 Front wheel hub remover (Brake drum remover)	 09942-15510 Sliding hammer	 09913-65210 Tie-rod end remover
 09944-78210 Bearing installer support	 09913-85230 Bearing puller attachment	 09913-61110 Bearing puller	 09900-06108 Snap ring pliers (closing type)
 09944-98010 Bearing installer	 09924-74510 Bearing installer handle	 09951-16090 Bearing & oil seal installer	 09944-66010 Oil seal installer
 09944-68510 Bearing installer attachment			

Fig. 3D-7-9

SECTION 3E

REAR SUSPENSION

NOTE:

- 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.

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Wheel Hub and Knuckle	3E-10
Wheel Bearing	3E-14
Stabilizer Bar	3E-14
REAR SUSPENSION INSPECTION	3E-16
REAR WHEEL ALIGNMENT	3E-18
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RECOMMENDED TORQUE SPECIFICATIONS	3E-19
REQUIRED SERVICE MATERIAL	3E-20
SPECIAL TOOLS	3E-20

GENERAL DESCRIPTION

The upper end of the strut is installed to the car body with a rubber mount inbetween and its lower side to the rear knuckle, whose lower end is connected to the suspension arm through the rubber bush. There is a coil spring between the suspension arm and car body.

Shown in the figure below are main components of the rear suspension.

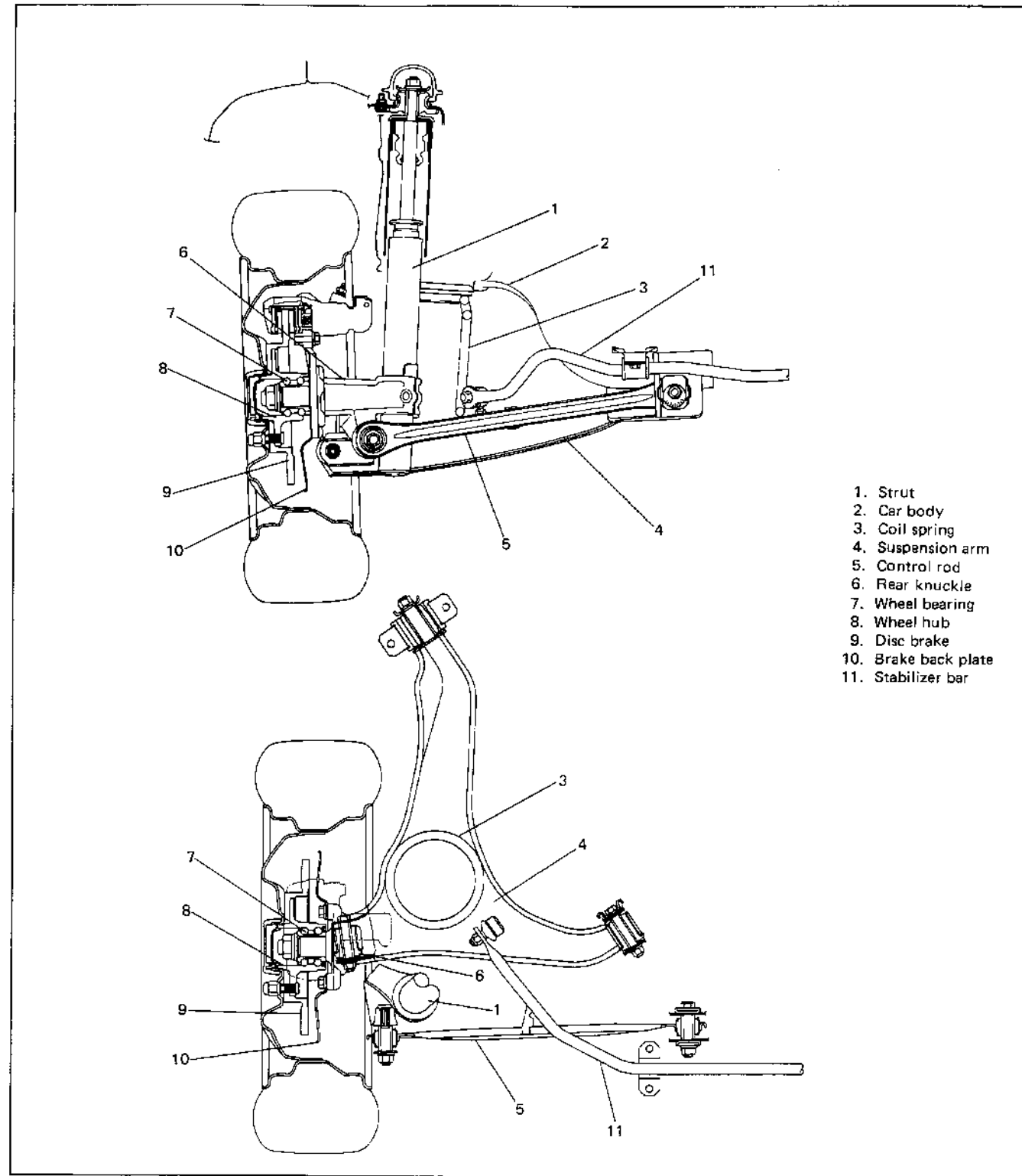


Fig. 3E-1

ON-CAR SERVICE

(REMOVE AND INSTALL)

CONTROL ROD

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Disconnect brake flexible hose from control rod.

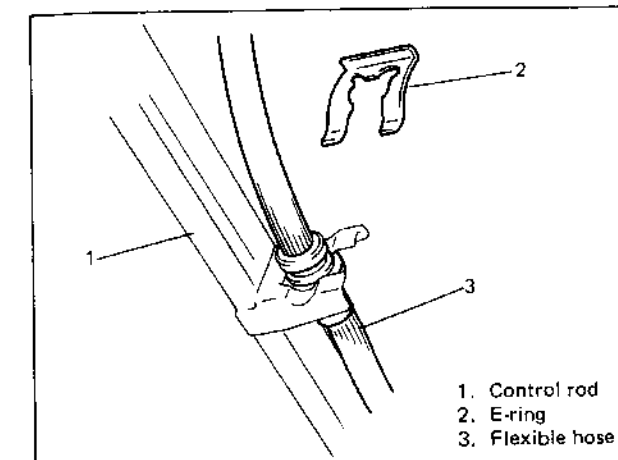


Fig. 3E-2

- 3) To facilitate toe adjustment after reinstallation, take following preparatory step before removing control rod. Confirm which one of lines stamped on washer is in the closest alignment with stamped line "A" on car body or put match marks.

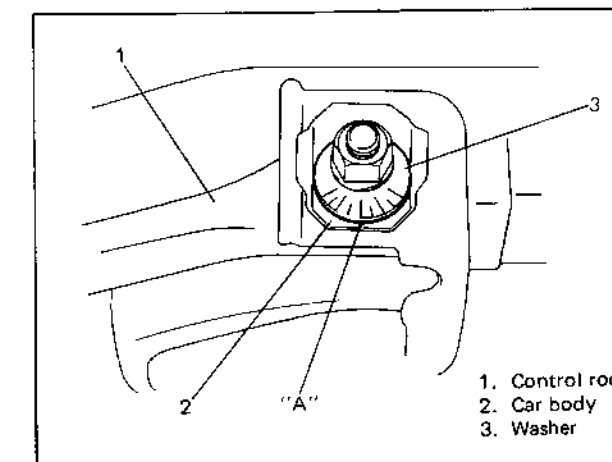


Fig. 3E-3

- 4) Remove control rod outside nut.
- 5) Loosen Control rod inside nut (body center side).
Hold inside bolt with another wrench to prevent it from turning as nut is turned.
- 6) Remove control rod inside bolt and control rod.

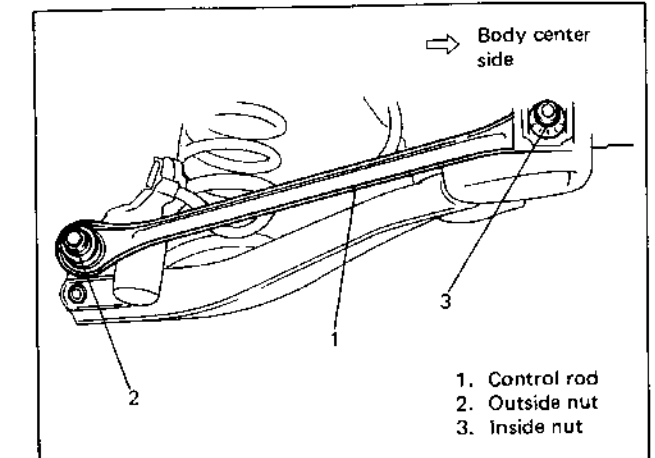


Fig. 3E-4

INSTALLATION

Install in reverse order of removal procedure, noting following items.

- 1) To determine installing direction of control rod, use installed position and shape of brake flexible hose mounting bracket welded on it, referring to Fig. 3E-5 which shows both control rods as installed.

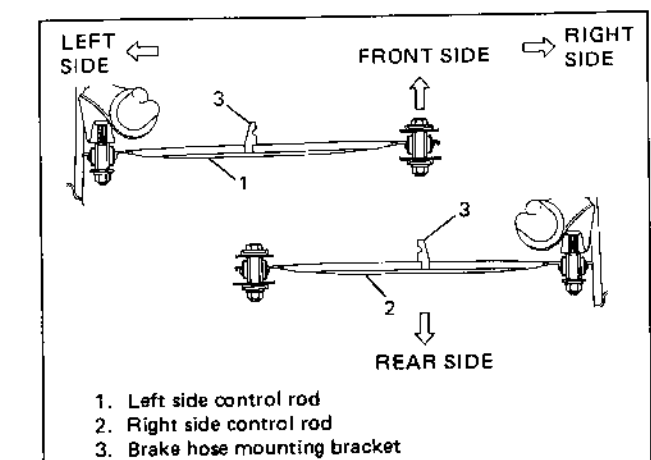


Fig. 3E-5

- 2) Install control rod inside bolt with its cam "B" faced down as shown below.

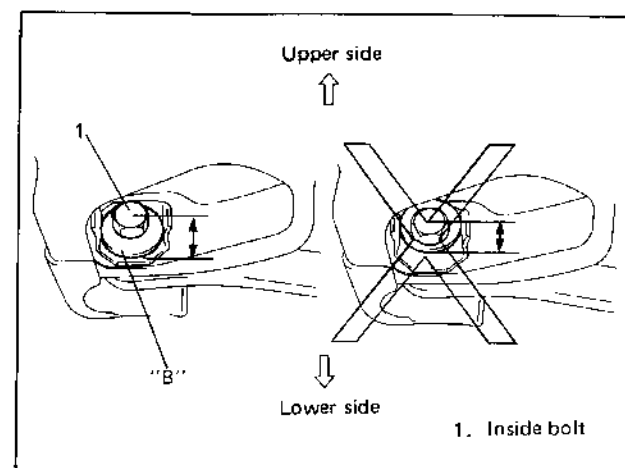


Fig. 3E-6

- 3) Tighten control rod nuts (inside & outside) to such extent that they can be turned by hand.
4) Connect brake flexible hose to bracket securely.

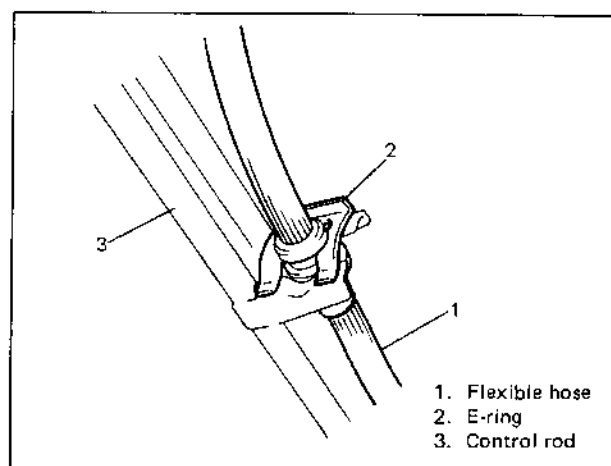


Fig. 3E-7

- 5) Install wheel and tighten wheel nuts to specified torque (Refer to Fig. 3E-53).
6) Lower hoist.
7) Tighten control rod outside nut and inside nut to specified torque.
It is the most desirable to have car off hoist and in non-loaded condition when tightening them.

NOTE:

Tighten inside nut with line "A" stamped on body aligned with such line as confirmed before removal or match marks aligned.

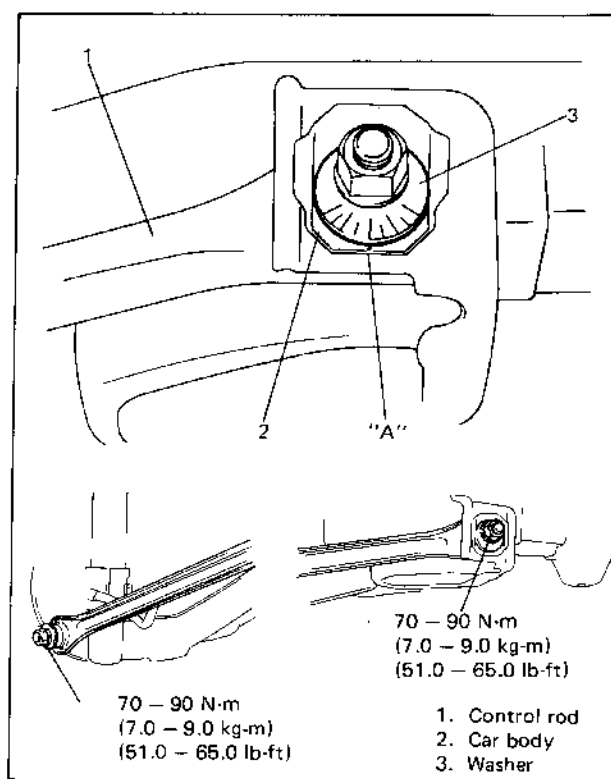


Fig. 3E-8

- 8) Check rear toe and adjust it as necessary. For check and adjustment procedures, Refer to p. 3E-18.

COIL SPRING AND SUSPENSION ARM**REMOVAL**

- 1) Hoist car and remove wheel.
2) To facilitate toe adjustment after reinstallation, confirm which one of lines stamped on washer is in the closest alignment with stamped line "A" on control rod inside mount part of car body or put match marks.
Then remove control rod inside bolt (body center side).

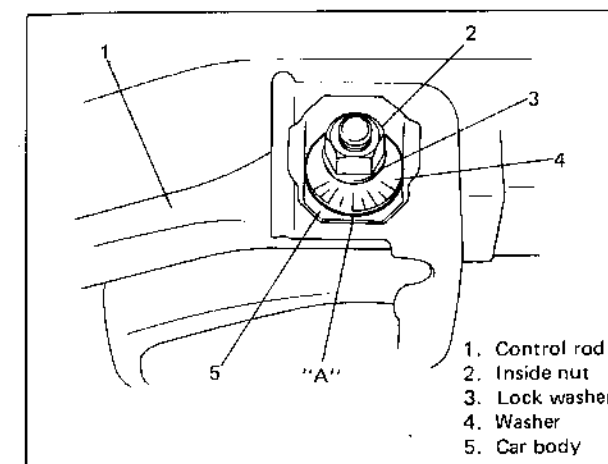


Fig. 3E-9

- 3) Remove outside (wheel side) of control rod from rear knuckle stud bolt and disconnect stabilizer bar from suspension arm.

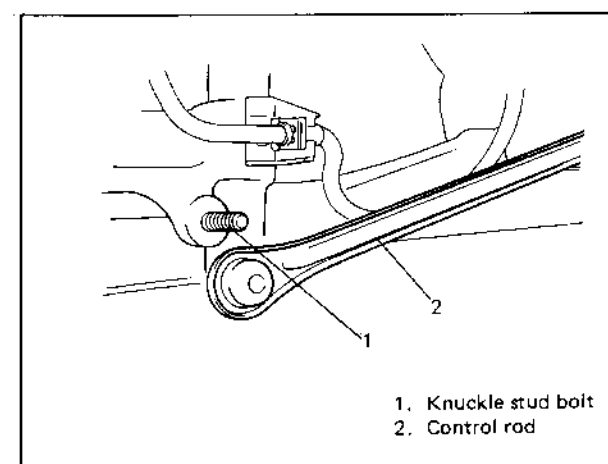


Fig. 3E-10

- 4) Loosen rear mount nut of suspension arm.

NOTE:

But don't remove bolt.

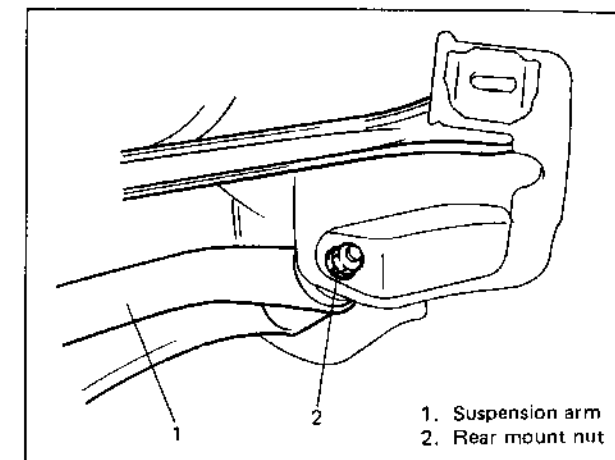


Fig. 3E-11

- 5) Loosen front nut of suspension arm and disconnect parking brake cable clamp from suspension arm.

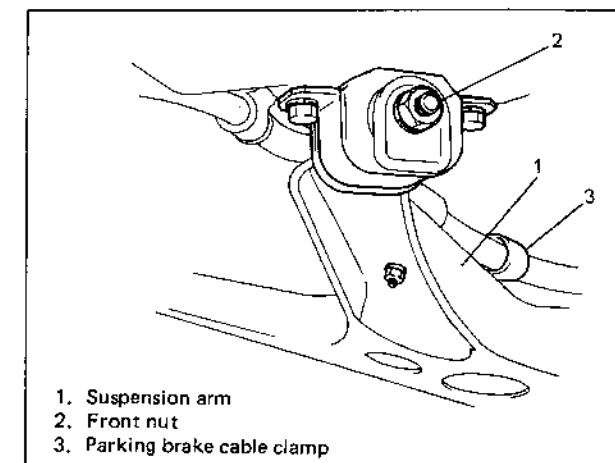


Fig. 3E-12

- 6) After loosening lower mount nut of knuckle, place jack under suspension arm to prevent it from lowering suddenly and then remove lower mount nut of knuckle.

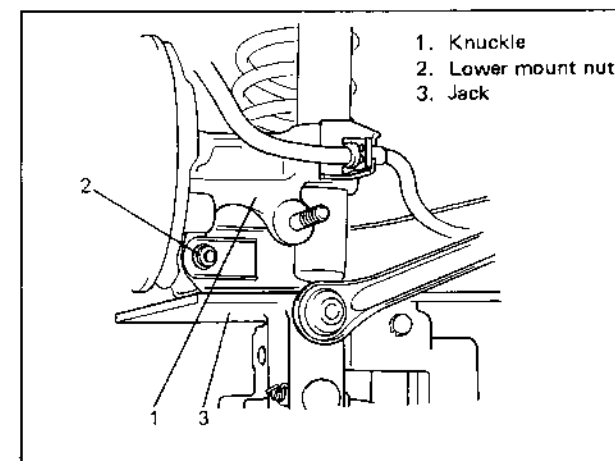


Fig. 3E-13

- 7) Raise jack placed under suspension arm a little and remove lower mount bolt of knuckle.

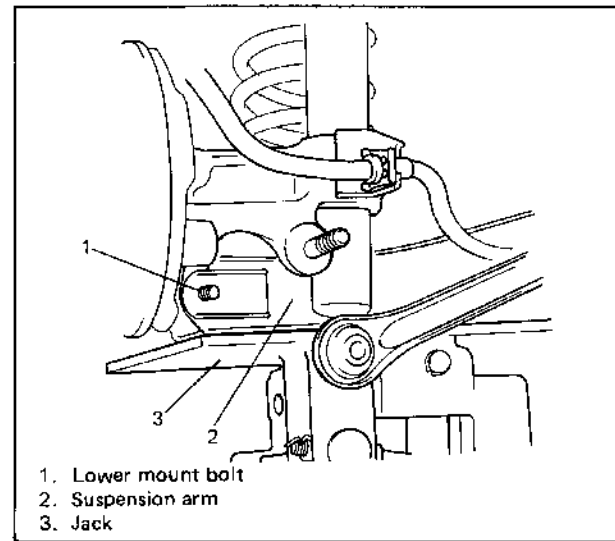


Fig. 3E-14

- 8) Move brake disc/brake back plate toward outside of car body (in arrow direction) to separate lower mount part of knuckle from suspension arm as shown below. Then lower jack gradually and remove coil spring.

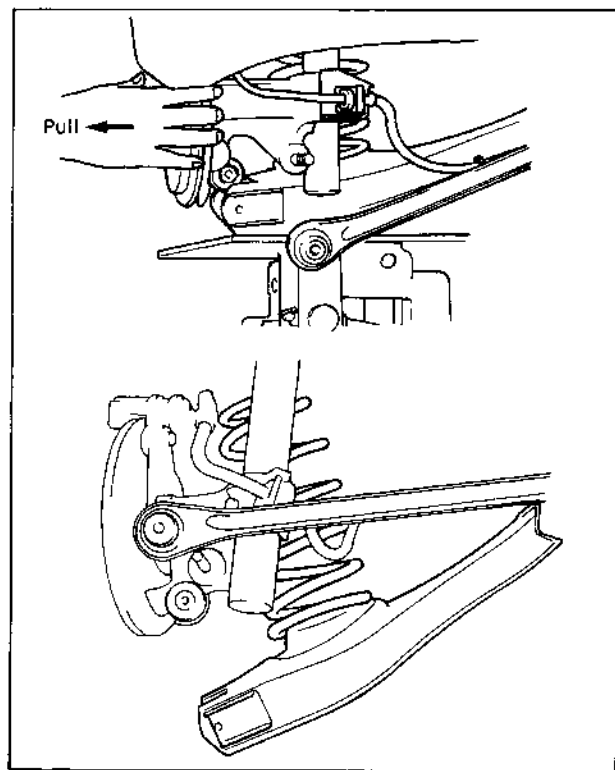


Fig. 3E-15

- 9) Remove suspension arm.
To remove its front part, remove bracket bolts as shown in figure below.

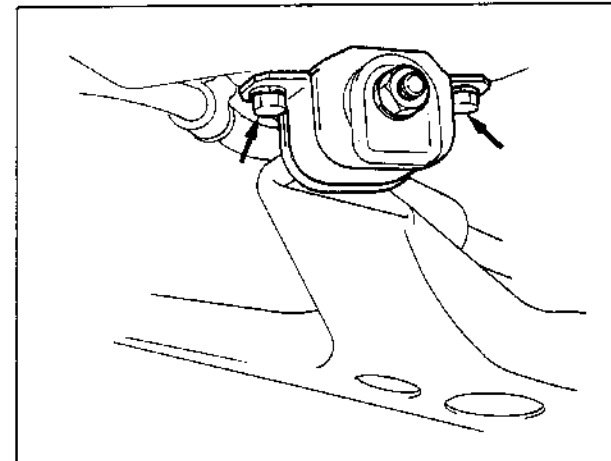


Fig. 3E-16

INSTALLATION

- 1) When installing front mount bush to suspension arm, set it so that its slit "A" (as shown in figure) faces outside of body. Also, make sure that it is installed properly in regard to its vertical direction, referring to figure below.

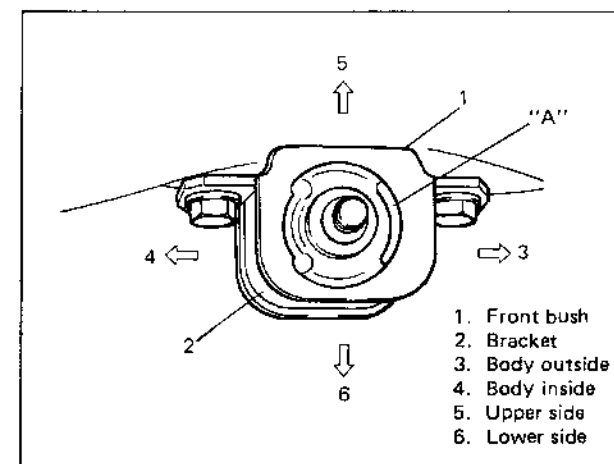


Fig. 3E-17

- 2) Tighten front mounting bracket bolts to specified torque. Tighten rear and front mounting nuts to such extent that they can be turned by hand. Check to make sure that front mounting washer is installed in proper direction referring to figure below.

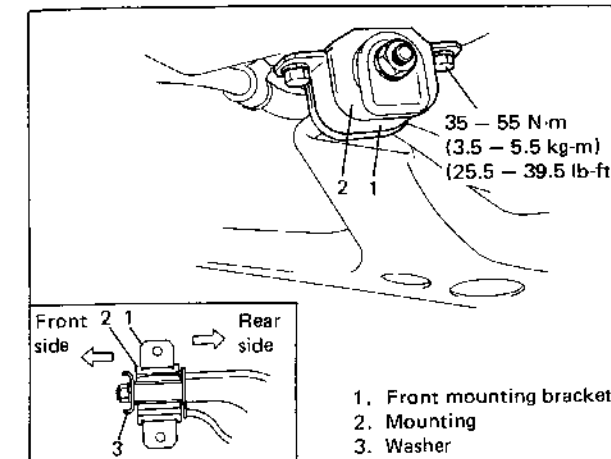


Fig. 3E-18

- 3) Place jack under suspension arm.
4) Install coil spring on spring seat of suspension arm and then raise suspension arm.

NOTE:

When seating coil spring, mate spring end with stepped part of suspension arm spring seat as shown.

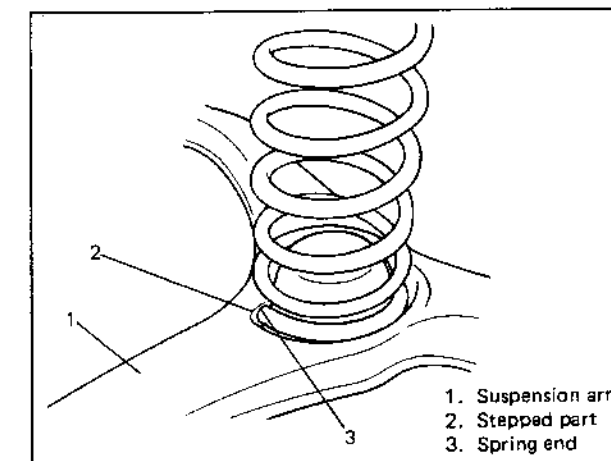


Fig. 3E-19

- 5) Install lower mount bolt of knuckle and torque nut to specification.

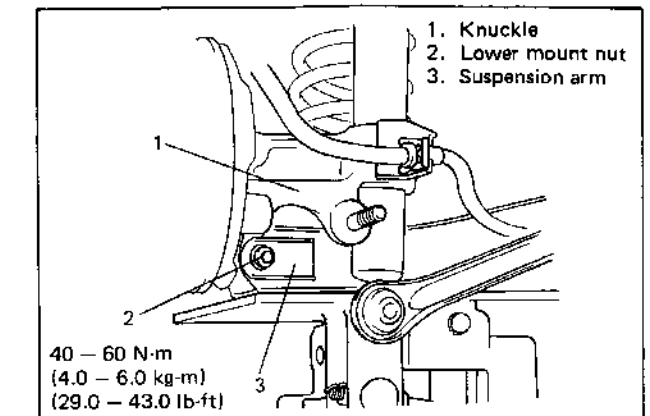


Fig. 3E-20

- 6) Remove jack from under suspension arm and install stabilizer bar to suspension arm and torque its bolts and nuts to specification. (Refer to p. 3E-15)
7) Install both inside and outside of control rod. When installing its inside bolt, refer to Control Rod INSTALLATION 2) on p. 3E-4. Install parking brake cable clamp to suspension arm.
8) Install wheel and tighten wheel nuts to specified torque. (Refer to Fig. 3E-53)
9) Lower hoist.
10) Tighten control rod outside nut and inside nut to specified torque.

When tightening them, it is the most desirable to have car off hoist and in non-loaded state. Also, when tightening inside nut, align line "A" stamped on body with such stamped line on washer as confirmed before removal or align match marks if marked.

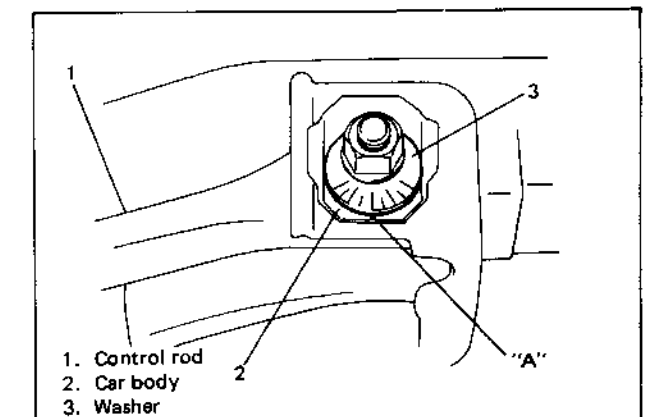


Fig. 3E-21

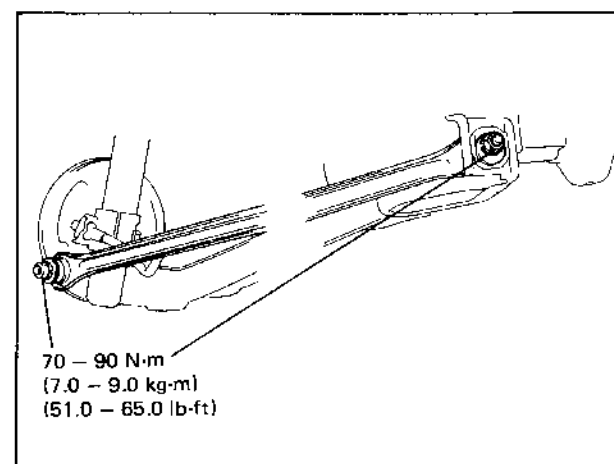


Fig. 3E-22

- 11) Tighten suspension arm front nut and rear nut to specified torque. It is desirable to have car off hoist and in non-loaded state when tightening them.

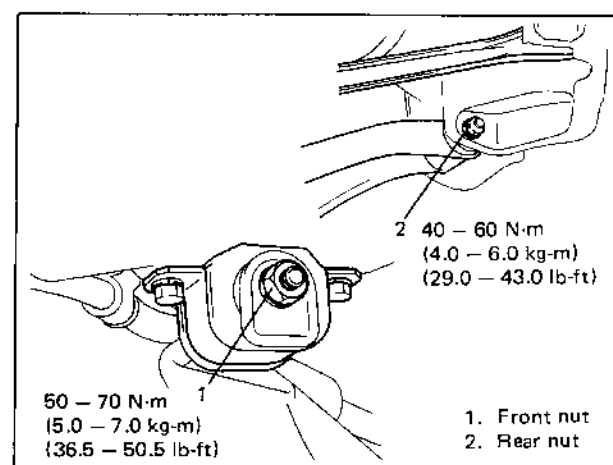


Fig. 3E-23

- 12) After tightening suspension arm front nut, check to make sure that washer as shown below is not tilted.

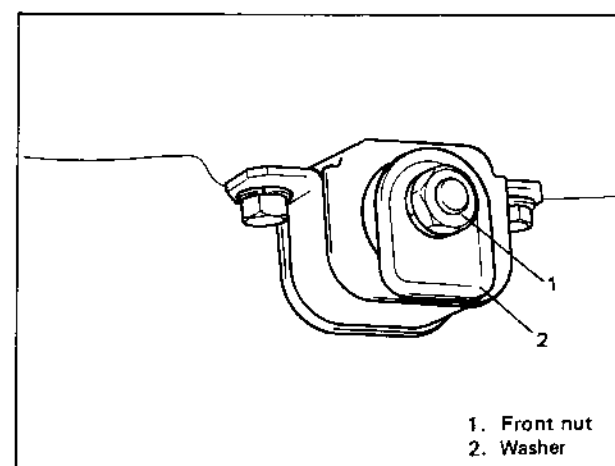


Fig. 3E-23-1

- 13) Check rear toe and adjust it as necessary. For check and adjustment procedures, refer to p. 3E-18.

REAR STRUT ASSEMBLY

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Place jack under suspension arm so that it will be supported when it lowers.
- 3) Remove strut support nuts and push down strut fully as arrow shows in figure below.

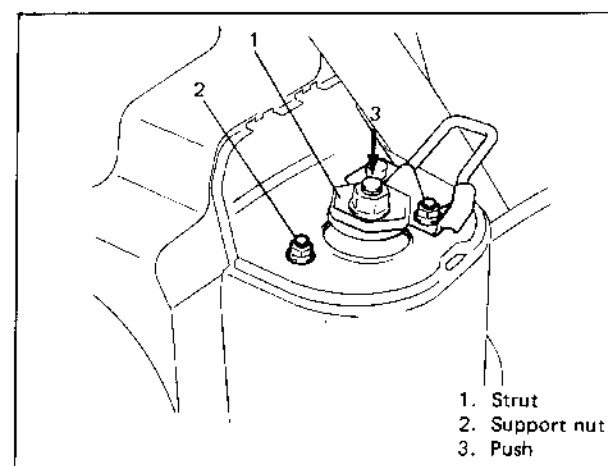


Fig. 3E-24

- 4) Remove strut lower mount bolt.

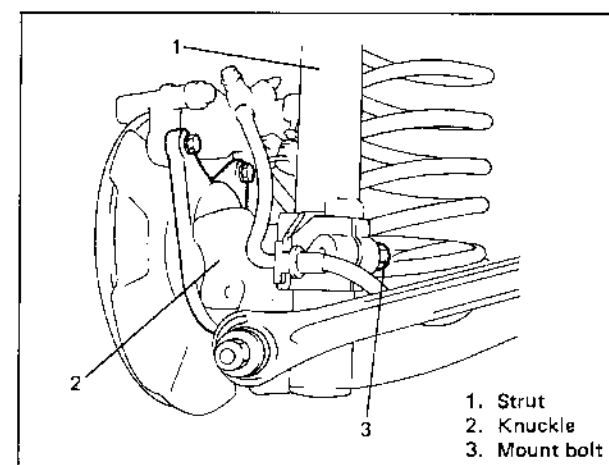


Fig. 3E-25

- 5) Remove strut from knuckle by pulling it up from upper side of knuckle. Make strut as short as possible for removal. If it is hard to remove it, open slit of knuckle a little by inserting a wedge as shown.

CAUTION:

Do not open slit wider than necessary.

WARNING:

Do not lower jack more than necessary for strut removal, for coil spring may come off, or so much as to make brake flexible hose stretch.

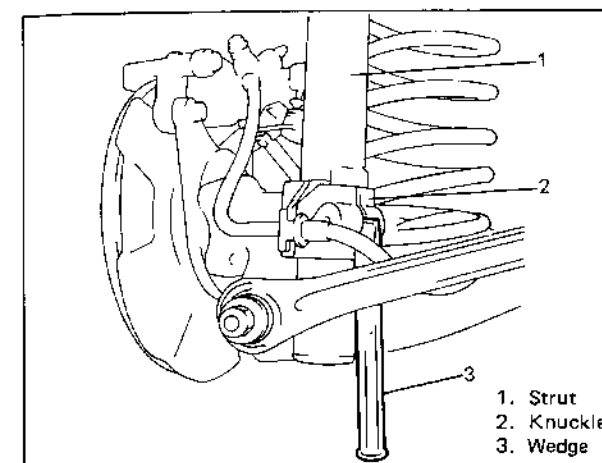


Fig. 3E-26

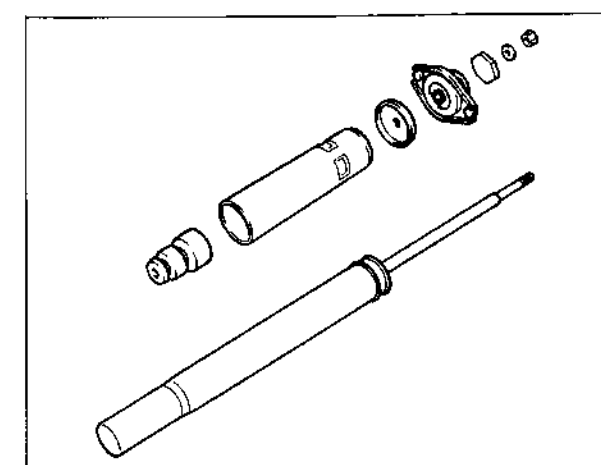


Fig. 3E-27

INSTALLATION

- 1) Make strut short by pushing it.

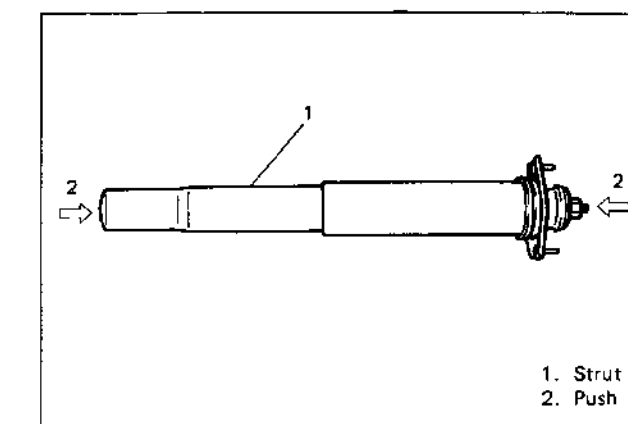


Fig. 3E-28

- 2) Install strut to knuckle.

Bring projection "A" on strut against slit of knuckle and push strut into knuckle till upper end of knuckle contacts "B" on strut as shown in figure below.

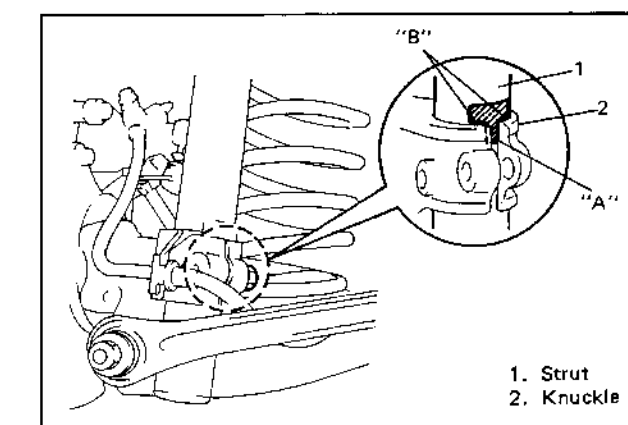


Fig. 3E-29

- 3) Tighten strut lower mount bolt to specified torque.

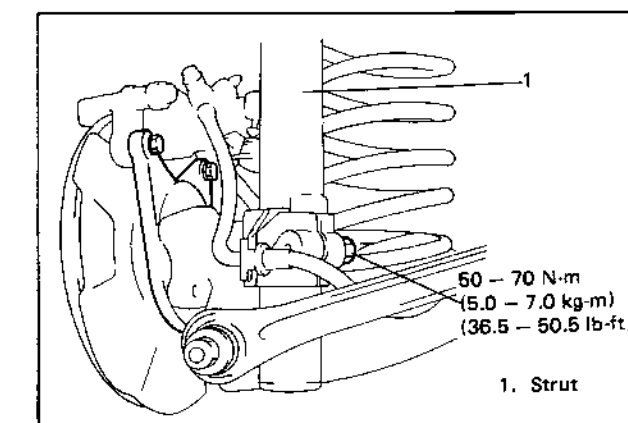


Fig. 3E-30

- 4) With strut extended fully, install upper part of strut to car body and tighten support nuts to specified torque.
If upper part of strut does not reach car body, raise jack under suspension arm a little.

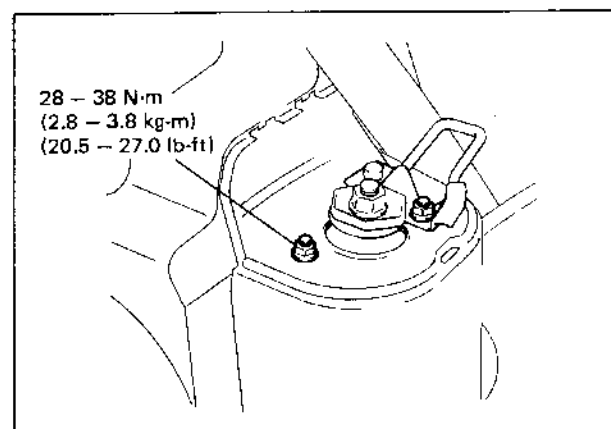


Fig. 3E-31

- 5) Remove jack from under suspension arm.
6) Tighten wheel nuts to specified torque (Refer to Fig. 3E-53).
7) Lower hoist.

WHEEL HUB AND KNUCKLE

REMOVAL

- 1) Perform Steps 1) to 5) of brake disc REMOVAL on page 5-35.
2) Remove spindle cap as shown (by hammering lightly at 3 locations around it so as not to deform or cause damage to seating part of cap).

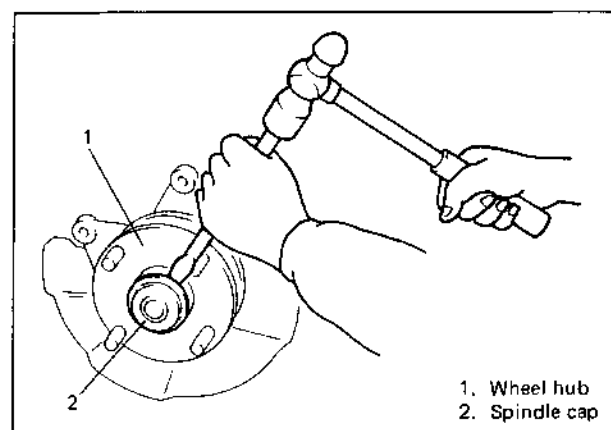


Fig. 3E-32

- 3) Uncalk spindle nut and remove spindle nut and washer.

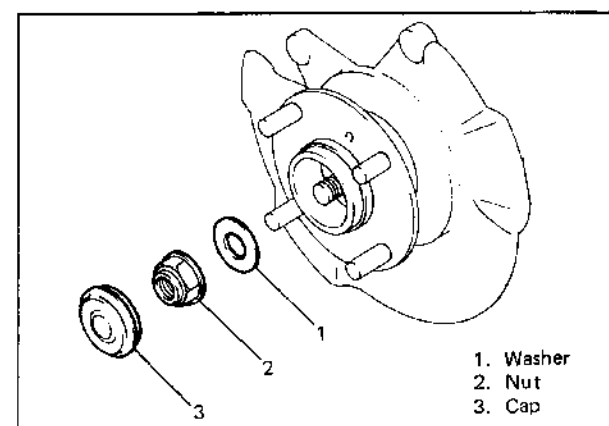


Fig. 3E-33

- 4) Pull wheel hub off by using special tools.

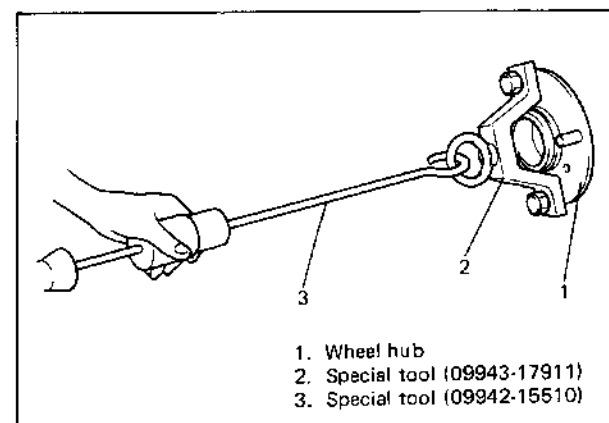


Fig. 3E-34

- 5) Disconnect brake hose bracket from knuckle.

NOTE:

During removal, be careful not to damage brake flexible hose.

Also, don't depress brake pedal.

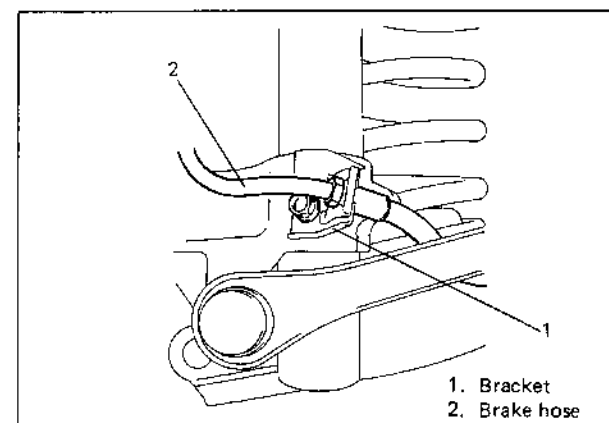


Fig. 3E-34-1

- 6) Remove brake disc dust cover and caliper carrier from knuckle.

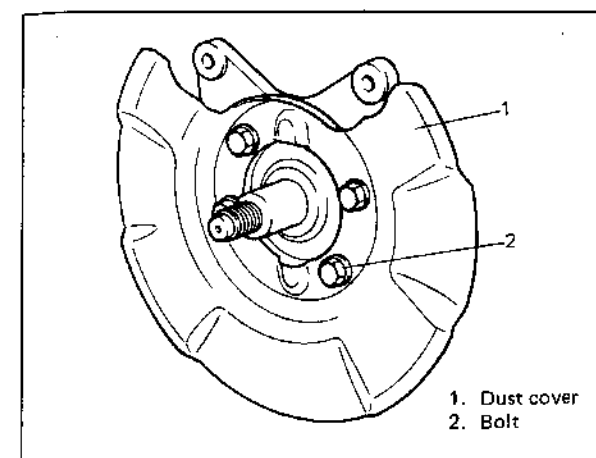


Fig. 3E-34-2

- 7) Place jack under suspension arm so as to prevent it from lowering.
8) Remove nut and washer from inside (body center side) of control rod. As preparatory step of this removal, check stamped line on washer to use for guide in reinstallation. Refer to SUSPENSION ARM REMOVAL 2) on p. 3E-5 for details.
9) Remove outside (wheel side) of control rod from rear knuckle stud bolt.

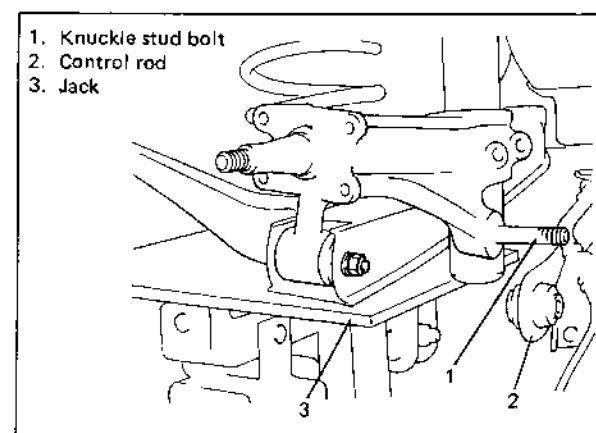


Fig. 3E-35

- 10) Remove strut lower mount bolt.

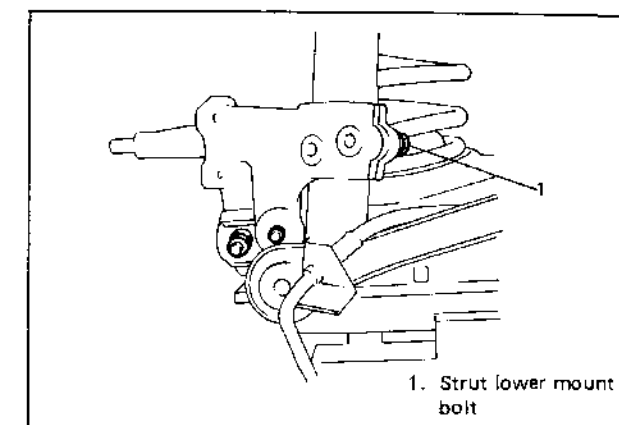


Fig. 3E-36

- 11) Remove knuckle lower mount bolt.

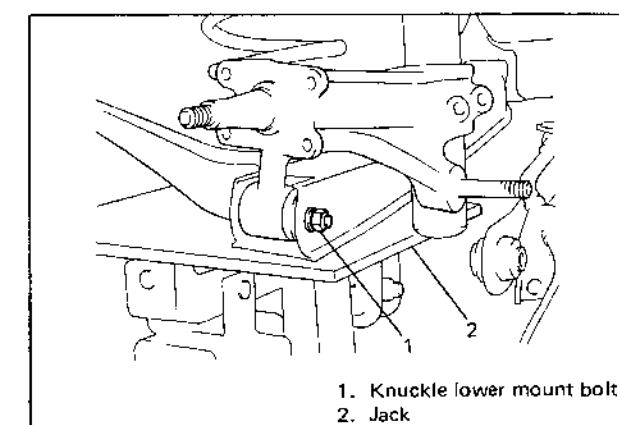


Fig. 3E-37

- 12) Disconnect knuckle from suspension arm and remove knuckle from strut.
If it is hard to remove knuckle from strut, open slit of knuckle a little by inserting wedge there as shown below.

CAUTION:
Don't open slit wider than necessary.

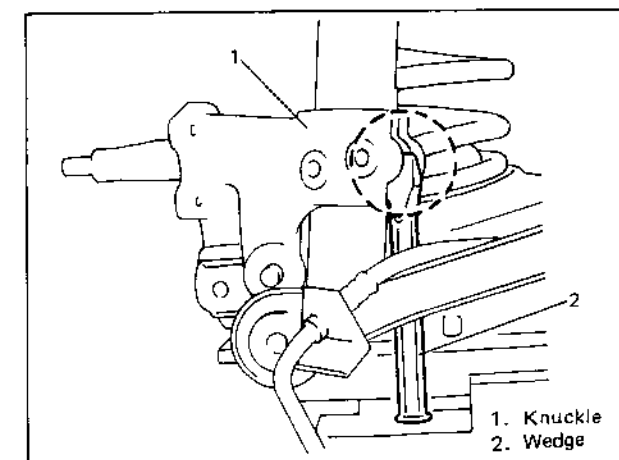


Fig. 3E-38

INSTALLATION**1) Install knuckle to strut.**

Bring projection "A" on strut against slit of knuckle and push strut into knuckle till upper end of knuckle contacts "B" on strut as shown in figure below.

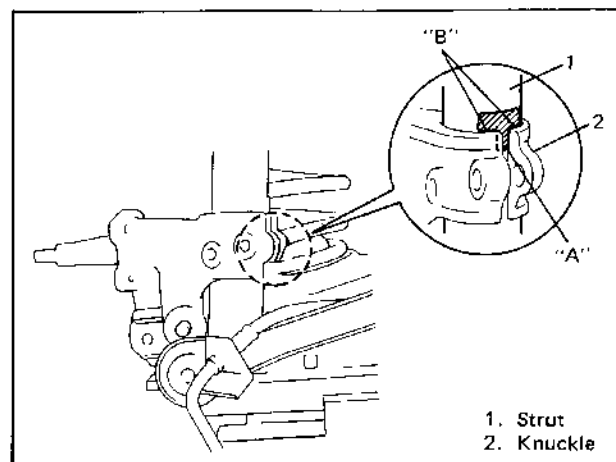


Fig. 3E-39

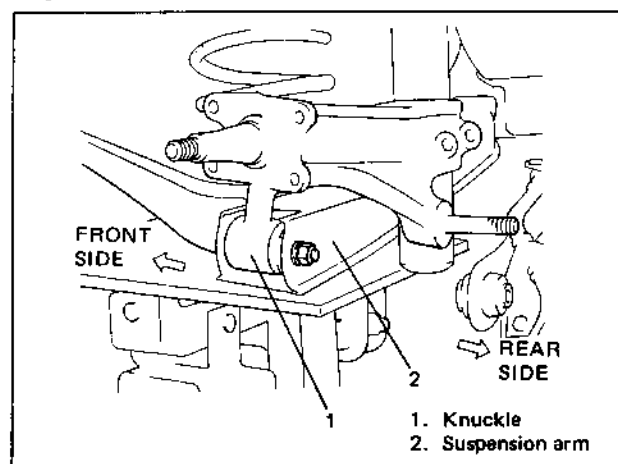
2) Install strut lower mount bolt.**3) Install lower mount part of knuckle to suspension arm.**

Fig. 3E-40

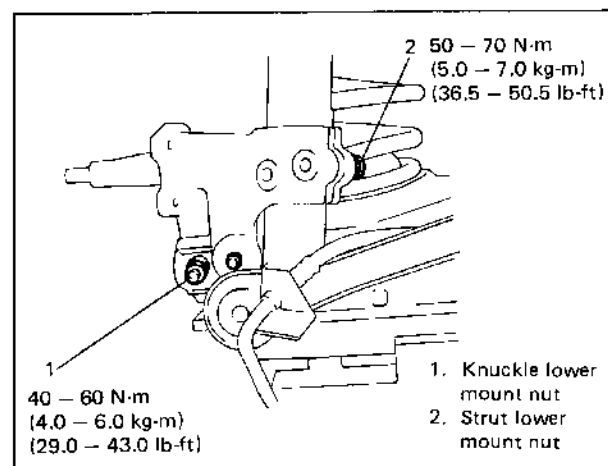
4) Tighten strut lower mount bolt to specified torque. For torque data, refer to Fig. 3E-41.**5) Remove jack from under suspension arm.****6) Torque lower mount nut of knuckle to specification.**

Fig. 3E-41

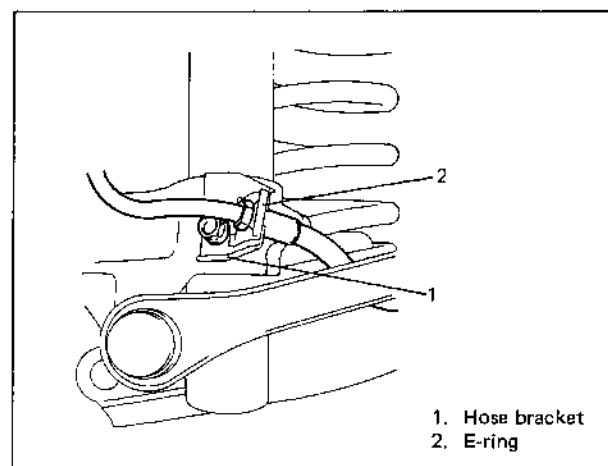
7) Install control rod and control rod nuts (inside & outside) and tighten them to such extent that they can be turned by hand.**8) Install brake hose bracket to knuckle and stabilizer bar to suspension arm (refer to Fig. 3E-46-3).**

Fig. 3E-42

9) Install brake caliper carrier and dust cover and tighten dust cover bolts to specified torque.

Refer to Fig. 3E-43 for installation direction of brake caliper carrier.

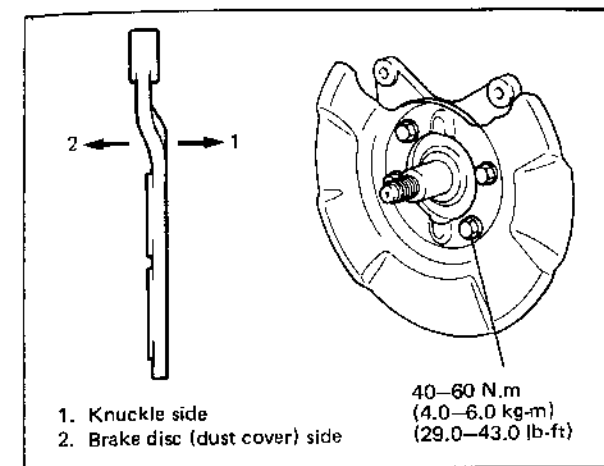


Fig. 3E-43

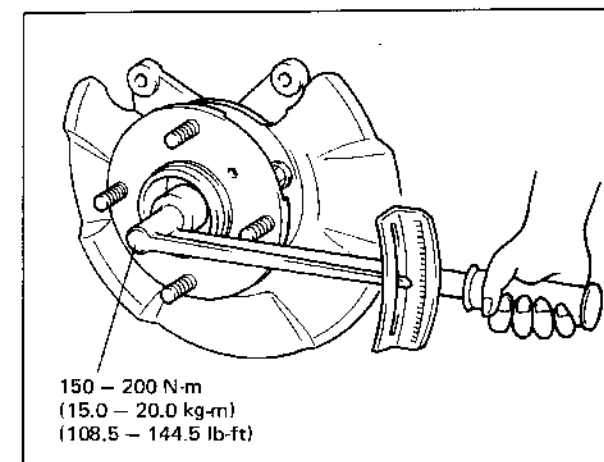
10) Install wheel hub, washer and nut.**11) Tighten spindle nut to specified torque.**

Fig. 3E-44

12) Calk spindle nut as shown.**NOTE:**

Removed spindle nut should be replaced with new one.

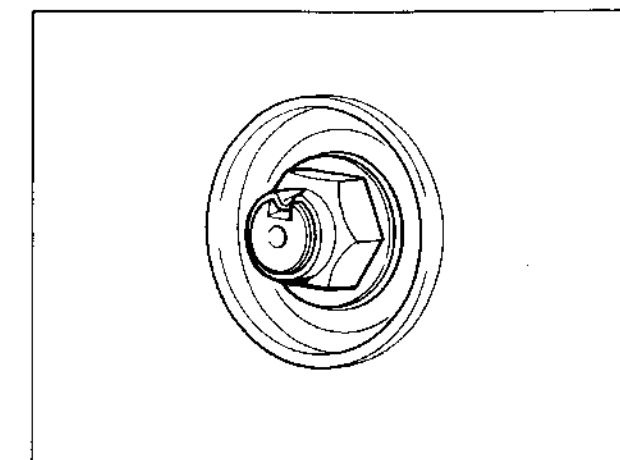


Fig. 3E-44-1

13) Install spindle cap.**NOTE:**

- When installing spindle cap, hammer lightly several locations on the collar of cap until collar comes closely into contact with wheel hub.
- If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with new one.

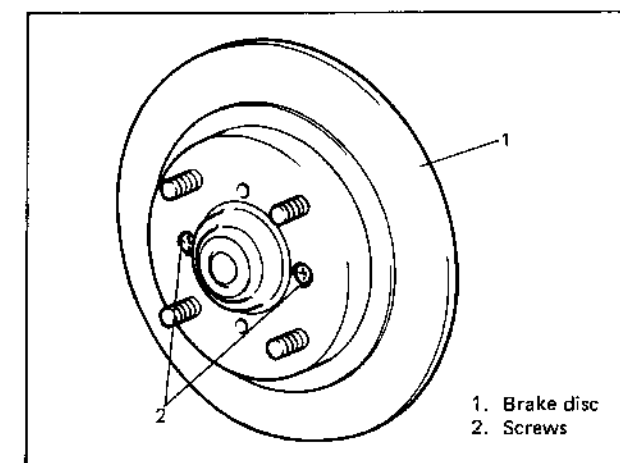
14) Install brake disc and tighten screws.

Fig. 3E-44-2

- 15) Install brake caliper (Refer to Step 2) of its INSTALLATION on page 5-35 of this manual).
- 16) Install wheel and tighten wheel nuts to specified torque. (Refer to Fig. 3E-53.)
- 17) Check to ensure that brake disc is free from dragging and proper braking is obtained.
- 18) Lower hoist.
- 19) Tighten outside and inside nuts of control rod to specified torque. When tightening inside nut, refer to CONTROL ROD INSTALLATION 7) on p. 3E-4. Then check toe.
- 20) Perform brake test (foot brake and parking brake).
- 21) Check each installed part for fluid leakage.

WHEEL BEARING

REMOVAL

Perform Steps 1) to 4) of wheel hub REMOVAL on p. 3E-10.

Wheel bearing and wheel hub form a solid unit. When wheel bearing is found defective and its replacement is necessary, replace hub assembly.

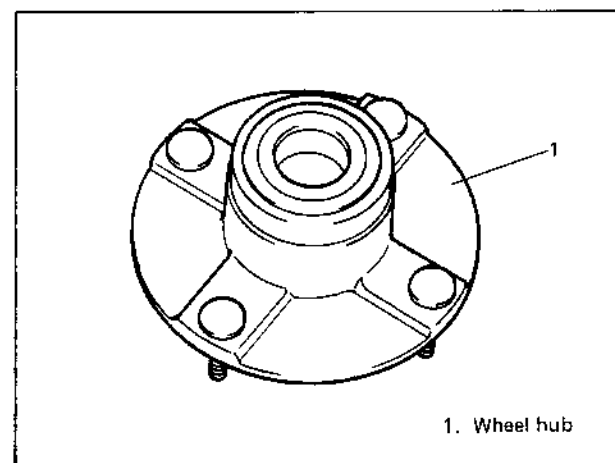


Fig. 3E-45

INSTALLATION

- 1) Install wheel hub, brake disc, caliper and wheel. (Refer to Steps 10) to 17) of WHEEL HUB INSTALLATION on p. 3E-12).
- 2) Lower hoist.
- 3) Perform brake test (foot brake and parking brake).

STABILIZER BAR

REMOVAL

- 1) Hoist car and remove stabilizer bar nuts (right & left).

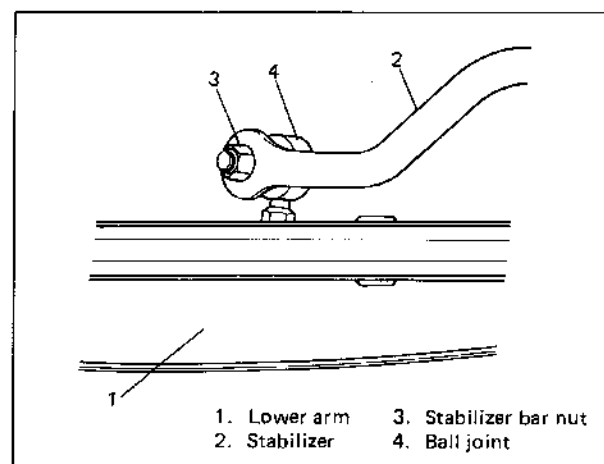


Fig. 3E-46

- 2) Remove stabilizer bar brackets and stabilizer bar.

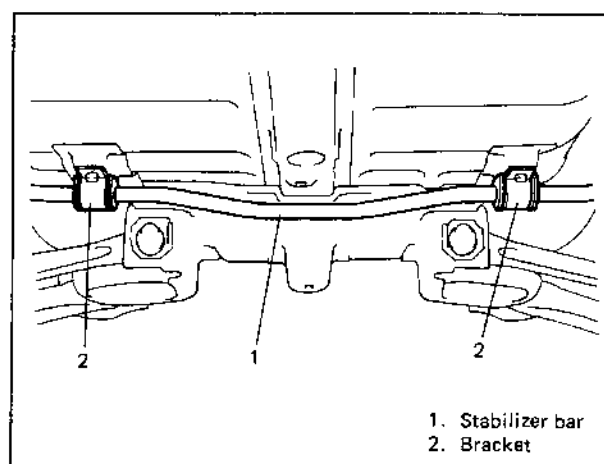


Fig. 3E-46-1

INSTALLATION

- 1) When installing stabilizer, loosely assemble all components while insuring that stabilizer is centered, side-to-side. Refer to Fig. 3E-46-2 for its check.
- 2) Install parts by reversing REMOVAL procedure.
- 3) Torque stabilizer nuts and bolts to specification. (Refer to Fig. 3E-46-3)

For correct installation of stabilizer bar, side-to-side, be sure that color paint on stabilizer bar aligns with mount bush, both right and left, as shown.

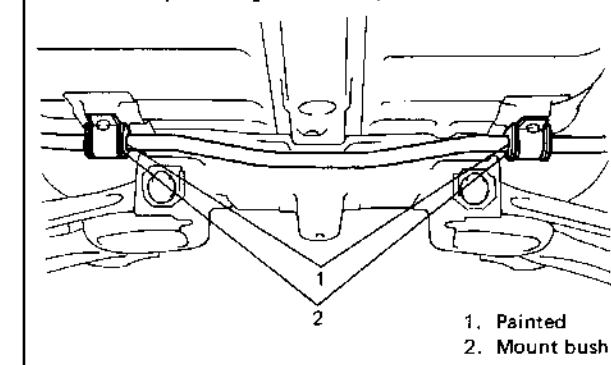


Fig. 3E-46-2

For installing directions (and position) of mount bushes and washers, refer to below figure.

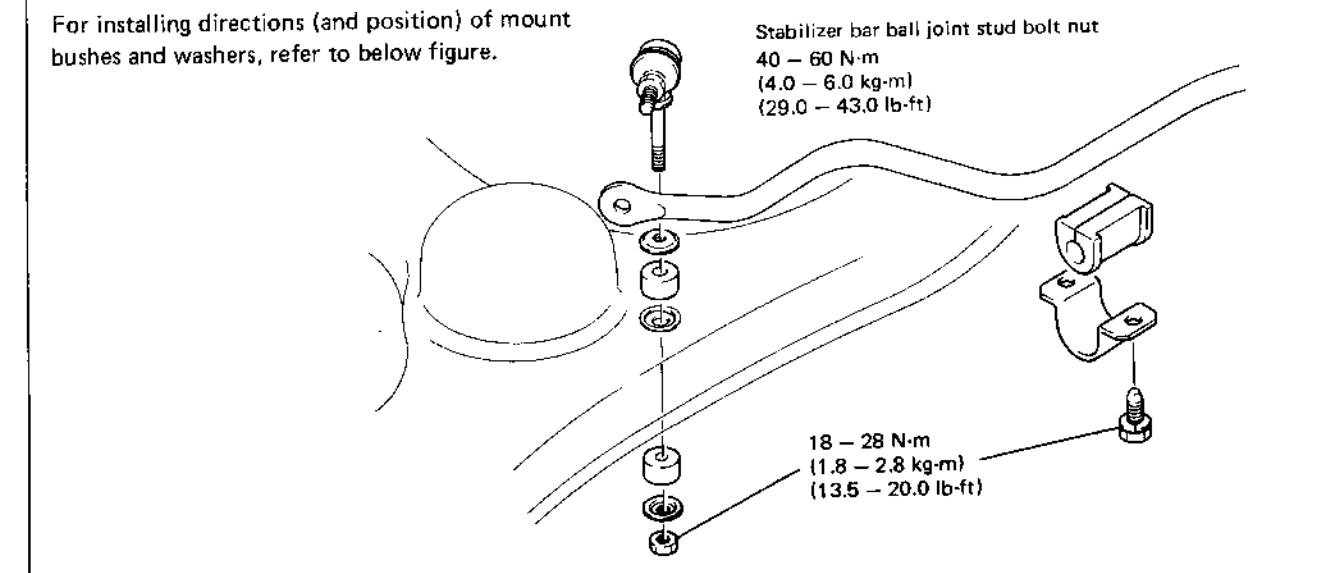


Fig. 3E-46-3

REAR SUSPENSION INSPECTION

STRUT DAMPER

- 1) Inspect strut for oil leakage. If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.

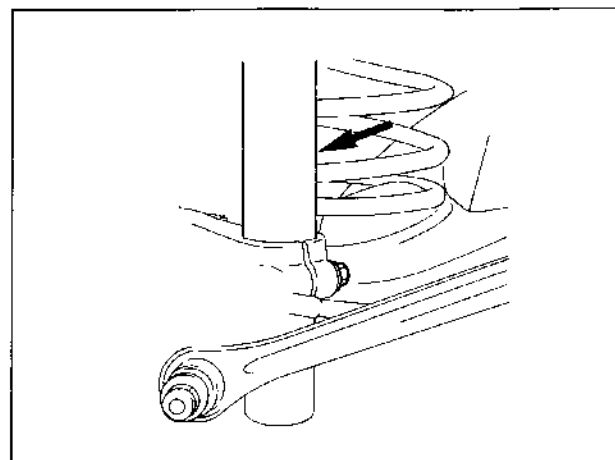


Fig. 3E-47

- 2) Strut function check

Check and adjust tire pressures as specified. Bounce car body three or four times continuously by pushing rear end on the side with strut to be checked. Apply the same amount of force at each push and note strut resistance both when pushed and rebounding. Also, note how many times car body rebounds before coming to stop after hands are off. Do the same for strut on the other side.

Compare strut resistance and number of rebound on the right with those on the left. And they must be equal in both. With proper strut, car body should come to stop the moment hands are off or after only one or two small rebounds. If struts are suspected, compare them with known good car or strut.

- 3) Inspect for damage or deformation.
- 4) Inspect for abnormal noise.
- 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.

Replace any parts found defective in Steps 2) — 7).

SUSPENSION CONTROL ARM, COIL SPRING AND KNUCKLE ARM

- Inspect for cracks, deformation or damage.
- Inspect bushing for damage, wear or breakage.

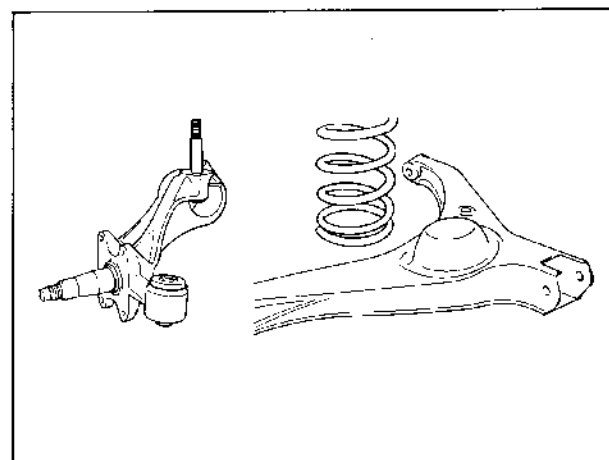


Fig. 3E-47-1

Replace any defective part.

CONTROL ROD

- Inspect for cracks, deformation or damage.
- Inspect bushings for wear and breakage.

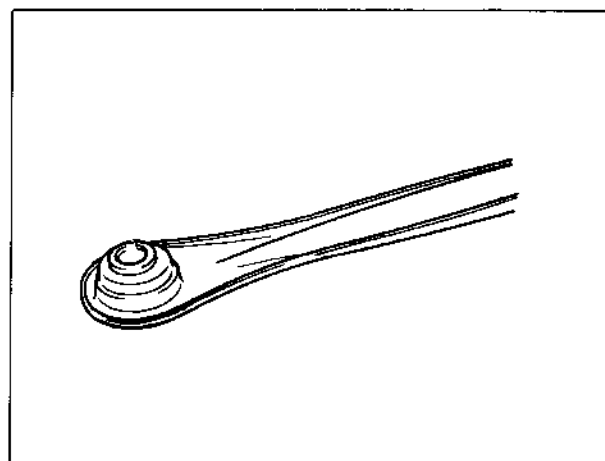


Fig. 3E-47-2

Replace any defective part.

REAR SUSPENSION FASTENERS

Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque, referring to Fig. 3E-53 of this section.

WHEEL DISC, NUT & BEARING

- Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
- Check wheel hub nuts for tightness and, as necessary, retighten to specification (Refer to Fig. 3E-53).
- Check wheel bearings for wear. When measuring thrust play, apply a dial gauge to spindle cap center.

Thrust play limit	Rear	0.3 mm (0.012 in)

When measurement exceeds limit, replace bearing.

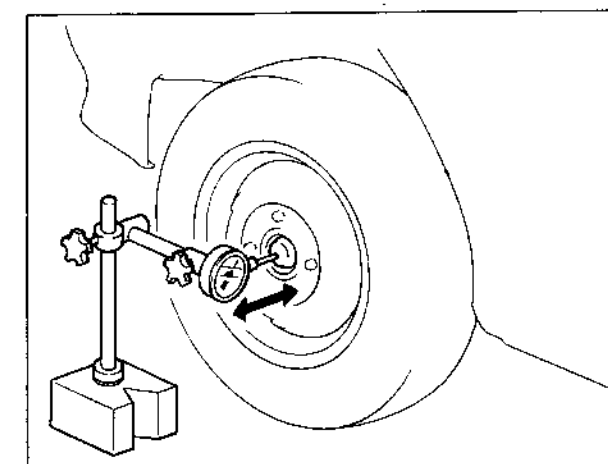


Fig. 3E-48

- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.

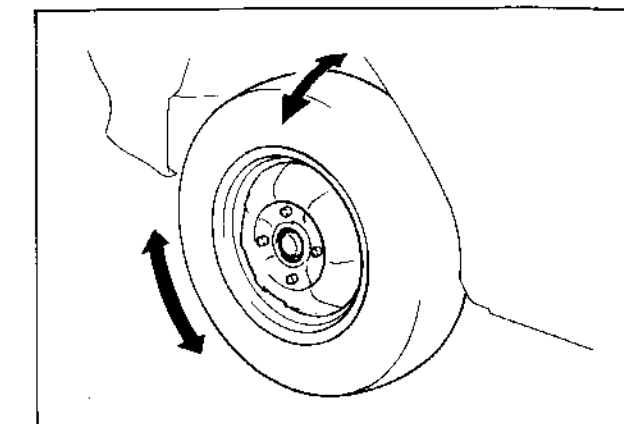


Fig. 3E-49

STABILIZER BAR, JOINT AND/OR BUSHING

BAR

Inspect for damage or deformation. If defective, replace.

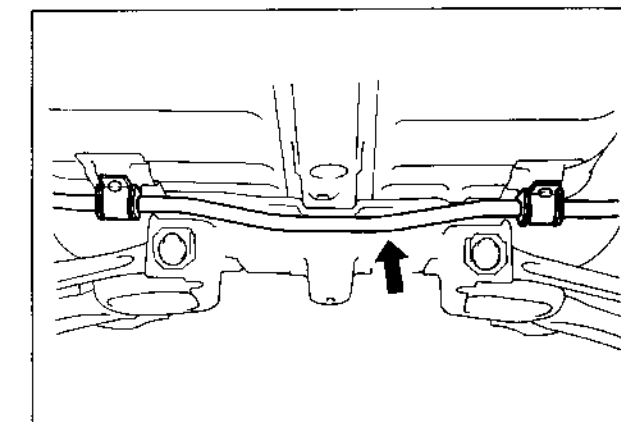


Fig. 3E-49-1

BUSHING

Inspect for damage, wear or deterioration. If defective, replace.

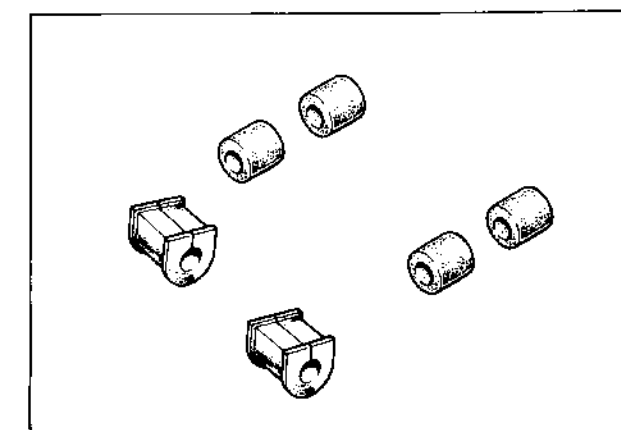


Fig. 3E-49-2

REAR WHEEL ALIGNMENT

Among factors for rear wheel alignment, only toe setting can be adjusted. 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 and damaged body should be repaired or damaged suspension should be replaced.

TOE SETTING

Amount of toe can be obtained by subtracting "A" from "B" as shown in Fig. 3E-50 and therefore is given in mm (in.).

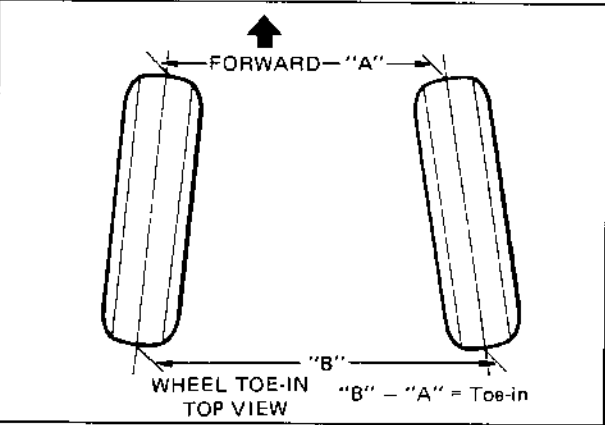


Fig. 3E-50

TOE INSPECTION AND ADJUSTMENT

Preparation for toe inspection and adjustment

- Place car in non-loaded state on level floor.
- Set steering wheel in straight state.
- Check that inflation pressure of each tire is adjusted properly and disc wheel is free from deflection.
- Check that each suspension part is free from bend, dent, wear or damage in any other form.
- Check that ground clearance at the right and left is just about the same.

INSPECTION

Measure toe with toe-in gauge.
Toe should be within following specification.

Toe-in	$2 \pm 2 \text{ mm (0.079} \pm 0.079 \text{ in.)}$

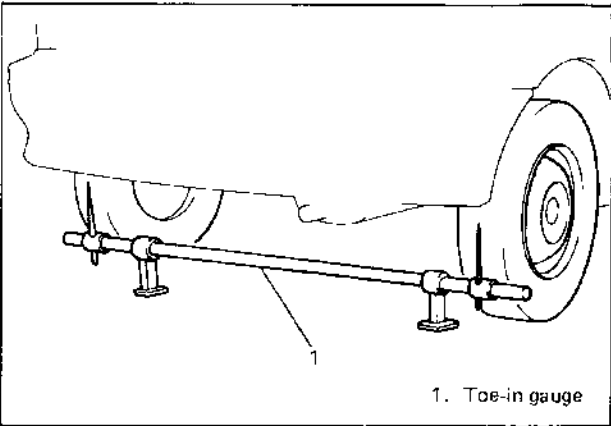


Fig. 3E-51

When checked with side slip tester, side slip should satisfy following specification.

Side slip	$2 \pm 3 \text{ mm/m}$ $(0.079 \pm 0.118 \text{ in/3 ft})$

If toe-in or side slip is out of above corresponding specification, adjust toe properly.

ADJUSTMENT

- 1) Loosen right and left control rod inside nuts.
- 2) Adjust toe to satisfy specification by turning right and left control rod inside bolts (cam bolts) by the same amount.
- 3) After adjustment, tighten right and left inside nuts to specified torque while holding cam bolt with another wrench to prevent it from turning.

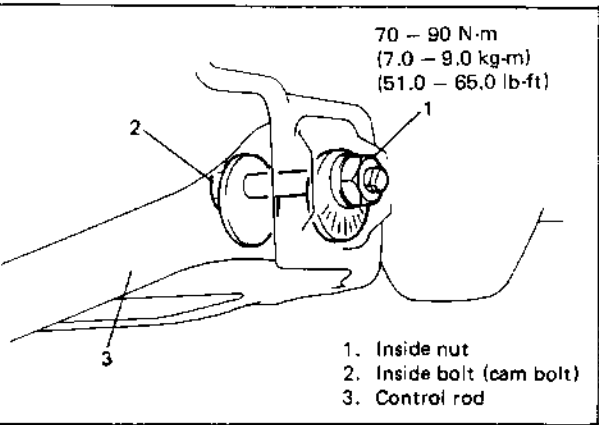


Fig. 3E-52

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg·m	lb·ft
1. Control rod outside nut	70 - 90	7.0 - 9.0	51.0 - 65.0
2. Control rod inside nut			
3. Suspension arm mounting bracket bolt	35 - 55	3.5 - 5.5	25.5 - 39.5
4. Suspension arm front nut	50 - 70	5.0 - 7.0	36.5 - 50.5
5. Suspension arm rear nut	40 - 60	4.0 - 6.0	29.0 - 43.0
6. Knuckle arm lower mount nut			
7. Strut support nut	28 - 38	2.8 - 3.8	20.5 - 27.0
8. Strut upper nut	40 - 60	4.0 - 6.0	29.0 - 43.0
9. Strut lower mount bolt	50 - 70	5.0 - 7.0	36.5 - 50.5
10. Rear spindle nut	150 - 200	15.0 - 20.0	108.5 - 144.5
11. Brake disc dust cover bolt	40 - 60	4.0 - 6.0	29.0 - 43.0
12. Brake caliper mount bolt			
13. Wheel nut	50 - 70	5.0 - 7.0	36.5 - 50.5

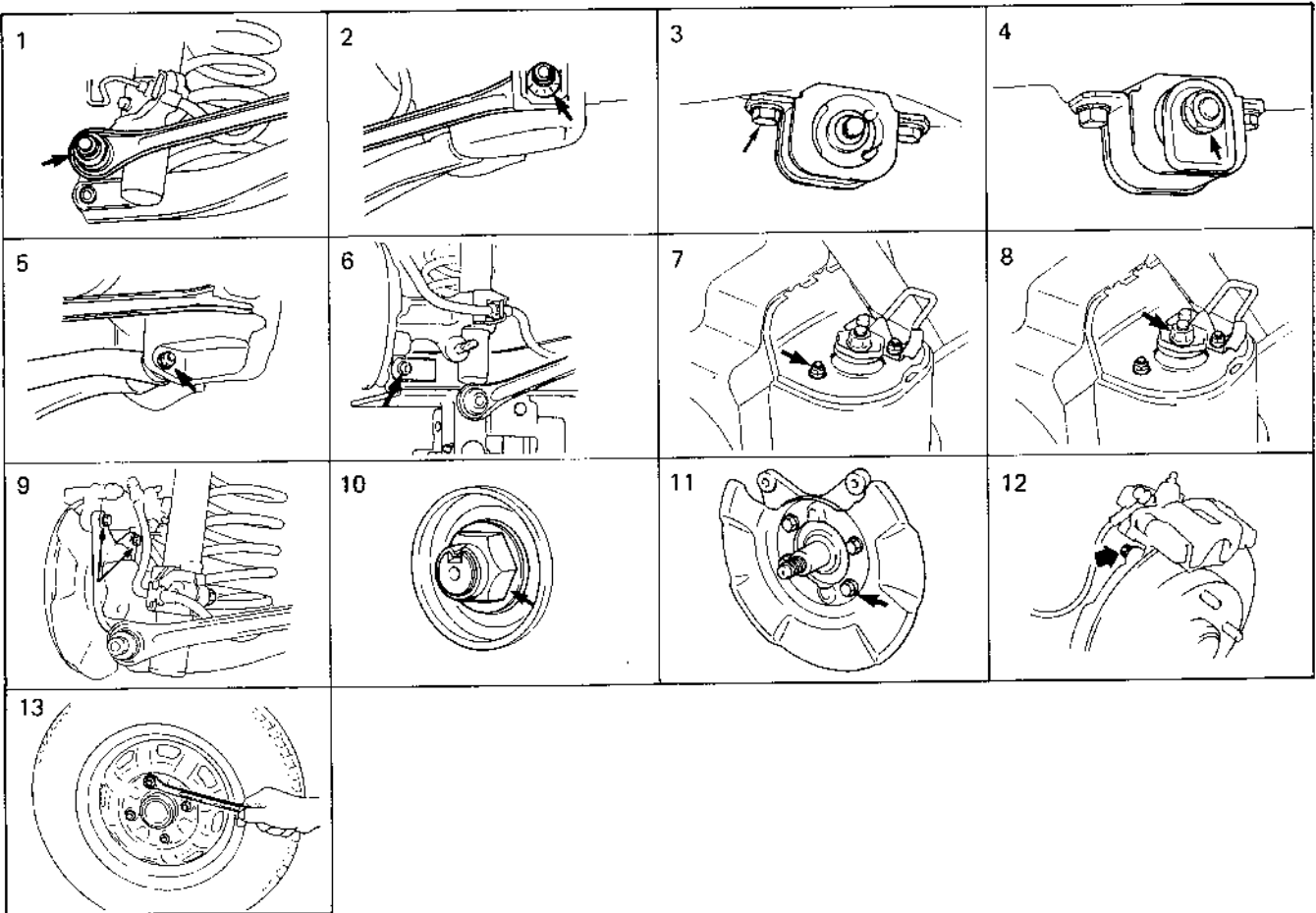
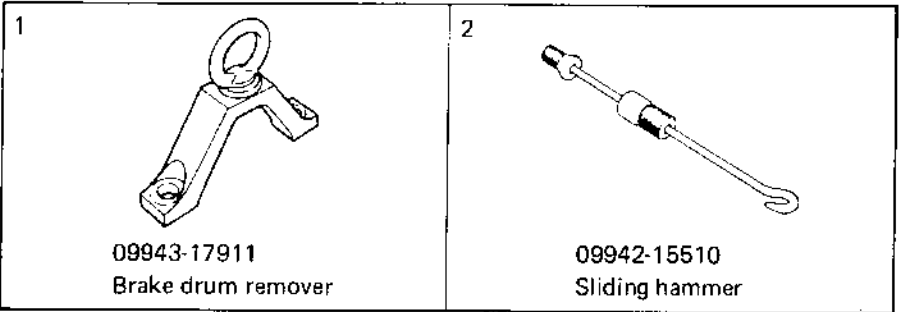


Fig. 3E-53

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	DOT 3	Brake reservoir tank

SPECIAL TOOLS



SECTION 3F

WHEELS AND TIRES

NOTE:

All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and system, 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.

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Tire placard	3F-3		

GENERAL DESCRIPTION

TIRES

This car is equipped with P175/60R 14 tire.
The tire is of tubeless type. The tire is designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressures.
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.

WHEELS

Standard equipment wheels are 14 x 5J steel or aluminum wheels.

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 car. Use of any other size or type tire may affect ride, handling, speedometer/odometer calibration, car ground clearance and tire or snow chain clearance to the body and chassis.

WARNING:

Do not mix different types of tires on the same car such as radial, bias and bias-belted tires except in emergencies, because 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.

The metric term for tire inflation pressure is the kilopascal (kPa). Tire pressures is usually printed in both kPa and psi on the Tire Placard. Metric tire gages are available from tool suppliers. The chart in Fig. 3F-1 converts commonly used inflation pressures from kPa to psi.

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

Fig. 3F-1 Tire Pressure Conversion Chart

REPLACEMENT WHEELS

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, air leak through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in Fig. 3F-2 may cause objectional vibrations.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim width, offset and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/odometer calibration, car ground clearance and tire clearance to body and chassis.

HOW TO MEASURE WHEEL RUNOUT

To measure the wheel runout, it is necessary to use an accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement.

Take measurements of both lateral runout and radial runout at both inside and outside of the rim flange. With the dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator. When the measured runout exceeds the specification and correction by the balancer adjustment is impossible, replace the wheel. If the reading is affected by welding, paint or scratch, it should be ignored.

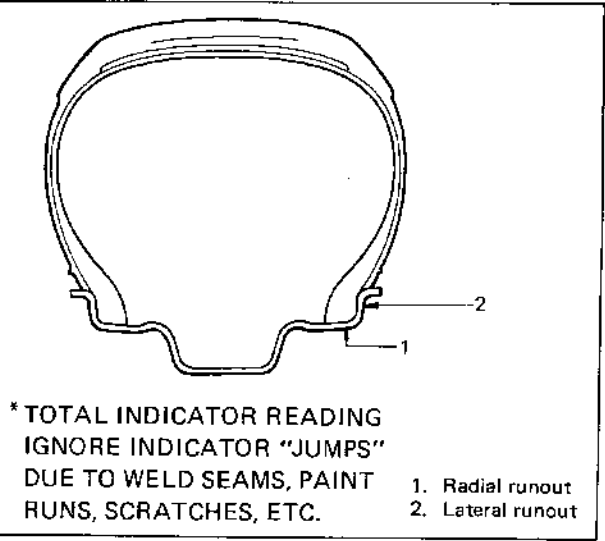


Fig. 3F-2 Wheel Runout

	Radial runout limit	Lateral runout limit
Steel wheel	1.14 mm (0.045 in.)	1.40 mm (0.055 in.)
Aluminum wheel	0.70 mm (0.028 in.)	0.70 mm (0.028 in.)

MAINTENANCE AND MINOR ADJUSTMENTS

WHEEL MAINTENANCE

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

WHEEL ATTACHING STUDS

If a broken stud is found, see Section 3E (rear) or Section 3D (front) for Note and Replacement procedure.

MATCHED TIRES AND WHEELS

(For car equipped with steel wheels)

Tires and wheels are matchmounted at the assembly plant. This means that the radially stiffest part of the tire, or "high spot", is matched to the smallest radius or "low spot" of the wheel. This is done to provide the smoothest possible ride.

The "high spot" of the tire is originally marked by paint dot on the outboard sidewall. This paint dot will eventually wash off the tire.

The "low spot" of the wheel is originally marked by paint dot on the wheel rim-flange. Properly assembled, the wheel rims' paint dot should be aligned with the tires' paint dot as shown in Fig. 3F-3.

Whenever a tire is dismounted from its wheel, it should be remounted so that the tire and wheel are matched. If the tire's paint dot cannot be located, a line should be scribed on the tire and wheel before dismounting to assure that it is remounted in the same position.

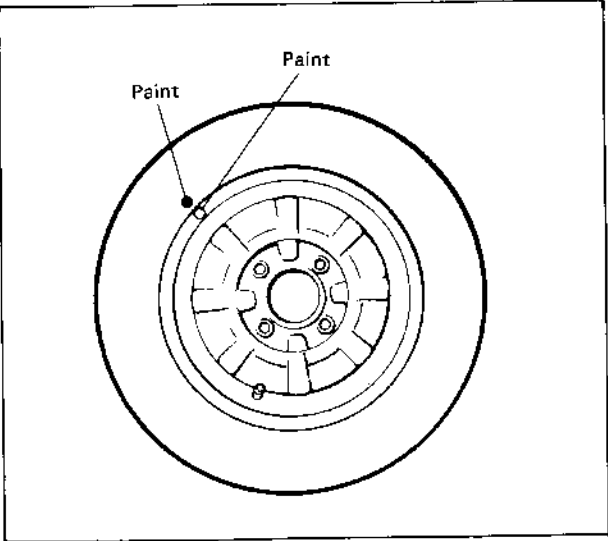


Fig. 3F-3 Matched Tires and Wheels

INFLATION OF TIRES

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, tread wear, tire life and resistance to bruises.

Tire pressure, with tires cold, (after car has set for three hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the tire placard located on the left door (right door for right-hand side steering car) lock pillar.

It is normal for tire pressure to increase to 28 kPa (4 psi) when the tires become hot during driving. Do not bleed or reduce tire pressure after driving. Bleeding reduces the "Cold Inflation Pressure".

Higher than recommended pressure can cause:

1. Hard ride
2. Tire bruising or carcass damage
3. Rapid tread wear at center of tire

Lower than recommended pressure can cause:

1. Tire squeal on turns
2. Hard Steering
3. Rapid and uneven wear on the edges of the tread
4. Tire rim bruises and rupture
5. Tire cord breakage
6. High tire temperature
7. Reduced handling
8. High fuel consumption

Unequal pressure on same axle can cause:

1. Uneven braking
2. Steering lead
3. Reduced handling
4. Swerve on acceleration

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

TIRE PLACARD

The tire placard is located on the left door (right door for right-hand side steering car) lock pillar and should be referred to for tire information. The placard lists the maximum load, tire size and cold tire pressure where applicable.

TIRE ROTATION

To equalize wear, rotate tires according to Fig. 3F-4. Radial tires should be rotated at the first 12,000 km (7,500 miles) and after that, tire rotation at least every 7,500 miles is recommended. Set tire pressure.

NOTE:

Due to their design, radial tires tend to wear faster in the shoulder area, particularly in front positions. This makes regular rotation especially necessary.

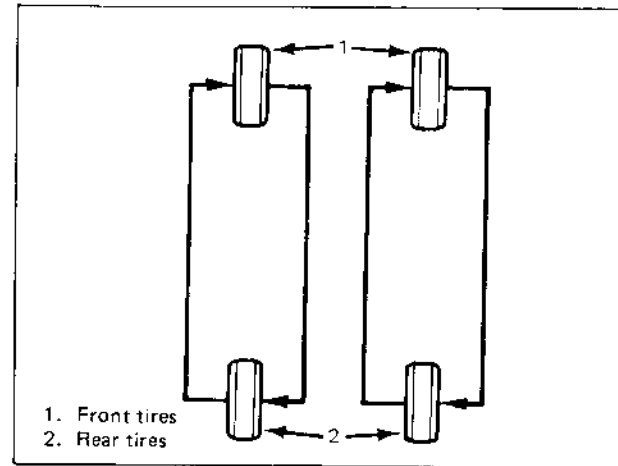


Fig. 3F-4 Tire Rotation

ON-CAR SERVICE

SERVICE OPERATIONS

METRIC LUG NUTS AND WHEEL STUDS

All models use metric lug nuts and wheel studs size: M12 x 1.25

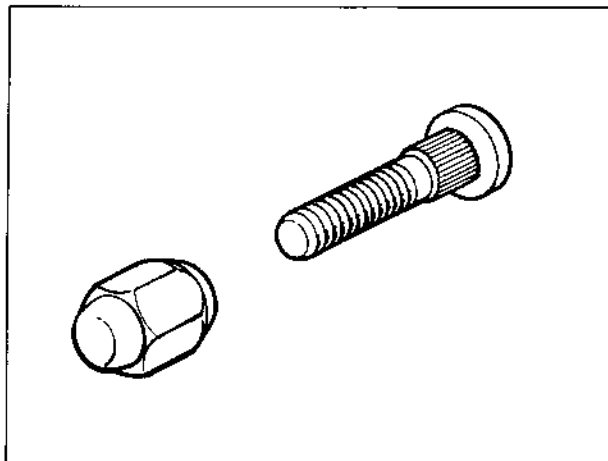


Fig. 3F-5 Metric Stud and Nut

WHEEL REMOVAL

- 1) Loosen wheel nuts by approximately 180° (half a rotation).
- 2) Hoist car.
- 3) Remove wheel.

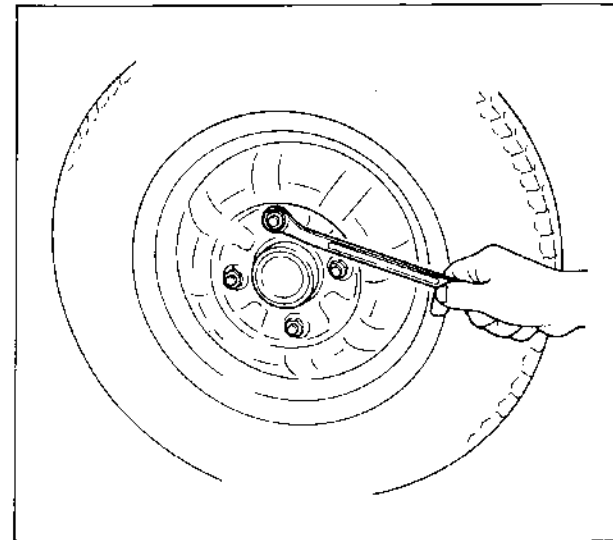


Fig. 3F-6

CAUTION:

Never use heat to loosen tight wheel because application of heat to wheel can shorten life of wheel and damage wheel bearings.

Wheel nuts must be tightened in sequence and to proper torque to avoid bending wheel or brake disc, Fig. 3F-7.

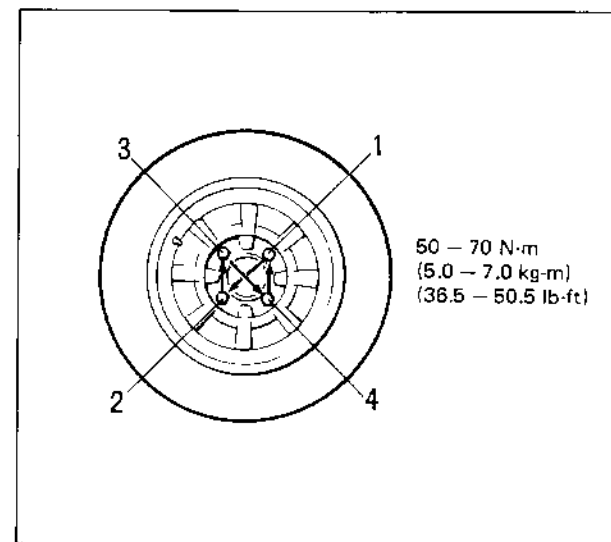


Fig. 3F-7 Wheel Nut Tightening Sequence

NOTE:

Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while car is moving.

TIRE MOUNTING AND DEMOUNTING

Use a tire changing machine to mount or demount tires. Follow equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tires as they may damage tire beads or wheel rim.

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or demounting a tire, bead area should be well lubricated with approved tire lubricant.

After mounting, inflate to specified pressure shown on tire placard so that beads are completely seated.

WARNING:

Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.

Do not exceed specified pressure when inflating. If specified pressure will not seat beads, deflate, re-lubricate and reinflate. Over inflation may cause bead to break and cause serious personal injury.

Install valve core and inflate to proper pressure.

TIRE REPAIR

There are many different materials and techniques on the market to repair tires. As not all of these work on all types of tires, tire manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from each tire manufacturer.

BALANCING WHEELS

There are two types of wheel and tire balance: static and dynamic. Static balance, Fig. 3F-8, is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.

Dynamic balance, Fig. 3F-9, is the equal distribution of weight on each side of the wheel centerline so that when the tire spins there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced may cause shimmy.

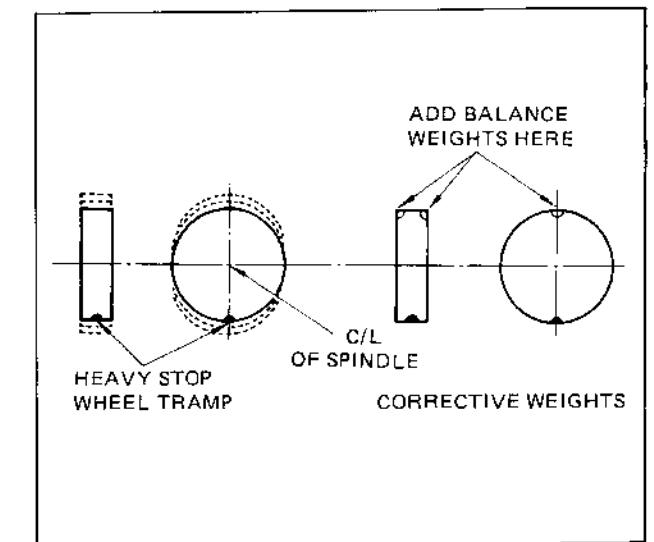


Fig. 3F-8 Static Unbalance Correction

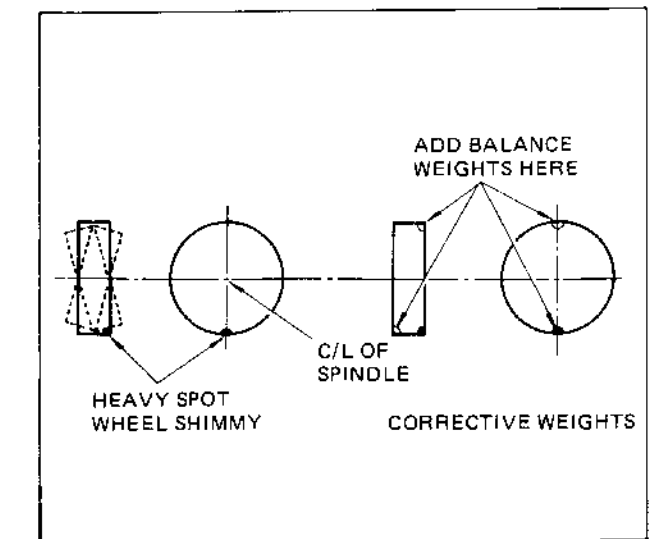


Fig. 3F-9 Dynamic Unbalance Correction

GENERAL BALANCE PROCEDURES

Deposits of mud, etc. must be cleaned from inside of rim.

WARNING:
Stones should be removed from the tread in order to avoid operator injury during spin balancing and to obtain good balance.

Each tire should be inspected for any damage, then balanced according to equipment manufacturer's recommendation.

OFF-CAR BALANCING

Most electronic off-car balancers are more accurate than the on-car spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-car spin balancing, this is overcome by their accuracy, usually to within 1/8 ounce.

ON-CAR BALANCING

On-car balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

WARNING:
Wheel spin should be limited to 35 mph (55 km/h) as indicated on speedometer. This limit is necessary because speedometer only indicates one-half of actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped. Unless care is taken in limiting drive wheel spin, spinning wheel can reach excessive speeds. This can result in possible tire disintegration or differential failure, which could cause serious personal injury or extensive car damage.

RECOMMENDED TORQUE SPECIFICATIONS

Wheel nuts: 50 — 70 N·m (5,0 — 7,0 kg·m, 36.5 — 50.5 lb·ft)

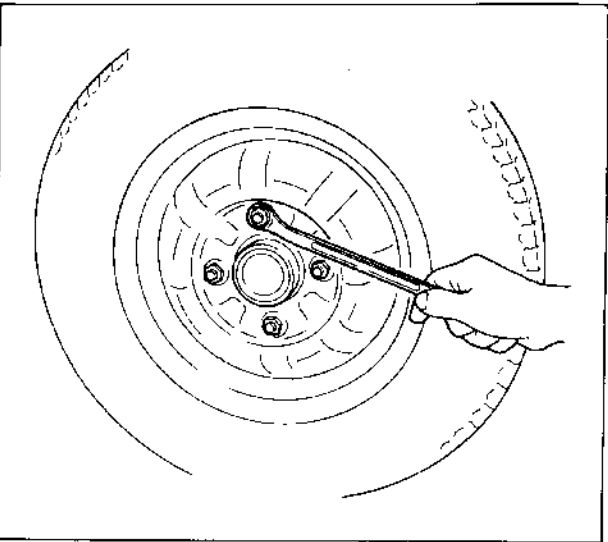


Fig. 3F-10

SECTION 4

FRONT DRIVE SHAFT
(Double Offset Joint (DOJ) Type)

NOTE:
This type of front drive shaft is used for manual transmission models.

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REMOVAL (Right side shaft) 4-3
DISASSEMBLY (Drive shaft) 4-4
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GENERAL DESCRIPTION

A constant velocity ball joint is used on the wheel side of front drive shaft and a constant velocity double offset joint (DOJ) on the differential side.

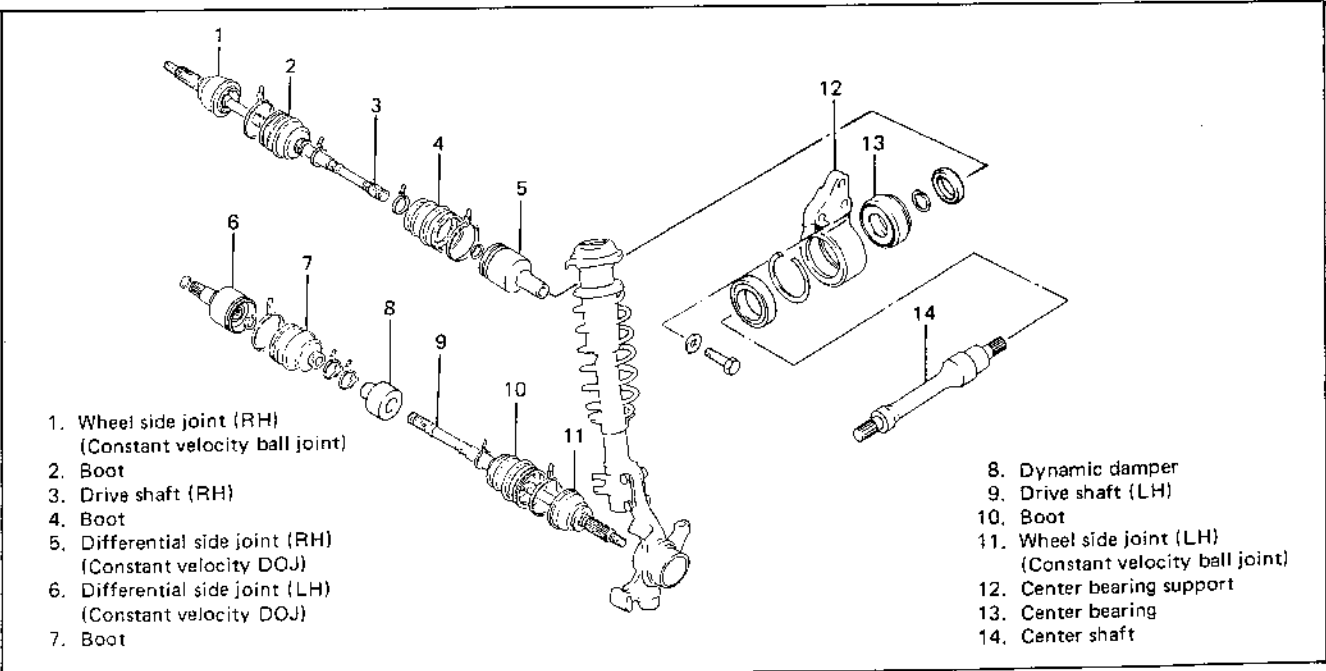


Fig. 4-1 Front Drive Shaft Assembly

REMOVAL (Left Side Shaft)**ON FLOOR**

Undo caulking and remove drive shaft nut and washer.

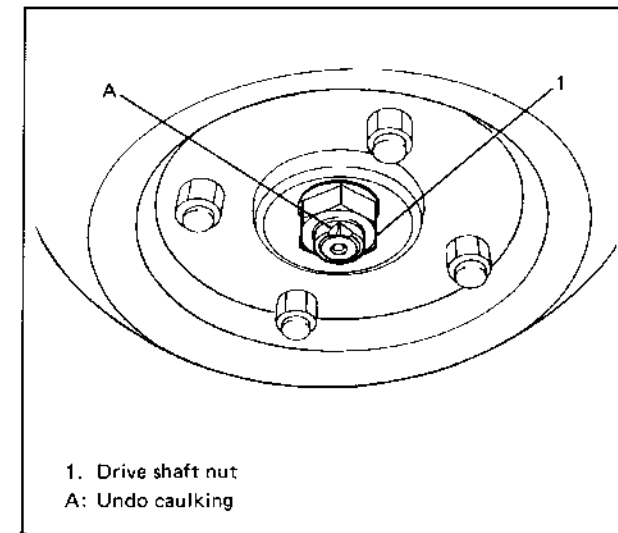


Fig. 4-2 Removing Drive Shaft Nut

ON LIFT

1. Drain transmission oil.
2. By using large size screwdrivers, pull out drive shaft joint so as to release snap ring fitting of joint spline at differential side.

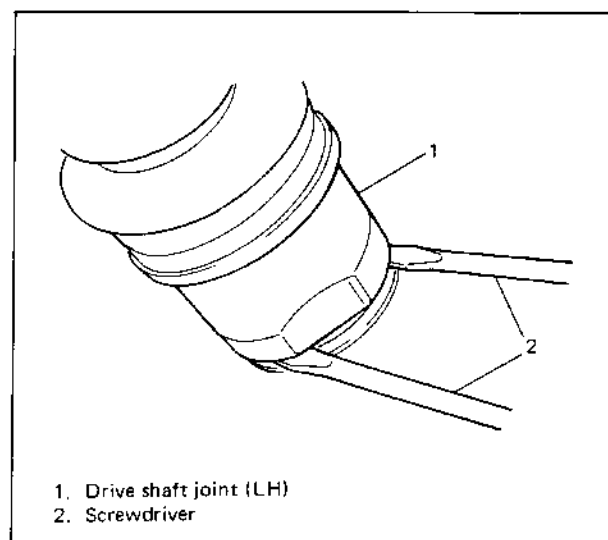


Fig. 4-3 Detaching Snap Ring from Differential

3. Disconnect stabilizer joint from suspension arm.
4. Remove ball stud bolt and nut, and then separate suspension arm from knuckle.

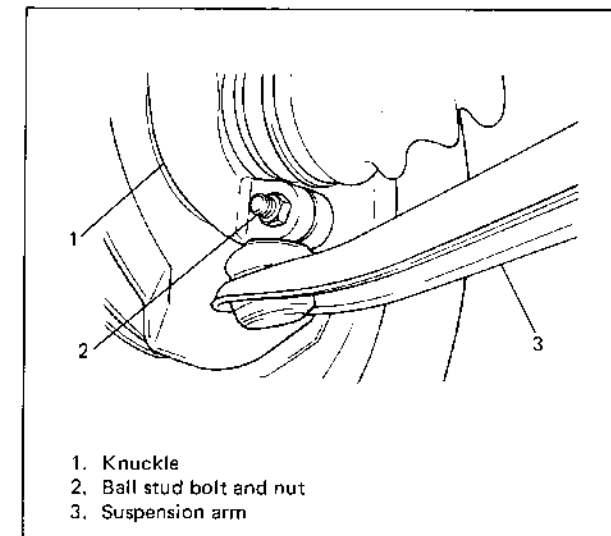


Fig. 4-4 Detaching Suspension Arm from Knuckle

5. To remove drive shaft assembly, pull out in-board joint from differential side and then wheel side joint from steering knuckle.

CAUTION:

To prevent breakage of boots, be careful not to bring them into contact with other parts, when removing drive shaft assembly.

REMOVAL (Right Side Shaft)**ON FLOOR**

Undo caulking and remove drive shaft nut and washer.

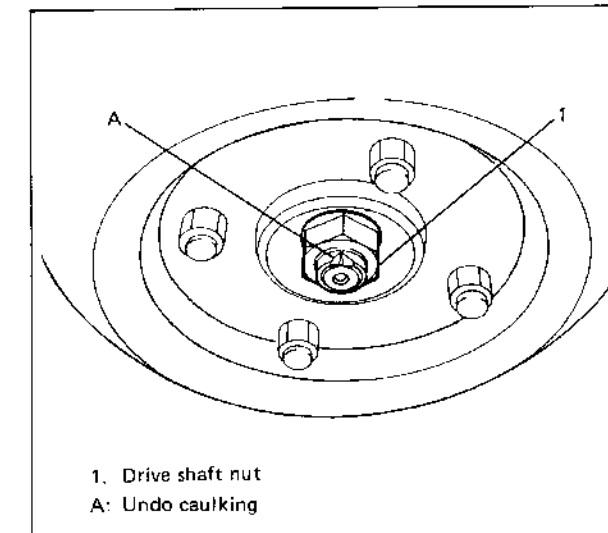


Fig. 4-5

ON LIFT

1. By using plastic hammer, drive out drive shaft joint so as to release snap ring fitting of joint spline at center shaft.

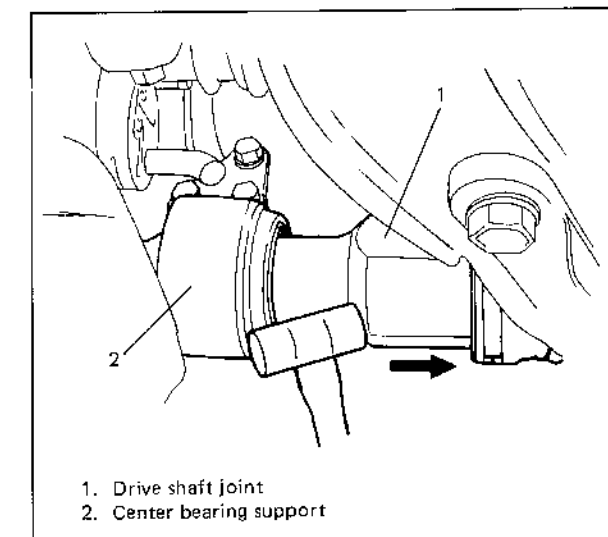


Fig. 4-6

2. Disconnect stabilizer joint from suspension arm.
3. Remove ball stud bolt and nut, and then separate suspension arm from knuckle.

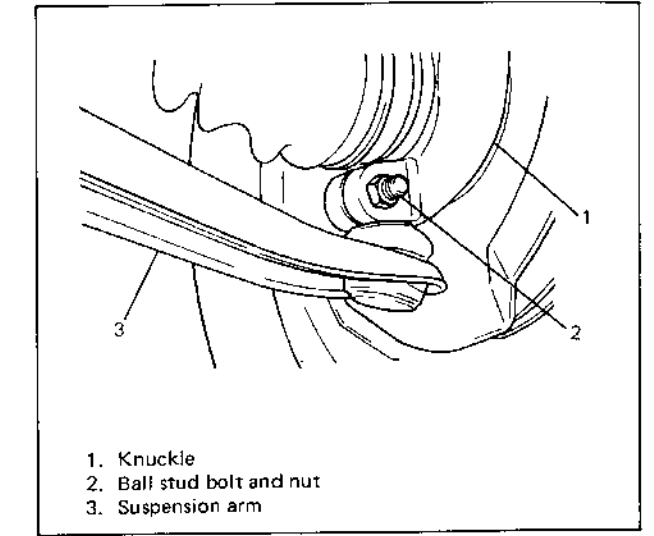


Fig. 4-7

4. To remove drive shaft assembly, pull out inboard joint from center shaft and then wheel side joint from steering knuckle.

CAUTION:

To prevent breakage of boots, be careful not to bring them into contact with other parts, when removing drive shaft assembly.

5. Drain transmission oil.
6. Loosen center bearing support bolts and remove center shaft from differential side gear.

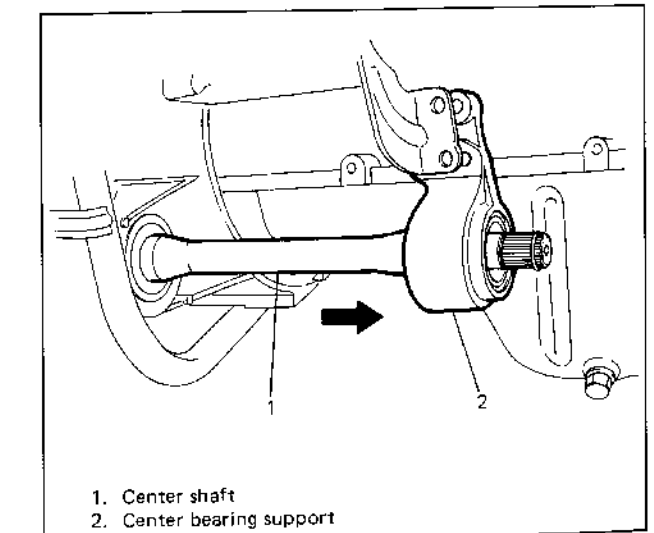


Fig. 4-8

DISASSEMBLY (Drive Shaft)

1. Remove boot band of differential side joint.

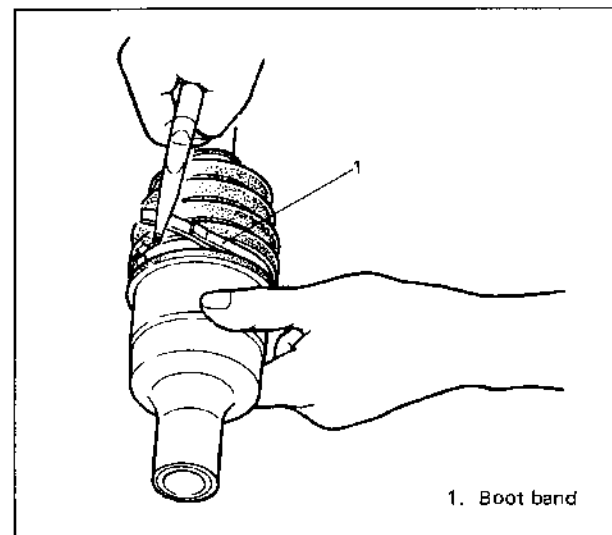


Fig. 4-9

2. Slide boot toward the center of shaft and remove snap ring from outer race, then take shaft out of outer race.

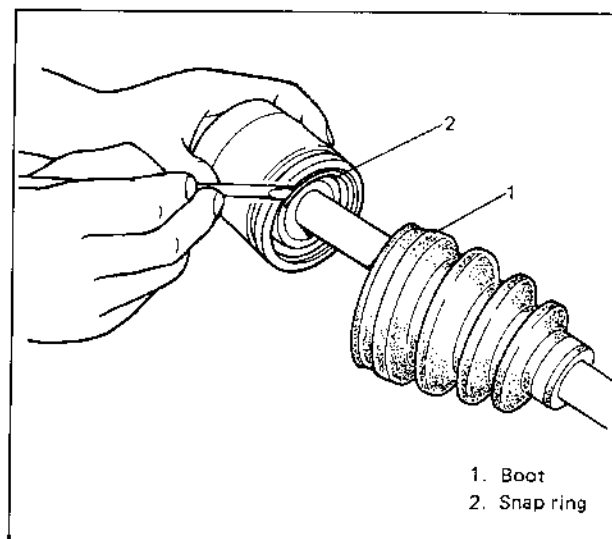


Fig. 4-10

3. Wipe off grease and remove circlip used to fix cage by using special tool (A).

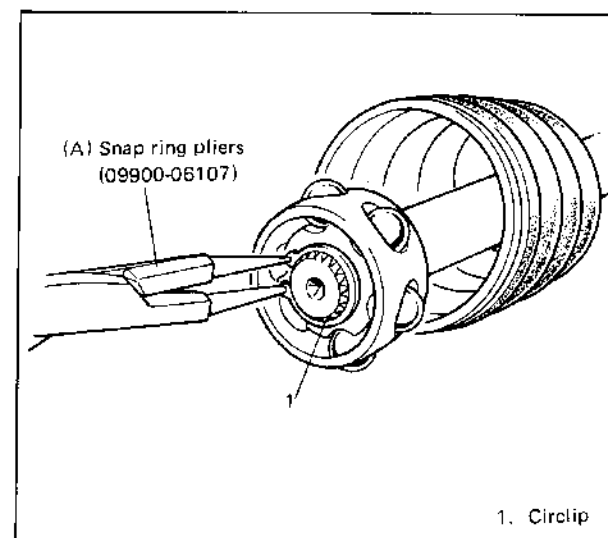


Fig. 4-11

4. Draw away cage and boot from shaft.

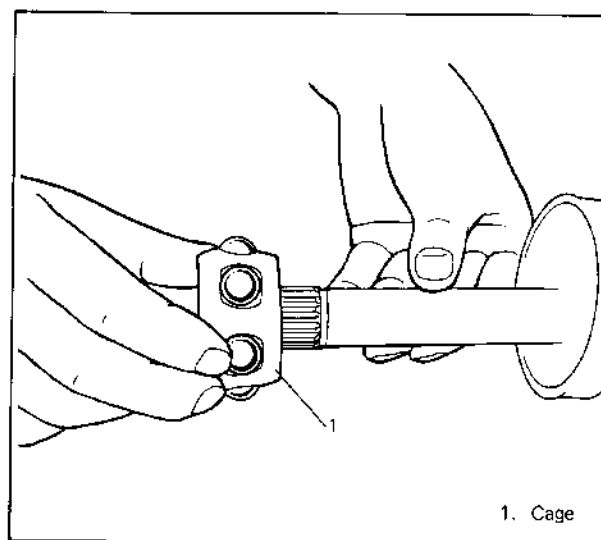


Fig. 4-12

NOTE:

Do not disassemble wheel side joint (outboard joint). If any malfunction is found in any joint, replace it as assembly.

INSPECTION

- Check boots for breakage or deterioration. Replace them as necessary.
- Check circlip, snap ring and boot bands for breakage or deformation. Replace as necessary.

DISASSEMBLY (Center Shaft and Center Bearing Support)

1. Remove right side oil seal from center bearing support.
2. Remove circlip.

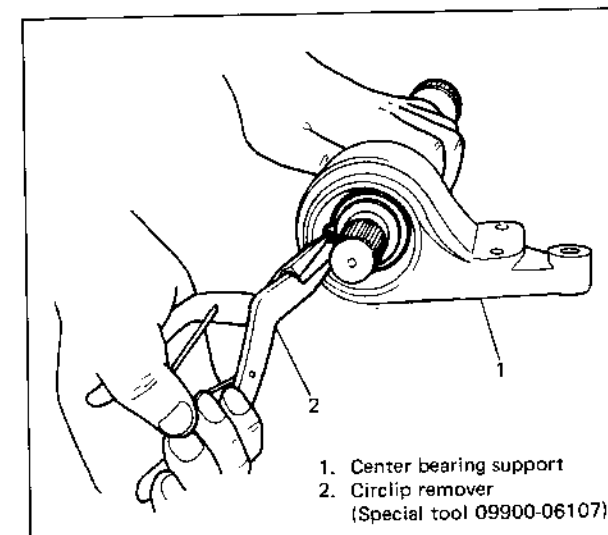


Fig. 4-13

3. By using hydraulic press, draw out center shaft from center bearing.

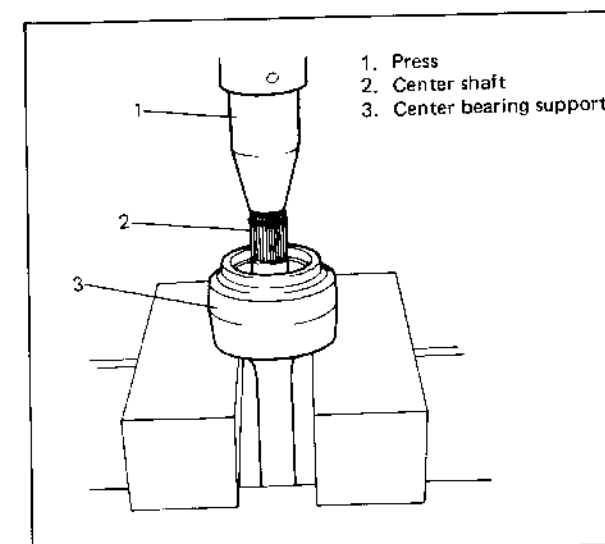


Fig. 4-14

4. Remove left side oil seal from center bearing support.
5. Remove bearing support circlip.

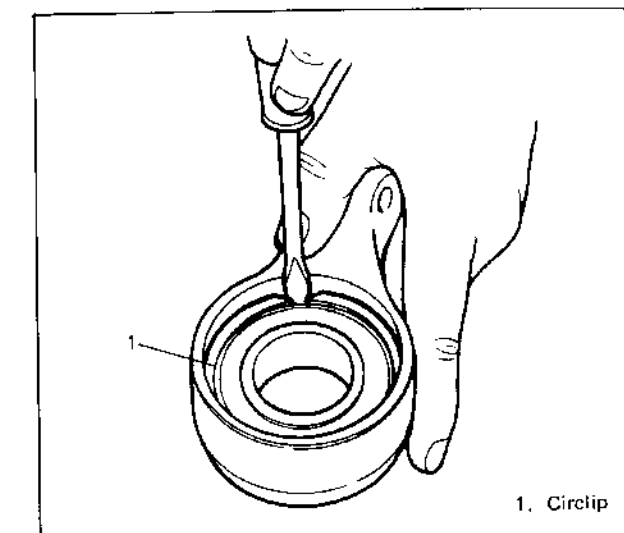


Fig. 4-15

6. Remove center bearing from center bearing support.

REASSEMBLY (Drive Shaft)

1. Wash disassembled parts (except boots). After washing, dry parts completely by blowing air.
2. Clean boots with cloth. DO NOT wash boots in degreaser, such as gasoline or kerosene, etc. Washing in degreaser causes deterioration of boot.

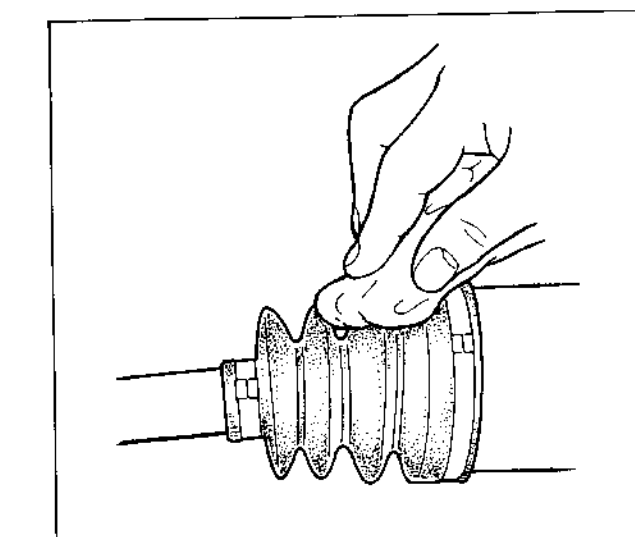


Fig. 4-16

3. Install boot onto drive shaft till its small diameter side fits to shaft groove and fix there with boot band.

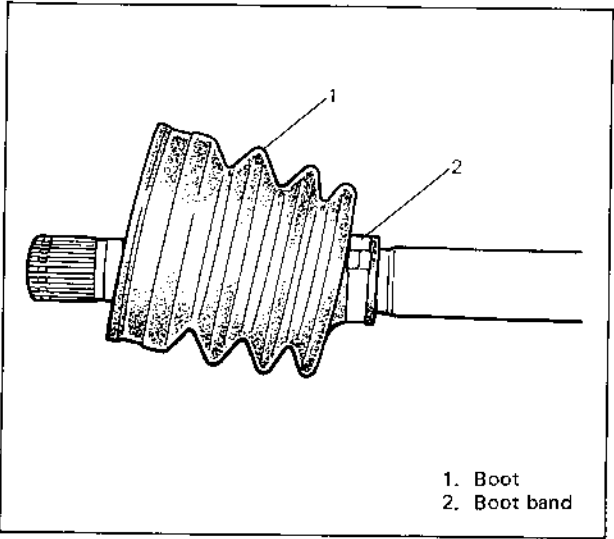


Fig. 4-17

4. Install cage to shaft.

CAUTION:
Install cage directing smaller outside diameter side to shaft end.

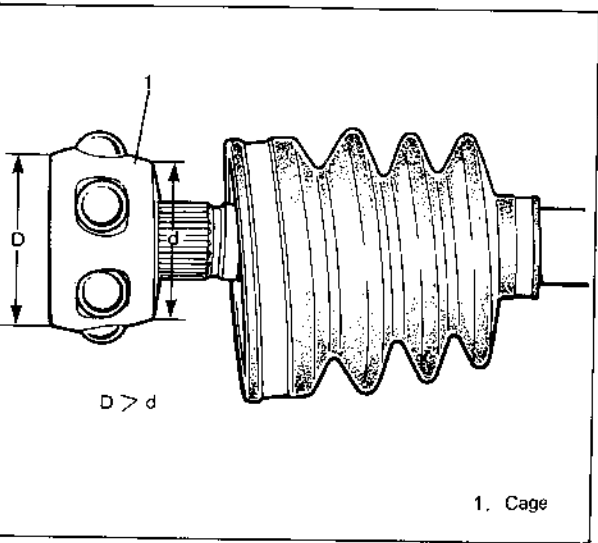


Fig. 4-18

5. Install circlip by using special tool (A).

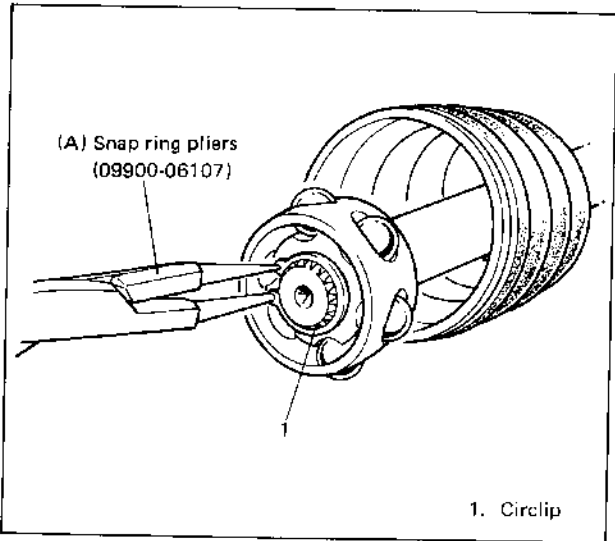


Fig. 4-19

6. Apply grease to entire surface of cage.
Use joint grease in tube included in differential side boot set or DOJ set of spare parts.

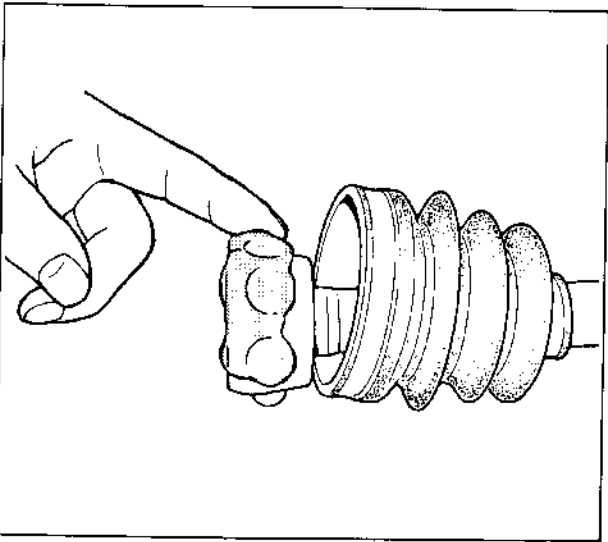


Fig. 4-20

7. Insert cage into outer race and fit snap ring into groove of outer race.

CAUTION:
Position opening of snap ring (A) so that it will not be lined up with a ball.

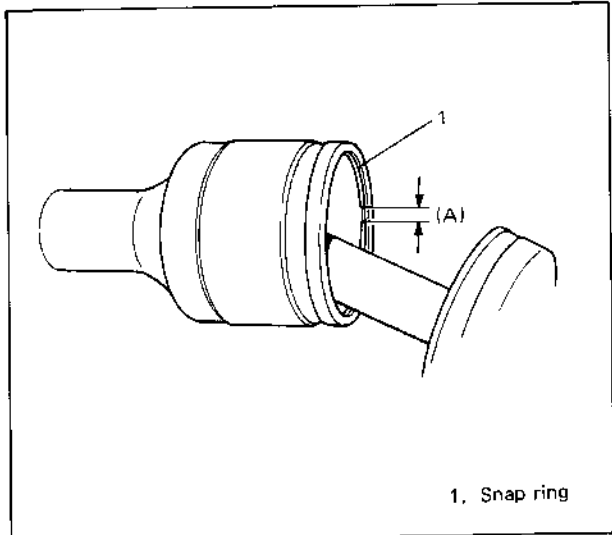


Fig. 4-21

8. Apply grease to inside of outer race, and fit boot to outer race.

After fitting boot, insert screw driver into boot on outer race side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

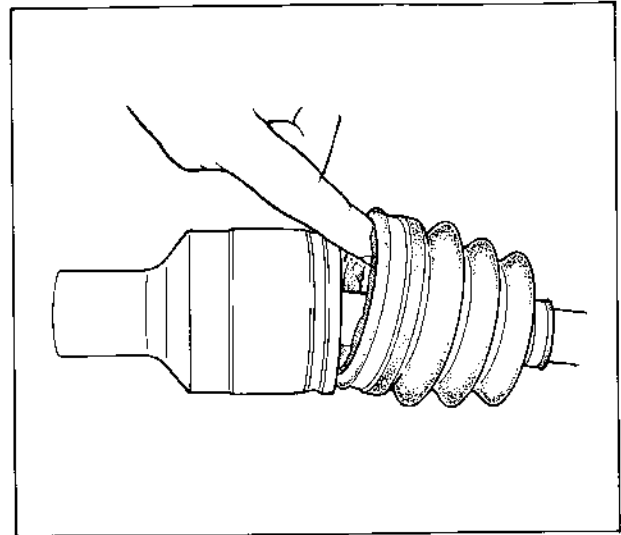


Fig. 4-22

9. When fixing boot to outer race with boot band, adjust so that measurements (A) and (B) become as indicated in figure below.

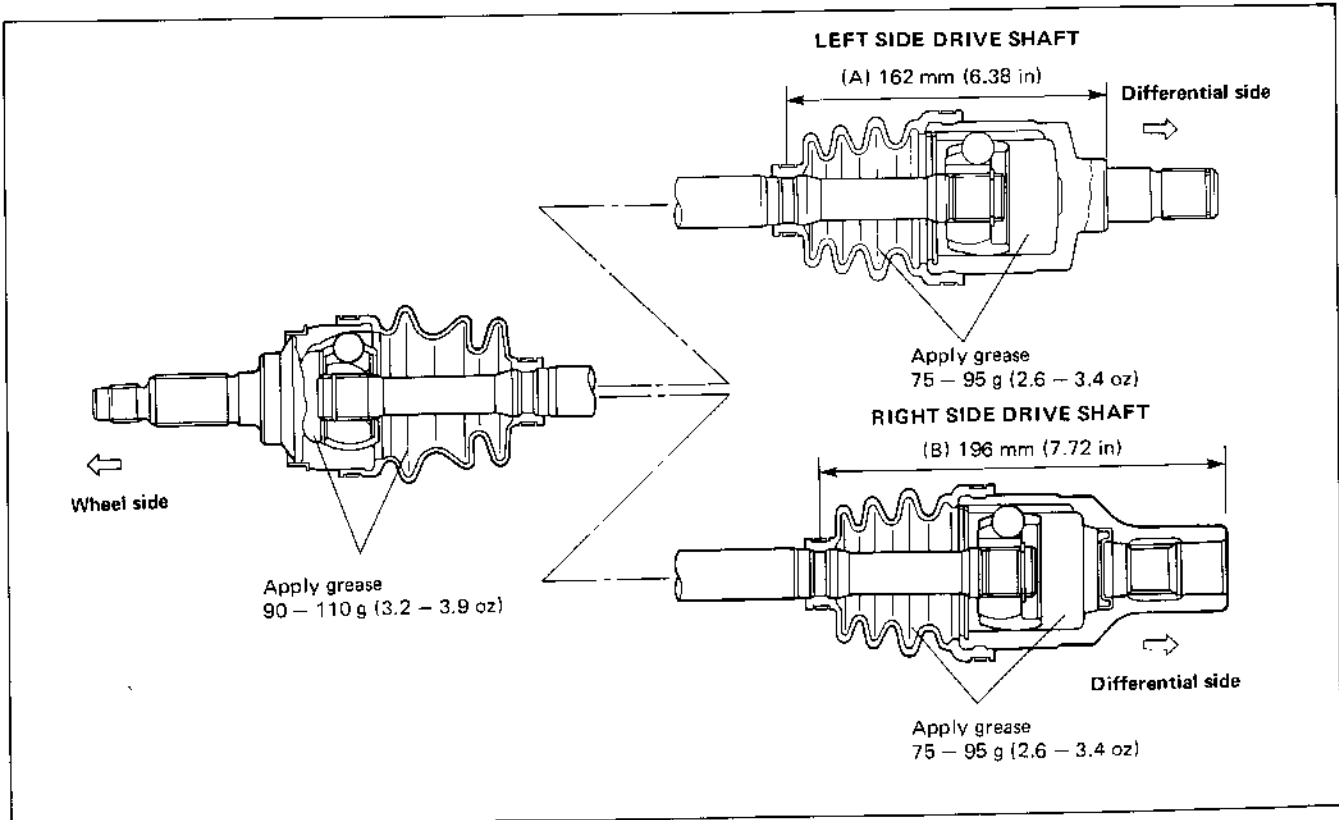


Fig. 4-23

REASSEMBLY (Center Shaft and Center Bearing Support)

Install center shaft by reversing removal procedure and noting following points.

- When installing bearing support circlip, make sure that it fits in circlip groove in center bearing support securely as shown below.

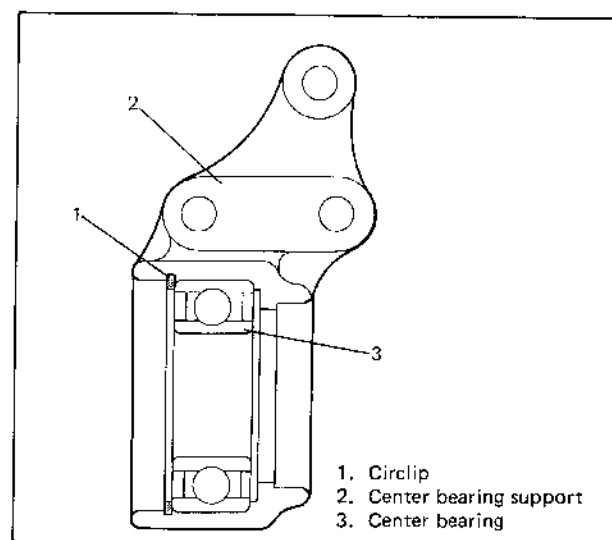


Fig. 4-24

- When installing left side oil seal, use care so that it is in proper direction by referring to below figure.

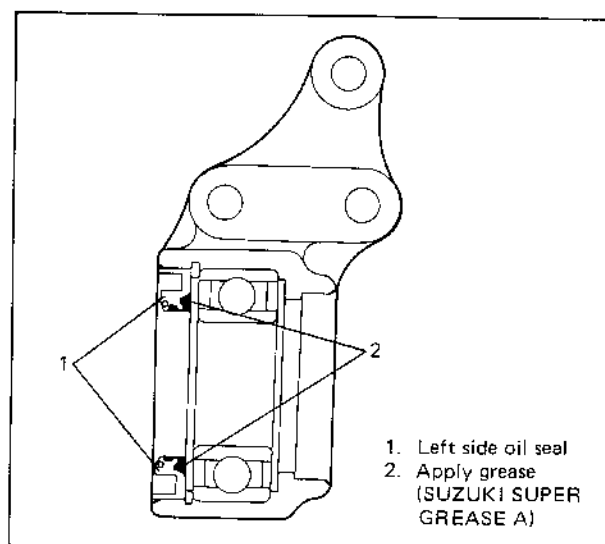


Fig. 4-25

- After press-fitting center shaft from left side oil seal side, fit circlip into groove in shaft securely.

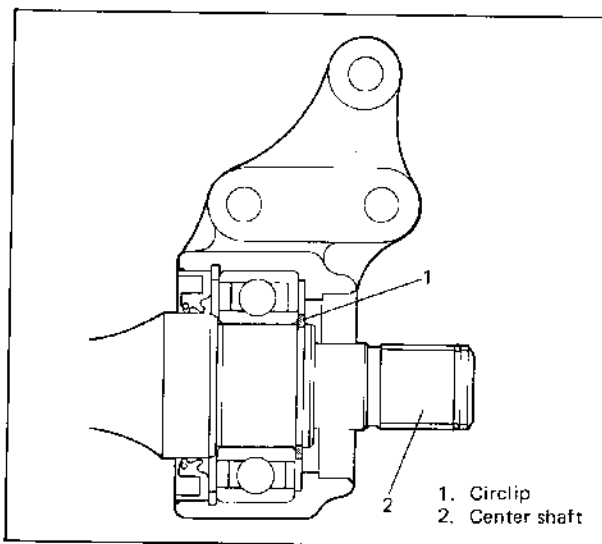


Fig. 4-26

- When installing right side oil seal, use care so that it is in proper direction by referring to below figure.

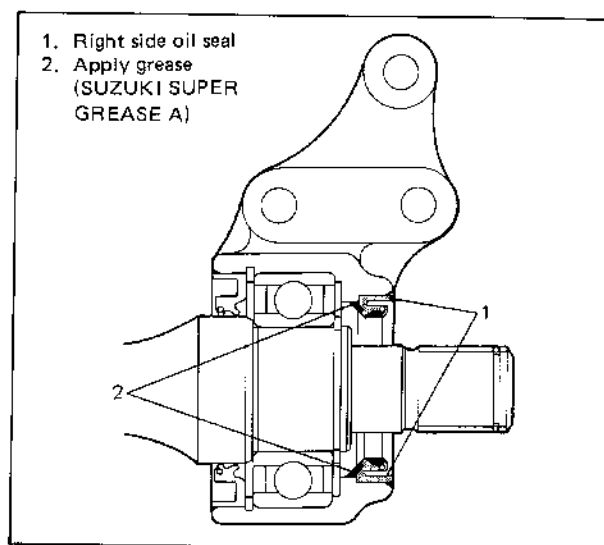


Fig. 4-27

INSTALLATION

Install drive shaft assembly by reversing removal procedure and noting following points.

- Clean front wheel bearing oil seal and then apply grease. Replace it if required.

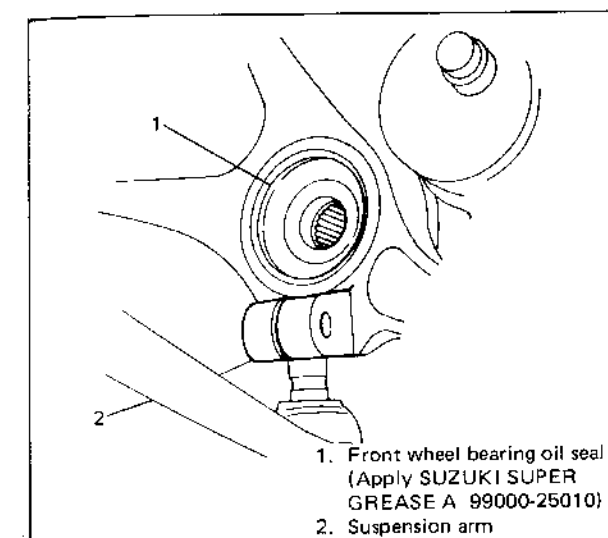


Fig. 4-28 Lubricating Oil Seal with Grease

- Install wheel side joint to steering knuckle first and then DOJ to differential side.
- Apply sealant to drain plug for manual transmission.
- Fill transmission with oil as specified.

CAUTION:

- Protect oil seals and boots from any damage, preventing them from unnecessary contact while installing drive shaft.
- Do not hit joint boot with hammer. Inserting joint only by hands is allowed.
- Make sure that differential side joint is inserted fully and its snap ring is seated as it was.

RECOMMENDED TORQUE SPECIFICATIONS

Fastener		Tightening torque		
		N·m	kg·m	lb·ft
Oil drain plug	M/T	25 – 30	2.5 – 3.0	18.5 – 21.5
	A/T	18 – 23	1.8 – 2.3	13.5 – 16.5
Oil filler and level plug	M/T	36 – 54	3.6 – 5.4	26.5 – 39.0
Ball joint stud bolt and nut		50 – 70	5.0 – 7.0	36.5 – 50.5
Drive shaft nut		150 – 200	15.0 – 20.0	108.5 – 144.5
Center bearing support bolt		40 – 60	4.0 – 6.0	29.0 – 43.0
Stabilizer joint nut		18 – 28	1.8 – 2.8	13.5 – 20.0

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lips
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	Oil drain plug for manual transmission

SECTION 4A

FRONT DRIVE SHAFT
(Tripod Joint Type)

NOTE:
This type of front drive shaft is used for automatic transmission models.

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DISASSEMBLY (Drive shaft)	4A-2
DISASSEMBLY (Center shaft and center bearing support)	4A-2
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REASSEMBLY (Center shaft and center bearing support)	4A-4
INSTALLATION	4A-4
REQUIRED SERVICE MATERIALS	4A-4

GENERAL DESCRIPTION

A constant velocity ball joint is used on the wheel side of front drive shaft and a constant velocity tripod joint on the differential side. The

drive shaft can slide through the tripod joint in the extension/contraction direction.

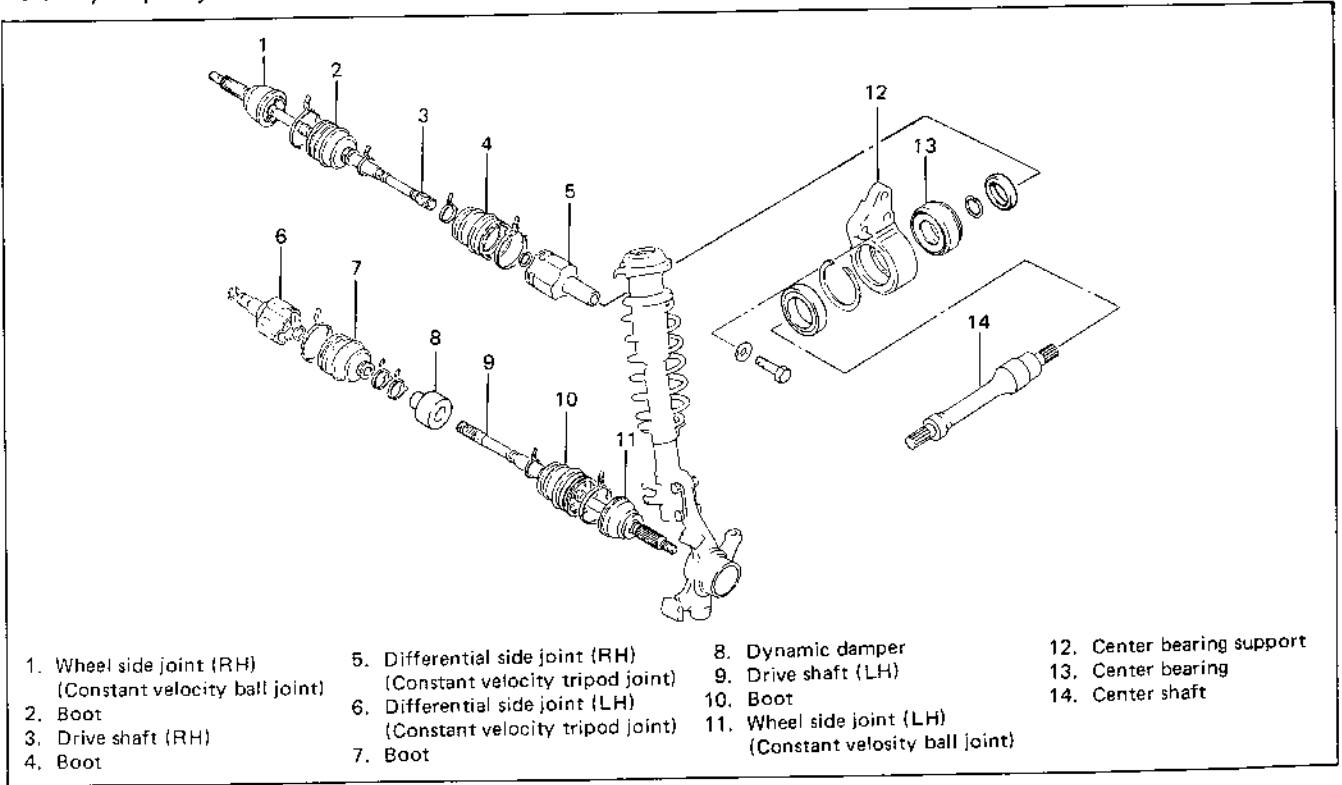


Fig. 4A-1 Front Drive Shaft Assembly

REMOVAL

When removing drive shaft (whether it is left side one or right side one), refer to REMOVAL description in Section 4 of this manual for its removal procedure.

DISASSEMBLY (Drive Shaft)

1. Remove tripod joint boot band, then take out tripod joint housing.

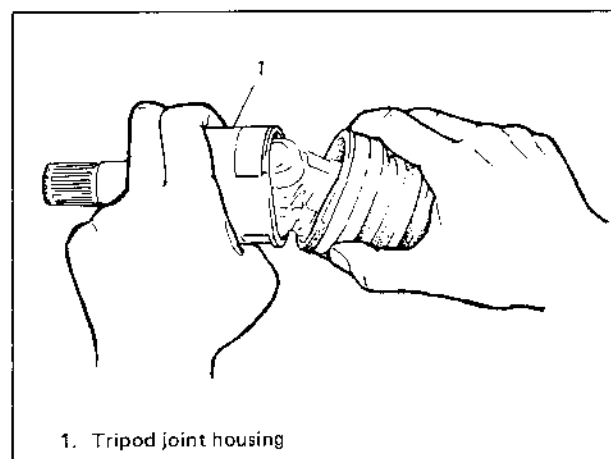


Fig. 4A-2 Removing Tripod Joint Housing

2. Remove grease from shaft and take off circlip by using special tool, then pull out spider from shaft.

CAUTION:

To prevent needle bearing of joint from being degreased, do not wash it if it is to be reused.

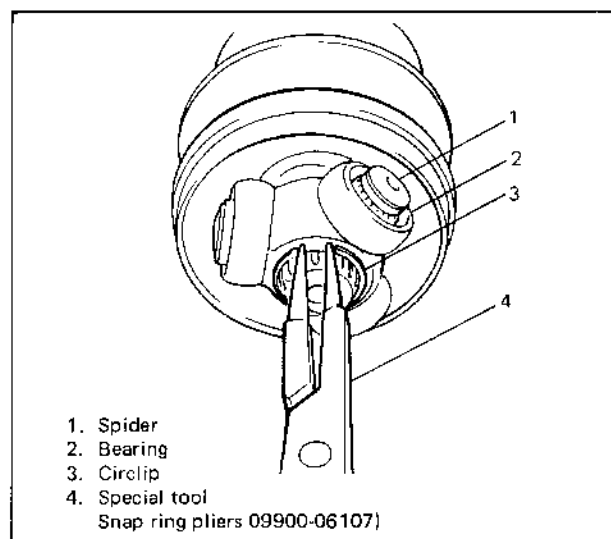


Fig. 4A-3 Removing Tripod Joint Spider

3. Remove boot band, then pull out differential side boot from shaft.
4. Undo band of dynamic damper, then pull out damper through shaft.
5. Undo boot bands of wheel side joint boot, then pull out boot through shaft.

CAUTION:

- Disassembly of wheel side joint is not allowed. If noise or damage exists in it, replace it as assembly.
- Do not disassemble tripod joint spider. If any malcondition is found in it, replace it as differential side joint assembly.

DISASSEMBLY (Center Shaft and Center Bearing Support)

For disassembly procedure of these parts, refer to DISASSEMBLY description in Section 4 of this manual.

INSPECTION

- Check boots for breakage or deterioration. Replace them as necessary.
- Check circlip, snap ring and boot bands for breakage or deformation. Replace as necessary.

REASSEMBLY (Drive Shaft)

Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly.

Make sure that wheel side joint assembly and tripod joint housing are washed thoroughly and air dried, and boots are cleaned with cloth if they are to be reused.

1. Apply grease to wheel side joint. Use black grease in tube included in wheel side boot set.
2. Install wheel side boot on shaft.
3. Fill up boot inside with grease and then fasten boot with bands.
4. Install dynamic damper on shaft.
5. Install differential side boot on shaft.
Apply grease to tripod joint. Use yellow grease in tube included in differential side boot set or differential side joint assembly of spare parts.
6. Install tripod joint spider on shaft, facing its chamfered spline inward (wheel side), then fasten it with circlip.

7. Fill up differential side boot inside with grease, then install housing and joint it with boot.
8. Fasten boot with bands.

CAUTION:

- To prevent any problem caused by washing solution, do not wash joint boots and tripod joint except its housing. Degreasing of those parts with cloth is allowed.
- To ensure full performance of joint as designed, be sure to distinguish between two types of grease in repair set and apply specified volume to respective joint, i.e. black grease (130 g tube) to wheel side joint and yellow one (130 g tube) to tripod joint.
- Bend each boot band against forward rotation.
- Do not squeeze or distort boot when fastening it with bands.
Distorted boot caused by squeezing air may reduce its durability.

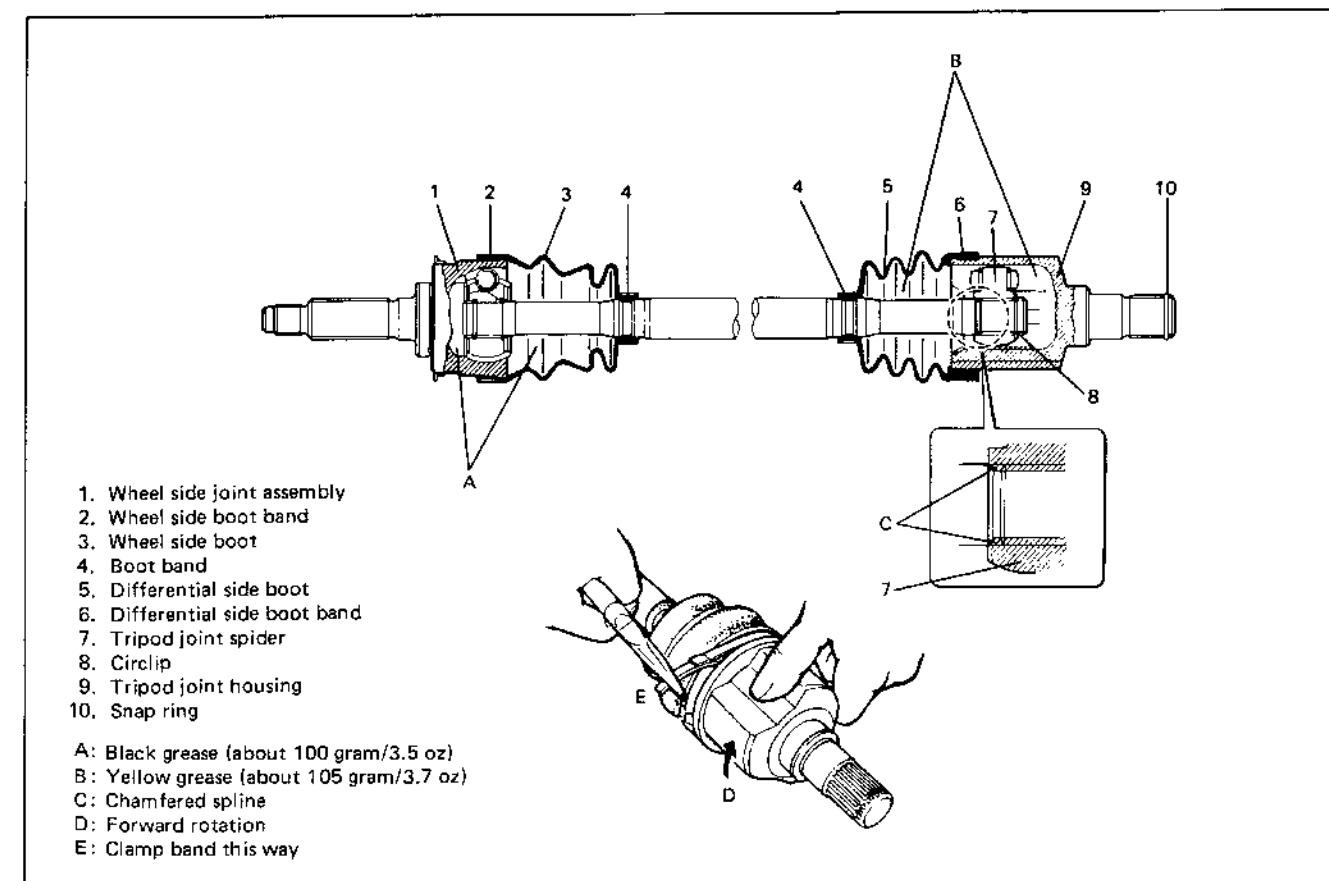


Fig. 4A-4 Assembling Front Drive Shaft

REASSEMBLY (Center Shaft and Center Bearing Support)

For reassembly procedure of these parts, refer to REASSEMBLY description in Section 4 of this manual.

INSTALLATION

Install drive shaft assembly by reversing removal procedure and noting following points.

- Clean front wheel bearing oil seal and then apply grease. Replace it if required.

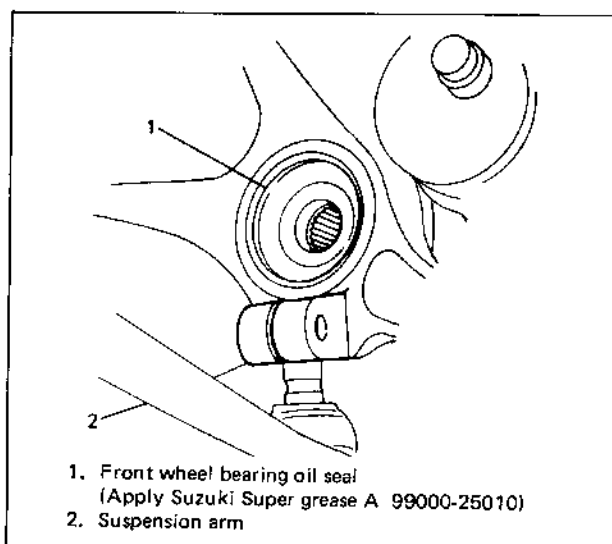


Fig. 4A-5 Lubricating Oil Seal with Grease

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lips

- Install wheel side joint to steering knuckle first and then tripod joint to differential side.

CAUTION:

- To avoid excessive expansion of boot and consequential disconnection of joint in boot, do not pull tripod joint housing.
- Protect oil seals and boots from any damage, preventing them from unnecessary contact while installing drive shaft.
- Do not hit joint boot with hammer. In setting joint only by hands is allowed.
- Make sure that differential side joint is inserted fully and its snap ring is seated as it was.

- Tighten each bolt and nut to specified torque. For torque data, refer to **RECOMMENDED TORQUE SPECIFICATION** table in Section 4 of this manual.
- Fill transmission with oil as specified.

NOTE:

For automatic transmission, carry out full step of fluid level check procedure i.e. **ROOM TEMPERATURE LEVEL CHECK** first, and then **NORMAL OPERATING TEMPERATURE LEVEL CHECK**, referring to p. 7B-46.

SECTION 5

BRAKES

NOTE:

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.

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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 two 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 right & rear left brakes and the other connects front left & rear right brakes.

The proportioning valve (P valve) is included in these circuits between the master cylinder and rear wheels.

In this brake system, the disc brake type is used for the front and rear wheel 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 pads are used for both parking and foot brakes.

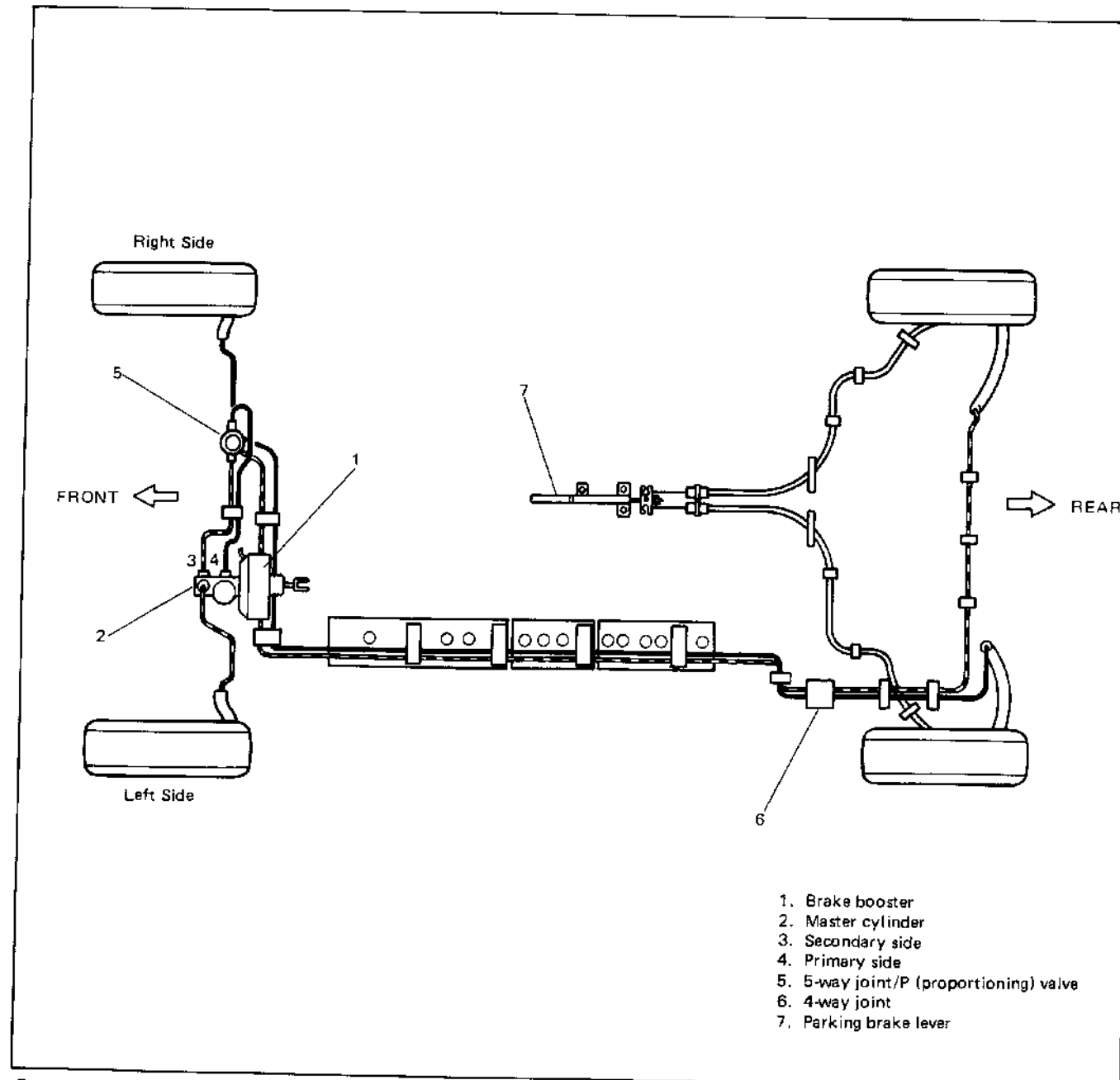


Fig. 5-1

FRONT DISC BRAKE CALIPER ASSEMBLY

GENERAL DESCRIPTION

This caliper has a single bore. 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 car.

For details, refer to OPERATION in the next page.

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.

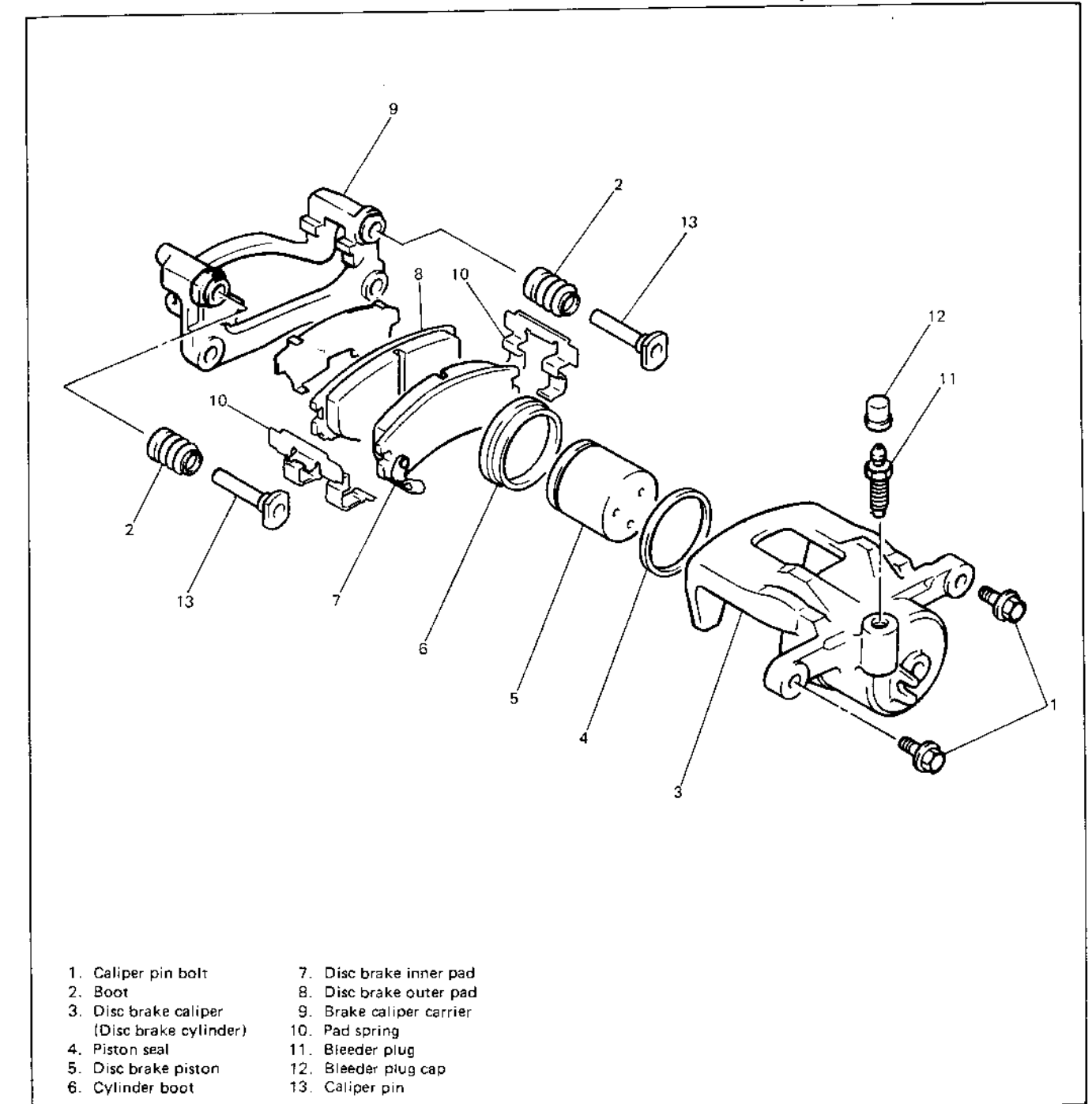


Fig. 5-2 Front Caliper Assembly

Caliper OPERATION**Single piston floating caliper type**

The single piston floating caliper type brake is employed in this model. One cylinder and one piston are used for this type. (The cylinder is constructed as a monoblock with the caliper.) Fluid pressure generated in the cylinder causes the pad (1) on the piston side to press against the disc. At the same time, the floating type caliper body is moved to the right by the cylinder pressure, as shown in below figure, which pulls pad (2) against the disc and so brakes the wheel.

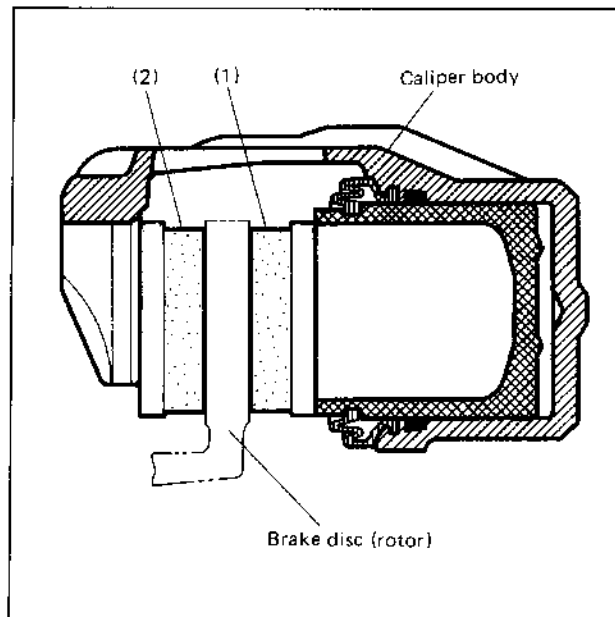


Fig. 5-3

The disc brake has no servo assistance as in drum braking, and it is necessary to increase the working pressure of the piston and pad. For this purpose, the wheel cylinder has a large bore. Even only a little change in clearance between the disc and pad has therefore a large influence on the brake pedal stroke. It is necessary to keep the clearance adjusted to the minimum at all times, by means of the piston (rubber) seal.

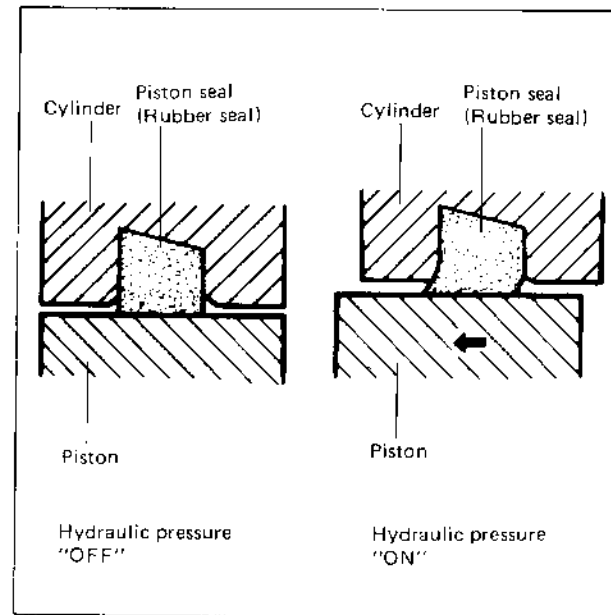


Fig. 5-4

Clearance correction

When oil pressure is applied to the piston, the piston moves forward. The rubber seal, which exerts considerable pressure against the piston, moves with the cylinder. However, as a part of the rubber seal has been fixed into a groove in the cylinder, the shape of the rubber seal is distorted toward internal end of the cylinder, as shown in above figure. When pressure is taken off from the foot brake pedal and fluid pressure is released from the piston, a restoring force is generated at the seal and pushes the piston back. As the pads wear away and the clearance between the disc and pads becomes larger, the piston moves a larger distance. The seal then could change in shape further but, since the end of the seal is fixed into the groove in the cylinder, the distortion is limited to the same amount as previously described. The piston moves further to cover the distance of clearance. The piston returns by the same distance and the rubber seal recovers its shape as described above and thus the clearance between the disc and pads is maintained in adjustment.

REAR DISC BRAKE CALIPER ASSEMBLY**GENERAL DESCRIPTION**

This caliper assembly is a single piston floating caliper type. It consists of such components as shown below and serves as foot brake and parking brake.

NOTE:

Replace all components included in repair kits to service this disc 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.

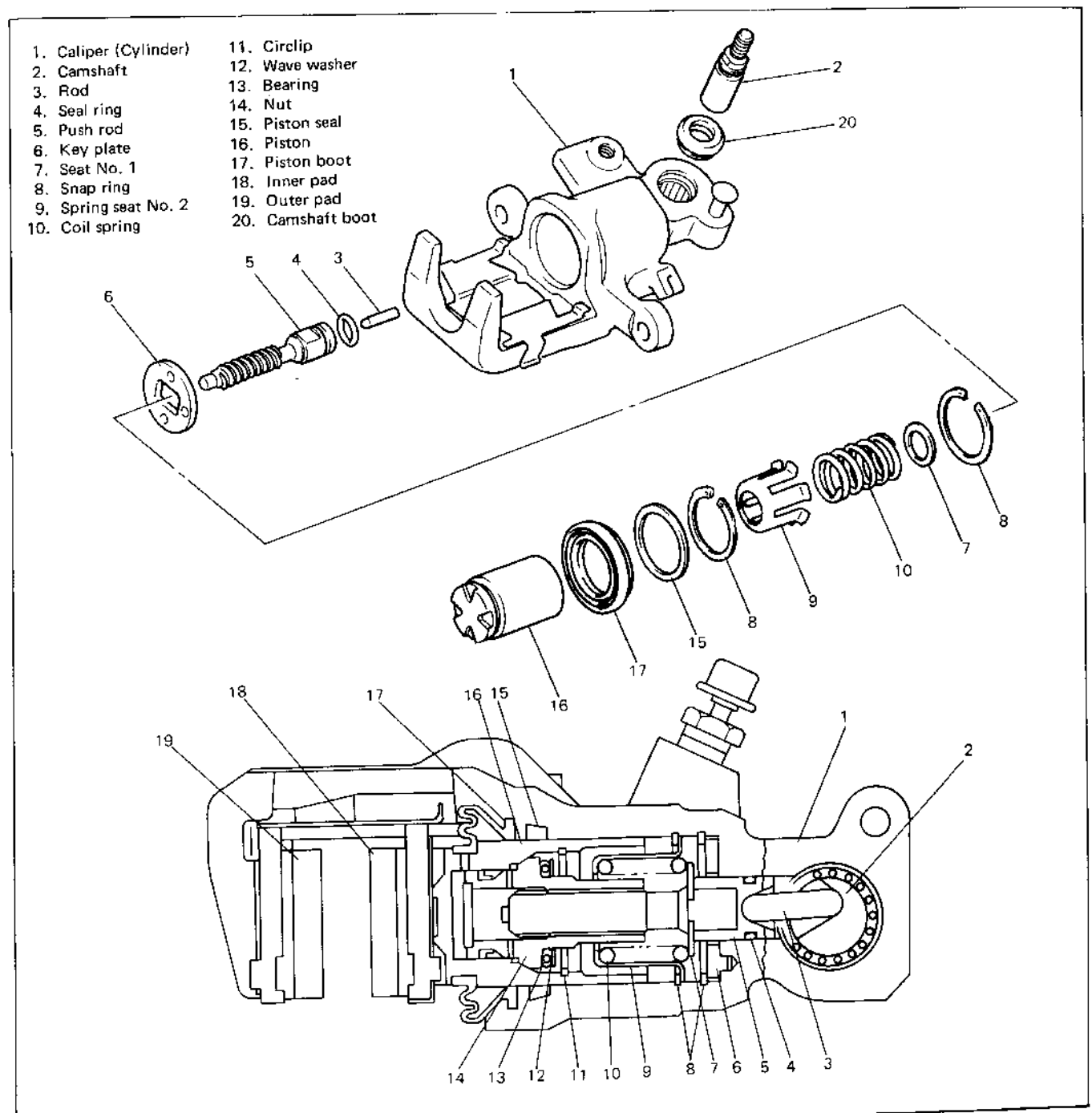


Fig. 5-5

STRUCTURE

As shown below, the piston has a nut, bearing and washer in it. The nut is pushed against the tapered part (clutch face which is "A" in the figure below) of the piston by the wave washer via the inbetween bearing.

The screw part ("B" in the figure) on the push rod is engaged with the nut and the coil spring force is applied to the push rod, which then pushes the rod toward the camshaft.

As the push rod is tightly fitted with the key plate, it can not turn.

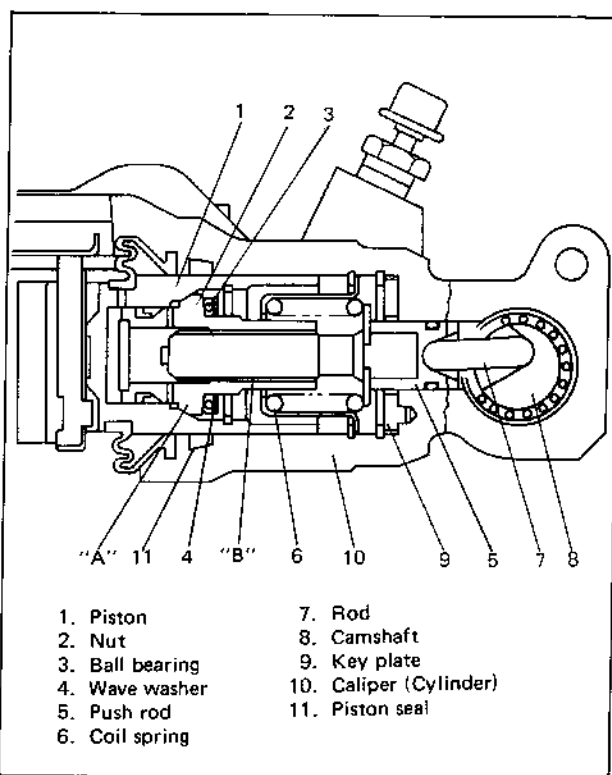


Fig. 5-6

OPERATION

[Foot brake]

When the brake pedal is depressed, the hydraulic pressure generated in the master cylinder makes the nut in the caliper (cylinder) and piston move in the rod direction by the amount of built in clearance at the screw part of the push rod. As the nut does not turn in this state, it does not act as an automatic adjust device.

When the disc-to-pad clearance grows larger and exceeds the built in clearance at the screw part of the push rod, the piston moves away from the nut in the rod direction (to the left in the figure). Then due to the screw torque (which causes the nut to turn) generated by the hydraulic pressure, the nut turns and moves in the rod direction for adjustment till nut-to-piston clearance is gone. Even when the clearance is gone, as long as the torque generated on the clutch face ("A" in Fig. 5-6) is smaller than that at the screw part of the nut ("B" in Fig. 5-6) the nut-to-piston clearance is adjusted on the basis of such conditions as deformation, etc.

As the hydraulic pressure increases, the torque generated at the screw part ("B") increases and when it exceeds that generated on the clutch face ("A"), the nut does not turn and the push rod compresses the spring and moves with the nut in the rod direction by the amount corresponding to the piston stroke caused by deformation, etc.

For the process after the piston has moved to the left till the brake force occurs, refer to the description under **FRONT BRAKE** in this section.

When the foot is taken off the brake pedal and the hydraulic pressure in the brake system lowers, the piston in the caliper moves back with the help of the piston seal and coil spring for the proper pad-to-disc clearance.

This clearance is determined by the built in clearance generated between the nut and the screw part of the push rod.

[Parking brake]

When the parking brake lever is pulled up, it causes the lever on the rear brake caliper to move (rotate) through the cable.

As the lever is made a part of the camshaft which is installed in the brake caliper (cylinder), the camshaft follows the lever movement.

As shown in the figure below, the camshaft has a cam (eccentric hole in a cone form), thereby the camshaft movement (rotation) is converted into the linear movement of the push rod in the rod direction through the rod.

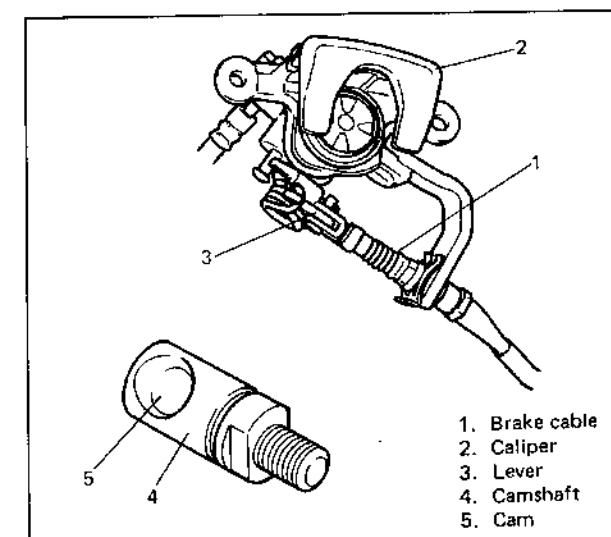


Fig. 5-7

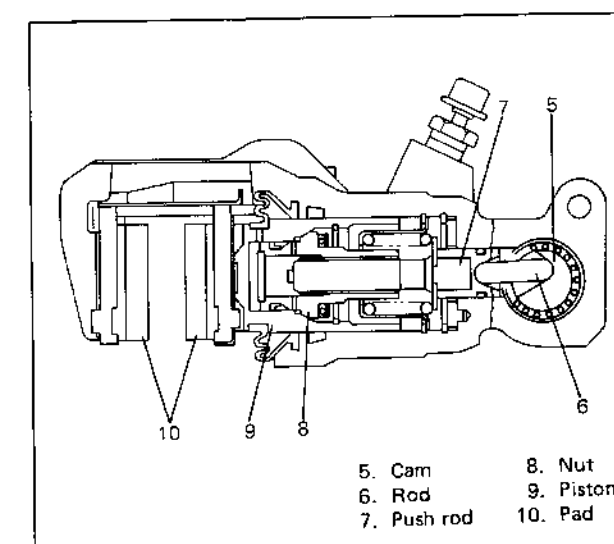


Fig. 5-8

The push rod is meshed with the nut and the outer part of the nut is pushed against the tapered part ("A" in Fig. 5-6) of the piston as described previously. Thus the push rod movement is transmitted to the piston through the nut.

In other words, the movement (rotation) of the lever on the caliper causes the piston to move forward (toward the pad). Then in the same way as with the foot brake, the inner and outer pads hold the disc between them to brake the car to a stop.

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 right front wheel brake and left rear wheel brake.

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

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.

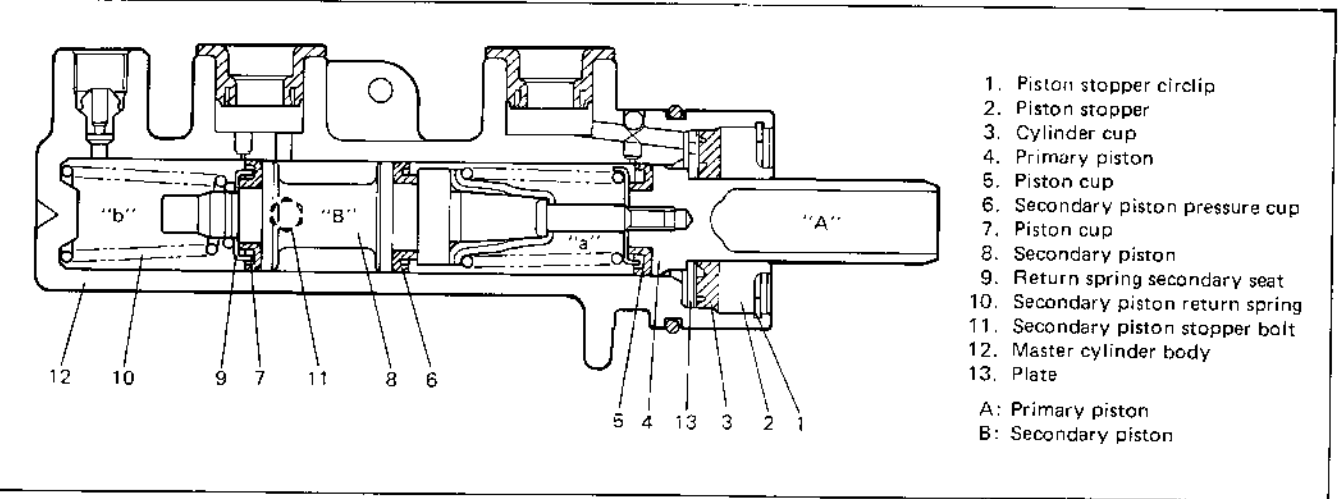


Fig. 5-9

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".

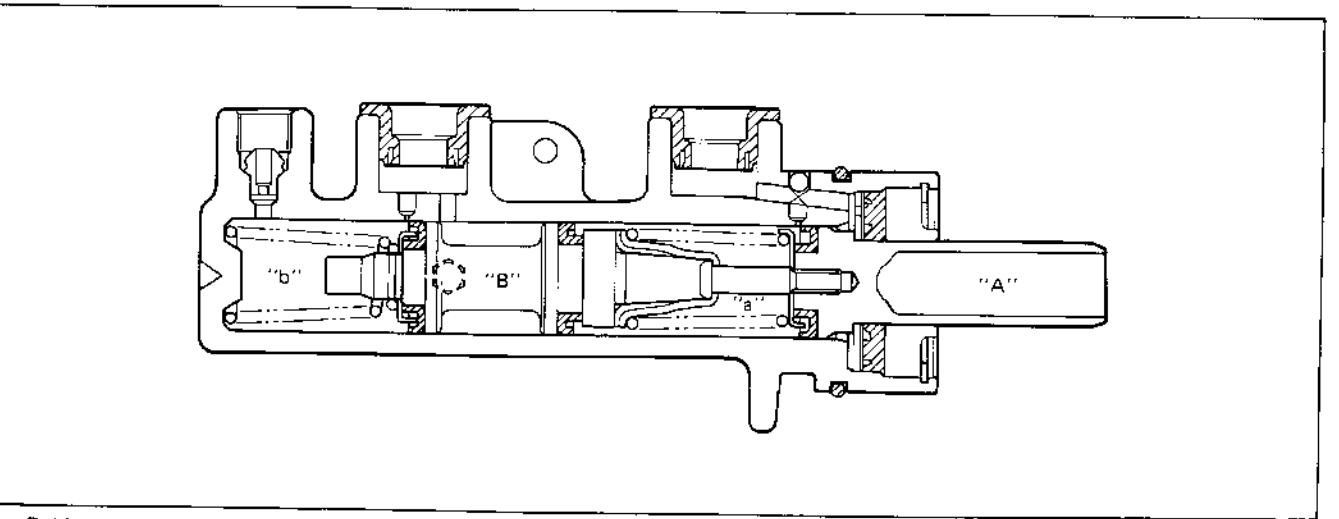


Fig. 5-10

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 left front wheel brake and right rear wheel brake.

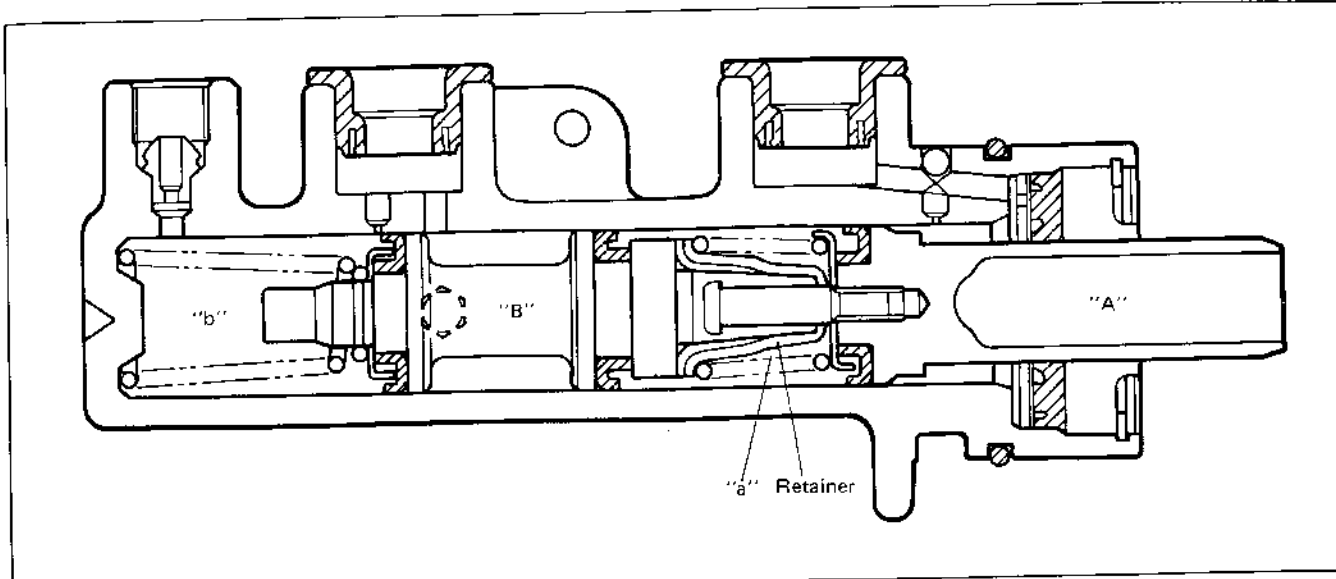


Fig. 5-11

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 right front wheel brake and left rear wheel brake. The below figure shows secondary piston "B" at halt.

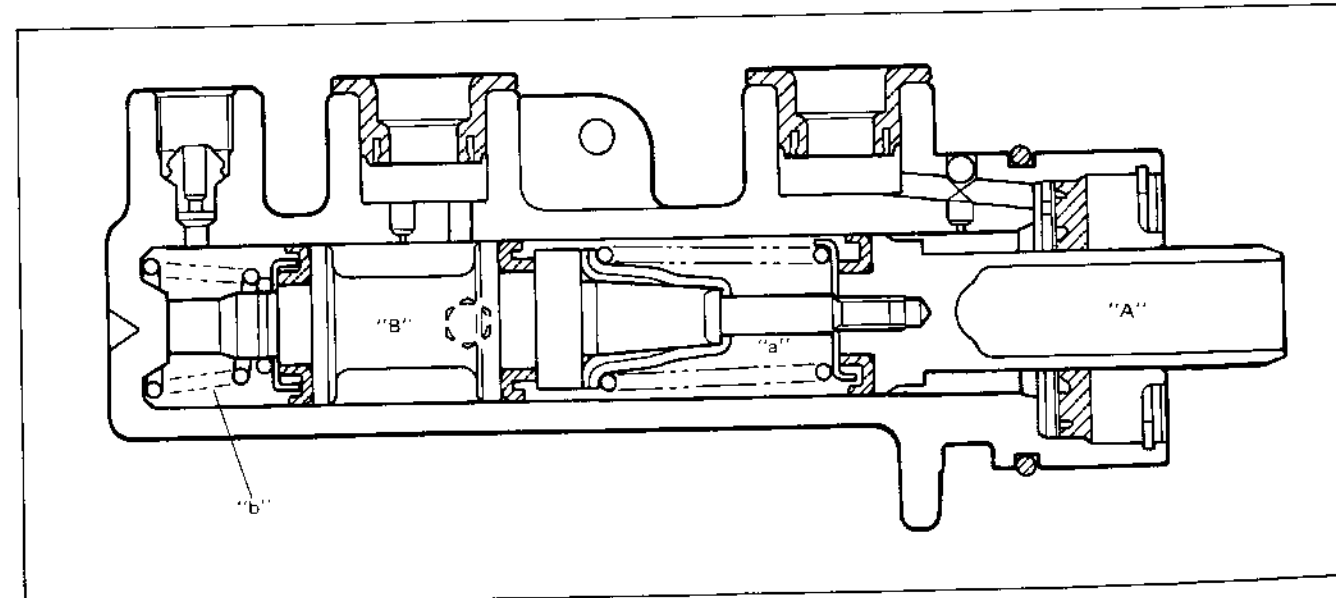


Fig. 5-12

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 a diaphragm of ϕ 155 mm (6 in.) effective diameter. Its operation is described in the following pages.

NOTE:

- Use all components included in repair kits to service this booster. Lubricate rubber parts, where indicated, with silicone grease provided in kits. The torque values specified are for dry, unlubricated fasteners. If any hydraulic component is removed or brake line disconnected, bleed the brake system.
- Never lubricate any hydraulic component with silicone grease.

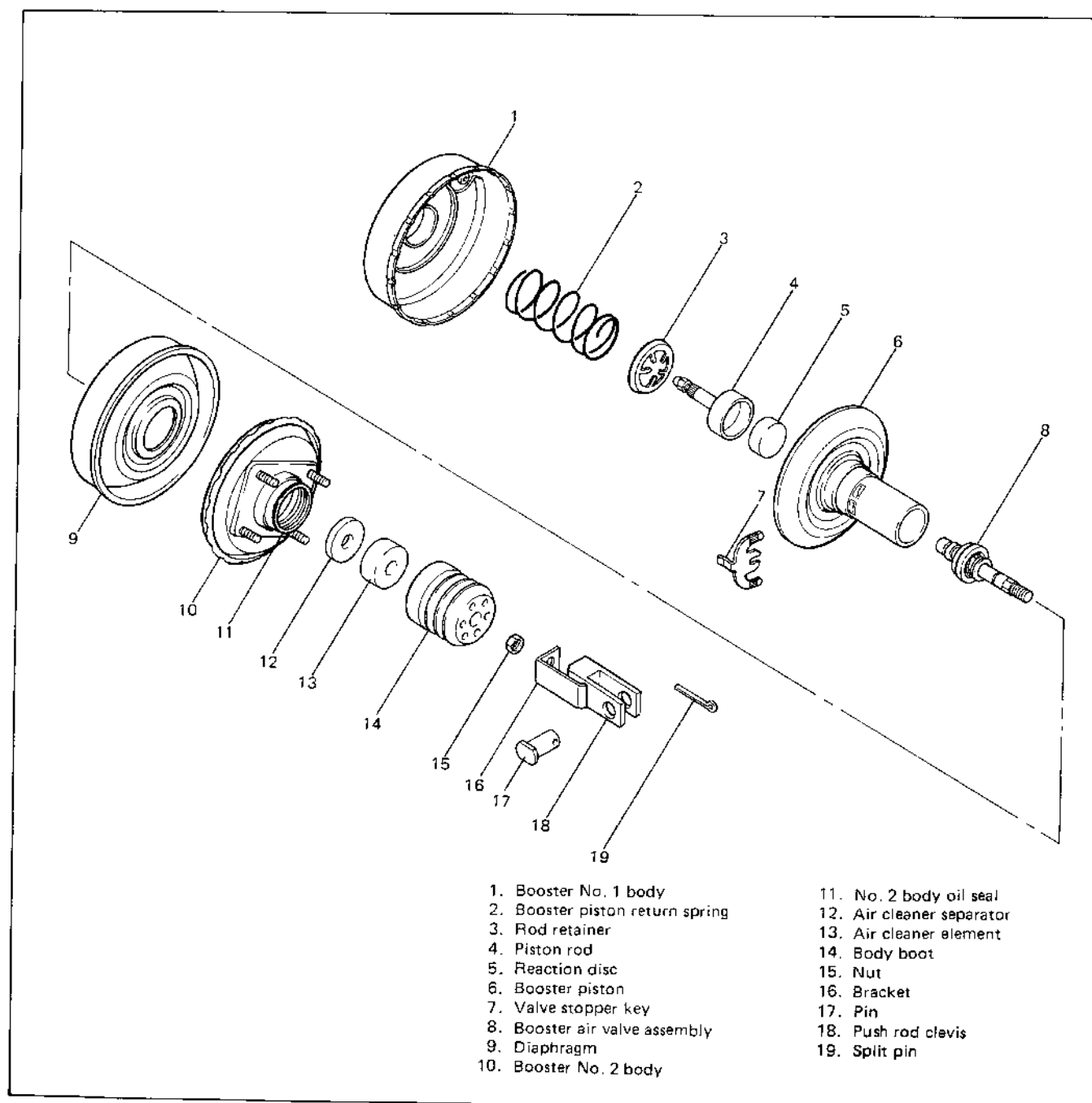


Fig. 5-13

Booster OPERATION

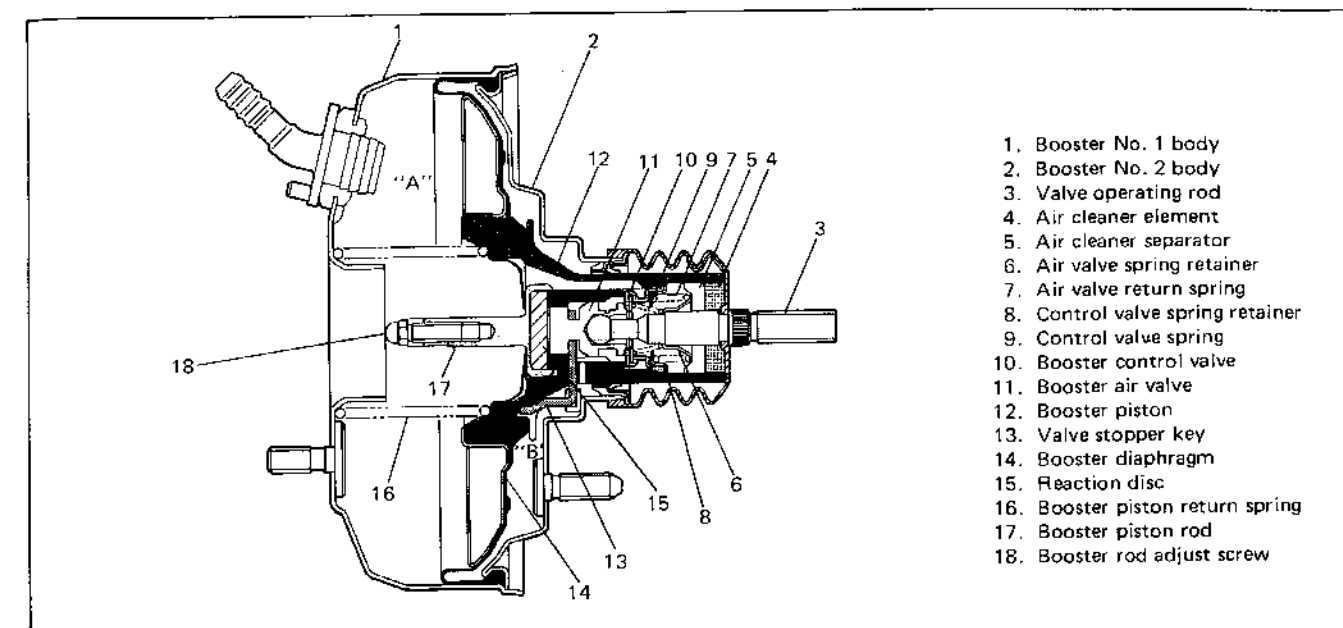


Fig. 5-14 Vacuum Booster Assembly

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 two 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 (control 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.

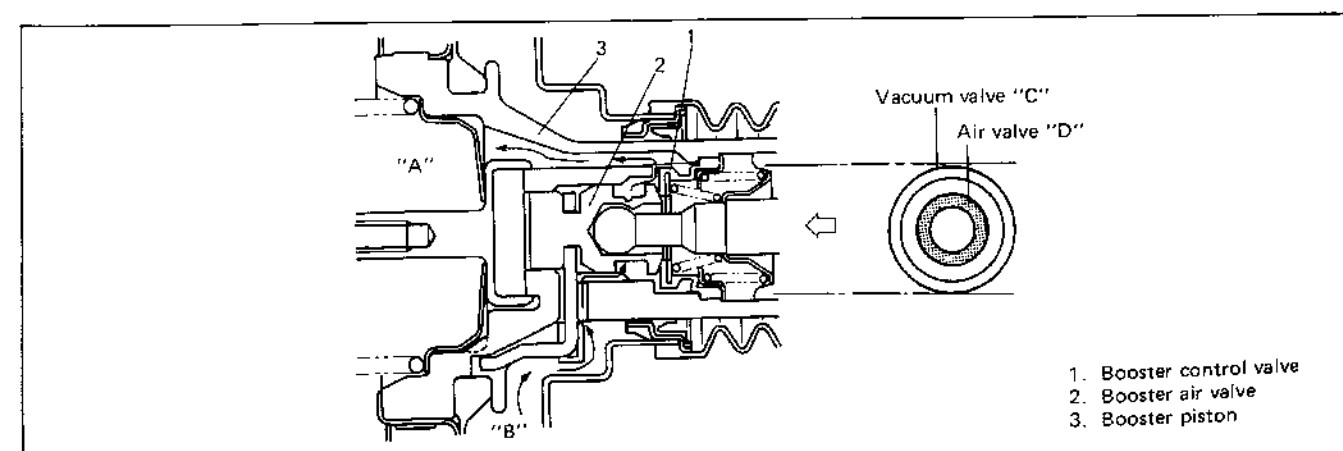


Fig. 5-15

When foot brake pedal is depressed

Being pushed by the operating rod, the booster air valve moves to the left as shown. Then the control valve is pushed against the booster piston seat closely by the valve spring force. Thus the vacuum valve (control valve "C") is closed to cut off between the chambers "A" and "B". At this time the air valve (control valve "D") is still closed.

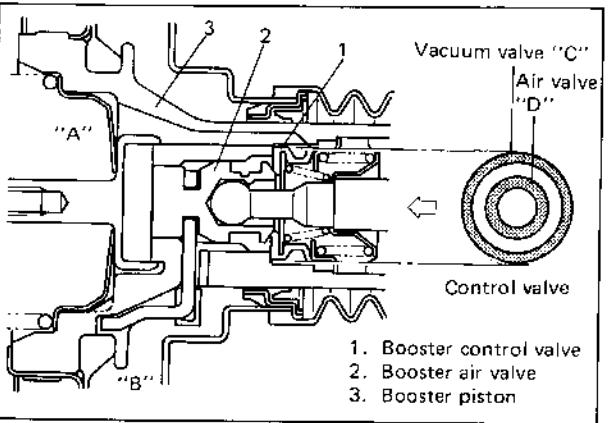


Fig. 5-16

As the booster air valve moves further to the left, it leaves the control valve and the air valve (control valve "D") opens to allow the air to flow into the chamber "B". The entry of air causes a difference in pressures between the chambers "A" and "B". When this pressure difference grows greater than the piston return spring force, the booster piston moves to the left and the booster control valve also moves to the left. The resulting air valve (control valve "D") closure stops the air flow into the chamber "B" and its pressure remains as it is. In this way, a small brake pedal depressing force is made into a strong push to the master cylinder push rod to produce high hydraulic pressure.

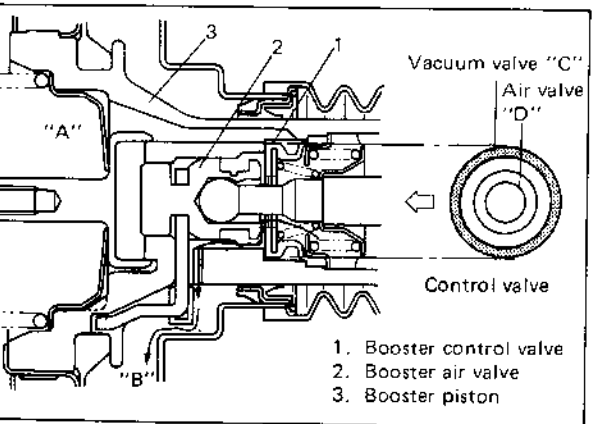


Fig. 5-17

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 valve "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".

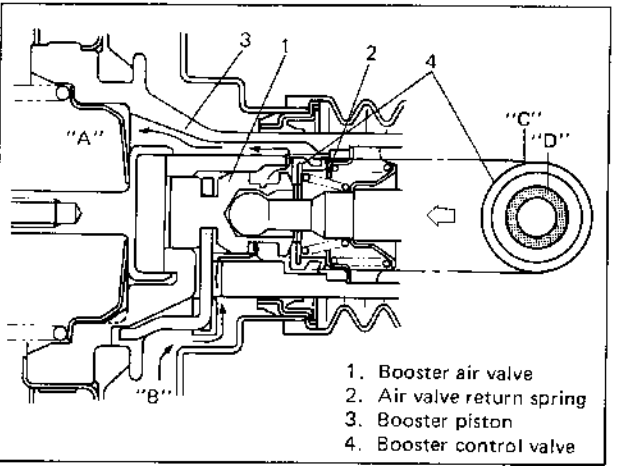


Fig. 5-18

Reference

Should any of the vacuum related parts in the booster be faulty, the brake force is not increased. Even then, however, the brake depressing force is transmitted to the valve operating rod, booster air valve, valve stopper key and booster piston in that order, to push the master cylinder push rod. Thus, the braking operation itself will not fail.

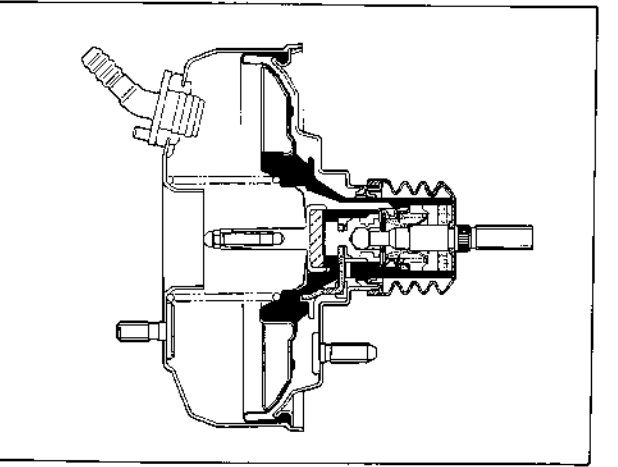


Fig. 5-19

DIAGNOSIS

ROAD TESTING BRAKES

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if the car stops evenly and effectively.

Also drive car to see if it leads to one side or the other without brake application. If it does, check the tire pressure, front end alignment and front suspension attachments for looseness. See diagnosis chart for other causes.

BRAKE FLUID LEAKS

Check the master cylinder fluid levels. While a slight drop in reservoir level does result from normal lining wear, an abnormally low level indicates a leak in the system. In such a case, check the entire brake system for leakage. If even a slight evidence of leakage is noted, the cause should be corrected or defective parts should be replaced.

SUBSTANDARD OR CONTAMINATED BRAKE FLUID

Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

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

If master cylinder piston seals are satisfactory, check for leakage or excessive heat conditions. If condition is not found, drain fluid, flush with brake fluid, refill and bleed system.

The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contained parts that have been subjected to contaminated fluid.

BRAKE DIAGNOSIS CHART A		
Condition	Possible Cause	Correction
Not enough braking force	1. Brake oil leakage from brake lines. 2. Brake disc or pads stained with oil. 3. Overheated brakes. 4. Badly worn brake pad linings. 5. Malfunctioning caliper assembly. 6. Air in system.	Locate leaking point and repair. Clean or replace. Determine cause and repair. Replace. Repair or replace. Bleed system.
Brake pull (Brakes not working in unison)	1. Pad linings are wet with water or stained with oil in some brakes. 2. Disc is out of round in some brakes. 3. Wheel tires are inflated unequally. 4. Malfunctioning caliper pistons. 5. Disturbed front end alignment. 6. Unmatched tires on same axle. 7. Restricted brake tubes or hoses. 8. Malfunctioning caliper assembly. 9. Loose suspension parts. 10. Loose calipers.	Replace. Replace. Inflate equally. Repair or replace. Adjust as prescribed. Tires with approximately the same amount of tread should be used on the same axle. Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake tubing. Check for stuck or sluggish pistons and proper lubrication of caliper slide bush. Caliper should slide. Check all suspension mountings. Check and torque bolts to specifications.
Noise (high pitched squeak without brake applied)	1. Front lining worn out.	Replace linings.

BRAKE DIAGNOSIS CHART B		
Condition	Possible Cause	Correction
Excessive pedal travel (Pedal stroke too large)	1. Partial brake system failure. 2. Insufficient fluid in master cylinder reservoirs. 3. Air in system. (pedal soft/spongy).	Check brake systems and repair as necessary. Fill reservoirs with approved brake fluid. Check for leaks and air in brake systems. Check warning light. Bleed system if required. Bleed system.
Dragging brakes (A very light drag is present in all disc brakes immediately after pedal is released)	1. Master cylinder pistons not returning correctly. 2. Restricted brake tubes or hoses. 3. Incorrect parking brake adjustment. 4. Badly worn piston seal in the caliper. 5. Sluggish parking-brake cables or linkage. 6. Caliper piston sticking.	Repair master cylinder. Check for soft hoses or damaged tubes and replace with new hoses and/or new double-walled steel brake tubing. Check and adjust to correct specifications. Replace. Repair or replace. Repair as necessary.
Pedal pulsation (Pedal pulsates when depressed for braking.)	1. Damaged or loose wheel bearings. 2. Distorted steering knuckle or rear wheel spindle. 3. Excessive disc lateral runout. 4. Parallelism not within specifications.	Replace wheel bearings. Replace knuckle or rear wheel spindle. Check per instructions. If not within specifications, replace or machine the disc. Check per instructions. If not within specifications, replace or machine the disc.
Braking noise	1. Glazed pad linings, or foreign matters stuck to linings. 2. Worn or distorted pad linings. 3. Loose front wheel bearings. 4. Loose mounting bolts.	Repair or replace pad. Replace pad. Replace wheel bearing. Retighten securing bolts.

ON CAR SERVICE

1. BRAKE PEDAL FREE HEIGHT ADJUSTMENT

For right-hand steering vehicle:

Height of brake pedal is normal if it is as high as clutch pedal.

For left-hand steering vehicle:

Height of brake pedal is normal if it is about 8 mm (0.3 in.) lower than clutch pedal.

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 within 114.5 – 115.5 mm (4.51 – 4.54 in.). See page 5-55.

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.

2. 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 "A" in figure) is within 0.5 – 1.0 mm (0.02 – 0.04 in.). Then tighten lock nut to specified torque.

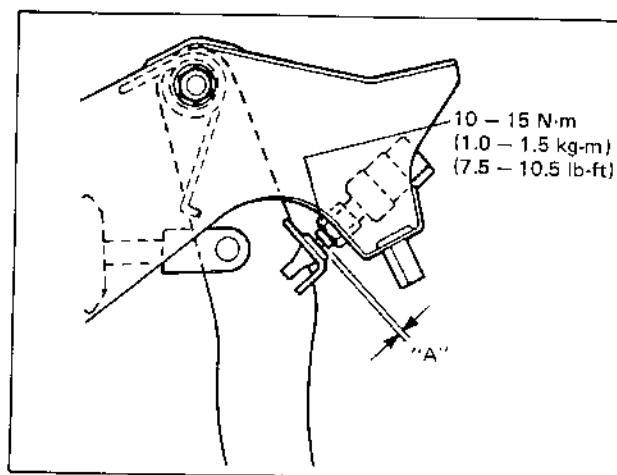


Fig. 5-20

3. 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 arm to wall clearance "B". It mustn't be less than 60 mm (2.36 in.).

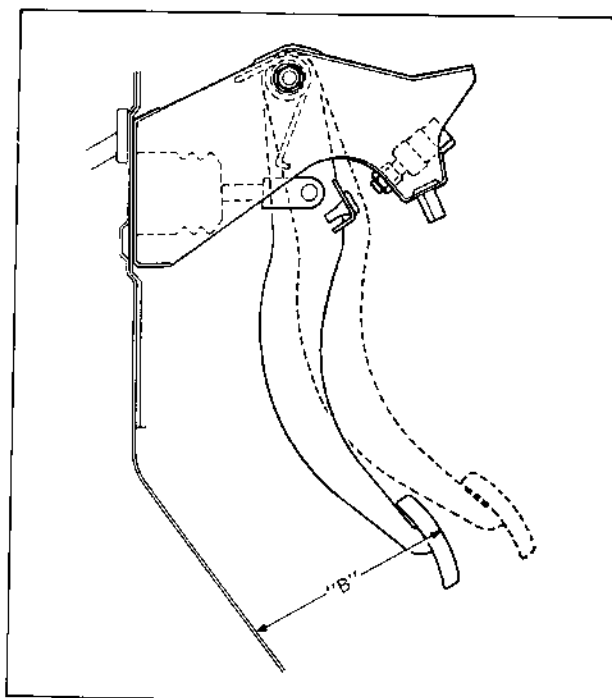


Fig. 5-21

4) If clearance "B" is less than 60 mm (2.36 in.), the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.

Should clearance "B" remain less than 60 mm (2.36 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.

- See page 5-19 for bleeding brake system.

4. FRONT BRAKE DISC INSPECTION

Refer to page 5-33 of this section for inspection point and procedure.

5. FRONT BRAKE 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 each end (or hole) of caliper and check lining thickness of outside and inside pads. If lining is worn and its thickness ("C" in figure) is less than 3 mm (0.12 in.), all pads must be replaced at the same time.

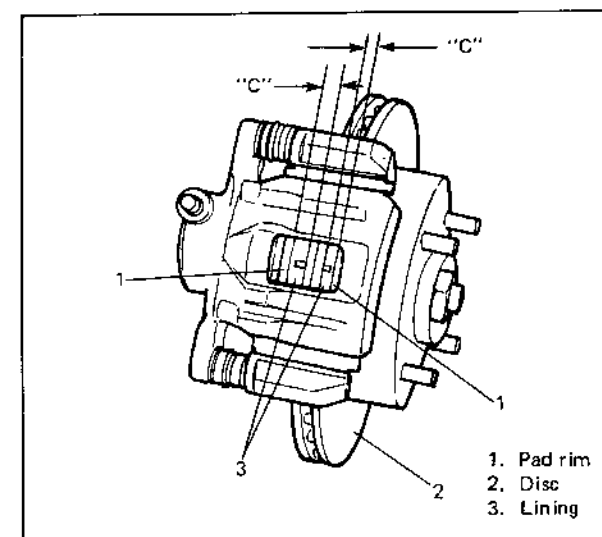


Fig. 5-22

6. BRAKE PEDAL PLAY INSPECTION

Pedal play should be within below 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.

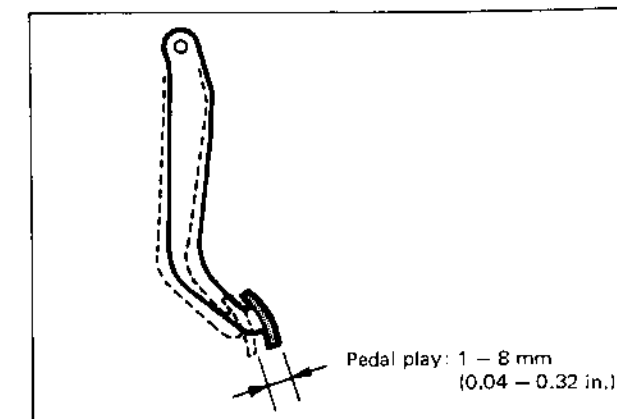


Fig. 5-23

7. 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.

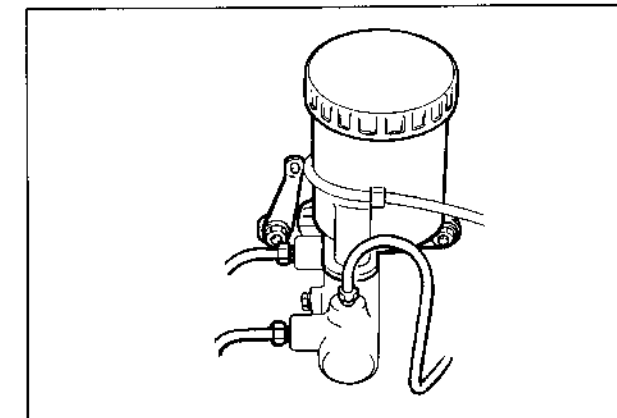


Fig. 5-24

8. REAR BRAKE DISC INSPECTION

Refer to page 5-44 of this section for inspection point and procedure.

9. REAR BRAKE 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 each end of caliper and check lining thickness of outside and inside pads. If lining is worn and its thickness ("C" in figure) is less than 1 mm (0.04 in.), all pads must be replaced at the same time.

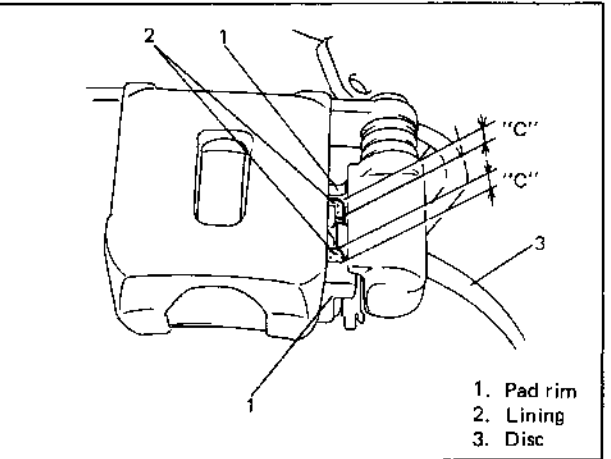


Fig. 5-25

10. PARKING BRAKE INSPECTION AND ADJUSTMENT

a) Inspection

Hold center of parking brake lever grip and pull it up with 20 to 25 kg (44 to 55 lbs) force. With parking brake lever pulled up as above, count ratchet notches in "A" as shown in figure. There should be 4 to 9 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.

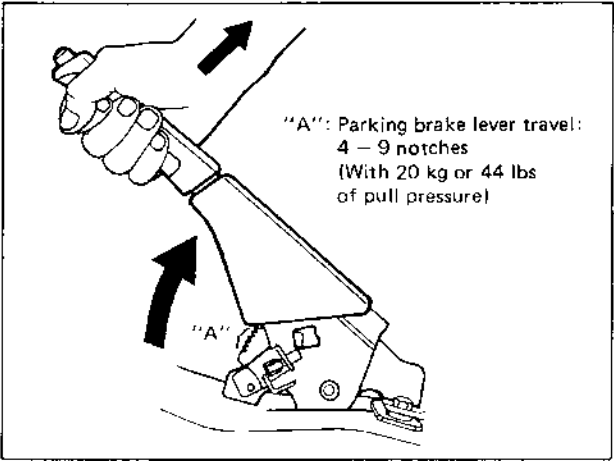


Fig. 5-26

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.

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 force.
- Rear brake pads are not worn beyond limit.

After confirming that above 5 conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening self locking nut (3 in figure below).

NOTE:

Check brake disc for dragging after adjustment.

Parking brake stroke; when lever is pulled up at 20 kg (44 lbs)	Within 4 - 9 notches

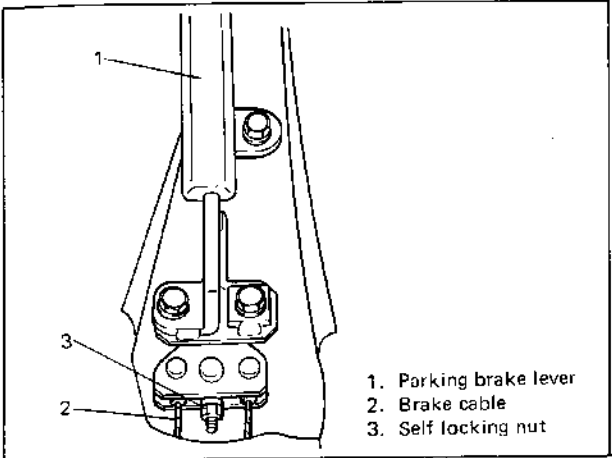


Fig. 5-27

11. 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.

12. BLEEDING BRAKES

NOTE:

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

Bleeding operation is necessary to remove air whenever it entered hydraulic brake system. Hydraulic lines of brake system are based on the diagonal split system. When a brake pipe or hose was disconnected at the wheel, bleeding operation must be performed at both ends of the line of the removed pipe or hose. When any joint part of the master cylinder or other joint part between the master cylinder and each brake (wheel) was removed, the hydraulic brake system must be bled at all 4 wheel brakes.

NOTE:

Perform bleeding operation starting with rear caliper farthest from master cylinder and then at front caliper of the same brake line. Do the same on the other brake line.

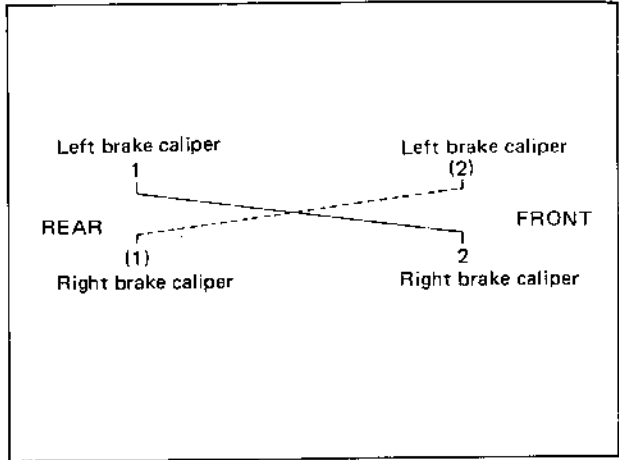


Fig. 5-28

- 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.

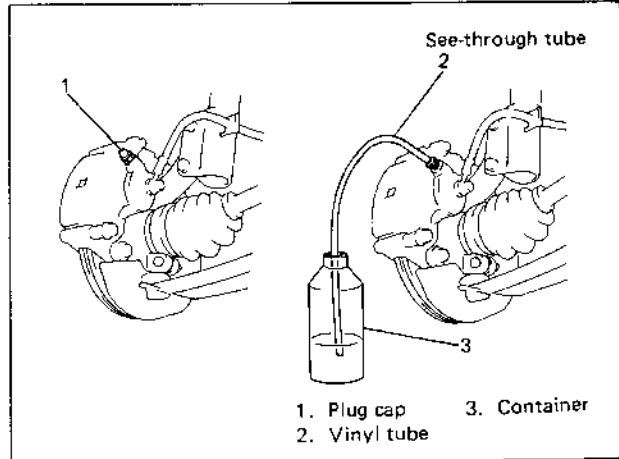


Fig. 5-29

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

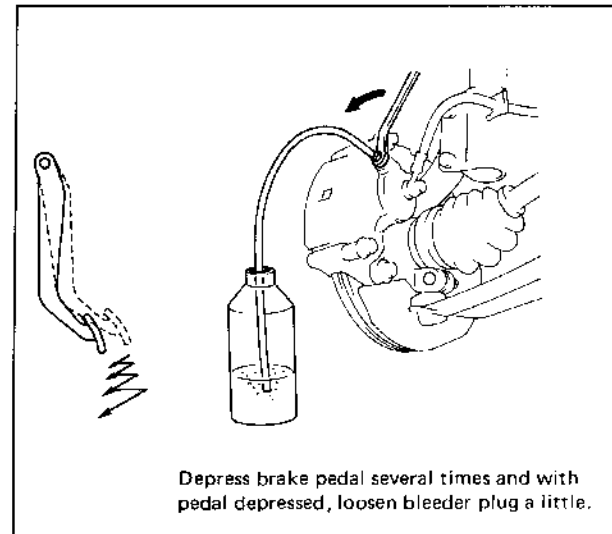


Fig. 5-30

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

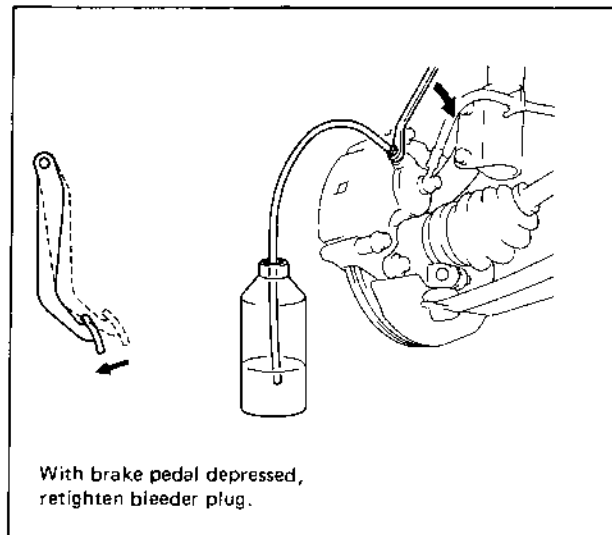


Fig. 5-31

- 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.
(For tightening torque specification of air bleeder plug, see page 5-60.)
7) Then attach bleeder plug cap.

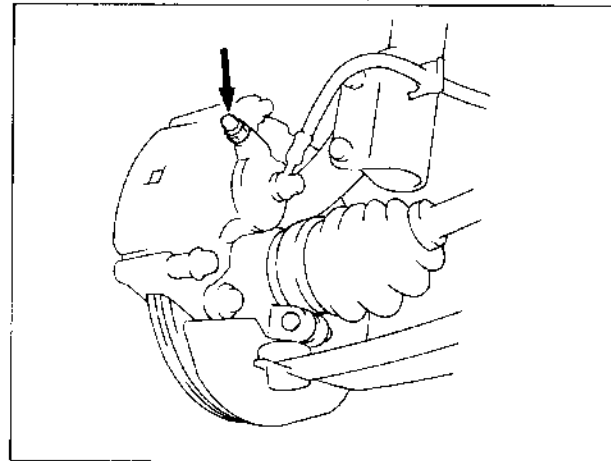


Fig. 5-32

- 8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.
9) Replenish fluid into reservoir up to specified level.

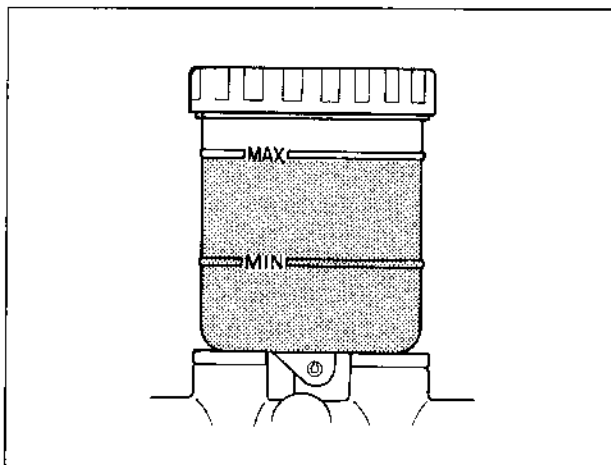


Fig. 5-33

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

13. BRAKE HOSE AND PIPE INSPECTION

HOSE

The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it is necessary to replace it.

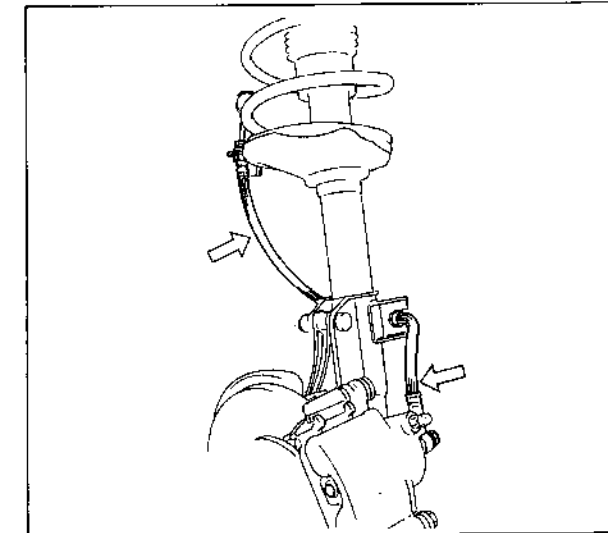


Fig. 5-34

PIPE

Inspect the tube for damage, cracks, dents and corrosion. If any defect is found, replace it.

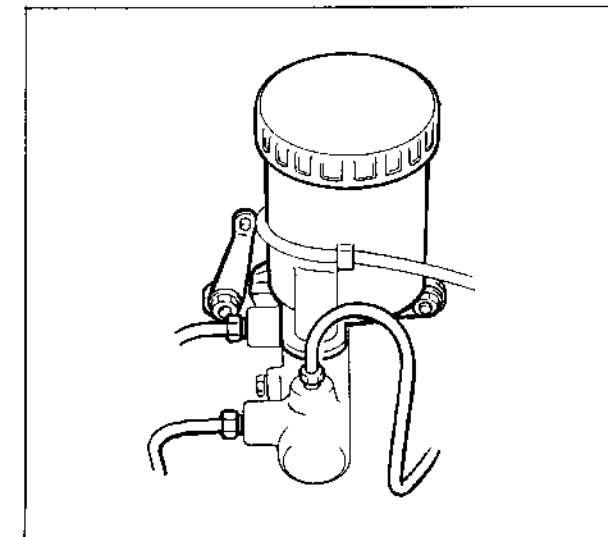


Fig. 5-35

14. BRAKE FLUID LEVEL INSPECTION

Be sure to use particular brake fluid either as indicated on reservoir cap of that car or recommended in owner's manual which comes along with that car.

Use of any other fluid is strictly prohibited.

Fluid level should be between MIN and MAX lines marked on reservoir.

When warning light lights sometimes during driving, replenish fluid to MAX line.

When fluid decreases quickly, inspect brake system for leakage. Correct leaky points and then refill to specified level.

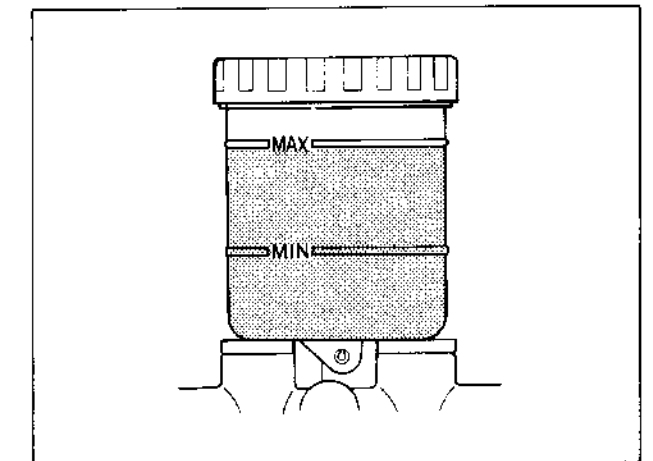


Fig. 5-36

CAUTION:

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

BRAKE HOSE/PIPE R & I

1. REMOVE AND INSTALL FRONT BRAKE HOSE/PIPE

- 1) Raise and suitably support car. Remove tire and wheel.
- This operation is not necessary when removing pipes connecting master cylinder and P valve.
- 2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.
- 3) 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.

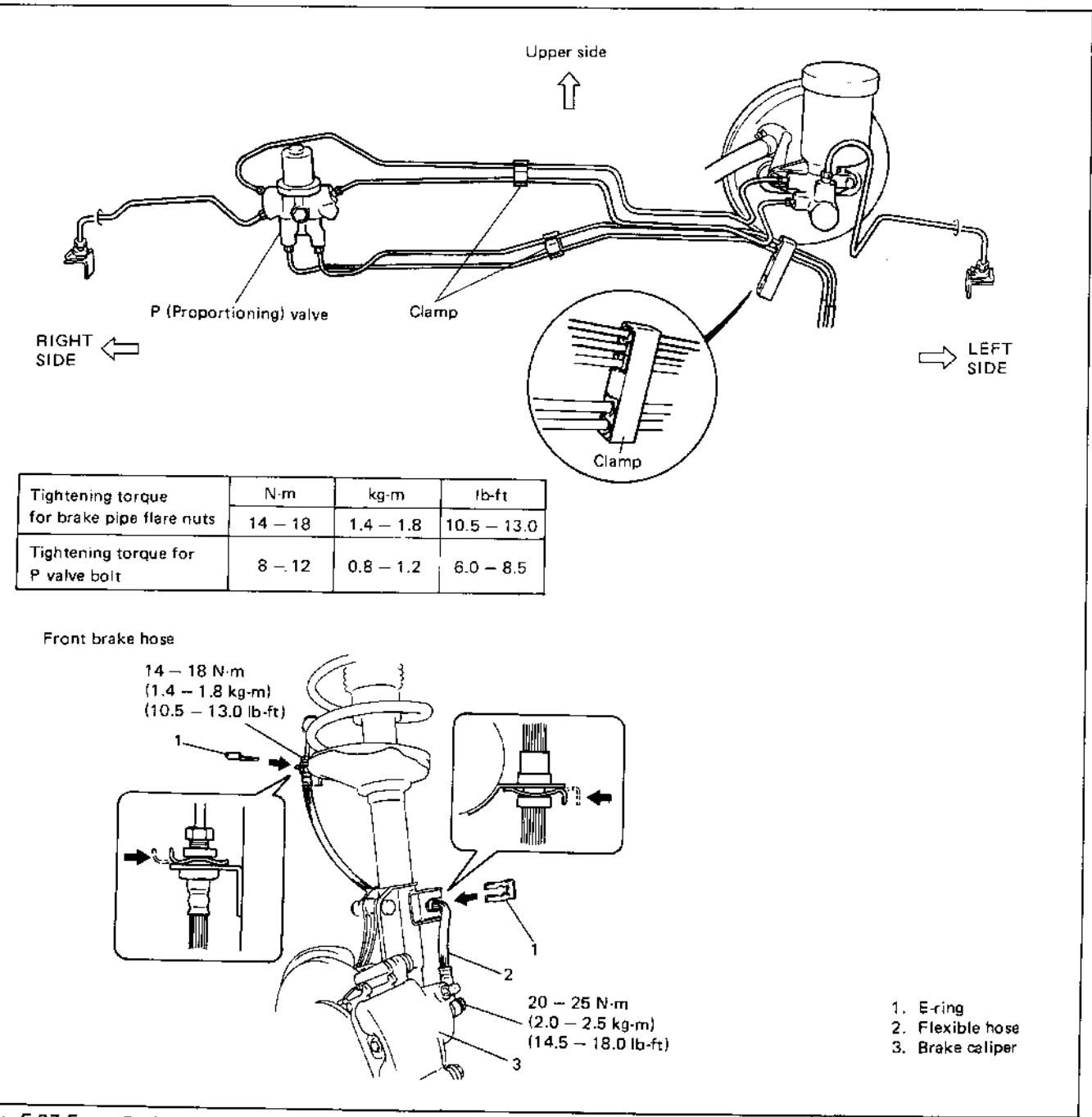


Fig. 5-37 Front Brake Hose/Pipe R & I

2. REMOVE AND INSTALL REAR BRAKE HOSE/PIPE

- 1) Raise and suitably support car. Remove tire and wheel.
- 2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.
- 3) Reverse brake hose installation procedure. Fill and maintain brake fluid level in reservoir. Bleed brake system.

PRECAUTION FOR INSTALLATION

- Never reuse protector nut once removed. Be sure to use a new one.
- Install clamps properly referring to figure below and tighten bolts.
- When installing hose, make sure that it has no twist or kink.

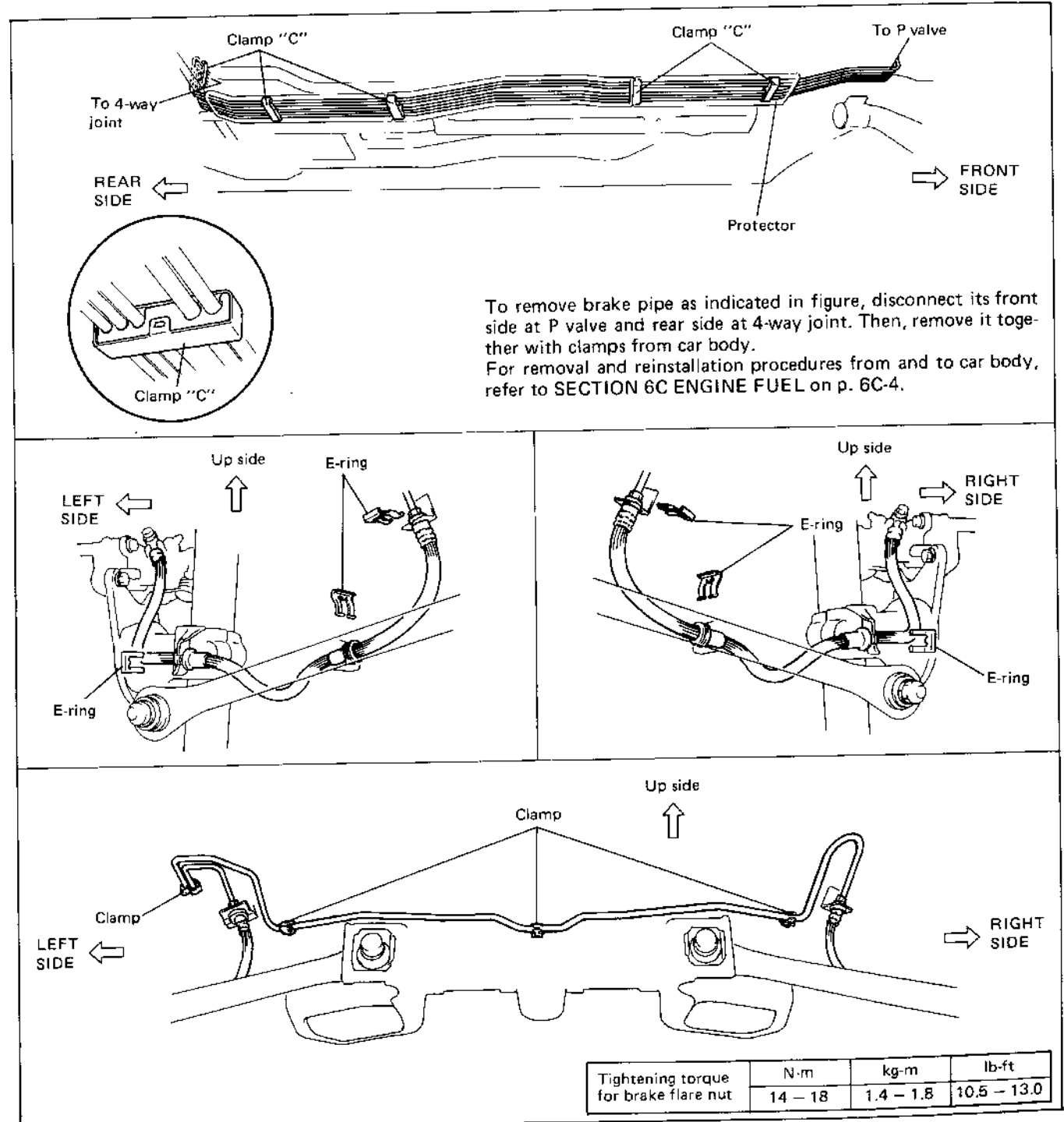


Fig. 5-38 Rear Brake Hose/Pipe R & I

PARKING BRAKE LEVER/CABLE R & I

1. REMOVE AND INSTALL PARKING BRAKE LEVER

REMOVAL

- 1) Remove parking brake lever cover.
- 2) Disconnect lead wire of parking brake switch at coupler.
- 3) Remove parking brake cable locking nut.
- 4) Remove parking brake lever bolts and then remove parking brake lever assembly from equalizer.
- 5) Remove equalizer from parking brake cable.

NOTE:

Don't disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

INSTALLATION

- 1) Install in reverse order of REMOVAL procedure.
- 2) After all parts are installed, parking brake lever needs to be adjusted. Refer to PARKING BRAKE INSPECTION AND ADJUSTMENT in this section (page 5-18).
- 3) Check rear brakes for dragging and brake system for proper performance.

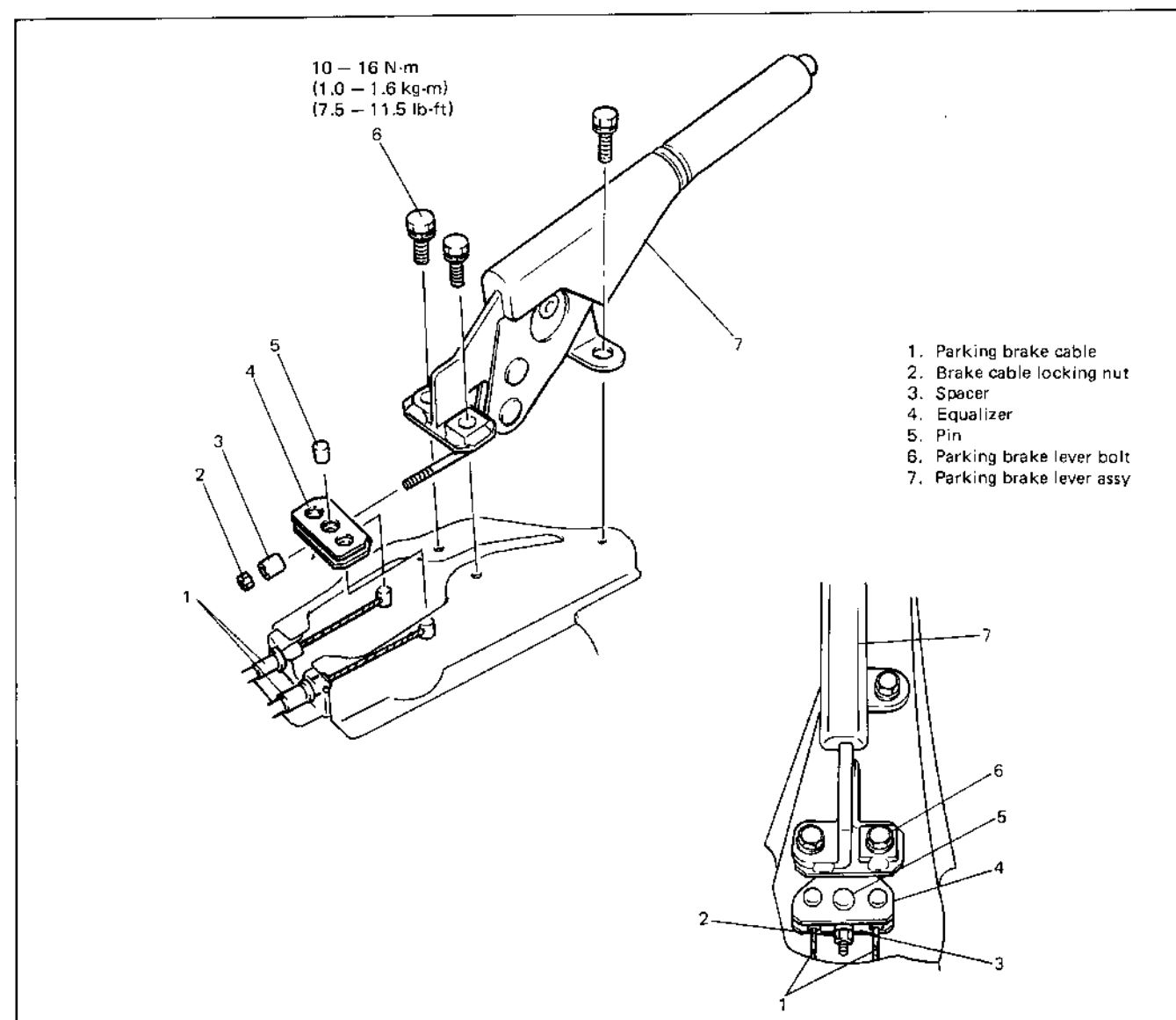


Fig. 5-39

2. REMOVE AND INSTALL PARKING BRAKE CABLE

REMOVAL

- 1) Remove parking brake lever cover.
- 2) Disconnect lead wire of parking brake switch at coupler.
- 3) Loosen parking brake cable locking nut.
- 4) Remove parking brake lever mounting bolts.
- 5) Disconnect brake cable from equalizer.
- 6) Hoist car and remove wheel.
- 7) Remove rear brake caliper pin bolts.

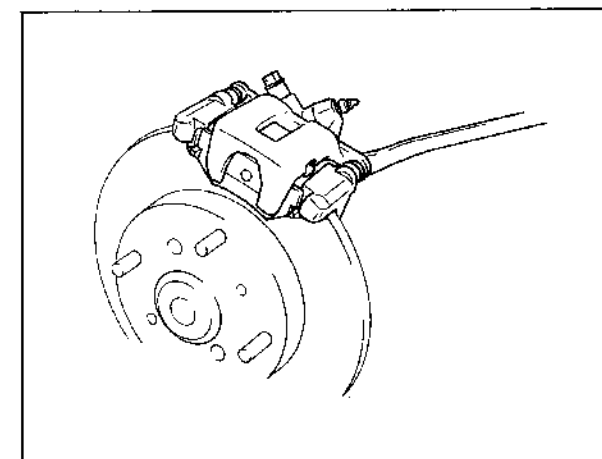


Fig. 5-40

- 8) Remove caliper from carrier.
- 9) Remove parking brake cable E-ring.
- 10) Disconnect brake cable from lever on the caliper.

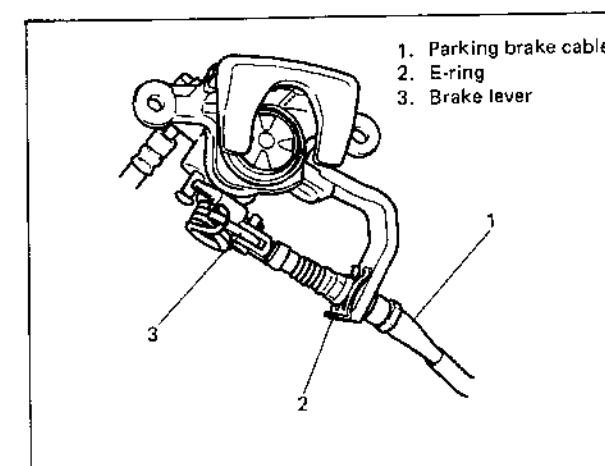


Fig. 5-41

INSTALLATION

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

- 1) Install brake cable stopper E-ring to bracket securely as shown in figure below.
- 2) Connect cable to brake lever and install connector pin and clip securely as shown in figure below.

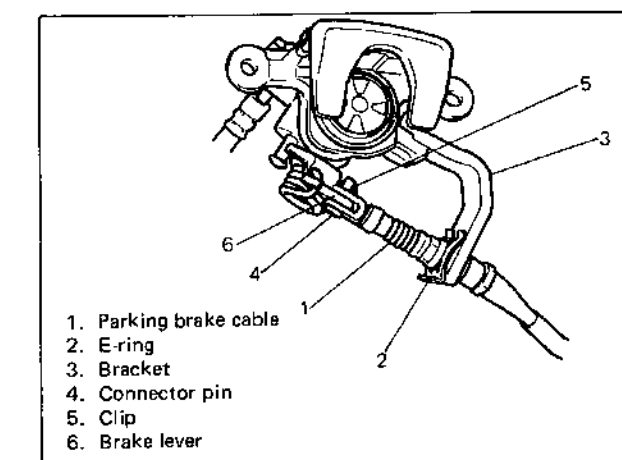


Fig. 5-42

- 3) Install caliper to carrier and torque caliper pin bolts to specification.

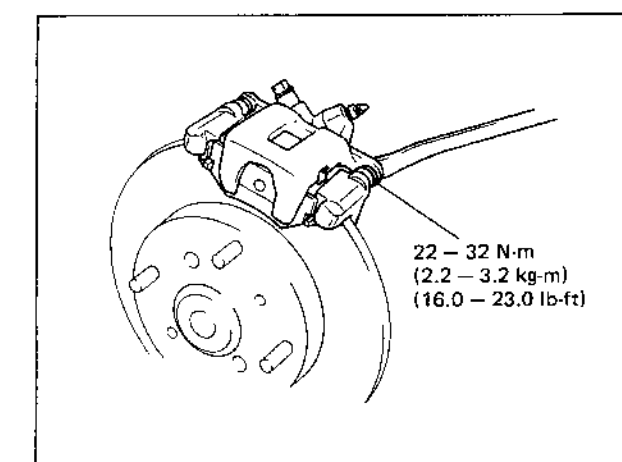


Fig. 5-43

- 4) Install wheel and torque wheel nuts to specification.
- 5) Lower hoist.

- 6) For proper routing and secure clamping of parking brake cable, refer to figure below.
- 7) For installation of cable to parking brake lever, refer to PARKING BRAKE LEVER INSTALLATION of this section, page 5-24.

- 8) Upon completion of installation, adjust cable. (Refer to PARKING BRAKE INSPECTION AND ADJUSTMENT of this section, page 5-18.) Then check rear brake for dragging and brake system for proper performance. After removing car from hoist, brake test should be performed.

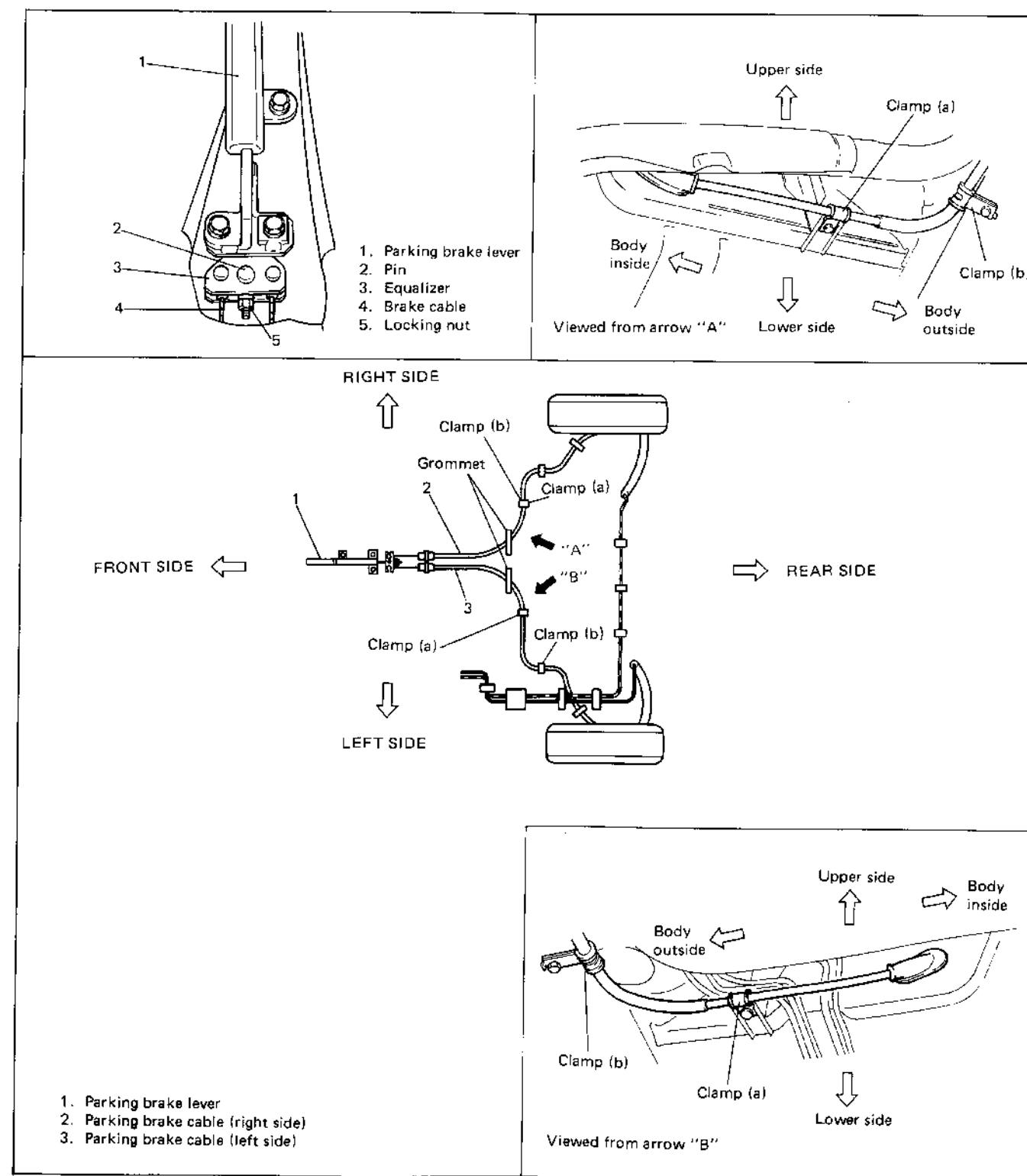


Fig. 5-44

FRONT DISC BRAKE R & I

1. REMOVE AND INSTALL PAD (SHOE & LINING)

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove caliper pin bolts.

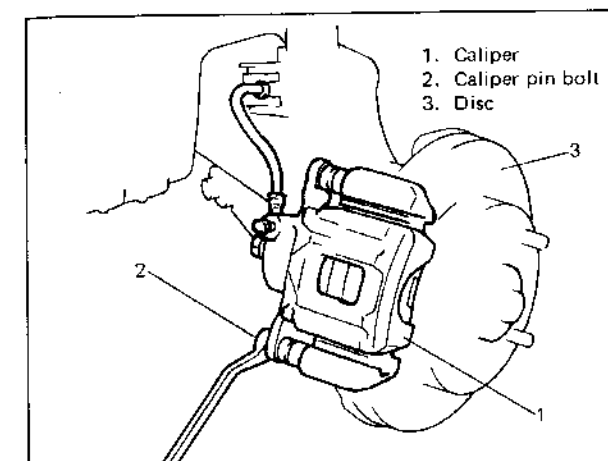


Fig. 5-45

- 3) Remove caliper from caliper carrier.

NOTE:

Hang removed caliper with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled. Don't operate brake pedal with pads removed.

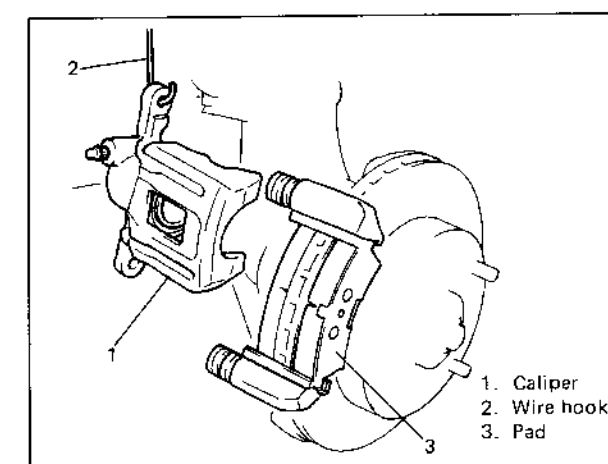


Fig. 5-46

- 4) Remove pads.

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

- 1) Install pad clips and pads.

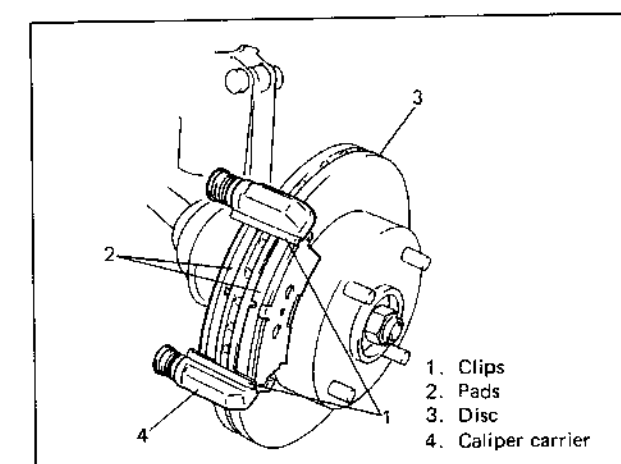


Fig. 5-47

- 2) Install caliper and torque caliper pin bolts to specification.

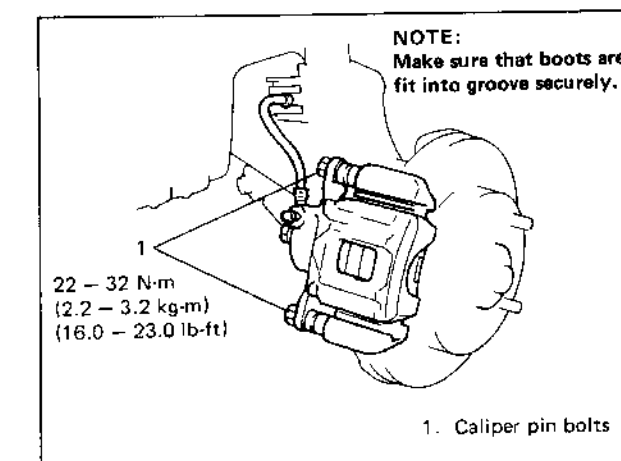


Fig. 5-48

- 3) Torque front wheel nuts to specification. (Refer to Fig. 5-149)
- 4) Upon completion of installation, perform brake test.

2. REMOVE AND INSTALL CALIPER ASSEMBLY

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove brake flexible hose mounting bolt from caliper. As this will allow fluid to flow out of hose, have a container ready beforehand.

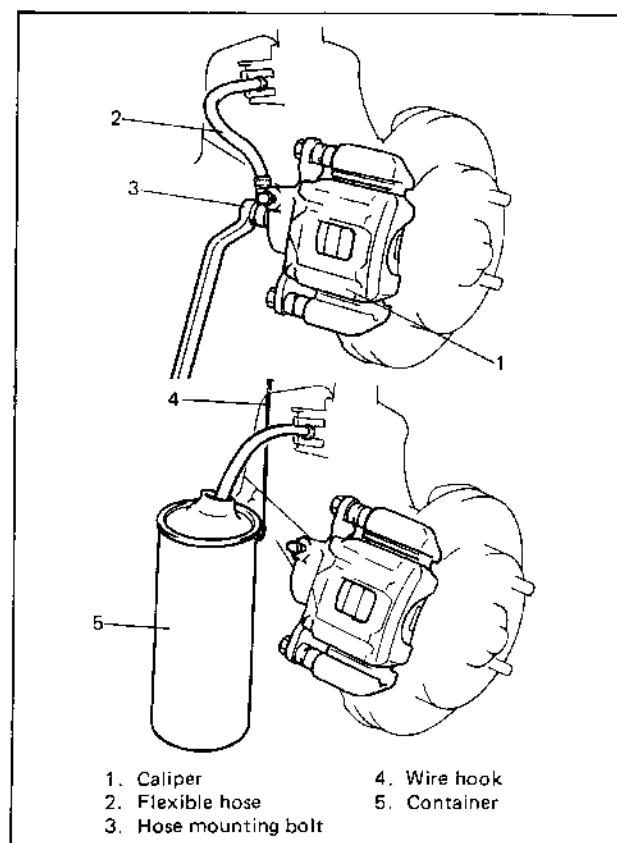


Fig. 5-49

- 3) Remove caliper pin bolts.

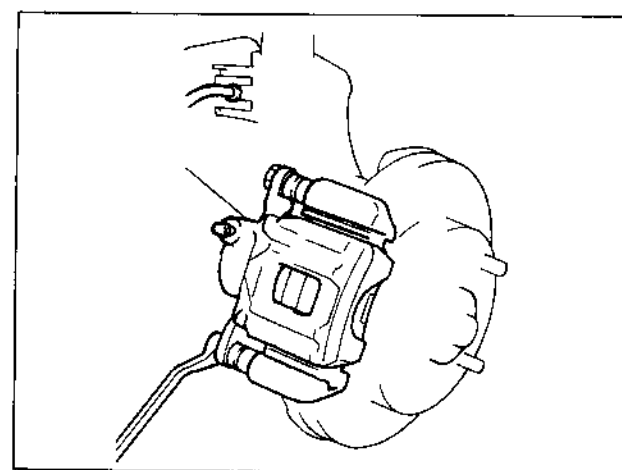


Fig. 5-50

- 4) Remove caliper from carrier.

INSTALLATION

- 1) Install caliper to caliper carrier.
- 2) Torque caliper pin bolts to specification.

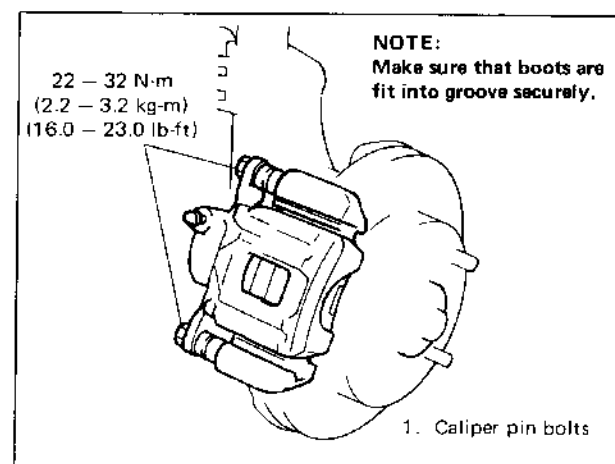


Fig. 5-51

- 3) Install brake flexible hose as shown and torque hose mounting bolt to specification.

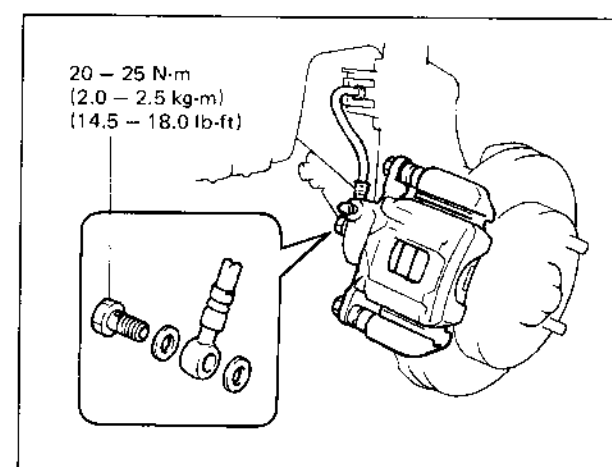


Fig. 5-52

- 4) Torque wheel nuts to specification.
(Refer to Fig. 5-149)
- 5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

3. REMOVE AND INSTALL SEAL, PISTON, DUST BOOT AND BLEEDER SCREW

REMOVAL

Before disassembly, clean all around caliper with brake fluid.

- 1) Blow compressed air into cylinder through bolt hole where flexible hose was fitted. With this air pressure, piston can be pushed out of cylinder.

WARNING:

Do not apply too highly compressed air which will cause piston to jump out of cylinder. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.

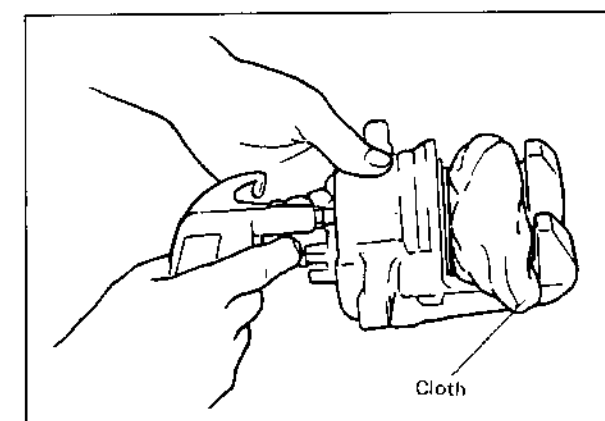


Fig. 5-53

- 2) Remove piston seal using a thin blade like a thickness gauge, etc.

NOTE:

Be careful not to damage inside (bore side) of cylinder.

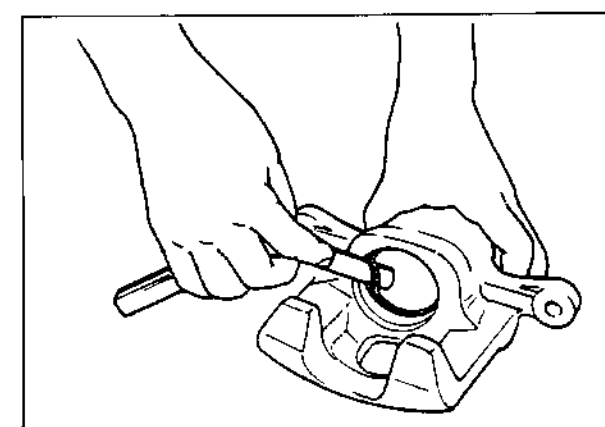


Fig. 5-54

INSTALLATION

Reassemble front brake in reverse order of disassembly, noting the following points.

CAUTION:

- Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.
- Never use other fluid or thinner.
- Before installing piston and piston seal to cylinder, apply fluid to them.
- After reassembling brake lines, bleed air from them.

Piston Seal

Piston seal is used to seal piston and cylinder and to adjust clearance between pad and disc. Replace with a new one at every overhaul. Fit piston seal into groove in cylinder taking care not to twist it.

Piston and Boot

- 1) Before inserting piston into cylinder, install boot onto piston as shown below.

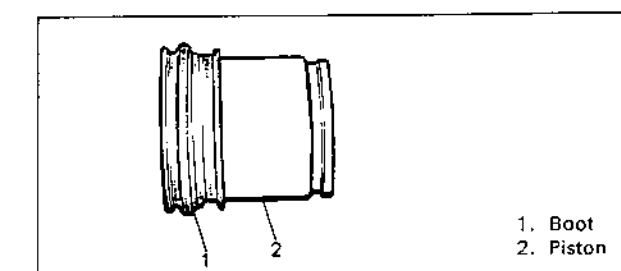


Fig. 5-55

- 2) Fit boot as it is in above figure into boot groove in cylinder with fingers.

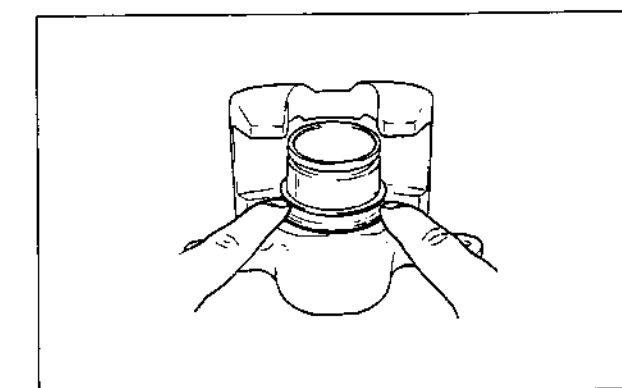


Fig. 5-56

- 3) Insert piston into cylinder by hand and fit boot in boot groove in piston.

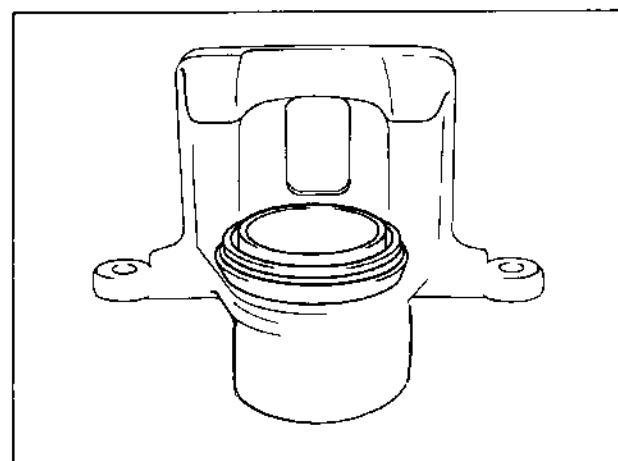


Fig. 5-57

- 4) To confirm that boot is fitted in its groove in cylinder properly, pull piston out of cylinder a little but do not take it all out.

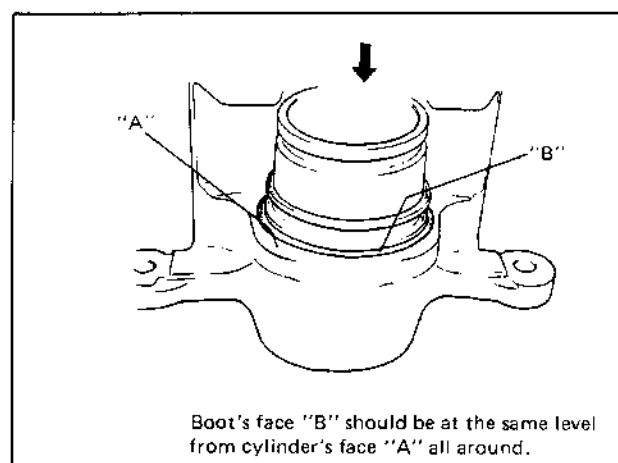


Fig. 5-58

- 5) Insert piston into cylinder by hand.

Caliper

Before installing caliper (cylinder body) to carrier, check to ensure that guide pin inserted in each caliper carrier hole can be moved smoothly in thrust direction.

NOTE:

Where temperature gets as low as -30°C in cold weather, use rubber grease whose viscosity varies very little even at -40°C (-40°F).

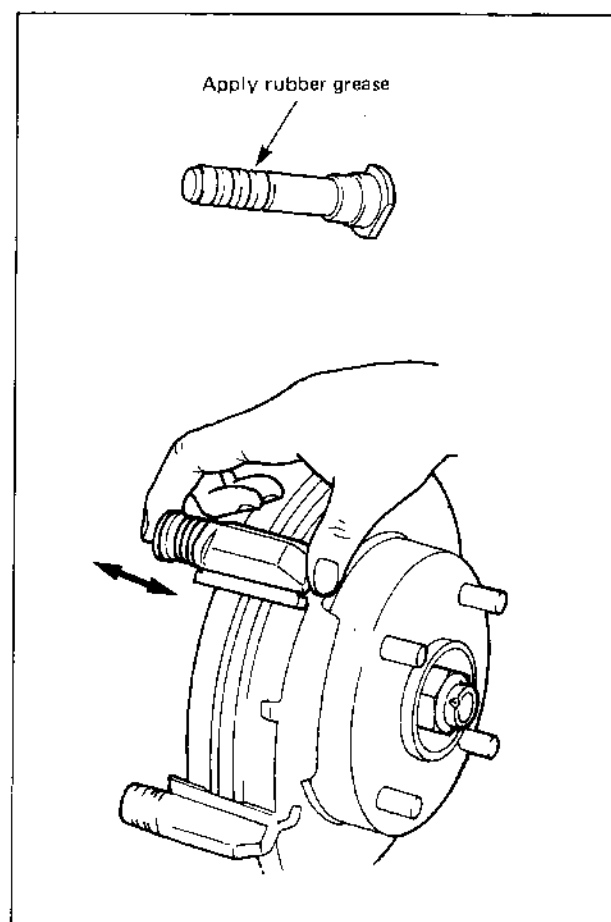


Fig. 5-59

4. REMOVE AND INSTALL DISC

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove caliper assembly by loosening carrier bolts (2 pcs).

CAUTION:

During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

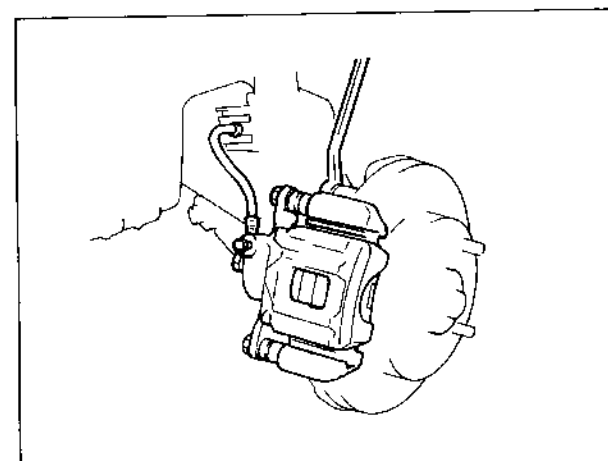


Fig. 5-60

- 3) Remove brake disc screws (2 pcs).

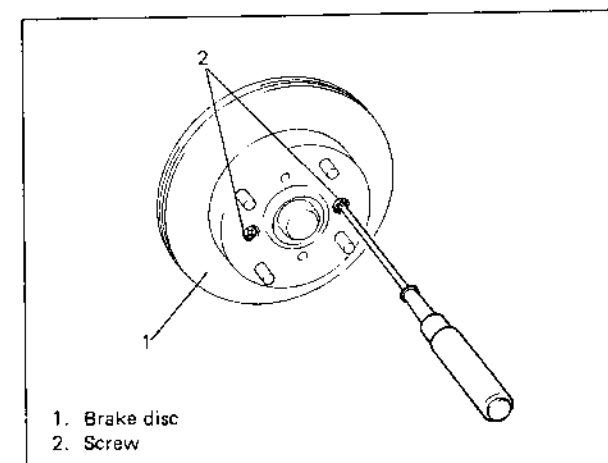


Fig. 5-61

- 4) Pull brake disc off by using 8 mm bolts (2 pcs).

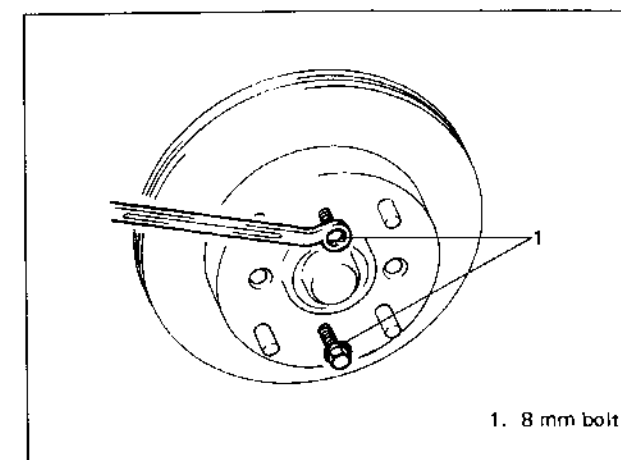


Fig. 5-62

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

- 1) Install disc to wheel hub.
- 2) Install caliper assembly to steering knuckle.
- 3) Torque caliper carrier bolts to specification.

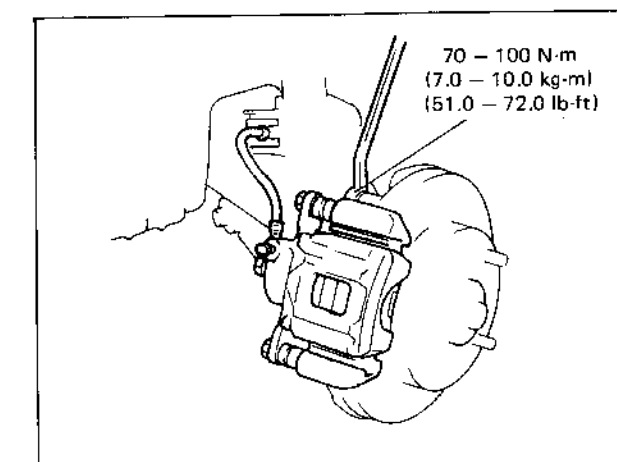


Fig. 5-63

- 4) Torque front wheel nuts to specification. (Refer to Fig. 5-149)
- 5) Upon completion of installation, perform brake test.

FRONT DISC BRAKE INSPECTION

1. INSPECT BRAKE PAD LINING

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

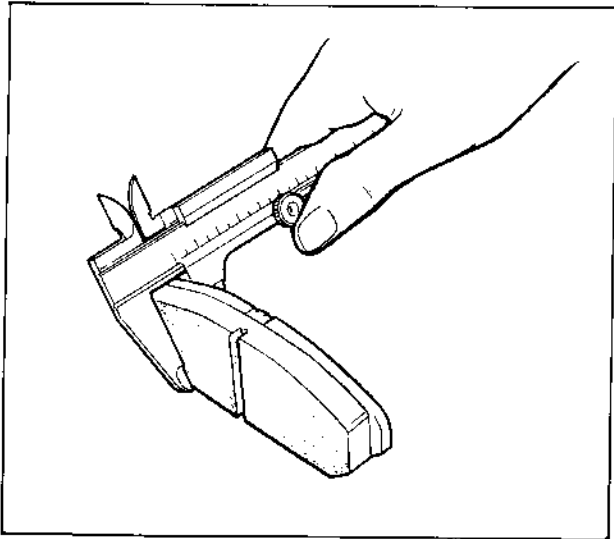


Fig. 5-64

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 + pad rim)	Standard 16.0 mm (0.630 in.)	Limit 8.0 mm (0.315 in.)

NOTE:

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

2. INSPECT BRAKE CALIPER INNER PARTS

Cylinder Slide Guide Pin

Check guide pin for smooth movement as shown. If it is found faulty, correct or replace. Apply rubber grease to guide pin outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperature as -40°C (-40°F).

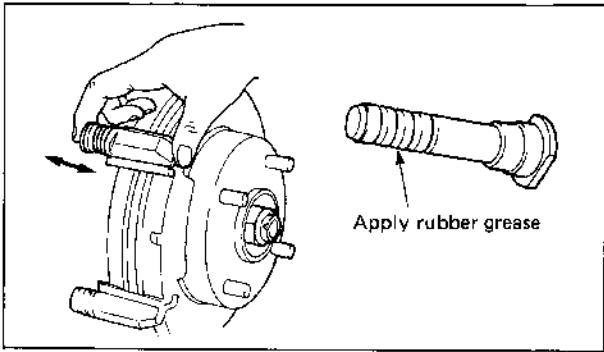


Fig. 5-65

Bush Dust Boot and Cylinder Boot

Check boots for breakage, crack and damage. If defective, replace.

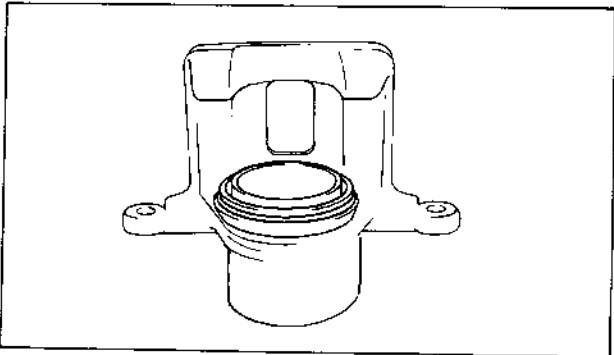


Fig. 5-66

Piston Seal

Excessive or uneven wear of pad lining may indicate unsmooth return of the piston. In such a case, replace rubber seal.

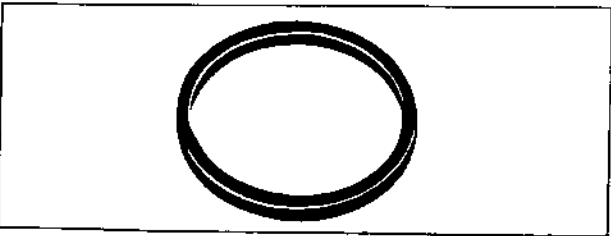


Fig. 5-67

3. INSPECT BRAKE DISC

Before this inspection, brake pads must be removed (according to steps 1) to 4) on page 5-27).

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.

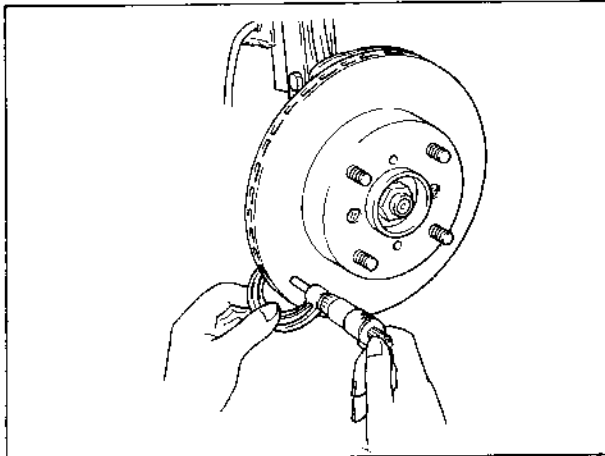


Fig. 5-68

	Standard	Limit
Disc thickness	18.5 mm (0.73 in.)	16.5 mm (0.65 in.)

To measure deflection of disc, take measurement at 2 points on its periphery and center with dial gauge while rotating it.

Limit on disc deflection	0.1 mm (0.0039 in.)

NOTE:

Check front wheel bearing for looseness before measurement.

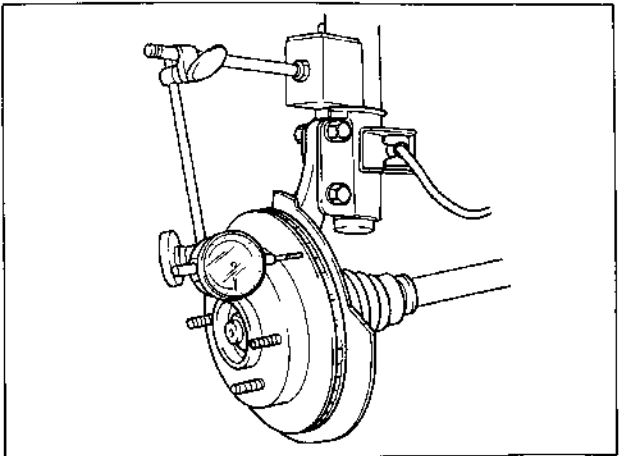


Fig. 5-69

REAR DISC BRAKE R & I

1. REMOVE AND INSTALL BRAKE PAD (SHOE & LINING)

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove caliper pin bolts.

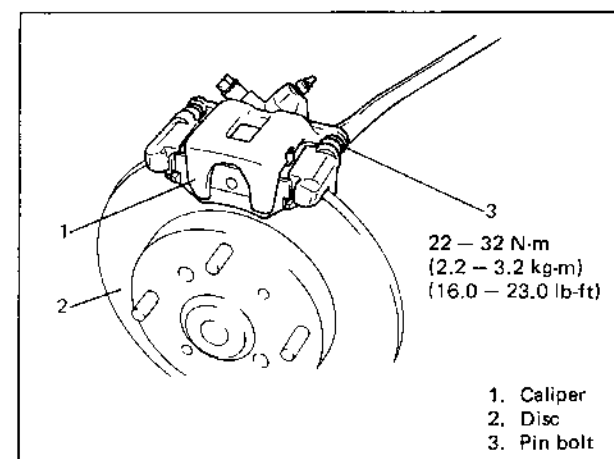


Fig. 5-71

- 3) Release parking brake lever.
- 4) Remove caliper from caliper carrier.

NOTE:

Hang removed caliper with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled. Do not operate brake pedal with pads removed.

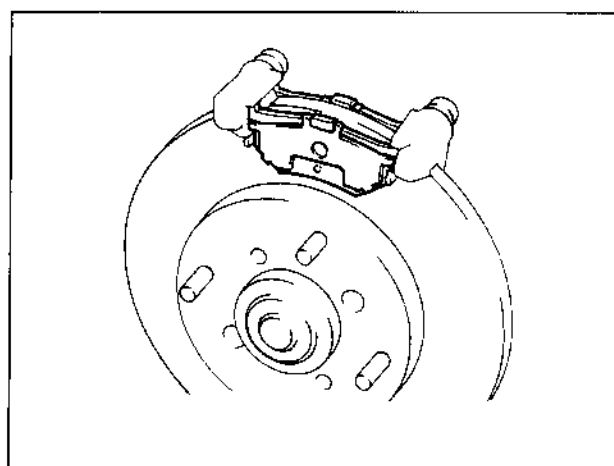


Fig. 5-72

- 5) Remove pads.

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

- 1) Install pad clips and pads to caliper carrier.

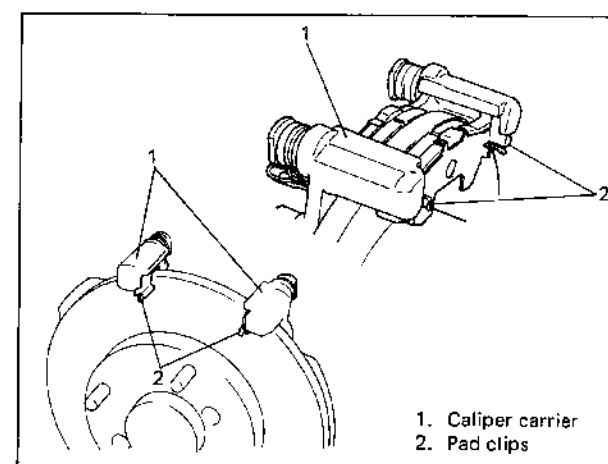


Fig. 5-73

- 2) Turn brake caliper piston clockwise to obtain clearance between brake disc and pad.

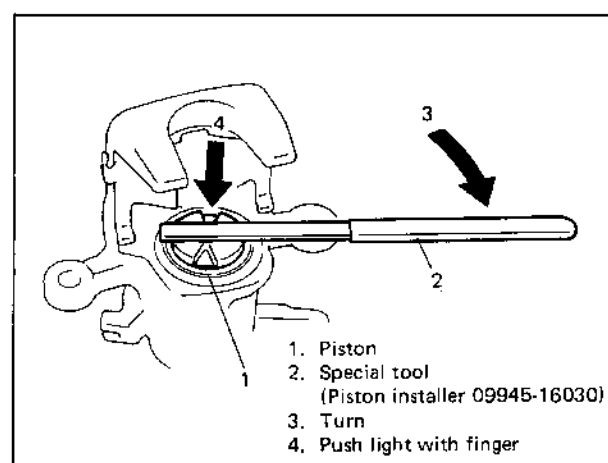


Fig. 5-74

- 3) Install caliper and torque caliper pin bolts to specification. (Refer to Fig. 5-71.)
- 4) Torque wheel nuts to specification.
- 5) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to five times so as to obtain proper disc-to-pad clearance. Check to ensure that brake disc is free from dragging and proper braking is obtained. Then remove car from hoist and perform brake test (foot brake and parking brake).

2. REMOVE AND INSTALL BRAKE DISC

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove brake disc screws.

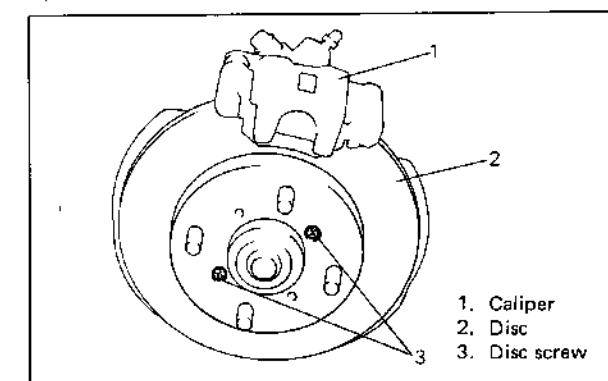


Fig. 5-75

- 3) Release parking brake lever.
- 4) Remove brake caliper assembly by loosening carrier bolts.

CAUTION:

During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

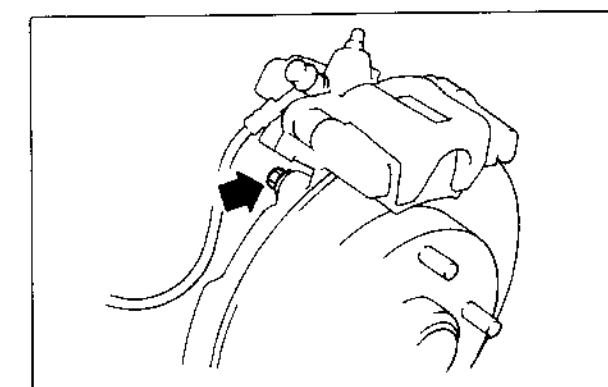


Fig. 5-76

- 5) Pull brake disc off by using 8 mm bolts.

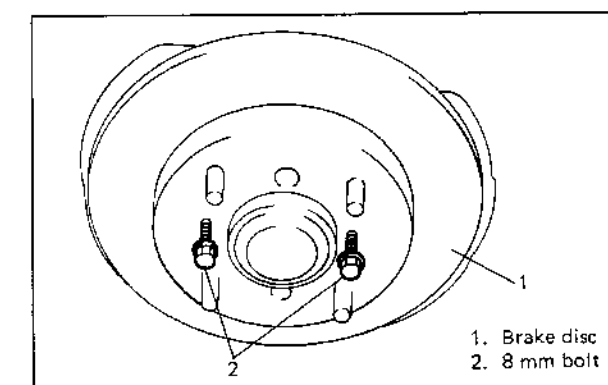


Fig. 5-77

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

- 1) Install brake disc to wheel hub.
- 2) Install caliper assembly and torque caliper carrier bolts to specification.

NOTE:

When it is hard to install caliper assembly to brake disc, increase disc-to-pad clearance to facilitate installation referring to 2) on page 5-34.

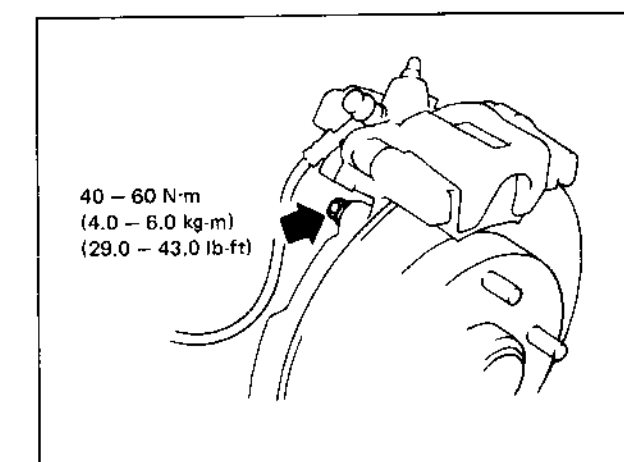


Fig. 5-78

- 3) Torque wheel nuts to specification.
- 4) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to five times so as to obtain proper disc-to-pad clearance.
- 5) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove car from hoist and perform brake test (foot brake and parking brake).

3. REMOVE AND INSTALL CALIPER ASSEMBLY

REMOVAL

- 1) Hoist car and remove wheel.
- 2) Remove brake flexible hose mounting bolt from caliper. As this will allow fluid to flow out of hose, have a container ready beforehand.

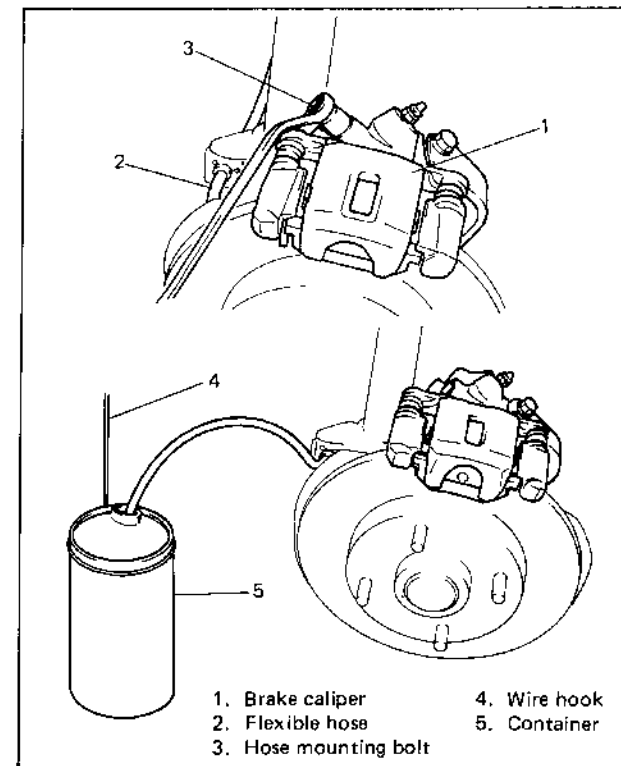


Fig. 5-79

- 3) Release parking brake lever and remove caliper pin bolts.

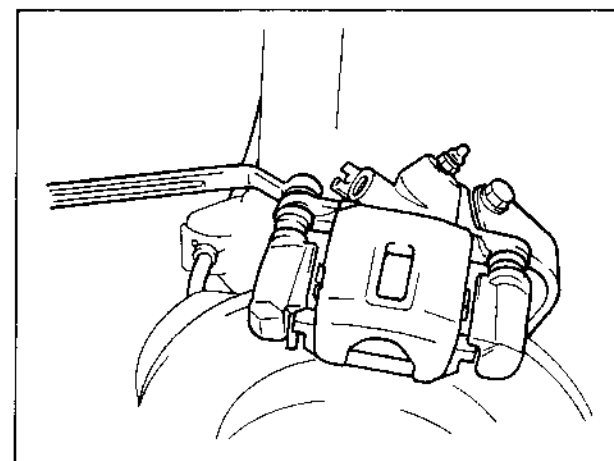


Fig. 5-80

- 4) Remove caliper from carrier.

- 5) Remove parking brake cable E-ring.

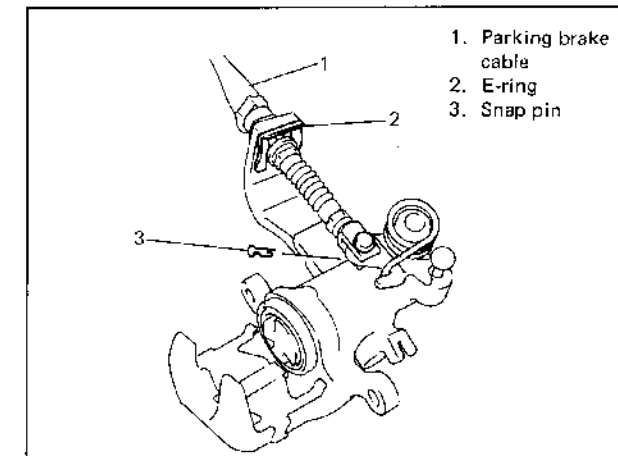


Fig. 5-81

- 6) Disconnect parking brake cable from lever on caliper.

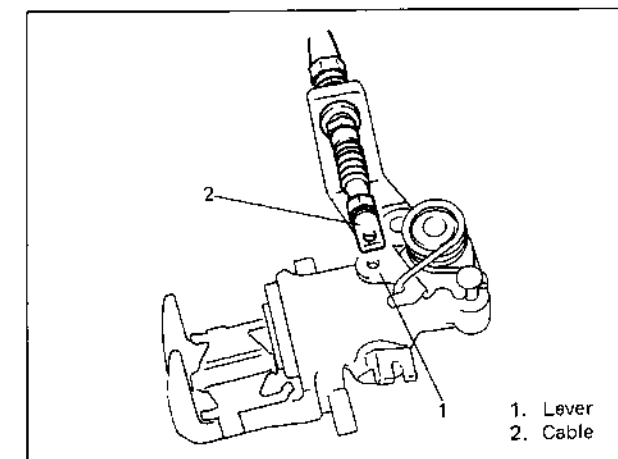


Fig. 5-82

- 7) Remove cover.

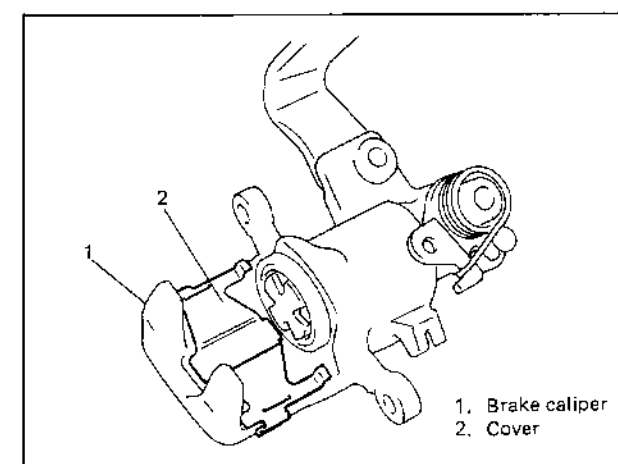


Fig. 5-83

INSTALLATION

Reassemble rear brake caliper in reverse order of disassembly, noting the following.

- 1) Install cover to caliper. (Refer to Fig. 5-83.)
- 2) Connect parking brake cable to camshaft lever and cable bracket.

After connecting cable to camshaft lever, be sure to install clip as shown below. Also, install E-ring securely to its bracket side.

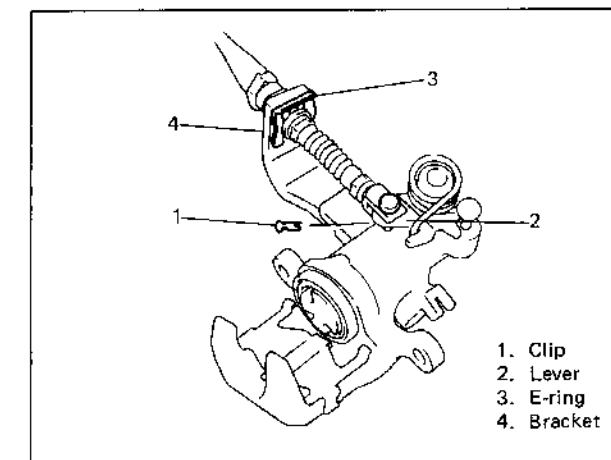


Fig. 5-84

- 3) Install caliper to carrier and torque cliper pin bolts.

For its installation procedure and torque data for pin bolt, refer to 2) and 3) of BRAKE PAD INSTALLATION on page 5-34.

- 4) Install brake flexible hose to caliper and tighten hose bolt to specified torque.

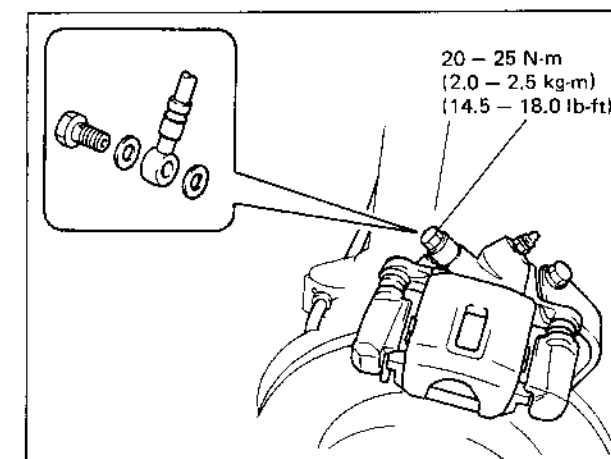


Fig. 5-85

- 5) Upon completion of installing all parts, fill reservoir tank with specified fluid and bleed brake system of entrapped air.
- 6) Check to make sure that system is free from fluid leakage.
- 7) Depress brake pedal with about 30 kg (66 lbs) load three to five times so as to obtain proper disc to pad clearance.
- 8) Check to ensure that brake drum is free from dragging and proper braking is obtained.
- 9) Check to make sure that parking brake lever stroke is as specified. If not, adjust.
- 10) Remove car from hoist and perform brake test (foot brake and parking brake).

4. REMOVE AND INSTALL SEAL, PISTON, DUST BOOT AND PARKING BRAKE CAM

REMOVAL

Before disassembly, clean all around caliper with brake fluid.

- 1) Remove piston and boot by turning piston counterclockwise with special tool (Piston installer) as shown below.

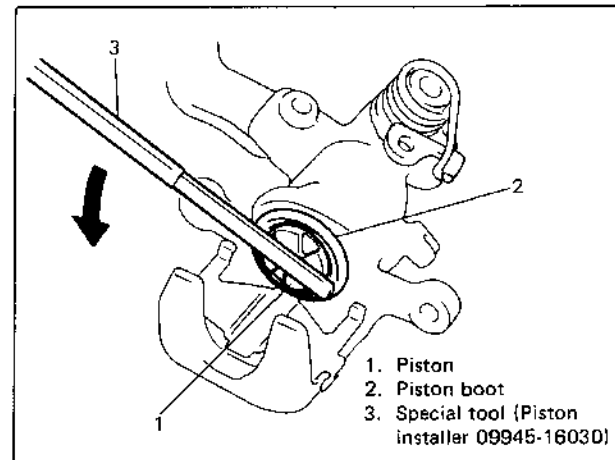


Fig. 5-86

- 2) Remove piston seal.

NOTE:

Be careful not to damage inside (bore side) of cylinder.

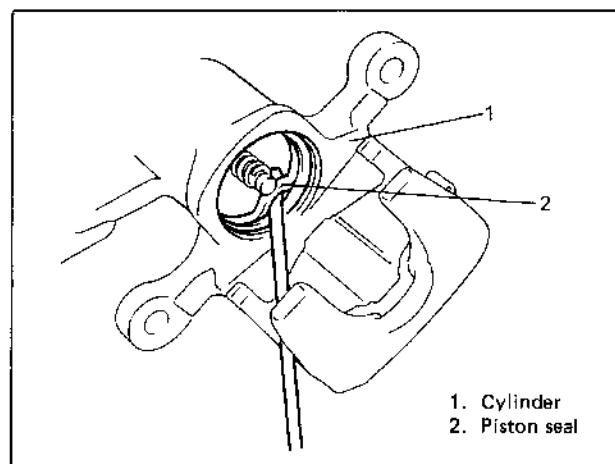


Fig. 5-87

- 3) Remove snap ring by using snap ring pliers (closing type).

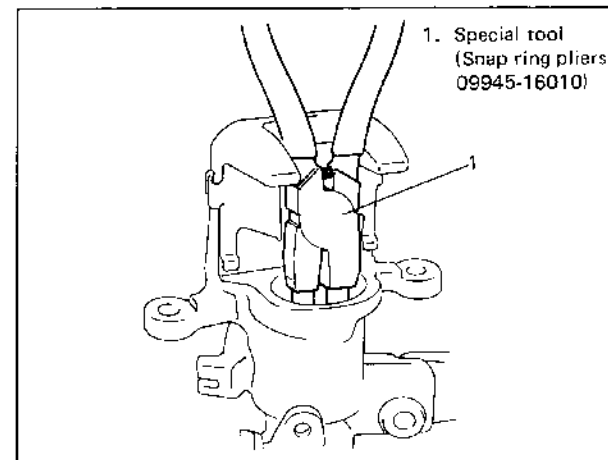


Fig. 5-88

- 4) Remove spring seat No. 2, coil spring and seat No. 1.

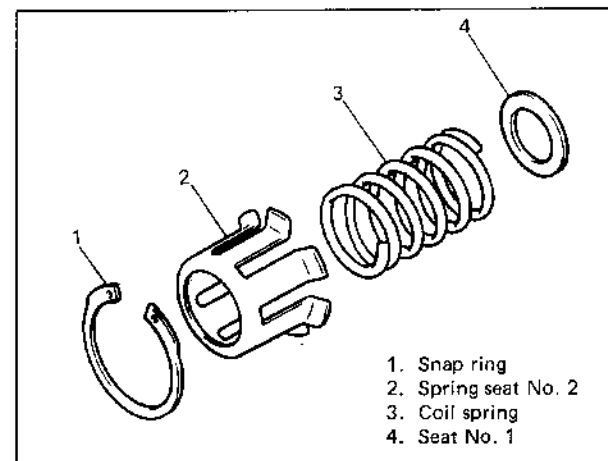


Fig. 5-89

- 5) Remove key plate snap ring by using snap ring pliers (special tool B).

- 6) Remove key plate, push rod and rod.

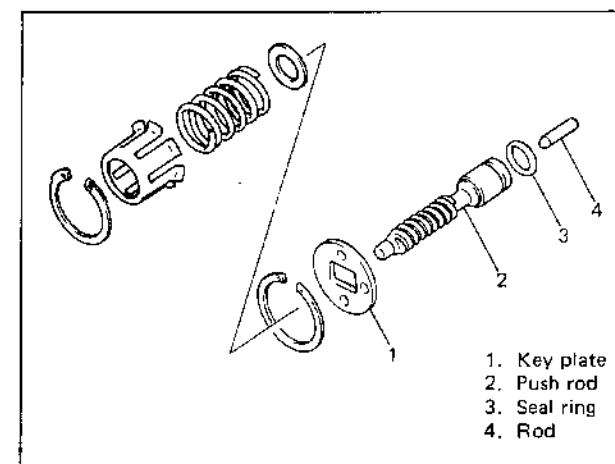


Fig. 5-90

- 7) Remove return spring.

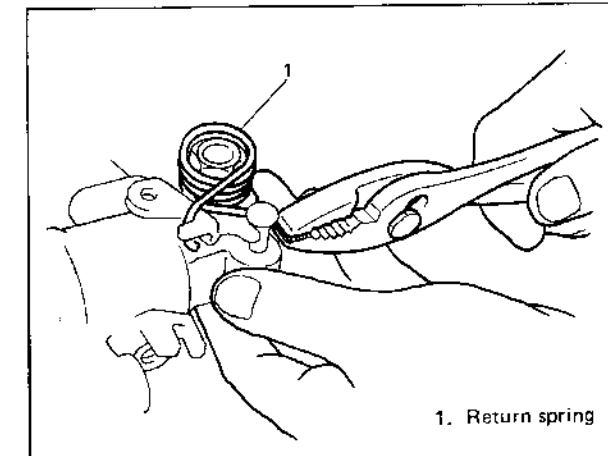


Fig. 5-91

- 8) Remove lever, camshaft and camshaft boot.

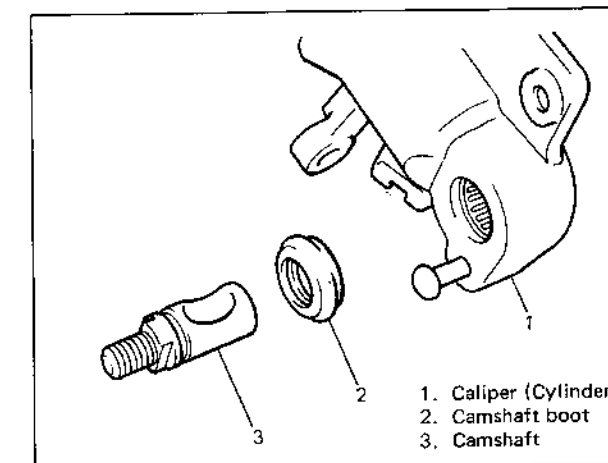


Fig. 5-92

INSTALLATION

Reassemble rear brake caliper inner parts in reverse order of disassembly, noting the following.

CAUTION:

Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.

Before installation, apply grease which is furnished in repair kit to such points of such parts as shown below and specified brake fluid to other parts.

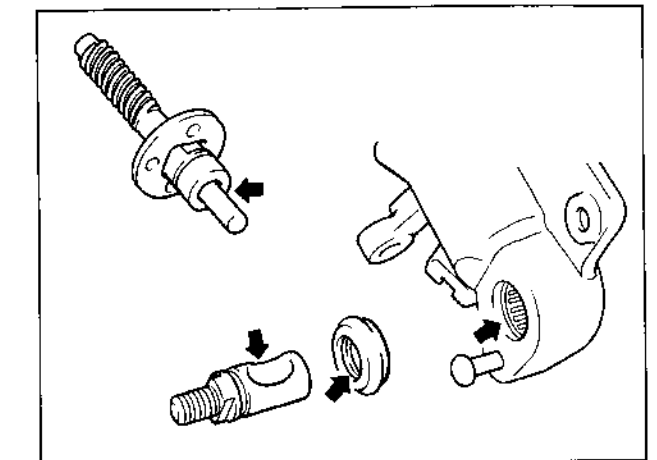


Fig. 5-93

- 1) Position camshaft bearing as shown below.

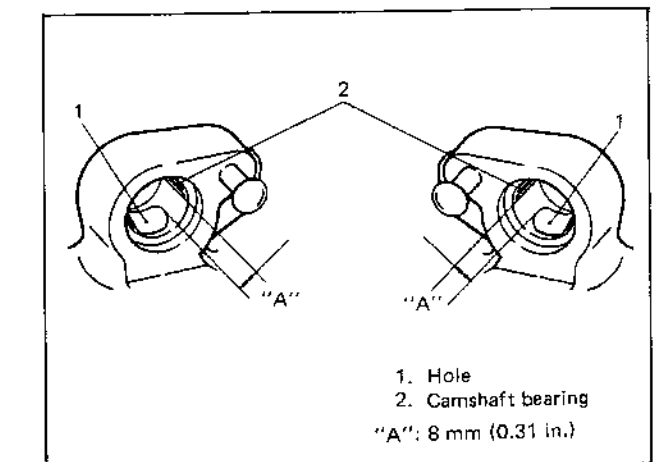


Fig. 5-94

2) When inserting camshaft into cylinder, determine its position in cylinder (caliper) by setting two cut faces at its end ("A" in figure) and dent in camshaft ("B" in figure) as shown below.

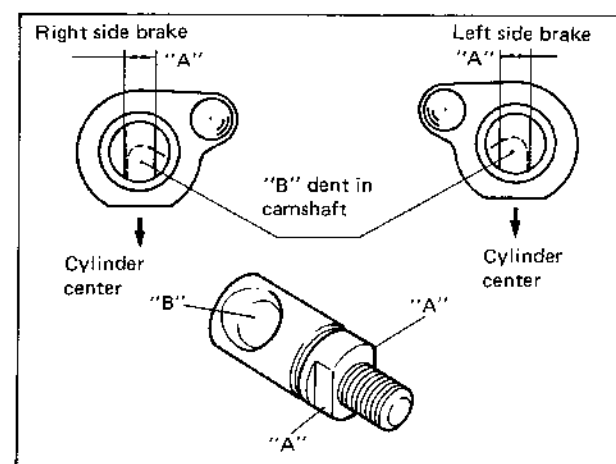


Fig. 5-95

3) Install parts onto push rod.

Check to make sure that ample amount of grease is applied to where rod is installed.

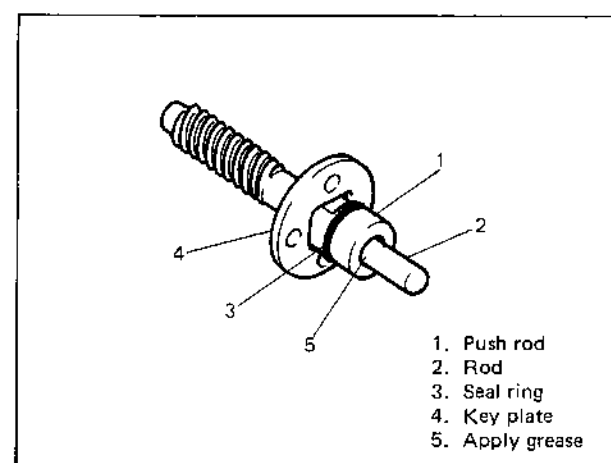


Fig. 5-96

4) Install what is assembled in above 3) into cylinder by fitting pin "A" of key plate into hole "B" in cylinder and snap ring into ring groove in cylinder securely.

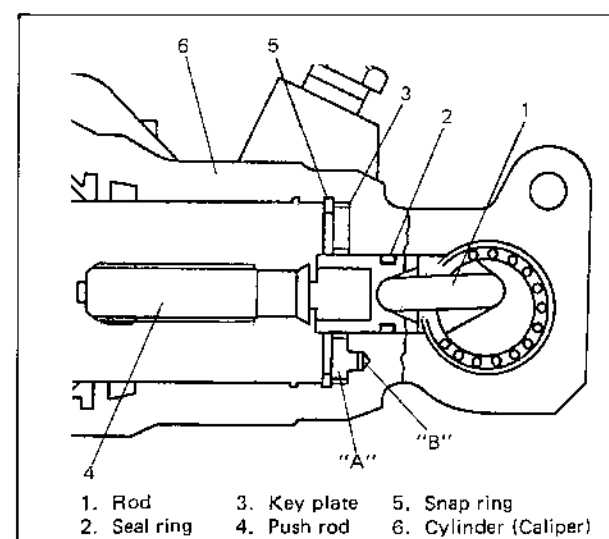


Fig. 5-97

5) While pressing screw part of push rod by hand, turn camshaft lightly in its full stroke. And check to make sure that push rod moves about 1 mm (0.039 in.) up and down.

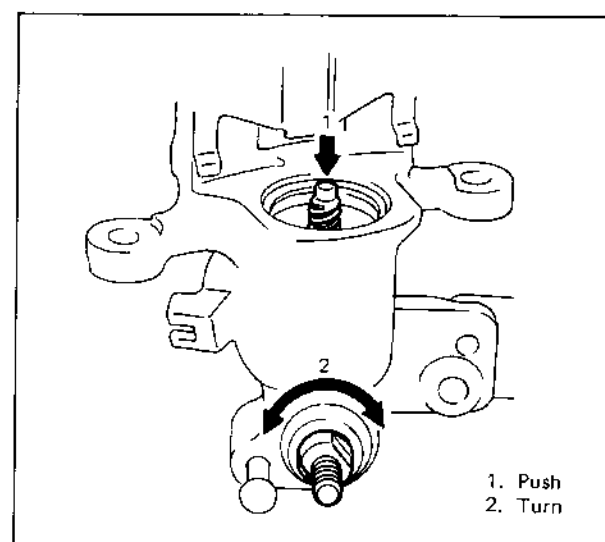


Fig. 5-97-1

If its up and down movement is not within or close to specification, it means that cam part of camshaft is in opposite position. Reinstall referring to step 2).

6) To facilitate installation of spring seat, push in its rim a little so that seat diameter becomes smaller than inner diameter of special tool (Spring seat gauge) on its "H" marked side as shown below.

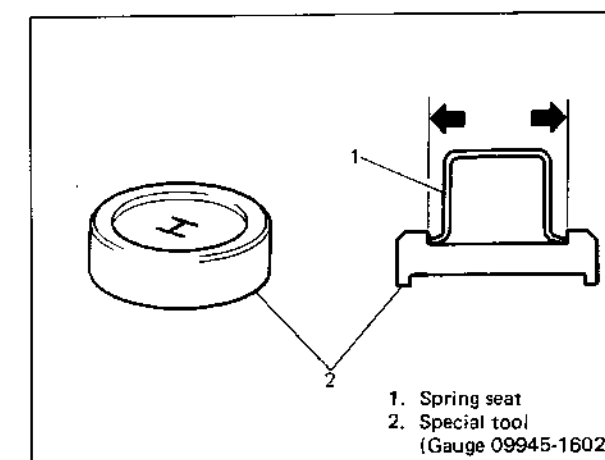


Fig. 5-97-2

7) Install seat No. 1, coil spring and spring seat No. 2 into cylinder.

Then tighten special tool (Spring installer nut) till spring seat No. 2 contacts snap ring fixing key plate lightly.

NOTE:

- Push in head of push rod with finger lightly before tightening special tool (Nut).
- When using special tool (Nut), check to make sure that arrow on it is directed as shown below.

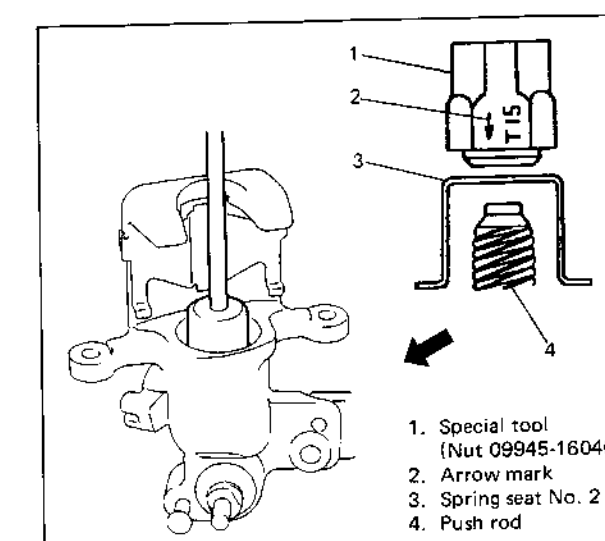


Fig. 5-97-3

8) Using snap ring pliers (closing type), install snap ring into ring groove in cylinder securely.

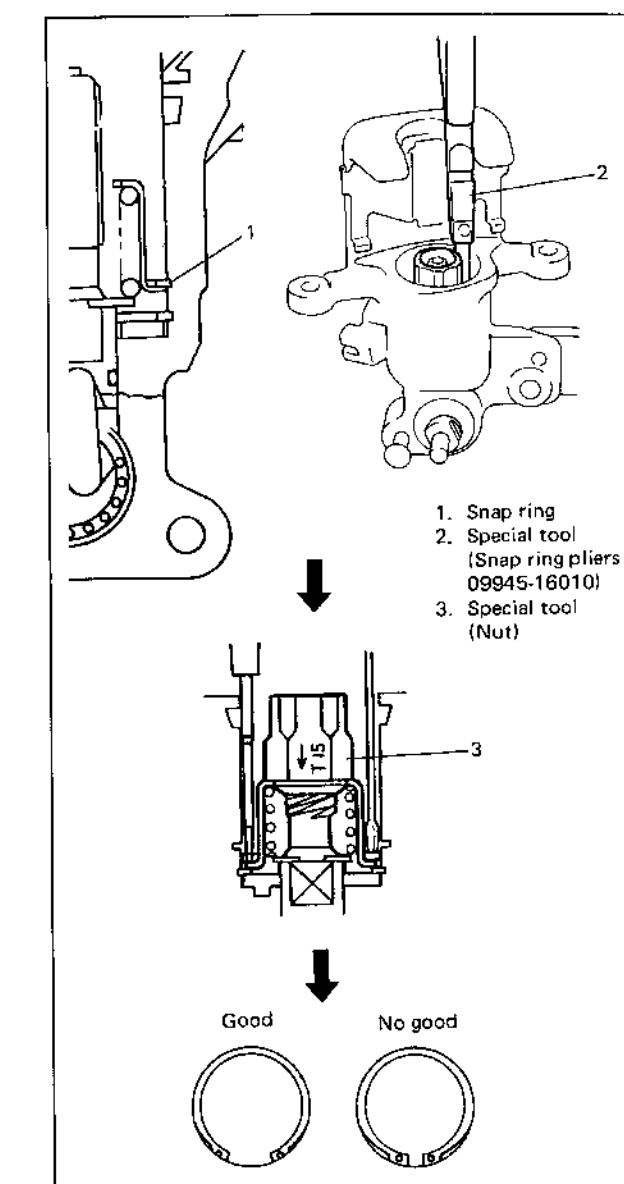


Fig. 5-97-4

9) Remove special tool (Nut) and install piston seal.

10) Install boot to piston as shown in figure. Then after fitting boot into boot groove in cylinder, install piston into cylinder. To install piston, push piston into screw part of push rod first and then turn piston clockwise by using special tool (Piston installer).

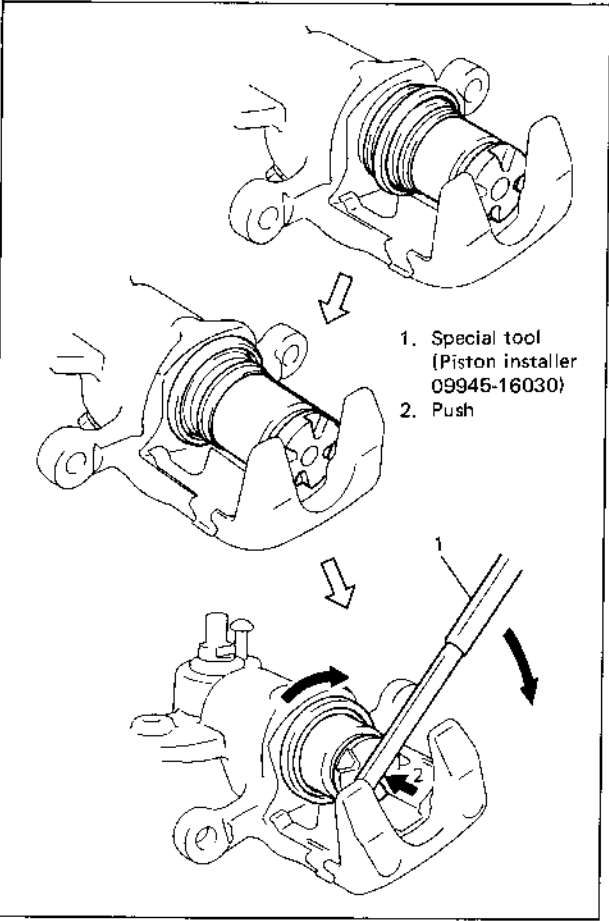


Fig. 5-97-5

11) After installing piston, position it as shown below.

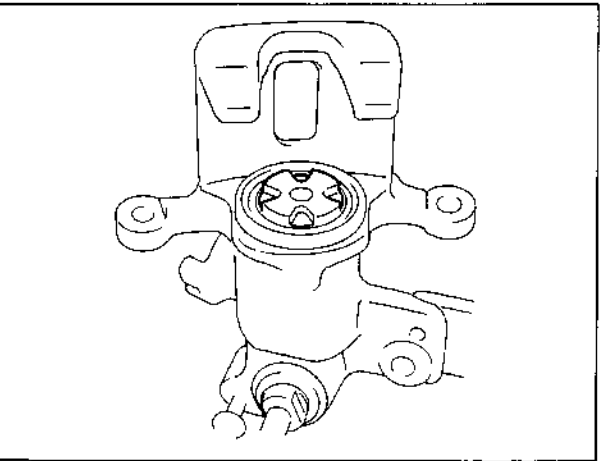


Fig. 5-97-6

12) Install camshaft lever and tighten lever nut to specification.

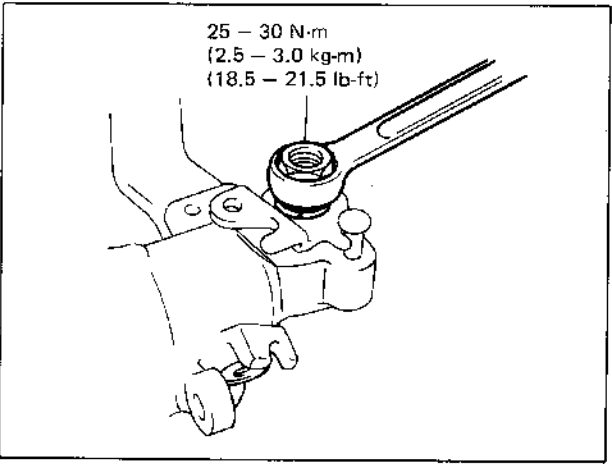


Fig. 5-97-7

13) Install return spring to lever and caliper body.

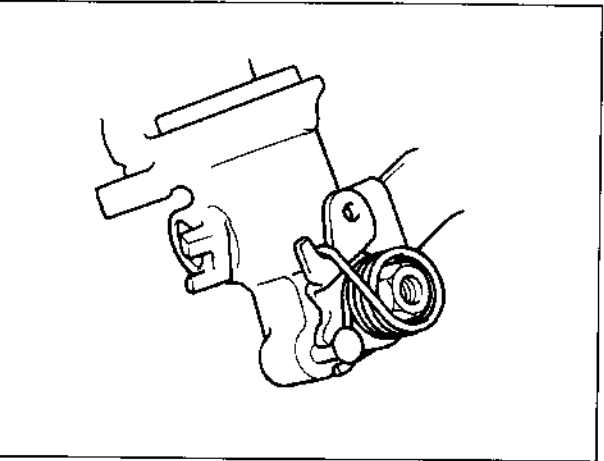


Fig. 5-97-8

14) Install rear caliper to car body.
For installation, carry out steps 1) to 10) of CALIPER INSTALLATION in this section.

REAR DISC BRAKE INSPECTION

1. INSPECT BRAKE PAD LINING

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

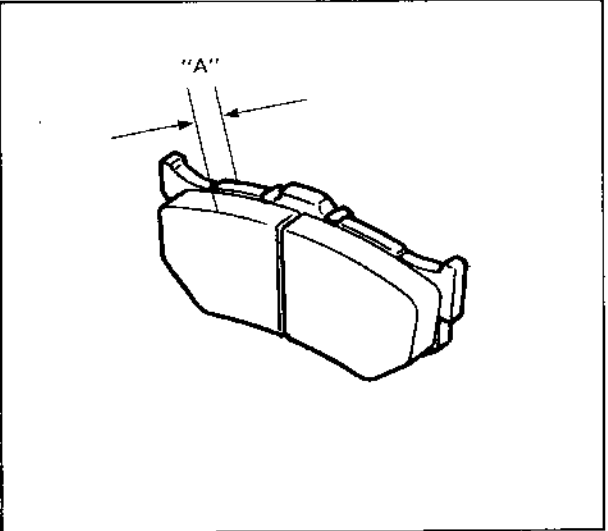


Fig. 5-98

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 "A" (lining + pad rim)	Standard	Limit
	13.0 mm (0.512 in.)	6.0 mm (0.236 in.)

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

2. INSPECT BRAKE CALIPER INNER PARTS

Cylinder Slide Guide Pin
Check guide pin for smooth movement as shown. If it is found faulty, correct or replace. Apply rubber grease to guide pin outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperature as -40°C (-40°F).

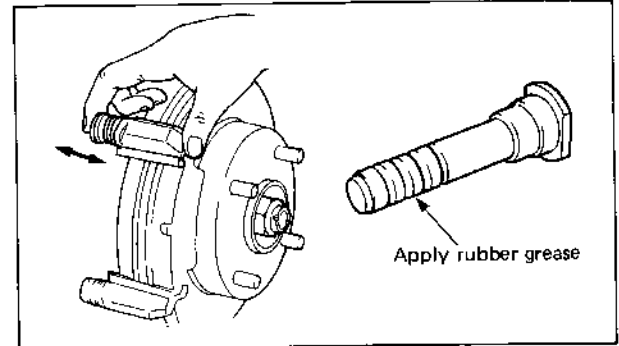


Fig. 5-99

Bush Dust Boot and Cylinder Boot
Check boots for breakage, crack and damage. If defective, replace.

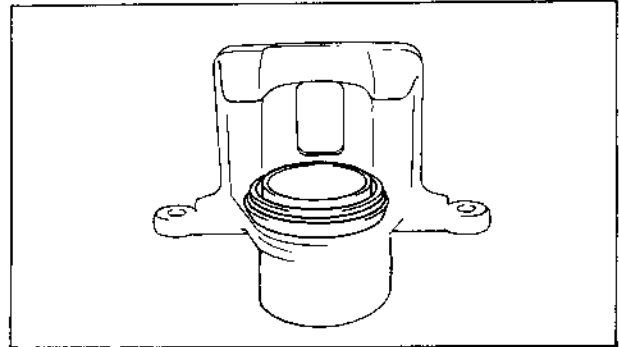


Fig. 5-100

Piston Seal
Excessive or uneven wear of pad lining may indicate unsmooth return of the piston. In such a case, replace rubber seal.

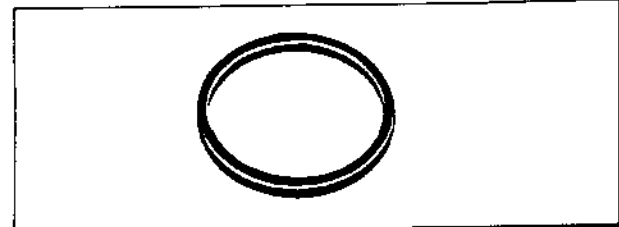


Fig. 5-101

3. INSPECT BRAKE DISC

Before this inspection, brake pads must be removed (according to steps 1) to 4) on page 5-34).

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.

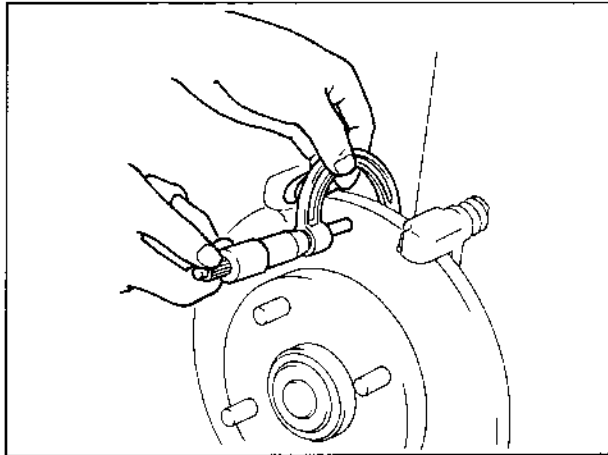


Fig. 5-102

	Standard	Limit
Disc thickness	10 mm (0.394 in.)	8 mm (0.315 in.)

To measure deflection of disc, take measurement at 2 points on its periphery and center with dial gauge while rotating it.

Limit on disc deflection	0.1 mm (0.0039 in.)

NOTE:
Check front wheel bearing for looseness before measurement.

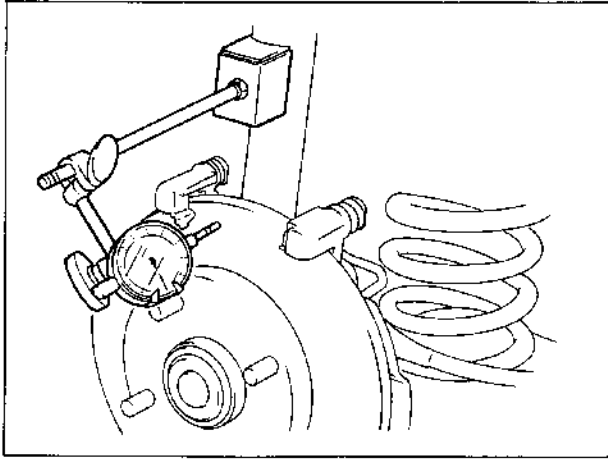


Fig. 5-103

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.

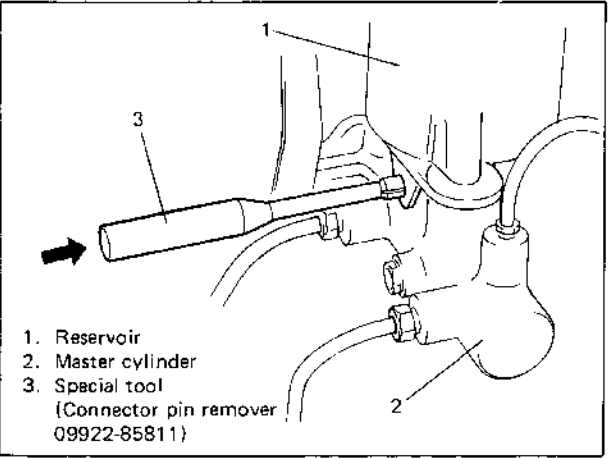


Fig. 5-104

- 5) Remove reservoir.

NOTE:
Do not allow brake fluid to get on painted surfaces.

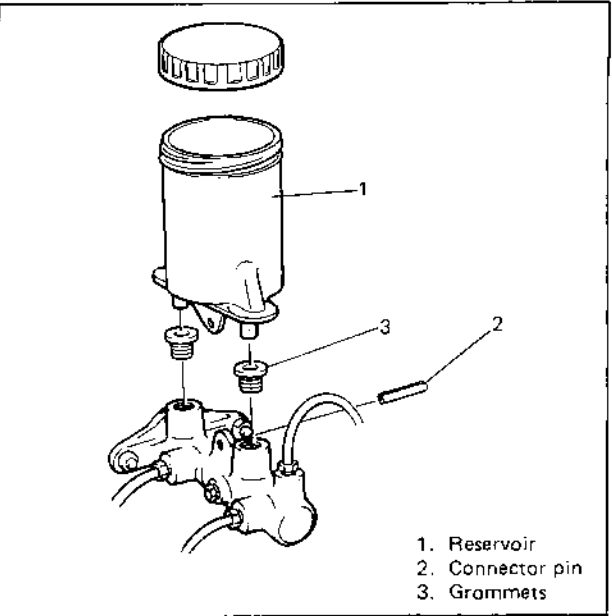


Fig. 5-105

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 become the same length.

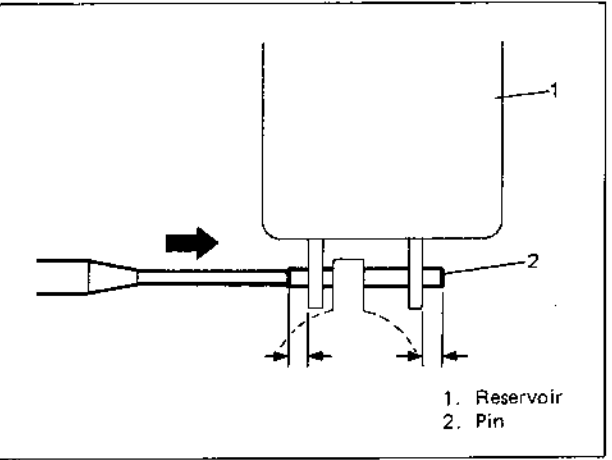


Fig. 5-106

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

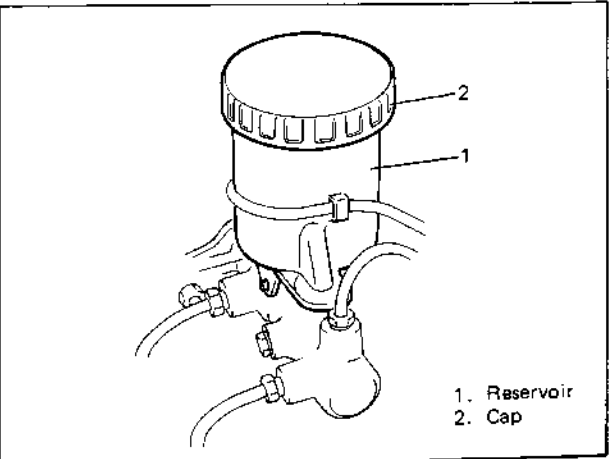


Fig. 5-107

2. REMOVE AND INSTALL MASTER CYLINDER ASSEMBLY

REMOVAL

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

NOTE:

Do not allow brake fluid to get on painted surfaces.

- 4) Remove two attaching nuts/washers.
- 5) Remove master cylinder.

INSTALLATION

NOTE:

- See NOTE at the beginning of this section.
- Adjust clearance between booster piston rod and primary piston with special tool (See page 5-56).

- 1) Install master cylinder as shown and torque attaching nuts to specification.
- 2) Attach three hydraulic lines and torque flare nuts to specification.
- 3) Connect reservoir lead wire.
- 4) Fill reservoir with specified brake fluid.
- 5) After installing, check brake pedal play and bleed air from system (See pages 5-19 and 5-20).

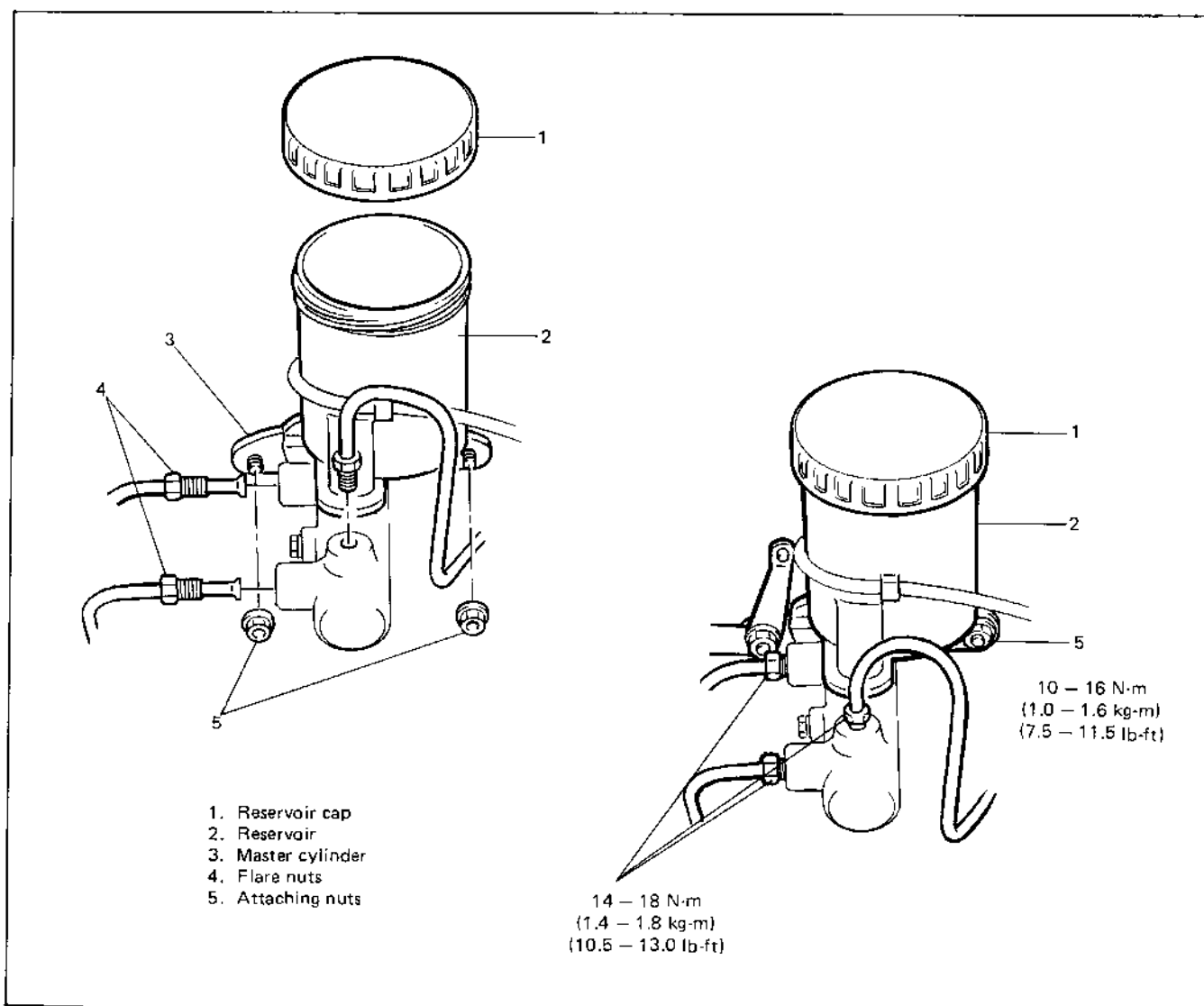


Fig. 5-108 Master Cylinder Repair - A

3. DISASSEMBLE AND ASSEMBLE MASTER CYLINDER

DISASSEMBLY

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

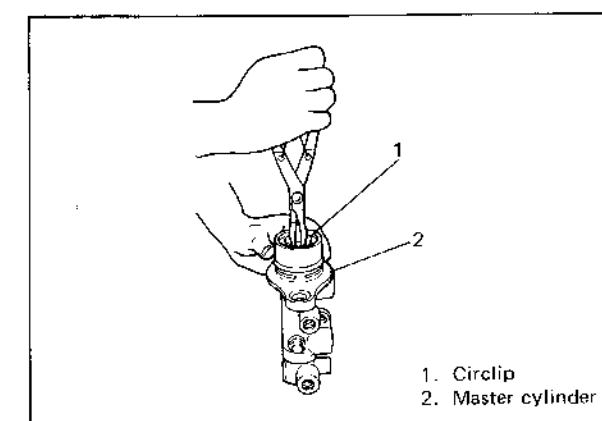


Fig. 5-109

- 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.

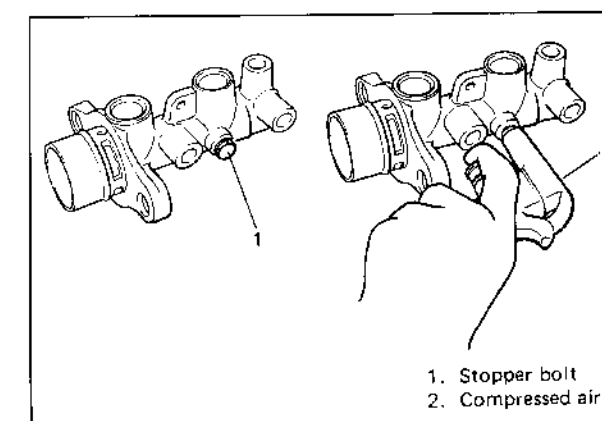


Fig. 5-110

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 in Fig. 5-112.
- 2) Install secondary piston assembly into cylinder.
- 3) Install primary piston in cylinder.
- 4) Depress, and install circlip.

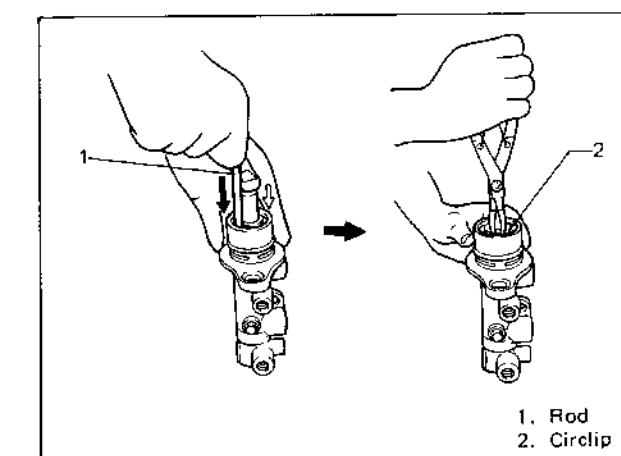


Fig. 5-111

- 5) Install piston stopper bolt with pistons pushed in all the way and tighten it to specified torque.
- 6) For installation on vehicle, refer to INSTALLATION on page 5-46.

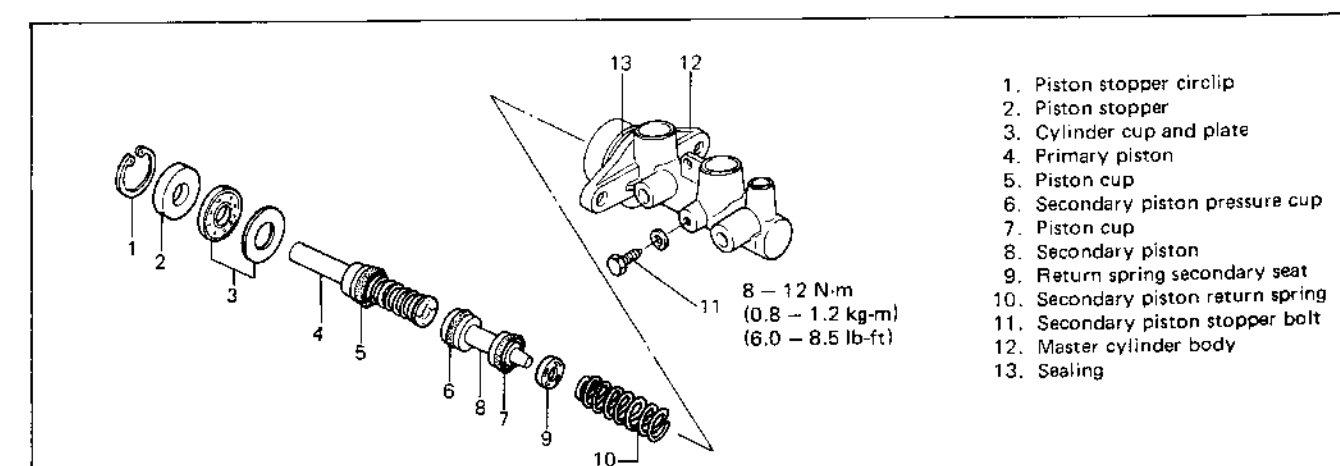


Fig. 5-112 Master Cylinder Repair - B

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.

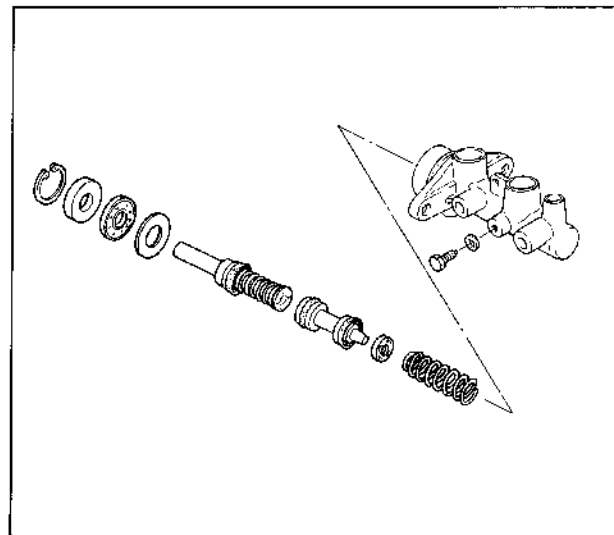


Fig. 5-113

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 of master cylinder with cast aluminum body 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 from cylinder bore surfaces.

2. FILL RESERVOIR

NOTE:

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.

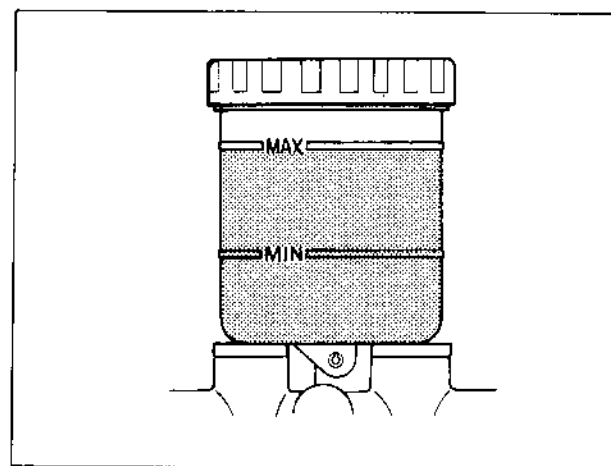


Fig. 5-114

BRAKE BOOSTER REPAIR

1. REMOVE AND INSTALL BOOSTER

REMOVAL

- 1) Remove master cylinder assembly, referring to steps 1) to 5) of its REMOVAL on page 5-46.
- 2) Disconnect vacuum hose from booster.
- 3) Disconnect push rod clevis from brake pedal arm.
- 4) Remove attaching nuts and then booster as shown.

INSTALLATION

NOTE:

- See NOTE at the beginning of this section.
 - Adjust clearance between booster piston rod and master cylinder piston with special tool. (See page 5-56.)
 - Check length of push rod clevis. (See page 5-55.)
- 1) Install booster to dash panel as shown. Then connect booster push rod clevis to pedal arm with clevis pin and split pin.
 - 2) Torque booster attaching nuts to specification.
 - 3) Install master cylinder to booster and torque attaching nuts to specification.
 - 4) Connect three brake pipes and torque flare nuts to specification. (See page 5-46.)
 - 5) Connect booster vacuum hose.
 - 6) Connect reservoir lead wire at coupler.
 - 7) Fill reservoir with specified fluid.
 - 8) Bleed air from brake system. (See air bleeding section, pages 5-19 and 5-20.)
 - 9) After installing, check pedal height and play. (See pages 5-16 and 5-17.)
 - 10) Perform brake test and check each installed part for fluid leakage

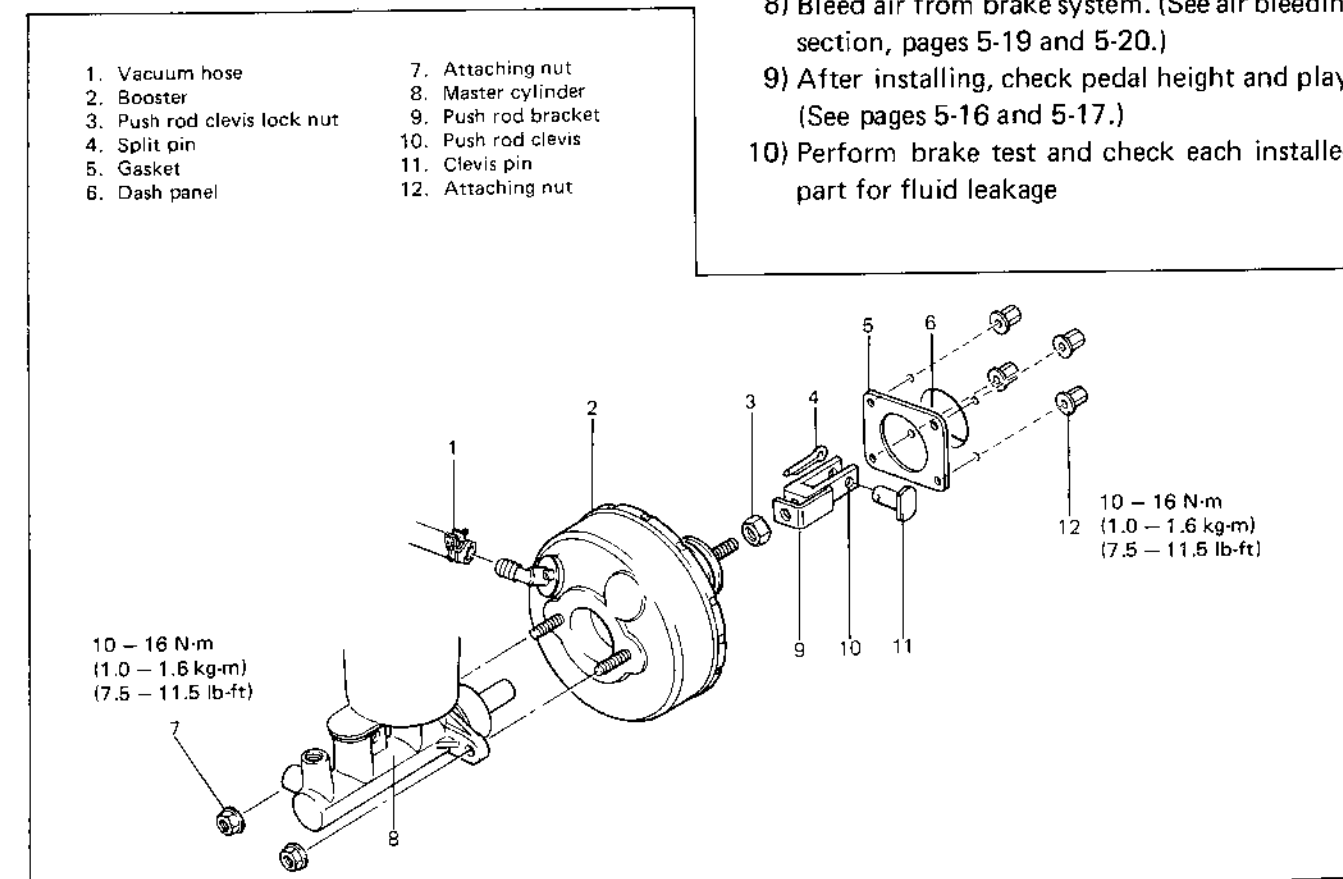


Fig. 5-115

2. DISASSEMBLE AND ASSEMBLE BOOSTER

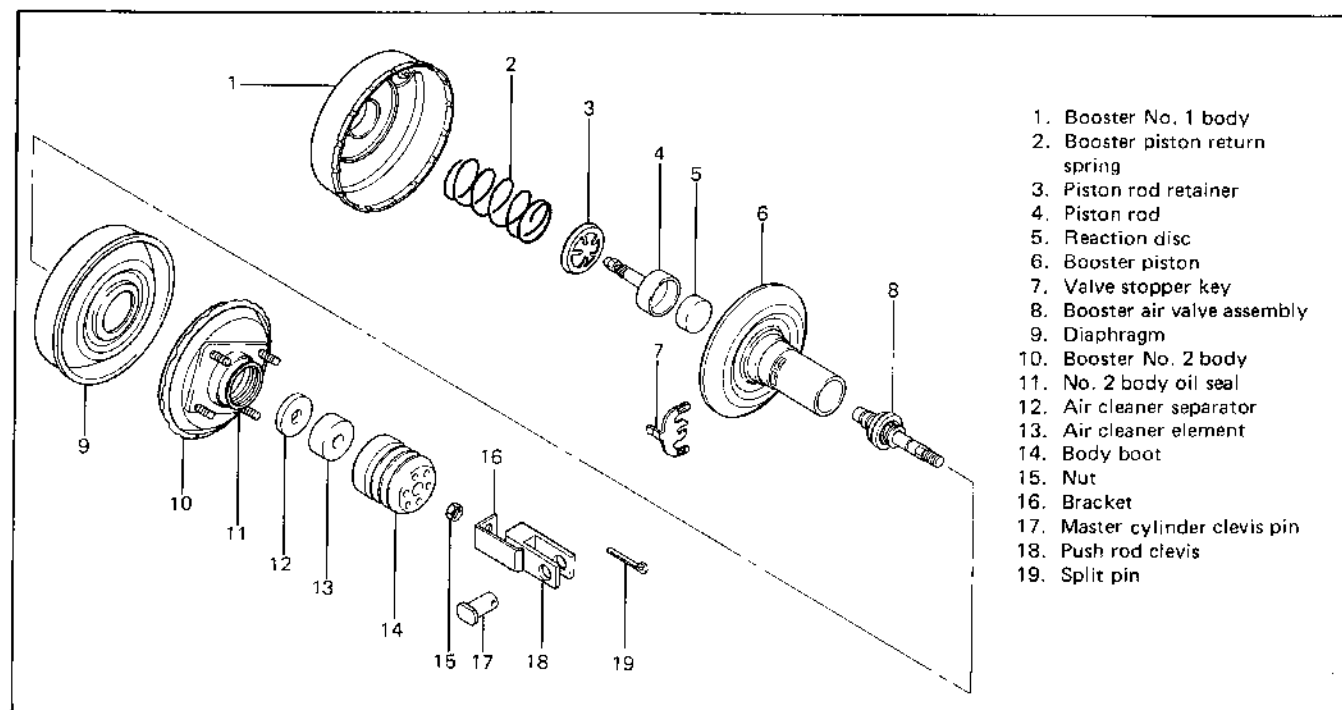


Fig. 5-116

DISASSEMBLY

1) Remove push rod clevis and nut.

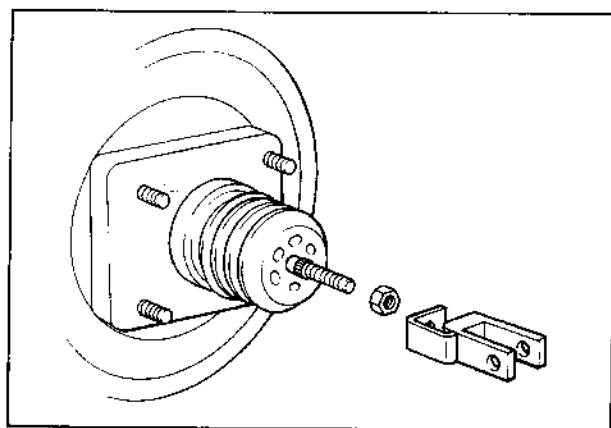


Fig. 5-117

2) Attach booster to special tool (A) as shown and install special tool (B) to booster as shown.

NOTE:

- When attaching, check to be sure that booster vacuum pipe is not in faulty contact with base of special tool (A).
- Be careful not to over-tighten nuts, or booster body will be deformed.

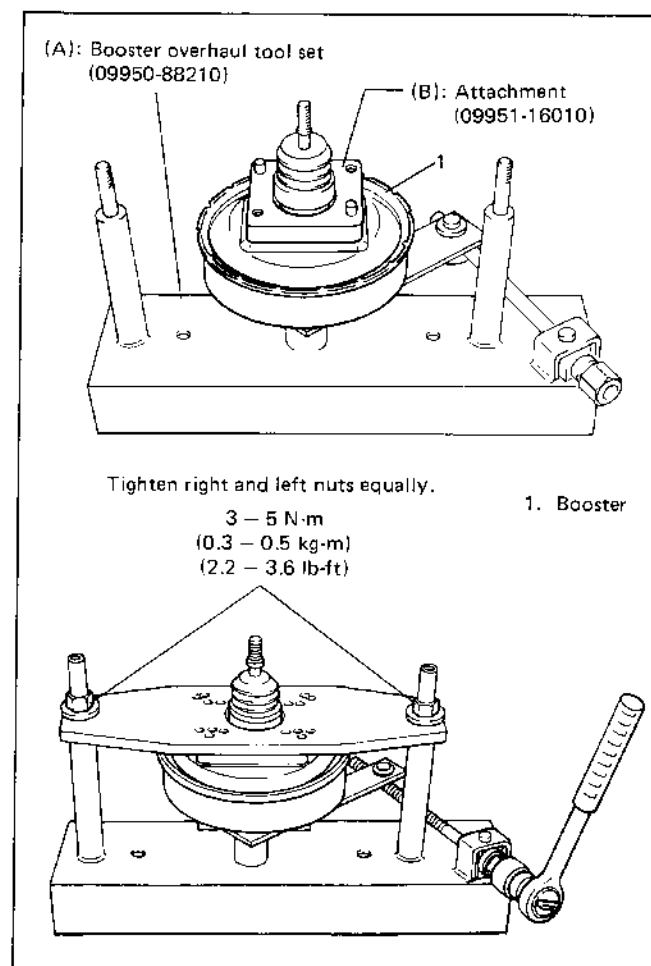


Fig. 5-118

3) Turn special tool bolt clockwise until No. 1 body projecting part and No. 2 body depressed part fit each other. Once they are matched, make match marking on No. 1 and No. 2 bodies to facilitate their installation.

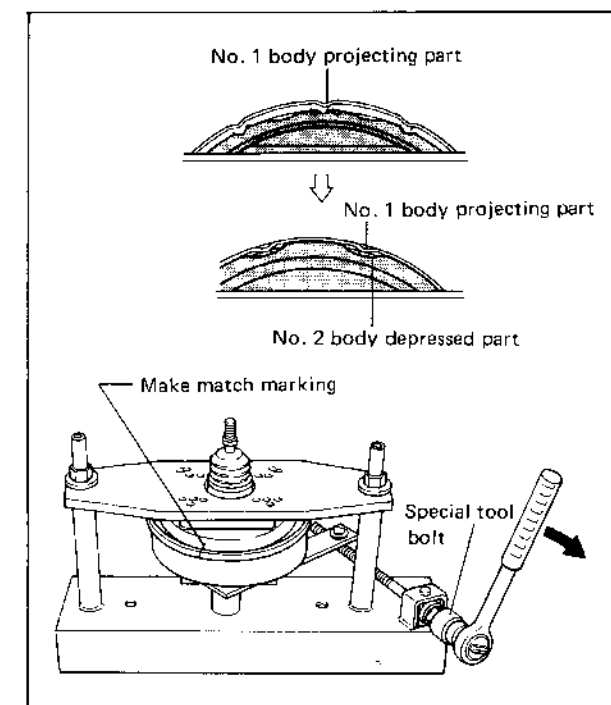


Fig. 5-119

4) Detach booster from special tool and separate No. 1 body and No. 2 body. Remove piston return spring.

WARNING:

When separating two bodies, carefully hold both bodies to prevent either body from jumping off by spring force.

5) From booster No. 2 body, remove piston rod, boot, air cleaner element and air cleaner separator in this order.

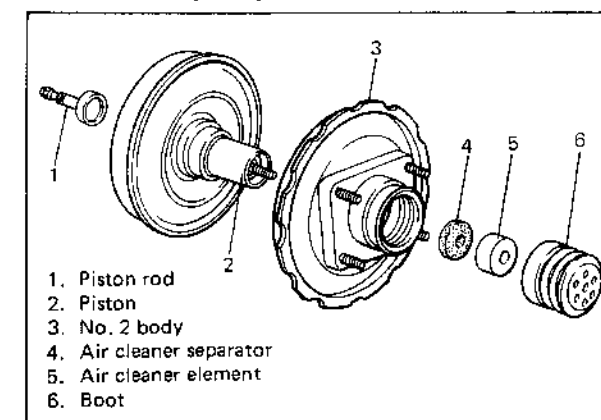


Fig. 5-120

6) Remove diaphragm from booster piston.

NOTE:

Don't use driver or other tool for removal. Pull it off by hand carefully handling piston groove area where diaphragm is fitted.

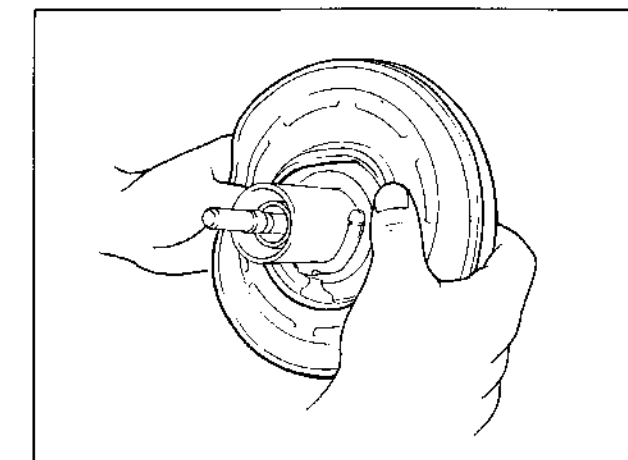


Fig. 5-121

7) While compressing air valve spring (by moving rod up and down as shown), remove valve stopper key. Then remove booster air valve assembly from booster piston.

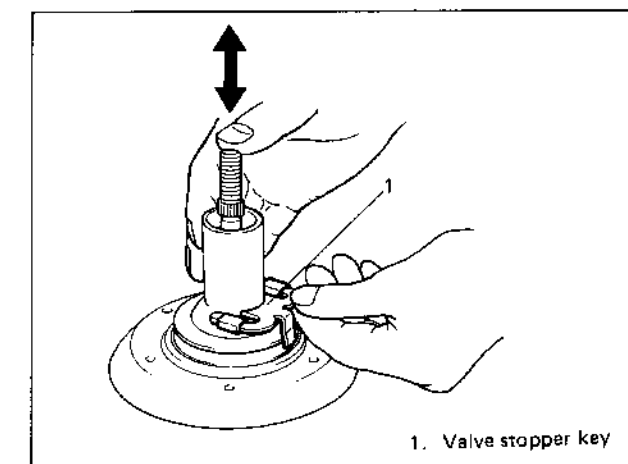


Fig. 5-122

NOTE:
Booster air valve assembly can't be disassembled.

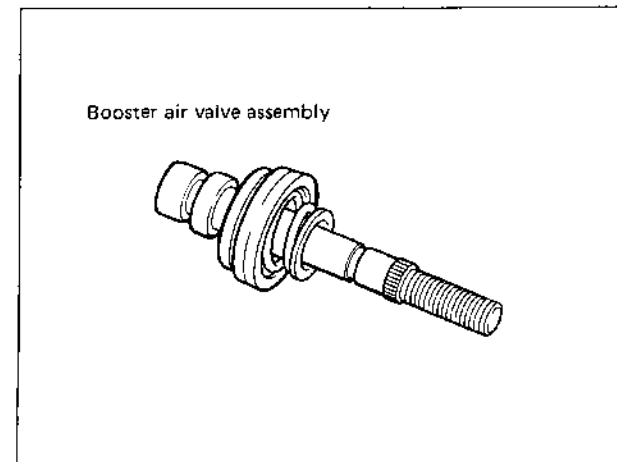


Fig. 5-123

8) Remove reaction disc from booster piston rod.

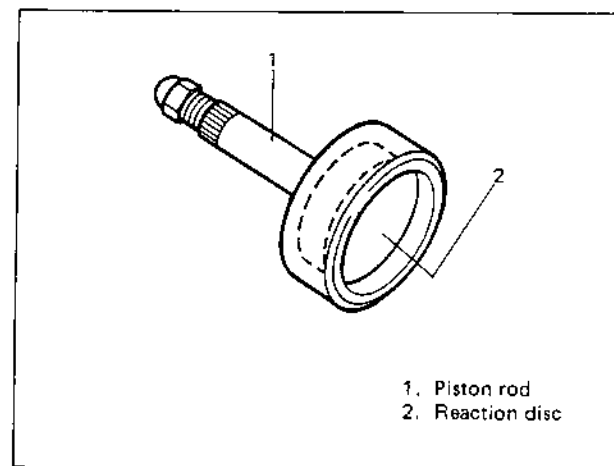


Fig. 5-124

9) Remove oil seal from booster No. 2 body with special tools as shown.

NOTE:
Removed oil seal must not be reused.

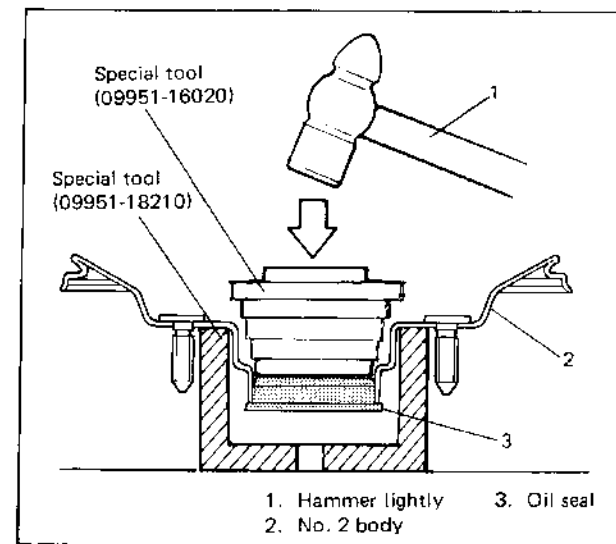


Fig. 5-125

ASSEMBLY

NOTE:

- See NOTE at the beginning of this section.
- Be sure to use silicon grease wherever application of grease is instructed during assembly.

1) Apply grease to new oil seal outer surface and oil seal lip as shown. Press-fit new oil seal to booster No. 2 body by using special tools (C) and (D).

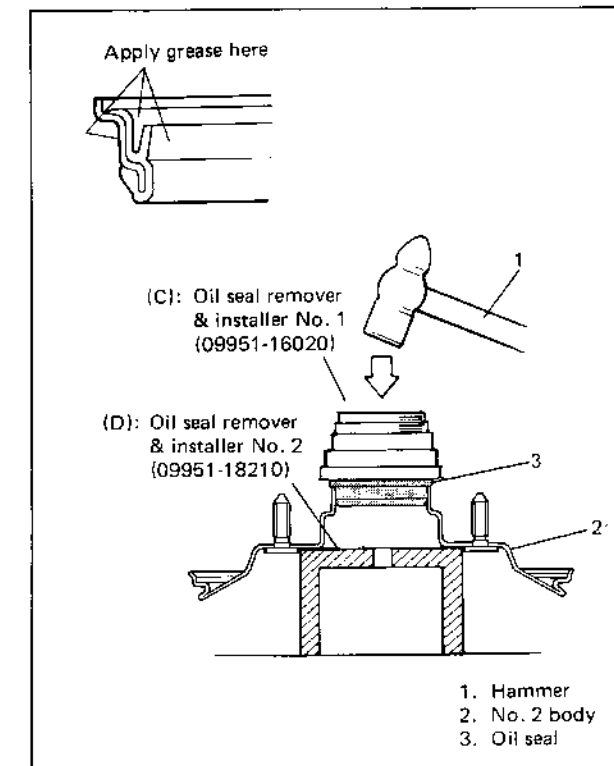


Fig. 5-126

2) Install booster air valve assembly to booster piston. Before installation, apply grease as shown.

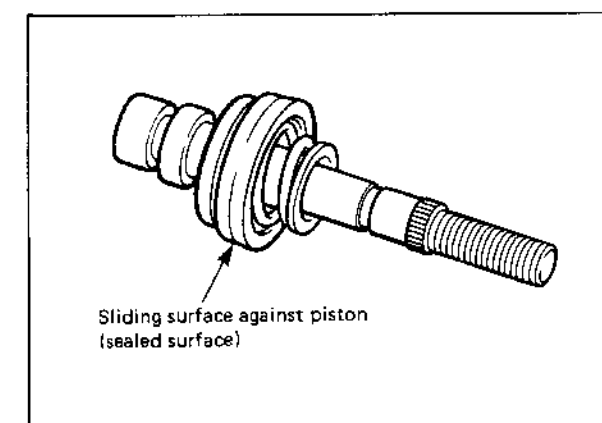


Fig. 5-127

3) Compress air valve assembly and insert valve stopper key.

NOTE:
Don't compress air valve assembly forcibly.

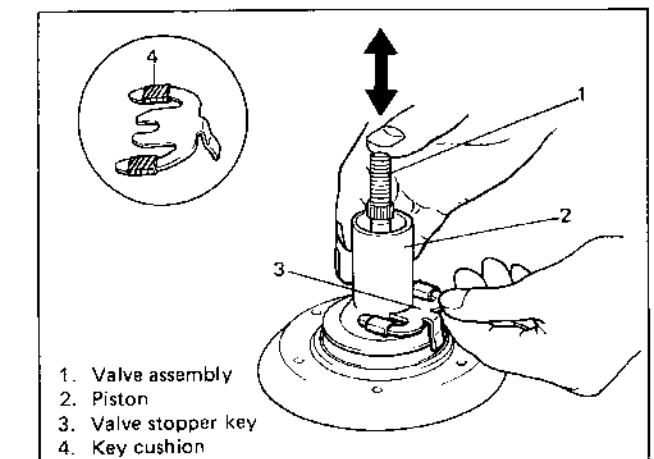


Fig. 5-128

4) Install diaphragm to booster piston by hand.

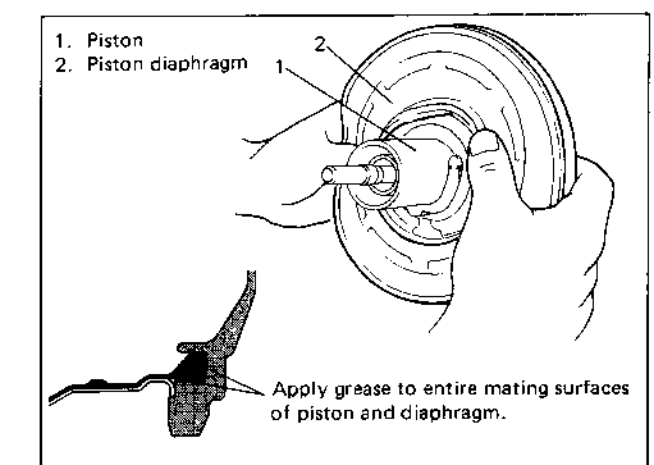


Fig. 5-129

5) Install booster piston to booster No. 2 body.

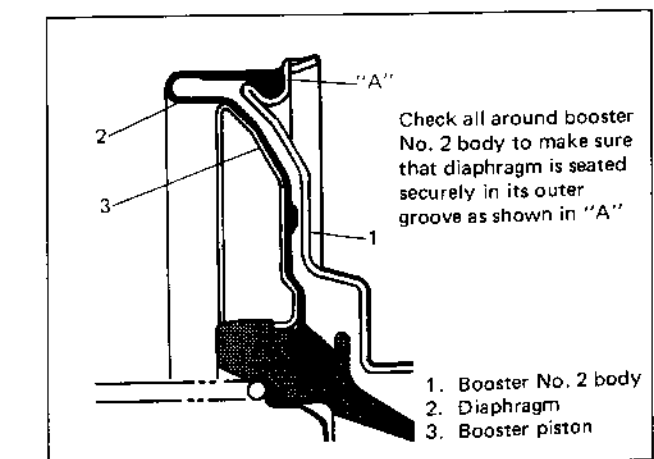


Fig. 5-130

- 6) Install air cleaner separator and then element to rod of air valve assembly.
- 7) Install body boot to booster No. 2 body. Both ends of boot must be fitted securely as shown.

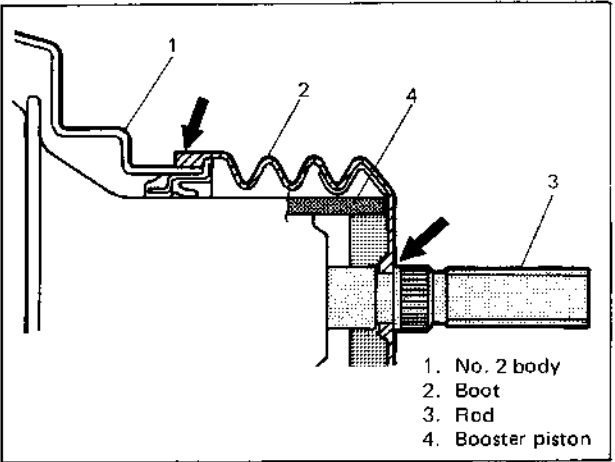


Fig. 5-131

- 8) Install reaction disc to booster piston rod after greasing its outer face.

NOTE:
Make sure that no air exists between piston rod and reaction disc.

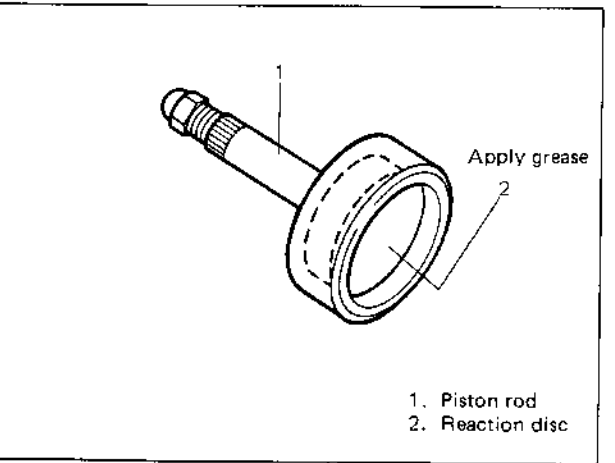


Fig. 5-132

- 9) Place No. 1 body on special tool (A).

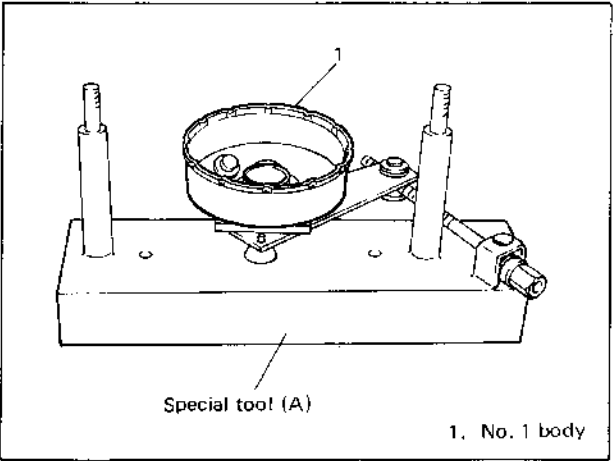


Fig. 5-133

- 10) Install piston rod, rod retainer and piston return spring to booster piston as shown below. Then install them to booster No. 1 body.

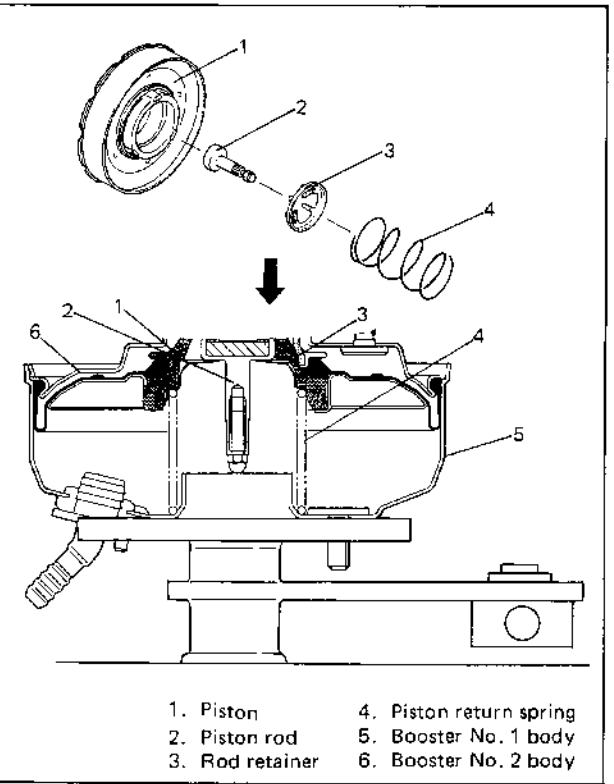


Fig. 5-134

- 11) Put No. 1 and No. 2 bodies together by aligning markings made before disassembly. Holding No. 2 body with upper plate (special tool) as shown, torque two nuts equally to specification.

Special tool nuts tightening torque	N·m	kg·m	lb·ft
	3 - 5	0.3 - 0.5	2.2 - 3.6

NOTE:
When holding No. 2 body, use care so that diaphragm is not caught by projections at 12 locations around No. 1 body.

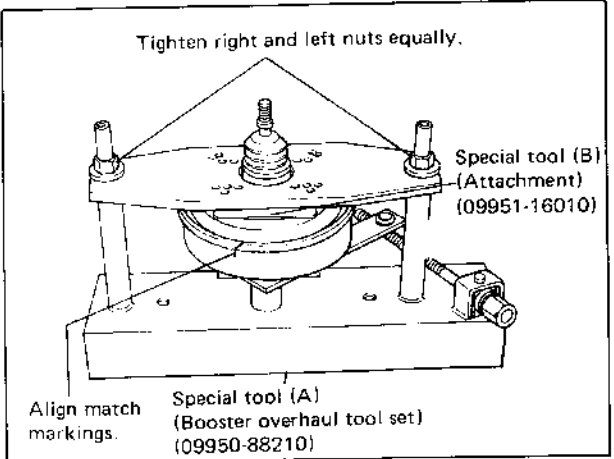


Fig. 5-135

- 12) Turn special tool bolt counterclockwise until No. 1 body projecting part comes to mid-position of No. 2 body depressed parts as shown.

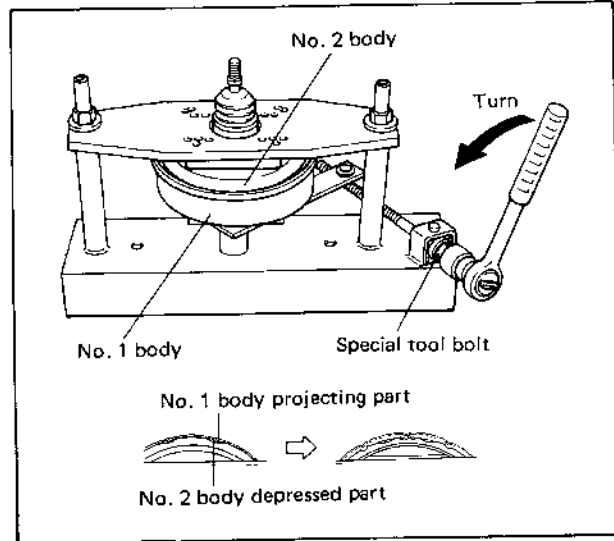


Fig. 5-136

- 13) Remove booster from special tool.
- 14) Install push rod clevis so that dimension "A" as shown below is within 114.5 - 115.5 mm (4.51 - 4.54 in) and torque nut to specification.

NOTE:
Dimension "A" does not include thickness of gasket.

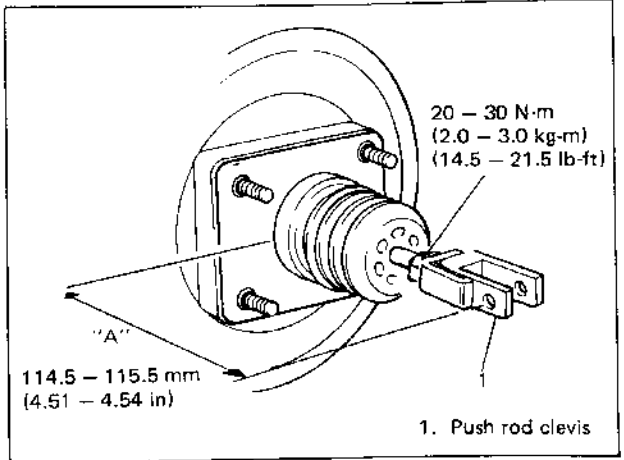


Fig. 5-137

NOTE:
Whenever booster was disassembled, make sure to check clearance between piston rod and master cylinder piston after reassembly. (For details, refer to page 5-56.)

- 15) For installation of booster, see steps 1) to 10) of its INSTALLATION on page 5-49.

BRAKE BOOSTER INSPECTION AND ADJUSTMENT

1. INSPECT BOOSTER INNER PARTS

NOTE:

After disassembly, soak all metal parts in ethyl alcohol. Wipe rubber diaphragm and plastic parts with a clean cloth. Use ethyl alcohol damped cloth to wipe out heavy dirt. Application of much ethyl alcohol especially to rubber parts is prohibited.

RUBBER PARTS

Wipe fluid from rubber parts and carefully inspect each rubber part for cuts, nicks or other damage. These parts are key to air flow control. If there is any question as to serviceability of rubber parts, **REPLACE** them.

METAL PARTS

BADLY DAMAGED ITEMS, OR THOSE WHICH WOULD TAKE EXTENSIVE WORK OR TIME TO REPAIR, SHOULD BE REPLACED. IN CASE OF DOUBT, INSTALL NEW PARTS.

2. INSPECT/ADJUST CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON

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

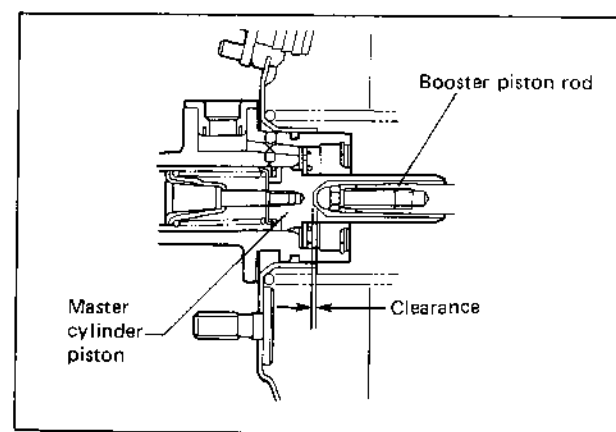


Fig. 5-138

- 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 (E) on master cylinder and push pin until contacts piston.

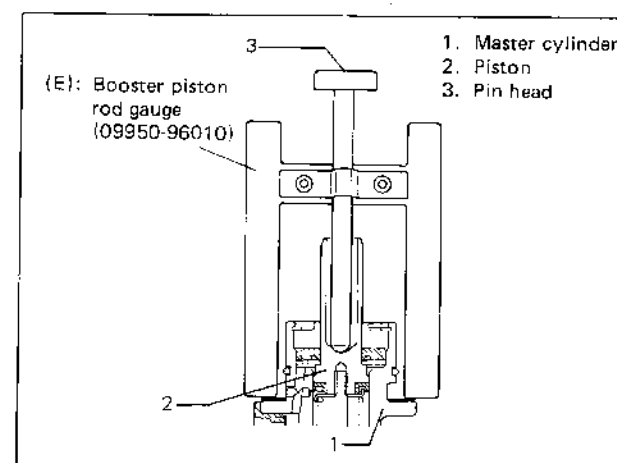


Fig. 5-139

- 2) Turn special tool upside down and place it on booster. Adjust booster piston rod length until rod end contacts pin head.
- 3) Adjust clearance by turning adjusting screw of piston rod.

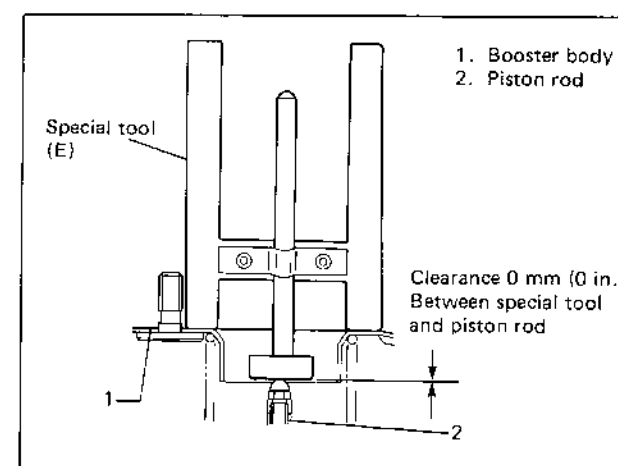


Fig. 5-140

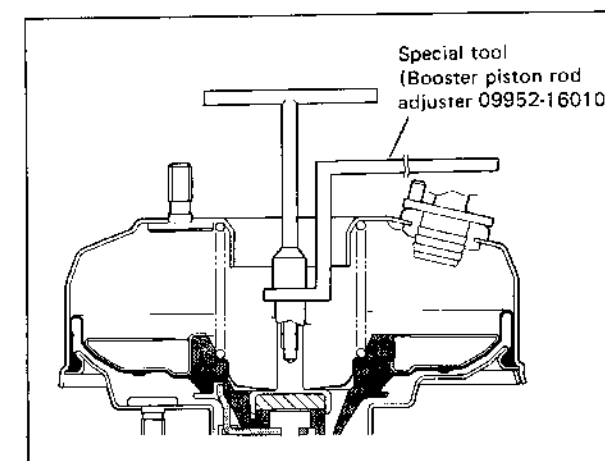


Fig. 5-141

Reference

When adjusted as above, if negative pressure is applied to booster with engine at idle, piston to piston rod clearance should become 0.10 – 0.35 mm (0.004 – 0.013 in.).

3. INSPECT BOOSTER OPERATION

There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE:

For this check, make sure that no air is in hydraulic line.

INSPECTION WITHOUT TESTER

Check Air Tightness

- 1) Start engine.
- 2) Stop engine after running for 1 to 2 minutes.
- 3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.

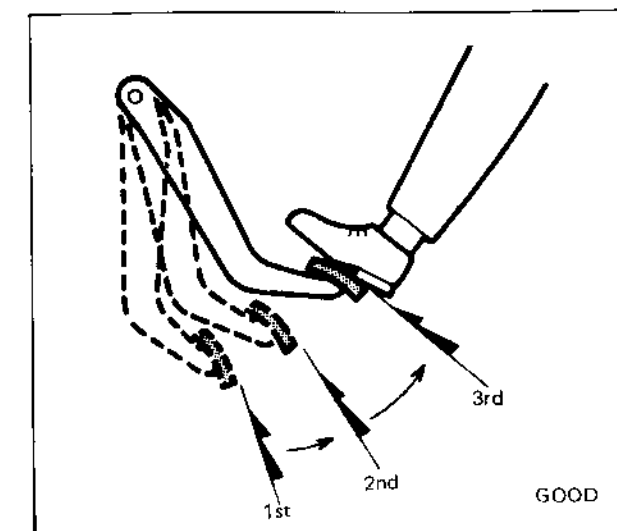


Fig. 5-142

- 4) If pedal travel doesn't change, air tightness isn't obtained.

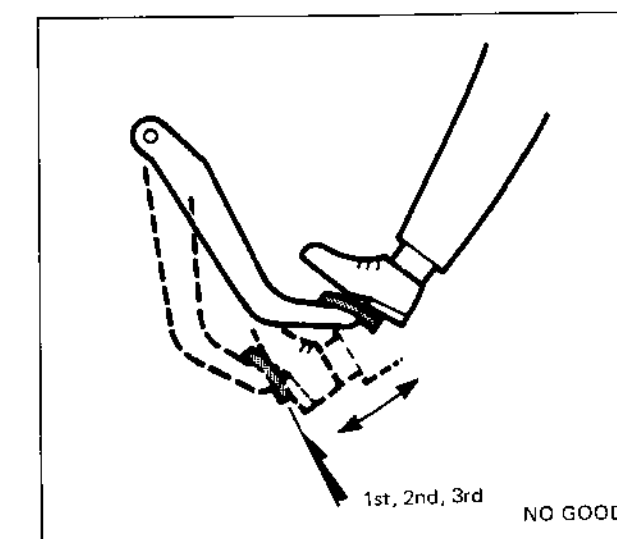


Fig. 5-143

NOTE:

If defective, inspect vacuum lines and sealing parts, and replace any faulty part. When this has been done, repeat the entire test!

Check Operation

1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.

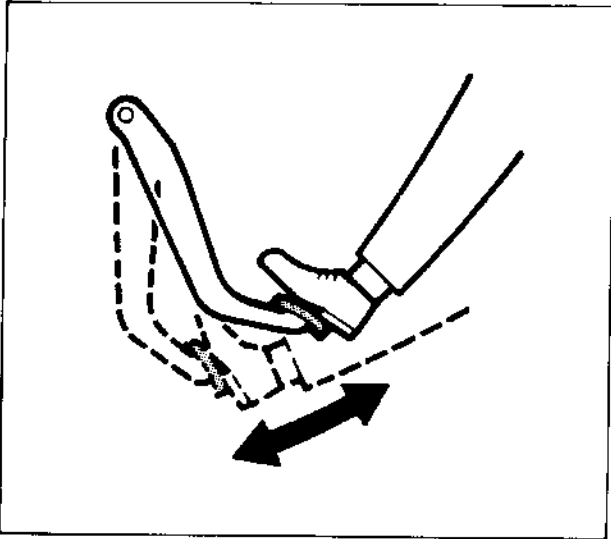


Fig. 5-144

2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.

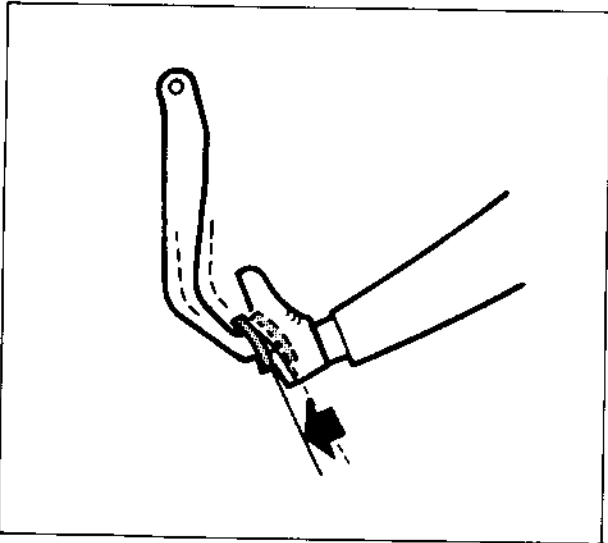


Fig. 5-145

Check Air Tightness Under Load

1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.

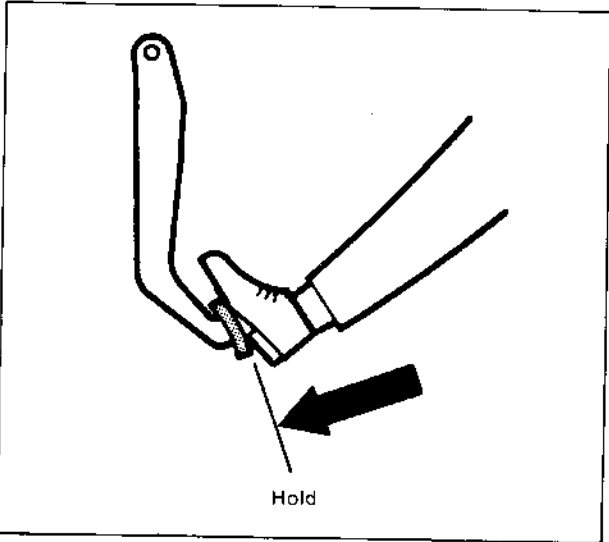


Fig. 5-146

2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

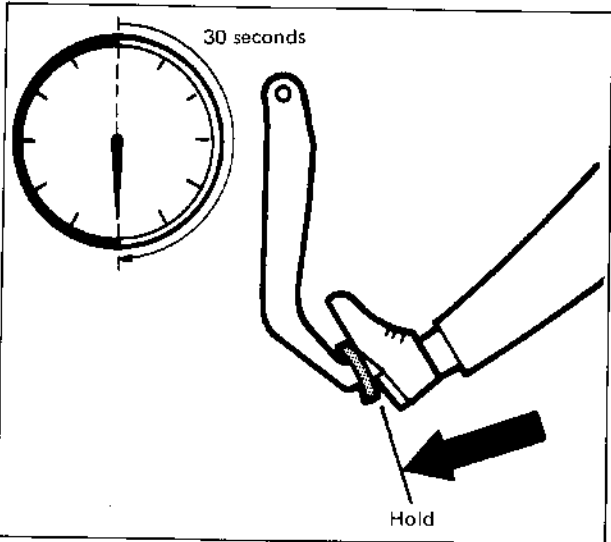


Fig. 5-147

4. BOOSTER INSPECTION TABLE

Part	Inspect For	Corrective Action
1. Booster piston	Cracks, distortion or damage.	Replace.
2. Air valve ass'y (Control valve and spring)	Damaged or worn seal surfaces.	Replace.
3. Reaction disc	Damage or wear.	Replace.
4. Diaphragm, boot and rubber	Damage.	Replace.
5. Piston rod and retainer	Damage, bend or cracks.	Replace.
6. Booster No. 1 & No. 2 body	1. Scratches, scores, pits, dents, or other damage affecting rolling or sealing of diaphragm or other seals. 2. Cracks, damage at ears, damaged threads on studs. 3. Bent or nicked locking lugs. 4. Loose studs.	Replace, unless easily repaired. Replace, unless easily repaired. Replace, unless easily repaired. Replace.
7. Air filters and separator	Dirt.	Replace.

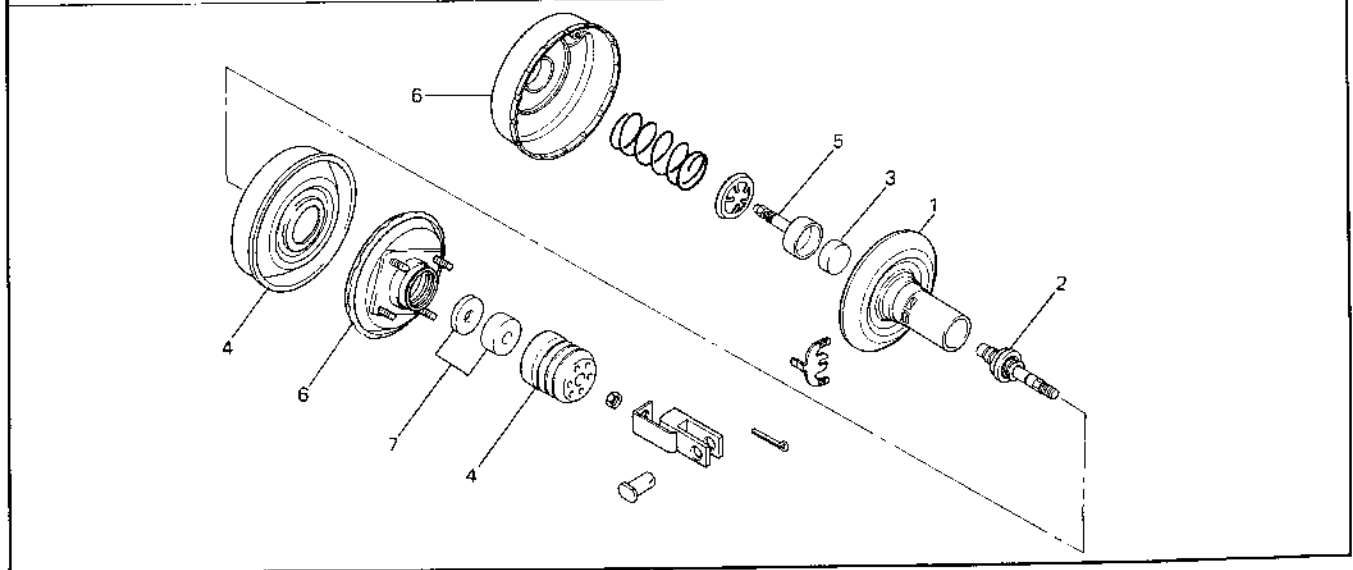


Fig. 5-148

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts		Tightening torque		
		N·m	kg·m	lb·ft
1. Brake caliper pin bolt (Front)		22 – 32	2.2 – 3.2	16.0 – 23.0
2. Brake caliper carrier bolt (Front)		70 – 100	7.0 – 10.0	51.0 – 72.0
3. Flexible hose bolt (Front & rear brake)		20 – 25	2.0 – 2.5	14.5 – 18.0
4. Brake caliper pin bolt (Rear)		22 – 32	2.2 – 3.2	16.0 – 23.0
5. Master cylinder nut or booster nut		10 – 16	1.0 – 1.6	7.5 – 11.5
6. Brake pipe 4-way joint bolt		8 – 12	0.8 – 1.2	6.0 – 8.5
7. Proportioning valve bolt				
8. Brake pipe flare nut		14 – 18	1.4 – 1.8	10.5 – 13.0
9. Brake pedal shaft nut		18 – 28	1.8 – 2.8	13.5 – 20.0
10. Rear spindle nut		150 – 200	15.0 – 20.0	108.5 – 144.5
11. Brake bleeder plug	(Front caliper)	7 – 10	0.7 – 1.0	5.5 – 7.5
	(Rear caliper)			
12. Wheel nut		50 – 70	5.0 – 7.0	36.5 – 50.5
13. Front drive shaft nut		150 – 200	15.0 – 20.0	108.5 – 144.5
14. Brake caliper carrier bolt (Rear)		40 – 60	4.0 – 6.0	29.0 – 43.0

Fig. 5-149

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir tank cap or described in owner's manual of car	• To fill master cylinder reservoir. • To clean and apply to inner parts of master cylinder and brake caliper (front and rear) when they are disassembled.
Silicone grease	Furnished in repair kit	• To apply to brake booster inner parts where application is instructed in this manual.
Rubber grease	Furnished in repair kit	• To apply to rear brake caliper inner parts where to applicate is instructed in this manual.

SPECIAL TOOLS

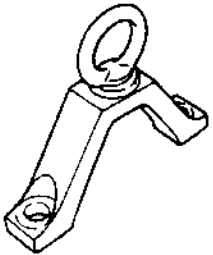
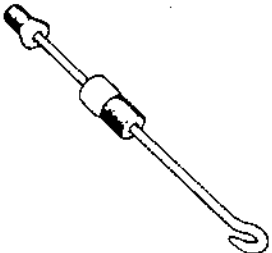
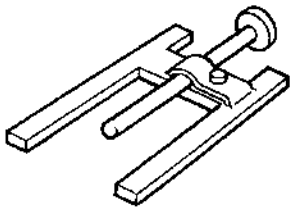
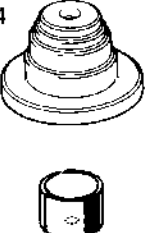
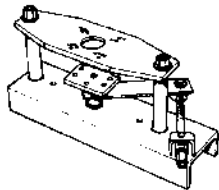
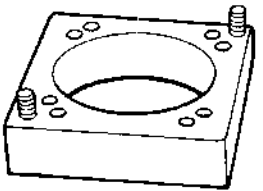
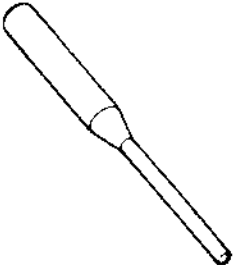
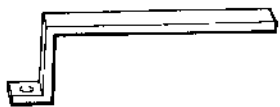
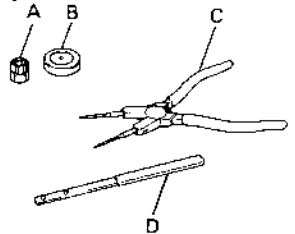
1  09943-17911 Brake drum remover (Front wheel hub remover)	2  09942-15510 Sliding hammer	3  09950-96010 Booster piston rod gauge	4  No. 1 09951-16020 No. 2 09951-18210 Booster No. 2 body Oil seal remover & Installer No. 1, No. 2
5  09950-88210 Booster overhaul tool set	6  09950-78210 Flare nut wrench (10 mm)	7  09951-16010 Booster overhaul attachment	8  09922-85811 Connector pin remover
9  09952-16010 Booster piston rod adjuster	10  A: Spring installer nut (09945-16040) B: Spring seat gauge (09945-16020) C: Snap ring pliers (09945-16010) D: Piston installer (09945-16030)		

Fig. 5-150

SECTION 6

ENGINE

CONTENTS

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ENGINE COOLING	6B-1	ENGINE EMISSION CONTROLS	6J-1
ENGINE FUEL	6C-1	ENGINE EXHAUST	6K-1
ENGINE EFI SYSTEM	6E-1		

GENERAL INFORMATION

STATEMENT ON CLEANLINESS
AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an 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.

- Throughout this manual, the four cylinders of the engine are identified by numbers; No. 1, No. 2, No. 3 and No. 4 counted from crankshaft pulley side to flywheel side as shown in Fig. 6-1.

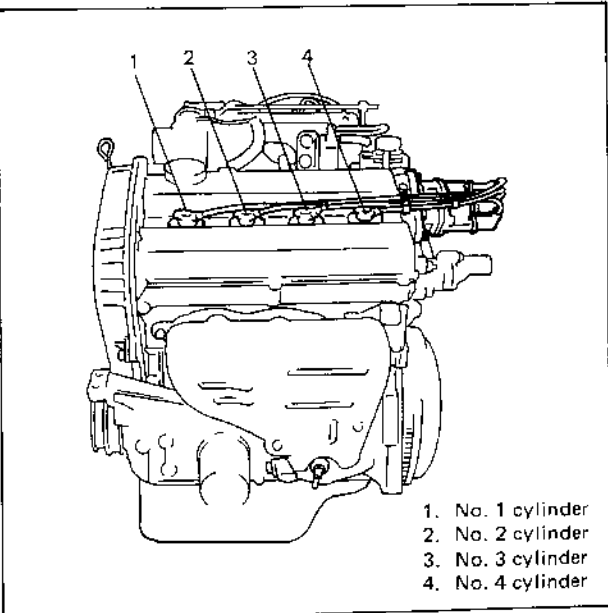


Fig. 6-1 Cylinder Numbers

GENERAL INFORMATION ON ENGINE SERVICE

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

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits. When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.
- Any time the throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.
- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock the lock before disconnection. With spring lock type coupler as shown in Fig. 6-2, push out spring before disconnection, but only within the extent that spring is not deformed. 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.

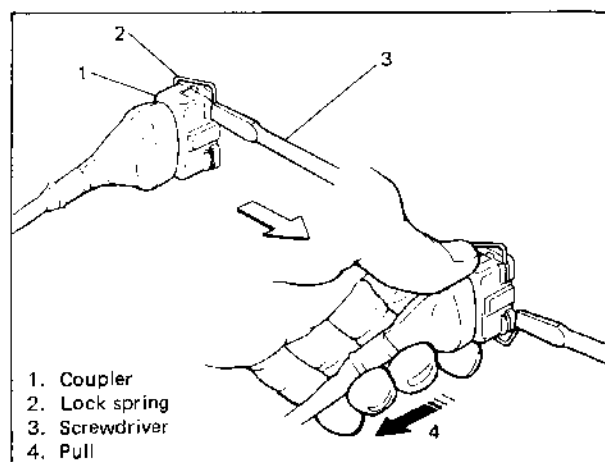


Fig. 6-2 Disconnection of Spring Lock Type Coupler

PRECAUTIONS ON FUEL LINE 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 relieve 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.

- 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 Fig. 6-3 Hose Connection.

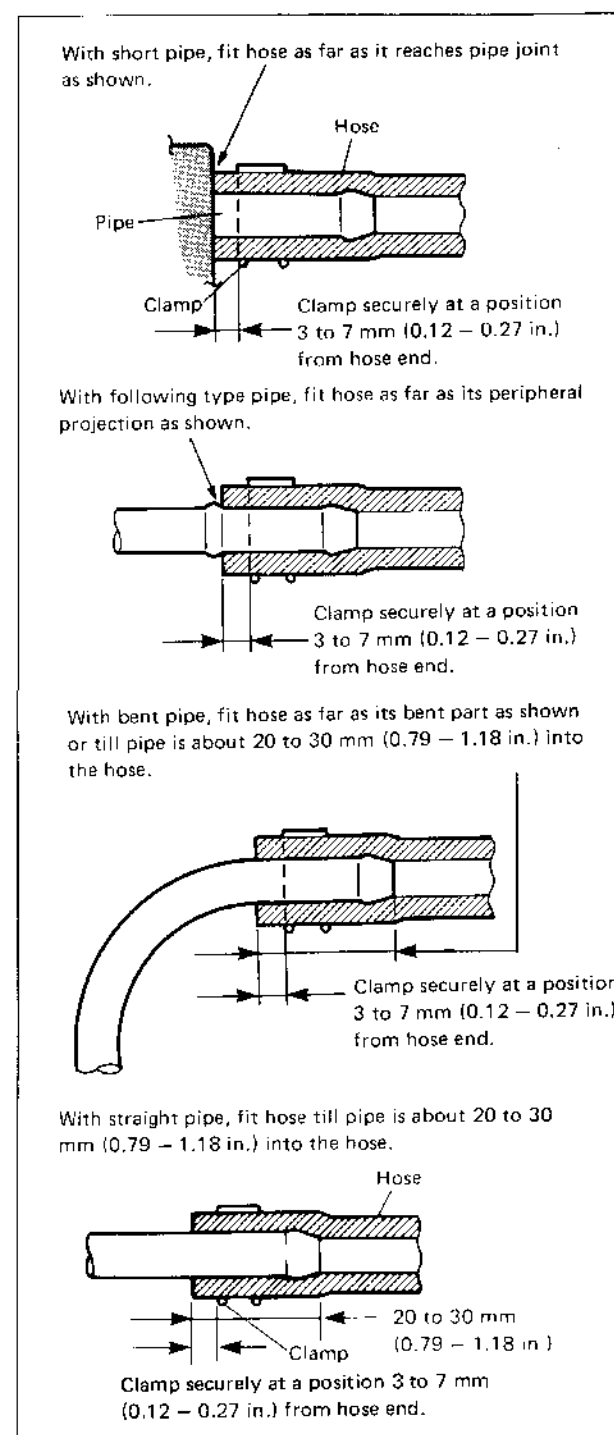


Fig. 6-3 Hose Connection

FUEL PRESSURE RELIEF PROCEDURE

1. Place transmission gear shift lever in "Neutral" (Shift selector lever to "P" range for A/T model), set parking brake, and block drive wheels.
2. Remove main fuse box cover and engine cooling water reservoir from its bracket.

3. Detach main fuse box from body and disconnect coupler from fuel pump relay.

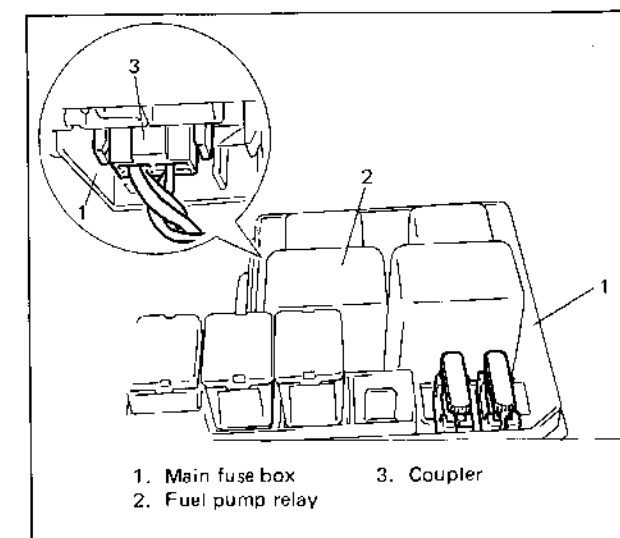


Fig. 6-4 Disconnecting Fuel Pump Relay Coupler

4. Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
5. Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2 — 3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6. Upon completion of servicing, connect coupler to fuel pump relay and fix main fuse box.

ABBREVIATIONS USED IN THIS SECTION

A/C	: Air-Conditioner
A/T	: Automatic Transmission
AFM	: Air Flow Meter
AFS	: Air Flow Sensor
CAS	: Crank Angle Sensor
ECM	: Electronic Control Module
EFI	: Electronic Fuel Injection
EGR	: Exhaust Gas Recirculation
ESA	: Electronic Spark Advance
ISC	: Idle Speed Control
M/T	: Manual Transmission
PCV	: Positive Crankcase Ventilation
REGTS	: Recirculated Exhaust Gas Temperature Sensor
TB	: Throttle Body
TPS	: Throttle Position Sensor
VSV	: Vacuum Switching Valve
WTG	: Water Temperature Gauge
WTS	: Water Temperature Sensor

ENGINE DIAGNOSIS

Condition	Possible Cause	Correction
Hard Starting (Engine cranks OK)	Ignition system out of order	
	• Blown fuse	Repair or replace
	• Faulty spark plug	Clean and adjust plug gap or replace
	• Leaky high-tension cord	Replace
	• Loose connection or disconnection of high-tension cords or lead wires	Repair or replace.
	• Maladjusted signal rotor air gap	Adjust
	• Faulty crank angle sensor (signal generator) in distributor	Replace
	• Faulty power unit	Replace
	• Improper ignition timing	Adjust
	• Faulty ignition coil	Replace
	• Cracked rotor or cap in distributor	Replace
	• Faulty noise suppressor	Replace
	Fuel system out of order	
	• Lack of fuel in fuel tank	Refill
	• Dirty fuel filter	Replace
	• Dirty or clogged fuel hose or pipe	Clean
	• Malfunctioning fuel pump	Replace
	Air intake system out of order	
	• Vacuum leaks from air intake system	Repair or replace
	• Air inhaling between air flow meter and throttle body	Repair or replace
	EFI system out of order	Refer to SECTION 6E
	Low compression	
	• Poor spark plug tightening or faulty gasket	Tighten to specified torque or replace gasket
	• Compression leak from valve seat	Remove cylinder head and lap valves
	• Sticky valve stem	Correct or replace valve and valve guide
	• Weak or damaged valve springs	Replace
	• Compression leak at cylinder head gasket	Repair or replace
	• Sticking or damaged piston ring	Replace
	• Worn piston, ring or cylinder	Replace ring and piston. Rebore or replace cylinder
	Others	
	• Broken valve timing belt	Replace
	• Malfunctioning PCV valve	Replace

Condition	Possible Cause	Correction
Engine has no power	Ignition system out of order	
	• Improper ignition timing	Adjust and check ignition timing advance referring to SECTION 6F
	• Faulty spark plug	Adjust or replace
	• Worn distributor terminals	Dress or replace. Also check rotor
	• Leaks, loose connection or disconnection of high-tension cord	Connect or replace as necessary
	Engine overheating	Refer to "Overheating" section
	Fuel system out of order	
	• Clogged fuel hose or pipe	Clean
	• Dirty or clogged fuel filter	Replace
	Air intake system out of order	
	• Clogged air cleaner element	Clean or replace
	• Vacuum leaks from air intake system	Repair or replace
	• Air inhaling between air flow meter and throttle body	Repair or replace
	EFI system out of order	Refer to SECTION 6E
	Low compression	Previously outlined
	Others	
	• Malfunctioning EGR valve (if equipped)	Check and replace as necessary
	• Dragging brakes	Repair or replace
	• Slipping clutch	Adjust or replace
Improper engine idling or engine fails to idle	Ignition system out of order.	
	• Faulty spark plug	Adjust or replace
	• Leaky or disconnected high tension cord	Connect or replace
	• Worn distributor terminals	Replace
	• Cracked cap in distributor with leakage inside	Replace
	• Improper ignition timing	Adjust and check ignition timing advance refer to SECTION 6F

Condition	Possible Cause	Correction
	Fuel system out of order • Shortage of fuel in fuel tank Air intake system out of order • Clogged air cleaner element • Vacuum leaks from air intake system • Air inhaling between air flow meter and throttle body EFI system out of order Engine overheating Low compression Others • Malfunctioning EGR valve (if equipped) • Malfunctioning PCV valve	Refill Clean or replace Repair or replace Repair or replace Refer to SECTION 6E Refer to "Overheating" section Previously outlined Check and replace as necessary Check and replace as necessary
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all car speeds. Usually most severe when first trying to make car move, as from a stop sign.)	Ignition system out of order • Improper ignition timing • Spark plug faulty or plug gap out of adjustment • Leaky high tension cord Fuel system out of order • Clogged fuel filter, hose or pipe Air intake system out of order • Clogged air cleaner element • Vacuum leaks from air intake system • Air inhaling between air flow meter and throttle body EFI system out of order Engine overheating Low compression Others • Malfunctioning EGR valve (if equipped)	Adjust Replace or adjust gap Replace Clean or replace Repair or replace Repair or replace Refer to SECTION 6E. Refer to "Overheating" section Previously outlined Check and replace as necessary

Condition	Possible Cause	Correction
Surges (Engine power variation under steady throttle or cruise. Feels like car speeds up and down with no change in accelerator pedal.)	Ignition system out of order • Leaky or loosely connected high-tension cord • Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.) • Cracked rotor or cap in distributor • Improper ignition timing Fuel system out of order • Clogged fuel filter • Kinky or damaged fuel hose and lines EFI system out of order Others • Malfunctioning EGR valve (if equipped)	Check and repair or replace Check and clean, adjust or replace Replace Adjust and check ignition timing advance referring to SECTION 6F Replace Check and replace as necessary Refer to SECTION 6E Check and replace as necessary
Excessive detonation (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 • Loose connection of high tension cord • Improper ignition timing Fuel system out of order. • Clogged fuel filter or fuel lines Air intake system out of order • Vacuum leaks from air intake system • Air inhaling between air flow meter and throttle body EFI system out of order Others • Excessive combustion chamber deposits • Malfunctioning EGR valve (if equipped)	Refer to "Overheating" section Replace Connect securely Adjust and check ignition timing advance referring to SECTION 6F Replace or clean Repair or replace Repair or replace Refer to SECTION 6E Remove carbon Check and replace as necessary

Condition	Possible Cause	Correction
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 and check ignition timing advance referring to SECTION 6F Flush, repair or replace Replace with proper grade oil Replace or clean (oil strainer) Replenish Repair or replace Repair Repair or replace Adjust or repair Replace
Poor gasoline mileage.	Fuel system out of order • Fuel leakage from fuel tank and lines Air intake system out of order • Clogged air cleaner element Ignition system out of order • Improper ignition timing • Leaks or loose connection of high-tension cord • Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc..) EFI system out of order Low compression Others • Poor valve seating • Dragging brakes • Slipping clutch • Thermostat out of order • Improper tire pressure • Malfunctioning EGR valve (if equipped)	Repair or replace Clean or replace Adjust and check ignition timing advance referring to SECTION 6F Repair or replace Clean, adjust or replace Refer to SECTION 6E Previously outlined Repair or replace Repair or replace Adjust or replace Replace Adjust Check and replace as necessary

Condition	Possible Cause	Correction
Excessive engine oil consumption	Oil leakage • Loose oil drain plug • Loose oil pan bolts • Deteriorated or broken oil pan sealant • Leaky crankshaft oil seals • Leaky cylinder head cover gasket • Improper tightening of oil filter • Loose oil pressure switch • Blown cylinder head gasket • Leaky camshaft oil seals 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 Remove carbon and replace rings Replace or rebore cylinder, and replace piston Replace piston and ring Reposition ring gap Replace Replace
Low oil pressure	• Not enough oil • Improper oil viscosity • Malfunctioning oil pressure switch • Clogged oil strainer • Functional deterioration of oil pump • Worn oil pump relief valve • Excessive clearance in various sliding parts	Replenish Use oil of proper viscosity Replace Clean Replace Replace Replace worn parts
Engine noise Note: Before checking 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	Replace Replace Replace Replace Tighten to specification Rebore or replace cylinder Replace piston and ring

SECTION 6A

ENGINE MECHANICAL

CONTENTS

Condition	Possible Cause	Correction
	Connecting rod noise • Worn rod bearing • Worn crank pin • Loose connecting rod nuts • Low oil pressure	Replace Repair by grinding or replace crankshaft Tighten to specification Previously outlined
	Crankshaft noise • Low oil pressure • Worn bearing • Worn crankshaft journal • Loose bearing cap bolts • Excessive crankshaft thrust play	Previously outlined Replace Repair by grinding, or replace crankshaft Tighten to specification Replace thrust bearing

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NOTE:
In this section, "EGR system (EGR valve, EGR modulator, VSV, REGTS and vacuum hoses)" appears in some description and illustrations but note that not all cars have this system. It is installed in the California spec. model.

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in-line 4 cylinders, 4 stroke cycle gasoline unit with its D.O.H.C. (Double Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration. Two camshafts (intake and exhaust sides), mounted over the cylinder head, are driven by

crankshaft by way of the timing belt and each of them opens and closes its valve via the hydraulic valve lash adjuster.

As two intake valves and two exhaust valves are installed to the cylinder head of each cylinder, there are 16 valves in all.

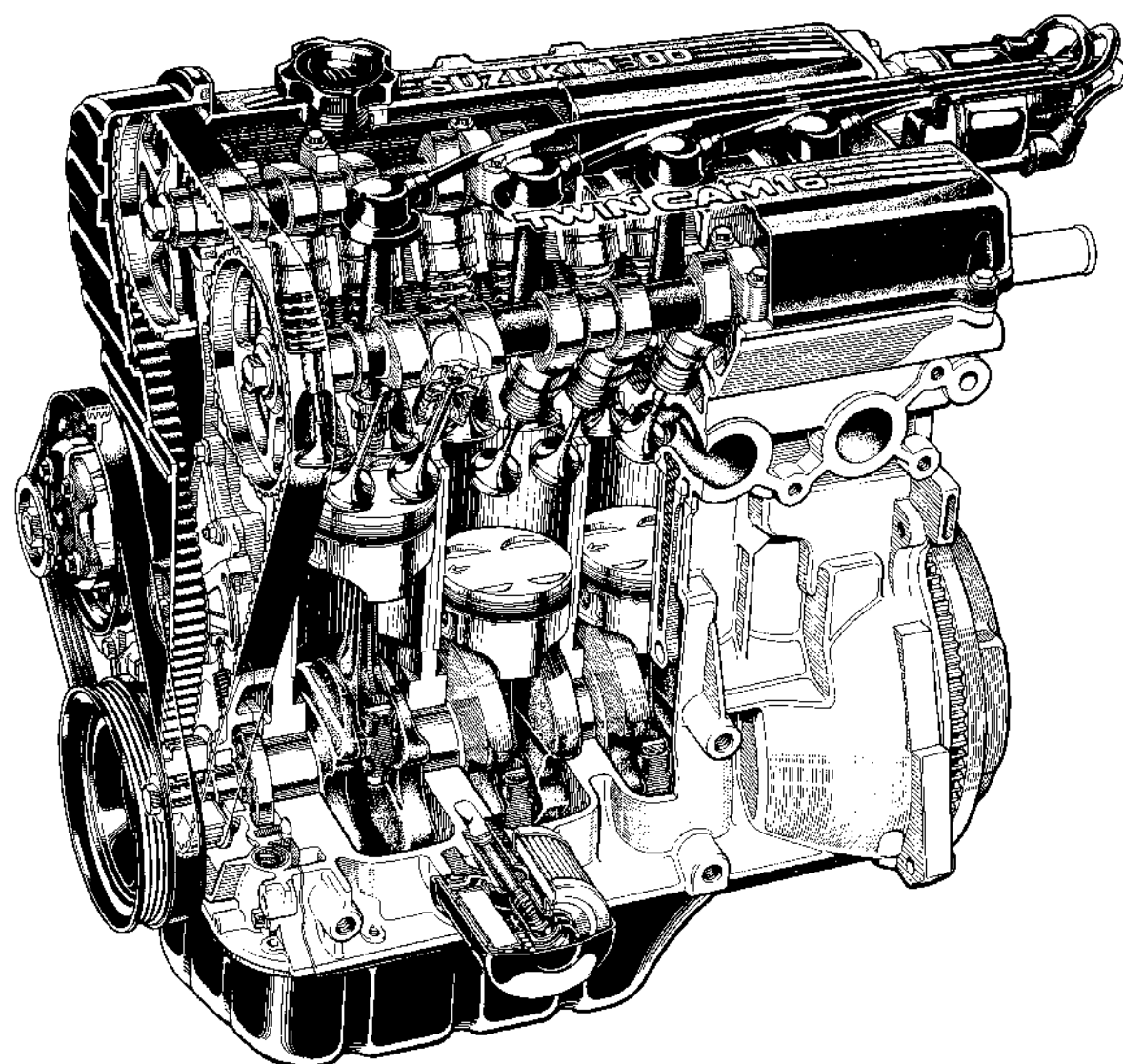


Fig. 6A-1 Engine Construction

ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.

Oil is drawn up through oil pump strainer and passed through pump to oil filter.

The filtered oil flows into two paths in cylinder block.

In one path, oil reaches crankshaft journal bearings.

Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall.

In another path, oil goes up to cylinder head and lubricates camshaft journals and hydraulic valve lash adjusters, etc., passing through oil gallery in cylinder head wall.

An oil relief valve is provided on oil pump. This valve starts relieving oil pressure when the pressure grows over about 4.5 kg/cm² (64 psi, 450 kPa). Relieved oil drains back to oil pan.

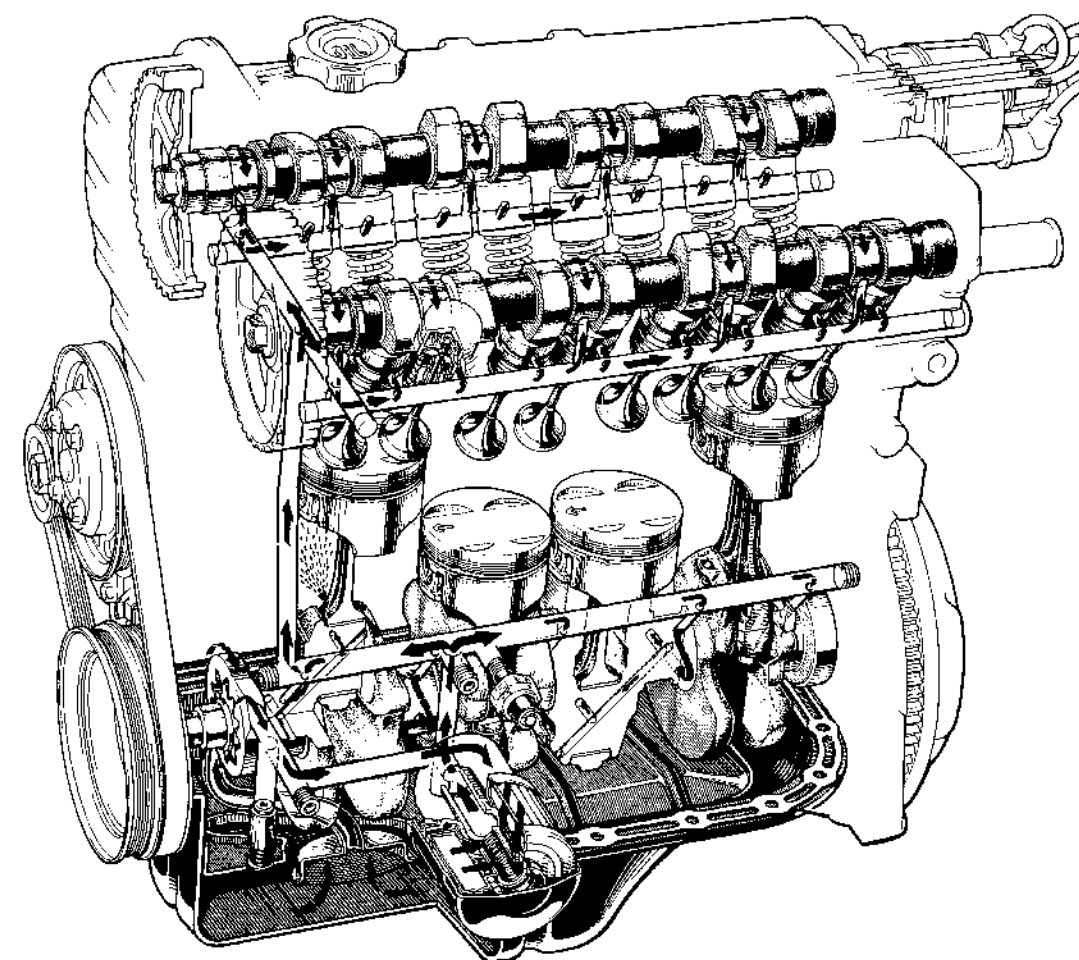


Fig. 6A-2 Engine Lubrication

CYLINDER BLOCK

The cylinder block is made of cast aluminum alloy and has 4 cylinders arranged "In-Line". A cylindrical cast iron sleeve is installed in each cylinder.

CRANKSHAFT AND MAIN BEARINGS

A monoblock crankshaft made of forged steel is supported by 5 main bearings which are of precision insert type. Four crank pins on the crankshaft are positioned 180° apart.

PISTONS, RINGS, PISTON PINS AND CONNECTING RODS

The piston is cast aluminum alloy, and has two compression rings and one oil ring.

Among two compression rings (top and 2nd rings), 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. The piston pin is offset 0.5 mm towards the major thrust side.

This allows a gradual change in thrust pressure against the cylinder wall as the piston travels its path. 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 HEAD, VALVE TRAIN AND HYDRAULIC VALVE LASH ADJUSTER

The cylinder head is made of cast aluminum alloy and has four combustion chambers arranged in-line. The combustion chamber is pent-roof 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 belt is mounted on the cylinder head. Each of them has eight cams and they operate the intake valves and exhaust valves respectively via the hydraulic valve lash adjuster.

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 changes and thus the bucket body, plunger and body, substantially as one unit, push down the valve stem to open the valve.
3. When pushing 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.

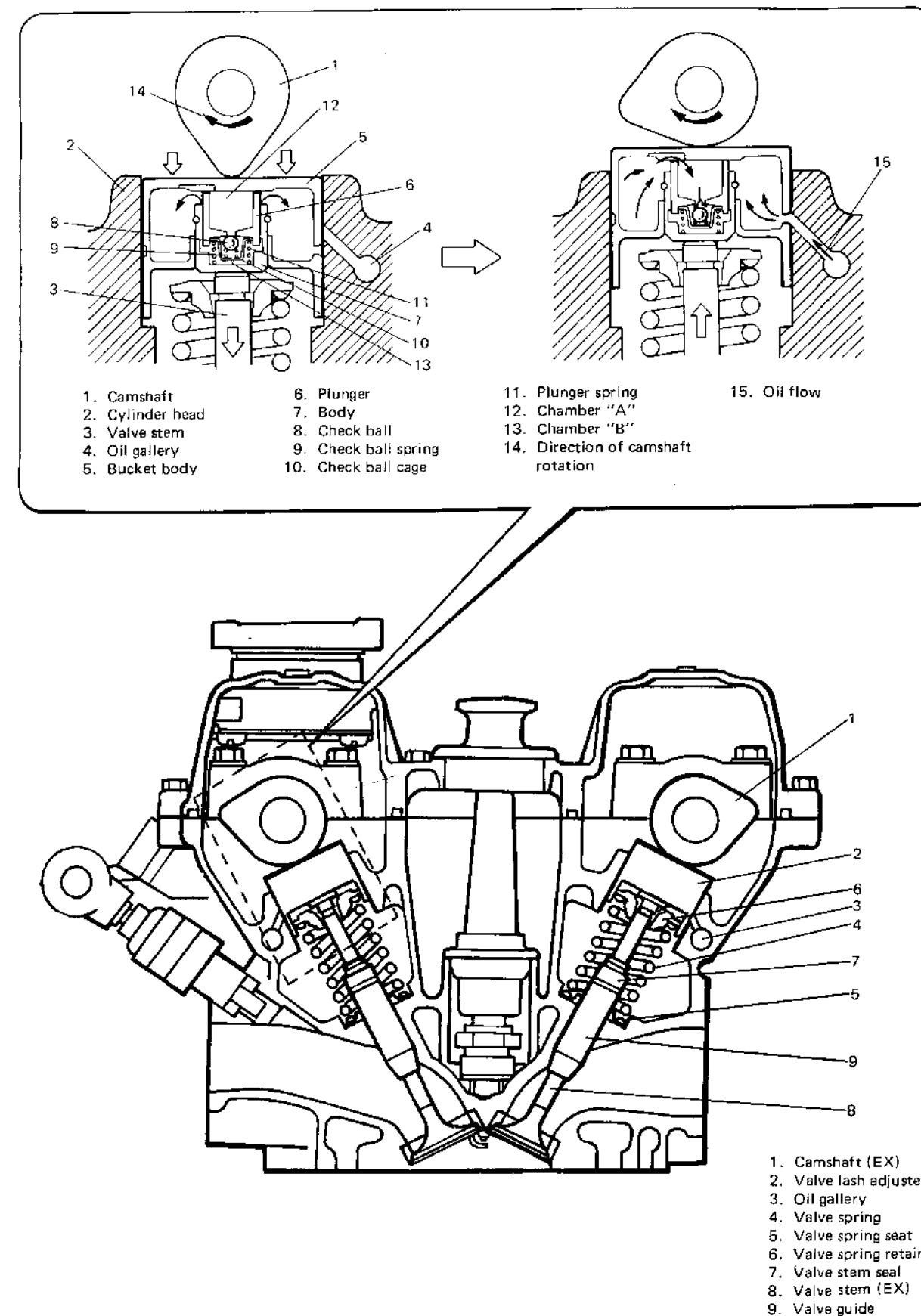


Fig. 6A-3 Operation of Hydraulic Valve Lash Adjuster

ON CAR SERVICE

COMPRESSION CHECK

Check compression pressure on all four cylinders as follows:

- 1. Warm up engine.
- 2. Stop engine after warming up.
- 3. Remove all spark plugs.
- 4. Remove 15A fuse for main relay shown in figure below.

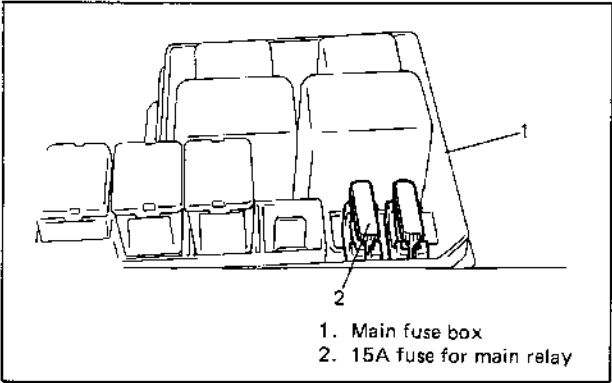


Fig. 6A-4 Removing 15A Fuse for Main Relay

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

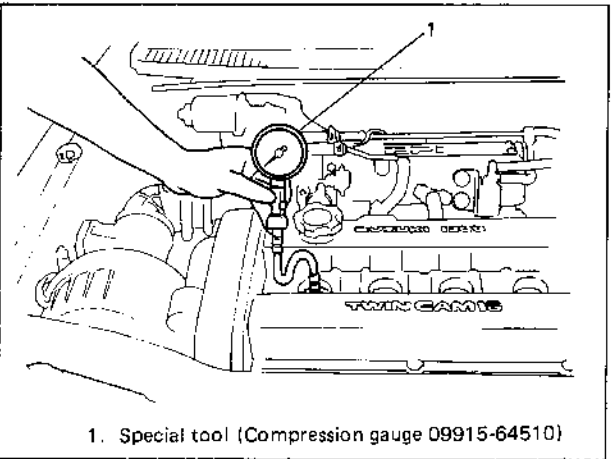


Fig. 6A-5 Installing Compression Gauge

- 6. Disengage clutch (to lighten starting load on engine) for M/T model, and depress accelerator pedal all the way to make throttle valve full-open.
- 7. Crank engine with fully charged battery, and read the highest pressure on compression gauge.

	Compression pressure
Standard	14.5 kg/cm ² (206.2 psi, 1450 kPa)/250 r/min or higher
Limit	11.0 kg/cm ² (156.4 psi, 1100 kPa)/250 r/min or higher
Max. difference between any two cylinders	1.0 kg/cm ² (14.2 psi, 100 kPa)

- 8. Carry out steps 5 through 7 on each cylinder to obtain four readings.
- 9. After checking, install 15A fuse, install spark plugs.

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

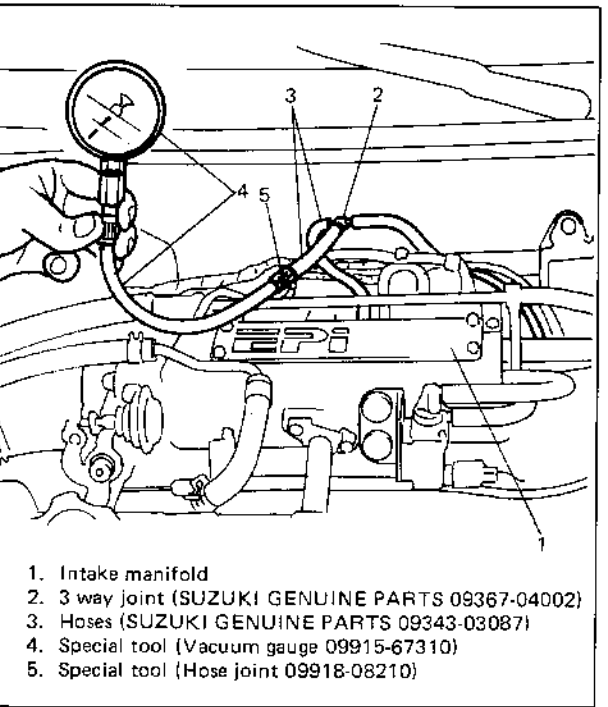


Fig. 6A-6 Installing Vacuum Gauge

- 3. Run engine at specified idle speed (see section 6E), and read vacuum gauge. Vacuum should be within following specification.

Vacuum specification	40 – 50 cmHg (15.7 – 19.7 in.Hg) at specified idling speed

- 4. After checking, connect vacuum hose.

OIL PRESSURE CHECK

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

- 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 the table in Section 0B.
- Oil leaks.
If leak is found, repair it.

- 1. Using special tool (Oil filter wrench), remove oil filter.
- 2. After removing oil filter, remove oil pressure switch from cylinder block.

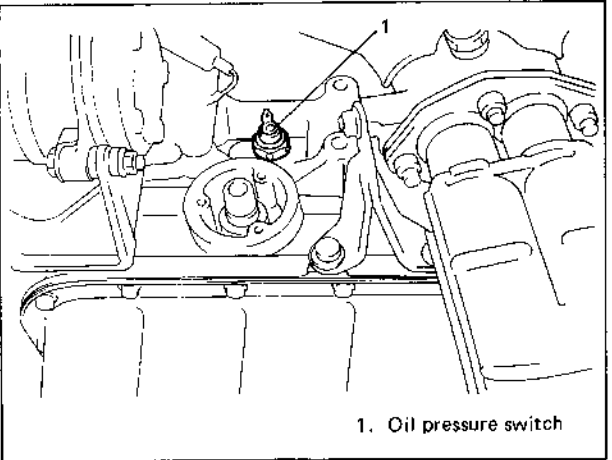


Fig. 6A-7 Oil Pressure Switch

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

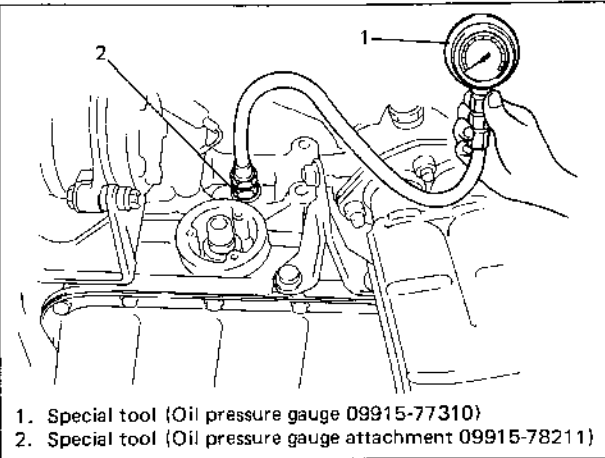


Fig. 6A-8 Oil Pressure Gauge Installation

- 4. Reinstall oil filter.
- 5. Start engine and warm it up to normal operating temperature.
- 6. After warming up, raise engine speed to 3,000 r/min and measure oil pressure.

Oil pressure specification	3.6 – 4.4 kg/cm ² 51.2 – 62.5 psi at 3,000 r/min (rpm)

- 7. After checking oil pressure, stop engine and remove oil filter and oil pressure gauge.
- 8. Before reinstalling oil pressure switch, be sure to wrap its screw threads with a sealing tape and tighten switch to specified torque.

Tightening torque for oil pressure switch	N·m	kg·m	lb·ft
	12 – 15	1.2 – 1.5	9.0 – 10.5

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

- 9. After oiling oil filter "O" ring (rubber gasket), screw oil filter on oil filter stand by hand until filter "O" ring contacts mounting surface.

CAUTION:
To tighten oil filter properly, it is important to accurately identify the position where filter "O" ring first contacts mounting surface.

10. Tighten filter $3/4$ (270°) turn from the point of contact with mounting surface using an oil filter wrench.

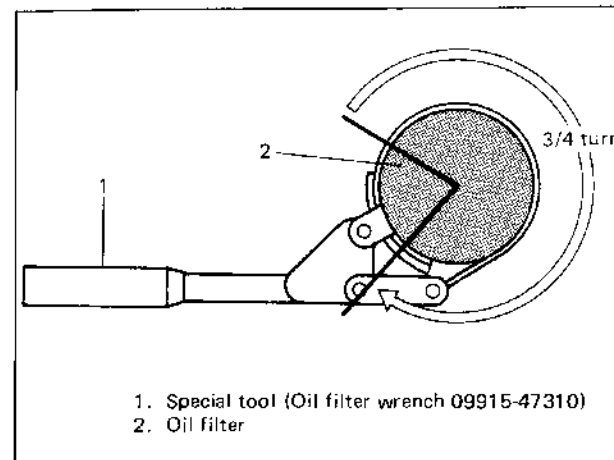


Fig. 6A-9 Tightening Oil Filter

CAUTION:

To prevent oil leakage, make sure that oil filter is tight, but do not overtighten it.

11. After installing oil filter, start engine and check oil filter for oil leakage.

AIR CLEANER ELEMENT

This air cleaner element is of dry type. Remember that it needs cleaning according to following procedure.

REMOVE OR DISCONNECT

1. Air cleaner assembly with AFM from AFM outlet hose and air cleaner bracket.

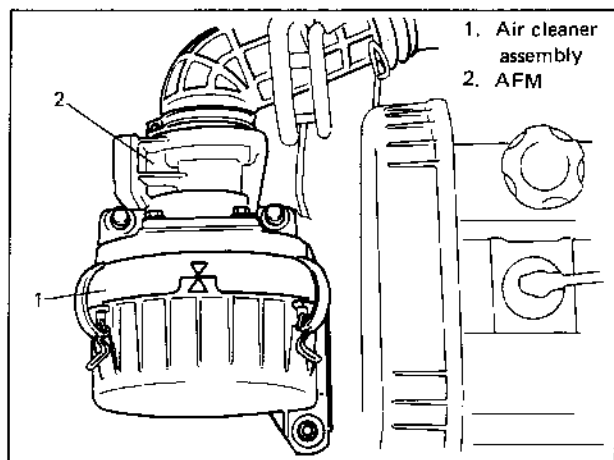


Fig. 6A-10 Removing Air Cleaner Assembly

2. Air cleaner element.

INSPECT

Check air cleaner element for dirt.

CLEAN

Blow off dust by using compressed air from air outlet side of element.

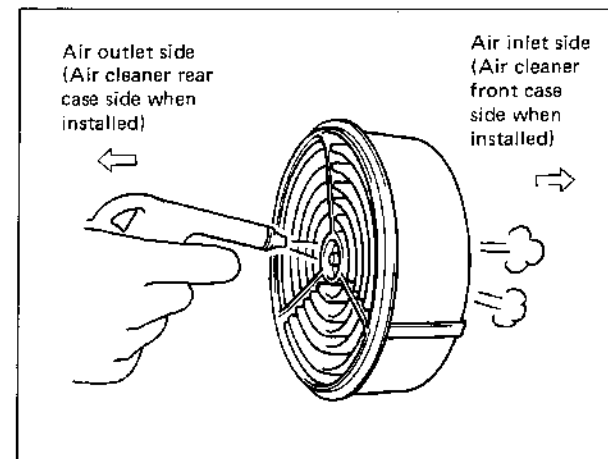


Fig. 6A-11 Cleaning Air Cleaner Element

INSTALL OR CONNECT

1. Air cleaner element to rear case.
2. Air cleaner front case, aligning embossed mark on it with another on rear case.
3. Air cleaner assembly with AFM to air cleaner bracket.

At the same time, be sure to fit air cleaner nozzle over resonator nozzle. Also, use care so that electric wires are not caught between air cleaner case and bracket.

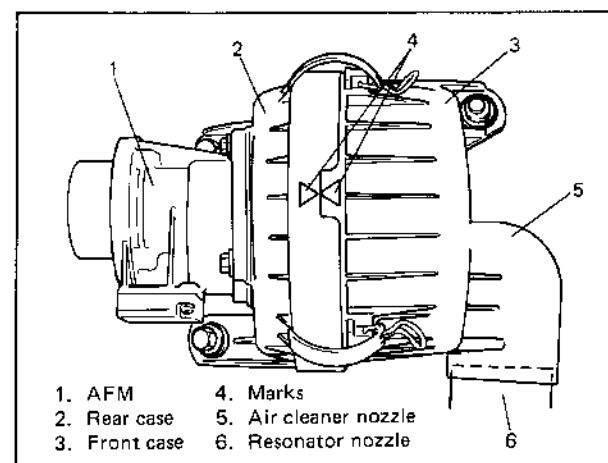


Fig. 6A-12 Installing Air Cleaner Assembly

4. AFM outlet hose.
Clamp it securely.

CYLINDER HEAD COVER**REMOVE OR DISCONNECT**

1. Negative cable at battery.
2. High-tension cords from cylinder head cover.
3. PCV hose and breather hose from cylinder head cover.
4. Below indicated bolt only among timing belt outside cover bolts.

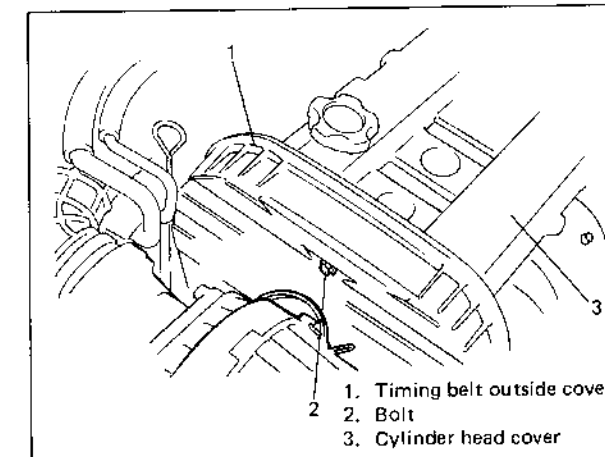


Fig. 6A-13 Removing Cylinder Head Cover

5. Cylinder head cover from cylinder head.

INSTALL OR CONNECT

1. Cylinder head cover gasket to head cover.
Before installing gasket, check it for deterioration or damage, and replace as necessary.
2. Cylinder head cover to cylinder head.
Tighten bolts of cylinder head cover by following sequence as indicated in figure below. Tighten a little at a time and evenly among bolts and repeat tightening sequence two to three times before they are tightened to specified torque.

Tightening torque for cylinder head cover bolt		N·m	kg·m	lb·ft
	No. 1	5 - 7	0.5 - 0.7	4.0 - 5.0
	No. 2	8 - 12	0.8 - 1.2	6.0 - 8.5

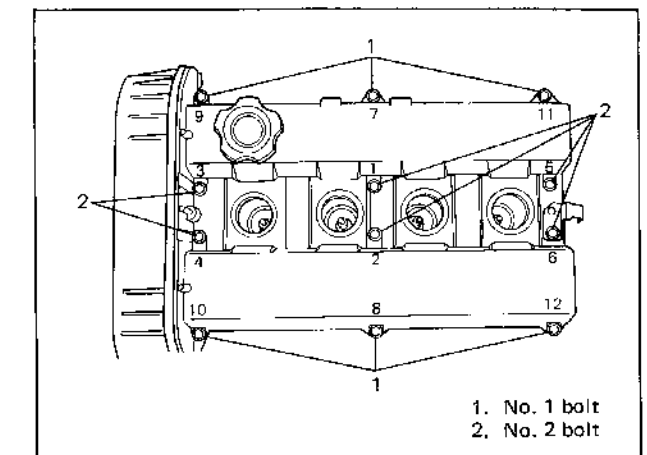


Fig. 6A-14 Tightening Sequence of Head Cover Bolts

3. Timing belt outside cover bolt.
Tighten bolt to specified torque.

Tightening torque for timing belt outside cover bolt	N·m	kg·m	lb·ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

4. PCV hose and breather hose.
Clamp breather hose securely.
5. High-tension cords.
6. Negative cable at battery.

THROTTLE BODY AND INTAKE MANIFOLD

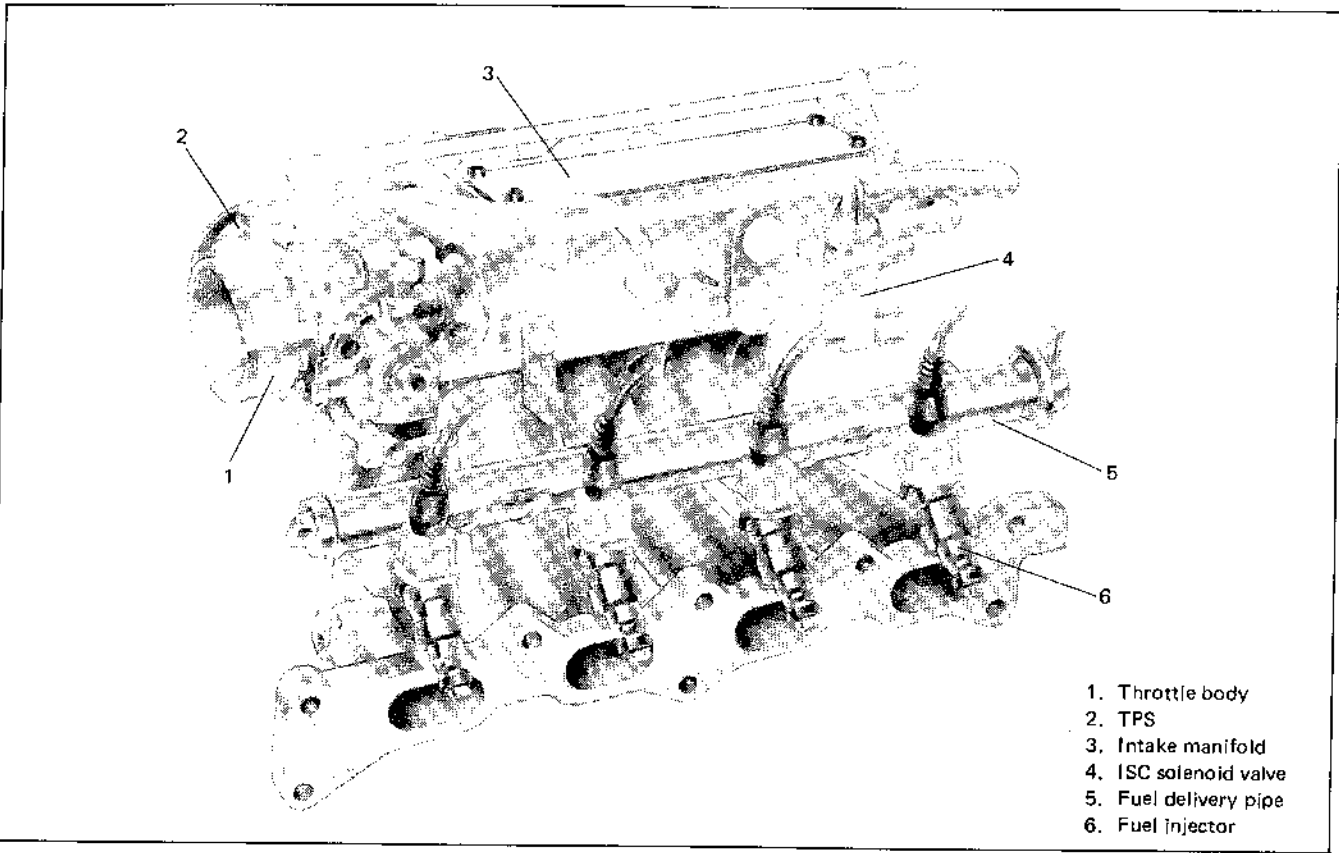


Fig. 6A-15 Throttle Body and Intake Manifold

REMOVE OR DISCONNECT

1. Negative cable at battery.
2. Drain cooling water.

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.

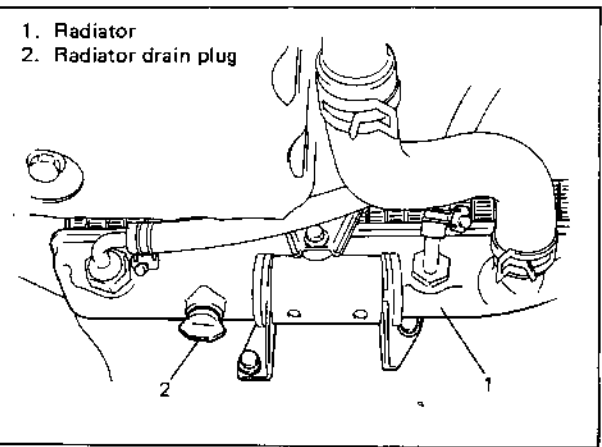


Fig. 6A-16 Radiator Drain Plug

3. Following hoses:
 - AFM outlet hose.
 - PCV hose.
 - Cylinder head cover breather hose.
 - A/C VSV hoses (if equipped).
 - Brake booster hose.
 - Canister purge hose from canister
 - Vacuum hose from fuel pressure regulator.
 - Vacuum hose from EGR valve (if equipped).
 - EGR modulator hose (if equipped).
4. Following electric wires:
 - REGTS (if equipped).
 - ISC solenoid valve.
 - Canister purge VSV.
 - EGR VSV (if equipped).
 - TPS.
 - Ground wires from intake manifold.
5. Accelerator cable from throttle valve lever and its bracket.
6. Engine cooling water hoses from air valve and throttle body respectively.
7. Generator adjusting arm stiffener.

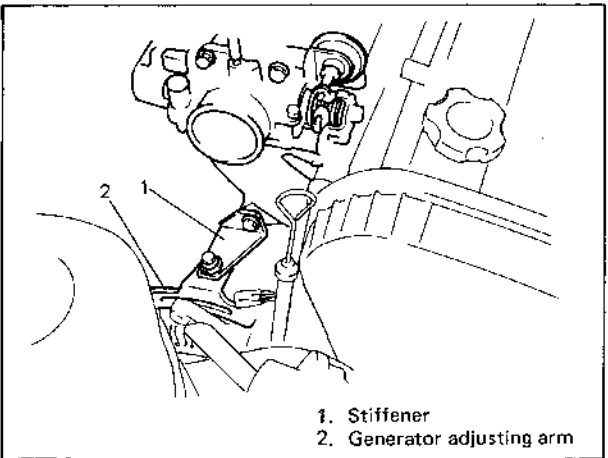


Fig. 6A-17 Removing Stiffener

8. Intake manifold bracket.

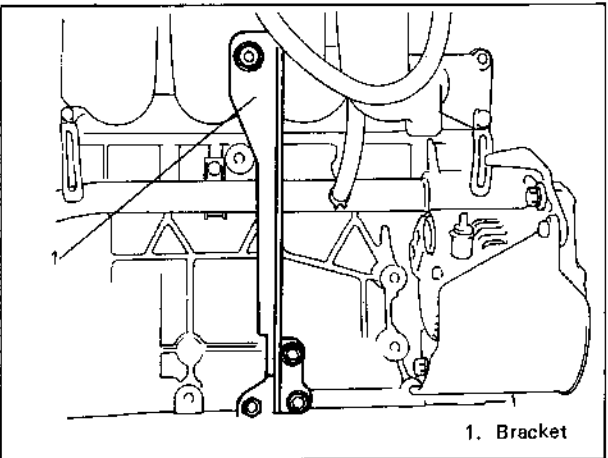


Fig. 6A-18 Removing Bracket

9. Intake manifold with throttle body from cylinder head.

INSTALL OR CONNECT

1. Intake manifold gasket to cylinder head. Use a new gasket.
2. Intake manifold with throttle body to cylinder head.
 - Install clamps as shown in Fig. 6A-19, and tighten bolts and nuts to specification.

Tightening torque for bolts and nuts	N·m	kg·m	lb·ft
	18 - 28	1.8 - 2.8	13.5 - 20.0

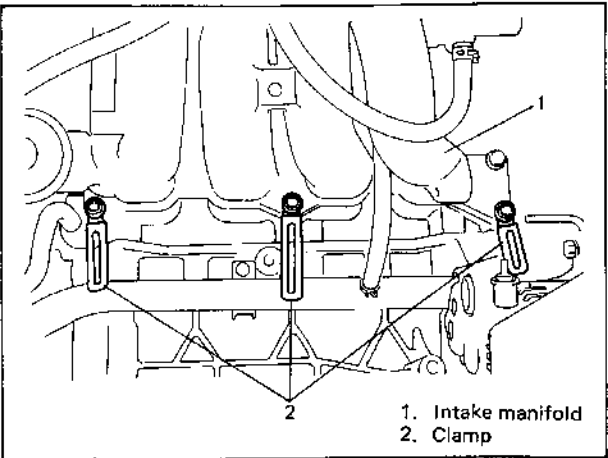


Fig. 6A-19 Clamps

3. Intake manifold bracket.
Tighten bolts and nut to specified torque.

Tightening torque for bracket bolts & nut	N·m	kg·m	lb·ft
	40 - 60	4.0 - 6.0	29.0 - 43.0

4. Generator adjusting arm stiffener.
Tighten bolts to specified torque.

Tightening torque for stiffener bolts	N·m	kg·m	lb·ft
	18 - 28	1.8 - 2.8	13.5 - 20.0

5. Engine cooling water hoses to throttle body and air valve.
6. Accelerator cable to throttle valve lever and its bracket.
Adjust accelerator cable play to specification according to description in Section 6E.
7. Electric wires.
8. Air and vacuum hoses.
9. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
10. Refill cooling system.
11. Negative cable at battery.
12. Upon completion of installation, start engine and check vacuum leaks and engine cooling water leaks.

EXHAUST MANIFOLD

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

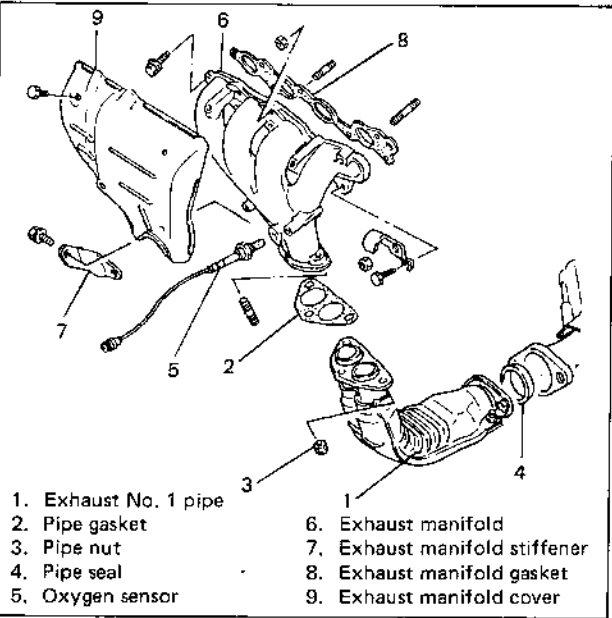


Fig. 6A-20 Exhaust Manifold, No. 1 Pipe, etc.

REMOVE OR DISCONNECT

- 1. Negative cable at battery.
- 2. Oxygen sensor coupler.
Release its wire from clamps.
- 3. Exhaust manifold cover.
- 4. Exhaust manifold stiffener bolt.
- 5. Exhaust No. 1 pipe nuts.

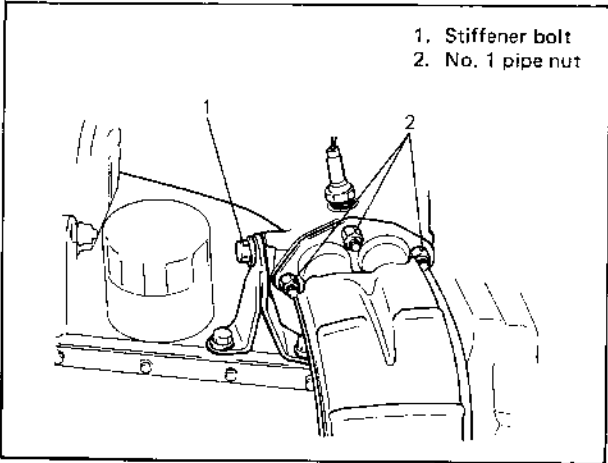


Fig. 6A-21 Stiffener Bolt and Pipe Nuts

- 6. Exhaust manifold and its gasket from cylinder head.

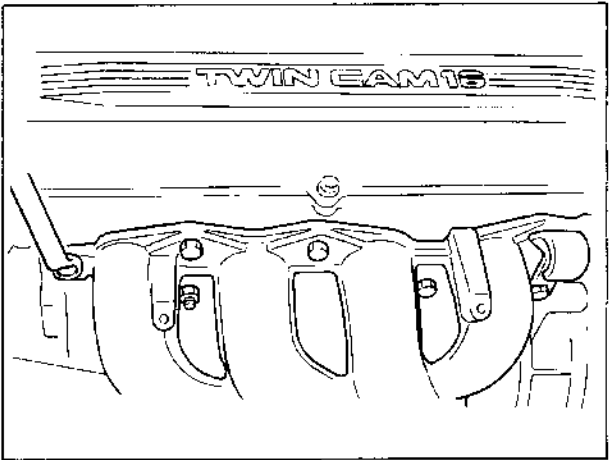


Fig. 6A-22 Removing Exhaust Manifold

INSTALL OR CONNECT

- 1. Manifold gasket to cylinder head.
Before installing gasket, check it for deterioration or damage, and replace as necessary.
- 2. Exhaust manifold.
Tighten manifold bolts and nuts to specified torque.

Tightening torque for bolts and nuts	N·m	kg·m	lb·ft
	18 - 28	1.8 - 2.8	13.5 - 20.0

- 3. Pipe gasket and exhaust No. 1 pipe.
Before installing pipe gasket, check it for deterioration or damage, and replace as necessary.
Tighten pipe nuts to specified torque.

Tightening torque for No. 1 pipe nut	N·m	kg·m	lb·ft
	40 - 60	4.0 - 6.0	29.0 - 43.0

- 4. Exhaust manifold stiffener bolt.

Tightening torque for stiffener bolt	N·m	kg·m	lb·ft
	40 - 60	4.0 - 6.0	29.0 - 43.0

- 5. Exhaust manifold cover.
- 6. Oxygen sensor coupler.
Clamp its wire securely.
- 7. Negative cable at battery.
- 8. Check exhaust system for exhaust gas leakage.

TIMING BELT AND BELT TENSIONER

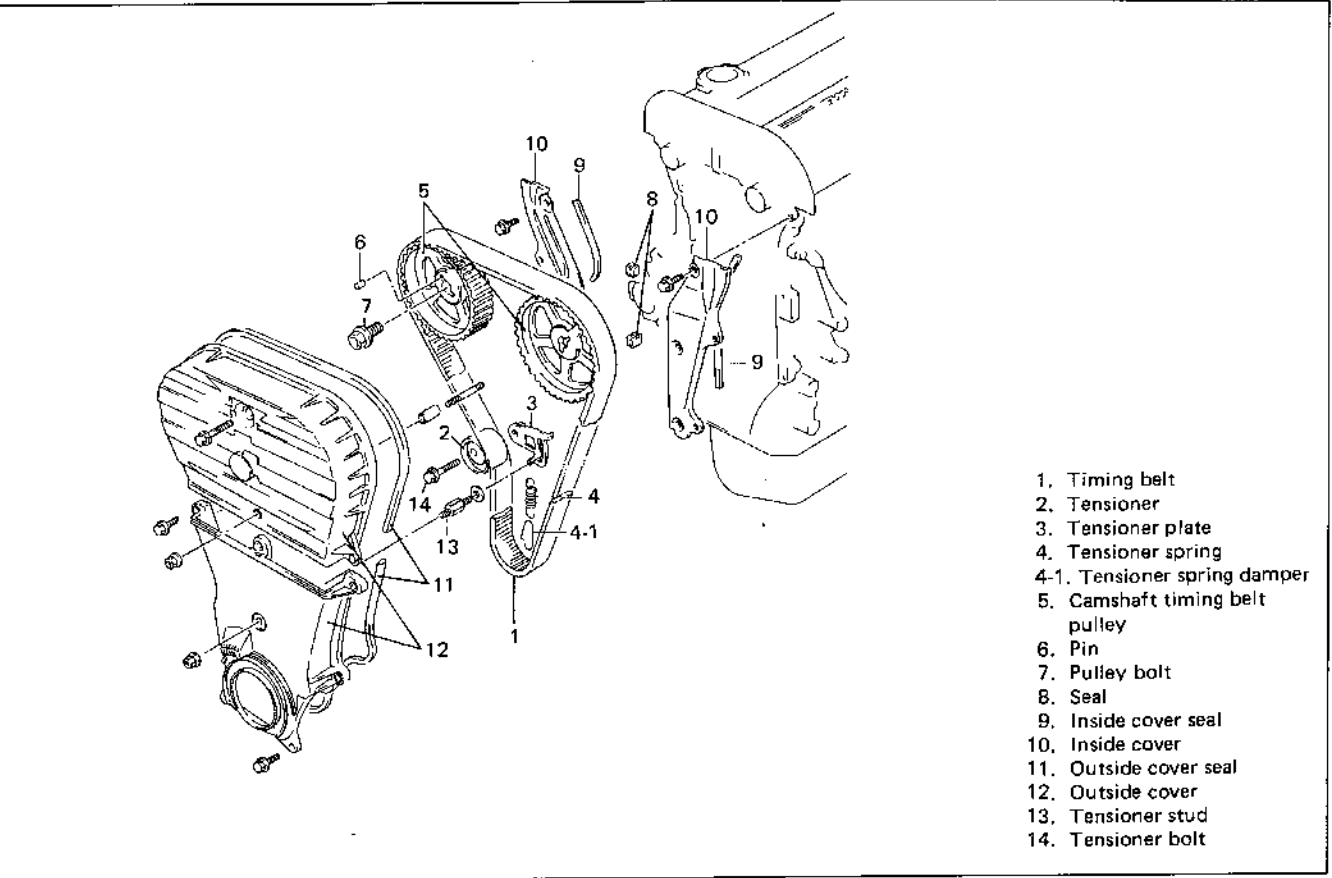


Fig. 6A-23 Timing Belt, Tensioner, Timing Belt Cover, Camshaft Timing Belt Pulley, etc.

REMOVE OR DISCONNECT

- 1. Negative cable at battery.
- 2. Air cleaner assembly with AFM and AFM outlet hose.
- 3. Air cleaner bracket.
- 4. Raise car.
- 5. Fender apron extension on right side. Remove clip after pushing center pin. But do not push it too far in, or it will fall off into fender.

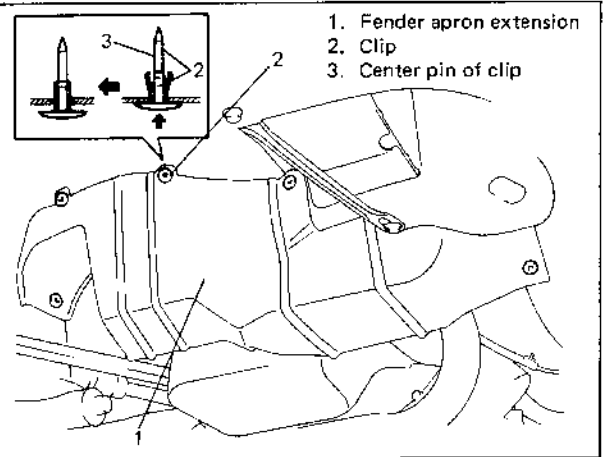


Fig. 6A-24 Removing Fender Apron Extension

- 6. Water pump belt and its pulley.
Loosen generator pivot bolts and its adjusting bolt and remove water pump belt.
- 7. Crankshaft pulley.
LOCK crankshaft to loosen crankshaft timing belt pulley bolt and crankshaft pulley bolts, as shown in Fig. 6A-25 or 6A-26.

NOTE:
To remove crankshaft pulley with engine assembly mounted on body, it is necessary to remove crankshaft timing belt pulley bolt. But if engine assembly is dismantled, bolt needs not be removed.

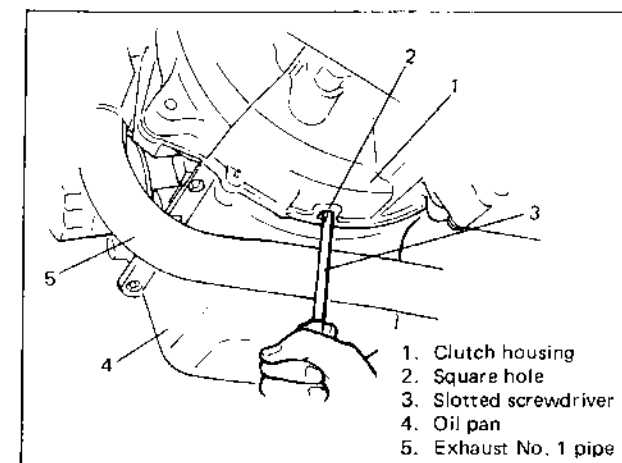


Fig. 6A-25 Locking Crankshaft for M/T Model

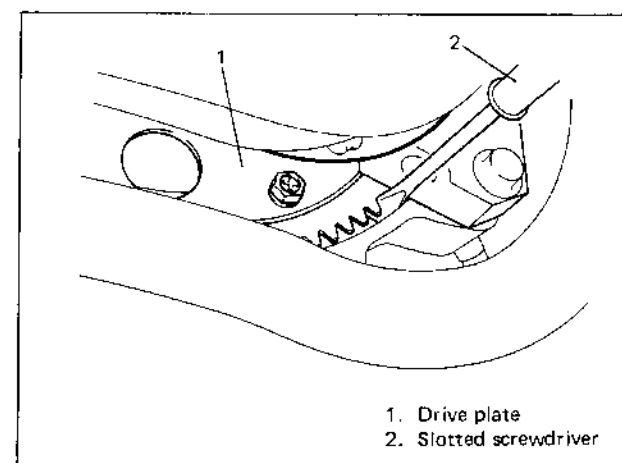


Fig. 6A-26 Locking Crankshaft for A/T Model

Using special tool (5 mm hexagon wrench bit), loosen crankshaft pulley bolts.

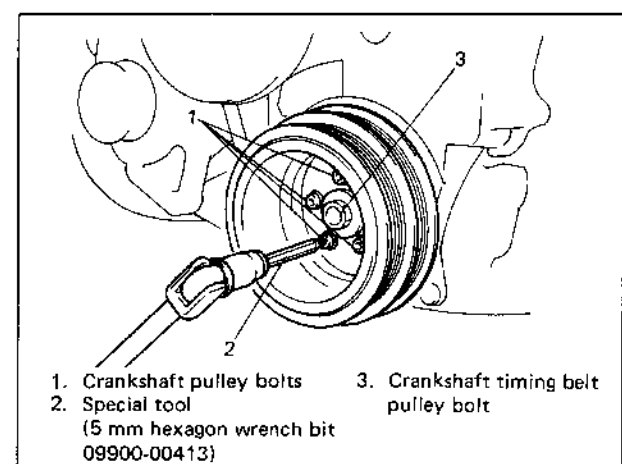


Fig. 6A-27 Loosening Crankshaft Pulley Bolt

Using special tool (17 mm socket), remove crankshaft timing belt pulley bolt and crankshaft pulley.

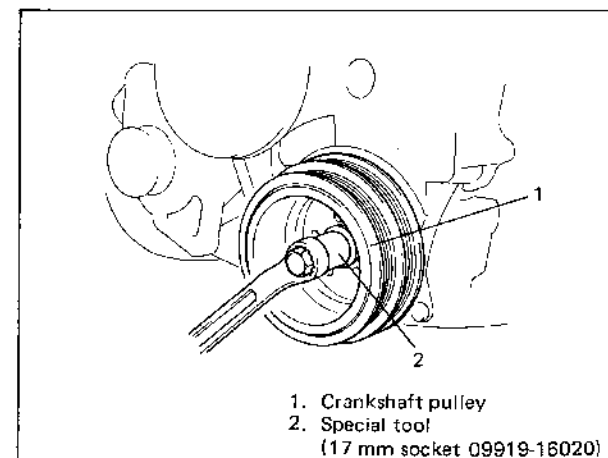


Fig. 6A-28 Removing Crankshaft Timing Belt Pulley Bolt and Crankshaft Pulley

8. Timing belt outside covers (upper & lower). To facilitate cover removal, loosen engine right side mounting bolt and push air cleaner bracket to the right as shown below.

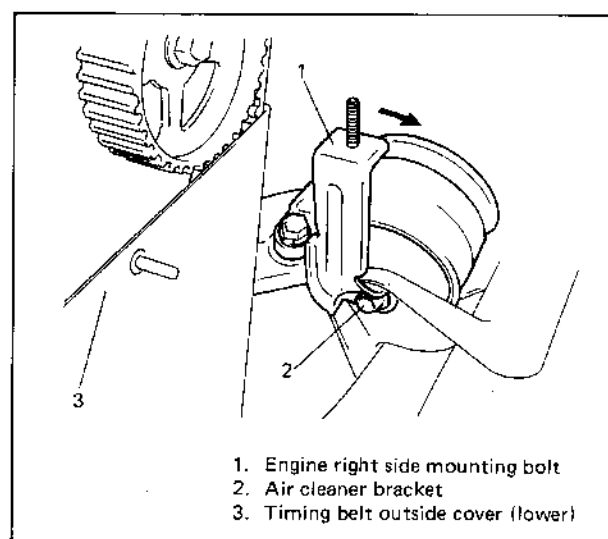


Fig. 6A-29 Air Cleaner Bracket

9. For reinstallation of timing belt, set camshaft timing belt pulleys and crankshaft timing belt pulley as shown below by turning crankshaft.

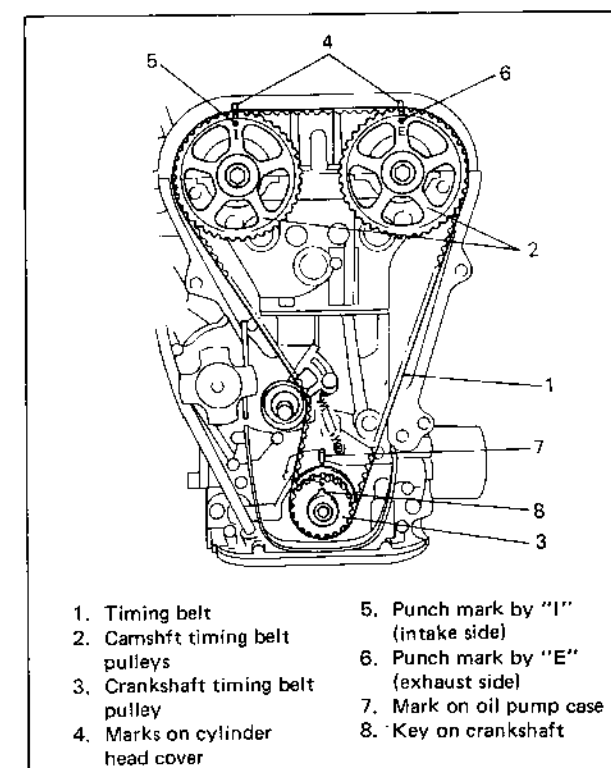


Fig. 6A-30 Alignment of Timing Belt Pulleys

10. Timing belt.

Remove tensioner stud and loosen tensioner bolt.

Remove tensioner spring and damper, and then remove timing belt.

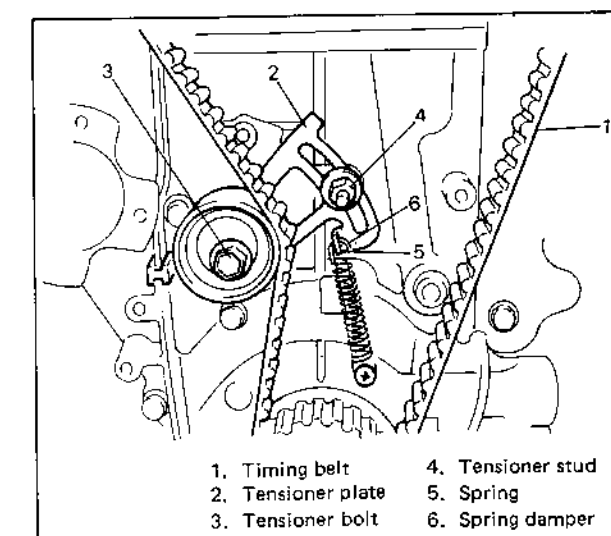
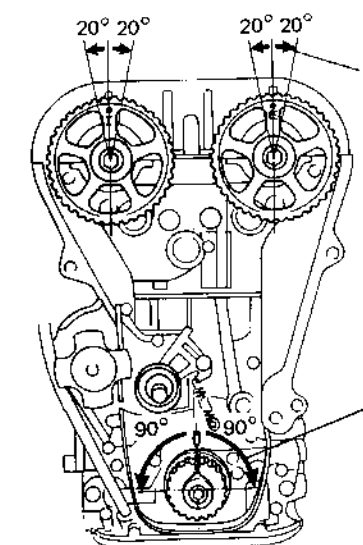


Fig. 6A-31 Removing Timing Belt

CAUTION:

- After timing belt is removed, never turn intake camshaft, exhaust camshaft and crankshaft independently more than such an extent as shown below. If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.



- Camshafts (IN & EX) allowable turning range By punch mark at "I" or "E", within 20° from mark on cylinder head cover on both right and left
- Crankshaft allowable turning range By key on crankshaft, within 90° from mark on oil pump case on both right and left

Fig. 6A-32 Allowable Turning Range of Camshafts and Crankshaft

- Never bend timing belt.

11. Tensioner and tensioner plate.

INSPECT

- Timing belt for wear or crack. Replace it as necessary.
- Tensioner for smooth rotation.

INSTALL OR CONNECT

1. Tensioner plate to tensioner.

Insert lug of tensioner plate into hole of tensioner.

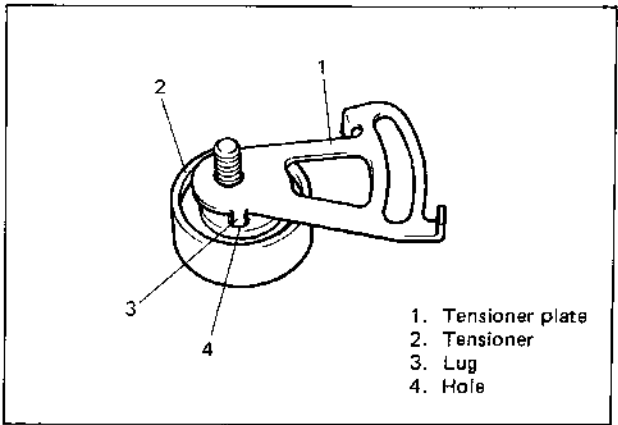


Fig. 6A-33 Lug and Hole

2. Tensioner and tensioner plate:

Do not tighten tensioner bolt with wrench yet. Hand tighten only at this time.

Check to ensure that plate movement in arrow direction as shown in Fig. 6A-34 causes tensioner to move in the same direction. If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.

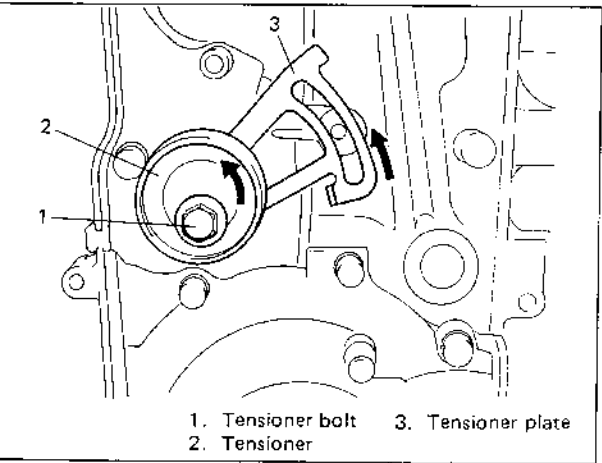


Fig. 6A-34 Tensioner Installation

3. Turn camshaft timing belt pulleys (IN & EX) so that punch mark at "I" mark on intake side camshaft timing belt pulley is aligned with mark on cylinder head cover and punch mark at "E" mark on exhaust side camshaft timing belt pulley with mark on cylinder head cover, but don't turn each pulley beyond each range specified in Fig. 6A-32.

If pulleys don't stop in place due to counter force of valve spring, hold them in place by using bolts and flanged nuts as shown in Fig. 6A-35.

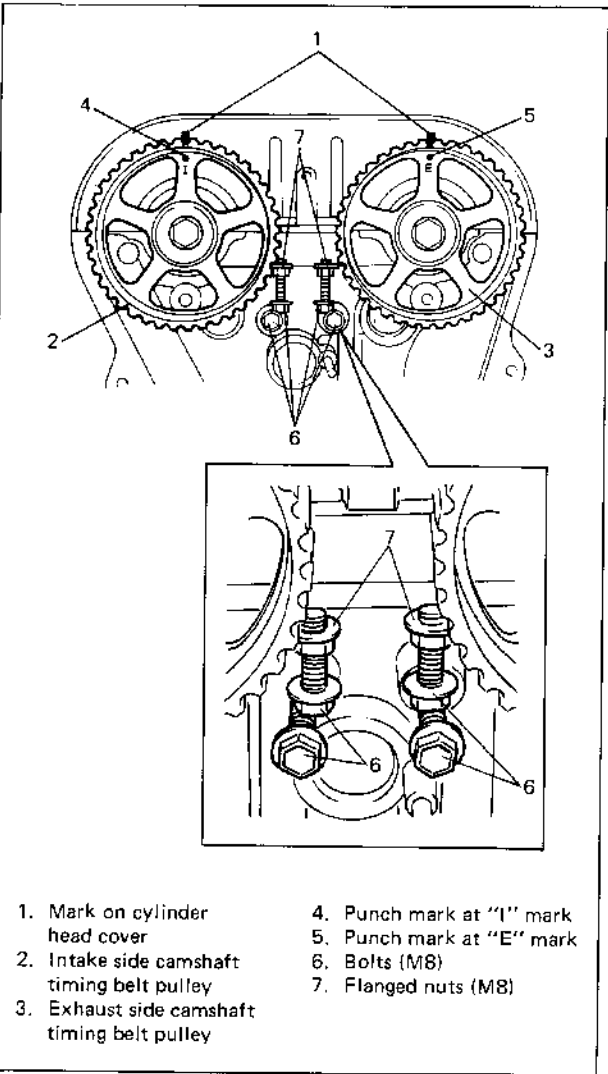


Fig. 6A-35 Timing Marks Alignment

4. Check that punch mark on crankshaft timing belt pulley is aligned with arrow mark on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on Fig. 6A-32.

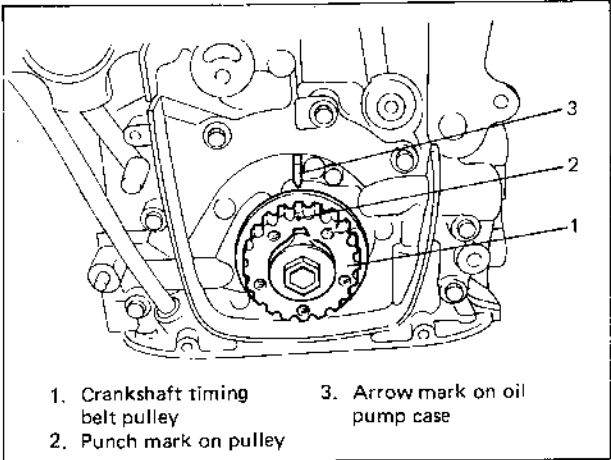


Fig. 6A-36 Timing Mark Alignment

5. Timing belt, tensioner spring and damper.

With three sets of marks aligned and tensioner plate pushed up, install timing belt on three pulleys in such a way that drive side of belt is free from any slack.

And then install tensioner spring and spring damper as shown in Fig. 6A-37, and hand-tighten tensioner stud. (Don't fix tensioner plate).

NOTE:

- When installing timing belt, match arrow mark (⇒) on timing belt with rotating direction of crankshaft.
- In this state, No. 1 piston is at top dead center of compression stroke.

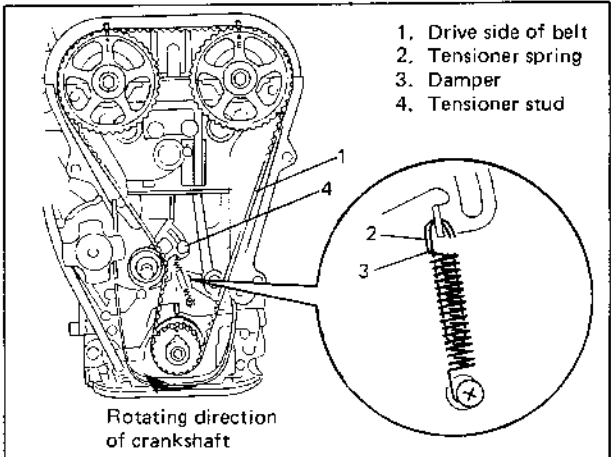


Fig. 6A-37 Installing Timing Belt and Tensioner Spring

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

Tightening torque	N·m	kg·m	lb·ft
for tensioner stud	9 - 12	0.9 - 1.2	7.0 - 8.5
for tensioner bolt	24 - 30	2.4 - 3.0	17.5 - 21.5

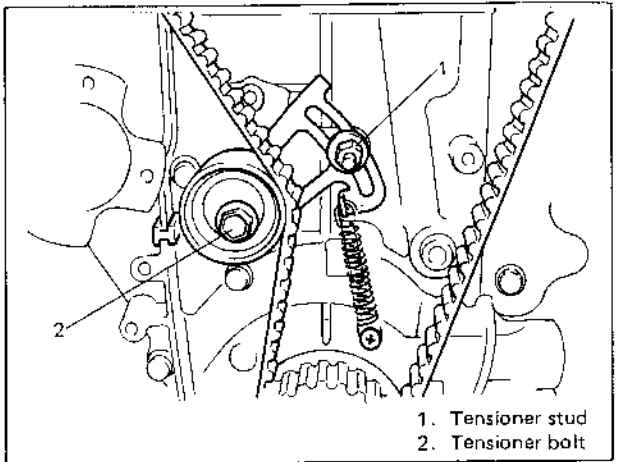


Fig. 6A-38 Tensioner Bolt and Stud

7. Timing belt outside cover (Upper & lower).

Before installing, make sure that seal is between water pump and oil pump case.

Tightening torque	N·m	kg·m	lb·ft
for timing belt outside cover bolt & nut	9 - 12	0.9 - 1.2	7.0 - 8.5

8. Crankshaft pulley.

Remove crankshaft timing belt pulley bolt and install crankshaft pulley. With crankshaft locked as shown in Fig. 6A-25 or 6A-26, tighten crankshaft pulley bolts and crankshaft timing belt pulley bolt to specified torque.

Tightening torque	N·m	kg·m	lb·ft
for crankshaft pulley bolts	9 - 12	0.9 - 1.2	7.0 - 8.5
for crankshaft timing belt pulley bolt	105-115	10.5-11.5	76.0 - 83.0

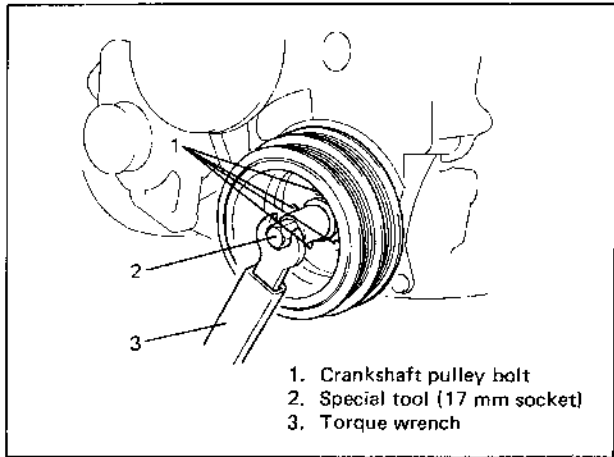


Fig. 6A-39 Tightening Pulley Bolt

9. Water pump pulley and water pump drive belt.

Refer to Section 6B for procedure to adjust belt tension.

Tightening torque for water pump pulley bolt	N-m	kg-m	lb-ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

10. Air cleaner bracket.
Tighten engine right side mounting bolt to specified torque.
11. Air cleaner assembly with AFM and AFM outlet hose.
12. Fender apron extension on right side.
13. Negative cable at battery.

OIL PAN AND OIL PUMP STRAINER

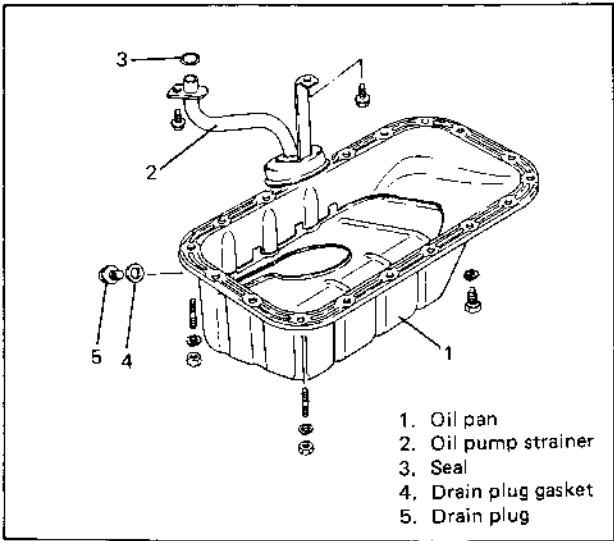


Fig. 6A-40 Oil Pan and Oil Pump Strainer

REMOVE OR DISCONNECT

1. Hoist car.
2. Drain engine oil by removing drain plug.

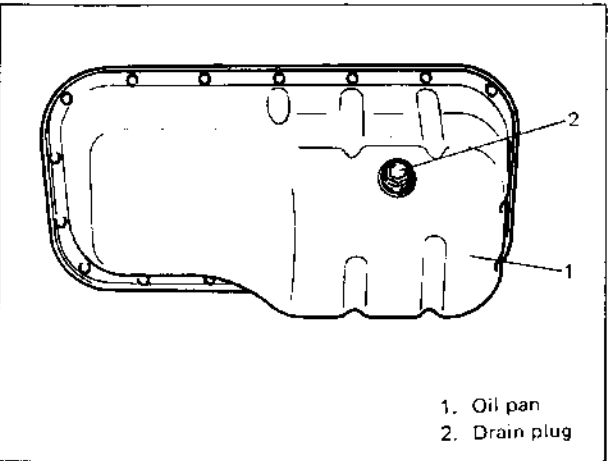


Fig. 6A-41 Drain Plug

3. Clutch housing (torque converter housing for A/T) lower plate.
4. Oil pan from cylinder block.
5. Oil pump strainer.

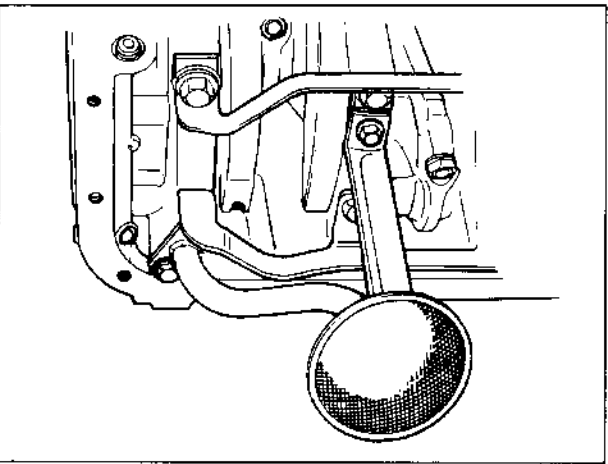


Fig. 6A-42 Oil Pump Strainer

CLEAN

- Inside of oil pan and oil pump strainer screen.

INSTALL OR CONNECT

1. Oil pump strainer.
Install seal in such position as shown in Fig. 6A-43.
- Tighten strainer bolt first and then bracket bolt to specified torque.

Tightening torque for bolts	N-m	kg-m	lb-ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

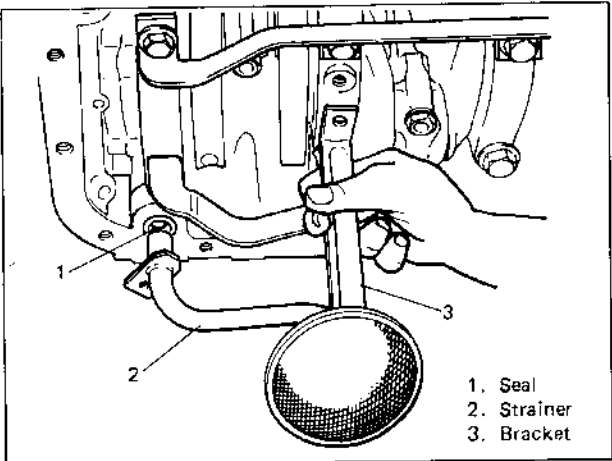


Fig. 6A-43 Installing Seal and Strainer

2. Clean mating surfaces of oil pan and cylinder block. Remove oil, old sealant, and dusts from mating surfaces.
- After cleaning, apply silicon type sealant to oil pan mating surface continuously as shown in Fig. 6A-44.

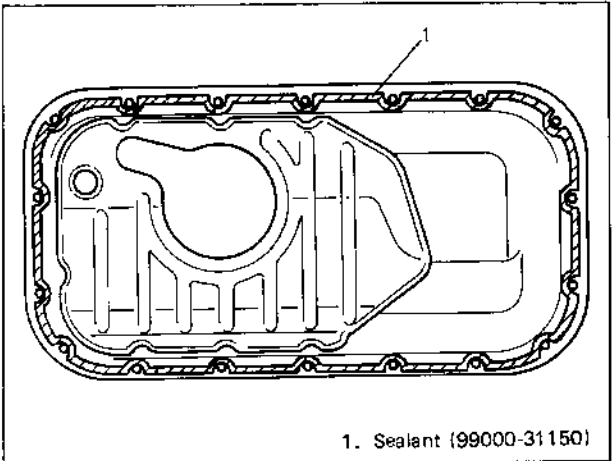


Fig. 6A-44 Applying Sealant to Oil Pan

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

Tightening torque for oil pan bolt and nut	N-m	kg-m	lb-ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

4. Gasket and drain plug to oil pan.
Tighten drain plug to specified torque.
- | Tightening torque for drain plug | N-m | kg-m | lb-ft |
|----------------------------------|---------|-----------|-------------|
| | 30 - 40 | 3.0 - 4.0 | 22.0 - 28.5 |
5. Clutch housing (torque converter housing for A/T) lower plate.
6. Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.

OIL PUMP

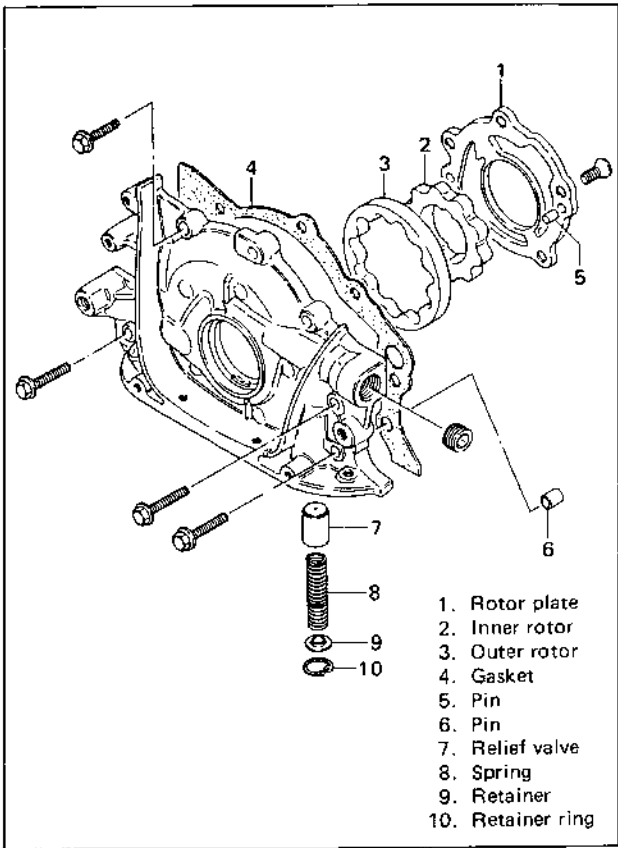


Fig. 6A-45 Oil Pump

REMOVE OR DISCONNECT

1. Negative cable at battery.
2. Hoist car.
3. Drain engine oil.
4. Water pump belt, pulley, generator and its bracket.
5. Crankshaft pulley, timing belt outside covers and timing belt as previously outlined.
6. Engine oil level gauge and its guide bolt.

7. Crankshaft timing belt pulley and timing belt guide.

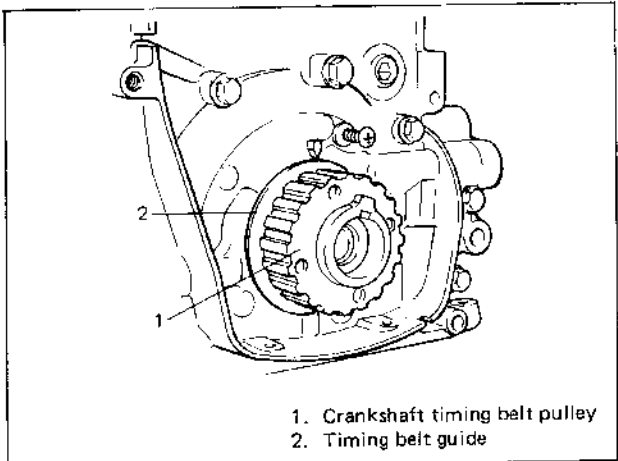


Fig. 6A-46 Crankshaft Timing Belt Pulley

8. Oil pan and oil pump strainer as previously outlined.
9. Oil pump assembly after removing 7 bolts securing pump.

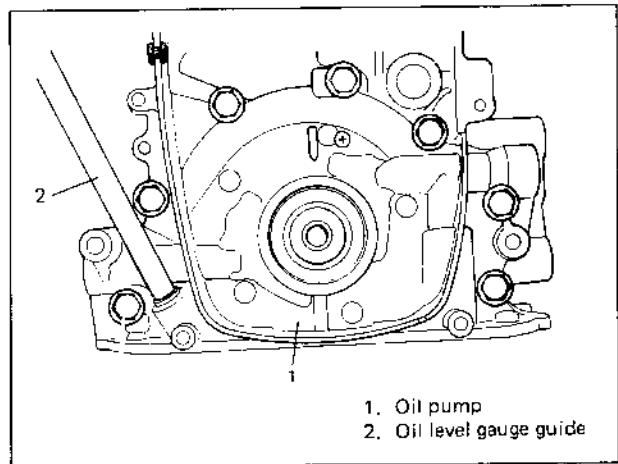


Fig. 6A-47 Oil Pump Assembly

DISASSEMBLE

1. Oil level gauge guide from oil pump.
Pull out guide from oil pump.

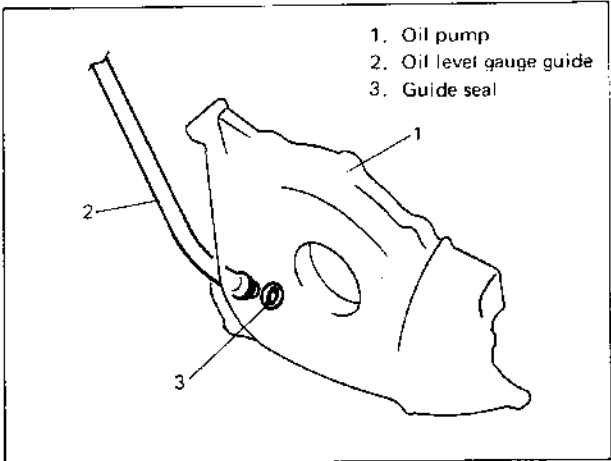


Fig. 6A-48 Oil Level Gauge Guide

2. Rotor plate:

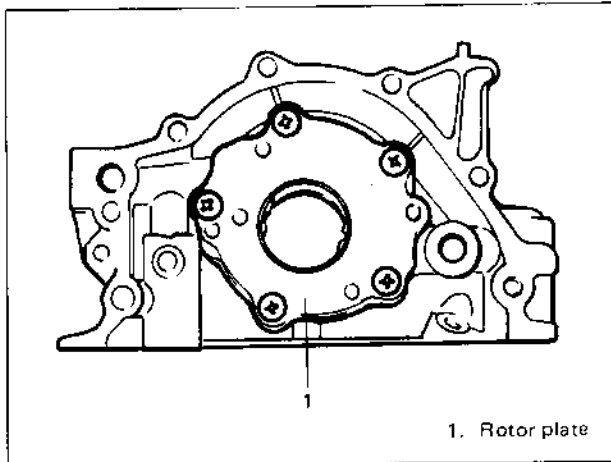


Fig. 6A-49 Rotor Plate

3. Outer rotor and inner rotor:

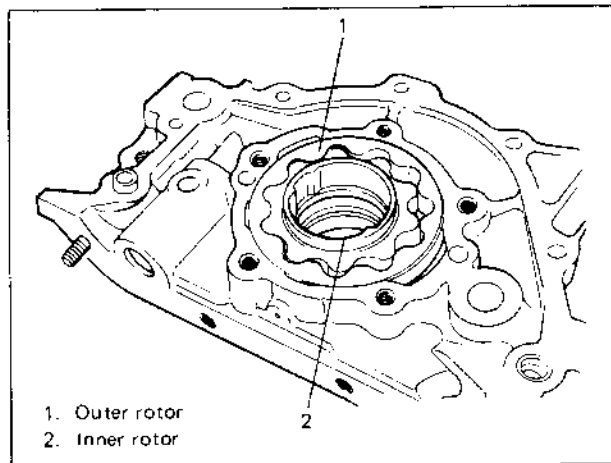


Fig. 6A-50 Outer Rotor and Inner Rotor

INSPECT

- Oil seal lip for fault or other damage. Replace as necessary.
- Outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

MEASURE

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

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

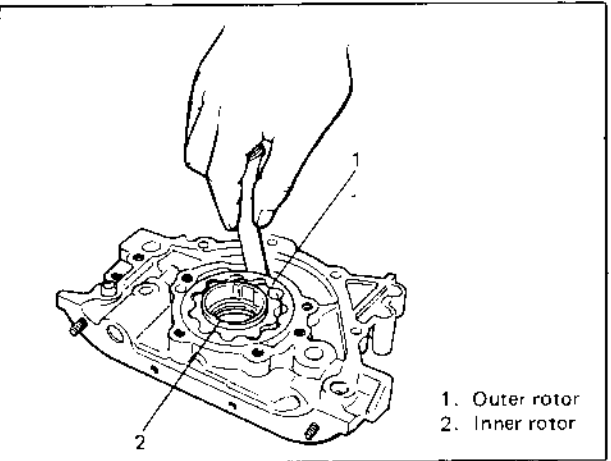


Fig. 6A-51 Measuring Radial Clearance

- **Side clearance**
Using straight edge and thickness gauge, measure side clearance.

Limit on side clearance	0.15 mm (0.0059 in.)

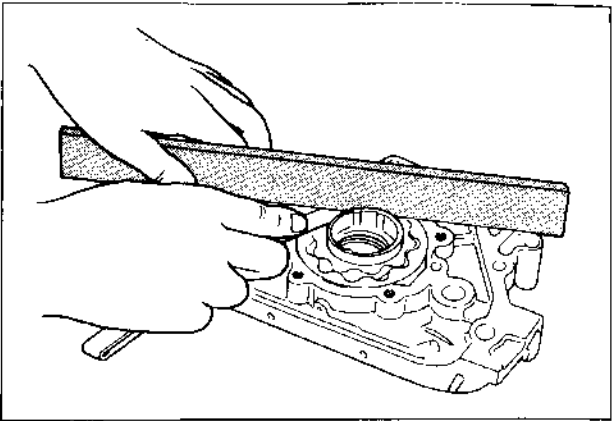


Fig. 6A-52 Measuring Side Clearance

ASSEMBLE

1. Wash, clean and then dry all disassembled parts.
2. Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.
3. Outer and inner rotors to pump case.
4. Rotor plate. Tighten 5 screws securely.
After installing plate, check to be sure that gears turn smoothly by hand.
5. Guide seal to pump case and then oil level gauge guide.
Refer to Fig. 6A-48 for guide seal.

INSTALL OR CONNECT

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

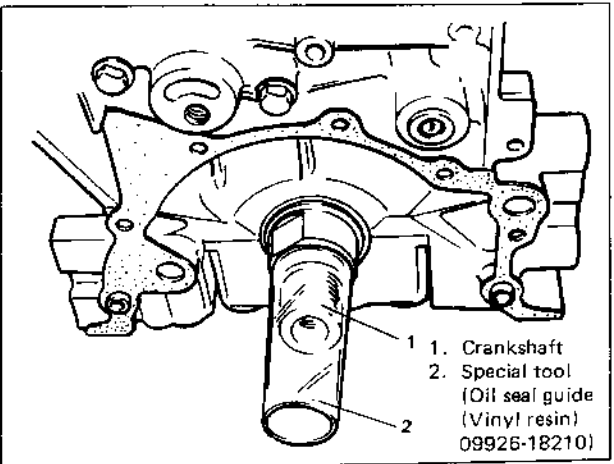


Fig. 6A-53 Special Tool (Oil Seal Guide) Installation

3. Oil pump to crankshaft and cylinder block:
Among 7 oil pump bolts, 4 No. 1 bolts are shorter than 3 No. 2 bolts in length. Install No. 1 and No. 2 bolts at such positions as shown in below figure, and tighten them to the specified torque.
After installing oil pump, check to be sure that oil seal lip is not upturned, and then remove special tool.

Tightening torque for oil pump bolt	N·m	kg·m	lb·ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

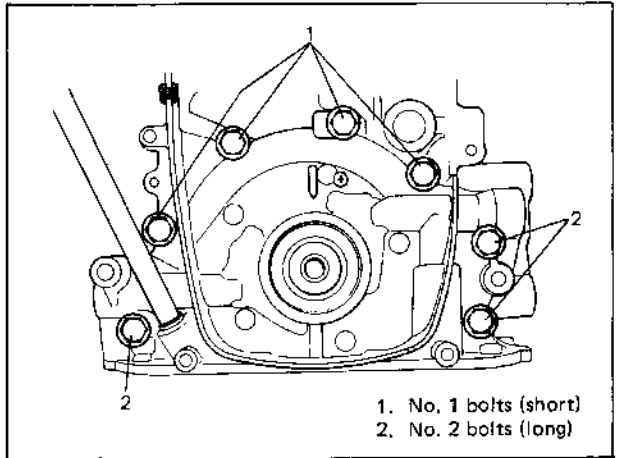


Fig. 6A-54 No. 1 and No. 2 Bolts

4. Rubber seal between oil pump and water pump.

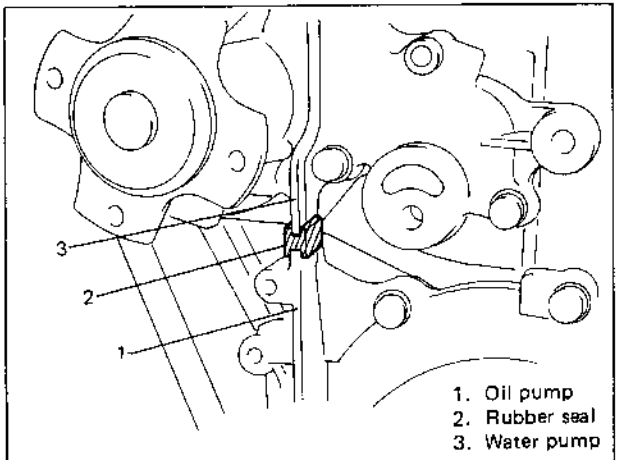


Fig. 6A-55 Installing Rubber Seal

5. Edge of oil pump gasket might bulge out: if it does, cut bulge off with a sharp knife, making edge smooth and flush with end faces of pump case and cylinder block.

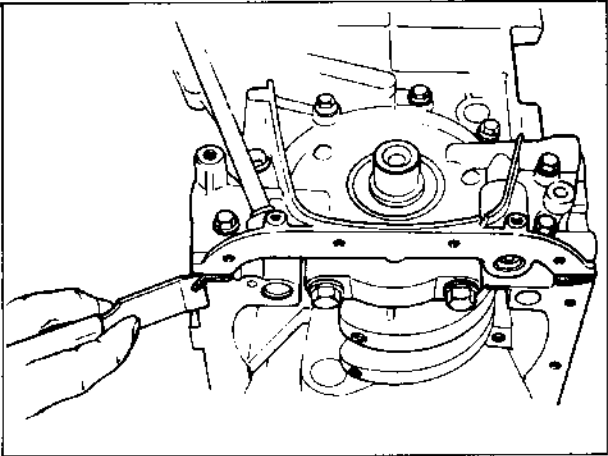


Fig. 6A-56 Cutting Edge of Gasket

6. Timing belt guide, key, and crankshaft timing belt pulley.
Refer to Fig. 6A-57 for proper installation of these parts.
Install timing belt guide in such a way that its concave side faces oil pump.

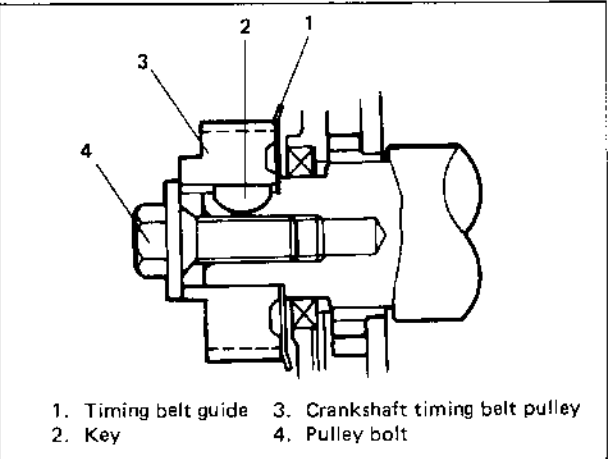


Fig. 6A-57 Installing Guide, Key and Pulley

- 7. Timing belt, tensioner, and other parts as previously outlined.
- 8. Adjust water pump belt tension.
- 9. Refill engine oil.
- 10. Negative cable at battery.
- 11. After completing installation, check oil pressure by running engine.

CAMSHAFT AND HYDRAULIC VALVE LASH ADJUSTER

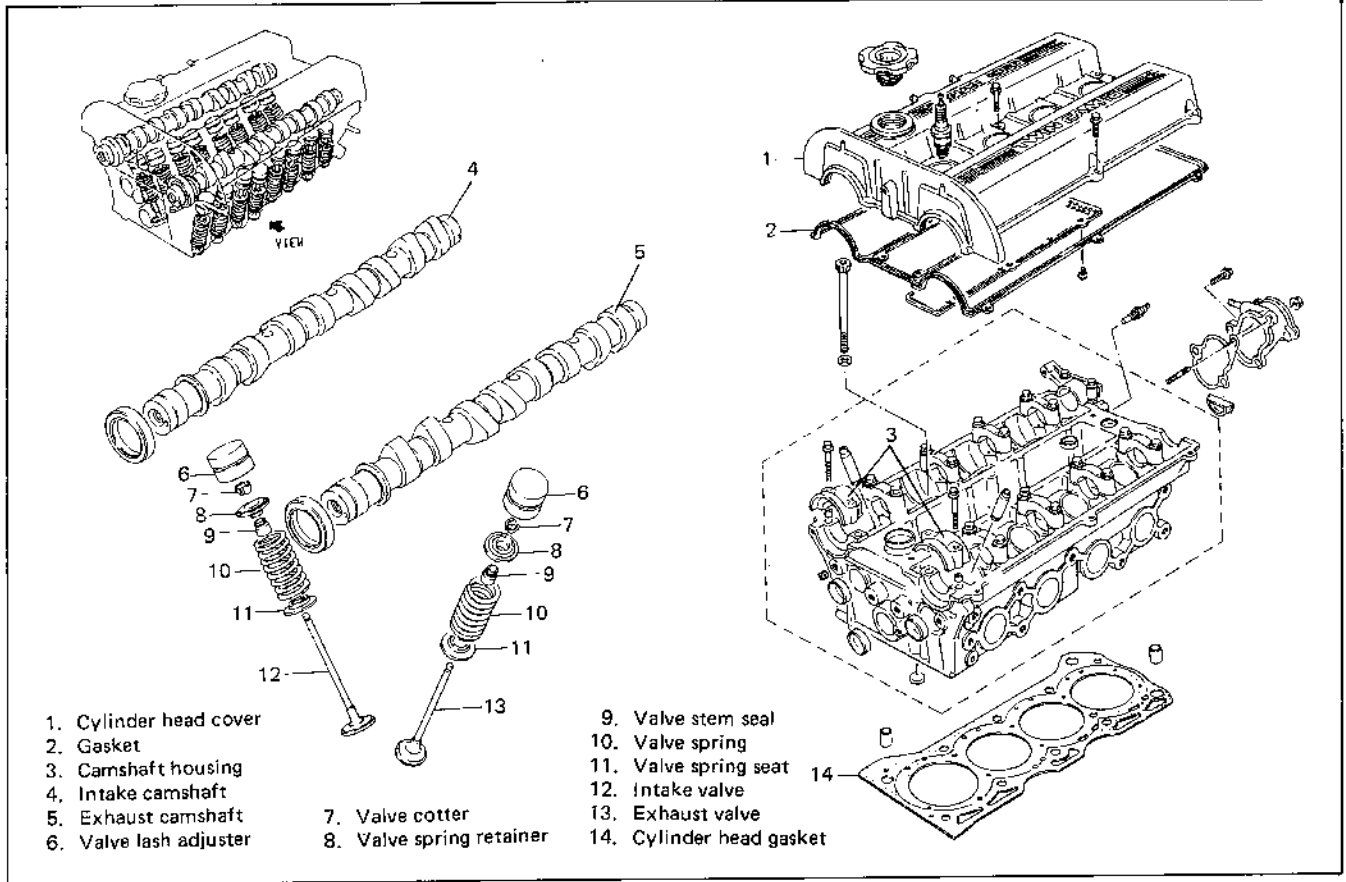


Fig. 6A-58 Camshaft, Camshaft Housing, Valve Lash Adjuster

REMOVE OR DISCONNECT

- 1. Negative cable at battery.
- 2. Timing belt as previously outlined.
- 3. After removing timing belt, set key on crankshaft in position as shown below by turning crankshaft. This is to prevent interference between valves and piston.

- 4. Cylinder head cover.
- 5. Distributor assembly.
- 6. Camshaft timing belt pulleys (IN & EX).
Lock camshaft with a proper size rod inserted into hole in it as shown below and then loosen camshaft timing belt pulley bolt.

NOTE:
Mating surfaces of cylinder head and cover must not be damaged in this work. So, put clean shop cloth between rod and mating surfaces, and use care not to bump rod against mating surfaces hard when loosening bolt.

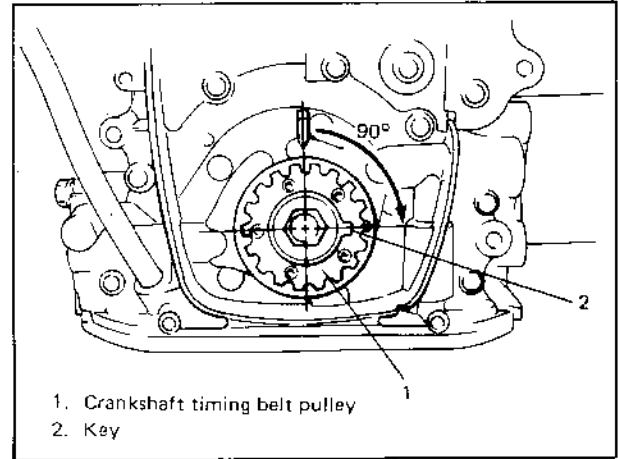


Fig. 6A-59 Position of Crankshaft Key

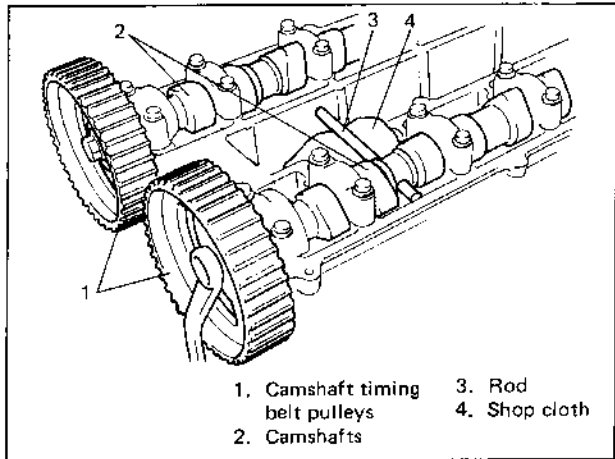


Fig. 6A-60 Loosening Pulley Bolt

7. Camshaft housing and camshaft from cylinder head.

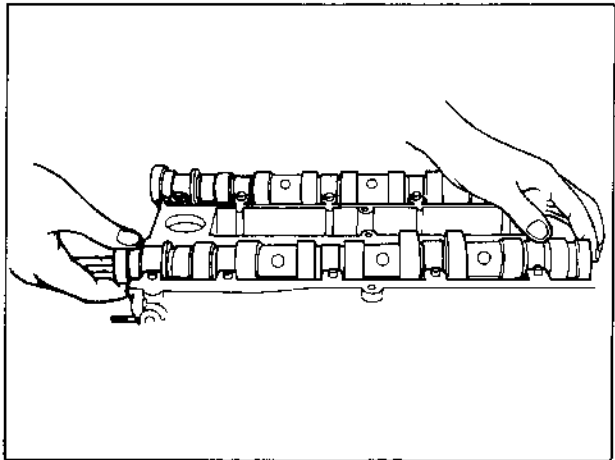


Fig. 6A-61 Removing Camshaft

8. Valve lash adjuster from cylinder head.

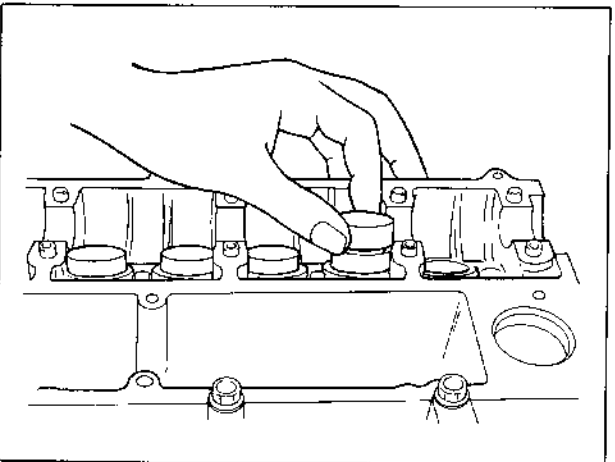


Fig. 6A-62 Removing Valve Lash Adjuster

NOTE:

- Never disassemble hydraulic valve lash adjuster.
- Don't apply force to body of adjuster, for oil in high pressure chamber in adjuster will leak.

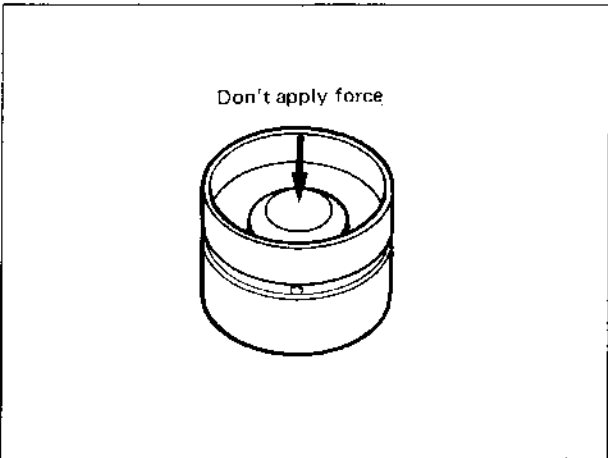


Fig. 6A-63 Valve Lash Adjuster

- 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.

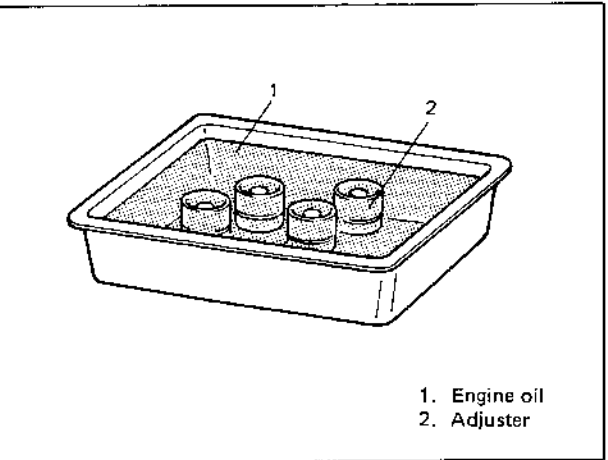


Fig. 6A-64 Storing Valve Lash Adjuster

INSPECT

Cam Wear

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

Cam height	Standard	Limit
Intake cam	40.436 – 40.596 mm (1.5920 – 1.5983 in.)	40.336 mm (1.5880 in.)
Exhaust cam	40.429 – 40.589 mm (1.5917 – 1.5979 in.)	40.329 mm (1.5877 in.)

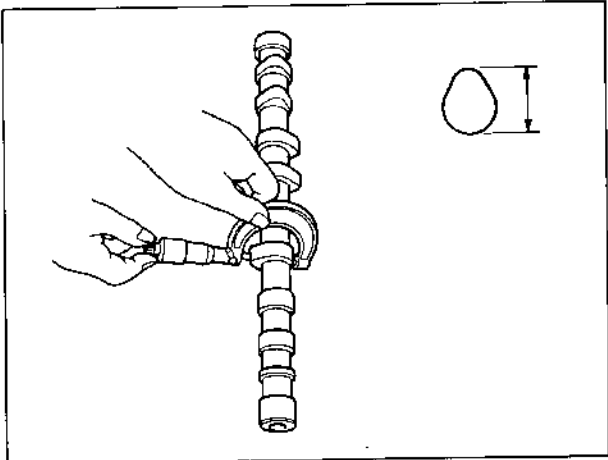


Fig. 6A-65 Measuring Cam Height

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.)

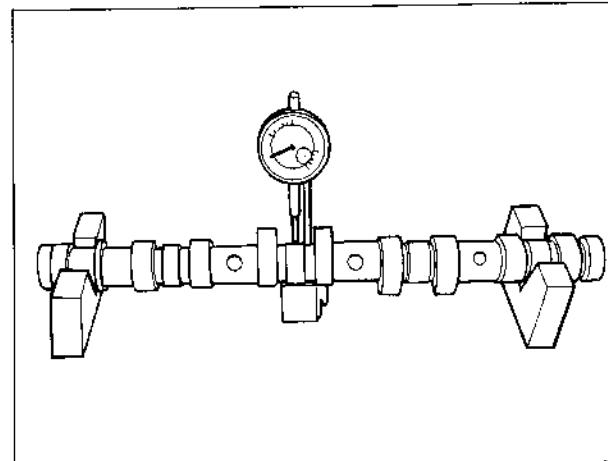


Fig. 6A-66 Measuring Camshaft Runout

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.

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 housings as outlined on p. 6A-28 and evenly torque housing bolts to specified torque. Housings MUST be torqued to specification in order to assure proper reading of camshaft journal clearance.

NOTE:

Do not rotate camshaft while gaging plastic is installed.

5. Remove housing, and using scale on gaging plastic envelop, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.020 – 0.062 mm (0.0008 – 0.0024 in.)	0.12 mm (0.0047 in.)

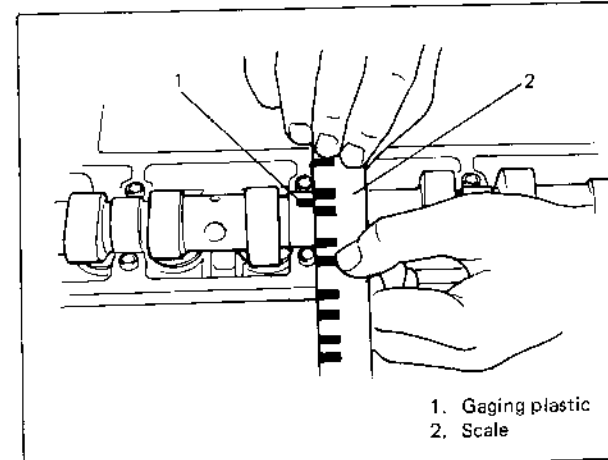


Fig. 6A-67 Measuring Camshaft Journal Clearance

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)	28.000 – 28.021 mm (1.1024 – 1.1032 in.)
Camshaft journal O.D. (IN & EX)	27.959 – 27.980 mm (1.1007 – 1.1015 in.)

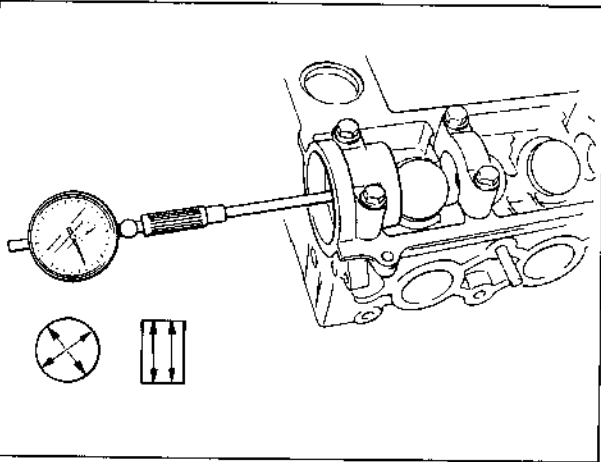


Fig. 6A-68 Measuring Journal Bore Dia.

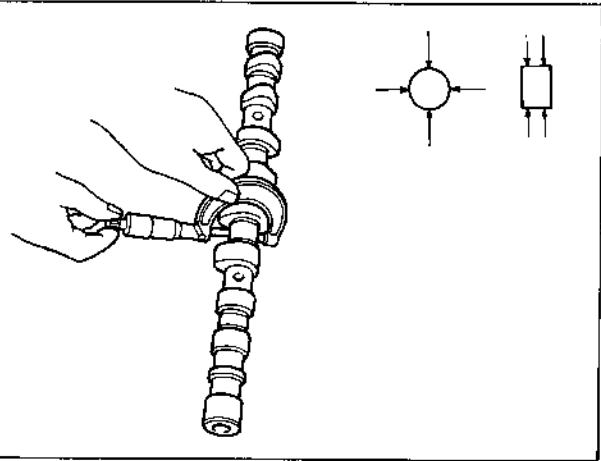


Fig. 6A-69 Measuring Camshaft Journal Dia.

Wear of Hydraulic Valve Lash Adjuster
Check adjuster for pitting, scratches, or damage. If any malfunction is found, replace.

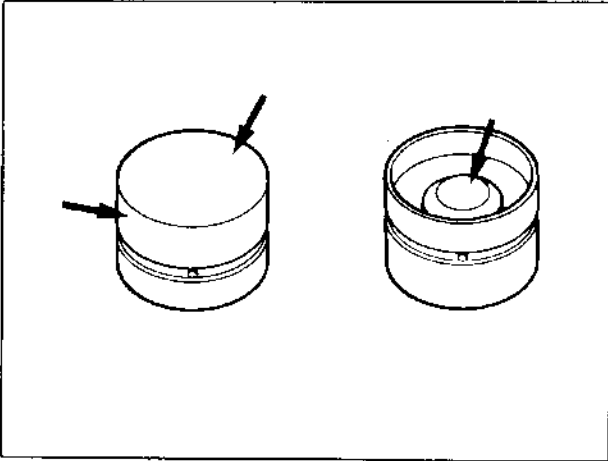


Fig. 6A-70 Checking Lash Adjuster

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.)

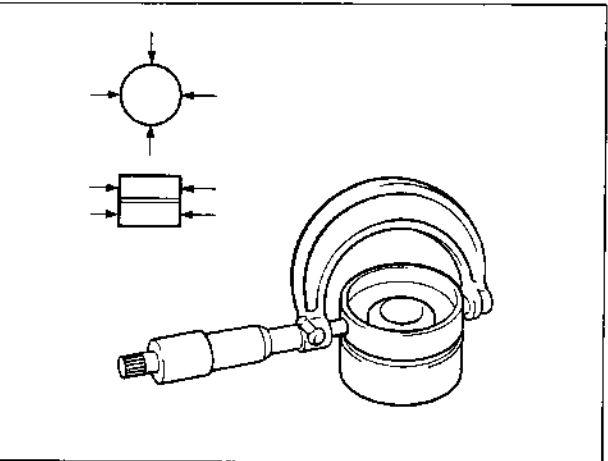


Fig. 6A-71 Measuring Valve Lash Adjuster Dia.

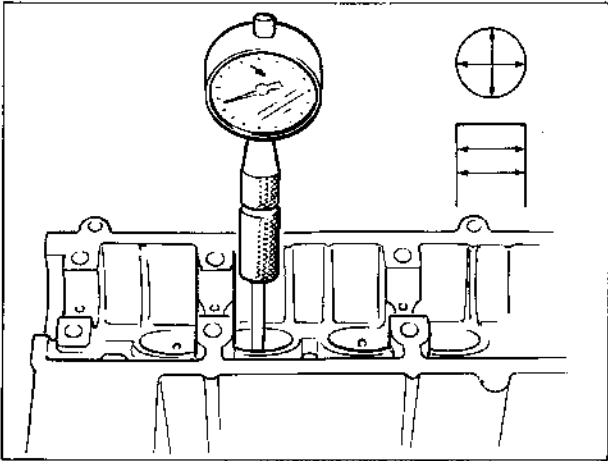


Fig. 6A-72 Measuring Cylinder Head Adjuster Bore

INSTALL OR CONNECT

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 camshaft journal 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.

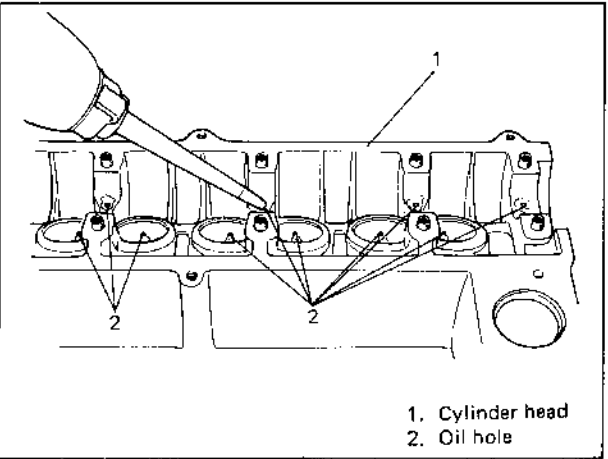


Fig. 6A-73 Filling Engine Oil

2. Valve lash adjuster to cylinder head
Apply engine oil around valve lash adjuster and then install it to cylinder head.

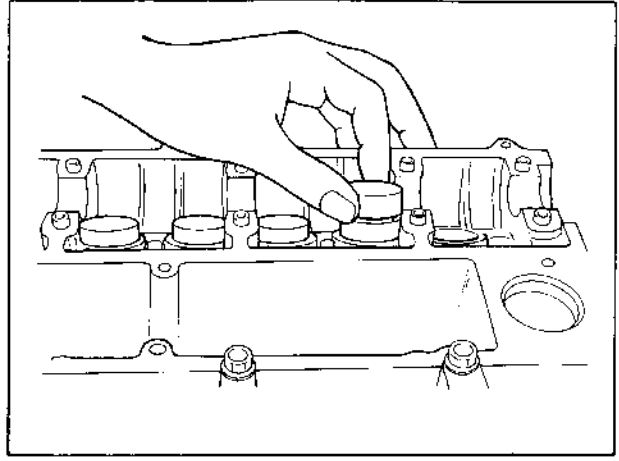


Fig. 6A-74 Installing Valve Lash Adjuster

3. Camshaft to cylinder head.
After applying engine oil to camshaft journal and all around cam, set camshaft to cylinder head so that camshaft timing belt pulley pin hole in camshaft is at lower center position.

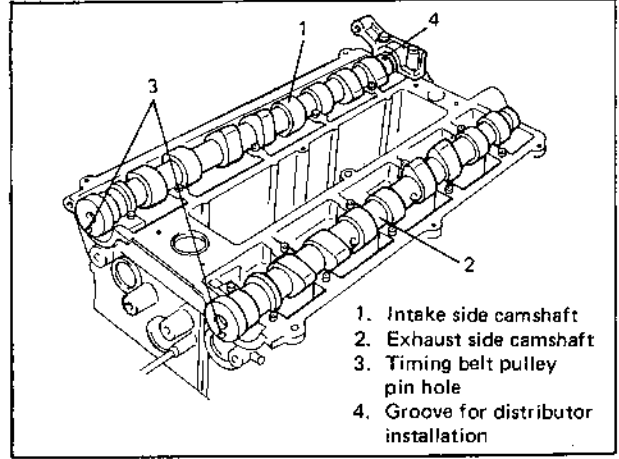


Fig. 6A-75 Installing Camshafts

4. Camshaft housing to camshaft and cylinder head.

- Apply engine oil to sliding surface of each housing against camshaft journal.
- Apply sealant (SUZUKI BOND NO. 1215, 99000-31110) to mating surface of "IN 1" and "EX 1" of housing which will mate with cylinder head.

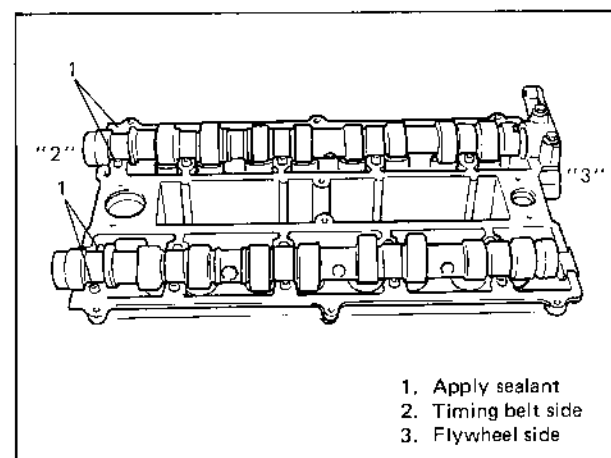


Fig. 6A-76 Applying Sealant

- Embossed marks are provided on each camshaft housing, indicating position and direction for installation.

Install housing as indicated by these marks.



- Identifies whether intake side housing or exhaust side one. Install housing with "IN" to intake side and one with "EX" to exhaust side.
- Indicates position from timing belt side. Install in numerical order starting from timing belt side.
- Indicates direction of housing. Install so that arrow is directed toward timing belt side.

- As camshaft housing "IN 1" or "EX 1" retains camshaft in proper position as to thrust direction, make sure to first fit housing "IN 1" or "EX 1" to No. 1 journal of camshaft securely.

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

Repeat the same tightening procedure for exhaust side housing bolts.

Tightening torque for housing bolt	N·m	kg·m	lb·ft
	9 - 12	0.9 - 1.2	7.0 - 8.5

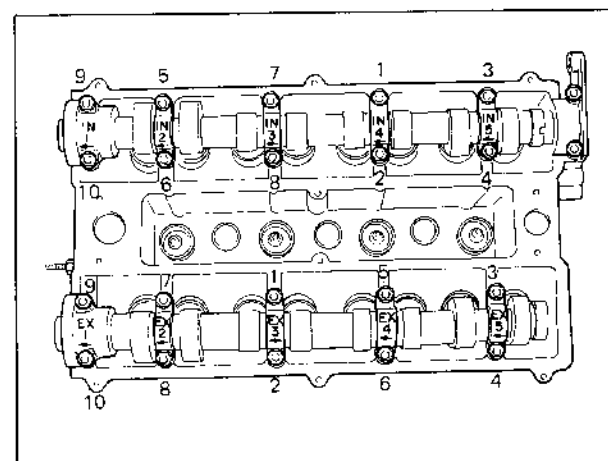


Fig. 6A-77 Tightening Sequence of Housing Bolts

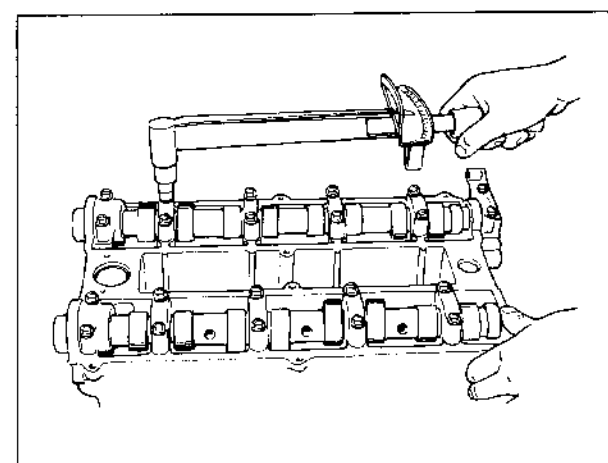


Fig. 6A-78 Tightening Housing Bolts

5. Camshaft oil seal (IN & EX).

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

6. Intake and exhaust camshaft timing belt pulleys to each camshaft after installing pins to each camshaft.

Intake and exhaust camshaft timing belt pulleys are the same but don't reverse them for reinstallation. (One which has been installed to intake side should be reinstalled to that same side and the same with exhaust side one.) A new camshaft timing belt pulley may be installed to either side.

For intake camshaft timing belt pulley, fit pulley pin on camshaft into slot at "I" mark on camshaft timing belt pulley. For exhaust camshaft timing belt pulley, fit pulley pin into slot at "E" mark.

Tighten pulley bolts (IN & EX) to specification respectively.

Tightening torque for pulley bolt	N·m	kg·m	lb·ft
	56 - 64	5.6 - 6.4	41.0 - 46.0

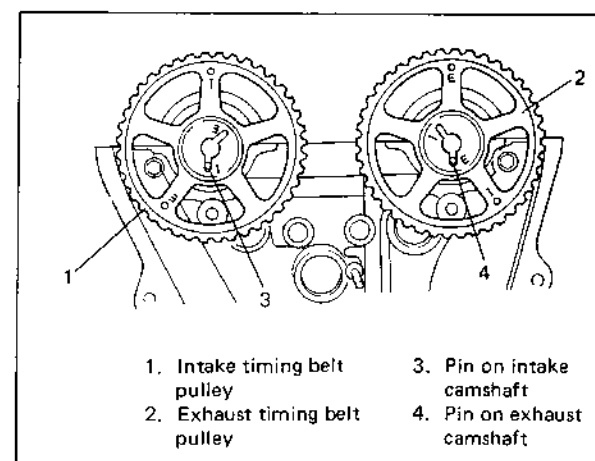


Fig. 6A-79 Installing Camshaft Timing Belt Pulleys

7. Cylinder head cover to cylinder head as previously outlined.

8. Timing belt, timing belt outside covers, crankshaft pulley, water pump pulley and water pump belt as previously outlined.

9. Distributor assembly.

Refer to Section 6F for installation.

10. Negative cable at battery.

11. Adjust ignition timing.

Refer to Section 6F for adjustment.

CAUTION:

- Don't turn camshafts or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshafts. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves themselves or valves and piston.
- If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 r/min., and then air will be purged and tapping sound will cease. Should tapping sound not cease, it is possible that valve lash adjuster is defective. Replace it if defective.

If defective adjuster can't be located by hearing among 16 of them, check as follows.

1) Stop engine and remove cylinder head cover.

2) Push adjuster downward by hand (with less than 20 kg or 44 lbs force) when cam crest is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

VALVES AND CYLINDER HEAD

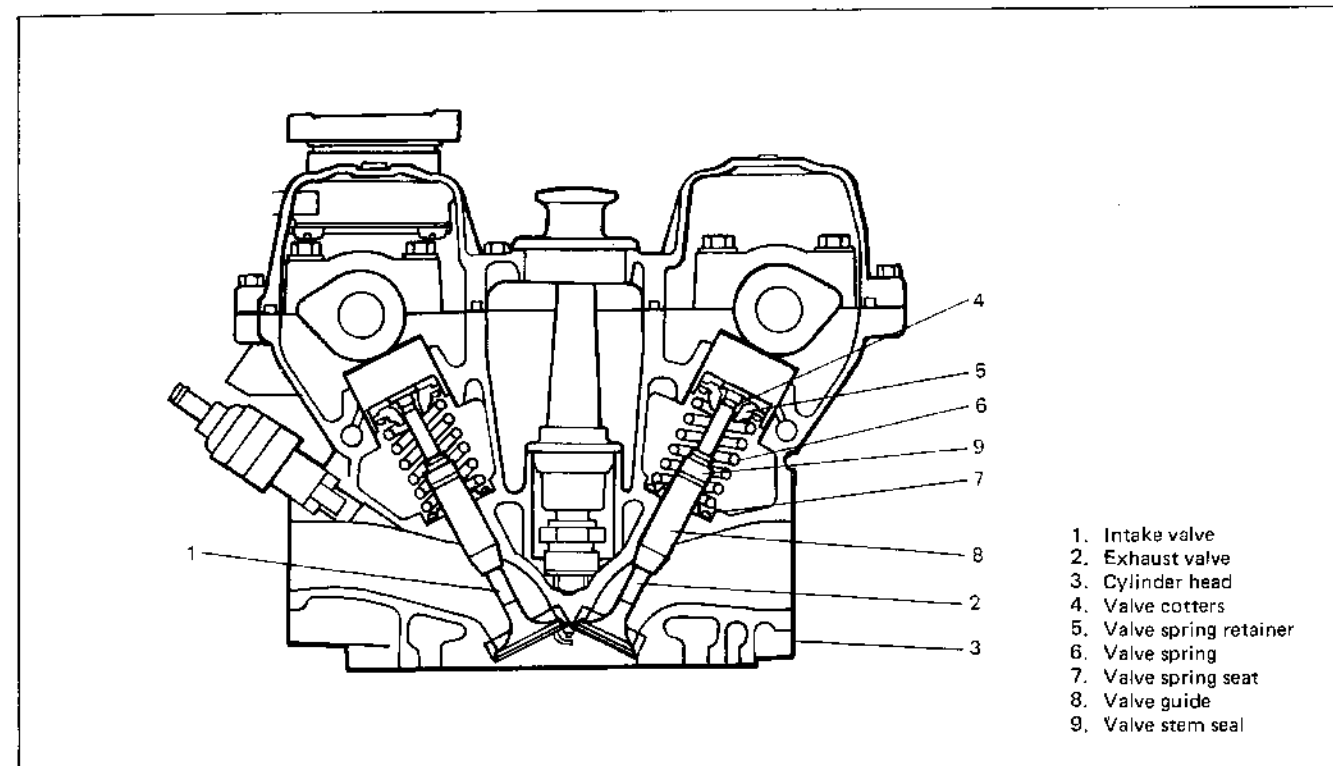


Fig. 6A-80 Cylinder Head, Valve, Valve Spring, Valve Guide, etc.

REMOVE OR DISCONNECT

1. Relieve fuel pressure according to procedure described in p. 6-3.
2. Negative cable at battery.
3. Drain cooling water.
4. Air cleaner assembly with AFM outlet hose.
5. Following electric wires:
 - TPS
 - Fuel injectors
 - Canister purge VSV
 - EGR VSV (if equipped)
 - Ground wires from intake manifold
 - ISC solenoid valve
 - REGTS (if equipped)
 - Center high tension cord from distributor
 - CAS (Distributor)
 - WTG
 - Radiator fan thermo switch
 - WTS
 - Oxygen sensor
 and release above wires from clamps.

6. Following vacuum hoses:
 - Brake booster hose
 - Canister purge hose
7. Accelerator cable from throttle lever and its bracket.
8. Following water hoses:
 - Radiator inlet hose from thermostat cap.
 - Heater inlet hose from cylinder head.
 - Throttle body inlet hose from throttle body.
9. Fuel feed hose and return hose from fuel delivery pipe.
10. Water pump pulley, crankshaft pulley and timing belt as previously outlined.
11. Timing belt inside cover.
12. Exhaust No. 1 pipe from exhaust manifold.
13. Generator adjusting arm stiffener.
14. Intake manifold bracket.
15. Cylinder head cover.

Refer to Fig. 6A-18.

16. Cylinder head bolts using 8 mm hexagon wrench bit.

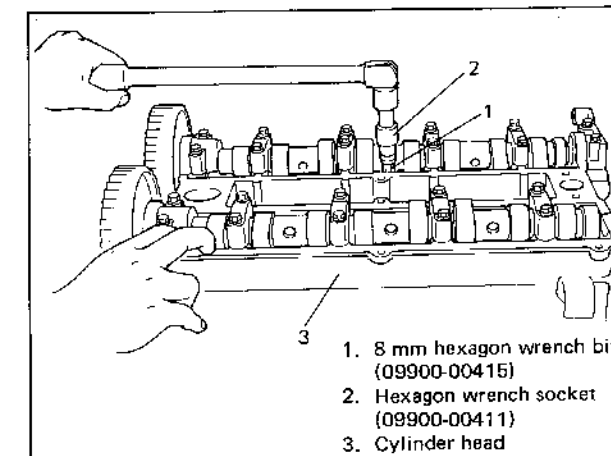


Fig. 6A-81 Loosening Head Bolts

17. Cylinder head with intake manifold, exhaust manifold, distributor, fuel delivery pipe and injectors.

NOTE:

In this state, one of 16 valves is out toward combustion chamber (i.e. it is open). Be sure NOT to place cylinder head on any flat surface with its mating surface with cylinder block facing down. It will cause damage to such open valve.

DISASSEMBLY

1. For ease in servicing cylinder head, remove intake manifold with throttle body, exhaust manifold, distributor, delivery pipe with injectors.
2. Remove camshaft timing belt pulleys (IN & EX), camshafts (IN & EX) and valve lash adjusters as previously outlined.
3. Using special tool (Valve lifter), compress the valve springs and then remove valve cotten by using special tool (Forceps).

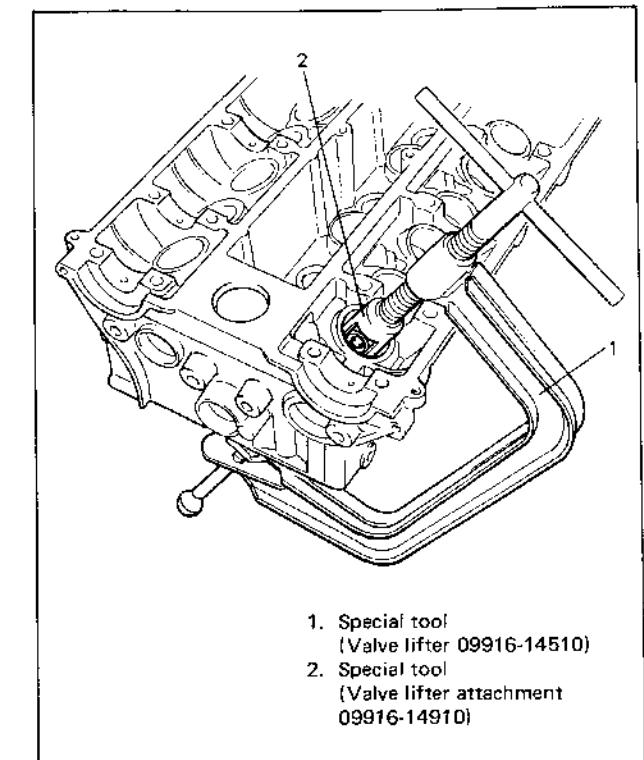


Fig. 6A-82 Installing Special Tool (Valve Lifter)

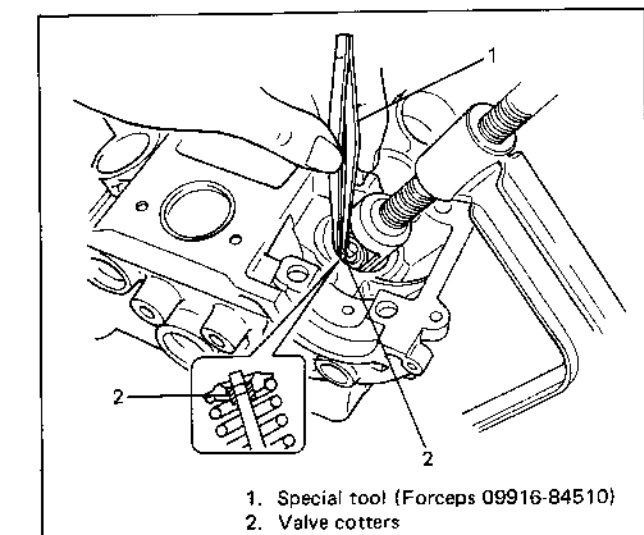


Fig. 6A-83 Removing Valve Cotten

4. Release special tool, and remove spring retainer and valve spring.
5. Remove valve from combustion chamber side.
6. 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.

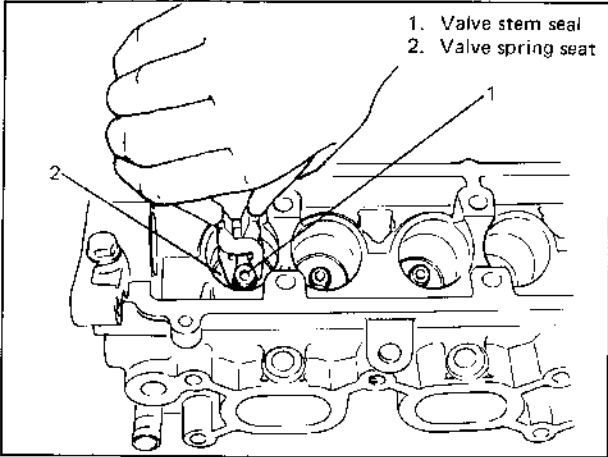


Fig. 6A-84 Removing Valve Stem Oil Seal

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

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

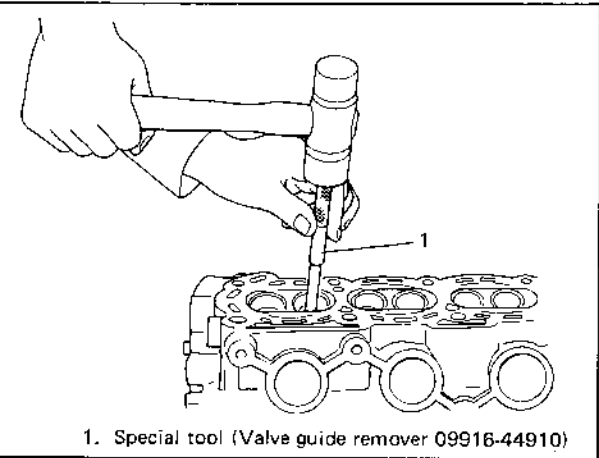


Fig. 6A-85 Removing Valve Guide

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

INSPECT
Valve Guides

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

Item		Standard	Limit
Valve stem diameter	In	5.465 – 5.480 mm (0.2152 – 0.2157 in.)	—
	Ex	5.450 – 5.465 mm (0.2146 – 0.2151 in.)	—
Valve guide I.D.	In & Ex	5.500 – 5.512 mm (0.2165 – 0.2170 in.)	—
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.035 – 0.062 mm (0.0014 – 0.0024 in.)	0.09 mm (0.0035 in.)

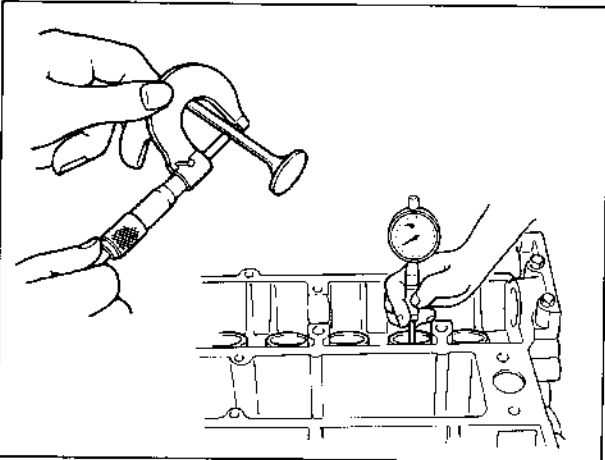


Fig. 6A-86 Measuring Valve Stem Dia. and Valve Guide I.D.

Valves

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

Valve head thickness		
	Standard	Limit
In	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.)

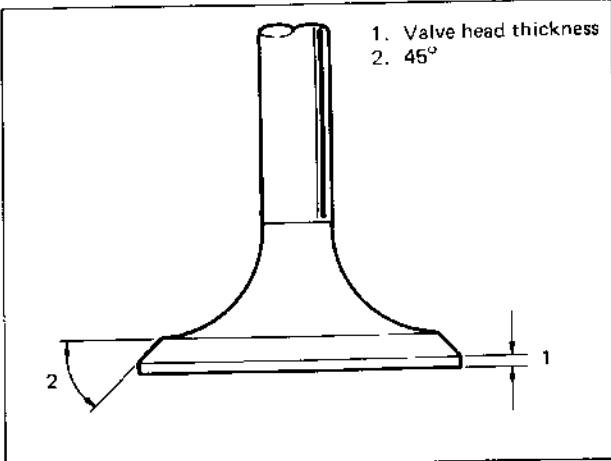


Fig. 6A-87 Valve Head Thickness

- Inspect valve stem end face for pitting and wear. If pitting or wear of stem end face is present, valve stem end may be resurfaced, providing that its length ① will not be reduced to less than 3.6 mm (0.14 in). If this length becomes less than 3.6 mm (0.14 in), valve must be replaced.

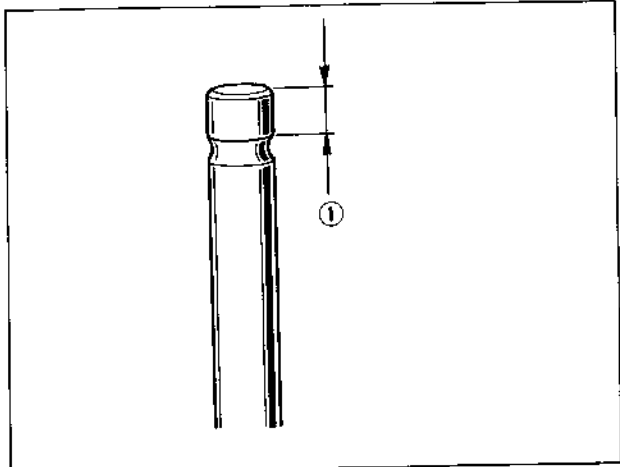


Fig. 6A-88 Valve Stem End Face

- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If measured runout exceeds limit, replace valve.

Limit on valve head radial runout	0.08 mm (0.003 in.)

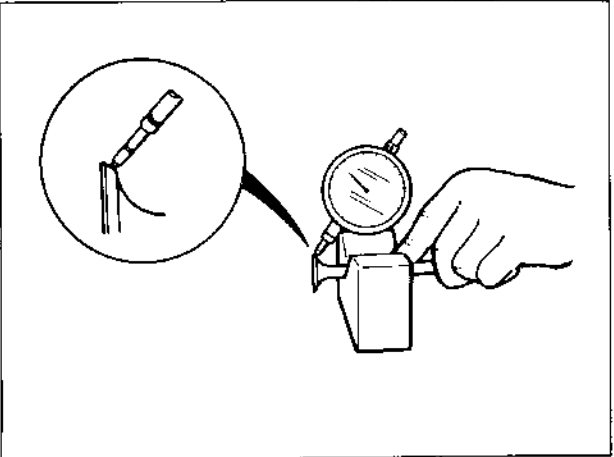


Fig. 6A-89 Measuring Radial Runout

- Seating contact width:
Produce a contact pattern on each valve in the usual manner, that is, by giving a uniform coat of Red-lead paste to valve seat and by rotatingly tapping each seat with valve head. Valve lapper (the tool used in valve lapping) must be used.
The pattern produced on seating face of each valve must be a continuous ring without any break, and width of pattern must be within following specification.

Standard seating width revealed by contact pattern on valve face	In	1.3 – 1.5 mm
	Ex	(0.0512 – 0.0590 in.)

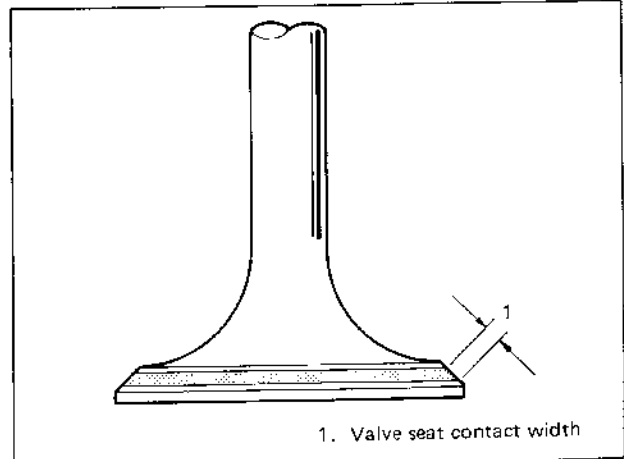


Fig. 6A-90 Valve Seating Contact Width

• Valve seat repair:

A valve seat not producing uniform contact with its valve or showing seating contact that is off the specified width must be repaired by regrinding or by cutting and regrinding and finished by lapping.

Valve seats for both intake and exhaust valves are machined to two different angles. Seat contact surface is cut 45° and area above contact surface (closest to combustion chamber) is cut to 15°.

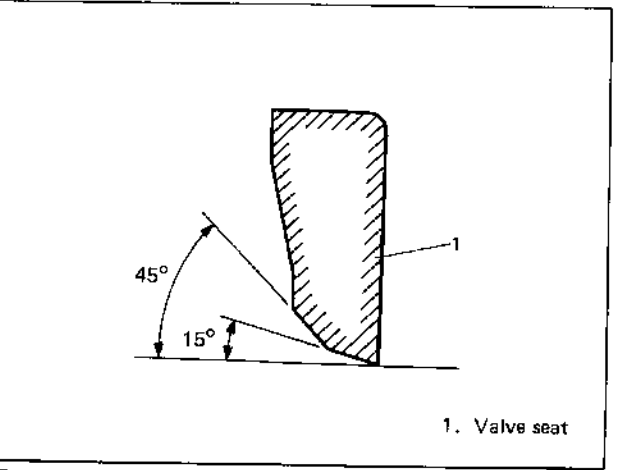


Fig. 6A-91 Valve Seat Angle

1. Using 45° valve seat cutter, descale and clean up seat with one or two turns.
2. Inspect seat by using previously described seat width measuring procedure. If seat is pitted or burned, additional seat conditioning with 45° cutter is required.

NOTE:

Cut only minimum amount necessary from seat to prevent possibility of valve stem becoming too close to cam.

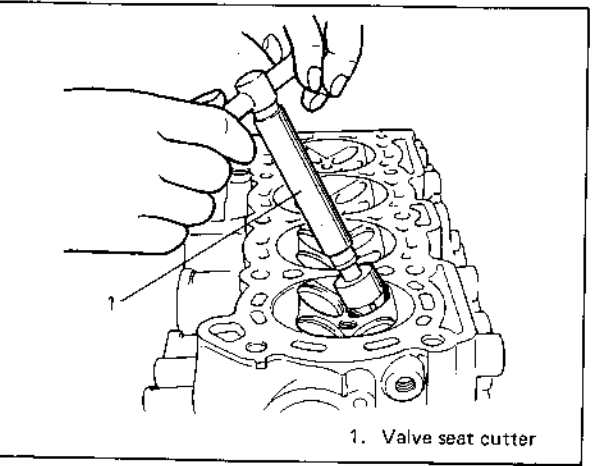


Fig. 6A-92 Valve Seat Cutting

If contact area is too wide, use 15° valve seat cutter to make it narrower.

If contact area is too narrow, use 45° valve seat cutter to widen it.

Standard seating width	1.3 – 1.5 mm (0.0512 – 0.0590 in.)

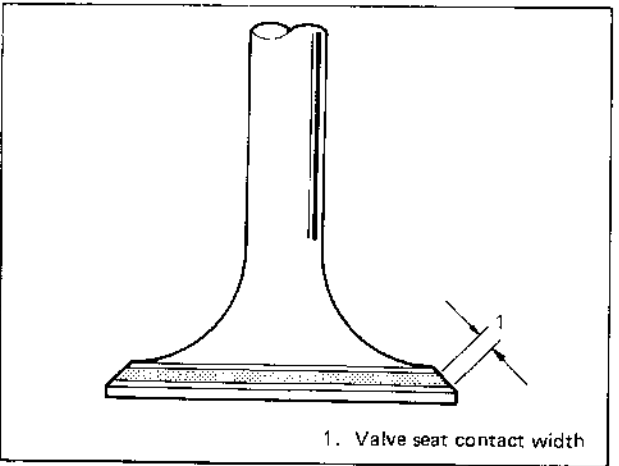


Fig. 6A-93 Valve Seating Contact Width

3. After desired seat width is obtained, lap valve on seat in two steps, first with a coarse size lapping compound applied to its face and secondly with a fine-size compound, each time using a valve lapper according to usual lapping method.

Cylinder Head

- Remove all carbon from combustion chambers.

NOTE:

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

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.
- Flatness of gasketed surface:
Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about # 400 (Waterproof silicon carbide abrasive paper): place paper on and over surface plate, and rub gasketed surface against paper to grind off high spots.

Should this fail to reduce thickness gauge readings to within the limit, replace cylinder head.

Leakage of combustion gases from this gasketed joint is often due to a warped gasketed surface; such leakage results in reduced power output.

Limit of distortion	0.05 mm (0.002 in.)

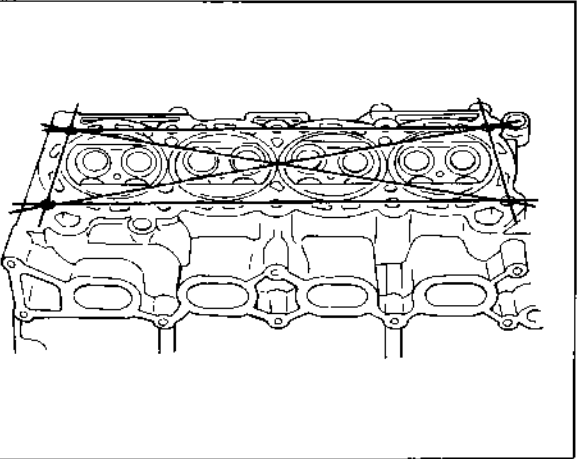


Fig. 6A-94 Locations for Measuring Distortion

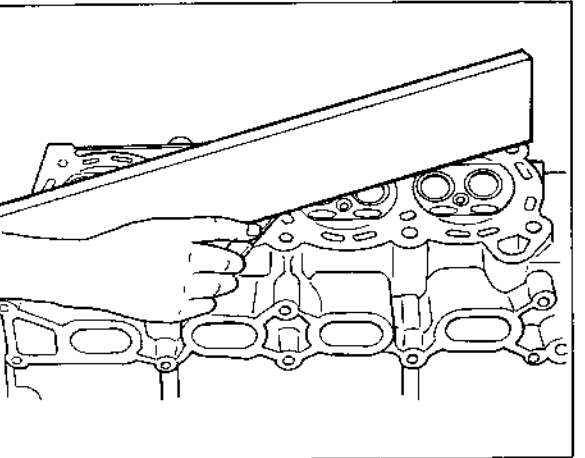


Fig. 6A-95 Measuring Surface

- Distortion of manifold seating faces:
Using a straightedge and thickness gauge, check seating faces of cylinder head for manifolds so as to determine whether they should be corrected or cylinder head be replaced.

Limit of distortion	0.10 mm (0.004 in.)

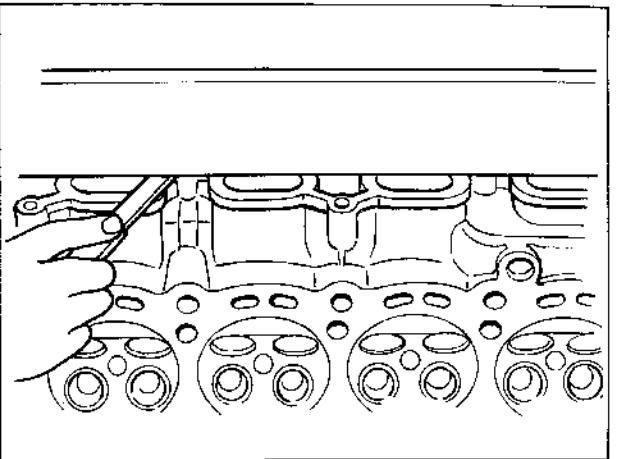


Fig. 6A-96 Measuring Surface of Intake Manifold Seating Face

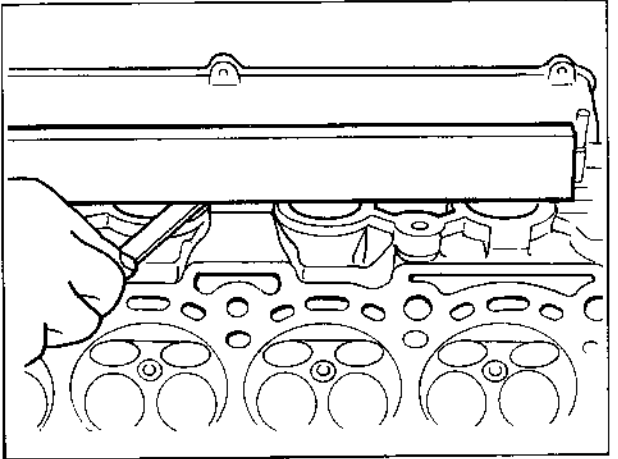


Fig. 6A-97 Measuring Surface of Exhaust Manifold Seating Face

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	51 mm (2.0079 in.)	49.7 mm (1.9567 in.)
Valve spring preload	27.5 – 33.5 kg for 42.5 mm (60.6 – 73.8 lb/1.67 in.)	25.7 kg for 42.5 mm (56.6 lb/1.67 in.)

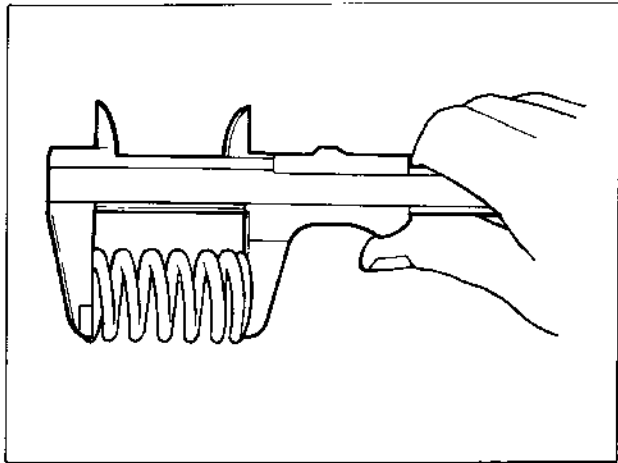


Fig. 6A-98 Measuring Free Length of Spring

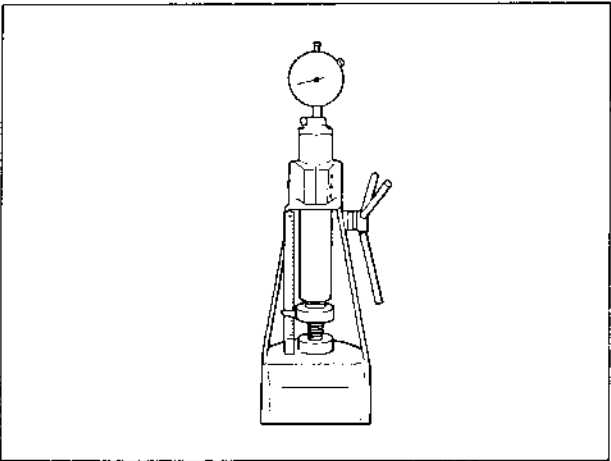


Fig. 6A-99 Measuring Spring Preload

- **Spring squareness:**
Using square and surface plate, 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 square- ness limit	2.0 mm (0.079 in.)

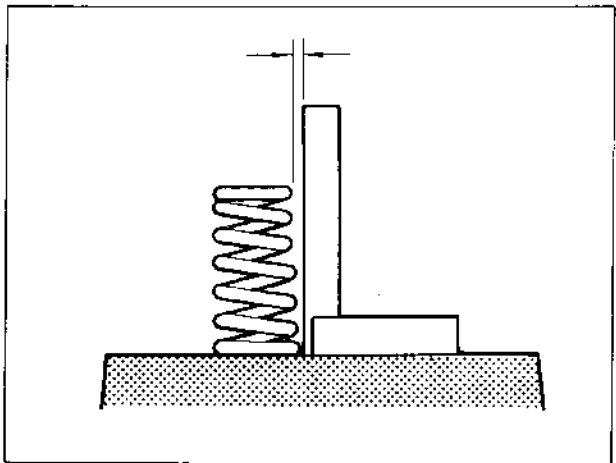


Fig. 6A-100 Measuring Spring Squareness

ASSEMBLY

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

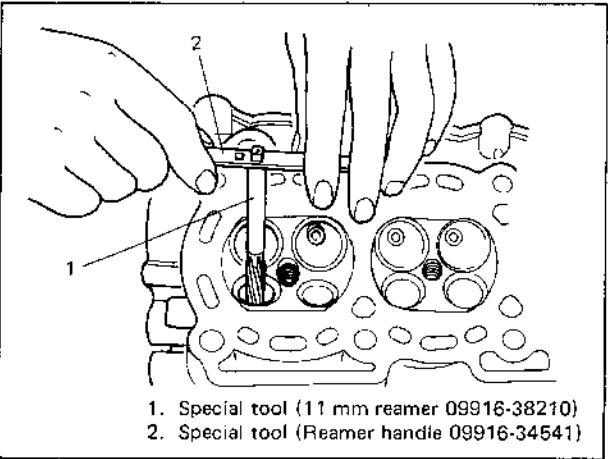


Fig. 6A-101 Reaming Guide Hole

2. 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. Refer to Fig. 6A-102.
Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head. After installing, make sure that valve guide protrudes by 23 mm (0.91 in.) from cylinder head (Fig. 6A-102).

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)	23 mm (0.91 in.)

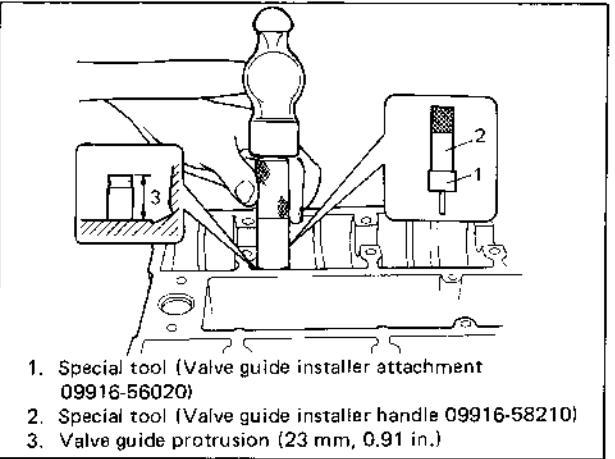


Fig. 6A-102 Installing Valve Guide

3. Ream valve guide bore with special tool (5.5 mm reamer). Be sure to clean it after reaming.

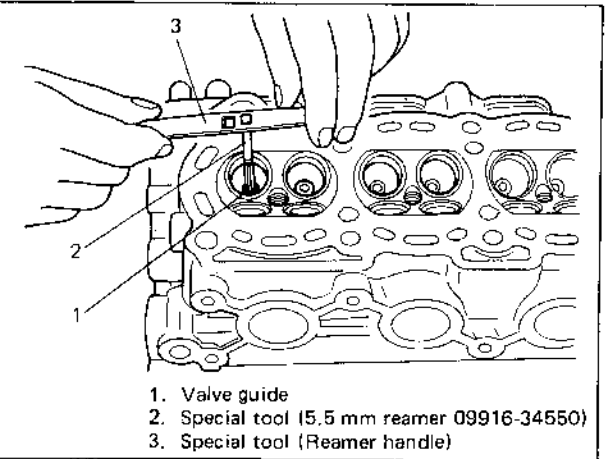


Fig. 6A-103 Reaming Valve Guide Bore

4. Valve spring seat to cylinder head.
5. 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.

NOTE:

- Do not reuse seal once disassembled. Be sure to install a 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.

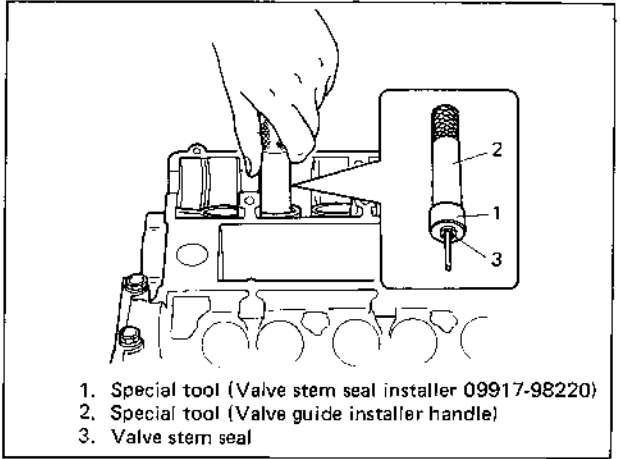


Fig. 6A-104 Installing Valve Stem Seal

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

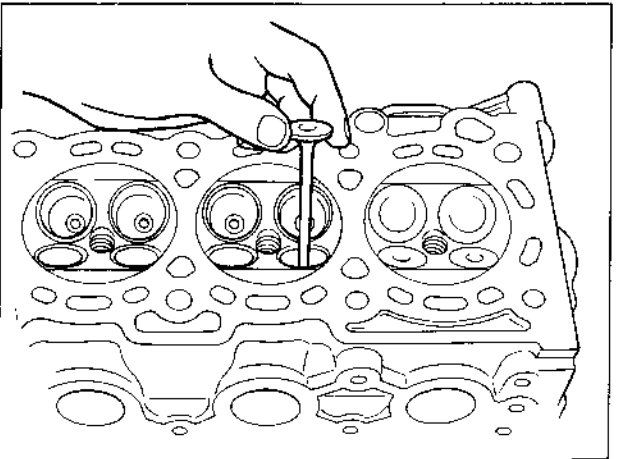


Fig. 6A-105 Installing Valve

7. 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).

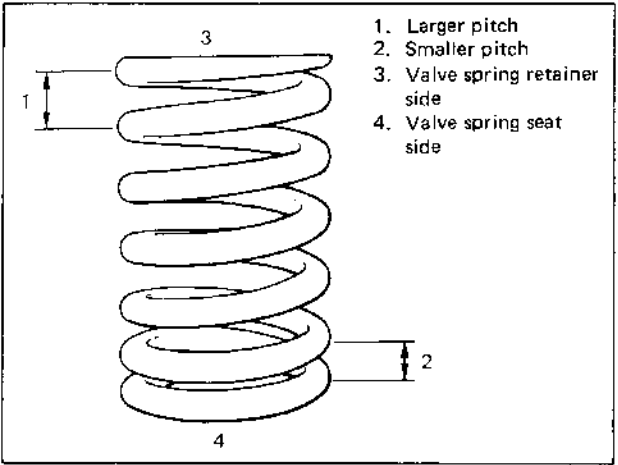


Fig. 6A-106 Installing Valve Spring

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

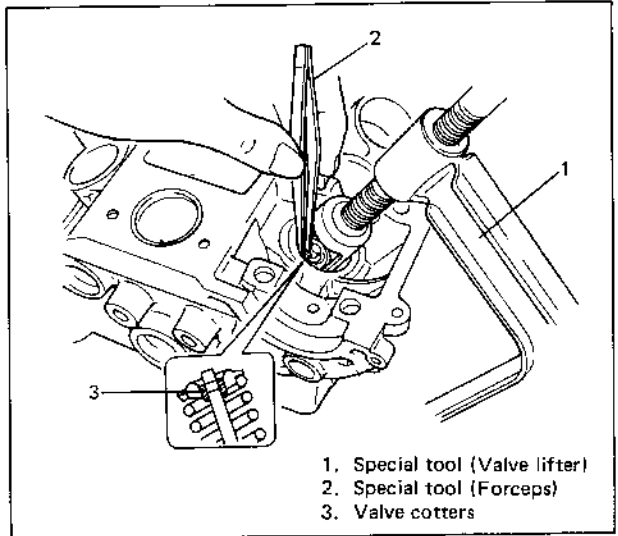


Fig. 6A-107 Installing Valve Cotters

9. Intake manifold with throttle body, exhaust manifold and delivery pipe with injectors.

INSTALL OR CONNECT

1. Cylinder head gasket.

Install new head gasket as shown in Fig. 6A-108 in such a way that "TOP" mark provided on the gasket comes to the top (toward cylinder head) and on crankshaft pulley side.

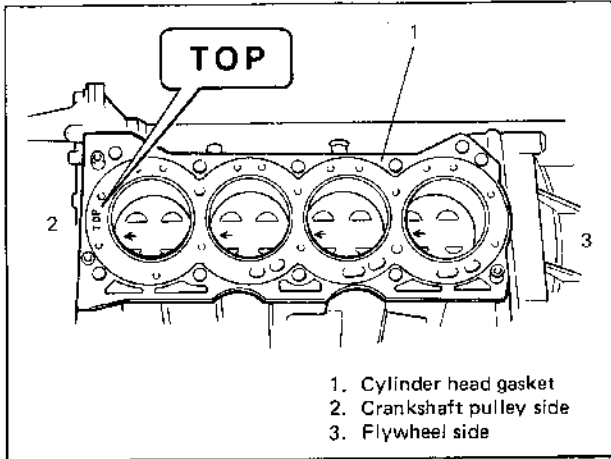


Fig. 6A-108 Installing Cylinder Head Gasket

2. Cylinder head:

After applying engine oil to cylinder head bolts, tighten them gradually with a torque wrench, following sequence given in below figure. Finally tighten bolts to specified torque.

Tightening torque for cylinder head bolts	N-m	kg-m	lb-ft
	65 - 70	6.5 - 7.0	47.5 - 50.5

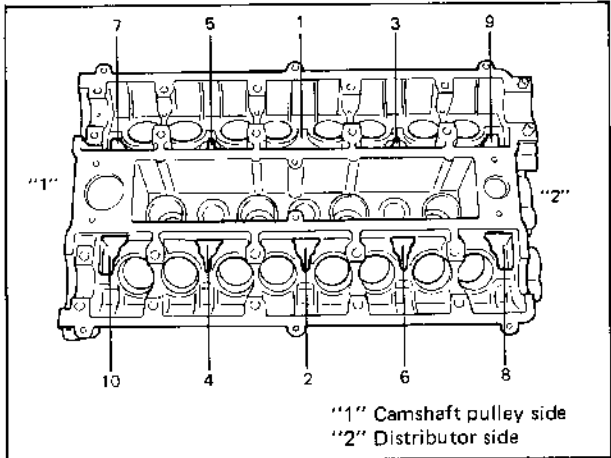


Fig. 6A-109 Tightening Sequence of Cylinder Head Bolts

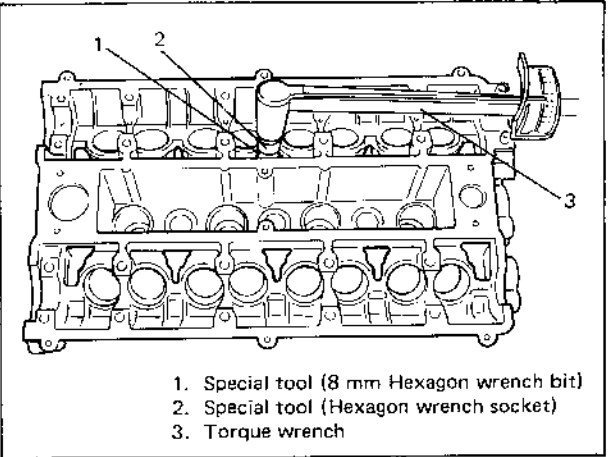


Fig. 6A-110 Tightening Head Bolts

- 3. Valve lash adjusters, camshafts (IN & EX) and camshaft timing belt pulleys (IN & EX) as previously outlined.
- 4. Cylinder head cover to cylinder head.
- 5. Timing belt inside covers.

Before installing inside covers, be sure that rubber seal is installed between water pump and cylinder head.

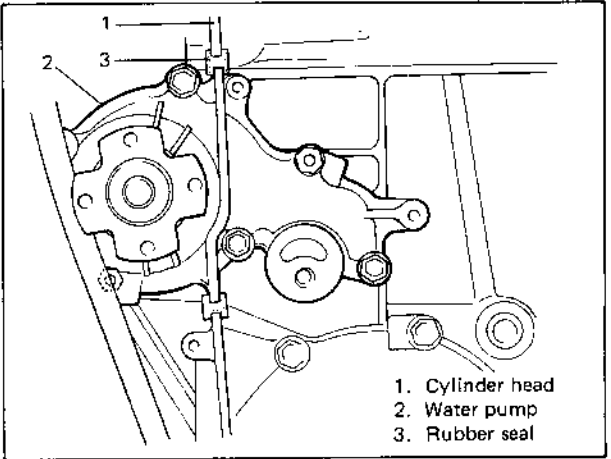


Fig. 6A-111 Installing Rubber Seal

- 6. Distributor to cylinder head. See section 6F for installation.
- 7. Reverse removal procedure for installation of remainder.
- 8. Adjust water pump belt. Refer to section 6B for adjusting procedure.
- 9. Adjust accelerator cable play according to procedure described in section 6E.
- 10. Refill cooling system, referring to section 6B.

- 11. Negative cable at battery.
- 12. Adjust ignition timing. Refer to section 6F for adjustment.
- 13. Upon completion of installation, verify that there is no fuel leakage, water leakage or exhaust gas leakage at each connection.

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS

REMOVE OR DISCONNECT

- 1. Cylinder head from cylinder block as previously outlined.
- 2. Drain engine oil.
- 3. Oil pan and oil pump strainer as previously outlined.
- 4. Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.
- 5. Rod bearing caps.
- 6. Install guide hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.

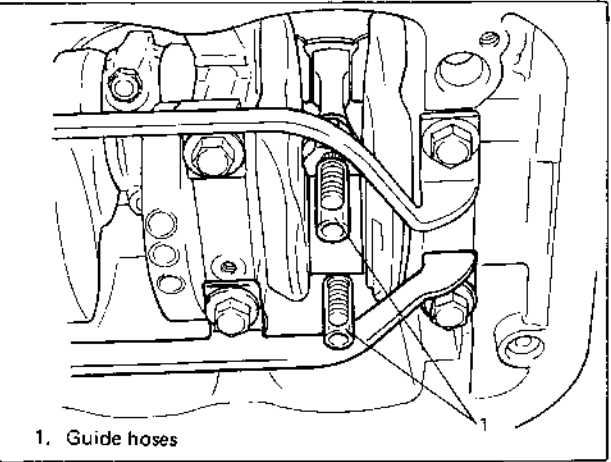


Fig. 6A-112 Installing Guide Hoses

DISASSEMBLY

- 1. Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
- 2. Piston pin from connecting rod.
 - Ease out piston pin circlips, as shown.

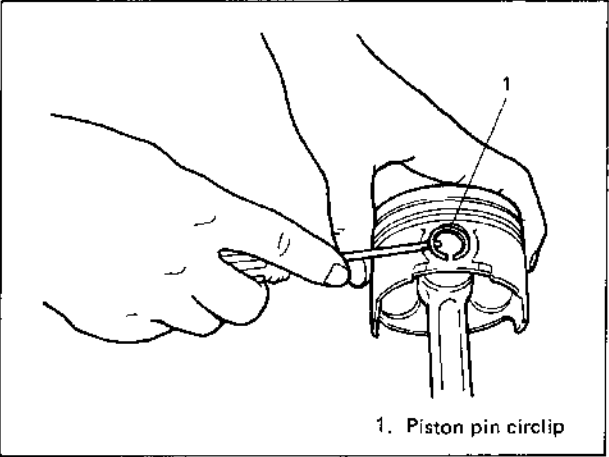


Fig. 6A-113 Removing Piston Pin Circlips

- Force piston pin out.

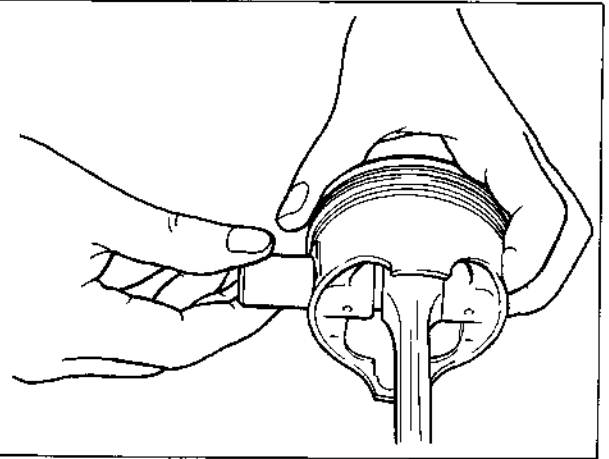


Fig. 6A-114 Removing Piston Pin

CLEAN

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

INSPECT

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.

- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in Fig. 6A-115. If any of following conditions is noted, rebore cylinder.
 1. Cylinder bore dia. exceeds limit.
 2. Difference of measurements at two positions exceeds taper limit.
 3. Difference between thrust and axial measurements exceeds out-of-round limit.

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

NOTE:

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

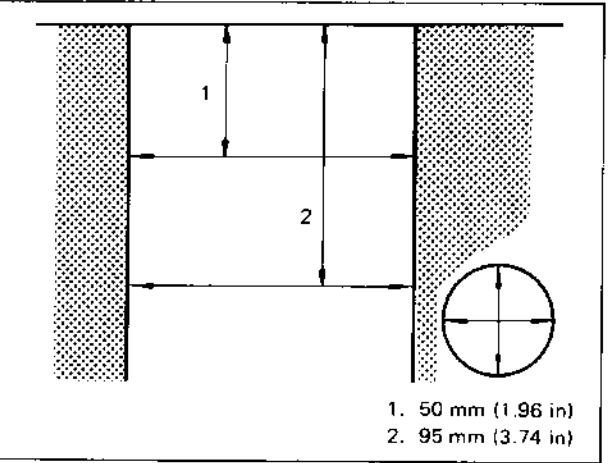


Fig. 6A-115 Positions to be Measured

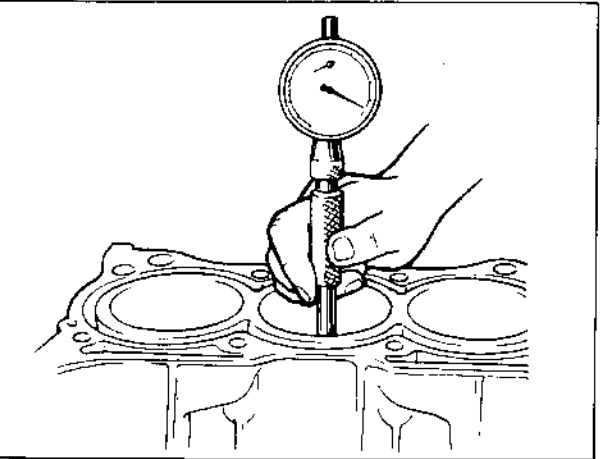


Fig. 6A-116 Measuring Cylinder Bore with Cylinder Gauge

Pistons

- Inspect piston for faults, cracks or other damage. Damaged or faulty piston should be replaced.
- Piston diameter;
As indicated in below figure, piston diameter should be measured at the height of 15 mm (0.59 in) from the piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	73.970 – 73.990 mm (2.9122 – 2.9129 in.)
	Over-size: 0.25 mm (0.0098 in.)	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
	0.50 mm (0.0196 in.)	74.470 – 74.480 mm (2.9319 – 2.9322 in.)

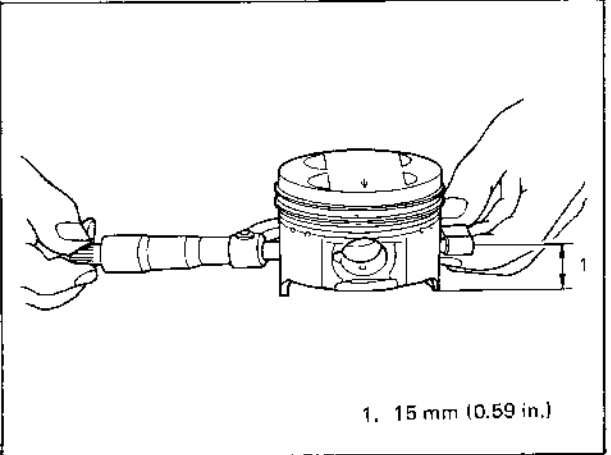


Fig. 6A-117 Measuring Piston Diameter with Micrometer

- 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 over-size 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 as shown in Fig. 6A-115.

- 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.)

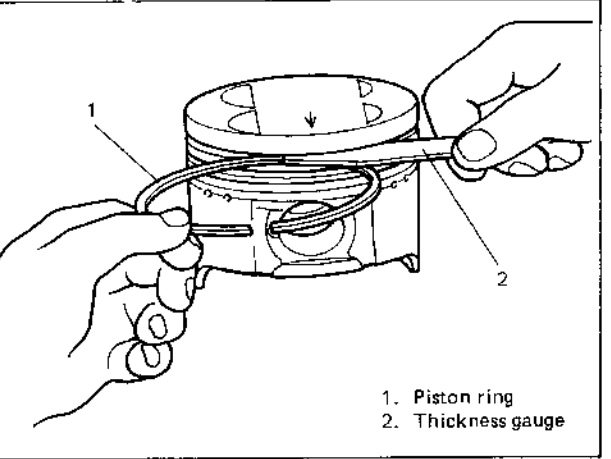


Fig. 6A-118 Measuring Ring Groove Clearance

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 the piston pin clearance in the small end. Replace the connecting rod if its small end is badly worn or damaged or if the clearance checked exceeds the limit.

Item	Standard	Limit
Pin clearance in small end	0.003 – 0.016 mm (0.0001 – 0.0006 in.)	0.05 mm (0.0020 in.)

Small-end bore	19.003 – 19.011 mm (0.7481 – 0.7484 in.)
Piston pin dia.	18.995 – 19.000 mm (0.7478 – 0.7480 in.)

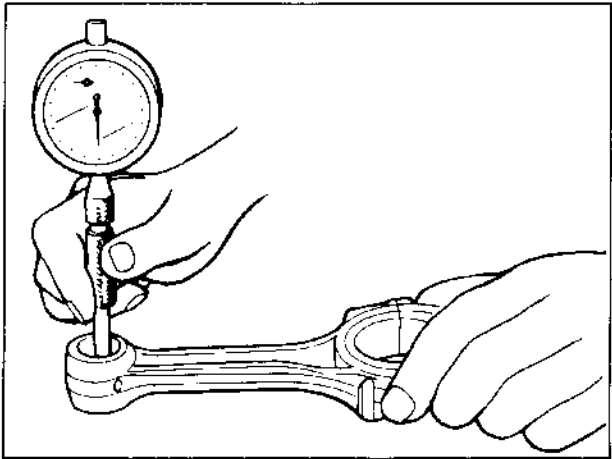


Fig. 6A-119 Measuring Small End Bore

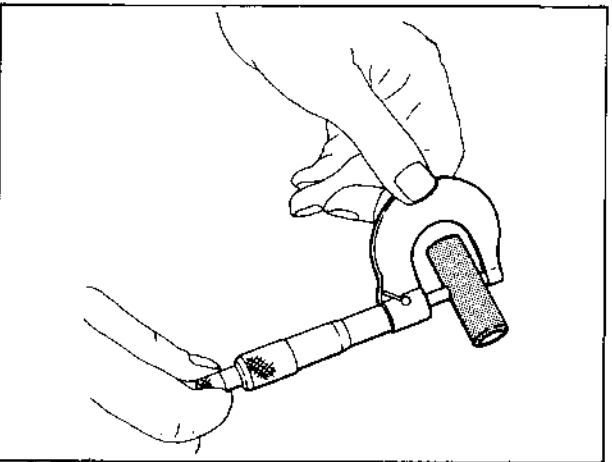


Fig. 6A-120 Measuring Piston Pin Diameter

Piston Rings

To measure end gap, insert piston ring into cylinder bore as shown in Fig. 6A-121 and then measure gap by using thickness gauge. If measured gap is out of specification, replace ring.

NOTE:

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

Item	Standard	Limit
Piston ring end gap	Top ring 0.20 – 0.30 mm (0.0079 – 0.0118 in.)	0.7 mm (0.0275 in.)
	2nd ring 0.20 – 0.30 mm (0.0079 – 0.0118 in.)	0.7 mm (0.0275 in.)
	Oil ring 0.20 – 0.60 mm (0.0079 – 0.0236 in.)	1.7 mm (0.0669 in.)

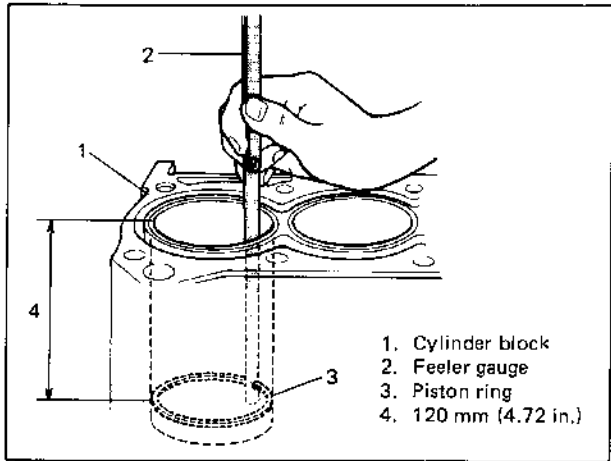


Fig. 6A-121 Measuring Piston Ring End Gap

Connecting Rod

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

Item	Standard	Limit
Big-end side clearance	0.10 – 0.20 mm (0.0039 – 0.0078 in.)	0.35 mm (0.0137 in.)

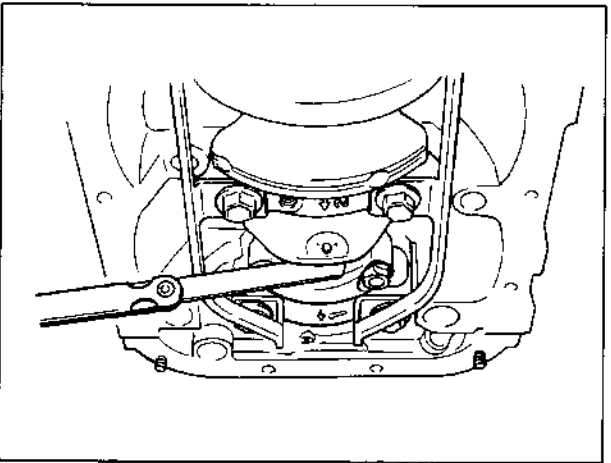


Fig. 6A-122 Measuring Side Clearance

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

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

Crank Pin and Connecting Rod Bearings

- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6529 – 1.6535 in.)
0.25 mm (0.0098 in.) undersize	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

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

- Rod bearing:
Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. For their distinction, 0.25 mm undersize bearing has "US025" stamped on its back-side as shown in Fig. 6A-123 but standard size one has no such number stamped.

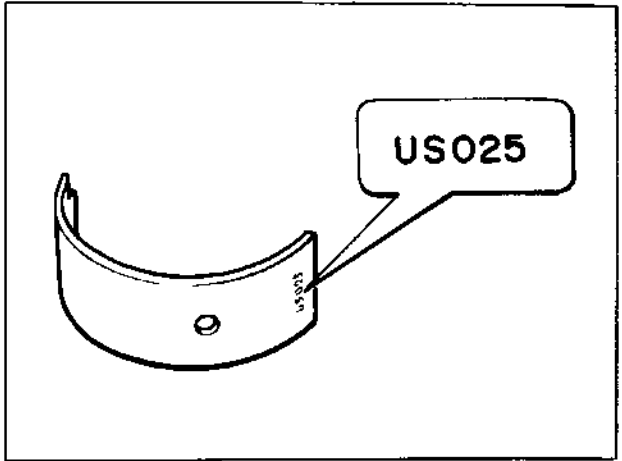


Fig. 6A-123 0.25 mm Undersize Bearing

- Rod bearing clearance:
1. Before checking bearing clearance, clean bearing and crank pin.
2. Install bearing in connecting rod and bearing cap.
3. Place a piece of gaging plastic the 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 the arrow mark on cap to crankshaft pulley side, as shown in Fig. 6A-124. After applying engine oil to rod bolts, tighten cap nuts to specified torque. DO NOT turn crankshaft with gaging plastic installed.

Tightening torque for rod bearing cap nuts	N·m	kg·m	lb·ft
	33 – 37	3.3 – 3.7	24.0 – 26.5

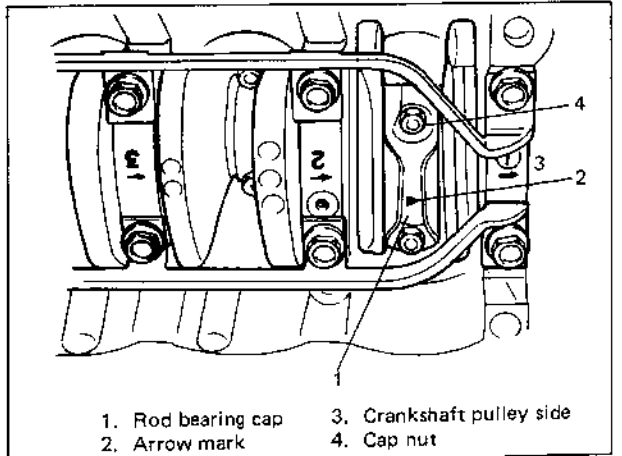


Fig. 6A-124 Installing Bearing Cap

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

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

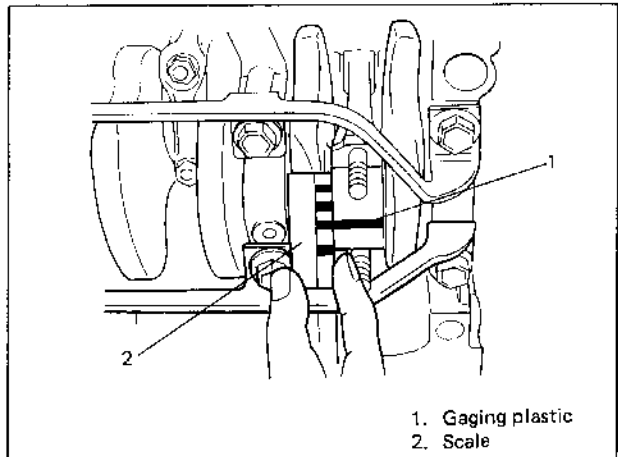


Fig. 6A-125 Measuring Rod Bearing Clearance

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.

ASSEMBLE

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 outside diameter of piston.

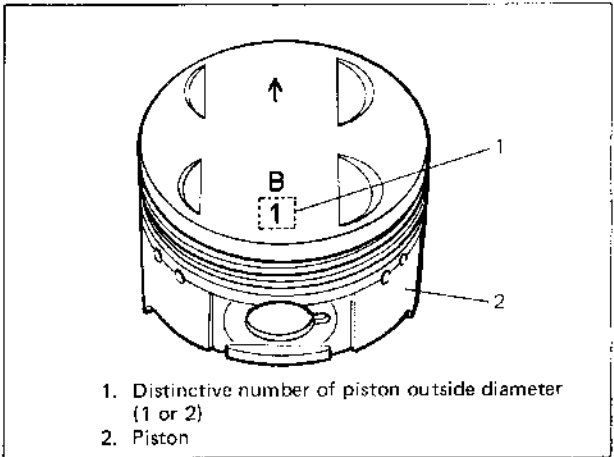


Fig. 6A-126 Piston Size Number

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

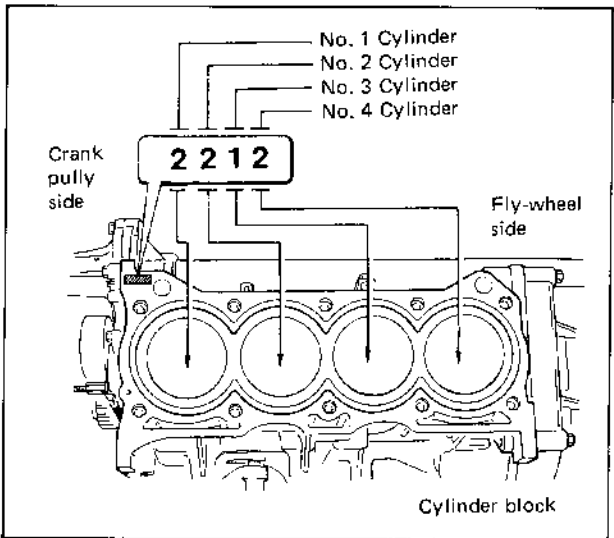


Fig. 6A-127 Cylinder Bore Number

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

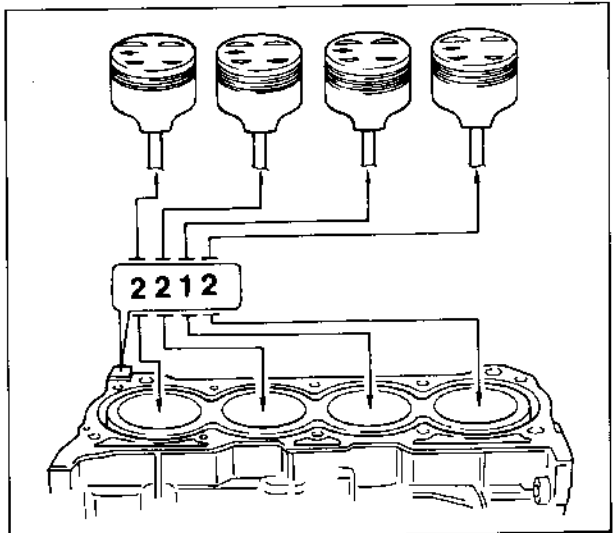


Fig. 6A-128 Piston-to-Cylinder Orientation

Piston		Cylinder		Piston-to-Cylinder Clearance
Number at the top (mark)	Outside diameter	Number (mark)	Bore diameter	
1	73.98–73.99 mm (2.9126–2.9130 in.)	1	74.01–74.02 mm (2.9138–2.9142 in.)	0.02–0.04 mm (0.0008–0.0015 in.)
2	73.97–73.98 mm (2.9122–2.9126 in.)	2	74.00–74.01 mm (2.9134–2.9138 in.)	0.02–0.04 mm (0.0008–0.0015 in.)

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

1. 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 indicated in below figure and insert piston pin to piston and connecting rod, and install piston pin circlip.

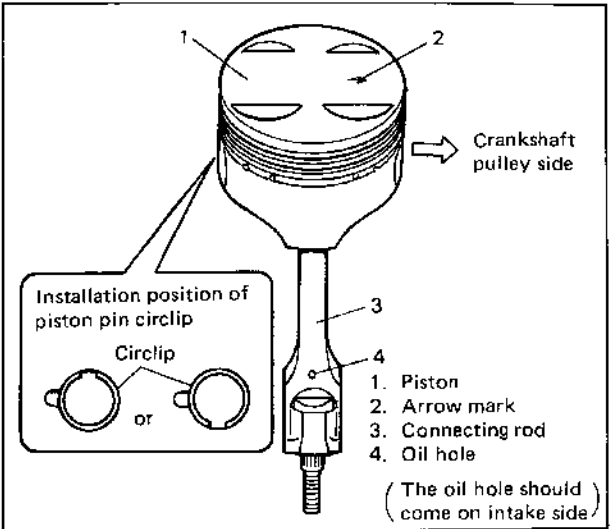


Fig. 6A-129 Fitting Connecting Rod to Piston

2. Piston rings to piston:

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

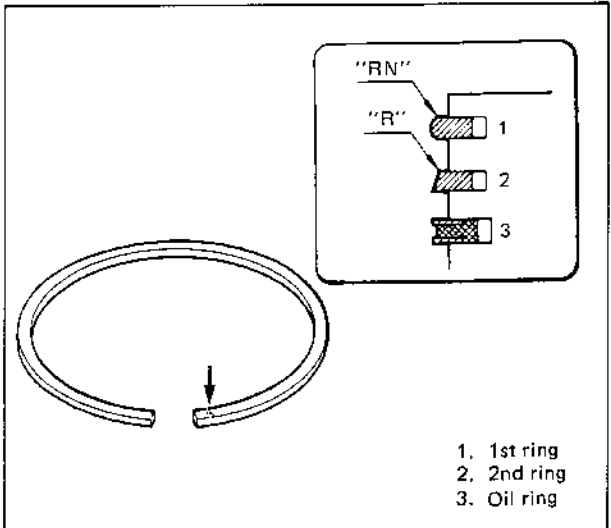


Fig. 6A-130 Installing Piston Rings

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

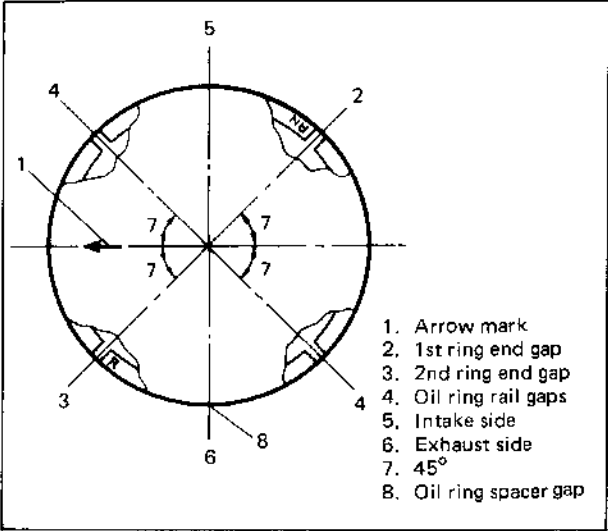


Fig. 6A-131 Positions of Piston Ring End Gaps

INSTALL OR CONNECT

1. Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crankpins.
2. 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. Refer to Fig. 6A-112 for installation of guide hoses.
3. When installing piston and connecting rod assembly into cylinder bore, direct arrow mark on piston head to crankshaft pulley side.

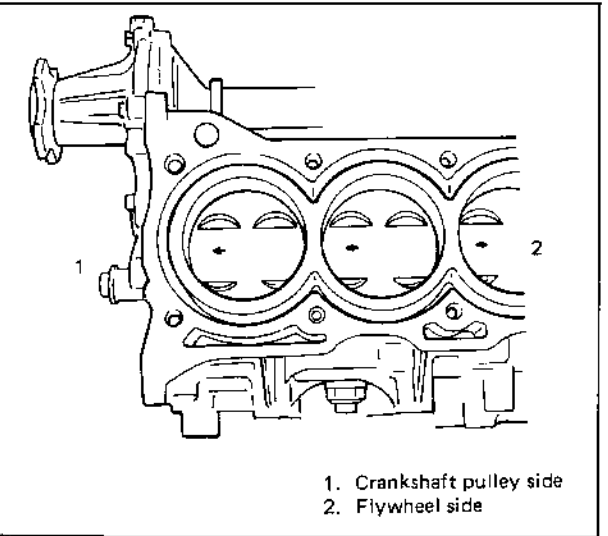


Fig. 6A-132 Direction of Arrow Mark on Piston Head

4. 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.

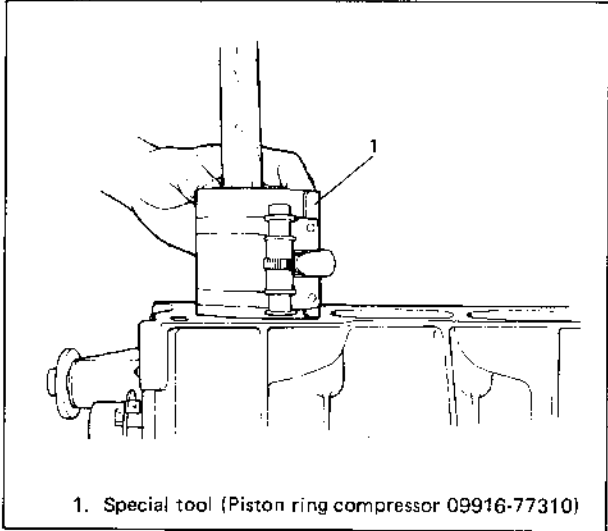


Fig. 6A-133 Installing Piston to Cylinder

5. Bearing cap:
When installing cap to rod, direct arrow mark on cap to crankshaft pulley side.
After applying engine oil to bolt threads, tighten cap nuts to specification.

Tightening torque for rod bearing cap nuts	N·m	kg·m	lb·ft
	33 - 37	3.3 - 3.7	24.0 - 26.5

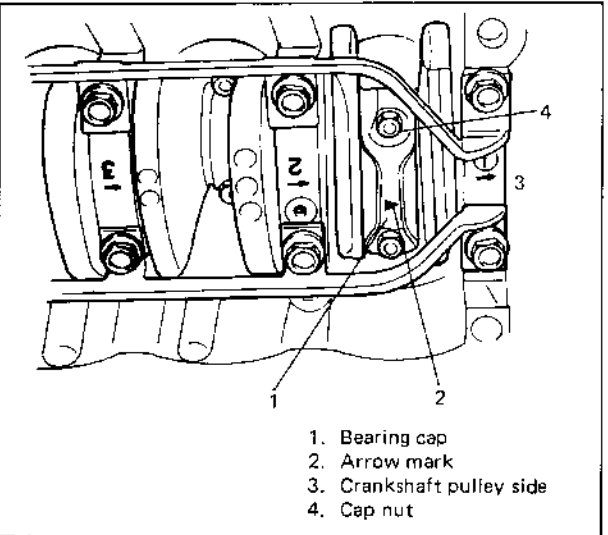


Fig. 6A-134 Installing Bearing Cap

6. Reverse removal procedure for installation of remainder, as previously outlined.
7. Adjust water pump belt tension. See section 6B for adjustment.
8. Adjust accelerator cable play. See section 6E for adjustment.
9. Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in section 0B.
10. Refill cooling system, referring to section 6B.
11. Negative cable at battery.
12. Check ignition timing and adjust as necessary.
13. Upon completion of installation, verify that there is no fuel leakage, water leakage or exhaust gas leakage at each connection.

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

REMOVE OR DISCONNECT

1. Relieve fuel pressure according to procedure described in p. 6-3.
2. Battery and its tray.
3. Engine hood after disconnecting front window washer hose.
4. Drain cooling system.
5. Air cleaner assembly with AFM outlet hose.
6. Radiator with cooling fan. Refer to Section 6B for removal.
7. Following electric wires:
 - Battery negative cable from transmission
 - A/T shift solenoids (Direct clutch and 2nd brake solenoids for A/T)
 - Noise filter ground wire
 - Shift switch of A/T
 - Speed sensor of A/T
 - Back-up light switch (M/T only)
 - High-tension cord from ignition coil
 - Distributor (CAS)
 - ISC solenoid valve
 - REGTS (if equipped)
 - WTG
 - Engine cooling fan thermo switch
 - WTS
 - Oxygen sensor
 - Canister purge VSV
 - EGR VSV (if equipped)
 - Ground wire from intake manifold
 - TPS
 - Fuel injector
 - Generator
 - Starter motor
 - Oil pressure gauge
 and release above wires from clamps.
8. Following cables:
 - Accelerator cable from throttle lever and its bracket
 - Clutch cable from M/T
 - Gear select cable and A/T oil pressure control cable from A/T
 - Speed meter cable from transmission

9. Following vacuum hoses:
 - Brake booster hose
 - Canister purge hose
 - A/C VSV hoses (if equipped)
10. Fuel return hose and fuel feed hose.
11. Heater inlet and outlet hoses.
12. Chacoal canister from body.
13. Hoist car.
14. Exhaust No. 1 pipe from exhaust manifold.
15. Gear shift control shaft and extension rod from M/T
16. Drain engine oil and transmission oil.
17. Left side drive shaft joint from differential gear of transmission.
Right side drive shaft joint from center bearing support.
Refer to Section 4 "Drive Shaft" for procedure to disconnect drive shaft joints.
For engine with transmission removal, it is not necessary to remove drive shaft from steering knuckle.
18. Engine rear torque rod bracket from A/T.
19. Lower car.
20. Install lifting device.
21. With M/T model, remove rear mounting from body. With A/T model, remove rear mounting nut.
22. Left side engine mounting bracket bolts and mounting bolt.
23. Right side engine mounting from its bracket.
24. Before lifting engine with transmission, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transmission.
25. Engine with transmission from body.

INSTALL OR CONNECT

1. Lower engine with transmission into engine compartment, but do not remove lifting device.
2. Right side engine mounting to its bracket.
3. Left side engine mounting bolt and its bracket bolts.
4. With M/T model, install rear mounting. With A/T model, install rear mounting nut.
5. Tighten bolts and nuts of all parts installed in above steps 2, 3 and 4 to specified torque.

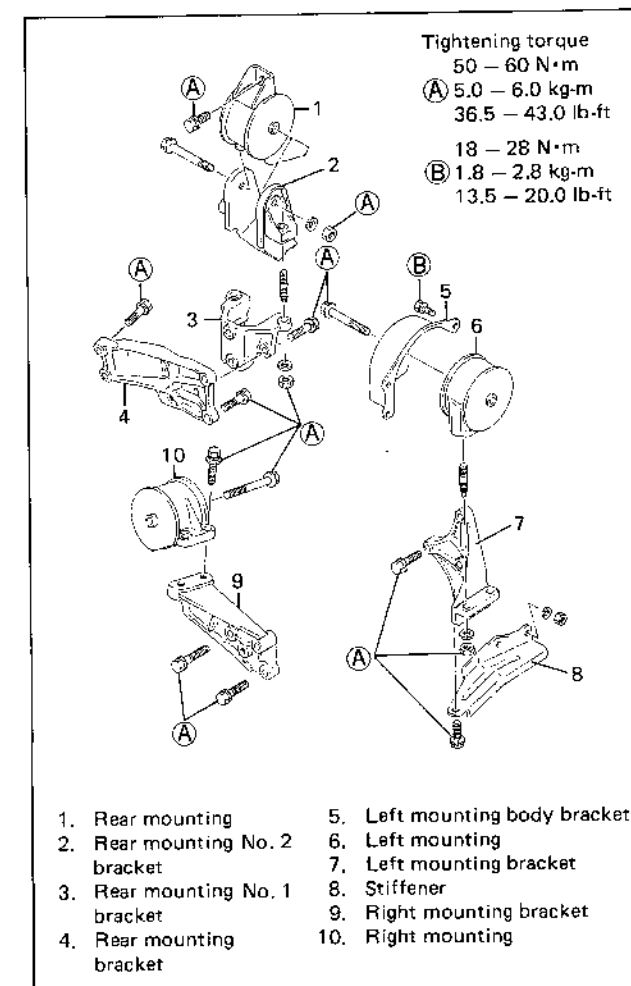


Fig. 6A-135 Engine Mounting (For M/T Model)

1. Rear torque rod
 2. Rear torque rod bracket
 3. Torque rod stiffener
 4. Left mounting body bracket
 5. Left mounting
 6. Left mounting bracket
 7. Right mounting bracket
 8. Right mounting
 9. Rear mounting bracket
 10. Rear mounting
 11. Rear mounting body No. 1 bracket
 12. Rear mounting body No. 2 bracket
- Tightening torque
50 – 60 N·m
A 5.0 – 6.0 kg·m
36.5 – 43.0 lb·ft
40 – 50 N·m
B 4.0 – 5.0 kg·m
29.0 – 36.0 lb·ft
18 – 28 N·m
C 1.8 – 2.8 kg·m
13.5 – 20.0 lb·ft

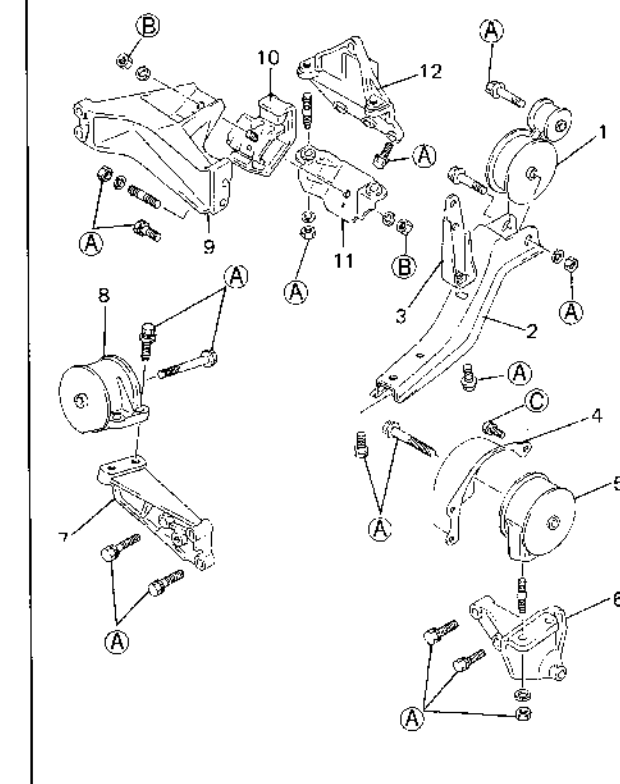
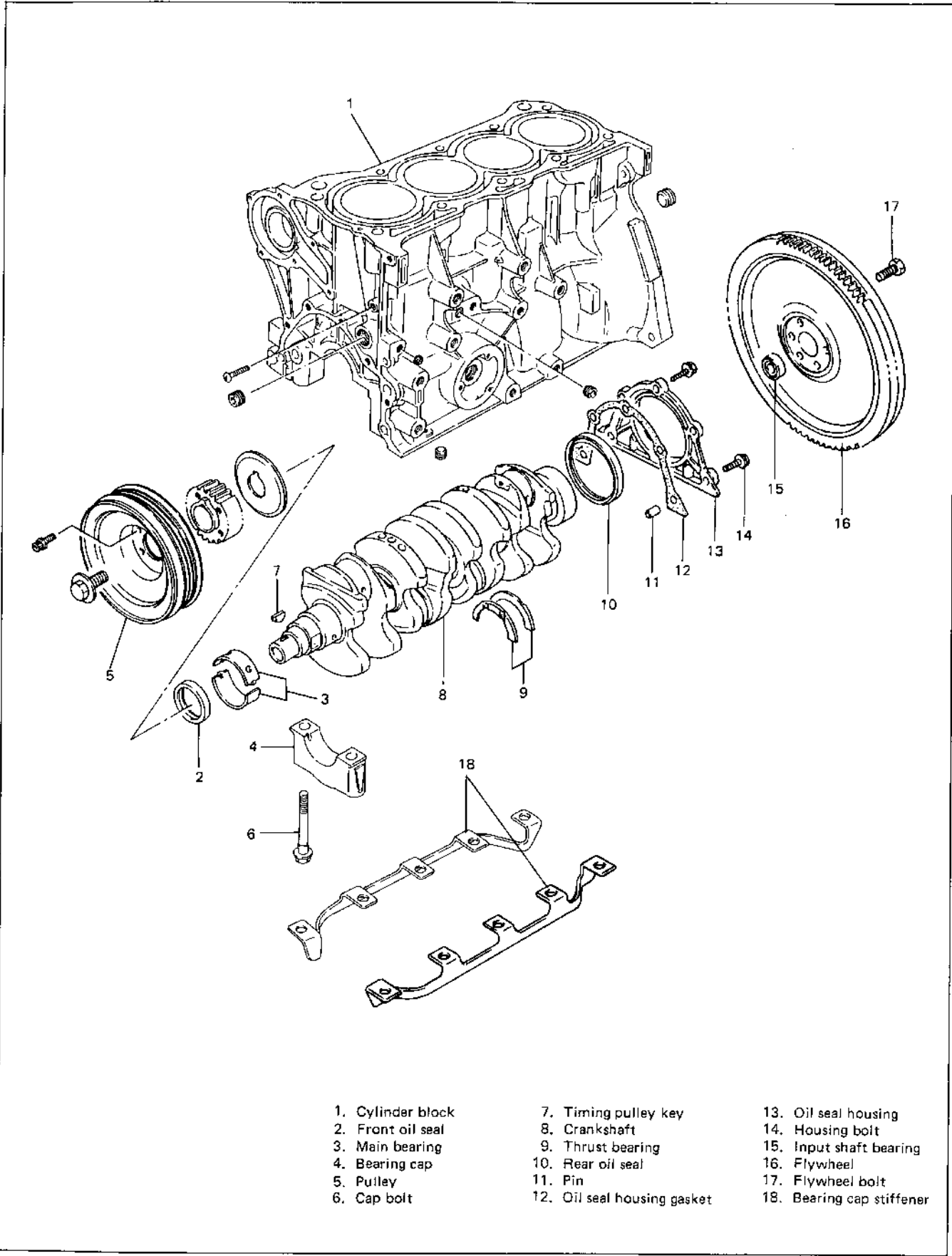


Fig. 6A-136 Engine Mounting (For A/T Model)

6. Remove lifting device.
7. Reverse removal procedures for installation of remainder.
 - Push in each drive shaft joint fully so that snap ring engages with differential gear or center bearing support. Use care not to damage oil seal lip when inserting.
 - Clamp electric wires securely.
8. Adjust clutch pedal free travel, referring to section 7C. (For M/T model)
Adjust gear select cable and oil pressure control cable, referring to section 7B. (For A/T model)
9. Adjust accelerator cable play, referring to section 6E.
10. Refill transmission with gear oil. (A/T fluid for A/T model), referring to section 0B.
11. Refill engine with engine oil, referring to section 0B.
12. Refill cooling system, referring to section 6B.
13. Upon completion of installation, verify that there is no fuel leakage, water leakage, transmission oil leakage or exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block	7. Timing pulley key	13. Oil seal housing
2. Front oil seal	8. Crankshaft	14. Housing bolt
3. Main bearing	9. Thrust bearing	15. Input shaft bearing
4. Bearing cap	10. Rear oil seal	16. Flywheel
5. Pulley	11. Pin	17. Flywheel bolt
6. Cap bolt	12. Oil seal housing gasket	18. Bearing cap stiffener

Fig. 6A-137 Main Bearing, Crankshaft and Cylinder Block

REMOVE OR DISCONNECT

1. Engine with transmission from body as previously outlined.
2. Transmission from engine.
With A/T model, remove transmission from engine according to procedure described in SECTION 7B.
3. Water pump belt, generator bracket, crankshaft pulley, timing belt, and crankshaft timing belt pulley, etc..
4. Cylinder head assembly.
5. Oil pan and oil pump strainer.
6. Pistons and connecting rods.
7. Oil pump and oil seal housing.
8. Main bearing caps and crankshaft.

INSPECT

Crankshaft

Crankshaft runout

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

Limit on runout	0.06 mm (0.0023 in.)

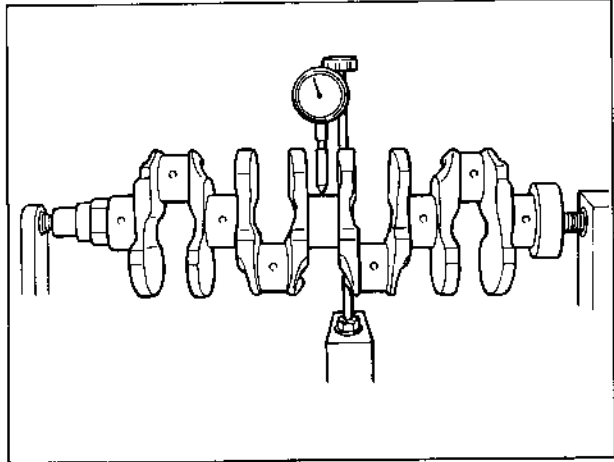


Fig. 6A-138 Measuring Runout

Crankshaft thrust play

Measure this play with crankshaft set in cylinder block in normal manner, that is, with thrust bearing and journal bearing caps installed. Tighten bearing cap bolts to specified torque. 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.

Tightening torque for main bearing cap bolts	N-m	kg-m	lb-ft
	50 - 57	5.0 - 5.7	36.5 - 41.0

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

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

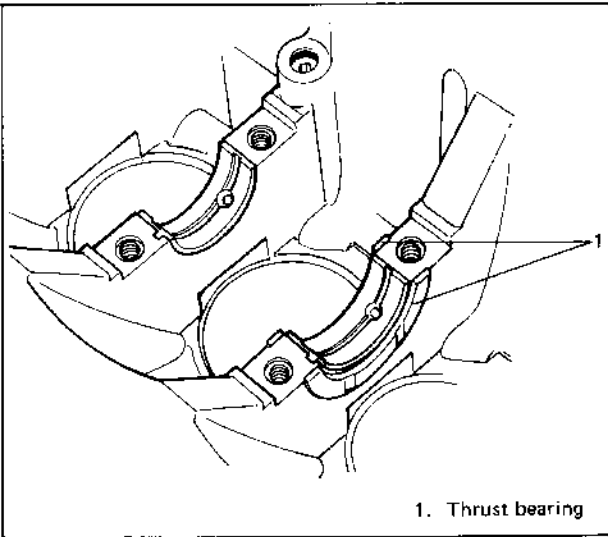


Fig. 6A-139 Thrust Bearings

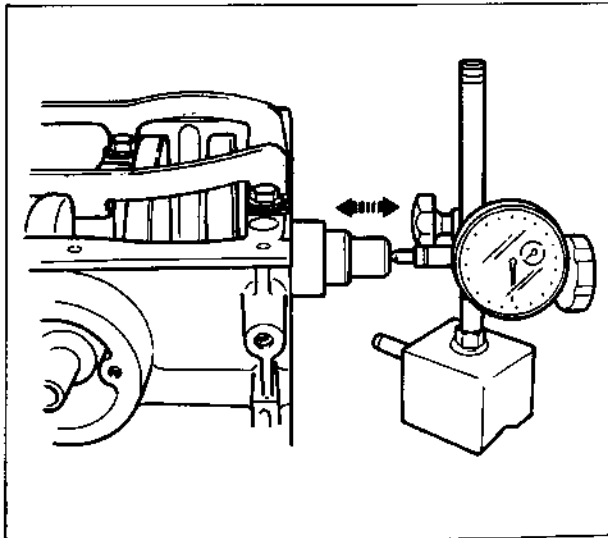


Fig. 6A-140 Measuring Thrust Play of Crankshaft

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

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

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

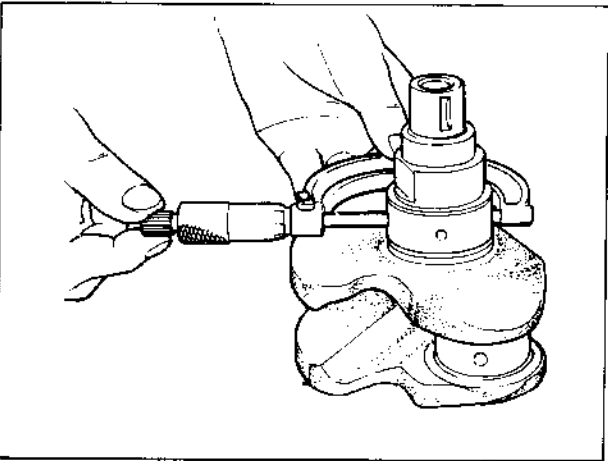


Fig. 6A-141 Checking Uneven Wear

Main Bearings

General information

- Service main bearings are available in standard-size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing has oil groove as shown in Fig. 6A-142. Install this half with oil groove to cylinder block.

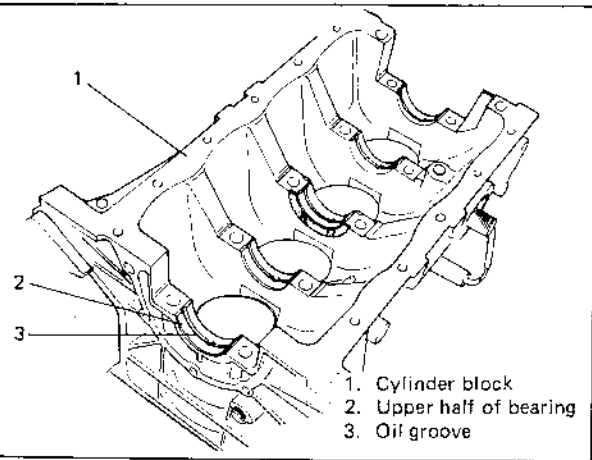


Fig. 6A-142 Installing Upper Half of Bearing

- On each main bearing cap, arrow mark and number are embossed as shown in Fig. 6A-143. When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers "1", "2", "3", "4" and "5". Tighten cap bolts to specified torque after applying engine oil to bolt thread.

Tightening torque for main bearing cap bolts	N·m	kg·m	lb·ft
	50 – 57	5.0 – 5.7	36.5 – 41.0

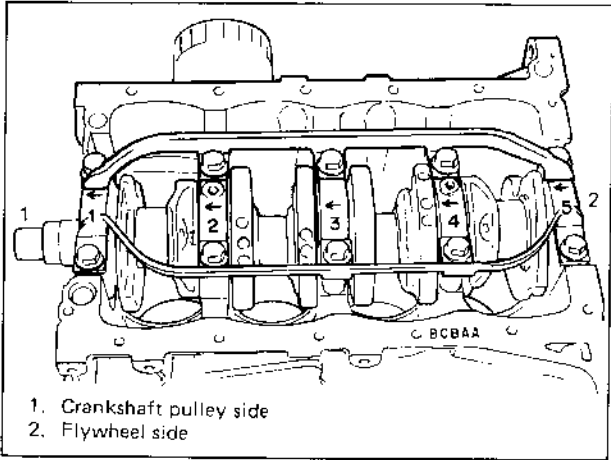


Fig. 6A-143 Installing Bearing Caps

Inspect

Check bearings for pitting, scratches, wear or damage.

If any malcondition is found, replace both upper and lower halves. Never replace only one half without replacing the other half.

Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

1. Remove bearing caps.
2. Clean bearings and main journals.
3. Place a piece of gaging plastic the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.
4. Install bearing cap as previously outlined and evenly torque cap bolts to specification. Bearing cap **MUST** be torqued to specification in order to assure proper reading of clearance.

NOTE:

Do not rotate crankshaft while gaging plastic is installed.

5. Remove cap, 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	Limit
	0.020 – 0.040 mm (0.0008 – 0.0016 in.)	0.060 mm (0.0023 in.)

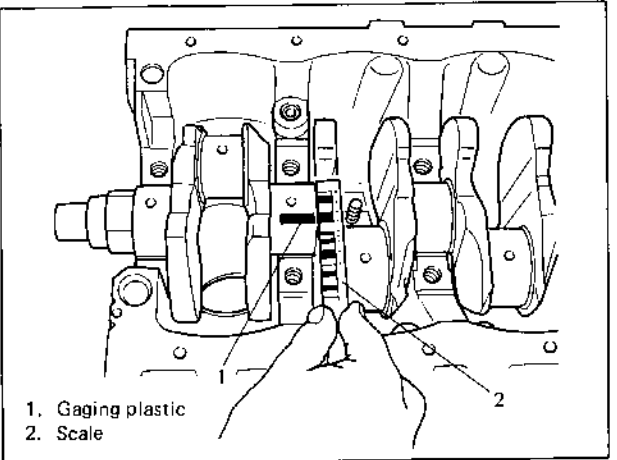


Fig. 6A-144 Measuring Main Bearing Clearance

Selection of main bearings

STANDARD BEARING:

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

1. First check journal diameter by using following procedure.

As shown in Fig. 6A-145, crank web of No. 1 cylinder has five stamped numerals.

The three kinds of numerals ("1", "2" and "3") represent following journal diameters.

Numerals stamped	Journal diameter
1	44.994 – 45.000 mm (1.7714 – 1.7716 in.)
2	44.988 – 44.994 mm (1.7712 – 1.7714 in.)
3	44.982 – 44.988 mm (1.7710 – 1.7712 in.)

The first, second, third, fourth and fifth (intake manifold side to exhaust manifold side) stamped numerals represent journal diameters at bearing caps "1", "2", "3", "4" and "5" respectively.

For example, in Fig. 6A-145, the first (upmost) numeral "3" indicates that journal dia. at bearing cap "1" is within 44.982 – 44.988 mm, and second one "1" indicates that journal dia. at cap "2" is within 44.994 – 45.000 mm.

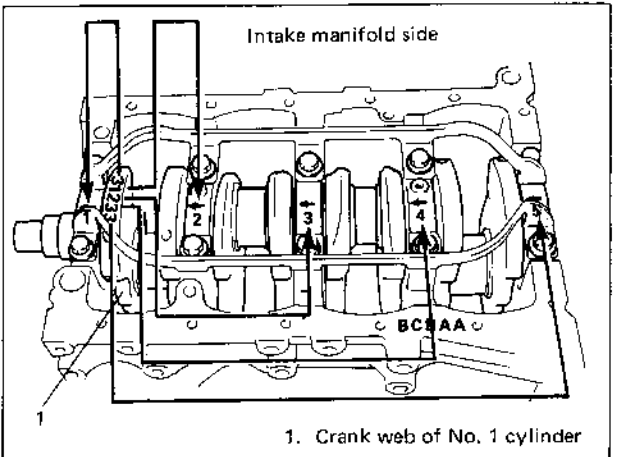


Fig. 6A-145 Stamped Numerals on Crank Web of No. 1 Cylinder

2. Next, check bearing cap bore diameter without bearing.
On mating surface of cylinder block, five alphabets are stamped as shown in Fig. 6A-146. Three kinds of alphabets ("A", "B" and "C") represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	49.000 – 49.006 mm (1.9292 – 1.9294 in.)
B	49.006 – 49.012 mm (1.9294 – 1.9296 in.)
C	49.012 – 49.018 mm (1.9296 – 1.9298 in.)

The first, second, third, fourth and fifth (left to right) stamped alphabets represent cap bore diameters of bearing caps "1", "2", "3", "4" and "5", respectively.
For example, in Fig. 6A-146, the first (leftmost) alphabet "B" indicates that cap bore dia. of bearing cap "1" is within 49.006 – 49.012 mm, and the fifth (rightmost) alphabet "A" indicates that cap bore dia. of cap "5" is within 49.000 – 49.006 mm.

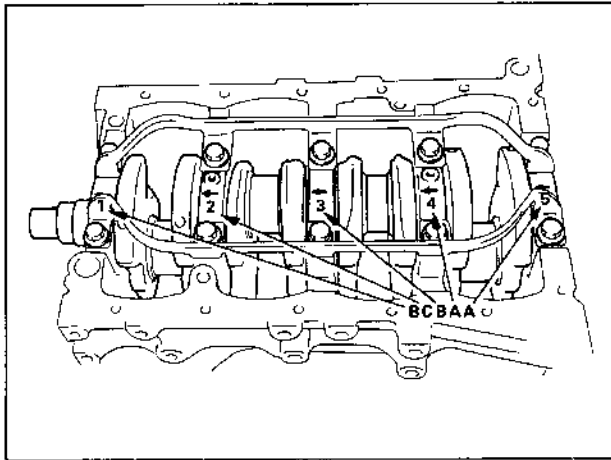


Fig. 6A-146 Stamped Alphabets on Cylinder Block

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 Fig. 6A-147. Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Black	1.999 – 2.003 mm (0.0787 – 0.0788 in.)
Colorless (no paint)	2.002 – 2.006 mm (0.0788 – 0.0789 in.)
Yellow	2.005 – 2.009 mm (0.0789 – 0.0790 in.)
Blue	2.008 – 2.012 mm (0.0790 – 0.0791 in.)

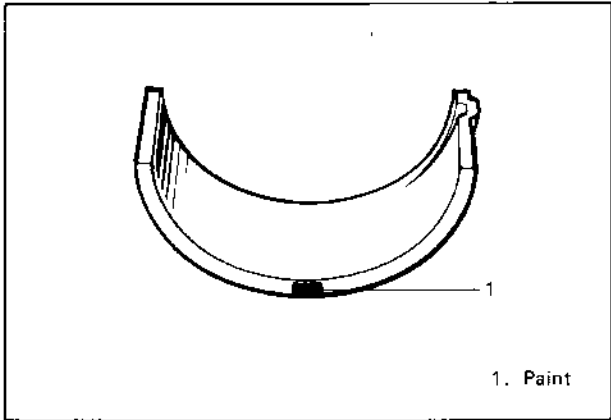


Fig. 6A-147 Paint on Standard Bearing

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

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

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 for any reason, select new standard bearings to be installed by referring to numerals stamped on new crankshaft and alphabets stamped on mating surface of new cylinder block.

UNDERSIZE BEARING (0.25 mm):
• 0.25 mm undersize bearing is available, in five kinds varying in thickness.
To distinguish them, each bearing is painted in following colors at such position as indicated in Fig. 6A-148.
Each color represents following thicknesses at the center of bearing.

Color painted	Bearing thickness
Green & Red	2.121 – 2.125 mm (0.0835 – 0.0836 in.)
Black & Red	2.124 – 2.128 mm (0.0836 – 0.0837 in.)
Red only	2.127 – 2.131 mm (0.0837 – 0.0838 in.)
Yellow & Red	2.130 – 2.134 mm (0.0838 – 0.0839 in.)
Blue & Red	2.133 – 2.137 mm (0.0839 – 0.0840 in.)

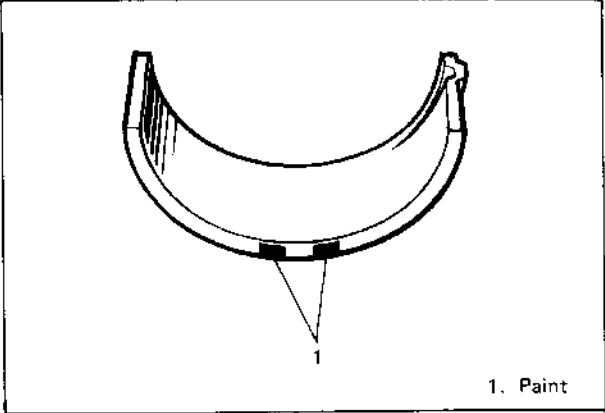


Fig. 6A-148 Paints on Undersize Bearing

• If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.

1. Regrind journal to following finished diameter.

Finished diameter	44.732 – 44.750 mm (1.7612 – 1.7618 in.)

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

		Measured journal diameter		
		44.744 – 44.750 mm (1.7616 – 1.7618 in.)	44.738 – 44.744 mm (1.7614 – 1.7616 in.)	44.732 – 44.738 mm (1.7612 – 1.7614 in.)
Alphabets stamped on mating surface of cylinder block	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
Undersize bearing to be installed.				

Rear Oil Seal

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

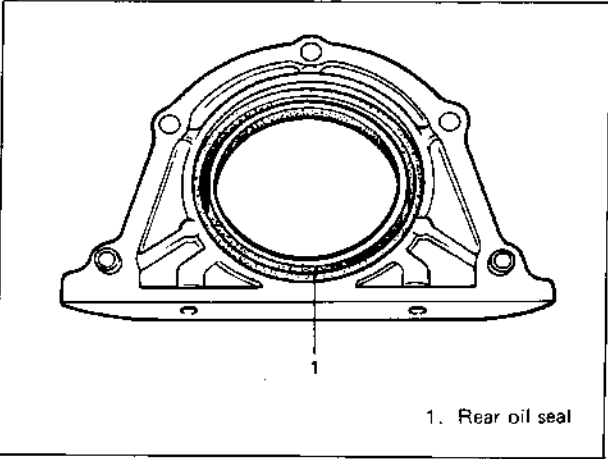


Fig. 6A-149 Rear Oil Seal

Flywheel (M/T model only)

- 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.)

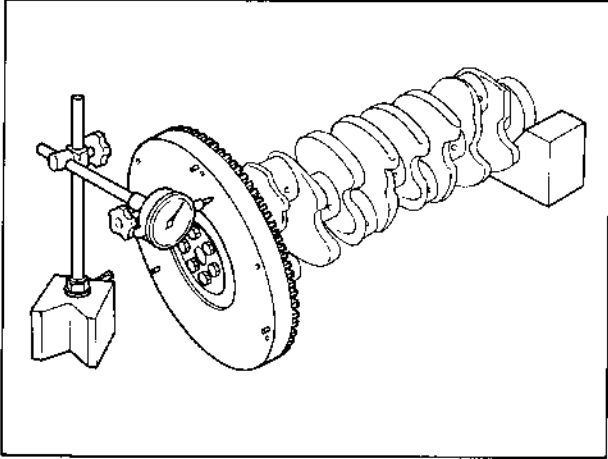


Fig. 6A-150 Measuring Runout

Cylinder Block

Distortion of gasketed surface

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

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

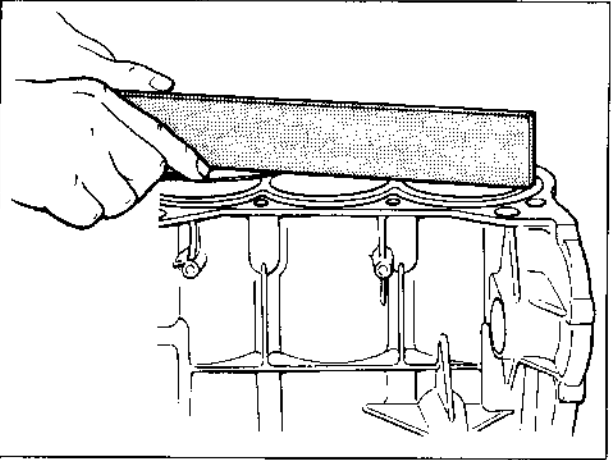


Fig. 6A-151 Checking Surface

Honing or reboring cylinders

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

Size	Piston diameter
O/S 0.25	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
O/S 0.50	74.470 – 74.480 mm (2.9318 – 2.9322 in.)

3. Using micrometer, measure piston diameter.

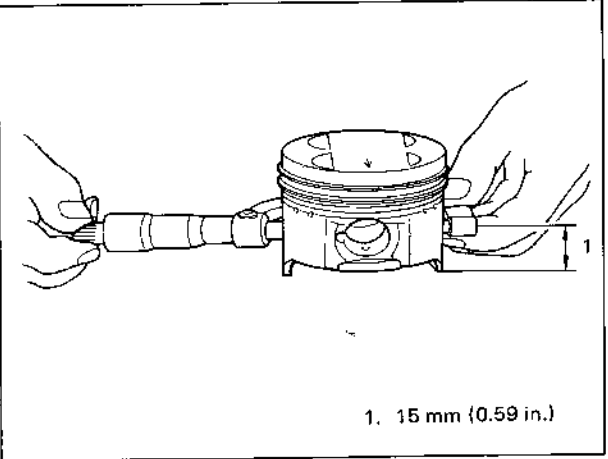


Fig. 6A-152 Measuring Piston Diameter

4. Calculate cylinder bore diameter to be rebored.

$D = A + B - C$

D : Cylinder bore diameter to be rebored.

A : Piston diameter as measured.

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

C : Allowance for honing = 0.02 mm
(0.0008 in.)

5. Rebore and hone cylinder to calculated dimension.

NOTE:

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

6. Measure piston clearance after honing.

INSTALL OR CONNECT

NOTE:

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

1. Main bearings to cylinder block.

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

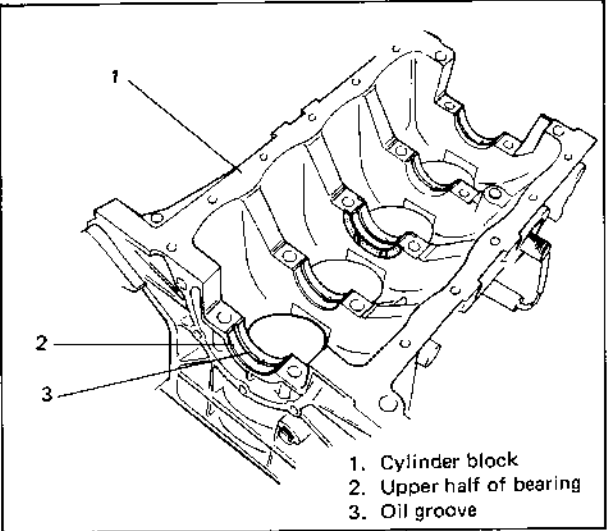


Fig. 6A-153 Installing Bearing Half with Oil Groove

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

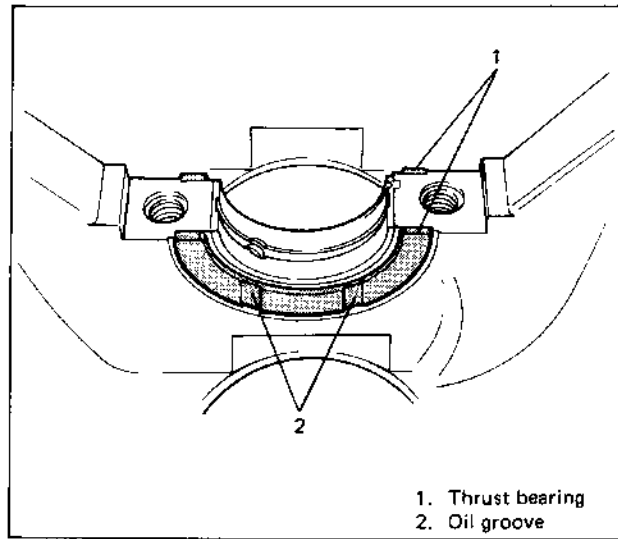


Fig. 6A-154 Installing Thrust Bearings

3. Crankshaft to cylinder block.
4. When fitting bearing caps to journals after setting crankshaft in place, be sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4, and 5, starting from pull-ey side.

Tightening torque for main bearing cap bolts	N·m	kg·m	lb·ft
	50 – 57	5.0 – 5.7	36.5 – 41.0

Tighten cap bolts after applying engine oil to bolt thread.
Gradual and uniform tightening is important for bearing cap bolts. Make sure that five caps become tight equally and progressively till specified torque is attained.

NOTE:
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turned by hand.

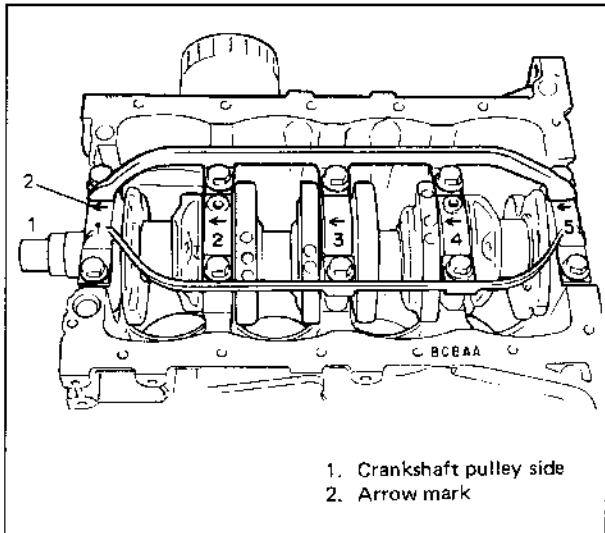


Fig. 6A-155 Installing Main Bearing Caps

5. Oil seal housing and its gasket:
Install new gasket. Do not reuse gasket removed in disassembly. Oil lip portion of oil seal before installing. Tighten housing bolts to specification.
After installing oil seal housing, gasket edges might bulge out; if so, cut off to make them flush with cylinder block and oil seal housing.

Tightening torque for housing bolts	N·m	kg·m	lb·ft
	10 – 13	1.0 – 1.3	7.5 – 9.0

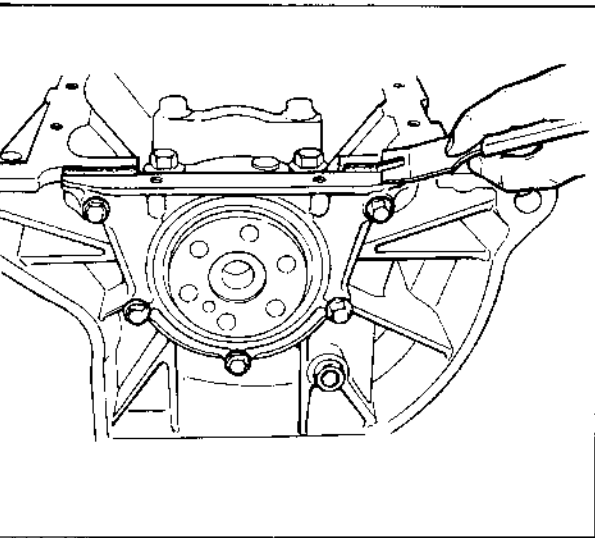


Fig. 6A-156 Cutting Off Edges of Gasket

6. Oil pump.
Refer to item "Oil pump" for installation of oil pump.
7. Flywheel (M/T model) or drive plate (A/T model)
Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

Tightening torque for flywheel or drive plate bolts	N·m	kg·m	lb·ft
	57 – 65	5.7 – 6.5	41.5 – 47.0

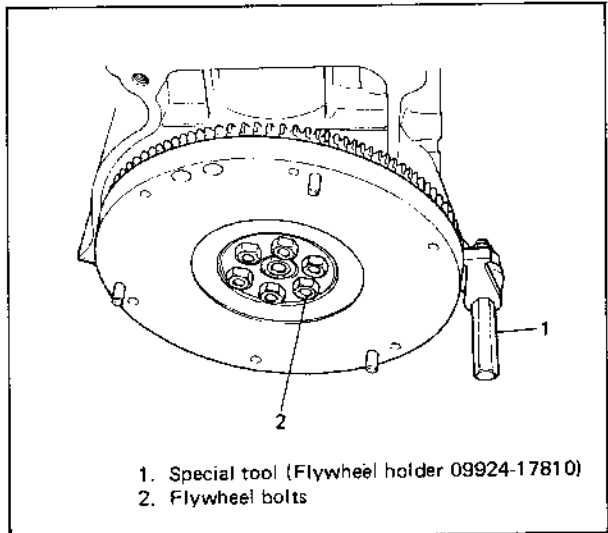


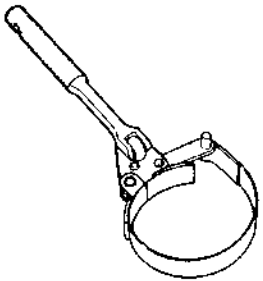
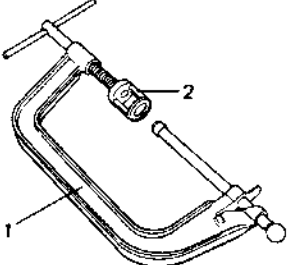
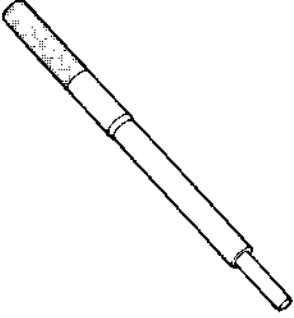
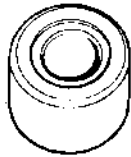
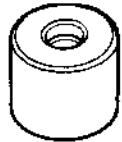
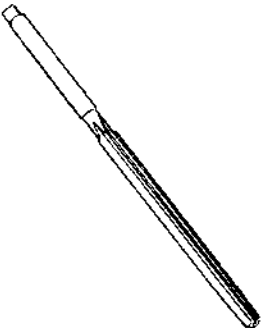
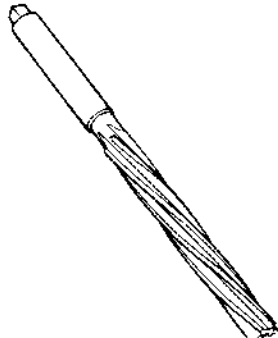
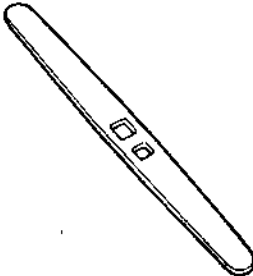
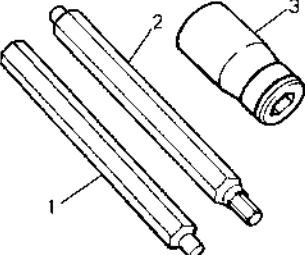
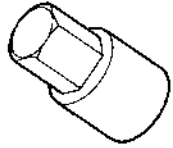
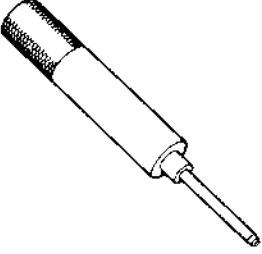
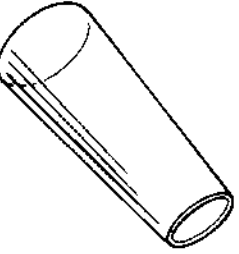
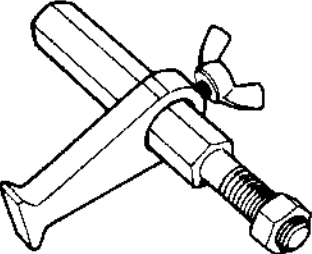
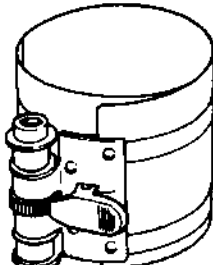
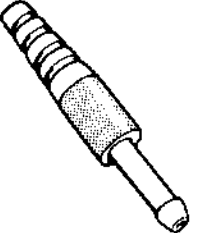
Fig. 6A-157 Flywheel

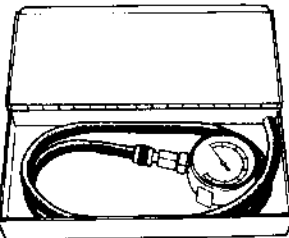
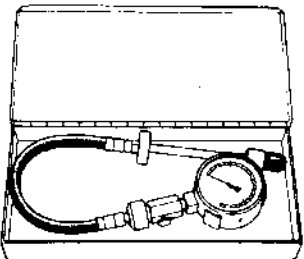
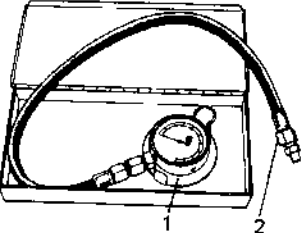
8. Pistons and connecting rods as previously outlined.
9. Oil pump strainer and oil pan.
10. Cylinder head assembly to cylinder block.

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.

11. Crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12. Clutch to flywheel (M/T model)
For clutch installation, refer to section 7C.
13. Engine with transmission to body as previously outlined.

SPECIAL TOOLS

 09915-47310 Oil filter wrench	 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment	 09916-44910 Valve guide remover	 09916-56020 Valve guide installer attachment
 09917-98220 Valve stem seal installer	 09916-34550 Reamer (5.5 mm)	 09916-38210 Reamer (11 mm)	 09916-34541 Reamer handle
 1. 09900-00415 8 mm Hexagon wrench bit 2. 09900-00413 5 mm Hexagon wrench bit 3. 09900-00411 Hexagon wrench socket	 09919-16020 17 mm socket	 09916-84510 Forceps	 09916-58210 Valve guide installer handle
 09926-18210 Oil seal guide (Vinyl resin)	 09924-17810 Flywheel holder	 09916-77310 Piston ring compressor	 09918-08210 Vacuum gauge hose joint

 09915-67310 Vacuum gauge	 09915-64510 Compression gauge	 1. 09915-77310 Oil pressure gauge 2. 09915-78211 Oil pressure gauge attachment

REQUIRED SERVICE MATERIALS

RECOMMENDED SUZUKI PRODUCT	USE
Sealant 1207C (99000-31150)	• For mating surfaces of cylinder block and oil pan.
SUZUKI BOND NO. 1215 (99000-31110)	• For mating surfaces of camshaft housings (No. 1) and cylinder head.

TORQUE SPECIFICATIONS

System	Fastening parts		Tightening torque		
			N·m	kg·m	lb·ft
Engine	Cylinder head bolt		65 – 70	6.5 – 7.0	47.5 – 50.5
	Spark plug		20 – 30	2.0 – 3.0	14.5 – 21.5
	Inlet & exhaust manifold bolt & nut		18 – 28	1.8 – 2.8	13.5 – 20.0
	Camshaft timing belt pulley bolt		56 – 64	5.6 – 6.4	41.0 – 46.0
	Camshaft housing bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Timing belt cover bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Crankshaft pulley bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Connecting rod bearing cap nut		33 – 37	3.3 – 3.7	24.0 – 26.5
	Crankshaft main bearing cap bolt		50 – 57	5.0 – 5.7	36.5 – 41.0
	Flywheel bolt		57 – 65	5.7 – 6.5	41.5 – 47.0
	Oil pressure switch		12 – 15	1.2 – 1.5	9.0 – 10.5
	Oil filter stand		20 – 25	2.0 – 2.5	14.5 – 18.0
	Oil pan bolt & nut		9 – 12	0.9 – 1.2	7.0 – 8.5
	Oil drain plug		30 – 40	3.0 – 4.0	22.0 – 28.5
	Cylinder head cover bolt	No. 1	5 – 7	0.5 – 0.7	4.0 – 5.0
		No. 2	8 – 12	0.8 – 1.2	6.0 – 8.5
	Exhaust pipe nut		40 – 60	4.0 – 6.0	29.0 – 43.0
	Oil pump strainer bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Oil pump case bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Crankshaft timing belt pulley bolt		105 – 115	10.5 – 11.5	76.0 – 83.0
	Timing belt tensioner bolt		24 – 30	2.4 – 3.0	17.5 – 21.5
	Timing belt tensioner stud		9 – 12	0.9 – 1.2	7.0 – 8.5
	Water pump pulley bolt		9 – 12	0.9 – 1.2	7.0 – 8.5
	Oil pump rotor plate screw		8 – 13	0.8 – 1.3	6.0 – 9.0
	Engine mounting & bracket bolt and nut		Refer to Fig. 6A-135 or 6A-136		

SECTION 6B

ENGINE COOLING

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GENERAL DESCRIPTION

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

2. When cooling water is warmed up to normal temperature and the thermostat opens, cooling water passes through the radiator core to be cooled as well as the above flow circuit.

COOLING SYSTEM CIRCULATION

1. While the engine is warmed up (thermostat closed), Cooling water circulates as follows.

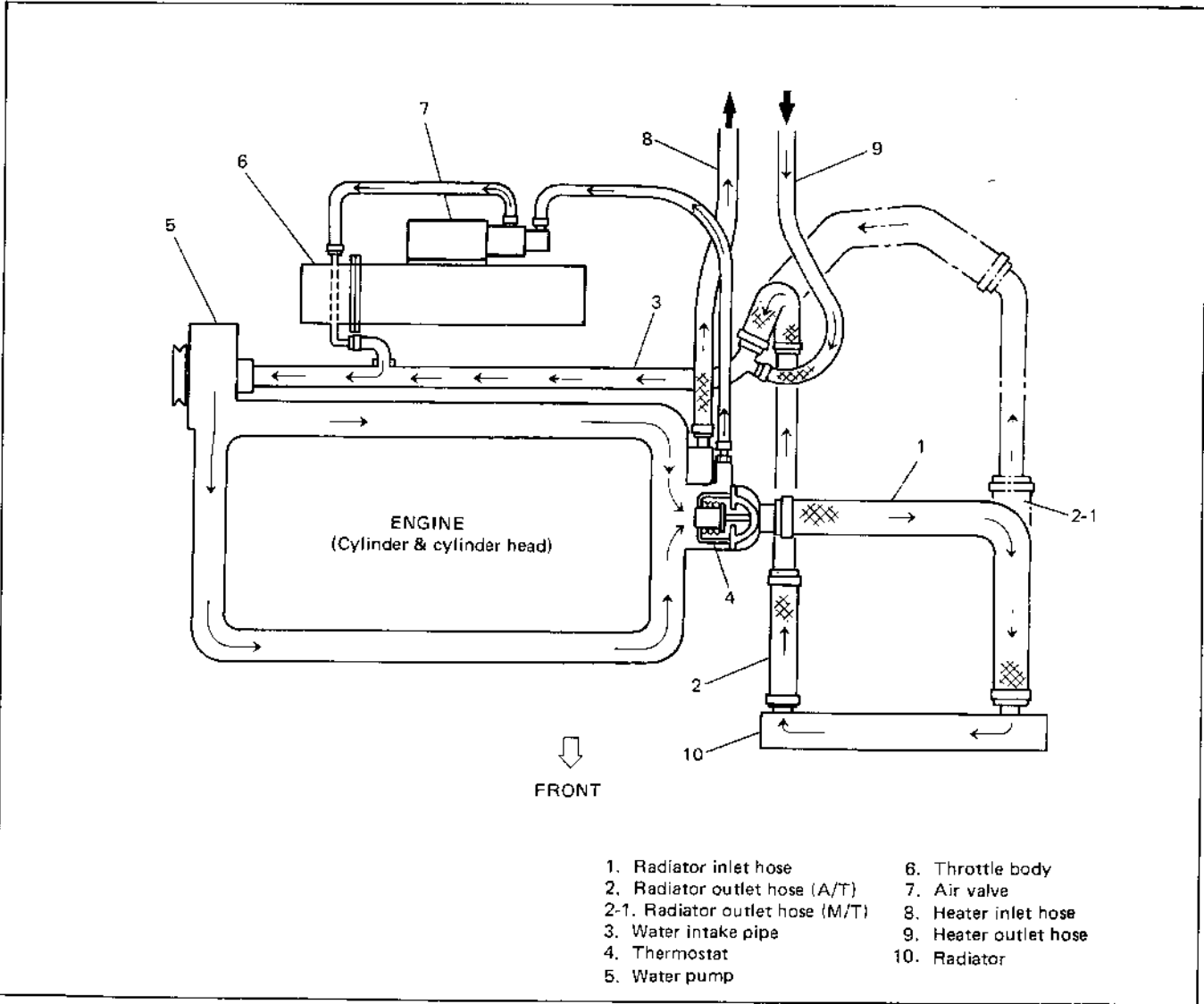
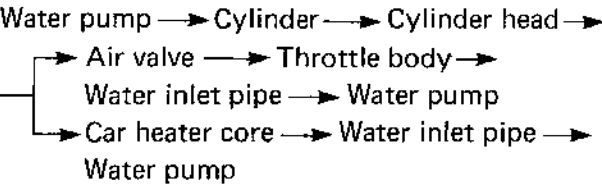


Fig. 6B-1 Engine Cooling System

RADIATOR CAP

A pressure-vent cap is used on the radiator. The cap contains a pressure valve and vacuum valve. The pressure valve is held against its seat by a spring of pre-determined strength which protects the cooling system by relieving the pressure if the pressure in cooling system rises by 0.9 kg/cm² (12.8 psi, 90 kPa). The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created in the system when it cools off and which otherwise might cause the radiator to collapse.

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

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

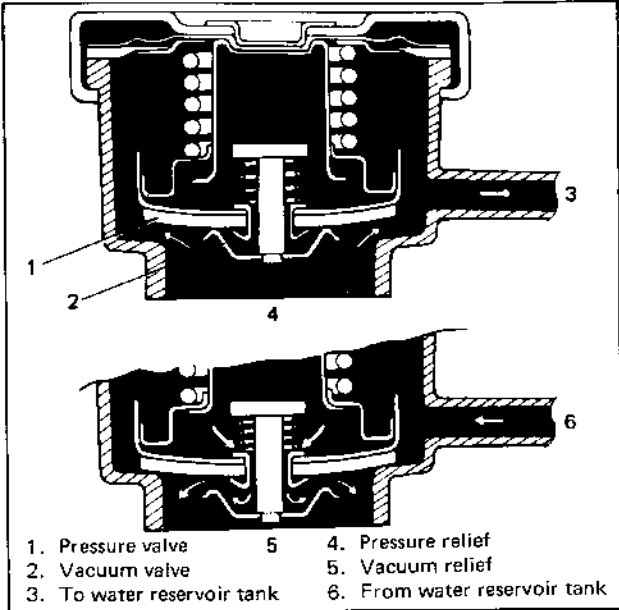


Fig. 6B-2 Pressure Type Radiator Cap

WATER RESERVOIR TANK

A "see-through" plastic reservoir tank is connected to the radiator by a hose. As the car is driven, the coolant is heated and expands. The portion of the coolant displaced by this expansion flows from the radiator into the reservoir tank.
When the car 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 tank.
Coolant should be added only to the reservoir tank as necessary.

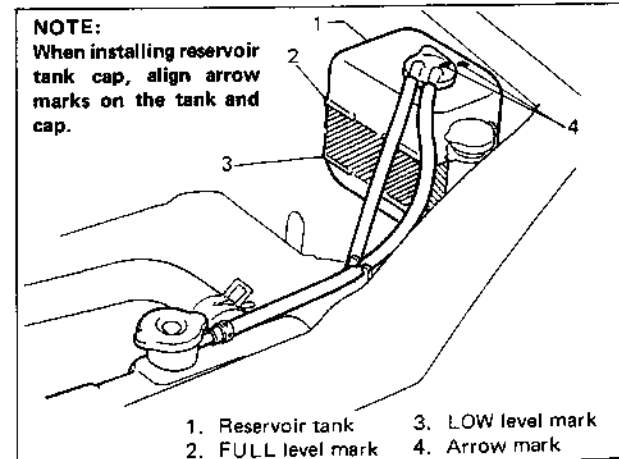


Fig. 6B-3 Water Reservoir Tank

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.

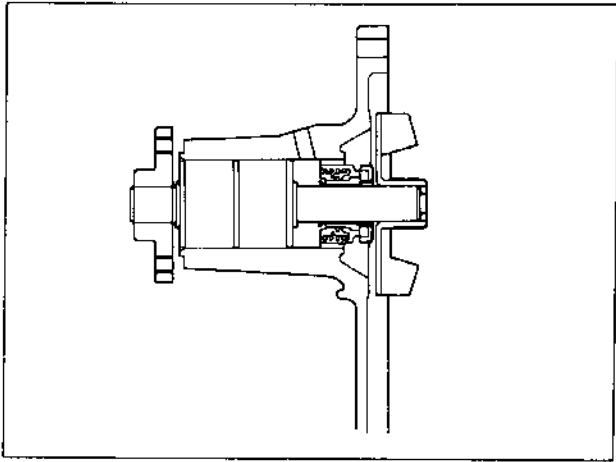


Fig. 6B-4 Water Pump

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.

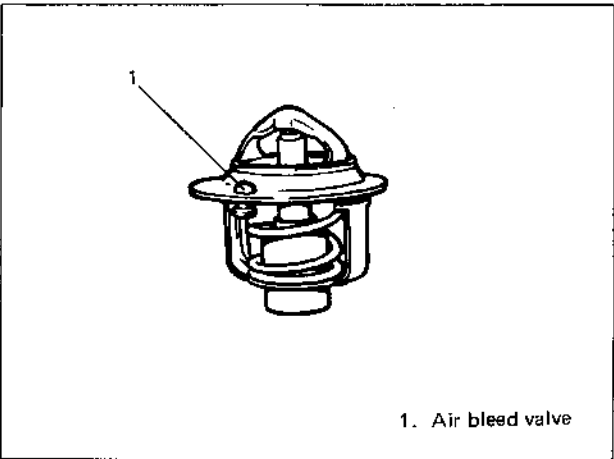


Fig. 6B-5 Thermostat

Thermostat functional spec. $\pm 2.8^{\circ}\text{C}$ (5°F)	
Temp. at which valve begins to open	82°C (179°F)
Temp. at which valve become fully open	95°C (203°F)

COOLING FAN

The cooling fan is driven by electric motor, and the motor is activated by thermo switch.

Fan thermo switch functional spec. $\pm 5^{\circ}\text{C}$ (9°F)	
Temp. at switch "ON"	More than 93°C (199°F)
Temp. at switch "OFF"	Less than 88°C (190°F)

WARNING:
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the thermo switch with the ignition switch in the "ON" position.

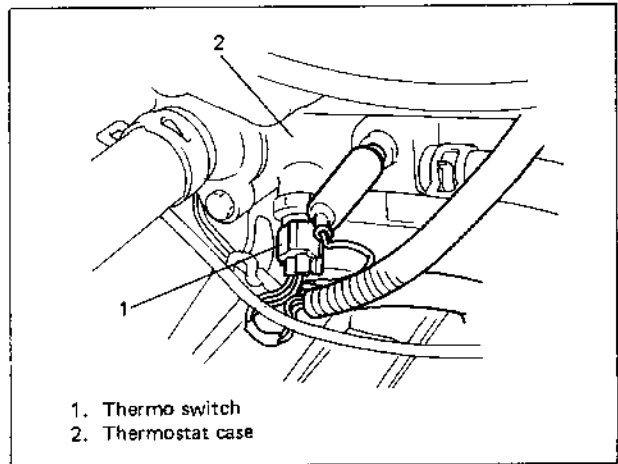


Fig. 6B-6 Thermo Switch

WATER TEMP GAUGE

A water temp gauge is located at thermostat case. This gauge activates a temp. meter gauge in the instrument cluster.

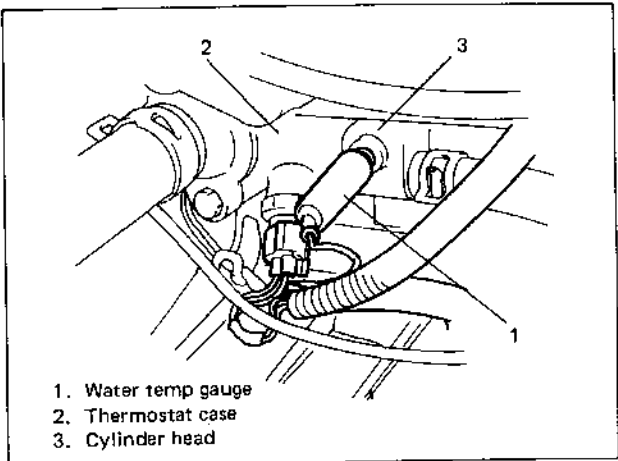


Fig. 6B-7 Water Temp Gauge

DIAGNOSIS

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

MAINTENANCE

COOLANT

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir tank. When the system cools down, the coolant is drawn back into the radiator.

The cooling system has been filled at the factory with a quality coolant that is a 50/50 mixture of water and GOLDEN CRUISER 1200 (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).

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.	1.41/3.29	2.35/2.35
	US pt.	2.98/6.95	4.96/4.96
	Imp. pt.	2.48/5.79	4.13/4.13

COOLANT CAPACITY

Engine, radiator and heater	About 4.1 liters (8.6/7.2 US/Imp pt.)
Reservoir tank	About 0.6 liters (1.3/1.1 US/Imp pt.)
Total	About 4.7 liters (9.9/8.3 US/Imp pt.)

NOTE:

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

COOLANT LEVEL

Coolant Level

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

WARNING:

To help avoid danger of being burned:

- do not remove reservoir tank cap while coolant is "boiling", and
- do not remove radiator cap while engine and radiator are still hot.

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

When engine is cool, check coolant level in reservoir tank. A normal coolant level should be between "FULL" and "LOW" marks on reservoir tank.

If coolant level is below "LOW" mark, remove reservoir tank cap and add proper coolant to tank to bring coolant level up to "FULL" mark. Then, reinstall cap.

NOTE:

- If proper quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system. They may be harmful to proper operation of system, and are unnecessary expense.
- When installing reservoir tank cap, align arrow marks on tank and cap.

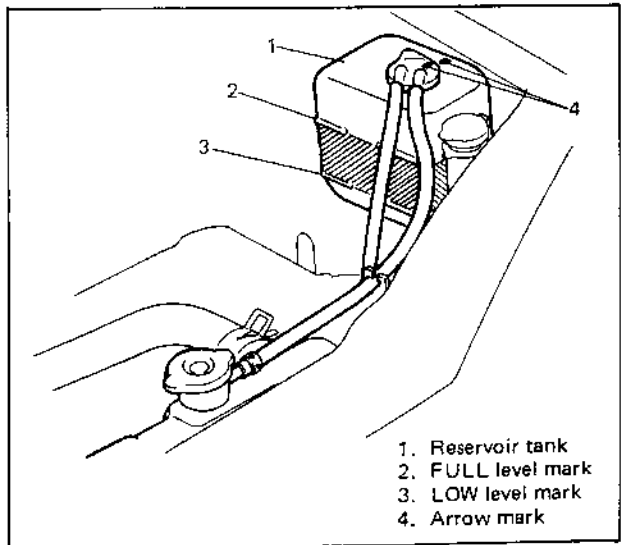


Fig. 6B-8 Checking Coolant Level

COOLING SYSTEM SERVICE

WARNING:

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

Cooling system should be serviced as follows.

1. Check cooling system for leakage or damage.
2. Wash radiator cap and filler neck with clean water by removing radiator cap when engine is cold.
3. Check coolant for proper level and freeze protection.
4. Using a pressure tester, check system and radiator cap for proper pressure holding capacity 0.9 kg/cm² (12.8 psi, 90 kPa). If replacement of cap is required, use proper cap specified for this vehicle.
5. Tighten hose clamps and inspect all hoses. Replace hoses whenever cracked, swollen or otherwise deteriorated.
6. Clean frontal area of radiator core.

NOTE:

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

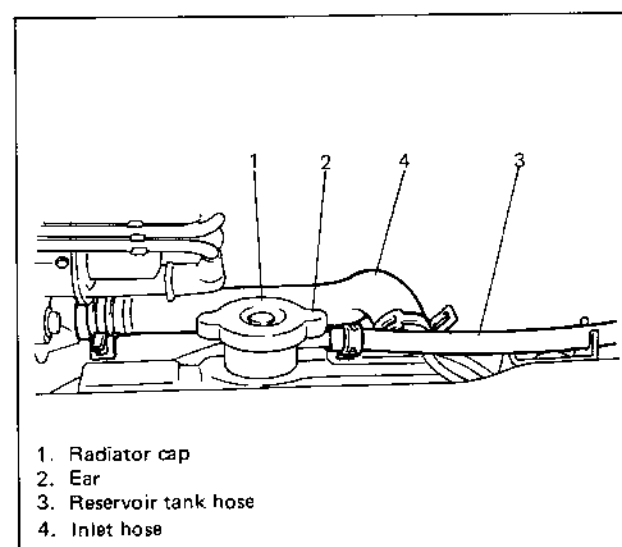


Fig. 6B-9 Installation of Radiator Cap

COOLING SYSTEM FLUSH AND REFILL

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

WARNING:

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

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

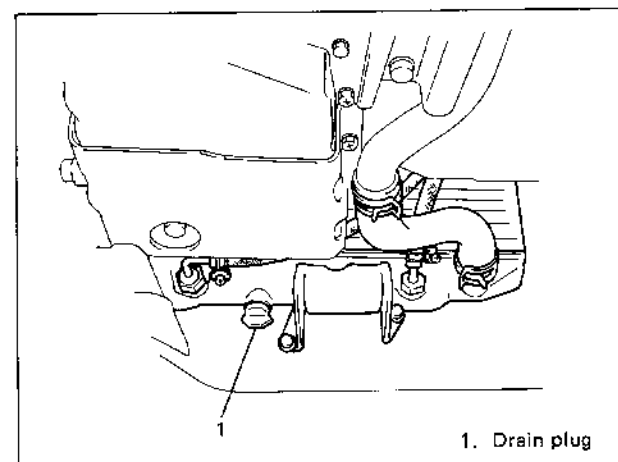


Fig. 6B-10 Radiator Drain Plug

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 water reservoir tank. Remove tank and pour out any fluid. Scrub and clean inside of tank with soap and water. Flush it well with clean water and drain. Reinstall tank and hose.

8. Add 50/50 mixture of GOLDEN CRUISER 1200 (good quality ethylene glycol anti-freeze) and water to radiator and tank. Fill radiator to the base of radiator filler neck and reservoir tank to "FULL" level mark. Reinstall reservoir tank cap, aligning the arrow marks on the tank 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 tank hose.

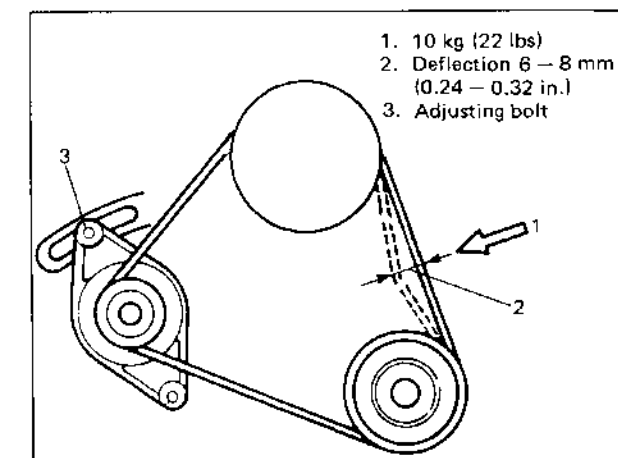


Fig. 6B-11 Checking Belt Tension

WATER PUMP BELT TENSION

WARNING:

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

1. To facilitate belt inspection, remove air cleaner assembly with AFM from its brackets.
2. Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer to page 6B-12 for procedure.
3. 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 specification	6 – 8 mm (0.24 – 0.32 in.) as deflection

NOTE:

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

4. If belt is too tight or too loose, adjust it to proper tension by displacing generator position.

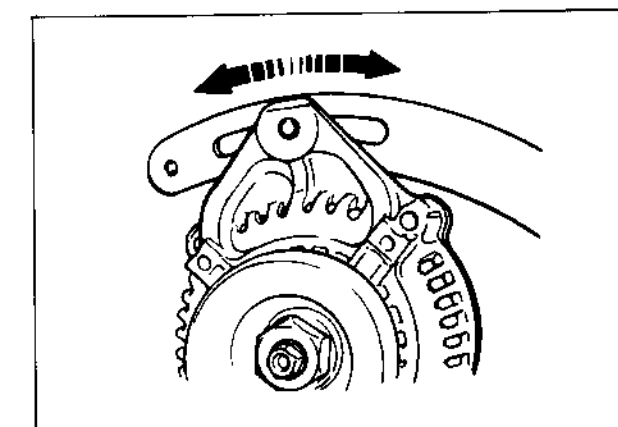


Fig. 6B-12 Adjusting Belt Tension

5. Tighten belt adjusting bolt and generator pivot bolts.
6. Install air cleaner assembly with AFM.
7. Connect negative cable at battery terminal.

ON CAR SERVICE

WARNING:

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

COOLANT DRAINING

1. Remove radiator cap.
2. Loosen drain plug on radiator to drain coolant.

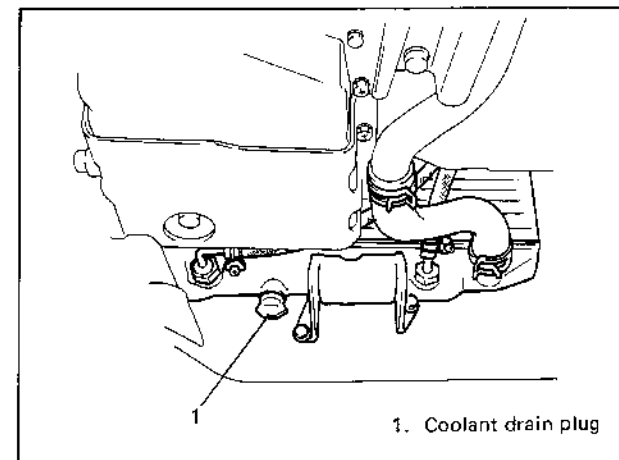


Fig. 6B-13 Drain Plug

3. After draining coolant, be sure to tighten drain plug securely.
4. Fill cooling system. (Refer to pages 6B-6 & 6B-7.)

COOLING WATER PIPES OR HOSES

REMOVAL

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

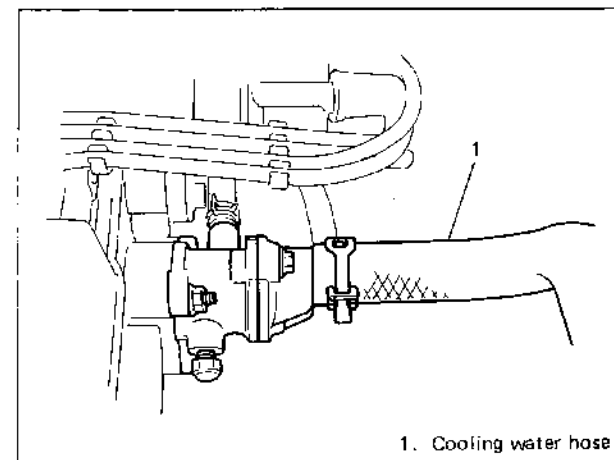


Fig. 6B-14 Water Hose

INSTALLATION

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

- Tighten each clamp bolt securely.
- Refill cooling system with proper coolant, referring to description on COOLANT on pages 6B-6 and 6B-7.

THERMOSTAT

REMOVAL

1. Disconnect negative cable at battery.
2. Drain cooling system and tighten drain plug.
3. Disconnect thermostat cap from thermostat case.

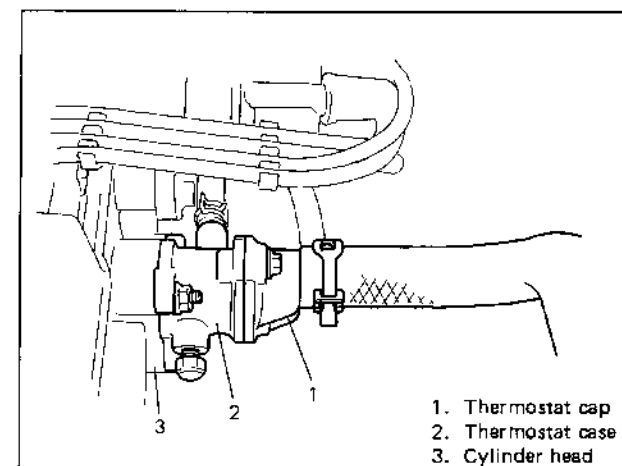


Fig. 6B-15 Removing Thermostat Cap

4. Remove thermostat.

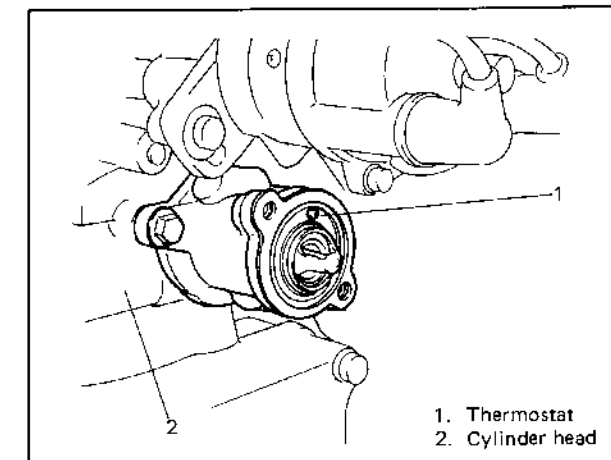


Fig. 6B-16 Removing Thermostat

INSPECTION

1. Make sure that air bleed valve of thermostat is clear. Should this valve be clogged, engine would tend to overheat.

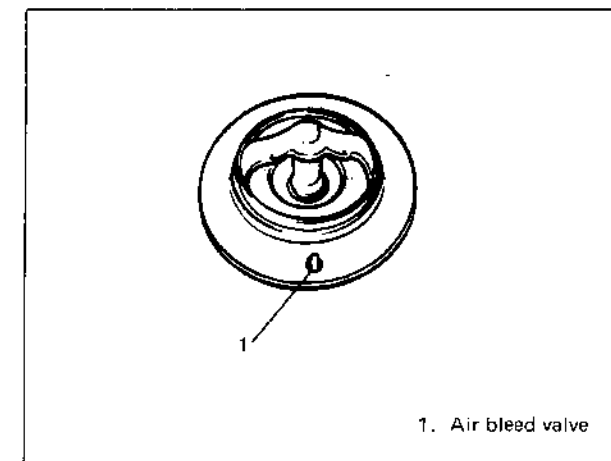


Fig. 6B-17 Air Bleed Valve of Thermostat

2. Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.
3. Check thermostatic movement of wax pellet as follows:
 - Immerse thermostat in water, and heat water gradually.
 - Check that valve starts to open at specific temperature.

- 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 re-used, will bring about overcooling or overheating tendency.

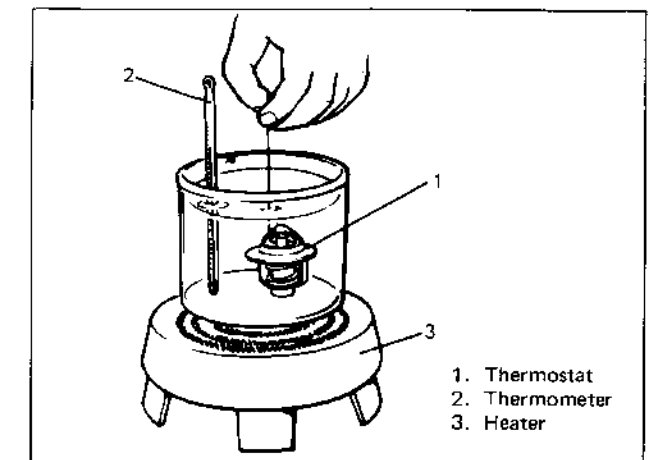


Fig. 6B-18 Checking Thermostat Valve Operation

INSTALLATION

1. When positioning thermostat on thermostat case, be sure to position it so that air bleed valve comes uppermost and into the recession of thermostat case.

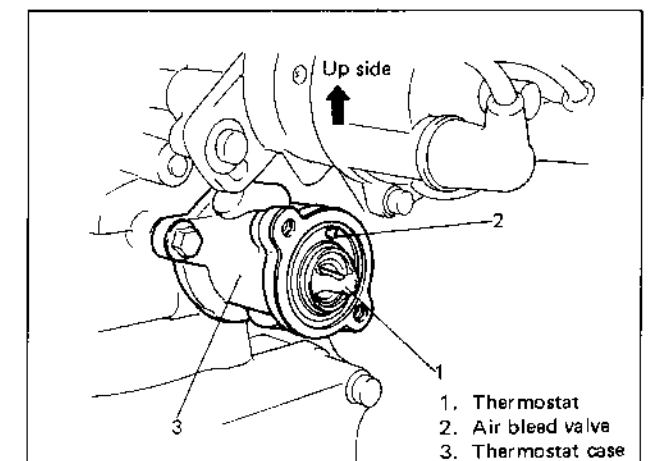


Fig. 6B-19 Installing Thermostat

2. Install new gasket and thermostat cap to thermostat case. When installing cap, align arrow marks on cap and case.
3. Fill cooling system.
4. Connect negative cable.
5. After installation, check each part for leakage.

WATER PUMP BELT

REMOVAL

- 1. Disconnect negative cable at battery.
- 2. Remove air cleaner assembly with AFM.
- 3. Loosen drive belt adjusting bolt and generator pivot bolts.

When servicing car equipped with air conditioner, remove compressor drive belt before removing water pump belt.

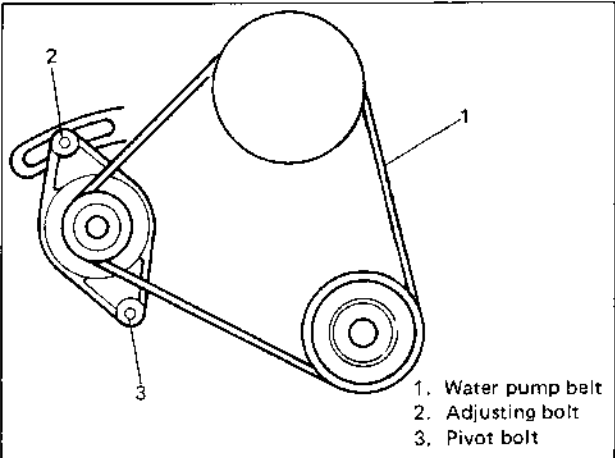


Fig. 6B-20 Loosening Adjusting Bolt and Pivot Bolts

- 3. Slacken belt by displacing generator and then remove it.

INSTALLATION

- 1. Install belt to water pump pulley, crankshaft pulley and generator pulley.
When servicing car equipped with air conditioner, install compressor drive belt, too.
- 2. Adjust belt tension.
For Adjustment of compressor drive belt tension, refer to SECTION 1B of this manual.
- 3. Tighten water pump belt adjusting bolt and pivot bolts.
- 4. Connect negative cable at battery.

WATER PUMP BELT TENSION INSPECTION AND ADJUSTMENT

For this inspection or adjustment, refer to WATER PUMP BELT TENSION on page 6B-9.

FAN THERMO SWITCH

REMOVAL

- 1. Disconnect negative cable at battery.
- 2. Drain cooling system.
- 3. Disconnect coupler of thermo switch lead wire.
- 4. Remove thermo switch from thermostat case.

INSTALLATION

Reverse removal procedure.
After installation, check for leakage.

INSPECTION

- 1. Connect an ohmmeter to the thermo switch.
- 2. Immerse the switch in water, and heat water gradually.
- 3. Check that the switch turns "ON" or "OFF" according to the below specification. If the switch is faulty, replace it.

Fan thermo switch functional spec. ± 5° C (41° F)	
Temp. at switch "ON" (Continuity)	More than 93° C (199° F)
Temp. at switch "OFF" (No continuity)	Less than 88° C (190° F)

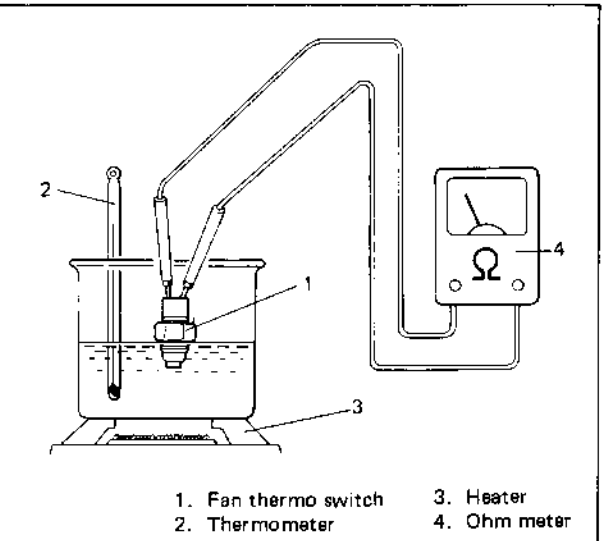


Fig. 6B-21 Checking Fan Thermo Switch

RADIATOR

REMOVAL

- 1. Disconnect negative cable at battery.
- 2. Drain cooling system by loosening drain plug of radiator.
- 3. Disconnect coupler of cooling fan motor lead wire.
- 4. Disconnect radiator inlet and outlet hoses, and reservoir tank hose.

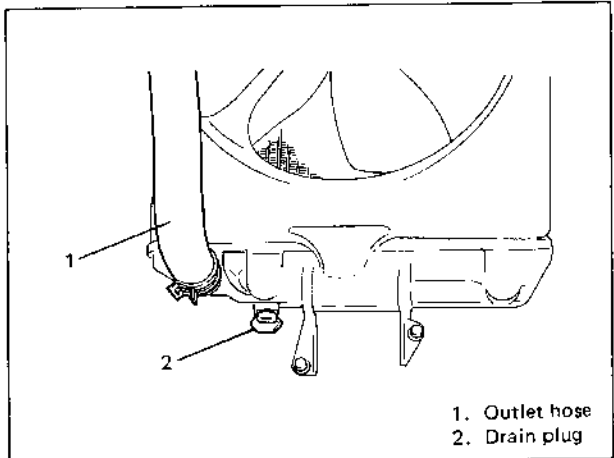


Fig. 6B-22 Radiator of M/T Car

- 5. With automatic transmission (A/T) car, disconnect additional 2 fluid hoses from radiator. Place some container under radiator to receive A/T fluid which will flow out when hose is disconnected.

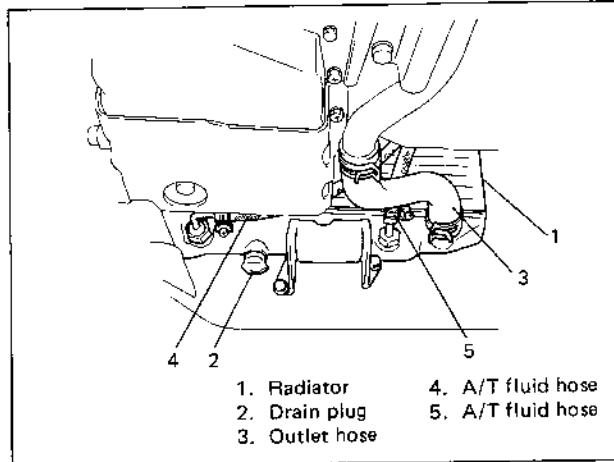


Fig. 6B-23 Radiator of A/T Car

- 6. Remove radiator and cooling fan motor.

INSPECTION

Check radiator for leakage or damage. Straighten bent fins, if any.

CLEAN

Clean frontal area of radiator cores.

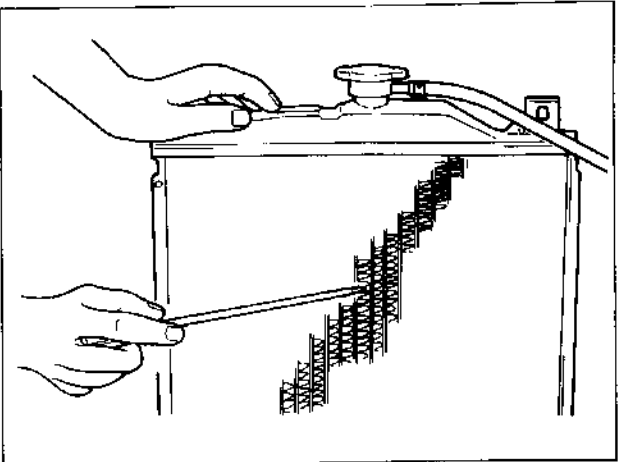


Fig. 6B-24

INSTALLATION

Reverse removal procedures.

NOTE:

- Refill cooling system with proper coolant referring to COOLANT section on pages 6B-6 and 6B-7.
- With automatic transmission car, fill A/T fluid up to specified level.
(For procedure to check A/T fluid and its level, refer to SECTION 7B.)
- After installation, check each joint for leakage.

WATER PUMP

- 1. Disconnect negative cable at battery.
- 2. Drain cooling system.
- 3. Remove timing belt and tensioner according to procedure described in item "TIMING BELT AND TENSIONER" of SECTION 6A.
- 4. Remove timing belt inside cover (rear side) and water pump belt adjusting arm.

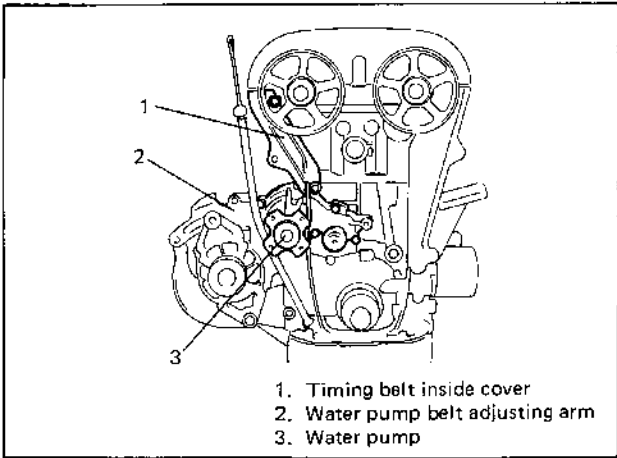


Fig. 6B-25 Removing Inside Cover

- 5. Remove water pump assembly.

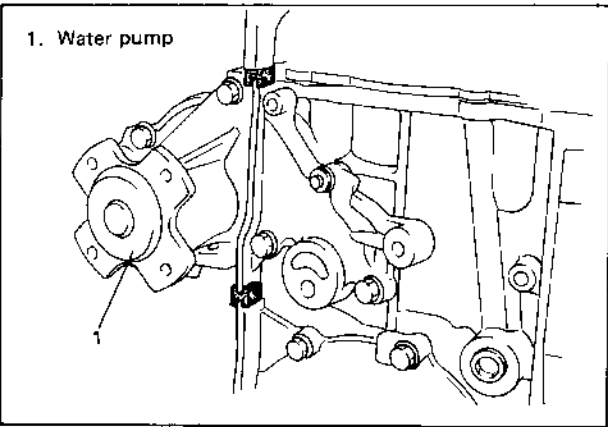


Fig. 6B-26 Removing Water Pump

INSPECT

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

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

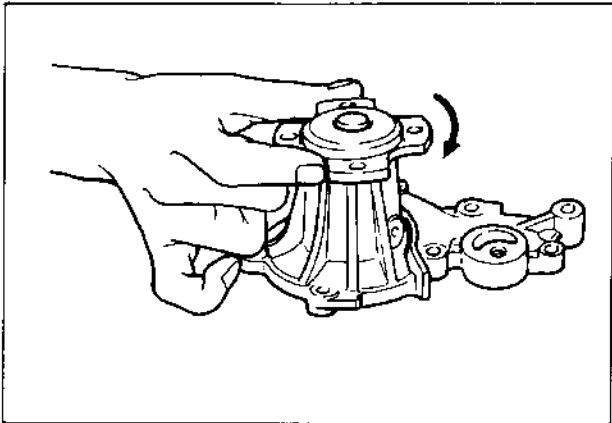


Fig. 6B-27 Checking Water Pump

INSTALLATION

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

Tightening torque for bolts & nuts	10 – 13 N·m
	1.0 – 1.3 kg-m
	7.5 – 9.0 lb-ft

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

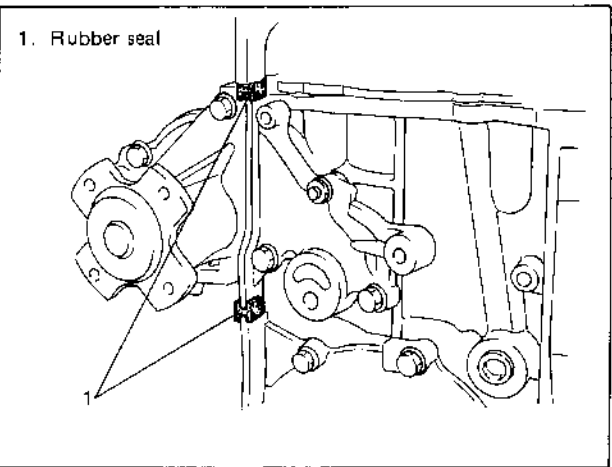


Fig. 6B-28 Installing Rubber Seal

- 4. Install timing belt inside cover, tensioner, timing belt and timing belt outside covers according to procedure described in item "TIMING BELT AND TENSIONER" of SECTION 6A.

NOTE:

- Special care must be used when installing belt tensioner and timing belt.
- Torque each bolt and nut to specification.
- Before installing outside covers, check to make sure that cover seal is fitted in groove of each cover properly.

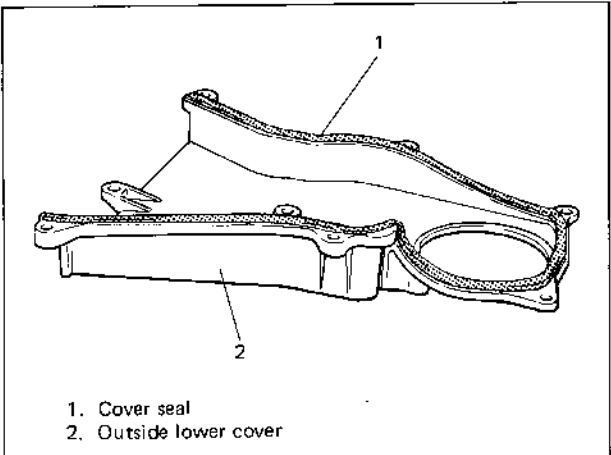


Fig. 6B-29 Checking Cover Seal

- 5. Install crankshaft pulley, water pump pulley, and pump drive belt referring to SECTION 6A.
- 6. Adjust water pump belt tension.
(Refer to page 6B-9.)
- 7. Install fender apron extension on right side.
- 8. Install air cleaner assembly with AFM.
- 9. Connect negative cable at battery.
- 10. Fill cooling system.
- 11. After installation, check each part for leakage.

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Ethylene glycol anti-freeze	GOLDEN CRUISER 1200 (Anti-freeze/Anti-corrosion coolant)	Additive to engine cooling system for improving cooling efficiency and for protection against rusting.

SECTION 6C

ENGINE FUEL

CONTENTS

GENERAL DESCRIPTION	6C-1	ON CAR SERVICE	6C-3
Fuel System	6C-1	Fuel Pump	Refer to SECTION 6E
Fuel Tank	6C-2	Fuel Lines	6C-3
Fuel Pump	Refer to SECTION 6E	Fuel Pipe	6C-4
Fuel Filter	6C-2	Fuel Filler Cap	6C-5
Fuel Filler Cap	6C-2	Fuel Filter	6C-5
		Fuel Tank	6C-6

CAUTION:
THE ENGINE OF THIS CAR 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 SYSTEM.

GENERAL DESCRIPTION

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 6E "EFI SYSTEM" and SECTION 6J "ENGINE EMISSION CONTROL" respectively.

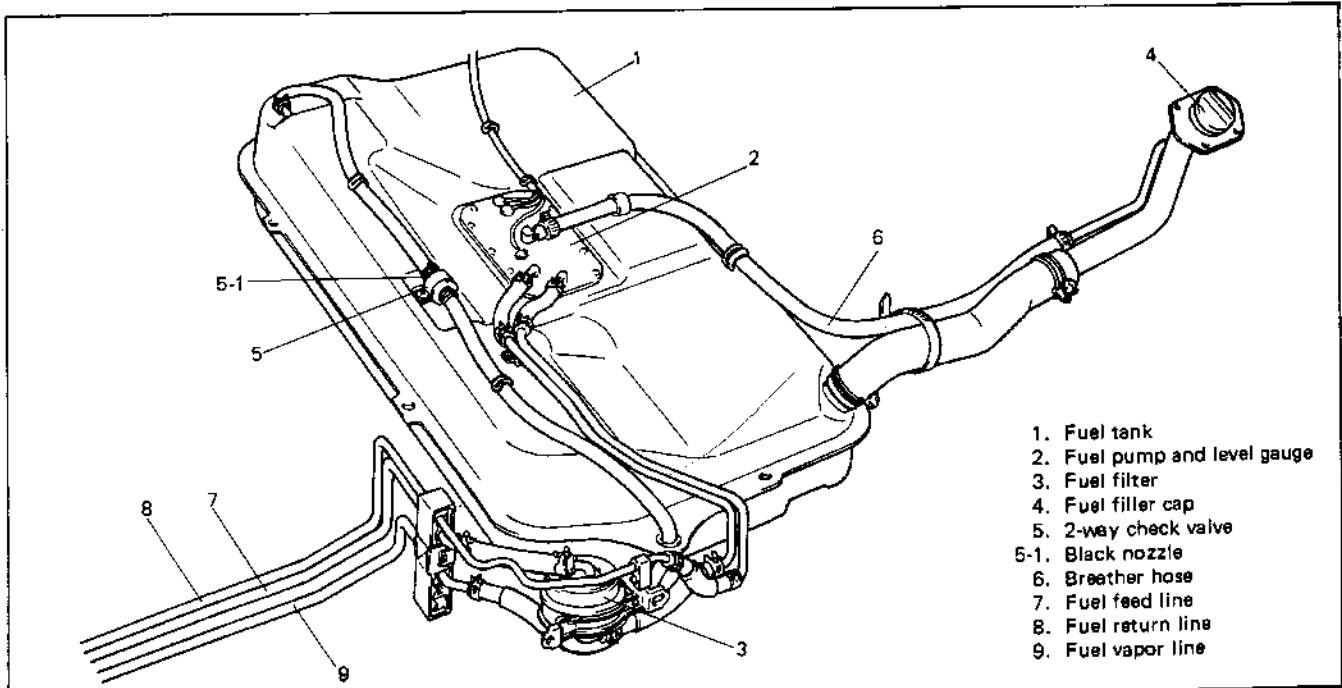


Fig. 6C-1 Fuel System

FUEL TANK

The fuel tank is located under the rear of the car. The fuel pump and fuel level gauge are installed on the upper part of fuel tank. Whenever servicing the fuel level gauge or the fuel pump, the fuel tank must be removed from the body.

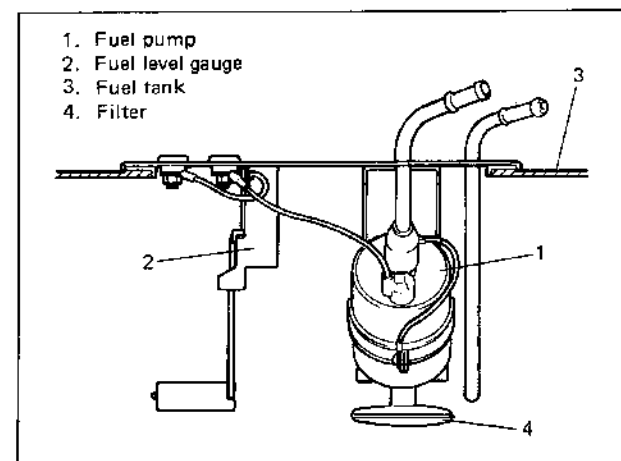


Fig. 6C-2 Fuel Pump and Level Gauge

FUEL FILTER

The fuel filter is located in front of fuel tank as shown in Fig. 6C-1 and filters the fuel sent under pressure from the fuel pump.

As it can't be disassembled, it must be replaced as an assembly.

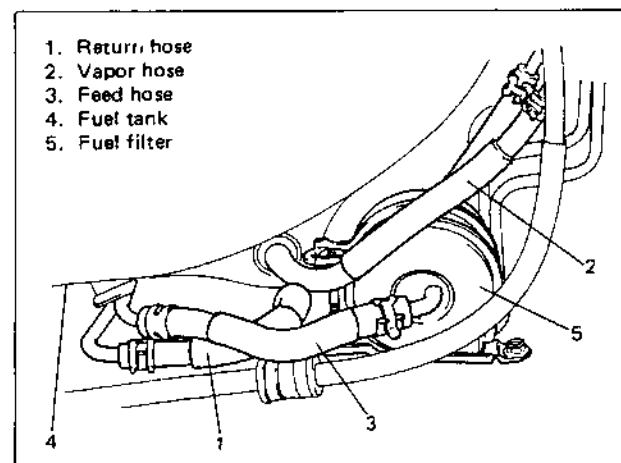


Fig. 6C-3 Fuel Filter

FUEL FILLER CAP

The fuel tank filler neck has a pressure-vacuum cap.

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would prevent sealing fuel vapors.

After the gasket on fuel filler cap and the filler neck flange contact, the ratchet produces a loud clicking noise, indicating the seal has been set.

This cap has a pressure relief valve and a vacuum relief valve inside.

If the pressure of fuel vapor in the fuel tank should exceed that for which fuel system is designed, the pressure relief valve opens to relieve the pressure.

The vacuum relief valve opens to relieve the vacuum created in the fuel tank.

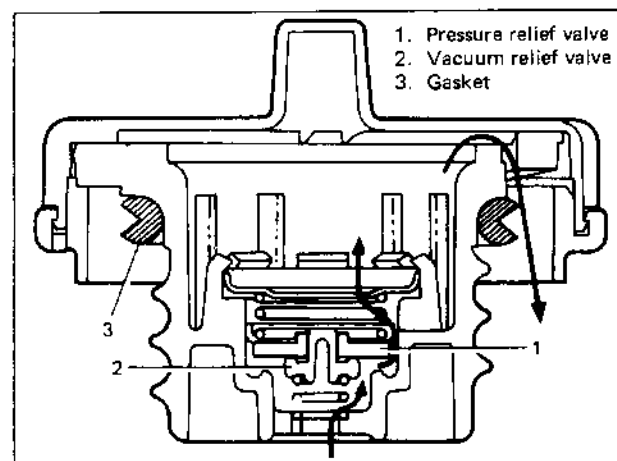


Fig. 6C-4 Fuel Filler Cap Cross-Section

ON-CAR SERVICE

WARNING:

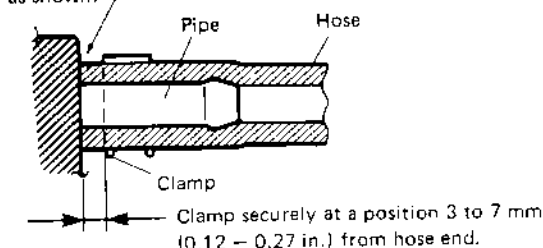
Before attempting service of any type on fuel system, following cautions should be always observed.

- 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 relieve 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 relieve fuel pressure according to procedure described on p. 6-3.

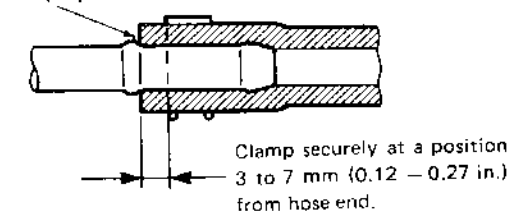
A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

- Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the following.

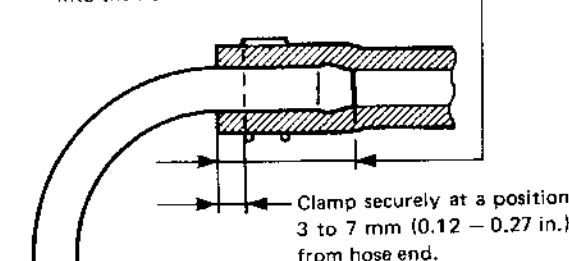
With short pipe, fit hose as far as it reaches pipe joint as shown.



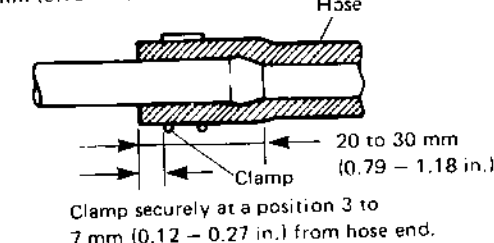
With following type pipe, fit hose as far as its peripheral projection as shown.



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



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



FUEL LINES

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

INSPECT

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

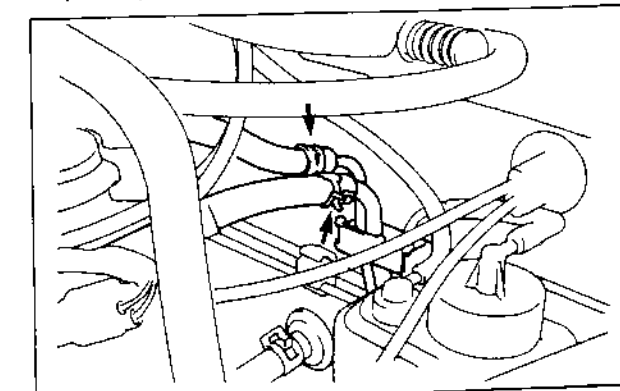


Fig. 6C-5 Fuel Lines Inspection

FUEL PIPE

REMOVE OR DISCONNECT

1. Relieve fuel pressure in fuel feed line according to procedure on p. 6-3.
2. Negative cable at battery.
3. Fuel hose from fuel pipe at the front and rear of each fuel pipe.

WARNING:

A small amount of fuel may be released after fuel hose is disconnected. In order to reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

4. Brake pipe from pipe joint referring to SECTION 5.
5. Pipe cover from body.
6. Put clamp position mark on body and pipes so that clamps can be installed on original position.
7. Pipes with clamp from body.

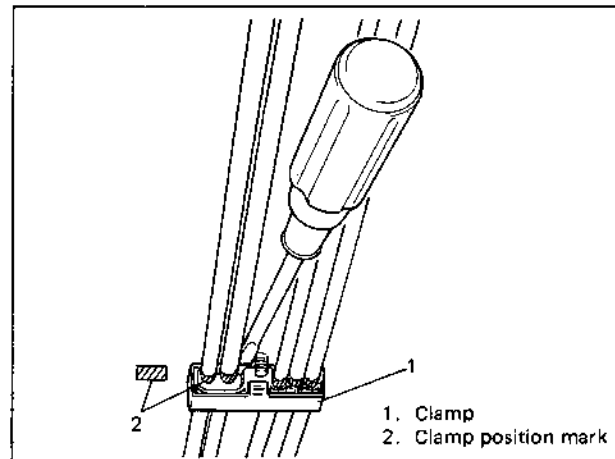


Fig. 6C-6 Detaching Clamp with Pipes

8. Clamp from pipes.

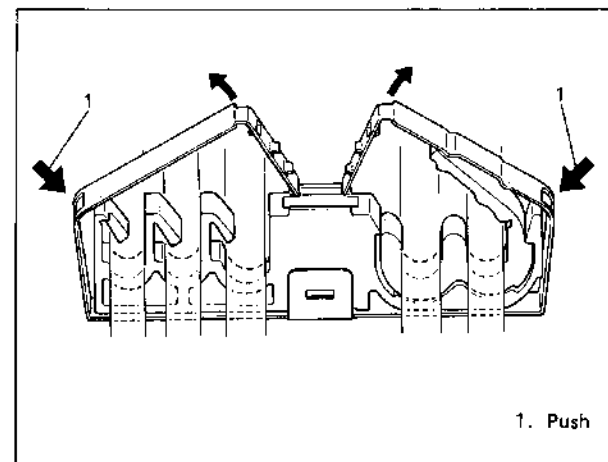


Fig. 6C-7 Removing Clamp

INSTALL OR CONNECT

1. Clamps to marked position on pipes.
If clamp is deformed or its claw is bent or broken, replace it with new one.
2. Pipes with pipe clamp to body.

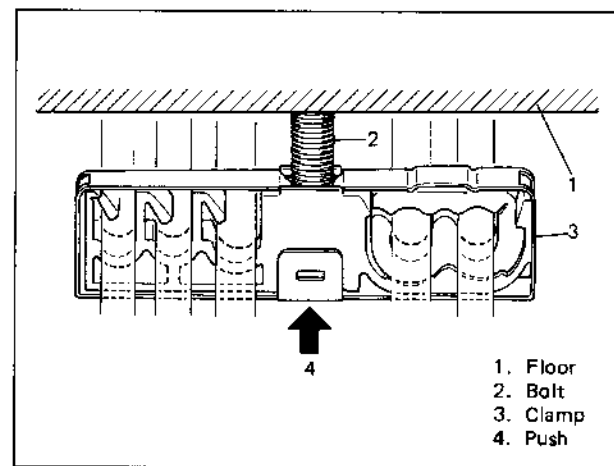


Fig. 6C-8 Installing Clamp

3. Pipe cover to body. Be sure to use new nuts.
4. Fuel hoses to fuel pipes.
5. Brake pipe joints referring to SECTION 5.
6. With engine "OFF" and ignition switch "ON", check for fuel leaks.
7. Bleed air in brake system referring to SECTION 5.

FUEL FILLER CAP

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

NOTE:

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

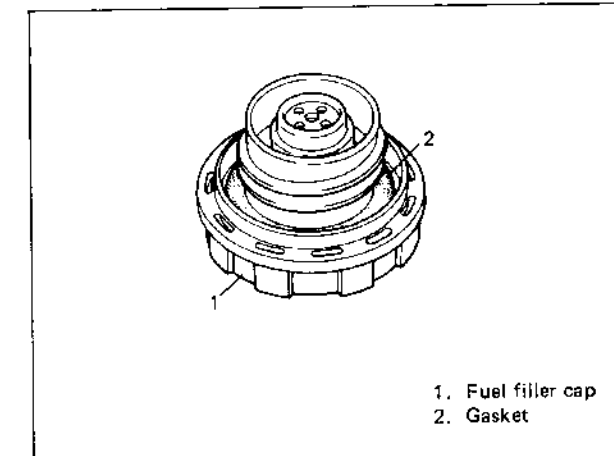


Fig. 6C-9 Fuel Filler Cap

FUEL FILTER

REMOVE OR DISCONNECT

1. Relieve fuel pressure in fuel feed line according to procedure described on p. 6-3.
2. Negative cable at battery.
3. Hoist car.
4. Place fuel container under fuel filter.
5. Inlet hose from fuel filter.

WARNING:

A small amount of fuel may be released after fuel hose is disconnected. In order to reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

6. Fuel filter outlet hose from fuel feed pipe.

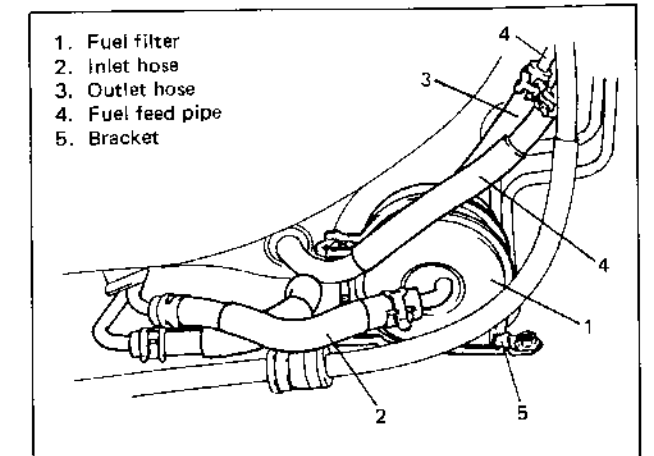


Fig. 6C-10 Disconnecting Hoses

7. Fuel filter with outlet hose from body.
8. Outlet hose and bracket from fuel filter.

INSTALL OR CONNECT

1. Filter bracket to filter.
Be sure to align match marks on filter and bracket before tightening bracket screw.

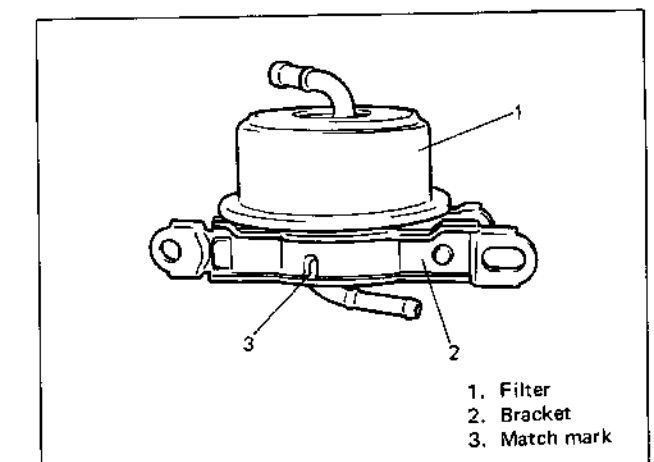


Fig. 6C-11 Installing Filter Bracket

2. Outlet hose to fuel filter outlet pipe.
3. Filter with outlet hose to body.
4. Outlet and inlet hoses.
Clamp hoses securely.
5. Negative cable to battery.
6. With engine "OFF" and ignition switch "ON", check for fuel leaks.

FUEL TANK

REMOVE OR DISCONNECT

1. Relieve fuel pressure in fuel feed line according to procedure described on p. 6-3.
2. Negative cable at battery.
3. Rear seat cushion referring to SECTION 9.
4. Fuel level gauge and fuel pump lead wire couplers, and detach wire tape.

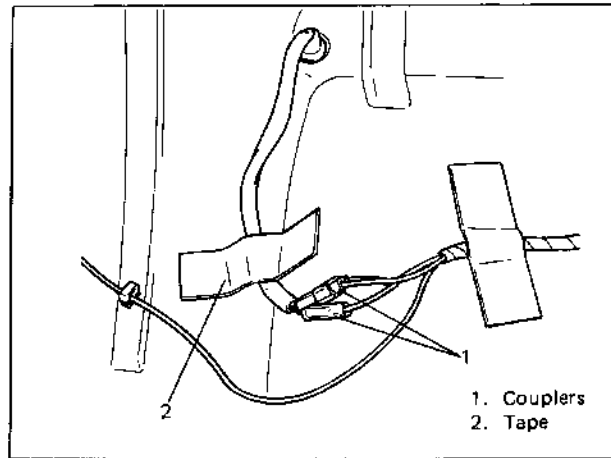


Fig. 6C-12 Disconnecting Couplers

5. Hoist car.
6. Fuel filler hose from fuel tank and breather hose from filler neck.

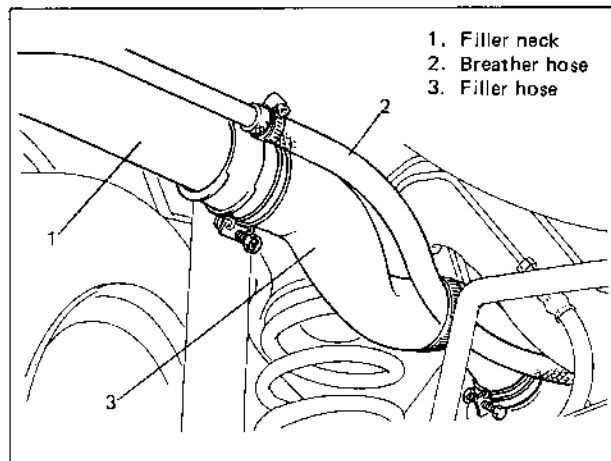


Fig. 6C-13 Breather and Filler Hoses

7. As fuel tank has no 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 to avoid possibility of fire or explosion.

8. Fuel hoses from pipes.

WARNING:

A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

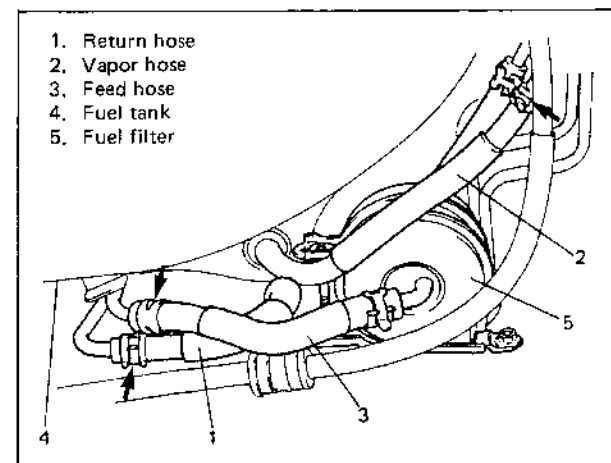


Fig. 6C-14 Disconnecting Hoses

9. Fuel tank from car.

INSPECT

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 gasket for leaks, visually inspect fuel tank for leaks and damage.

Replace any damaged or malconditioned parts.

FUEL TANK PURGING PROCEDURE

CAUTION:

This purging procedure will NOT remove all fuel vapor. Do not attempt any repair on tank using heat or flame as an explosion resulting in personal injury could occur.

Following procedure is used for purging fuel tank.

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

INSTALL OR CONNECT

1. Fuel pump and fuel level gauge to fuel tank. Use new gasket.
2. 2-way check valve to fuel tank directing its black nozzle toward fuel tank. Refer to Fig. 6C-1.
3. Fuel hoses and pipes to fuel tank as shown in Fig. 6C-1. Clamp hoses and wire harness securely.
4. Fuel breather hose to fuel tank.
5. Fuel tank to car.
6. Fuel filler hose to tank and breather hose to filler neck as shown in Fig. 6C-13 and clamp them securely.
7. Fuel hoses to filter and pipes as shown in Fig. 6C-14 and clamp them securely.
8. Fuel pump and level gauge couplers. Fix its wire with tape as shown in Fig. 6C-12.
9. Rear seat cushion referring to SECTION 9.
10. Negative cable to battery.
11. With engine "OFF" and ignition switch "ON", check for fuel leaks.

SECTION 6E

ELECTRONIC FUEL INJECTION (EFI) SYSTEM

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GENERAL DESCRIPTION

The EFI system in this car supplies the combustion chambers with air/fuel mixture of optimized ratio under widely varying driving conditions. It uses the multi-point fuel injection system which injects fuel into the each intake port of the cylinder head.

This system has 3 major sub-systems: air intake system, fuel delivery system and electronic control system.

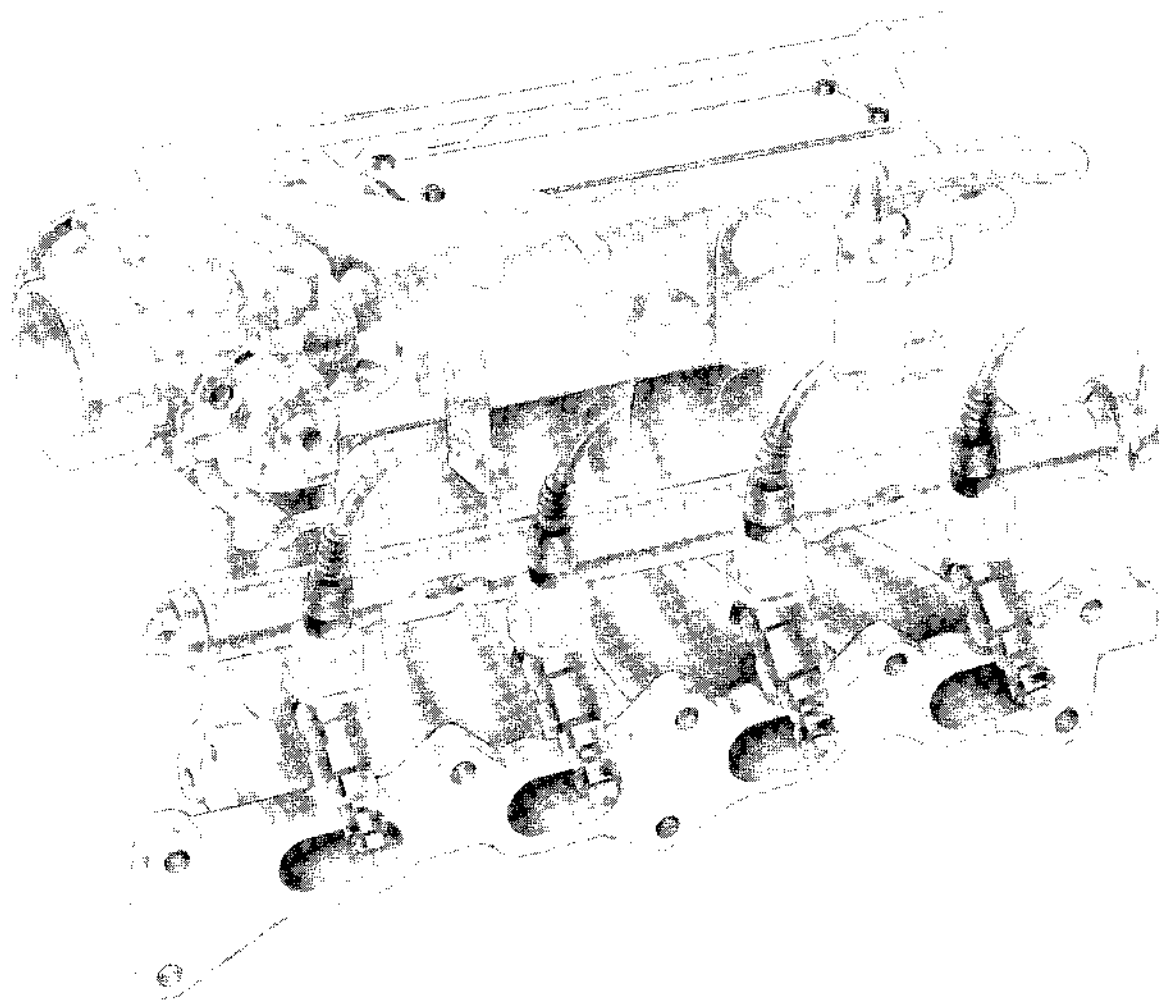
Air intake system includes air cleaner, air flow meter, throttle body, air valve, ISC solenoid valve and intake manifold.

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 control system equipped in only California spec. model.
- Evaporative emission control system.
- Throttle valve opening signal output for A/T.
- ESA (Electronic Spark Advance) system.



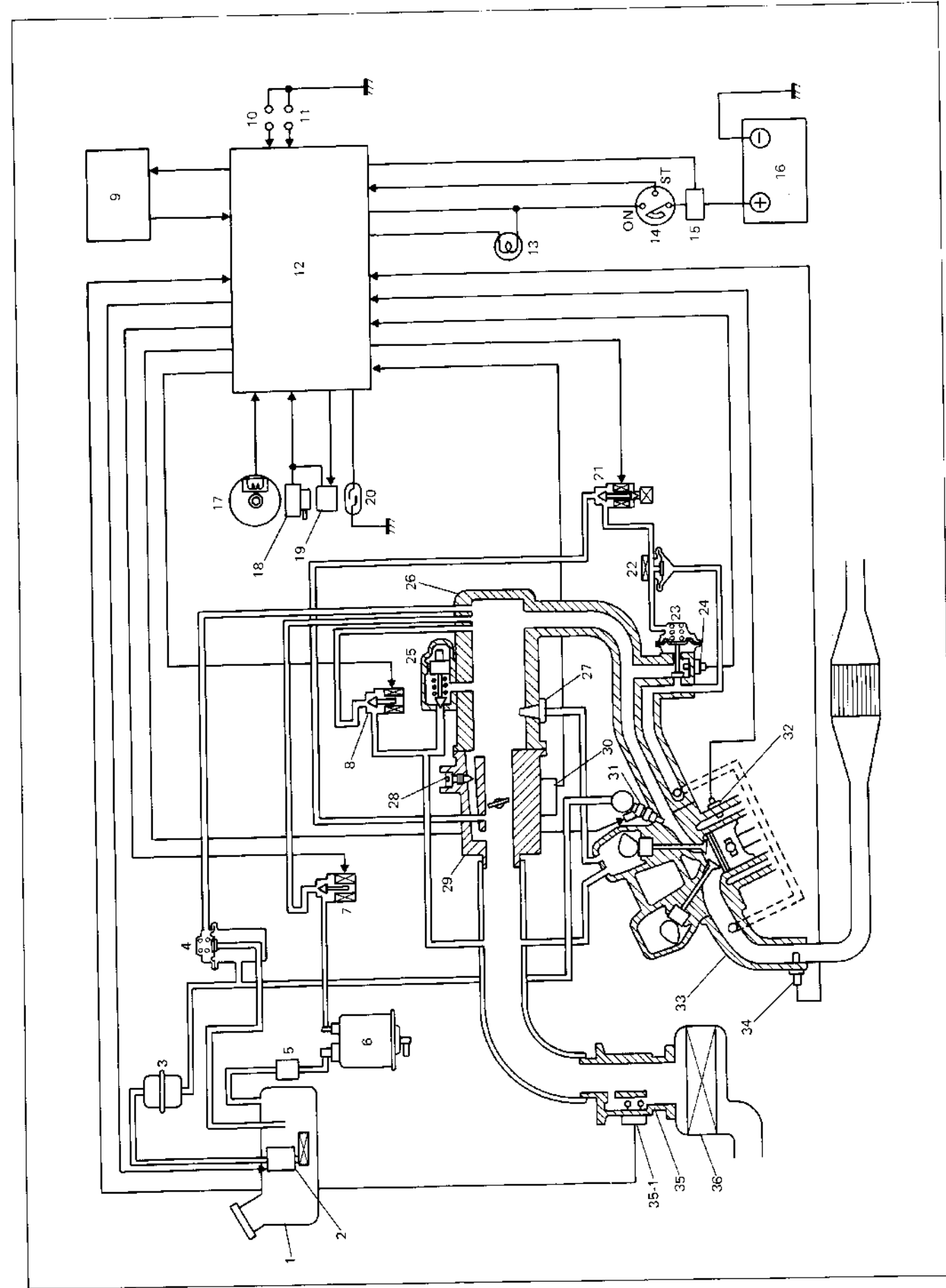


Fig. 6E-1 EFL System

1. Fuel tank
2. Fuel pump
3. Fuel filter
4. Fuel pressure regulator
5. 2-way check valve
6. Charcoal canister
7. Canister purge VSV
8. ISC solenoid valve
9. A/T control module (A/T only)
10. Diagnosis switch terminal
11. Test switch terminal
12. ECM
13. "CHECK ENGINE" light
14. Main switch
15. Main fuse
16. Battery
17. CAS (in distributor)
18. Ignition coil
19. Power unit
20. Speed sensor (in speedometer)
21. EGR VSV
22. EGR modulator
23. EGR valve
24. REGTS
25. Air valve
26. Intake manifold
27. PCV valve
28. Idle speed adjusting screw
29. Throttle body
30. TPS
31. Fuel injector
32. WTS
33. Exhaust manifold
34. Oxygen sensor
35. AFM
- 35-1. AFS
36. Air cleaner

AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, air flow meter, air flow meter outlet hose, throttle body, air valve, ISC solenoid valve and intake manifold.

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

When the engine is idling, when it is cold or when the ISC solenoid 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.

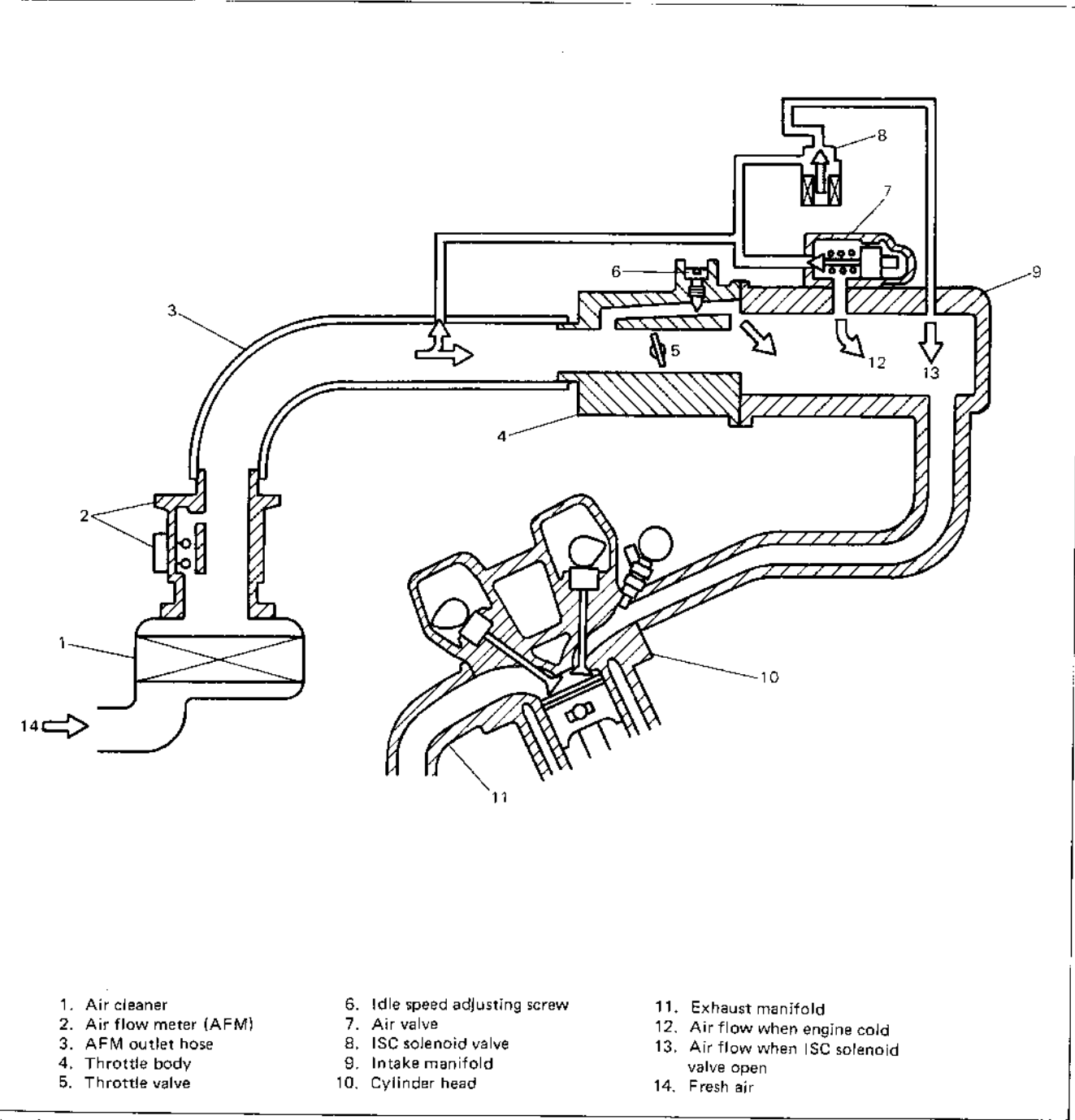


Fig. 6E-2 Air Intake System

THROTTLE BODY

The throttle body consists of the main bore, air bypass passage, vacuum passage (for EGR system, if equipped) and the following parts.

- Throttle valve which is interlocked with the accelerator pedal and controls the amount of the intake air
- Idle speed adjusting screw which controls the amount of bypass air to adjust engine idle speed
- TPS which detects the throttle valve opening and sends a signal to ECM
- Dash-pot which closes the throttle valve gradually in rapid deceleration.

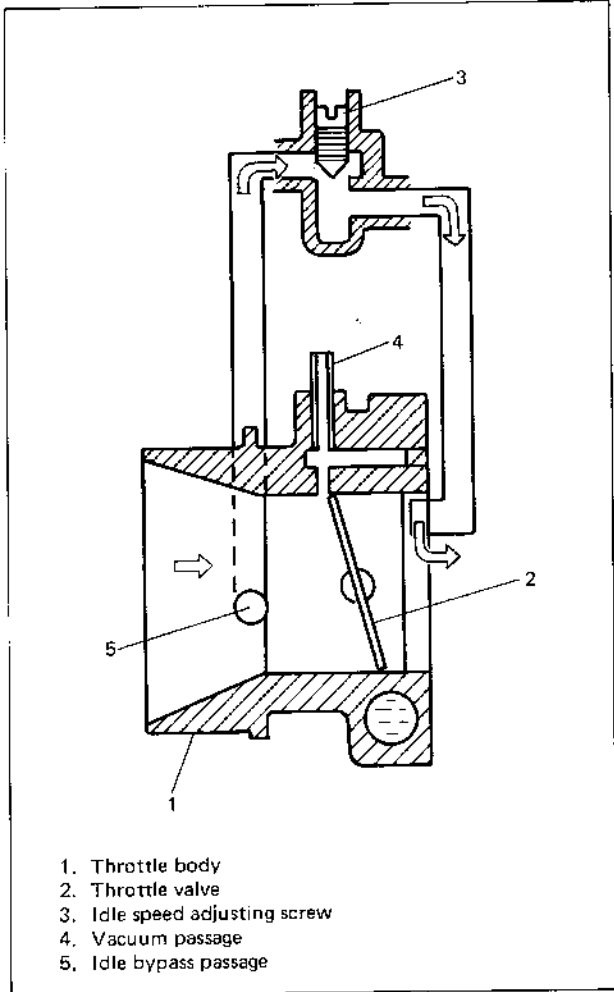


Fig. 6E-3 Throttle Body Cross-Section

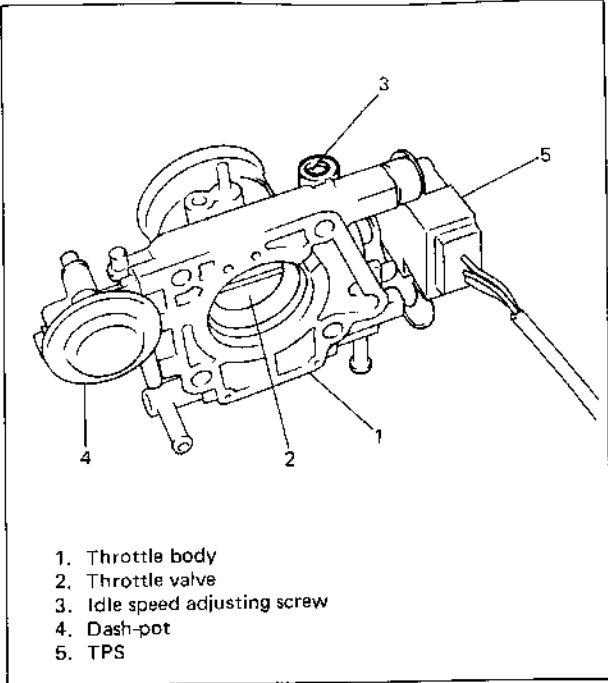


Fig. 6E-4 Throttle Body

AIR VALVE

The air valve located on the intake manifold consists of thermo wax, springs, and valve. When the engine is cold, it sends the air into the intake manifold without letting it pass through the throttle valve to increase the engine speed, and thus the engine is warmed up.

Operation

When the engine is cold (or engine cooling water is lower than about 70°C (158°F)), the thermo-wax contracts. In this state, the valve opens by the spring force, allowing the air to be drawn into the intake manifold. Thus the amount of intake air increases even when the throttle valve is fully closed and the engine speed rises to the fast idle state which is higher than the idle speed.

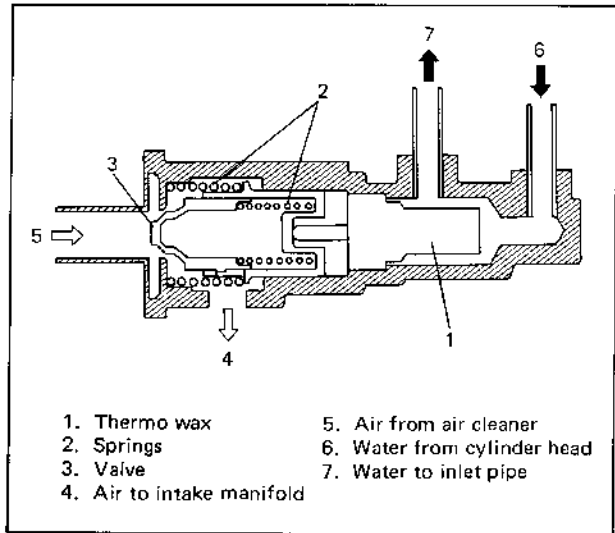


Fig. 6E-5 Opening Air Valve

As the engine is warmed up, the thermo-wax expands gradually, then the piston pushes the valve gradually, and the amount of air passing through the air valve decreases and so does the engine speed. When the engine cooling water temperature reaches about 70°C (158°F), the valve is fully closed and the engine speed is back to the normal idle speed.

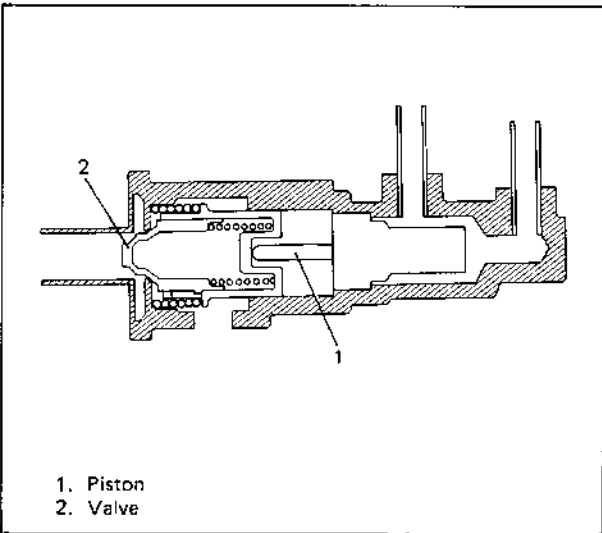


Fig. 6E-6 Closing Air Valve

ISC (Idle Speed Control) SOLENOID VALVE
The ISC solenoid valve opens and closes air by-pass passage according to the signal from ECM. When it opens, the air is supplied to the intake manifold.

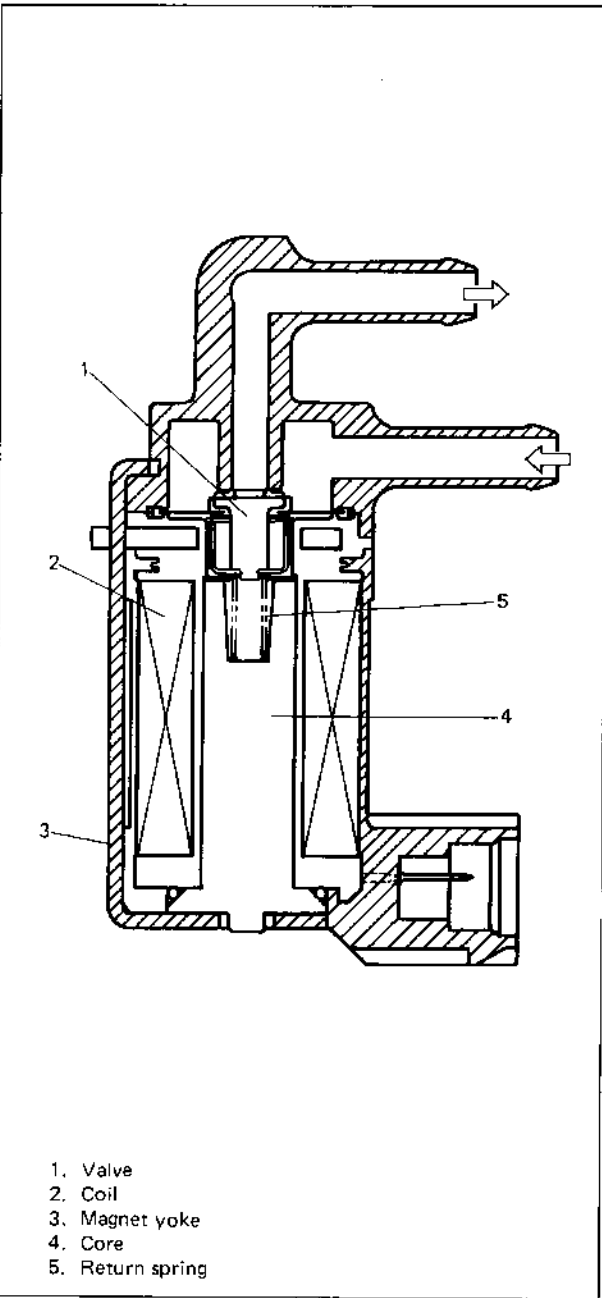


Fig. 6E-7 ISC Solenoid Valve Cross-Section

FUEL DELIVERY SYSTEM

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

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

As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept

a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM.

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

For the structure and operation of the fuel tank and filter, refer to SECTION 6C "ENGINE FUEL".

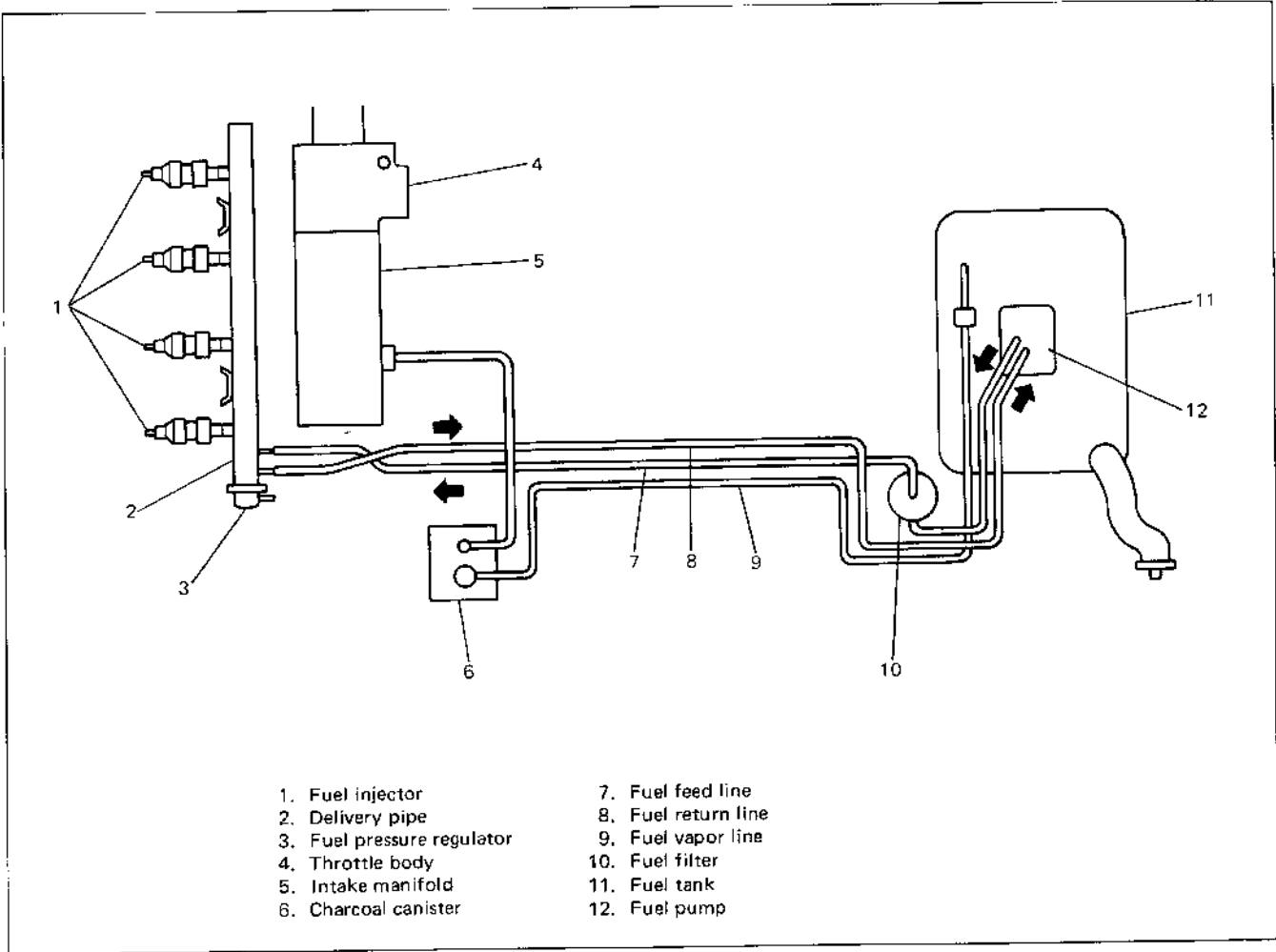


Fig. 6E-8 Fuel Delivery System

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 gooves 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.

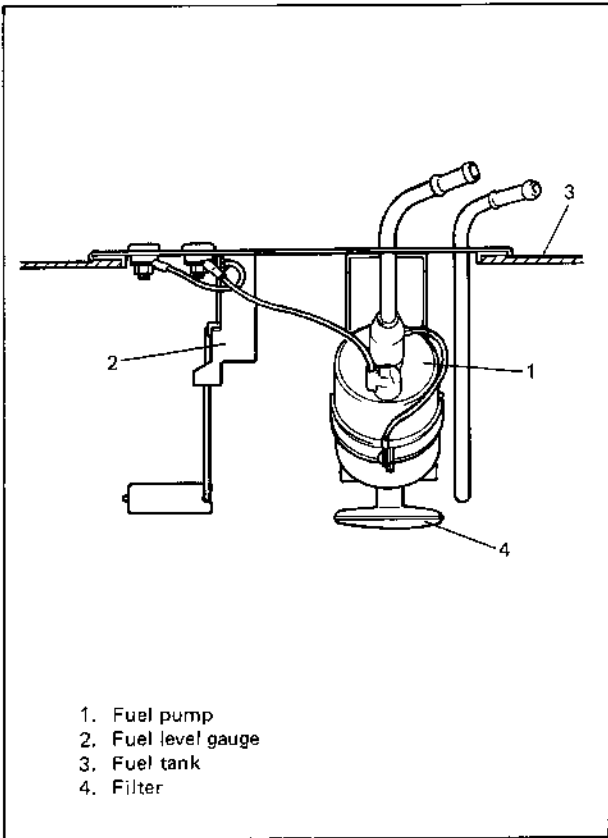


Fig. 6E-9 Fuel Pump Mounting

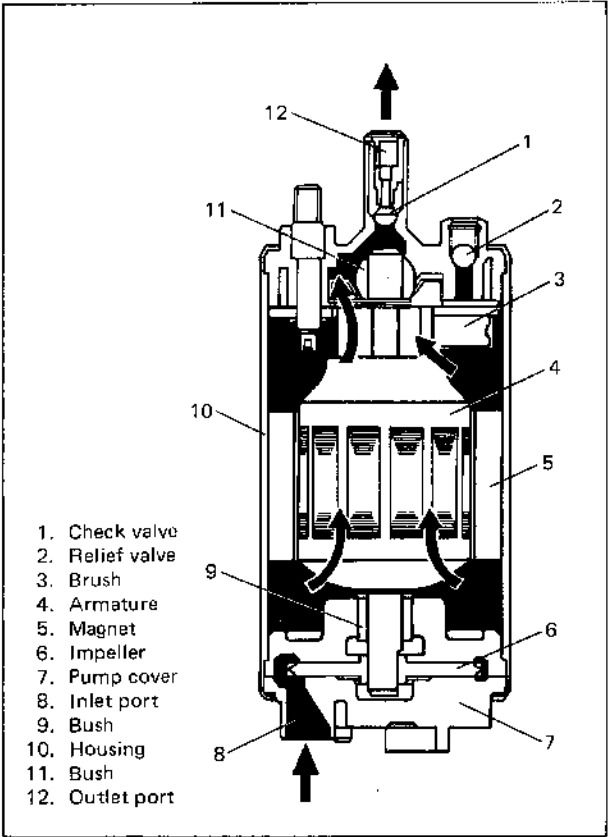


Fig. 6E-10 Fuel Pump Cross-Section

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 2.55 kg/cm^2 (255 kPa , 36.2 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 2.55 kg/cm^2 (255 kPa , 36.2 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.

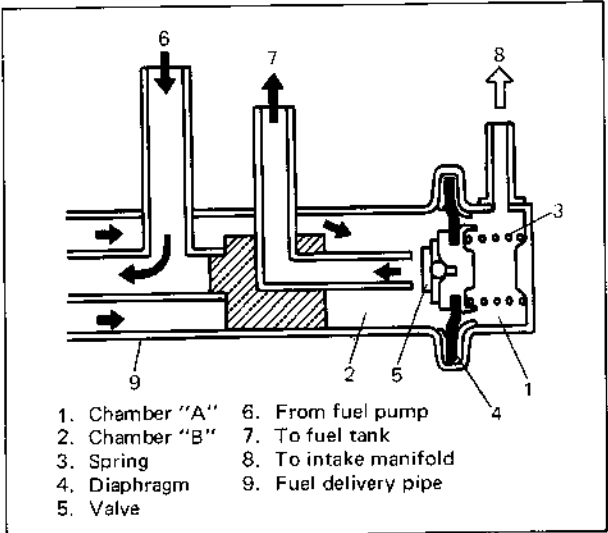


Fig. 6E-11 Fuel Pressure Regulator Cross-Section

FUEL INJECTOR

There are 4 injectors (one for each cylinder), each of which is installed between the cylinder head 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 needle 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).

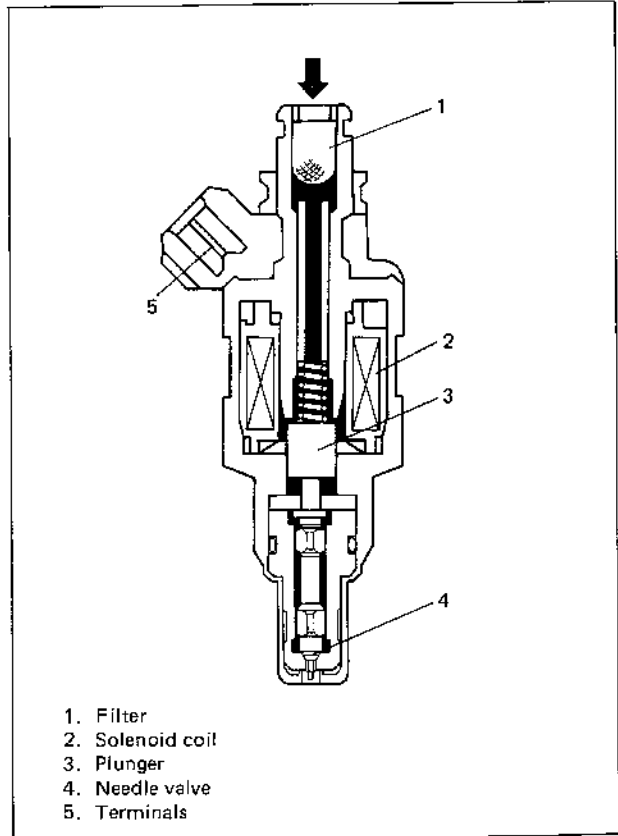


Fig. 6E-12 Fuel Injector Cross-Section

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 six sub systems:

- Fuel injection control system
- ISC solenoid valve control system

- Fuel pump control system
- EGR control system (For California spec. model only)
- Evaporative emission control system
- ESA (Electronic Spark Advance) system

Also, with A/T model, ECM sends throttle valve opening signal to A/T control module to control A/T.

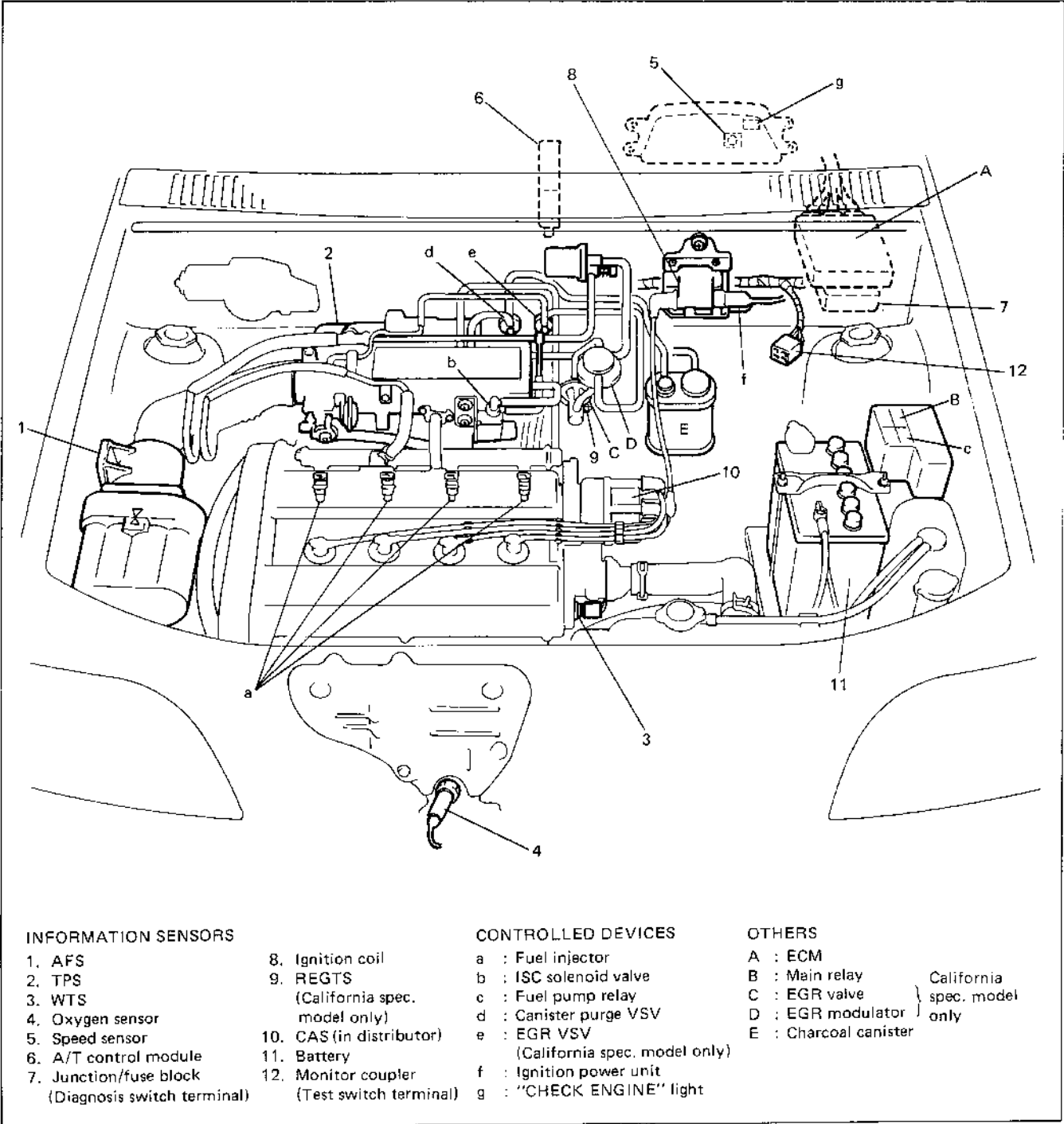


Fig. 6E-13 Parts Location

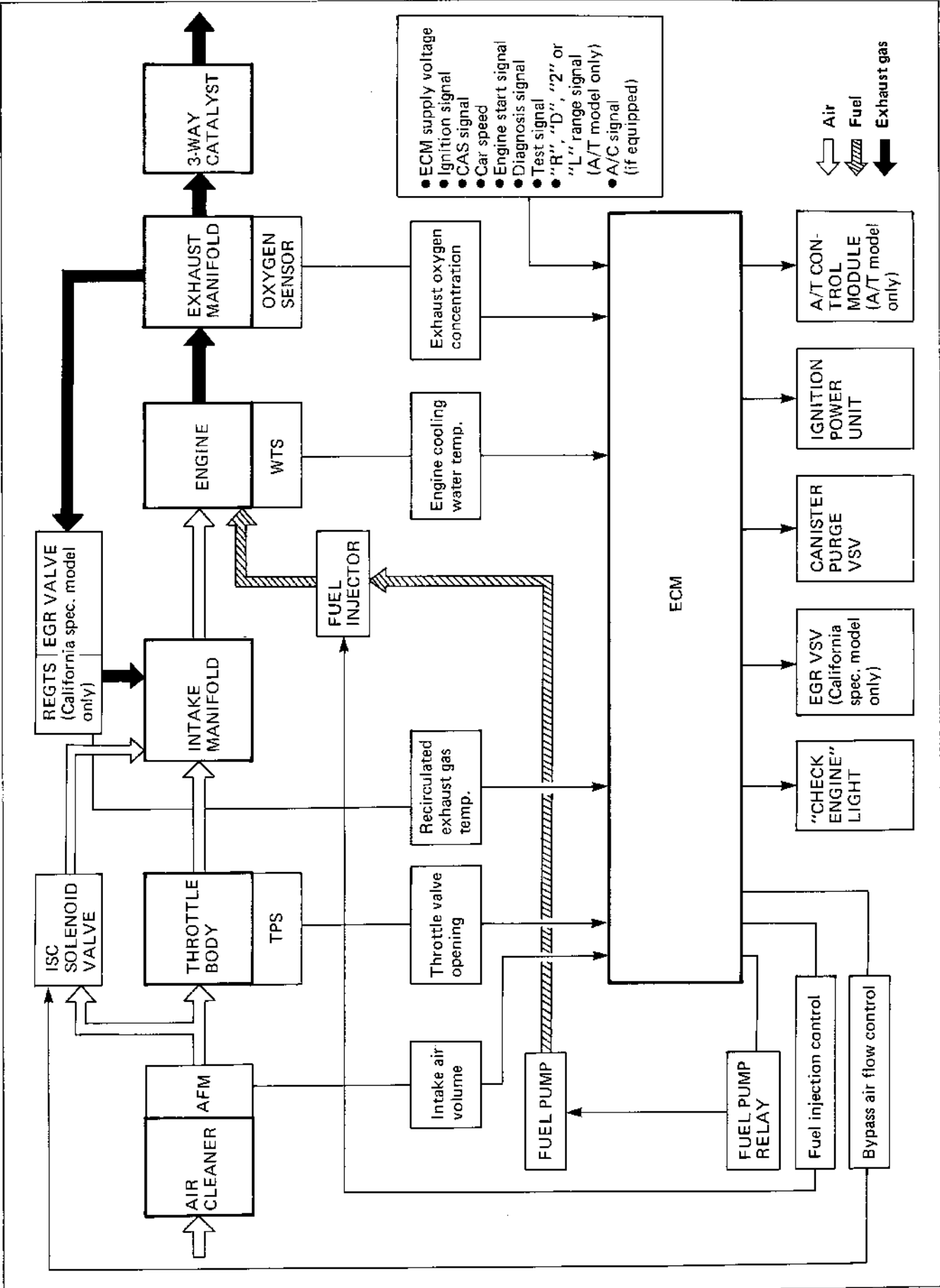


Fig. 6E-14 System Schematic

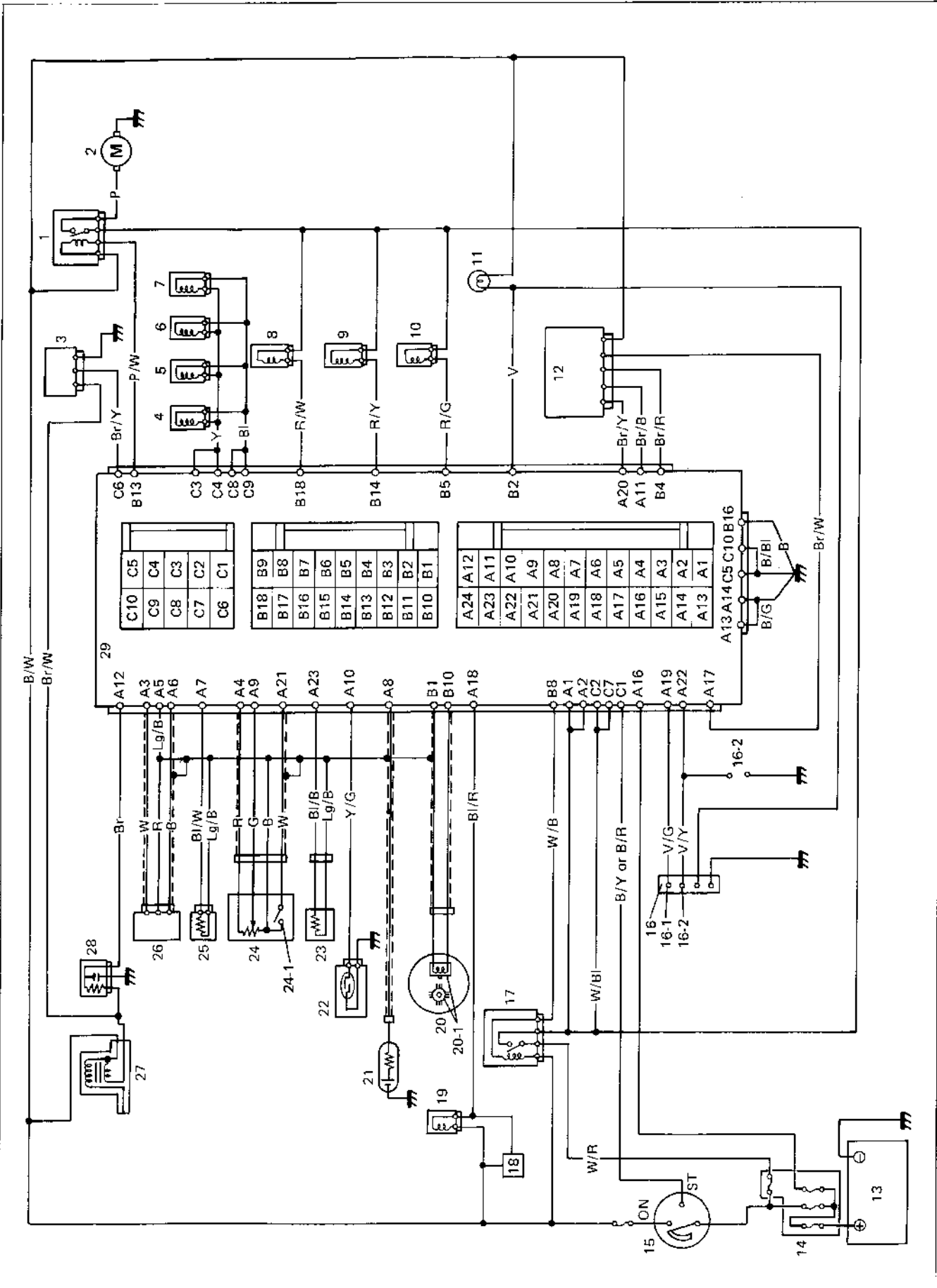


Fig. 6E-15 System Wiring Diagram

- 1. Fuel pump relay
- 2. Fuel pump
- 3. Ignition power unit
- 4. Fuel injector No. 1
- 5. Fuel injector No. 2
- 6. Fuel injector No. 3
- 7. Fuel injector No. 4
- 8. ISC solenoid valve
- 9. EGR VSV
(California spec. model only)
- 10. Canister purge VSV
- 11. "CHECK ENGINE" light
- 12. A/T control module
(A/T model only)
- 13. Battery
- 14. Main fuse
- 15. Main switch
- 16. Monitor coupler
- 16-1. Test switch terminal
- 16-2. Diagnosis switch terminal

- 17. Main relay
- 18. A/C amplifier
(only for car with A/C)
- 19. A/C VSV
(only for car with A/C)
- 20. Distributor
- 20-1. Crank angle sensor
- 21. Oxygen sensor
- 22. Speed sensor
- 23. REGTS
(California spec. model only)
- 24. TPS
- 24-1. Idle switch
- 25. WTS
- 26. AFS
- 27. Ignition coil
- 28. Noise suppressor
- 29. ECM

Wire color

B	: Black
B/Bl	: Black/Blue
B/G	: Black/Green
B/R	: Black/Red
B/W	: Black/White
B/Y	: Black/Yellow
Bl	: Blue
Bl/B	: Blue/Black
Bl/R	: Blue/Red
Bl/W	: Blue/White
Br	: Brown
Br/B	: Brown/Black
Br/R	: Brown/Red
Br/W	: Brown/White
Br/Y	: Brown/Yellow
G	: Green
Gr	: Gray
Gr/W	: Gray/White
Lg	: Light green
Lg/W	: Light green/White
Lg/Y	: Light green/Yellow
P	: Pink
P/W	: Pink/White
R	: Red
R/B	: Red/Black
R/G	: Red/Green
R/Y	: Red/Yellow
R/W	: Red/White
Sb	: Skyblue
V	: Violet
V/G	: Violet/Green
W	: White
W/Bl	: White/Blue
W/R	: White/Red
Y	: Yellow
Y/B	: Yellow/Black

Electronic 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, ISC solenoid valve, fuel pump relay, etc. but also self-diagnosis function and fail-safe function as described in the following section.

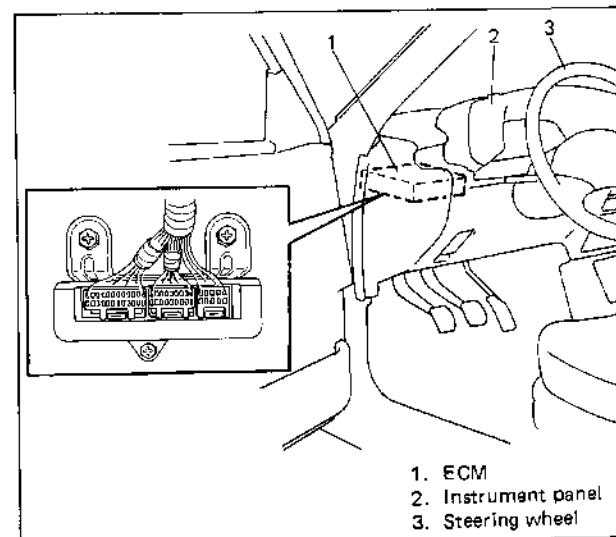


Fig. 6E-16 ECM location

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 "CHECK ENGINE" light.

- Oxygen sensor
 - Water temp. sensor
 - Throttle position sensor
 - Speed sensor
 - Air flow sensor
 - Ignition signal
 - Crank angle sensor
 - EGR system
 - Fuel injector
 - CPU (Central Processing Unit) of ECM
- (California spec. model only)

ECM and "CHECK ENGINE" light operate as follows.

- "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 EFI system. This is only to check the "CHECK ENGINE" light bulb and its circuit.
- If the above areas of EFI system is free from any trouble after the engine start (while engine is running), "CHECK ENGINE" light turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes "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 30 seconds or longer.) ECM also indicates trouble area in memory by means of flashing of "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 code when engine fails to start, crank engine and then ground diagnostic switch terminal with ignition switch ON.

Fail-safe function

Even when a trouble has occurred in such areas of EFI system that include the following parts and a failure signal is sent to ECM, control over the injector, ISC solenoid valve and others 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.

- Water temp. sensor
- Throttle position sensor
- Speed sensor
- Air flow sensor
- CPU in ECM

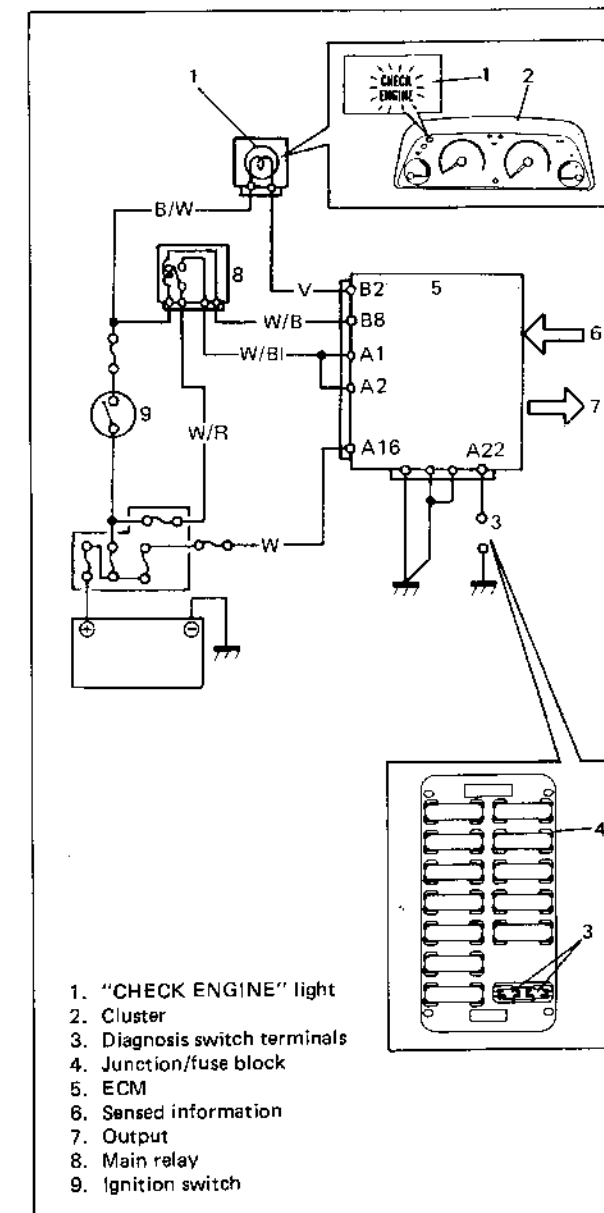


Fig. 6E-17 "CHECK ENGINE" Light Circuit

Air Flow Meter (AFM)

The air flow meter consisting of air flow sensor and body is installed between air cleaner and AFM outlet hose. It detects the amount of air drawn into the engine and sends that information to ECM as a voltage signal. ECM uses the signal as one of the signals to control fuel injectors.

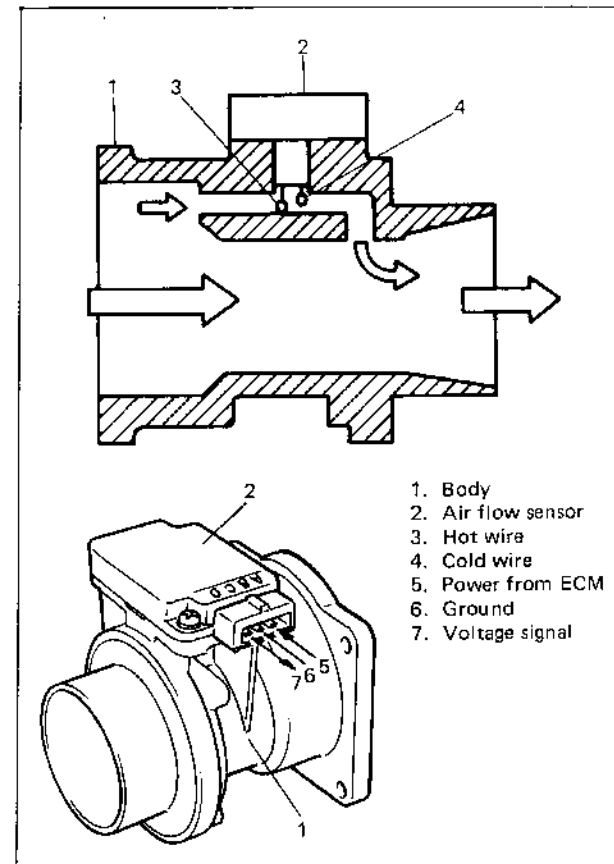


Fig. 6E-18 AFM

[Principle]

When a hot wire energized with a constant current (resistance wire heated by a current to a high temperature) is placed in the air flow, its heat is absorbed by the air flow and temperature rise of the hot wire reduces (heat is conducted to air, which moves and absorbs heat). The less air flows (is drawn), the less heat is dissipated (absorbed) from the hot wire and the more air, the more heat dissipation (absorption) from the hot wire. Therefore, if the temperature of the hot wire is maintained constant by regulating the amount of electric current flowing to the hot wire, the amount of air flow (intake air) can be measured by the amount of flowing current, for the amount of current corresponds to that of the intake air.

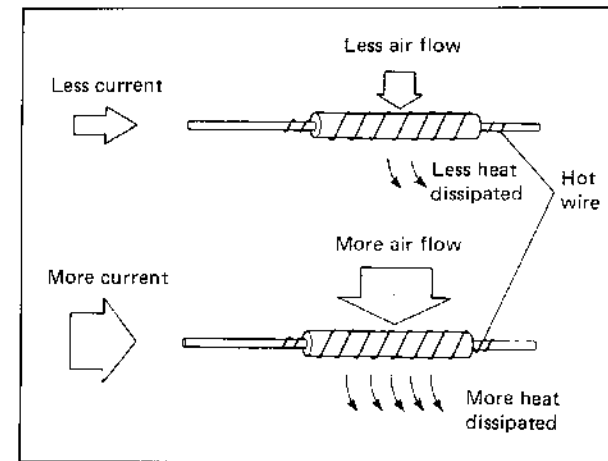


Fig. 6E-19 Amount of Air Flow and That of Current When Hot Wire Temperature is Kept Constant

The air flow sensor uses the above described principle and has a circuit as shown in Fig. 6E-20. The hot wire temperature is detected by the circuit in which the hot wire and reference resistor are connected. Also, as the hot wire temperature is affected by the air temperature, the intake air temperature is detected by the circuit in which the cold wire and reference resistor are connected so as to compensate the changes in hot wire temperature. And by putting these two circuits in the bridge structure, the current flowing to the hot wire is regulated to corresponds to the amount of the intake air and thus the hot wire temperature is kept constant. Then the current flowing to the hot wire, as a voltage signal, is transmitted to ECM. As it corresponds to the amount of the intake air as described above, the voltage rises higher as the intake air increases.

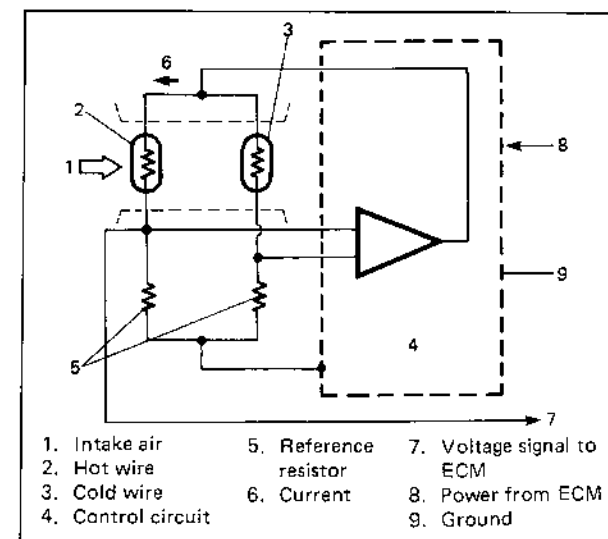


Fig. 6E-20 AFS Circuit

Throttle Position Sensor (TPS)

The throttle position sensor consisting of a contact point (idle switch and a potentiometer) is installed on the throttle body, and detects the throttle valve opening.

The throttle opening in the idle state is detected by means of the contact point which turns ON in that state.

But beyond that, the full opening is detected by the potentiometer as follows.

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 ON/OFF signal and sensor output voltage, ECM detects the throttle valve opening.

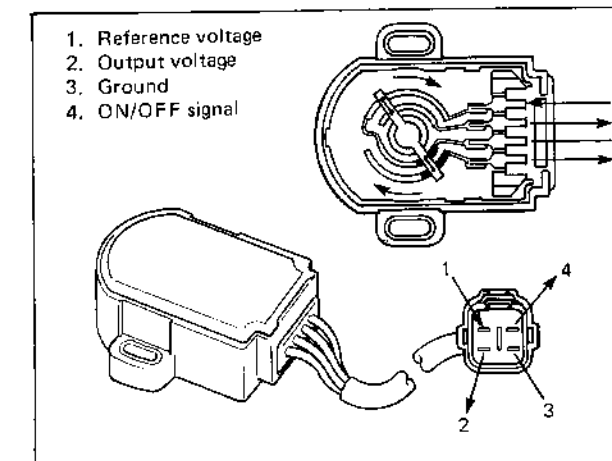


Fig. 6E-21 TPS

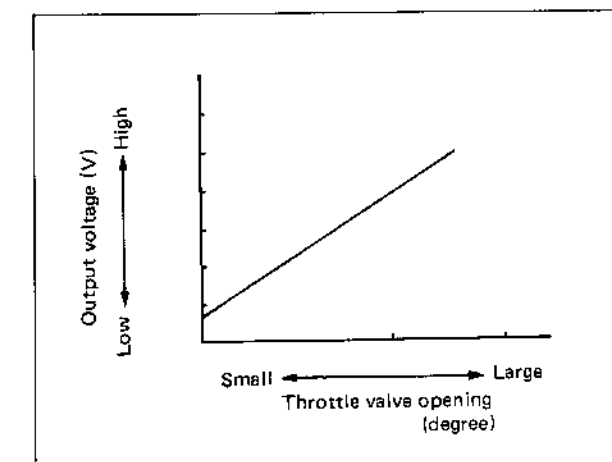


Fig. 6E-22 Output Characteristic

ECM uses the signal from TPS as one of the signals to control fuel injector, ISC solenoid valve, ignition timing, canister purge VSV and EGR VSV (if equipped).

Also, ECM converts the voltage signal from TPS into ON/OFF signal and sends it to A/T control module, where it is used as one of the signals to control the automatic transmission.

Water Temperature Sensor (WTS)

Located at the side of cylinder head, this sensor measures the temperature of the engine cooling water and converts its change into that in resistance through the thermister.

That is, as cooling water temperature lowers, resistance increases and as it rises, resistance decreases.

By monitoring the resistance of the water temperature sensor, ECM detects the engine cooling water temperature and that affects most systems under the control of ECM.

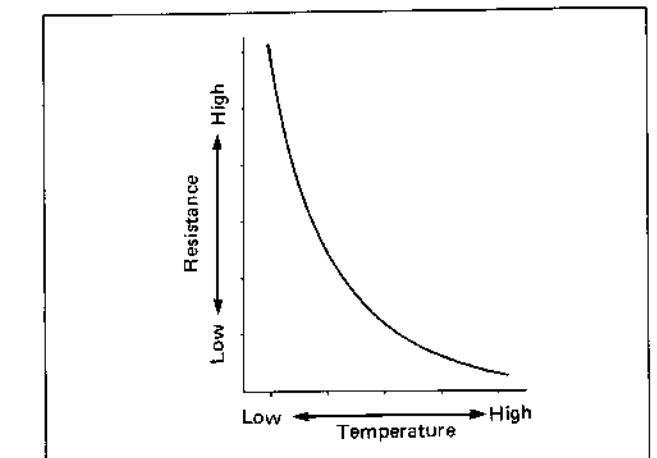


Fig. 6E-23 Water Temperature Sensor Characteristic

Oxygen Sensor

The oxygen sensor is located on the exhaust manifold to detect the concentration of oxygen in the exhaust gases. It consists of the zirconia element (with thin platinum surface coating) which generates electromotive force, lead wire which draws out the electromotive force and cover and housing which protect the zirconia element from damage.

The zirconia element, by its property, generates the electromotive force when a difference in oxygen concentration exists between its faces. As its temperature rises, the change of the electromotive force is amplified by catalytic reaction of the platinum. The oxygen sensor makes use of this property. As atmosphere is introduced into the oxygen sensor, the inside of the zirconia element is exposed to the atmosphere and outside to exhaust gases. Thus the difference in concentration between the inside and the outside of the zirconia element varies with the oxygen concentration in the exhaust gases.

The large concentration difference results in about 1V of the electromotive force and small difference results in about 0V. To put in other words, if the amount of oxygen in the exhaust gases is less (air-fuel mixture is richer than the stoichiometric mixture), about 1V of electromotive force is generated and if more (air-fuel mixture is leaner than the stoichiometric mixture), almost none is generated. In this way, the oxygen sensor detects whether the oxygen concentration is high or low (or the mixture is leaner or richer than the stoichiometric mixture).

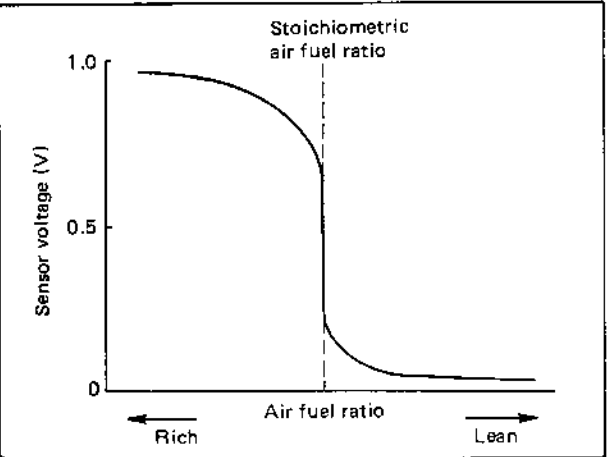


Fig. 6E-24 Output Characteristic

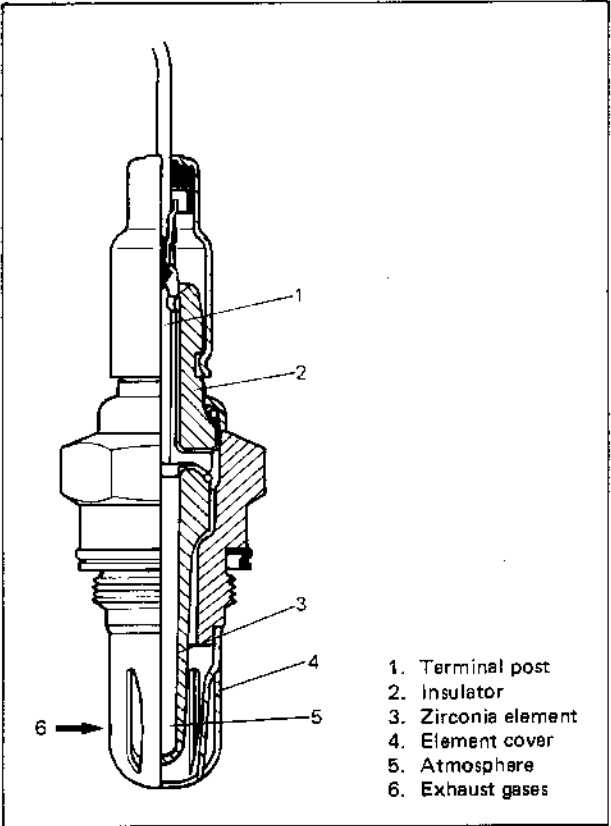


Fig. 6E-25 Oxygen Sensor

Speed Sensor

The speed sensor consisting of the lead switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the lead switch to turn ON and OFF. Such ON/OFF frequency increases or decreases in proportion with the car speed and is sent to ECM as pulse signals.

ECM uses it as one of the signals to control the ISC solenoid valve.

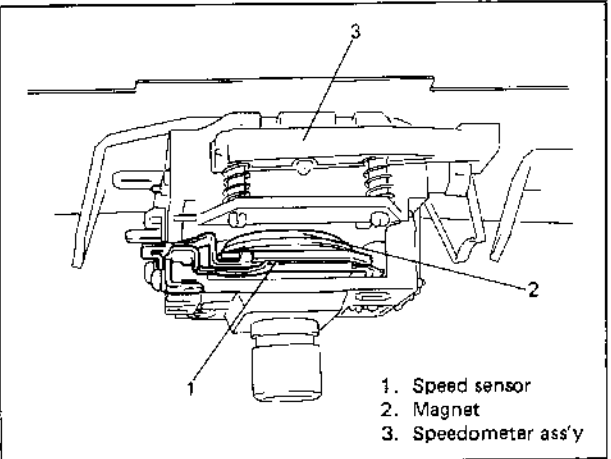


Fig. 6E-26 Speed Sensor

Crank Angle Sensor

The crank angle sensor located in the distributor consists of the signal generator (pick-up coil and magnet) and signal rotor.

As the signal rotor turns, AC voltage is generated in the pick-up coil which varies in pulsatory way as shown below. This pulse signal (12 pulses/revolution) is sent to ECM where it is used to calculate the engine speed and also as one of the signals to control various devices.

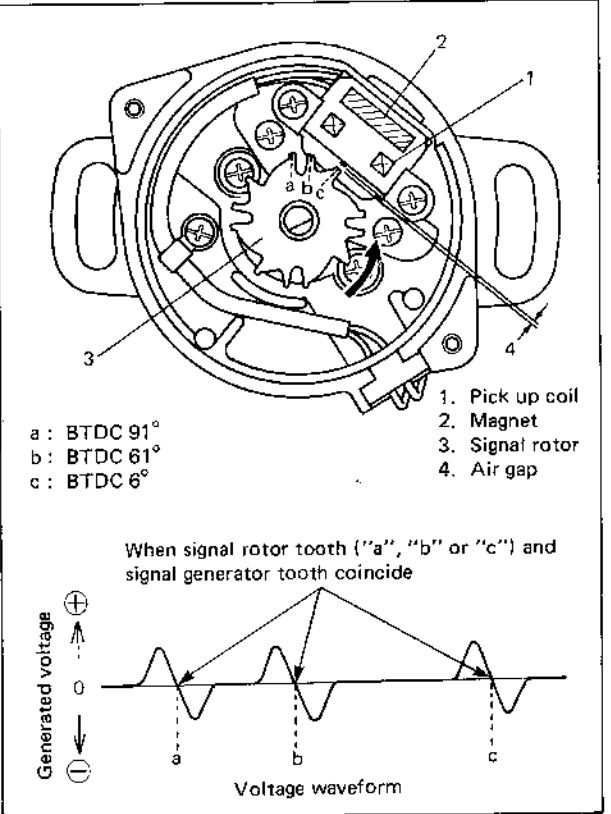


Fig. 6E-27 Crank Angle Sensor

Ignition Signal

This signal is sent from the ignition coil primary circuit.

Monitoring this signal, ECM detects whether the ignition spark is emitted or not and stops injector operation when this signal is not inputted.

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 ignition timing.

"R", "D", "2" or "L" Range Signal

This signal is sent from A/T control module as a battery voltage signal only when A/T is in "R", "D", "2" or "L" range. Thus, ECM judges whether A/T is in one of the above ranges or otherwise (i.e. in "P" or "N" range) and uses it as one of the signals to control the fuel injector and ISC solenoid valve.

Air-Conditioner Signal (Car with air-conditioner only)

This signal is sent from the air-conditioner circuit. ECM detects whether the air-conditioner is operating or not through the signal and uses it as one of the signals for controlling ISC solenoid valve operation.

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.

Diagnosis Switch Terminal

There are two diagnosis switch terminals; one included in the junction/fuse block and the other in the monitor coupler in the engine room. When either diagnosis switch terminal is grounded, a diagnosis signal is fed to ECM which then outputs self-diagnosis code and at the same time fixes the ON time of ISC solenoid valve constant.

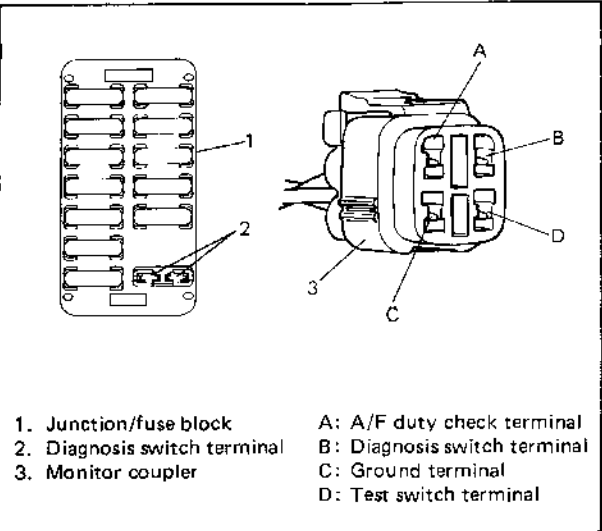


Fig. 6E-28 Diagnosis and Test Switch Terminals

Test Switch Terminal

The test switch terminal is included in the monitor coupler. When this terminal is grounded, ECM sets the ignition timing to the initial ignition timing.

When both test switch terminal and diagnosis switch terminal are grounded, ECM outputs A/F duty through the A/F duty check terminal. Also, "CHECK ENGINE" light stays ON at this time, but it is nothing abnormal.

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

There are two types of injection timing. One is "synchronous injection" in which injection is synchronous with the CAS signal and the other is "asynchronous injection" in which injection takes place independently of the CAS signal.

• Synchronous injection at start

When the engine is cranking, all four injectors start injecting the fuel simultaneously at every CAS 6° signal (ignition signal) or every two CAS 6° signals (ignition signals) depending on the engine cooling water temperature. It occurs several times till the injection time within one ignition cycle becomes as specified (the time is determined according to the signals from sensors).

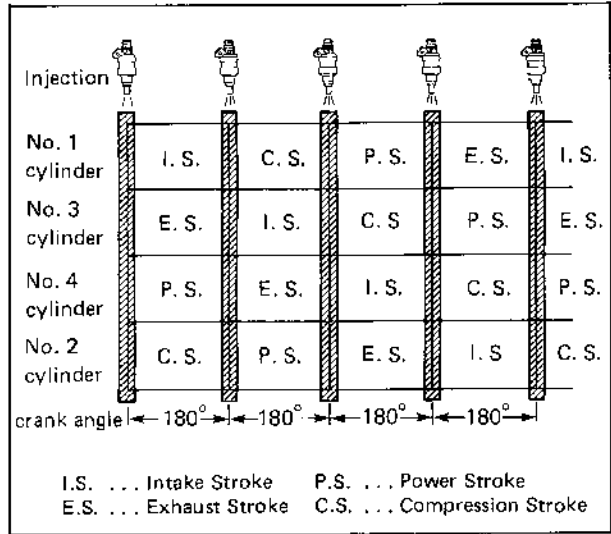


Fig. 6E-29 Synchronous Injection at Start

• Synchronous injection while low speed and low load

When the engine speed is lower than 6,000 r/min. and the engine is under low load, all four injectors inject fuel simultaneously and synchronously at every four CAS 6° signals, that is, twice every crankshaft turn.

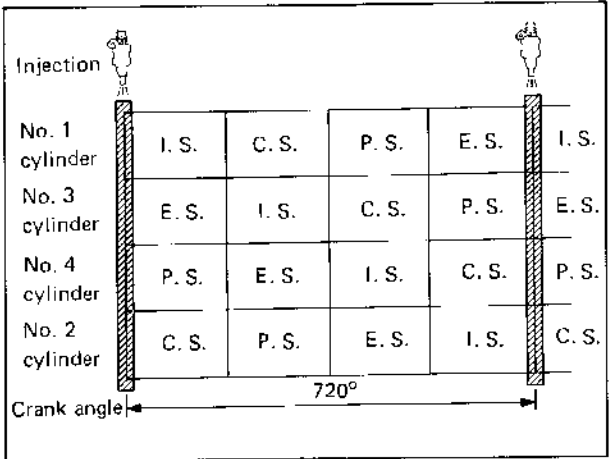


Fig. 6E-30 Synchronous Injection While Low Speed and Low Load

• Synchronous injection while high speed or high load

When the engine speed is higher than 6,000 r/min. or the engine is under high load, all four injectors inject fuel simultaneously and synchronously at every two CAS 6° signals, that is, once every crankshaft turn.

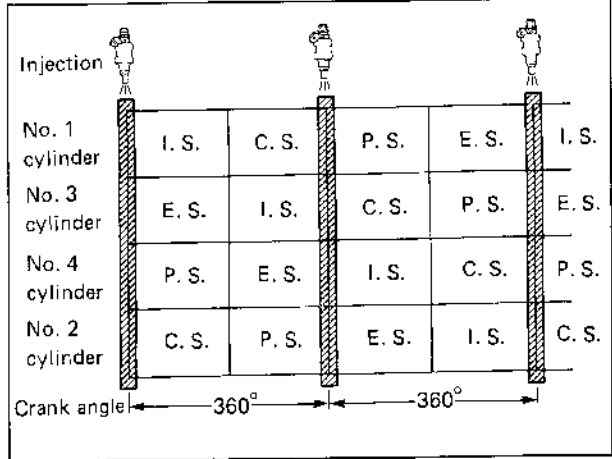


Fig. 6E-31 Synchronous Injection While High Speed or High Load

• Asynchronous injection

When the accelerator pedal is depressed (when the idle switch turns OFF from ON and when the throttle valve opening increases suddenly), four injectors inject fuel simultaneously once to a few times in addition to the synchronous injection and independently of the CAS signal.

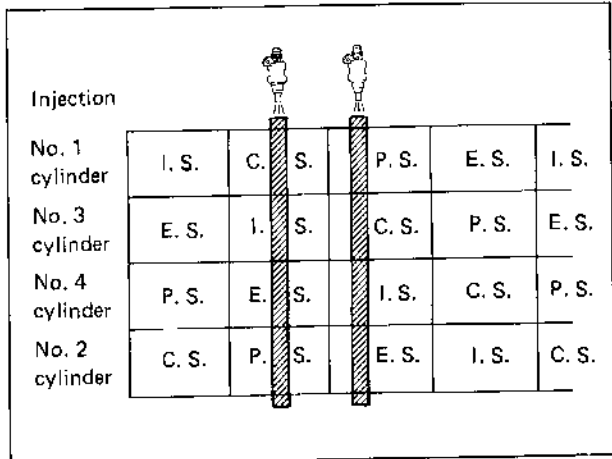


Fig. 6E-32 Asynchronous Injection

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.

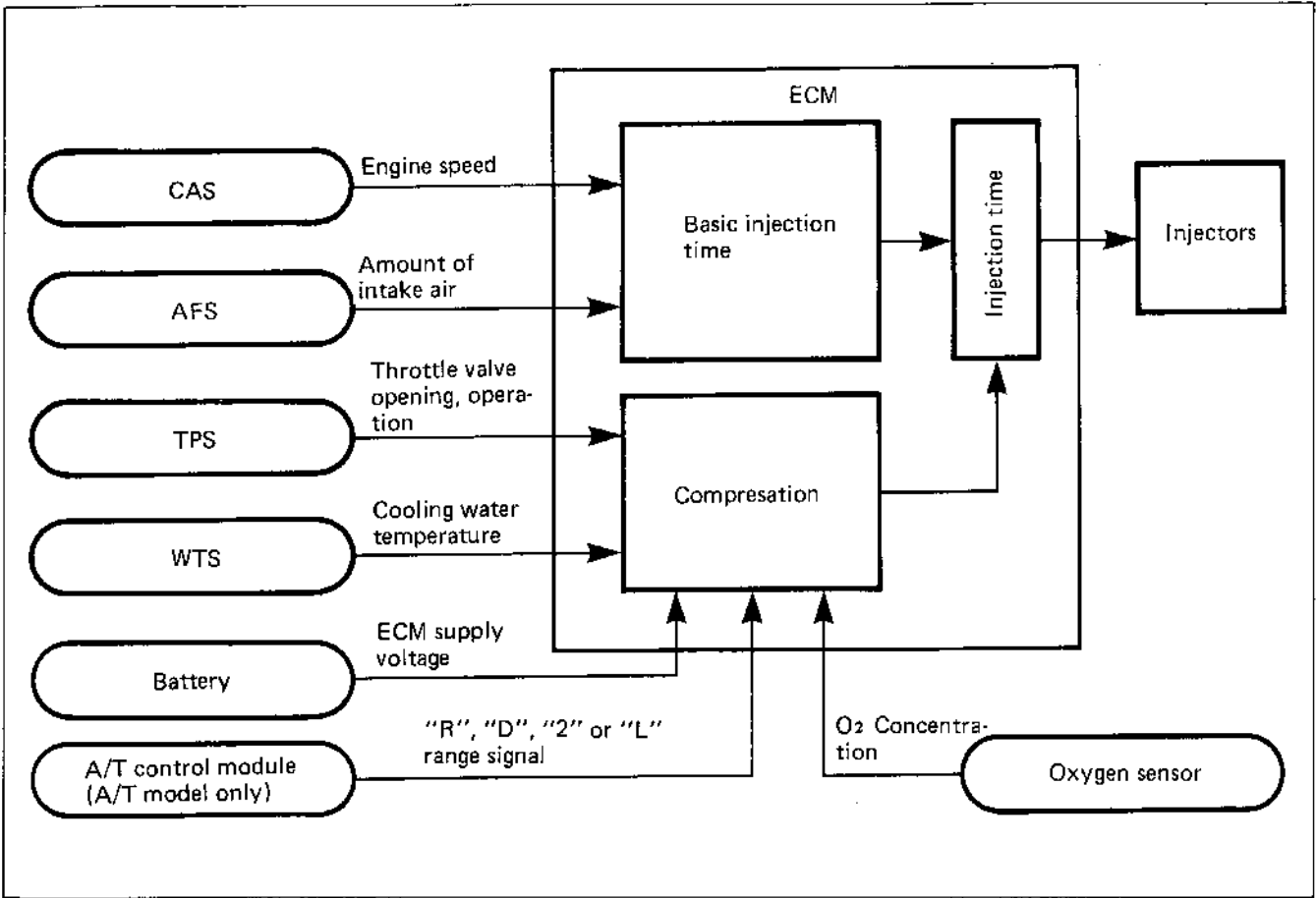


Fig. 6E-33 Parameter Diagram for Fuel Injection Control System

Injection time at engine cranking

To improve the starting performance of the engine, the injection time is determined separately from the basic injection time which is determined depending on the engine speed and amount of intake air. For this purpose, the injection time is controlled according to the engine cooling water temp., intake air volume and throttle valve opening.

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 cooling water temperature.

Enriching compensation while warming up

When the engine is cold, enriching compensation is made to ensure good driveability till the engine cooling water temperature reaches the specified level.

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 cooling water temperature.

Power enriching compensation

To ensure smooth acceleration and good driveability under the high load driving condition, enriching compensation is carried out.

Enriching compensation after idling

Immediately after idling (when the accelerator pedal is depressed from the idle state and the idle switch turns OFF from ON), the amount of injected fuel is increased to stabilize the engine speed and obtain smooth acceleration performance. The increased amount depends on the engine cooling water temperature.

Enriching compensation when shifting to "R", "D", "2" or "L" range (For A/T model)

To stabilize the engine speed when the temperature is very low, enriching compensation is carried out when the selector lever is shifted from "P" or "N" range to "R", "D", "2" or "L" range.

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

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 7,500 r/min to prevent over-run which affects the engine adversely and it starts again when the engine speed reduces to less than 7,460 r/min.

Air/fuel ratio feed back compensation

It is necessary to keep the air/fuel mixture close to the theoretical air/fuel ratio (14.7) to obtain efficient performance of the 3-way catalyst and high clarification rate of CO, HC and NOx in the exhaust gas. For that purpose, ECM operates as follows. It first compares the signal from the oxygen sensor with a specified reference voltage and if the signal is higher, it detects that the air/fuel ratio is richer than the theoretical air/fuel ratio and reduces fuel. On the other hand, if the signal is lower, it detects that the air/fuel ratio is leaner and increases fuel. By repeating these operations, it adjusts the air/fuel ratio closer to the theoretical air/fuel ratio.

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.

- At engine start and when fuel injection is increased after engine start
- When engine cooling water temperature is low
- When highly loaded or throttle valve fully opened and fuel injection is increased
- At fuel cut
- When oxygen sensor is cold
- When engine is running at high speed (higher than about 4,400 r/min.)

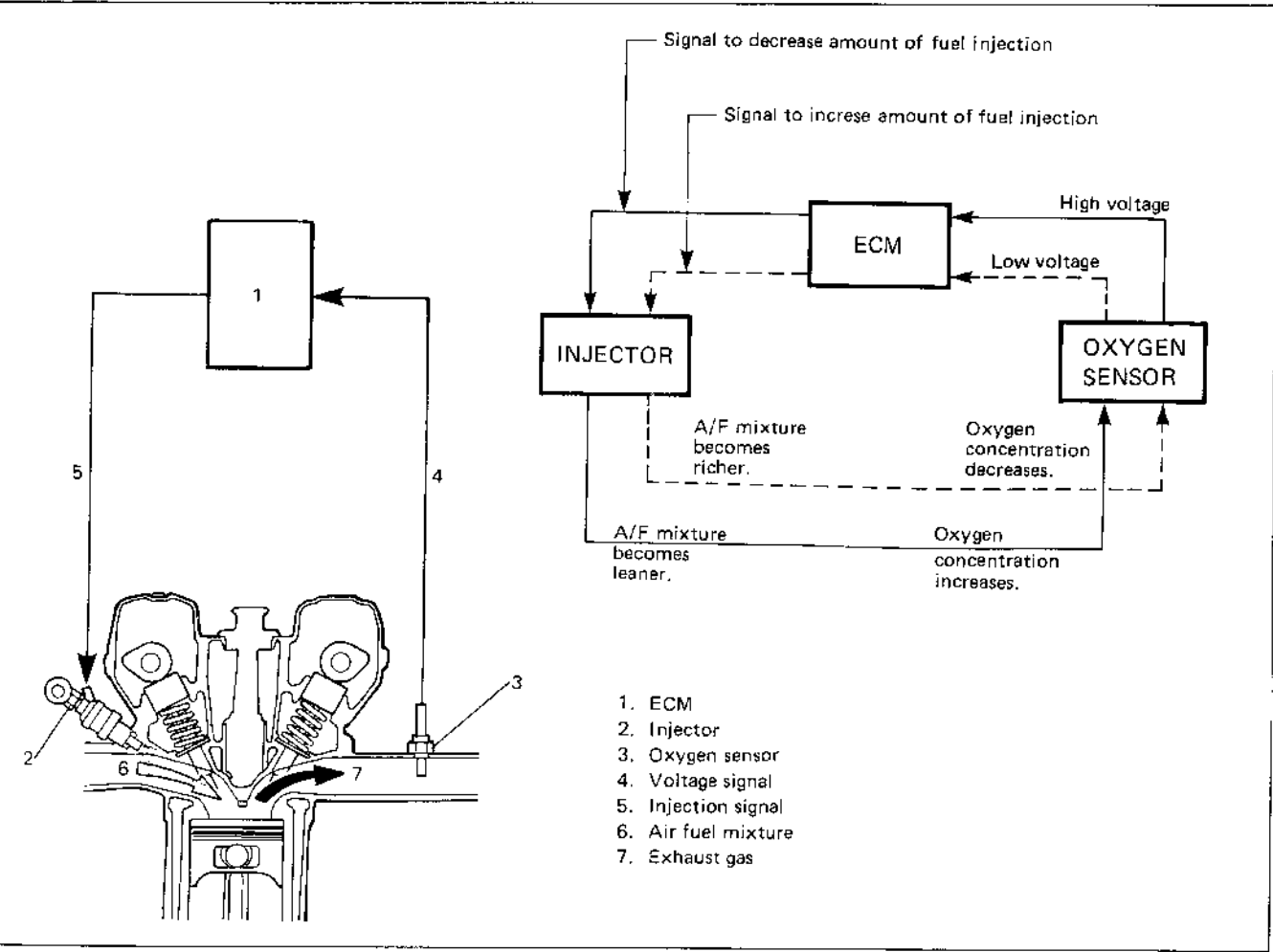


Fig. 6E-34 A/F Ratio Feed Back Compensation

ISC SOLENOID VALVE CONTROL SYSTEM

This system controls the bypass air flow by means of ECM and ISC solenoid valve for the following three 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, air-conditioner 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)

Operation

ISC solenoid valve opens the bypass air passage when it is turned ON by ECM and closes it when turned OFF.

ECM detects the engine condition by using signals from various sensors and switches and while repeating ON and OFF cycle of ISC solenoid valve at a certain rate (19.5 times a second), it controls bypass air flow by increasing and decreasing its ON time within a cycle.

While the engine is cranking, ECM keeps ISC solenoid valve ON (maximum ON time rate within one cycle) so as to obtain better start of the engine.

When the accelerator pedal is depressed while the engine is running (the idle switch is OFF and the throttle valve is at other than idle position), ECM sets the ON time of the ISC solenoid valve (rate of ON time within one cycle) so that it is determined by the engine conditions and keeps it. When decelerating (at fuel cut), on the other hand, ECM keeps the valve ON (maximum ON time rate within one cycle) to obtain dash-pot effect. When fuel cut is over, ECM reduces the valve ON time gradually (i.e., the bypass air flow is reduced gradually).

When the car is at a stop, the throttle valve is at the idle position and the engine is running, ECM controls the bypass air flow by increasing or decreasing ON time of ISC solenoid valve so that the engine speed is kept at a specified idle speed.

With an air-conditioner equipped car, when the air-conditioner is ON, a certain amount of the bypass air is supplied by the air-conditioner VSV independently of this system. The bypass air supplied by this system is used for fine control to keep the idle speed as specified.

NOTE:

This system automatically adjusts the engine idle speed to specification by means of ECM. If such specified idle speed is not available, it is necessary to adjust the basic idle speed with the idle speed adjusting screw as follows. With the diagnosis switch terminal grounded and ON time of ISC solenoid valve fixed constant, adjust the engine idle speed as specified.

Engine idle speed specifications at engine normal operating temperature are as follows.

(Unit: r/min)

		Air-conditioner OFF	Air-conditioner ON
M/T model		850 ± 50	900 ± 50
A/T model	At "P" or "N" range	850 ± 50	900 ± 50
	At "R", "D", "2" or "L" range	850 ± 50	750 ± 50

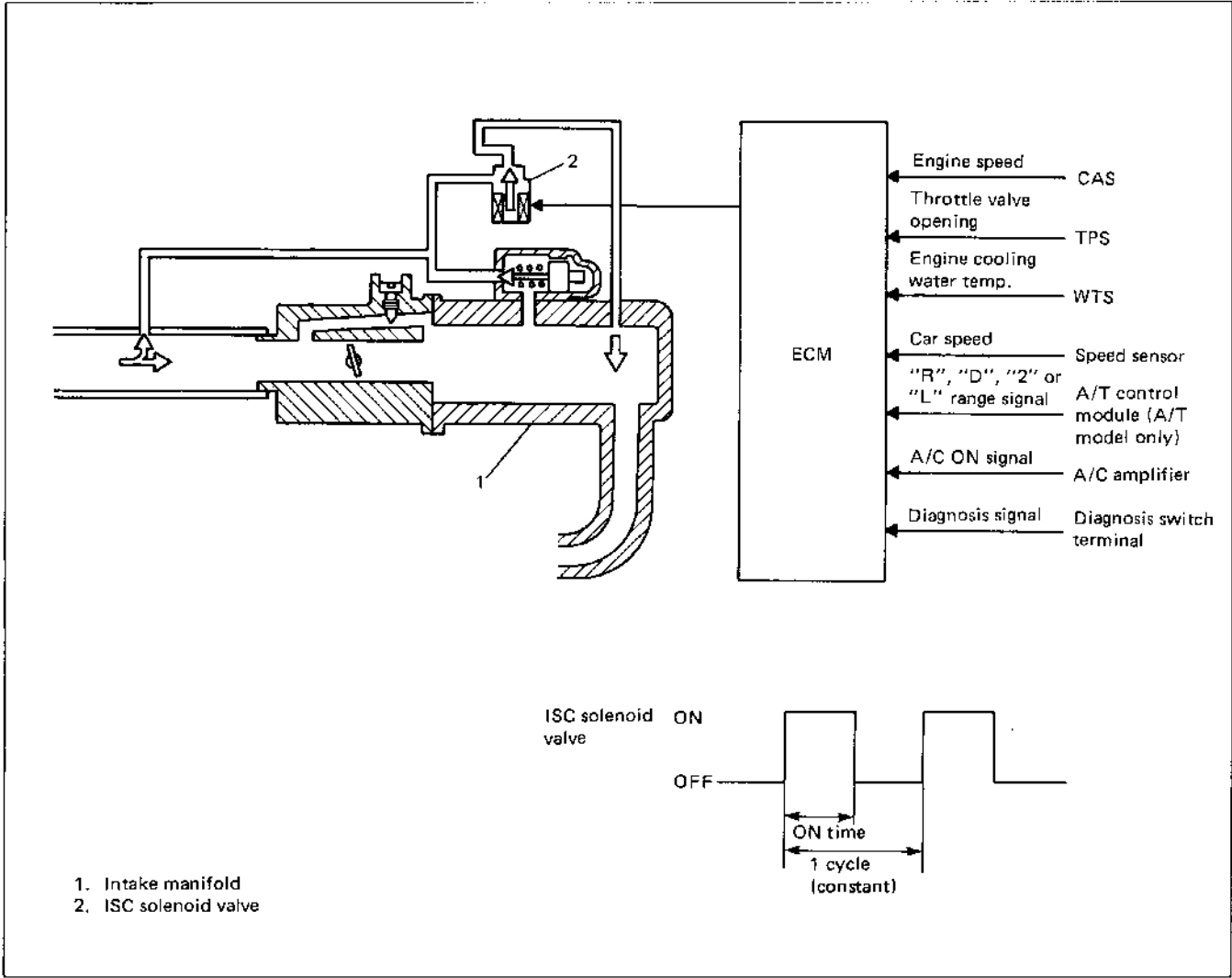


Fig. 6E-35 ISC Solenoid Valve Control System

FUEL PUMP CONTROL SYSTEM

ECM controls ON/OFF operation of the fuel pump by turning it ON via the fuel pump relay under either of the following conditions.

- For 3 seconds after ignition switch ON.
- While CAS signal is inputted to ECM.

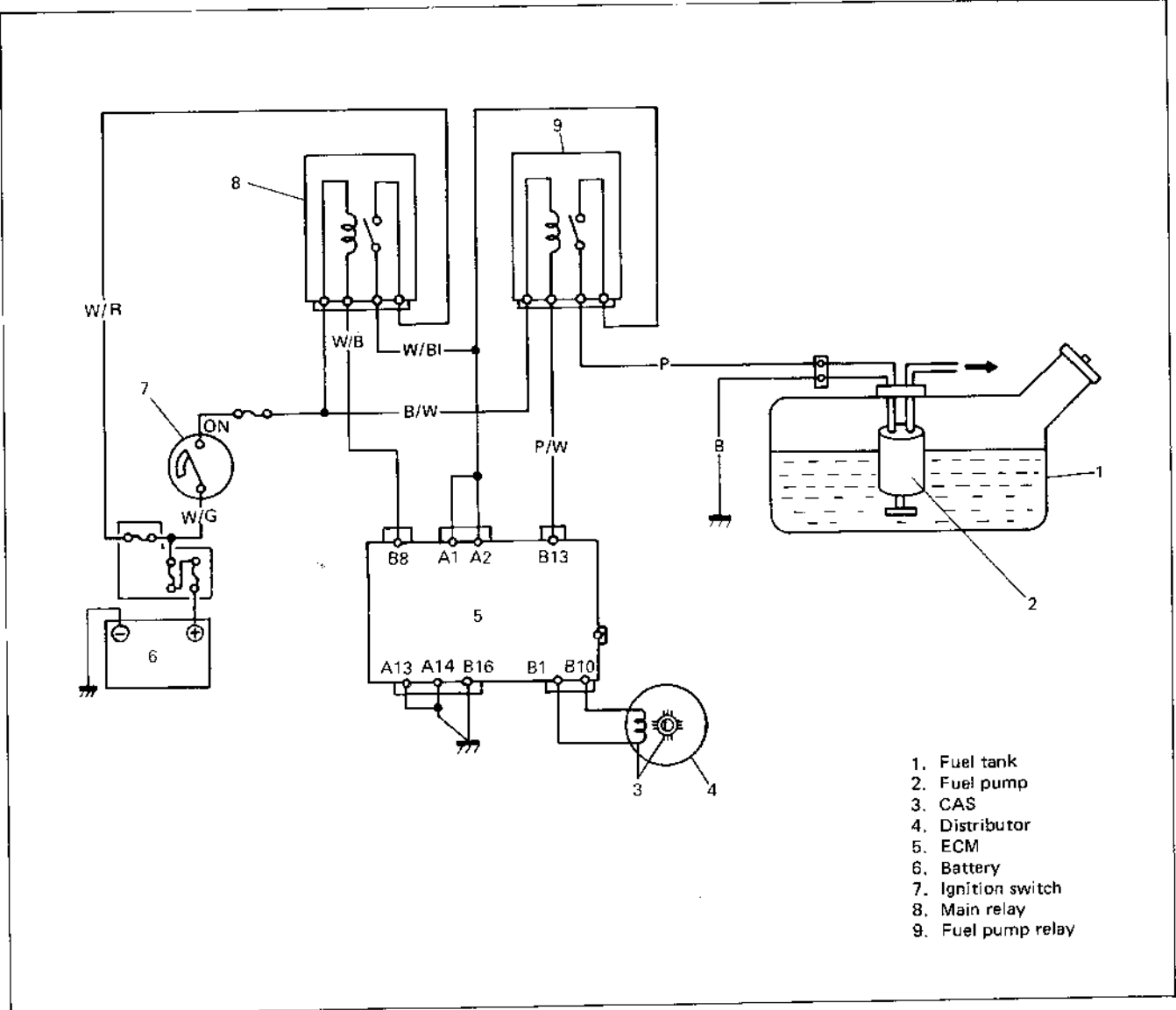


Fig. 6E-36 Fuel Pump Circuit

EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM (For California spec. model only)

This system controls the formation of NO_x emission by recirculating the exhaust gas into the combustion chamber through the intake manifold.

The EGR valve is controlled by EGR modulator and VSV controlled by ECM according to signals from various sensors.

The diaphragm mounted in the EGR modulator is operated by back pressure of the exhaust gas to open and close the valve. By this opening and closing action of the valve, the EGR modulator controls the vacuum transmitted to the EGR valve.

Under a low load condition such as low speed driving, the exhaust pressure is low. In this state, the diaphragm in the EGR modulator is pushed down by the spring force and the modulator valve opens to allow the air into the vacuum passage from the outside.

As a result, the vacuum transmitted to the EGR valve becomes smaller and so does the opening of the EGR valve.

Thus, less amount of exhaust gas is recirculated to the intake manifold.

Under a high load condition such as high speed driving, on the other hand, the exhaust pressure

is high. By the high exhaust pressure, the diaphragm in the modulator is pushed up and closes its valve. As the air does not enter the vacuum passage in this state, the vacuum transmitted to the EGR valve grows larger and so does the opening of the EGR valve.

Thus, larger amount of exhaust gas is recirculated to the intake manifold.

Under any one of the following conditions, ECM closes the vacuum passage of VSV. In this state, as the vacuum is not transmitted to the EGR valve, it remains closed.

- When engine cooling water temp. is lower than 50°C (122°F) or higher than 100°C (212°F)
- When engine speed is lower than 1000 r/min.
- When throttle valve is at idle position
- At engine start and when fuel injection is increased after engine start
- When engine is running under high load

Other than the above, EGR valve opens and closes in accordance with the EGR modulator operation.

The operation of EGR valves is monitored by ECM through the signal from the REGTS (Recirculated Exhaust Gas Temperature Sensor) which measures the temperature in the exhaust passage. Should anything abnormal occur, "CHECK ENGINE" light turns ON to warn it.

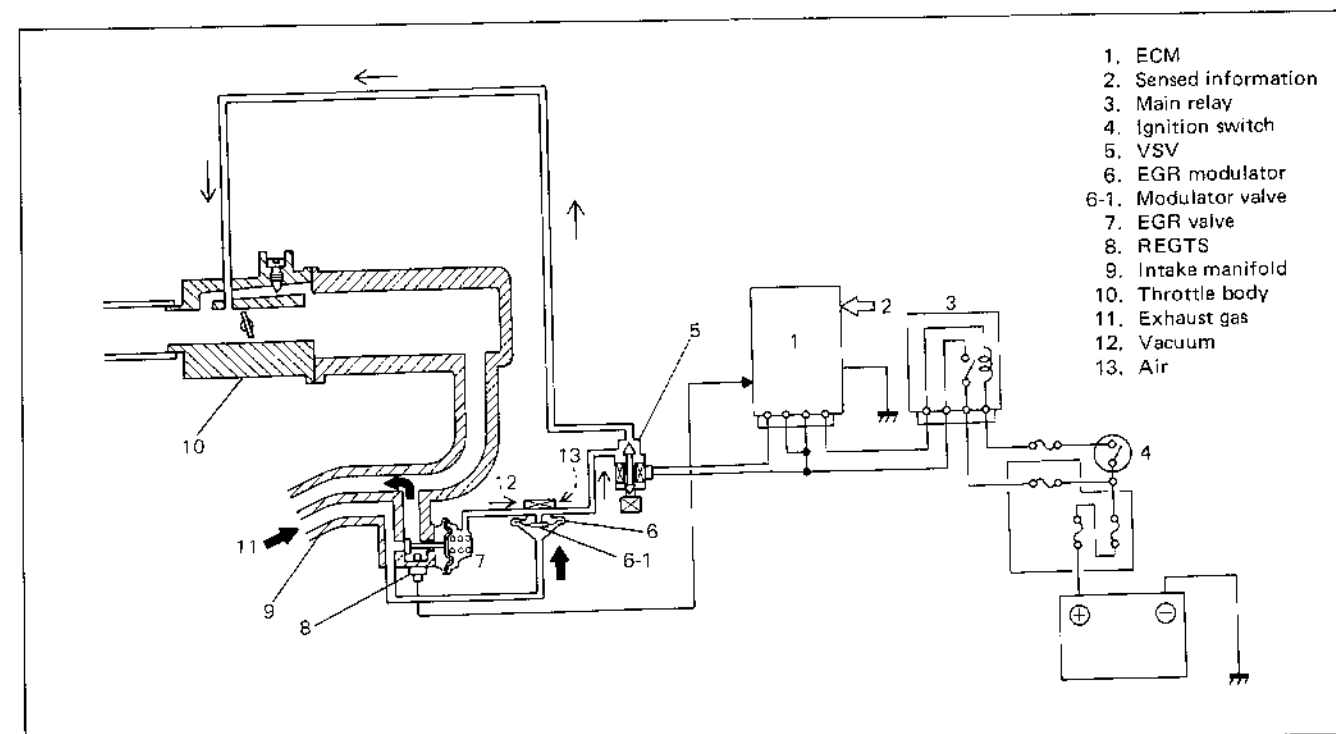


Fig. 6E-37 EGR System (California spec. model only)

EVAPORATIVE EMISSION 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 2-way check valve and enters the charcoal canister where the charcoal absorbs and stores the fuel vapor.

The canister purge VSV is controlled by ECM according to signals from various sensors.

Only when the following conditions are all satisfied, ECM opens vacuum passage of VSV.

- When engine cooling water temp. is higher than 60°C (140°F)
- When engine speed is higher than 1500 r/min.
- When throttle valve opens wider than idle position (Idle switch OFF)
- When engine is running with the load higher than specified.

As a result, 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 2-way check 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 charcoal 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.

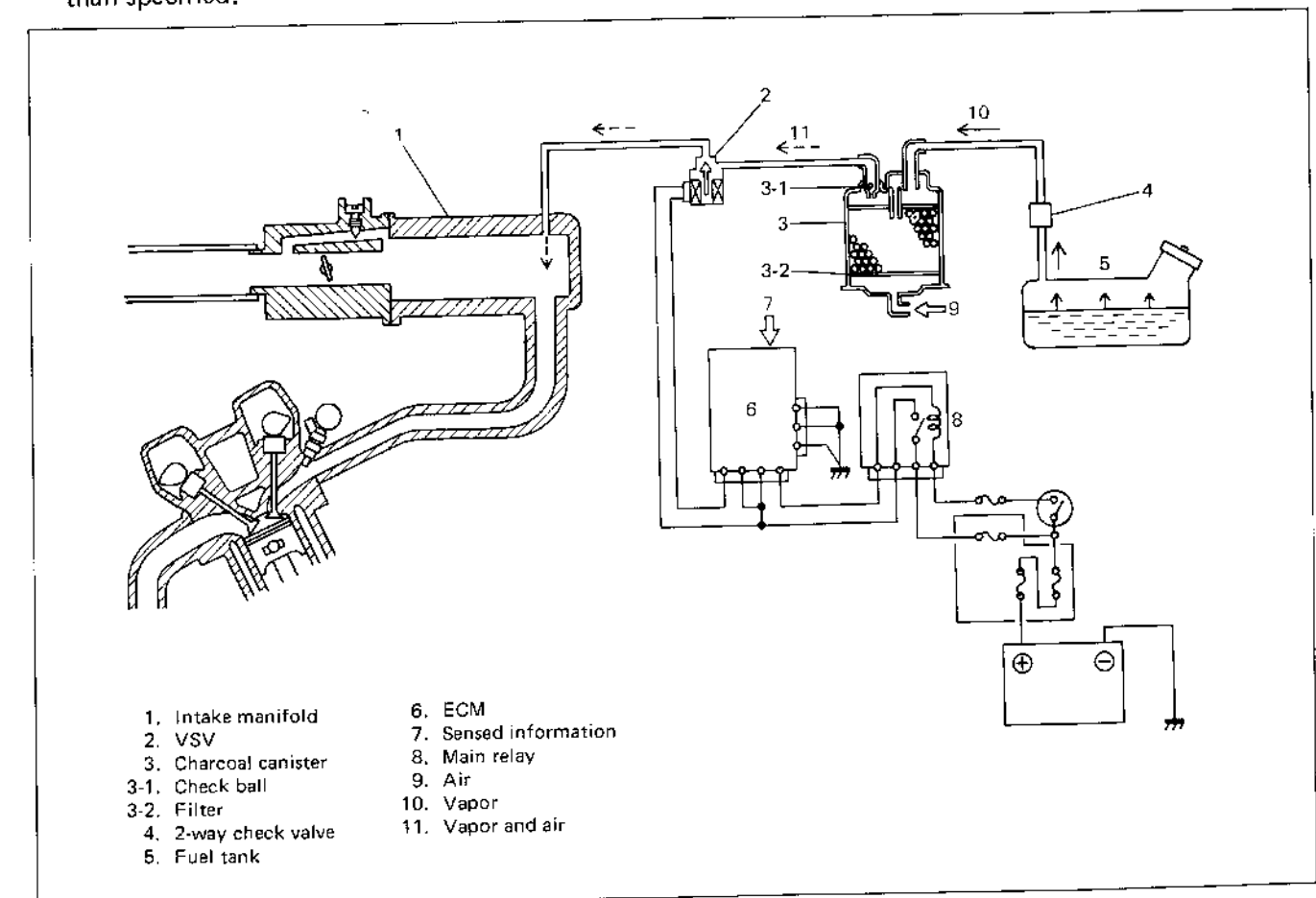


Fig. 6E-38 Evaporative Emission Control System

**THROTTLE VALVE OPENING SIGNAL
OUTPUT FOR A/T**

Receiving the throttle valve opening signal from the throttle position sensor, ECM converts it into the three ON/OFF signals and sends them to A/T control module through A20, A11, and B4 terminals. Then A/T control module uses them as the signals to control the automatic transmission.

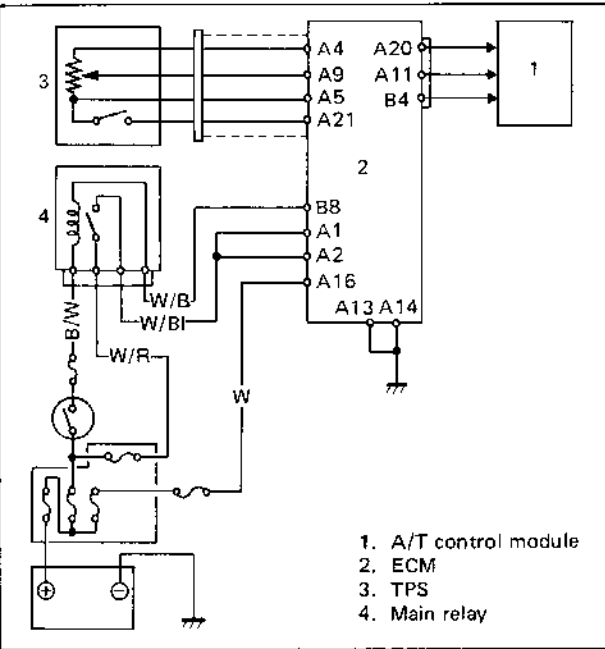


Fig. 6E-39 Signal Output Circuit

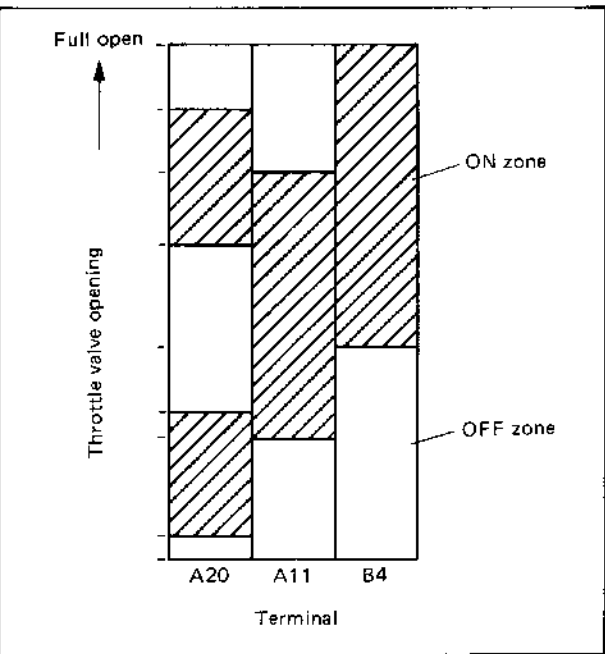


Fig. 6E-40 ON/OFF Signal Diagram

**ESA (ELECTRONIC SPARK ADVANCE)
SYSTEM**

This system controls electronically the time of electric current flow to ignition primary coil 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 a signal to the power unit.

The power unit turns ON and OFF the primary current of the ignition coil according to the signal from ECM.

Control of this system includes four different types as follows.

- Ignition timing control at engine start
- Ignition timing control at engine idling
- Ignition timing control at any time other than engine start and idling
- Electric current flow time control

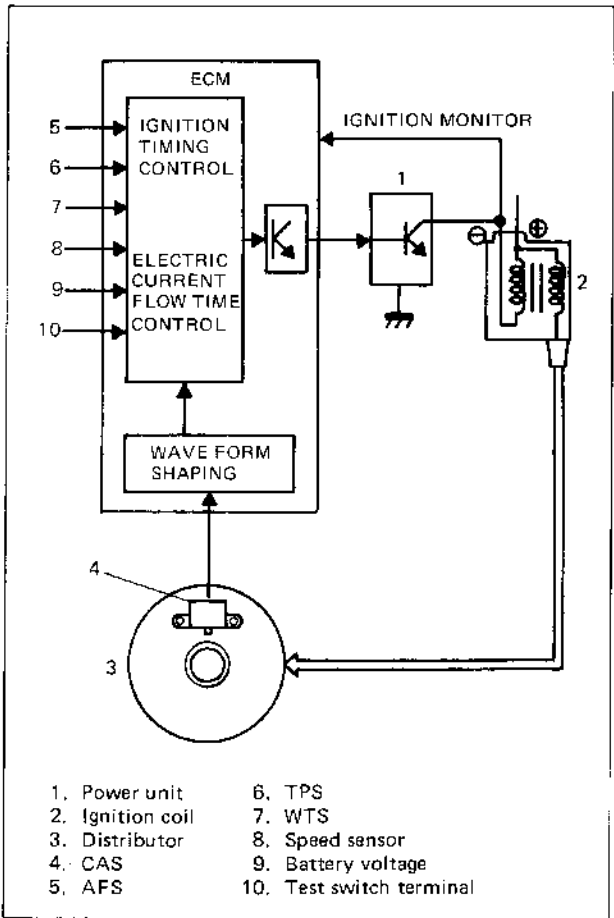


Fig. 6E-40-1 System Diagram

Ignition Timing Control at Engine Start

To obtain better starting performance of the engine at the engine start (when the engine start switch is turned ON or the engine speed is lower than 400 r/min.) ESA system sets the ignition timing to the initial ignition timing (6° BTDC).

Ignition Timing Control at Engine Idling

When the idle switch is ON and the car speed is lower than 20 km/h (12 mile/h), the final ignition timing is determined by adding a compensation which varies with the engine speed to the ignition timing determined according to the engine cooling water temperature.

Ignition Timing Control at Any Time Other Than Engine Start and Idling

Under any conditions other than the above (with the idle switch OFF and the engine running), the ignition timing is determined according to the intake air volume and the engine speed.

Electric Current Flow Time Control

To stabilize the secondary voltage generated in the ignition coil to a proper level, ESA system controls the time of primary current flow to the ignition coil.

NOTE:

The ignition timing is controlled by ECM as described above. Therefore, when checking or adjusting the ignition timing, the ignition timing must be fixed to the initial one by grounding the test switch terminal.

DIAGNOSIS

ECM has a system self-diagnosis function as described previously (p. 6E-16).

Investigate where the trouble is by referring to "Diagnostic Flow Chart" and "Diagnostic Code" in this section.

PRECAUTIONS IN DIAGNOSING TROUBLES IN EFI SYSTEM

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC CODE]

- Before identifying diagnostic code indicated by "CHECK ENGINE" light, don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse.
Such disconnection will erase trouble stored in ECM memory.
- If abnormality or malfunction lies in two or more areas, "CHECK ENGINE" light indicates applicable codes three times each.
And flashing of these codes is repeated as long as diagnosis switch terminal is grounded (spare fuse is connected) and ignition switch is held at ON position.
- Take a note of diagnostic code indicated first.

[INTERMITTENT TROUBLES]

- When the following conditions apply, it means that an intermittent trouble occurred in EFI system once although it is in good condition now.
 - * "CHECK ENGINE" light remains OFF while the engine is running with the diagnosis switch terminal ungrounded, but
 - * A defect indicating diagnostic code No. is indicated when inspecting (that is, when the diagnosis switch terminal is grounded with the ignition switch ON)

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.

[NOTES ON SYSTEM CIRCUIT INSPECTION]

- Never connect any tester (voltmeter, ohmmeter, or whatever) to ECM when its coupler is disconnected. Attempt to do it may cause damage to ECM.
- Never connect an ohmmeter to ECM with its coupler connected to it. Attempt to do it may cause damage to ECM and sensors.
- Be sure to use a voltmeter with high impedance ($M\Omega/V$ minimum) or a digital type voltmeter. Any other voltmeter should not be used because accurate measurements are not obtained.

- When disconnecting and connecting coupler, make sure to turn ignition switch OFF.
- 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.
- When connecting a probe of ohmmeter, voltmeter, etc. to coupler terminal, be sure to connect it from wire harness side of coupler.

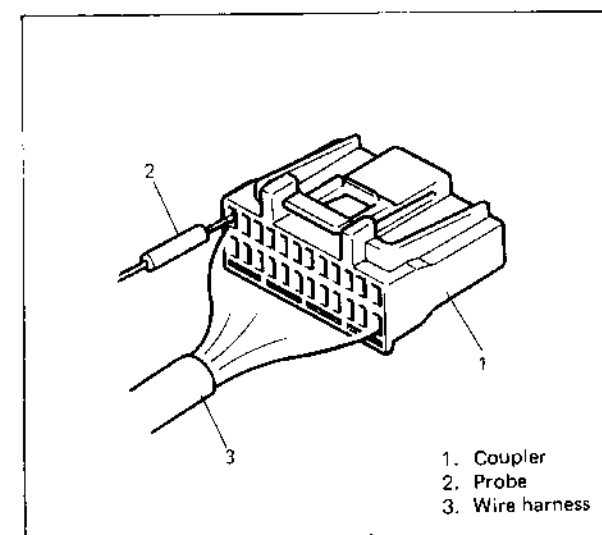


Fig. 6E-41 Connecting Meter Probe

- 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 in Fig. 6E-42, connect probe as shown to avoid opening female terminal.
Never connect probe where male terminal is supposed to fit.

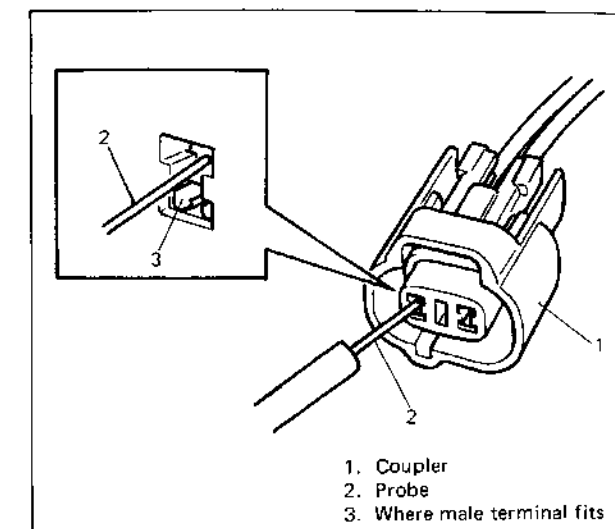


Fig. 6E-42 Connecting Meter Probe

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

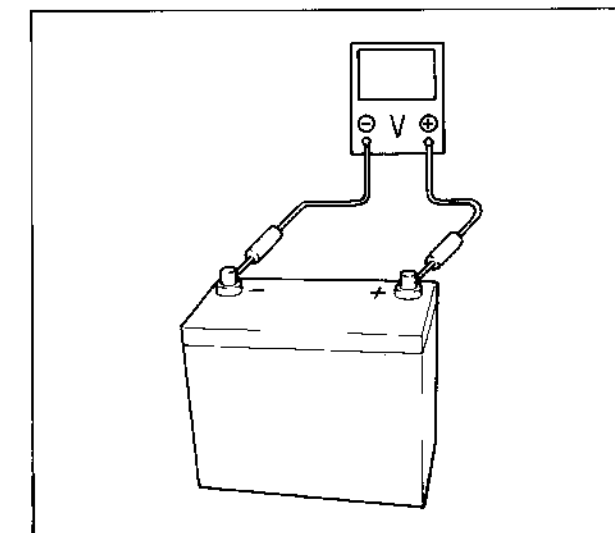


Fig. 6E-43 Checking Battery Voltage

- 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 probes of voltmeter improperly may cause the sensor or ECM to be shorted and damaged.

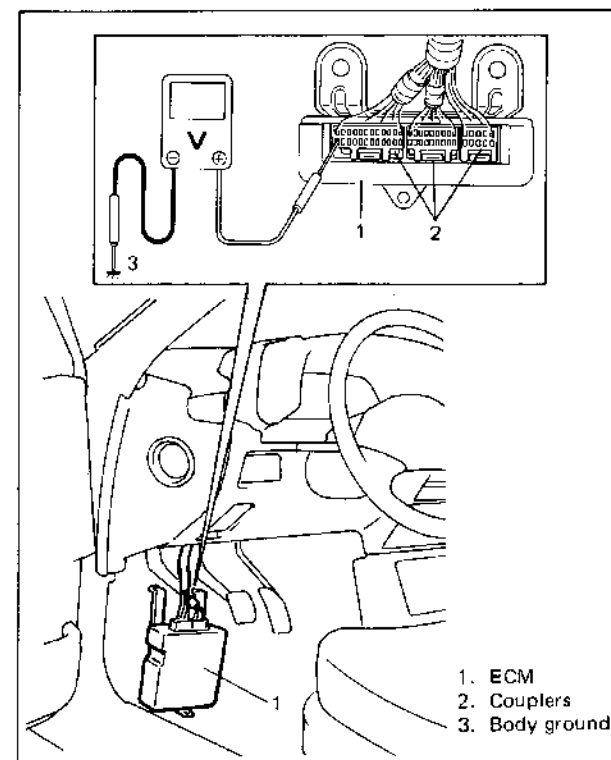


Fig. 6E-44 Checking Voltage

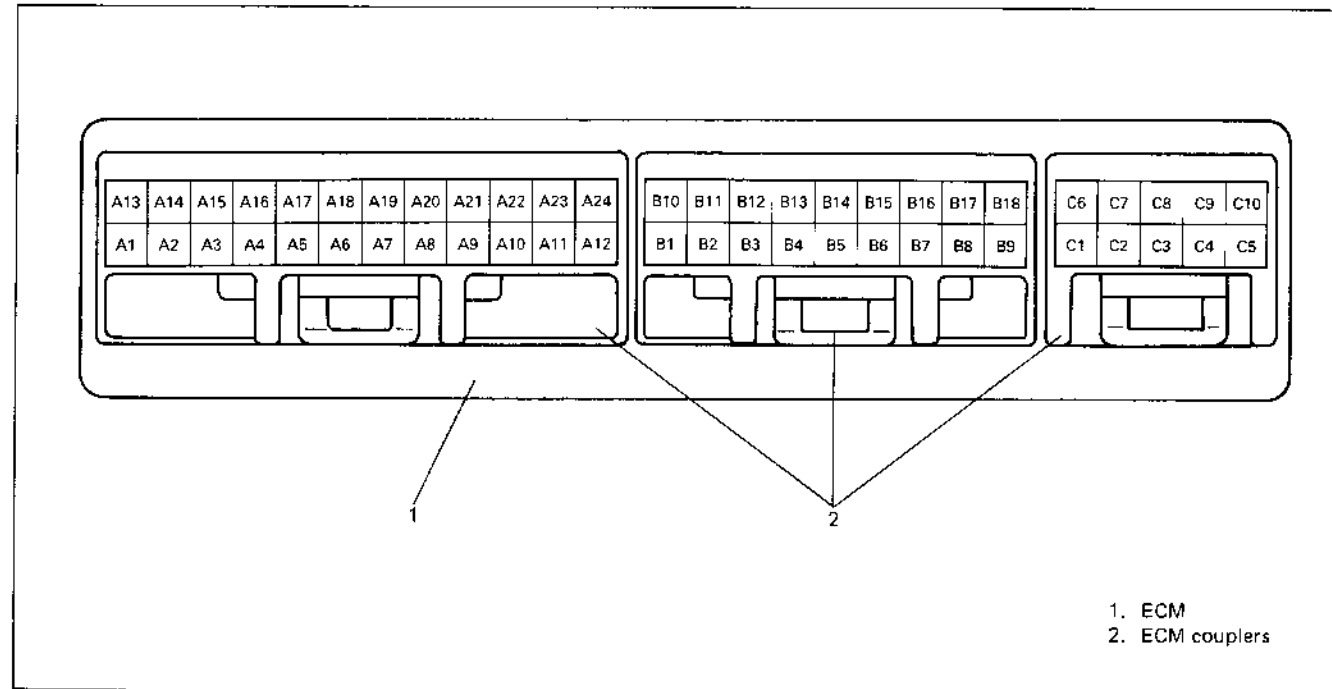


Fig. 6E-45 ECM Coupler Terminal Position (Viewed from wire harness side)

DIAGNOSTIC FLOW CHART

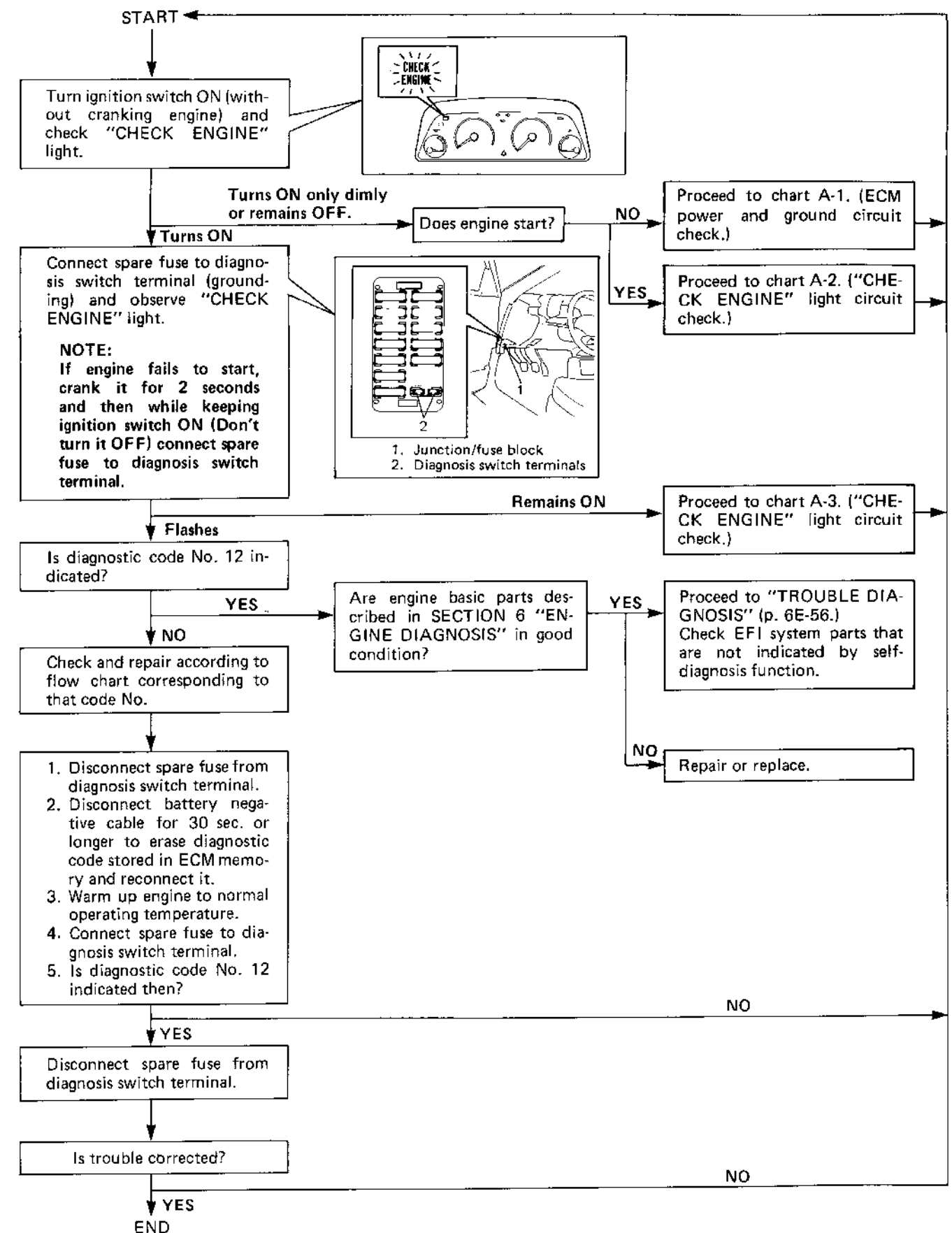
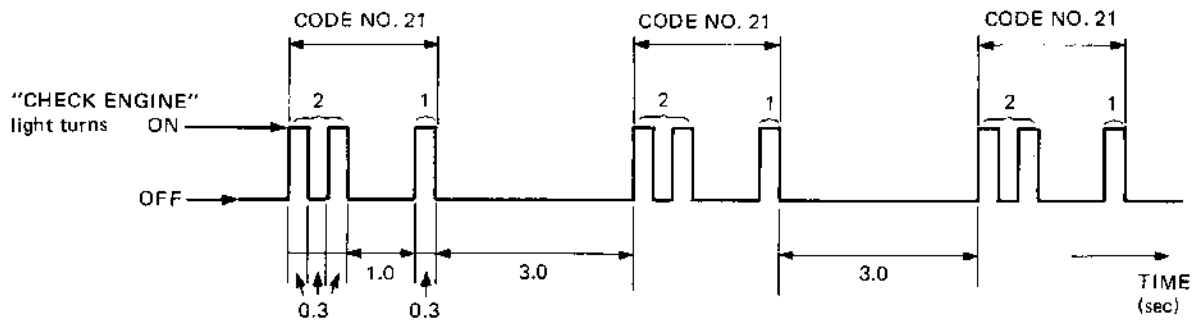


Fig. 6E-47 Diagnostic Flow Chart for EFI System

DIAGNOSTIC CODE TABLE

EXAMPLE: THROTTLE POSITION SENSOR FAILURE (CODE NO. 21)



DIAGNOSTIC CODE		DIAGNOSTIC AREA	DIAGNOSIS
NO.	MODE		
12		Normal	This code appears when none of the other codes (below codes) is identified.
13		Oxygen sensor	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No.
14		Water temperature sensor	
15		sensor	
21		Throttle position sensor	
22			
24		Speed sensor	
33		Air flow sensor	
34			
41		Ignition signal	
42		Crank angle sensor	
51		EGR system (California spec. model only)	
52		Fuel leakage from fuel injector (California spec. model only)	
ON		ECM	ECM failure

Fig. 6E-46 Diagnostic Code Table

A-1 ECM POWER AND GROUND CIRCUIT CHECK

("CHECK ENGINE" LIGHT DOESN'T LIGHT OR LIGHTS ONLY DIMLY AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.)

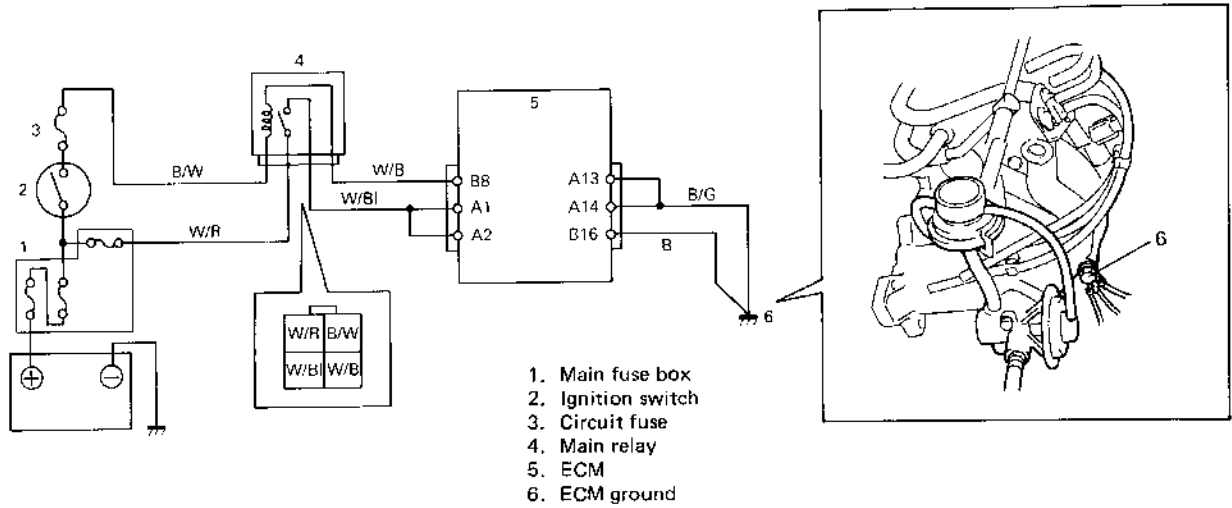
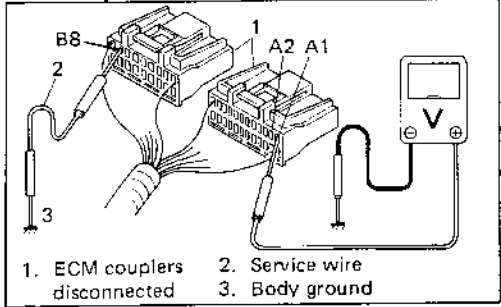
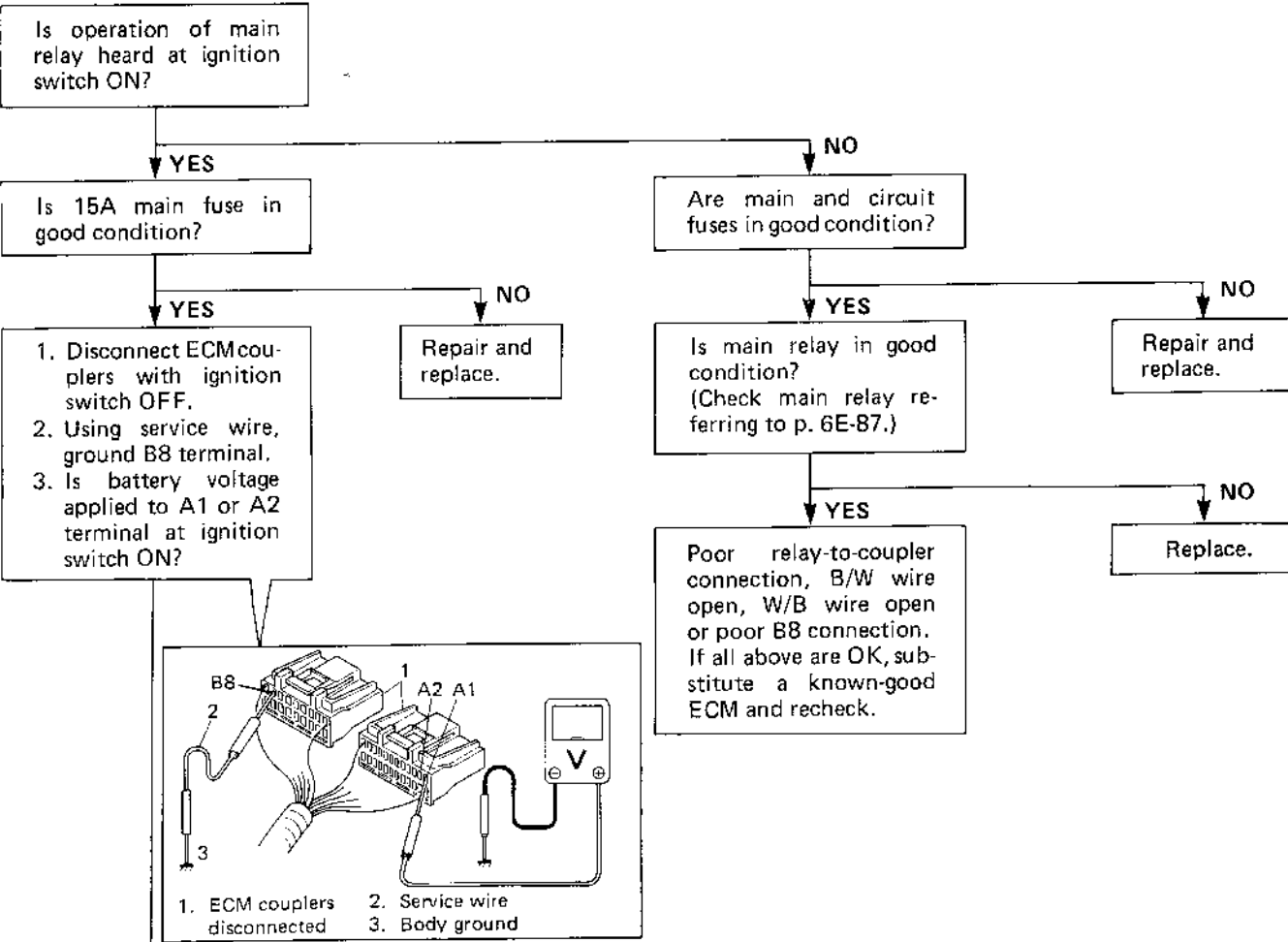


Fig. 6E-48 ECM Power and Ground Circuit



To be continued

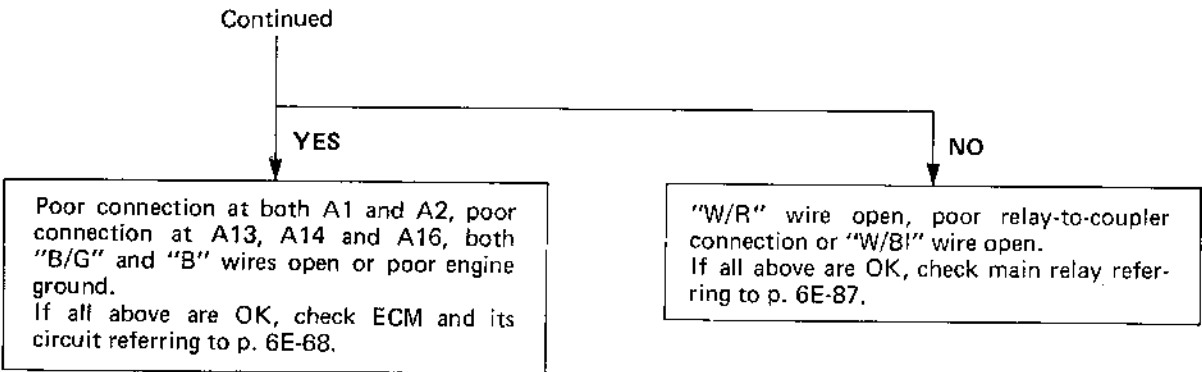


Fig. 6E-49 Diagnostic Flow Chart A-1 For ECM Power and Ground Circuit

A-2 "CHECK ENGINE" LIGHT CIRCUIT CHECK
("CHECK ENGINE" LIGHT DOES NOT LIGHT BUT ENGINE STARTS.)

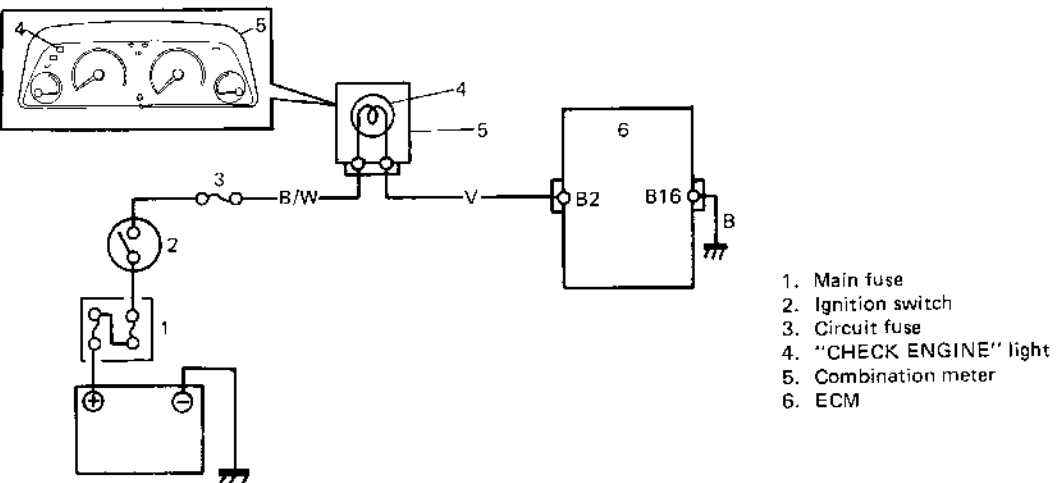


Fig. 6E-50 "CHECK ENGINE" Light Circuit

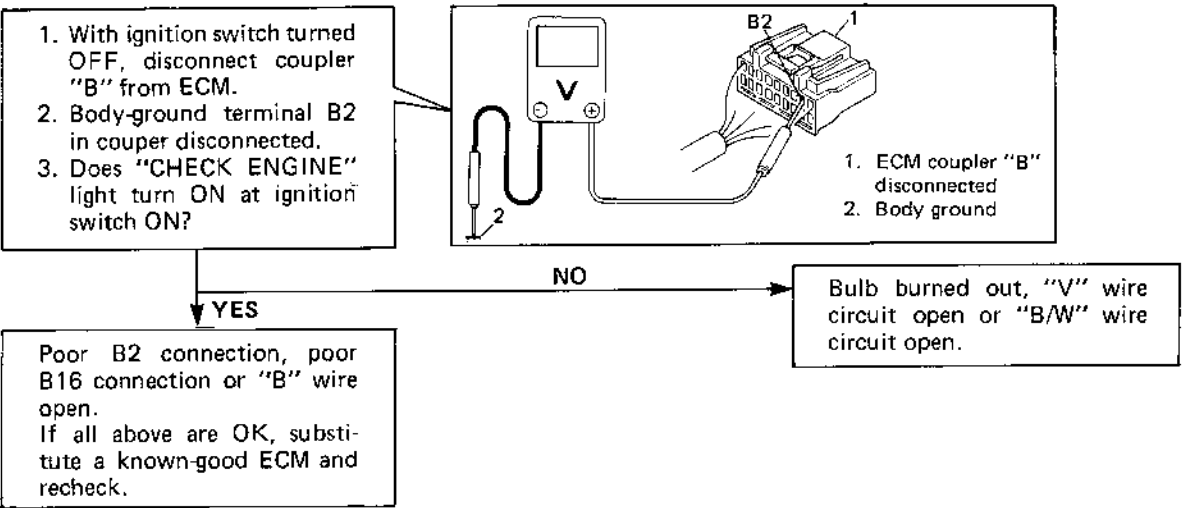


Fig. 6E-51 Diagnostic Flow Chart A-2 For "CHECK ENGINE" Light Circuit

A-3 "CHECK ENGINE" LIGHT CIRCUIT CHECK

("CHECK ENGINE" LIGHT DOESN'T FLASH OR JUST REMAINS ON EVEN WITH SPARE FUSE CONNECTED TO DIAGNOSIS SWITCH TERMINAL.)

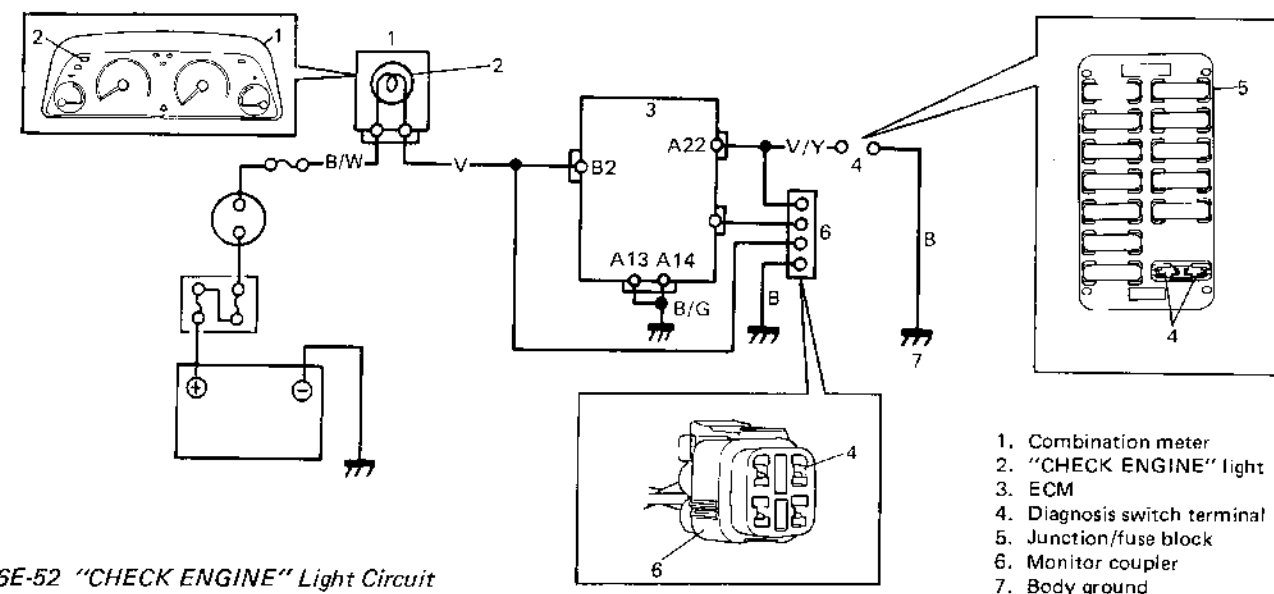


Fig. 6E-52 "CHECK ENGINE" Light Circuit

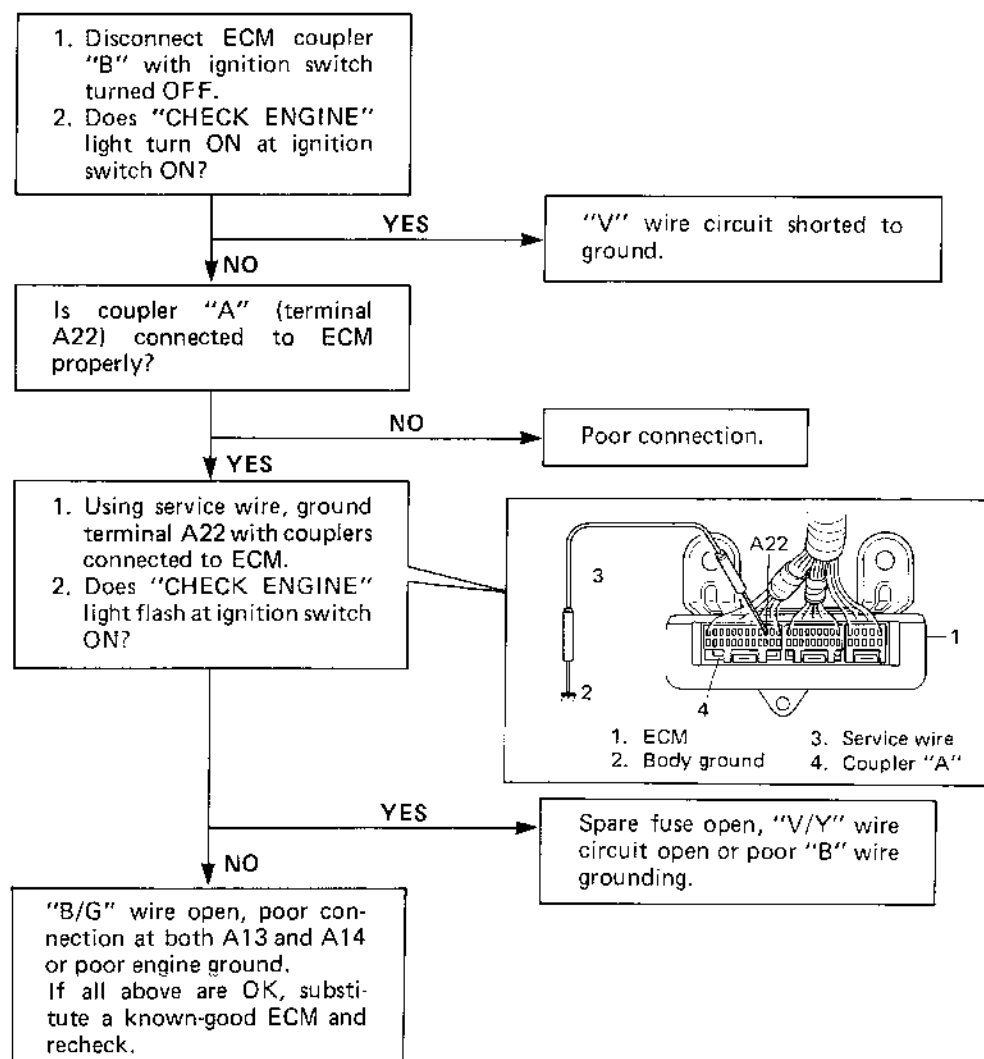


Fig. 6E-53 Diagnostic Flow Chart A-3 For "CHECK ENGINE" Light Circuit

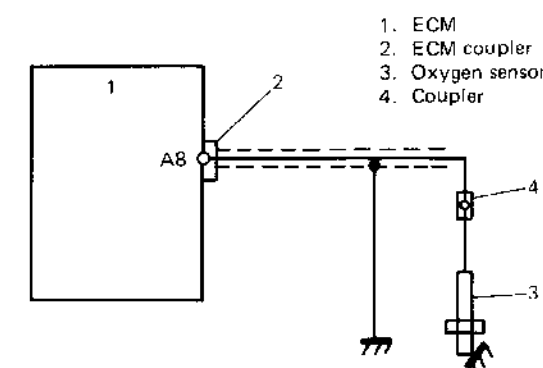
CODE NO. 13 OXYGEN SENSOR CIRCUIT (SIGNAL VOLTAGE DOESN'T CHANGE)

Fig. 6E-54 Oxygen Sensor Circuit

NOTE:

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

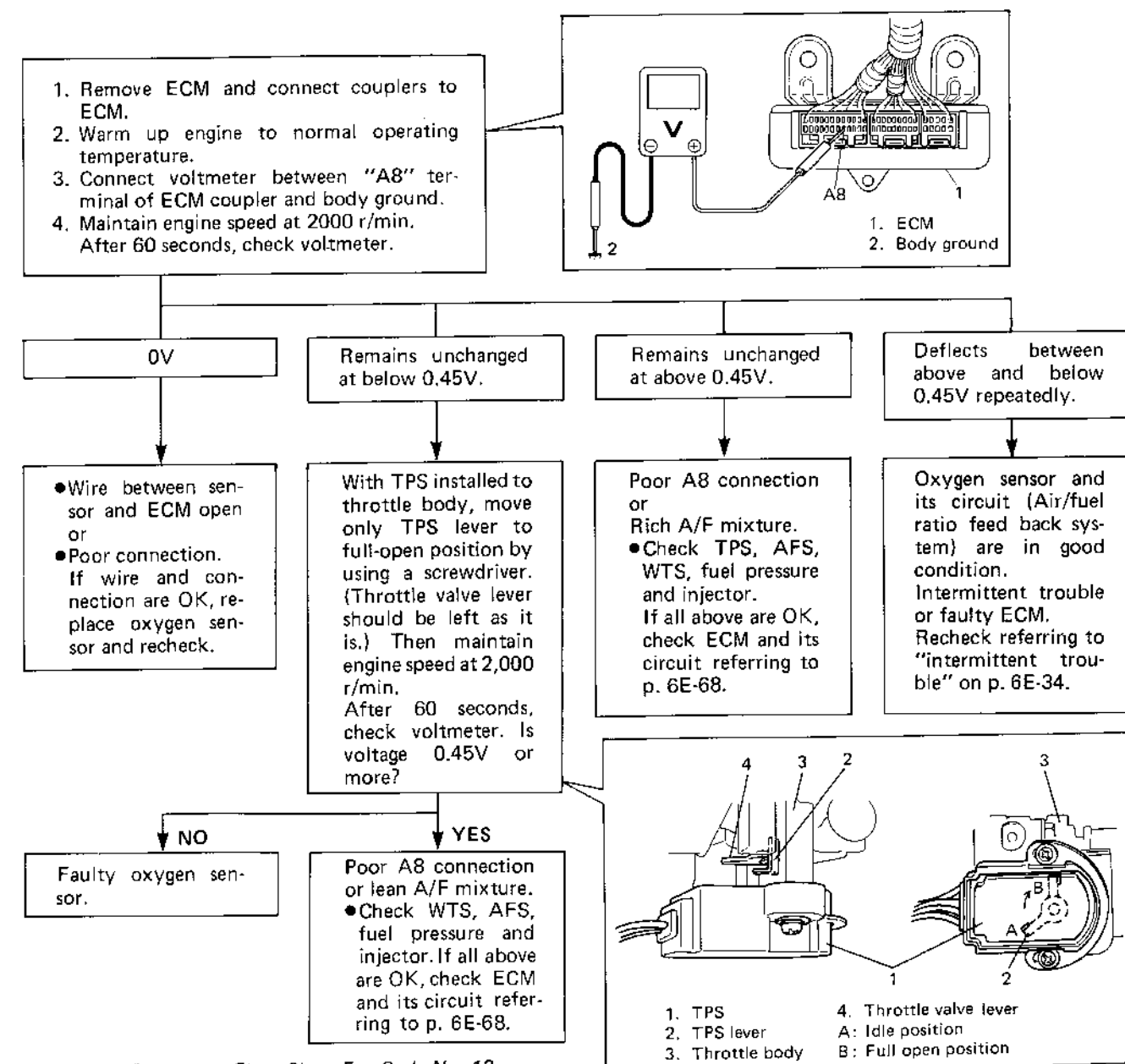


Fig. 6E-55 Diagnostic Flow Chart For Code No. 13

CODE NO. 14 WTS (WATER TEMPERATURE SENSOR) CIRCUIT (LOW TEMPERATURE INDICATED, SIGNAL VOLTAGE HIGH)

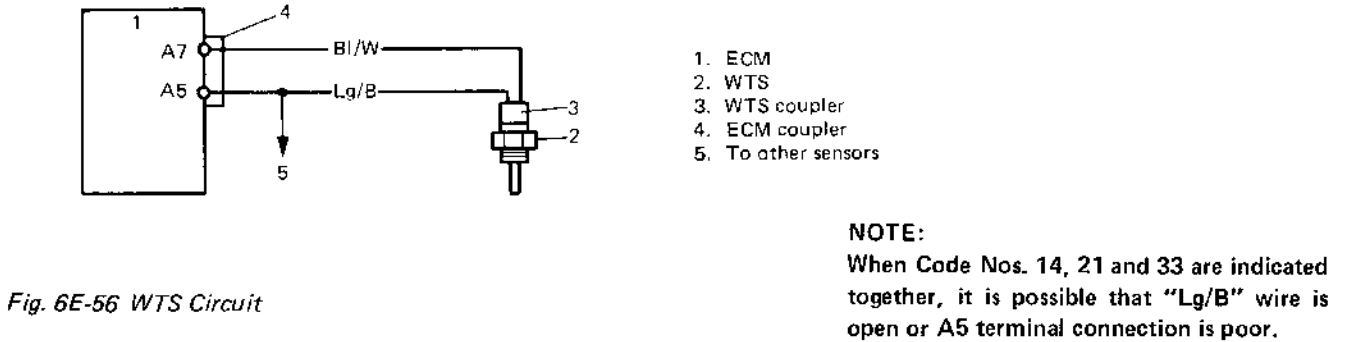


Fig. 6E-56 WTS Circuit

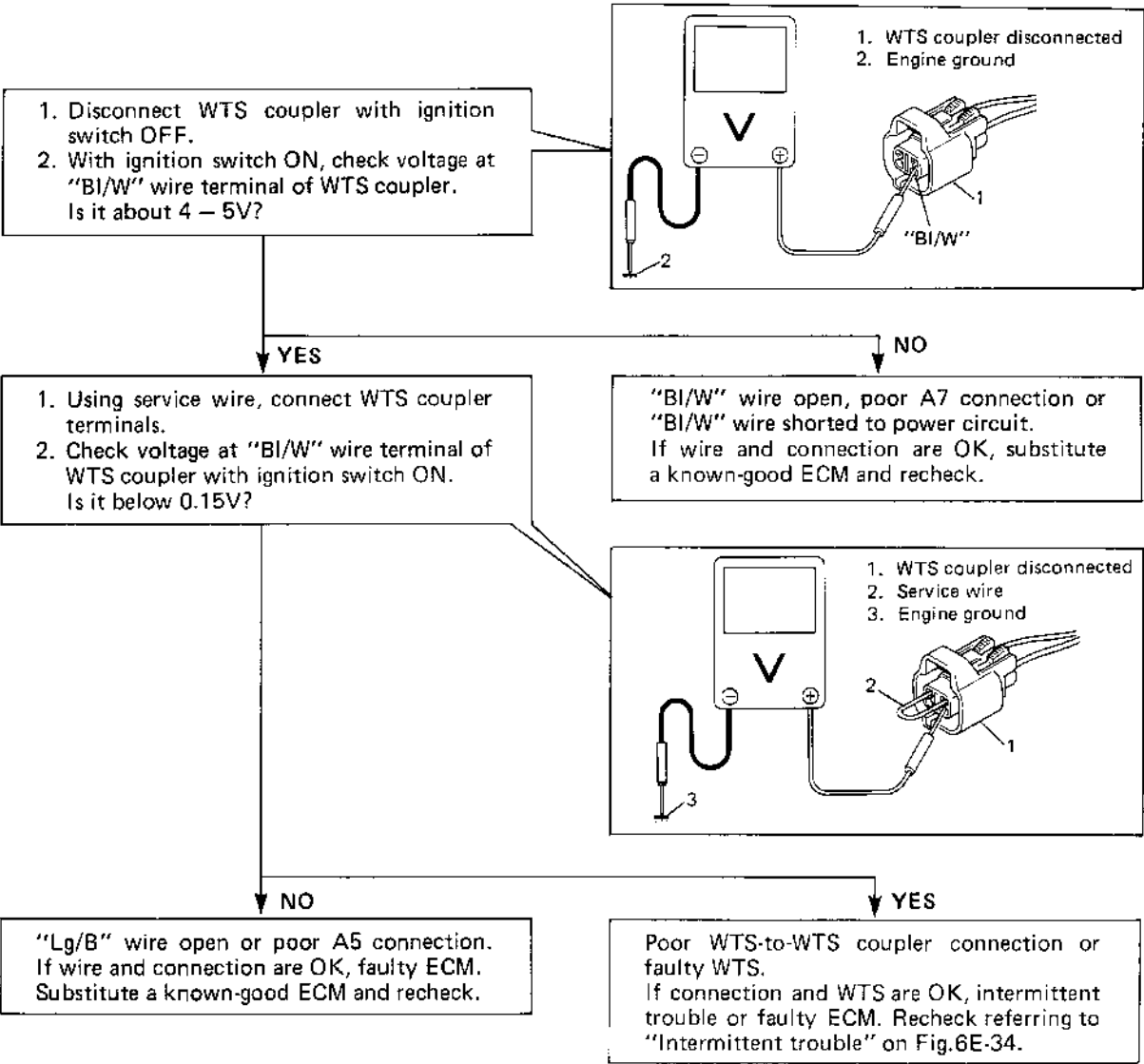


Fig. 6E-57 Diagnostic Flow Chart For Code No. 14

CODE NO. 15 WTS (WATER TEMPERATURE SENSOR) CIRCUIT (HIGH TEMPERATURE INDICATED, SIGNAL VOLTAGE LOW)

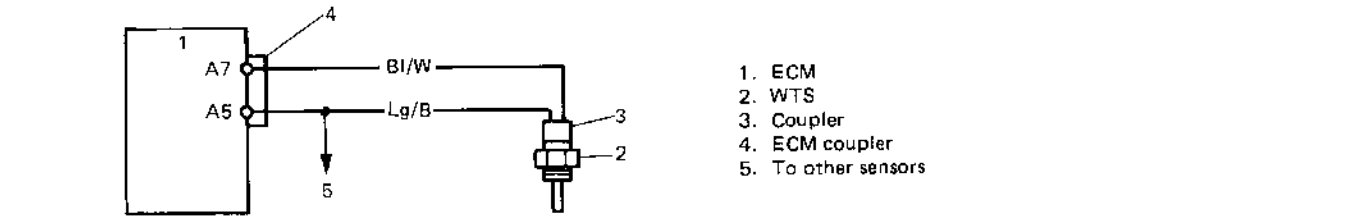


Fig. 6E-58 WTS Circuit

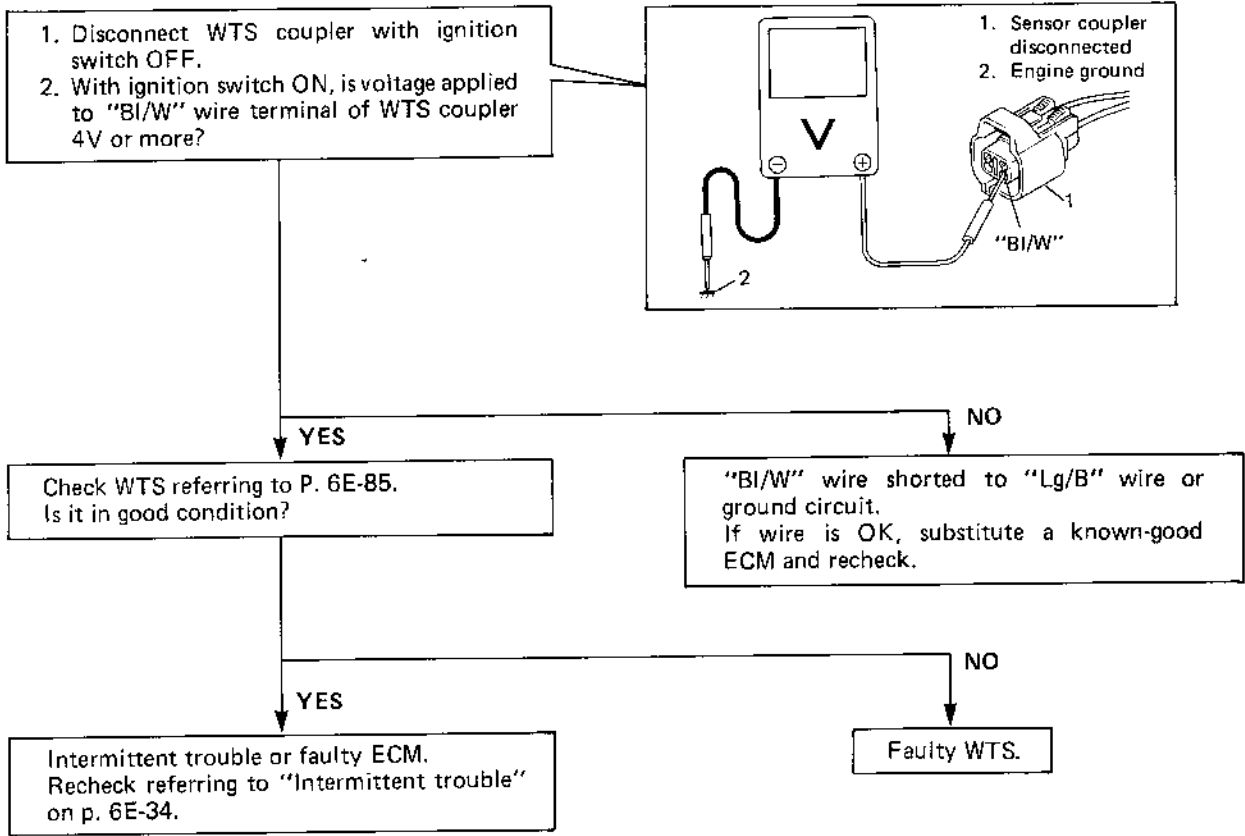


Fig. 6E-59 Diagnostic Flow Chart For Code No. 15

CODE NO. 21 TPS (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE HIGH)

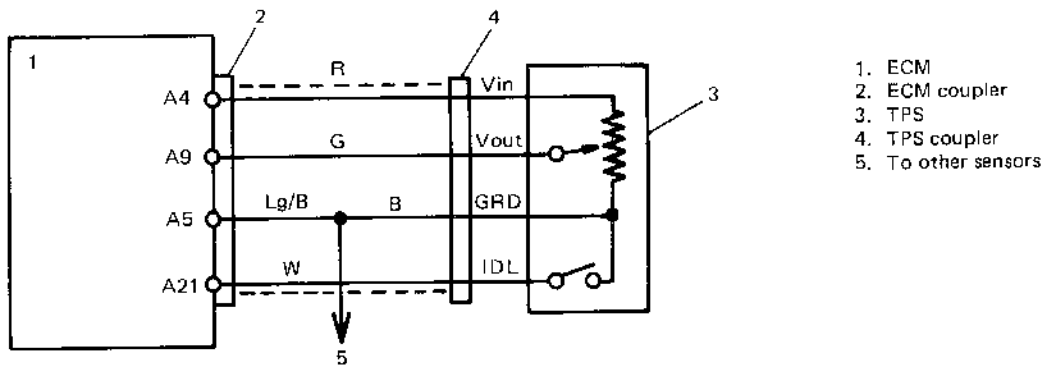


Fig. 6E-60 TPS Circuit

NOTE:
Be sure to turn OFF ignition switch for this check.

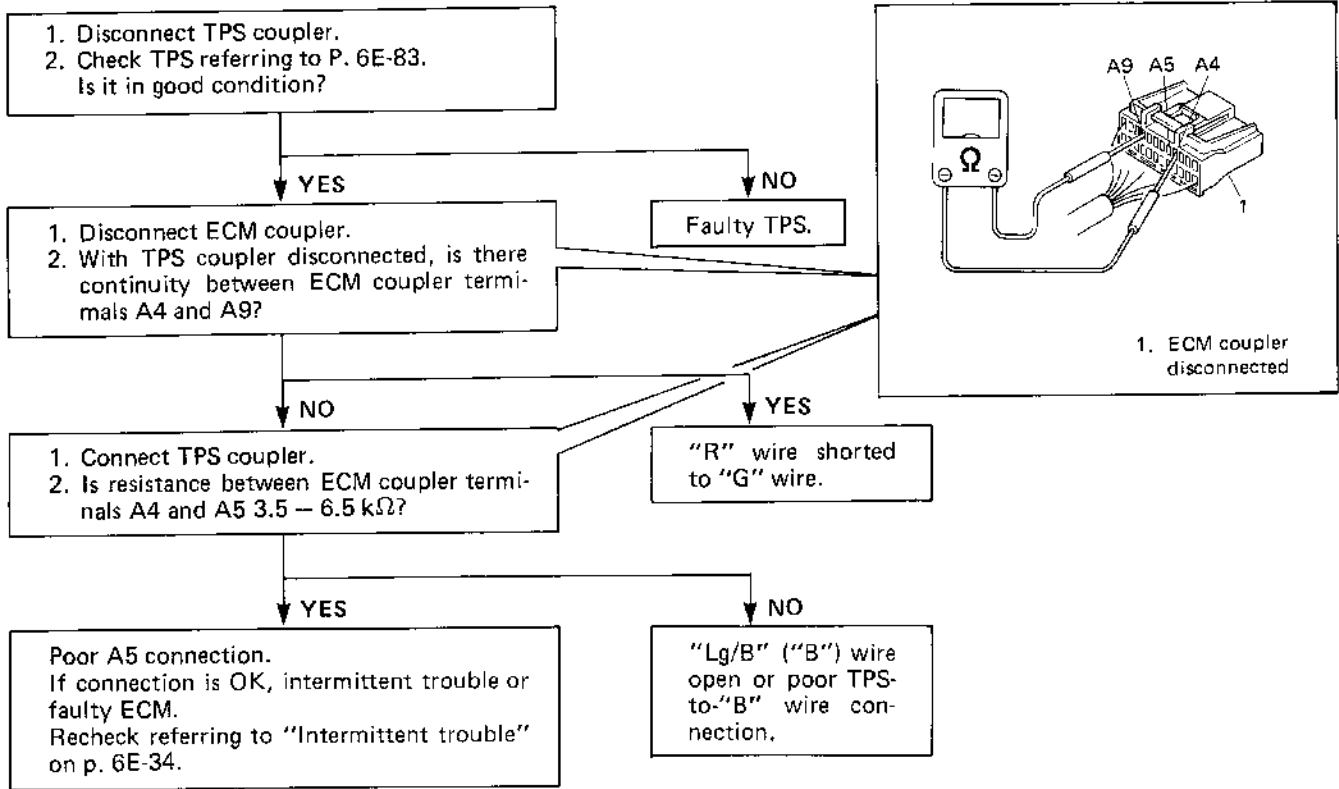


Fig. 6E-61 Diagnostic Flow Chart For Code No. 21

CODE NO. 22 TPS (THROTTLE POSITION SENSOR) CIRCUIT (SIGNAL VOLTAGE LOW)

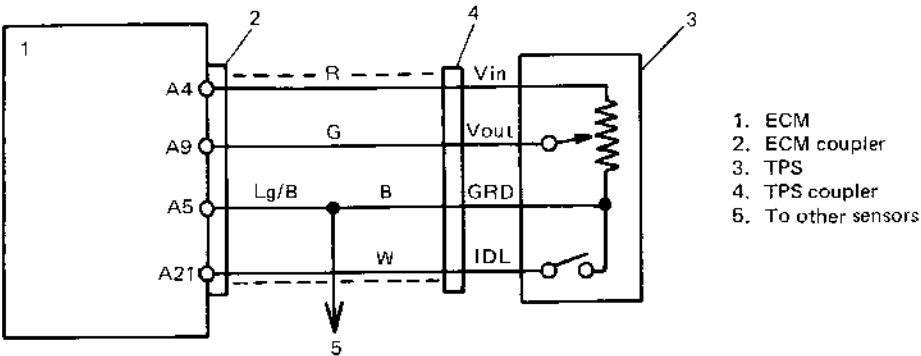


Fig. 6E-62 TPS Circuit

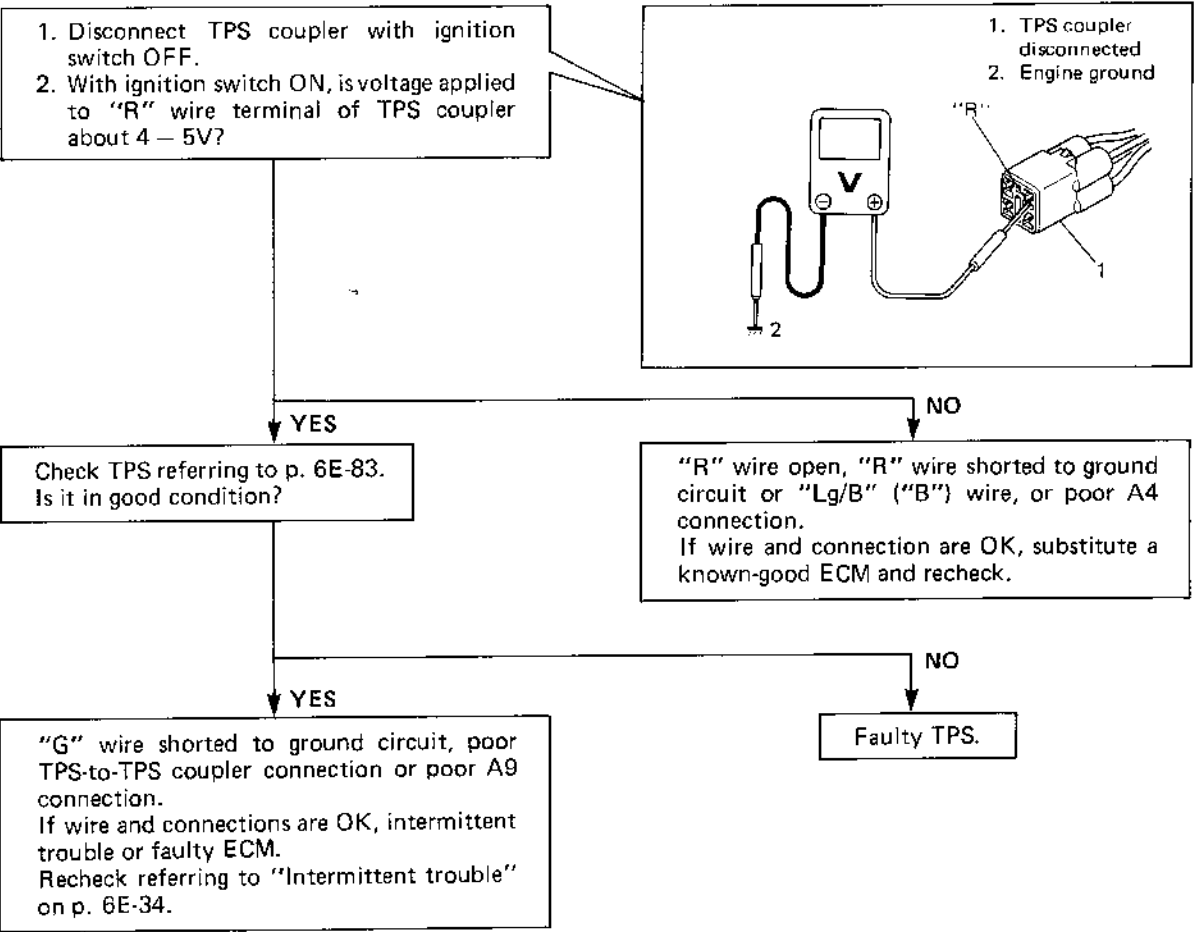


Fig. 6E-63 Diagnostic Flow Chart For Code No. 22

CODE NO. 24 SPEED SENSOR CIRCUIT (CAR SPEED LOWER THAN 1 km/h (0,6 mile/h) ALTHOUGH FUEL IS KEPT CUT AT LOWER THAN 4000 r/min FOR LONGER THAN 4 SECONDS)

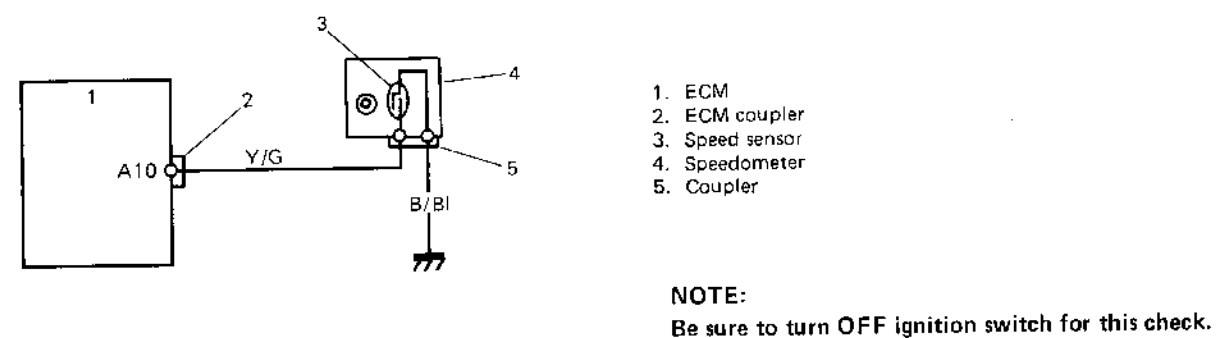


Fig. 6E-64 Speed Sensor Circuit

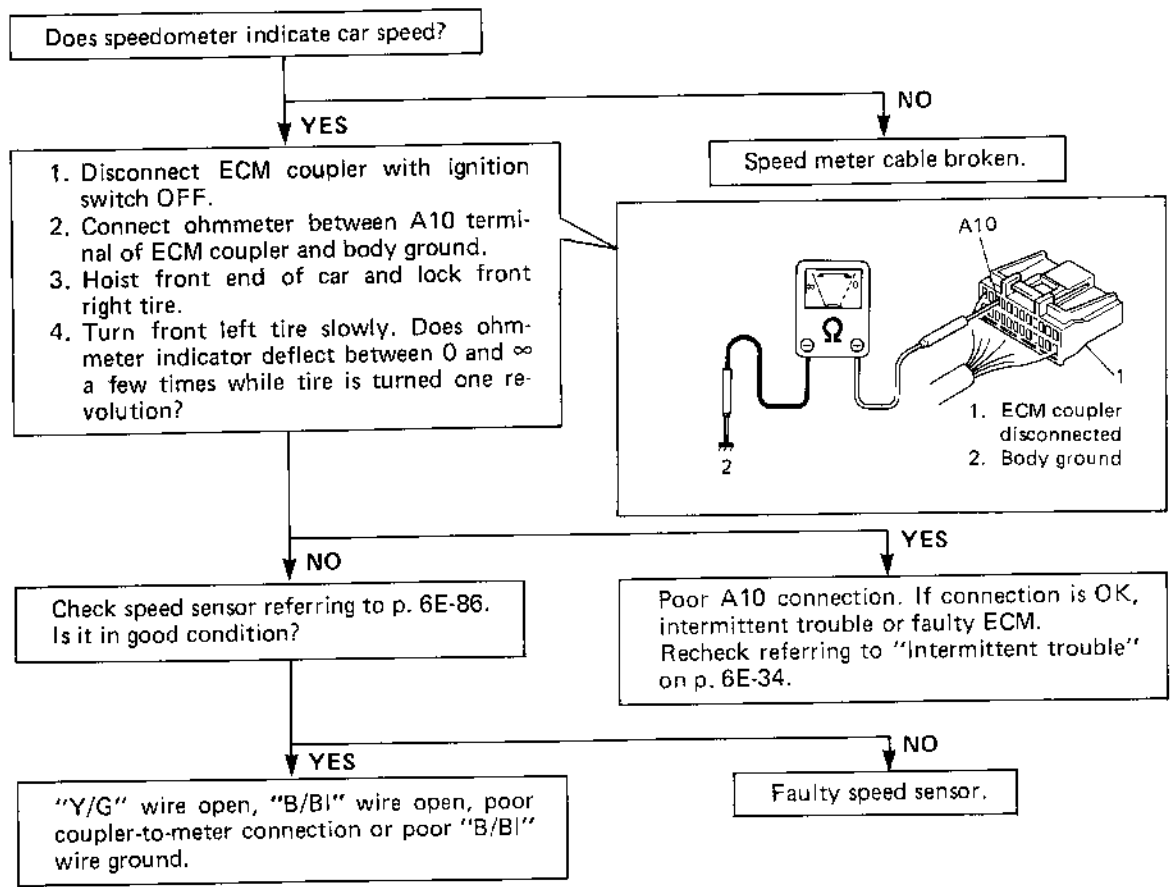


Fig. 6E-65 Diagnostic Flow Chart For Code No. 24

CODE NO. 33 AFS (AIR FLOW SENSOR) CIRCUIT (SIGNAL VOLTAGE HIGH AT 2000 r/min OR LESS)

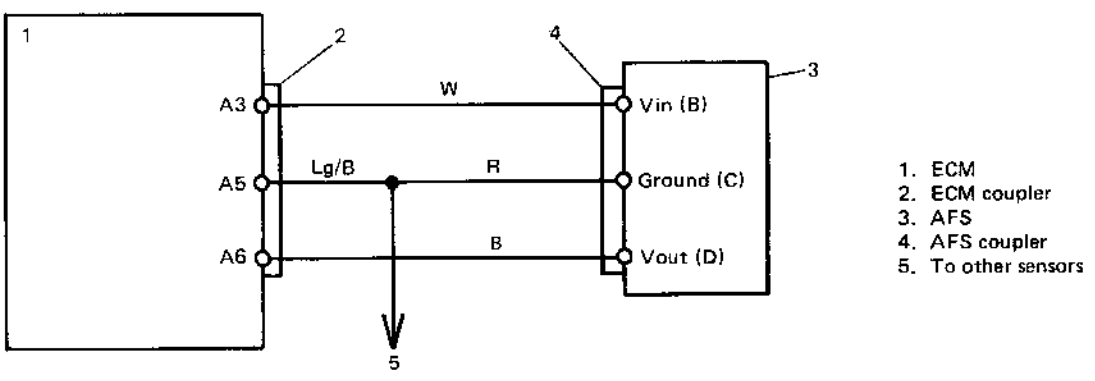


Fig. 6E-66 AFS Circuit

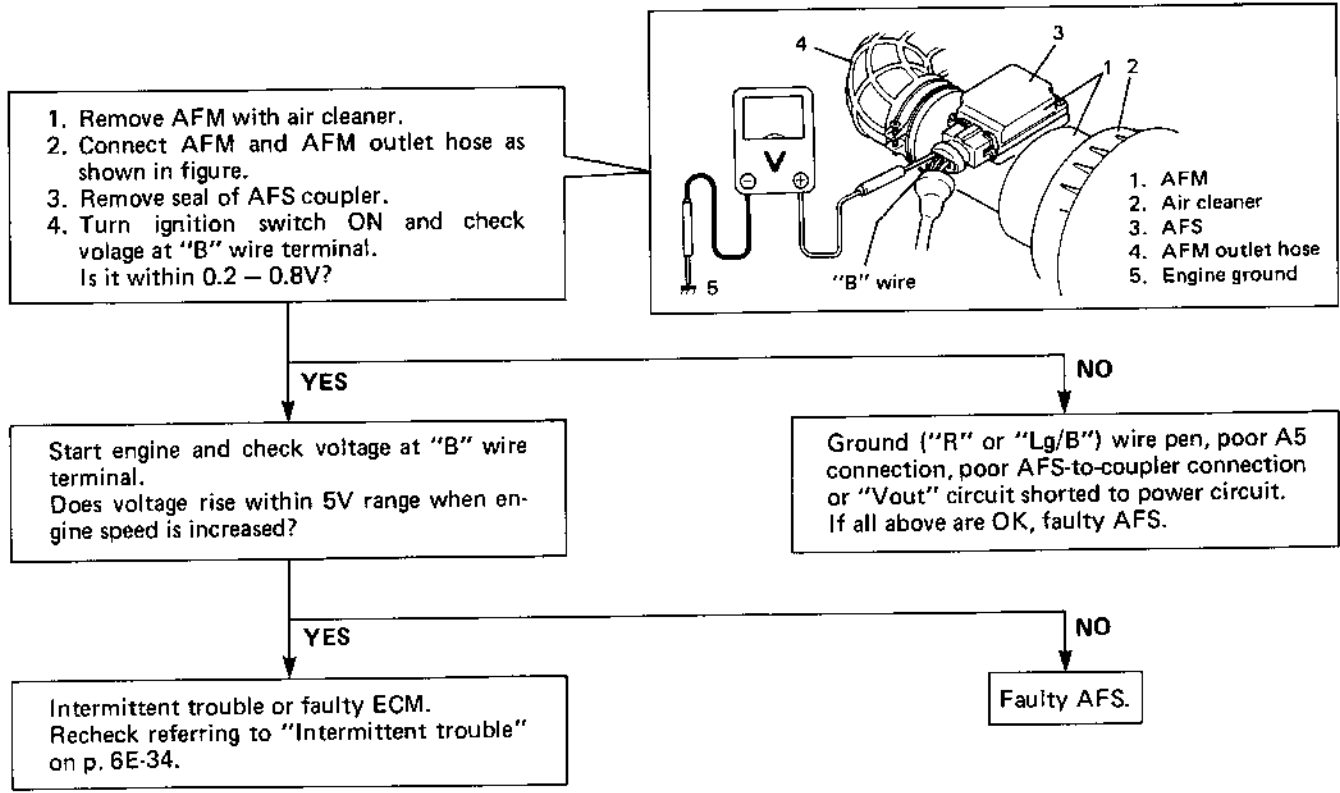


Fig. 6E-67 Diagnostic Flow Chart For Code No. 33

CODE NO. 34 AFS (AIR FLOW SENSOR) CIRCUIT (SIGNAL VOLTAGE LOW)

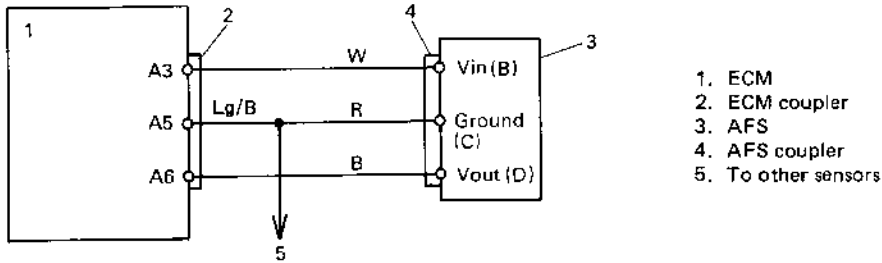


Fig. 6E-68 AFS Circuit

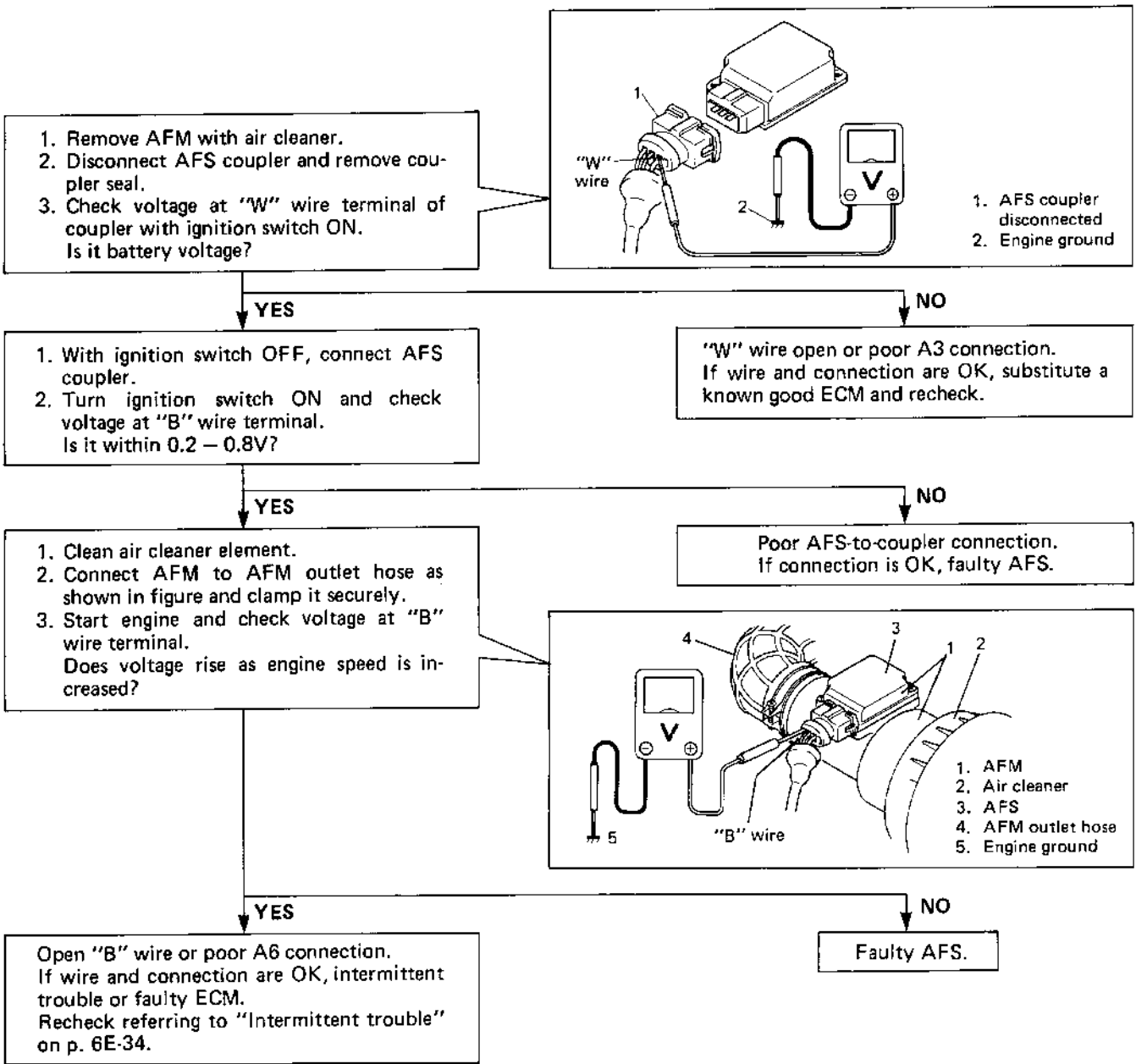


Fig. 6E-69 Diagnostic Flow Chart For Code No. 34

CODE NO. 41 IGNITION SIGNAL CIRCUIT (IGNITION SIGNAL NOT INPUTTED)

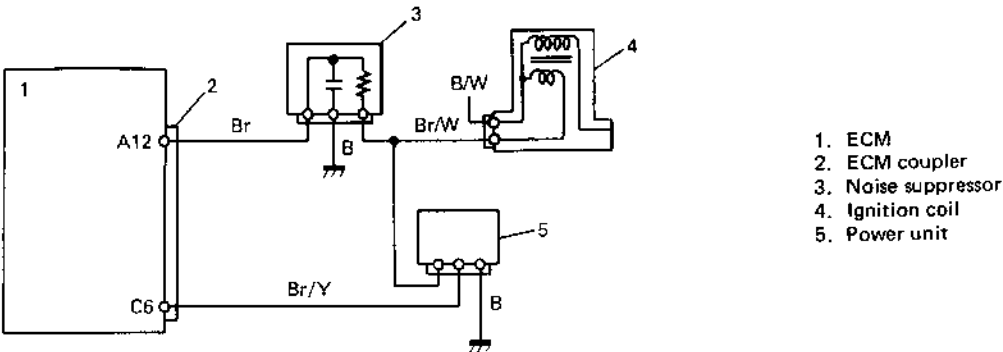


Fig. 6E-70 Ignition Signal Circuit

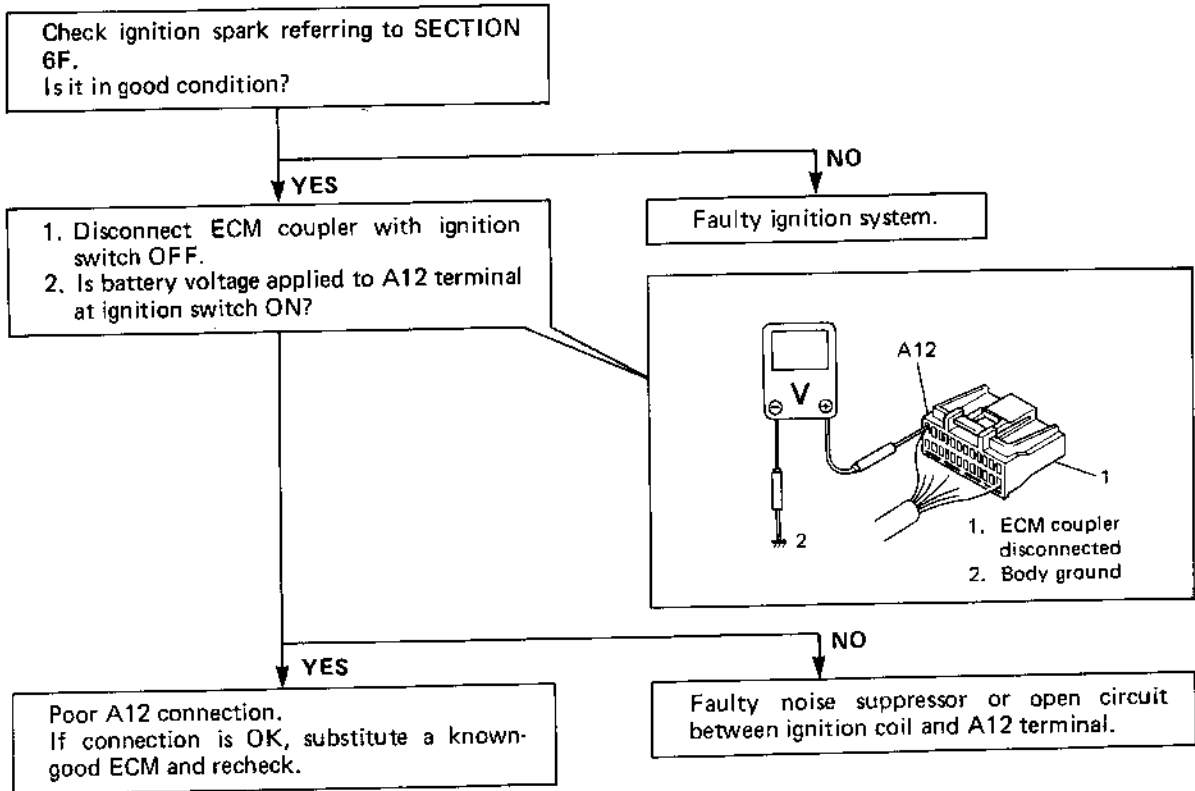


Fig. 6E-71 Diagnostic Flow Chart For Code No. 41

CODE NO. 51 EGR SYSTEM AND REGTS (RECIRCULATED EXHAUST GAS TEMPERATURE SENSOR) CIRCUIT (RECIRCULATED EXHAUST GAS TEMP. DOESN'T CHANGE)

1. ECM
2. ECM coupler
3. Crank angle sensor
4. Coupler
5. Distributor

The diagram illustrates a steam engine system with the following components and connections:

- 1:** Steam engine cylinder and piston assembly.
- 2:** Check valve on the exhaust line.
- 3:** Steam inlet valve to the cylinder.
- 4:** Check valve on the water supply line.
- 5:** Water pump driven by the engine.
- 6:** Water tank with a float valve (7) and a steam heating coil.
- 8:** Inlet to the water tank.
- 9:** Control valve for the water pump.
- Pipes and Labels:**
 - Bl/B:** Pipe from the water tank to the cylinder.
 - Lg/B:** Pipe from the water tank to the pump.
 - R/Y:** Pipe from the pump to the water tank.
 - W/B:** Pipe from the water tank to the control valve.
 - W/R:** Pipe from the control valve to the pump.
 - B14 A1 A2 B8:** Labels for the water tank's internal components.

- ```

graph TD
 A[Check signal rotor air gap referring to SECTION 6F.
Is it in good condition?] -- YES --> B[Check crank angle sensor referring to SECTION 6F.
Is it in good condition?]
 A -- NO --> C[Mal-adjusted air gap.]
 B -- YES --> D[Open wires between sensor and ECM, poor B1 connection, poor B10 connection or sensor wires shorted to each other.
If wires and connections are OK, intermittent trouble or faulty ECM.
Recheck referring to "Intermittent trouble" on p. 6E-34.]
 B -- NO --> E[Faulty crank angle sensor.]

```

*Fig. 6E-74 EGR System*

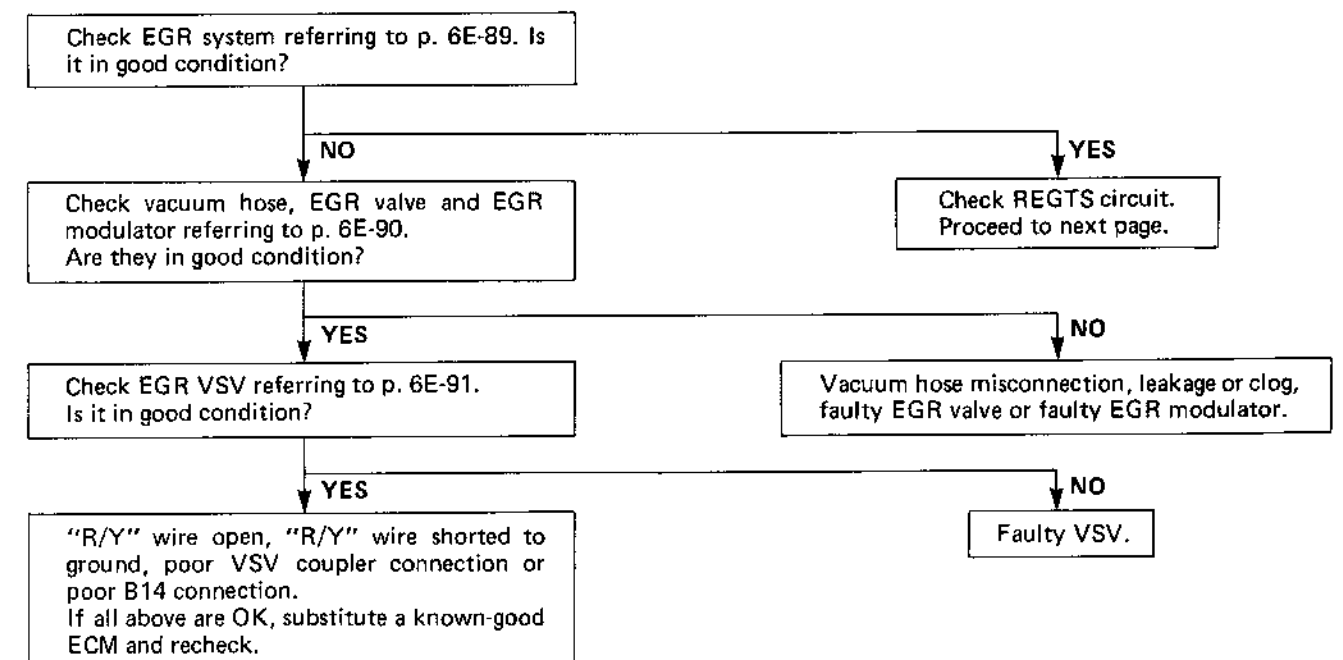


Fig. 6E-75 Diagnostic Flow Chart For Code No. 51 (1) (California spec. model only)



## CODE NO. 51 (CONTINUED)

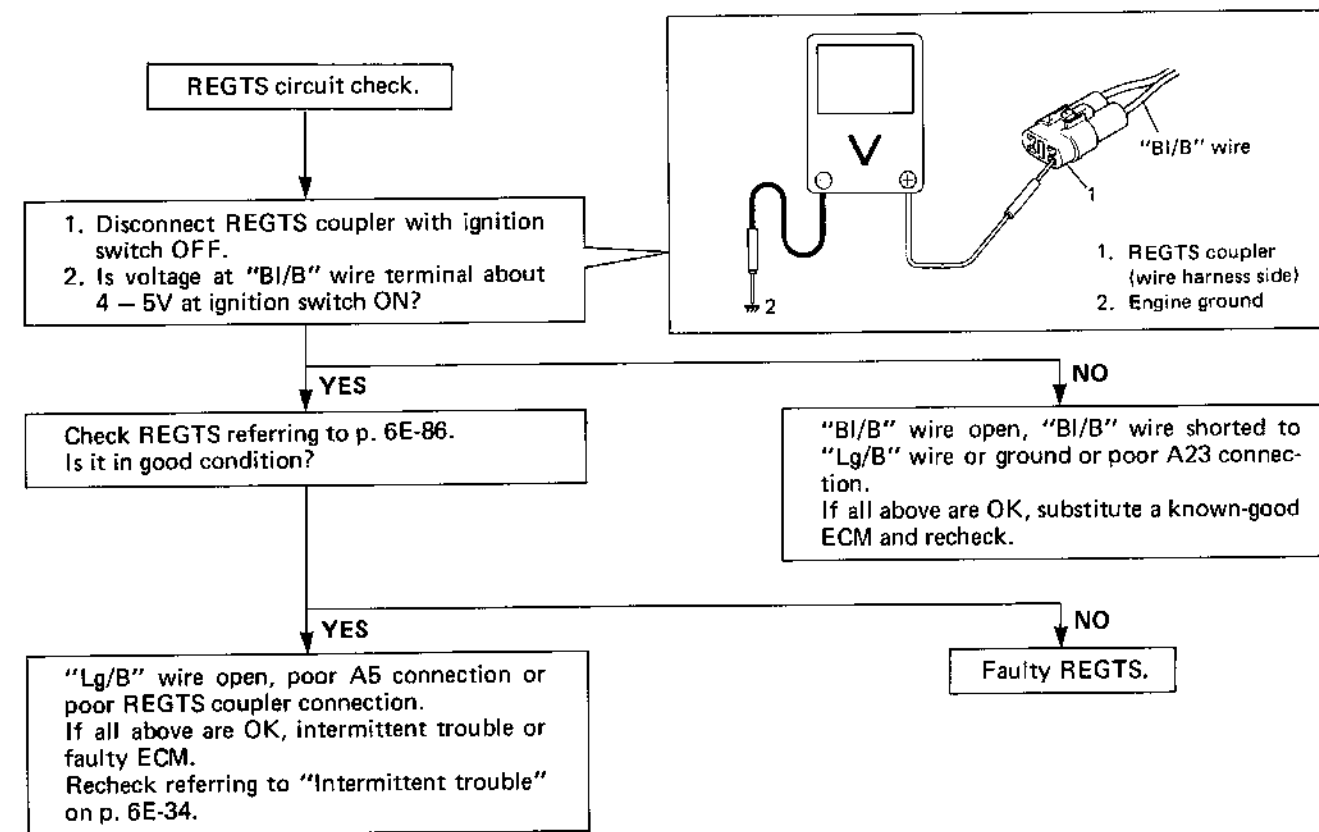


Fig. 6E-76 Diagnostic Flow Chart For Code No. 51 (2) (California spec. model only)

## CODE NO. 52 FUEL INJECTOR (FUEL LEAKAGE FROM FUEL INJECTOR, OXYGEN SENSOR OUTPUT VOLTAGE DOES NOT REDUCE TO LOWER THAN 0.35V WHEN FUEL IS CUT FOR LONGER THAN 1 SEC.)

California spec. model only

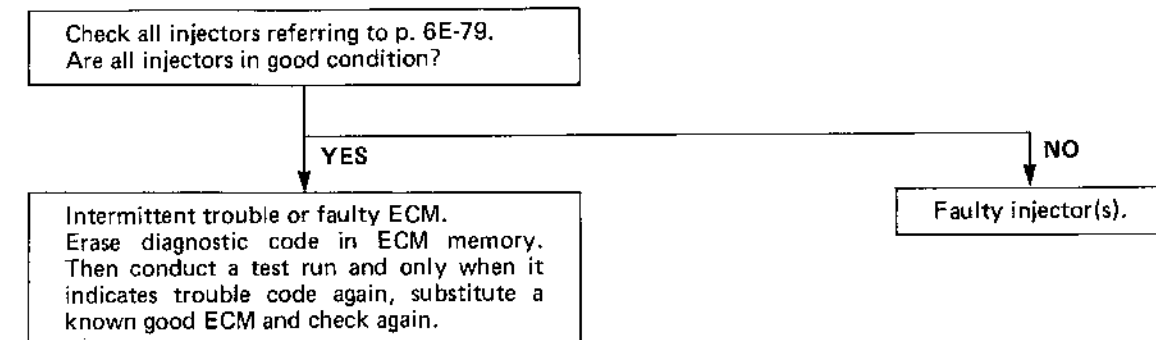


Fig. 6E-77 Diagnostic Flow Chart For Code No. 52 (California spec. model only)

TROUBLE DIAGNOSIS

This section describes trouble diagnosis of EFI system parts whose trouble is not indicated by the self-diagnosis function.

When diagnostic code No. 12 is indicated by the self-diagnosis function and assuredly those engine basic parts as described in "ENGINE DIAGNOSIS" are all in good condition, check below EFI system parts which may be a possible cause for each symptom of the engine.

| SYMPTOM                                                                                                                                                                                        | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                    | INSPECTION                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Hard or no starting</b><br>(Engine cranks OK)                                                                                                                                               | <ul style="list-style-type: none"> <li>Shortage of fuel in fuel tank</li> <li>Vacuum leaks in air intake system</li> <li>Faulty fuel pump or its circuit open</li> </ul>                                                                                                                                                                                                          | 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. |
|                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Fuel injector circuit faulty</li> <li>Fuel pressure out of specification</li> <li>Poor performance of WTS or AFS</li> <li>Faulty ECM</li> </ul>                                                                                                                                                                                            | Diagnostic Flow Chart B-2<br>Diagnostic Flow Chart B-3<br>See p. 6E-85 or 6E-82<br>See p. 6E-68.                                         |
| <b>NOTE:</b><br>If engine is warm and hard to start but starts easily with accelerator pedal depressed, check ISC solenoid valve control system first. (Advance to Diagnostic Flow Chart B-4.) |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                          |
| <b>Engine fails to idle</b>                                                                                                                                                                    | <ul style="list-style-type: none"> <li>Shortage of fuel in fuel tank</li> <li>Vacuum leaks in air intake system</li> <li>Maladjusted idle speed adjusting screw</li> <li>Faulty air valve</li> <li>Faulty EGR system (if equipped)</li> <li>Fuel pressure out of specification</li> <li>Faulty injector(s)</li> <li>Poor performance of WTS or AFS</li> <li>Faulty ECM</li> </ul> | See p. 6E-73<br>See p. 6E-76<br>See p. 6E-89<br>Diagnostic Flow Chart B-3<br>See p. 6E-79<br>See p. 6E-85 or 6E-82<br>See p. 6E-68       |
| <b>NOTE:</b><br>When engine stops only at quick deceleration, check ISC solenoid valve control system first. (Advance to Diagnostic Flow Chart B-4.)                                           |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                          |

| SYMPTOM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                                                                                            | INSPECTION                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Improper engine idle speed</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Maladjusted accelerator cable play</li> <li>Vacuum leaks in air intake system</li> <li>Faulty ISC solenoid valve control system</li> <li>Faulty A/C VSV control system (if equipped)</li> <li>Maladjusted idle speed adjusting screw</li> <li>Faulty air valve</li> <li>Fuel pressure out of specification</li> <li>Faulty injector(s)</li> <li>Poor performance of WTS, TPS or AFS</li> <li>Faulty ECM</li> </ul> | See p. 6E-73<br><br>Diagnostic Flow Chart B-4<br>See section 1B<br><br>See p. 6E-73<br>See p. 6E-76<br>Diagnostic Flow Chart B-3<br>See p. 6E-79<br>See p. 6E-85, 6E-83 or 6E-82<br>See p. 6E-68 |
| <b>NOTE:</b> <ul style="list-style-type: none"> <li>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, ISC solenoid valve control system, air valve and A/C VSV control system (if equipped) in that order.</li> <li>If engine idle speed lowers below specification only when electric load is applied (e.g. headlight ON), check ISC solenoid valve control system first.</li> <li>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.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                  |
| <b>Engine has no or poor power</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Maladjusted accelerator cable play</li> <li>Vacuum leaks in air intake system</li> <li>Faulty EGR system (if equipped)</li> <li>Fuel pressure out of specification</li> <li>Faulty injector(s)</li> <li>Poor performance of TPS, WTS or AFS</li> <li>Faulty ECM</li> </ul>                                                                                                                                         | Check if throttle valve opens fully when accelerator pedal is depressed fully.<br><br>See p. 6E-89<br>Diagnostic Flow Chart B-3<br>See p. 6E-79<br>See p. 6E-83, 6E-85 or 6E-82<br>See p. 6E-68  |
| <b>Engine hesitates when accelerating</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Vacuum leaks in air intake system</li> <li>Faulty EGR system (if equipped)</li> <li>Fuel pressure out of specification</li> <li>Faulty injector(s)</li> <li>Poor performance of TPS, WTS or AFS</li> <li>Faulty ECM</li> </ul>                                                                                                                                                                                     | See p. 6E-89<br>Diagnostic Flow Chart B-3<br>See p. 6E-79<br>See p. 6E-83, 6E-85 or 6E-82<br>See p. 6E-68                                                                                        |

| SYMPTOM                                                                                      | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                                                    | INSPECTION                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Surges</b><br>(Variation in car speed is felt although accelerator pedal is not operated) | <ul style="list-style-type: none"> <li>Faulty EGR system (if equipped)</li> <li>Variable fuel pressure (clogged fuel filter, faulty fuel pressure regulator, etc.)</li> <li>Poor performance of AFS</li> <li>Faulty injector(s)</li> <li>Faulty ECM</li> </ul>                                                                                                                                                    | <p>See p. 6E-89<br/>Diagnostic Flow Chart B-3</p> <p>See p. 6E-82<br/>See p. 6E-79<br/>See p. 6E-68</p>                                                                                     |
| <b>Poor gasoline mileage</b>                                                                 | <ul style="list-style-type: none"> <li>High idle speed</li> <li>Fuel pressure out of specification or fuel leakage</li> <li>Poor performance of TPS, WTS or AFS</li> <li>Faulty injector(s)</li> <li>Faulty ECM</li> </ul>                                                                                                                                                                                        | <p>Refer to item "Improper engine idle speed" previously outlined<br/>Diagnostic Flow Chart B-3</p> <p>See p. 6E-83, 6E-85 or 6E-82<br/>See p. 6E-79<br/>See p. 6E-68</p>                   |
| <b>Excessive hydrocarbon (HC) emission</b>                                                   | <ul style="list-style-type: none"> <li>Engine not at normal operating temperature</li> <li>Clogged air cleaner</li> <li>Faulty ignition system</li> <li>Low compression</li> <li>Lead contamination of catalytic converter</li> <li>Fuel pressure out of specification</li> <li>A/F feed back compensation fails — Poor performance of AFS, TPS or WTS</li> <li>Faulty injector(s)</li> <li>Faulty ECM</li> </ul> | <p>See Section 6F<br/>See Section 6<br/>Check for absence of filler neck restrictor<br/>Diagnostic Flow Chart B-3</p> <p>See p. 6E-82, 6E-83 or 6E-85<br/>See p. 6E-79<br/>See p. 6E-68</p> |
| <b>Excessive carbon monoxide (CO)</b>                                                        | <ul style="list-style-type: none"> <li>Engine not at normal operating temperature</li> <li>Clogged air cleaner</li> <li>Faulty ignition system</li> <li>Low compression</li> <li>Lead contamination of catalytic converter</li> <li>Fuel pressure out of specification</li> <li>A/F feed back compensation fails — Poor performance of AFS, TPS or WTS</li> <li>Faulty injector(s)</li> <li>Faulty ECM</li> </ul> | <p>See Section 6F<br/>See Section 6<br/>Check for absence of filler neck restrictor<br/>Diagnostic Flow Chart B-3</p> <p>See p. 6E-82, 6E-83 or 6E-85<br/>See p. 6E-79<br/>See p. 6E-68</p> |

| SYMPTOM                                         | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                                | INSPECTION                                                                                                                                                                              |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Excessive nitrogen oxides (NOx) emission</b> | <ul style="list-style-type: none"> <li>Vacuum leaks in air intake system</li> <li>Improper ignition timing</li> <li>Lead contamination of catalytic converter</li> <li>Faulty EGR system (if equipped)</li> <li>Fuel pressure out of specification</li> <li>A/F feed back compensation fails — Poor performance of AFS, TPS or WTS</li> <li>Faulty injector(s)</li> <li>Faulty ECM</li> </ul> | <p>See Section 6F<br/>Check for absence of filler neck restrictor<br/>See p. 6E-89<br/>Diagnostic Flow Chart B-3<br/>See p. 6E-82, 6E-83 or 6E-85<br/>See p. 6E-79<br/>See p. 6E-68</p> |

B-1 FUEL PUMP CIRCUIT CHECK

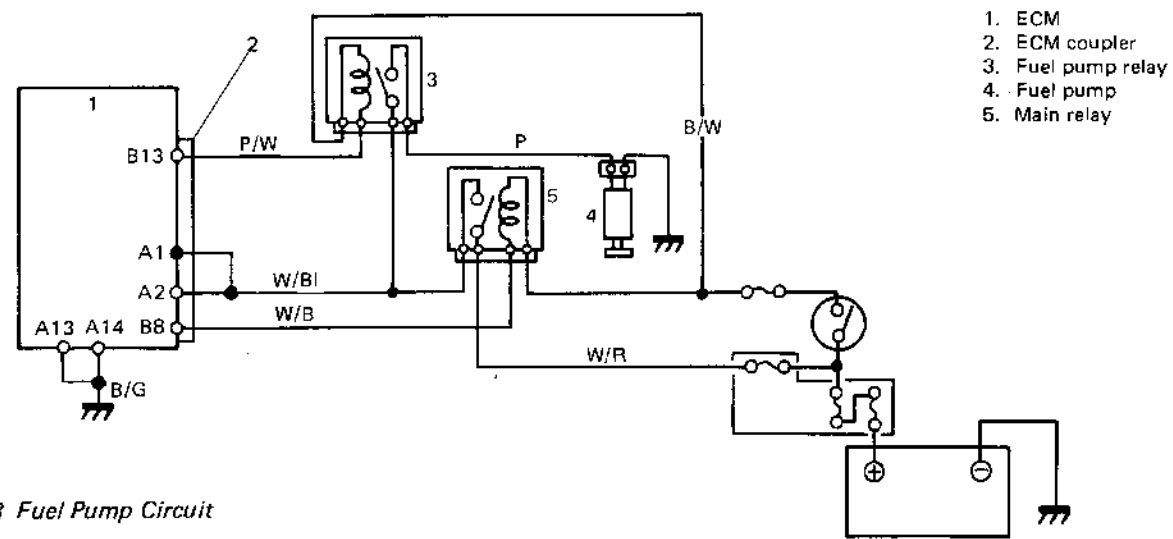


Fig. 6E-78 Fuel Pump Circuit

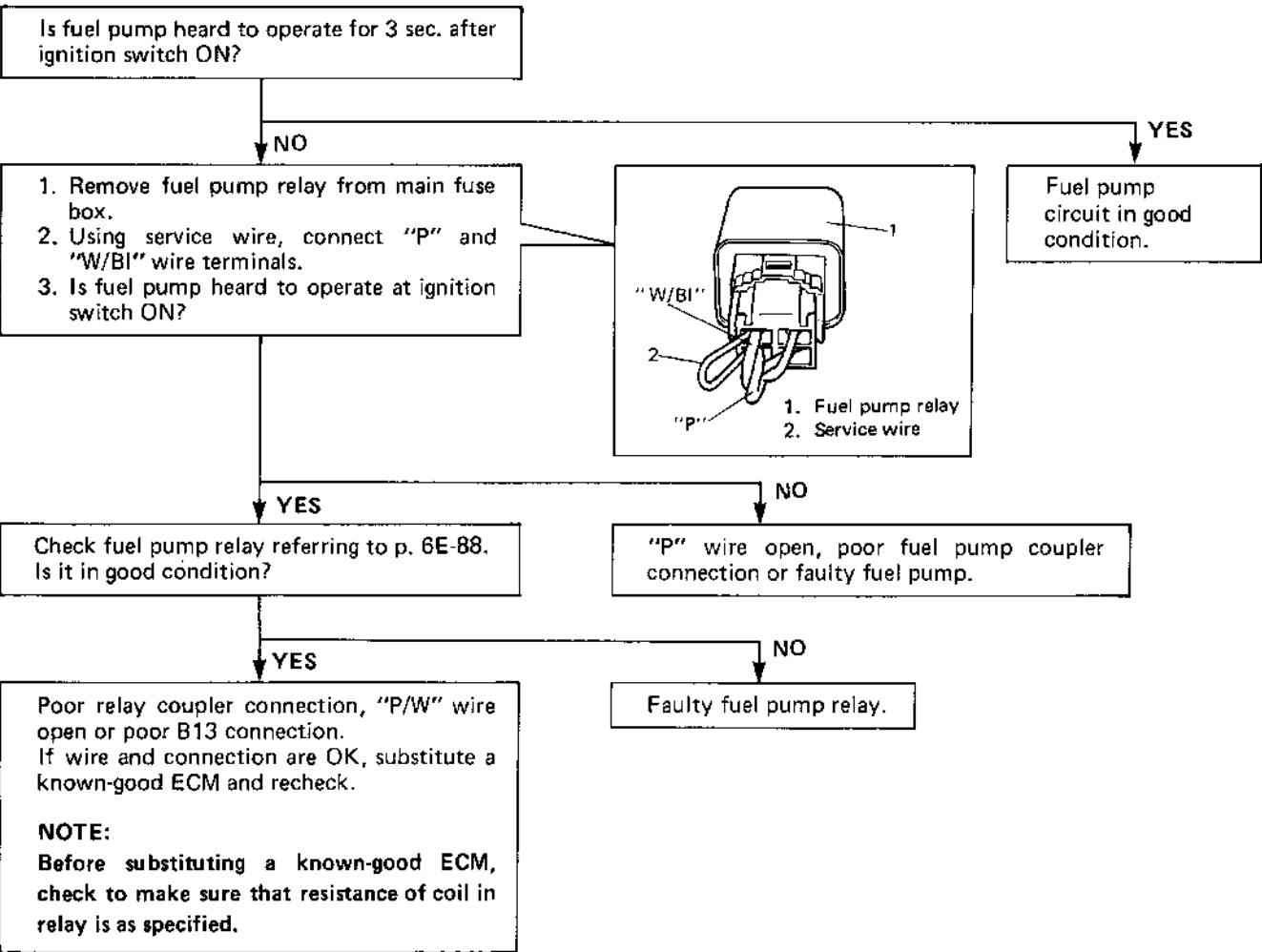


Fig. 6E-79 Diagnostic Flow Chart B-1 For Fuel Pump and Its Circuit Check

B-2 FUEL INJECTOR CIRCUIT CHECK

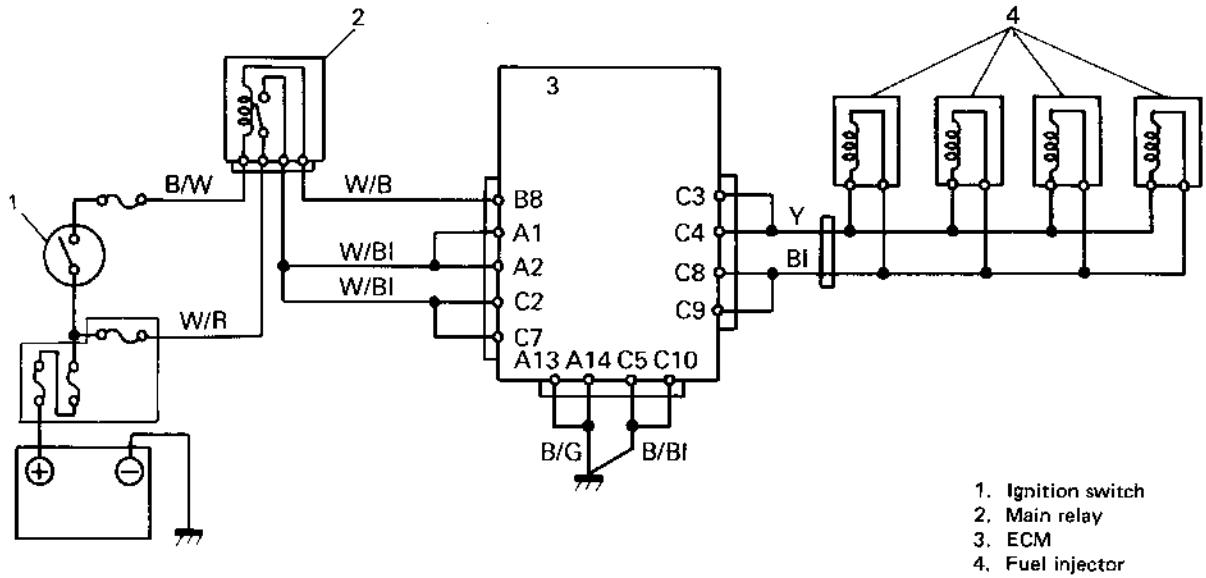
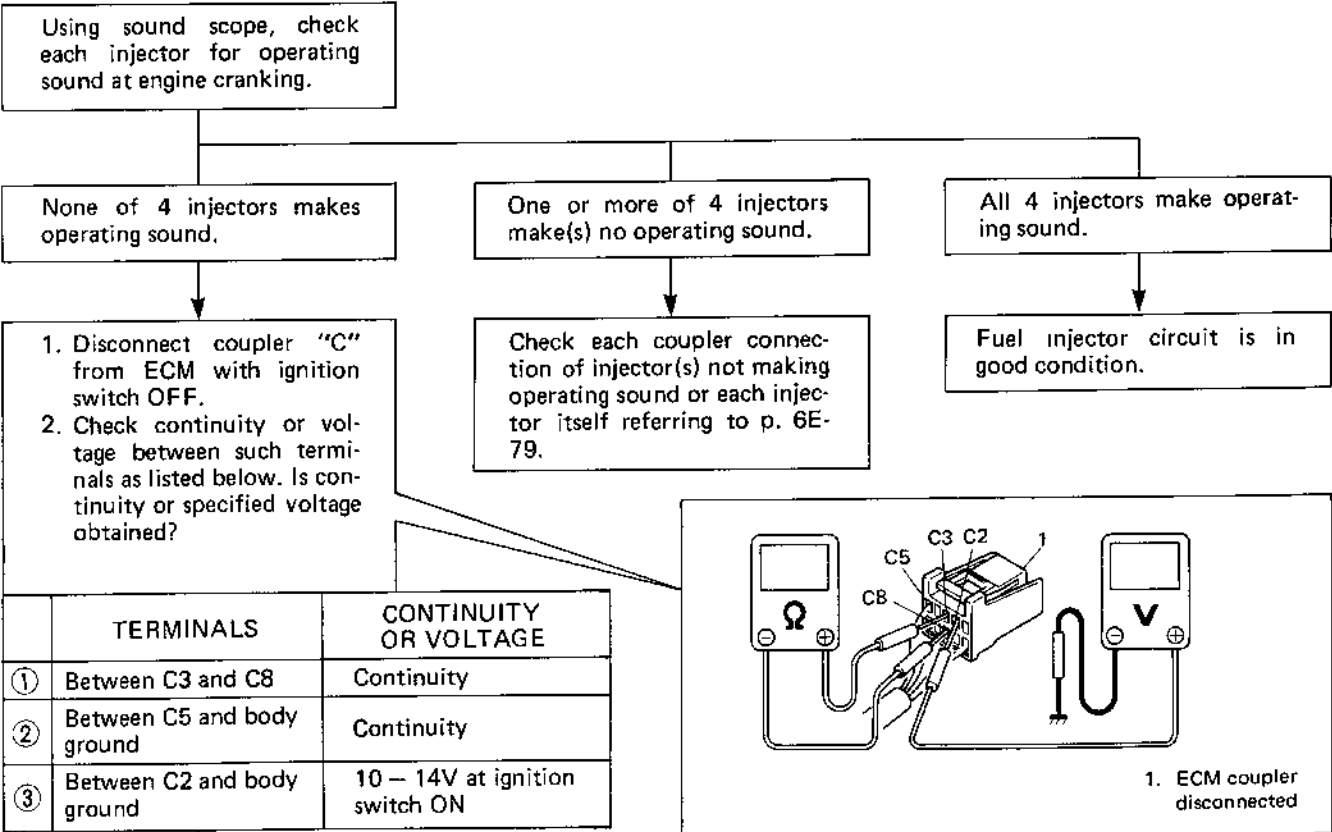


Fig. 6E-80 Injector Circuit



To be continued

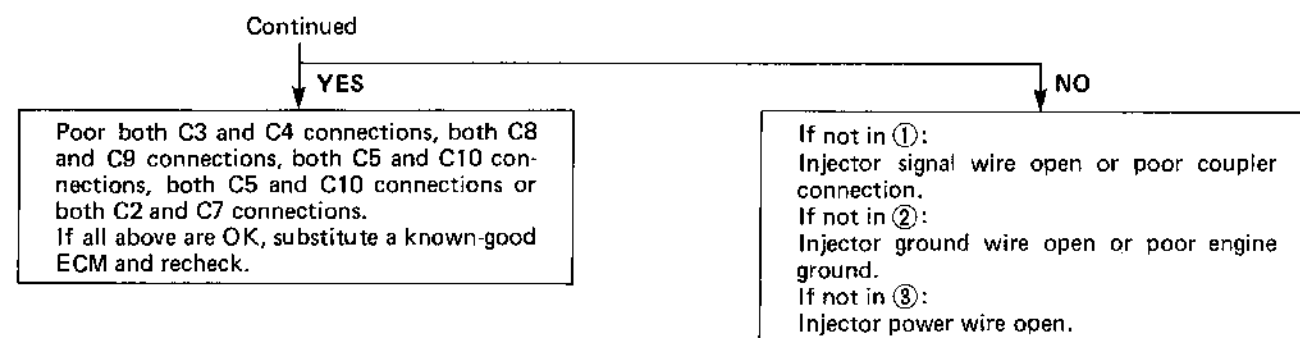


Fig. 6E-81 Diagnostic Flow Chart For Injector Circuit

## B-3 FUEL PRESSURE CHECK

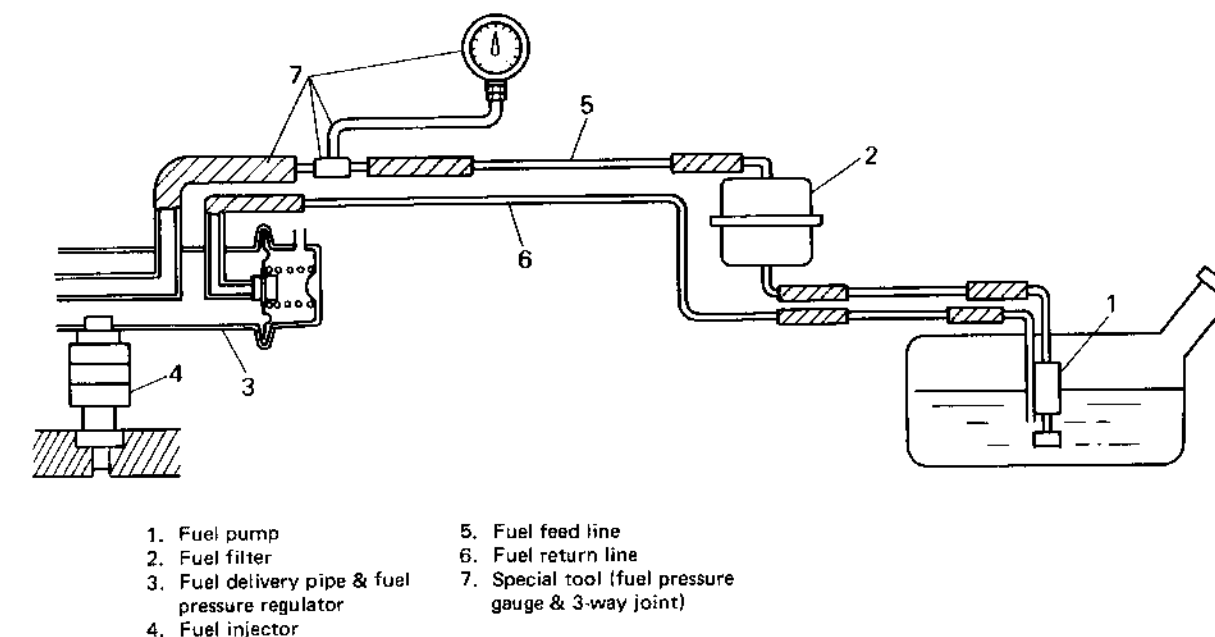


Fig. 6E-82 Fuel Pressure Check

## 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.

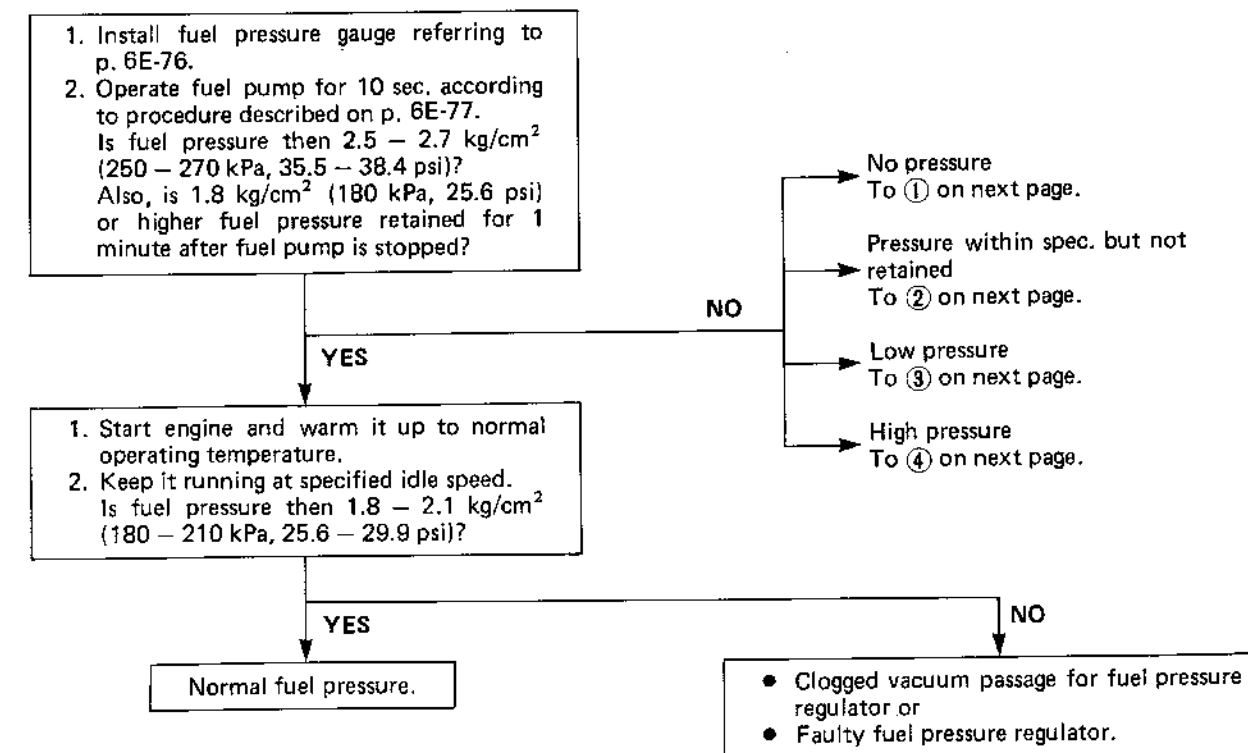


Fig. 6E-83 Diagnostic Flow Chart B-3 For Fuel Pressure Check (1)

B-3 FUEL PRESSURE CHECK (continued)

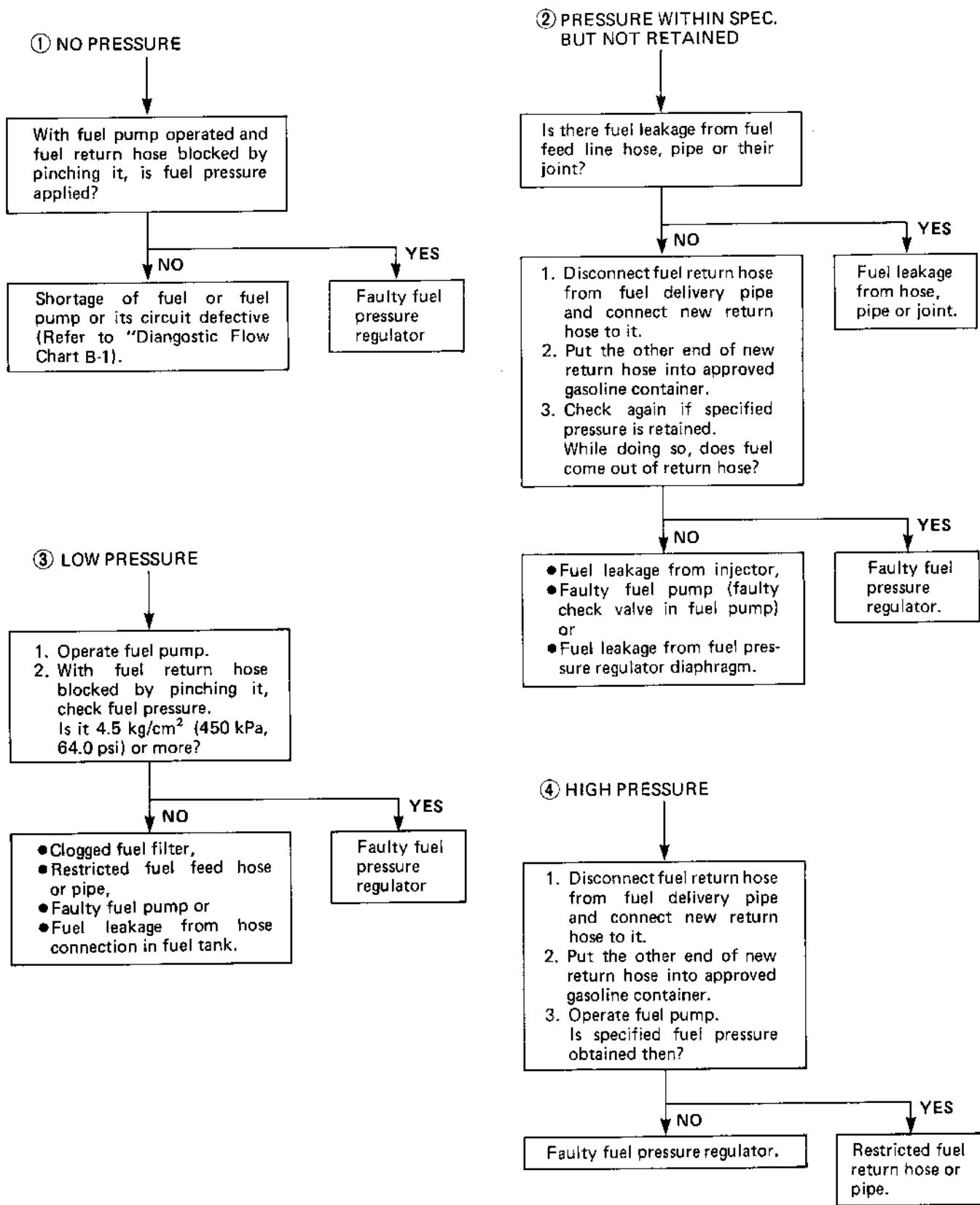


Fig. 6E-84 Diagnostic Flow Chart B-3 For Fuel Pressure Check (2)

B-4 ISC SOLENOID VALVE CONTROL SYSTEM CHECK

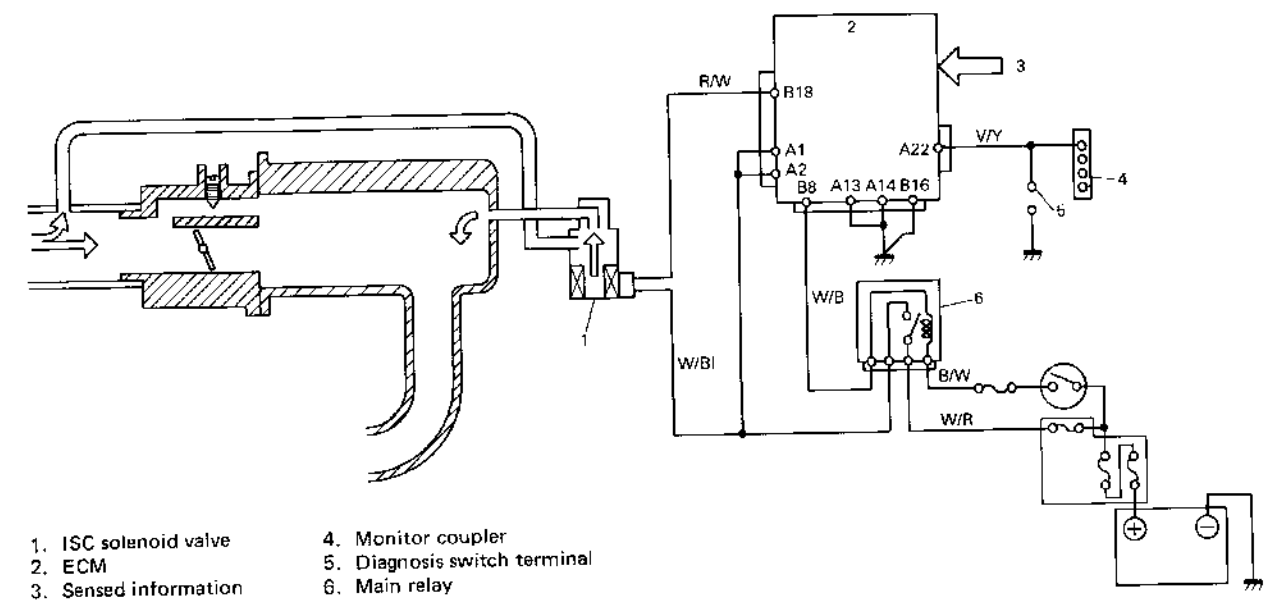
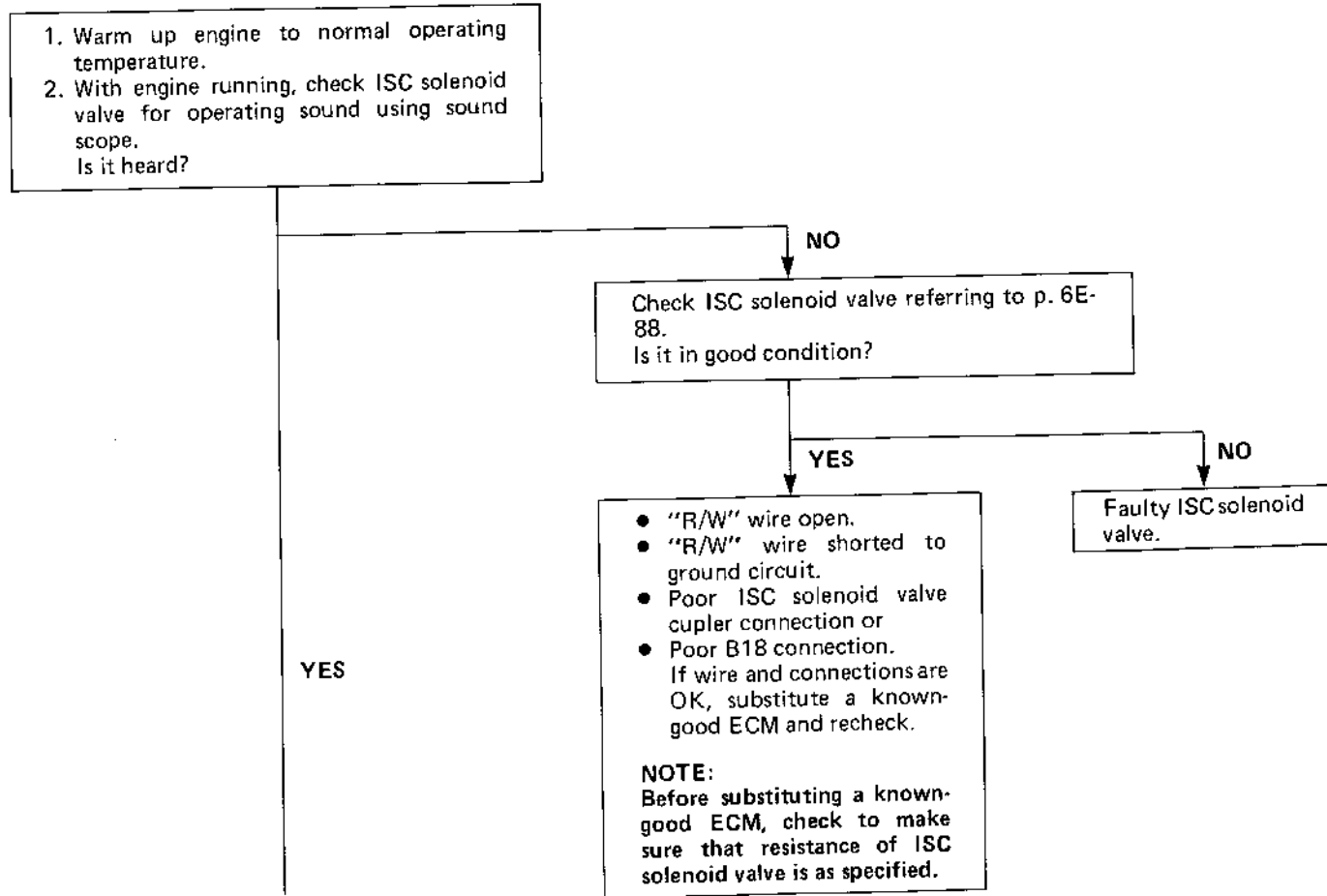


Fig. 6E-85 ISC Solenoid Valve Circuit



To be continued



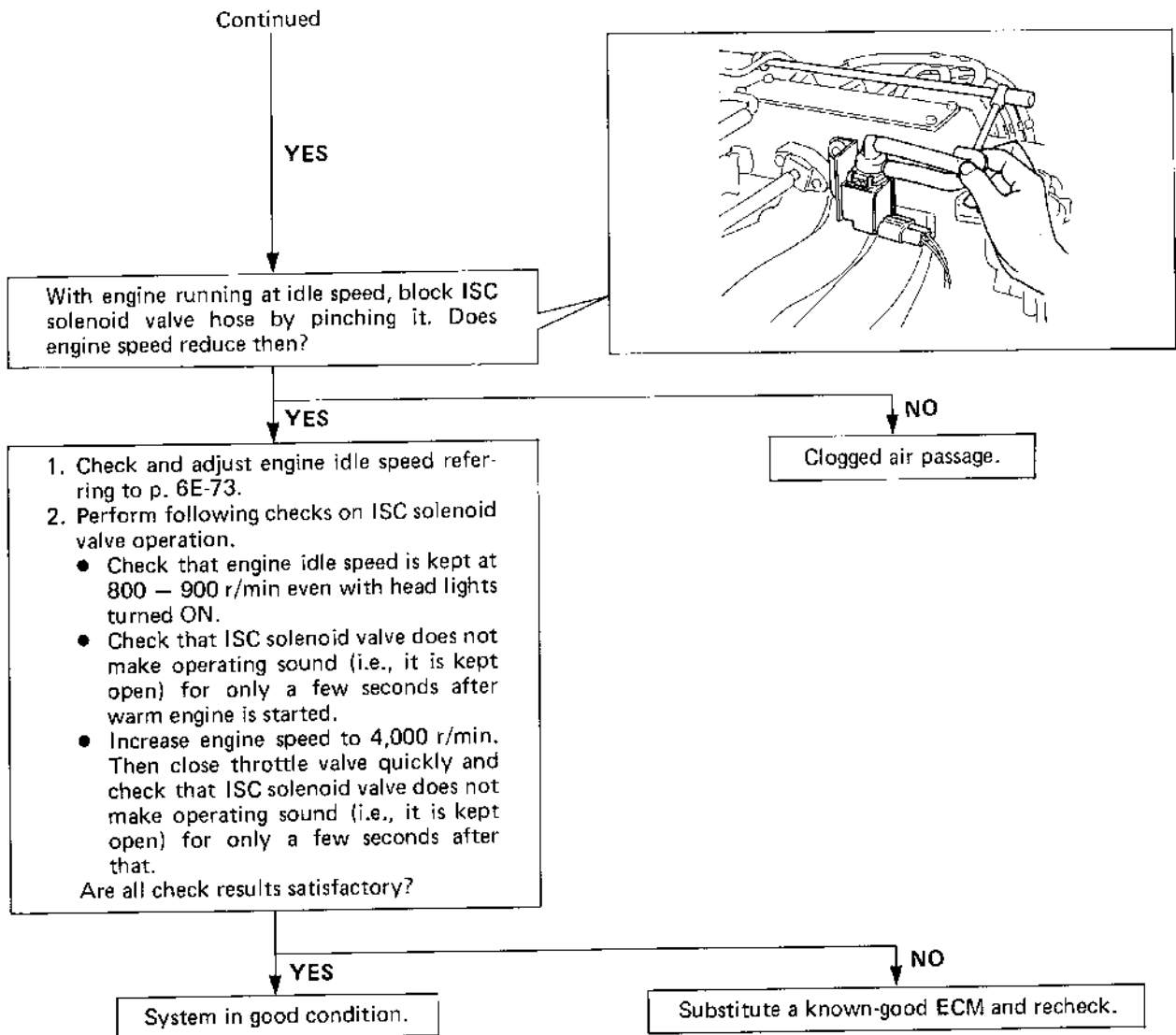


Fig. 6E-86

B-5 ENGINE START SIGNAL CHECK

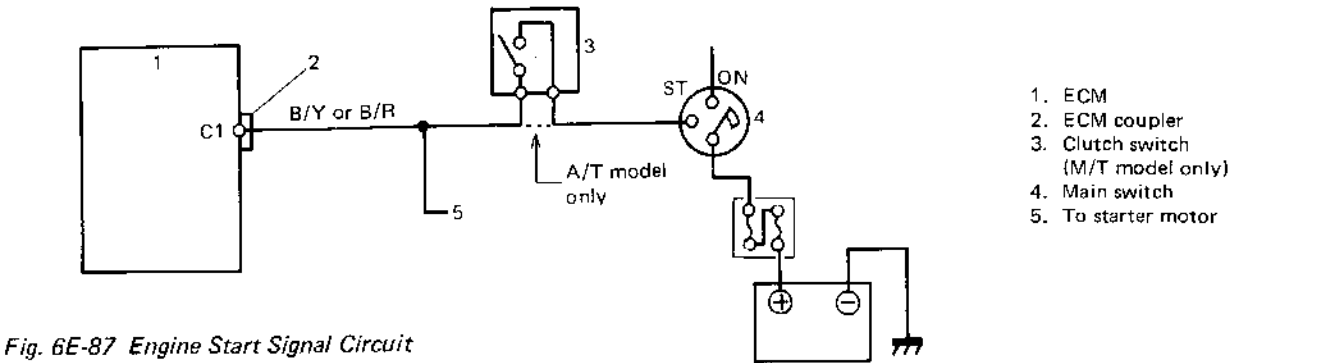


Fig. 6E-87 Engine Start Signal Circuit

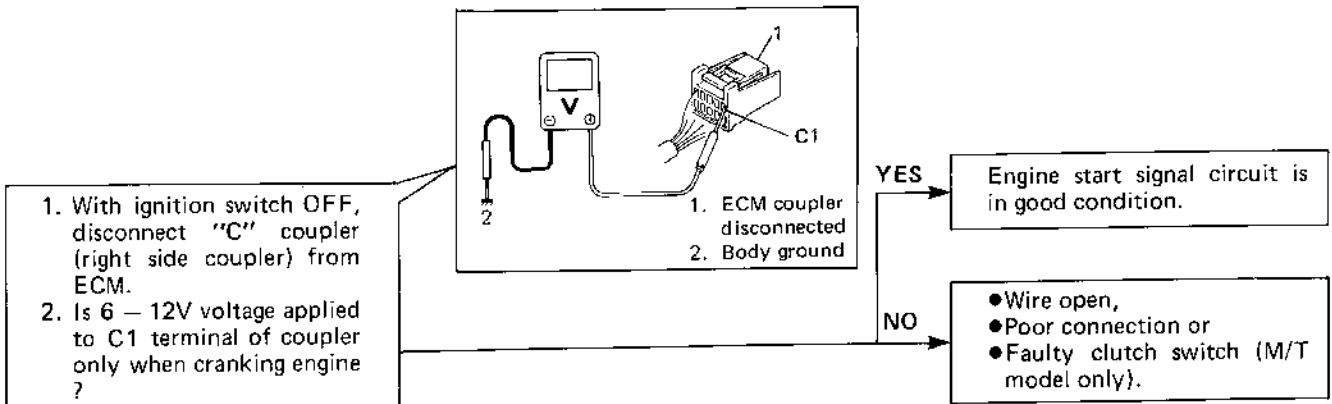


Fig. 6E-88 Engine Start Signal Check

B-6 "R", "D", "2" OR "L" RANGE SIGNAL CHECK (A/T MODEL ONLY)

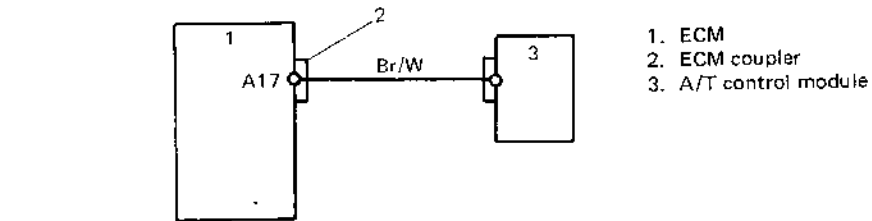


Fig. 6E-89 "R", "D", "2" or "L" Range Signal Circuit

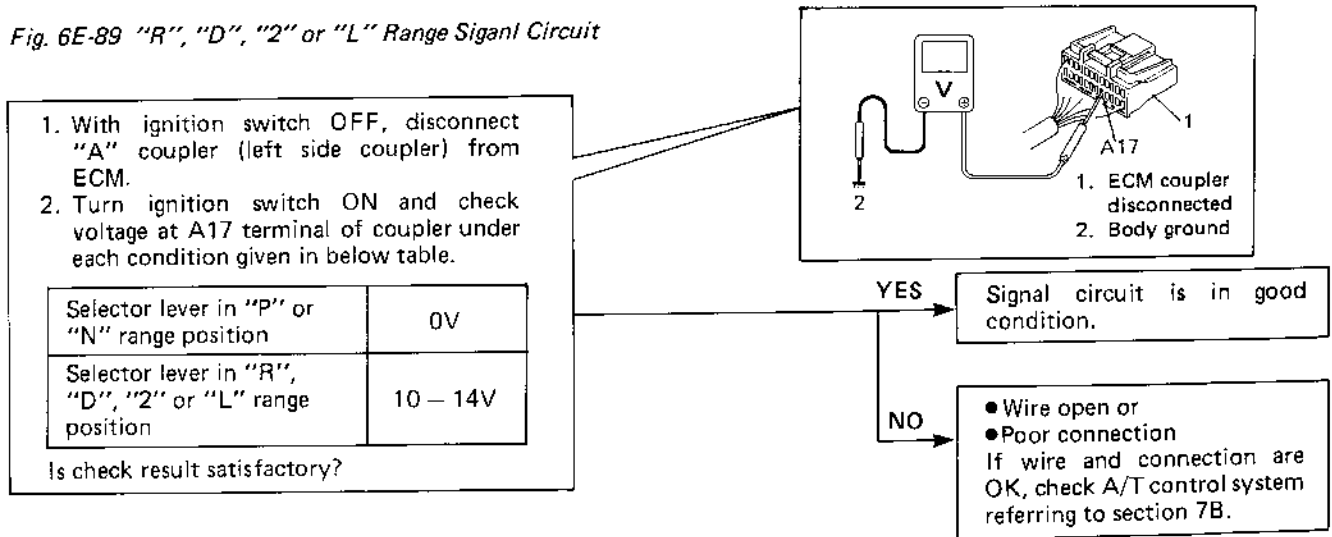


Fig. 6E-90 "R", "D", "2" or "L" Range Signal Check (A/T Model Only)

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 6E-82.
- 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.

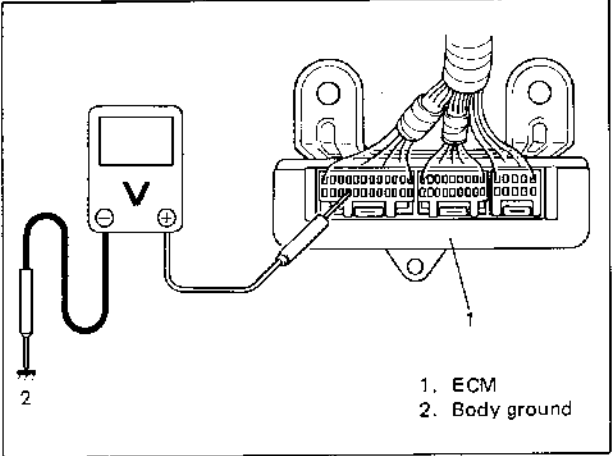


Fig. 6E-91 Checking Voltage

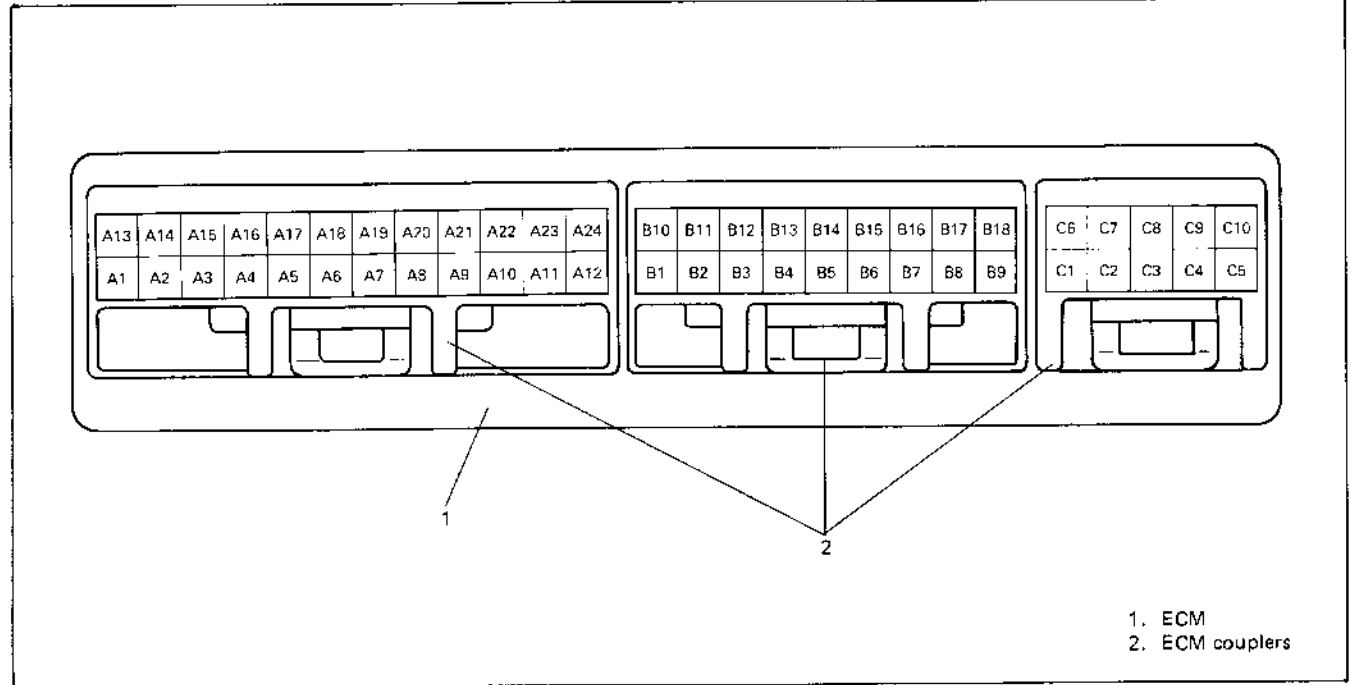


Fig. 6E-92 ECM Coupler Terminals

| TERMINAL                             | CIRCUIT                                                   | STANDARD VOLTAGE                                           | CONDITION                                                                                                                                                         |
|--------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1<br>A2                             | Power source                                              | 10 – 14V                                                   | Ignition switch ON                                                                                                                                                |
| A3                                   | Power source of AFS                                       | 10 – 14V                                                   | Ignition switch ON                                                                                                                                                |
| A4                                   | Power source of TPS                                       | 4.0 – 5.5V                                                 | Ignition switch ON                                                                                                                                                |
| A5                                   | Sensor ground                                             | —                                                          | —                                                                                                                                                                 |
| A6                                   | AFS signal                                                | 0.2 – 0.8V                                                 | Ignition switch ON                                                                                                                                                |
| A7                                   | WTS                                                       | 1.0 – 3.0V                                                 | Ignition switch ON<br>Engine cooling water temp.: 80° C (176° F)                                                                                                  |
| A8                                   | Oxygen sensor                                             | Indicator deflection repeated between over and under 0.45V | While engine running at 2000 r/min for 1 minute or longer after warmed up                                                                                         |
| A9                                   | TPS signal                                                | 0 – 1V                                                     | Ignition switch ON<br>Throttle valve at idle position                                                                                                             |
|                                      |                                                           | 3.0 – 5.0V                                                 | Ignition switch ON<br>Throttle valve at full open position                                                                                                        |
| A10                                  | Speed sensor signal                                       | Indicator deflection repeated between 0V and 3 – 5V        | Ignition switch ON<br>Front left tire turned slowly with front right tire locked                                                                                  |
| A11<br>A20<br>B4<br>(A/T model only) | Throttle valve opening output signal (A/T control module) | 10 – 14V                                                   | Ignition switch ON<br>Throttle valve at idle position                                                                                                             |
|                                      |                                                           | 0 – 1V<br>↓<br>10 – 14V                                    | Ignition switch ON<br>Opening throttle valve slowly causes voltage to vary as given at the left. (Refer to Fig. 6E-160 for relations between opening and voltage) |
| A12                                  | Ignition signal                                           | 10 – 14V                                                   | Ignition switch ON                                                                                                                                                |
| A13<br>A14                           | Ground                                                    | —                                                          | —                                                                                                                                                                 |
| A15                                  | —                                                         | —                                                          | —                                                                                                                                                                 |
| A16                                  | Power source for back up circuit                          | 10 – 14V                                                   | Ignition switch ON and OFF                                                                                                                                        |
| A17<br>(A/T model only)              | "R", "D", "2" or "L" range signal (A/T control module)    | 0 – 2V                                                     | Ignition switch ON, Selector lever in "P" or "N" range position                                                                                                   |
|                                      |                                                           | 10 – 14V                                                   | Ignition switch ON, Selector lever in "R", "D", "2" or "L" range position                                                                                         |
| A18                                  | Air-conditioner ON/OFF signal (if equipped)               | 8 – 14V                                                    | Ignition switch ON                                                                                                                                                |
|                                      |                                                           | 0 – 2V                                                     | While engine running at idle speed, Air-conditioner ON                                                                                                            |



| TERMINAL                             | CIRCUIT                   | STANDARD VOLTAGE                       | CONDITION                                                                                                               |
|--------------------------------------|---------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| A19                                  | Test switch terminal      | 10 – 14V                               | Ignition switch ON                                                                                                      |
|                                      |                           | 0 – 1V                                 | Ignition switch ON<br>Test switch terminal grounded                                                                     |
| A21                                  | Idle switch (in TPS)      | 0 – 1V                                 | Ignition switch ON<br>Throttle valve at idle position                                                                   |
|                                      |                           | 3.0 – 5.0V                             | Ignition switch ON<br>Throttle valve opens larger than idle position                                                    |
| A22                                  | Diagnosis switch terminal | 10 – 14V                               | Ignition switch ON                                                                                                      |
|                                      |                           | 0 – 1V                                 | Ignition switch ON<br>Diagnosis switch terminal grounded                                                                |
| A23<br>(California spec. model only) | REGTS                     | 4.0 – 5.0V                             | Ignition switch ON<br>Sensor ambient temp.: 20°C (68°F)                                                                 |
| A24                                  |                           |                                        |                                                                                                                         |
| B1                                   | CAS (positive)            |                                        |                                                                                                                         |
| B2                                   | "CHECK ENGINE" light      | 0 – 3V                                 | Ignition switch ON<br>Diagnosis switch terminal ungrounded                                                              |
|                                      |                           | 10 – 14V                               | Engine running<br>Diagnosis switch terminal ungrounded                                                                  |
|                                      |                           | Indicator deflection within 1.2V – 14V | Diagnosis switch terminal grounded<br>Test switch terminal grounded, while engine running at 2000 r/min after warmed up |
| B3                                   |                           |                                        |                                                                                                                         |
| B5                                   | Canister purge VSV        | 10 – 14V                               | Ignition switch ON                                                                                                      |
| B6<br>B7                             |                           |                                        |                                                                                                                         |
| B8                                   | Main relay ground         | 0 – 2V                                 | Ignition switch ON                                                                                                      |
| B9                                   |                           |                                        |                                                                                                                         |
| B10                                  | CAS (negative)            |                                        |                                                                                                                         |
| B11<br>B12                           |                           |                                        |                                                                                                                         |
| B13                                  | Fuel pump relay ground    | 0 – 4V                                 | For 3 seconds after ignition switch ON                                                                                  |
|                                      |                           | 10 – 14V                               | When over 3 seconds after ignition switch ON                                                                            |
| B14<br>(California spec. model only) | EGR VSV                   | 10 – 14V                               | Ignition switch ON                                                                                                      |
| B15                                  |                           |                                        |                                                                                                                         |

| TERMINAL  | CIRCUIT                                      | STANDARD VOLTAGE | CONDITION             |
|-----------|----------------------------------------------|------------------|-----------------------|
| B16       | Ground                                       |                  |                       |
| B17       |                                              |                  |                       |
| B18       | ISC solenoid valve                           | 10 – 14V         | Ignition switch ON    |
| C1        | Engine start signal<br>(Engine start switch) | 6 – 12V          | While engine cranking |
|           |                                              | 0 – 1V           | Other than above      |
| C2<br>C7  | Power source for injector                    | 10 – 14V         | Ignition switch ON    |
| C3<br>C4  | Injector (positive)                          |                  |                       |
| C5<br>C10 | Ground for injector                          |                  |                       |
| C6        | Ignition output signal                       | 0V               | Ignition switch ON    |
|           |                                              | 1 – 3V           | While engine cranking |
| C8<br>C9  | Injector (negative)                          |                  |                       |

**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 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 ambient temperature is 20°C (68°F).

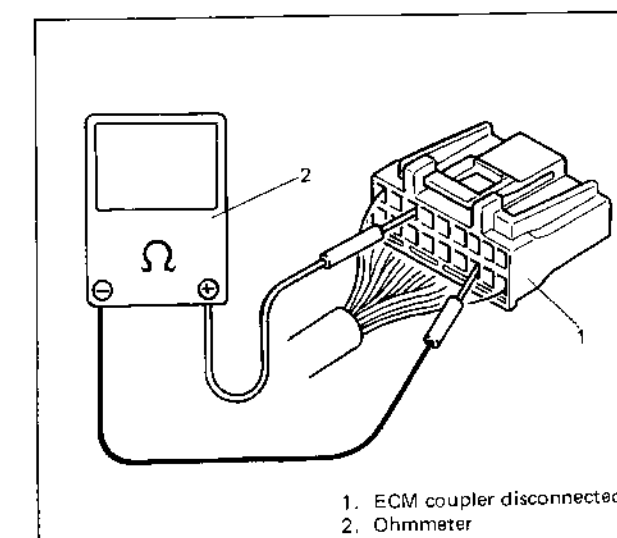


Fig. 6E-93 Checking Resistance

| TERMINALS                             | CIRCUIT                   | STANDARD RESISTANCE                         | CONDITION                                                        |
|---------------------------------------|---------------------------|---------------------------------------------|------------------------------------------------------------------|
| A7 — A5                               | WTS                       | Approx. 320 Ω                               | Engine cooling water temp. 80°C (176° F)                         |
| A9 — A5                               | TPS                       | 0 — 500 Ω                                   | Throttle valve at idle position                                  |
|                                       |                           | 3.5 — 6.5 kΩ                                | Throttle valve at full open position                             |
| A10 — Body ground                     | Speed sensor              | Ohmmeter indicator deflects between 0 and ∞ | While front left tire turned slowly with front right tire locked |
| A13 — Body ground                     | Ground                    | 0 (Zero)                                    | _____                                                            |
| A14 — Body ground                     | Ground                    | 0 (Zero)                                    | _____                                                            |
| A19 — Body ground                     | Test switch terminal      | ∞ (Infinity)                                | Test switch terminal ungrounded                                  |
|                                       |                           | 0 (Zero)                                    | Test switch terminal grounded                                    |
| A21 — A5                              | Idle switch (in TPS)      | 0 (Zero)                                    | Throttle valve is at idle position                               |
|                                       |                           | ∞ (Infinity)                                | Throttle valve opens larger than idle position                   |
| A22 — Body ground                     | Diagnosis switch terminal | ∞ (Infinity)                                | Diagnosis switch terminal ungrounded                             |
|                                       |                           | 0 (Zero)                                    | Diagnosis switch terminal grounded                               |
|                                       |                           |                                             |                                                                  |
| B1 — B10                              | CAS                       | 588 — 882 Ω                                 | _____                                                            |
| B5 — A1                               | Canister purge VSV        | 33 — 39 Ω                                   | _____                                                            |
| B14 — A1                              | EGR VSV                   | 33 — 39 Ω                                   | _____                                                            |
| B16 — Body ground                     | Ground                    | 0 (Zero)                                    | _____                                                            |
| B18 — A1                              | ISC solenoid valve        | 30 — 33 Ω                                   | _____                                                            |
| C5 — Body ground<br>C10 — Body ground | Ground                    | 0 (Zero)                                    | _____                                                            |

ON CAR SERVICE

GENERAL

When hoses have been disconnected and system's component removed for service, be sure to re-install component properly, and route and connect hoses correctly after service. Refer to Emission Control Information Label for proper routing of hoses.

ACCELERATOR CABLE ADJUSTMENT

Check accelerator cable for play and adjust if necessary.

Cable play should be within specification. If out of specification, loosen accelerator cable lock nut and adjust by turning adjusting nut. Be sure to tighten lock nut securely after adjustment.

|                        |                               |
|------------------------|-------------------------------|
| Accelerator cable play | 3 — 5 mm<br>(0.12 — 0.20 in.) |
|------------------------|-------------------------------|

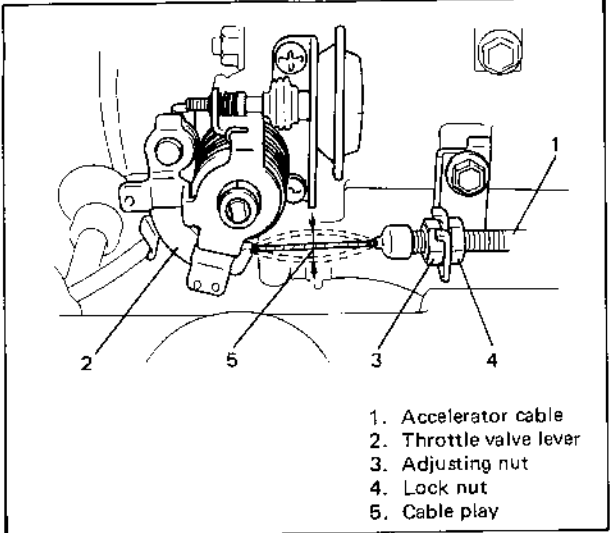


Fig. 6E-94 Accelerator Cable Play

IDLE SPEED ADJUSTMENT (INCLUDING AIR-CONDITIONER VSV ADJUSTMENT)

Before idle speed check and adjustment, make sure of the following.

- Lead wires and hoses of EFI 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, etc.) are out of service.
- Air-conditioner is OFF, if equipped.
- Air cleaner has been properly installed and is in good condition.

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

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 and block drive wheels.

1. Warm up engine to normal operating temperature.
2. Set tachometer
3. Connect spare fuse to diagnosis switch terminal in junction/fuse block, and amount of air supplied by ISC solenoid valve will be kept constant.

NOTE:

At this time, "CHECK ENGINE" light should indicate diagnostic code No. 12. If not, check and repair according to "Diagnostic Flow Chart" on p. 6E-37.

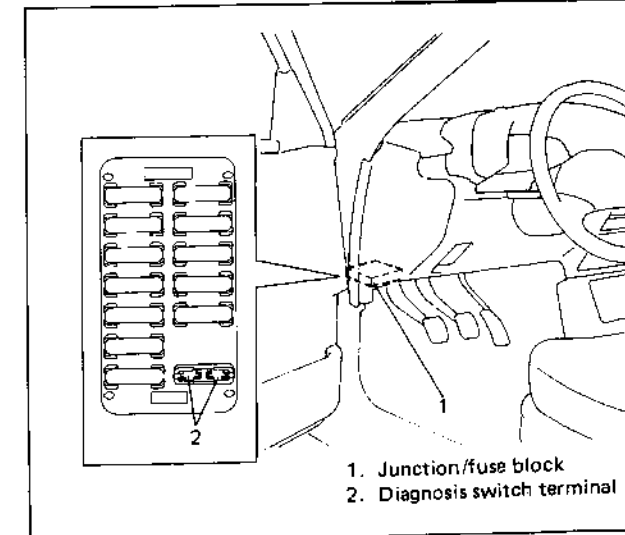


Fig. 6E-95 Grounding Diagnosis Switch Terminal

4. Check to ensure that idle speed is within below specification.

|                   |                 |
|-------------------|-----------------|
| Engine Idle speed | 850 ± 50 r/min. |
|-------------------|-----------------|

5. If idle speed is not within specified range, adjust it by turning idle speed adjusting screw.

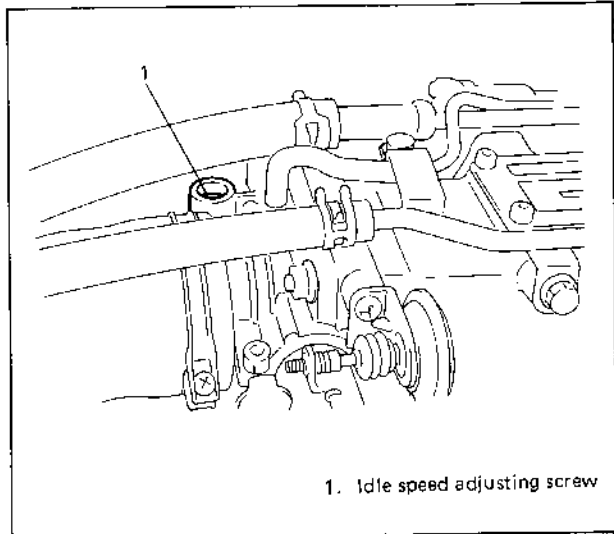


Fig. 6E-96 Idle Speed Adjusting Screw

6. This step is for checking and/or adjusting engine idle speed when air-conditioner is working.

With cars without air conditioner, advance to steps 7 and 8. With air-conditioner equipped ones, follow procedure described below.

- 1) Turn air-conditioner switch ON and set heater blower switch to low speed position. Then check that air-conditioner is working.
- 2) Check to ensure that idle speed is within below specification.

|                                           |                 |
|-------------------------------------------|-----------------|
| Engine idle speed with air-conditioner ON | 900 ± 50 r/min. |
|-------------------------------------------|-----------------|

3) If it is not within specified range, adjust it by turning adjusting screw of air-conditioner VSV.

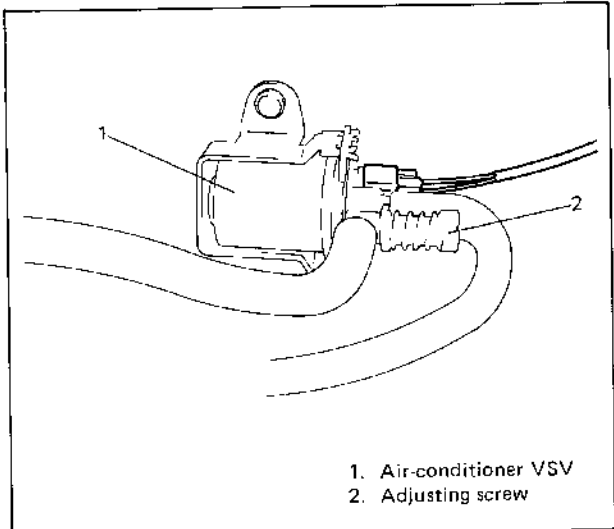


Fig. 6E-97 Adjusting Screw for Air-Con. VSV

7. Upon completion of adjustment, install adjusting screw cap to throttle body.
8. Disconnect spare fuse from diagnosis switch terminal.

## AIR INTAKE SYSTEM

### THROTTLE BODY

#### On-Car Inspection

- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.  
With finger placed against vacuum nozzle, increase engine speed a little and check that vacuum is applied.

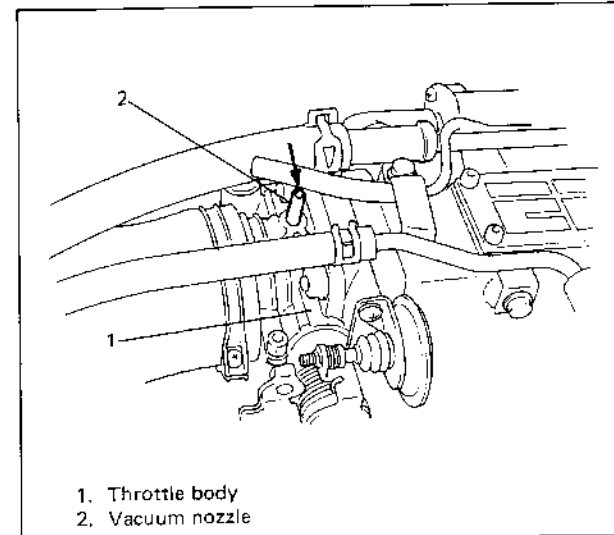


Fig. 6E-98 Checking Vacuum Passage

### Removal

1. Disconnect battery negative cable at battery.
2. Drain cooling system.
3. Disconnect accelerator cable from throttle valve lever and cable bracket.
4. Remove AFM outlet hose.
5. Disconnect TPS coupler.
6. Disconnect vacuum hose from throttle body.
7. Disconnect engine cooling water hoses from throttle body.

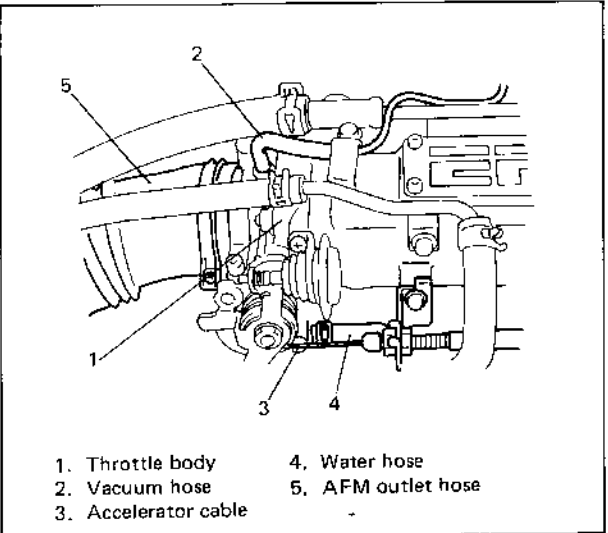


Fig. 6E-99 Disconnecting Hoses, Cable, etc.

8. Remove throttle body from intake manifold.

### Cleaning

Clean below passage by blowing compressed air.

#### NOTE:

- TPS, dash-pot and other components containing rubber (resin) or throttle valve shaft seals must not be placed in a solvent or cleaner bath. Chemical reaction will cause these parts to swell, harden or get distorted.
- Don't put drills or wires into passages for cleaning. It causes damage in passages.

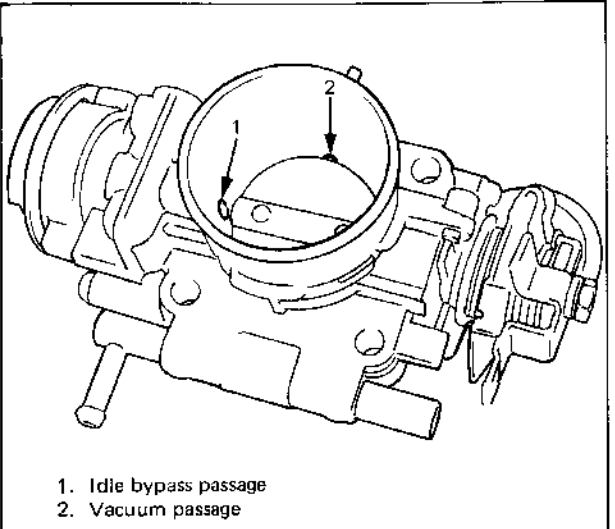


Fig. 6E-100 Cleaning Passage

### Installation

1. Clean mating surfaces and install throttle body gasket to intake manifold. Use new gasket.
2. Install throttle body to intake manifold and tighten bolts and nuts to specified torque.

| Tightening torque for throttle body bolts & nuts | N·m     | kg·m      | lb·ft       |
|--------------------------------------------------|---------|-----------|-------------|
|                                                  | 18 - 28 | 1.8 - 2.8 | 13.0 - 20.0 |

3. Connect water hoses.
4. Connect vacuum hose.
5. Connect TPS coupler securely.
6. Install AFM outlet hose and clamp it securely.
7. Install accelerator cable to throttle valve lever and cable bracket.  
Adjust cable play to specification according to procedure described on p. 6E-73.
8. Refill cooling system referring to Section 6B.
9. Connect negative cable at battery.

AIR VALVE

On-Car Inspection

This is an easy on-car check. For further complete check, remove air valve and check it as shown in Fig. 6E-102.

1. With engine stopped, remove air valve cap.  
Check visually that air valve is open when engine is cool (engine cooling water temp. is 60°C, 140°F or lower) and closed when engine is hot (engine cooling water temp. 70°C, 158°F or higher).

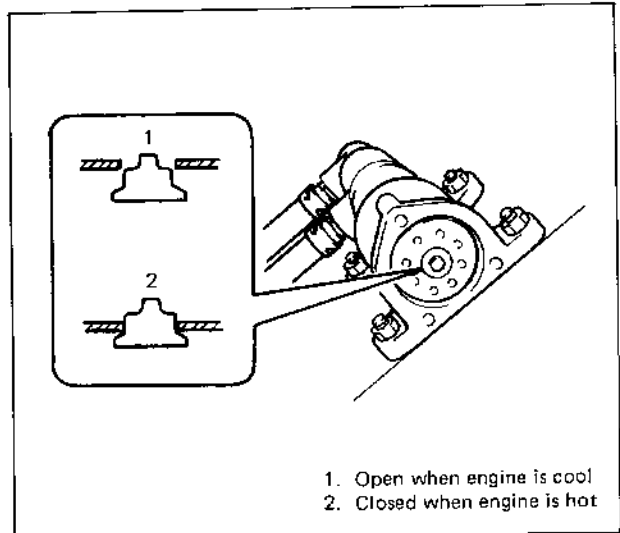


Fig. 6E-101 Checking Air Valve

2. Be sure to use new gasket when reinstalling air valve cap.

Removal

1. Disconnect negative cable from battery.
2. Drain cooling system.
3. Disconnect engine cooling water hoses from air valve.
4. Disconnect air hose.
5. Remove air valve from intake manifold.

Inspection

1. Remove air valve cap.
2. Immerse thermo wax of air valve in water as shown below. Check visually that air valve closes gradually as water temperature rises and closes fully at higher than about 70°C, 158°F.

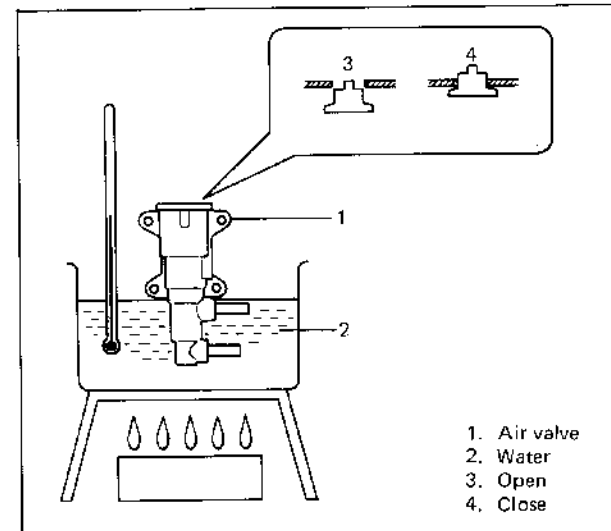


Fig. 6E-102 Checking Air Valve

Installation

Reverse removal procedure noting the following.

- Use new gasket.
- Clamp hoses securely.

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1. Relieve fuel pressure according to procedure described on p. 6-3.
2. Remove ISC solenoid valve and EGR modulator bracket (if equipped).
3. Disconnect fuel feed hose from fuel delivery pipe.

CAUTION:

A small amount of fuel may be released after fuel line is disconnected.  
In order to reduce chance of personal injury, cover fitting to be disconnected with a shop cloth. Place that cloth in an approved container when disconnection is completed.

4. Connect special tool (fuel pressure gauge, hose & 3-way joint) between fuel delivery pipe and fuel feed hose, and clamp hoses securely to ensure no leak occurs during checking.

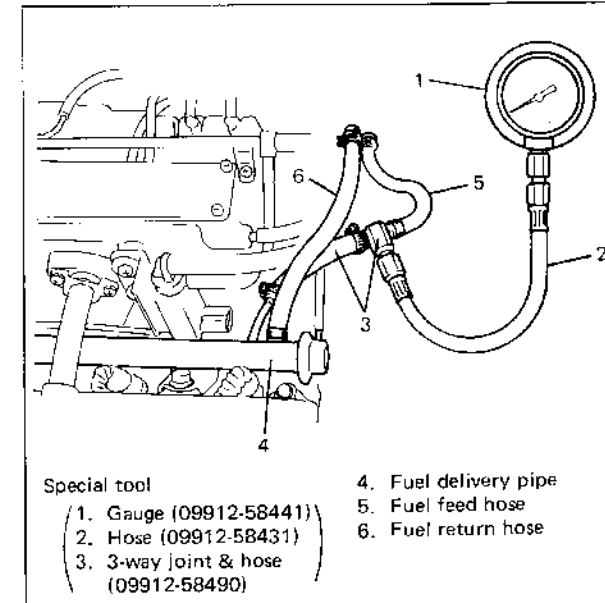


Fig. 6E-103 Connecting Fuel Pressure Gauge

5. Check that battery voltage is above 11V.
6. Remove fuel pump relay from main fuse box after disconnecting its coupler, and then re-connect coupler to fuel pump relay.

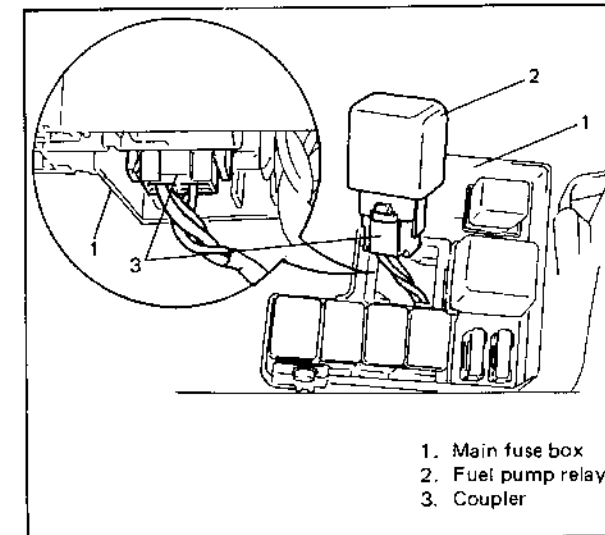


Fig. 6E-104 Removing Fuel Pump Relay

7. To operate fuel pump, connect Pink and White/Blue wire terminals by using service wire and then turn ON ignition switch.

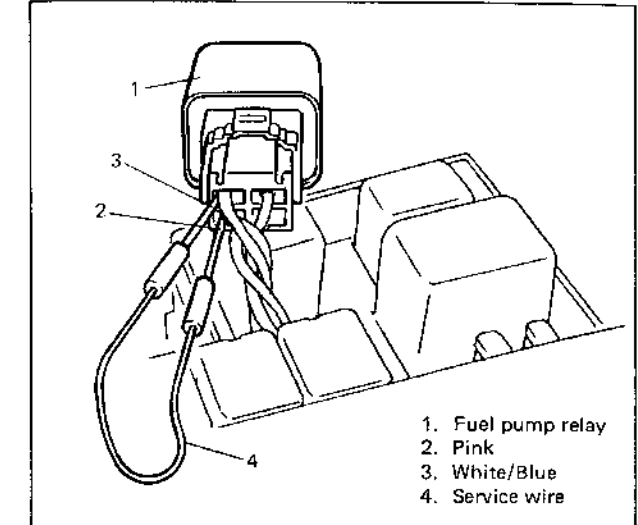


Fig. 6E-105 Operating Fuel Pump

8. Measure fuel pressure under each of following conditions.

| CONDITION                                                         | FUEL PRESSURE                                                    |
|-------------------------------------------------------------------|------------------------------------------------------------------|
| With fuel pump operating and engine at stop                       | 2.5 – 2.7 kg/cm <sup>2</sup><br>250 – 270 kPa<br>35.5 – 38.4 psi |
| For 1 min. after fuel pump stop (Pressure reduces as time passes) | Over 1.8 kg/cm <sup>2</sup><br>180 kPa<br>25.6 psi               |

9. Disconnect service wire.
10. Install ISC solenoid valve.
11. Start engine and warm it up to normal operating temperature.  
Measure fuel pressure at specified idle speed.

| CONDITION               | FUEL PRESSURE                                                    |
|-------------------------|------------------------------------------------------------------|
| At specified idle speed | 1.8 – 2.1 kg/cm <sup>2</sup><br>180 – 210 kPa<br>25.6 – 29.9 psi |

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Chart B-3" and check each possibly defective part. Replace if found defective.

12. Relieve fuel pressure according to procedure described on p. 6-3.
13. Remove fuel pressure gauge, hose & 3-way joint after removing ISC solenoid valve.
14. Connect fuel feed hose to fuel delivery pipe and clamp it securely.

- 15. Install ISC solenoid valve and EGR modulator bracket (if equipped).
- 16. Start engine and check for fuel leaks.

FUEL PUMP

Fuel Pump On-Car Inspection

**CAUTION:**  
When fuel filler cap is removed in any procedure, work must be done with no smoking, in a well-ventilated area and away from any open flames.

- 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.

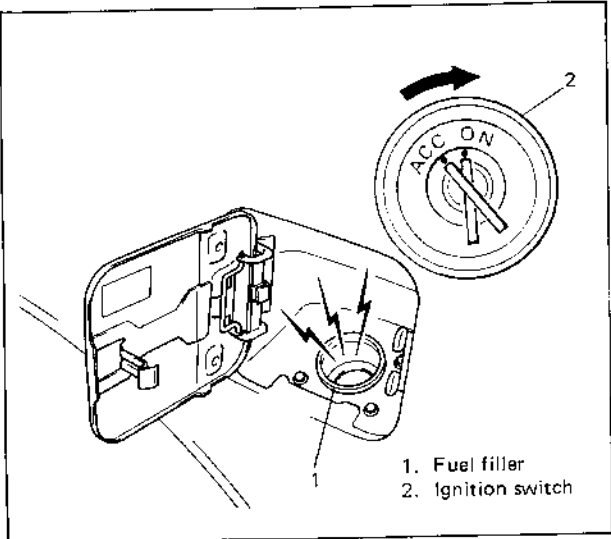


Fig. 6E-106 Checking Fuel Pump

- If above check result is not satisfactory, advance to "Diagnostic Flow Chart B-1".
- 2. Fuel pressure should be felt at fuel return hose for 3 seconds after ignition switch ON.

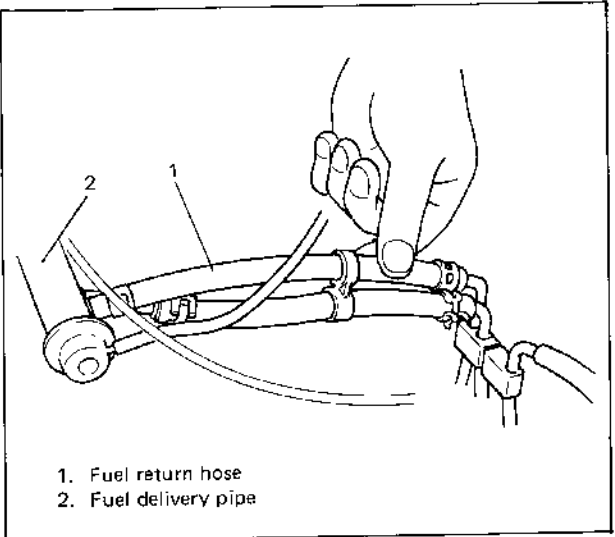


Fig. 6E-107 Checking Fuel Pressure

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 & level gauge from fuel tank.

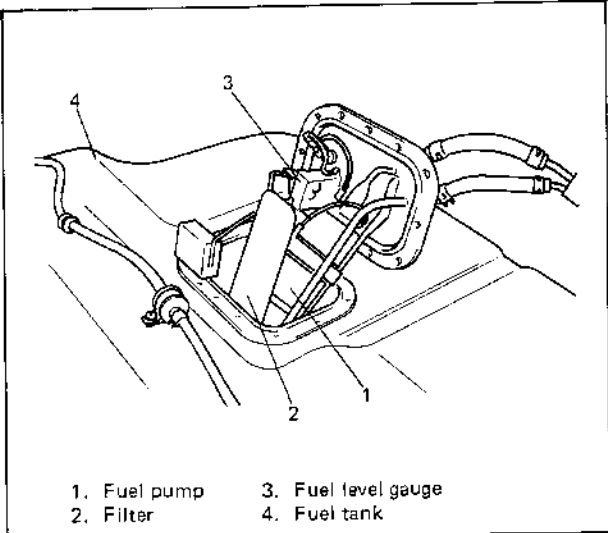


Fig. 6E-108 Removing Fuel Pump & Level Gauge

- 2. Remove fuel pump from its bracket.

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 & level gauge to fuel tank and then install fuel tank to body according to procedure described in section 6C.

FUEL DELIVERY PIPE (FUEL PRESSURE REGULATOR)

For removal and installation of fuel delivery pipe, refer to item "FUEL INJECTOR".

FUEL INJECTOR

On-Car 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.

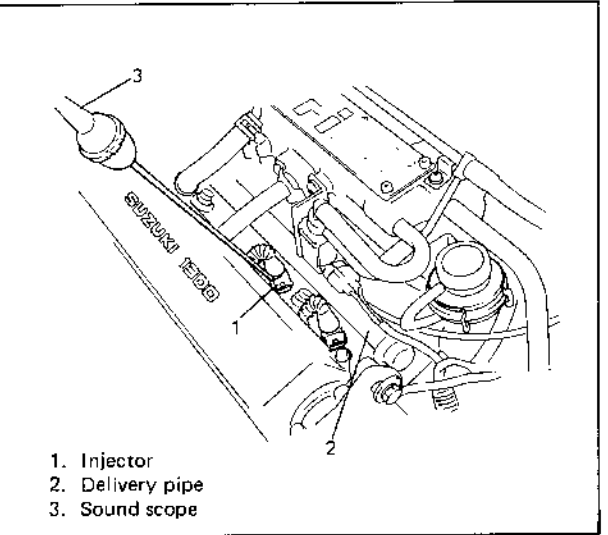


Fig. 6E-109 Checking Injector Operation

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 | 1.5 - 2.2 $\Omega$ |
|------------------------|--------------------|

If resistance is out of specification, replace.

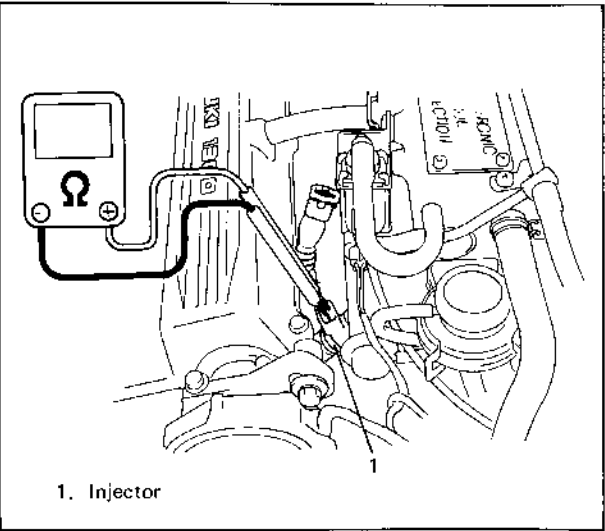


Fig. 6E-110 Checking Injector Resistance

- 3. Connect coupler to injector securely.

Removal

- 1. Relieve fuel pressure according to procedure described on p. 6-3.
- 2. Disconnect battery negative cable at battery.
- 3. Remove ISC solenoid valve and EGR modulator bracket from intake manifold.
- 4. Disconnect fuel hoses (fuel feed and return hoses) and vacuum hose from delivery pipe.
- 5. Disconnect coupler from each injector.
- 6. Remove fuel delivery pipe with fuel injectors.

NOTE:

Be careful not to drop injectors.

- 7. Remove injectors from delivery pipe.

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.

- 1. Install injectors to fuel delivery pipe and hold them with special tool (injector holder).
- 2. Connect fuel delivery pipe and fuel pipes (fuel feed pipe and return pipe) of car with fuel hoses (special tool). Clamp them securely.
- 3. Connect special tool (injector test lead) to injector.

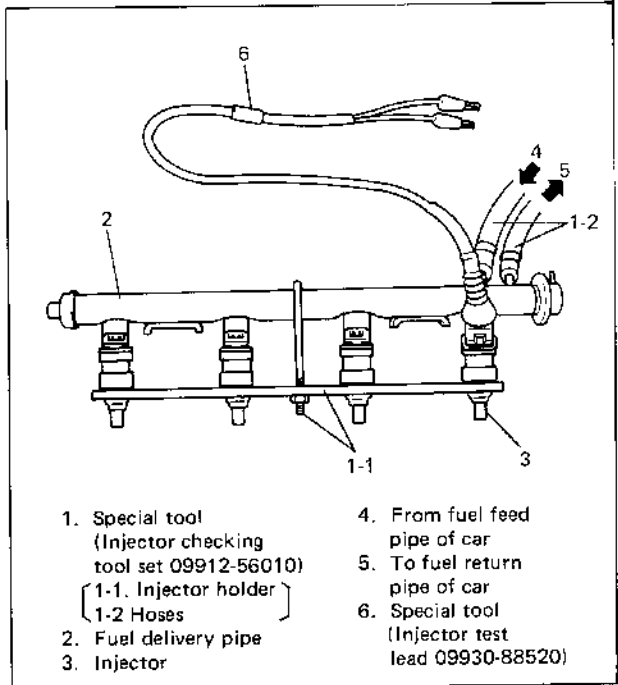


Fig. 6E-111 Installation of Checking Tool Set

- 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. Operate fuel pump according to procedure described on p. 6E-77.
- 7. Check fuel hose connections for fuel leakage.
- 8. Connect injector test lead to battery for 15 seconds and measure injected fuel volume with graduated cylinder.

**WARNING:**  
When connecting or disconnecting lead wire to battery which actuates injector, spark is emitted and fuel or its vapor from injector may catch fire. To prevent such a danger, keep injector and cylinder as far apart as possible from battery, electric devices and open flames.

Test each injector two or three times.  
If not within specification, replace injector.

|                      |                                                                |
|----------------------|----------------------------------------------------------------|
| Injected fuel volume | 59 – 72 cc/15 sec<br>(1.99/2.08 – 2.43/2.53 US/Imp. oz/15 sec) |
|----------------------|----------------------------------------------------------------|

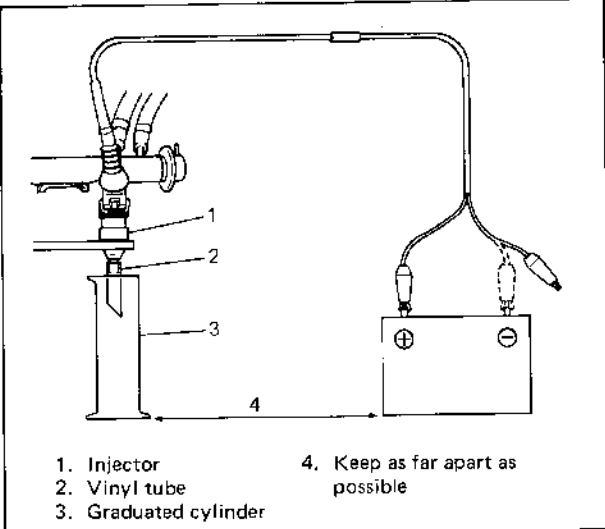


Fig. 6E-112 Checking Injection Amount

- 9. After checking injection volume, 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. |
|--------------|-----------------------|

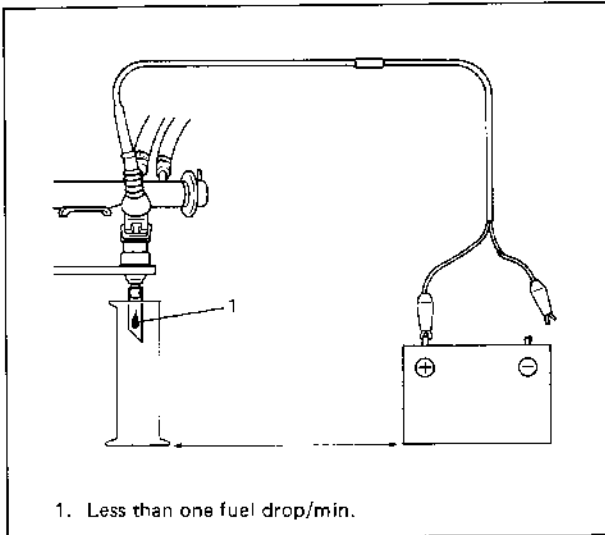


Fig. 6E-113 Checking Fuel Leakage

- 10. In the same way, also check injection volume and leakage of other 3 injectors.
- 11. Disconnect service wire from fuel pump relay. Then release fuel pressure in fuel feed line by actuating injector.
- 12. Remove special tool from injectors and fuel delivery pipe.

Installation

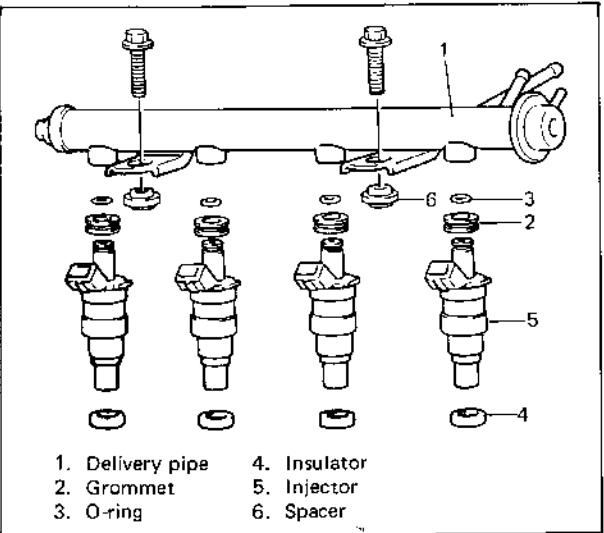


Fig. 6E-114 Fuel Injector, Delivery Pipe, etc.

- 1. Replace injector O-ring with new one using care not to damage it. Install grommet to injector.
- 2. Apply thin coat of fuel to O-rings and then install injectors into delivery pipe. Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring. Replace it with new one.

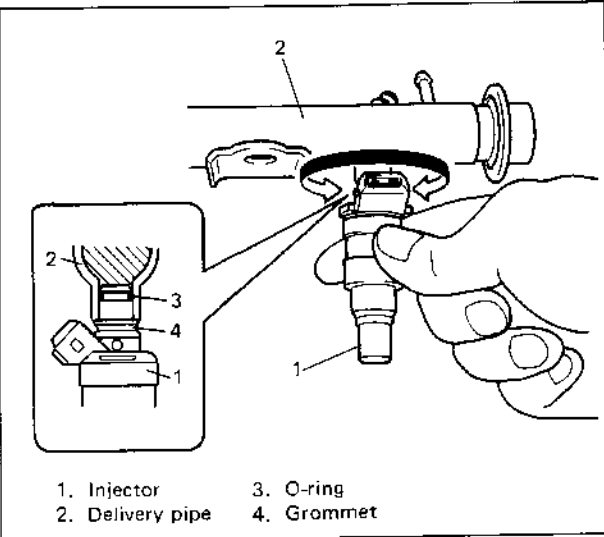


Fig. 6E-115 Checking O-ring Installation

- 3. Check if insulator is scored or damaged. If it is, replace with new one.  
Install insulators and spacers to cylinder head.

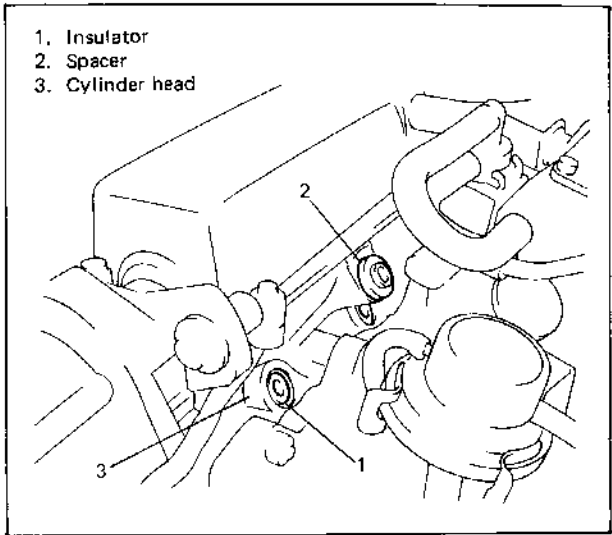


Fig. 6E-116 Installing Insulators and Spacers

- 4. Install injectors with delivery pipe and tighten delivery pipe bolt to specified torque. Make sure that injectors rotate smoothly.

|                                          |         |           |             |
|------------------------------------------|---------|-----------|-------------|
| Tightening torque of delivery pipe bolts | N·m     | kg·m      | lb·ft       |
|                                          | 18 – 28 | 1.8 – 2.8 | 13.5 – 20.0 |

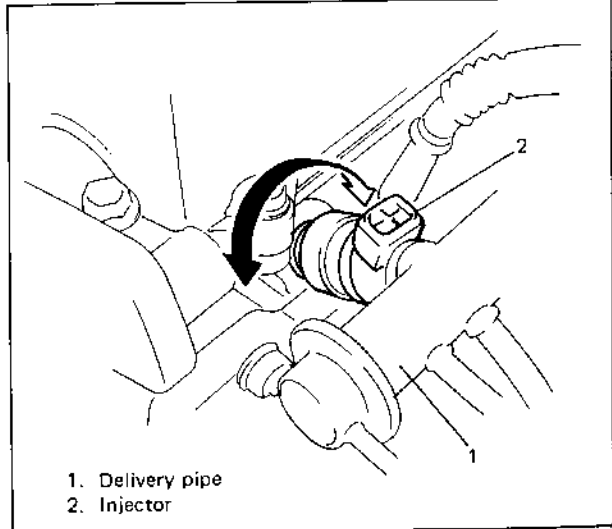


Fig. 6E-117 Checking Injector Installation

- 5. Connect fuel hoses and vacuum hose to delivery pipe.
- 6. Connect couplers to injectors securely.
- 7. Install EGR modulator bracket and ISC solenoid valve to intake manifold.
- 8. Connect battery negative cable.
- 9. With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.



ELECTRONIC CONTROL SYSTEM

ELECTRONIC CONTROL MODULE (ECM)

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

Removal

- 1. Disconnect battery negative cable at battery.
- 2. Lower junction/fuse block after removing its bolts.
- 3. Disconnect couplers from ECM while releasing coupler lock.
- 4. Remove ECM from body.

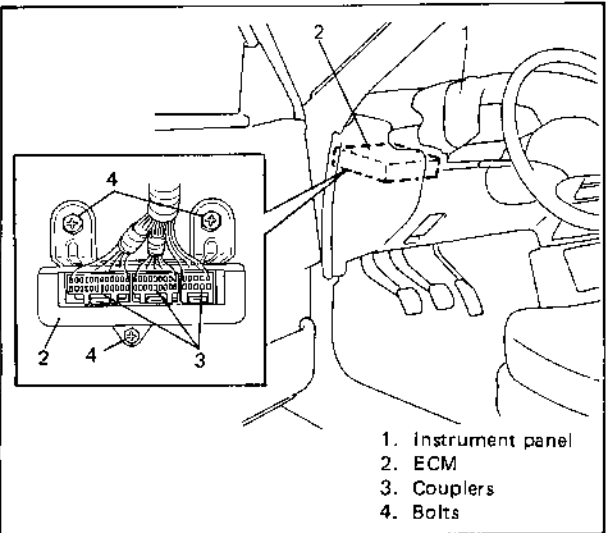


Fig. 6E-118 Removing ECM

Installation

- 1. Install ECM to body.
- 2. Connect couplers to ECM securely.
- 3. Fix junction/fuse block with bolts.
- 4. Connect battery negative cable at battery.

Inspection

Refer to P. 6E-68 for inspection.

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

AIR FLOW METER (AFM)

**NOTE:**  
Don't separate air flow sensor from its body.  
(Don't disassemble AFM.)

Removal

- 1. Disconnect battery negative cable at battery.
- 2. Remove AFM with air cleaner case.
- 3. Disconnect coupler from AFS.
- 4. Separate AFM from air cleaner case.

Inspection

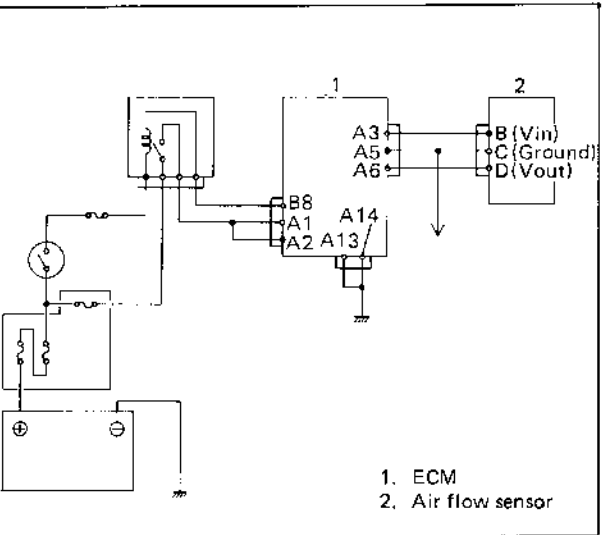


Fig. 6E-119 AFS Circuit

**NOTE:**  
Use voltmeter with high-impedance (10 k $\Omega$ /V minimum) or digital type voltmeter.

- 1. Connect AFS coupler.
  - 2. Remove coupler seal from AFS coupler.
  - 3. Connect battery negative cable.
  - 4. Connect voltmeter between coupler terminals "B" and "C".
- Turn ignition switch ON and check that voltage is about 12V.

If not, check if wire harness is open or connection at A3 and A5 is poor.

- 5. After confirming voltage between "B" and "C" as in step 4, check voltage (signal voltage) between "D" and "C".
- Voltmeter reading should be as specified below when air is not blown to hot wire, while it should increase as air is blown harder.

|                                      |                |
|--------------------------------------|----------------|
| Signal voltage when air is not blown | 0.2 – 0.8 volt |
|--------------------------------------|----------------|

**NOTE:**  
It is strictly prohibited to blow compressed air by using air gun or the like.

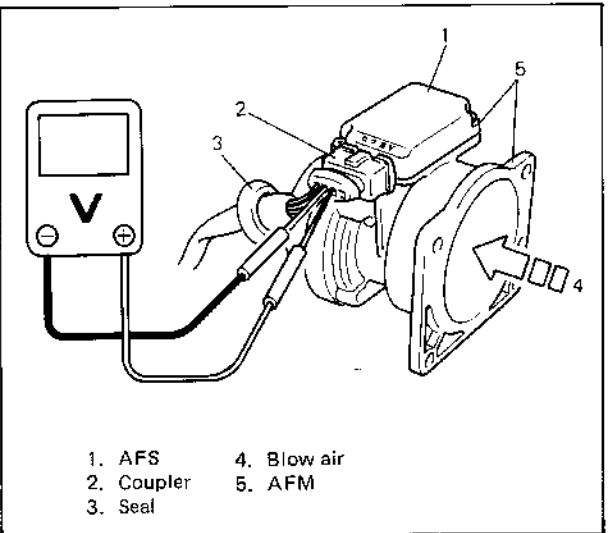


Fig. 6E-120 Checking AFS

If check result doesn't satisfy above description, AFS coupler connection is poor or AFS is faulty.

- 6. Install coupler seal securely.

Installation

- 1. Install AFM to air cleaner case.  
Check AFM gasket for damage or deterioration. Replace if necessary.
- 2. Connect coupler to AFS.
- 3. Install air cleaner case with AFM to body.
- 4. Connect battery negative cable.

THROTTLE POSITION SENSOR (TPS)

Inspection

- 1. Disconnect battery negative cable at battery.
- 2. Disconnect TPS coupler.
- 3. Using ohmmeter, check resistance between each terminals under each condition given in below table.

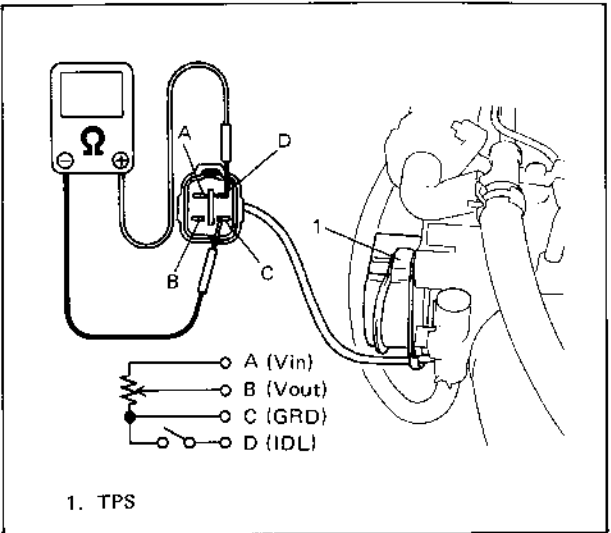


Fig. 6E-121 Checking TPS

| TERMINALS                               | CONDITION                                                         | RESISTANCE           |
|-----------------------------------------|-------------------------------------------------------------------|----------------------|
| Between C and D terminals (Idle switch) | When throttle lever-to-stop screw clearance is 0.3 mm (0.012 in.) | 0 – 500 $\Omega$     |
|                                         | When throttle lever-to-stop screw clearance is 0.9 mm (0.035 in.) | $\infty$             |
| Between C and A terminals               | —                                                                 | 3.5 – 6.5 k $\Omega$ |
| Between C and B terminals               | Throttle valve is at idle position                                | 0 – 500 $\Omega$     |
|                                         | Throttle valve is fully opened                                    | 3.5 – 6.5 k $\Omega$ |

If idle switch check result is not satisfactory, adjust installation angle of TPS and if found defective in the other check, replace TPS.

- 4. Connect TPS coupler securely.
- 5. Connect battery negative cable.

Adjustment

1. Disconnect battery negative cable and disconnect TPS coupler.
2. Loosen TPS screws.
3. Insert 0.65 mm (0.025 in) thickness gauge between throttle stop screw and throttle lever.

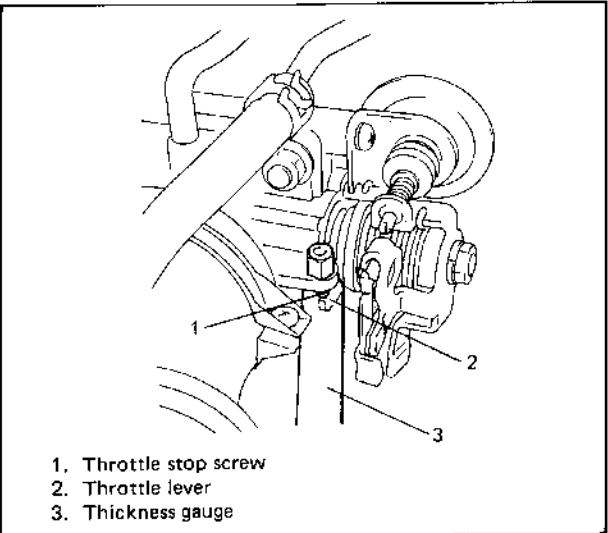


Fig. 6E-122 Inserting Thickness Gauge

4. Connect ohmmeter between C and D terminals.
5. First, turn TPS clockwise fully and then counterclockwise gradually to find position where ohmmeter reading changes from 0 (Zero, continuity) to  $\infty$  (no continuity). Then fix TPS at that position by tightening screws to specified torque.

| Tightening torque of TPS screw | N-m | kg-m | lb-ft |
|--------------------------------|-----|------|-------|
|                                | 3.5 | 0.35 | 2.5   |

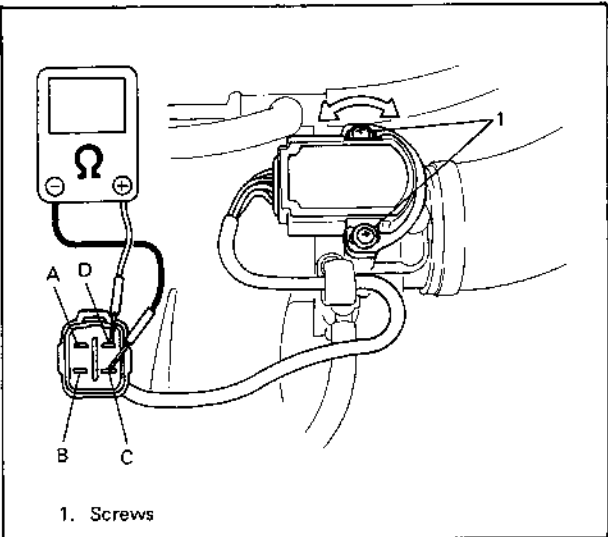


Fig. 6E-123 Adjusting TPS

6. Check that there is no continuity between terminals C and D when 0.9 mm (0.035 in) thickness gauge is inserted.
7. Check that there is continuity between terminals C and D when 0.3 mm (0.012 in) thickness gauge is inserted.

If check result is unsatisfactory in steps 6 and 7, it means that installation angle of TPS is not adjusted properly. Therefore, start all over again from step 1.

**CAUTION:**  
As throttle stop screw is factory adjusted precisely, don't remove or adjust it.

8. Connect coupler to TPS securely and connect battery negative cable.

Removal

1. Disconnect battery negative cable at battery.
2. Disconnect coupler from TPS.
3. Remove TPS from throttle body.

Installation

1. Install TPS and guard plate to throttle body. Then hand-tighten TPS screws.

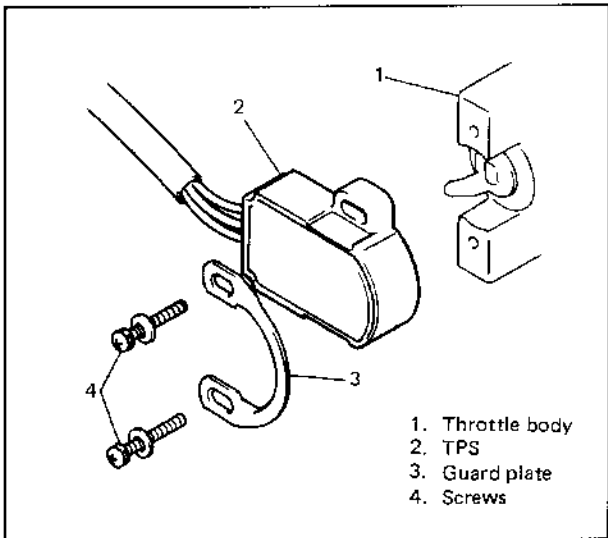


Fig. 6E-124 Installing TPS

2. Adjust intallation angle of TPS according to procedure described in item "Adjustment".
3. Connect coupler to TPS securely.
4. Connect battery negative cable to battery.

WATER TEMPERATURE SENSOR (WTS)

Removal

1. Disconnect battery negative cable at battery.
2. Drain engine cooling system.
3. Disconnect WTS coupler.
4. Remove WTS from cylinder head.

Inspection

Immerse temperature sensing part of WTS 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 Fig. 6E-126, replace WTS.

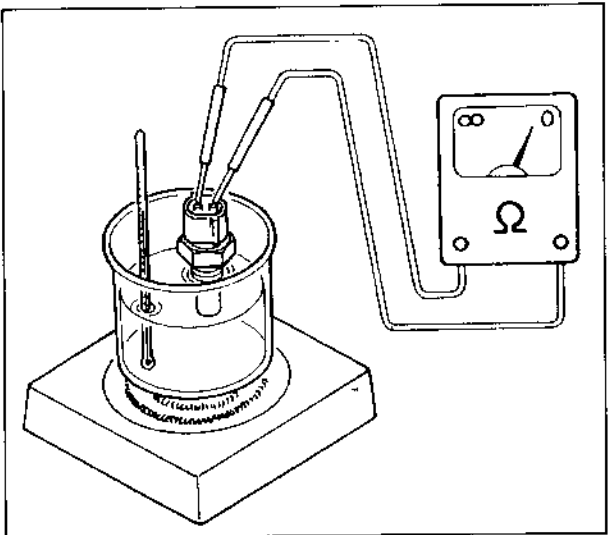


Fig. 6E-125 Checking WTS

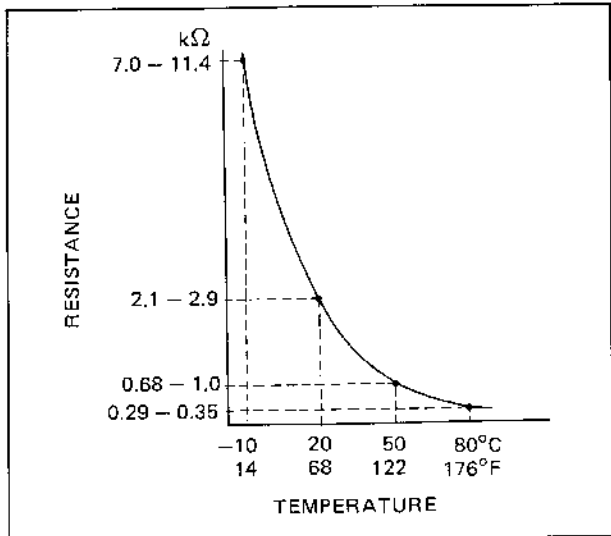


Fig. 6E-126 WTS Characteristic

Installation

Reverse removal procedure noting the following.

- Check gasket for damage and replace if necessary.
- Tighten WTS to specified torque.

| Tightening torque for WTS | N-m    | kg-m      | lb-ft      |
|---------------------------|--------|-----------|------------|
|                           | 5 - 15 | 0.5 - 1.5 | 4.0 - 10.5 |

- Connect coupler to WTS securely.
- Be sure to check that no cooling water leakage exists after installation.

OXYGEN SENSOR

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 and release its wire harness from clamps.
3. Remove oxygen sensor from exhaust manifold.

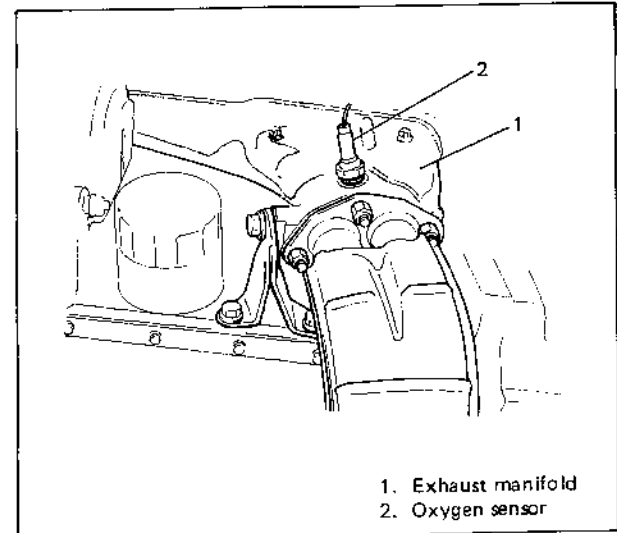


Fig. 6E-127 Removing Oxygen Sensor



Installation

Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

| Tightening torque for oxygen sensor | N-m     | kg-m      | lb-ft       |
|-------------------------------------|---------|-----------|-------------|
|                                     | 45 – 55 | 4.5 – 5.5 | 33.0 – 39.5 |

- Connect coupler of oxygen sensor and clamp wire harness securely.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.

SPEED SENSOR

Inspection

1. Disconnect negative cable at battery.
2. Remove combination meter from instrument panel.
3. Connect ohmmeter between "GND" screw and "RSW" screw 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.

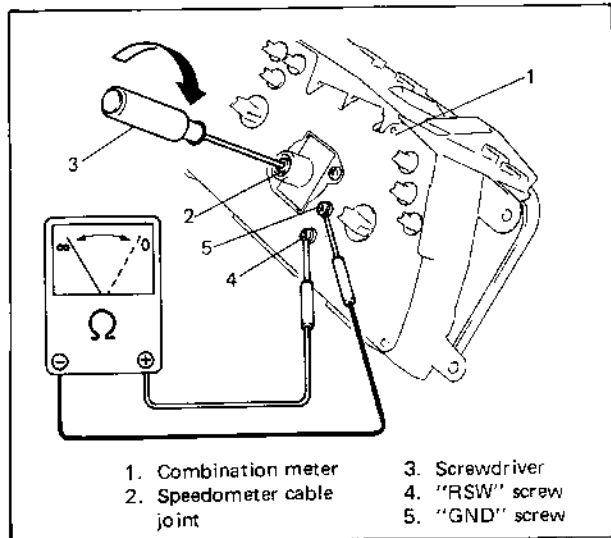


Fig. 6E-128 Checking Speed Sensor

Replace speedometer if check result is not satisfactory.

4. Install combination meter to instrument panel.
5. Connect negative cable to battery.

RECIRCULATED EXHAUST GAS TEMPERATURE SENSOR (REGTS, For California spec. model only)

Removal

1. Disconnect battery negative cable.
2. Disconnect REGTS coupler.
3. Remove REGTS.

Inspection

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

If measured resistance doesn't show such characteristic as shown below, replace.

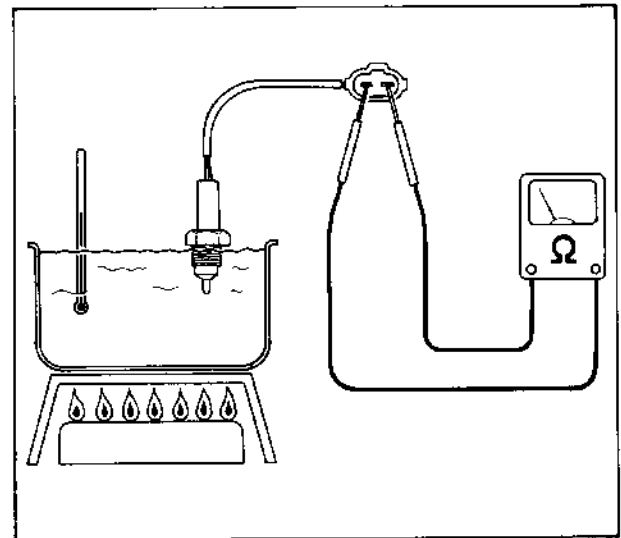


Fig. 6E-129 Checking REGTS

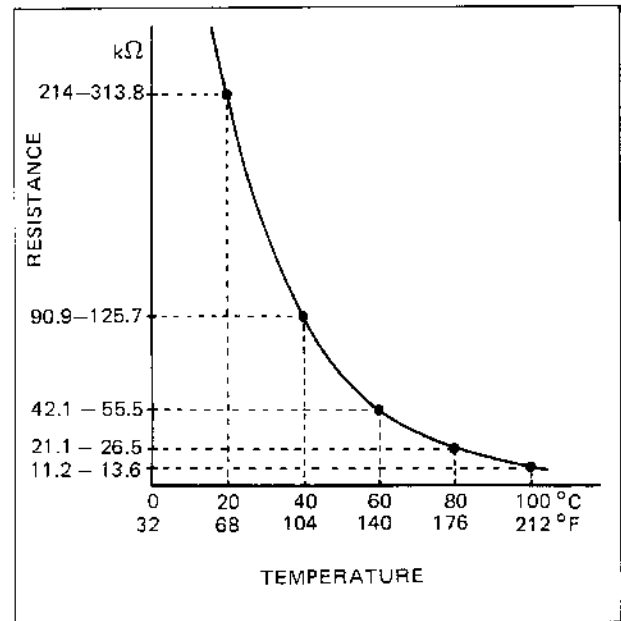


Fig. 6E-130 REGTS Characteristic

Installation

Reverse removal procedure noting the following.

- Tighten REGTS to specified torque.

| Tightening torque for REGTS | N-m     | kg-m      | lb-ft      |
|-----------------------------|---------|-----------|------------|
|                             | 10 – 20 | 1.0 – 2.0 | 7.5 – 14.0 |

- Connect sensor coupler securely.

MAIN RELAY

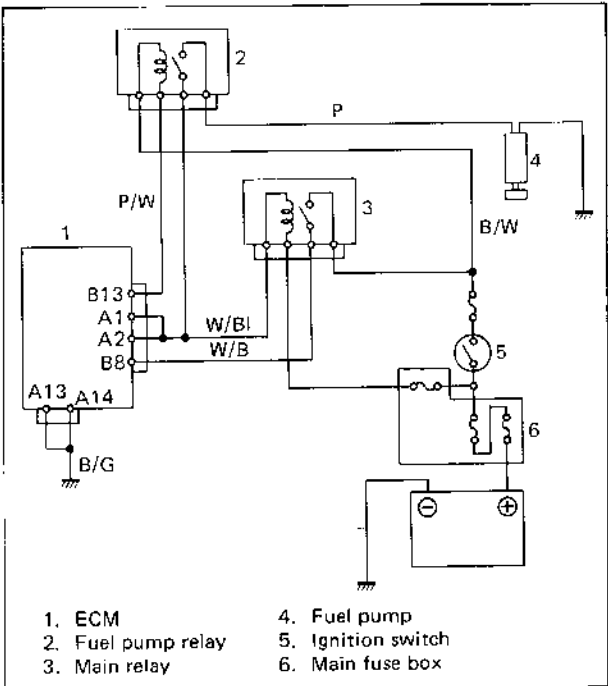


Fig. 6E-131 Main Relay and Fuel Pump Relay Circuits

Inspection

1. Disconnect negative cable at battery.
2. Remove main relay from main fuse box after disconnecting its coupler.

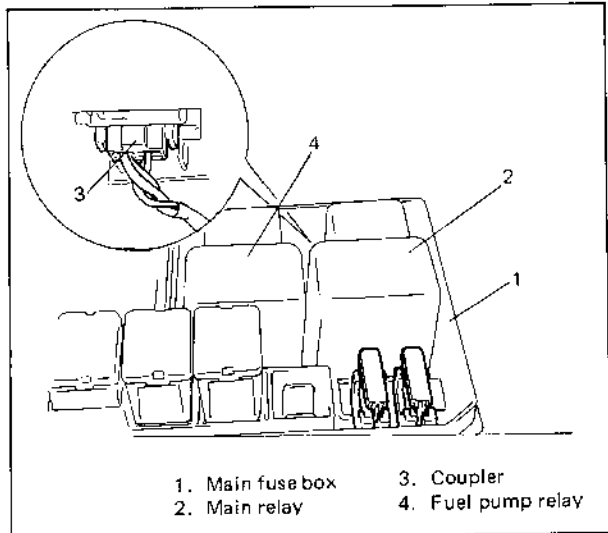


Fig. 6E-132 Removing Main Relay

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.

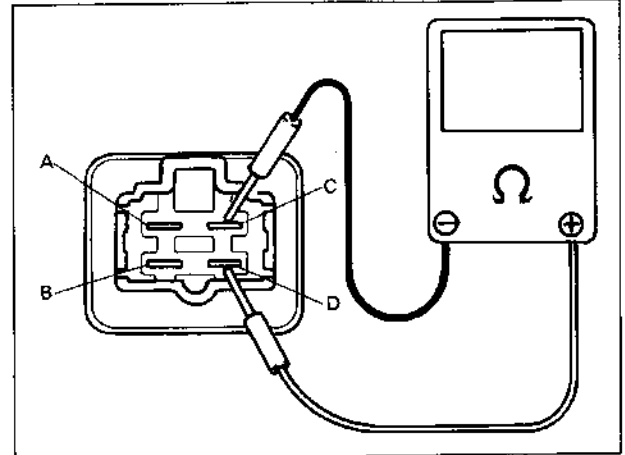


Fig. 6E-133 Checking Main Relay Resistance

| TERMINALS       | RESISTANCE   |
|-----------------|--------------|
| Between A and B | ∞ (infinity) |
| Between C and D | 56 – 84 Ω    |

4. Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".

If found defective, replace.

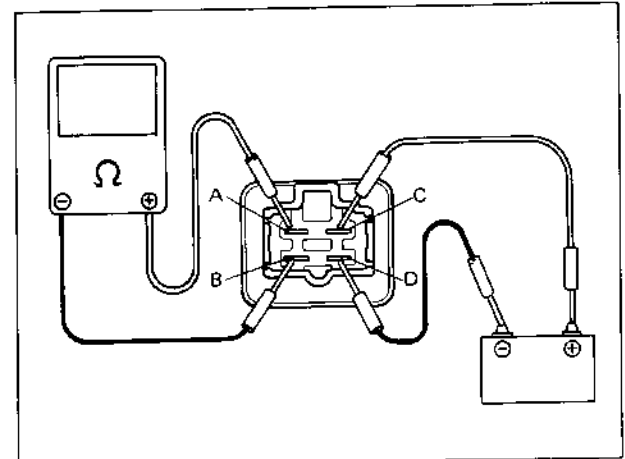


Fig. 6E-134 Checking Main Relay Operation

## 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.

## 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.

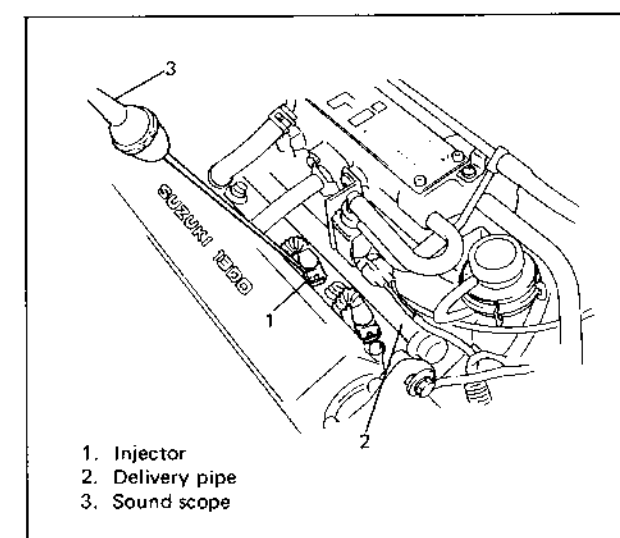


Fig. 6E-135 Checking Fuel Cut Operation

## ISC SOLENOID VALVE

## Inspection

1. With ignition switch "OFF", disconnect ISC solenoid valve coupler.
2. Check resistance between each two terminals of ISC solenoid valve.

|                                  |                  |
|----------------------------------|------------------|
| Resistance of ISC solenoid valve | 30 — 33 $\Omega$ |
|----------------------------------|------------------|

If it is within specification, proceed to next operation check. If not, replace.

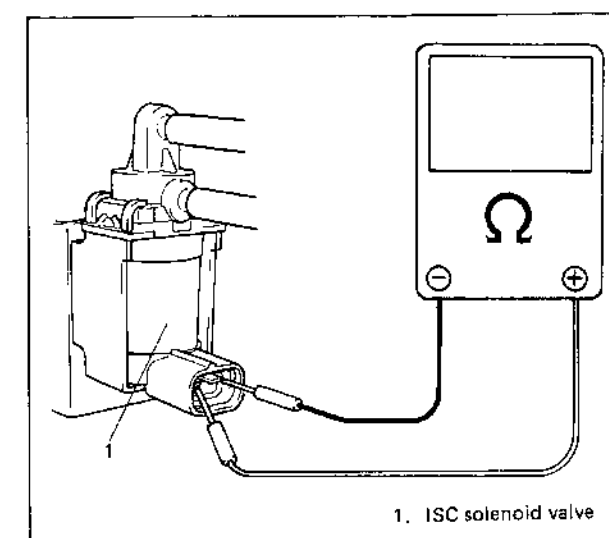


Fig. 6E-136 Checking Resistance

3. Disconnect ISC solenoid valve hoses from intake manifold and pipe.
4. Blow into nozzle "A". Air should not come out of nozzle "B".

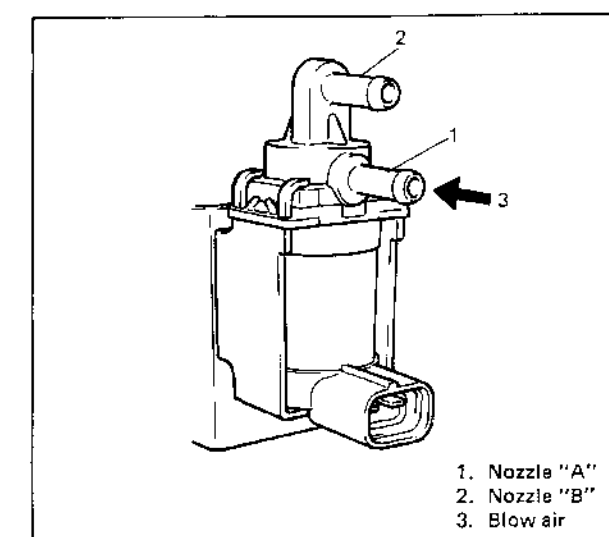


Fig. 6E-137 Checking ISC Solenoid Valve (1)

5. Connect 12V-battery to ISC solenoid valve terminals. In this state, blow nozzle "A". Air should come out of nozzle "B".

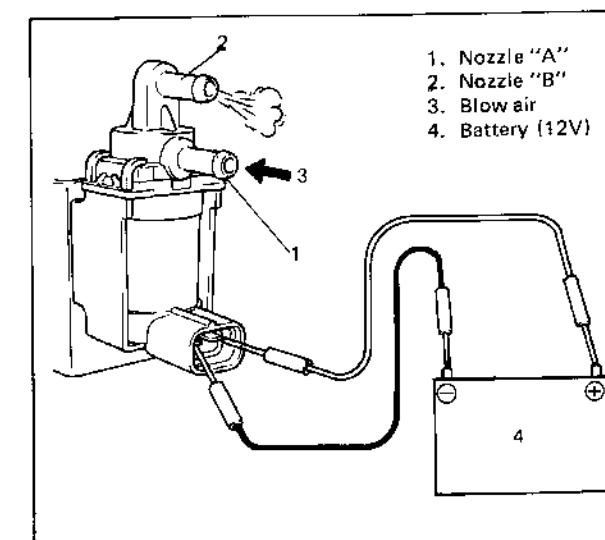


Fig. 6E-138 Checking ISC Solenoid Valve (2)

If check result is not as described above, replace ISC solenoid valve.

6. Connect ISC solenoid valve coupler securely.
7. Connect hoses to intake manifold and pipe securely.

## EGR CONTROL SYSTEM (For California spec. model only)

## System Inspection

## NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1. When engine is cool (cooling water temperature is below 50°C, 122°F), start engine and race it, and check that EGR valve diaphragm is not operating in this state.

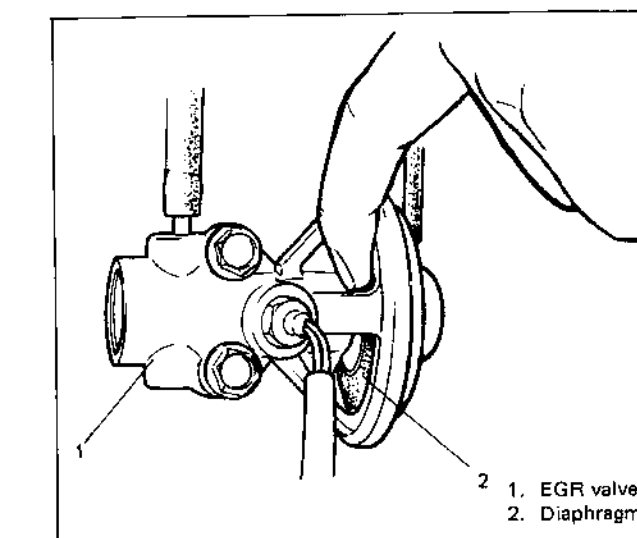


Fig. 6E-139 Checking EGR Valve Diaphragm

2. Warm up engine to normal operating temperature and race it after warming up. Then check to be sure that diaphragm moves toward 1 in Fig. 6E-140 during acceleration and toward 2 during deceleration.

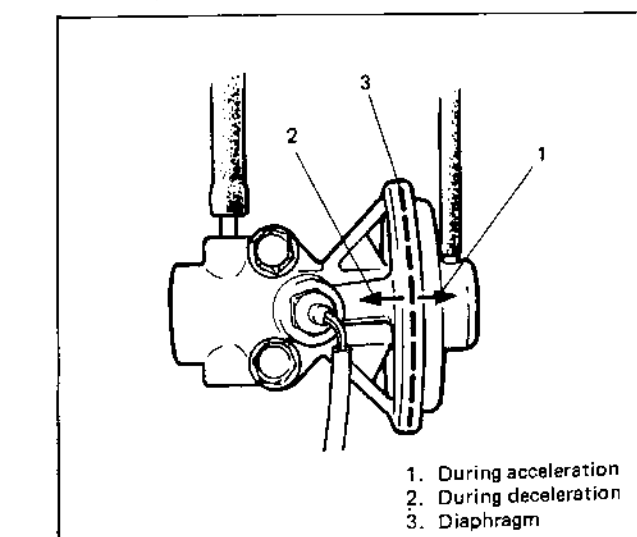


Fig. 6E-140 Movement of EGR Valve Diaphragm

If EGR valve fails to operate properly, check vacuum hoses EGR valve, EGR modulator, VSV, wire harness and ECM.

3. Keep engine running at idle speed and open EGR valve by hand, and engine should either stop or reduce its speed. If neither occurs, EGR passage is clogged. Clean it.

**Vacuum Hose Inspection**

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

**EGR Valve Inspection**

1. Disconnect vacuum hose from EGR modulator.
  2. Connect vacuum pump gauge to its hose.
  3. Check that EGR valve diaphragm moves smoothly and that it is held at the same position when 20 cmHg vacuum is applied to EGR valve.
- If diaphragm doesn't move smoothly, or it isn't held at the same position, replace EGR valve.

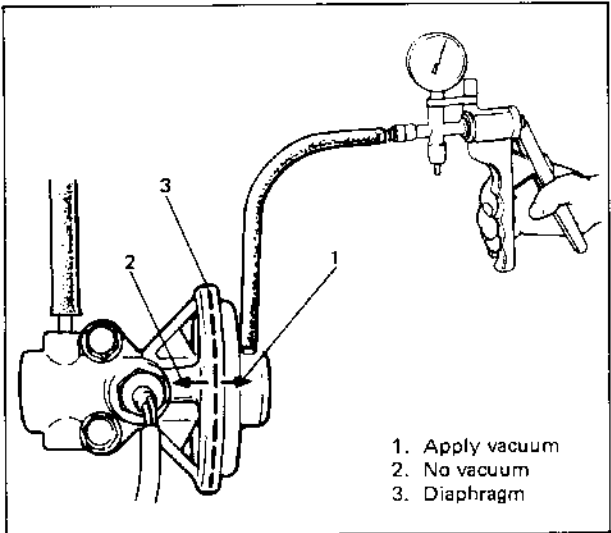


Fig. 6E-141 Checking EGR Valve

4. After checking, be sure to connect vacuum hose.

**EGR Modulator Inspection**

1. Check filter for contamination and damage. Using compressed air, clean filter.

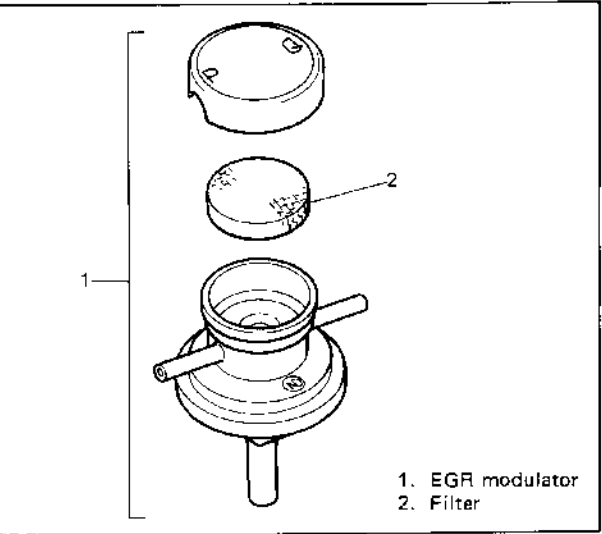


Fig. 6E-142 Filter of EGR Modulator

2. Remove EGR modulator and plug nozzle with finger. Blow air into another nozzle and check that air passes through to air filter side freely.

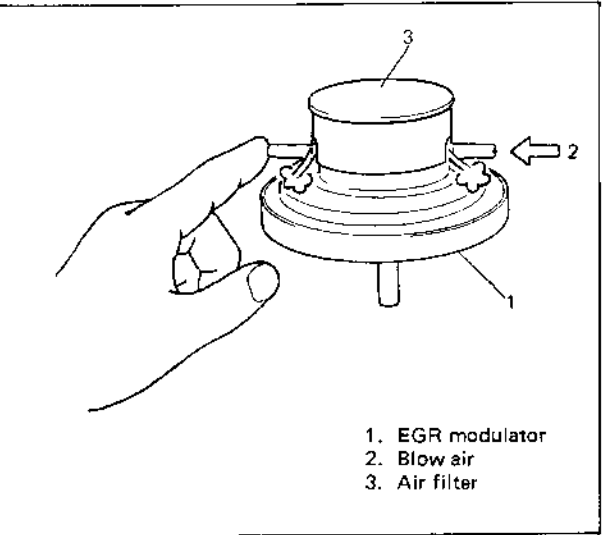


Fig. 6E-143 Checking EGR Modulator (1)

3. Connect vacuum pump gauge to nozzle "P" and plug nozzle "Q" with finger. While blowing air into nozzle "A", operate vacuum pump gauge and check that vacuum is applied to modulator. Then stop blowing nozzle "A" and check that vacuum pump gauge indicates "0" (zero). If check result is not satisfactory, replace EGR modulator.

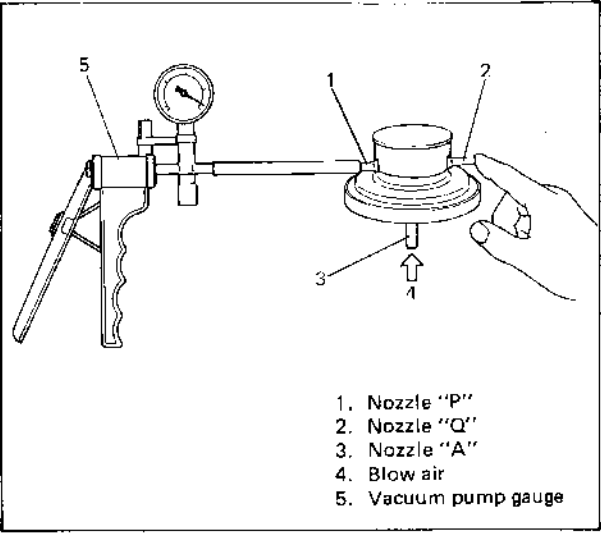


Fig. 6E-144 Checking EGR Modulator (2)

4. After checking, install modulator and connect hoses securely. Refer to emission control information label for connection.

**VSV (Vacuum Switching Valve) Inspection**

1. With ignition switch OFF, disconnect coupler from VSV.
2. Check resistance between two terminals of VSV.

|                       |           |
|-----------------------|-----------|
| Resistance of EGR VSV | 33 – 39 Ω |
|-----------------------|-----------|

If resistance is as specified, proceed to next operation check. If not, replace.

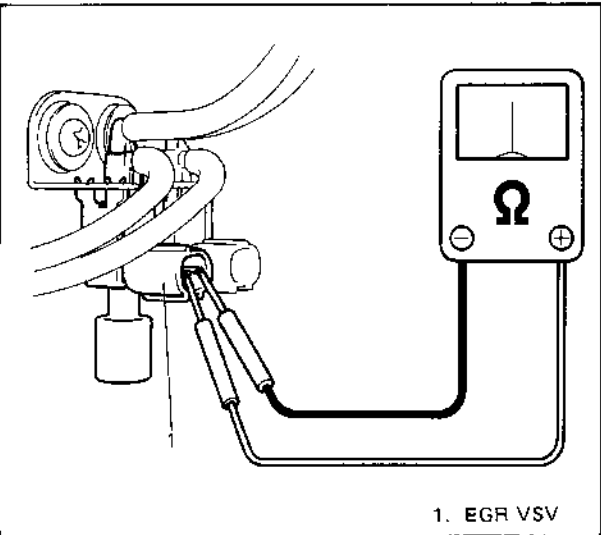


Fig. 6E-145 Checking Resistance

3. Remove VSV.
4. Blow into nozzle "A". Air should come out of filter and not out of nozzle "B".

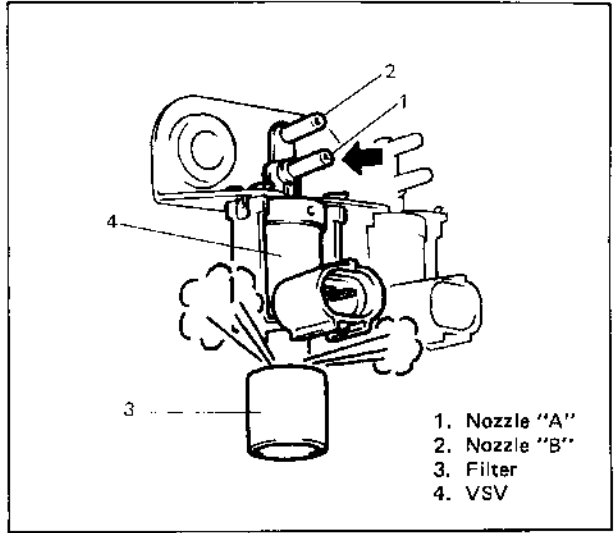


Fig. 6E-146 Checking VSV (1)

5. Connect 12V-battery to VSV terminals. In this state, blow nozzle "A". Air should come out of nozzle "B" and not out of filter.

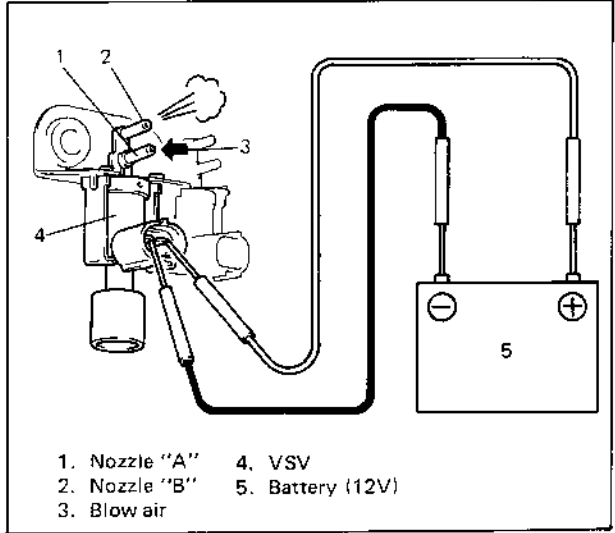


Fig. 6E-147 Checking VSV (2)

If check result is not as described above, replace VSV.

6. Install VSV and connect vacuum hoses. Refer to emission control information label for proper connection.
7. Connect VSV coupler securely.

EVAPORATIVE EMISSION CONTROL SYSTEM

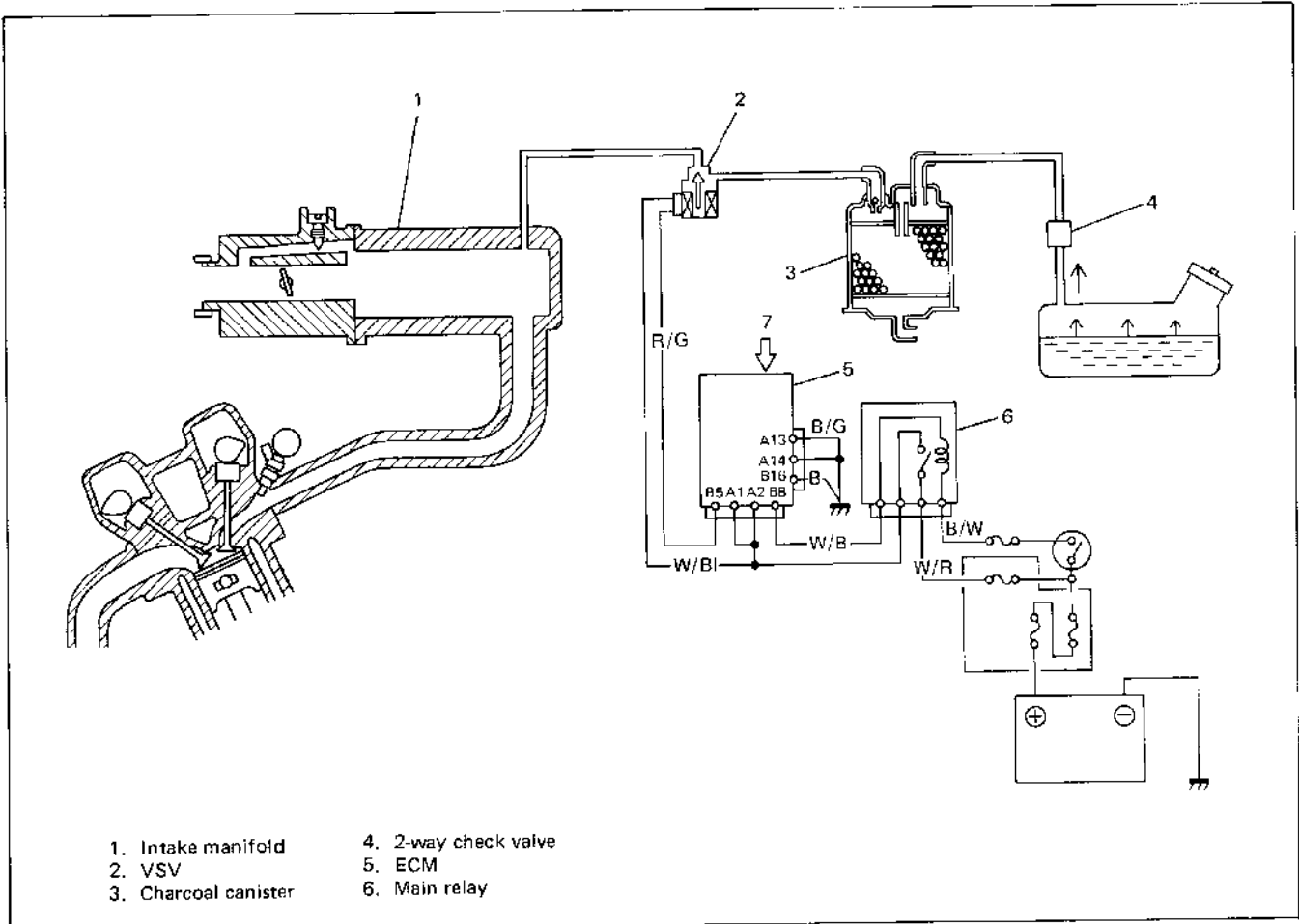


Fig. 6E-148 System Diagram

Canister Purge 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. Start engine and disconnect canister purge hose from canister.  
With following conditions all satisfied, place finger against the end of disconnected hose as shown and check that vacuum is felt there. Also check that vacuum is not felt when even one condition is not satisfied.
  - When engine cooling water temp. is higher than 60°C (140°F).
  - When engine speed is increased to higher than 1500 r/min.
  - When throttle valve opens wider than idle position (Idle switch OFF).

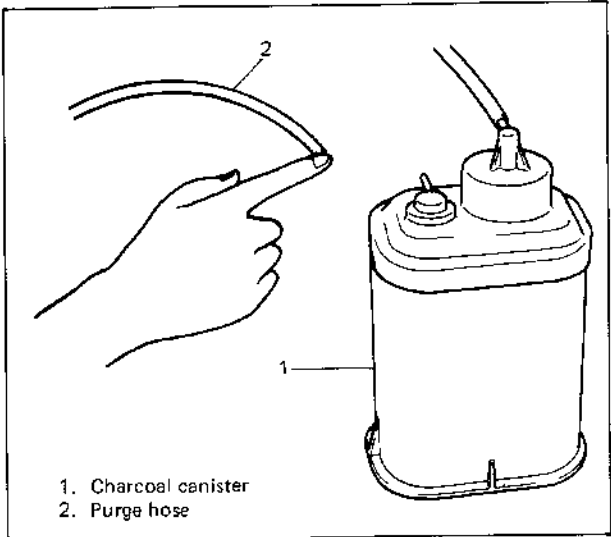


Fig. 6E-149 Checking VSV Operation

If check result is not satisfactory, check vacuum passage, hoses, VSV, wire harness and ECM. Refer to p. 6E-68 for ECM check.

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.

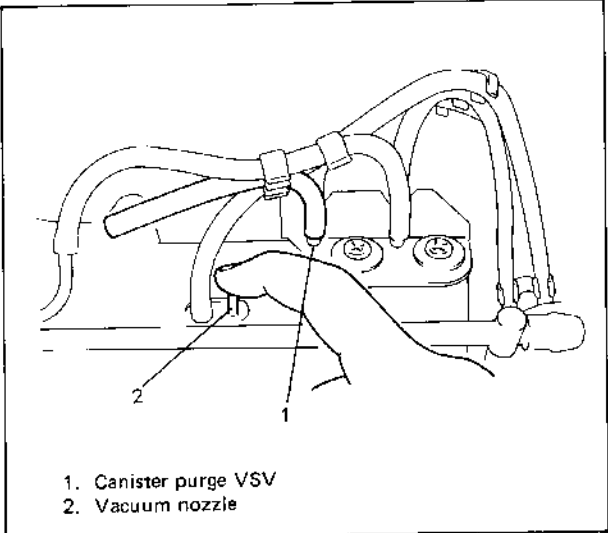


Fig. 6E-150 Checking Vacuum Passage

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

VSV (Vacuum Switching Valve) Inspection

1. With ignition switch OFF, disconnect coupler from VSV.
2. Check resistance between two terminals of VSV.

|                         |           |
|-------------------------|-----------|
| Resistance of purge VSV | 33 – 39 Ω |
|-------------------------|-----------|

If resistance is as specified, proceed to next operation check. If not, replace.

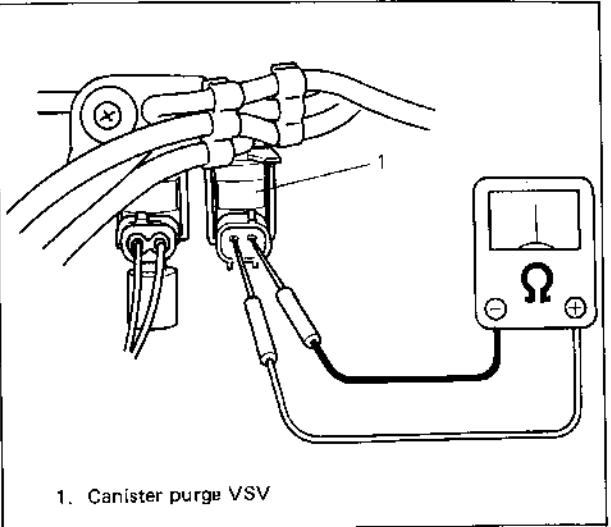


Fig. 6E-151 Checking Resistance

3. Remove VSV.
4. Blow into nozzle "A". Air should not come out of nozzle "B".

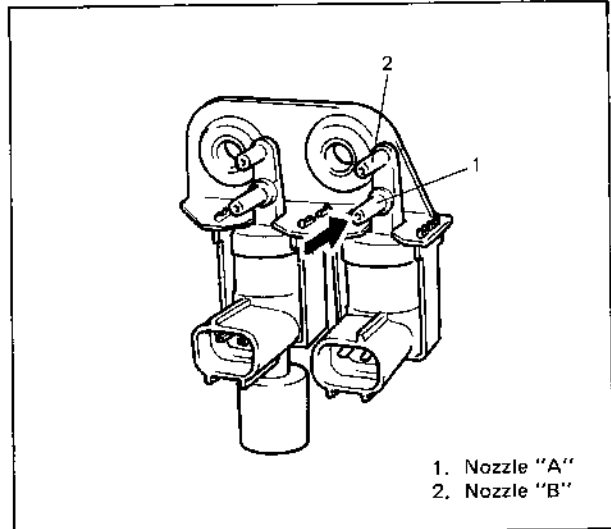


Fig. 6E-152 Checking VSV (1)

- Connect 12V-battery to VSV terminals. In this state, blow nozzle "A". Air should come out of nozzle "B".

**WARNING:**  
Do not suck the air through VSV. Fuel vapor inside VSV is harmful.

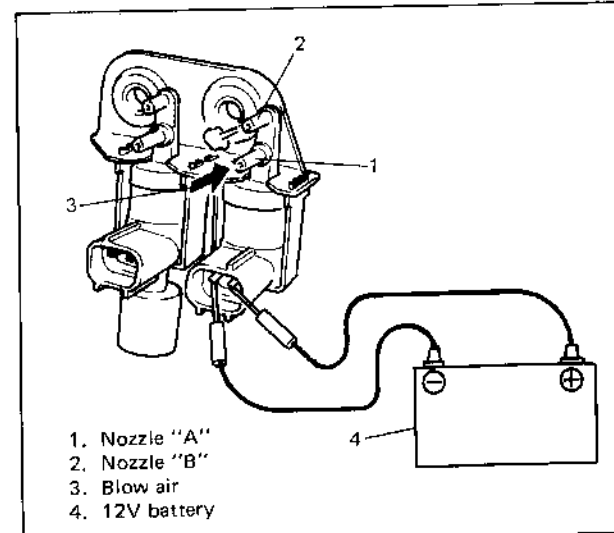


Fig. 6E-153 Checking VSV (2)

If check result is not as described, replace VSV.

- Install VSV and connect vacuum hoses. Refer to emission control information table for proper connection.
- Connect VSV coupler securely.

### Charcoal Canister Inspection

**WARNING:**  
DO NOT SUCK nozzles on canister. Fuel vapor inside canister is harmful.

- Disconnect vacuum hoses from canister.
- Remove charcoal canister.
- When air is blown into "TANK" nozzle, air should come out from "AIR" nozzle.

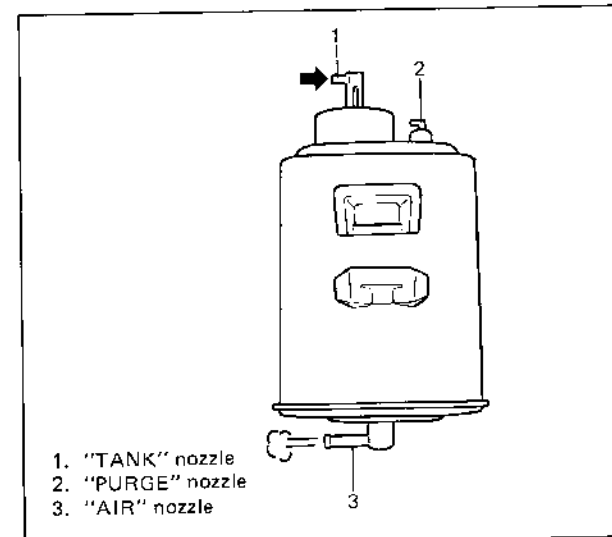


Fig. 6E-154 Blowing "TANK" Nozzle

- With "AIR" nozzle closed with finger, blow air hard into "TANK" nozzle, and air should come out of "PURGE" nozzle.

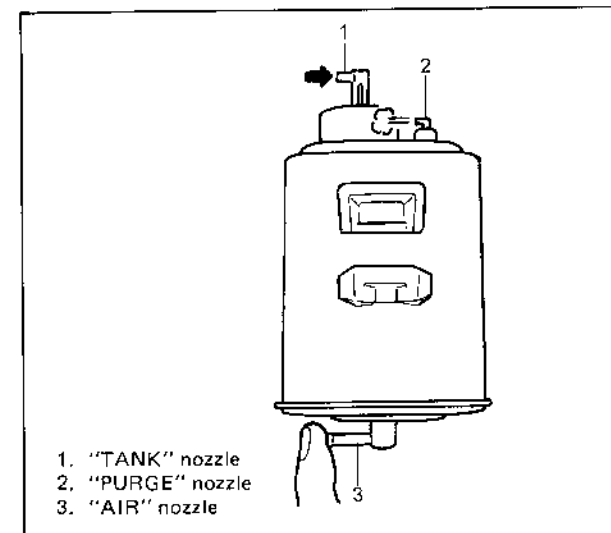


Fig. 6E-155 Blowing "TANK" Nozzle

- When air is blown into "PURGE" nozzle, no air should come out from other two nozzles.

If operation differs from above description, charcoal canister must be replaced.

- Install canister to body and connect hoses to canister.

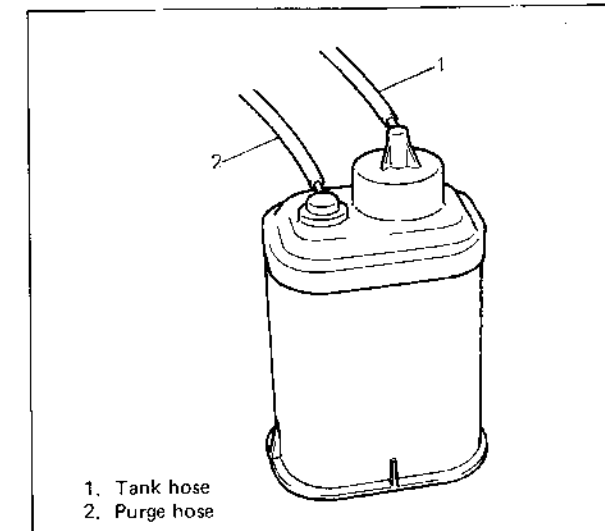


Fig. 6E-156 Connecting Hoses

### 2-Way Check Valve

#### Removal

- Remove fuel tank from body according to procedure described in section 6C.
- Remove 2-way check valve from fuel tank.

#### Inspection

- Blow hard from fuel tank side (black side of check valve), and air should pass through valve smoothly and come out from its orange side.
- Blow only softly from orange side, and air should come out from black side.
- If air doesn't pass through valve in step 1 or hard blow is required in step 2, replace 2-way check valve.

**WARNING:**  
DO NOT SUCK air through 2-way check valve. Fuel vapor inside the valve is harmful.

#### Installation

Reverse removal sequence to install 2-way check valve.

When connecting check valve between hoses, refer to below figure for installing direction.

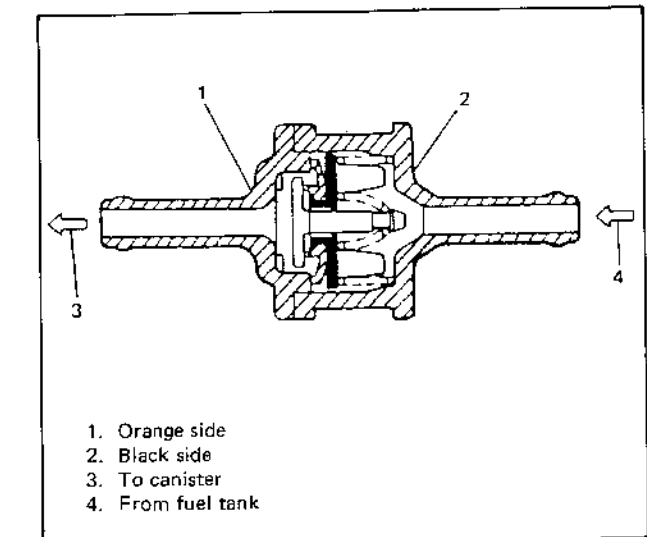


Fig. 6E-157 2-Way Check Valve

### OUTPUT SIGNAL OF THROTTLE VALVE OPENING (A/T model only)

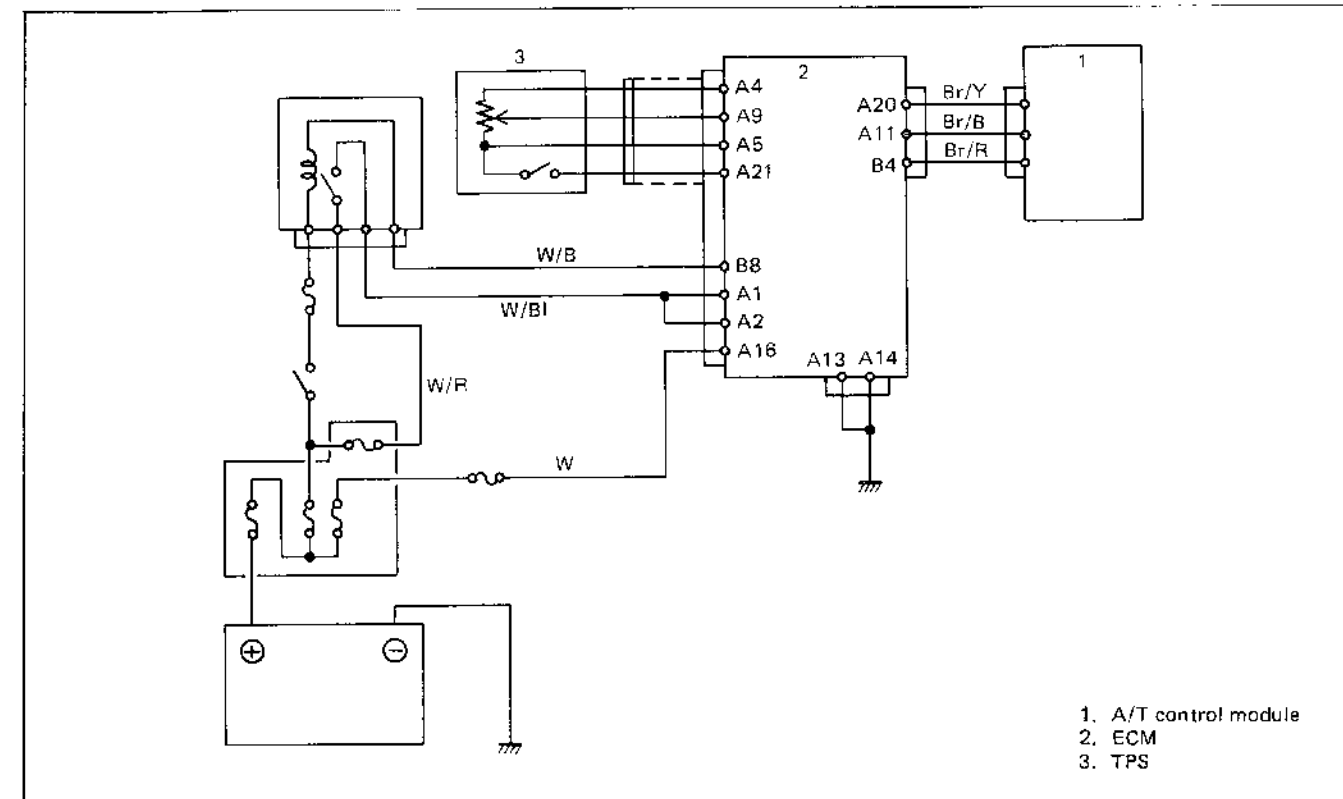


**Fig. 6E-158 Signal Output Circuit**

## Inspection

1. Check voltage at each terminal for "Br/Y", "Br/B" and "Br/R" wires of A/T control module while depressing accelerator pedal gradually.  
A/T control module is located under instrument panel and at the right of steering column bracket.

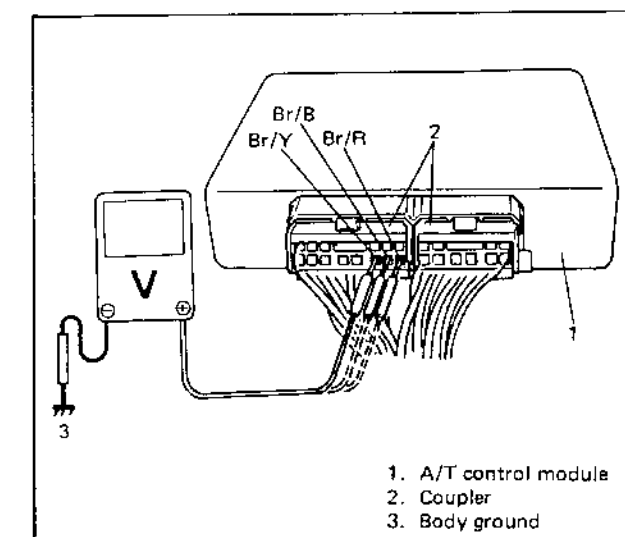


**Fig. 6E-159 Checking Output Signal**

Voltage at each terminal should vary as shown in following ON/OFF signal diagram.

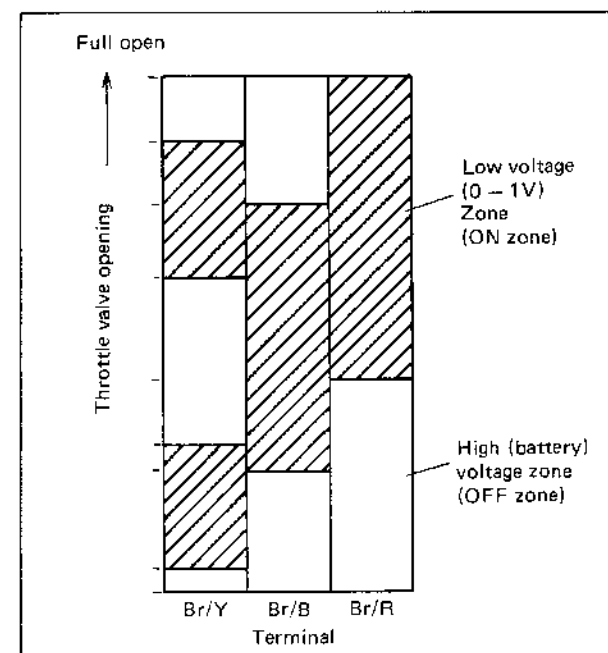


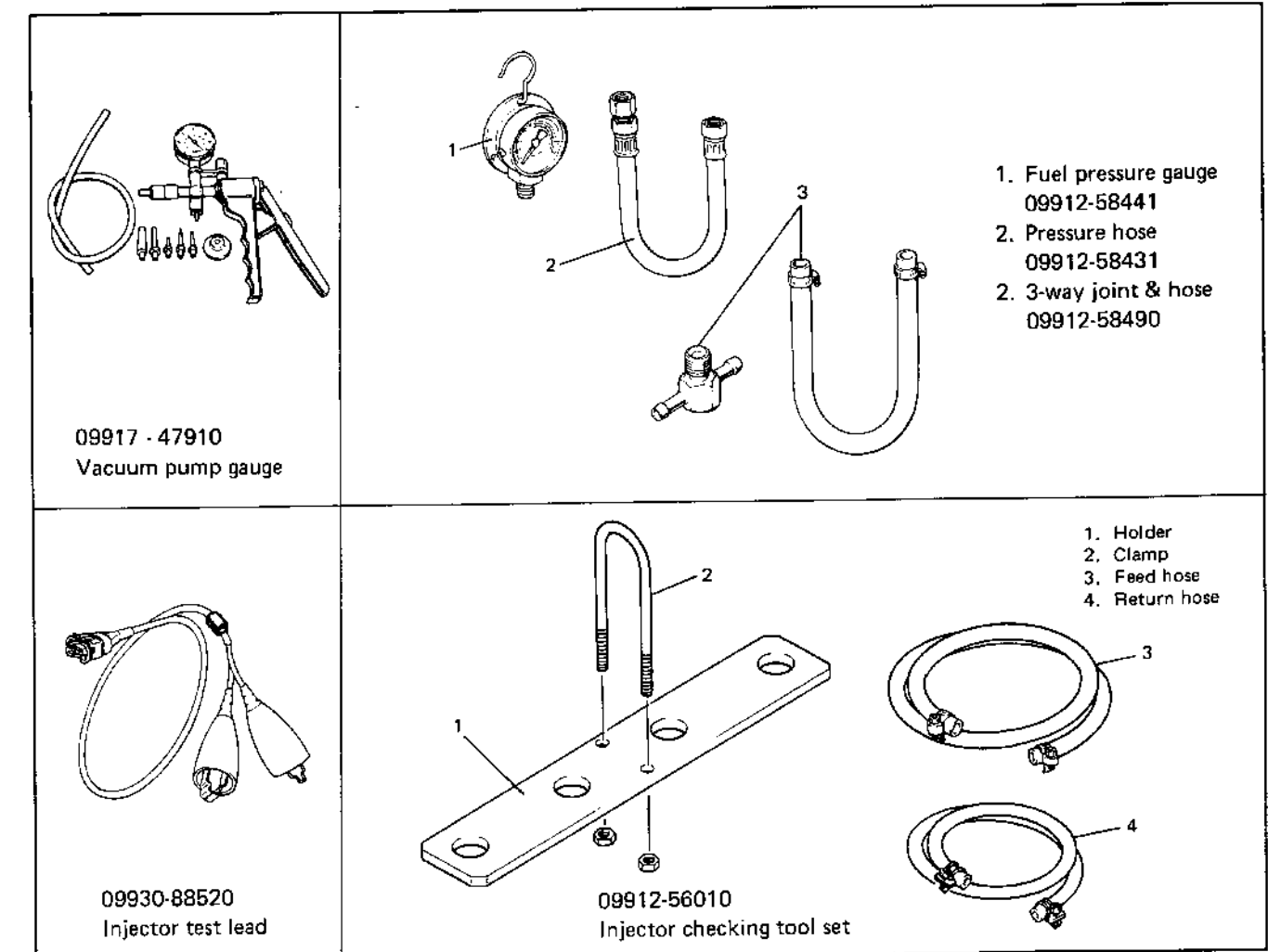
*Fig. 6E-160 ON/OFF Signal Diagram*

If check result is not satisfactory, check each wire harness, coupler connections, TPS and ECM. Refer to p. 6E-68 for ECM check.

## TORQUE SPECIFICATIONS

| Fastening parts              | Tightening torque |           |             |
|------------------------------|-------------------|-----------|-------------|
|                              | N·m               | kg·m      | lb·ft       |
| Throttle body bolts and nuts | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| Fuel delivery pipe bolts     | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| TPS screws                   | 3.5               | 0.35      | 2.5         |
| WTS                          | 5 – 15            | 0.5 – 1.5 | 4.0 – 10.5  |
| Oxygen sensor                | 45 – 55           | 4.5 – 5.5 | 33.0 – 39.5 |
| REGTS                        | 10 – 20           | 1.0 – 2.0 | 7.5 – 14.0  |

## SPECIAL TOOLS





SECTION 6F

IGNITION SYSTEM

CONTENTS

|                           |      |                        |       |
|---------------------------|------|------------------------|-------|
| GENERAL DESCRIPTION ..... | 6F-1 | Distributor .....      | 6F- 6 |
| DIAGNOSIS .....           | 6F-2 | Power Unit .....       | 6F- 7 |
| ON-CAR SERVICE .....      | 6F-4 | Ignition Timing .....  | 6F- 8 |
| Power Supply Check .....  | 6F-4 | DISTRIBUTOR UNIT ..... | 6F- 9 |
| Ignition Spark Test ..... | 6F-4 | Dismounting .....      | 6F- 9 |
| High Tension Cords .....  | 6F-4 | Remounting .....       | 6F- 9 |
| Spark Plugs .....         | 6F-5 | SPECIAL TOOLS .....    | 6F-10 |
| Noise Suppressor .....    | 6F-6 |                        |       |
| Ignition Coil .....       | 6F-6 |                        |       |

GENERAL DESCRIPTION

The ignition system used for this car has an ESA (Electronic Spark Advance) system and consists of the following parts.

- 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 power unit.
- Power unit  
It turns ON and OFF the primary current of the ignition coil according to the signal from ECM.
- Ignition coil  
When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding.
- Distributor  
It distributes a high voltage current to each plug.
- High-tension cords and spark plugs
- CAS (Crank Angle Sensor)  
Located in the distributor, it converts the crank angle into voltage variation and sends it to ECM. For its details, refer to Section 6E.
- AFM, TPS, WTS and speed sensor  
For their details, refer to Section 6E.

In ESA 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 power unit.

Thus ignition timing is controlled to yield the best engine performance.

For more information, refer to Section 6E.

6F-2 IGNITION SYSTEM

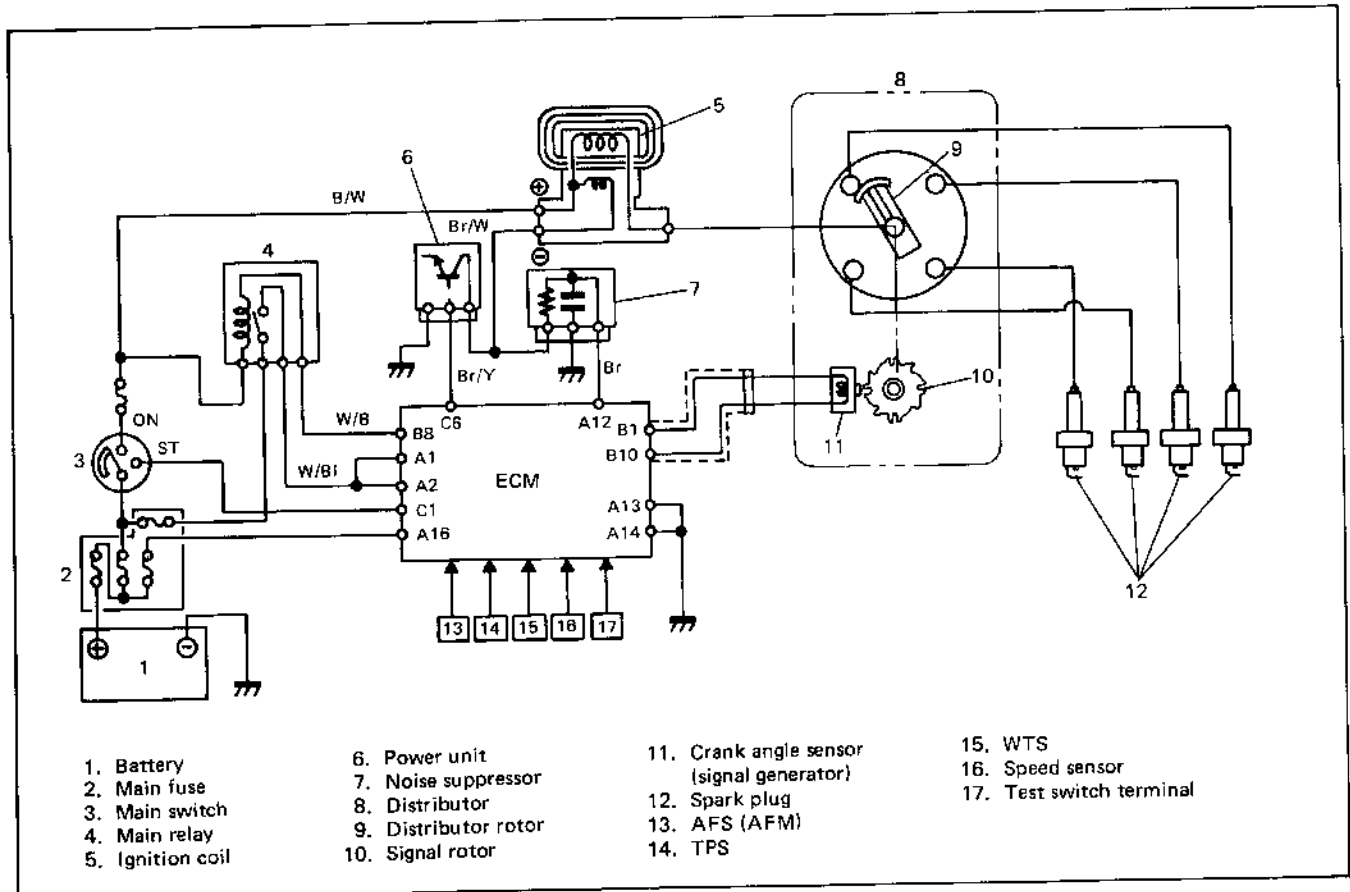


Fig. 6F-1 Ignition Circuit Diagram for ESA Ignition System

DIAGNOSIS

| Condition                                          | Possible cause                                                                                                                                                                                                                                                                                                                                                                                                                                   | Correction                                                                                                                                                   |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine cranks, but will not start or hard to start | <b>No spark</b> <ul style="list-style-type: none"><li>Blown fuse for ignition coil</li><li>Loose connection or disconnection of lead wires or high-tension cord(s)</li><li>Faulty high-tension cord(s)</li><li>Faulty spark plug(s)</li><li>Cracked rotor or cap</li><li>Maladjusted signal rotor air gap</li><li>Faulty ignition coil</li><li>Faulty noise suppressor</li><li>Faulty CAS</li><li>Faulty power unit</li><li>Faulty ECM</li></ul> | Replace<br>Connect securely<br><br>Replace<br>Adjust, clean or replace<br>Replace<br>Adjust<br>Replace<br>Replace<br>Replace<br>Replace<br>Replace<br>Adjust |
|                                                    | <b>Maladjusted ignition timing</b>                                                                                                                                                                                                                                                                                                                                                                                                               | Adjust                                                                                                                                                       |
| Poor fuel economy or engine performance            | <ul style="list-style-type: none"><li>Incorrect ignition timing</li><li>Faulty spark plug(s)</li><li>Faulty ECM</li></ul>                                                                                                                                                                                                                                                                                                                        | Adjust<br>Adjust, clean or replace<br>Replace                                                                                                                |

SELF-DIAGNOSIS

- To insure correct diagnosis, check to confirm that battery voltage is within standard value when engine is standstill.
- Turn on ignition switch and make sure that "CHECK ENGINE" light lights.
- If engine will not start but cranking is possible, crank it for more than 2 seconds.
- While ignition switch is ON, insert a spare fuse to DIAG SW in junction/fuse block and then read diagnostic code (observe "CHECK ENGINE" light).

DIAGNOSTIC CODE NO. 41



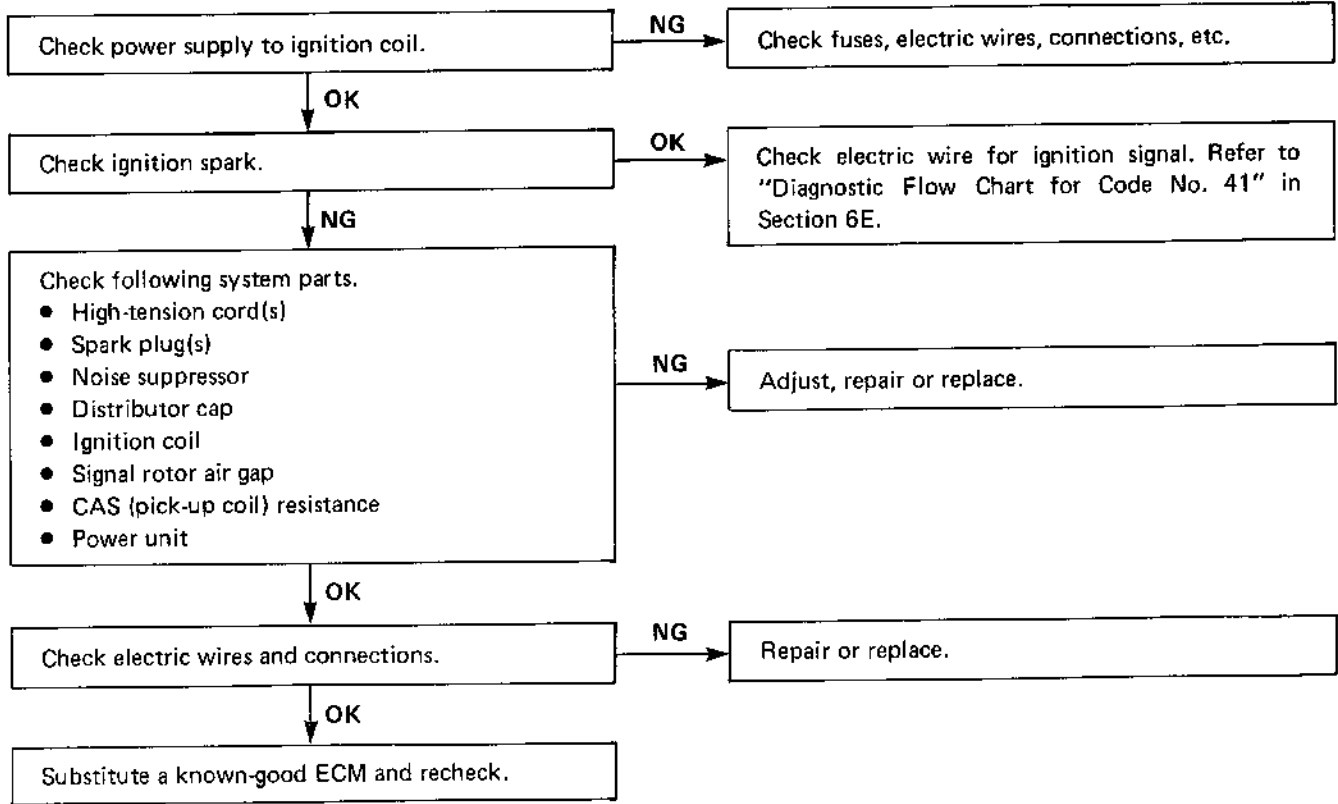
ECM indicates that no ignition signal is inputted while engine is running or being cranked. Diagnose trouble according to "Diagnostic Flow Chart for Code No. 41" in Section 6E.

DIAGNOSTIC CODE NO. 42



ECM memory indicates that no crank angle sensor signal has been experienced for more than 2 seconds while engine is being cranked. Diagnose trouble according to "Diagnostic Flow Chart for Code No. 42" in Section 6E.

DIAGNOSTIC FLOW CHART (When engine does not start though it is cranked up)





ON-CAR SERVICE

POWER SUPPLY CHECK

1. Remove coupler cover from ignition coil coupler and check to make sure that coil terminals have battery voltage with ignition switch ON.
2. If no voltage or low voltage is found, check fuse, couplers and wiring harness.

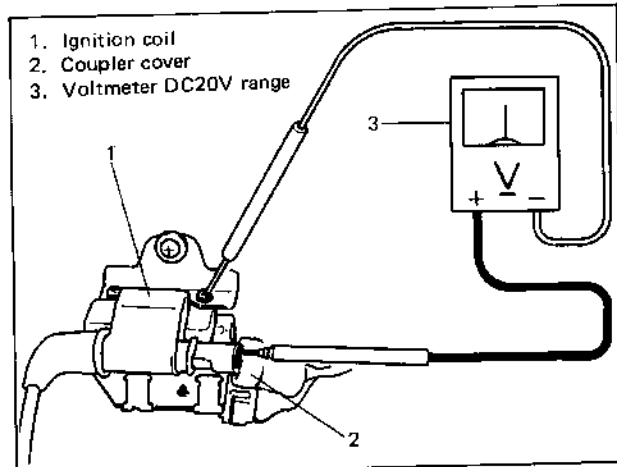


Fig. 6F-2 Checking Power Supply to Ignition Coil

IGNITION SPARK TEST

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.

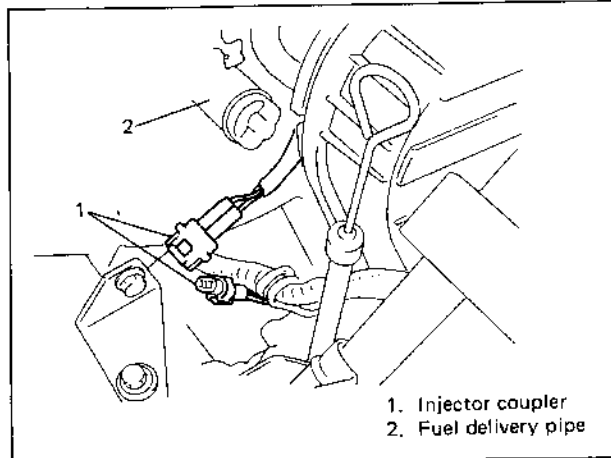


Fig. 6F-3 Disconnecting Injector Coupler

2. Remove spark plugs and connect them to high tension cords, and then ground spark plugs.

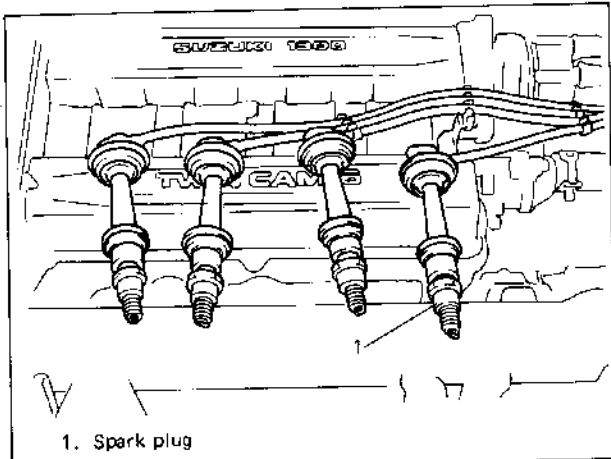


Fig. 6F-4 Checking Ignition Spark

3. Crank engine and check if each spark plug sparks.
4. If no spark is emitted, inspect high tension cords, spark plugs, ignition coil, distributor, etc.

HIGH TENSION CORDS

1. Remove high tension cord at ignition coil while gripping its cap.
2. Remove distributor cap installed with high tension cords.
3. Remove high tension cord clamp bolts.
4. Pull out high tension cords from spark plugs while gripping each cap.

CAUTION:

- Removal of high tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).
- For the same reason, pull out each connection by gripping cap portion.

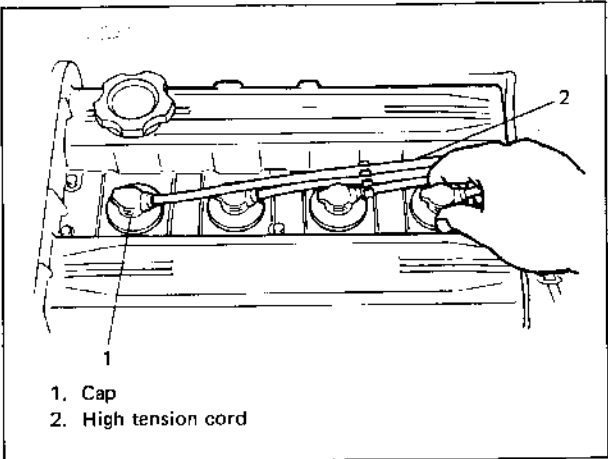


Fig. 6F-5 Removing High Tension Cord

5. Measure resistance of high tension cord by using ohmmeter.

|                              |                                 |
|------------------------------|---------------------------------|
| High tension cord resistance | 10 – 22 kΩ/m<br>3.0 – 6.7 kΩ/ft |
|------------------------------|---------------------------------|

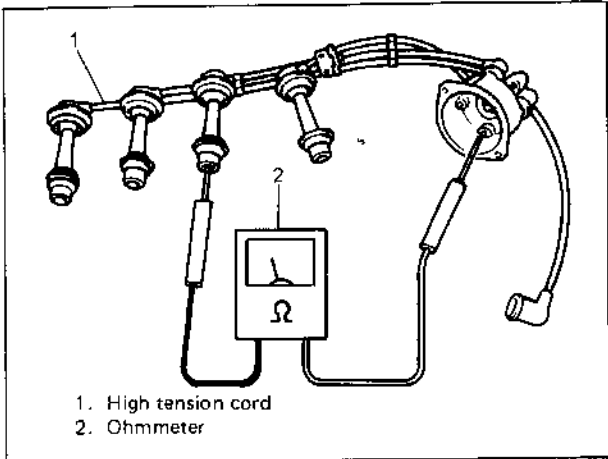


Fig. 6F-6 Measuring High Tension Cord Resistance

6. If resistance exceeds specification, inspect distributor terminal and replace high tension cord(s) and/or distributor cap as required.

CAUTION:

- Never attempt to use metal conductor high tension cords as replacing parts.
- Insert each cap portion fully when installing high tension cords.

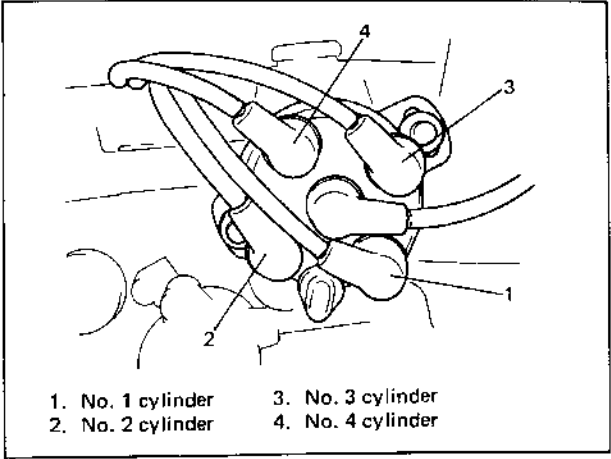


Fig. 6F-7 High-Tension Cord Distribution

SPARK PLUGS

1. Pull out high tension cords by gripping their caps and then remove spark plugs.
2. Inspect them for:
  - Electrode wear
  - Carbon deposits
  - Insulator damage
3. If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

|                 |                                  |          |
|-----------------|----------------------------------|----------|
| Spark plug type | NGK                              | BPR6ES   |
|                 | NIPPON DENSO                     | W20EPR-U |
| Air gap A       | 0.7 – 0.8 mm<br>0.027 – 0.031 in |          |

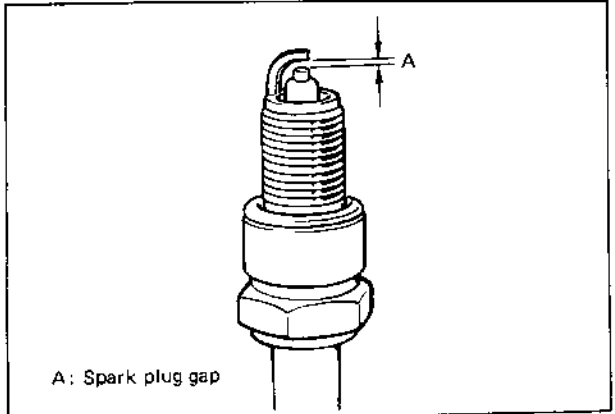


Fig. 6F-8 Checking Spark Plug Gap

4. Install spark plugs and torque them to specification.

|                              |         |           |             |
|------------------------------|---------|-----------|-------------|
| Spark plug tightening torque | N-m     | kg-m      | lb-ft       |
|                              | 25 – 30 | 2.5 – 3.0 | 18.0 – 21.5 |

5. Install high tension cords securely by gripping their caps.

NOISE SUPPRESSOR

- 1. Disconnect coupler of noise suppressor.
- 2. Using ohmmeter, check to be sure that condenser is not conductive and resister has resistance of about 2.2 kΩ.
- 3. If check result is not satisfactory, replace noise suppressor.

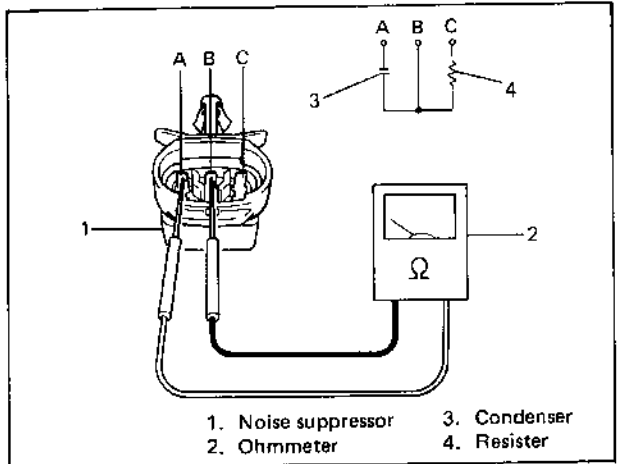


Fig. 6F-9 Checking Noise Suppressor

IGNITION COIL

- 1. Pull out high tension cord by gripping its cap.
- 2. Disconnect ignition coil coupler.
- 3. Measure primary and secondary coil resistances.

|                                             |           |                |
|---------------------------------------------|-----------|----------------|
| Ignition coil resistance<br>(at 20°C, 68°F) | Primary   | 0.72 – 0.88 Ω  |
|                                             | Secondary | 10.2 – 14.0 kΩ |

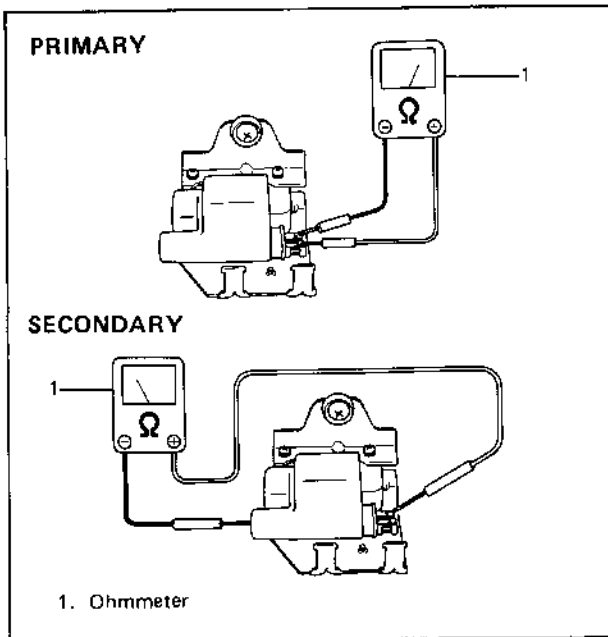


Fig. 6F-10 Measuring Ignition Coil Resistance

- 4. If resistance is out of specification, replace coil with new one.

DISTRIBUTOR

Distributor Cap and Rotor

Check cap and rotor for crack and their terminals for corrosion and wear. Replace as necessary.

Signal Rotor Air Gap

- 1. Remove distributor cap.
- 2. Using thickness gauge, measure air gap, between signal rotor tooth and generator.

|                      |                                       |
|----------------------|---------------------------------------|
| Signal rotor air gap | 0.2 – 0.3 mm<br>(0.0079 – 0.0118 in.) |
|----------------------|---------------------------------------|

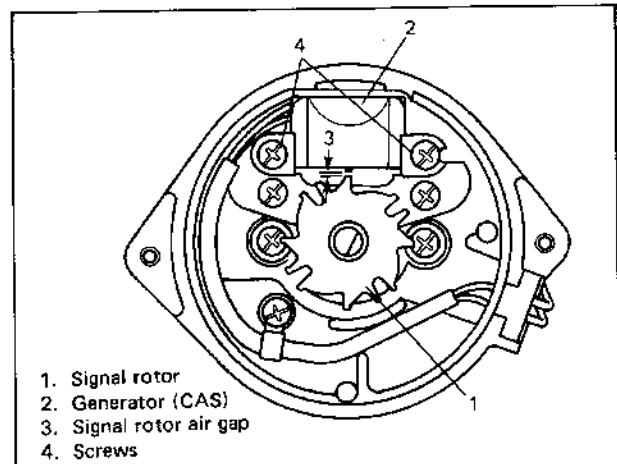


Fig. 6F-11 Checking Air Gap

- 3. If gap is out of specification, loose signal generator securing screws. Using blade (—) screw driver, move generator and adjust gap to specification. After adjustment, tighten securing screws and recheck gap.

NOTE:

Check to make sure that signal generator tooth is free from any metal particles.

- 4. Install distributor cap.

Pick Up Coil Resistance

- 1. Disconnect distributor lead coupler.
- 2. Measure resistance of pickup coil by using ohmmeter.
- 3. If resistance is out of specification, replace signal generator as follows.

|                                                  |             |
|--------------------------------------------------|-------------|
| Pick up coil resistance<br>(around at 20°C/68°F) | 588 – 882 Ω |
|--------------------------------------------------|-------------|

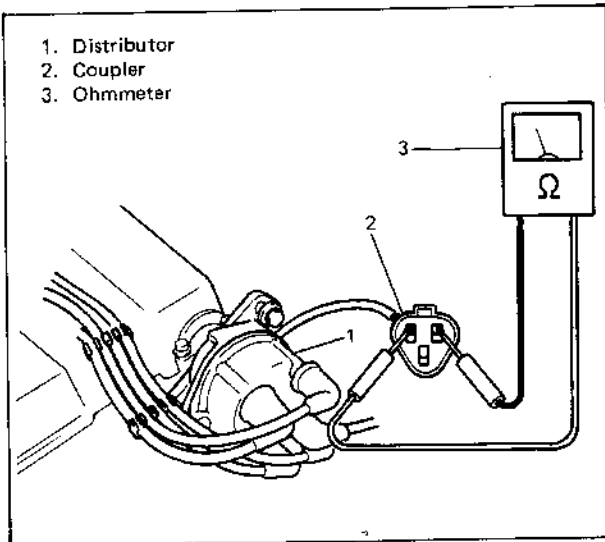


Fig. 6F-12 Measuring Pickup Coil Resistance

- 4. Remove distributor cap.
- 5. Remove signal generator securing screws and lead wire clamp screws.

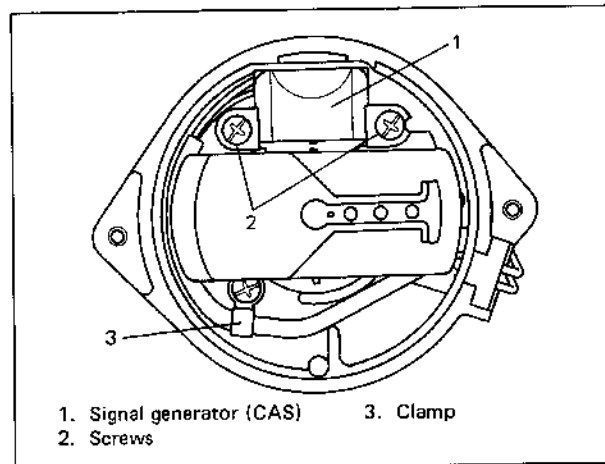


Fig. 6F-13 Removing Signal Generator

- 6. Replace signal generator.
- 7. Adjust signal rotor air gap to specification as previously outlined.
- 8. Install distributor cap seal and cap.

POWER UNIT

Before this check, prepare 2 new 1.5V batteries and an analog type ohmmeter.

- 1. Remove power unit from ignition coil bracket.

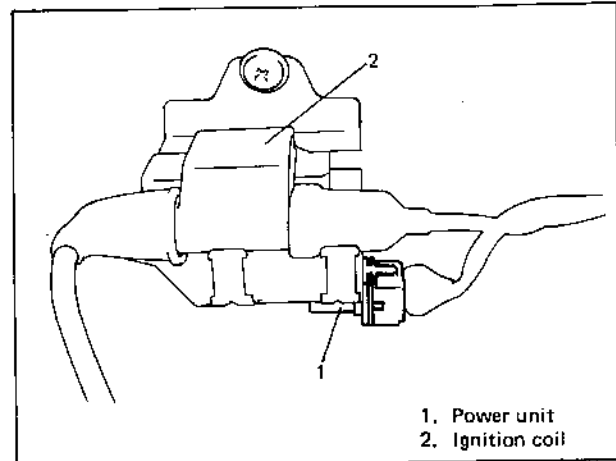


Fig. 6F-14 Power Unit

- 2. Arrange 2 new 1.5V batteries in series (check that total voltage is about 3.0V).

Connect positive terminal of ohmmeter to "G" terminal of power unit and negative terminal to "OC" terminal.

Check continuity between "G" and "OC" terminals with about 3V voltage applied to its "IB" terminal and also none applied.

|                                     |                          |
|-------------------------------------|--------------------------|
| No voltage applied to "IB" terminal | No continuity (infinity) |
| Voltage applied to "IB" terminal    | Continuity               |

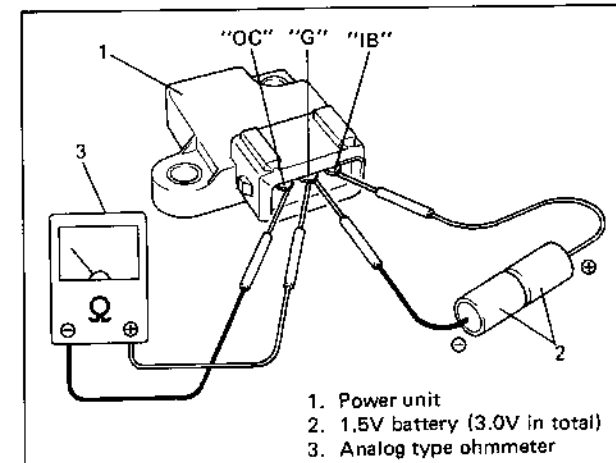


Fig. 6F-15 Checking Power Unit

If check result is not satisfactory, replace power unit.

- 3. Install power unit.

# IGNITION TIMING

## INSPECTION AND ADJUSTMENT

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.
4. Set timing light to No. 1 high tension cord.
5. Remove monitor coupler cap beside ignition coil.
6. Connect C and D terminals of monitor coupler or D to body by using service wire so that ignition timing is fixed on initial one.

### NOTE:

Using timing light, check to make sure that ignition timing doesn't change even when engine speed is increased. If it does, that indicates ungrounded D terminal which prevents accurate inspection and adjustment. Therefore, be sure to ground it securely.

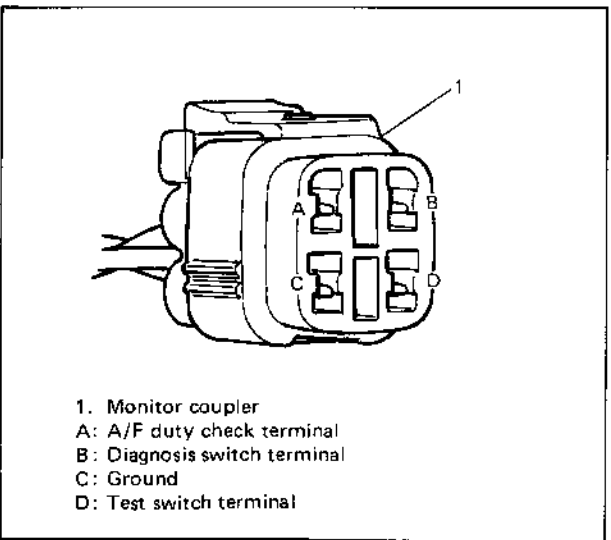


Fig. 6F-16 Fixing Ignition Timing

7. Using timing light, check that timing is within specification.

|                                                         |                                             |
|---------------------------------------------------------|---------------------------------------------|
| Initial ignition timing (Test switch terminal grounded) | $6 \pm 1^\circ$ BTDC at $850 \pm 50$ r/min. |
|---------------------------------------------------------|---------------------------------------------|

|                |               |
|----------------|---------------|
| Ignition order | 1 - 3 - 4 - 2 |
|----------------|---------------|

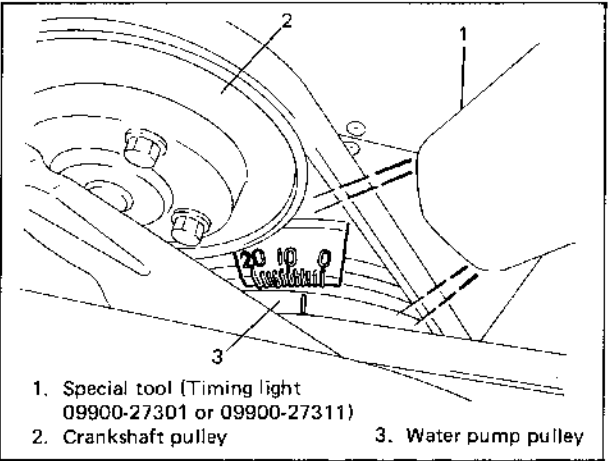


Fig. 6F-17 Checking Ignition Timing

8. If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.
9. After tightening distributor flange bolts, recheck that ignition timing is within specification.

| Tightening torque for distributor flange bolts | N·m     | kg·m      | lb·ft      |
|------------------------------------------------|---------|-----------|------------|
|                                                | 10 - 16 | 1.0 - 1.6 | 7.0 - 11.5 |

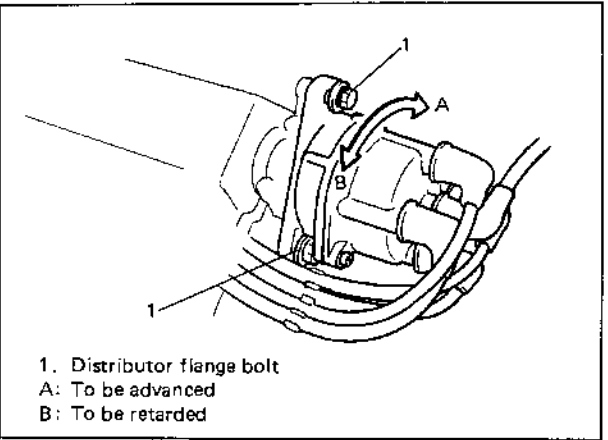


Fig. 6F-18 Adjusting Ignition Timing

10. After checking and/or adjusting, disconnect service wire from monitor coupler.

### NOTE:

In this state (test switch terminal ungrounded, idle switch ON and car stopped), ignition timing may vary more or less of initial ignition timing but it is nothing abnormal.

11. Check that increasing engine speed advances ignition timing. If not, check TPS (idle switch), test switch terminal circuit, engine start signal circuit and ECM.

# DISTRIBUTOR UNIT

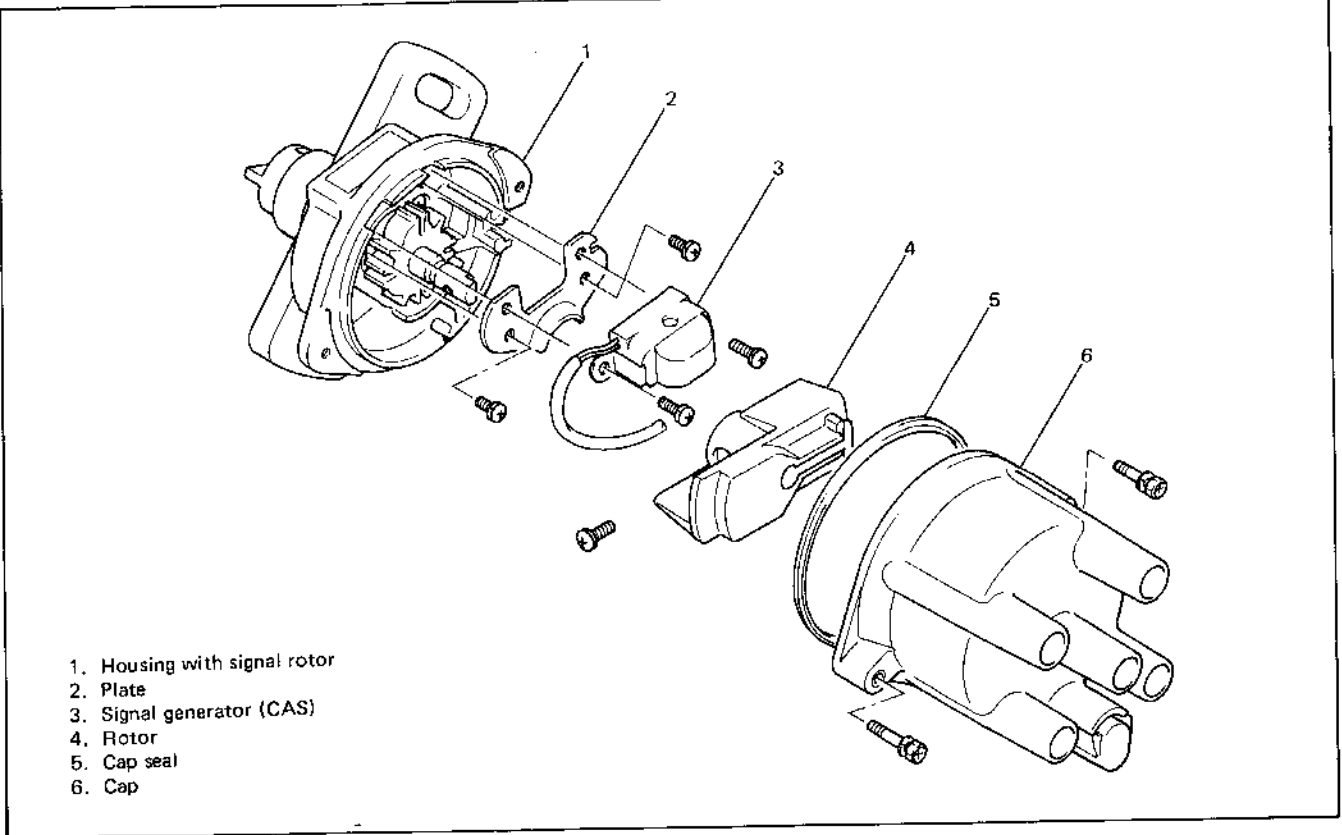


Fig. 6F-19 Conventional Solid State Distributor Components

## DISMOUNTING

1. Disconnect distributor lead coupler.
2. Remove distributor cap screws and cap.
3. Remove distributor flange bolts.
4. Pull out distributor housing assembly.

## REMOUNTING

### NOTE:

- Before installing distributor, check to make sure that its O ring is in good condition.
- If new O ring is installed, apply oil.

1. Install distributor without cap to camshaft. Fit the dogs of distributor coupling into the slots of camshaft, when installing. The dogs of distributor coupling are offset. Therefore, if the dogs can not be fitted into the slots, turn the distributor shaft by 180 degree and try again.

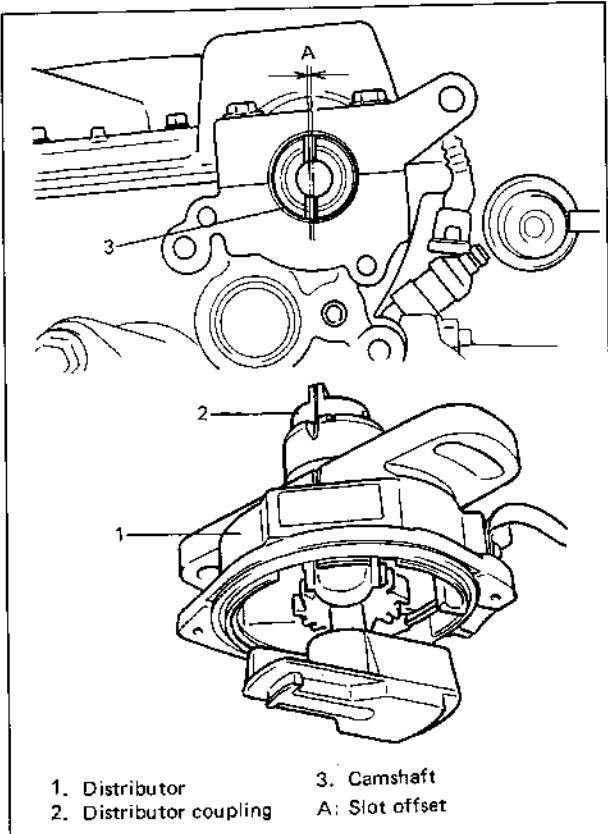
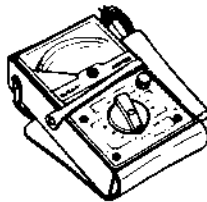
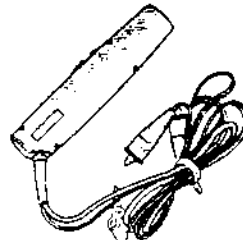
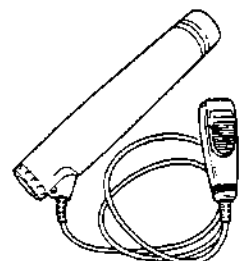


Fig. 6F-20 Camshaft Slot and Coupling

2. Lightly install flange bolts and prepare for ignition timing adjustment.
3. Check to make sure that rotor is in good condition.
4. Inspect distributor cap and clean or replace as required.
5. Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
6. Connect distributor lead coupler.

### SPECIAL TOOLS

|                                                                                    |                                                                                    |                                                                                     |  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|  |  |  |  |
| 09900-25002<br>Pocket tester                                                       | 09900-27301<br>Timing light (DC 12V)                                               | 09900-27311<br>Timing light (Dry cell type)                                         |  |

### SECTION 6G

## CRANKING SYSTEM

(1.2 KW for A/T)

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|                                       |       |                                              |       |
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| Starting Motor .....                  | 6G- 2 | Remove and Install Motor Brush .....         | 6G- 6 |
| <b>DIAGNOSIS</b> .....                | 6G- 3 | Remove and Install Armature/Yoke .....       | 6G- 7 |
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|                                       |       | <b>SPECIFICATIONS</b> .....                  | 6G-16 |

### GENERAL DESCRIPTION

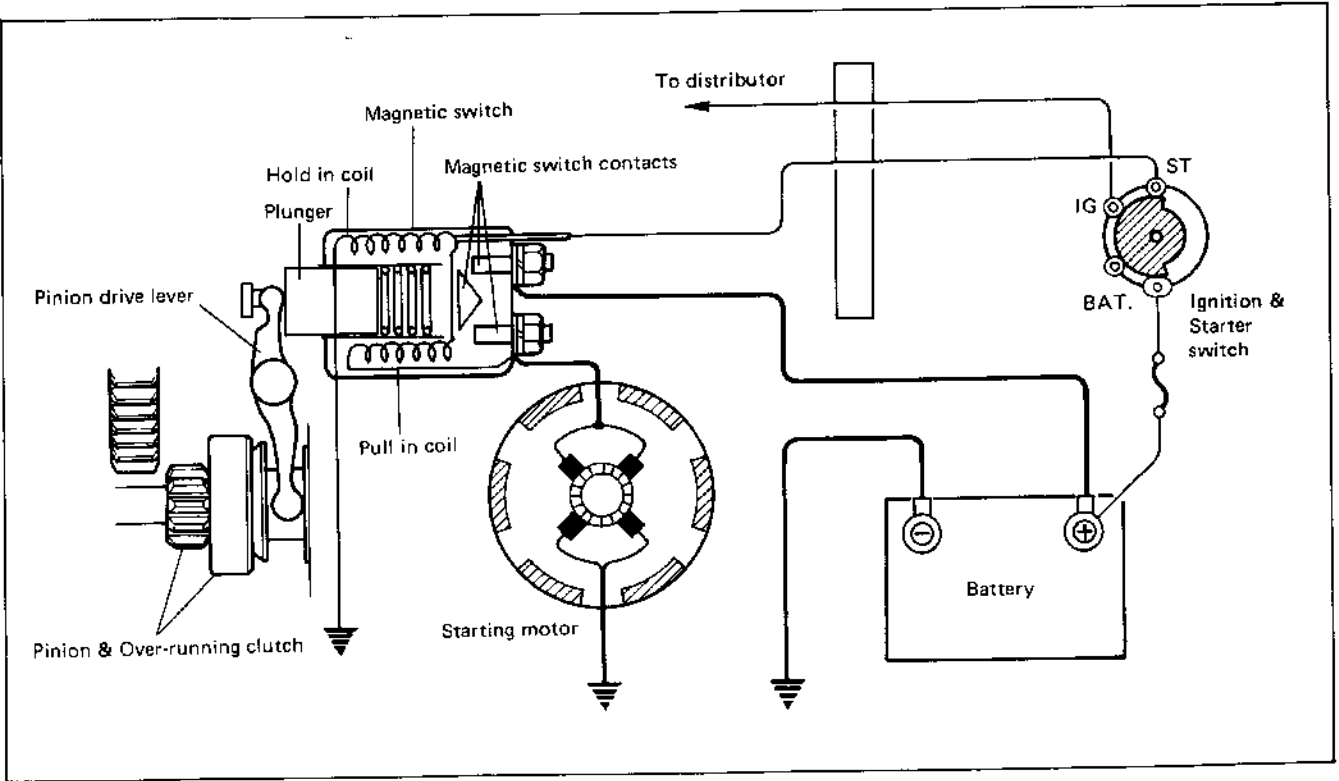


Fig. 6G-1 Cranking Circuit

### CRANKING CIRCUIT

The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected

electrically as shown in Fig. 6G-1. Only the starting motor will be covered in this portion.

STARTING MOTOR

The starting motor consists of parts shown in Fig. 6G-2 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. In the circuit shown in Fig. 6G-1, the magnetic (motor) switch coils are magnetized when the ignition switch is closed. The resulting plunger and pinion drive lever movement causes the pinion to engage the engine flywheel gear and

the magnetic switch main contacts to close, and cranking takes place. When the engine starts, the pinion 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.

**NOTE:**  
Make sure to apply grease before assembly where so indicated in the figure below.

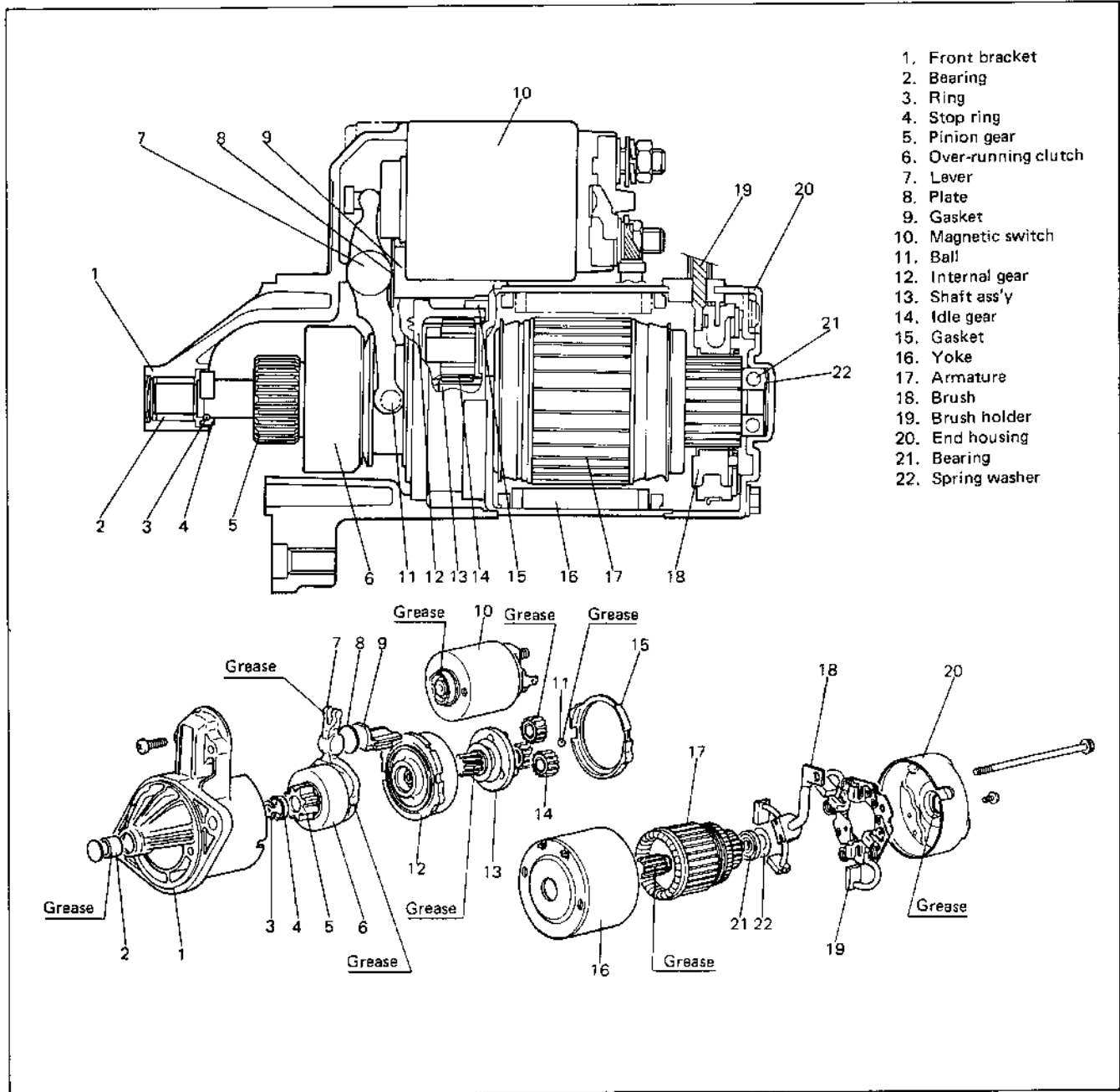


Fig. 6G-2

DIAGNOSIS

Possible symptoms due to starting system trouble are:

- Starting motor does not run (or runs slowly),
- Starting motor runs but fails to crank engine, or
- 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.

Don't remove motor just because starting motor does not run. Check following items and narrow down the scope of possible causes.

- 1) Condition of trouble
- 2) Tightness of battery terminals (including ground cable connection on the engine side) and starting motor terminals.
- 3) Discharge of battery
- 4) Mounting of starting motor

| Condition          | Possible Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Correction                                                                                                                                                                                                                             |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor not running. | <b>No operating sound of magnetic switch</b><br>1. Battery run down.<br>2. Battery voltage too low due to battery deterioration.<br>3. Poor contact in battery terminal connection.<br>4. Loose grounding cable connection.<br>5. Fuse is set loose or blown off.<br>6. Poor contacting action of ignition switch.<br>7. Lead wire socket loose in place.<br>8. Open-circuit between ignition switch and magnetic switch.<br>9. Open-circuit in pull-in coil.<br>10. Poor sliding of plunger.<br>11. Shift lever switch is not in P or N, or not adjusted. | Recharge battery.<br>Replace battery.<br><br>Retighten or replace.<br><br>Retighten.<br>Tighten or replace.<br>Replace.<br><br>Retighten.<br>Repair.<br><br>Replace magnetis switch.<br>Replace.<br>Shift in P or N, or adjust switch. |
|                    | <b>Operating sound of magnetic switch heard.</b><br>1. Battery run down.<br>2. Battery voltage too low due to battery deterioration.<br>3. Loose battery cable connections.<br>4. Burnt main contact point, or poor contacting action of magnetic switch.<br>5. Brushes are seating poorly or worn down.<br>6. Weakened brush spring.<br>7. Burnt commutator.<br>8. Layer short-circuit of armature.                                                                                                                                                       | Recharge battery.<br>Replace battery.<br><br>Retighten.<br>Replace magnetic switch.<br><br>Repair or replace.<br><br>Replace.<br>Replace.<br>Replace.                                                                                  |

| Condition                                           | Possible Cause                                                                                                                                                                                                                                                                                                   | Correction                                                                                                            |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Starting motor running but too slow (small torque). | If battery and wiring are satisfactory, inspect starting motor.<br>1. Insufficient contact of magnetic switch main contacts.<br>2. Layer short-circuit of armature.<br>3. Disconnected, burnt or worn commutator.<br>4. Worn brushes.<br>5. Weakened brush springs.<br>6. Burnt or abnormally worn end bushings. | Replace.<br><br>Replace.<br>Repair or replace.<br><br>Replace brush.<br>Replace spring.<br>Replace busing.            |
| Starting motor running, but not cranking engine.    | 1. Worn pinion tip.<br>2. Poor sliding of over-running clutch.<br>3. Clutch slipping (idling) due to defective roller springs.<br>4. Worn teeth of ring gear.                                                                                                                                                    | Replace over-running clutch.<br>Replace over-running clutch.<br>Replace over-running clutch.<br><br>Replace flywheel. |
| Noise                                               | 1. Abnormally worn bush.<br>2. Worn pinion or worn teeth of ring gear.<br>3. Poor sliding of pinion (failure in return movement).<br>4. Worn internal or idle gear teeth.                                                                                                                                        | Replace bush.<br>Replace pinion or flywheel.<br>Repair or replace.<br><br>Replace.                                    |
| Starting motor does not stop running.               | 1. Fused contact points of magnetic switch.<br>2. Short-circuit between turns of magnetic switch coil (layer short-circuit).<br>3. Failure of returning action in ignition switch.                                                                                                                               | Repair or replace.<br><br>Replace.<br><br>Replace.                                                                    |

ON VEHICLE SERVICE

Starting motors do not require lubrication except during overhaul. When the motor is disassembled for any reason, lubricate as shown in Fig. 6G-2.

REMOVAL AND INSTALLATION

STARTING MOTOR

- Use following procedure to remove starter:
- 1) Disconnect negative battery lead at battery.
  - 2) Disconnect magnetic switch lead wire and battery cable from starting motor terminals.
  - 3) Remove two starting motor mount bolts.
  - 4) Remove starting motor.
  - 5) To install, reverse the above procedure.

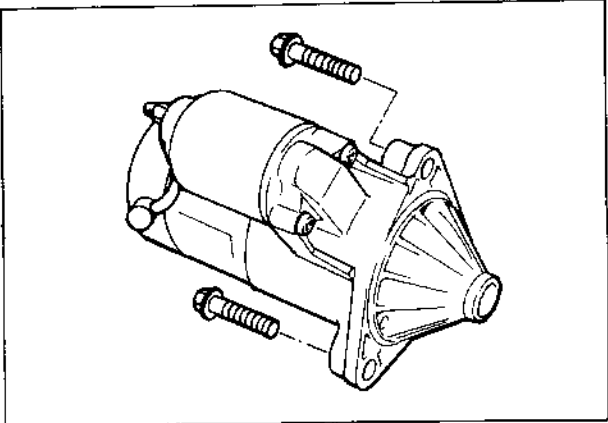


Fig. 6G-3 Starting Motor Mounting

STARTING MOTOR REPAIR

MAGNETIC SWITCH

REMOVAL

NOTE:  
Before disassembling starting motor, be sure to put match mark as shown in the figure below so that any possible mistake can be avoided.

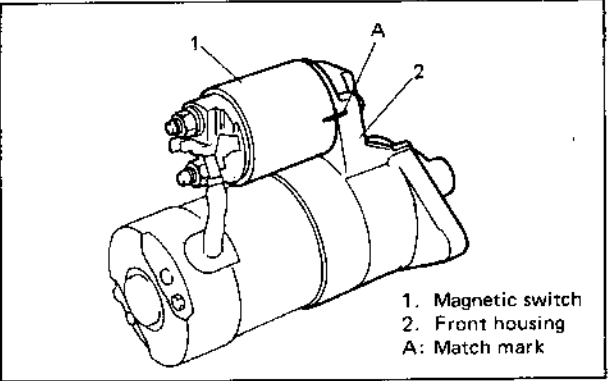


Fig. 6G-4

- 1) Disconnect wire (switch to motor) from magnetic switch terminal.

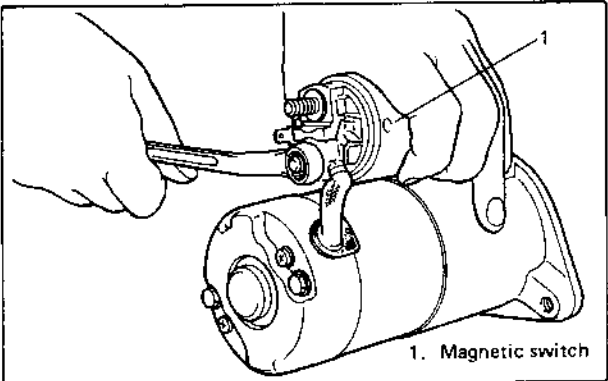


Fig. 6G-5

- 2) Remove magnetic switch assembly.

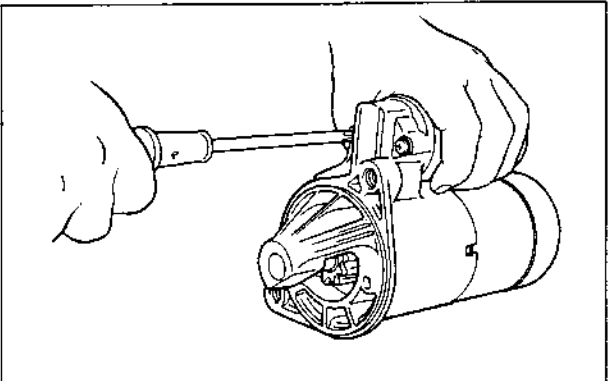


Fig. 6G-6

NOTE:  
Don't disassemble this switch. If defective, replace as a complete assembly.

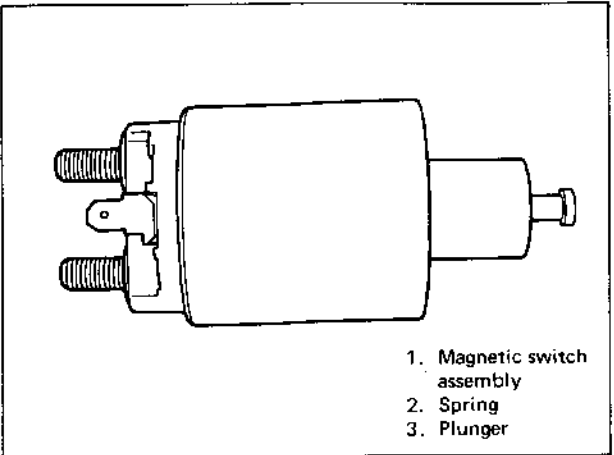


Fig. 6G-7

INSTALLATION

Before installation, inspect plunger joint for wear and replace defective parts.

- 1) Apply grease. (Refer to Fig. 6G-2)
- 2) Install switch assembly into front housing, referring to below figure especially for its vertical direction. And then tighten screws.

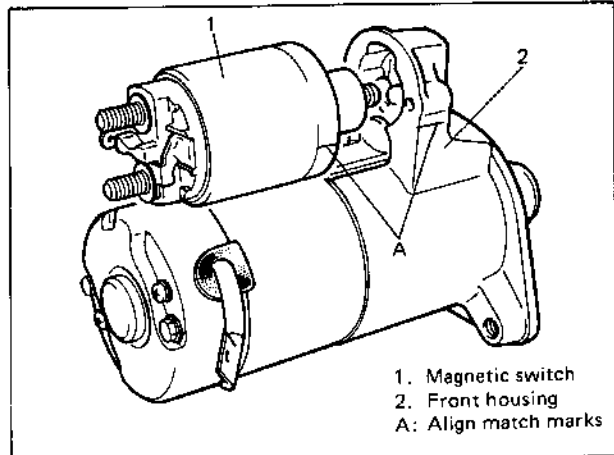


Fig. 6G-8

- 3) Connect wire from motor to magnetic switch terminal.
- 4) Check switch for operation. (See page 6G-15)



**MOTOR BRUSH****REMOVAL**

- 1) Remove rear bracket.

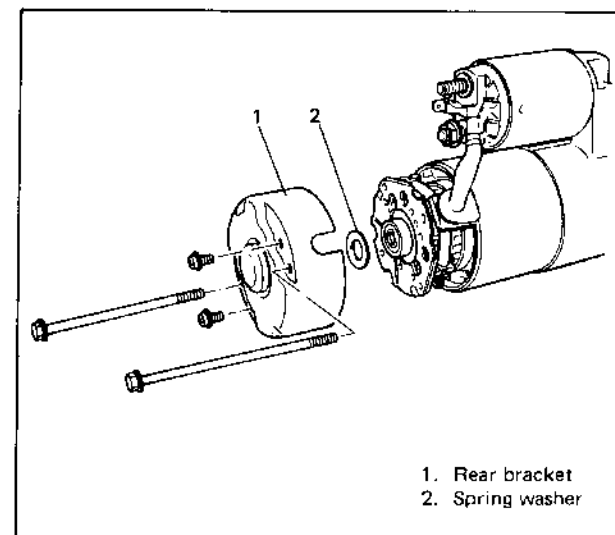


Fig. 6G-9

- 2) Remove brush holder and brushes.

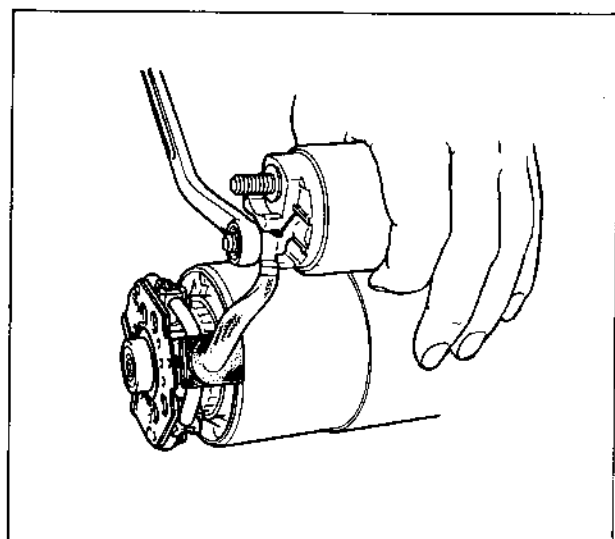


Fig. 6G-10

**INSTALLATION**

Install in reverse order of REMOVAL, noting the following.

- 1) Apply grease. (Refer to Fig. 6G-2)
- 2) With brushes mounted to brush holder, install them onto commutator. Then set spring to each of 4 brushes so that it contacts commutator by spring force.

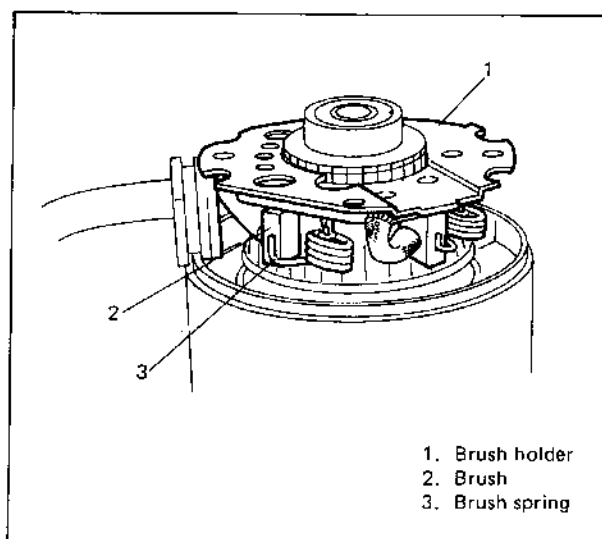


Fig. 6G-11

- 3) Fit spring washer between rear bracket and shaft as shown below.

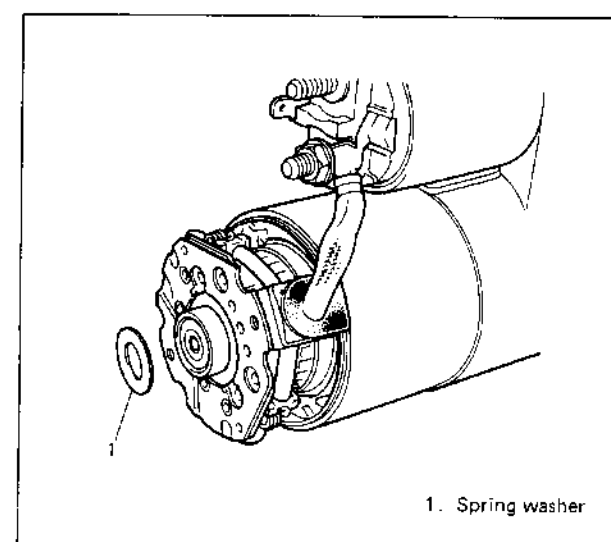


Fig. 6G-12

- 4) Install rear bracket.
- 5) Check motor for operation (See page 6G-15).

**ARMATURE/YOKE****REMOVAL****NOTE:**

Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in the figure below so that any possible mistake can be avoided.

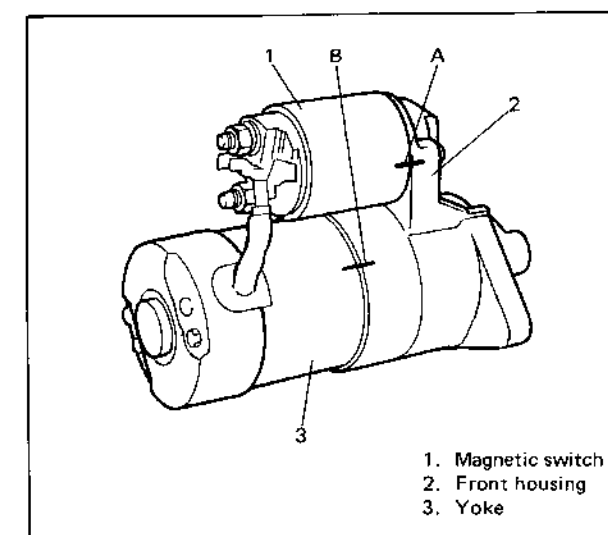


Fig. 6G-13

- 1) Remove magnetic switch. (Refer to page 6G-5)
- 2) Remove brush holder. (Refer to page 6G-6)
- 3) Remove armature and yoke.

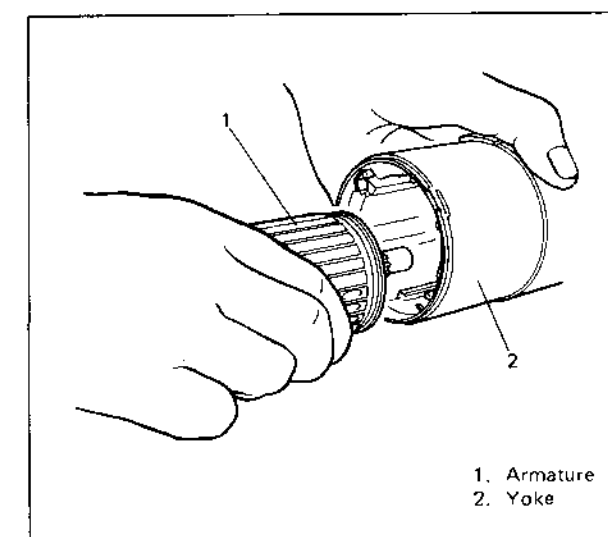


Fig. 6G-14

**INSTALLATION**

Install in reverse order of REMOVAL, noting the following.

- 1) Apply grease. (Refer to Fig. 6G-2)

**NOTE:**

If ball of armature shaft came out when removed, be sure to apply grease to ball and put it back in.

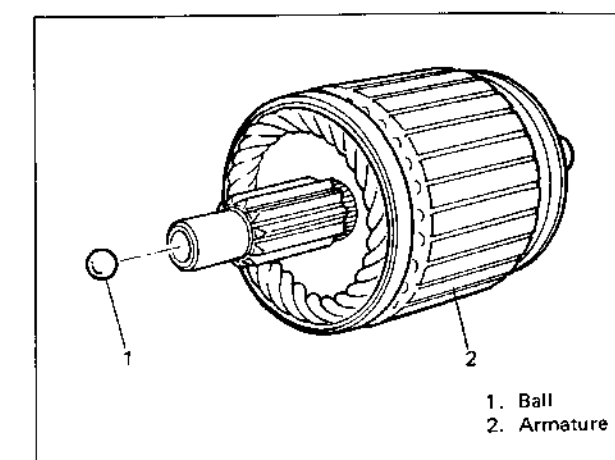


Fig. 6G-15

- 2) Install armature into yoke.

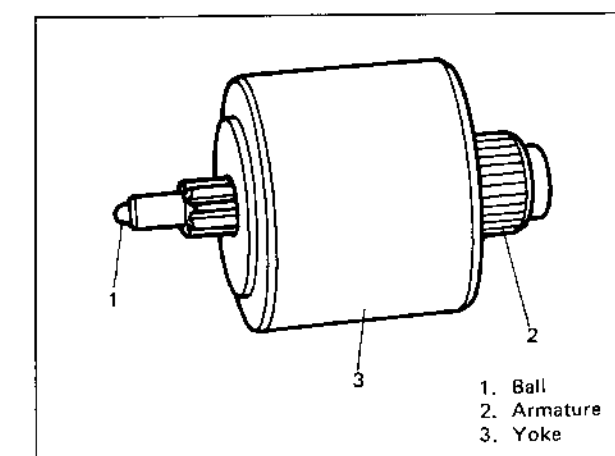


Fig. 6G-16

- 3) Install yoke and armature into front housing while aligning match mark "B" provided before disassembly.
- 4) Install brush holder. (Refer to page 6G-6)
- 5) Install magnetic switch. (Refer to page 6G-5)
- 6) Carry out PERFORMANCE TEST referring to page 6G-15 in this section.

**OVER-RUNNING CLUTCH**

**REMOVAL**

**NOTE:**

Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in figure below so that any possible mistake can be avoided.

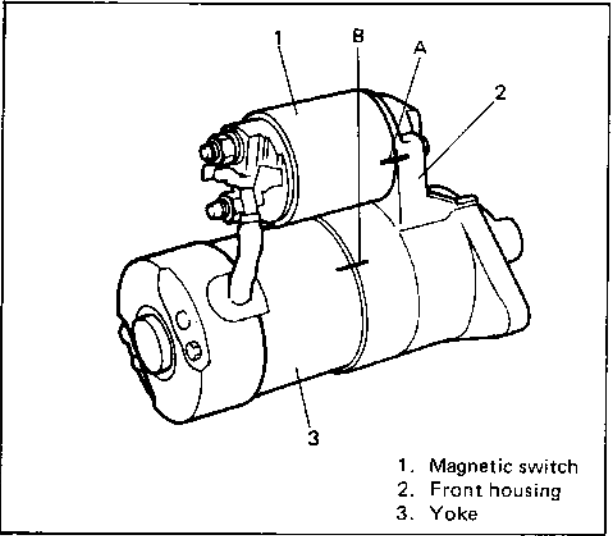


Fig. 6G-17

- 1) Remove magnetic switch assembly. (For details, refer to steps 1) and 2) of Magnetic Switch REMOVAL described on page 6G-5.)
- 2) Remove rear bracket.
- 3) Remove brush holder and brushes.

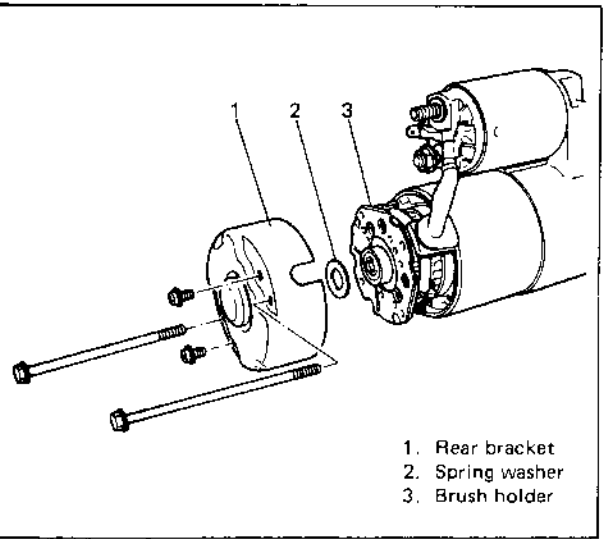


Fig. 6G-18

- 4) Remove yoke and armature.

- 5) Remove packing and idle gears.

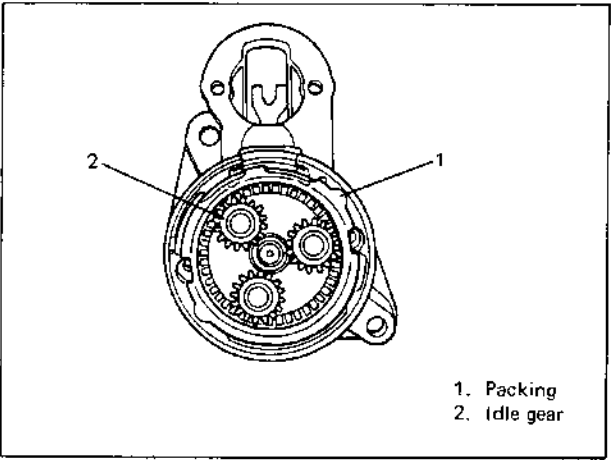


Fig. 6G-19

- 6) Remove seal rubber and plate.

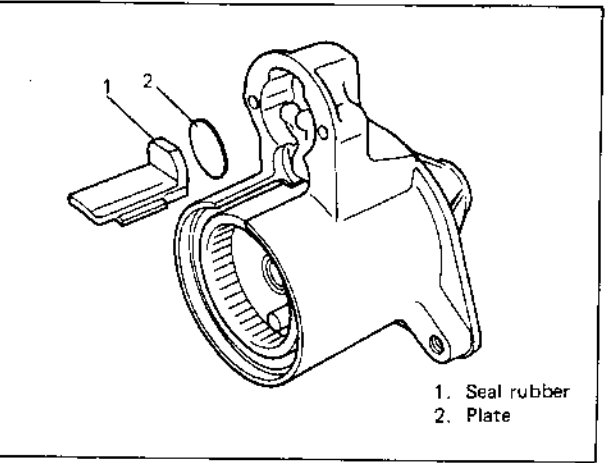


Fig. 6G-20

- 7) Remove shaft assembly with lever.

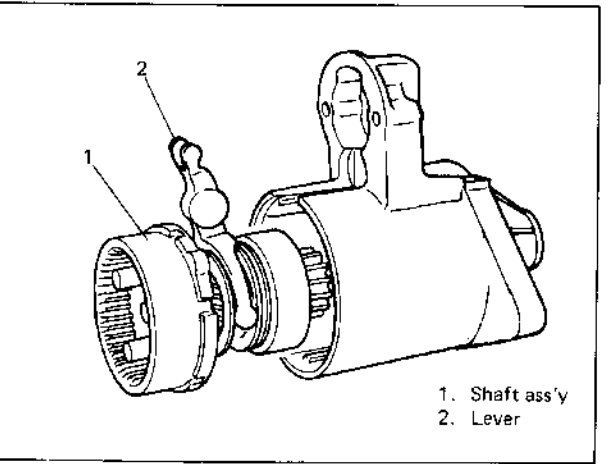


Fig. 6G-21

- 8) Remove over-running clutch by removing rings.

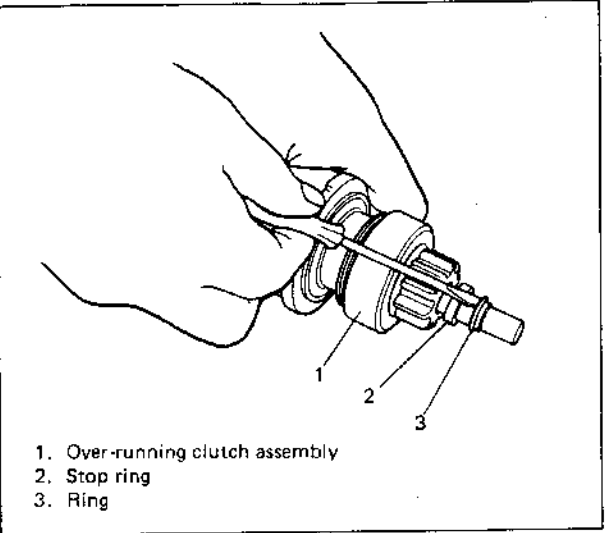


Fig. 6G-22

**INSTALLATION**

Install in reverse order of REMOVAL, noting the following.

- 1) Apply grease. (Refer to Fig. 6G-2)
- 2) Install over-running clutch assembly to gear shaft, using care for installing direction of gear shaft stop ring.

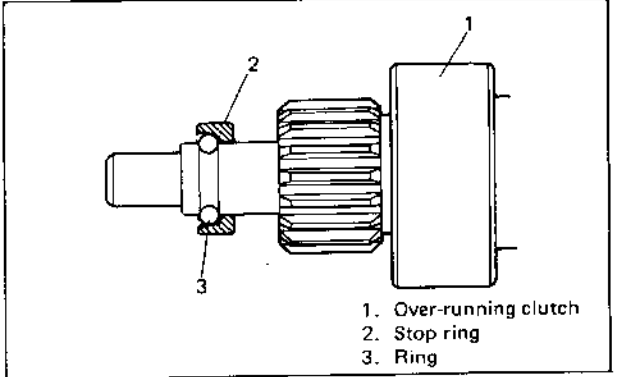


Fig. 6G-23

- 3) Insert shaft ass'y into front housing with lever positioned as shown below.

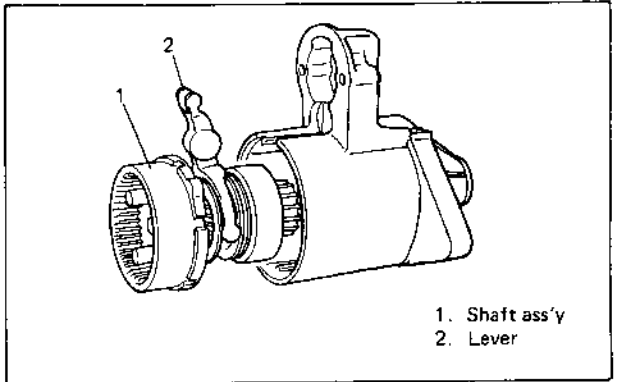


Fig. 6G-24

- 4) Install packing so that cuts in packing align with holes for through bolt in front housing.

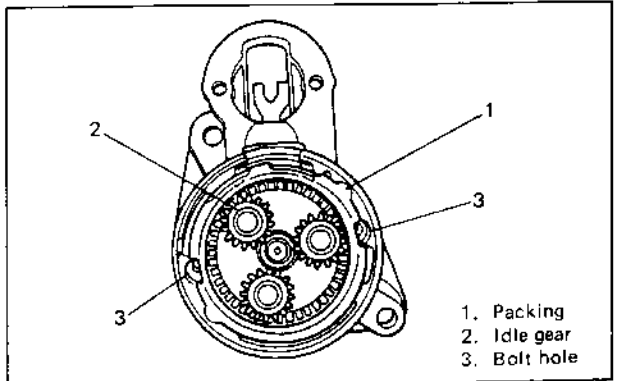


Fig. 6G-25



5) Install plate and seal rubber to front housing.

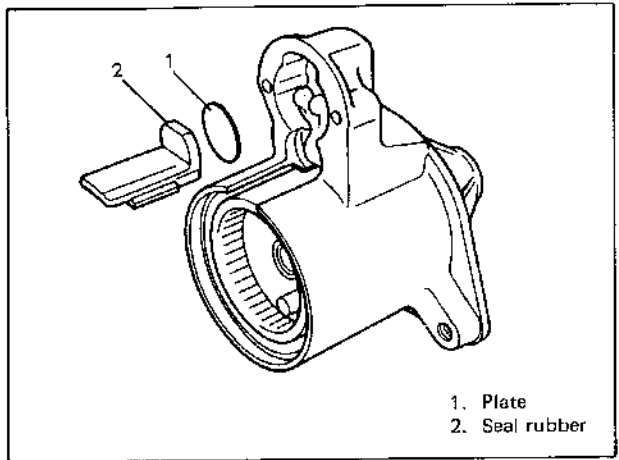


Fig. 6G-26

6) Apply grease to ball and install ball into shaft hole.

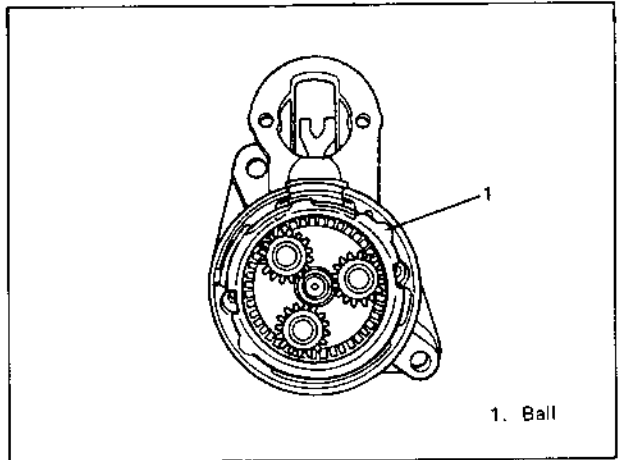


Fig. 6G-27

7) Install yoke and armature to front housing by aligning match marks provided before removal.

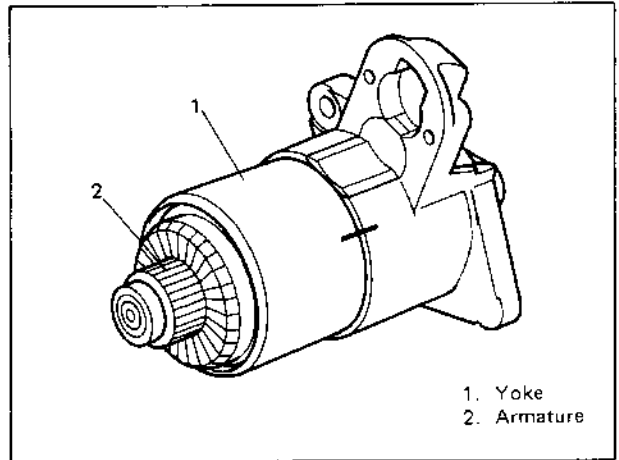


Fig. 6G-28

8) Install brushes and brush holder. (For details, refer to steps 1) to 4) of Brush INSTALLATION on page 6G-6.)

9) Tighten rear bracket bolts and brush holder screws.

10) Install magnetic switch assembly and connect wire (switch to motor) to switch terminal. (For details, refer to steps 1) to 3) of Magnetic Switch INSTALLATION on page 6G-5.)

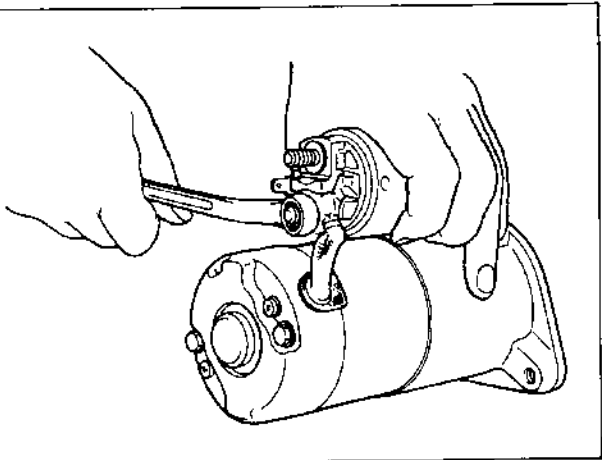


Fig. 6G-29

11) Upon completion of assembly, carry out PERFORMANCE TEST referring to page 6G-15 in this section.

## STARTING MOTOR INSPECTION

### 1. INSPECT ARMATURE

Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.

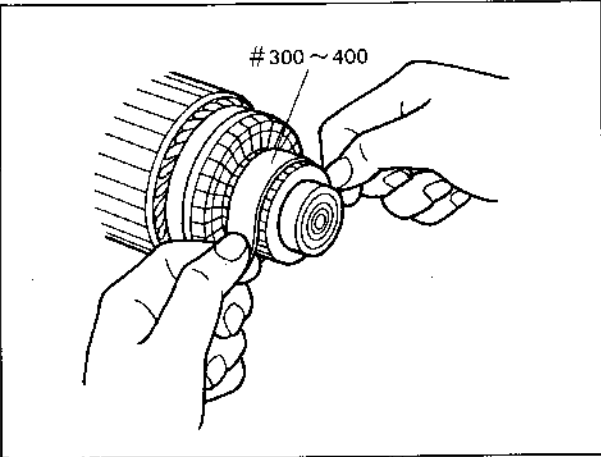


Fig. 6G-30

Check commutator for uneven wear. If deflection of dial gauge pointer exceeds limit, repair or replace.

**NOTE:**  
Below specification presupposes that armature is free from bend. Bent shaft must be replaced.

| Commutator out of round | Standard                     | Limit              |
|-------------------------|------------------------------|--------------------|
|                         | 0.05 mm (0.0019 in.) or less | 0.4 mm (0.015 in.) |

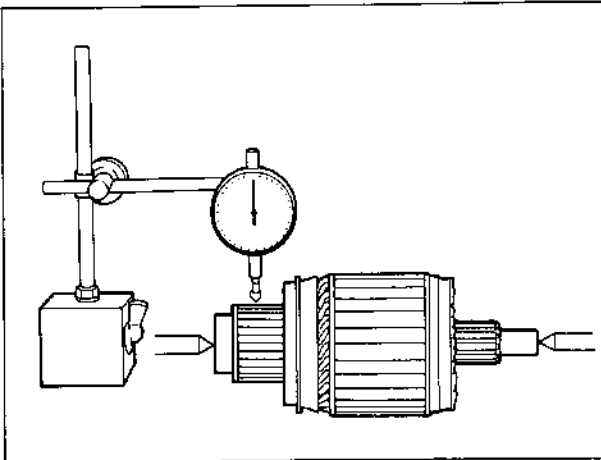


Fig. 6G-31

Inspect commutator for wear. If below the limit, replace armature.

| Commutator outside diameter | Standard           | Limit              |
|-----------------------------|--------------------|--------------------|
|                             | 29.4 mm (1.16 in.) | 28.8 mm (1.13 in.) |

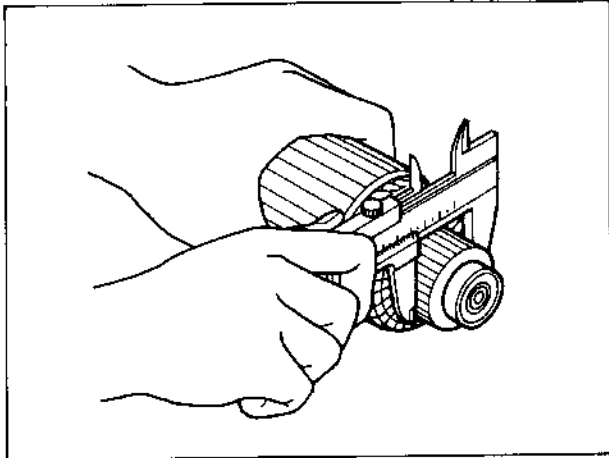


Fig. 6G-32

Inspect commutator for mica depth. Correct or replace if below the limit.

| Commutator mica depth | Standard                           | Limit               |
|-----------------------|------------------------------------|---------------------|
|                       | 0.5 - 0.8 mm (0.0196 - 0.0314 in.) | 0.2 mm (0.0078 in.) |

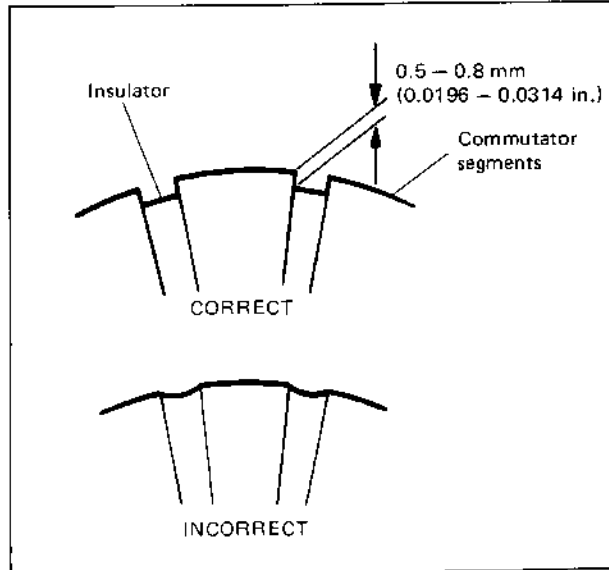


Fig. 6G-33

**Ground Test**

Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.

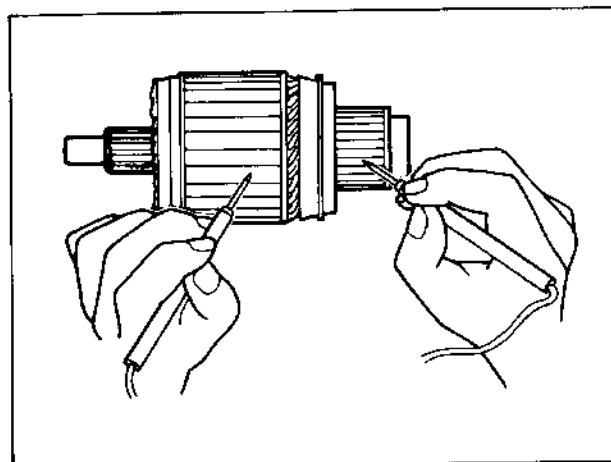


Fig. 6G-34

**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.

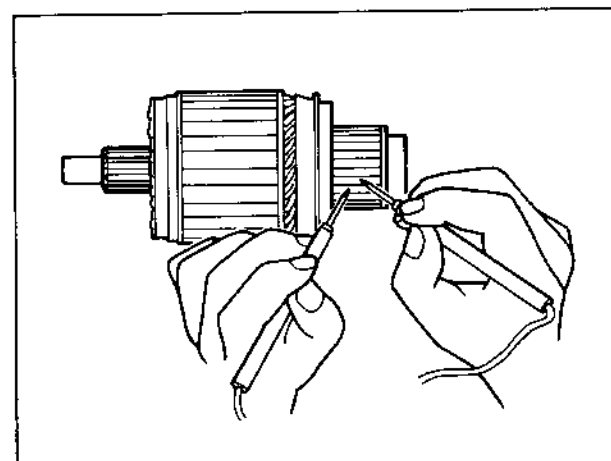


Fig. 6G-35

**2. INSPECT PLUNGER**

Inspect plunger for wear. Replace if necessary.

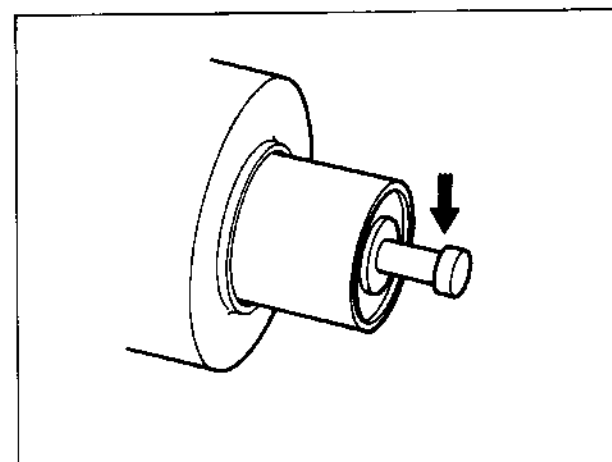


Fig. 6G-36

**3. INSPECT BRUSH**

- Check brushes for wear. If below the limit, replace brush.

|              | Standard              | Limit               |
|--------------|-----------------------|---------------------|
| Brush length | 17.5 mm<br>(0.69 in.) | 12 mm<br>(0.47 in.) |

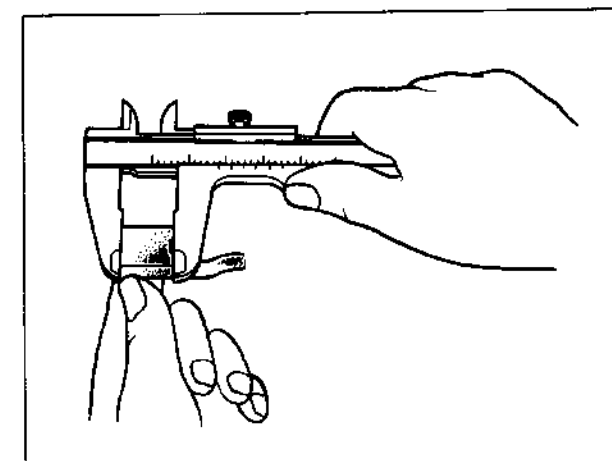


Fig. 6G-37

- Install brushes to each brush holder and check for smooth movement.

**4. INSPECT BRUSH HOLDER AND SPRING**

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.

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.

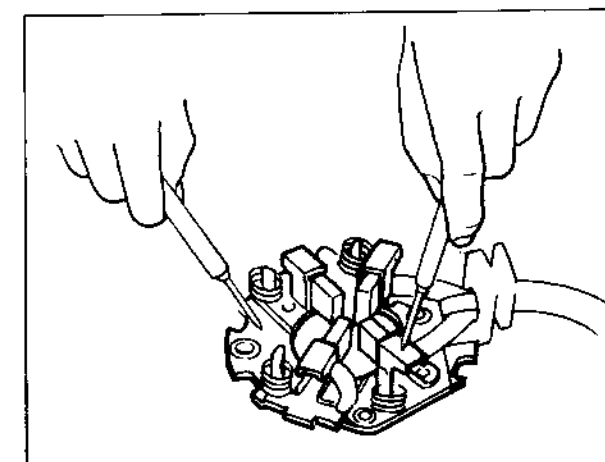


Fig. 6G-38

Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

|                      | Standard            | Limit               |
|----------------------|---------------------|---------------------|
| Brush spring tension | 1.9 kg<br>(4.19 lb) | 0.7 kg<br>(1.54 lb) |

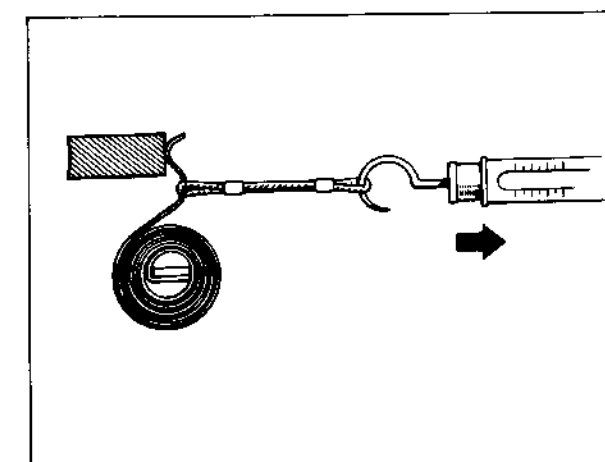


Fig. 6G-39

**5. INSPECT 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.

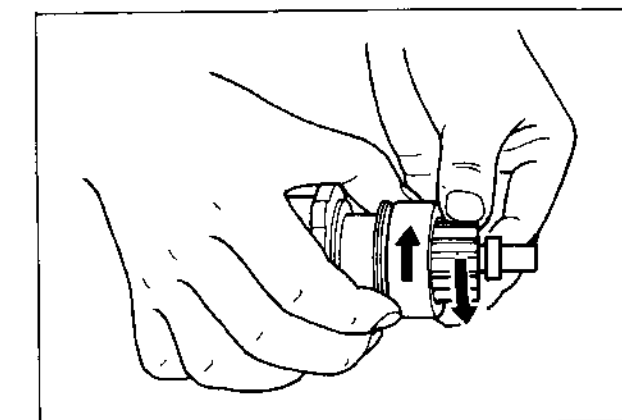


Fig. 6G-40

Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.

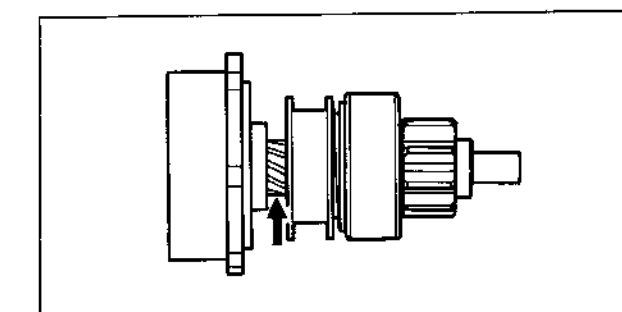


Fig. 6G-41

**6. INSPECT ARMATURE SHAFT BUSH AND BEARING**

Inspect bushes for wear or damage. Replace if necessary.

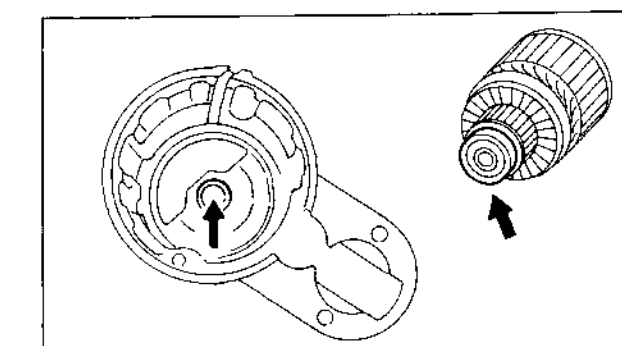


Fig. 6G-42

**7. INSPECT MAGNETIC SWITCH**

Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.

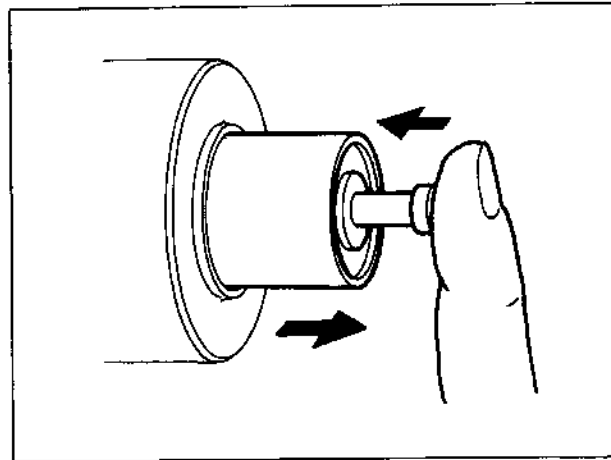


Fig. 6G-43

**Pull-In Coil Open Circuit Test**

Check for continuity across magnetic switch 'S' terminal and 'M' terminal. If no continuity exists, the coil is open and should be replaced.

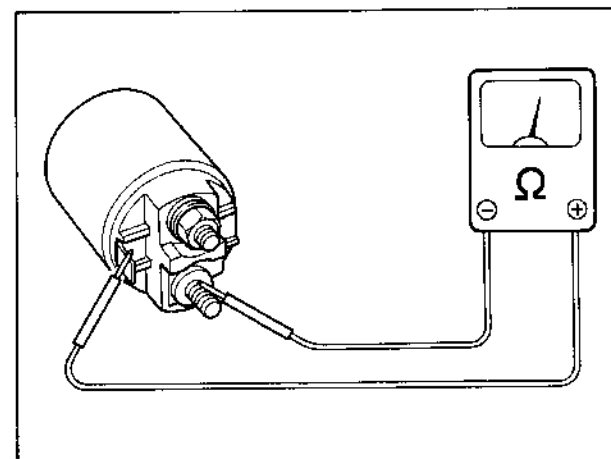


Fig. 6G-44

**Hold In Coil Open Circuit Test**

Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, the coil is open and should be replaced.

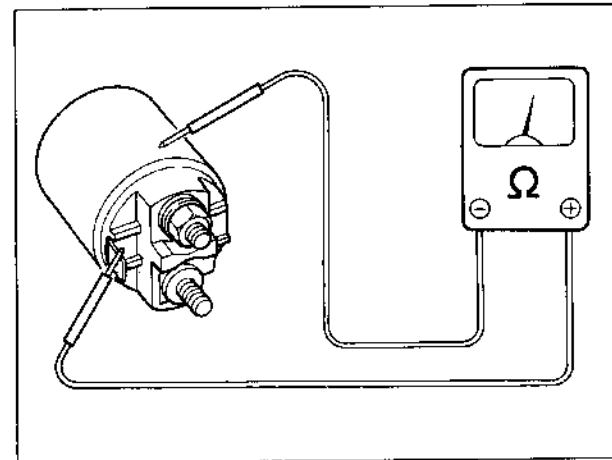


Fig. 6G-45

**8. INSPECT GEARS**

Inspect internal gear and idle gear for wear, damage or other abnormal conditions. Replace if necessary.

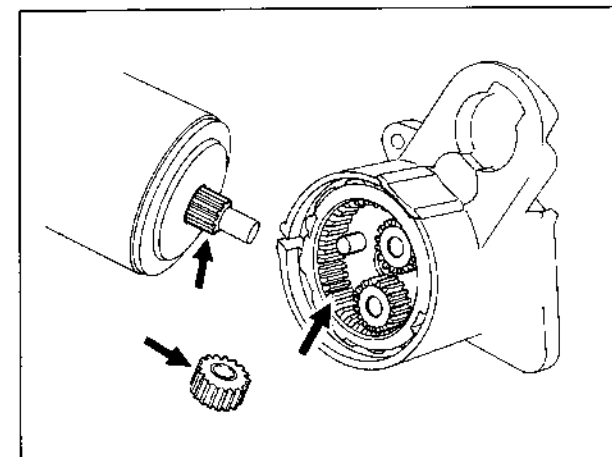


Fig. 6G-46

**9. PERFORMANCE TEST****CAUTION:**

These test must be performed within 3 – 5 seconds to avoid burning out the coil.

**1) Pull-In Test**

Connect battery to magnetic switch as shown. Check that plunger moves outward. If plunger does not move, replace magnetic switch.

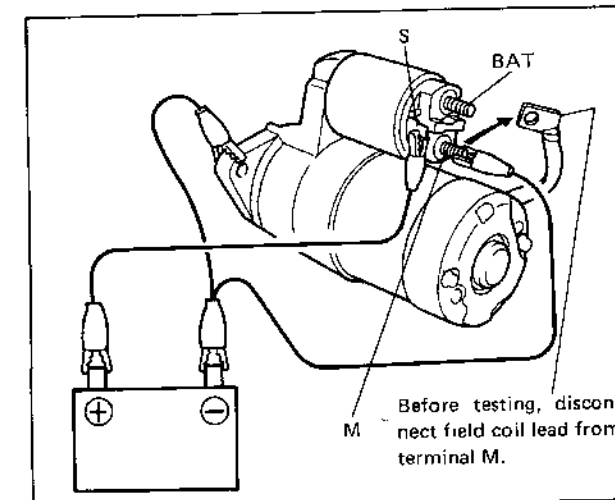


Fig. 6G-47

**2) Hold-In Test**

While connected as above with plunger out, disconnect negative lead from terminal 'M'. Check that plunger remains out. If plunger returns inward, replace magnetic switch.

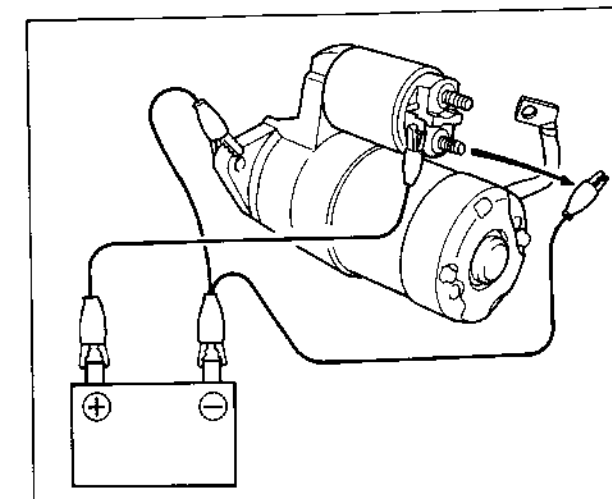


Fig. 6G-48

**3) Check Plunger Return**

Disconnect negative lead from switch body. Check that plunger returns inward. If plunger does not return, replace magnetic switch.

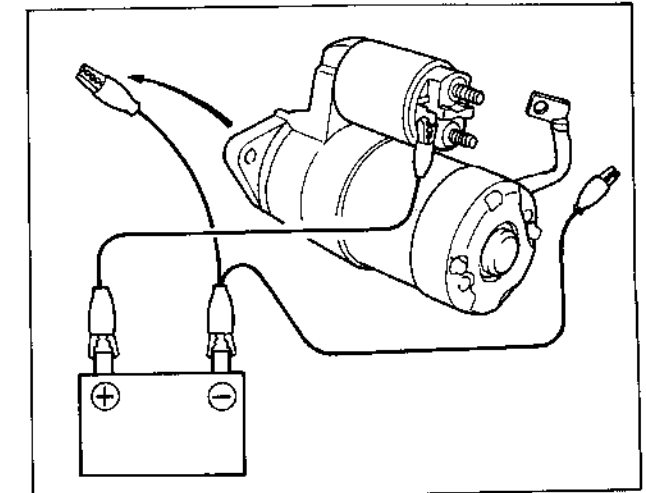


Fig. 6G-49

**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 reads the specified current.

| Specified current    |
|----------------------|
| Less than 90A at 11V |

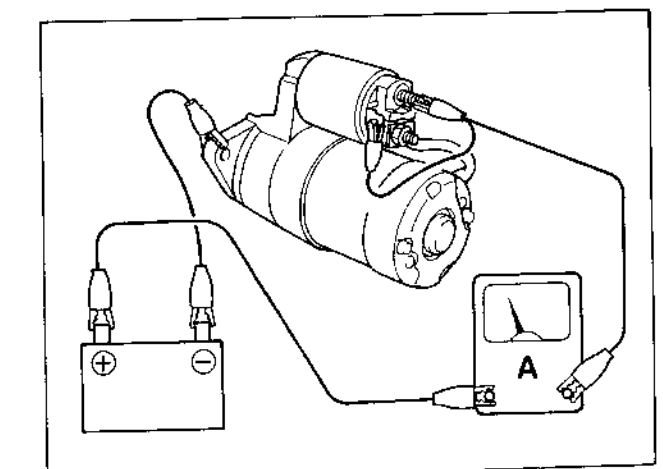


Fig. 6G-50

SPECIFICATIONS

|                                   |                                                                      |
|-----------------------------------|----------------------------------------------------------------------|
| Voltage                           | 12 volts                                                             |
| Output                            | 1.2 kW                                                               |
| Rating                            | 30 seconds                                                           |
| Direction of rotation             | Clockwise as viewed from pinion side                                 |
| Brush length                      | 17.5 mm (0.69 in.)                                                   |
| Number of pinion teeth            | 8                                                                    |
| No-load characteristic            | 90A maximum at 11.0 volts, 3,000 r/min (rpm) minimum                 |
| Load characteristic               | 300A maximum at 7.7 volts, 0.93 kg-m torque, 850 r/min (rpm) minimum |
| Locked rotor current              | 780A maximum at 4.0 volts, 1.9 kg-m minimum                          |
| Magnetic switch operating voltage | 8 volts maximum                                                      |

SECTION 6G1

CRANKING SYSTEM  
(1.0 KW for M/T)

CONTENTS

|                                  |       |                                |        |
|----------------------------------|-------|--------------------------------|--------|
| GENERAL DESCRIPTION .....        | 6G1-1 | Armature .....                 | 6G1-7  |
| Cranking Circuit .....           | 6G1-1 | Yoke .....                     | 6G1-8  |
| Starting Motor .....             | 6G1-1 | Brush .....                    | 6G1-8  |
| DIAGNOSIS .....                  | 6G1-4 | Brush holder .....             | 6G1-9  |
| UNIT REPAIR OVERHAUL .....       | 6G1-5 | Overrunning clutch .....       | 6G1-9  |
| Dismounting and Remounting ..... | 6G1-5 | Performance Test .....         | 6G1-9  |
| Disassembly .....                | 6G1-6 | Pull-in test .....             | 6G1-9  |
| Reassembly .....                 | 6G1-7 | Hold-in test .....             | 6G1-9  |
| Inspection and Correction .....  | 6G1-7 | Pinion return test .....       | 6G1-10 |
|                                  |       | No-load performance test ..... | 6G1-10 |

GENERAL DESCRIPTION

CRANKING CIRCUIT

The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically as shown in Fig. 6G1-1. Only the starting motor will be covered in this section.

STARTING MOTOR

The starting motor consists of yoke assembly, armature assembly, overrunning clutch assembly, magnetic switch assembly, drive end frame (housing), rear end frame (commutator end housing), brush holder and drive lever.

In the circuit shown in Fig. 6G1-1, 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 overrunning clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.

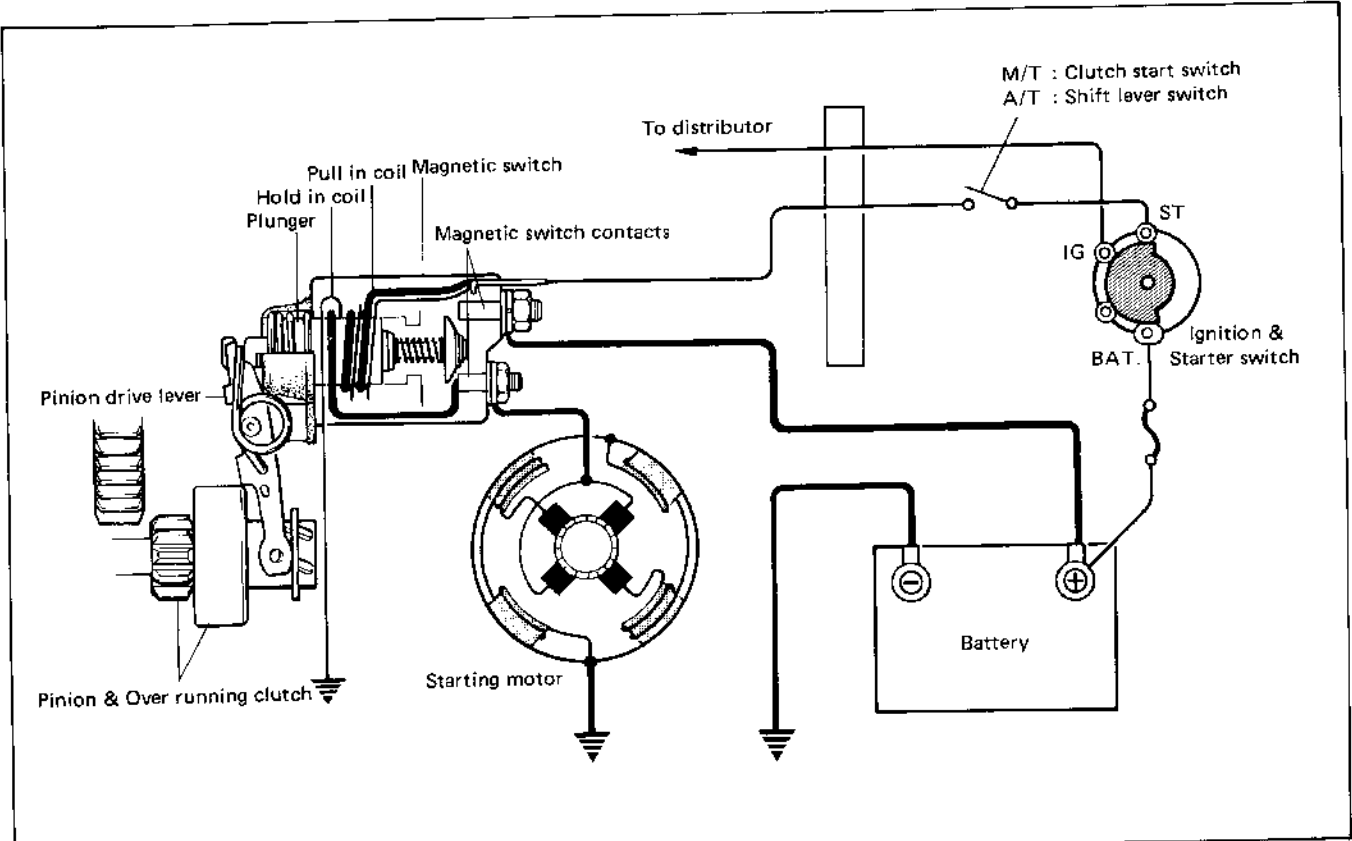


Fig. 6G1-1 Basic Cranking Circuit

SPECIFICATIONS

|                                   |         |                                   |                                            |
|-----------------------------------|---------|-----------------------------------|--------------------------------------------|
| Voltage                           |         | 12 volts                          |                                            |
| Output                            |         | 1.0 kW                            |                                            |
| Rated time                        |         | 30 seconds                        |                                            |
| Rotation                          |         | Clockwise viewed from pinion side |                                            |
| Brush length                      |         | 14 mm (0.551 in)                  |                                            |
| Number of pinion teeth            |         | 8                                 |                                            |
| Performance                       |         | Condition                         | Guarantee                                  |
| Around at 20°C (68°F)             | No load | 11.5V                             | 90A maximum 3,000 r/min. minimum           |
|                                   | Load    | 8.7V 230A                         | 0.78 kg-m minimum 1,000 r/min. minimum     |
|                                   | Lock    | 2.5V                              | 310A maximum 0.87 kg-m (6.3 lb-ft) minimum |
| Magnetic switch pull-in operation |         | 8 volts maximum at 20°C (68°F)    |                                            |

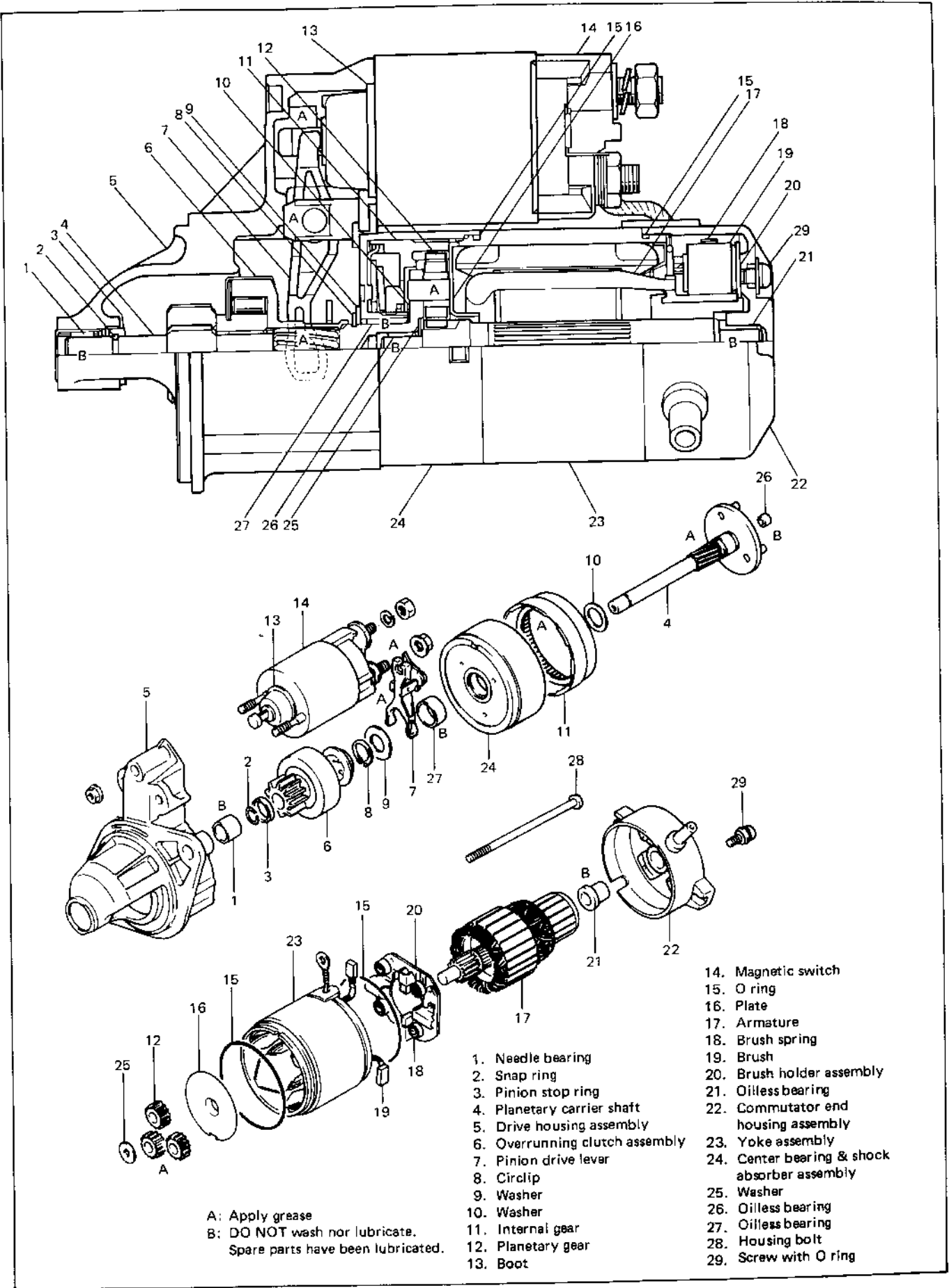


Fig. 6G1-2

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.

- Condition of trouble
- Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
- Discharge of battery

| Condition         | Possible Cause                                                                      | Correction                                         |
|-------------------|-------------------------------------------------------------------------------------|----------------------------------------------------|
| Motor not running | <b>No operating sound of magnetic switch</b>                                        |                                                    |
|                   | 1. Clutch pedal is not depressed fully or clutch start switch is not adjusted (M/T) | Depress clutch pedal or adjust clutch start switch |
|                   | 2. Battery run down                                                                 | Recharge battery                                   |
|                   | 3. Battery voltage too low due to battery deterioration                             | Replace battery                                    |
|                   | 4. Poor contact in battery terminal connection                                      | Retighten or replace                               |
|                   | 5. Loose grounding cable connection                                                 | Retighten                                          |
|                   | 6. Fuse set loose or blown off                                                      | Tighten or replace                                 |
|                   | 7. Poor contacting action of ignition switch                                        | Replace                                            |
|                   | 8. Lead wire coupler loose in place                                                 | Retighten                                          |
|                   | 9. Open-circuit between ignition switch and magnetic switch                         | Repair                                             |
|                   | 10. Open-circuit in pull-in coil                                                    | Replace magnetic switch                            |
|                   | 11. Poor sliding of plunger                                                         | Replace                                            |
| Motor not running | <b>Operating sound of magnetic switch heard</b>                                     |                                                    |
|                   | 1. Battery run down                                                                 | Recharge battery                                   |
|                   | 2. Battery voltage too low due to battery deterioration                             | Replace battery                                    |
|                   | 3. Loose battery cable connections                                                  | Retighten                                          |
|                   | 4. Burnt main contact point, or poor contacting action of magnetic switch           | Replace magnetic switch                            |
|                   | 5. Brushes are seating poorly or worn down                                          | Repair or replace                                  |
|                   | 6. Weakened brush spring                                                            | Replace                                            |
|                   | 7. Burnt commutator                                                                 | Replace                                            |
|                   | 8. Poor grounding of field coil                                                     | Repair                                             |
|                   | 9. Layer short-circuit of armature                                                  | Replace                                            |
|                   | 10. Crankshaft rotation obstructed                                                  | Repair                                             |

| Condition                                          | Possible Cause                                                               | Correction                  |
|----------------------------------------------------|------------------------------------------------------------------------------|-----------------------------|
| Starting motor running but too slow (small torque) | <b>If battery and wiring are satisfactory, inspect starting motor</b>        |                             |
|                                                    | 1. Insufficient contact of magnetic switch main contacts                     | Replace                     |
|                                                    | 2. Layer short-circuit of armature                                           | Replace                     |
|                                                    | 3. Disconnected, burnt or worn commutator                                    | Repair or replace           |
|                                                    | 4. Poor grounding of field coil                                              | Repair                      |
|                                                    | 5. Worn brushes                                                              | Replace                     |
|                                                    | 6. Weakened brush springs                                                    | Replace spring              |
|                                                    | 7. Burnt or abnormally worn end bushings                                     | Replace                     |
| Starting motor running, but not cranking engine    | 1. Worn pinion tip                                                           | Replace over-running clutch |
|                                                    | 2. Poor sliding of over-running clutch                                       | Replace                     |
|                                                    | 3. Over-running clutch slipping                                              | Replace                     |
|                                                    | 4. Worn teeth of ring gear                                                   | Replace flywheel            |
|                                                    | 5. Shock absorber slipping                                                   | Replace                     |
| Noise                                              | 1. Abnormally worn bush                                                      | Replace                     |
|                                                    | 2. Worn pinion or worn teeth of ring gear                                    | Replace pinion or flywheel  |
|                                                    | 3. Poor sliding of pinion (failure in return movement)                       | Repair or replace           |
| Starting motor does not stop running               | 1. Fused contact points of magnetic switch                                   | Replace                     |
|                                                    | 2. Short-circuit between turns of magnetic switch coil (layer short-circuit) | Replace                     |
|                                                    | 3. Failure of returning action in ignition switch                            | Replace                     |

UNIT REPAIR OVERHAUL

For overhauling of starting motor, it is recommended that component parts should be cleaned thoroughly. However, yoke assembly, armature coil, overrunning clutch assembly, magnetic switch assembly, rubber or plastic parts and center bearing & shock absorber assembly are NOT ALLOWED to be washed in degreasing tank or with grease dissolving solvent. Those parts should be cleaned by blowing air and wiping with cloth.

DISMOUNTING AND REMOUNTING

1. Disconnect negative (—) battery lead at battery.
2. Disconnect magnetic switch lead wire and battery cable from starting motor terminals.
3. Remove 2 mounting bolts.
4. Remove starting motor.
5. To remount, reverse above procedure.



DISASSEMBLY

**NOTE:**  
Before disassembling starting motor, be sure to put match mark as shown in the figure below so that any possible mistake can be avoided.

- 1. Remove magnetic switch.
- 2. Remove housing bolts, then remove motor assembly with end housing, reduction gear assembly (center bearing & shock absorber) with overrunning clutch and drive lever.

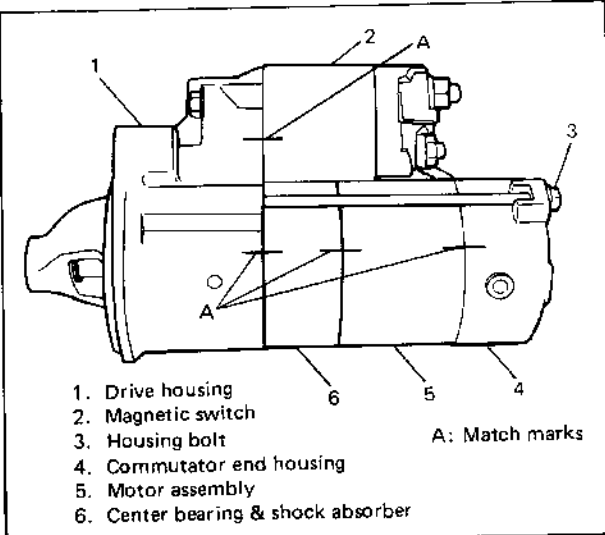


Fig. 6G1-3

- 3. To overhaul reduction gear assembly, remove plate, planetary gears and washer.

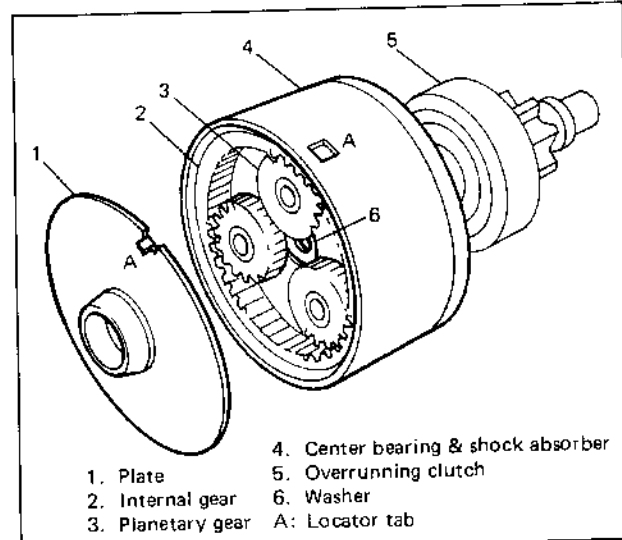


Fig. 6G1-4 Reduction Gear Assembly

- 4. Remove snap ring, then pull out pinion stop ring and overrunning clutch.

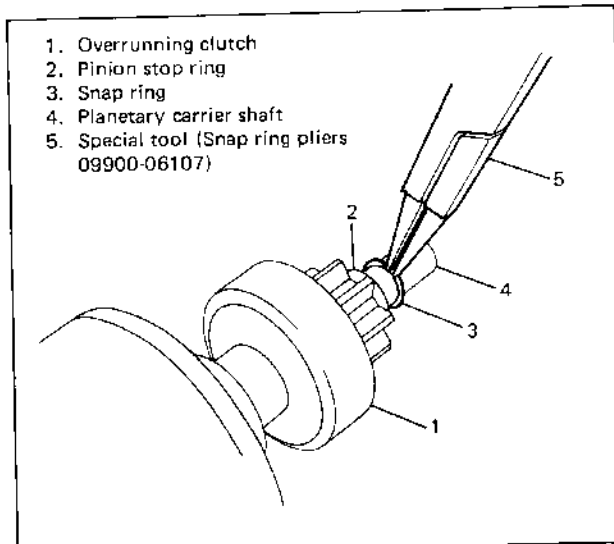


Fig. 6G1-5 Removing Overrunning Clutch

- 5. Using special tool, remove circlip, then take out planetary carrier shaft from center bearing & shock absorber.

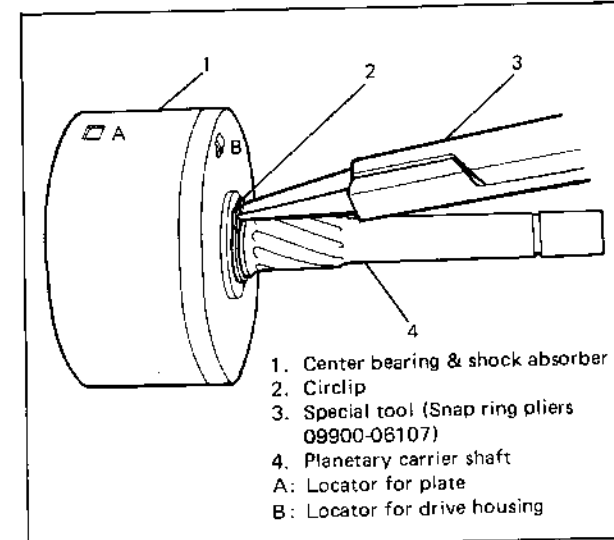


Fig. 6G1-6 Removing Circlip

REASSEMBLY

- 1. Inspect component parts and replace with new ones as necessary.
- 2. Assemble motor and magnetic switch in reverse order of removal applying grease to specified portions in Fig. 6G1-2.

**NOTE:**  
Be sure to align match marks as shown in the Fig. 6G1-3.

- 3. Torque each bolt and nut to specification.

**NOTE:**

- Install O rings without fail.
- When assembling motor parts, make sure locators are aligned each other.

**CAUTION:**

- Washing, adjusting and disassembling of shock absorber (clutch plate) are not allowed.
- New needle bearing and oilless bearings have been lubricated when they are supplied as spare parts. DO NOT wash with grease dissolving solvent nor lubricate them with other lubricant.

| Tightening torque    | N·m    | kg·m      | lb·ft     |
|----------------------|--------|-----------|-----------|
| Housing bolts        | 5 - 7  | 0.5 - 0.7 | 4.0 - 5.0 |
| Magnetic switch nuts | 6 - 11 | 0.6 - 1.1 | 4.5 - 7.5 |
| Lead wire nuts       | 8 - 12 | 0.8 - 1.2 | 6.0 - 8.5 |

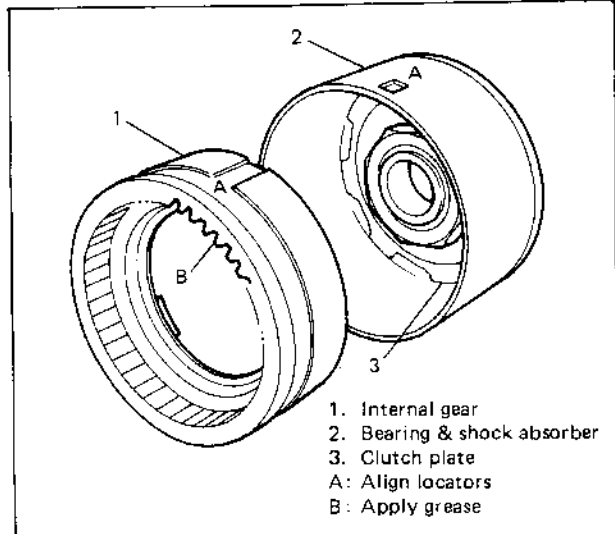


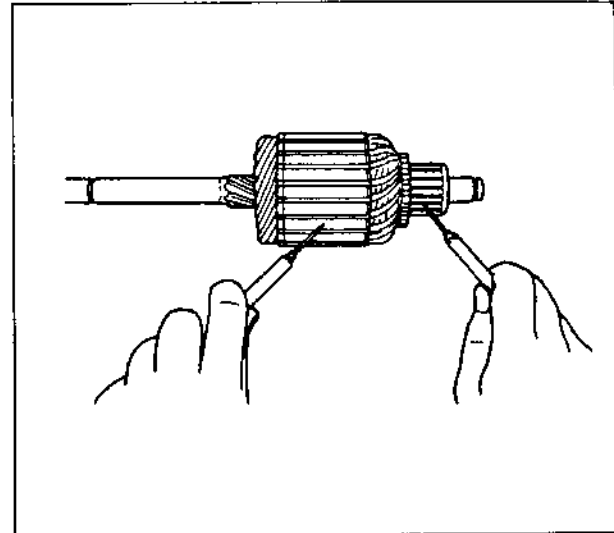
Fig. 6G1-7 Assembling Internal Gear

INSPECTION AND CORRECTION

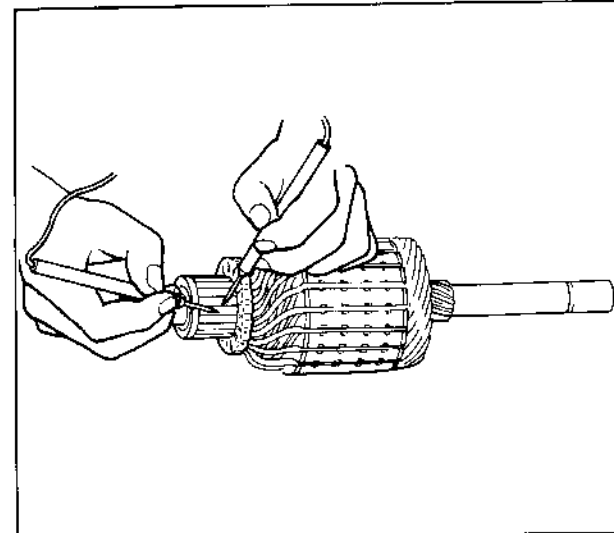
**NOTE:**  
For inspection and correction not found in this section, refer to STARTING MOTOR INSPECTION of SECTION 6G.

ARMATURE

**Ground**  
Between commutator segment and armature core should be insulated. Use ohmmeter for inspection.



**Open Circuit**  
Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.



**Commutator Run-out**

Check commutator for run-out with armature supported on V blocks. Correct it by using lathe, if required.

|                                                       |                    |
|-------------------------------------------------------|--------------------|
| Comutator run-out<br>Service limit<br>(maximum value) | 0.05 mm (0.002 in) |
|-------------------------------------------------------|--------------------|

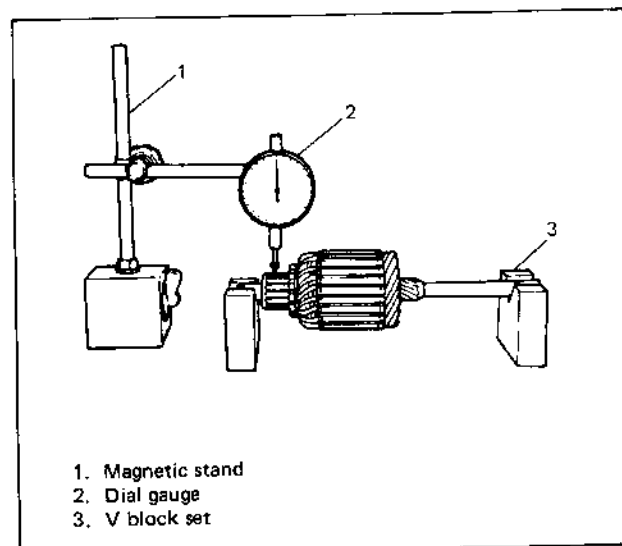


Fig. 6G1-10 Checking Commutator Run-Out

**Commutator Diameter**

Check for wear and replace armature if diameter is below limit.

|                                                         |                  |
|---------------------------------------------------------|------------------|
| Commutator diameter<br>Service limit<br>(minimum value) | 27 mm (1.063 in) |
|---------------------------------------------------------|------------------|

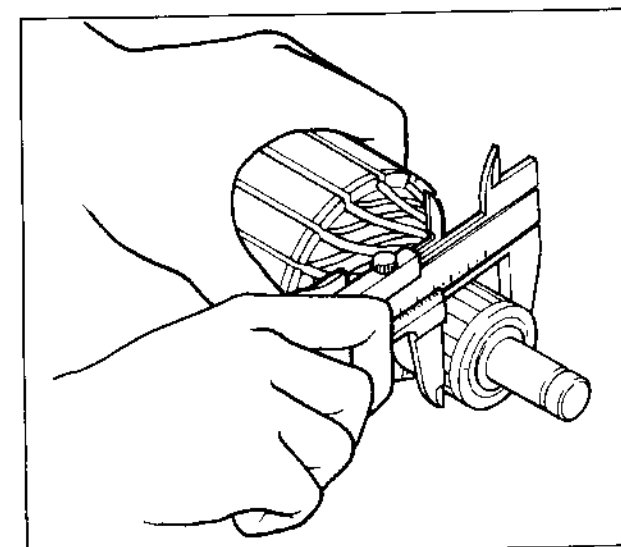


Fig. 6G1-11 Checking Commutator Diameter

**Commutator Surface**

Correct and clean surface by using # 400 emery cloth. Also check mica depth and correct it as required.

|                                                             |                   |
|-------------------------------------------------------------|-------------------|
| Commutator mica<br>depth A service limit<br>(minimum value) | 0.2 mm (0.008 in) |
|-------------------------------------------------------------|-------------------|

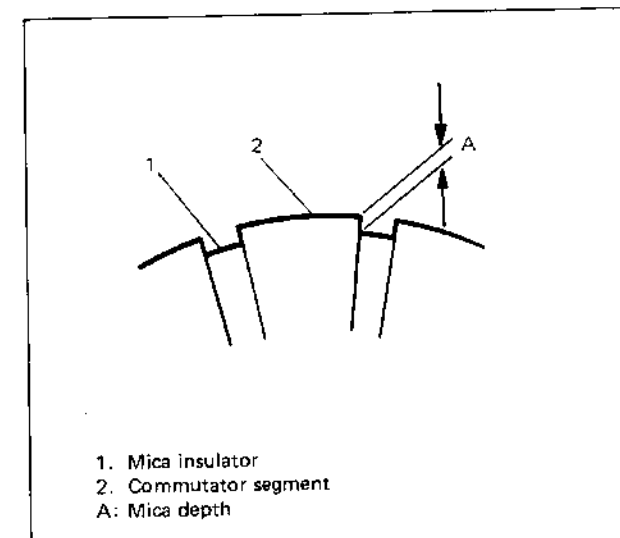


Fig. 6G1-12 Checking Mica Depth

**YOKE**

Check field coil for continuity. There should be continuity between brush and yoke body.

**BRUSH**

Measure length of brushes and replace them as necessary.

|                                               |                   |
|-----------------------------------------------|-------------------|
| Brush length service<br>limit (minimum value) | 9.0 mm (0.354 in) |
|-----------------------------------------------|-------------------|

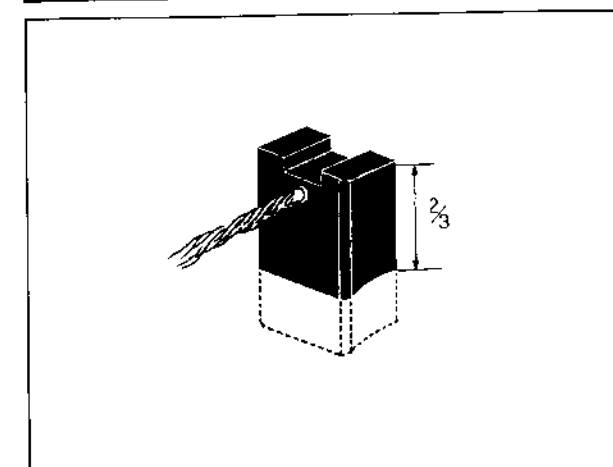


Fig. 6G1-13 Checking Brush Length

**BRUSH HOLDER**

Check brush springs for rust or breakage. Also check brush holder for rust and positive plates for insulation. Replace it as assembly, if required.

**OVERRUNNING CLUTCH**

Inspect one way clutch for free rotation in A direction and locked up in the other way round. Also check pinion for abnormal wear and replace it as assembly, if required.

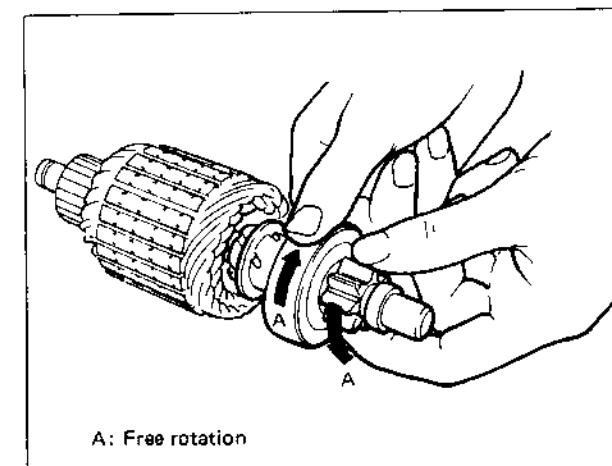


Fig. 6G1-14 Checking Overrunning Clutch

**PERFORMANCE TEST****CAUTION:**

Each test must be performed within 3 – 5 seconds to avoid coil from burning.

**PULL-IN TEST**

Connect test leads as shown below and check that pinion (overrunning clutch) jumps out. If it does not, replace magnetic switch.

**NOTE:**

Before testing, disconnect field coil lead from terminal M.

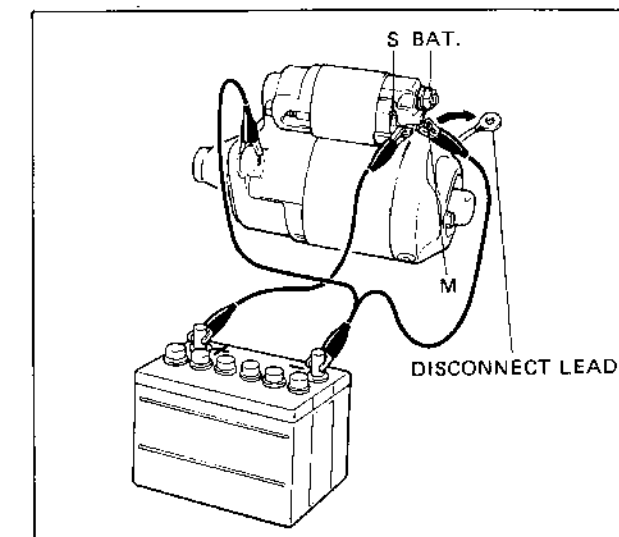


Fig. 6G1-15 Checking Pull-in Coil

**HOLD-IN TEST**

While connected as the above with pinion out, disconnect negative lead from terminal M and check that pinion remains out. If not, replace magnetic switch.

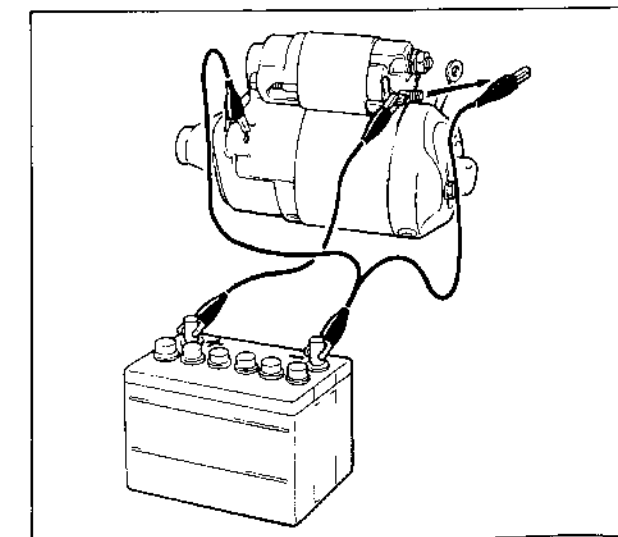


Fig. 6G1-16 Checking Hold-in Coil



**PINION (PLUNGER) RETURN TEST**

As a next step to the above, disconnect negative lead and check to make sure that pinion returns inward quickly.

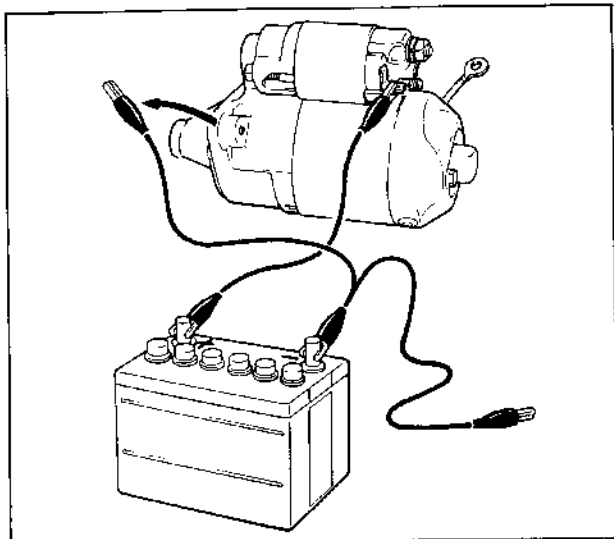


Fig. 6G1-17 Checking Pinion Return

**NO-LOAD PERFORMANCE TEST**

Connect test leads as follows and check that motor runs without fail with pinion moved out. Also check that ammeter indicates specified current.

|                 |                     |
|-----------------|---------------------|
| No load current | Within 90A at 11.5V |
|-----------------|---------------------|

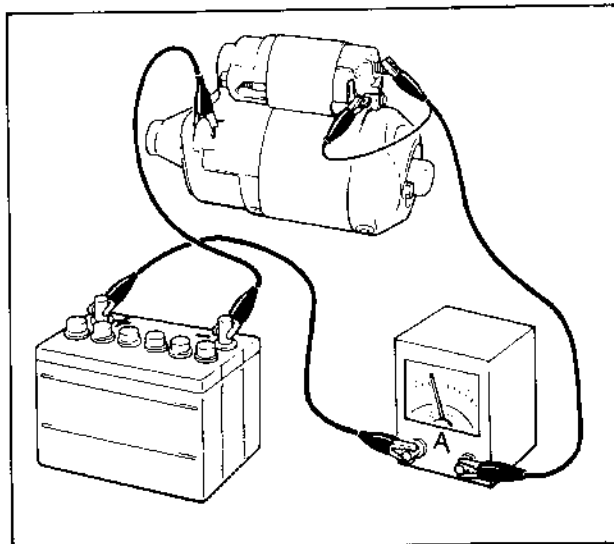


Fig. 6G1-18 Checking No-load Performance

**SECTION 6H**

**CHARGING SYSTEM**

**CONTENTS**

|                                    |       |                                   |       |
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**BATTERY**

**GENERAL DESCRIPTION**

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

**COMMON CAUSES OF FAILURE**

A battery is not designed to last indefinitely; however, with proper care, it will provide many years of service. If the battery tests good but fails to perform satisfactorily in service, the following are some factors that may point to the cause of trouble:

1. Accessories left on overnight.
2. Slow average driving speeds for short periods.
3. Electrical load exceeding generator output particularly with addition of after market equipment.
4. Defects in charging system such as high resistance, slipping drive belt, loose generator output terminal, faulty generator or voltage regulator.
5. Battery abuse, including failure to keep battery cable terminals clean and tight or loose battery hold down.
6. Mechanical problems in electrical system such as shorted or pinched wires.

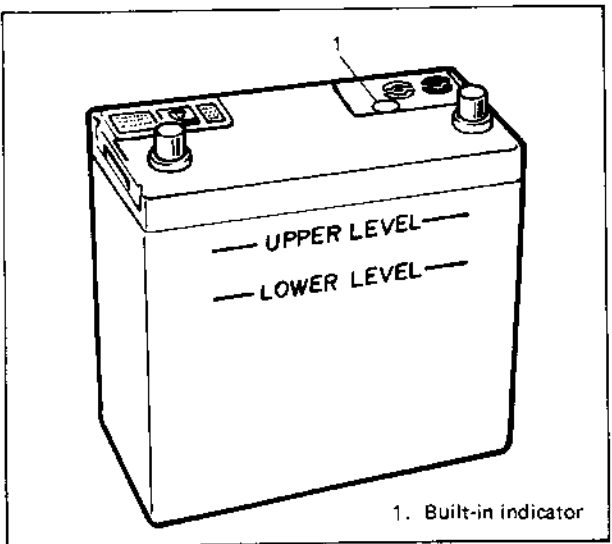


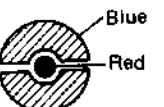
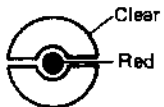
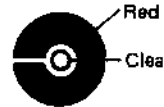
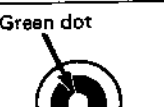
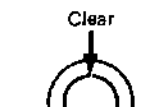
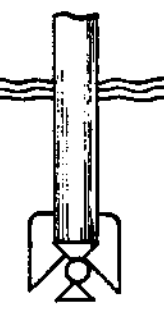
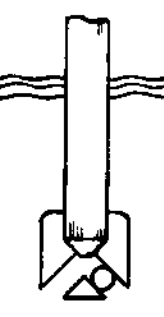
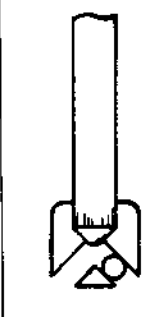
Fig. 6H-1 Furukawa 55B24R(S)-MF 12V 45AH/20HR or Equivalent

## VISUAL INSPECTION

The external condition of the battery should be checked periodically for damage such as cracked cover or case.

## BUILT-IN INDICATOR

The battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.

| DIAGNOSIS    | OK                                                                                  | CHARGING NECESSARY                                                                  | LOW LEVEL ELECTROLYTE REPLACE BATTERY                                               |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| FURUKAWA     |    |    |    |
| DELCO        |  |  |  |
| GRAVITY BALL |  |  |  |

Three types of indication available under normal operation are as follows.

- 1. Blue With Red Dot - or - Green Dot**  
Battery is ready for testing.
- 2. Clear with Red Dot - or - Dark**  
If there is a cranking complaint, battery should be tested as described in Diagnosis section. Charging and electrical systems should also be checked at this time.

## 3. Red With Clear Dot - or - Clear or Light Yellow

This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration. When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

## CARRIER AND HOLD-DOWN

The battery carrier and hold-down clamp should be clean and free from corrosion before installing the battery. The carrier should be in good condition so that it will support the battery securely and keep it level. Make certain there are no parts in carrier before installing the battery. To prevent the battery from shaking in its carrier, the hold-down bolts should be tight but not over-tightened.

## 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.

## 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.

## DIAGNOSIS

### VISUAL INSPECTION

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed. If not, move on to load test.

### INDICATOR CHECK

#### 1. Blue With Red Dot - or - Green Dot

Proceed to load test.

#### 2. Clear With Red Dot - or - Dark

Charge battery as outlined under charging procedure section and proceed to load test.

### LOAD TEST

1. Connect voltmeter and battery load tester across battery terminals.
2. Apply 200 ampere load for 15 seconds to remove surface charge. Remove load.

3. Wait 15 seconds to let battery recover and apply specified load. Read voltage after 15 seconds.
4. If voltage does not drop below the minimum as listed below, battery is good. Temperature of battery will affect minimum voltage required to pass load test. See below chart and estimate the temperature battery has been exposed to for the last several hours.

| Battery load test voltage |                                             |
|---------------------------|---------------------------------------------|
| Estimated temperature     | Minimum required voltage under 15 sec. load |
| 21°C/70°F                 | 9.6                                         |
| 10°C/50°F                 | 9.4                                         |
| 0°C/30°F                  | 9.1                                         |
| -10°C/15°F                | 8.8                                         |
| -18°C/0°F                 | 8.5                                         |
| Below -18°C/0°F           | 8.0                                         |

## ON-CAR SERVICE

### CHARGING PROCEDURES

When it is necessary to charge battery, following safety precautions must be taken.

1. DO NOT CHARGE battery if indicator is red with clear dot -or- clear or light yellow. Replace battery.
2. Disconnect negative (-) cable from battery.
3. If battery feels hot 52°C (125°F), or if violent gassing or spewing of electrolyte through vent holes occur, discontinue charging or reduce charging rate. Charge battery until indicator turns blue with red dot -or- green. Tipping or shaking battery may be necessary to make indicator turn blue.

Temperature of battery itself will affect charging rate, and most charging equipment will not charge at a constant rate. For example, if charg-

ing starts as 30 amperes and drops off to 10 amperes after 1 hour, average current for that hour is 20 amperes and actual boost charge is 20 ampere-hours. Battery can be fast charged or slow charged with ordinary charges. Either method will restore battery to full charge.

### JUMP STARTING IN CASE OF EMERGENCY

#### WITH AUXILIARY (BOOSTER) BATTERY

#### CAUTION:

Do not push or tow vehicle to start. Damage to emission system and/or to other parts of vehicle 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.
- Never expose battery to open flame or electric spark. Batteries generate gas which is flammable and explosive.
- Remove rings, watches, and other jewelry. Wear approved eye protection.
- 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.
- 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.
- Batteries should always be kept out of reach of children.

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 built-in indicator. If it is red with clear dot -or- clear or light yellow, replace battery.
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 that is providing jump start and turn off electrical accessories. Then start engine of the vehicle with discharged battery.
6. Reverse connecting procedure exactly when disconnecting jumper cables. Negative cable must be disconnected from engine that was jump started first.

**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.

**OFF-CAR SERVICE****DISMOUNTING AND REMOUNTING**

1. Disconnect negative cable.
2. Disconnect positive cable.
3. Remove retainer nuts and retainer.
4. Remove battery.
5. To install, reverse removal procedure.
6. Torque battery cables to specification.

**NOTE:**

Check to be sure that ground cable has enough clearance to hood panel by terminal.

| Tightening torque           |     | N-m     | kg-m      | lb-ft       |
|-----------------------------|-----|---------|-----------|-------------|
| Ground bolt to body         |     | 6 - 10  | 0.6 - 1.0 | 4.5 - 7.0   |
| Ground bolt to transmission | M/T | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |
|                             | A/T | 50 - 60 | 5.0 - 6.0 | 36.5 - 43.0 |

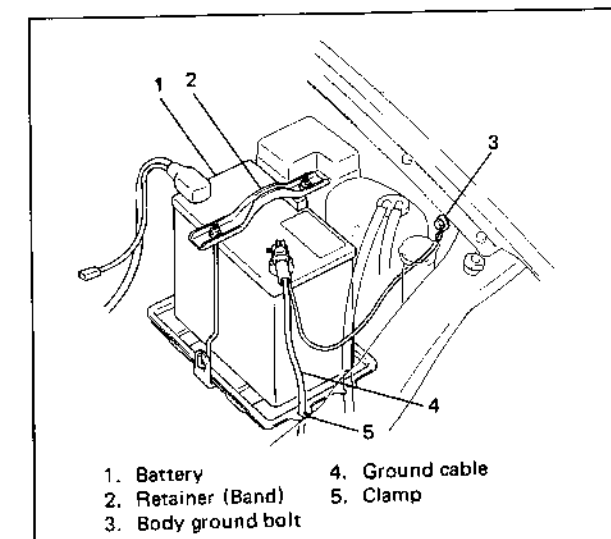


Fig. 6H-2 Installing Battery

**CHARGING A VERY FLAT OR COMPLETELY DISCHARGED BATTERY**

1. Measure voltage at battery terminals with an accurate voltmeter. If below 10 volts, then charge current will be very low and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on ammeters available in the field.
2. Set battery charger on high setting.

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

4. Battery chargers vary in the amount of voltage and current they provide. Time required for battery to accept measurable charger current at various voltages may be as follows.

**VOLTAGE**

- A: 16.0 or more . . . . . Up to 4 hours  
 B: 14.0 - 15.9 . . . . . Up to 8 hours  
 C: 13.9 or less . . . . . Up to 16 hours

If charge current is still not measurable at the end of above charging times, battery should be replaced.

If charge current is measurable during above charging time, battery is considered to be good and charging should be completed in normal manner.

5. It is important to remember that a completely discharged battery must be recharged for a sufficient number of ampere hours (AH) to restore it to a useable state. As a general rule of thumb, use nominal AH plus extra about 30 % as number of ampere-hours of charge, which will usually bring blue with red dot -or- green dot into view. If battery is 45 AH, required AH for complete recharge will be  $45 \times 1.3 = 58.5$ .

Therefore, following low ampere long hour charge will be recommended.

- 3 ampere charge x 20 hours . . . . . 60 AH or
  - 5 ampere charge x 12 hours . . . . . 60 AH, etc.
6. It is recommended that any battery recharged by this procedure be LOAD TESTED to verify serviceability.

GENERATOR

GENERAL DESCRIPTION

The basic charging system is the IC integral regulator charging system. The internal components are connected electrically as shown in Fig. 6H-4.

The generator features a solid state regulator that is mounted inside the generator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring and frame. The generator 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 rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator A.C. voltages to a D.C. voltage which appears at the generator output terminal. The neutral diodes serve to convert the voltage fluctuation at the neutral point to direct current for increasing the generator output.

A condenser mounted in the regulator assembly protects the diodes from high voltages and suppresses radio noise.

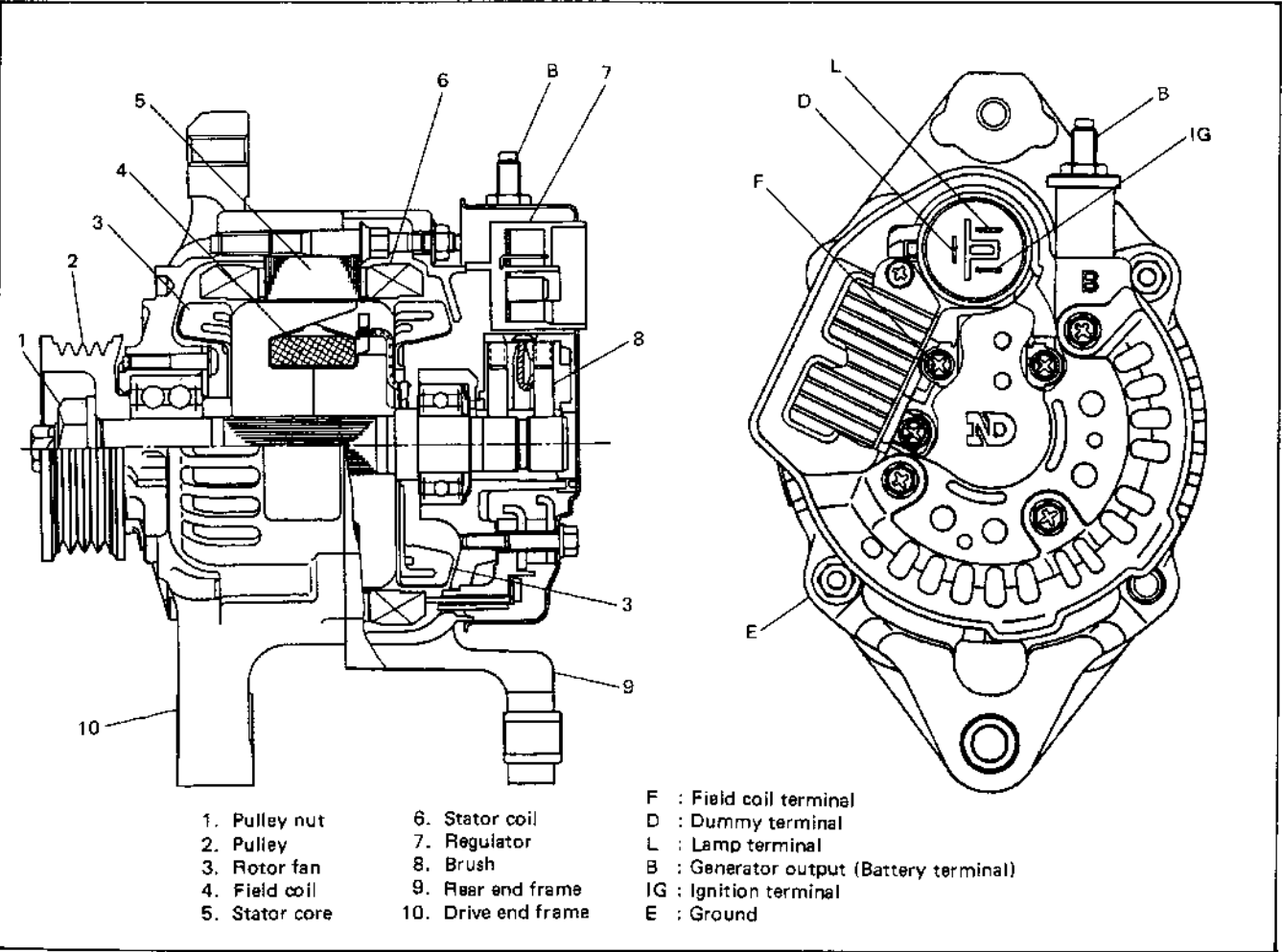


Fig. 6H-3 Generator Cutaway

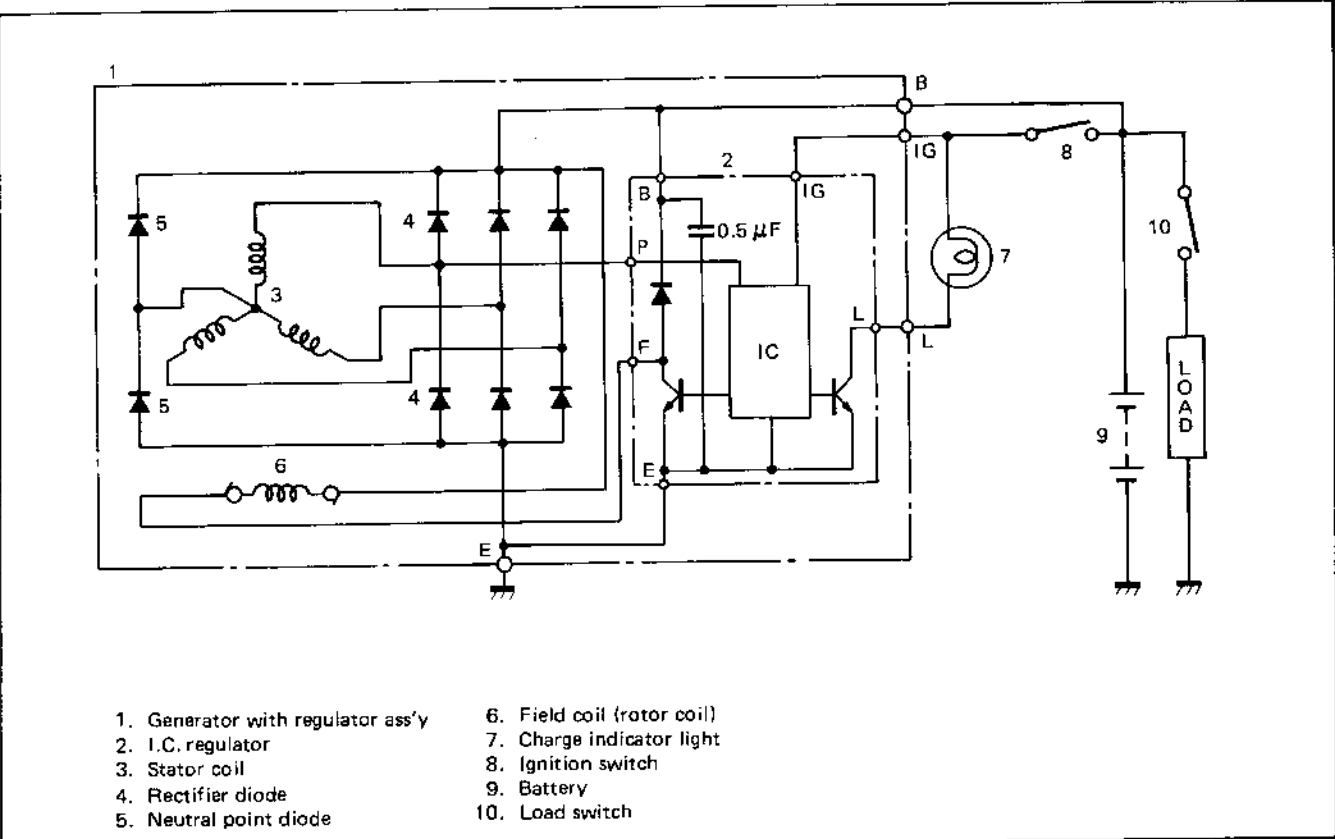


Fig. 6H-4 Generator Schematic

SPECIFICATIONS

|                        |                                              |                                 |                                   |
|------------------------|----------------------------------------------|---------------------------------|-----------------------------------|
| Rated voltage          | 12V                                          | Permissible ambient temperature | -30 to 90° C<br>-22 to 194° F     |
| Maximum output         | 50A (Hot at 13.5V)                           | Polarity                        | Negative ground                   |
| Permissible max. speed | 18,000 r/min.                                | Rotation                        | Clockwise viewed from pulley side |
| No-load speed          | 1,110 r/min.                                 |                                 |                                   |
| Setting voltage        | 14.2 to 14.8V (5,000 r/min. 10A 25° C/77° F) |                                 |                                   |

DIAGNOSIS

To avoid generator damage, always follow precautions shown below.

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 section describing battery charging.

Trouble in charging system will show up as one or more of following conditions:

1. Faulty indicator lamp operation.
2. An undercharged battery as evidenced by slow cranking or indicator clear with red dot.
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

| Symptom                                                                                 | Possible cause                                                                                                                                                                                  | Correction                                                                                                            |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Charge light does not light with ignition ON and engine off                             | <ul style="list-style-type: none"><li>• Fuse blown</li><li>• Light burned out</li><li>• Wiring connection loose</li><li>• IC regulator faulty</li></ul>                                         | <p>Check fuse</p> <p>Replace light</p> <p>Tighten loose connections</p> <p>Replace IC regulator</p>                   |
| Charge light does not go out with engine running (battery requires frequent recharging) | <ul style="list-style-type: none"><li>• Drive belt loose or worn</li><li>• Battery cables loose, corroded or worn</li><li>• IC regulator or alternator faulty</li><li>• Wiring faulty</li></ul> | <p>Adjust or replace drive belt</p> <p>Repair or replace cables</p> <p>Check charging system</p> <p>Repair wiring</p> |

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 normally. 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 at the right.

Voltmeter

Set between generator B terminal and ground.

Ammeter

Set between generator B terminal and battery (+) terminal.

6. Measure current and voltage.

No-load Check

Run engine from idling up to 2,000 r/min. and read meters.

NOTE:

- Consideration should be taken that voltage differs somewhat with regulator case temperature.
- Discharged battery does not fit for this test. Before testing, make sure that battery is fully charged.

CAUTION:

While engine is running, do not disconnect battery terminal. It may cause damage to electronic parts.

|                  |                             |
|------------------|-----------------------------|
| Standard current | 10 A maximum                |
| Standard voltage | 14.2 – 14.8 V at 25°C, 77°F |

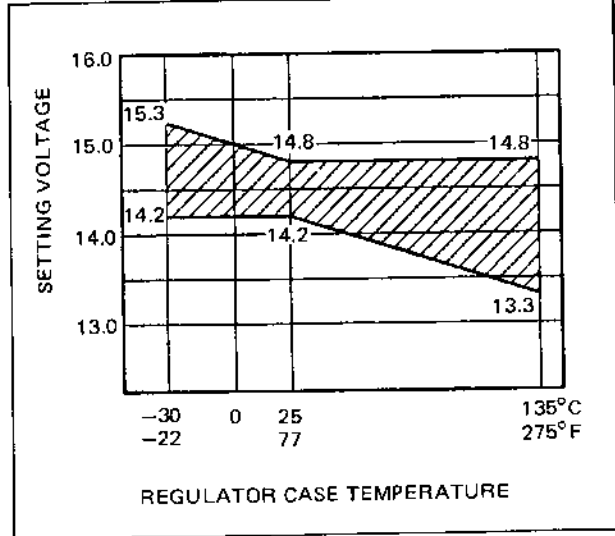


Fig. 6H-5 Temperature Characteristic

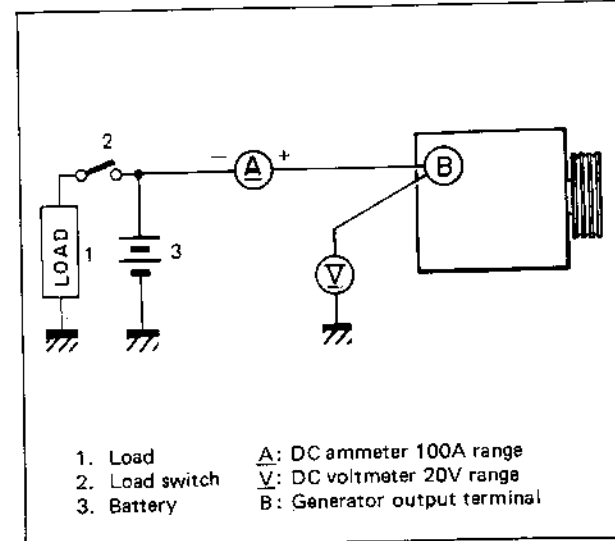


Fig. 6H-6 Measuring Generator Output

Higher voltage

If voltage is higher than standard value, replace IC regulator.

Lower voltage

If voltage is below standard, proceed to following check.

Ground F terminal and start engine, then measure voltage at B terminal.

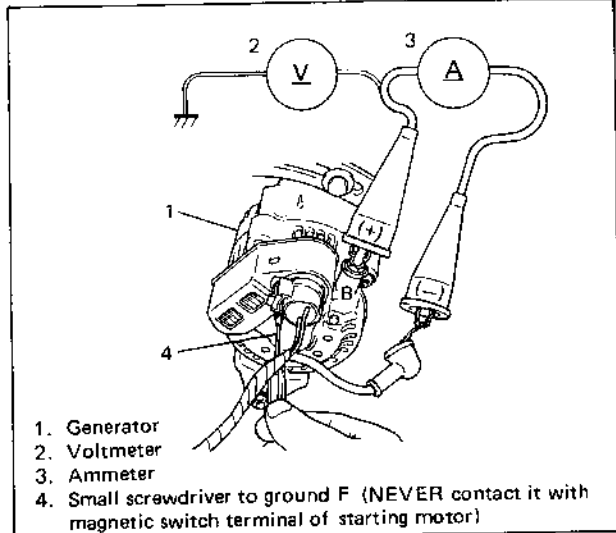


Fig. 6H-7 Checking Generator

If voltage rises above standard, it is considered that generator itself is good but IC regulator has been damaged.

If voltage is below standard, generator itself has problem.

Load Check

Run engine at 2,000 r/min. and turn on headlights and heater fan. Measure current and if it is less than 20A, repair or replace generator.

OVERCHARGED BATTERY

1. To determine battery condition, refer to Battery section.
2. If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, proceed to disassembly section of generator service and check field windings for grounds and shorts. If problem exists, replace rotor and then check to make sure that output voltage is within specification.

UNIT REPAIR OVERHAUL

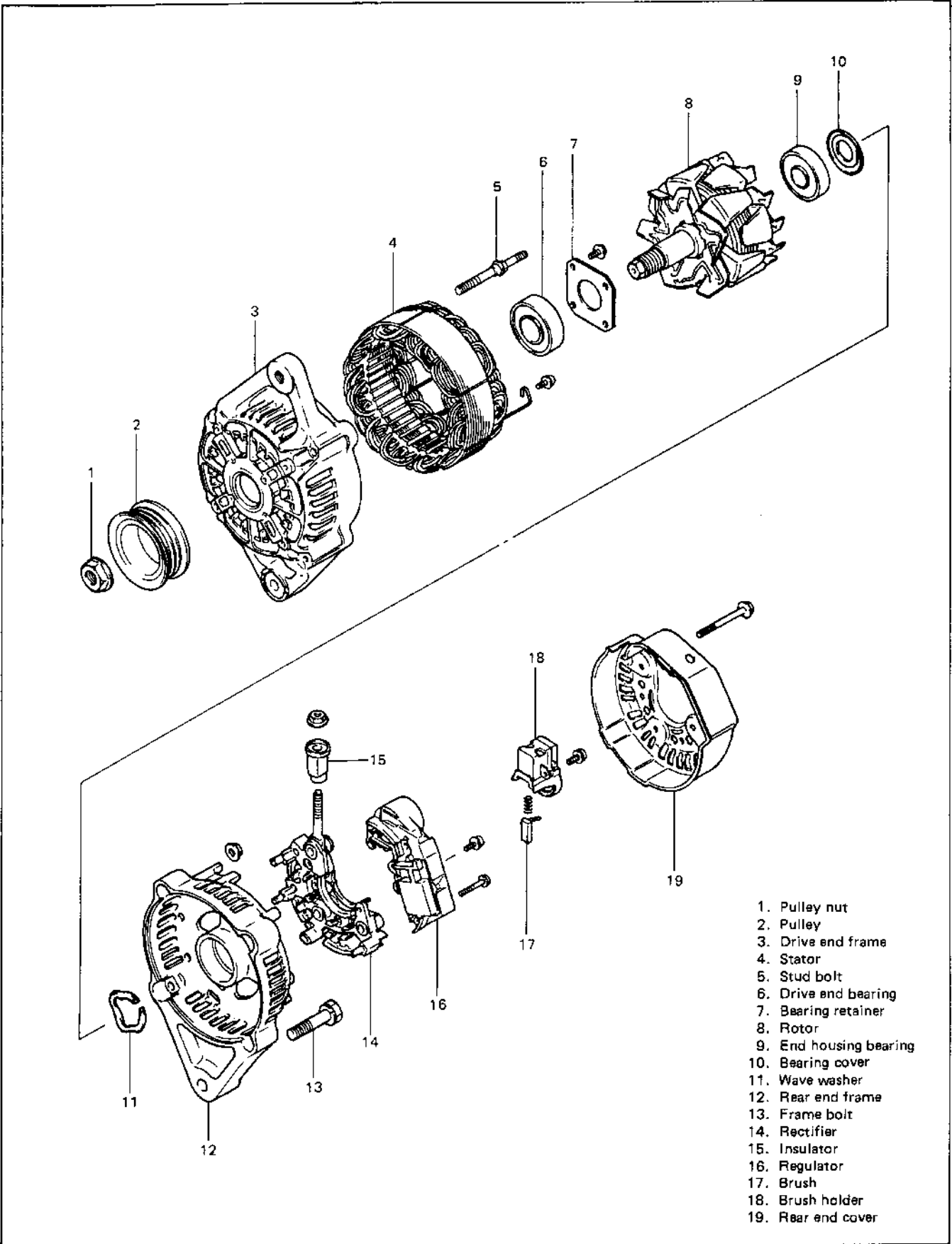


Fig. 6H-8 Generator Exploded View

DISMOUNTING AND REMOUNTING

1. Disconnect negative cable at battery.
2. Remove air cleaner case with air flow meter and air flow meter outlet hose.
3. Disconnect B terminal wire and coupler.
4. Remove generator cover bolt.
5. Remove generator drive belt adjusting bolt.
6. Remove cover.
7. Remove mounting bolts and then take out belt and generator assembly downward.
8. To remount, reverse above procedure giving specified tension to drive belt.

NOTE:  
For belt tension refer to SECTION 6B.

| Tightening torque     | N-m     | kg-m      | lb-ft       |
|-----------------------|---------|-----------|-------------|
| ● Mounting bolts      | 18 - 28 | 1.8 - 2.8 | 13.0 - 20.0 |
| ● Adjusting bolts     |         |           |             |
| Generator cover bolts | 4 - 7   | 0.4 - 0.7 | 3.0 - 5.0   |
| B terminal outer nut  | 6 - 10  | 0.6 - 1.0 | 4.5 - 7.0   |

DISASSEMBLY

1. 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 cosequential shaft or tool damage.
- Do not attempt to hold pulley by using vise or pipe wrench so as not to distort it.

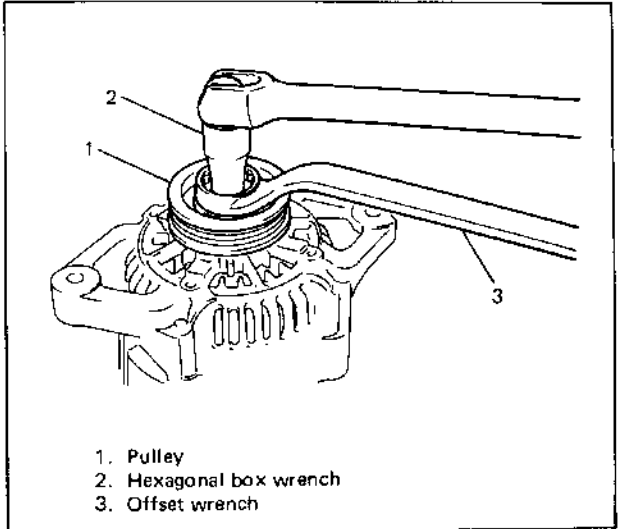


Fig. 6H-9 Removing Pulley Nut

2. Remove B terminal nut and insulator.
3. Remove 3 screws and take off rear end cover.
4. Remove 2 screws, then pull out brush holder assembly.
5. Remove 3 screws and then take out IC regulator.
6. Remove 4 screws, stretch stator coil leads and then take out rectifier.

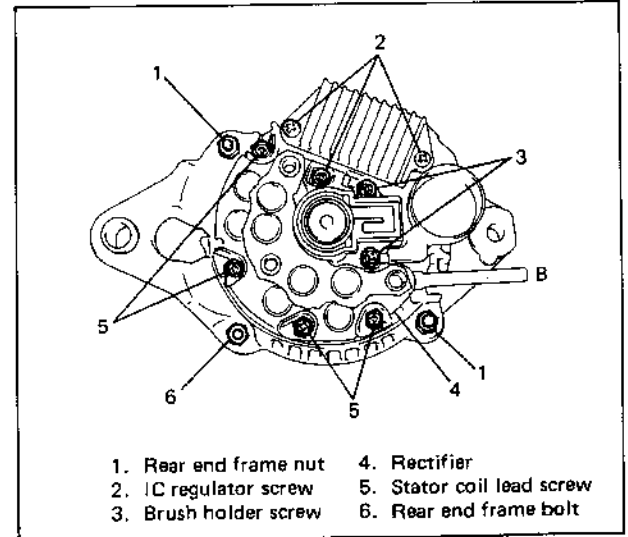


Fig. 6H-10 Removing Rectifier



7. Remove rear end frame bolts and nuts, and then drive out rear end frame with rotor tapping shaft lightly by using plastic hammer.

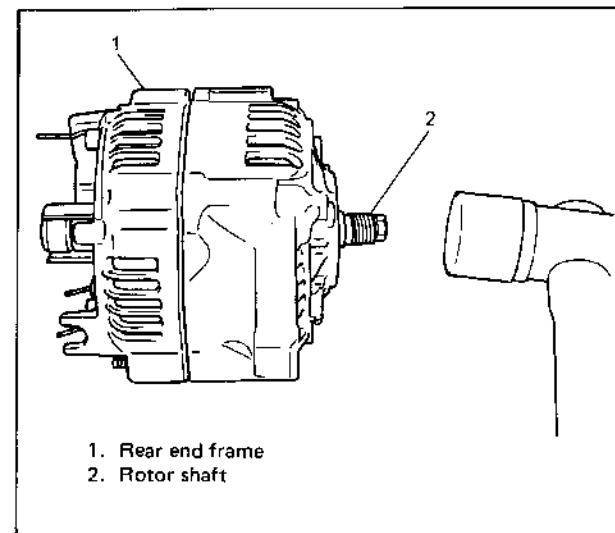


Fig. 6H-11 Removing Rear End Frame

8. Separate rear end frame from rotor tapping frame evenly by using plastic hammer.

**CAUTION:**

Do not hit shaft at slip ring side, when separating rotor and rear end frame.

9. Use bearing puller to remove end housing bearing.

**CAUTION:**

Care must be exercised so as not to distort cooling fan blade while applying puller.

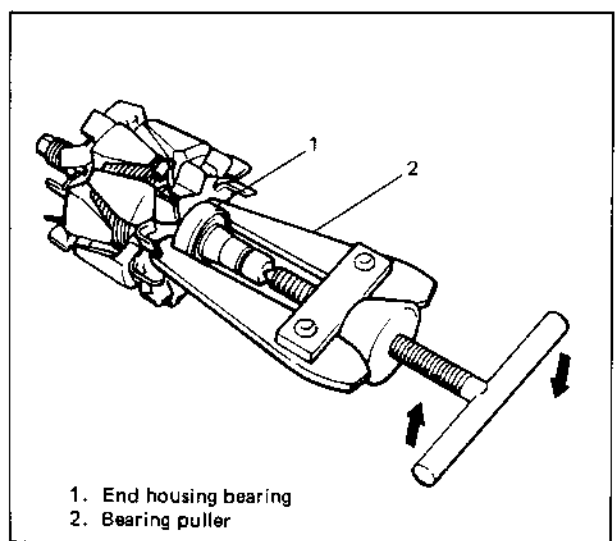


Fig. 6H-12 Removing Rear Bearing

10. Remove 4 screws, retainer plate and then drive out drive end bearing.

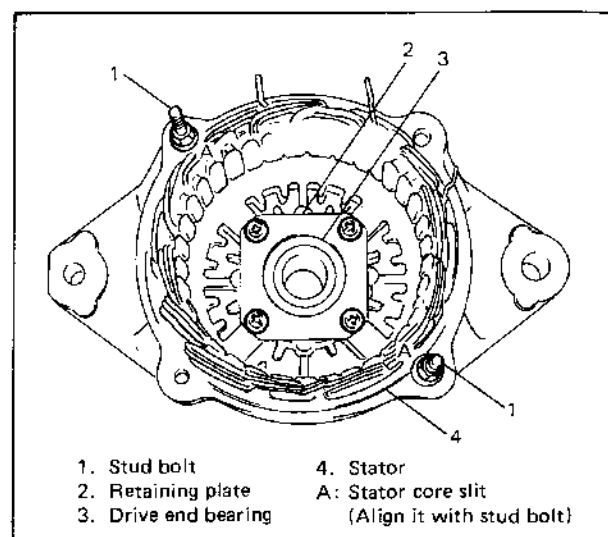


Fig. 6H-13 Removing Front Bearing

11. If required, remove stud bolts and then pull out stator.

**NOTE:**

Heating drive end frame may facilitate removal of stator.

**REASSEMBLY**

Judging from faulty conditions noted before disassembly and what is found through inspection after disassembly, prepare replacing parts and reassemble generator by reversing removal procedure.

**NOTE:**

- Align stator slits with stud bolts when inserting stator coil assembly into drive end frame.
- When installing brush holder assembly, make sure that brushes and slip rings have been degreased thoroughly.

**CAUTION:**

- When installing rectifier, check to confirm that stator leads have enough clearance with cooling fan blades.
- Care should be taken not to overtighten B terminal insulator nut.

| Tightening torque      | N-m      | kg-m      | lb-ft       |
|------------------------|----------|-----------|-------------|
| Stud bolts             | 7 - 8.8  | 0.7-0.88  | 5.5 - 6.0   |
| • Frame bolts and nuts |          |           |             |
| • B terminal inner nut | 4 - 5    | 0.4 - 0.5 | 3.0 - 3.5   |
| Pulley nut             | 95 - 130 | 9.5-13.0  | 69.0 - 94.0 |

**INSPECTION AND CORRECTION****ROTOR****Ground**

Between slip rings and rotor core should be insulated. Use ohmmeter for inspection.

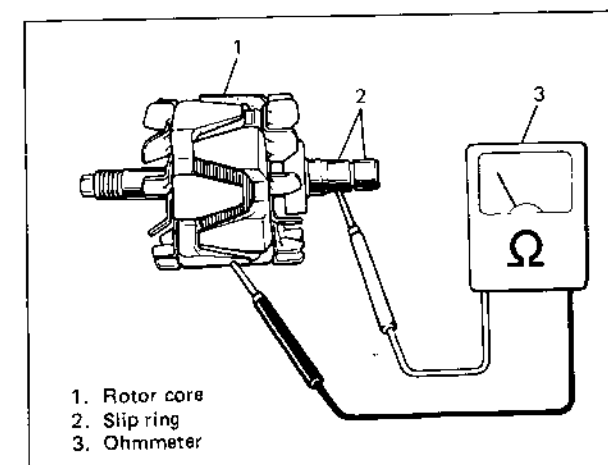


Fig. 6H-14 Checking Field Coil Insulation

**Open Circuit**

Check continuity and resistance of field coil by applying ohmmeter probes to slip rings. If resistance is out of specification, replace rotor.

|                       |                    |
|-----------------------|--------------------|
| Field coil resistance | 2.8 - 3.0 $\Omega$ |
|-----------------------|--------------------|

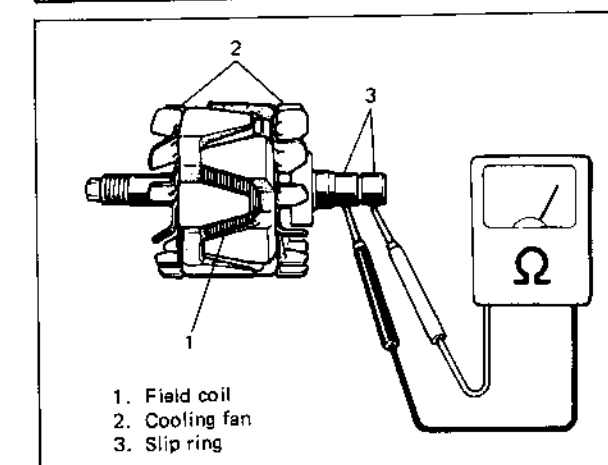


Fig. 6H-15 Checking Field Coil Continuity

**FAN**

Make sure that fan blades are all in good condition.

**BEARING**

Check for smooth rotation by hand.

**STATOR****Ground**

Using ohmmeter, check to make sure that stator coil is insulated from core.

**Open Circuit**

Check continuity between neutral point A and each phase B.

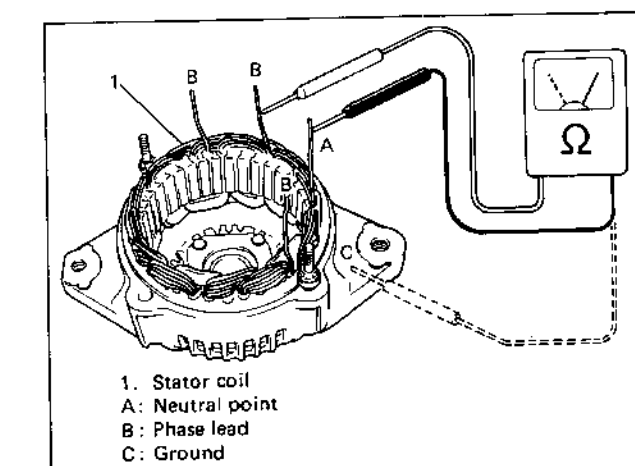


Fig. 6H-16 Checking Stator Coil

**DRIVE END BEARING**

Before remove it. Check for smooth rotation by hand.

RECTIFIER

Using k $\Omega$  range ohmmeter, check continuity between B terminal and ground. Put a tester probe to terminal B and the other probe to ground, then swap two probes. Only one direction should have continuity and the other should be infinity. If not, replace rectifier assembly.

**CAUTION:**  
Do not use 500V megger for testing rectifier. It will cause to damage diodes in rectifier.

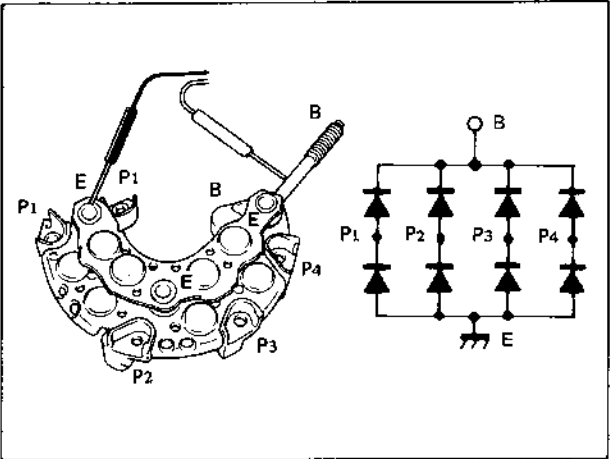


Fig. 6H-17 Checking Rectifier

CONDENSER

Use condenser tester to check condition of condenser.

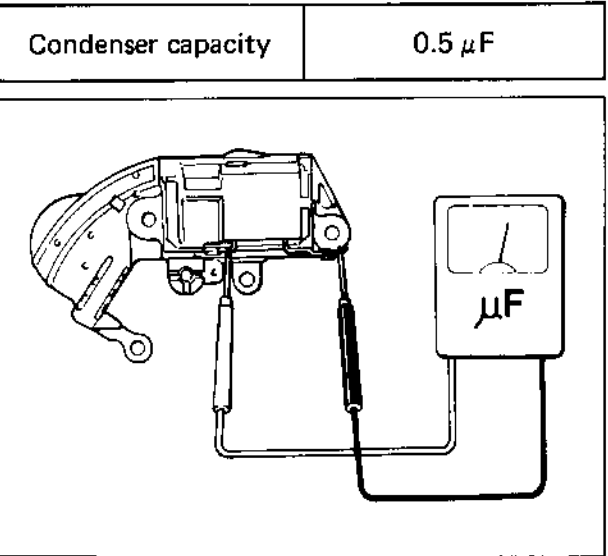


Fig. 6H-18 Checking Condenser

BRUSH

Check each brush for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush with holder.

|                       |         |
|-----------------------|---------|
| Brush length service  | 4.5 mm  |
| limit (minimum value) | 0.18 in |

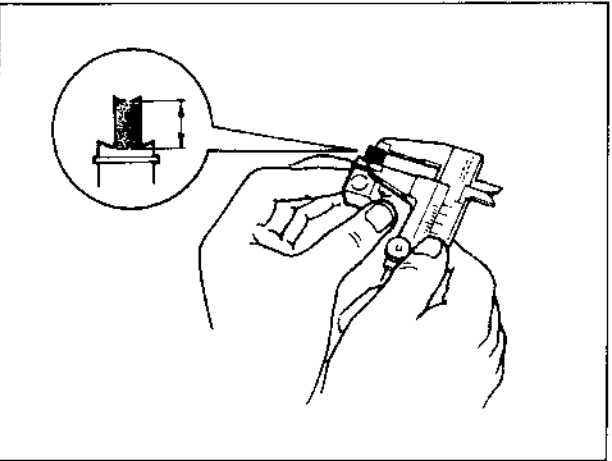


Fig. 6H-19 Checking Brush Length

SECTION 6J

EMISSION CONTROLS

CONTENTS

|                                                                      |                                                         |
|----------------------------------------------------------------------|---------------------------------------------------------|
| GENERAL DESCRIPTION                                                  | 6J-2                                                    |
| Emission Control Information Label                                   | 6J-2                                                    |
| Positive Crankcase Ventilation (PCV) System                          | 6J-2                                                    |
| Dash-Pot System                                                      | 6J-3                                                    |
| Three-Way Catalyst                                                   | 6J-3                                                    |
| Air/Fuel Ratio Feed Back Compensation                                | ] ..... Refer to SECTION 6E "EFI SYSTEM"                |
| Exhaust Gas Recirculation (EGR) System (California spec. model only) |                                                         |
| Evaporative Emission Control System                                  |                                                         |
| DIAGNOSIS                                                            | Refer to SECTION 6 "ENGINE" and SECTION 6E "EFI SYSTEM" |
| ON CAR SERVICE                                                       | 6J-4                                                    |
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| Dash-Pot System                                                      | 6J-5                                                    |
| Air/Fuel Ratio Feed Back Compensation                                | ] ..... Refer to SECTION 6E "EFI SYSTEM"                |
| EGR System (California spec. model only)                             |                                                         |
| Evaporative Emission Control System                                  |                                                         |



GENERAL DESCRIPTION

EMISSION CONTROL INFORMATION LABEL

The Emission Control Information Label is located on the underside of the hood. The label contains important emission specifications and setting procedures, as well as a vacuum hoses schematic with emission components identified. When servicing the engine or emission systems, the Emission Control Information Label should be checked for up-to-date information.

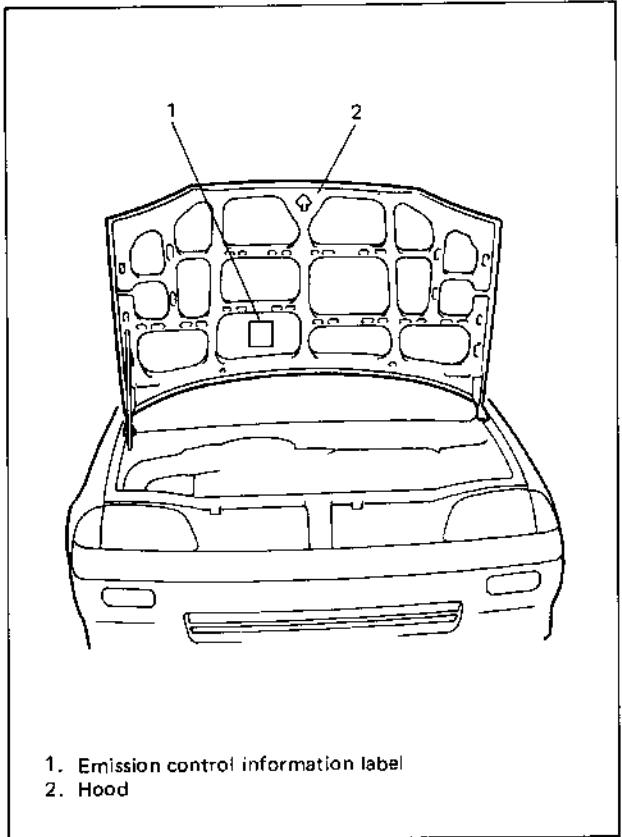


Fig. 6J-1 Emission Control Information Label

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.

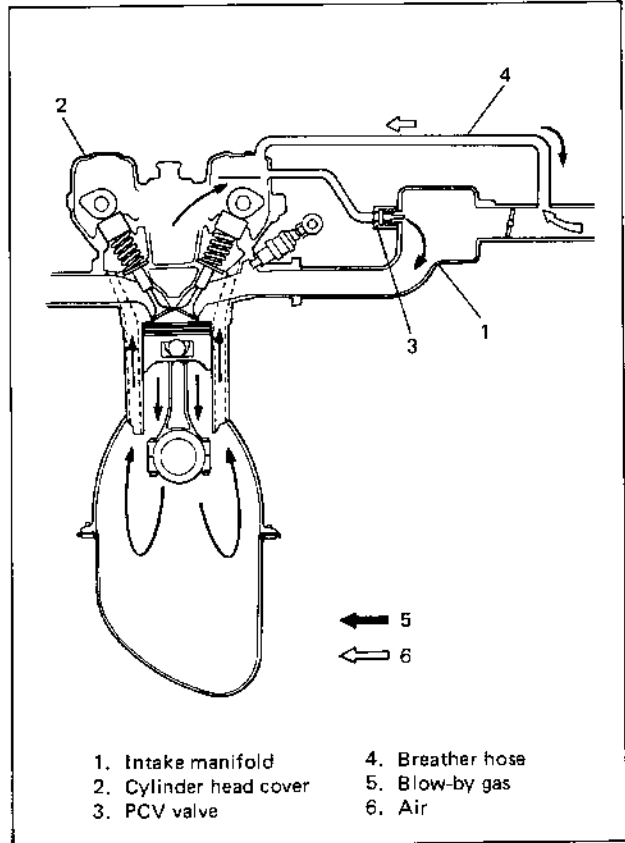


Fig. 6J-2 PCV System Operation

DASH-POT SYSTEM

This system prevents the throttle valve from returning to the idle position immediately when the accelerator pedal is released suddenly, thereby preventing inefficient combustion due to too rich air/fuel mixture and reducing the amount of unburned hydrocarbon (HC).

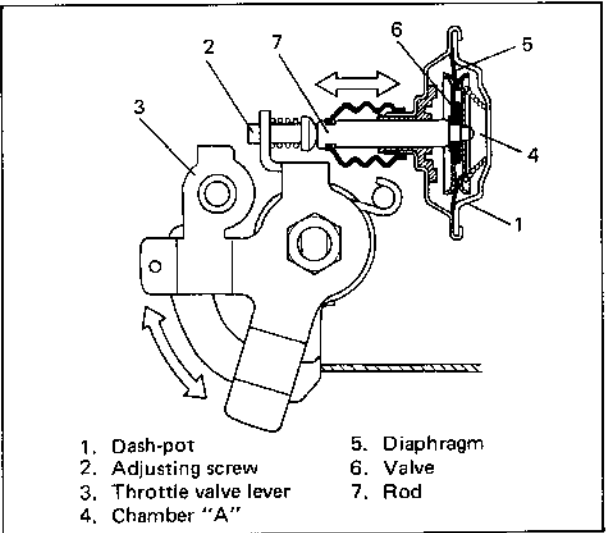


Fig. 6J-3 Dash-Pot Cross Section

When the accelerator pedal is depressed and the throttle valve is opened, the dash-pot rod is pushed out owing to the force of the spring in the dash-pot. The valve is open and the air is drawn into the chamber "A" through the hole in the plate and thus the rod moves smoothly. When the accelerator pedal is released rapidly, the throttle valve lever contacts the dash-pot rod which has been pushed out. Then, as the air in the chamber "A" is compressed and the valve closes, the air escapes gradually through the orifice between the plate and valve. In this way, the rod returns gradually and the throttle valve closes likewise.

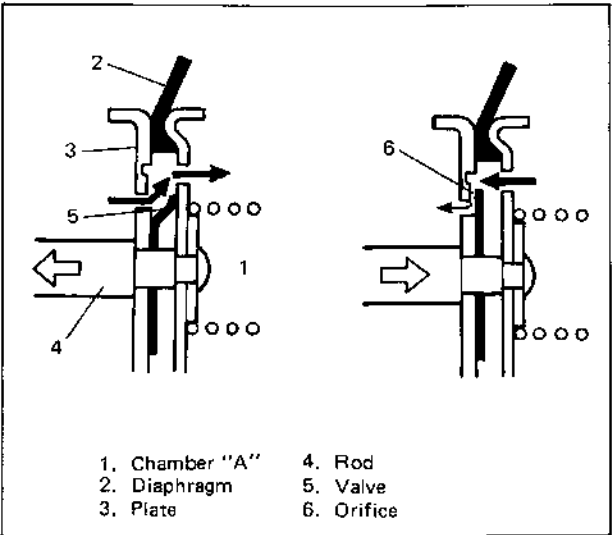


Fig. 6J-4 Dash-Pot Operation

THREE-WAY CATALYST

The three-way catalyst is provided in the exhaust system (exhaust No. 2 pipe). The function of the catalyst is to reduce the emission of CO, HC and NOx in the exhaust gas by oxidizing or converting them into CO<sub>2</sub>, H<sub>2</sub>O and N<sub>2</sub> respectively.

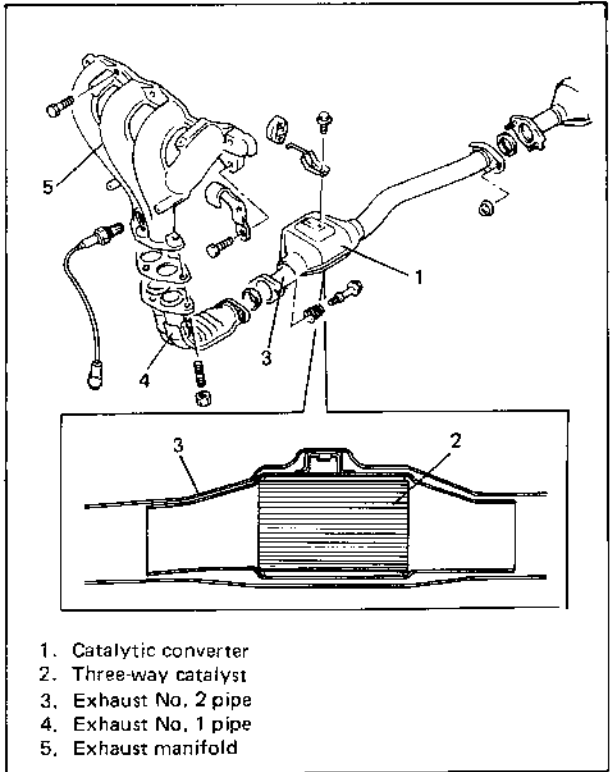


Fig. 6J-5 Catalytic Converter

## ON CAR 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 Emission Control Information Label for proper routing of hoses.

### 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.

#### PCV HOSE INSPECTION

Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.

#### PCV VALVE INSPECTION

1. Disconnect PCV hose from PCV valve.
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. Replace as necessary.

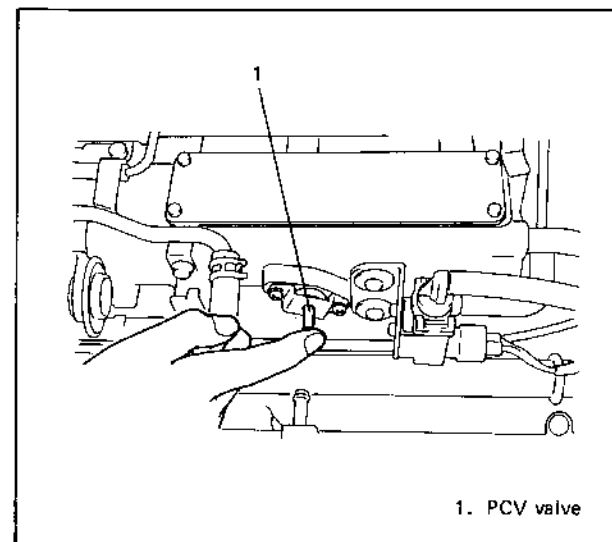


Fig. 6J-6 Checking Vacuum

4. After checking vacuum, stop engine and check PCV valve for sticking. With engine stopped, connect a new hose to PCV valve for inspection. Blow air into the hose and check that air flows with difficulty from cylinder head side to intake manifold side. If air flows without difficulty, valve is stuck in "Open" position. Replace PCV valve.

#### WARNING:

Do not suck air through PCV valve. Petroleum substances inside the valve and fuel vapor inside the intake manifold are harmful.

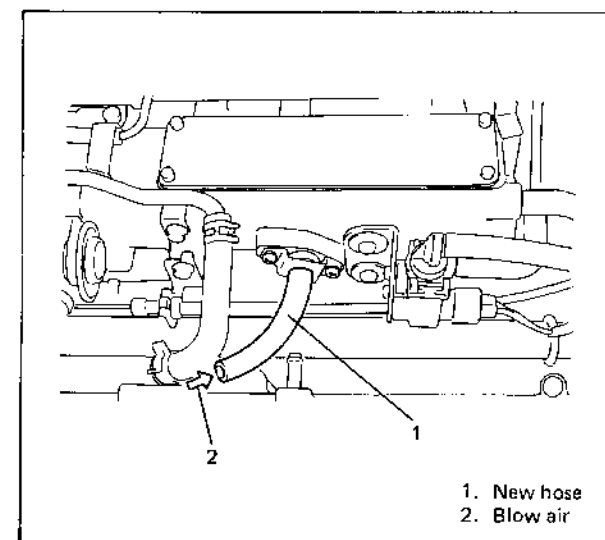


Fig. 6J-7 Checking PCV Valve for Sticking

5. After removing the hose, connect PCV hose.

### DASH-POT SYSTEM

#### DASH-POT OPERATION CHECK

1. Open throttle valve by hand and check that dash-pot rod is pushed out smoothly (toward the left in figure below).

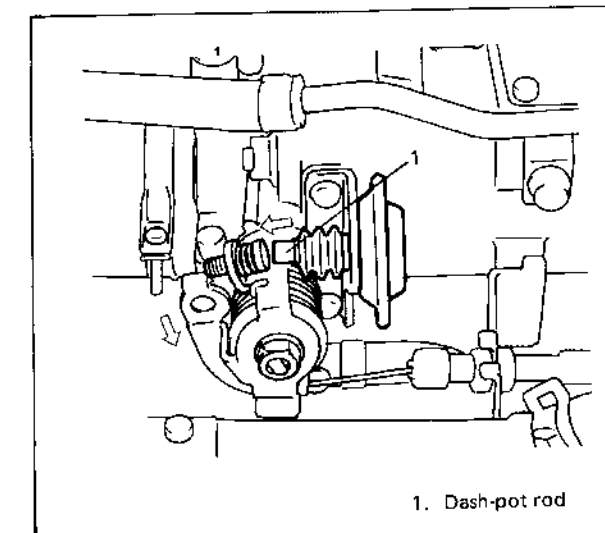


Fig. 6J-8 Checking Dash-Pot Operation

2. Release throttle valve lever and check that it contacts dash-pot rod and then returns to its idle position slowly. If it doesn't, replace.

3. With engine running, move throttle valve lever away from dash-pot rod and then move it back gradually.

In doing so, check that engine speed at which throttle valve lever (adjusting screw) contacts tip of dash-pot rod is within following specification.

If not, adjust it with adjusting screw.

|                                                              |                      |
|--------------------------------------------------------------|----------------------|
| Engine speed when throttle valve lever contacts dash-pot rod | 3,000 – 3,400 r/min. |
|--------------------------------------------------------------|----------------------|

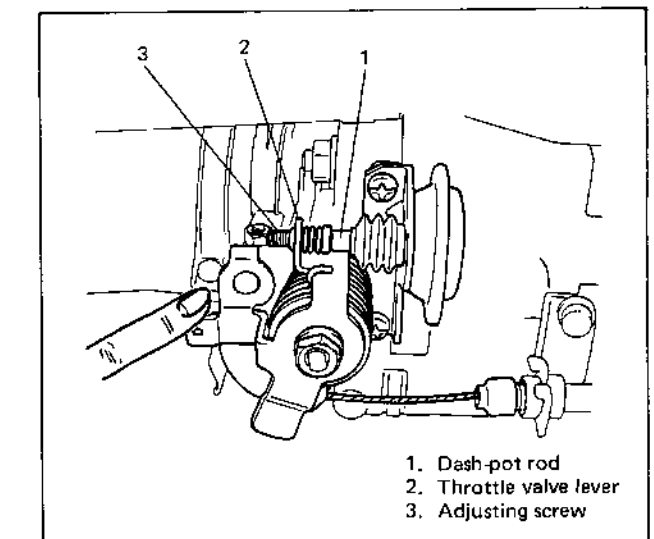


Fig. 6J-9 Adjusting Dash-Pot

#### DASH-POT INSPECTION AND ADJUSTMENT

#### NOTE:

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

1. Start engine and warm it up to normal operating temperature.
2. Check to make sure that no electric load is applied to engine and engine idle speed is within specification.

SECTION 6K

**EXHAUST SYSTEM**

**CONTENTS**

GENERAL DESCRIPTION ..... 6K-1

MAINTENANCE ..... 6K-2

ON VEHICLE SERVICE ..... 6K-2

**GENERAL DESCRIPTION**

The exhaust system consists of an exhaust manifold, an exhaust No. 1 pipe, an exhaust No. 2 pipe, a muffler, a tail pipe and seals and gasket etc., and the exhaust No. 2 pipe has the catalytic converter.

The catalytic converter is an emission control device added to the exhaust system to lower the

levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOX) pollutants in the exhaust gas.

The catalyst in the catalytic converter is of "Three-way" type.

**THE CATALYTIC CONVERTER REQUIRES USE OF UNLEADED FUEL ONLY.**

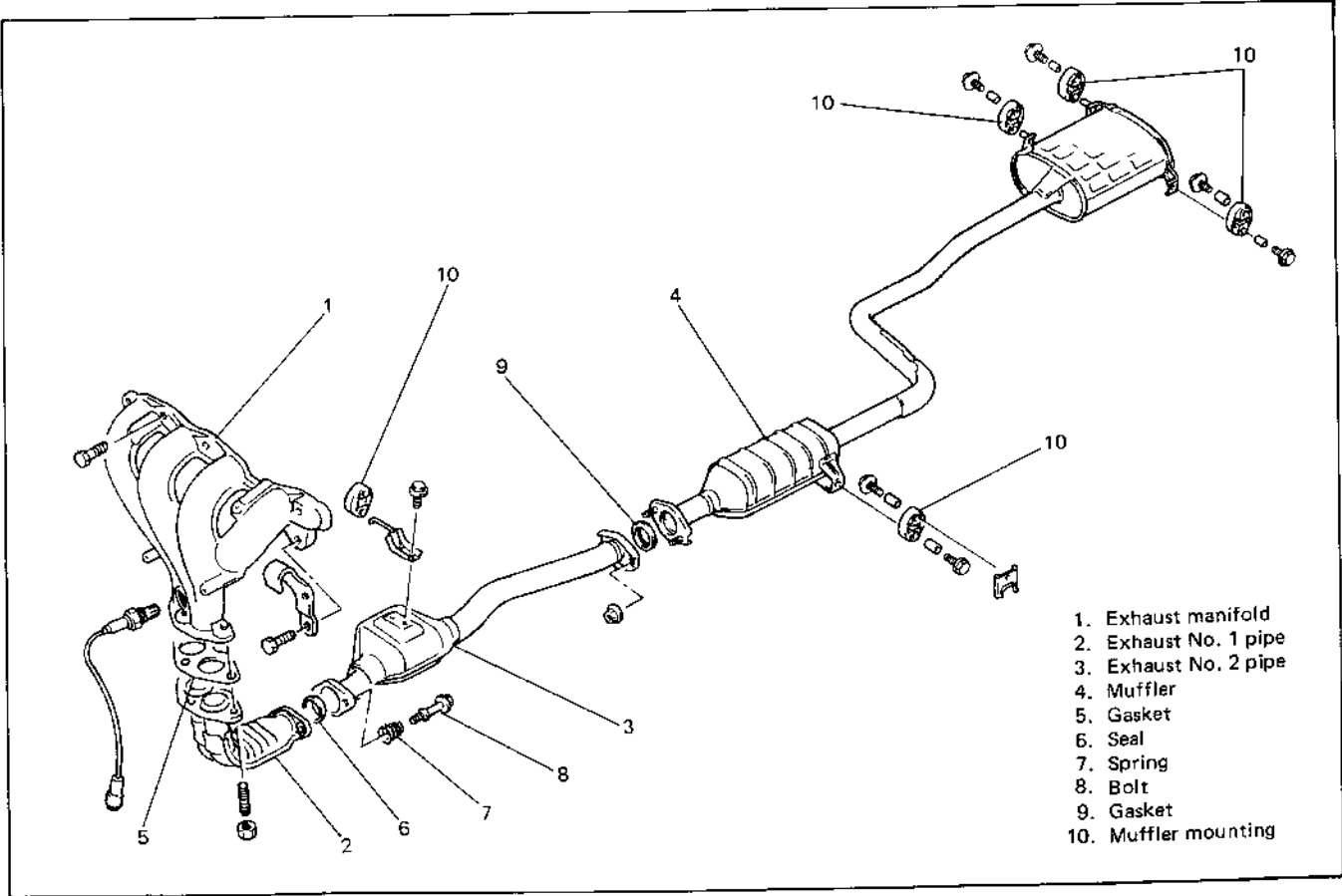


Fig. 6K-1 Exhaust System

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.

At every interval of periodic maintenance service, and when car 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 connection, dent and damage.  
If bolts or nuts are loosened, tighten them to specified torque. Refer to "ON CAR SERVICE" for torque data.
- Check nearby body areas for damaged, missing, or mispositioned part, open seam, hole, loose connection or any other defect which could permit exhaust fumes to seep into car.
- 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.

ON CAR SERVICE

- Refer to Section 6A for removal and installation procedures of exhaust manifold.
- For replacement of center pipe, muffler, tail pipe or any part used to mount or connect them, be sure to hoist car and observe WARNING given at the left of this page.

**CAUTION:**  
As exhaust No. 2 pipe has catalytic converter in it, it should not be exposed to any impulse. Be careful not to drop it or hit it against something.

- When exhaust manifold is removed, check gaskets and seal for deterioration or damage. Replace them as necessary.
- Tighten bolts and nuts to specified torques when reassembling.  
Refer to Fig. 6K-2 for location of bolts and nuts.

SECTION 7A

MANUAL TRANSMISSION

CONTENTS

|                                                 |       |                                       |       |
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| Differential Side Oil Seal .....                | 7A- 7 | Countershaft assembly .....           | 7A-23 |
| Gear Shift Control .....                        | 7A- 9 | Gear shifter .....                    | 7A-26 |
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|                               |       |
|-------------------------------|-------|
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| SPECIAL TOOLS .....           | 7A-37 |

GENERAL DESCRIPTION

CONSTRUCTION AND SERVICING

The transmission provides five forward speeds and one reverse speed by means of three synchronizers and three shafts — input shaft, countershaft and reverse gear shaft. All forward gears are in constant mesh, and reverse uses a sliding idler gear arrangement.

The low speed synchronizer is mounted on counter shaft and engaged with counter shaft first gear or second gear, while the high speed synchronizer is done on input shaft and engaged with input shaft third gear or fourth gear.

The fifth speed synchronizer on input shaft is engaged with input shaft fifth gear mounted on the input shaft.

The countershaft turns the final gear and differential assembly, thereby turning the front drive shafts which are attached to the front wheels.

For servicing, it is necessary to use genuine sealant or its equivalent on mating surfaces of transmission case which is made of aluminum. The case fastening bolts must be tightened to specified torque by means of torque wrench. It is also important that all parts are thoroughly cleaned with cleaning fluid and air dried before reassembling.

Further, care must be taken to adjust preload of counter shaft taper roller bearings. New synchronizer rings are prohibited from being lapped with respective gear cones by using lapping compound before they are assembled.

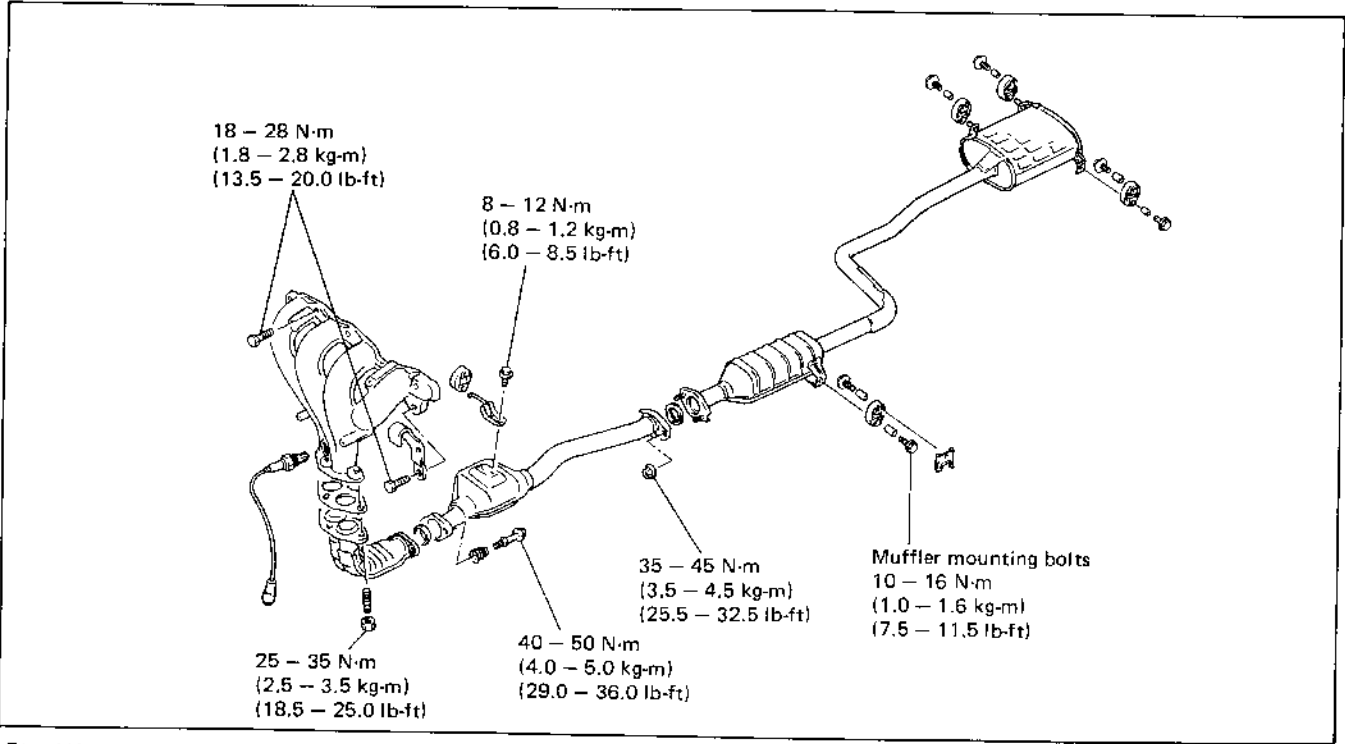


Fig. 6K-2 Recommended Torque Specification

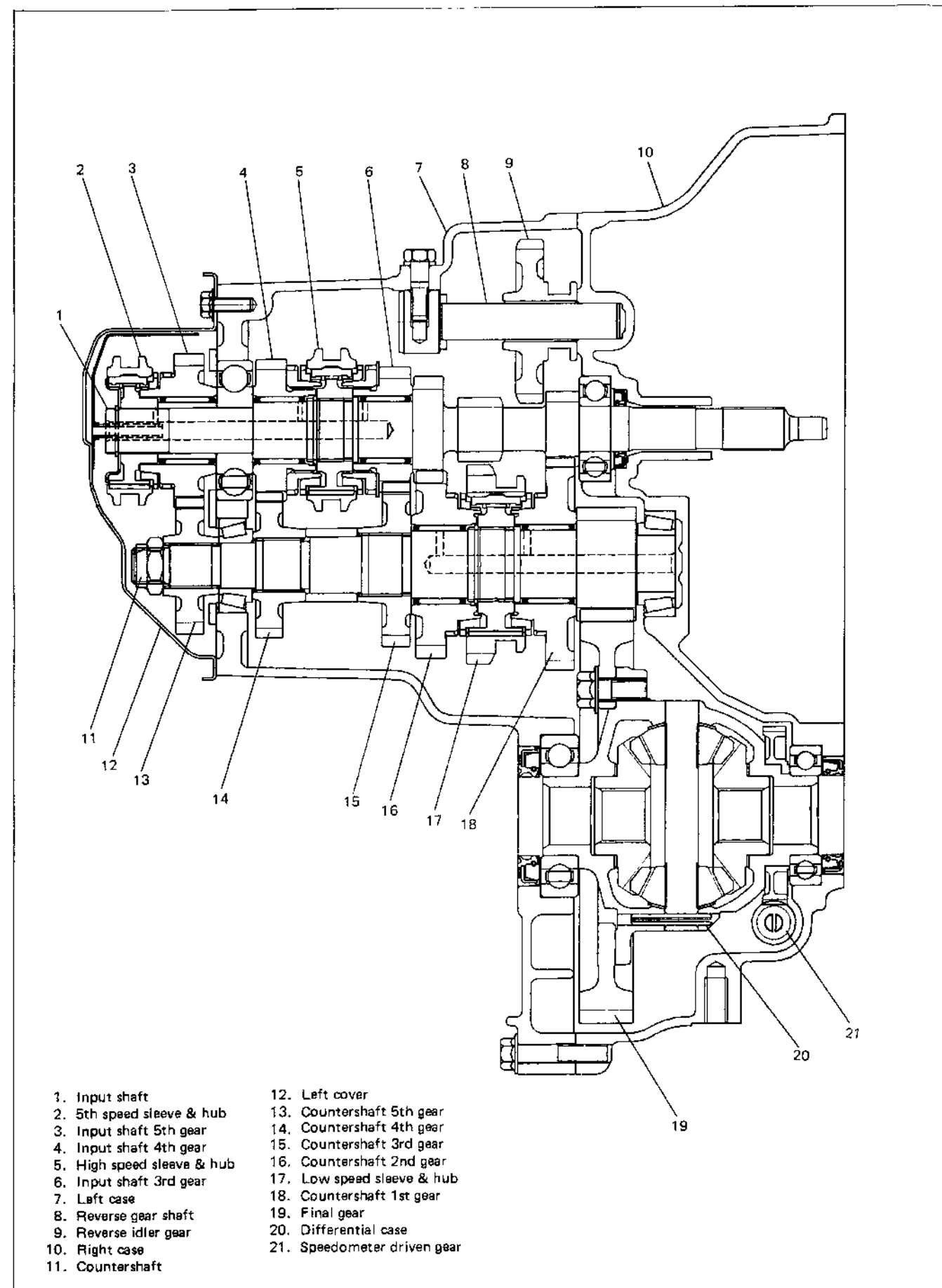


Fig. 7A-1 Manual Transmission Cutaway

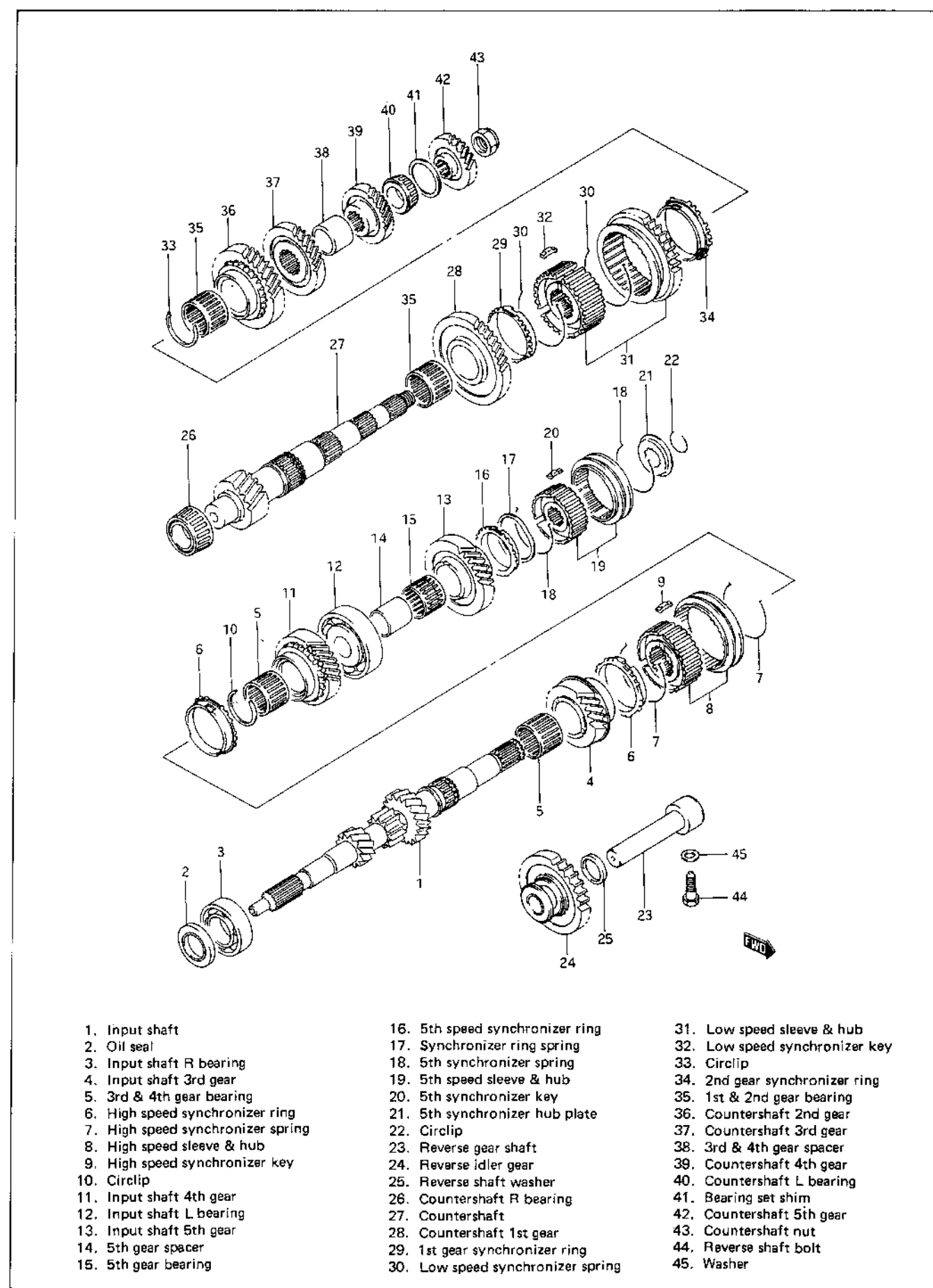


Fig. 7A-2 Manual Transmission Exploded View

## GEAR SHIFT MECHANISM

Movement of gear shift control lever is transmitted to gear shift shaft through gear shift control shaft, and gear shift & select shaft through gear shift arm and gear shift yoke, and

then gear shift & select lever to each gear shift yoke, shaft and fork or arm. Gear shift interlock plate is provided to prevent the gear from engaging double.

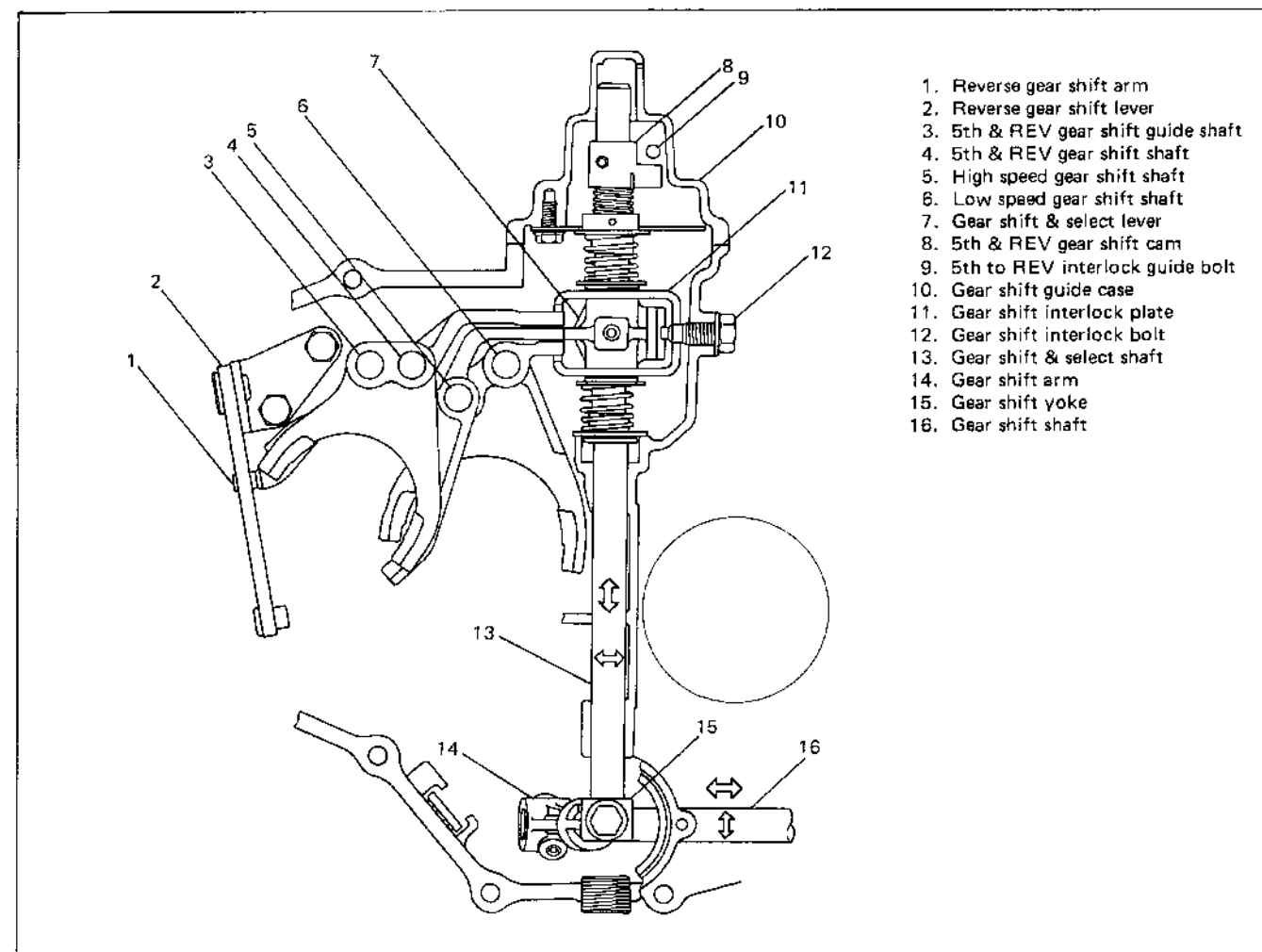


Fig. 7A-3 Gear Shifting Mechanism

### 5TH & REVERSE GEAR SHIFT CAM

5th & reverse gear shift cam, cam guide return spring and 5th to reverse interlock guide bolt are provided to prevent the gear from being directly shifted from 5th to reverse.

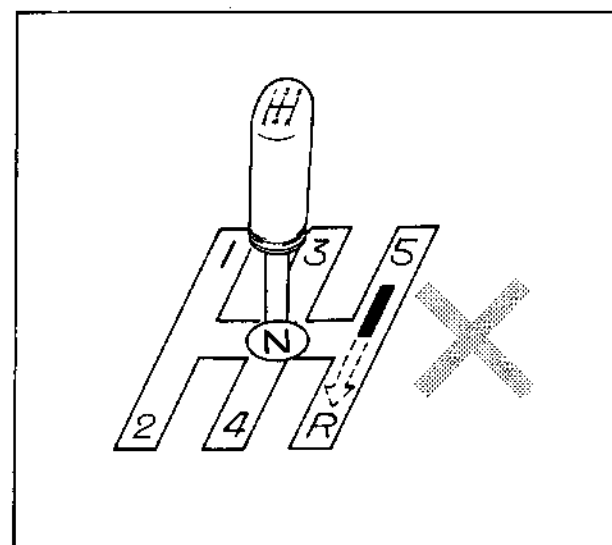


Fig. 7A-4 Gear Shifting Pattern

1. When gear is shifted to 5th speed, 5th & reverse gear shift cam turns clockwise with gear shift & select shaft and it is pushed up by cam guide return spring to the position where interlock guide bolt prevents the cam from being shifted to reverse straight.

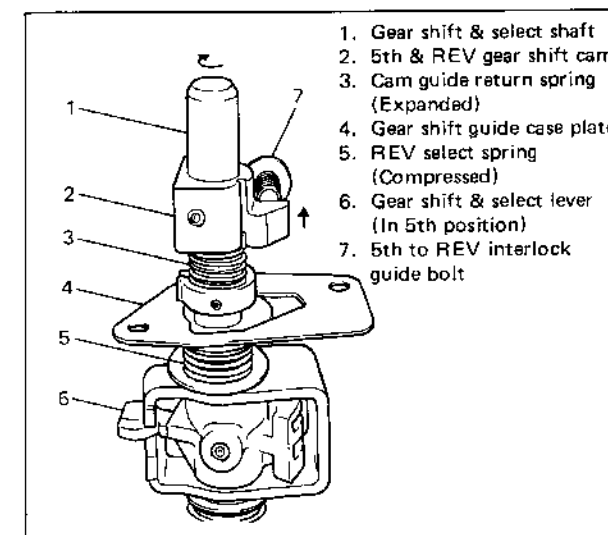


Fig. 7A-5 Shifted in 5th Speed

2. Shifting from 5th to neutral is available and further shift to reverse is interrupted. However, when shift & select shaft is moved to neutral of 3rd - 4th position, shift limit cam mechanism is canceled as shown below.

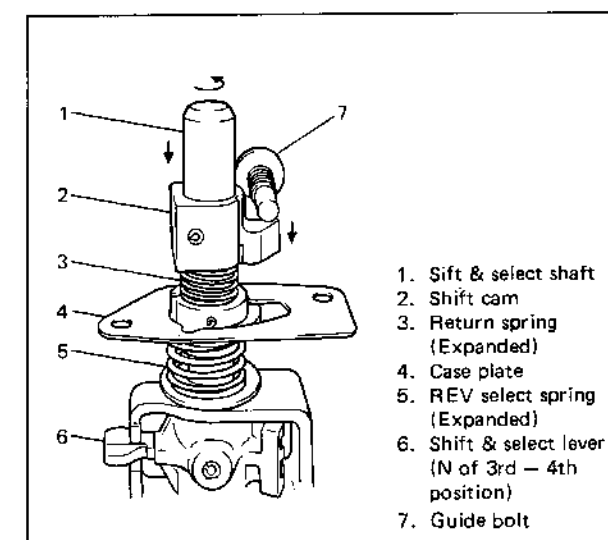


Fig. 7A-6 Neutral of 3rd - 4th Position

3. Selected position in neutral of 5th - REV is shown in the following figure. While shift & select shaft moves up to allow shift & select lever to shift in 5th or reverse position, shift cam stays because of interference of guide bolt.

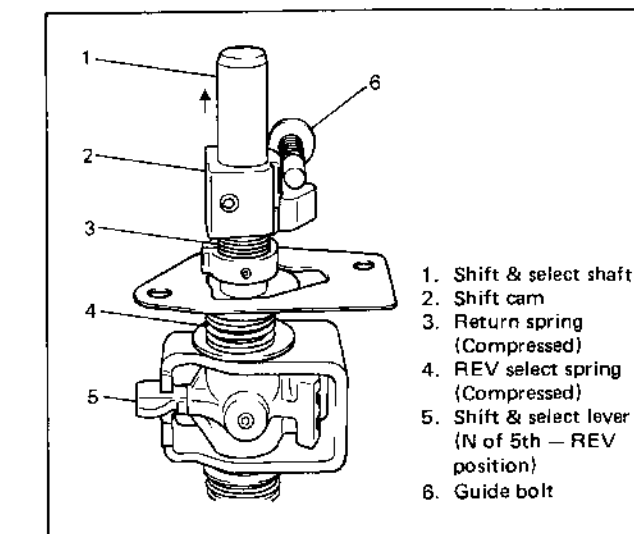


Fig. 7A-7 Neutral of 5th - REV Position

4. Now the mechanism is ready to be shifted to reverse without interference of shift cam.

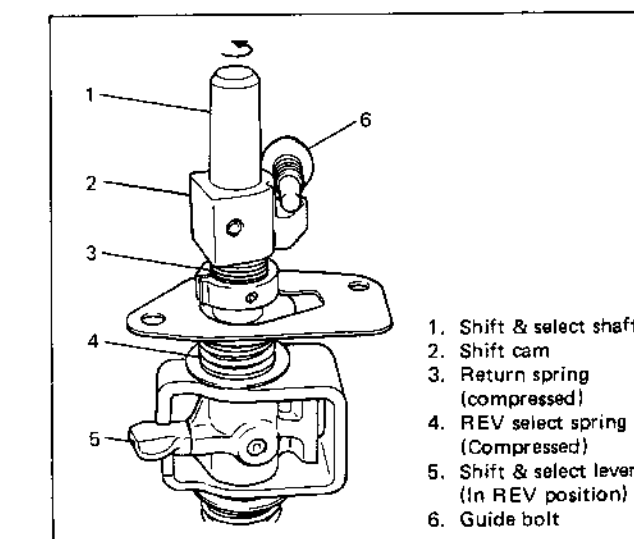


Fig. 7A-8 Shifted in Reverse



DIAGNOSIS

| Condition                  | Possible cause                                 | Correction              |
|----------------------------|------------------------------------------------|-------------------------|
| Gears slipping out of mesh | • Worn shift fork shaft                        | Replace                 |
|                            | • Worn shift fork or synchronizer sleeve       | Replace                 |
|                            | • Weak or damaged locating springs             | Replace                 |
|                            | • Worn bearings on input shaft or countershaft | Replace                 |
|                            | • Worn chamfered tooth on sleeve and gear      | Replace sleeve and gear |
| Hard shifting              | • Inadequate lubricant                         | Replenish               |
|                            | • Improper clutch pedal free travel            | Adjust                  |
|                            | • Distorted or broken clutch disc              | Replace                 |
|                            | • Damaged clutch pressure plate                | Replace clutch cover    |
|                            | • Worn synchronizer ring                       | Replace                 |
|                            | • Worn chamfered tooth on sleeve or gear       | Replace sleeve or gear  |
|                            | • Worn gear shift control shaft joint bush     | Replace                 |
| Noise                      | • Distorted shift shaft                        | Replace                 |
|                            | • Inadequate or insufficient lubricant         | Replenish               |
|                            | • Damaged or worn bearing(s)                   | Replace                 |
|                            | • Damaged or worn gear(s)                      | Replace                 |
|                            | • Damaged or worn synchronizer parts           | Replace                 |

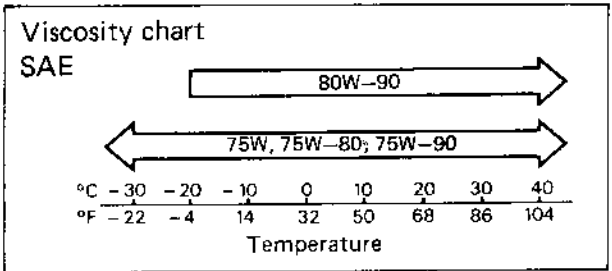
ON-CAR SERVICE

OIL CHANGE

1. Before changing or inspecting oil, be sure to stop engine and lift car horizontally.
2. With car lifted up, check oil level and leakage. If leakage exists, correct it.
3. Drain old oil and fill new specified oil as in the following table by specified amount (up to level hole).
4. Torque drain and level/filler plugs as specified below. Apply sealant to drain plug before installation.

NOTE:

- It is highly recommended to use API GL-5 SAE 75W gear oil.
- Whenever car is hoisted for any other service work than oil change, also be sure to check for oil leakage.



|                   |                                                                    |
|-------------------|--------------------------------------------------------------------|
| Oil specification | API GL-5, SAE 75W;<br>API GL-4, SAE 75W/<br>80 – 85, 80W or 80W/90 |
| Oil capacity      | 2.4 liters<br>5.0/4.2 US/Imp. pt                                   |

|                   |         |           |             |
|-------------------|---------|-----------|-------------|
| Tightening torque | N·m     | kg·m      | lb·ft       |
| Filler/level plug | 36 – 54 | 3.6 – 5.4 | 26.5 – 39.0 |
| Drain plug        | 25 – 30 | 2.5 – 3.0 | 18.5 – 21.5 |

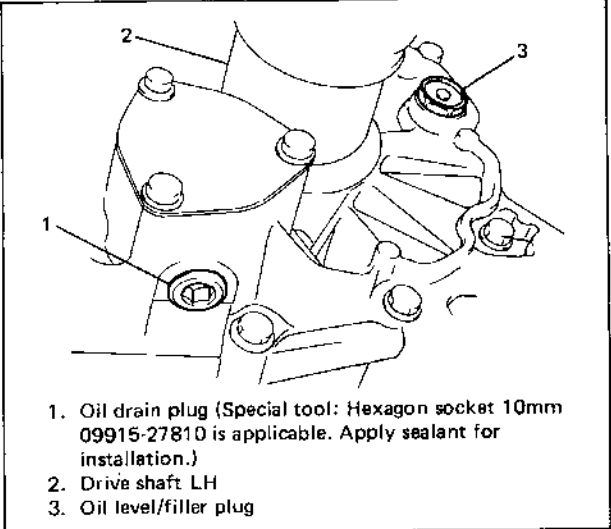


Fig. 7A-9 Changing Transmission Oil

DIFFERENTIAL SIDE OIL SEAL

REPLACEMENT

1. Lift up car and drain transmission oil.
2. Remove ball stud bolt and nut, and then separate suspension arm from knuckle.

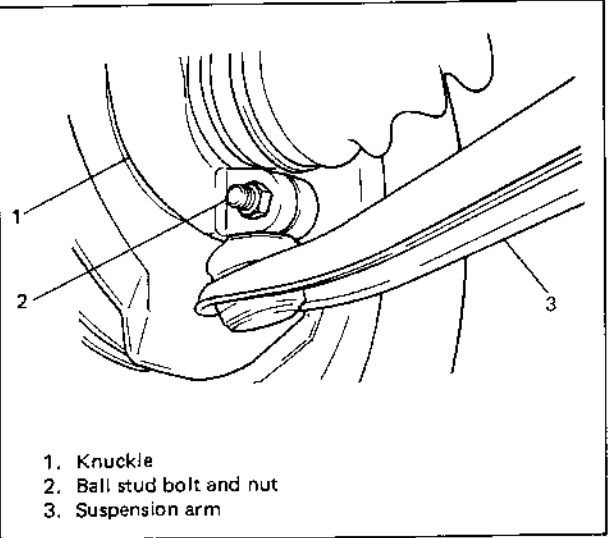


Fig. 7A-10 Detaching Suspension Arm from Knuckle

3. • In case of left side oil seal removal:  
By using large size screwdrivers, pull out left side drive shaft joint so as to release snap ring fitting of joint spline at differential side.

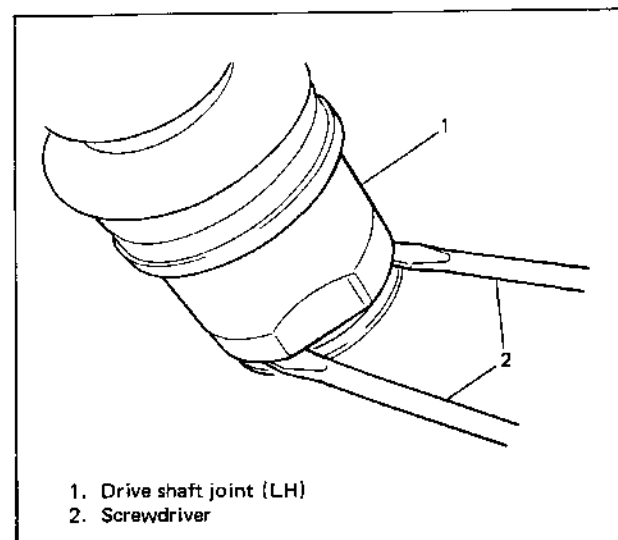


Fig. 7A-11 Detaching Left Side Drive Shaft Joint from Differential Gear

- In case of right side oil seal removal:  
After removing center bearing support bolts, pull out center drive shaft from differential gear.

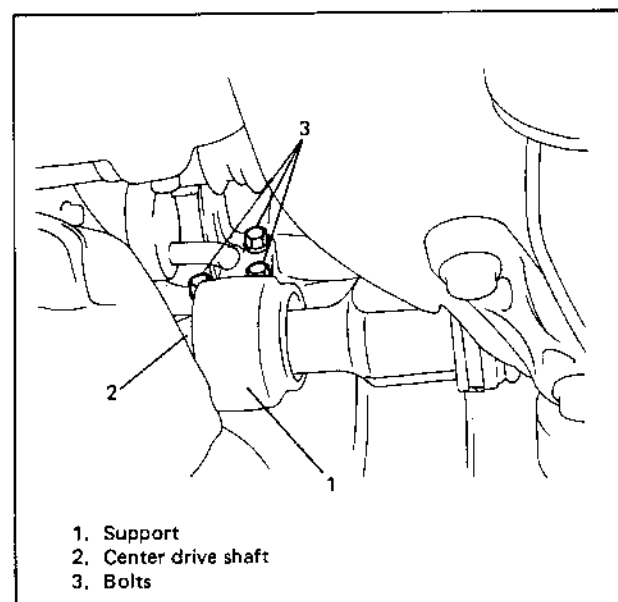


Fig. 7A-11-1 Detaching Center Drive Shaft from Differential Gear

4. Pushing knuckle portion outward, detach drive shaft at differential side.  
5. Remove oil seal and install a new one until it becomes flush with case surface by using special tool and hammer.

#### NOTE:

When install oil seal, face its spring side inward.

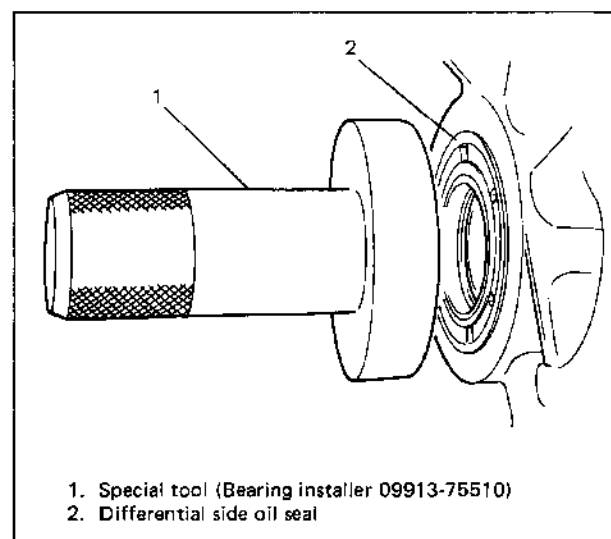


Fig. 7A-12 Installing Differential Side Oil Seal

6. Apply grease to oil seal lip and at the same time check drive shaft where oil seal contacts and make sure of its smoothness.  
7. Insert left side drive shaft joint or center drive shaft to differential gear.  
With right side drive shaft, install center bearing support.

| Tightening torque of support bolt | N·m     | kg·m      | lb·ft       |
|-----------------------------------|---------|-----------|-------------|
|                                   | 40 - 60 | 4.0 - 6.0 | 29.0 - 43.0 |

#### CAUTION:

- Be careful not to scratch oil seal lip with drive shaft joint while inserting.
- Make sure to insert drive shaft joint fully and seat its snap ring as it was.
- Do not hit joint boot with hammer or the like. Nothing but hands is allowed to use when inserting joint.

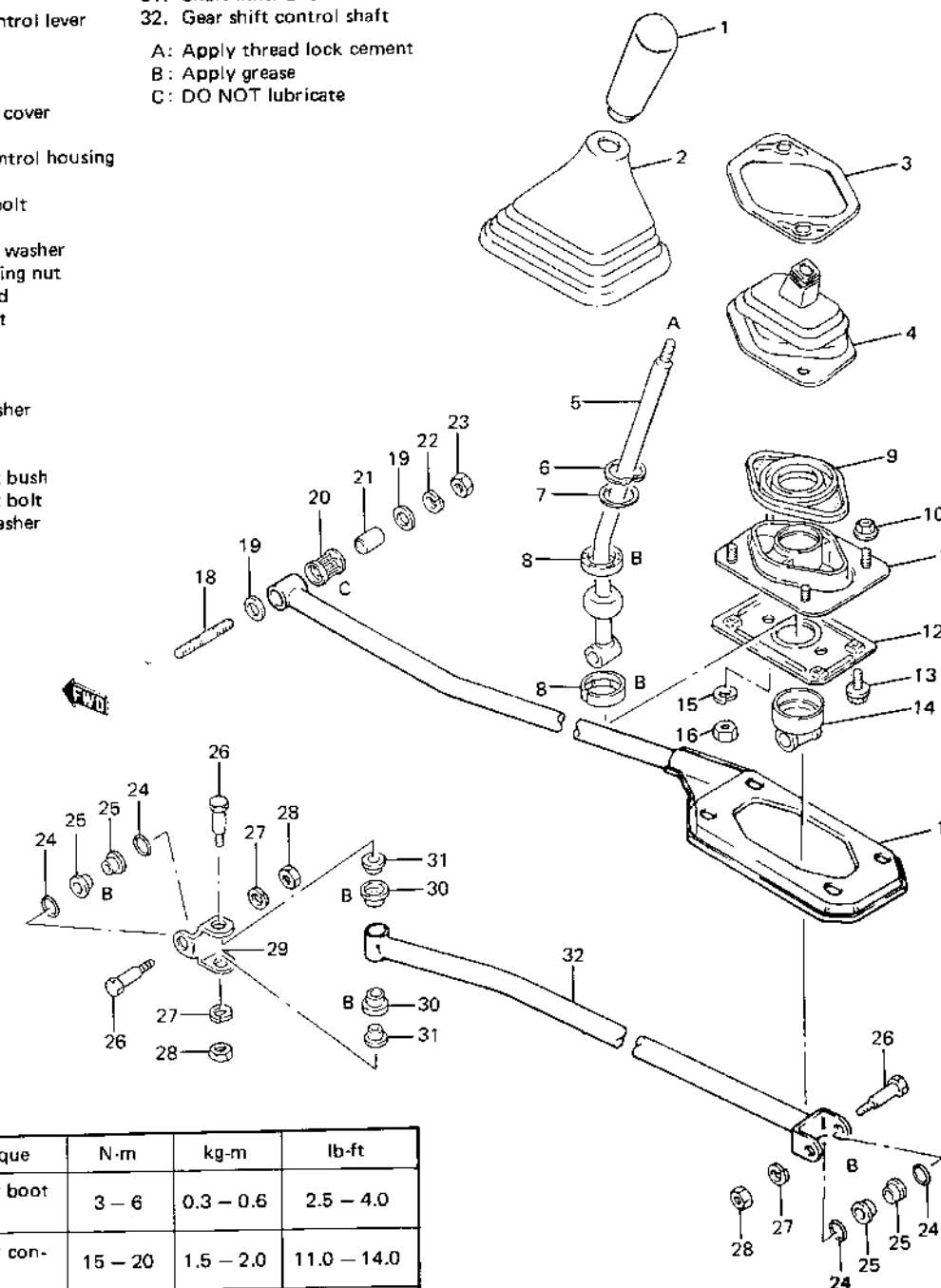
8. Connect ball stud with knuckle and fasten with bolt to specification.

| Tightening torque      | N·m     | kg·m      | lb·ft       |
|------------------------|---------|-----------|-------------|
| Ball stud bolt and nut | 50 - 70 | 5.0 - 7.0 | 36.5 - 50.5 |

9. Fill transmission oil as specified and make sure that oil has been sealed with oil seal.

## GEAR SHIFT CONTROL

- Control lever knob
  - Boot No. 2
  - Boot cover
  - Boot
  - Gear shift control lever
  - Circlip
  - Adjust shim
  - Seat
  - Housing dust cover
  - Housing nut
  - Gear shift control housing
  - Guide plate
  - Guide plate bolt
  - Rear boot
  - Housing lock washer
  - Control housing nut
  - Extension rod
  - Rod stud bolt
  - Rod washer
  - Rod bush
  - Spacer
  - Rod lock washer
  - Rod nut
  - O ring
  - Control shaft bush
  - Control shaft bolt
  - Shaft lock washer
  - Shaft nut
  - Gear shift control joint
  - Shaft outer bush
  - Shaft inner bush
  - Gear shift control shaft
- A: Apply thread lock cement  
B: Apply grease  
C: DO NOT lubricate



| Tightening torque                | N·m     | kg·m      | lb·ft       |
|----------------------------------|---------|-----------|-------------|
| Housing nuts for boot cover      | 3 - 6   | 0.3 - 0.6 | 2.5 - 4.0   |
| Housing nuts for control housing | 15 - 20 | 1.5 - 2.0 | 11.0 - 14.0 |
| Guide plate bolts                | 8 - 10  | 0.8 - 1.0 | 6.0 - 7.0   |
| Control housing nuts             | 25 - 40 | 2.5 - 4.0 | 18.5 - 28.5 |
| Extension rod stud bolt          | 15 - 20 | 1.5 - 2.0 | 11.0 - 14.0 |
| Extension rod nut                | 25 - 40 | 2.5 - 4.0 | 18.5 - 28.5 |
| Control shaft bolts and nuts     | 15 - 20 | 1.5 - 2.0 | 11.0 - 14.0 |

Fig. 7A-13 Gear Shift Control Components



REMOVAL

On Lift

1. Disconnect gear shift control shaft from gear shift control lever by removing control shaft bolt and nut.
2. Remove 4 guide plate bolts and loosen extension rod nut at transmission end and then move extension rod aside.

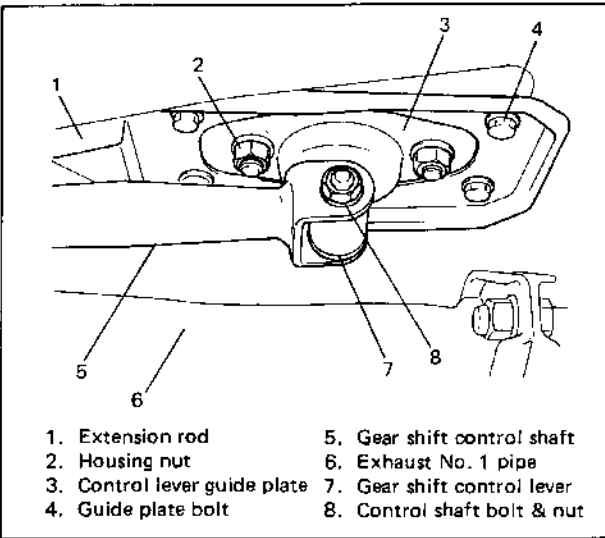


Fig. 7A-14 Removing Gear Shift Control Lever

In Cabin

1. Remove 2 screws from shift control lever cover, if the cover is equipped.
2. Remove 4 control lever housing nuts and then push shift control lever boot(s) into floor hole to take out shift control lever assembly from under the floor.

On Bench

1. Holding control lever knob with soft jawed vise, loosen its screw and remove control lever.
2. Remove 2 housing nuts, and then disassemble control lever.

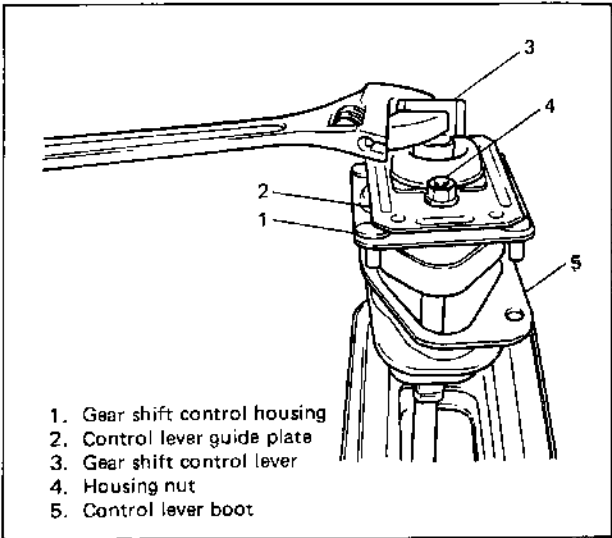


Fig. 7A-15 Removing Control Lever Knob

INSTALLATION

1. Assemble control lever by reversing removal procedure, replacing parts with new ones as required. Select shim for adjusting vertical play of control lever, if necessary. Apply grease to turning or sliding portions.

NOTE:

Check control lever for smooth movement after assembly.

|                                 |                                                          |
|---------------------------------|----------------------------------------------------------|
| Control lever vertical play     | 0 – 0.2 mm<br>0 – 0.007 in                               |
| Available shim size (thickness) | 0.8, 1.0, 1.2 and 1.4 mm<br>0.03, 0.04, 0.05 and 0.06 in |

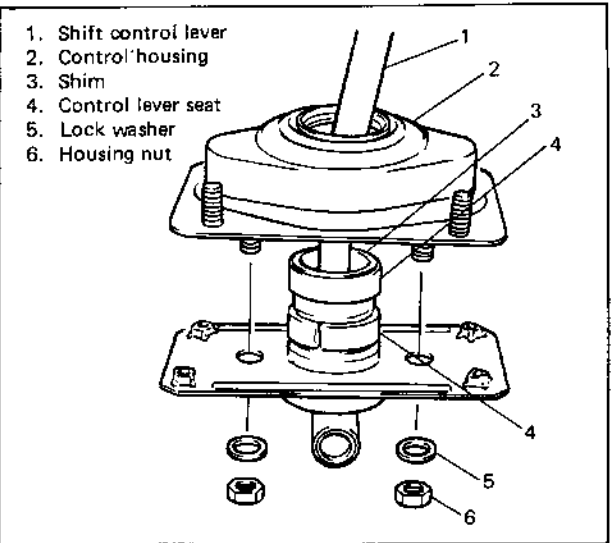


Fig. 7A-16 Assembling Gear Shift Control Lever

2. Apply thread lock cement and then install knob to control lever. Make sure that knob is aligned with lever.
3. Install control lever assembly and related parts as they were. For positioning control lever, loosely install 4 guide plate bolts and 4 control lever housing nuts first, adjust position and then tighten those nuts and bolts.

NOTE:

- Do not apply grease to extension rod bush of transmission end.
- Apply grease to gear shift control shaft bushes.
- Make sure that boots are installed correctly.

|                                      |                   |
|--------------------------------------|-------------------|
| Control lever position: "A" distance | 270 mm<br>10.6 in |
|--------------------------------------|-------------------|

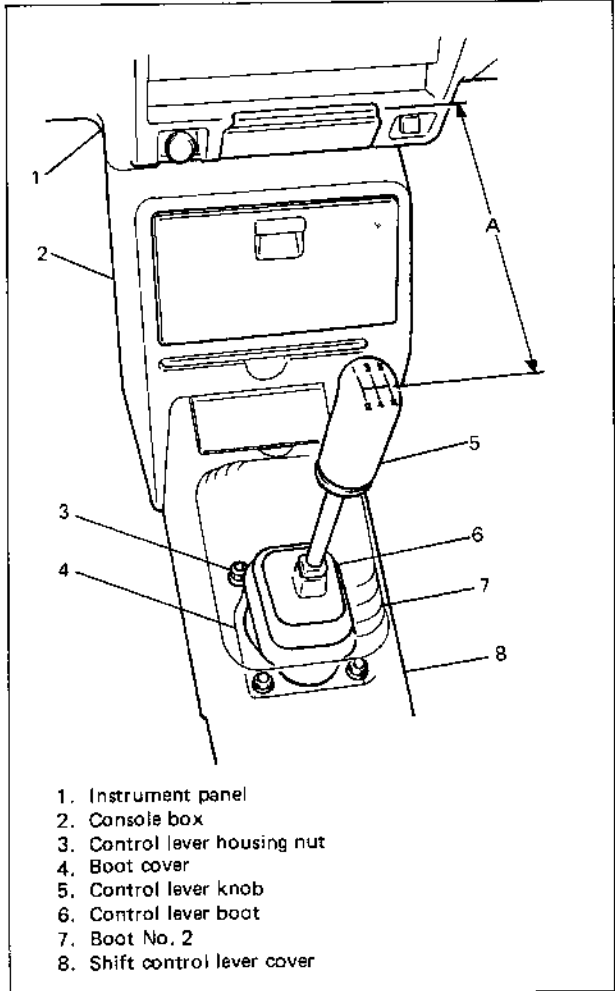


Fig. 7A-17 Installing Shift Control Lever

SPEEDOMETER DRIVEN GEAR

REMOVAL

1. Pull up speedometer cable boot, pull out speedometer case clip and then disconnect speedometer cable from case.
2. Remove bolt and pull out speedometer driven gear case assembly by hand.
3. Using pin remover of 2.8 – 3.0 mm (0.11 in) diameter, drive out spring pin and then take out speedometer driven gear.
4. Remove oil seal by using special tools (Bearing remover and sliding hammer) holding flat portion of driven gear case by soft jawed vise.

INSTALLATION

1. Apply grease to a new oil seal and install it to case bore up to the bottom with its spring side facing down. Valve guide remover may be used for installation.
2. Check driven gear for abnormal wear or distortion and insert good one into case after applying oil.
3. Install spring pin supporting flat portion of case by wood block, and then make sure that gear rotates smoothly.
4. Check O-ring and case surface for their flawlessness, apply oil to O-ring and then install case assembly to transmission.
5. Connect cable, set case clip and boot as they were.

CAUTION:

- Do not compress oil seal excessively so as to prevent its distortion.
- Never hit driven gear and gear case.
- While inserting case assembly into transmission, rotate driven gear by using small screwdriver so that gear will mesh smoothly.
- Never push or hit slit portion of case when installing it to transmission.

|                                 |       |           |           |
|---------------------------------|-------|-----------|-----------|
| Tightening torque for case bolt | N·m   | kg·m      | lb·ft     |
|                                 | 4 – 7 | 0.4 – 0.7 | 3.0 – 5.0 |

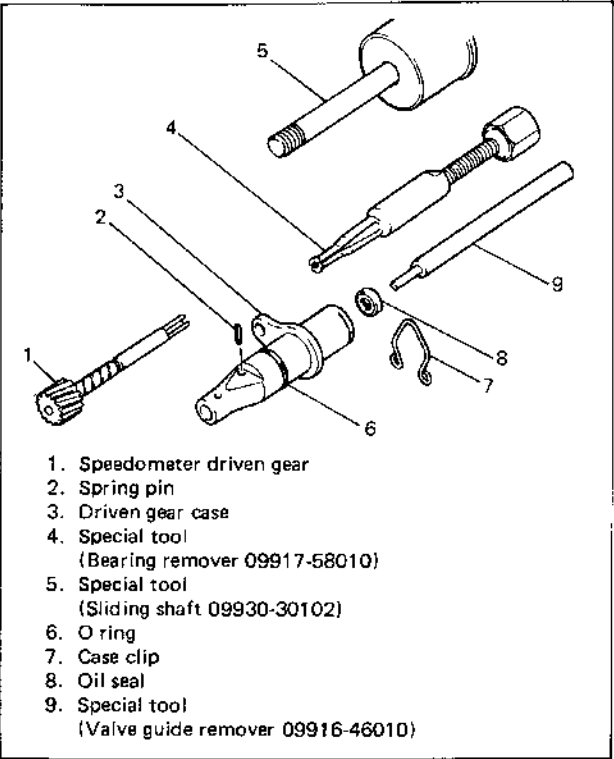


Fig. 7A-18 Speedometer Driven Gear

6. Make sure that oil level is as specified.

## UNIT REPAIR OVERHAUL

### DISMOUNTING OF TRANSMISSION

#### UNDER HOOD

1. Disconnect battery ground cable.
2. Remove battery and its tray.
3. Remove clutch cable joint nut, joint pin from cable and then cable itself from bracket.
4. Undo wiring harness clamps and couplers.
5. Take off speedometer cable boot, speedometer case clip and then speedometer cable from case.
6. Detach radiator outlet pipe from transmission side cover.
7. Remove transmission fastening bolts.
8. Remove starter taking out its 2 bolts. Starting motor plate should also come down.

#### ON LIFT

1. Drain transmission oil. Special tool (10 mm hexagon socket) and ratchet wrench are applicable.
2. Remove fender apron extension of left side.

3. Remove exhaust No. 1 pipe nuts to disconnect their joint.
4. Remove gear shift control shaft bolt and nut, then detach control shaft from gear shift shaft.
5. Remove extension rod nut and then pull out rod with washers.

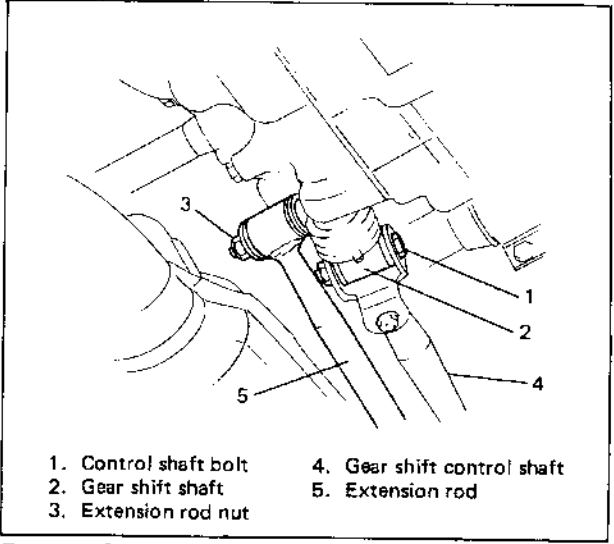


Fig. 7A-19 Removing Rear Portion

6. Remove clutch housing lower plate.
7. Remove ball stud bolt and nut from right and left knuckles, then disconnect each suspension arm.
8. Disconnect left side drive shaft joint from differential gear of transmission. By using large size screwdrivers, pull out drive shaft joint at differential side so as to release snap ring fitting of joint.

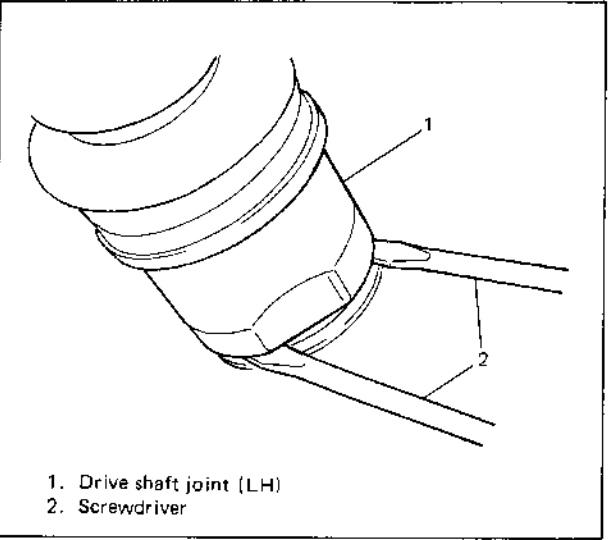


Fig. 7A-20 Detaching Left Side Drive Shaft Joint from Differential Gear

9. Remove center bearing support bolts and pull out center drive shaft from differential gear.

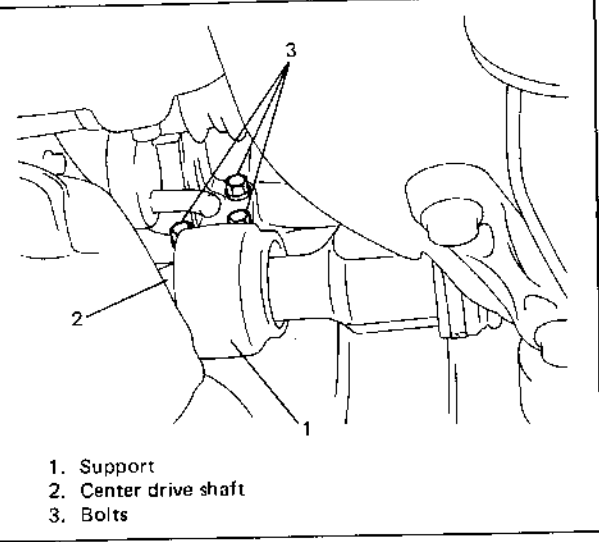


Fig. 7A-21 Detaching Center Drive Shaft from Differential Gear

10. Remove transmission stiffener.
11. Remove transmission to engine bolt and nut.
12. Remove engine rear mounting bracket bolts.
13. Lower car and support engine with hoist.
14. Support transmission with transmission jack.
15. Remove engine mounting LH bracket and its stiffener.

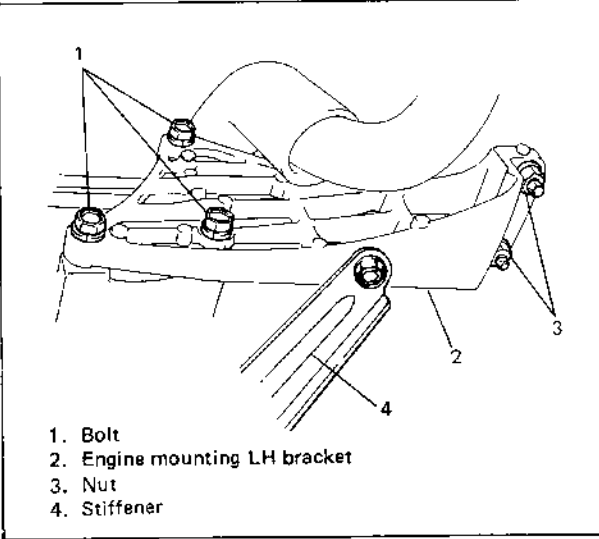


Fig. 7A-22 Removing LH Mounting Bracket

16. Other attached parts from transmission, if any.
17. Pull transmission out so as to disconnect input shaft from clutch disc and then lower it.

## REMounting

For remounting, reverse dismounting procedure. Use specified torque as given below.

| Tightening torque                       | N·m | kg·m | lb·ft |
|-----------------------------------------|-----|------|-------|
| • Transmission to engine bolts and nuts |     |      |       |
| • Engine rear mounting bracket bolts    | 40  | 4.0  | 29.0  |
| • Engine mounting LH bracket bolts      | 60  | 6.0  | 43.0  |
| • Exhaust No. 1 pipe to manifold nuts   |     |      |       |
| • Center bearing support bolts          |     |      |       |
| Engine mounting LH bracket nuts         | 50  | 5.0  | 36.5  |
|                                         | 60  | 6.0  | 43.0  |
| Ball stud bolt and nut                  | 50  | 5.0  | 36.5  |
|                                         | 70  | 7.0  | 50.5  |
| Extension rod nut                       | 25  | 2.5  | 18.5  |
|                                         | 40  | 4.0  | 28.5  |
| Gear shift control shaft bolt and nut   | 15  | 1.5  | 11.0  |
|                                         | 20  | 2.0  | 14.5  |

- Before installing engine rear mounting bracket bolt (upper side), apply sealant (SUZUKI BOND No. 1215) to its thread.
- Push in left side drive shaft joint fully so as to snap ring of shaft engages with differential gear.

#### NOTE:

Apply grease to gear shift control shaft bushes, however, DO NOT lubricate extension rod bush.

#### CAUTION:

- Care should be taken not to scratch oil seal lip with drive shaft while raising transmission.
- Do not hit drive shaft joint with hammer when installing it into differential gear.

- Set each clamp for wiring securely.
- After connecting clutch cable, be sure to adjust its play properly (Refer to p. 7C-4 for free travel of clutch pedal).

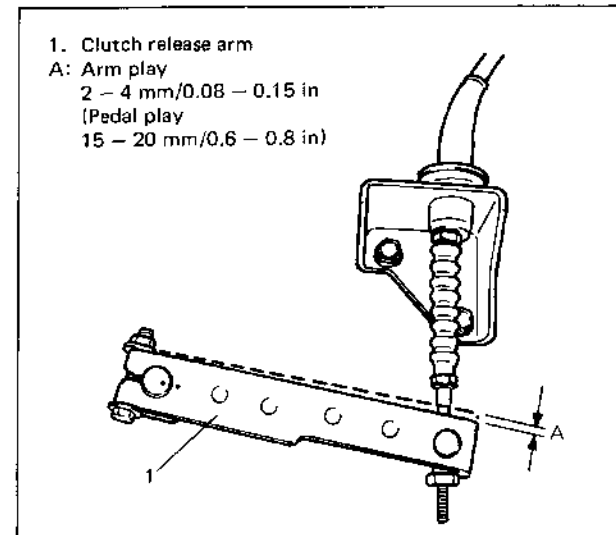


Fig. 7A-23 Adjusting Clutch Play

- Fill transmission with oil as specified.
- Connect battery and check function of engine, clutch and transmission.

## DISASSEMBLING UNIT

### FIFTH GEAR

1. Remove 8 bolts and take off transmission side cover.
2. Using special tool, remove circlip and then hub plate.

#### CAUTION:

Care should be taken not to distort side cover when it is removed from left case.

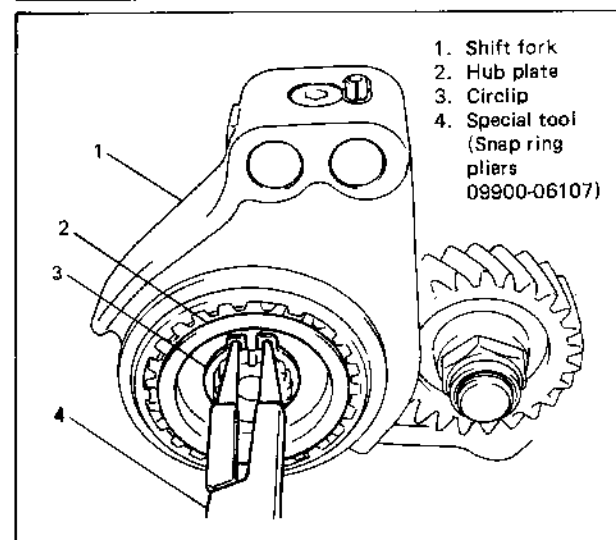


Fig. 7A-24 Removing Circlip and Hub Plate

3. Remove shift fork plug and guide ball.
4. Drive out spring pin by using special tool and hammer.

#### NOTE:

Use of magnet would facilitate removal of guide ball.

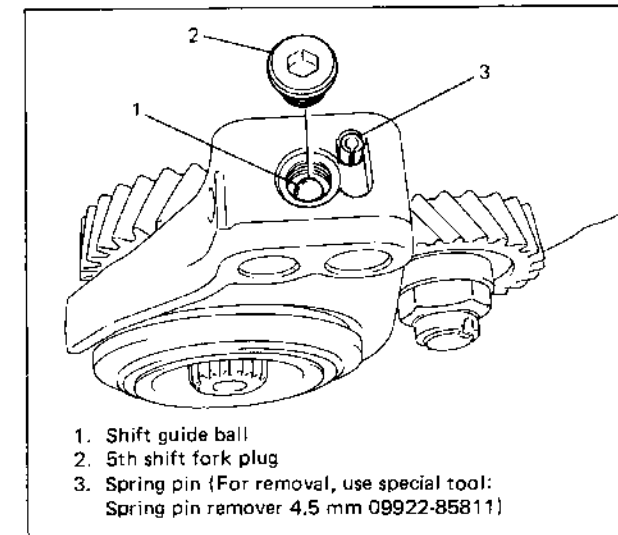


Fig. 7A-25 Removing Screw, Ball and Spring Pin

5. Remove gear shift fork, sleeve & hub assembly, synchronizer ring spring, synchronizer ring and 5th gear all together. Gear puller is required for this work.

#### CAUTION:

Be carefull not to pinch synchronizer ring spring when removing.

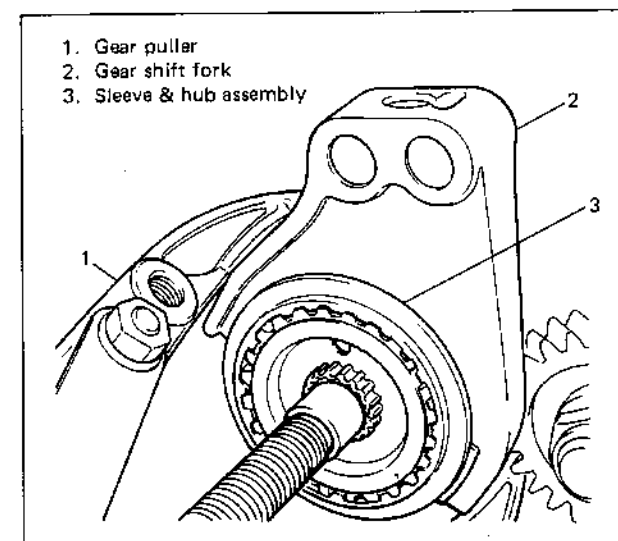


Fig. 7A-26 Removing Sleeve &amp; Hub Assembly

6. Unfasten caulking of countershaft nut, install main shaft 5th gear and special tool to stop rotation of shafts, and then remove countershaft nut.

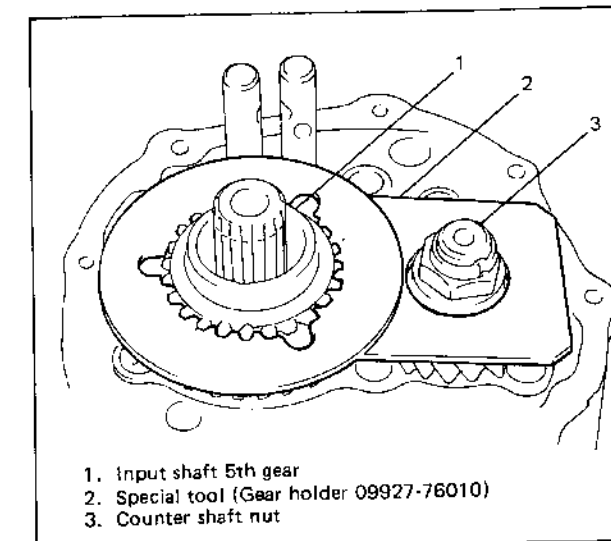


Fig. 7A-27 Removing Counter Shaft Nut

7. Remove special tool, main shaft 5th gear, needle bearing and then counter shaft 5th gear. Gear puller would be necessary if spline fitting of counter shaft 5th gear is tight.
8. Remove 6 screws and take off left case plate, and then bearing set shim.

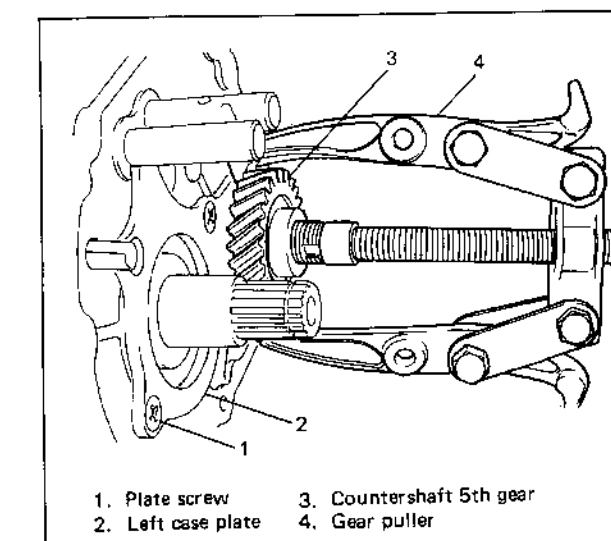


Fig. 7A-28 Removing 5th Gear and Left Case Plate

## GEAR SHIFTER, MAIN SHAFT AND COUNTERSHAFT

1. Remove 3 bolts from left case cap and then take off cap.

2. Remove gear shift yoke bolt.

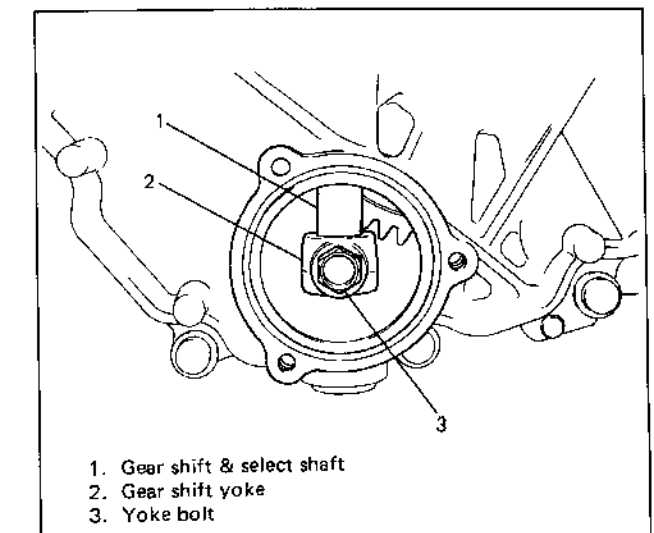


Fig. 7A-29 Removing Gear Shift Yoke Bolt

3. Remove 3 gear shift fork shaft bolts with washers, then take out locating springs and steel balls.
4. Remove 4 bolts from gear shift guide case, and then remove wiring harness clamp bracket and guide case.
5. Remove gear shift interlock bolt with washer.
6. Remove back up light switch.

#### NOTE:

Removal of 5th to REV interlock bolt is not necessary for removing gear shift & select shaft assembly.

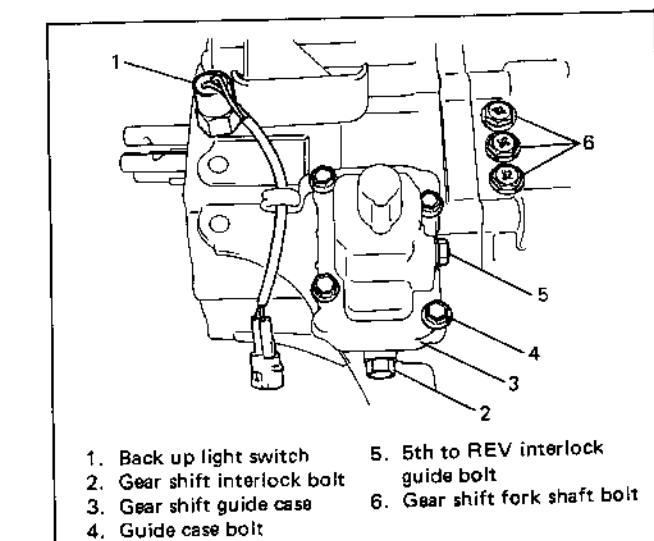


Fig. 7A-30 Removing Gear Shift Guide Case

7. Pull out gear shift & select shaft assembly.

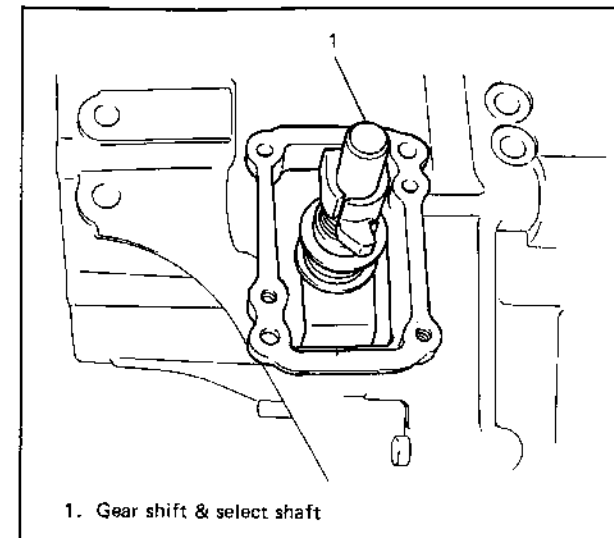


Fig. 7A-31 Removing Shift & Select Shaft Assembly

8. Remove reverse shaft bolt with washer.

9. Remove 11 case bolts from outside and another 2 from clutch housing side.

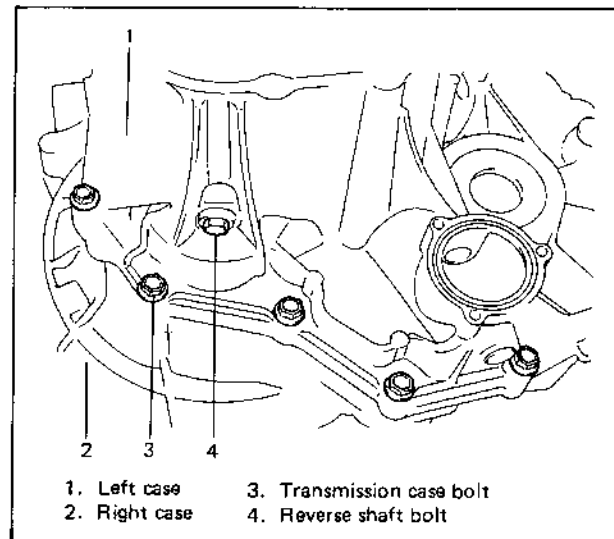


Fig. 7A-32 Removing Case Bolts

10. Tapping left case flanges with plastic hammer, remove left case.

11. Remove gear shift yoke.

12. Pull out reverse gear shaft with washer, then take off reverse idler gear.

13. Pull out 5th & REV gear shift guide shaft together with 5th & REV gear shift shaft.

#### NOTE:

When removing 5th & REV gear shift shaft and guide shaft, push up high speed gear shift shaft and shift it to 4th to facilitate removal of 5th & REV shifter.

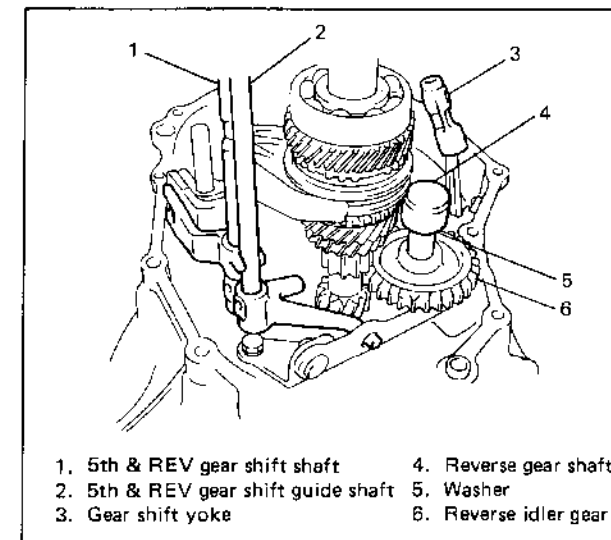


Fig. 7A-33 Removing Reverse Idler Gear

14. Tapping input shaft end with plastic hammer, push it out as assembly from case a little, then take out input shaft assembly, countershaft assembly, high speed gear shift shaft and low speed gear shift shaft all at once.

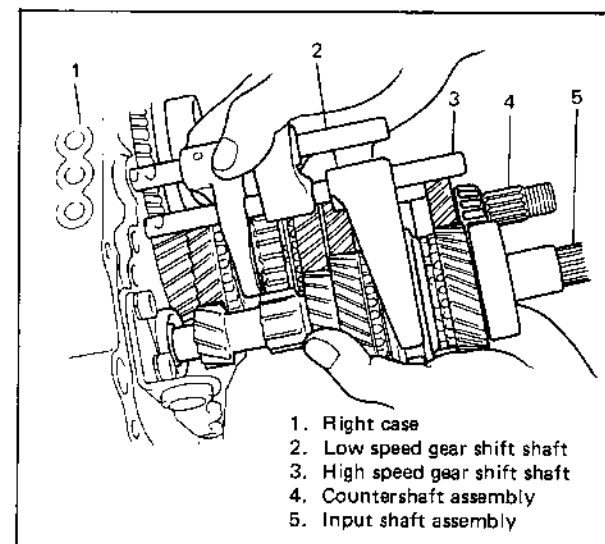


Fig. 7A-34 Removing Input and Counter Shafts

15. Remove countershaft L bearing cup from left case.

16. Remove differential side L oil seal also from left case.

#### RIGHT CASE

1. Remove differential gear assembly from right case.

2. Remove bolt and then pull out speedometer driven gear case with gear.

#### CAUTION:

Be careful not to damage speedometer driven gear case when removing it.

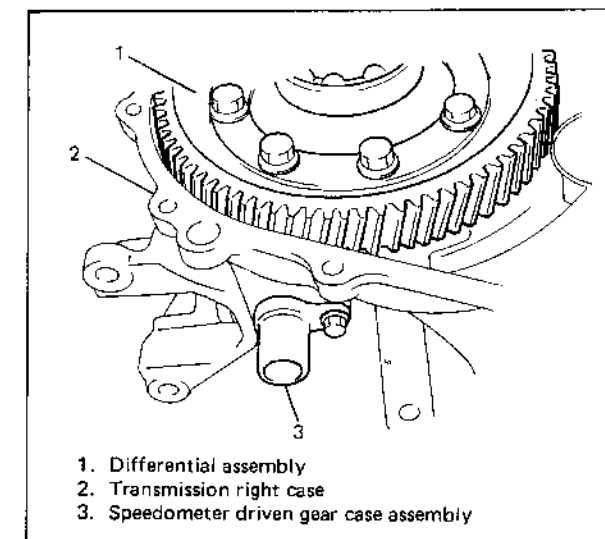


Fig. 7A-35 Removing Differential Assembly

3. Remove input shaft oil seal by using special tools (combination of bearing remover and sliding shaft).

4. Also pull out countershaft R bearing cup by using special tool.

#### NOTE:

If input shaft R bearing has been left in right case, pull it out by using bearing remover 09923-73210 with sliding shaft 09930-30102.

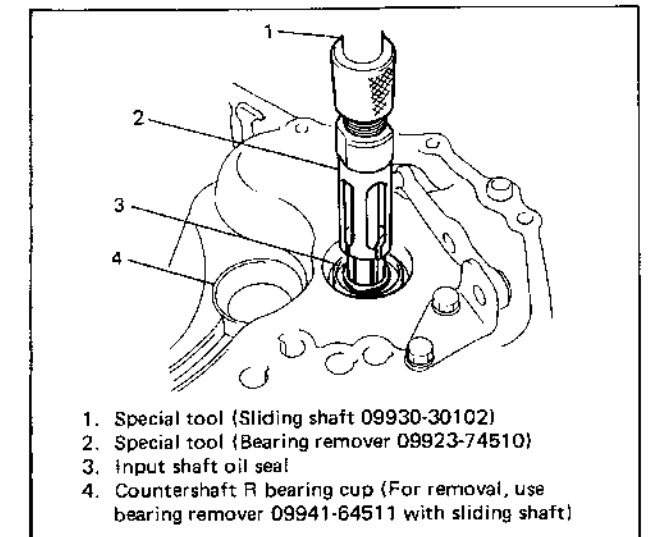


Fig. 7A-36 Removing Input Shaft Oil Seal

5. Take out magnet from case.

6. Remove bolt and then pull out gear shift arm.

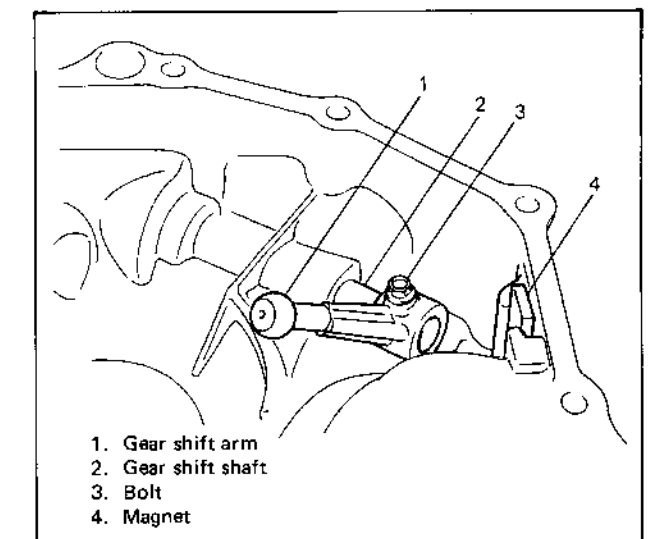


Fig. 7A-37 Removing Gear Shift Arm

7A-18 MANUAL TRANSMISSION

- 7. Remove gear shift shaft bolt with washer, then take out spring and steel ball.
- 8. Remove gear shift shaft, boot and oil seal.

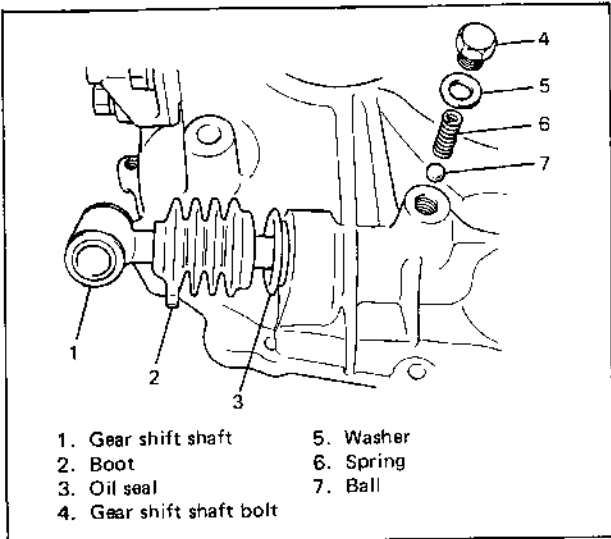


Fig. 7A-38 Removing Gear Shift Shaft

- 9. Remove differential side R oil seal from right case.

SUB ASSEMBLY SERVICE

RIGHT CASE

- 1. If reverse gear shift lever has been removed, fasten it with 2 bolts after applying thread lock cement.
- 2. Install input shaft oil seal facing its spring side upward. Use special tool and hammer for installation and apply grease to oil seal lip.
- 3. Install countershaft R bearing cup by using special tools and hammer.

NOTE:

- When installing reverse gear shift lever, set distance A between lever end and shaft bore to be 5 mm (0.2 in).
- Distance A can be measured by installing reverse gear shaft provisionally.
- When A is 5 mm (0.2 in), clearance between reverse idler gear groove and shift lever end will be 1 mm (0.04 in).

| Tightening torque for reverse gear shift lever bolts | N-m     | kg-m      | lb-ft       |
|------------------------------------------------------|---------|-----------|-------------|
|                                                      | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |

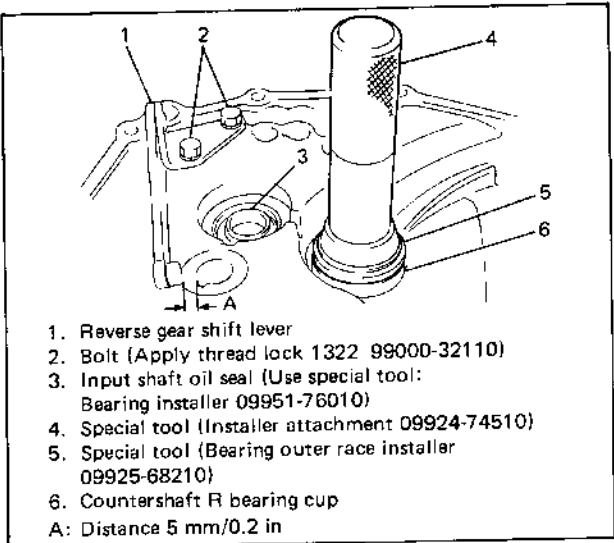


Fig. 7A-39 Installing Reverse Gear Shift Lever

- 4. Apply grease to gear shift shaft oil seal at its lip and install it up to bottom of the bore by using special tool and hammer.

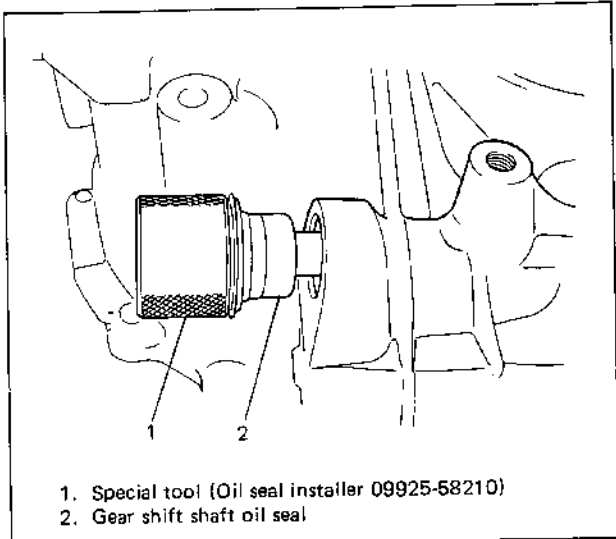


Fig. 7A-40 Installing Gear Shift Shaft Oil Seal

- 5. Install gear shift shaft, boot, steel ball, spring and tighten bolt with washer applied with sealant.
- 6. Install differential side R oil seal until it becomes flush with case surface by using special tool with hammer, and then apply grease to its lip.

NOTE:

- Bring breather of gear shift shaft boot downward.
- Face diff. side oil seal spring side inward.

| Tightening torque for gear shift shaft bolt | N-m     | kg-m      | lb-ft      |
|---------------------------------------------|---------|-----------|------------|
|                                             | 10 - 16 | 1.0 - 1.6 | 7.5 - 11.5 |

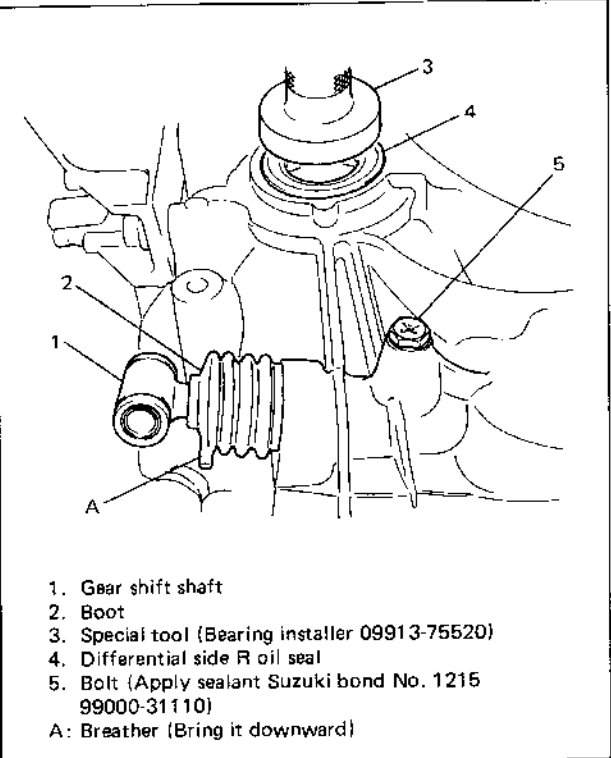


Fig. 7A-41 Installing Gear Shift Shaft

- 7. Insert gear shift arm in gear shift shaft, then fasten them with bolt applied with thread lock cement.
- 8. Place magnet into case as it was.

| Tightening torque for gear shift arm bolt | N-m     | kg-m      | lb-ft       |
|-------------------------------------------|---------|-----------|-------------|
|                                           | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |

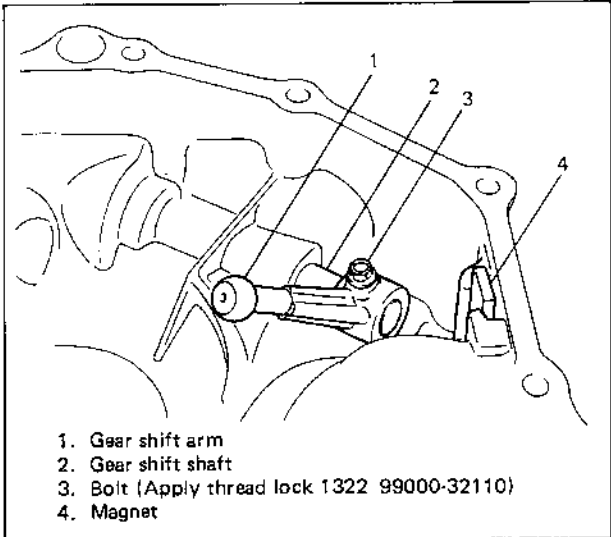


Fig. 7A-42 Installing Gear Shift Arm

LEFT CASE

- 1. If input oil gutter has been removed, install it with bolt applied with thread lock cement.

| Tightening torque for oil gutter bolt | N-m   | kg-m      | lb-ft     |
|---------------------------------------|-------|-----------|-----------|
|                                       | 4 - 7 | 0.4 - 0.7 | 3.0 - 5.0 |

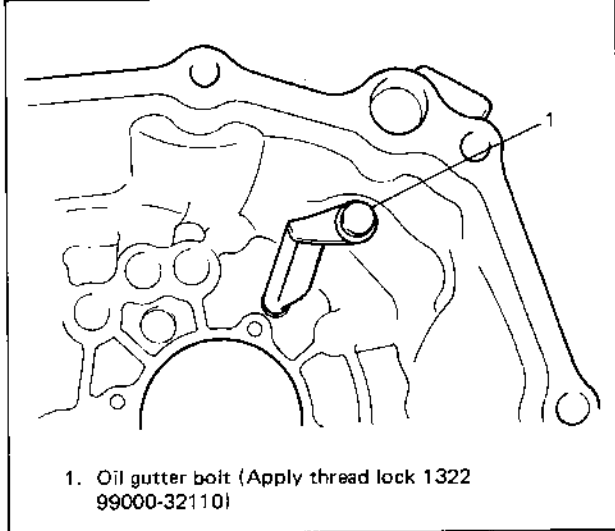


Fig. 7A-43 Installing Oil Gutter

- 2. Install differential side L oil seal until it becomes flush with case surface by using special tool with hammer, and then apply grease to its lip.

NOTE:

Face oil seal spring side inward.

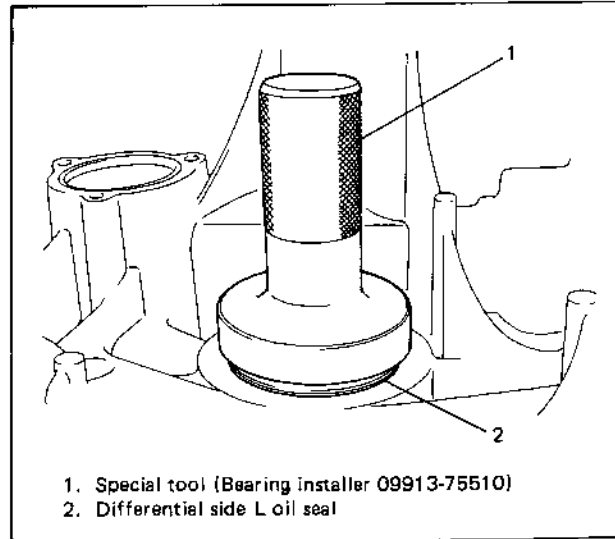


Fig. 7A-44 Installing Differential Side L Oil Seal

3. Install countershaft L bearing cup into case bore by tapping it with plastic hammer lightly.

### INPUT SHAFT ASSEMBLY

#### Disassembly

1. Remove input shaft R bearing by using bearing puller and press.

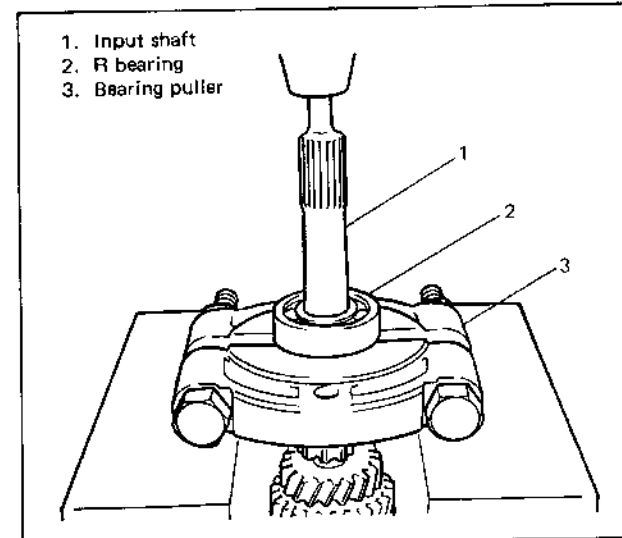


Fig. 7A-45 Removing Input Shaft R Bearing

2. Drive out 5th gear spacer, L bearing and 4th gear all at once by using puller and press.

#### CAUTION:

- To avoid gear tooth from being damaged, support it at flat side of bearing puller.
- Stop press work in the middle way and take out 5th gear bush to prevent it from being compressed and then continue to remove bearing with gear.

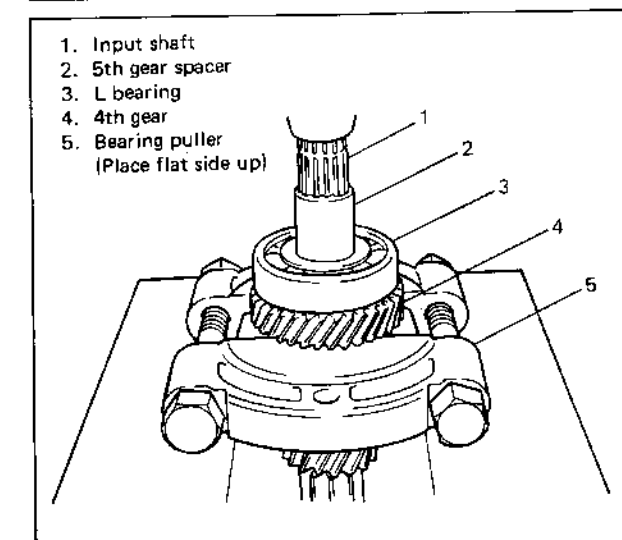


Fig. 7A-46 Removing Input Shaft L Bearing

3. Take out 4th gear needle bearing and high speed synchronizer ring.
4. Using special tool, remove circlip.

#### NOTE:

For smooth removal of circlip, it is recommended to correct tool tips to be flat.

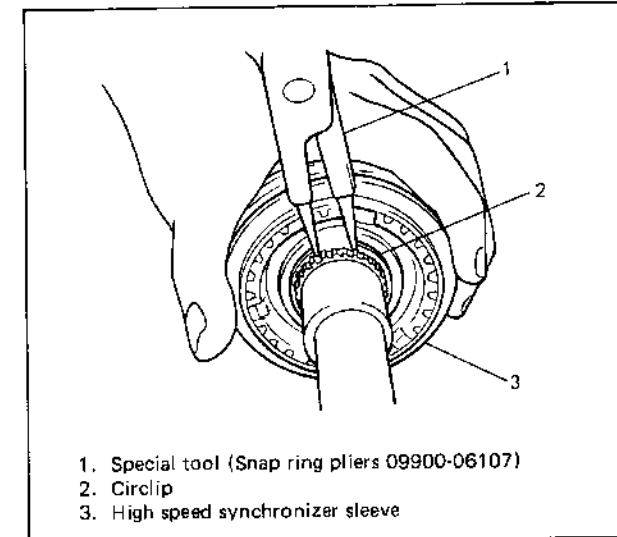


Fig. 7A-47 Removing Circlip

5. Drive out high speed synchronizer sleeve & hub assembly together with 3rd gear by using puller and press.

#### CAUTION:

Make sure to use flat side of puller to avoid causing damage to 3rd gear tooth.

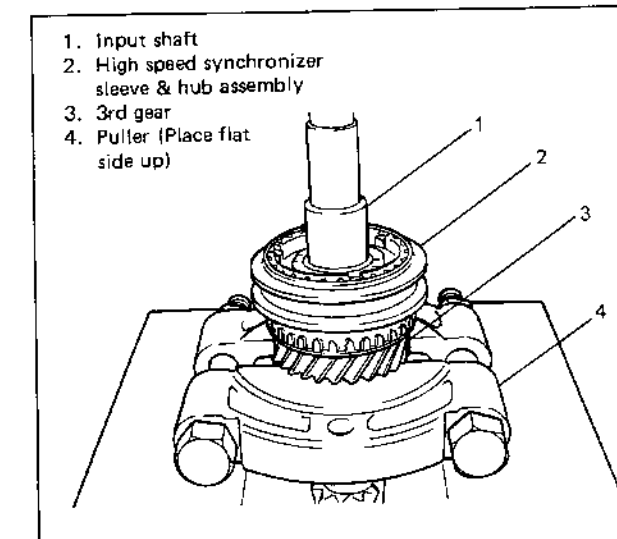


Fig. 7A-48 Removing High Speed Sleeve &amp; Hub

6. Take out 3rd gear needle bearing from shaft.
7. Disassemble synchronizer sleeve & hub assembly.

#### Inspection and Reassembly

1. Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2. If synchronizer parts need to be repaired, check clearance A between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

| Standard clearance A             | Service limit      |
|----------------------------------|--------------------|
| 1.0 – 1.4 mm<br>0.039 – 0.055 in | 0.5 mm<br>0.019 in |

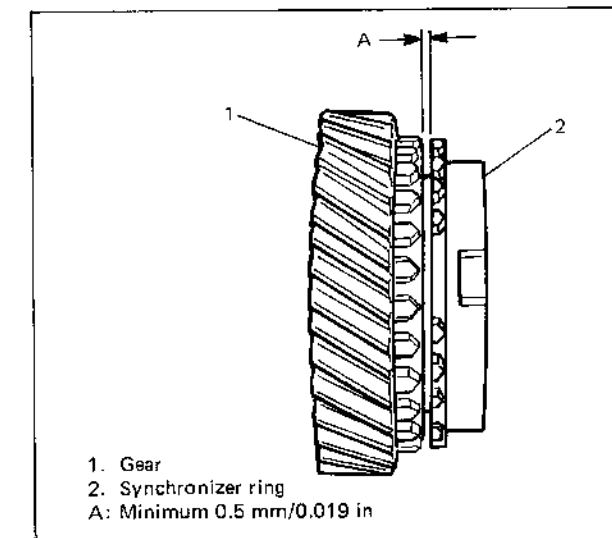


Fig. 7A-49 Checking Gear and Synchronizer Ring

3. To ensure lubrication, air blow oil holes and make sure that they are free from any obstruction.

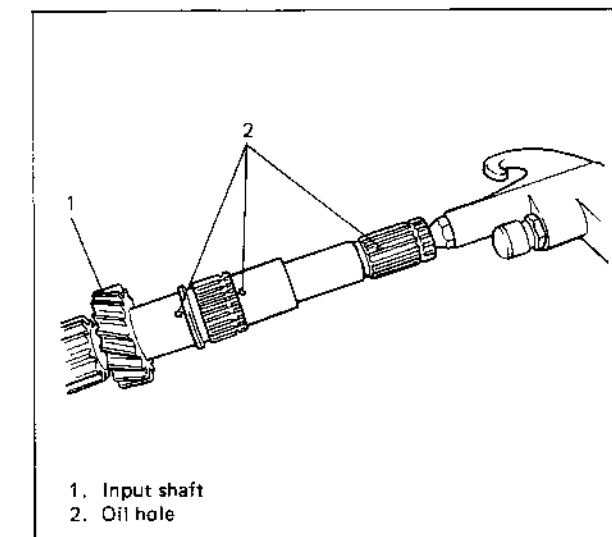


Fig. 7A-50 Air Checking Oil Holes

4. Fit high speed synchronizer sleeve to hub, insert 3 keys in it and then set springs as illustrated below.

#### NOTE:

- No specific direction is assigned to high speed synchronizer sleeve or each key but it is assigned as assembly.
- Size of high speed synchronizer sleeve, hub, keys and springs is between those of low speed and 5th speed ones.

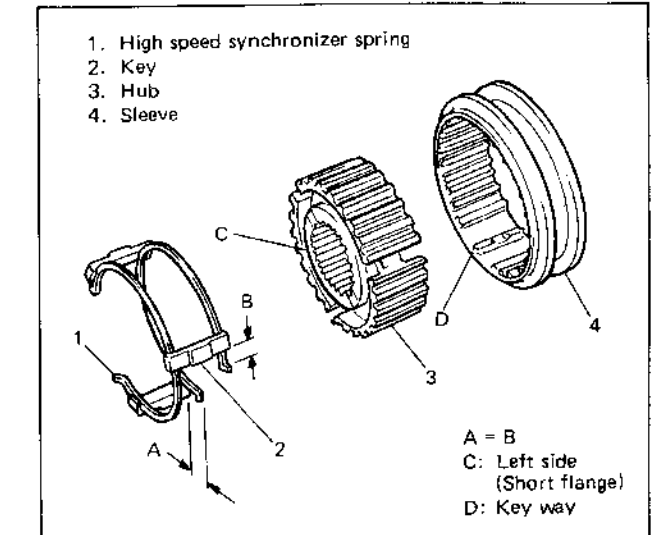


Fig. 7A-51 Assembling High Speed Sleeve &amp; Hub

5. Drive in R bearing by using special tool and hammer.

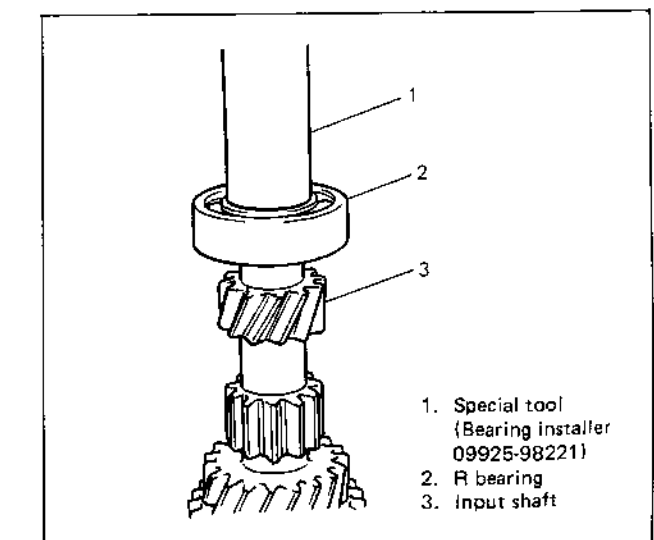


Fig. 7A-52 Press-fitting Input Shaft R Bearing



6. Install 3rd gear needle bearing, apply oil to it, then install 3rd gear and synchronizer ring.
7. Drive in high speed sleeve & hub assembly by using special tool and hammer.

**NOTE:**

- While press-fitting sleeve & hub, make sure that synchronizer ring key slots are aligned with keys in sleeve & hub assembly.
- Check free rotation of 3rd gear after press-fitting sleeve & hub assembly.
- Needle bearings and synchronizer rings for 3rd and 4th are identical respectively.

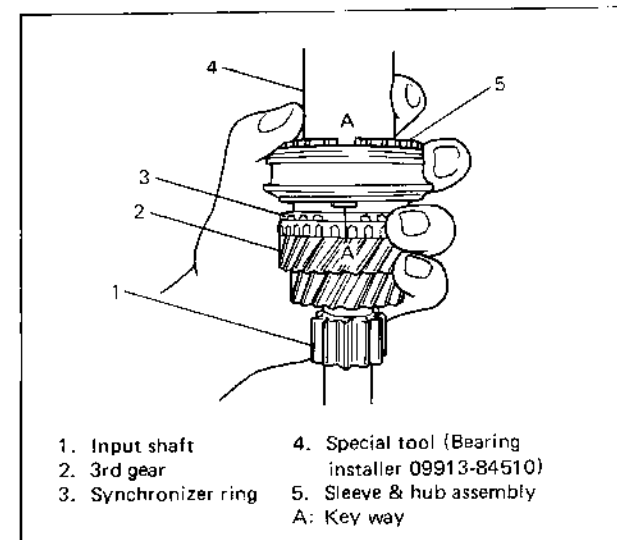


Fig. 7A-53 Press-fitting High Speed Sleeve &amp; Hub

8. Install circlip, needle bearing, apply oil to bearing, then install synchronizer ring and 4th gear.

**CAUTION:**

Confirm that circlip is installed in groove securely.

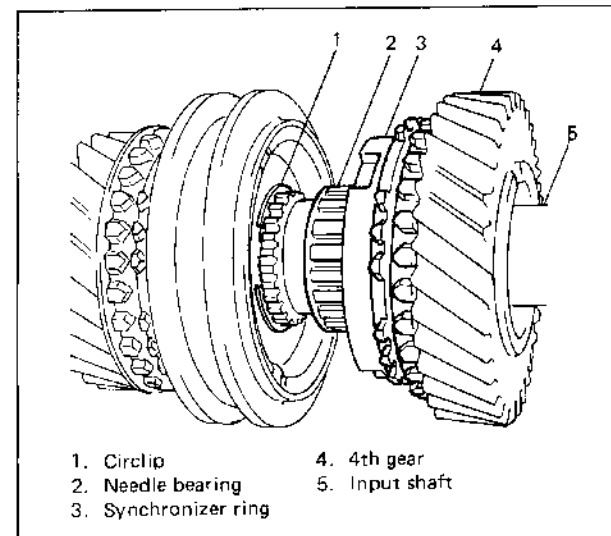


Fig. 7A-54 Installing Circlip

9. Press-fit L bearing by using special tool and hammer.
10. Using the same special tool, drive in 5th gear spacer.

**CAUTION:**

To prevent 5th gear spacer from being distorted because of excessive compression, do not press-fit it with L bearing at once.

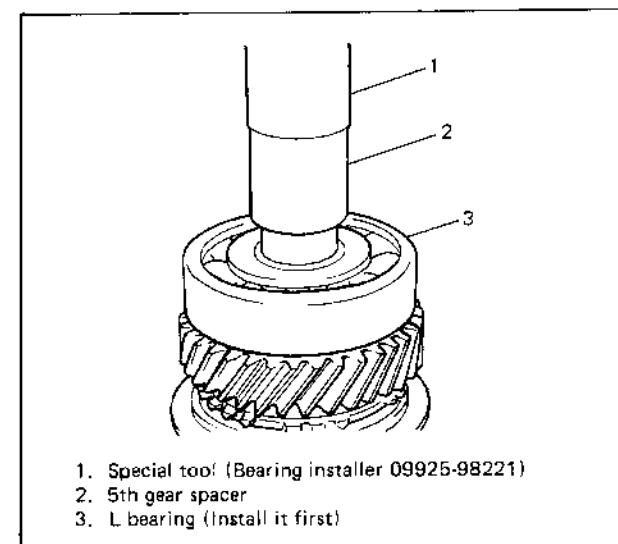


Fig. 7A-55 Press-fitting L Bearing and Spacer

**COUNTERSHAFT ASSEMBLY****Disassembly**

1. Drive out L bearing cone with 4th gear by using puller and press.

**CAUTION:**

- Use puller and press that will bear at least 5 ton (11,000 lb) safely.
- To avoid tooth damage, support 4th gear at flat side of puller.

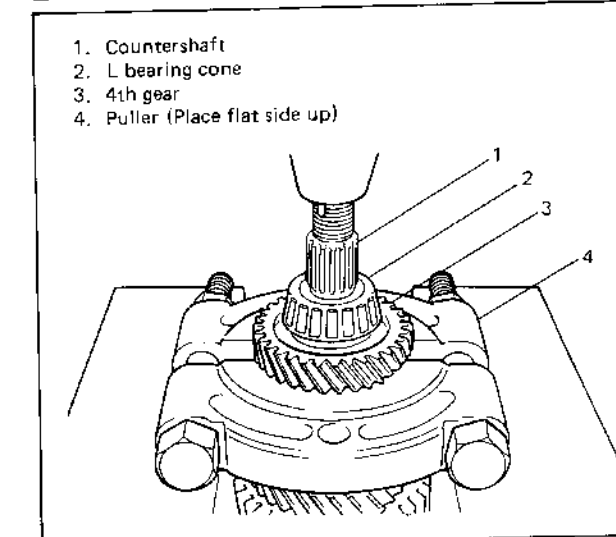


Fig. 7A-56 Removing Countershaft 4th Gear

2. Apply puller to 2nd gear and drive out 3rd & 4th gear spacer together with 2nd gear by using press. Needle bearing would come out with 2nd gear.

**CAUTION:**

If compression exceeds 5 ton (11,000 lb), release compression once, reset puller support and then continue press work again.

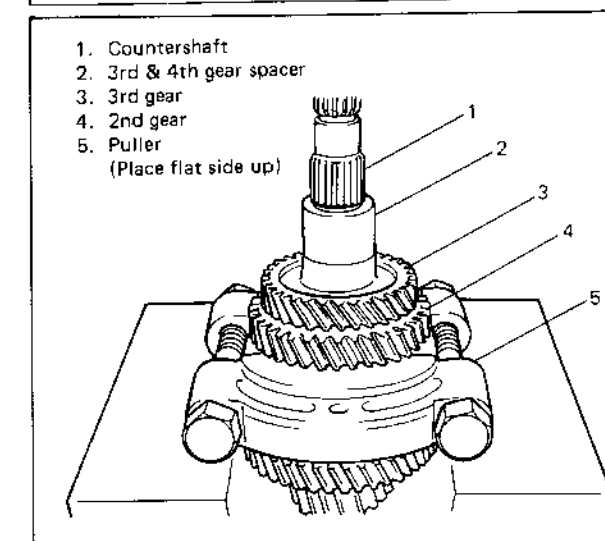


Fig. 7A-57 Removing Spacer and 3rd Gear

3. Take out 2nd synchronizer ring.
4. Using special tool, remove circlip.

**NOTE:**

Correct tool tips to be flat to facilitate removal of circlip.

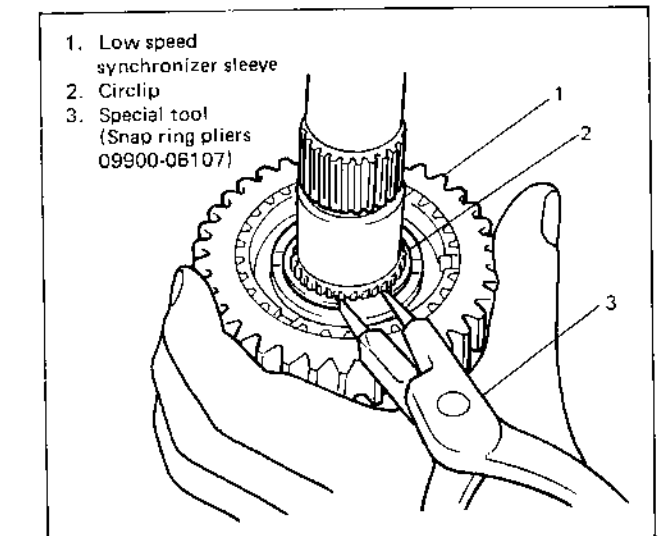


Fig. 7A-58 Removing Circlip

5. Apply puller to 1st gear and drive out low speed synchronizer sleeve & hub assembly with gear by using press.

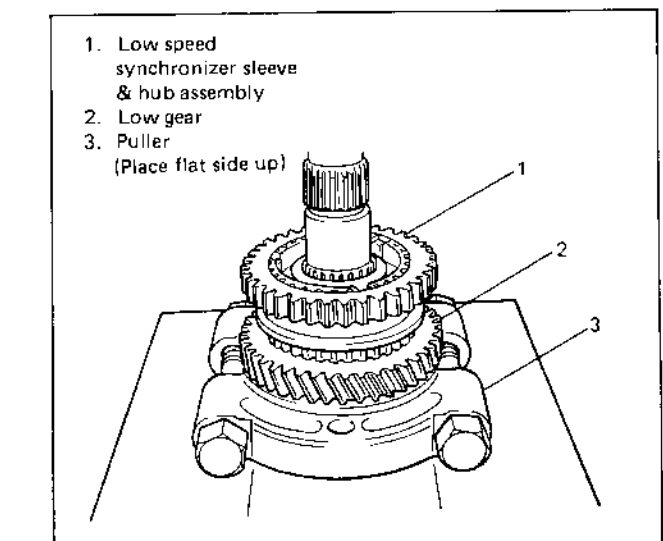


Fig. 7A-59 Removing Low Speed Sleeve &amp; Hub

6. Disassemble synchronizer sleeve & hub assembly.
7. Take out needle bearing from shaft.
8. Remove R bearing cone by using puller, metal stick and press.

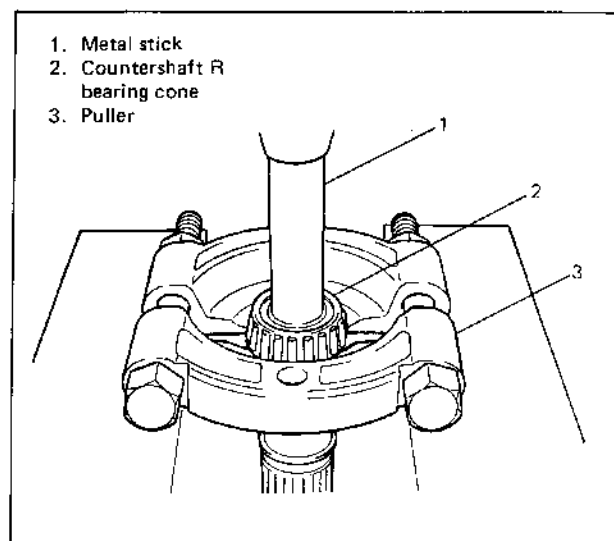


Fig. 7A-60 Removing Countershaft R Bearing Cone

**Inspection and Reassembly**

1. Clean all components thoroughly, inspect them and replace with new ones as necessary.
2. If synchronizer parts need to be repaired, check clearance A between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

| Standard clearance A             | Service limit      |
|----------------------------------|--------------------|
| 1.0 – 1.4 mm<br>0.039 – 0.055 in | 0.5 mm<br>0.019 in |

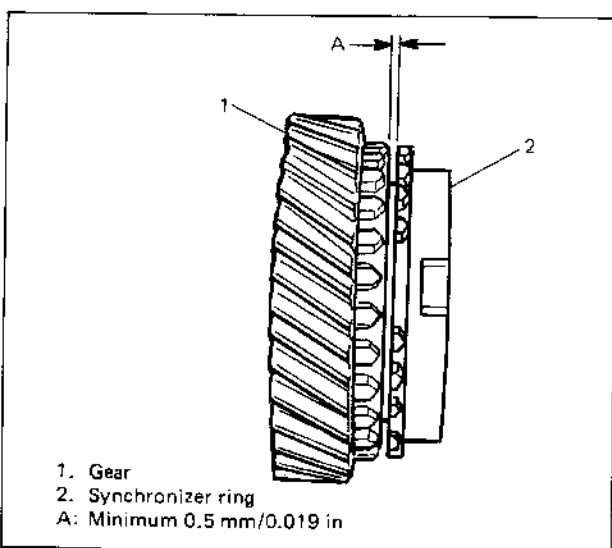


Fig. 7A-61 Checking Gear and Synchronizer Ring

3. To ensure lubrication, air blow oil holes and make sure that they are free from any obstruction.

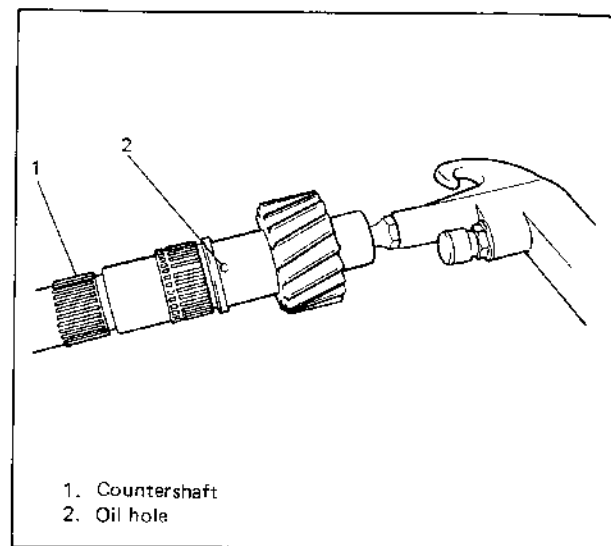


Fig. 7A-62 Air Checking Oil Holes

4. Fit high speed synchronizer sleeve to hub, insert 3 keys in it and then set springs as illustrated below.

**NOTE:**

- No specific direction is assigned to low speed synchronizer hub or each key but it is assigned as assembly.
- Size of low speed synchronizer keys and springs are the largest compared with those of high speed and 5th speed ones.

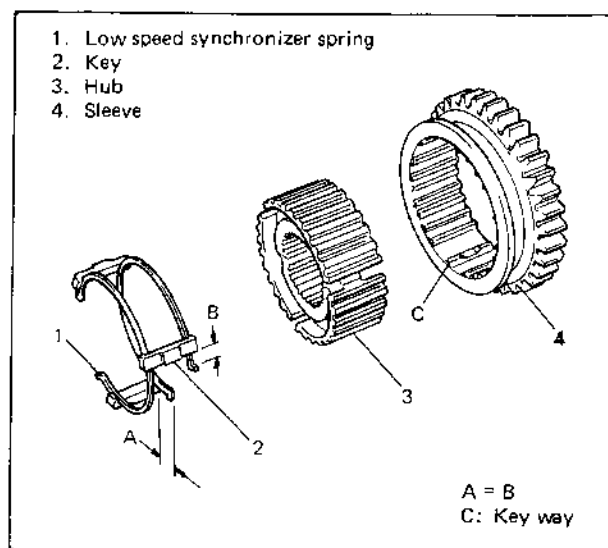


Fig. 7A-63 Assembling Low Speed Sleeve &amp; Hub

5. Install R bearing cone by using special tool and hammer.

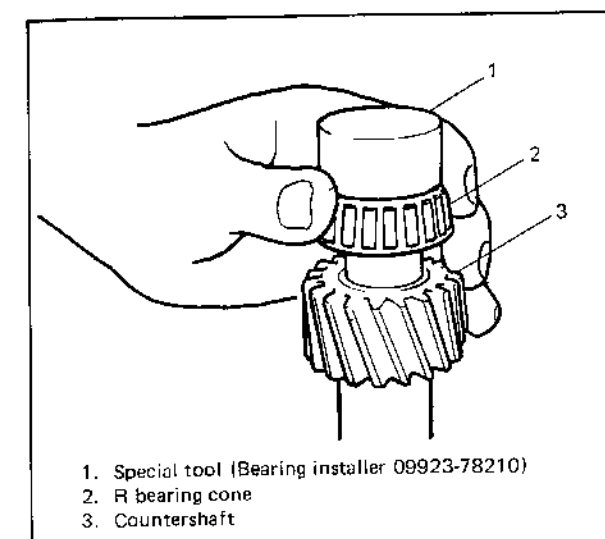


Fig. 7A-64 Press-fitting R Bearing Cone

6. Install needle bearing, apply oil to it, then install 1st gear and 1st gear synchronizer ring.

**NOTE:**

- Key slot width of 1st synchronizer ring is smaller than that of 2nd synchronizer ring. Distinguish the difference properly.
- Needle bearings for 1st and 2nd gear are identical.

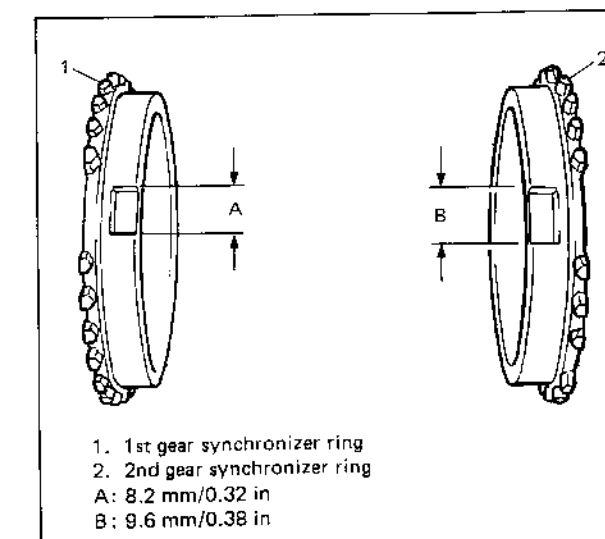


Fig. 7A-65 Difference of 1st and 2nd Rings

7. Drive in low speed sleeve & hub assembly by using special tool and hammer.

**NOTE:**

- Support shaft with special tool as illustrated below so that retainer of bearing cone will be free from compression.
- Make sure that synchronizer ring key slots are aligned with keys while press-fitting sleeve & hub assembly.
- Check free rotation of 1st gear after press-fitting sleeve & hub assembly.

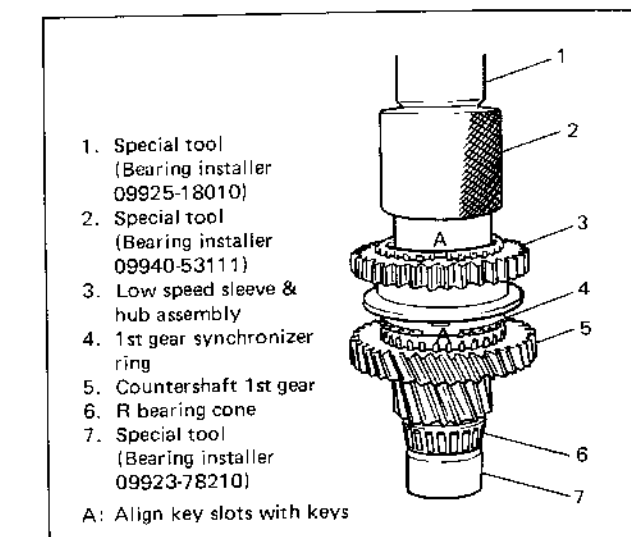


Fig. 7A-66 Press-fitting Low Speed Sleeve &amp; Hub

8. Install circlip, needle bearing, apply oil to bearing, then install 2nd gear synchronizer ring and 2nd gear.

**CAUTION:**

Confirm that circlip is installed in groove securely.

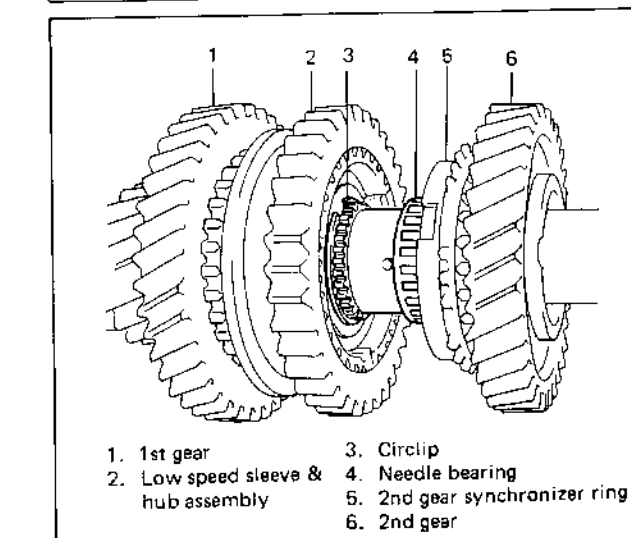


Fig. 7A-67 Installing Circlip



9. Press-fit 3rd gear and spacer by using special tool and press.

**NOTE:**

It is recommended to press-fit spacer and 3rd gear first, and then 4th gear later separately so that countershaft will not be compressed excessively.

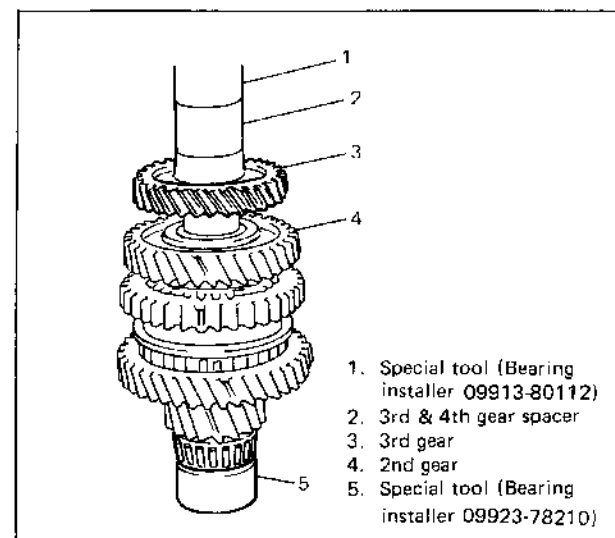


Fig. 7A-68 Press-fitting 3rd Gear and Spacer

10. Press-fit 4th gear by using the same procedure as the above.
11. Install L bearing cone by using special tool and hammer.

**NOTE:**

For protection of bearing cone, always support shaft with special tool as illustrated.

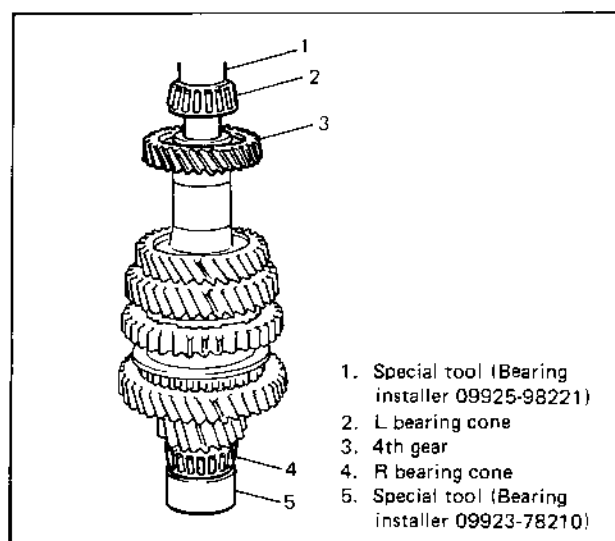


Fig. 7A-69 Press-fitting L Bearing Cone

**GEAR SHIFTER****Gear Shift & Select Shaft Assembly**

- To disassemble component parts, use special tools (spring pin remover 4.5 mm 09922-85811, 6 mm 09925-78210) and 2.8 – 3.0 mm (0.11 in) pin remover in addition.
- Clean all parts thoroughly, inspect them and replace with new ones as required.
- Assemble component parts by reversing removal procedure.

**NOTE:**

- When driving in spring pins, prevent shaft from being bent by supporting it with wood block.
- Assemble 5th & REV gear shift cam by winding cam guide return spring, and then drive in spring pin.
- Locate low speed select spring (Bleu – Lower position) and reverse select spring (Red – Upper position) correctly.

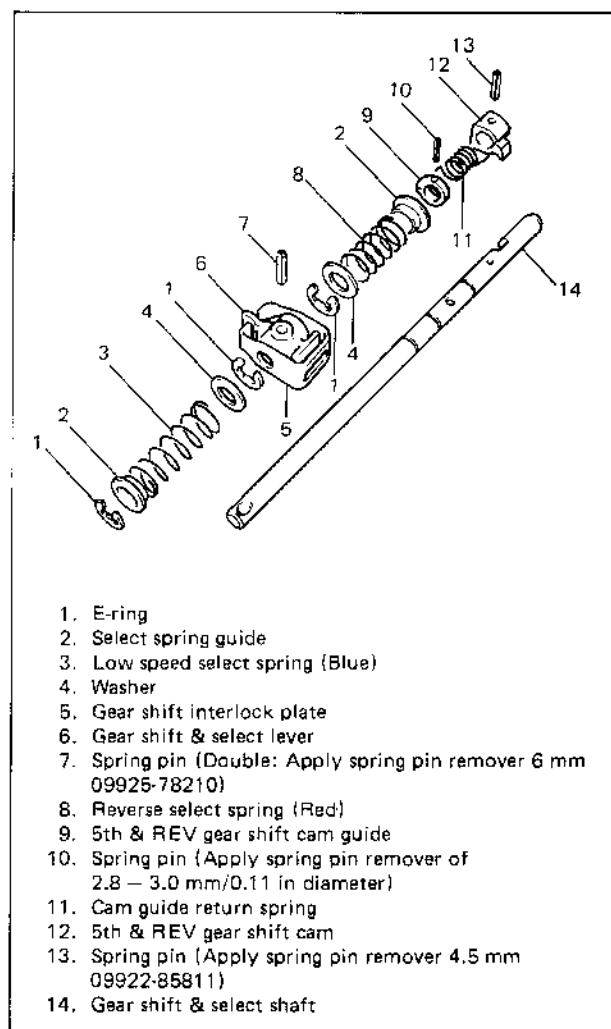


Fig. 7A-70 Gear Shift &amp; Select Shaft Assembly

**High Speed and Low Speed Gear Shift Shafts**

- Before disassembling shift shaft assemblies, determine necessity of parts replacement by checking them for abnormal wear or distortion. Use feeler gauge for checking clearance A between sleeve and shift fork.

**NOTE:**

For correct judgement of parts replacement, carefully inspect contact portion of fork and sleeve.

|                     |                 |
|---------------------|-----------------|
| Maximum clearance A | 1.0 mm/0.039 in |
|---------------------|-----------------|

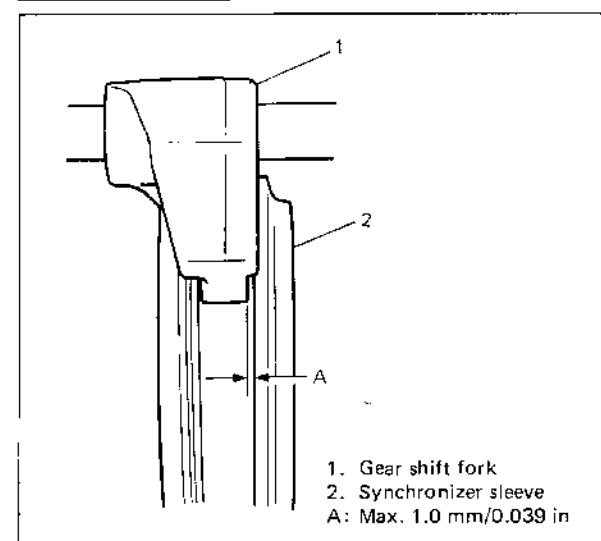


Fig. 7A-71 Checking Sleeve-to-Fork Clearance

- Disassemble component parts by using spring pin remover 4.5 mm (09922-85811) and hammer.
- Assemble shift shafts as shown below while making sure that component parts are in proper order.

**NOTE:**

- Correct shaft surface by using oil stone, if any scratch or dent is found.
- Support shaft with wood blocks when driving in spring pins.

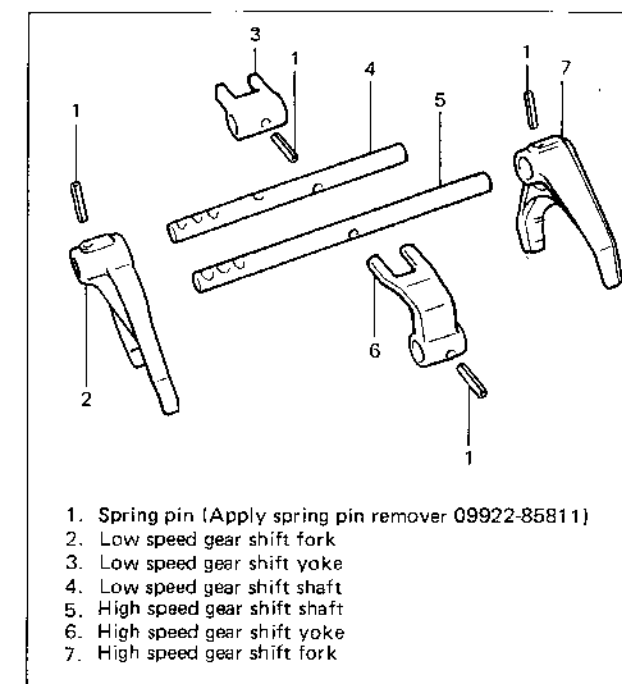


Fig. 7A-72 Assembling Low and High Speed Shifters

**5th & REV Gear Shifter**

- Disassemble component parts by using spring pin remover 4.5 mm (09922-85811) and hammer.
- Replace or correct parts as required and assemble shafts making sure that component parts are in proper order as shown below.

**NOTE:**

- Distinguish reverse gear shift arm spring (Blue) from low speed locating spring (Purple).
- Install 2 steel balls in reverse gear shift arm without fail.
- Drive in spring pin for reverse shift arm facing slit A toward front.

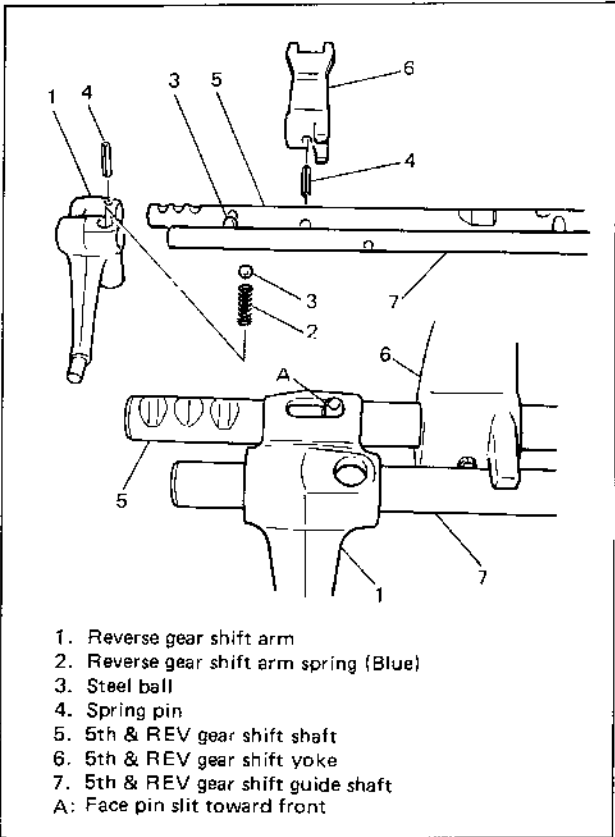


Fig. 7A-73 Assembling 5th & REV Shifter

DIFFERENTIAL ASSEMBLY

Disassembly

1. Using special tool, remove R bearing.
2. Take out speedometer drive gear.

NOTE:

In case that half-moon type puller is used with press for bearing removal, remove final gear in advance.

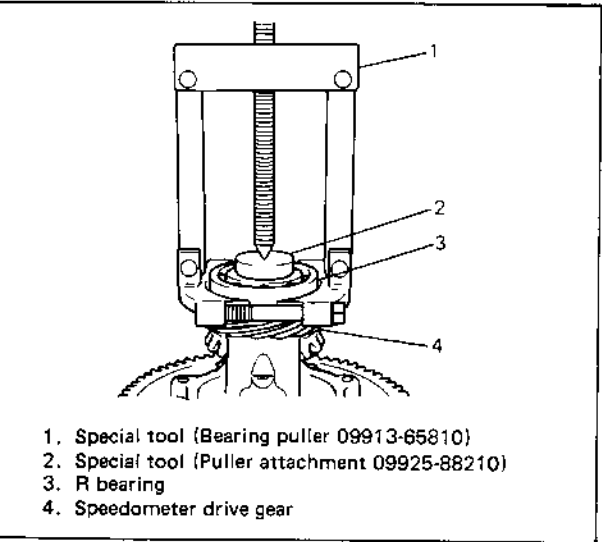


Fig. 7A-74 Removing Differential Side Bearing

3. Remove L bearing by using puller while supporting its center shaft as described above.
4. Support differential case with soft jawed vise and remove 8 final gear bolts then take out final gear.
5. Using special tool and hammer, drive out differential side pinion shaft pin and then disassemble component parts.

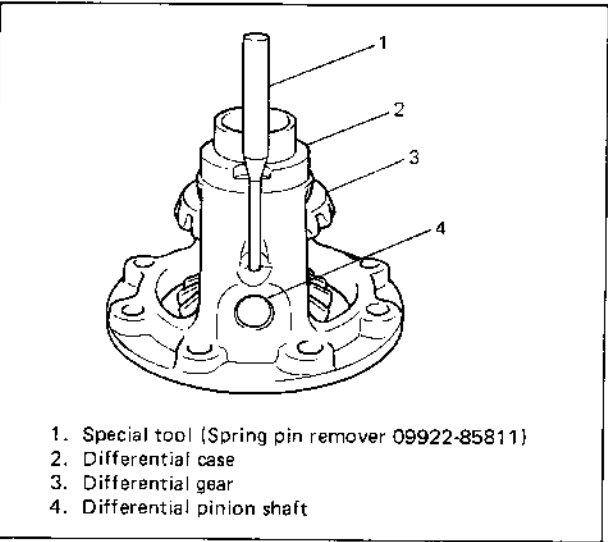


Fig. 7A-75 Removing Spring Pin

Adjustment and Reassembly

Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly. Make sure that all parts are clean.

1. Assemble differential gear and measure thrust play of differential gear as follows.

Left side

- Hold differential assembly with soft jawed vise and apply measuring tip of dial gauge to top surface of gear.
- Using 2 screwdrivers, move gear up and down and read movement of dial gauge pointer.

Right side

- Using similar procedure to the above, set dial gauge tip to gear shoulder.
- Move gear up and down by hand and read dial gauge.

|                    |                  |
|--------------------|------------------|
| Diff. gear thrust  | 0.05 – 0.33 mm   |
| play specification | 0.002 – 0.013 in |

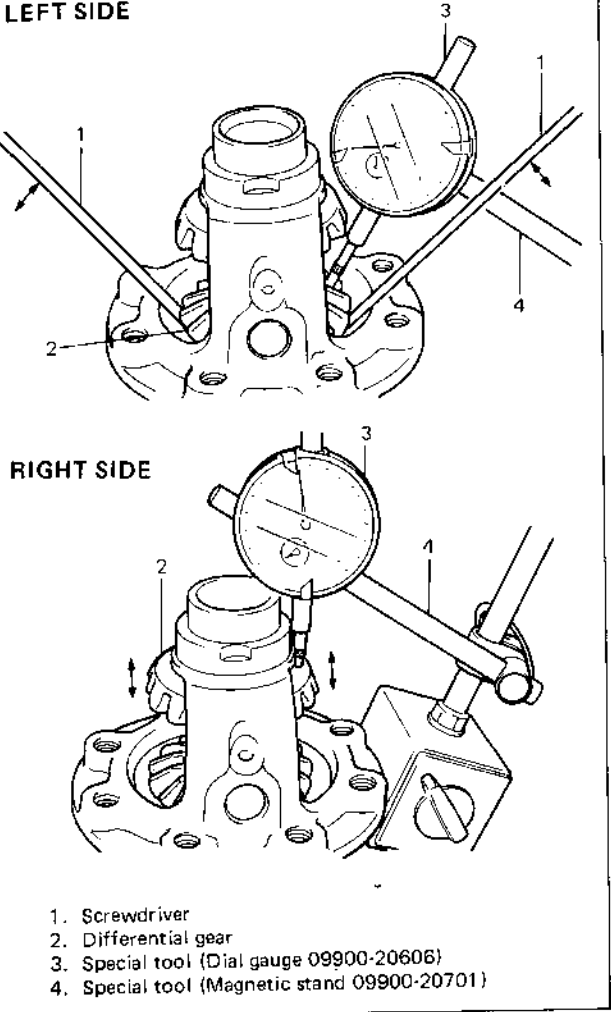


Fig. 7A-76 Measuring Gear Thrust Play

2. If thrust play is out of specification, select suitable thrust washer from among following available sizes, install it and check again that specified gear play is obtained.

|                                   |                                                                                                      |
|-----------------------------------|------------------------------------------------------------------------------------------------------|
| Available thrust washer thickness | 0.9, 0.95, 1.0, 1.05, 1.1, 1.15 and 1.2 mm<br>0.035, 0.037, 0.039, 0.041, 0.043, 0.045, and 0.047 in |
|-----------------------------------|------------------------------------------------------------------------------------------------------|

3. Drive in spring pin from right side till it is flush with differential case surface.
4. Press-fit L bearing by using special tool and copper hammer.
5. Install speedometer drive gear, support differential assembly as illustrated so as to L bearing is floating, and then press-fit R bearing like L bearing in Step 4.

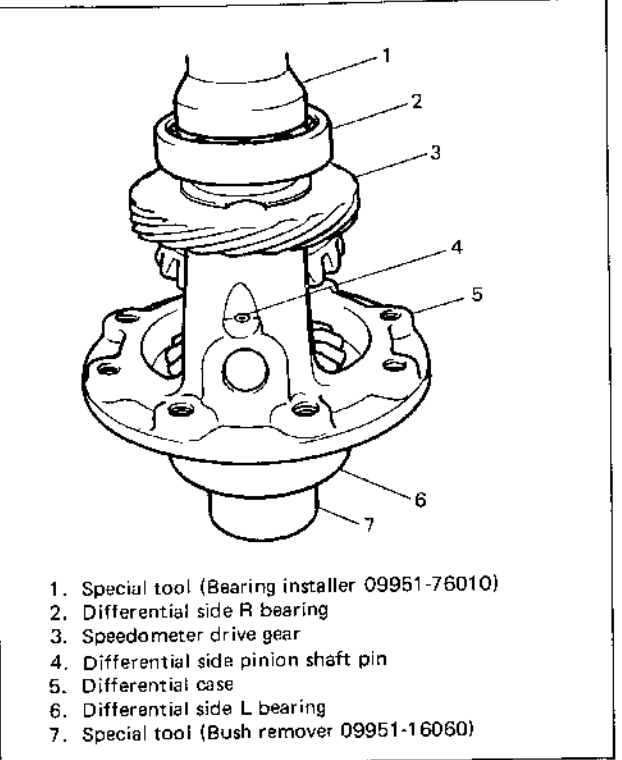


Fig. 7A-77 Press-fitting Differential Side Bearing

6. Hold differential assembly with soft jawed vise, install final gear and then tighten it with 8 bolts to specified torque.

CAUTION:

Use of any other bolts than specified ones is prohibited.

|                                        |         |           |             |
|----------------------------------------|---------|-----------|-------------|
| Tightening torque for final gear bolts | N-m     | kg-m      | lb-ft       |
|                                        | 80 – 90 | 8.0 – 9.0 | 58.0 – 65.0 |

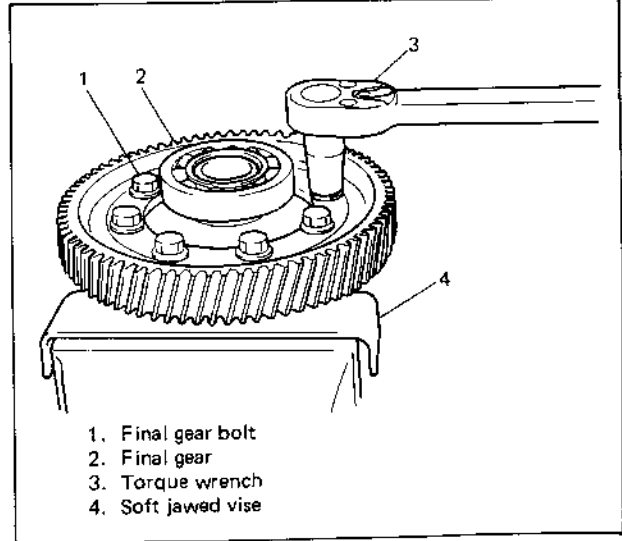


Fig. 7A-78 Tightening Final Gear Bolts

ASSEMBLING UNIT

DIFFERENTIAL TO LEFT CASE

1. Install differential assembly into right case.
2. Insert speedometer driven gear case assembly applied with oil to its O ring and gear, then tighten it with bolt.

CAUTION:

- While inserting case assembly into transmission, turn final gear by hand slightly so that gear can mesh easily.
- Never push or hit slit portion of case when inserting it. Such attempt may cause case to break.

| Tightening torque for case bolt | N·m   | kg·m      | lb·ft     |
|---------------------------------|-------|-----------|-----------|
|                                 | 4 - 7 | 0.4 - 0.7 | 3.0 - 5.0 |

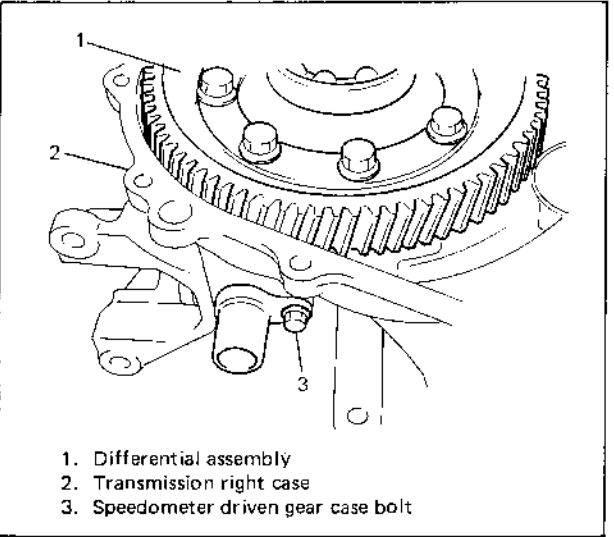


Fig. 7A-79 Installing Differential Assembly

3. Join input shaft, countershaft, low speed gear shift shaft and high speed gear shift shaft assemblies all together, then install them into right case.

NOTE:

- Input shaft R bearing on shaft can be installed into right case by tapping shaft with plastic hammer.
- Check to make sure that counter shaft is engaged with final gear while installing.

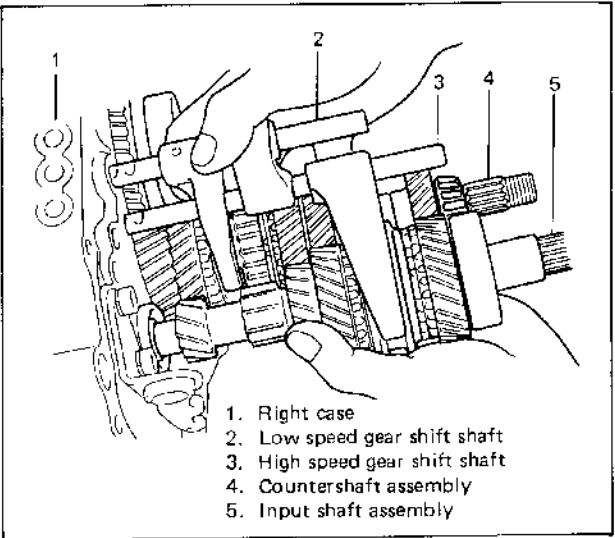


Fig. 7A-80 Installing Input Shaft and Countershaft

4. Install 5th & REV gear shift shaft with 5th & REV gear shift guide shaft into right case. Reverse gear shift arm has to be joined with reverse gear shift lever at the same time.

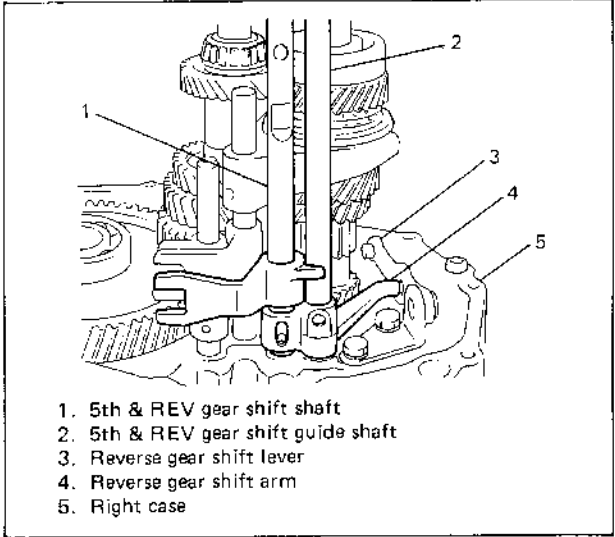


Fig. 7A-81 Installing 5th & REV Shifter

5. Make reverse idler gear with reverse gear shift lever, insert reverse gear shaft into case through idler gear and then align A in shaft with B in case.

NOTE:

- Make sure that washer has been installed in shaft at above the gear.
- Check to confirm that reverse gear shift lever end has clearance 1 mm (0.04 in) to idler gear groove.

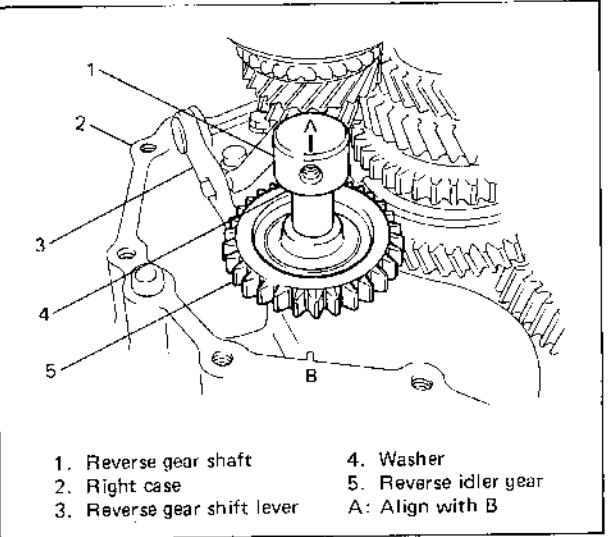


Fig. 7A-82 Aligning Reverse Gear Shaft

6. Clean mating surfaces of both right and left cases, coat mating surface of left case with sealant evenly then mate it with right case.
7. Tighten case with 11 bolts from outside to specified torque.
8. Install reverse shaft bolt with aluminum washer and tighten it.

| Tightening torque  | N·m     | kg·m      | lb·ft       |
|--------------------|---------|-----------|-------------|
| Case bolt          | 15 - 22 | 1.5 - 2.2 | 11.0 - 15.5 |
| Reverse shaft bolt | 10 - 18 | 1.0 - 1.8 | 7.5 - 13.0  |

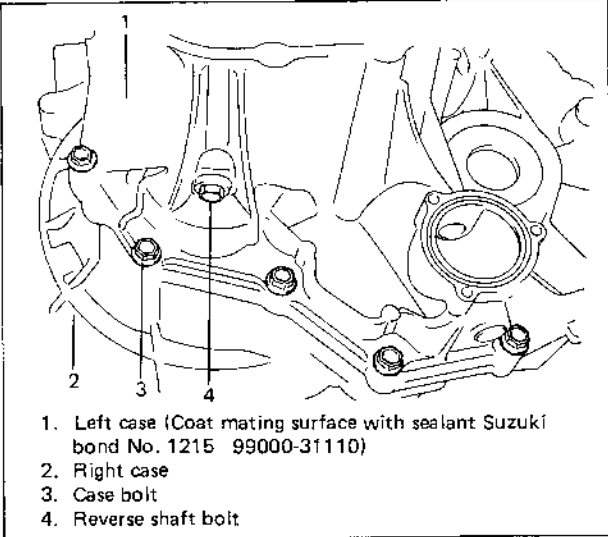


Fig. 7A-83 Fastening Case Bolts

9. Install another 2 case bolts from clutch housing side and tighten them to specification.

10. Check locating springs for deterioration and replace with new ones as necessary.
11. Install steel ball and locating spring for respective gear shift shaft and tighten with bolt.

| Locating spring free length | Standard            | Service limit       |
|-----------------------------|---------------------|---------------------|
| Low speed and 5th & REV     | 26.1 mm<br>1.028 in | 25.0 mm<br>0.984 in |
| High speed                  | 40.1 mm<br>1.579 in | 39.0 mm<br>1.535 in |

| Tightening torque for gear shift fork shaft bolts | N·m     | kg·m      | lb·ft      |
|---------------------------------------------------|---------|-----------|------------|
|                                                   | 10 - 16 | 1.0 - 1.6 | 7.5 - 11.5 |

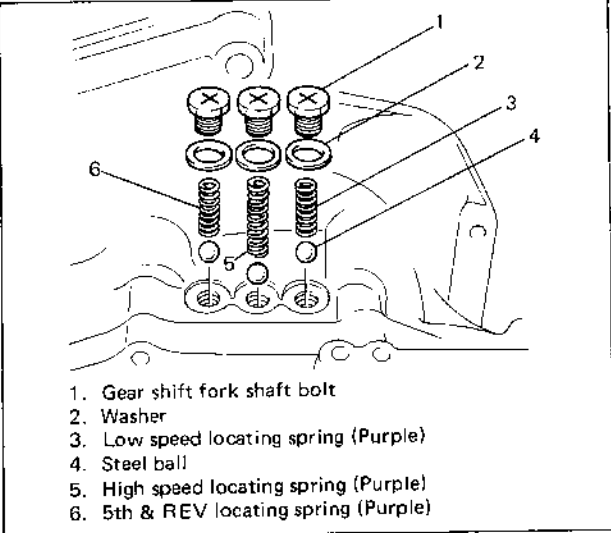


Fig. 7A-84 Installing Locating Springs

FIFTH GEARS

1. To seat countershaft L bearing cup to bearing cone, tap cup by using special tool and plastic hammer.

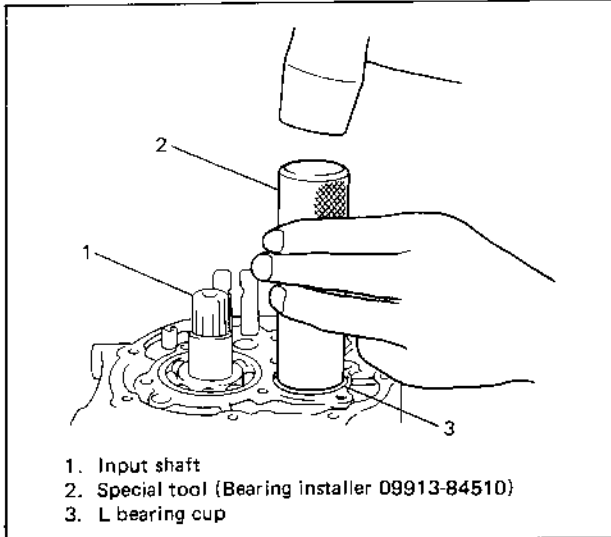


Fig. 7A-85 Seating Counter Shaft L Bearing Cup

2. Put a shim on bearing cup provisionally, place straight edge over it and compress it by hand through straight edge, and then measure A (Clearance between case surface and straight edge) by using feeler gauge.
3. By repeating above step, select a suitable shim which adjusts clearance A to specification and put it on bearing cup.

**NOTE:**

Insert 0.1 mm (0.004 in) feeler to know whether or not a shim fulfills specification quickly.

|                 |                    |
|-----------------|--------------------|
| Clearance A:    | 0.08 – 0.12 mm     |
| Shim protrusion | 0.0032 – 0.0047 in |

|                          |                                                                                                                                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Available shim thickness | 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0, 1.05, 1.1 and 1.15 mm<br>0.021, 0.023, 0.025, 0.027, 0.029, 0.031, 0.033, 0.035, 0.037, 0.039, 0.041, 0.043 and 0.045 in |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

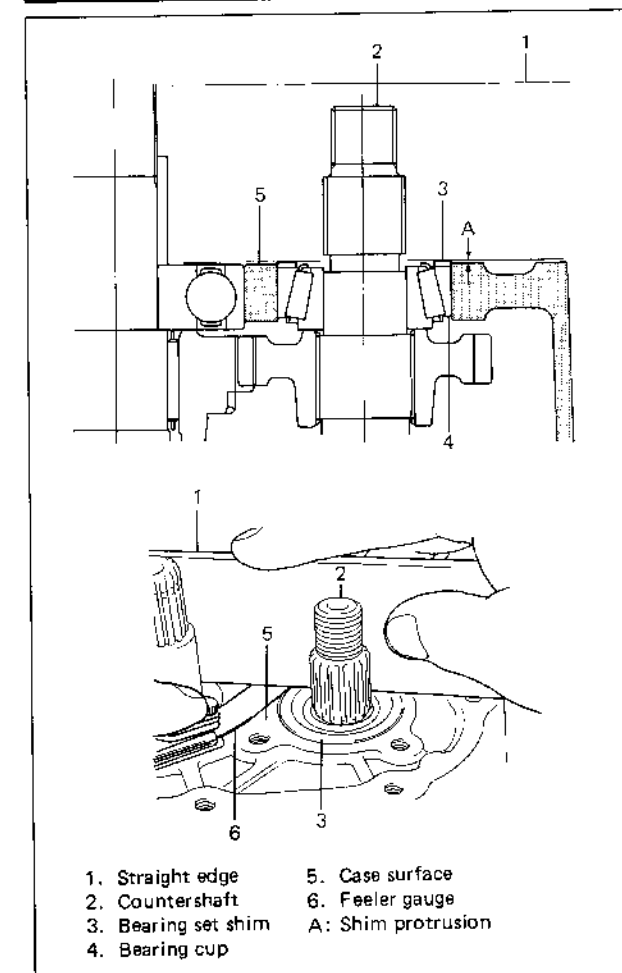


Fig. 7A-86 Selecting Bearing Set Shim

4. Place left case plate inserting its end in groove of shift guide shaft and then tighten it with 6 screws applied with thread lock cement.

**NOTE:**

After tightening screws, make sure that counter shaft can be rotated by hand feeling some load.

|                                              |       |           |           |
|----------------------------------------------|-------|-----------|-----------|
| Tightening torque for left case plate screws | N·m   | kg·m      | lb·ft     |
|                                              | 6 – 7 | 0.6 – 0.7 | 4.5 – 5.0 |

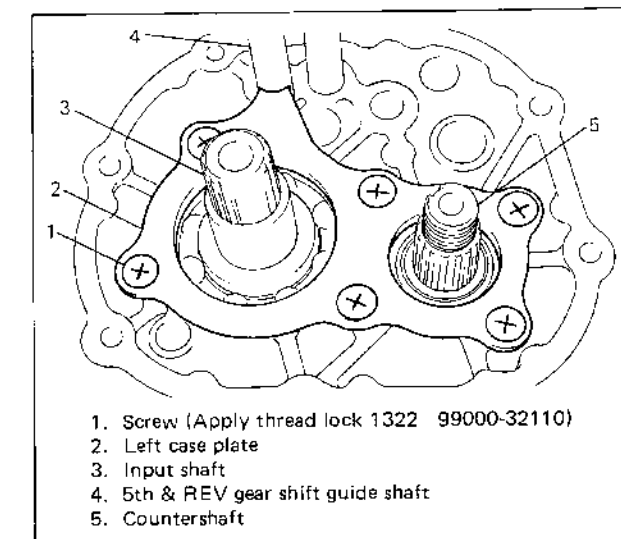


Fig. 7A-87 Fastening Left Case Plate Screw

5. Assemble 5th speed synchronizer sleeve and hub with keys and springs.

**NOTE:**

Short side C in keys, long boss D in hub and chamfered spline F in sleeve should face inward (5th gear side).

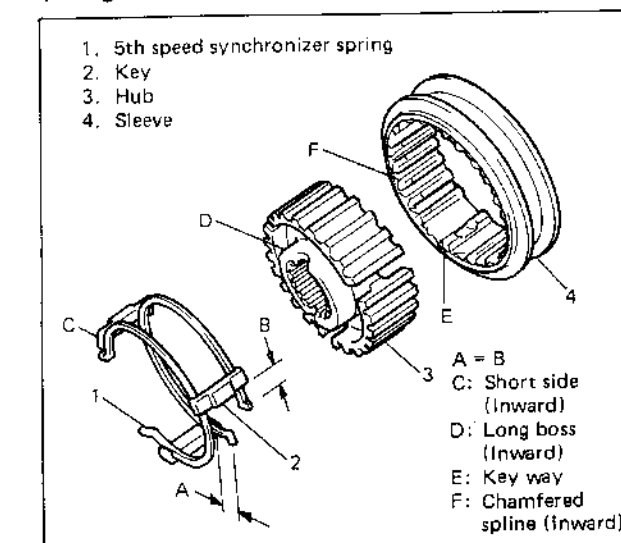


Fig. 7A-88 Assembling 5th Speed Sleeve &amp; Hub

6. Install 5th gear to counter shaft facing machined boss A inward.

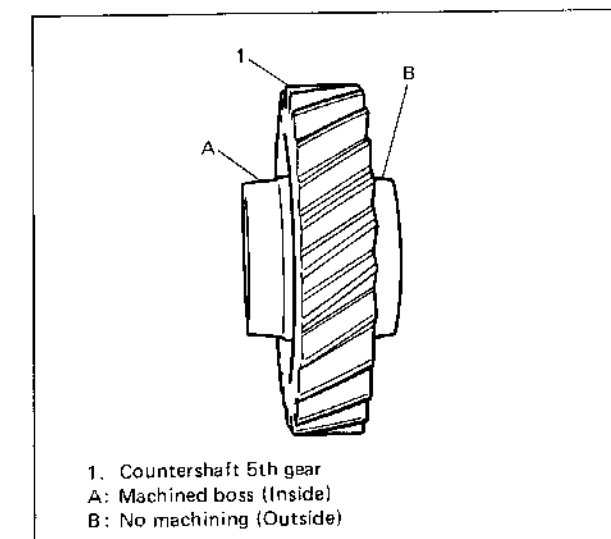


Fig. 7A-89 Counter Shaft 5th Gear

7. Install needle bearing to input shaft, apply oil then install 5th gear and special tool to stop shaft rotation.
8. Install countershaft nut and tighten it to specification.

|                                        |         |           |             |
|----------------------------------------|---------|-----------|-------------|
| Tightening torque for countershaft nut | N·m     | kg·m      | lb·ft       |
|                                        | 60 – 80 | 6.0 – 8.0 | 43.5 – 57.5 |

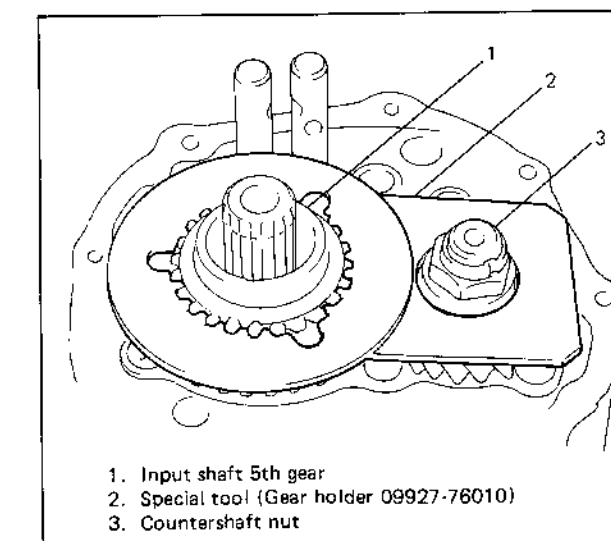


Fig. 7A-90 Tightening Countershaft Nut

9. Remove special tool, then caulk nut at C with caulking tool and hammer.
10. Install synchronizer ring then ring spring.
11. Fit 5th gear shift fork to sleeve & hub assembly and install them into input shaft, shift shaft and shift guide shaft at once aligning hub oil groove A with shaft mark B.

**NOTE:**

Long boss of hub faces inward (gear side).

**CAUTION:**

Be careful not to pinch synchronizer ring spring by hub.

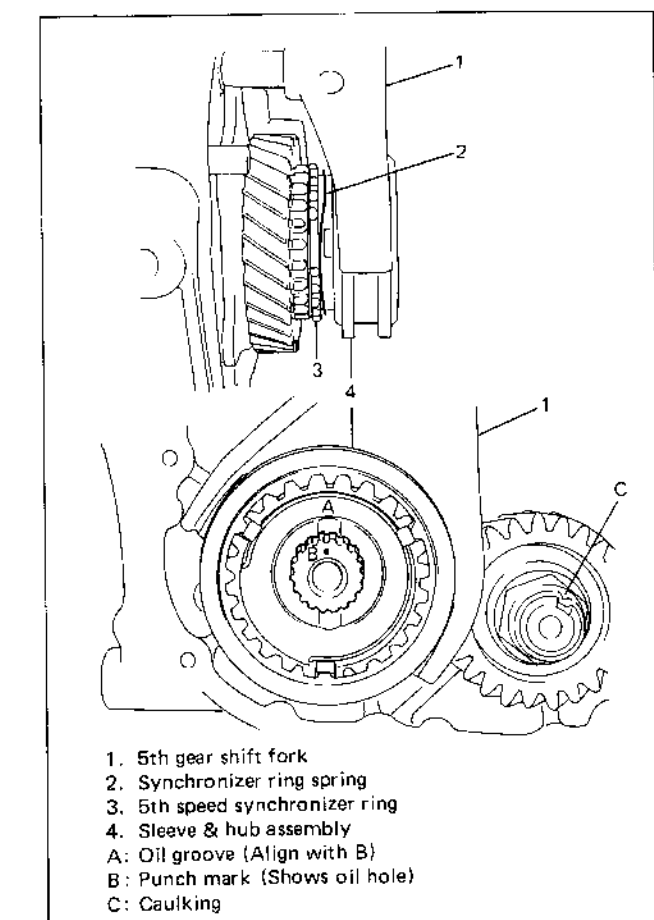


Fig. 7A-91 Installing 5th Speed Sleeve &amp; Hub

12. Drive in spring pin facing its slit A outward.  
13. Install steel ball, tighten shift fork plug applied with thread lock cement.  
14. Fit hub plate and fix it with circlip.

**CAUTION:**

- Coat shift fork plug with thread lock cement reasonably. If it is done to much, excess may interfere in ball movement and cause hard shift to 5th speed.
- Make sure circlip is installed in shaft groove securely.

| Tightening torque for shift fork plug | N-m     | kg-m      | lb-ft      |
|---------------------------------------|---------|-----------|------------|
|                                       | 10 - 15 | 1.0 - 1.5 | 7.5 - 10.5 |

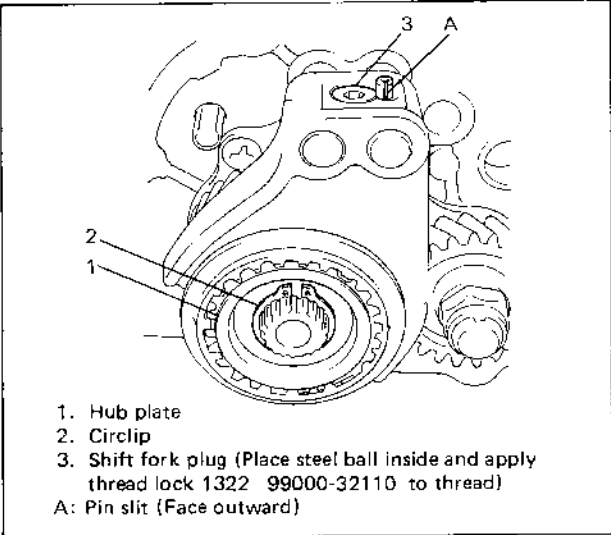


Fig. 7A-92 Installing Circlip

15. Clean mating surface of both left case and left cover, coat mating surface A with sealant evenly, mate it with left case and then tighten with 8 bolts.

| Tightening torque for left cover bolts | N-m    | kg-m      | lb-ft     |
|----------------------------------------|--------|-----------|-----------|
|                                        | 8 - 12 | 0.8 - 1.2 | 6.0 - 8.5 |

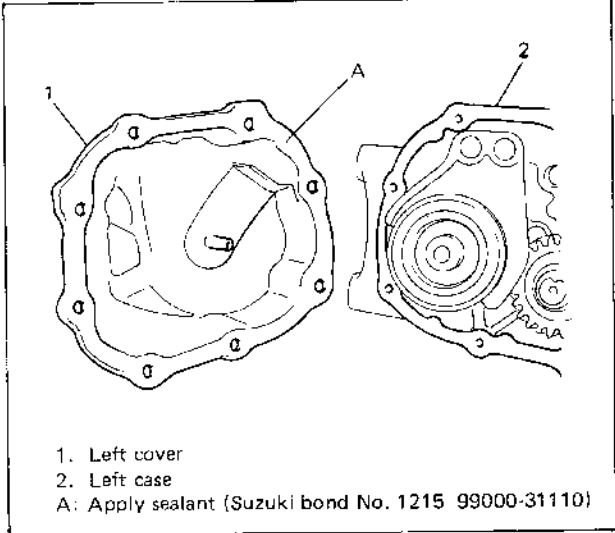


Fig. 7A-93 Installing Side Cover

**GEAR SHIFT & SELECT SHAFT ASSEMBLY**

1. If gear shift guide case has been disassembled or replaced, tighten bolts as specified below. Also air check breather hole A.  
2. Clean mating surface of guide case and coat it with sealant evenly.

| Tightening torque               | N-m     | kg-m      | lb-ft       |
|---------------------------------|---------|-----------|-------------|
| Gear shift case plate bolt      | 4 - 7   | 0.4 - 0.7 | 3.0 - 5.0   |
| 5th to REV interlock guide bolt | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |

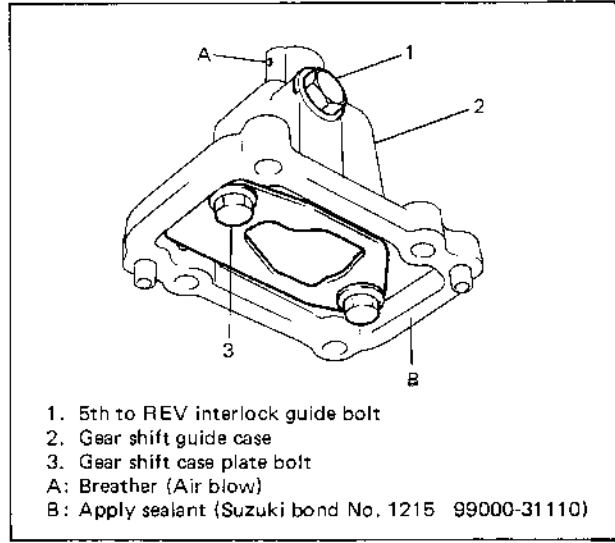


Fig. 7A-94 Assembling Gear Shift Guide Case

3. Install gear shift yoke and join it with gear shift arm.  
4. Install gear shift & select shaft assembly into transmission and join its bottom end with gear shift yoke.  
5. Tighten yoke and shaft with bolt applied with thread lock cement.  
6. Install gear shift interlock bolt with washer and tighten it to specification.

**NOTE:**

When installing gear shift & select shaft assembly, position gear in neutral so that gear shift interlock plate will go in smoothly.

| Tightening torque           | N-m     | kg-m      | lb-ft       |
|-----------------------------|---------|-----------|-------------|
| • Gear shift yoke bolt      | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |
| • Gear shift interlock bolt |         |           |             |

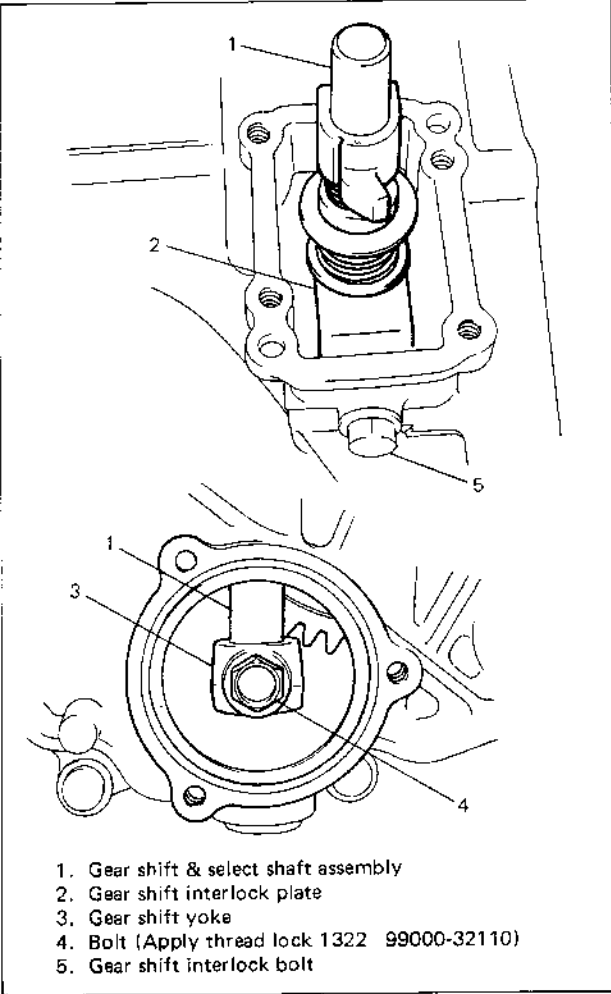


Fig. 7A-95 Installing Gear Shift & Select Shaft

7. Clean mating surface of left case and put gear shift guide case applied with sealant on it.  
8. Place wiring harness clamp bracket and fasten it together with gear shift guide case.  
9. Install back up light switch and clamp its lead.  
10. Clean left case cap and mating surface of left case, check condition of O ring and then fasten cap with 3 bolts.

| Tightening torque             | N-m     | kg-m      | lb-ft       |
|-------------------------------|---------|-----------|-------------|
| • Gear shift guide case bolts | 8 - 12  | 0.8 - 1.2 | 6.0 - 8.5   |
| • Left case cap bolts         |         |           |             |
| Back up light switch          | 16 - 23 | 1.6 - 2.3 | 12.0 - 16.5 |

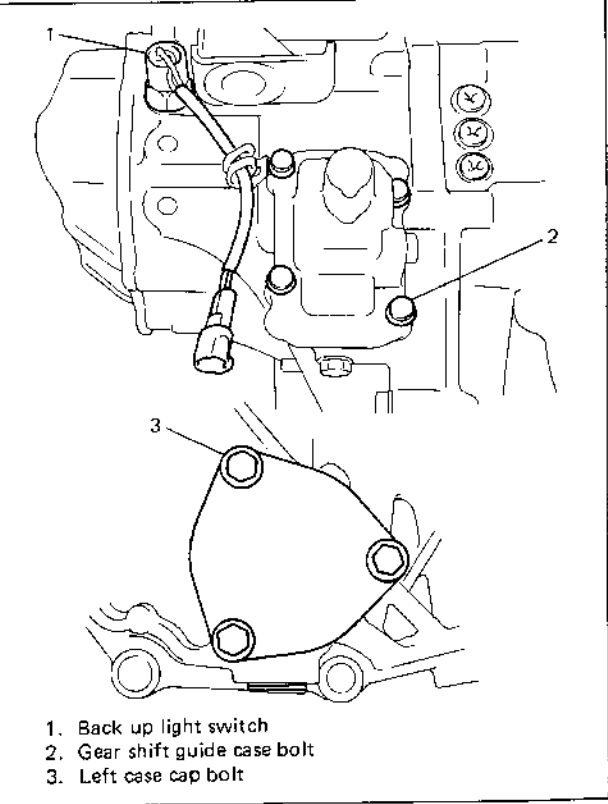


Fig. 7A-96 Installing Gear Shift Guide Case

11. Check input shaft for rotation in each gear position.  
12. Also confirm function of back up light switch in reverse position by using ohmmeter.

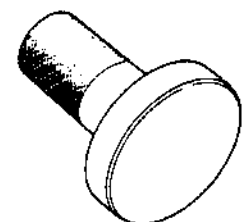
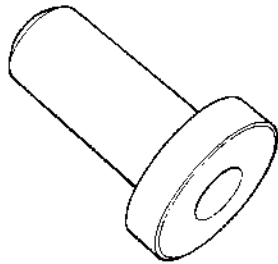
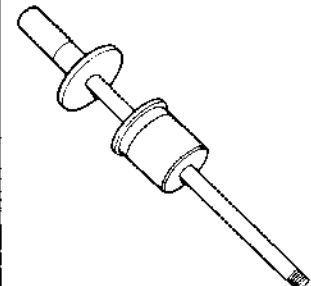
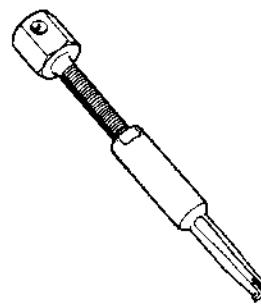
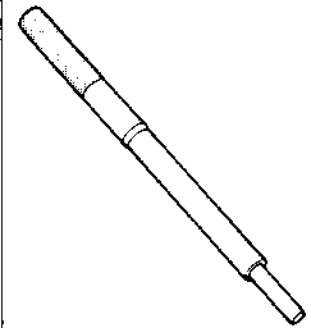
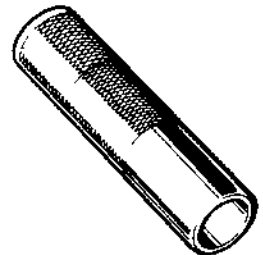
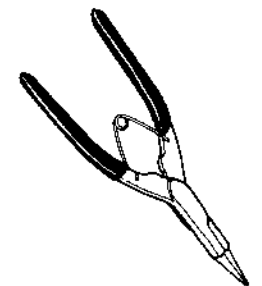
## RECOMMENDED TORQUE SPECIFICATIONS

| Fastening portion                                 | Tightening torque |           |             |
|---------------------------------------------------|-------------------|-----------|-------------|
|                                                   | N·m               | kg-m      | lb-ft       |
| 1. Oil filler/level plug                          | 36 – 54           | 3.6 – 5.4 | 26.5 – 39.0 |
| 2. Oil drain plug                                 | 25 – 30           | 2.5 – 3.0 | 18.5 – 21.5 |
| 3. Ball stud bolt and nut                         | 50 – 70           | 5.0 – 7.0 | 36.5 – 50.5 |
| 4. Gear shift control housing nuts for boot cover | 3 – 6             | 0.3 – 0.6 | 2.5 – 4.0   |
| 5. Housing nuts for control housing               | 15 – 20           | 1.5 – 2.0 | 11.0 – 14.0 |
| 6. Guide plate bolts                              | 8 – 10            | 0.8 – 1.0 | 6.0 – 7.0   |
| 7. Control housing nuts                           | 25 – 40           | 2.5 – 4.0 | 18.5 – 28.5 |
| 8. Extension rod stud bolt                        | 15 – 20           | 1.5 – 2.0 | 11.0 – 14.0 |
| 9. Extension rod nut                              | 25 – 40           | 2.5 – 4.0 | 18.5 – 28.5 |
| 10. Gear shift control shaft bolts and nuts       | 15 – 20           | 1.5 – 2.0 | 11.0 – 14.0 |
| 11. Speedometer driven gear case bolt             | 4 – 7             | 0.4 – 0.7 | 3.0 – 5.0   |
| 12. Transmission to engine bolts and nuts         | 40 – 60           | 4.0 – 6.0 | 29.0 – 43.0 |
| 13. Engine rear mounting bracket bolts            | 40 – 60           | 4.0 – 6.0 | 29.0 – 43.0 |
| 14. Engine mounting LH bracket bolts              | 40 – 60           | 4.0 – 6.0 | 29.0 – 43.0 |
| 15. Exhaust No. 1 pipe to manifold nuts           | 40 – 60           | 4.0 – 6.0 | 29.0 – 43.0 |
| 16. Center bearing support bolts                  | 40 – 60           | 4.0 – 6.0 | 29.0 – 43.0 |
| 17. Engine mounting LH bracket nuts               | 50 – 60           | 5.0 – 6.0 | 36.5 – 43.0 |
| 18. Reverse gear shift lever bolts                | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 19. Gear shift arm bolt                           | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 20. Oil gutter bolt                               | 4 – 7             | 0.4 – 0.7 | 3.0 – 5.0   |
| 21. Final gear bolts                              | 80 – 90           | 8.0 – 9.0 | 58.0 – 65.0 |
| 22. Transmission case bolts                       | 15 – 22           | 1.5 – 2.2 | 11.0 – 15.5 |
| 23. Reverse shaft bolt                            | 10 – 18           | 1.0 – 1.8 | 7.5 – 13.0  |
| 24. Gear shift fork shaft bolts                   | 10 – 16           | 1.0 – 1.6 | 7.5 – 11.5  |
| 25. Left case plate screws                        | 6 – 7             | 0.6 – 0.7 | 4.5 – 5.0   |
| 26. Counter shaft nut                             | 60 – 80           | 6.0 – 8.0 | 43.5 – 57.5 |
| 27. 5th shift fork plug                           | 10 – 15           | 1.0 – 1.5 | 7.5 – 10.5  |
| 28. Left cover bolts                              | 8 – 12            | 0.8 – 1.2 | 6.0 – 8.5   |
| 29. Gear shift case plate bolt                    | 4 – 7             | 0.4 – 0.7 | 3.0 – 5.0   |
| 30. 5th to REV interlock guide bolt               | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 31. Gear shift yoke bolt                          | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 32. Gear shift interlock bolt                     | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 33. Gear shift guide case bolts                   | 8 – 12            | 0.8 – 1.2 | 6.0 – 8.5   |
| 34. Left case cap bolts                           | 8 – 12            | 0.8 – 1.2 | 6.0 – 8.5   |
| 35. Back up light switch                          | 16 – 23           | 1.6 – 2.3 | 12.0 – 16.5 |

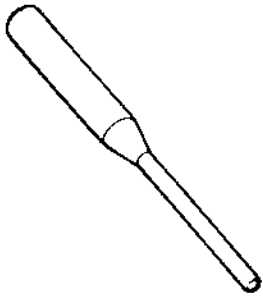
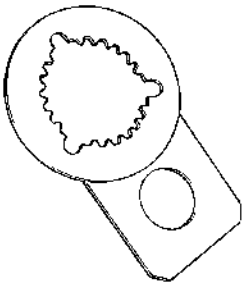
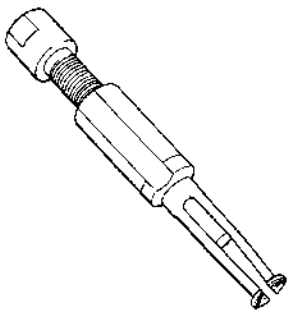
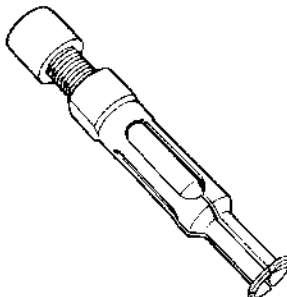
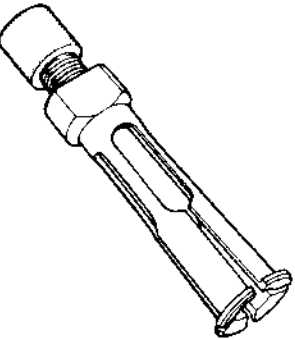
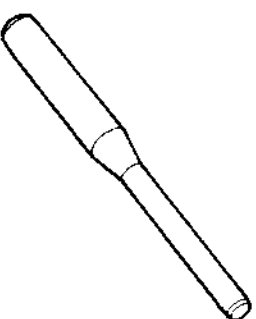
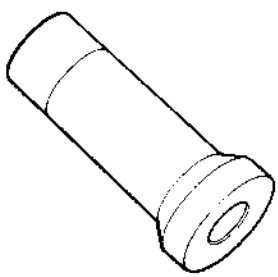
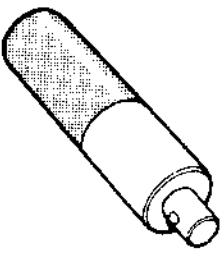
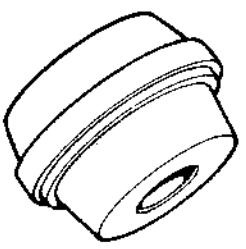
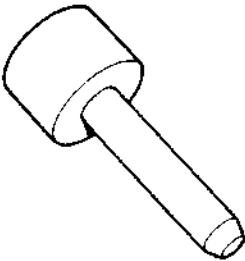
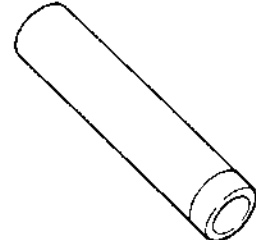
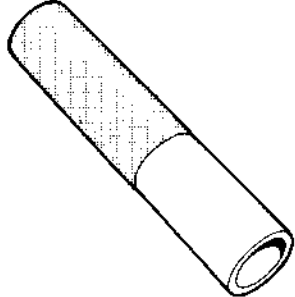
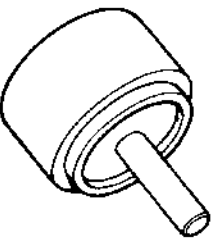
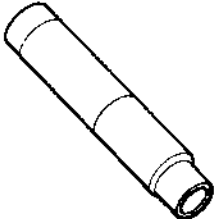
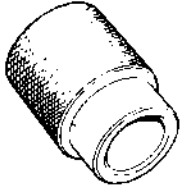
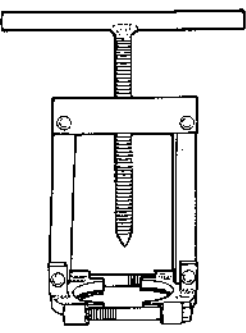
## REQUIRED SERVICE MATERIALS

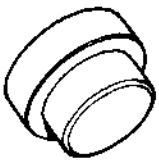
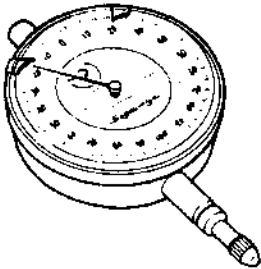
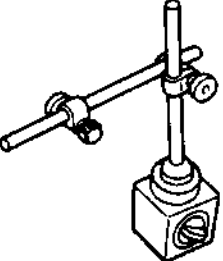
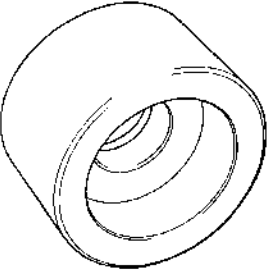
| MATERIAL           | RECOMMENDED SUZUKI PRODUCT          | USE                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lithium grease     | SUZUKI SUPER GREASE A (99000-25010) | <ul style="list-style-type: none"> <li>Oil seal lips</li> <li>Gear shift control lever</li> <li>Gear shift control shaft bushes</li> </ul>                                                                                          |
| Sealant            | SUZUKI BOND NO. 1215 (99000-31110)  | <ul style="list-style-type: none"> <li>Oil drain plug</li> <li>Gear shift shaft bolt</li> <li>Mating surface of transmission case</li> <li>Mating surface of side cover</li> <li>Mating surface of gear shift guide case</li> </ul> |
| Thread lock cement | THREAD LOCK 1322 (99000-32110)      | <ul style="list-style-type: none"> <li>Control lever knob</li> <li>Reverse gear shift lever bolts</li> <li>Oil gutter bolt</li> <li>Left case plate screws</li> <li>Gear shift yoke bolt</li> </ul>                                 |

## SPECIAL TOOLS

|                                                                                                                              |                                                                                                                             |                                                                                                                           |                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <br>09915-27810<br>Hexagon socket 10 mm | <br>09913-75510<br>Bearing installer   | <br>09913-75520<br>Bearing installer  | <br>09930-30102<br>Sliding shaft                    |
| <br>09917-58010<br>Bearing remover      | <br>09916-46010<br>Valve guide remover | <br>09913-80112<br>Bearing installer | <br>09900-06107<br>Snap ring pliers (Opening type) |



|                                                                                                                                                   |                                                                                                                                            |                                                                                                                                         |                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <p>9</p>  <p>09922-85811<br/>Spring pin remover 4.5 mm</p>       | <p>10</p>  <p>09927-76010<br/>Gear holder</p>             | <p>11</p>  <p>09923-73210<br/>Bearing remover</p>     | <p>12</p>  <p>09923-74510<br/>Bearing remover</p>      |
| <p>13</p>  <p>09941-64511<br/>Bearing remover</p>                | <p>14</p>  <p>09925-78210<br/>Spring pin remover 6 mm</p> | <p>15</p>  <p>09951-76010<br/>Bearing installer</p>   | <p>16</p>  <p>09924-74510<br/>Installer attachment</p> |
| <p>17</p>  <p>09925-68210<br/>Bearing outer race installer</p> | <p>18</p>  <p>09925-58210<br/>Oil seal installer</p>    | <p>19</p>  <p>09925-98221<br/>Bearing installer</p> | <p>20</p>  <p>09913-84510<br/>Bearing installer</p>  |
| <p>21</p>  <p>09923-78210<br/>Bearing installer</p>            | <p>22</p>  <p>09925-18010<br/>Bearing installer</p>     | <p>23</p>  <p>09940-53111<br/>Bearing installer</p> | <p>24</p>  <p>09913-65810<br/>Bearing puller</p>     |

|                                                                                                                                                |                                                                                                                                 |                                                                                                                                     |                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <p>25</p>  <p>09925-88210<br/>Bearing puller attachment</p> | <p>26</p>  <p>09900-20606<br/>Dial gauge</p> | <p>27</p>  <p>09900-20701<br/>Magnetic stand</p> | <p>28</p>  <p>09951-16060<br/>Bush remover</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|

SECTION 7B

**AUTOMATIC TRANSMISSION**

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## GENERAL DESCRIPTION

The automatic transmission consists of the hydraulic torque converter, electronically controlled 3-speed automatic transmission, countershaft and differential.

The transmission consists of 2 planetary gears, 2 disk clutches, 1 band brake, 1 disk brake and 1 one-way clutch. Its operation is controlled by selecting a position from 6 positions (P, R, N, D, 2 and L) manually by means of the selector lever installed on the compartment floor.

In the D or 2 range, the gear ratio is changed for the 1st, 2nd or 3rd speed (D range only) automatically by electronic control.

### TORQUE CONVERTER

The torque converter is of 3-element hydraulic type and consists of the pump, turbine and stator in a unit incapable of disassembly. The pump is mounted to the crankshaft (drive plate), the turbine to the input shaft and the stator to the transmission case (oil pump cover) by way of the one-way clutch.

The torque converter, which increases torque when starting, accelerating and up-hill driving, functions as a fluid clutch while driving at a constant speed.

For the automatic transmission fluid, DEXRON II or its equivalent must be used. Lubrication in the automatic transmission is provided by the oil pump which is operated by the engine revolution. Therefore, the engine should not be stopped even during coasting to obtain proper lubrication.

When it becomes necessary to be towed, front wheels must be raised so as not to roll them.

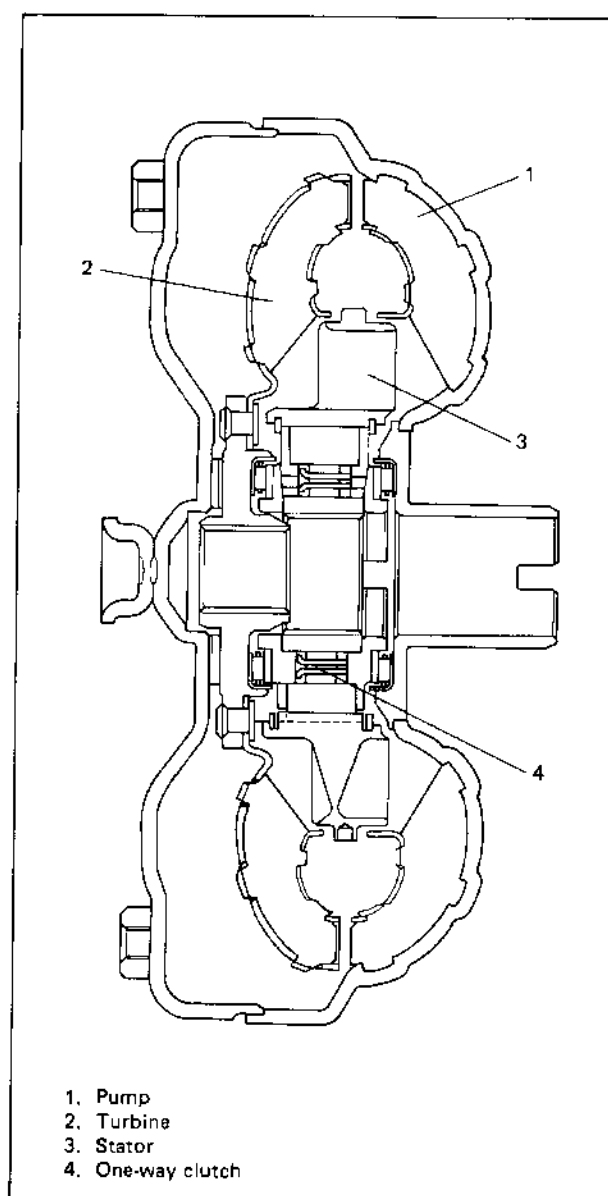


Fig. 7B-1 Torque Converter Cross Section

### PLANETARY GEAR UNITS

In this unit, the sun gear is mounted in its center and engaged with it are 4 pinion gears supported by a carrier. Then, the outer ring gear is engaged with them. Depending on gear combinations, revolution is changed in speed or direction.

Among the units which operate in connection with the planetary gear unit, there are a direct clutch, a second brake, a forward clutch, a one-way clutch and a 1st-reverse brake.

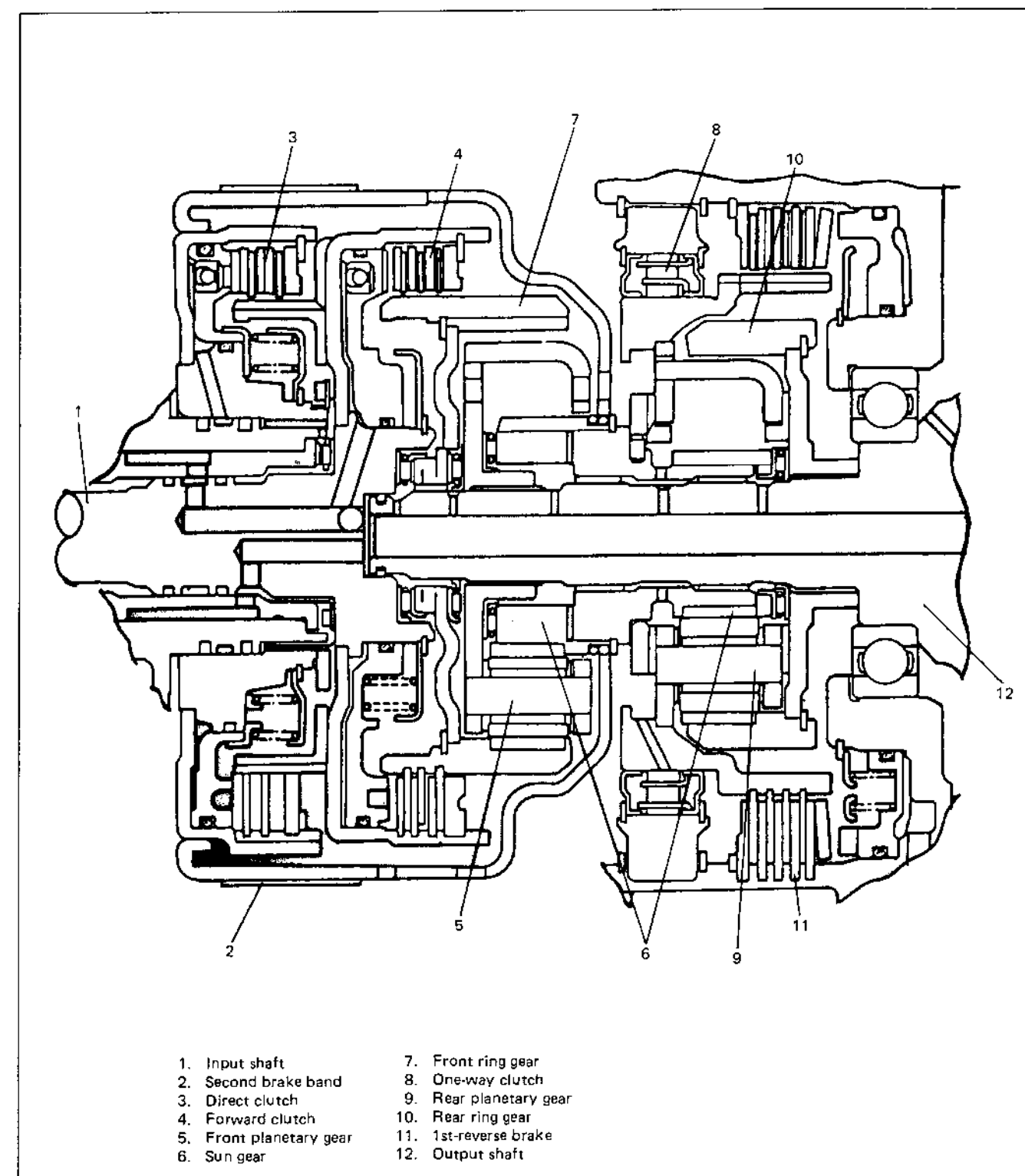


Fig. 7B-2 Planetary Gear Sets Cross Section

DIRECT CLUTCH

The direct clutch connects the input shaft and the sun gear (common to both front and rear planetary gear units). It operates at the 3rd gear

in the D range and in the R range. At the same time, the forward clutch operates in the former and the 1st-reverse brake in the latter.

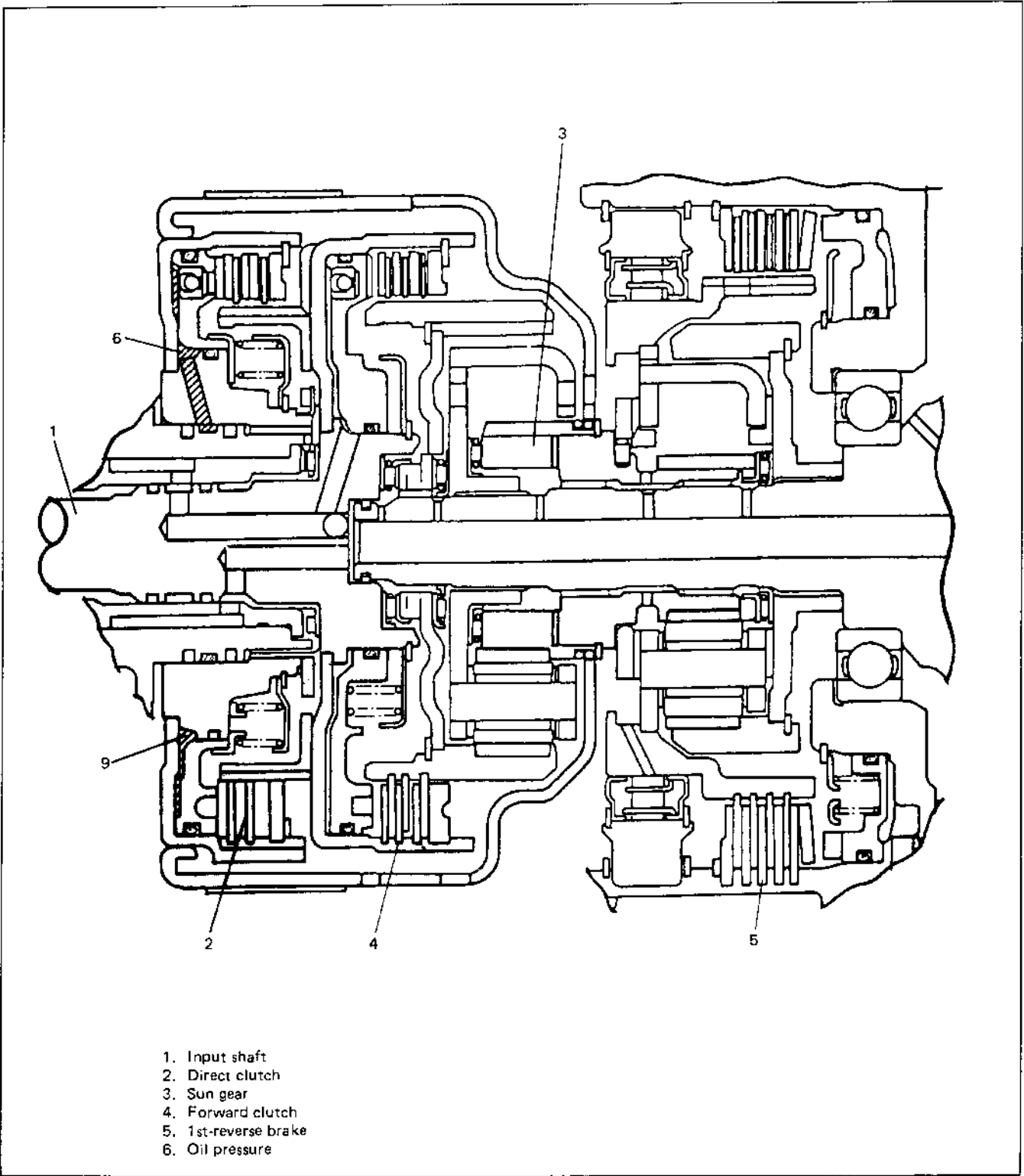


Fig. 7B-3 Direct Clutch Cross Section

FORWARD CLUTCH

The forward clutch connects the input shaft and ring gear of the front planetary gear. It operates in the ranges other than P, R and N. The units which operate simultaneously with the forward clutch are as follows.

- One-way clutch at the 1st gear in D, 2 or L.
- Second brake at the 2nd gear in D, 2 or L.
- Direct clutch at the 3rd gear in D.
- 1st-reverse brake at the 1st gear in L.

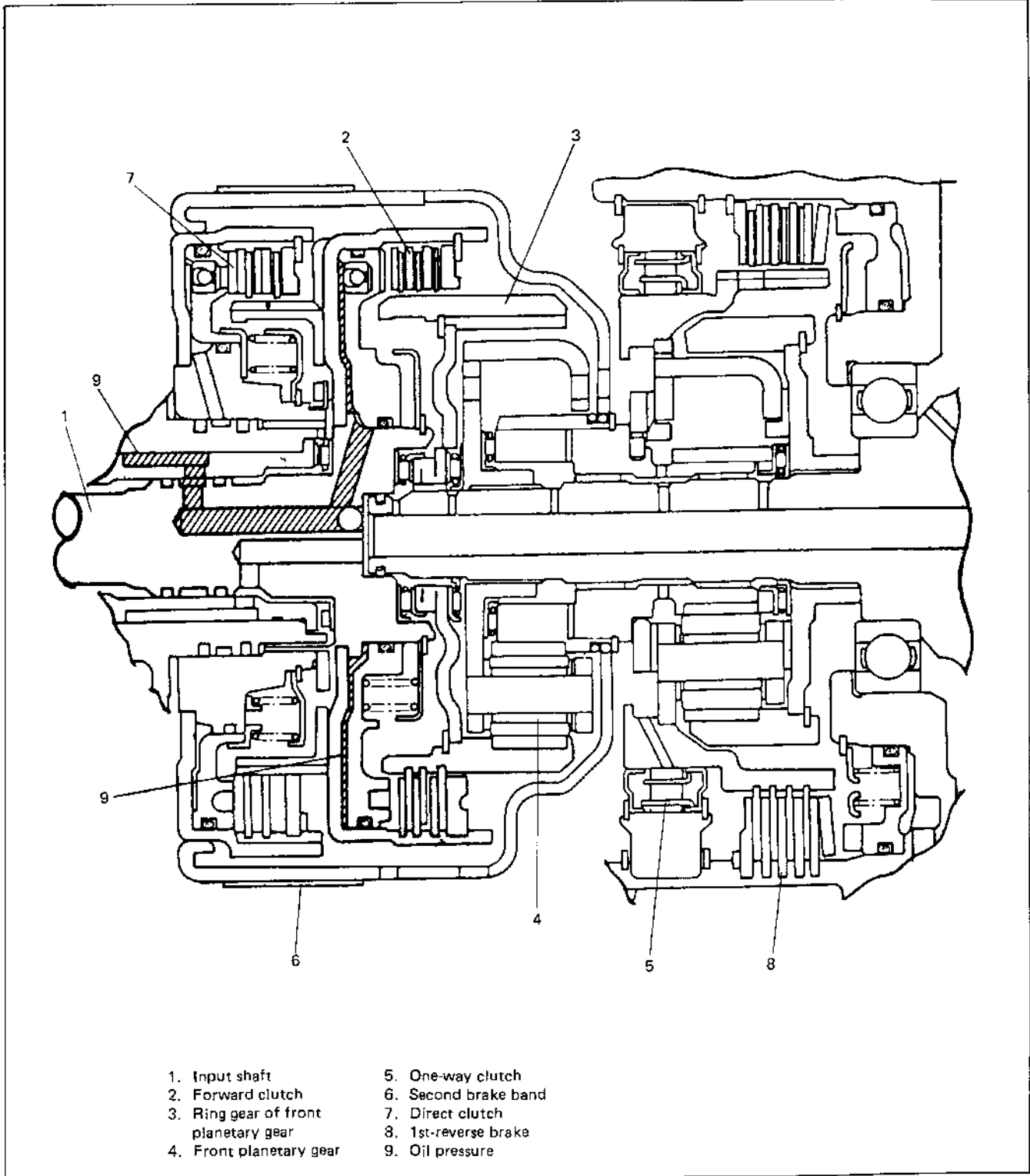


Fig. 7B-4 Forward Clutch Cross Section

## SECOND BRAKE

The second brake is of band type. It holds the sun gear of the front and rear planetary gear

units stationary. It operates at the 2nd gear in D, 2 or L simultaneously with the forward clutch.

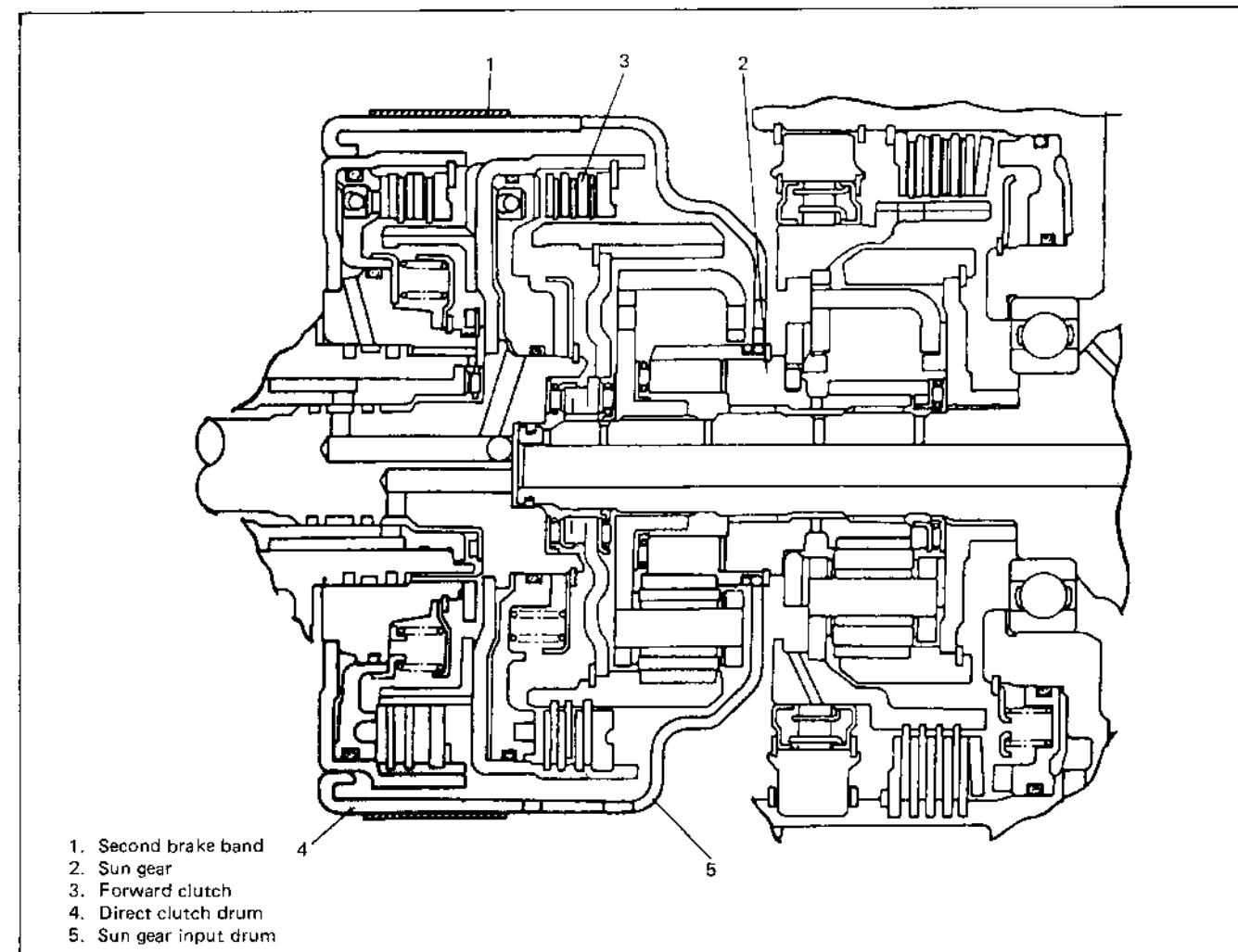


Fig. 7B-5 Second Brake Cross Section

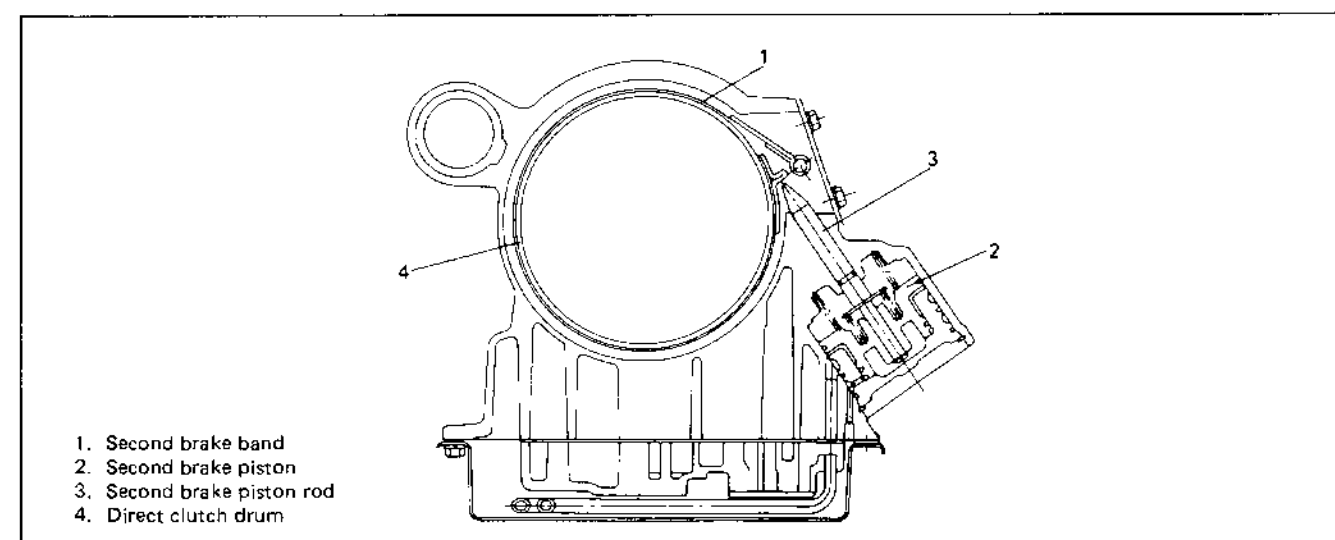


Fig. 7B-6 Second Brake Piston Cross Section

## FIRST & REVERSE BRAKE

The 1st-reverse brake holds the rear planetary carrier stationary. It operates in L or R. At the

same time, the forward clutch operates in L and the direct clutch in R.

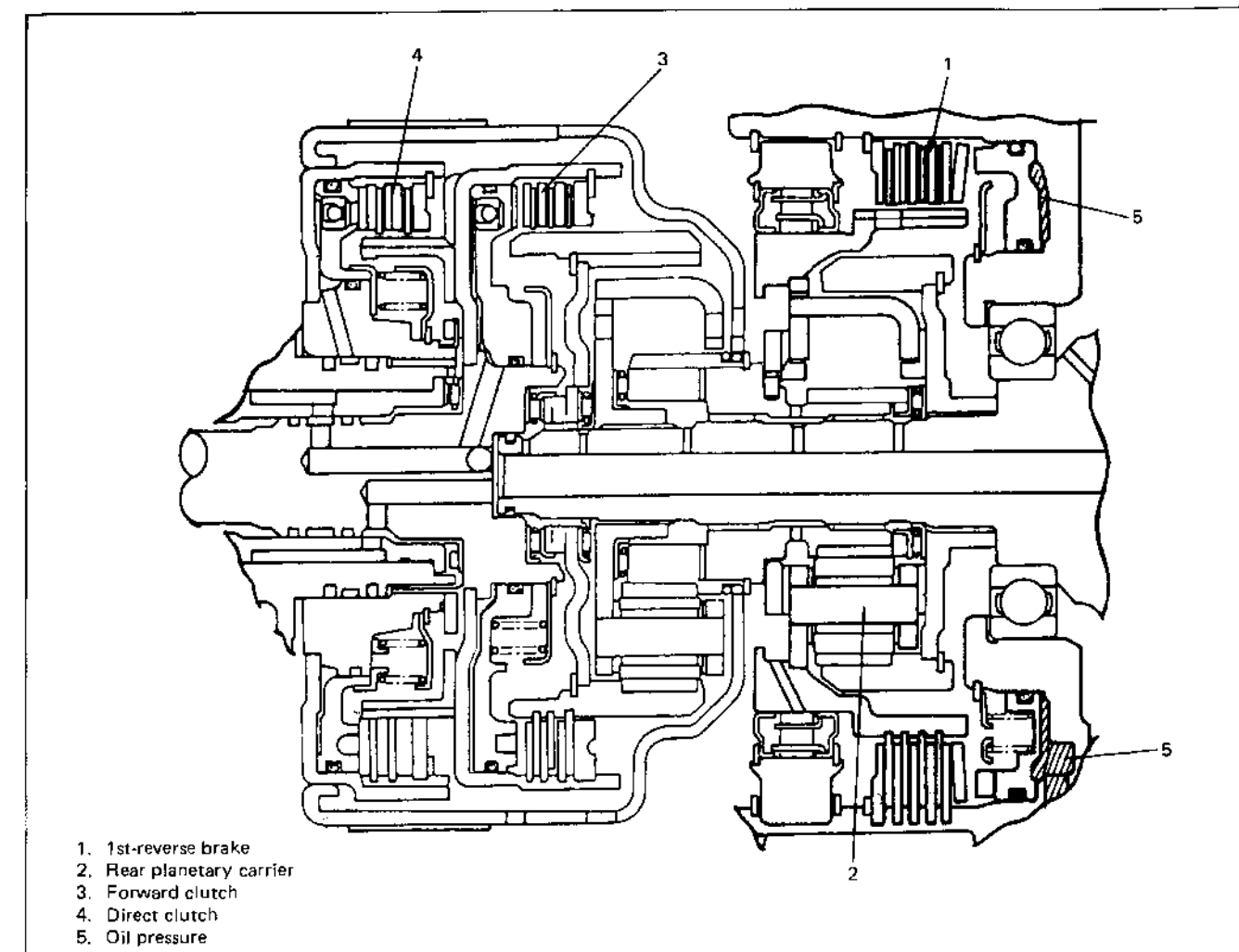


Fig. 7B-7 First & Reverse Brake Cross Section

## ONE-WAY CLUTCH

The sprag type one-way clutch is used between the rear planetary carrier and the transmission case. It consists of a one-way clutch race, sprags and a retainer, and the one-way clutch race is mounted to transmission case. When the rear planetary carrier is in motion to turn in the arrow direction the first gear in D, 2 or L, the sprags stick between carrier and race, and prevent the planetary carrier from turning in the arrow direction.

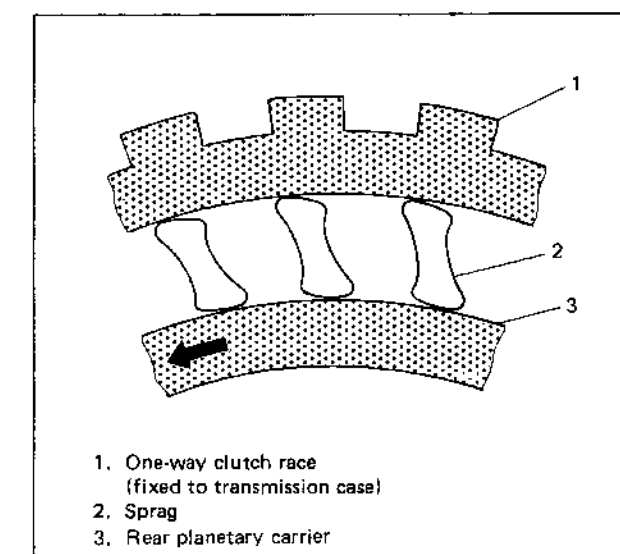


Fig. 7B-8 One-Way Clutch

## POWER FLOW

**1ST GEAR IN "D" OR "2" RANGE**

As oil pressure is applied to the forward clutch, the input shaft and the front planetary ring gear are engaged. This allows the clockwise revolution of the input shaft to be transmitted directly to the ring gear and then through from the planetary carrier to the output shaft.

On the other hand, the sun gear which is engaged with the pinion gears of the front plane-

tary gear turns counterclockwise. As this revolution is transmitted to the pinions of the rear planetary gear, the rear planetary carrier would also turn counterclockwise. However, being held by the one-way clutch, it cannot turn. Consequently, the pinions turn clockwise on their axes and this causes the ring gear of the rear planetary gear and output shaft to turn clockwise.

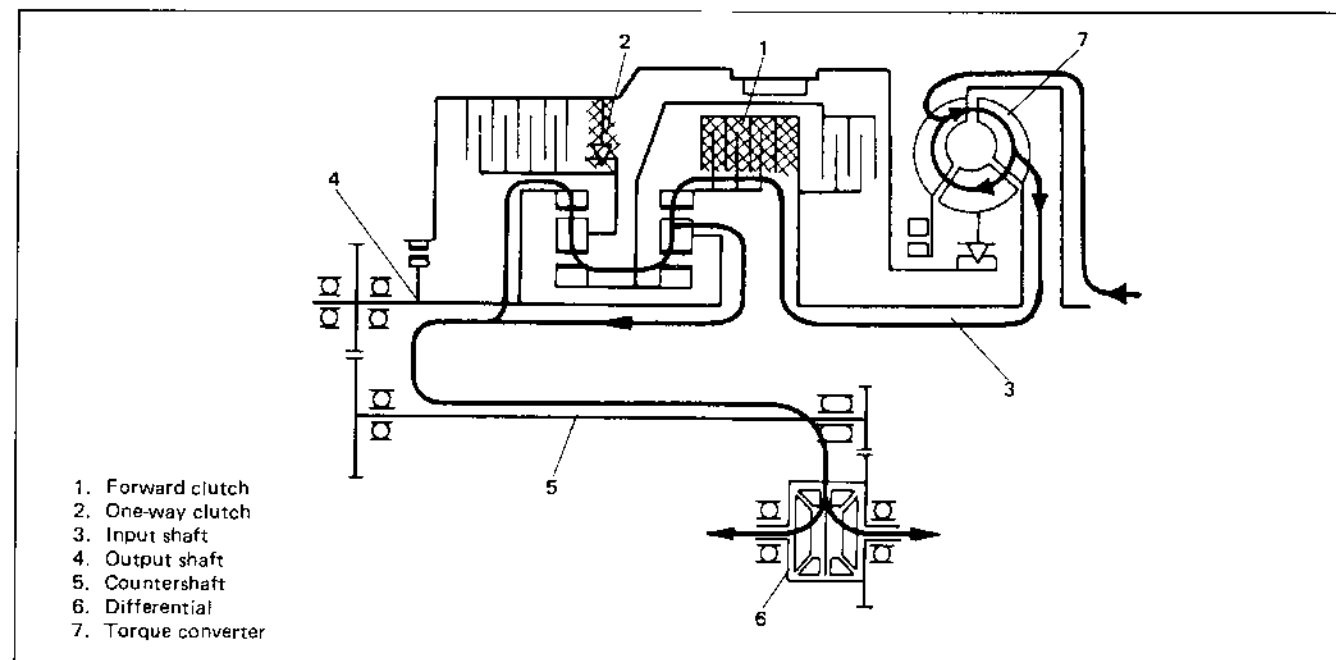


**Fig. 7B-9 Power Flow of 1st Gear in D or 2-range (1)**

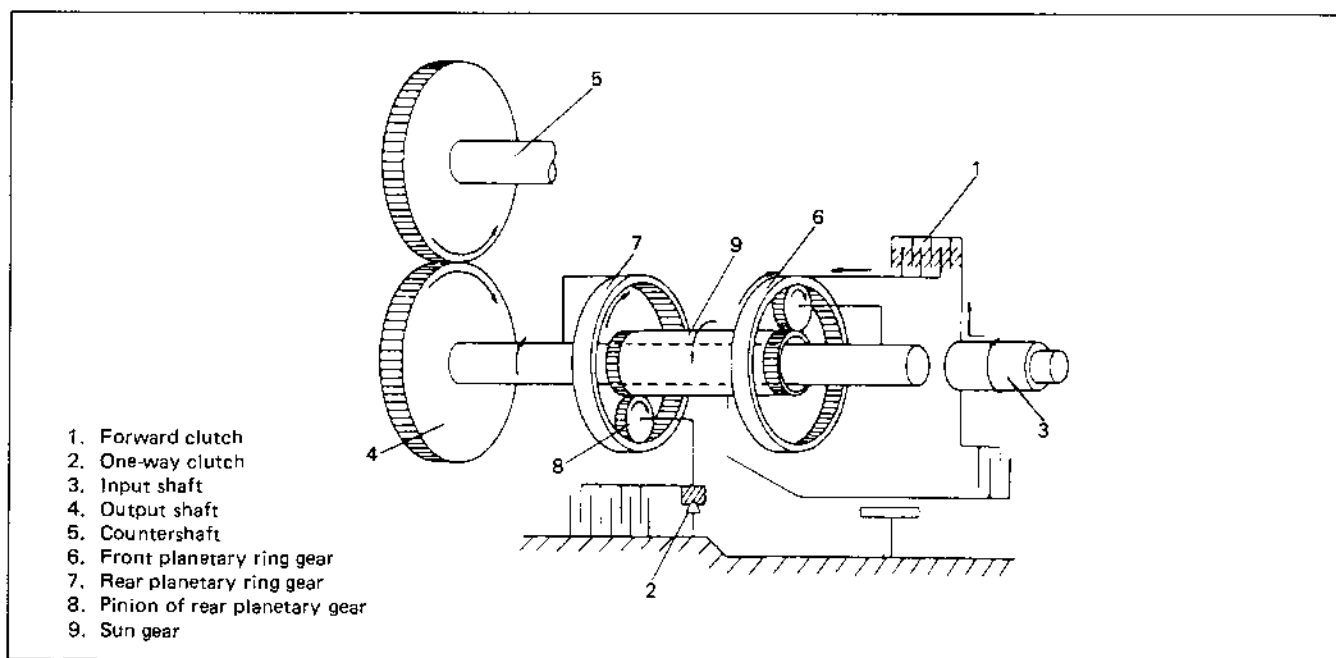


**Fig. 7B-10 Power Flow of 1st Gear in D or 2-range (2)**

### 2ND GEAR IN "D", "2" OR "L" RANGE

As oil pressure is applied to the forward clutch, the input shaft and the ring gear of the front planetary gear are engaged. This allows the revolution of the input shaft to be transmitted directly to the ring gear, causing the front planetary carrier to turn clockwise. In this state, the sun gear, being engaged with the pinions of the front planetary gear, would turn counterclock-

wise. However, the second brake is in operation and prevents it from turning. As a result, the pinions of the front planetary gear turn around the sun gear. Therefore, the front planetary ring gear and then the output shaft turn clockwise.

The 2nd gear in L is operated only when the selector lever is shifted to L at a higher than 53 km/h (33 mile/h) speed.

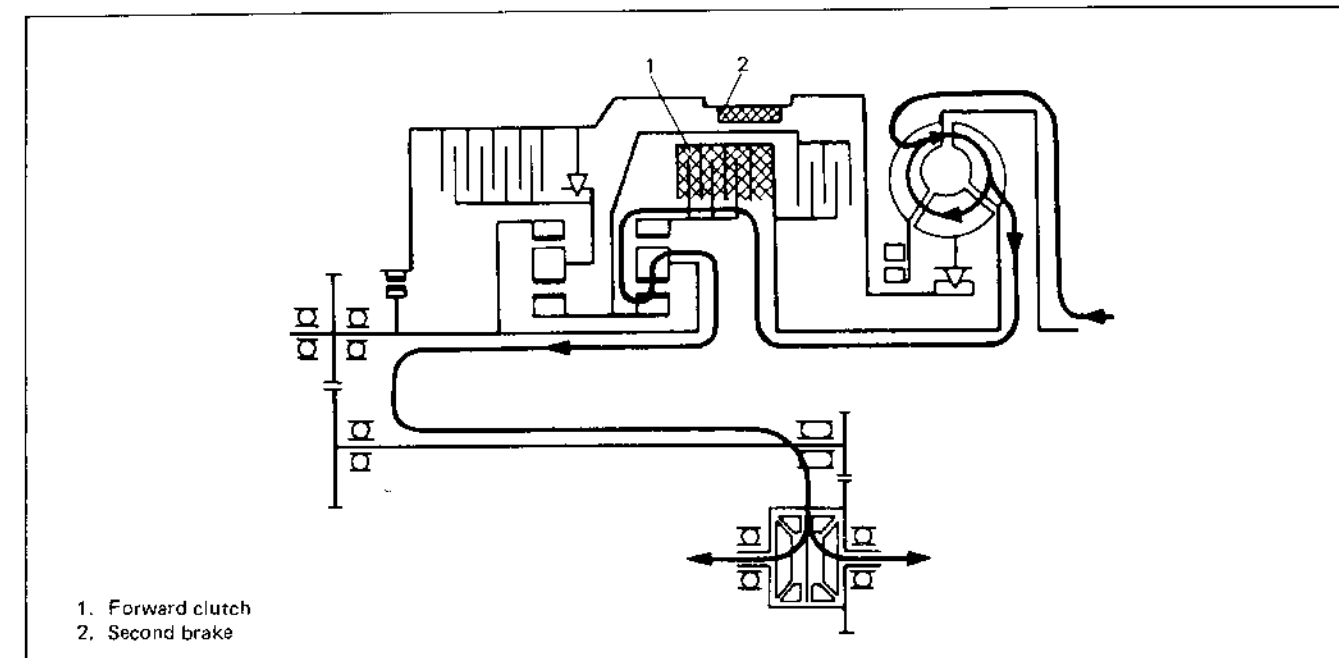


**Fig. 7B-11 Power Flow of 2nd Gear in D or 2-range (1)**

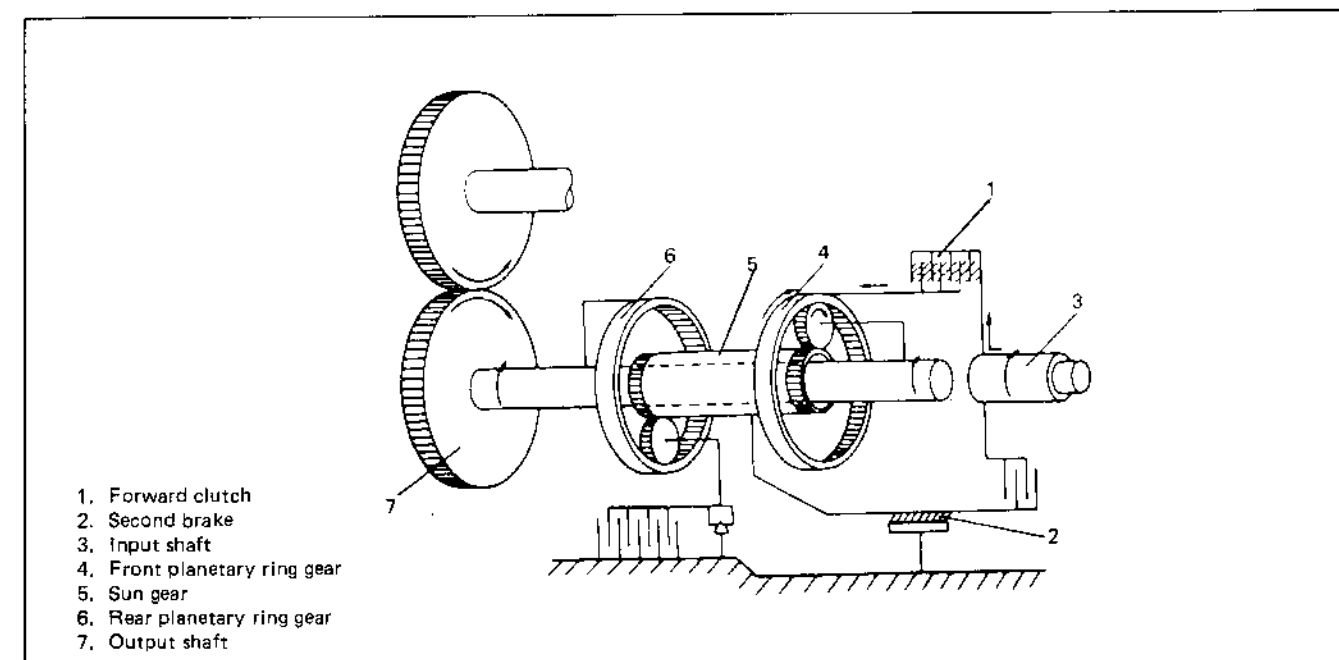


**Fig. 7B-12 Power Flow of 2nd Gear in D or 2-range (2)**

**3RD GEAR IN "D" RANGE**

As oil pressure is applied to the forward clutch and the direct clutch, the input shaft is engaged with the ring gear and the sun gear of the front planetary gear. In other words, the input shaft is

directly connected to the planetary gear unit itself. As a result, the pinions of the planetary gear are locked and thus the input shaft revolution is transmitted directly to the output shaft.

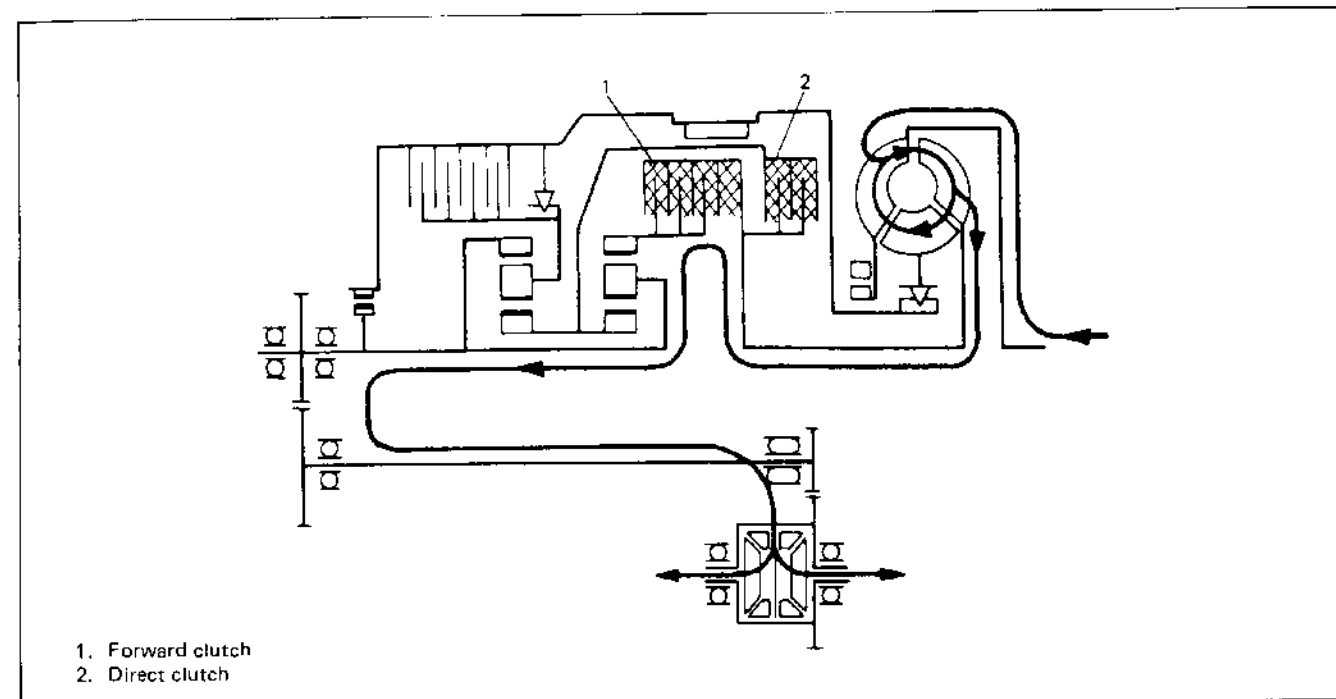


Fig. 7B-13 Power Flow of 3rd Gear in D-range (1)

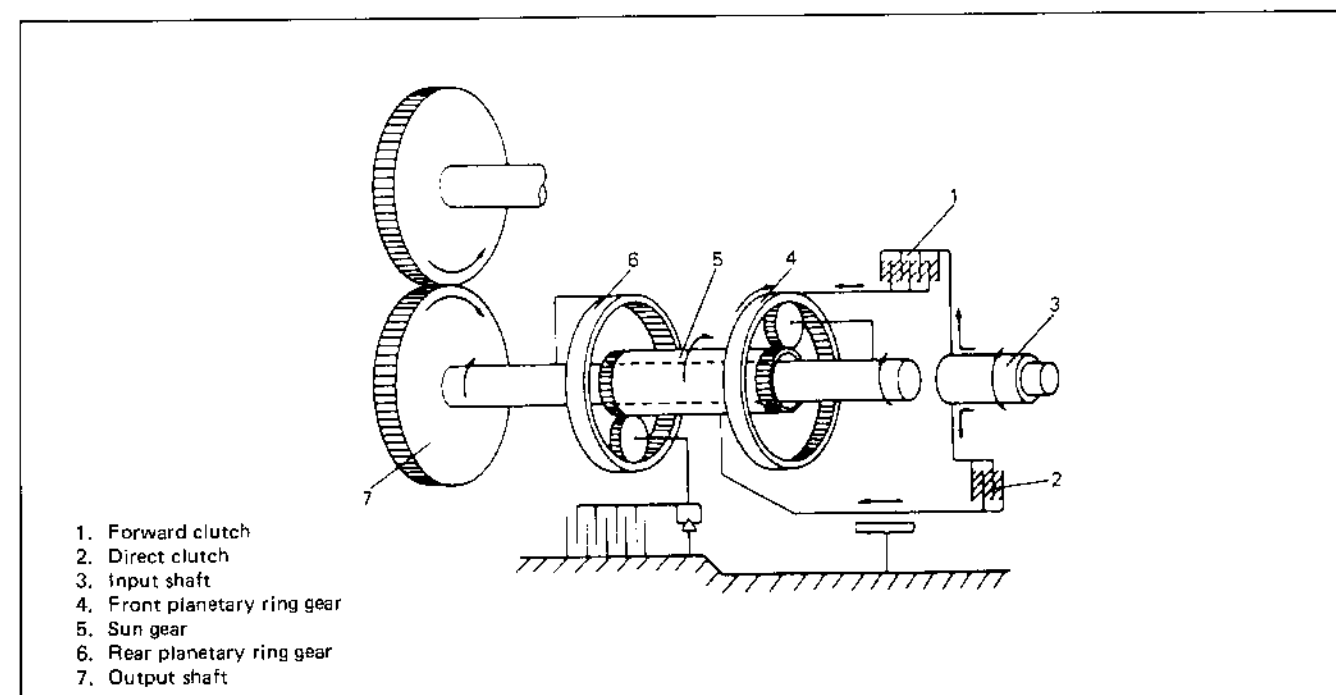


Fig. 7B-14 Power Flow of 3rd Gear in D-range (2)

**"L" RANGE**

The torque flow from the engine is the same as at the 1st gear in D or 2 range, but in this range, the 1st-reverse brake is put into operation to prevent the rear planetary carrier from clockwise revolution which occurs when engine brake is applied. In other words, when driving in D or 2 range, the counterclockwise revolution of the rear planetary carrier is stopped by means of the

one-way clutch, but when the engine brake is applied, the torque (clockwise) from the output shaft acts to prevent the one-way clutch from operating and the rear planetary carrier idles. This puts the 1st-reverse brake into operation so as to hold the rear planetary carrier stationary. Thus engine braking force is provided.

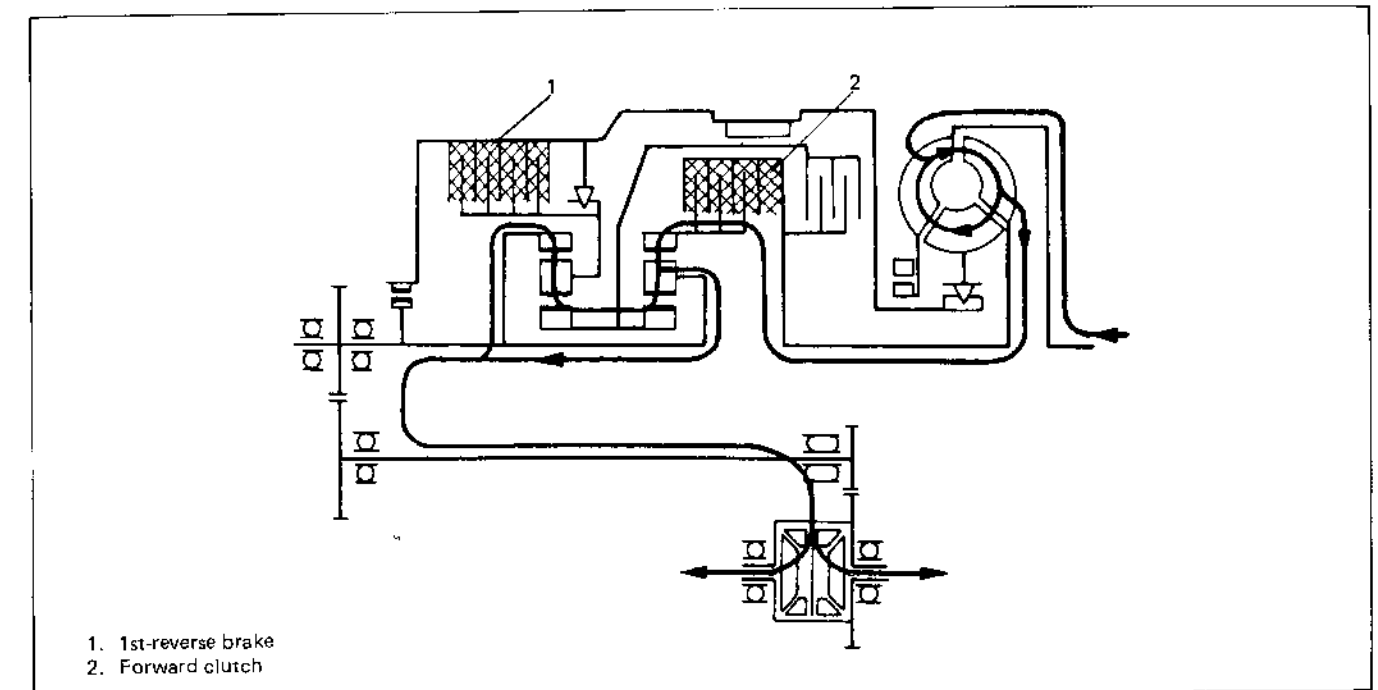


Fig. 7B-15 L-range Power Flow (1)

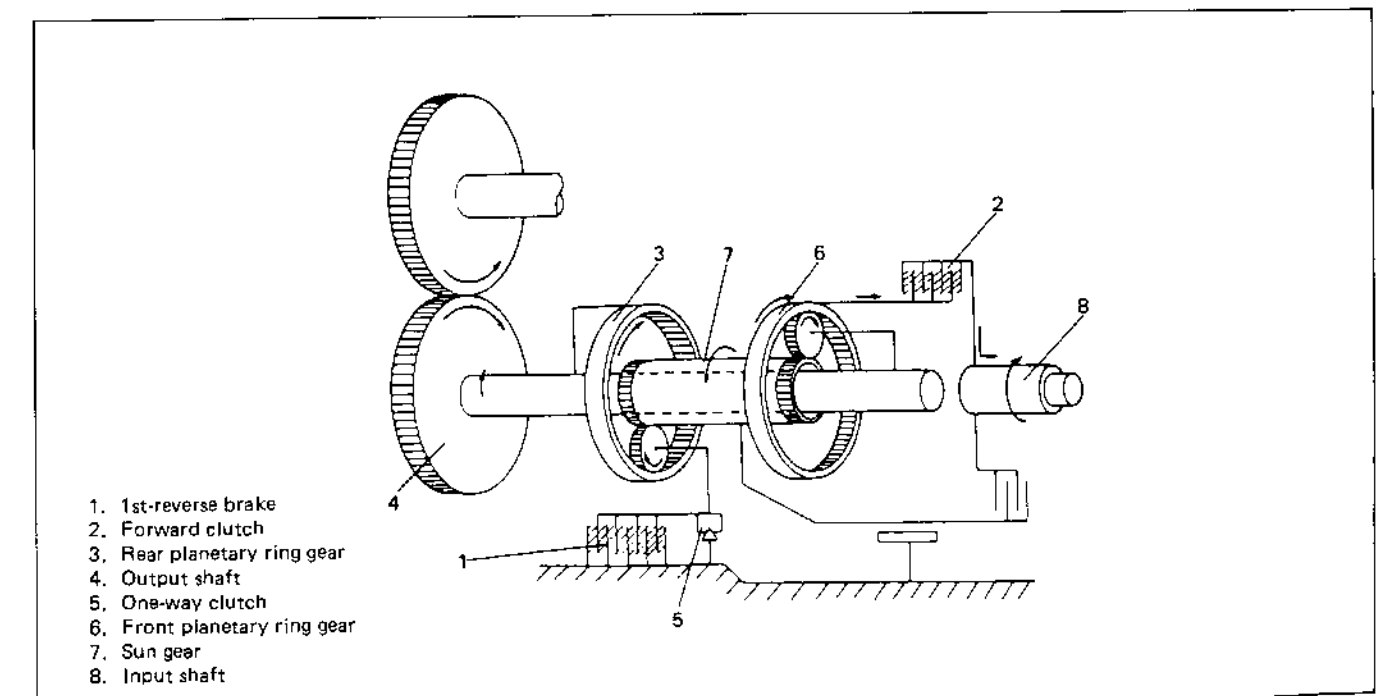


Fig. 7B-16 L-range Power Flow (2)

**"R" RANGE**

As oil pressure is applied to the direct clutch, the input shaft is engaged with the sun gear of the planetary gear. This allows the torque to be transmitted directly from the input shaft to the sun gear. On the other hand, the 1st-reverse brake is also at work and therefore the rear planetary carrier is held stationary. In this state,

the pinions do not turn around the sun gear but turn around counterclockwise on their axes and cause the ring gear to turn counterclockwise. As the output shaft is spline fitted to the rear planetary ring gear, it also turns counterclockwise, thereby the car moves rearward.

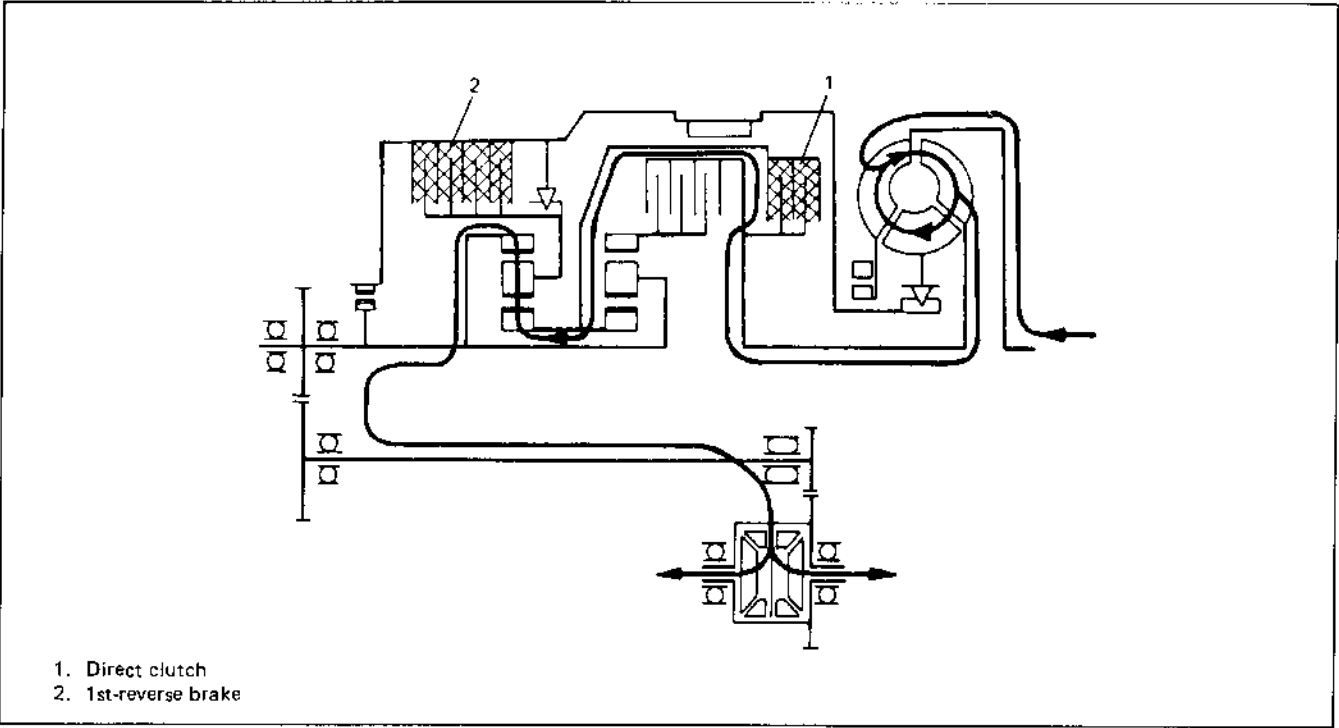


Fig. 7B-17 R-range Power Flow (1)

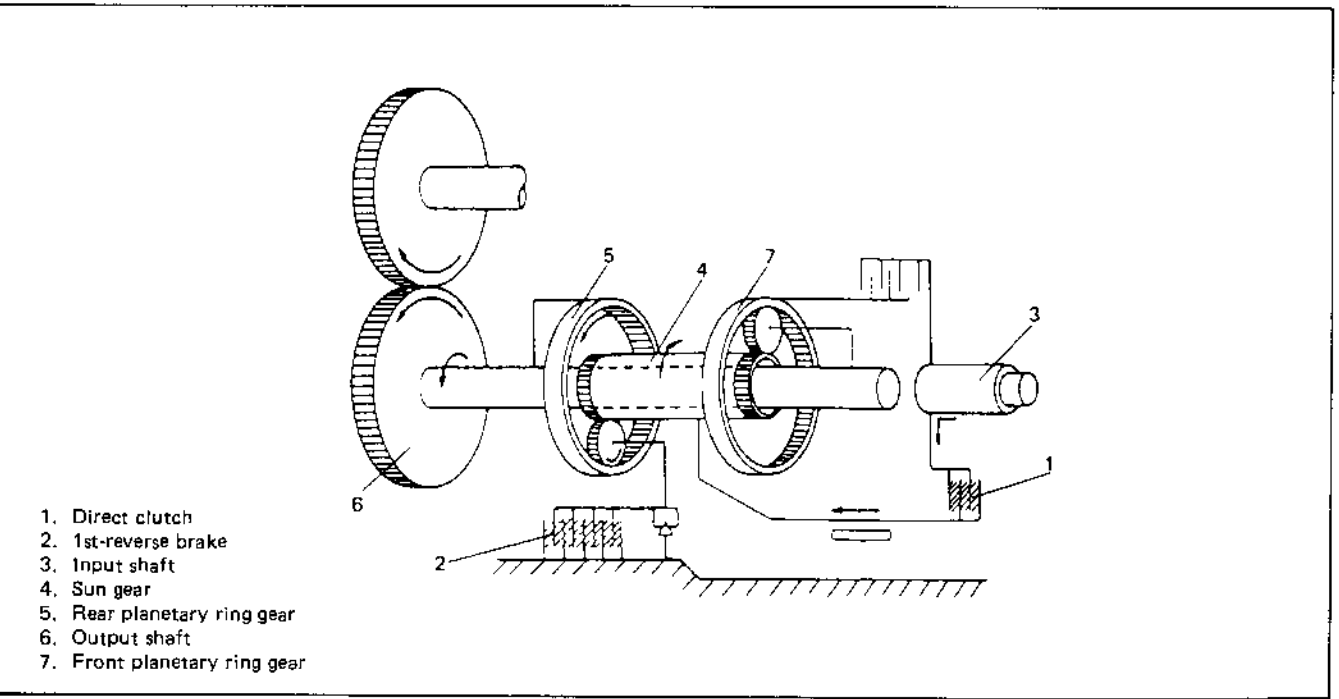


Fig. 7B-18 R-range Power Flow (2)

**"N" OR "P" RANGE**

As the forward clutch and direct clutch are released, the engine torque is not transmitted from the input shaft to the output shaft. In P range, the parking lock pawl is engaged with the park-

ing lock gear which is incorporated with the drive gear of the output shaft and thus the front wheels are mechanically locked.

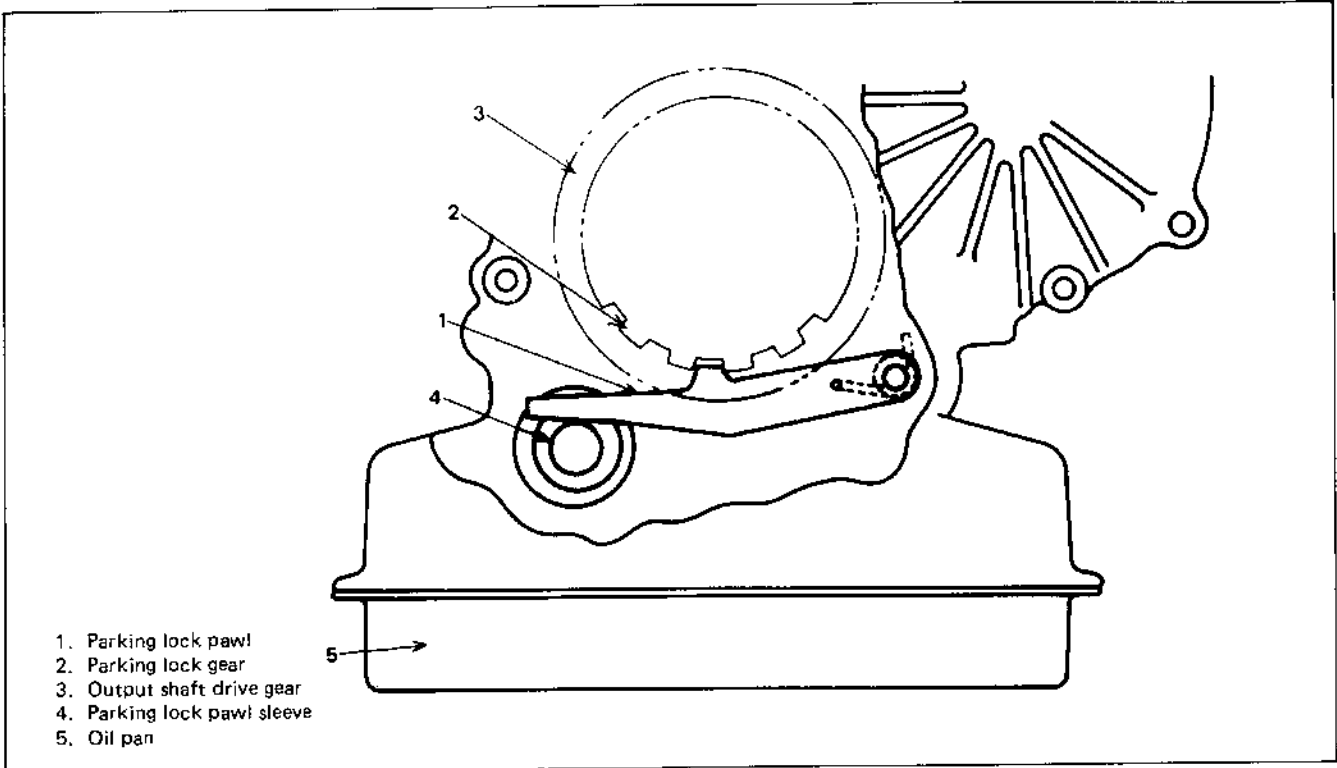


Fig. 7B-19 P-range

**COMPONENTS OPERATION CHART**

| Range | Gear    | Forward Clutch | Direct Clutch | Second Brake | 1st & Reverse Brake | One-way Clutch | Parking Lock Pawl |
|-------|---------|----------------|---------------|--------------|---------------------|----------------|-------------------|
| P     | Parking | —              | —             | —            | **○                 | —              | ○                 |
| R     | Reverse | —              | ○             | —            | ○                   | —              | —                 |
| N     | Neutral | —              | —             | —            | —                   | —              | —                 |
| D     | 1st     | ○              | —             | —            | —                   | ○              | —                 |
|       | 2nd     | ○              | —             | ○            | —                   | —              | —                 |
|       | 3rd     | ○              | ○             | —            | —                   | —              | —                 |
| 2     | 1st     | ○              | —             | —            | —                   | ○              | —                 |
|       | 2nd     | ○              | —             | ○            | —                   | —              | —                 |
| L     | 1st     | ○              | —             | —            | ○                   | ○              | —                 |
|       | *2nd    | ○              | —             | ○            | —                   | —              | —                 |

○ : Operated

\*: To prevent overrevolution of engine, this 2nd gear is operated only when selector lever is shifted to L range at a higher than 53 km/h (33 mile/h) speed.

\*\* : When engine is running.



**OIL PRESSURE CONTROL SYSTEM**

The oil pressure control system fundamentally consists of three parts: (1) oil pressure producing system which consists of an oil pump to produce oil pressure and regulator valve to regulate the pressure, (2) oil circuit to feed fluid into

the torque converter, the oil cooler and the transmission components to be lubricated, and (3) control system to shift the gear of the planetary gear unit by acting on each clutch and brake.

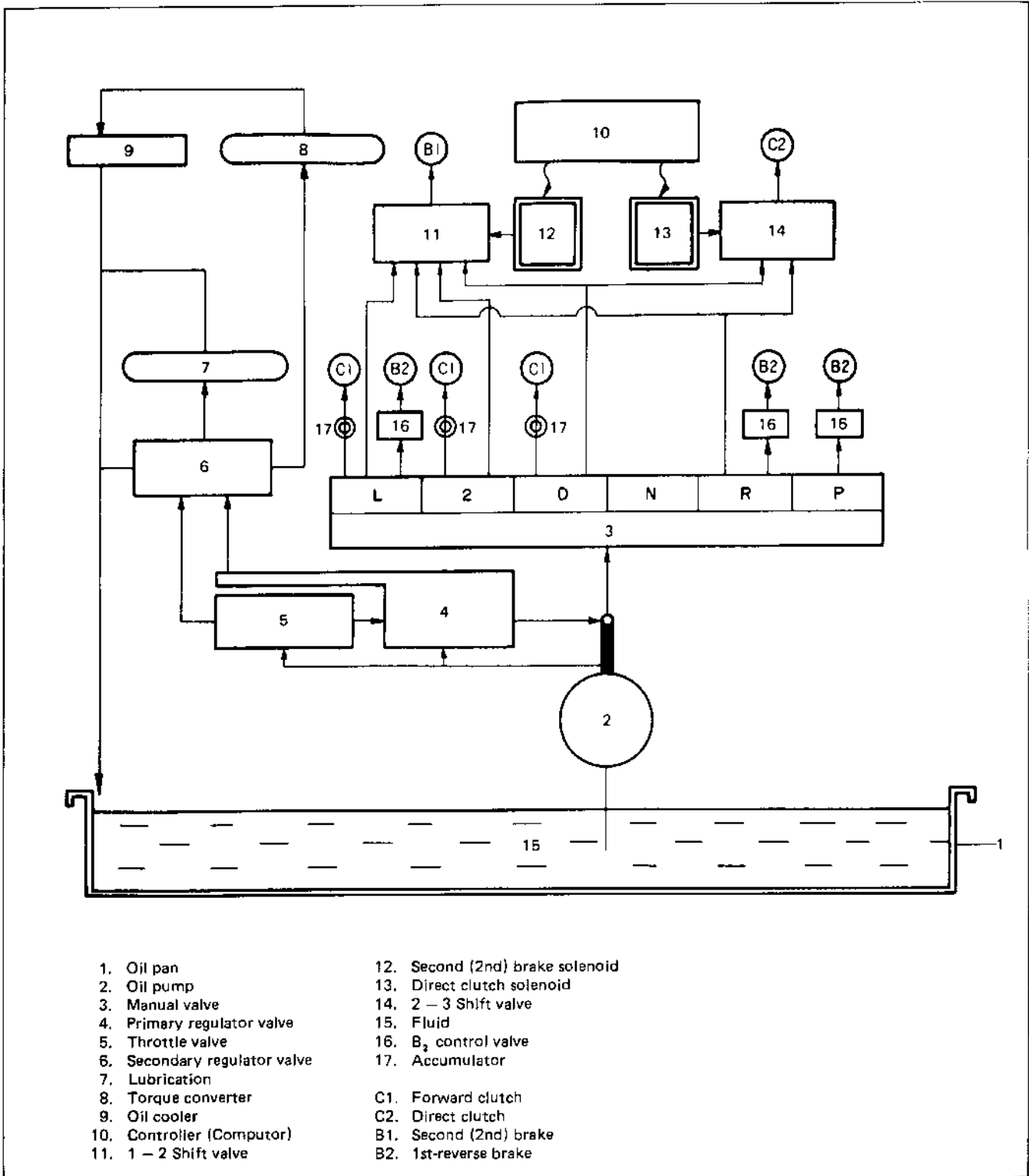


Fig. 7B-20 Oil Pressure Control System Diagram

**VALVE BODY**

The valve body is installed in the oil pan and has valves to control oil pressure. In the valve body, oil passages connect valves.

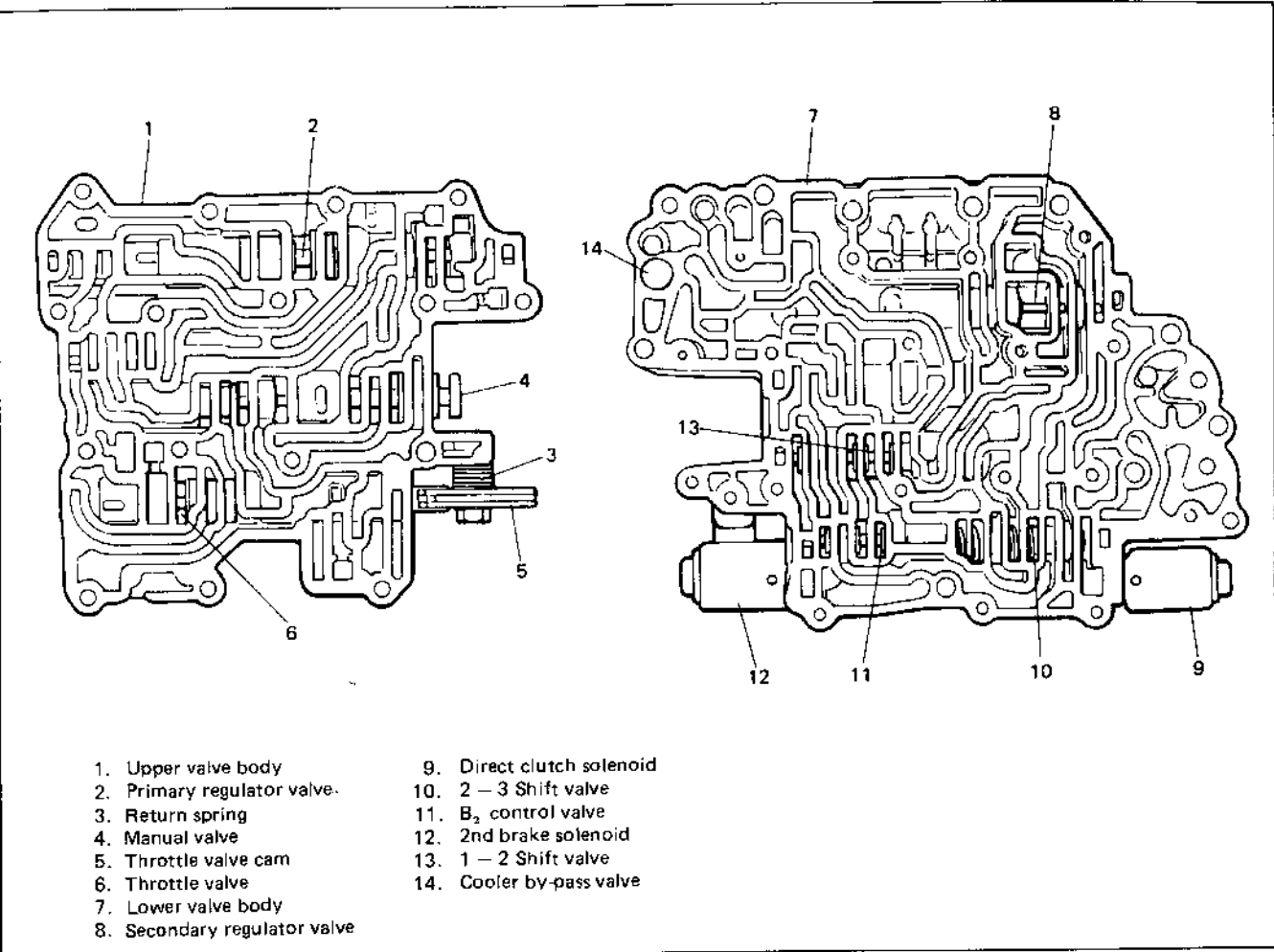


Fig. 7B-21 Upper and Lower Valve Body

**OIL PUMP**

The oil pump is of the internal gear type. It feeds fluid to the torque converter, lubricates each part of the transmission and delivers oil pressure to operate each clutch and brake. The oil pump is driven together with the pump impeller by the engine.

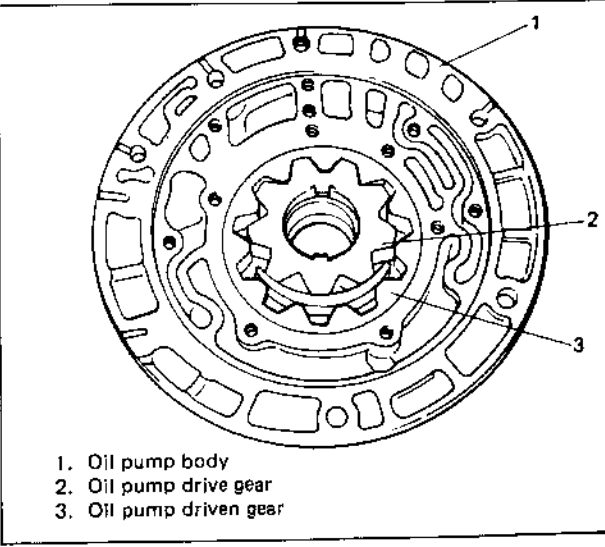


Fig. 7B-22 Oil Pump

**MANUAL VALVE**

The manual valve is directly connected with the selector lever by wire. It opens and closes the oil passage mechanically so as to form respective oil pressure circuit for L, 2, D, N, R, or P range according to the selector lever movement.

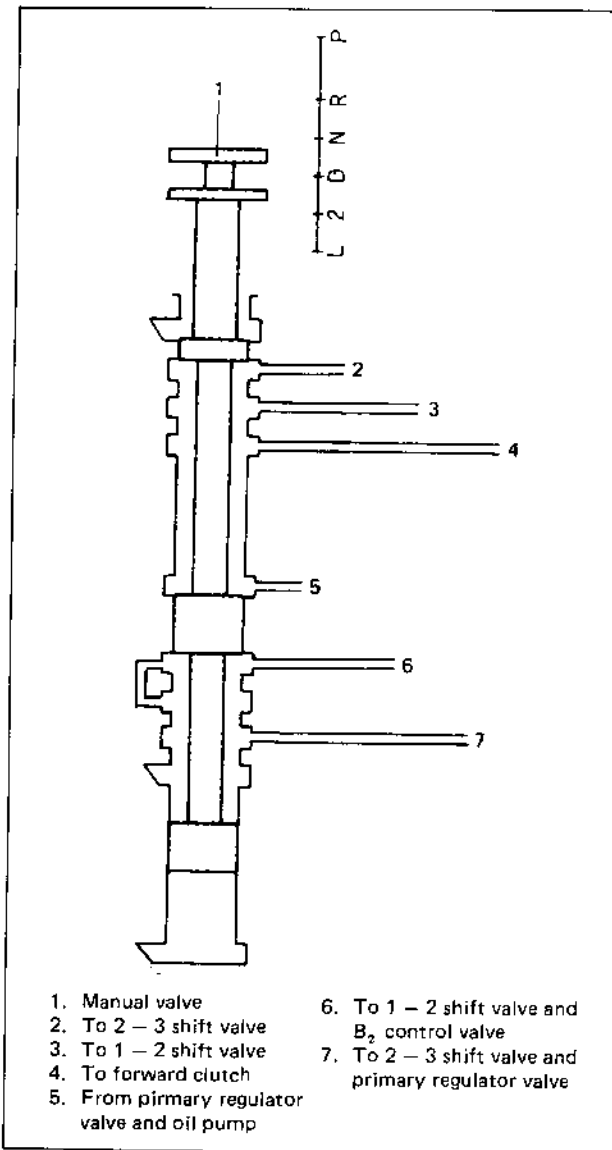


Fig. 7B-23 Manual Valve

**THROTTLE VALVE**

As the throttle valve is linked with the accelerator pedal by wire, it produces the throttle pressure corresponding to the extent to which the accelerator pedal is depressed which is, in other words, the engine output.

When the accelerator pedal is depressed, the throttle cam pushes the shift plug which then compresses two springs to move the throttle

valve. Thus the line pressure passage is opened and the throttle pressure is produced.

The throttle pressure is also applied to the back of the throttle valve to push back the valve. The throttle pressure is determined by the tensile force of the springs (position of the shift plug) and applied to the primary and secondary regulator valves to regulate the line pressure.

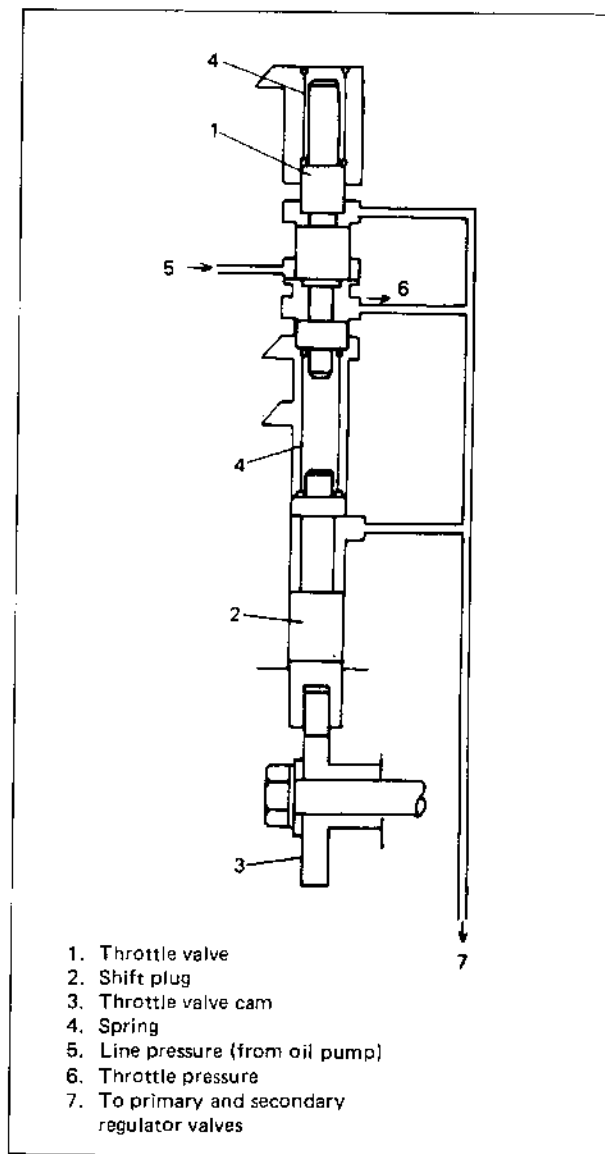


Fig. 7B-24 Throttle Valve

**PRIMARY REGULATOR VALVE**

This valve regulates the oil pressure produced by the oil pump (line pressure) to correspond to each condition of use. It is operated by the throttle pressure, line pressure when in reverse and the springs.

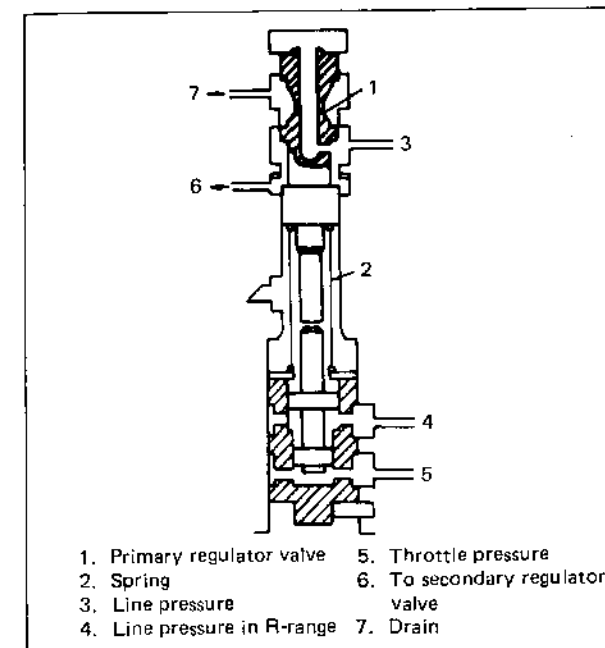


Fig. 7B-25 Primary Regulator Valve

**SECONDARY REGULATOR VALVE**

This valve regulates the oil pressure to the torque converter and lubricating oil pressure to each part of the transmission by means of the throttle pressure and the spring.

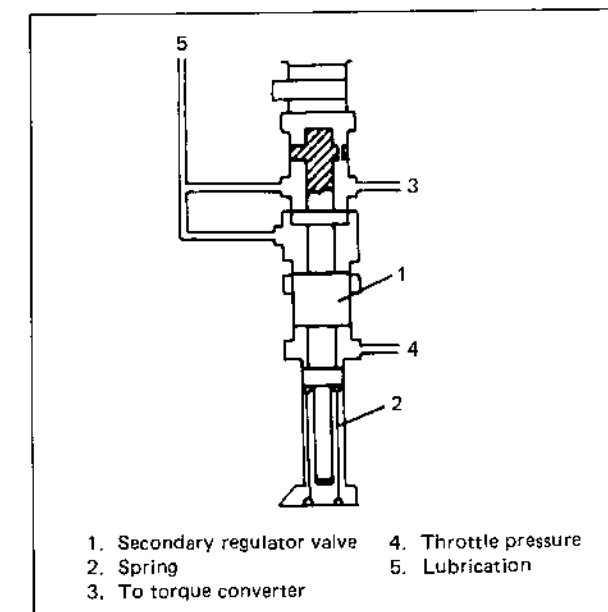
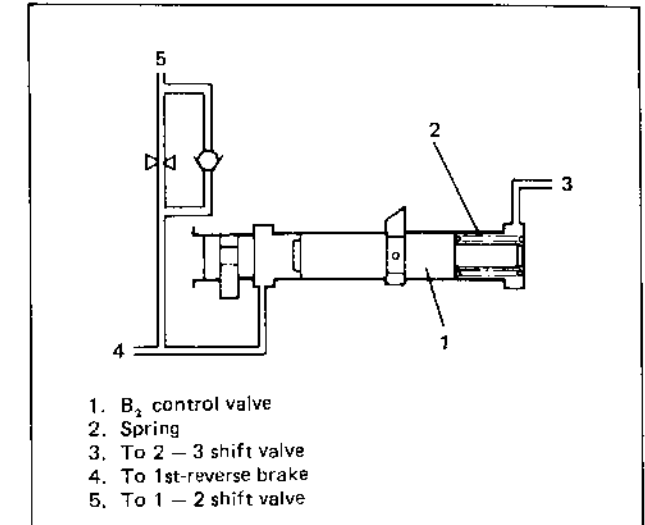


Fig. 7B-26 Secondary Regulator Valve

**B<sub>2</sub> CONTROL VALVE**

When in L range, this valve controls the line pressure acting on the 1st-reverse brake to reduce a shock.

Fig. 7B-27 B<sub>2</sub> Control Valve**COOLER BY-PASS VALVE**

This valve is provided to keep the oil pressure in the torque converter constant.

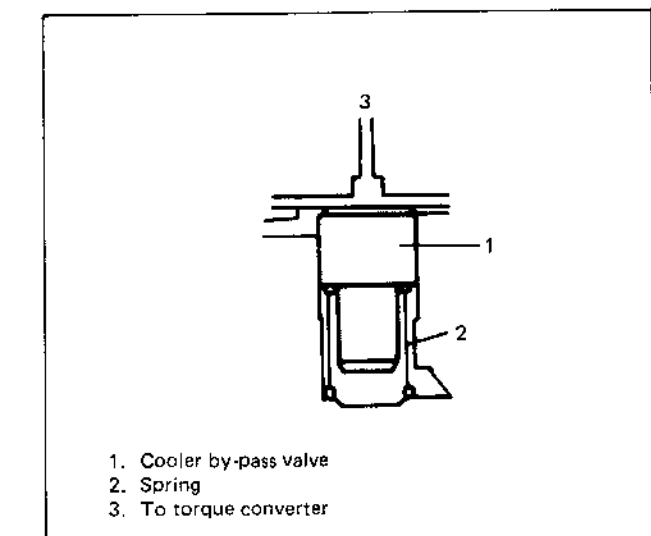


Fig. 7B-28 Cooler By-pass Valve

**1-2 SHIFT VALVE**

This valve carries out the gear shift between 1st and 2nd gears. When the 2nd brake solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the 2nd brake and thus the transmission is shifted into 2nd gear.

When the oil pressure to the 2nd brake solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 1st gear.

In L or R range, the fluid pressure is applied to the 1st-reverse brake when the 2nd brake solenoid operates.



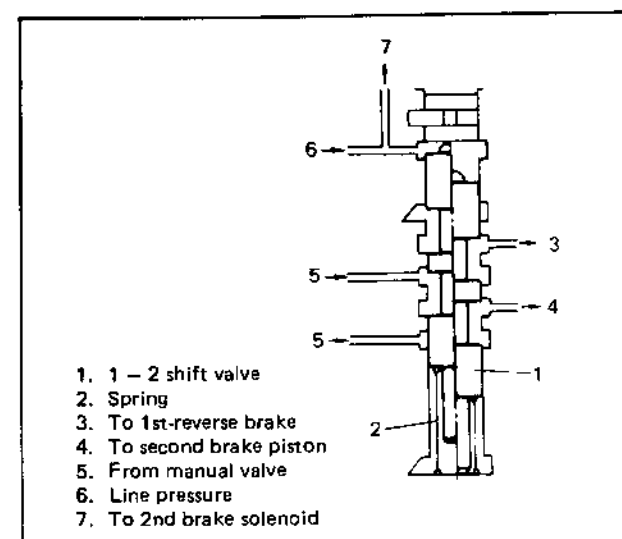


Fig. 7B-29 1 - 2 Shift Valve

**2-3 SHIFT VALVE**

This valve carries out the gear shift between 2nd and 3rd gears. When the direct clutch solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the direct clutch and thus the transmission is shifted from the 2nd to the 3rd gear. When the oil pressure to the solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 2nd gear.

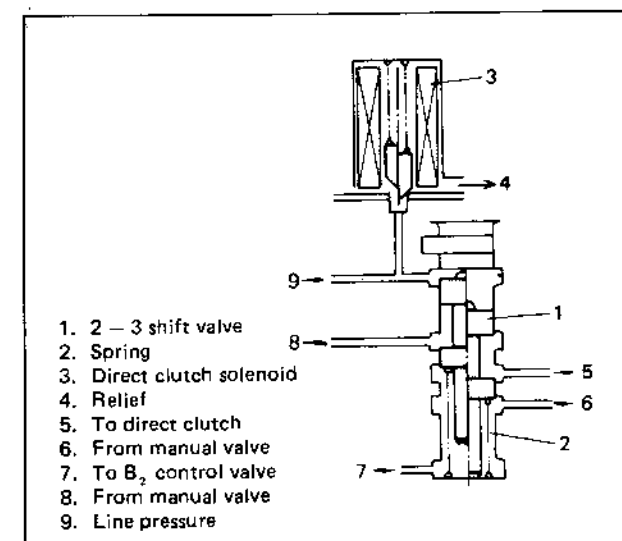


Fig. 7B-30 2 - 3 Shift Valve

**ACCUMULATOR**

This serves to reduce a shock in each gear shift. There are two accumulators, one for the forward clutch and the other for the 2nd brake.

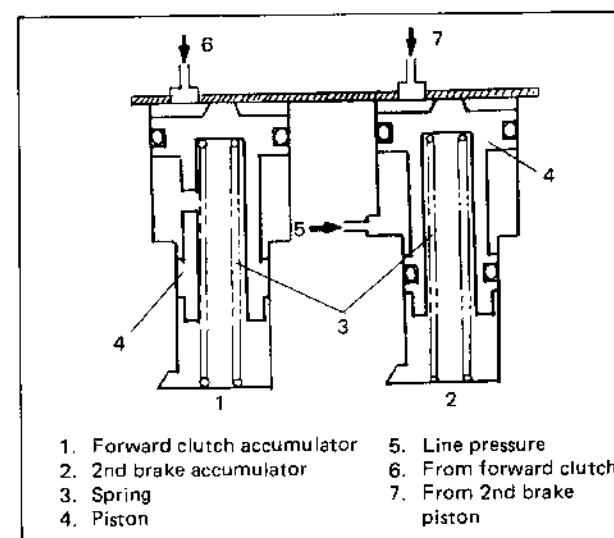


Fig. 7B-31 Accumulator

**DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS**

These solenoids turn ON and OFF by the electric signals from the controller (computer). They serve to control the gear shift by operating the 1 - 2 and 2 - 3 shift valves. Direct clutch solenoid operates the 2 - 3 shift valve, and 2nd brake solenoid does the 1 - 2 shift valve. When the solenoid valve is ON, the valve moves up to relieve the line pressure and when OFF, the valve moves down and therefore the line pressure is applied to the shift valve.

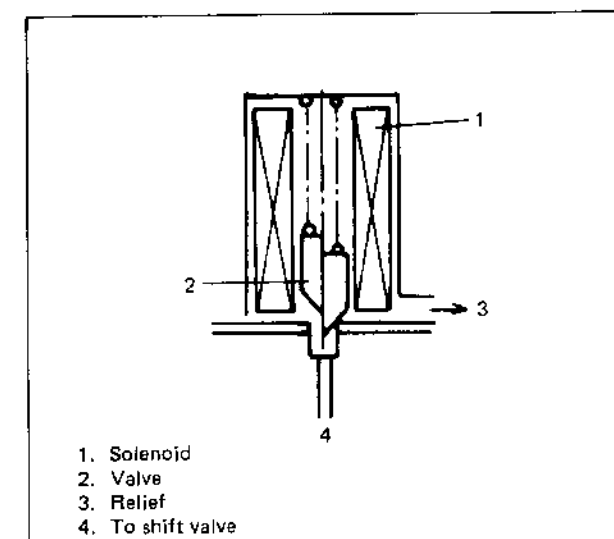


Fig. 7B-32 Direct Clutch and 2nd Brake Solenoids

**OIL CIRCUIT IN "N" RANGE**

When the engine is started and the oil pump starts to operate, fluid in the oil pan passes through the oil pump, is regulated by the primary regulator valve and sent to the torque converter. Also, the fluid which is further regulated by the secondary regulator valve lubricates

each part of the transmission.

In this range, the oil pressure is not applied to any clutch or brake as the line pressure from the regulator valve is stopped by means of the manual valve.

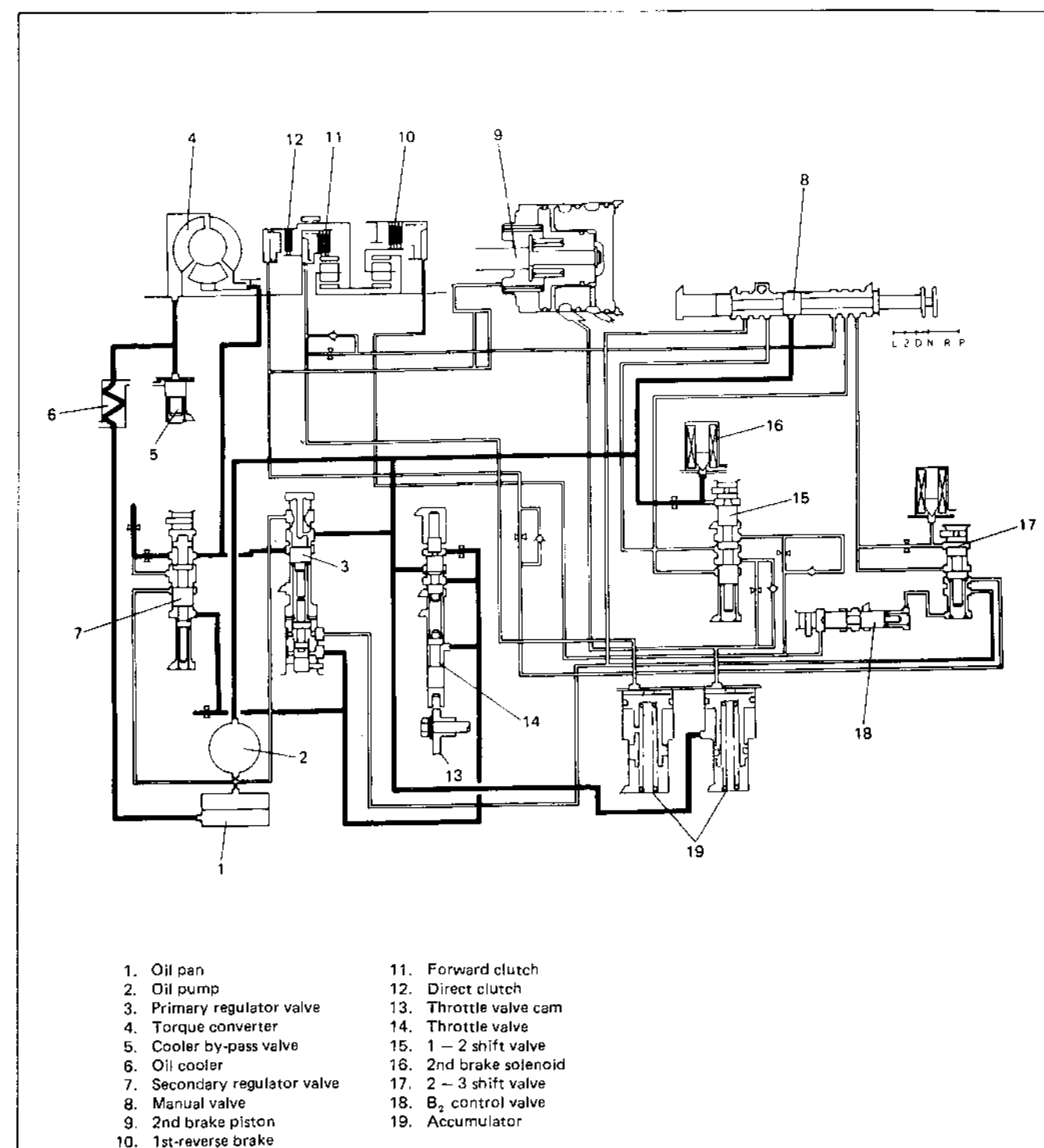


Fig. 7B-33 Oil Circuit in N-range

### OIL CIRCUIT IN "D" OR "2" RANGE (1ST GEAR)

The line pressure which has passed through the manual valve is applied directly to the forward clutch. As this causes the clutch to be engaged, the 1st gear is shifted. The line pressure is also applied to the accumulator to reduce shocks at the time of clutch engagement.

As the direct clutch and the 2nd brake solenoids receive the electric signal from the controller, that is, they are turned ON, they relieve the line pressure. Therefore, neither the 1 — 2 nor 2 — 3 shift valve operates due to no oil pressure.

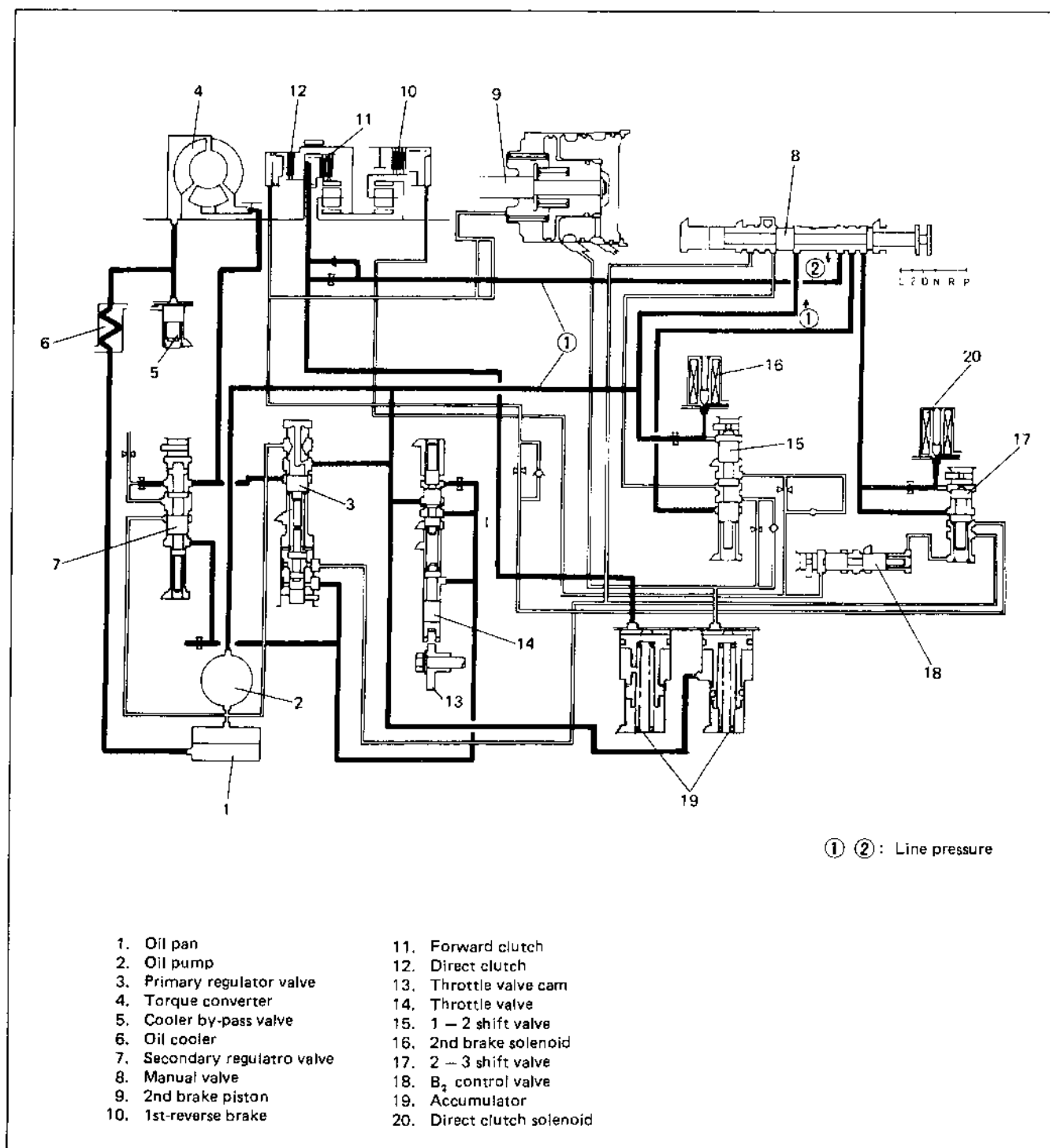


Fig. 7B-34 Oil Circuit in D or 2-range (1st Gear)

### OIL CIRCUIT IN "D" OR "2" RANGE (2ND GEAR)

As the car speed is accelerated at the 1st gear and reaches the 2nd gear shift point, the 2nd brake solenoid turns OFF and closes the relief circuit. This causes the line pressure ① to act on the 1 — 2 shift valve. Then the valve moves to allow the line pressure ③ to be applied to the 2nd brake and the 2nd gear is attained. At this

time, the line pressure ③ is also applied to the accumulator to reduce a shock occurring when the 2nd brake works.

The same oil circuit acts in D when the car speed is lowered to the shift down point from the 3rd to the 2nd gear.

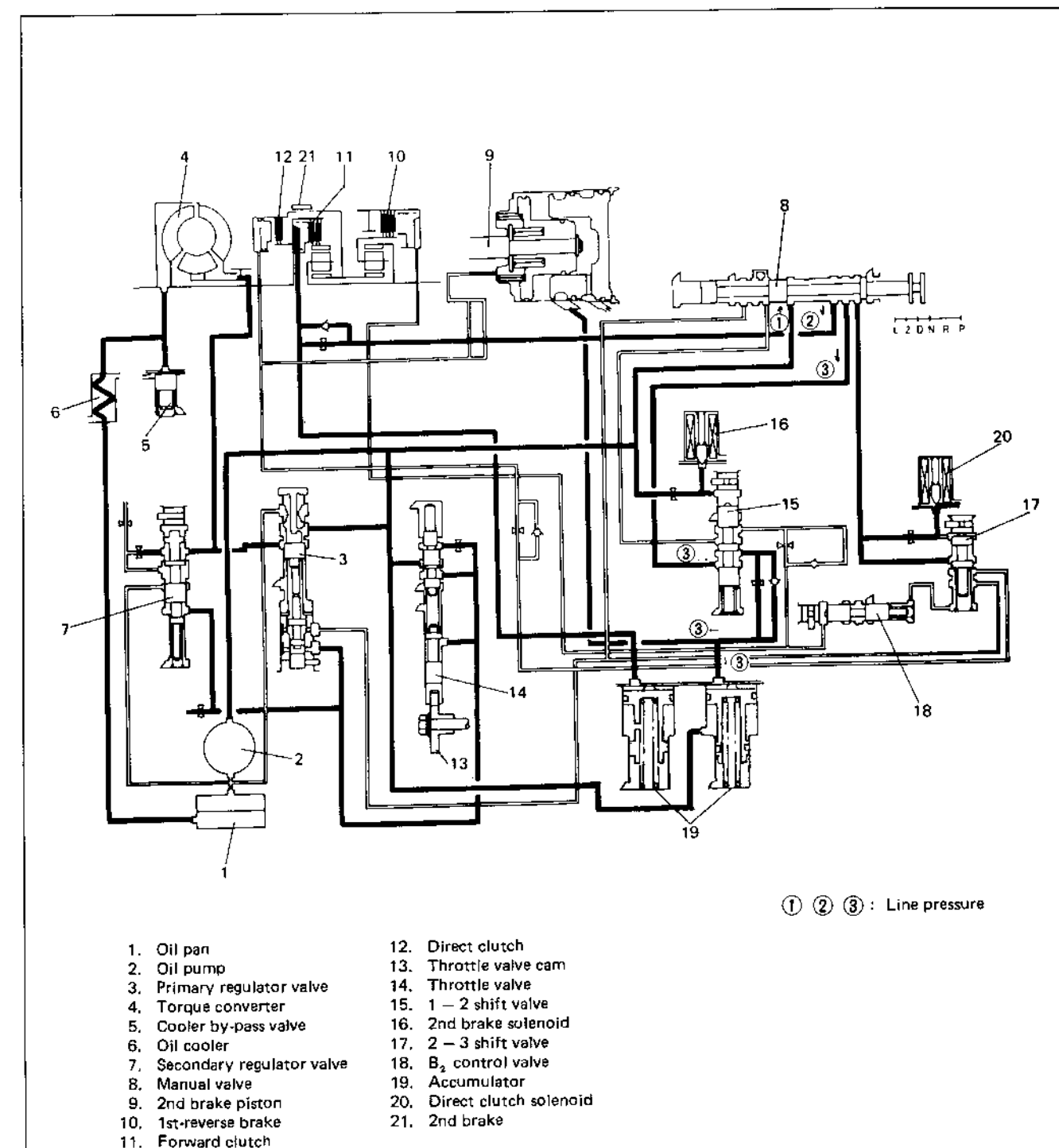


Fig. 7B-35 Oil Circuit in D or 2-range (2nd Gear)

**OIL CIRCUIT IN "D" RANGE (3RD GEAR)**

As the car speed is further accelerated in the 2nd gear and reaches the 3rd gear shift point, the direct clutch solenoid turns OFF and closes the relief circuit. This causes the line pressure ④ to be applied to the 2 – 3 shift valve. Then the oil pressure is applied to the direct clutch to make it engaged. At the same time, the oil pressure acts, as a back pressure, on the 2nd brake piston. Thus the 2nd brake piston is pushed back, the

2nd brake is released and the 3rd gear is attained. In this state, as the 2nd brake solenoid is OFF, the 1 – 2 shift valve is at work and opens the oil passage to the 2nd brake but the 2nd brake does not operate. It is because the oil pressure to the 2nd brake is balanced with the above mentioned back pressure and the return spring force pushes back the piston to prevent the 2nd brake from operating.

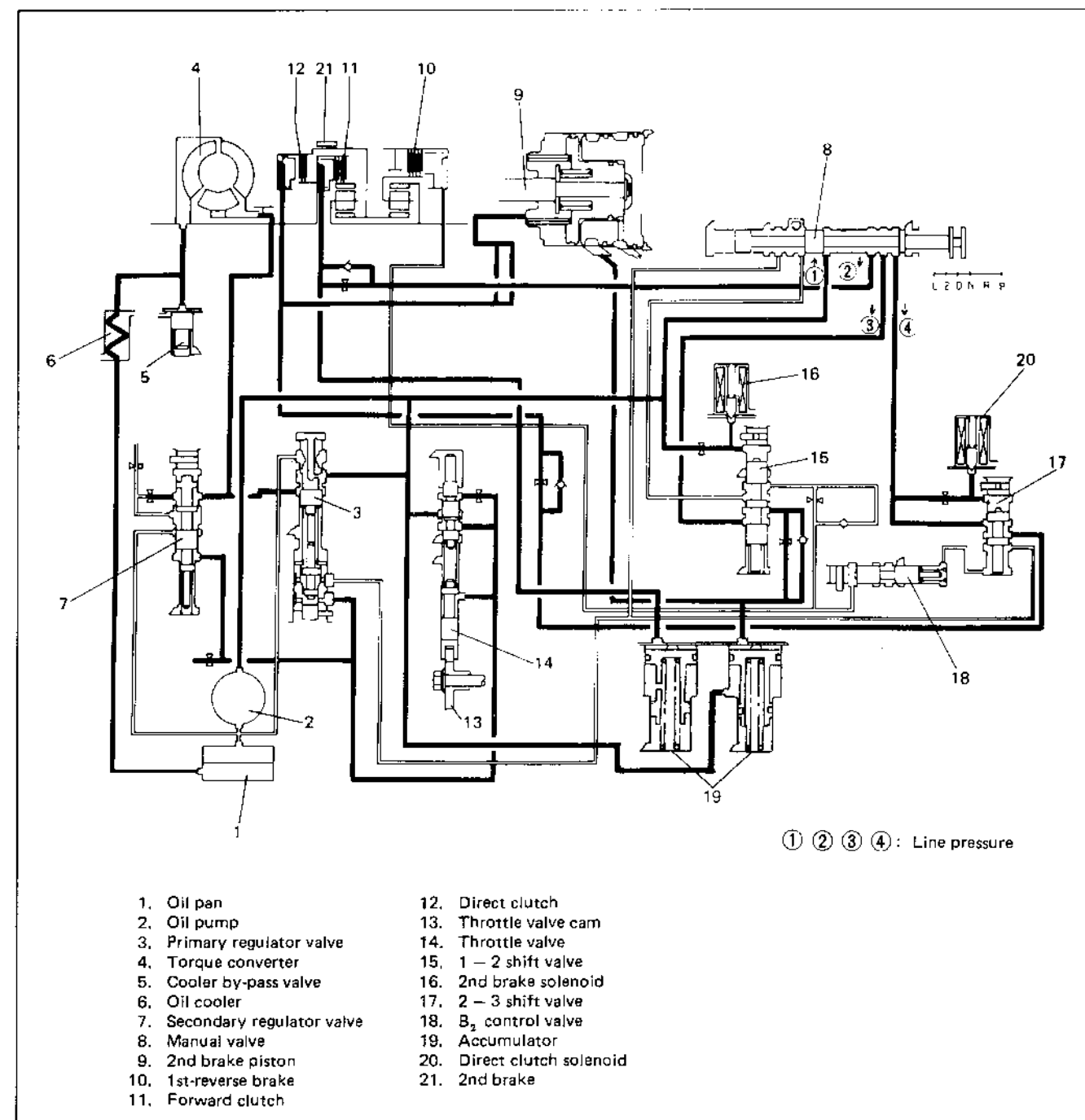


Fig. 7B-36 Oil Circuit in D-range (3rd Gear)

**OIL CIRCUIT IN "L" RANGE**

The line pressure ①, after passing through the manual valve, comes out as the line pressures ② and ⑤. The line pressure ② is applied to the forward clutch. In this state, as the 2nd brake solenoid is OFF because it is not electrically charged from the controller, the line pressure ① is applied to the 1 – 2 shift valve. Then the line pressure is applied to the 1st-reverse brake. Consequently the 1st gear is attained.

When the selector lever is shifted to L at a speed higher than 53 km/h (33 mile/h), the 2nd brake solenoid is electrically actuated and the solenoid valve opens to allow the line pressure ① to be relieved. Then the 1 – 2 shift valve is pushed back by its return spring and the passage of the line pressure ⑤ is switched from the 1st-reverse brake to the 2nd brake piston. Therefore, the 2nd gear is attained until the car speed lowers.

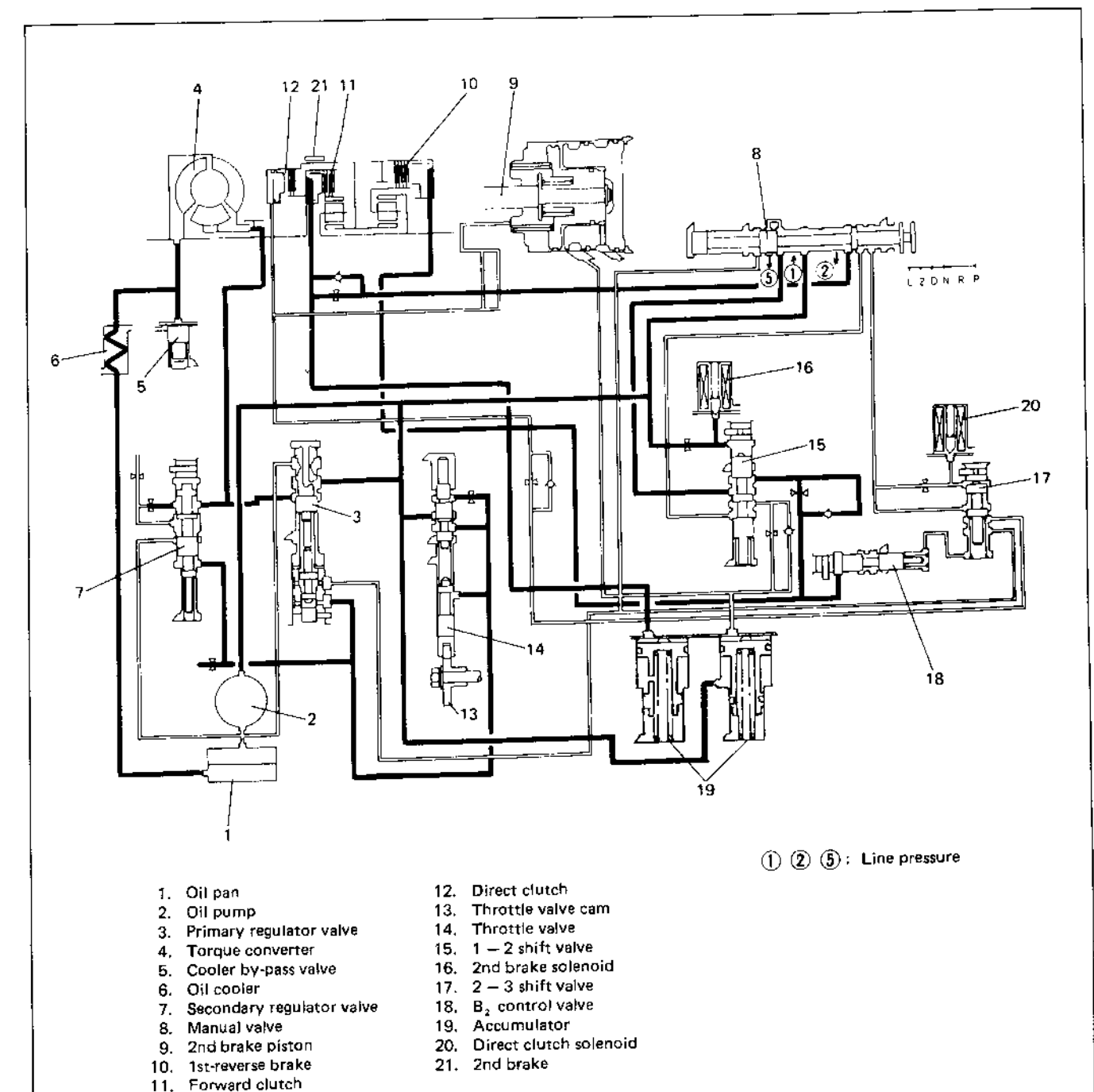


Fig. 7B-37 Oil Circuit in L-range

OIL CIRCUIT "R" RANGE

The line pressure ①, after passing through the manual valve, comes out as the line pressures ⑤ and ⑥. In this state, as the 2nd brake solenoid is OFF, the line pressure ① is applied to the 1 - 2 shift valve and the line pressure ⑤ is applied to the 1st-reverse brake after passing

through the B<sub>2</sub> control valve. On the other hand, the line pressure ⑥ is applied to the direct clutch via the 2 - 3 shift valve, thus resulting in the reverse gear. Also, a part of the line pressure ⑥ acts on the primary regulator valve to regulate the line pressure ①.

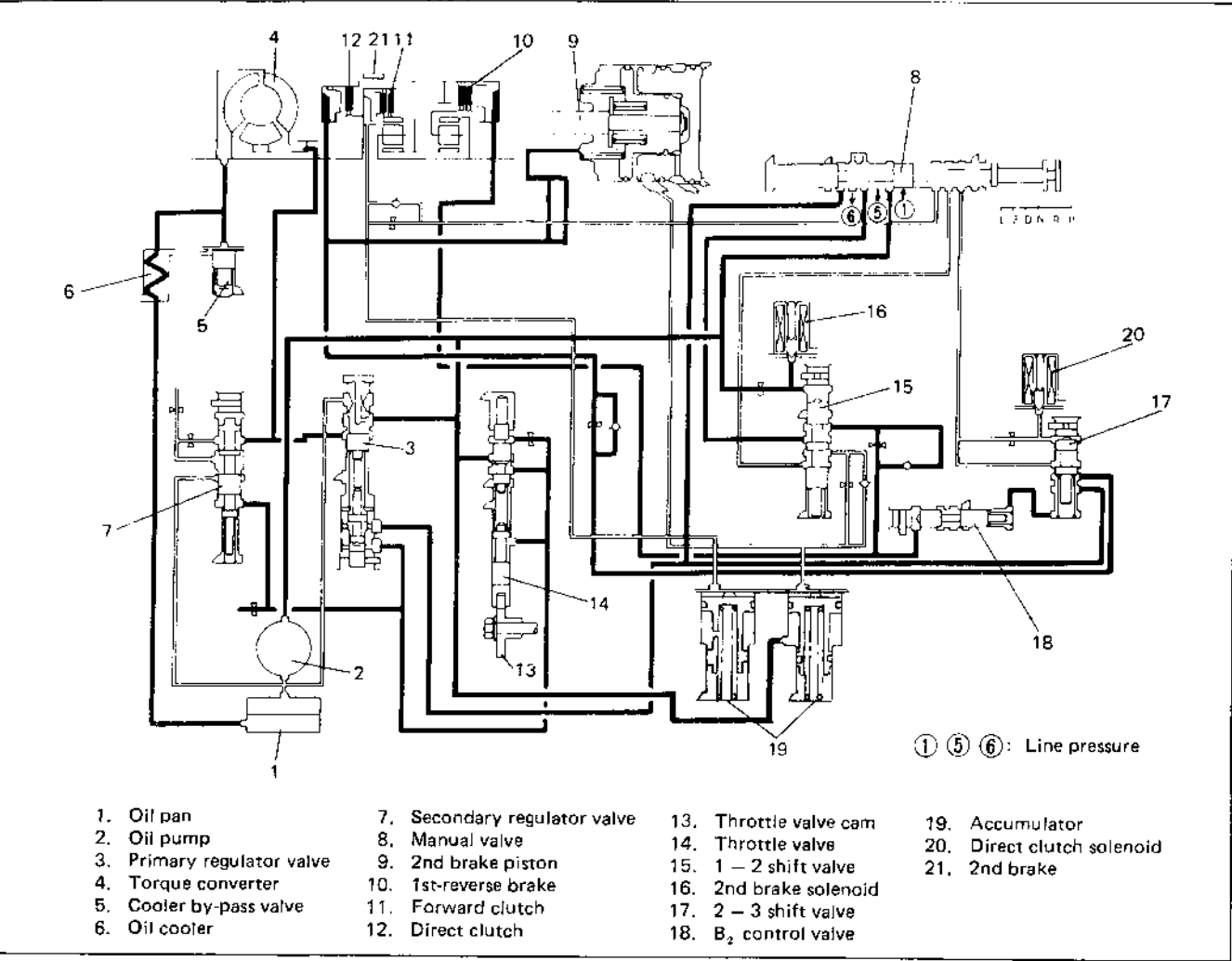


Fig. 7B-38 Oil Circuit in R-range

OIL COOLING SYSTEM

The oil cooler of dual pipe type is built in the lower tank of the engine cooling radiator and cools off the automatic transmission fluid.

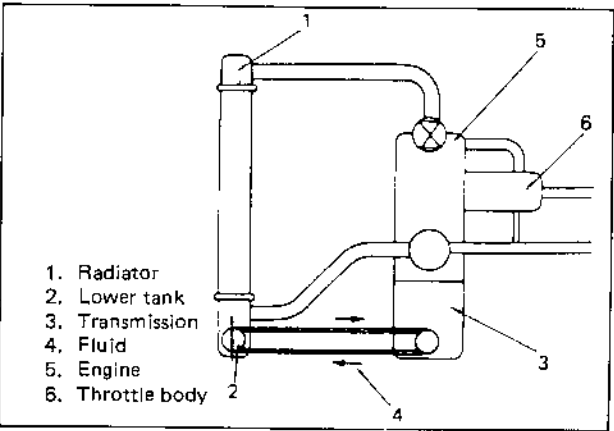


Fig. 7B-39 Oil Cooling System

ELECTRIC SHIFT CONTROL SYSTEM

A/T CONTROL MODULE (CONTROLLER)

The controller controls the 2nd brake solenoid and the direct clutch solenoid by sending electric signals to them so as to attain automatic gear shift between the 1st and 2nd gears, and the 2nd and 3rd gears.

Equipped as controller sensed parameters are the throttle position sensor (TPS), shift lever switch and speed sensor. These switch and sensors sense the throttle valve opening, selector lever's position and car speed, and send those signals to the controller. Then, the controller opens and closes valves of the above solenoids according to these signals. The controller is located at the right hand of steering column.

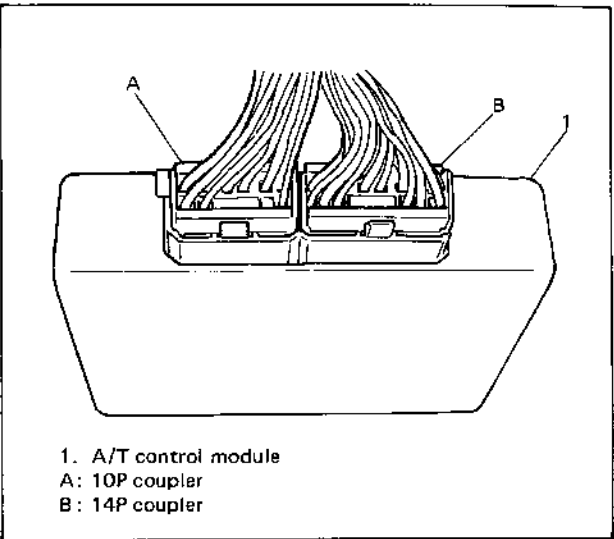
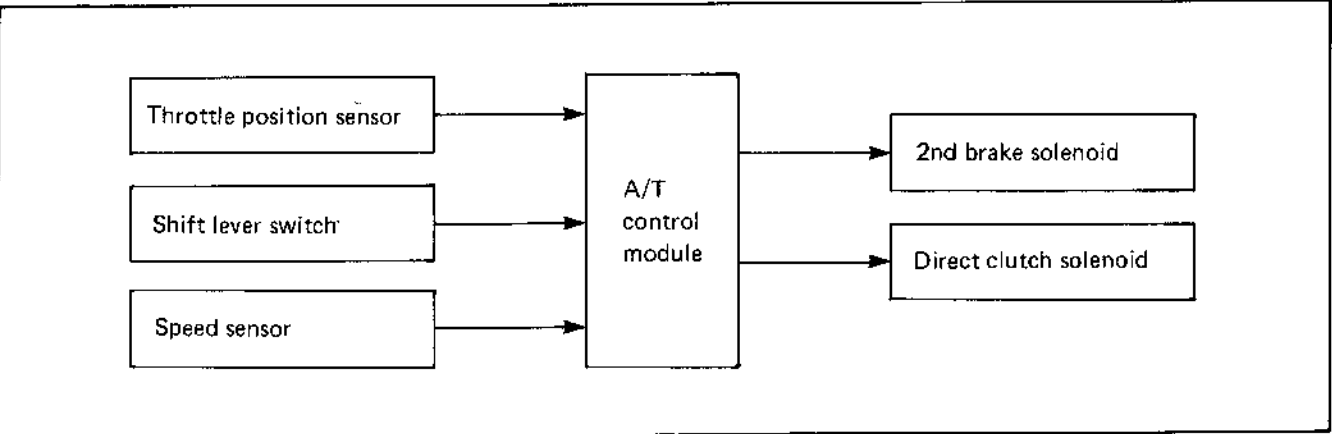


Fig. 7B-40 A/T Control Module

GEAR SHIFT CONTROL SYSTEM



THROTTLE POSITION SENSOR (TPS)

The throttle position sensor consisting of an idle switch and a potentiometer is connected to the throttle valve shaft.

Idle signal (ON signal when idling) and throttle valve opening signal (output voltage) are transmitted from TPS to ECM as voltage signal. The signal is converted to ON OFF informations in ECM and they are sent to A/T controller through three lines.

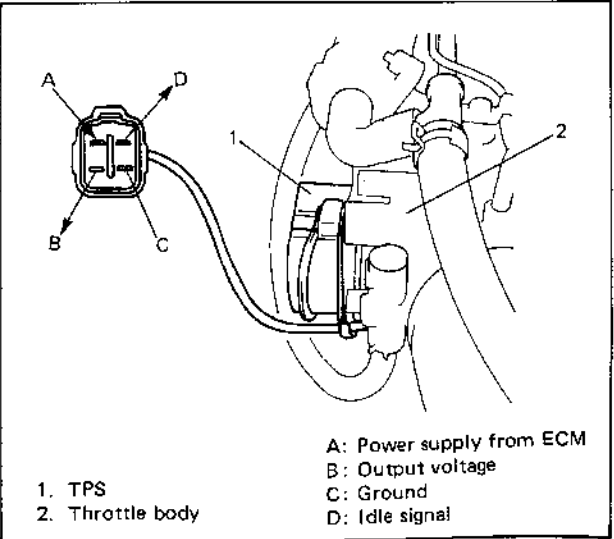


Fig. 7B-41 Throttle Position Sensor

### SHIFT LEVER SWITCH

Being linked with the selector lever, this switch changes selector lever positions into electric signals and send them to the controller. The contact points of this switch for P and N ranges are also connected with the starting motor circuit. So when the selector lever is shifted to the P or N position, the contact points for P or N range are connected and cause the starting motor to operate by turning the starter switch ON. When the selector lever is in any other position than P and N, the switch remains OFF and therefore the starting motor cannot be operated, that is, the engine cannot be started.

Also, as its contact point for R range is connected with the back up light circuit, only when the selector lever is shifted to R range, the contact point contacts to light the back up light.

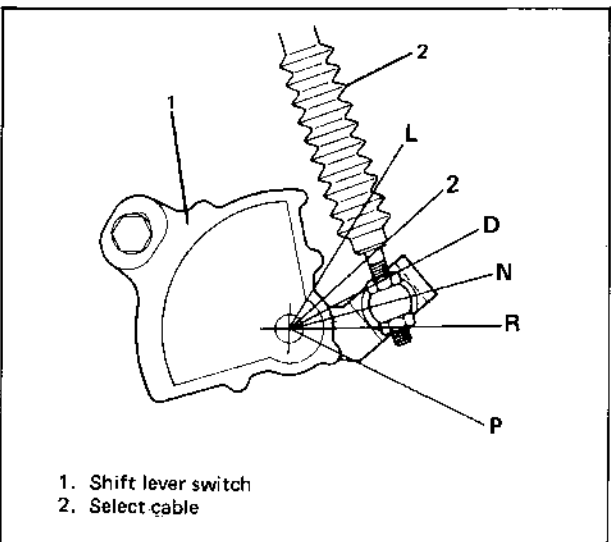


Fig. 7B-42 Shift Lever Switch

### OPERATION OF DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

| Range                  | D   |     |     | 2   |     | L   |       | P, N & R |
|------------------------|-----|-----|-----|-----|-----|-----|-------|----------|
|                        | 1st | 2nd | 3rd | 1st | 2nd | 1st | (2nd) |          |
| Direct clutch solenoid | ○   | ○   | X   | X   | ○   | X   | X     | X        |
| 2nd brake solenoid     | ○   | X   | X   | ○   | X   | X   | ○     | X        |

○ : Operated (Solenoid Valve is Open)

X : Unoperated (Solenoid Valve is Closed)

### DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

These solenoids are mounted on the valve body. They are turned ON and OFF by the signals from the controller and actuate each shift valve (1 → 2 and 2 → 3 valves) so as to control transmission gear shift.

2nd brake solenoid operates 1 → 2 shift valve, and direct clutch solenoid does 2 → 3 shift valve.

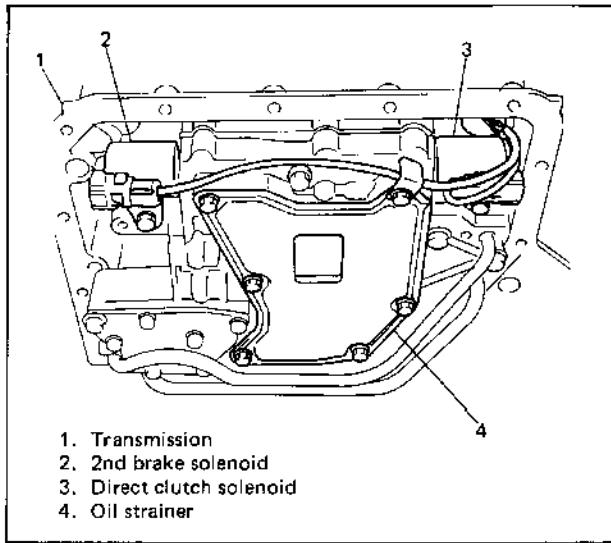


Fig. 7B-43 Direct Clutch and 2nd Brake Solenoid

### SPEED SENSOR

The speed sensor consists of a magnetic core with magnet and coil. It is mounted on transmission case with 0.6 mm (0.024 in) air gap between the core end and countershaft gear tooth. While the countershaft rotates, magnetic flux is cut by gear tooth thus a pulse is generated in the sensor coil according to the speed. And then, the pulse is transmitted to A/T control module as speed signal.

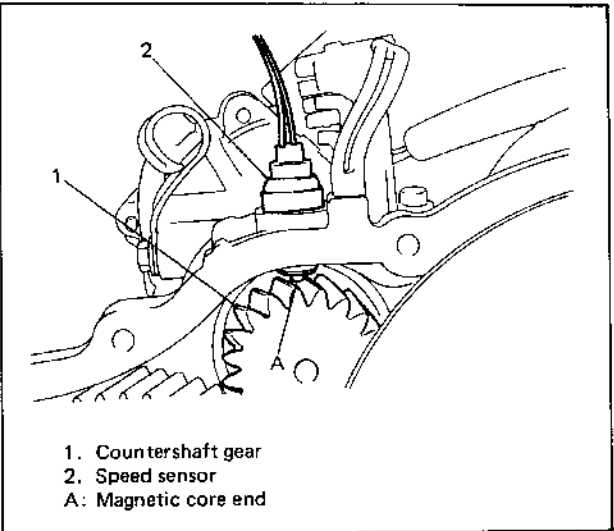
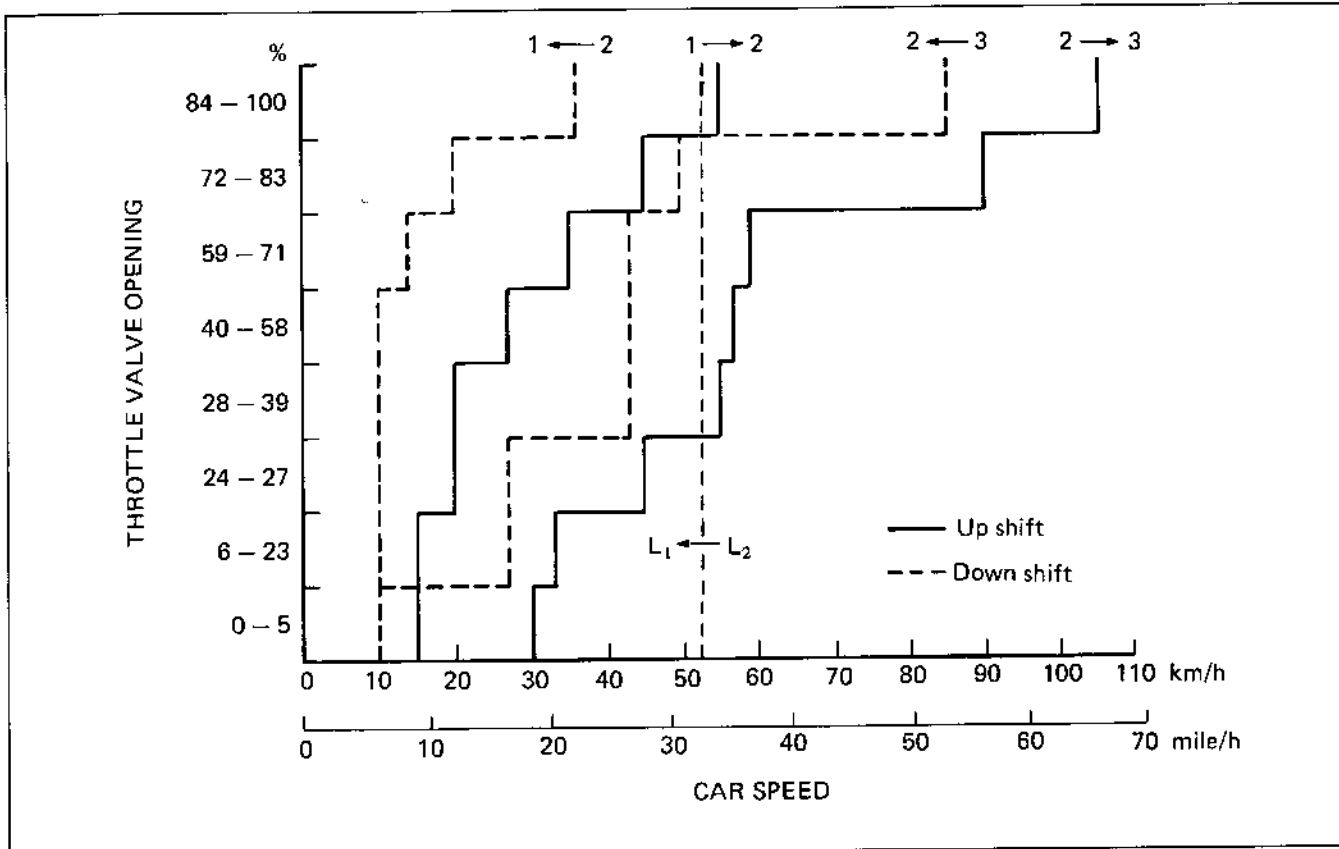


Fig. 7B-44 Speed Sensor

### AUTOMATIC SHIFT DIAGRAM

Automatic shift schedule as a result of shift control is shown below. In case that selector lever is shifted to L at a higher than 53 km/h (33 mile/h) speed, 2nd gear is operated and then down shifts to 1st at a speed lower than that. No up shift is available in L.



| Throttle   | Speed  | Selector Gear |       | D or 2 |       | D     |       | D or 2 |       | L     |       |
|------------|--------|---------------|-------|--------|-------|-------|-------|--------|-------|-------|-------|
|            |        | 1 → 2         | 2 → 3 | 3 → 2  | 2 → 1 | 1 → 2 | 2 → 3 | 3 → 2  | 2 → 1 | 2 → 1 | 2 → 1 |
| Full close | Km/h   | 15            | 30    | 10     | 10    | 53    |       |        |       |       |       |
|            | mile/h | 9             | 19    | 6      | 6     | 33    |       |        |       |       |       |
| Full open  | Km/h   | 55            | 105   | 85     | 36    | 53    |       |        |       |       |       |
|            | mile/h | 34            | 65    | 53     | 22    | 33    |       |        |       |       |       |

DIAGNOSIS

TRANSMISSION UNIT

SYSTEMATIC TROUBLE SHOOTING

Before performing troubleshooting for mechanical function described hereafter, make sure to check each of the following.

- 1. Engine coolant temperature is at normal operating temperature.
- 2. Engine idle speed is 800 – 900 rpm.

- 3. Transmission fluid level is between FULL HOT and LOW HOT on oil level gauge at normal operating temperature of transmission fluid.
- 4. Accelerator cable, oil pressure control cable and select cable are adjusted properly.
- 5. Electric circuit of gear shift control system is free from break, coupler disconnection and poor contact.

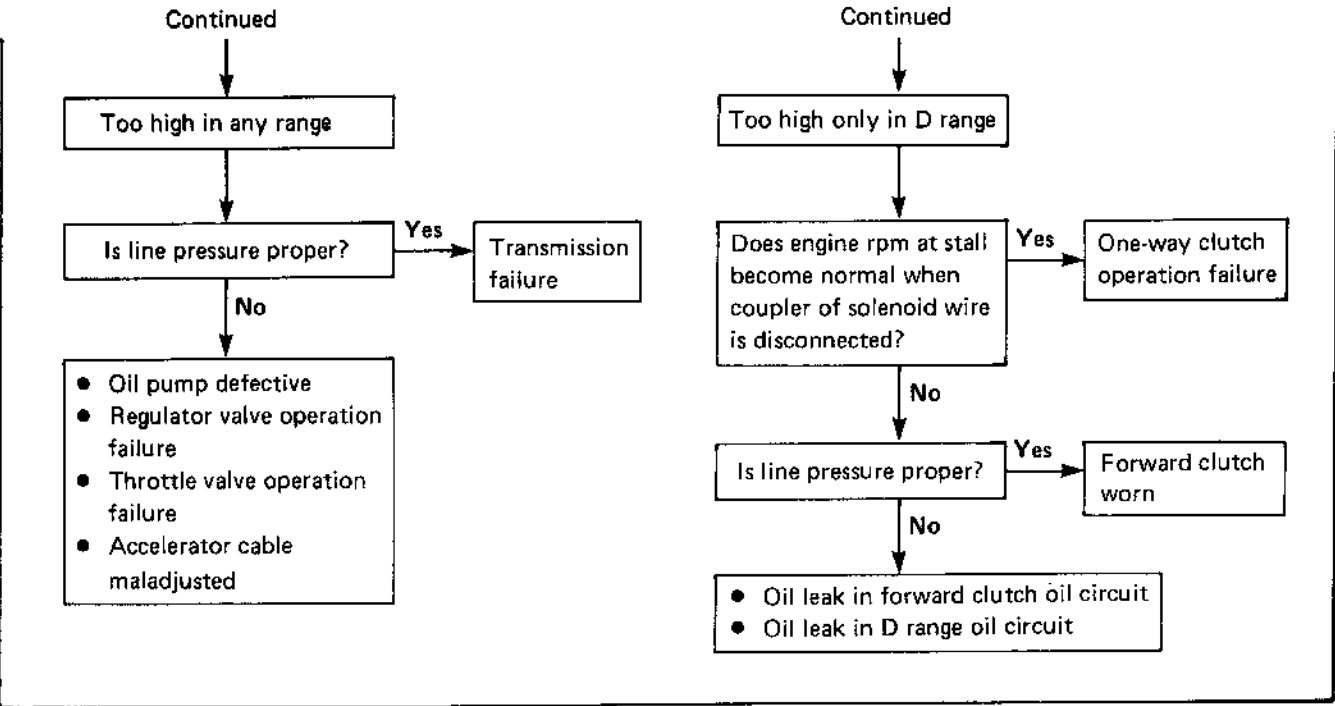
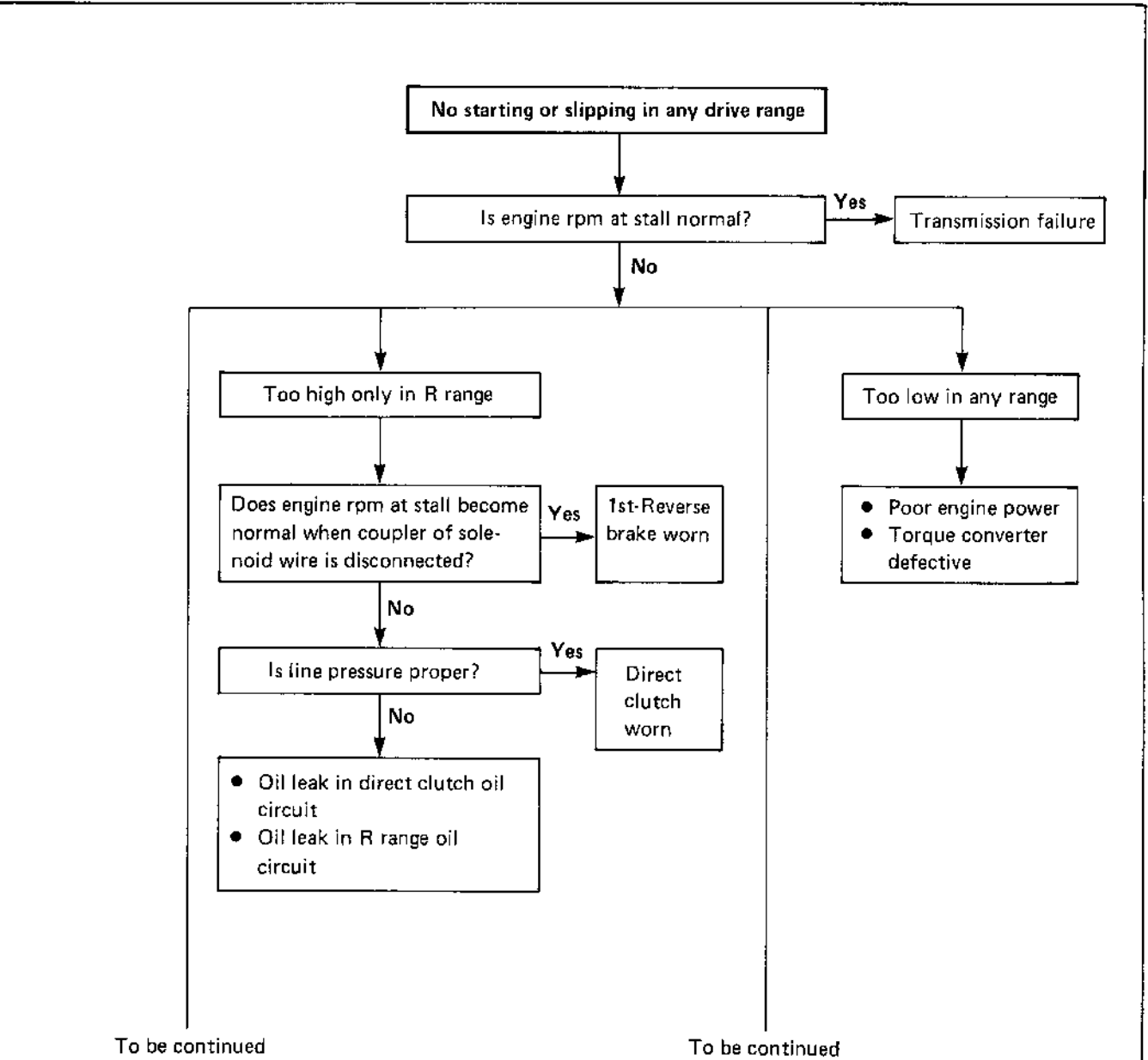


Fig. 7B-45 Stall Test and Line Pressure Test

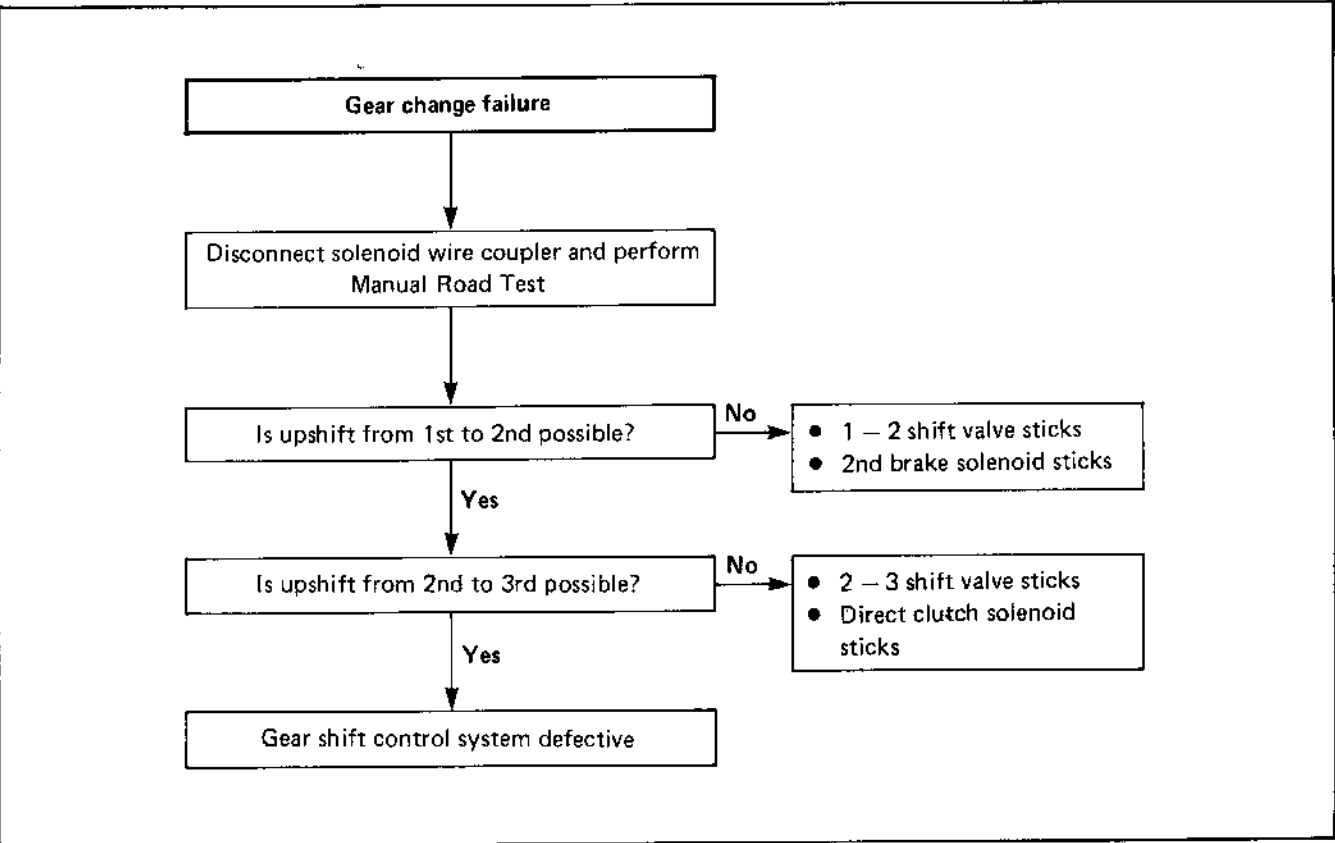


Fig. 7B-46 Manual Road Test



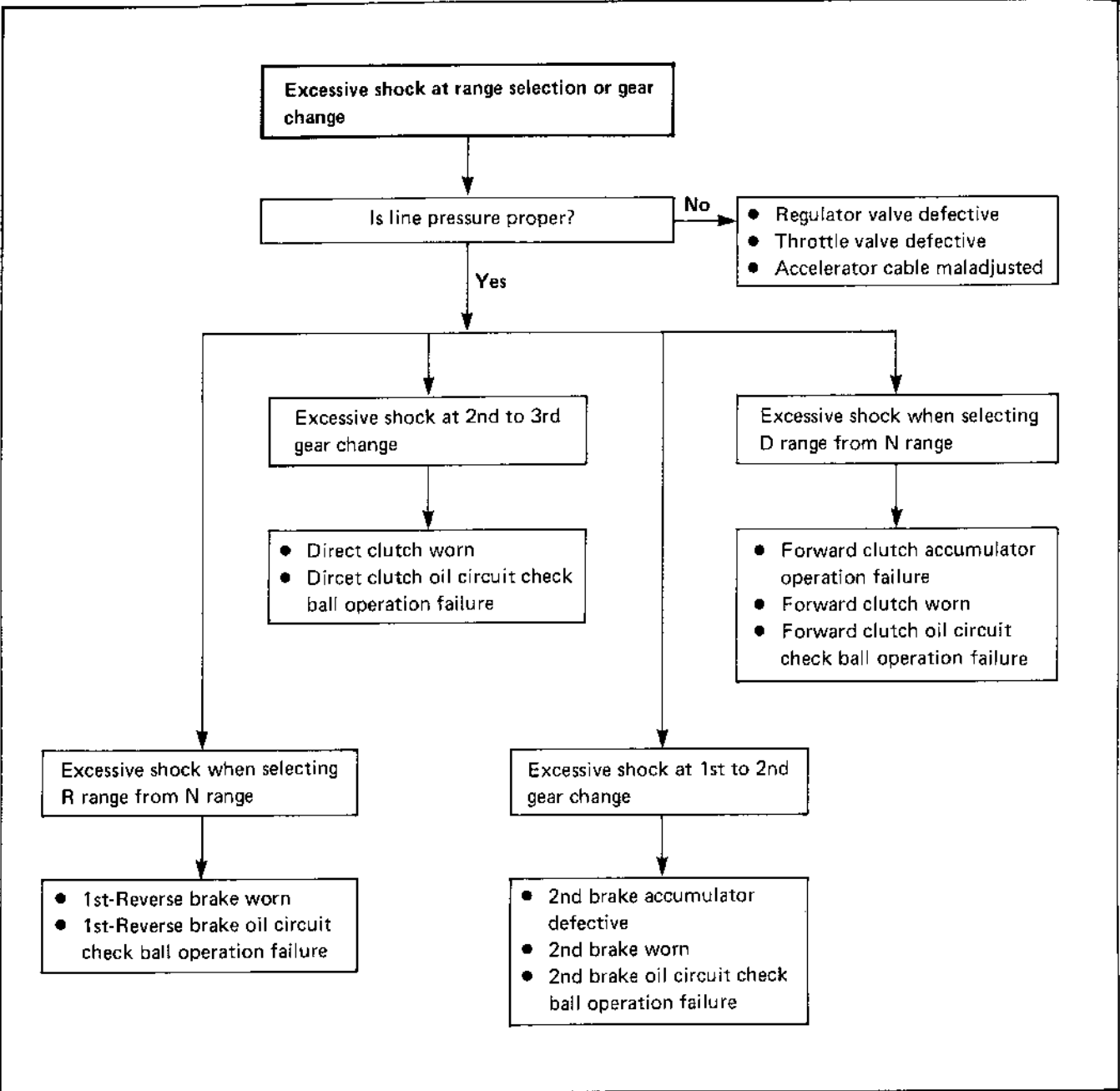


Fig. 7B-47 Line Pressure Test and Road Test

**STALL TEST**

This test is to check overall performance of automatic transmission and engine by measuring stall speed at D and R ranges. Be sure to perform this test only when transmission fluid is at normal operating temperature and its level is between FULL HOT and LOW HOT.

**CAUTION:**

Do not run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.

1. Install tachometer.
2. Apply parking brake and block car wheels.
3. Start engine with selector lever shifted to P.
4. Depress brake pedal.
5. Shift selector lever to D and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
6. Release accelerator pedal immediately after stall speed is checked.
7. In the same way, check stall speed at R range.
8. Stall speed should be within following specification.

|             |                     |
|-------------|---------------------|
| Stall speed | 2,000 – 2,500 r/min |
|-------------|---------------------|

9. Possible causes for out-of-specification stall speed are as follows. Check each part which is suspected to be the cause.

| Stall speed measured                 | Possible causes                                                                                                   |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Lower than specification             | <ul style="list-style-type: none"><li>• Engine output insufficient</li><li>• Torque converter defective</li></ul> |
| Higher than specification in D range | <ul style="list-style-type: none"><li>• Forward clutch slippage</li><li>• One-way clutch defective</li></ul>      |
| Higher than specification in R range | <ul style="list-style-type: none"><li>• Direct clutch slippage</li><li>• 1st – reverse brake slippage</li></ul>   |

**LINE PRESSURE TEST**

This test is to check oil pressure system for operation by measuring oil pressure in oil pressure line. Make sure to perform this test only when transmission fluid is at normal operating temperature.

**NOTE:**

- Make sure that transmission fluid level is between FULL HOT and LOW HOT marks on oil level gauge at normal operating temperature of fluid.
- Check that transmission is free from fluid leakage.

1. With engine at stop, remove plug and connect oil pressure gauge to plug hole.
2. Install tachometer.
3. Apply parking brake and block car wheels.
4. With selector lever shifted to P, start engine.
5. Depress brake pedal fully.
6. Shift selector lever to D and check oil pressure with engine running at idling speed and at stall speed respectively.
7. Repeat the same check as in step 6 with selector lever shifted to R.

**CAUTION:**

Do not run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.

8. If line pressure is within respective specification in below table, oil pressure system is in good condition.

| Engine speed                         | Line pressure                                                 |                                                                        |
|--------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------|
|                                      | D range                                                       | R range                                                                |
| Idling speed<br>(800 – 900 r/min)    | 2 – 4 kg/cm <sup>2</sup><br>28.5 – 56.8 psi<br>200 – 400 kPa  | 5.5 – 8 kg/cm <sup>2</sup><br>78.2 – 113.7 psi<br>550 – 800 kPa        |
| Stall speed<br>(2,000 – 2,500 r/min) | 6 – 8 kg/cm <sup>2</sup><br>85.3 – 113.7 psi<br>600 – 800 kPa | 12.0 – 15.5 kg/cm <sup>2</sup><br>170.6 – 220.4 psi<br>1200 – 1550 kPa |

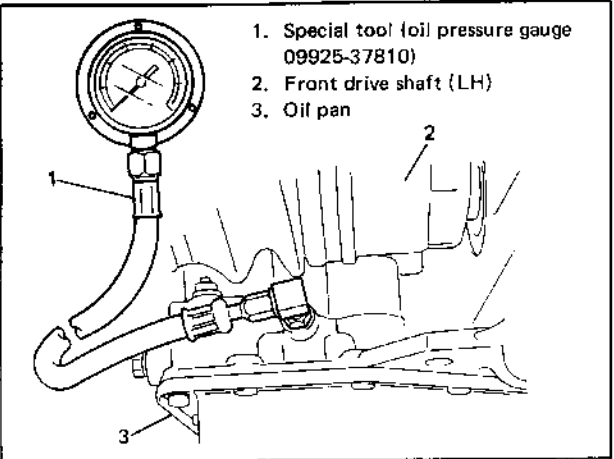


Fig. 7B-48 Checking Line Pressure

9. Possible causes for out-of-specification line pressure are as follows. Check each part which is suspected to be the cause.
10. Reinstall plug and tighten it to specification.

| Tightening torque for case plug | N·m   | kg·m      | lb·ft     |
|---------------------------------|-------|-----------|-----------|
|                                 | 6 - 9 | 0.6 - 0.9 | 4.5 - 6.5 |

| Line pressure                               | Possible causes                                                                                                                                                                                                          |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Higher than specification in D and R ranges | <ul style="list-style-type: none"><li>Regulator valve defective</li><li>Throttle valve in valve body defective</li><li>Accelerator cable and oil pressure control cable maladjusted</li></ul>                            |
| Lower than specification in D and R ranges  | <ul style="list-style-type: none"><li>Oil pump defective</li><li>Regulator valve defective</li><li>Throttle valve in valve body defective</li><li>Accelerator cable and oil pressure control cable maladjusted</li></ul> |
| Lower than specification only in D range    | <ul style="list-style-type: none"><li>Forward clutch oil pressure system oil leakage</li><li>D range oil pressure system oil leakage</li></ul>                                                                           |
| Lower than specification only in R range    | <ul style="list-style-type: none"><li>Direct clutch oil pressure system oil leakage</li><li>1st - reverse brake oil pressure system oil leakage</li><li>R range oil pressure system oil leakage</li></ul>                |

**ROAD TEST**

This test is to check if upshift and downshift take place at specified speeds while actually driving car on a level road.

**WARNING:**

- Carry out the test in very little traffic area to prevent an accident.
- The test requires 2 persons, a driver and a tester.

- Warm up engine.
- With engine running at idle, shift selector lever to D.
- Accelerate car speed by depressing accelerator pedal very little (within 4 deg. of throttle valve opening).
- Check if upshift takes place from 1st to 2nd at about 15 km/h (9 mile/h) and from 2nd to 3rd at about 30 km/h (19 mile/h).
- Stop car once. Then start it again and while accelerating by depressing accelerator pedal fully, check if upshift takes place from 1st to 2nd at 55 km/h (34 mile/h) and from 2nd to 3rd at 105 km/h (65 mile/h).
- Stop car again.
- Start car and keep it running at 25 km/h (15 mile/h) and then release accelerator pedal completely. 1 or 2 seconds later, depress accelerator pedal fully and check if downshift from 2nd to 1st takes place.
- Keep car running at 75 km/h (47 mile/h) and in the same way as in step 7, check if downshift from 3rd to 2nd takes place.
- If upshift or downshift fails to take place at each specified speed in the road test, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

| Condition                                  | Possible causes                                                                                                                                                                                                       |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No upshift from 1st to 2nd                 | <ul style="list-style-type: none"><li>1 - 2 shift valve defective</li><li>2nd brake solenoid defective</li><li>Controller defective, or disconnection or poor connection in controller electric circuit</li></ul>     |
| No upshift from 2nd to 3rd                 | <ul style="list-style-type: none"><li>2 - 3 shift valve defective</li><li>Direct clutch solenoid defective</li><li>Controller defective, or disconnection or poor connection in controller electric circuit</li></ul> |
| No downshift from 2nd to 1st or 3rd to 2nd | <ul style="list-style-type: none"><li>Throttle position sensor defective</li><li>Controller defective, or disconnection or poor connection in controller electric circuit</li></ul>                                   |

**MANUAL ROAD TEST**

This test checks the gears being used in L, 2 or D range when driven with unoperated gear shift control system. Test drive car on a level road.

- With selector lever in P, start engine and warm it up.
- After warming up engine, disconnect coupler of solenoid wire as shown in figure.

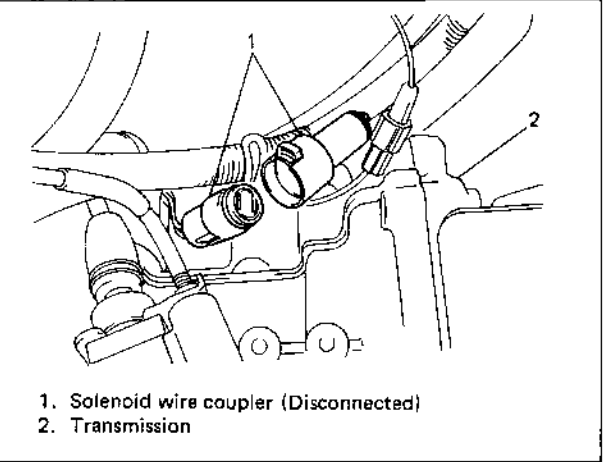


Fig. 7B-49 Disconnecting Solenoid Wire Coupler

- With selector lever in L range, start car and accelerate to 30 km/h (19 mile/h). Check in this state that 1st gear is being used.
- At 30 km/h (19 mile/h), shift selector lever to 2 range and accelerate to 60 km/h (37 mile/h). Check in this state that 2nd gear is being used.
- At 60 km/h (37 mile/h), shift selector lever to D range and check that 3rd gear is used when speed is higher than 60 km/h (37 mile/h).
- After above checks, stop car then engine, and connect solenoid wire coupler.

**ENGINE BRAKE TEST**

**WARNING:**

Before test, make sure that there is no car behind so as to prevent rear-end collision.

- While driving car in 3rd gear of D range, shift selector lever down to 2 range and check if engine brake operates.
- In the same way as in step 1, check engine brake for operation when selector lever is shifted down to L range.
- If engine brake fails to operate in above tests, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

| Condition                                     | Possible cause              |
|-----------------------------------------------|-----------------------------|
| Fails to operate when shifted down to 2 range | Second brake defective      |
| Fails to operate when shifted down to L range | 1st-reverse brake defective |

**"P" RANGE TEST**

- Stop car on a slope, shift selector lever to P range and at the same time apply parking brake.
- After stopping engine, release parking brake lever gradually and check that car remains stationary.



**SHIFT SOLENOID CHECK**

Whenever shift solenoids are removed from transmission, verify their valve function physically before they are reinstalled.

1. Apply oiler to solenoid and give compression by hands and then check to be sure that transmission fluid from oiler does not come out from side holes of solenoid when battery voltage is not conducted.
2. Holding the above condition, conduct battery voltage and then make sure that fluid is exhausted with vigor.

**NOTE:**

If fluid does not come out with vigor in above step 2 inspection, do not re-use that solenoid.

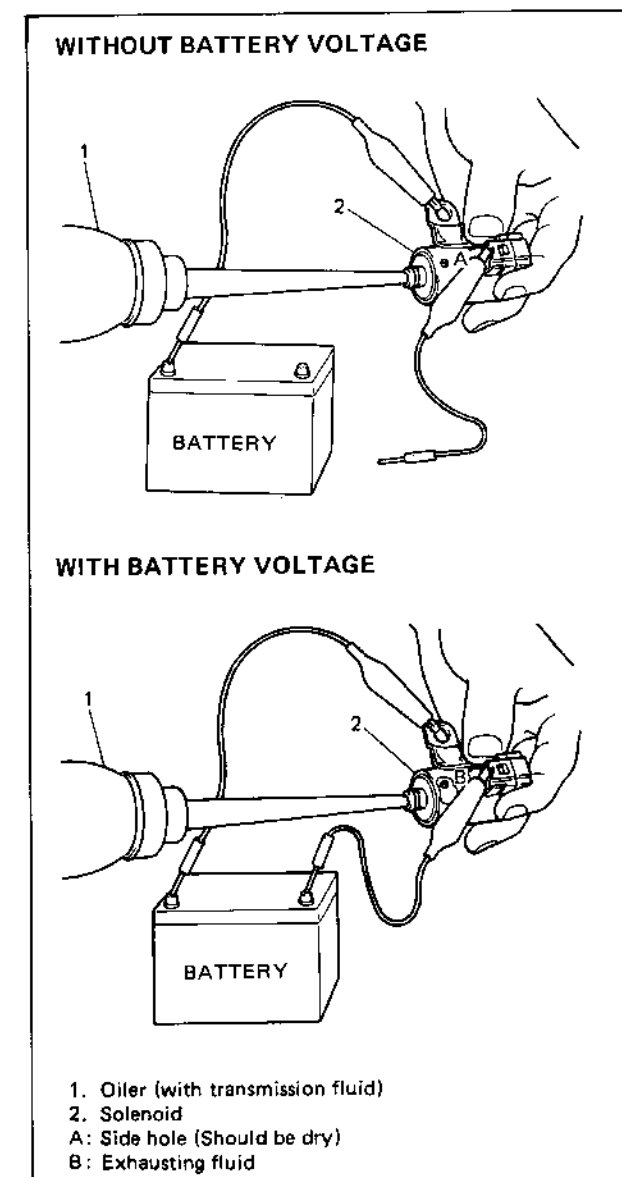


Fig. 7B-50 Checking Solenoid Valve Function

**ELECTRIC SHIFT CONTROL SYSTEM**

Process trouble shooting for electric control

system by using SELF-DIAGNOSIS and SYSTEMATIC TROUBLE SHOOTING and find a defective area reasonably.

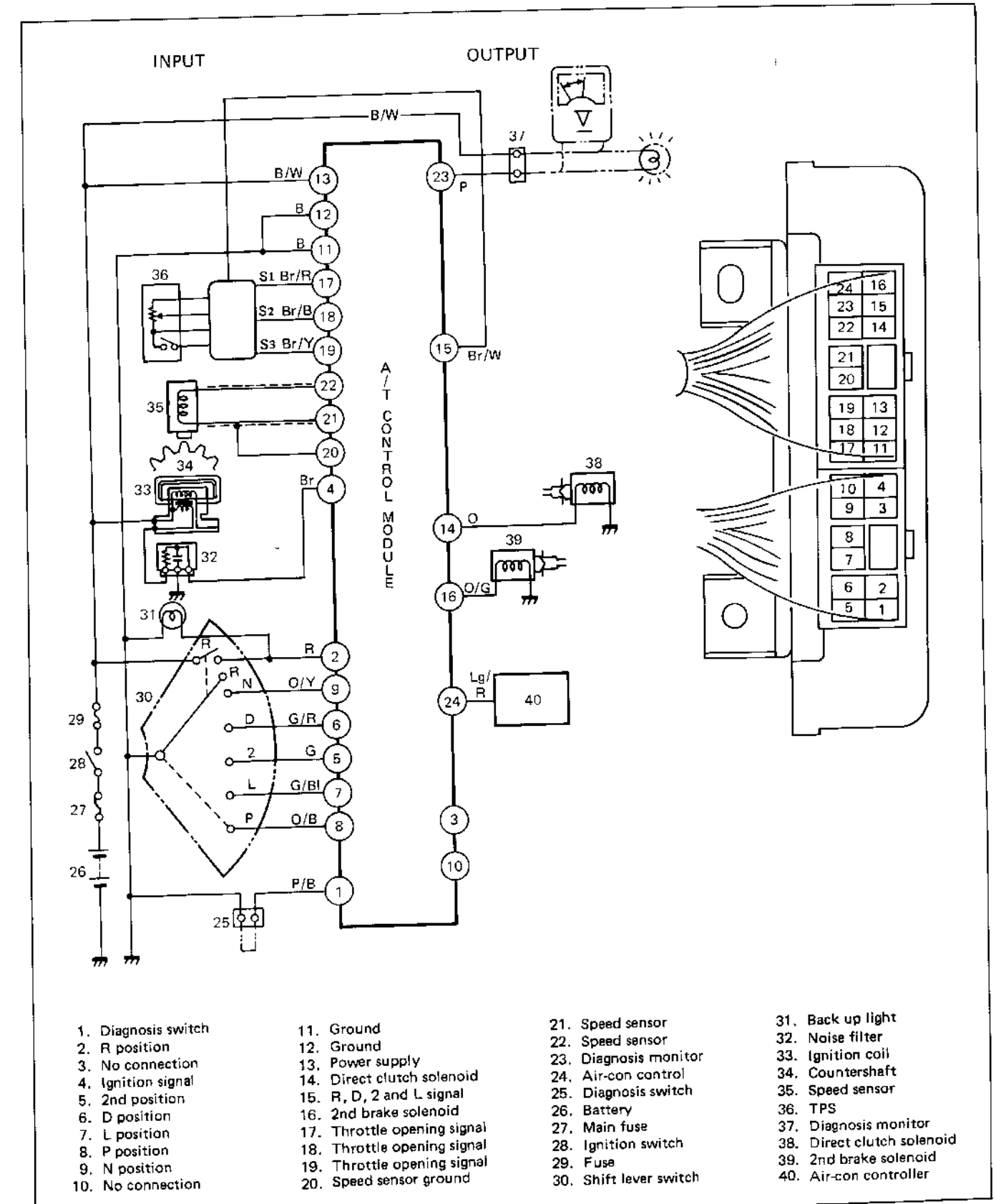


Fig. 7B-51 Gear Shift Control System Wiring Diagram

SELF-DIAGNOSIS

1. After test driving, hold engine running in P position applied with parking brake.
2. Connect voltmeter probes to monitor coupler (green coupler) under dash panel beside steering column at the right.
3. Using a coupler with lead, make a short circuit at DIAG SW coupler (black coupler) beside monitor coupler.
4. To read diagnostic code, watch swing of voltmeter indicator.

NOTE:

- Frequency of code signal is the same with the one for EFI. Refer to p. 6E-38.
- All applicable code will be indicated from smaller number to large number in order.
- Code memory, if any, will be erased when ignition switch is turned off.
- Instead of using voltmeter, code may be read by connecting small bulb (12V 1.4 or 3.4W) into monitor coupler.

- Ignition signal is used for fail-safe but it is not a factor of shift control.

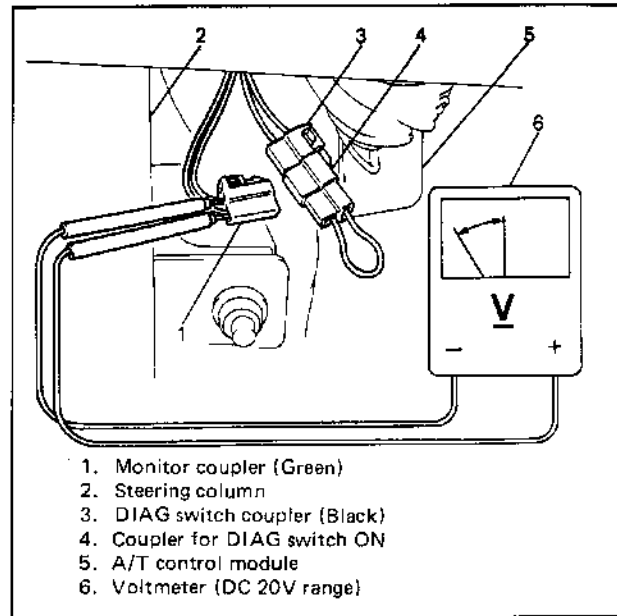


Fig. 7B-52 Monitoring Diagnostic Code

| Diagnostic Code |      | Diagnostic Area            | Diagnosis                                                                                                                                   |
|-----------------|------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| No.             | Mode |                            |                                                                                                                                             |
| 12              |      | Normal                     | No problem exists as far as self-diagnosis system is concerned.                                                                             |
| 21              |      | Direct clutch solenoid     | Open circuit.                                                                                                                               |
| 22              |      |                            | Short circuit to ground.                                                                                                                    |
| 23              |      | 2nd brake solenoid         | Open circuit.                                                                                                                               |
| 24              |      |                            | Short circuit to ground.                                                                                                                    |
| 25              |      | R, D, 2 and L range signal | Short circuit to ground in wiring to ECM. Use positions other than P or N for diagnosis.                                                    |
| 31              |      | Speed sensor               | Open circuit while running. However, this code does not appear once ignition switch is turned off.                                          |
| 32              |      | Shift lever switch         | 2 points or more are grounded at once or all points are open.                                                                               |
| 33              |      | Ignition signal            | No ignition signal for more than 9 seconds while running at 30 km/h (19 mile/h) or more with throttle position sensor opened more than 28%. |

SYSTEMATIC TROUBLE SHOOTING

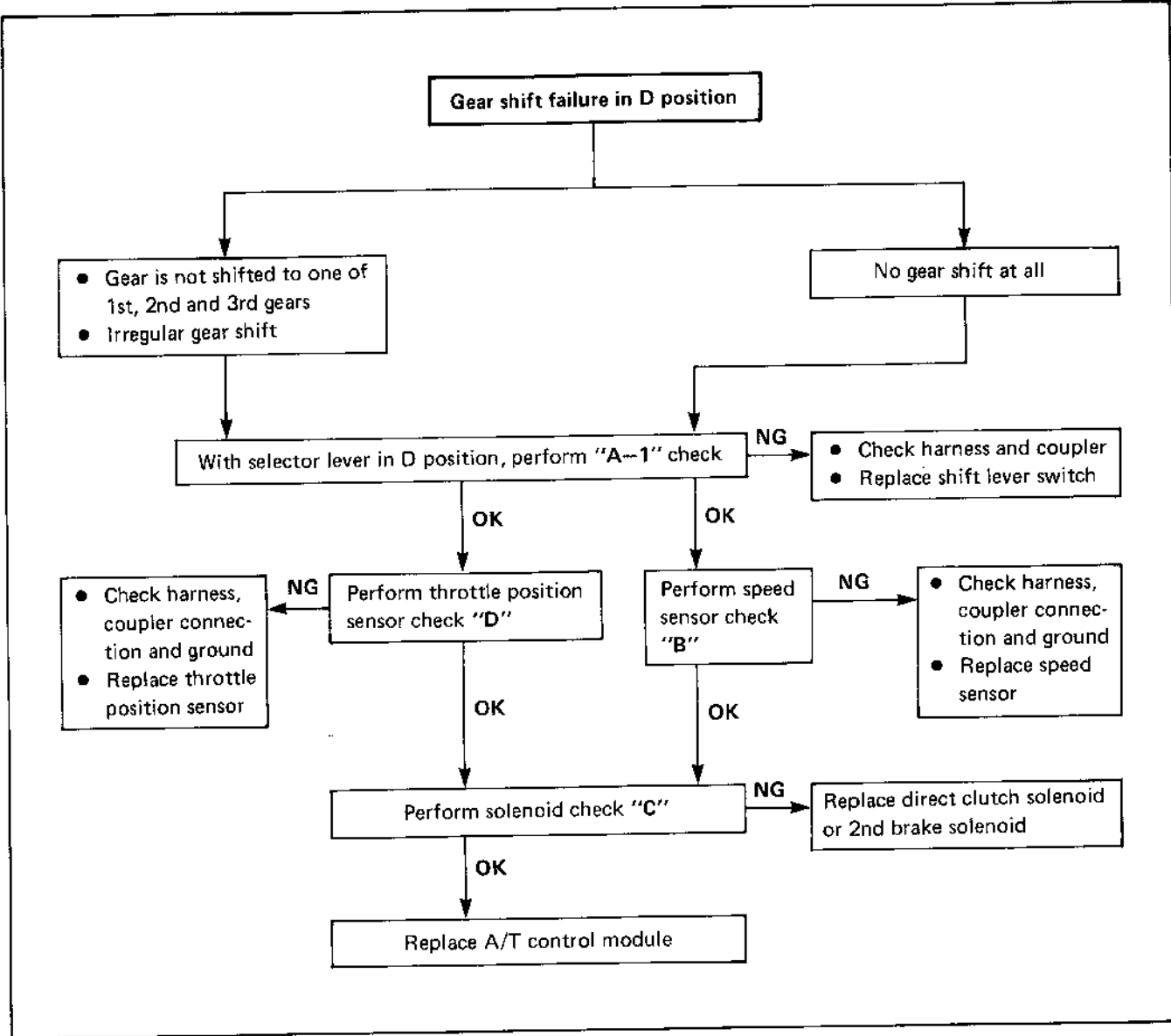


Fig. 7B-53 Gear Shift Failure in D

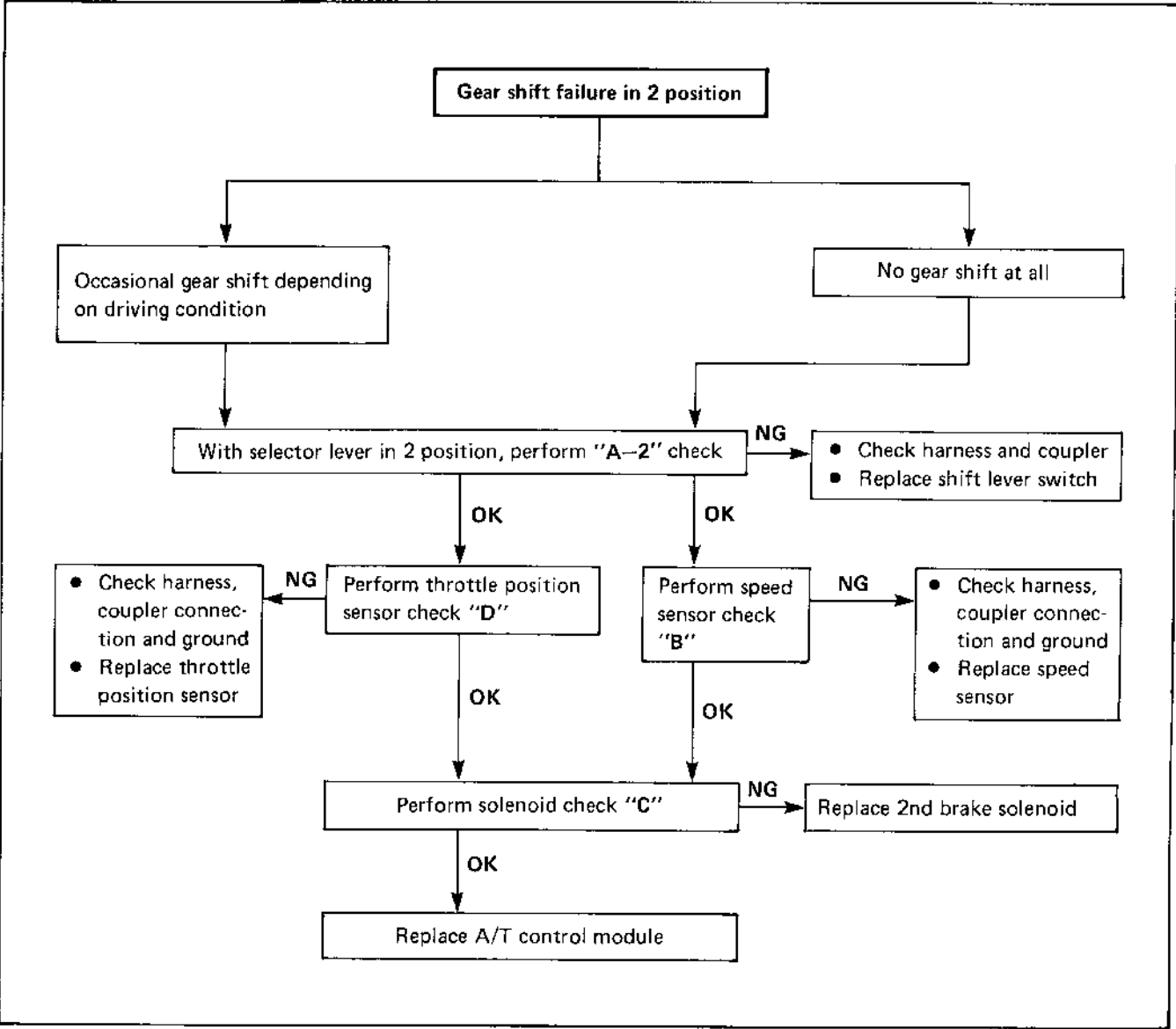


Fig. 7B-54 Gear Shift Failure in 2

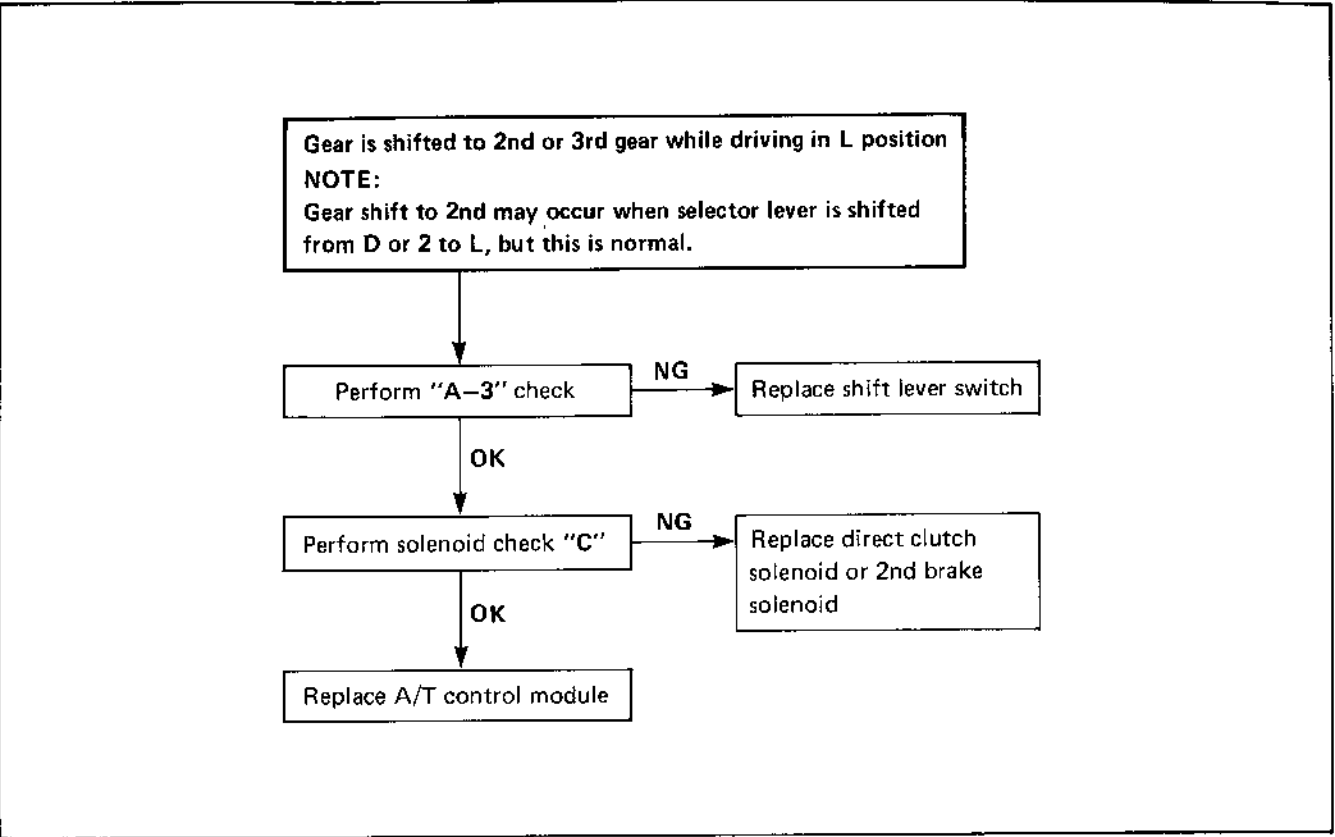


Fig. 7B-55 Gear Shift Failure in L

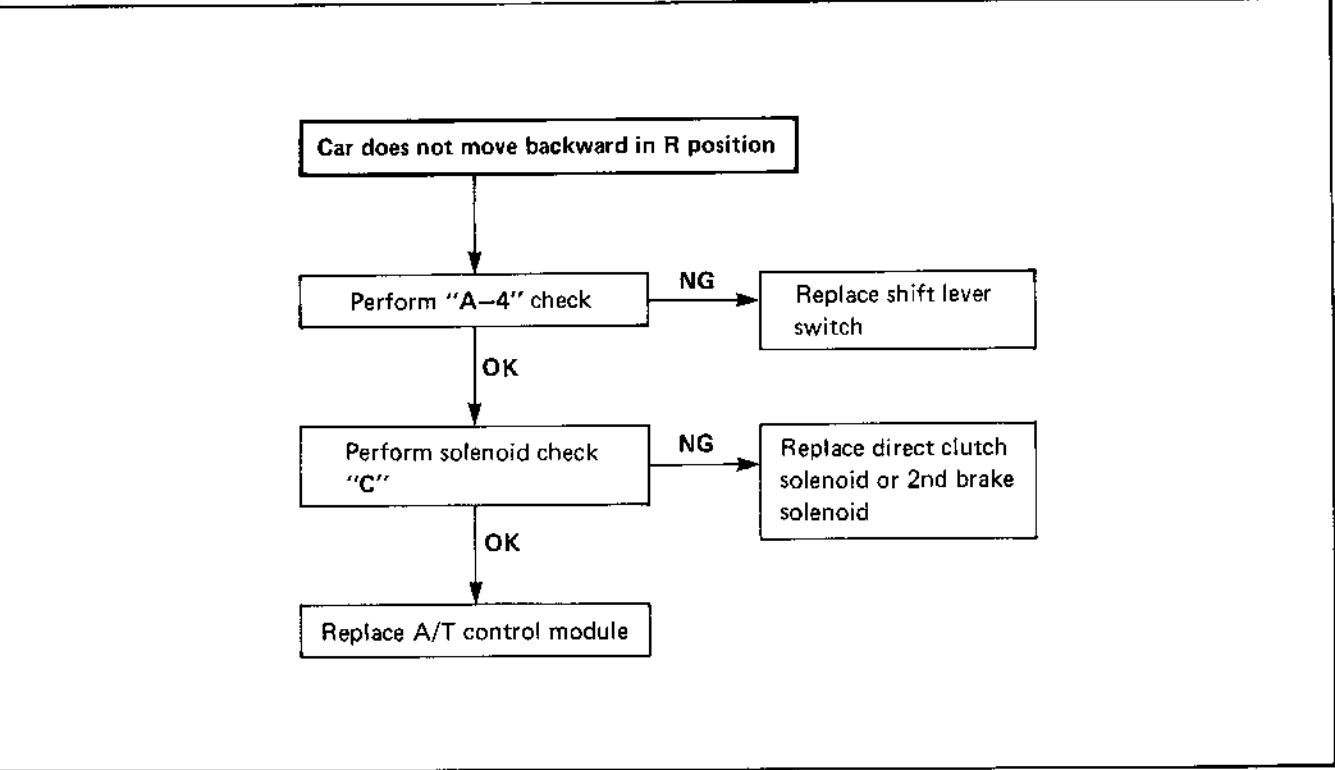


Fig. 7B-56 No Moving in R

## SHIFT LEVER SWITCH CHECKING PROCEDURE

1. Turn OFF ignition switch.
2. Disconnect couplers from A/T control module.
3. For each check, bring ohmmeter probes in touch with coupler terminals from harness side.

### A-1 Check Procedure

Shift selector lever in D and check continuity between following terminals

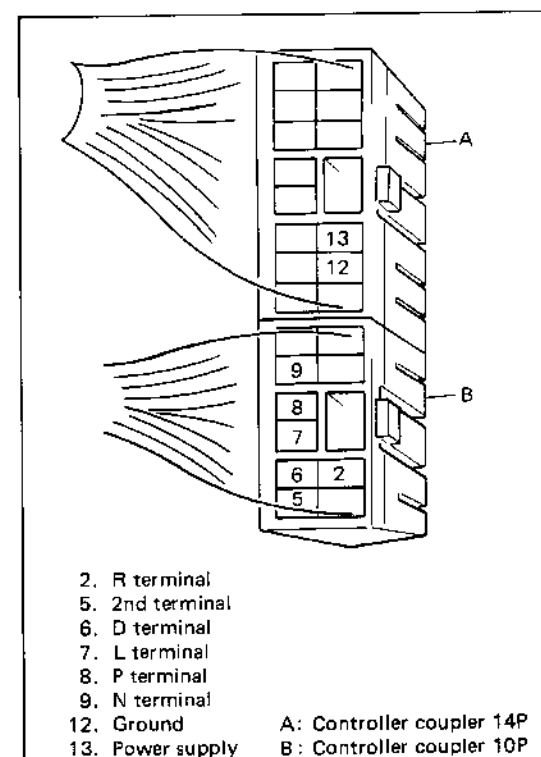
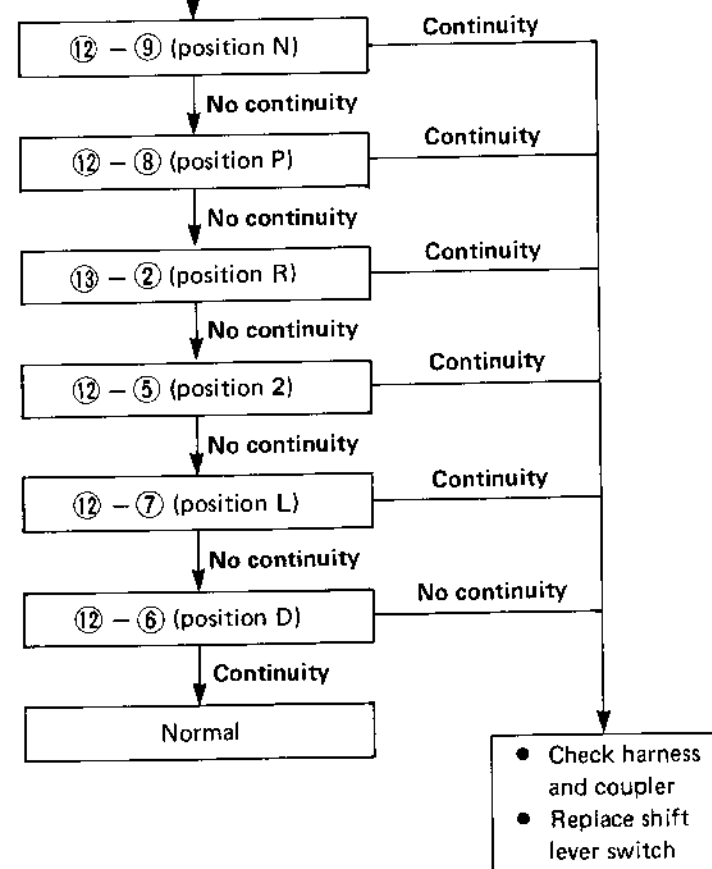


Fig. 7B-57 A-1 Check

### A-2 Check Procedure

Shift selector lever in 2 and check continuity between following terminals

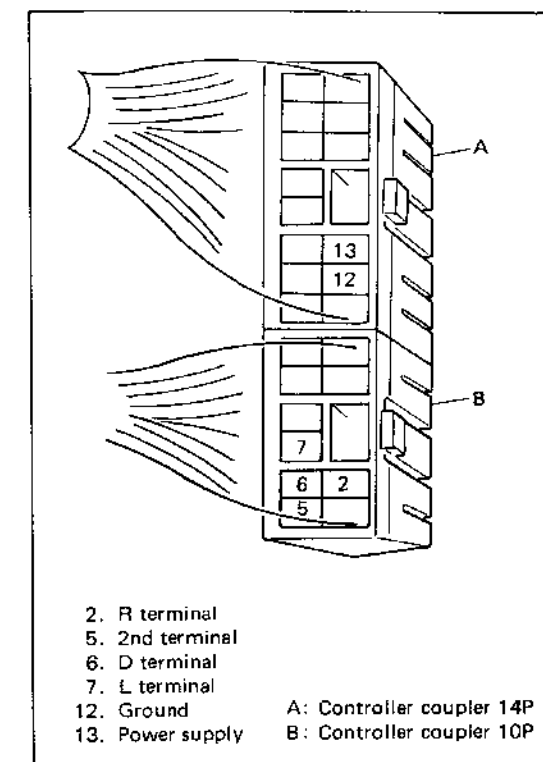
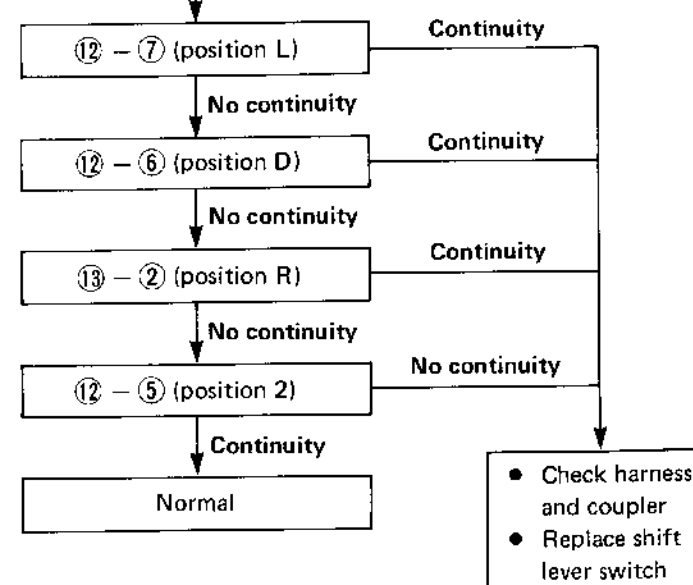


Fig. 7B-58 A-2 Check

### A-3 Check Procedure

Shift selector lever in L and check continuity between following terminals

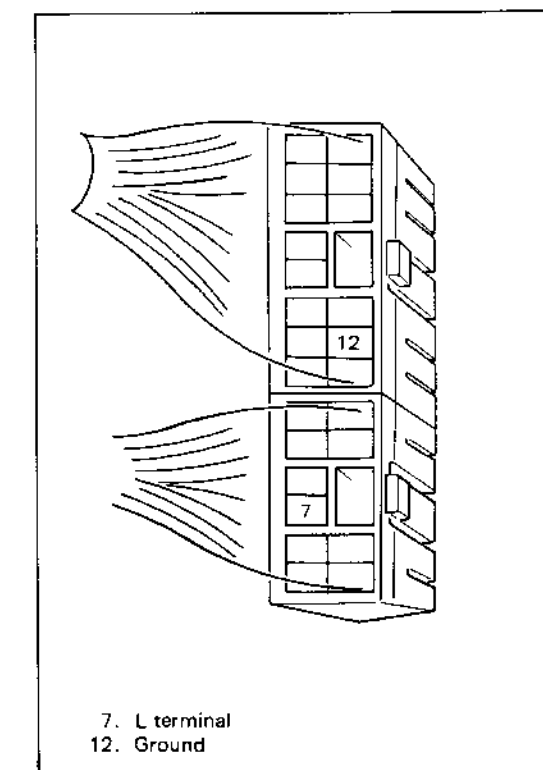
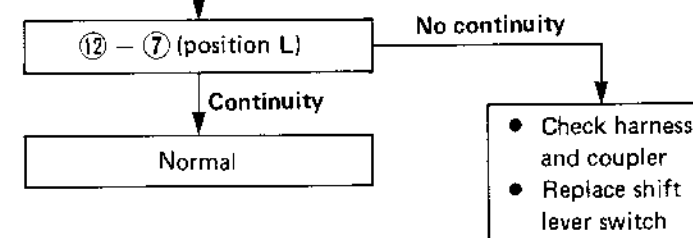


Fig. 7B-59 A-3 Check

**A-4 Check Procedure**

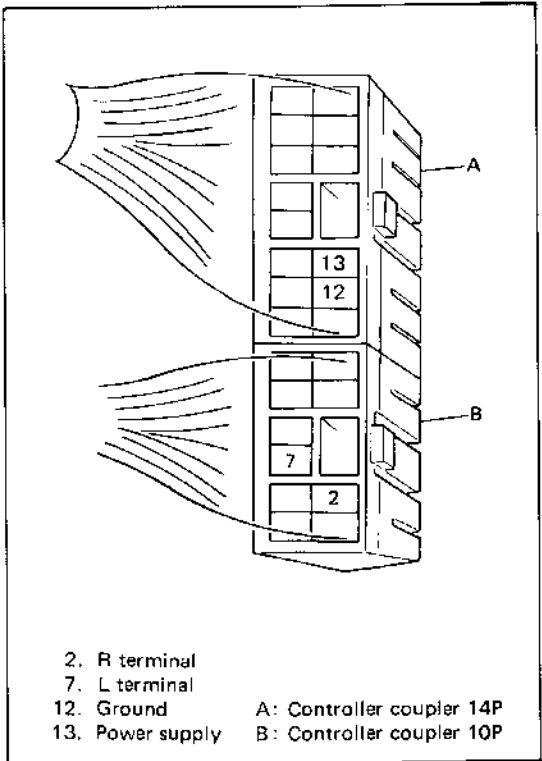
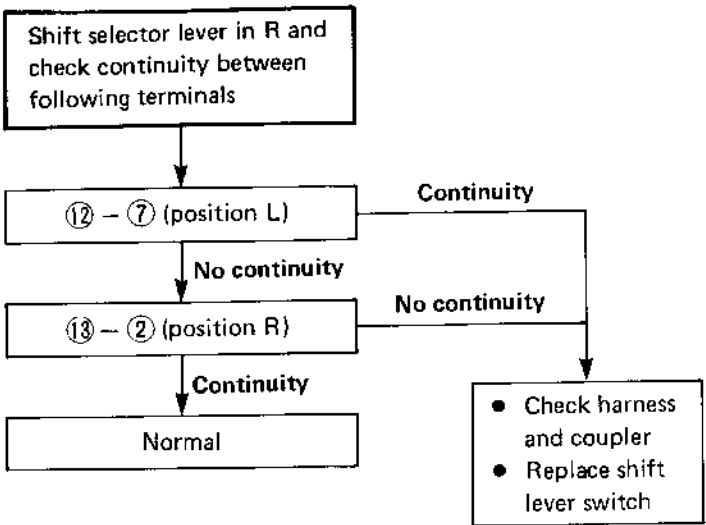


Fig. 7B-60 **A-4** Check

**N P Check Procedure**

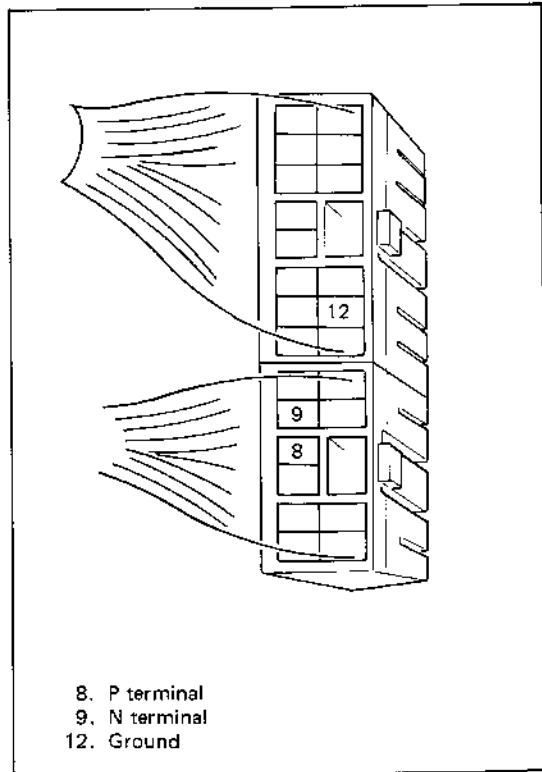
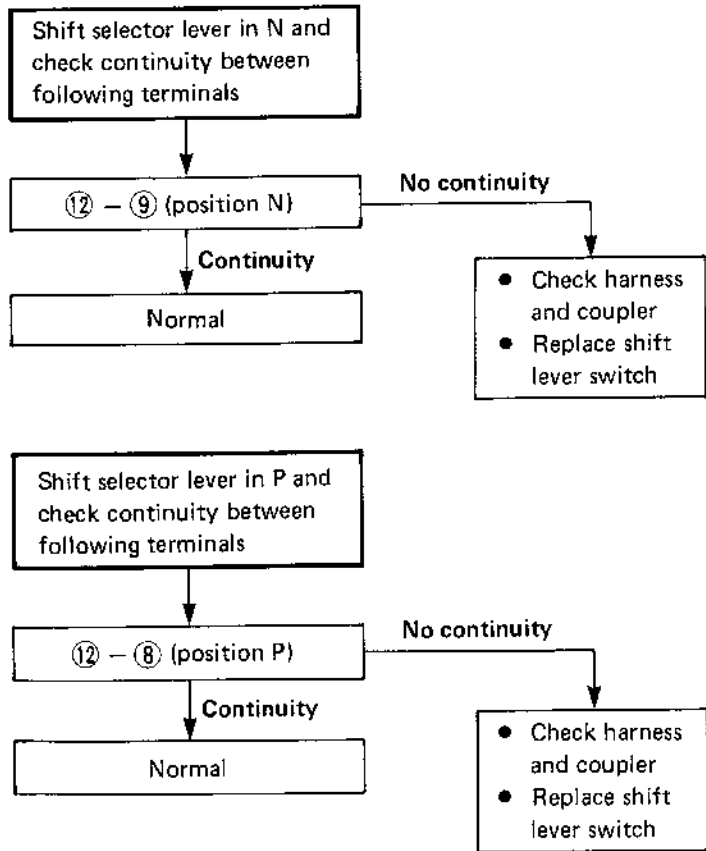


Fig. 7B-61 **N P** Check

Separately from the above inspection, shift lever switch itself can be checked on continuity

in each shift position. Refer to following table for connection and lead wire color.

| Position | Shift lever switch lead wire color |            |      |       |           |            |     |        |           |              |
|----------|------------------------------------|------------|------|-------|-----------|------------|-----|--------|-----------|--------------|
|          | Black                              | Blue/White | Blue | Green | Green/Red | Green/Blue | Red | Yellow | Black/Red | Black/Yellow |
| P        | ○                                  | ○          |      |       |           |            |     |        | ○         | ○            |
| R        |                                    |            |      |       |           |            | ○   | ○      |           |              |
| N        | ○                                  |            | ○    |       |           |            |     |        | ○         | ○            |
| D        | ○                                  |            |      | ○     |           |            |     |        |           |              |
| 2        | ○                                  |            |      |       | ○         |            |     |        |           |              |
| L        | ○                                  |            |      |       |           | ○          |     |        |           |              |

**SPEED SENSOR CHECKING PROCEDURE B**

1. Turn OFF ignition switch.
2. Disconnect coupler(s) from A/T control module.
3. Bring ohmmeter probes in touch with coupler terminals from harness side.

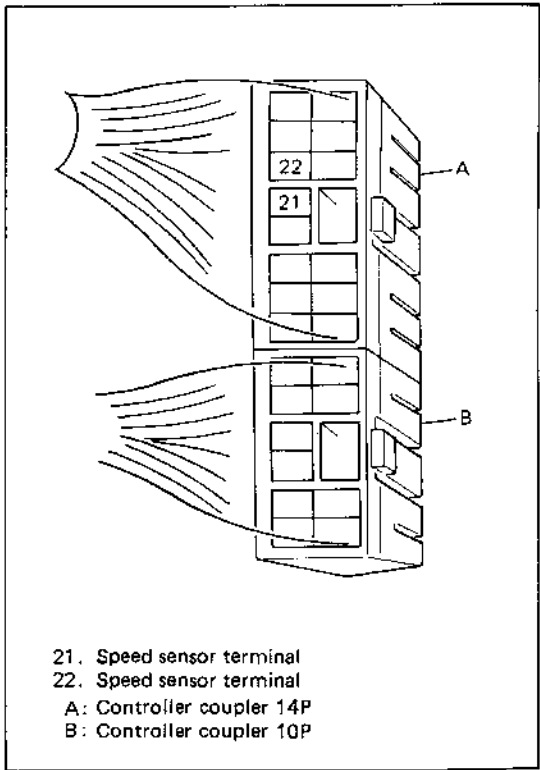
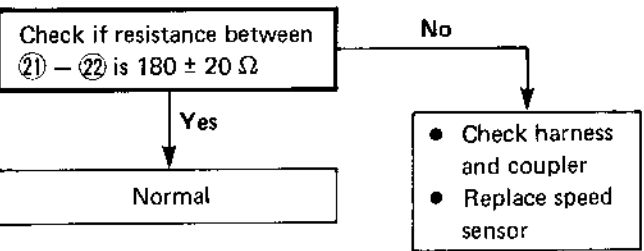


Fig. 7B-62 **B** Check

Separately from the above inspection, speed sensor itself can be checked on its resistance by disconnecting coupler.

**NOTE:**

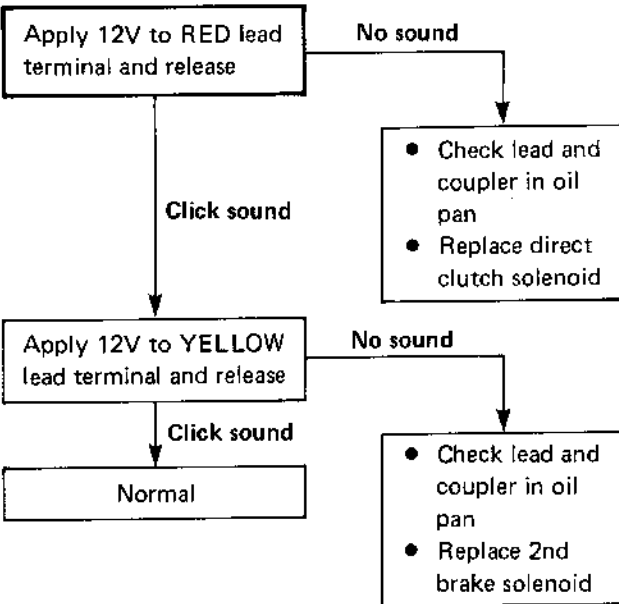
- Function of speed sensor can be checked by measuring generated pulse as voltage.
- For its measurement, use an analog type voltmeter while spinning wheels on lift and with selector lever in D position.

| Speed sensor specifications           |                  |
|---------------------------------------|------------------|
| Coil resistance                       | 180 ± 20 Ω       |
| Output voltage at 40 km/h (37 mile/h) | Approximately 1V |

**SHIFT SOLENOID CHECKING PROCEDURE**

**C**

1. Disconnect shift solenoid coupler from harness.
2. Apply 12V to each terminal in solenoid coupler and check to be sure that a click sound is heard.



**NOTE:**

Refer to 7B-34 for physical function check of solenoid valves.

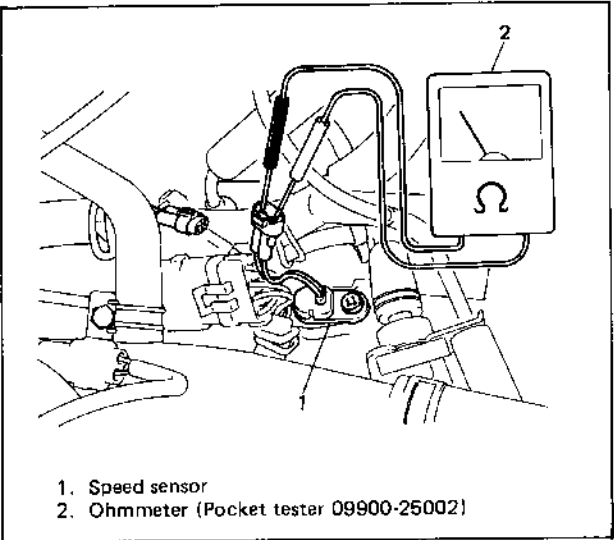


Fig. 7B-63 Checking Speed Sensor Resistance

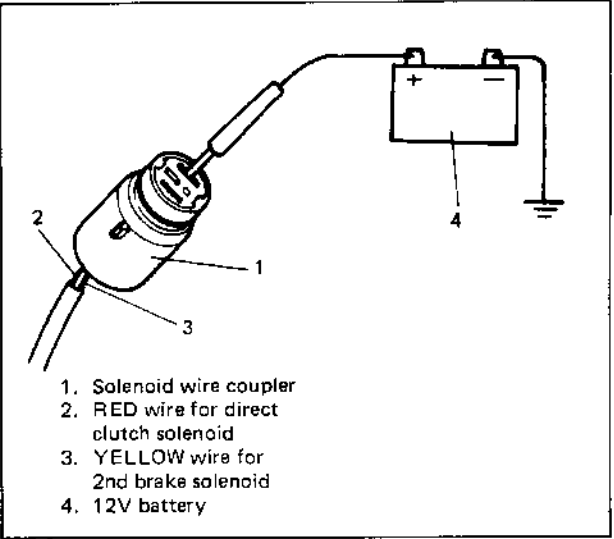


Fig. 7B-64 C Check

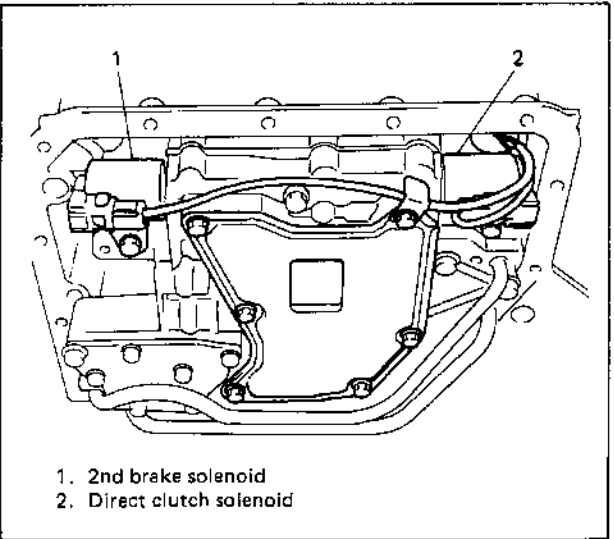


Fig. 7B-65 Direct Clutch and 2nd Brake Solenoid

Shift solenoid circuit will be checked by using ohmmeter at controller coupler.

1. With ignition switch turned OFF, disconnect controller coupler.
2. Bring ohmmeter probes in touch with coupler terminals from harness side and measure each resistance.

| Solenoid      | Terminal | Resistance |
|---------------|----------|------------|
| Direct clutch | ⑭ - ⑫    | 13 Ω       |
| 2nd brake     | ⑯ - ⑫    | 13 Ω       |

**THROTTLE VALVE OPENING SIGNAL**

**CHECKING PROCEDURE D**

1. Disconnect coupler(s) from A/T control module.
2. Bring voltmeter probes in touch with coupler terminals from harness side.

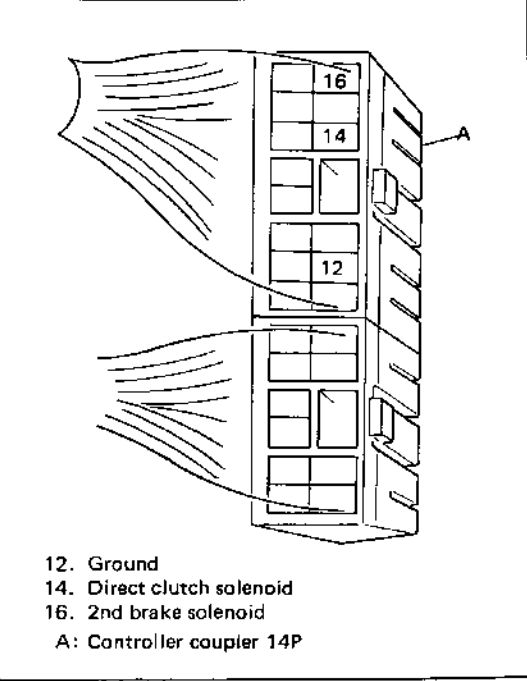
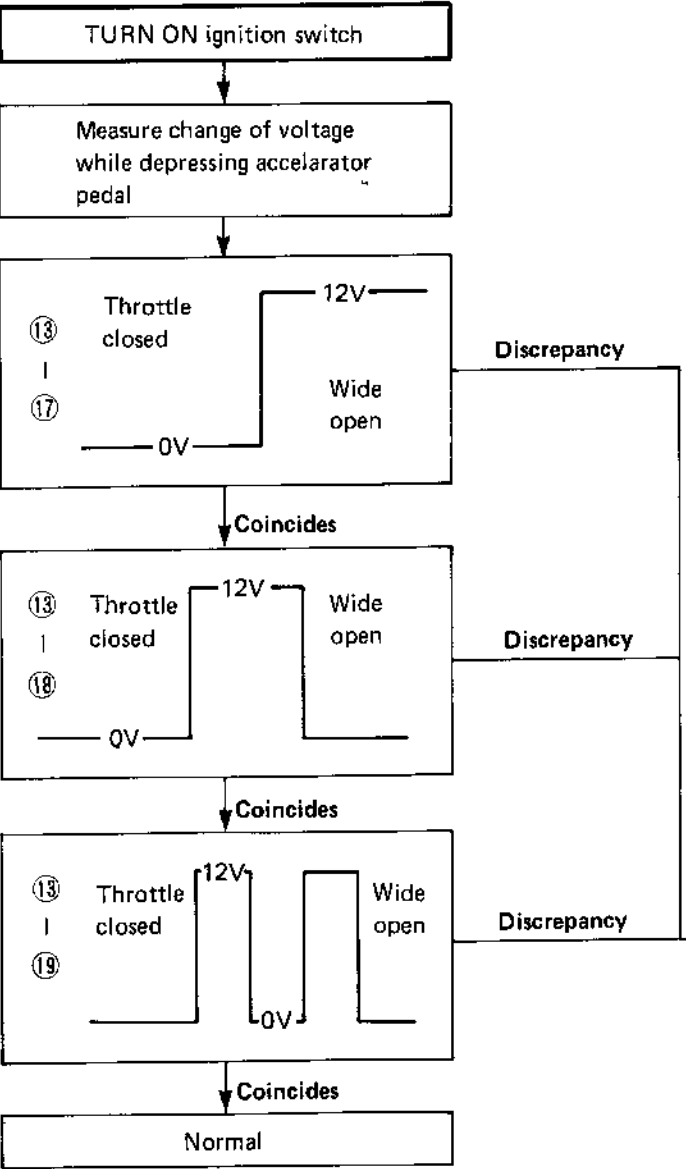


Fig. 7B-66 Checking Solenoid Circuit

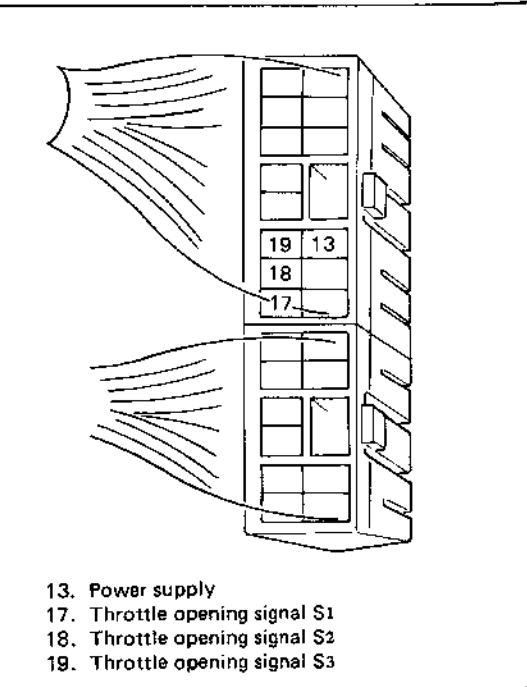


Fig. 7B-67 Checking Throttle Position Sensor



ON-CAR SERVICE

MAINTENANCE SERVICE

FLUID LEVEL

HOT Level Check at Normal Operating Temperature

Be sure to check fluid level at every engine oil change. As automatic transmission is designed to operate at normal operating temperature which corresponds to 70°C – 80°C (158°F – 176°F) of fluid, perform fluid level check when fluid temperature is within the above temperature range. Driving at 60 km/h (37 mile/h) in D range for about 15 minutes will raise fluid temperature to normal operating temperature.

- 1. Place car on level surface.
- 2. Apply parking brake and block car wheels.
- 3. With selector lever in P position, start engine. But DO NOT RACE ENGINE.
- 4. Run engine at idle speed and move selector lever through each range and put it in P position again.
- 5. With engine running at idle, remove oil level gauge from oil filler tube and wipe off oil level gauge with clean cloth.

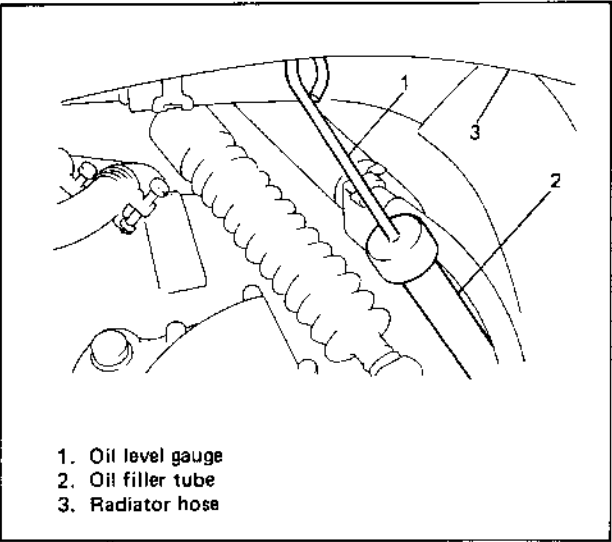


Fig. 7B-68 Oil Level Gauge and Oil Filler Tube

- 6. Reinsert oil level gauge all the way into oil filler tube.
- 7. Take up the gauge and check oil level on it. The level should be between FULL HOT and LOW HOT marks. If level is below LOW HOT mark, add fluid to bring level to FULL HOT mark.

NOTE:

- Do not overfill. Overfilling can cause foaming and loss of fluid through vent. Then slippage and transmission failure can result.
- Bringing fluid level from LOW HOT to FULL HOT requires 0.35 liters (0.74/0.62 US/Imp. pt).
- Lesser volume than following table may fill up transmission, in case that oil pan only is removed leaving valve body as it is and reinstalled soon.

| Fluid specification                    |
|----------------------------------------|
| DEXRON-II automatic transmission fluid |

| Fluid capacity                                        |                                   |
|-------------------------------------------------------|-----------------------------------|
| Pan and valve body removal (left for 2 hours or more) | 3.5 liters<br>3.7/3.1 US/Imp. qt. |
| Overhaul (assembled with a new torque converter)      | 4.9 liters<br>5.2/4.3 US/Imp. qt. |

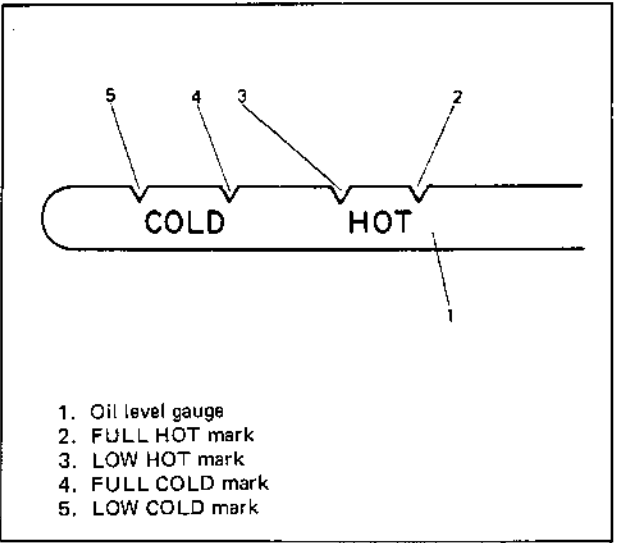


Fig. 7B-69 Fluid Level

COLD Level Check at Room Temperature of About 25°C (77°F)

If transmission was overhauled or fluid was drained for oil pan (and or valve body) service, refill fluid after assembling and check its level according to following procedure.

- 1. Place car on level surface.
- 2. Apply parking brake and block car wheels.
- 3. With selector lever in P position, start engine and run it at idle for 5 minutes. DO NOT RACE ENGINE.
- 4. Move selector lever through each range and put it in P position again.
- 5. With engine running at idle, check fluid level on oil level gauge. Fluid level should be between FULL COLD and LOW COLD marks on oil level gauge.
- 6. If level is below LOW COLD mark, add fluid to bring level between LOW COLD and FULL COLD marks. Use DEXRON-II or equivalent automatic transmission fluid. DO NOT OVER-FILL.

The above COLD level check is strictly temporary. Therefore, as a final check perform HOT level check at normal operating temperature as described previously.

FLUID CHANGE INTERVALS

Under normal driving conditions, change transmission fluid every 160,000 km (100,000 miles). However, if the car is usually used under one or more of following severe conditions, change fluid every 25,000 km (15,000 miles).

Severe Condition

- In heavy city traffic where outside temperature regularly reaches 32°C (90°F).
- In very hilly or mountainous areas.
- Commercial use, such as taxi, police car or delivery service.

CHANGING FLUID

- 1. Raise car.
- 2. With transmission cool, remove drain plug and drain fluid.

- 3. Install drain plug gasket and drain plug to oil pan, and tighten drain plug to specification.
- 4. Remove oil level gauge from oil filler tube, and add new fluid from oil filler tube. Use DEXRON-II or equivalent automatic transmission fluid.

NOTE:

- About 0.8 liters (0.8/0.7 US/Imp. qt.) of fluid would be necessary to refill oil pan.
- Draining or refilling volume of fluid may change depending on draining time or temperature etc.

| Tightening torque for drain plug | N-m     | kg-m      | lb-ft       |
|----------------------------------|---------|-----------|-------------|
|                                  | 18 – 23 | 1.8 – 2.3 | 13.5 – 16.5 |

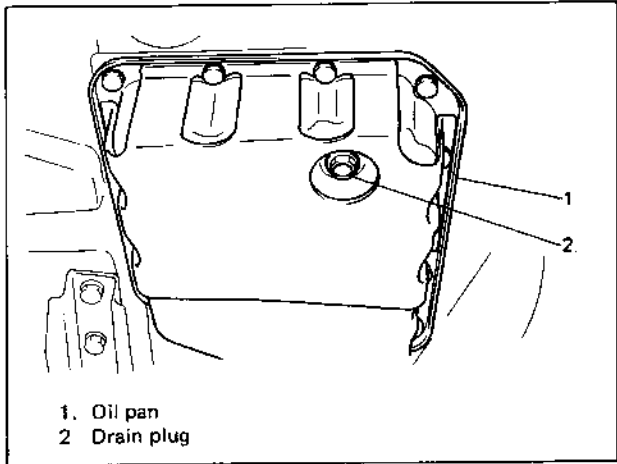


Fig. 7B-70 Drain Plug

- 5. Check fluid level with transmission at room temperature and at normal operating temperature as perviously outlined.

OIL COOLER HOSES

Rubber hoses for oil cooler should be replaced every 4 years or 75,000 km (45,000 miles), when replacing it, be sure to note the following.

- Replace clamps at the same time.
- Insert hose as far as its limit mark.
- Tighten clamps to specified torque.
- Check for fluid leakage after replacing.
- Confirm fluid level at normal operating temperature.

| Tightening torque for oil hose clamps | N-m | kg-cm | lb-in |
|---------------------------------------|-----|-------|-------|
|                                       | 1.5 | 15    | 13    |

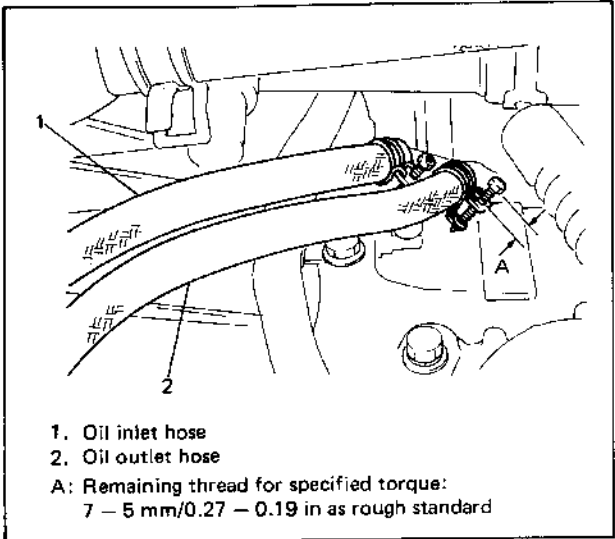


Fig. 7B-71 Oil Cooler Hoses

OIL PAN GASKET

REMOVAL

1. Raise car and drain transmission fluid.
2. Oil pan from transmission.  
After removing oil pan bolts, tap around oil pan lightly with a plastic hammer for removal.

CAUTION:

- Never hammer oil pan hard, or it may get deformed. It is recommended to hit oil pan indirectly through wood block.
- Do not force oil pan off by using a flat tip screwdriver or the like as it may cause damage to gasketed surface.

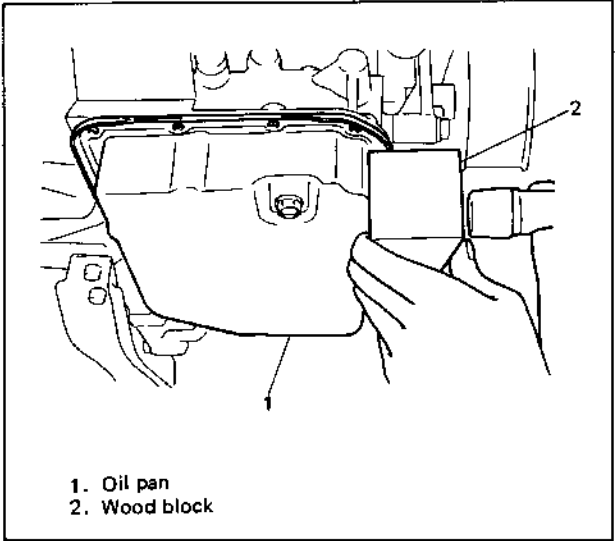


Fig. 7B-72 Removing Oil Pan

3. Oil pan gasket.  
Remove gasket on mating surface thoroughly.

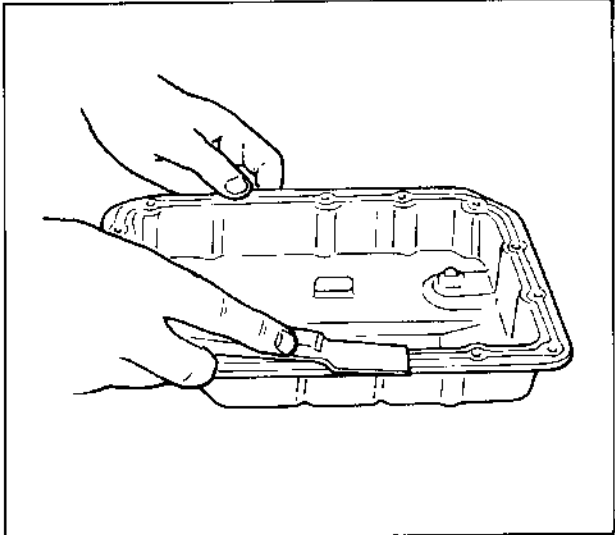


Fig. 7B-73 Removing Oil Pan Gasket

INSTALLATION

- For oil pan installation, reverse its removal procedure using care for the following.
1. Make sure to use new gasket.
  2. Clean inside of oil pan before installation.
  3. Clean oil cleaner magnet and install it in the position right below oil strainer.

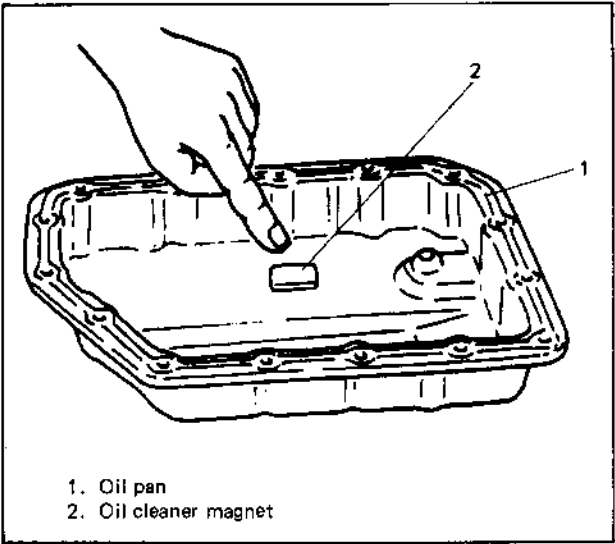


Fig. 7B-74 Oil Cleaner Magnet Installation

4. There are 15 oil pan securing bolts in all and two of them have cross slot in their heads. Mount these cross slotted bolts in such positions as shown in figure after applying sealant to their threads. However, do not apply sealant to other 13 bolts.
5. Tighten oil pan bolts to the following torque one after another diagonally.

CAUTION:

- Do not use sealant to gasket surface.
- Over tightening of bolts may cause fluid leakage.

| Tightening torque for oil pan bolt | N·m   | kg·m      | lb·ft     |
|------------------------------------|-------|-----------|-----------|
|                                    | 4 - 6 | 0.4 - 0.6 | 3.0 - 4.0 |

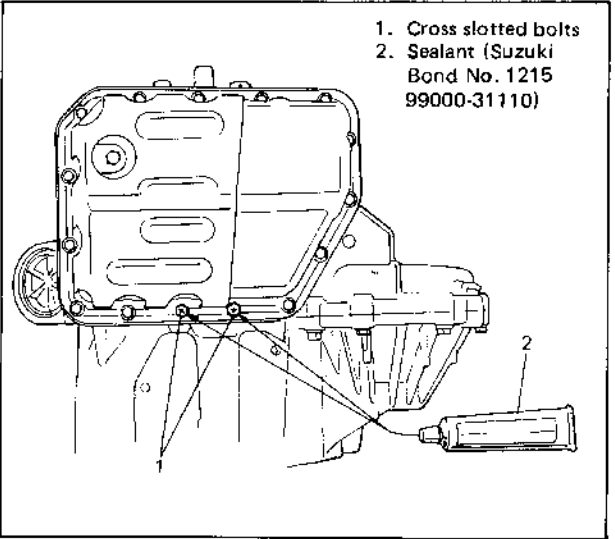


Fig. 7B-75 Oil Pan Bolt Installation

6. Upon completion of installation, warm up transmission and check for fluid level and leakage.

OIL STRAINER

1. Drain transmission fluid.
2. Remove oil pan.
3. Remove oil strainer.
4. Clean oil strainer.
5. Install oil strainer to lower valve body.
6. Reinstall oil pan and refill transmission fluid.
7. Upon completion of installation, warm up transmission and check for fluid level and leakage.

| Tightening torque for oil strainer bolts | N·m   | kg·m      | lb·ft |
|------------------------------------------|-------|-----------|-------|
|                                          | 5 - 6 | 0.5 - 0.6 | 4.0   |

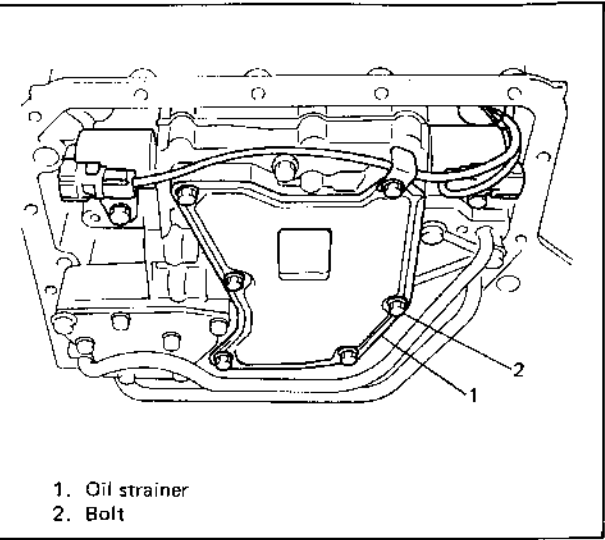


Fig. 7B-76 Oil Strainer

SHIFT SOLENOIDS

REMOVAL

1. Drain transmission fluid and remove oil pan.
2. Couplers from direct clutch and 2nd brake solenoids, and then solenoids themselves.
3. Solenoid wire harness with grommet from upper side.

| Tightening torque for shift solenoid bolts | N·m   | kg·m      | lb·ft     |
|--------------------------------------------|-------|-----------|-----------|
|                                            | 7 - 9 | 0.7 - 0.9 | 5.5 - 6.5 |

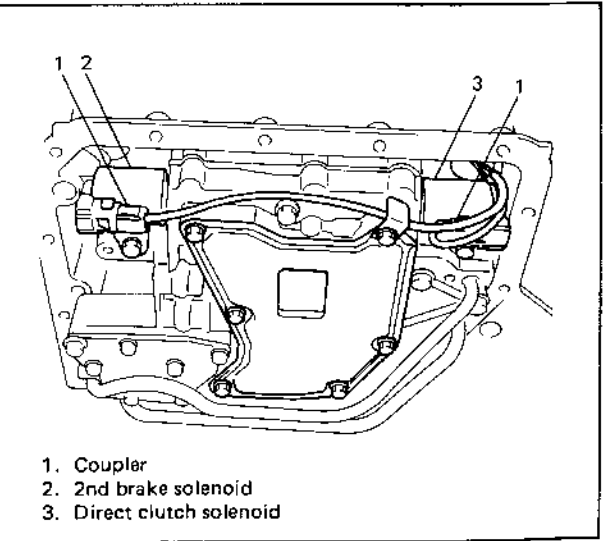


Fig. 7B-77 Solenoids

INSTALLATION

1. Solenoid wire harness to transmission case. If grommet seal (O ring) is damaged, replace.



2. Direct clutch and 2nd brake solenoids to lower valve body. If solenoid seal (O ring) is damaged, replace.
3. Solenoid wires to each solenoid.
4. Oil pan to transmission and then refill transmission fluid.
5. Solenoid wire harness coupler.
6. Upon completion of installation, warm up transmission and check for fluid level and leakage.

## SPEED SENSOR

1. Undo wiring harness clamp.
2. Disconnect speed sensor coupler.
3. Remove speed sensor bolt.
4. Pull out speed sensor by gripping sensor body.
5. For installing, reverse removal procedure.

### NOTE:

Check to be sure that O ring is in good condition.

| Tightening torque for speed sensor bolt | N-m | kg-m    | lb-ft   |
|-----------------------------------------|-----|---------|---------|
|                                         | 7-9 | 0.7-0.9 | 5.5-6.5 |

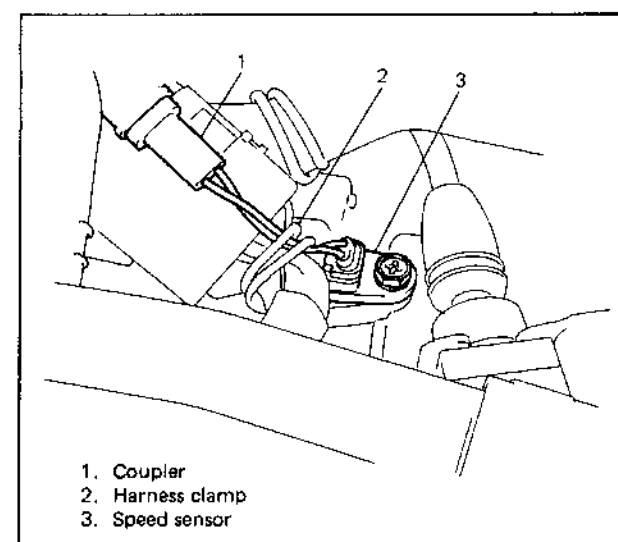


Fig. 7B-78 Speed Sensor

## OIL PRESSURE CONTROL CABLE REMOVAL

1. Oil pressure control cable from accelerator cable after removing cable cover.
2. Drain transmission fluid.
3. Oil pan.
4. Oil pressure control cable from throttle valve cam.

5. Oil pressure control cable from transmission case.

### NOTE:

Oil pressure control cable can be disconnected from throttle valve cam without removal of 2nd brake solenoid.

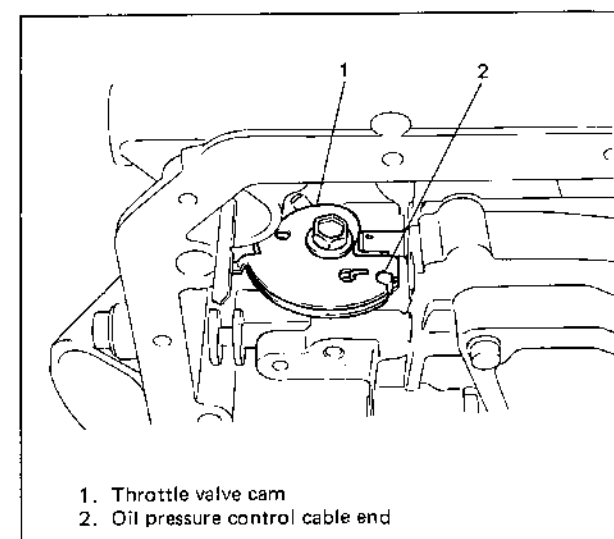


Fig. 7B-79 Throttle Valve Cam

## INSTALLATION

Reverse removal procedure for installation. After connecting oil pressure control cable to accelerator cable, check and adjust oil pressure control cable play.

### ADJUSTMENT

1. With cable cover removed, adjust clearance A to specification by turning nuts B. Nuts C can be used for this adjustment if necessary.
2. Tighten nuts and install cable cover.

|                           |                           |
|---------------------------|---------------------------|
| Control cable clearance A | 0 - 0.5 mm<br>0 - 0.02 in |
|---------------------------|---------------------------|

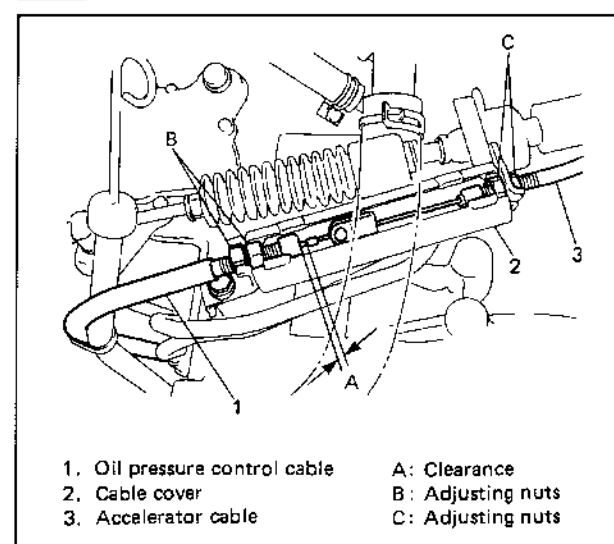


Fig. 7B-80 Adjusting Oil Pressure Control Cable

## BACK DRIVE SYSTEM

This system is a safety device to prevent select lever from being released from P position without using ignition key and steering lock from operating while driving (i.e. ignition key cannot be turned to LOCK position or taken out of key slot unless selector lever is in P position). Three mechanisms in it are as follows.

### 1. STEERING LOCK

When selector lever is in positions other than P, lock lever interrupts key cylinder to turn to LOCK position, thus steering is kept to be operated free. However, when selector lever is shifted in P, lock lever is released, thus allowing ignition key to be removed and then steering is locked.

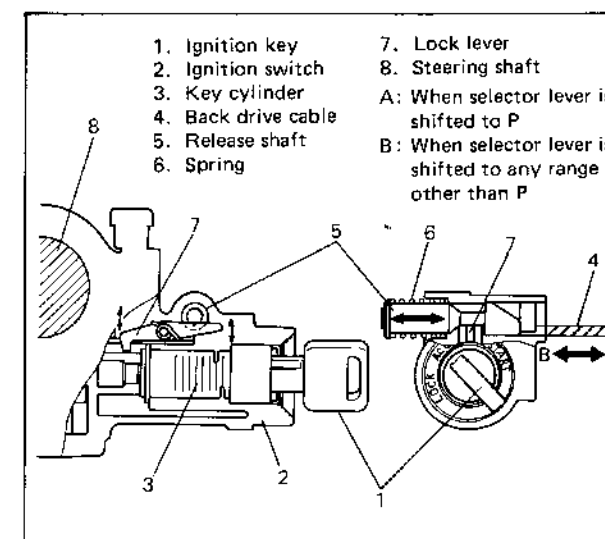


Fig. 7B-81 Ignition Switch Lock Mechanism

### 2. BACK DRIVE SOLENOID

Unless ignition key is turned ON, selector lever is kept in P by interruption of lock plate which is pushed by solenoid spring. However, when key is switched ON, lock plate is turned back by solenoid magnetic force, thus allowing selector lever to be shifted.

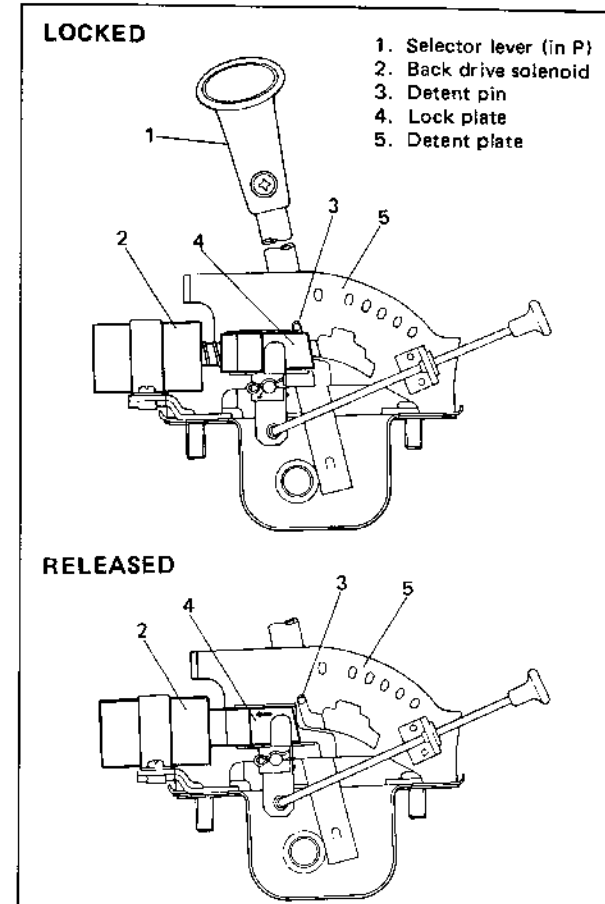


Fig. 7B-82 Back Drive Solenoid

### 3. MANUAL RELEASE

As an auxiliary device, manual release is equipped.

Without ignition key, shift lock can be released by pulling release knob.

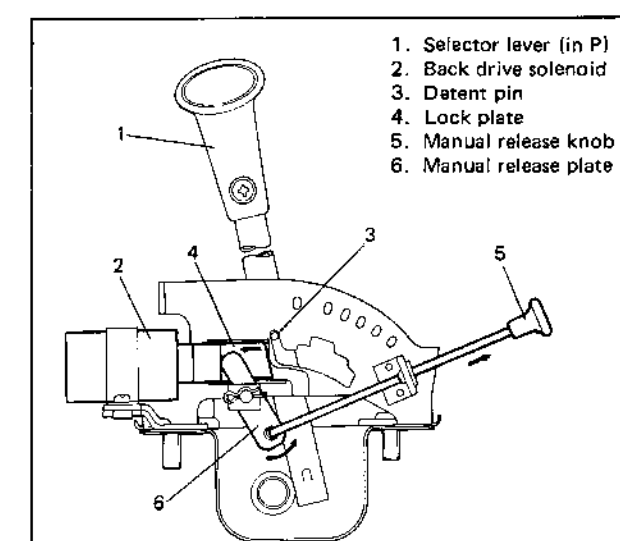


Fig. 7B-83 Manual Release

## BACK DRIVE SOLENOID

1. Remove console box, parking brake lever cover, shift control lever cover, and then select indicator.
2. Replace back drive solenoid.
3. Install indicator and covers as they were.

### NOTE:

- Shift selector lever to L to facilitate work.
- Apply grease to sliding portion and make sure that lock plate slides smoothly when manual release knob is pulled and released.
- Check that detent pin is locked at P position by lock plate.
- Check to confirm that lock plate is pulled in when ignition key is turned ON, so allowing detent pin to be pushed down.

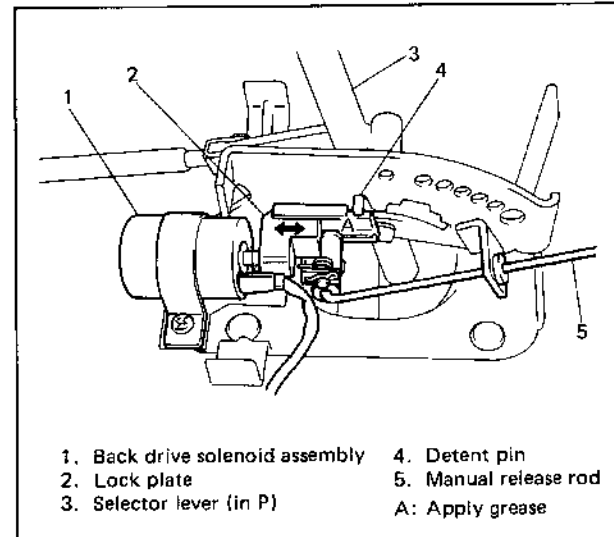


Fig. 7B-84 Installing Back Drive Solenoid

## BACK DRIVE CABLE

### REMOVAL AND INSTALLATION

1. Remove steering column cover and column hole cover by removing their fastening screws.
2. Remove back drive cable clamp screw located at steering lock.
3. Push in release shaft A fully and disconnect cable end.

### NOTE:

- Removal of steering column nuts may extend head clearance of clamp screw and allow easy removal/installation.
- If necessary, hand-make very short screwdriver for this removal/installation.
- Do not remove release shaft E ring.

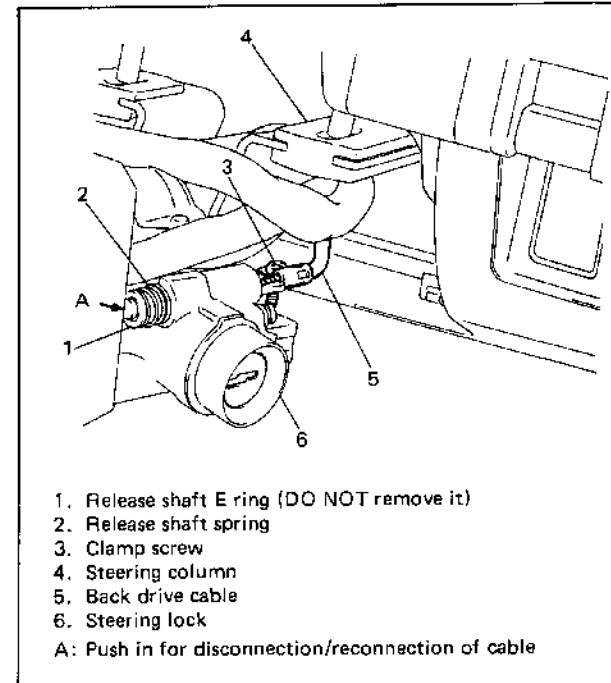


Fig. 7B-85 Back Drive Cable at Steering Lock

4. With console box and parking brake lever cover removed, take out cable by loosening nut and removing clip in manual selector.
5. To install a new cable, reverse removal procedure.

### ADJUSTMENT

1. With cable nuts A and B loosened, shift selector lever to P.
2. While pulling outer cable in arrow C direction in figure all the way, align nut B with bracket and tighten lock nut A.

### NOTE:

- When outer cable is pulled in arrow C direction, release shaft spring in steering lock should be depressed fully.
- Make sure that ignition key can be turned from ACC to LOCK and removed from key cylinder when selector lever is in P.
- Make also sure that key can not be turned to LOCK when selector lever is in any other than P.

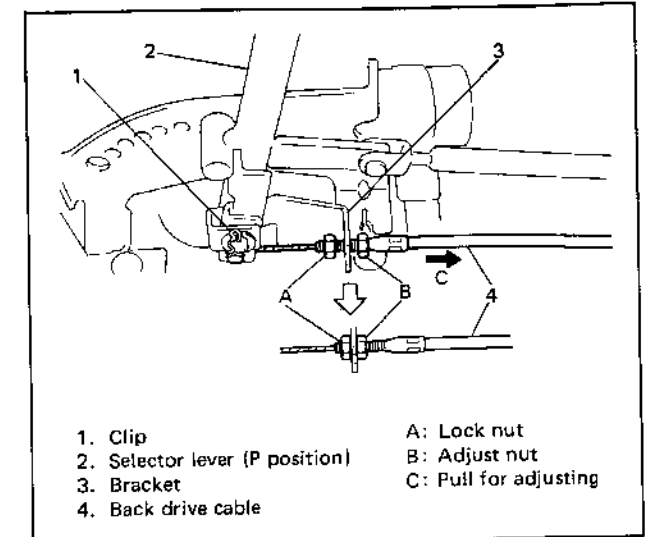


Fig. 7B-86 Adjusting Back Drive Cable

## SELECT CABLE

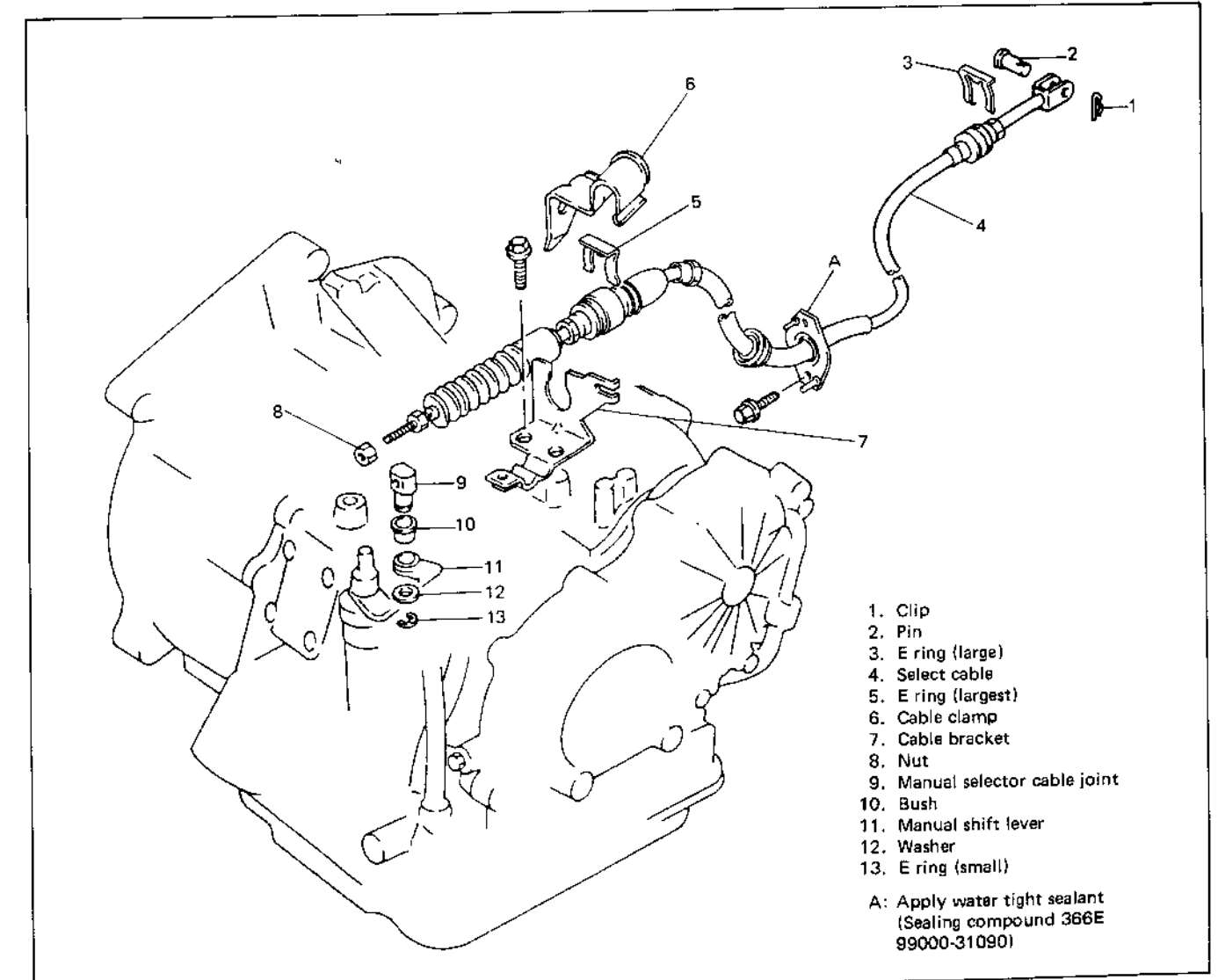


Fig. 7B-87 Select Cable Components

**REMOVAL**

1. Console box, if equipped.
2. Parking brake lever cover and shift control lever cover.
3. Select indicator.
4. Select cable from selector lever and then from floor bracket.
5. Select cable from transmission.
6. Select cable from dash panel.

**INSTALLATION**

Install select cable by reversing removal procedure. Apply grease to pin and cable joint. Adjusting procedure is as follows.

**ADJUSTMENT**

1. Before tightening cable end nut, shift selector lever to N.
2. Also shift manual shift lever to N.

**NOTE:**

Make sure that nut and cable joint have clearance under above conditions.

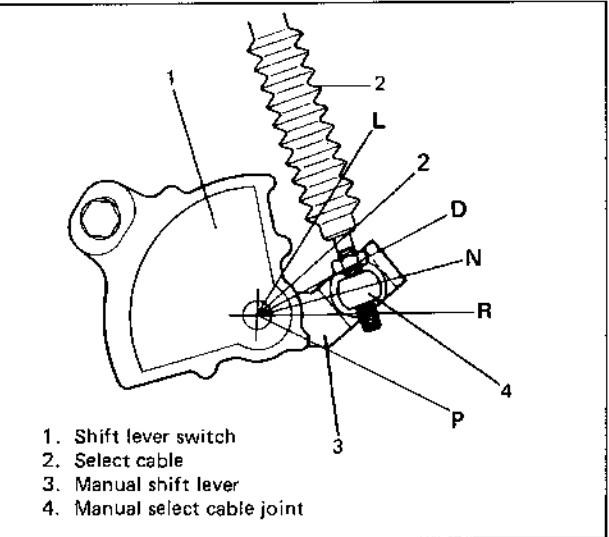


Fig. 7B-88 Shifting Manual Selector and Manual Shift Lever to N

3. Turn nut A by hand till it contacts manual select cable joint. Then tighten nut B with wrench.

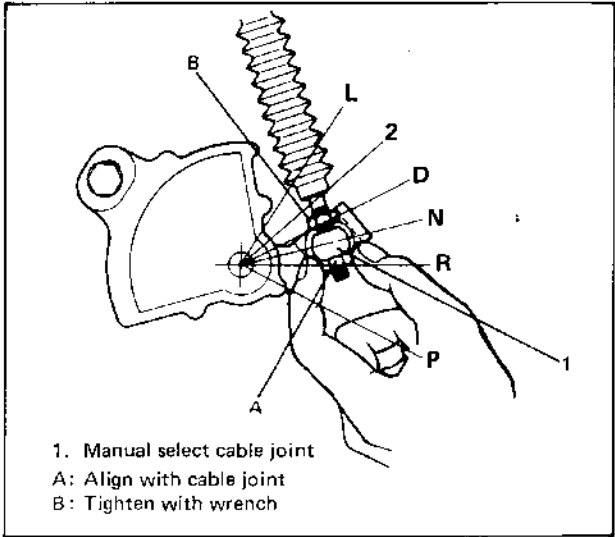


Fig. 7B-89 Fastening Cable End Nuts

4. After select cable was installed, check for the following.
  - Push car with selector lever shifted to P. Car should not move.
  - Car can not be driven in N.
  - Car can be driven in D, 2 and L.
  - Car can be backed in R.

**SHIFT LEVER SWITCH**

**REMOVAL**

1. Shift lever switch coupler.
2. Shift lever switch from transmission.

**CAUTION:**  
Do not overhaul shift lever switch.

**INSTALLATION**

1. Shift manual shift lever to N, that is, to shift selector lever to N.

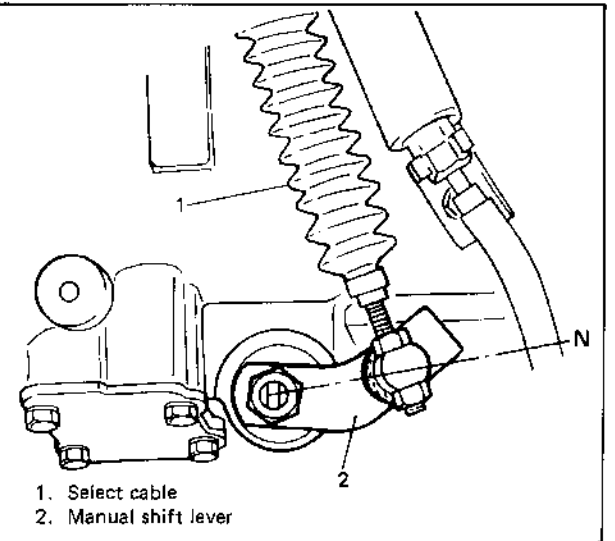


Fig. 7B-90 Manual Shift Lever in N Position

2. Using flat tip screwdriver, turn shift lever switch joint clockwise or counterclockwise to the position shown in figure and check that a "click" is heard from joint at this position.

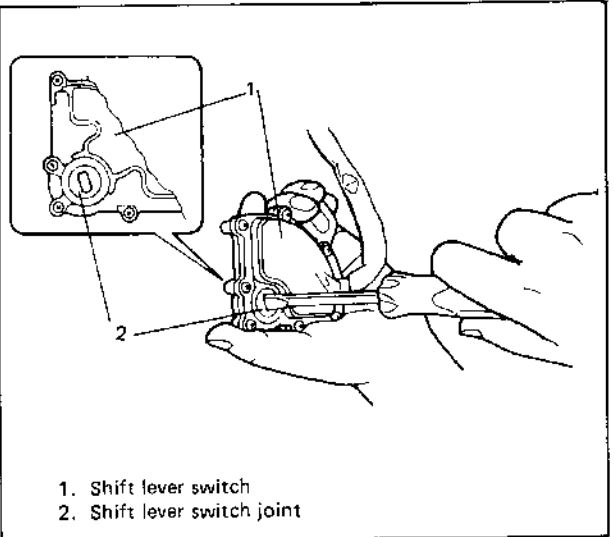


Fig. 7B-91 Shift Lever Switch Joint

3. After installing shift lever switch to manual shift shaft, move shift lever switch by hand in arrow direction as shown in figure. Stop at the position where a "click" from joint is heard or felt by hand and then secure it.

| Tightening torque for shift lever switch bolt | N·m     | kg·m      | lb·ft      |
|-----------------------------------------------|---------|-----------|------------|
|                                               | 13 - 23 | 1.3 - 2.3 | 9.5 - 16.5 |

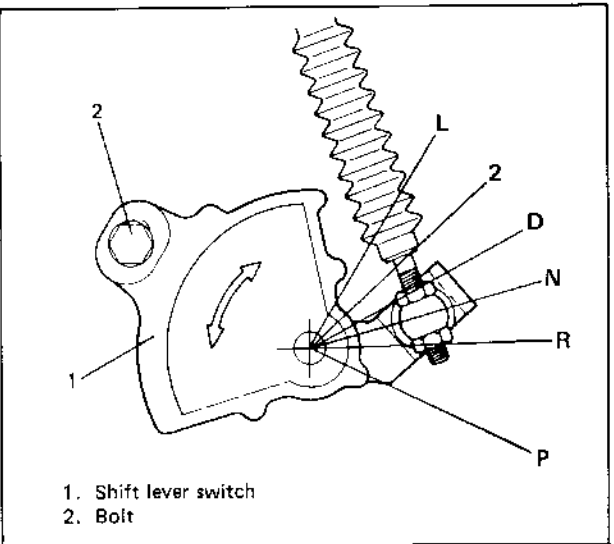


Fig. 7B-92 Adjusting Shift Lever Switch Position

4. Coupler and clamp.
5. Upon completion of shift lever switch installation, check for its proper installation according to the following.
  - 1) Apply parking brake and block car wheels.
  - 2) With selector lever shifted to P, turn starter switch ON and check that this causes starting motor to operate.
  - 3) Shift selector lever from P to N, turn starter switch ON and check that this causes starting motor to operate.
  - 4) Shift selector lever from N to L and then back to N, turn starter switch ON and check that this causes starting motor to operate.
  - 5) Shift selector lever from N to P and check starting motor for operation as in step 4).
  - 6) Check to make sure that in any other range than P and N, starting motor doesn't operate even when starter switch is turned ON.
  - 7) Turn ignition switch ON (without starting engine) and shift selector lever to R. Then check that back up lights light.
6. If any check result was unsatisfactory in step 5, remove shift lever switch and perform step 1 to 4 all over again.

MANUAL SELECTOR

REMOVAL

- 1. Selector knob screw and then selector knob by turning it counterclockwise.
- 2. Console box, if equipped.
- 3. Parking brake lever cover.
- 4. Shift control lever cover.
- 5. Select indicator assembly.
- 6. Illumination lamp coupler.
- 7. Select cable from selector lever.
- 8. Back drive cable.
- 9. Back drive solenoid coupler.
- 10. Raise car.
- 11. 4 housing nuts.
- 12. Lever housing with selector lever from floor.

NOTE:

- When taking off knob by turning it, push its push button.
- Knob and push button must not be disassembled.
- Do not drive out detent pin.

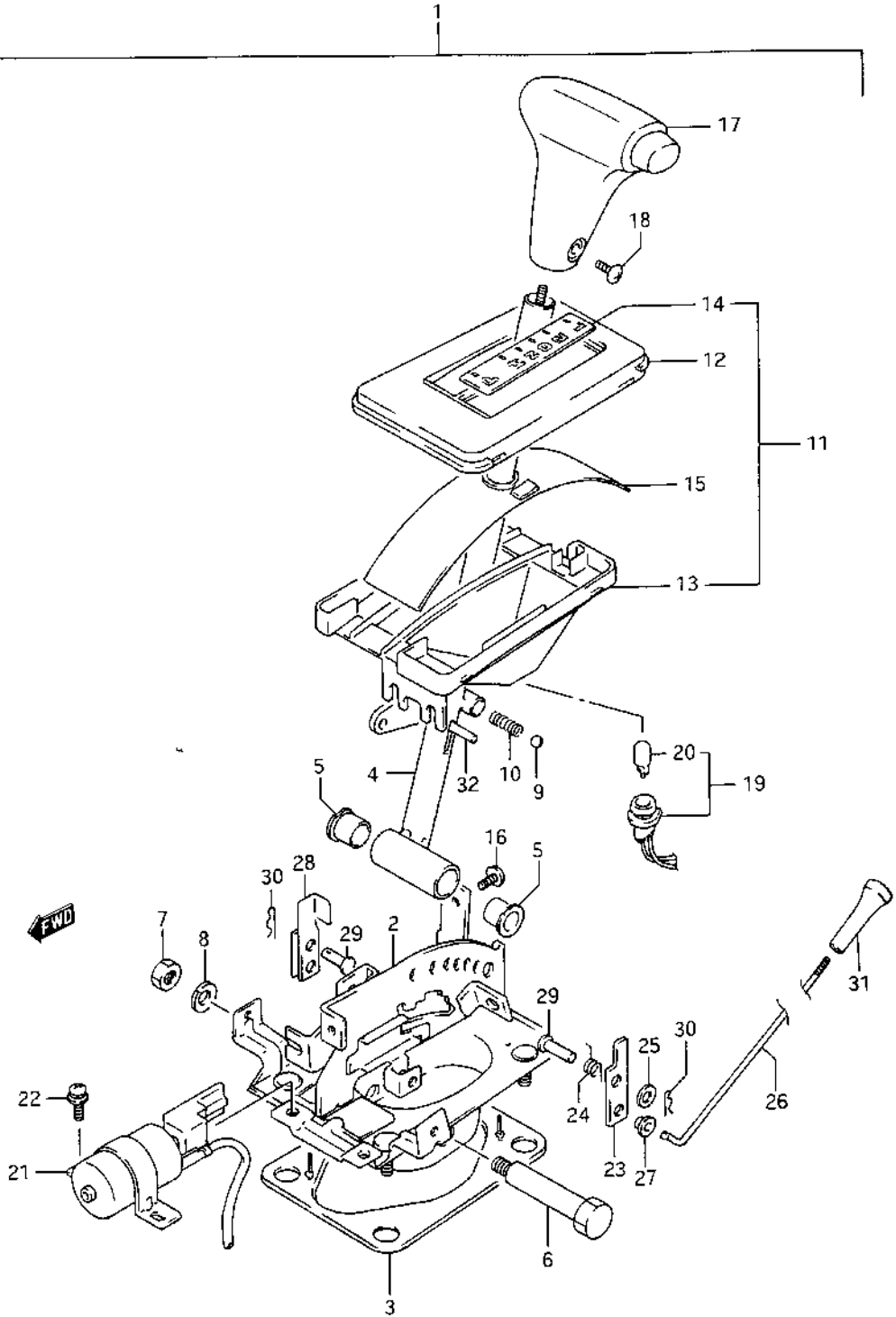
INSTALLATION

Assemble selector by reversing removal procedure, replacing parts with new ones as necessary. Apply grease to portions indicated as A in figure.

NOTE:

- When installing knob, make sure that there is a slight clearance between detent pin and cam bottom when knob button is pushed in all the way.
- Check selector for proper operation as follows.
  - 1. With knob button pushed half way, N to R and D to 2 shifts are available (but not any other shift).
  - 2. With knob button pushed all the way in, 2 to L and R to P shifts are available.
- For adjustment of back drive cable, refer to p. 7B-53.
- Check that illumination lamp lights when light switch is turned ON.

| Tightening torque        | N·m     | kg·m      | lb·ft       |
|--------------------------|---------|-----------|-------------|
| Selector lever shaft nut | 18 – 22 | 1.8 – 2.2 | 13.0 – 15.5 |
| Housing nuts             | 10 – 16 | 1.0 – 1.6 | 7.5 – 11.5  |



- |                           |                        |                          |                        |
|---------------------------|------------------------|--------------------------|------------------------|
| 1. Selector assembly      | 9. Locating ball       | 17. Selector lever knob  | 25. Washer             |
| 2. Selector lever housing | 10. Locating spring    | 18. Screw                | 26. Manual return rod  |
| 3. Housing sheet          | 11. Indicator assembly | 19. Illumination lamp    | 27. Manual return bush |
| 4. Selector lever         | 12. Upper cover        | 20. Bulb                 | 28. Key release plate  |
| 5. Selector lever bush    | 13. Lower cover        | 21. Back drive solenoid  | 29. Joint pin          |
| 6. Selector lever shaft   | 14. Position plate     | 22. Solenoid screw       | 30. Joint clip         |
| 7. Nut                    | 15. Slide cover        | 23. Manual return plate  | 31. Manual return knob |
| 8. Lock washer            | 16. Indicator screw    | 24. Manual return spring | 32. Detent pin         |

Fig. 7B-93 Manual Selector Components

TRANSMISSION UNIT REPAIR OVERHAUL

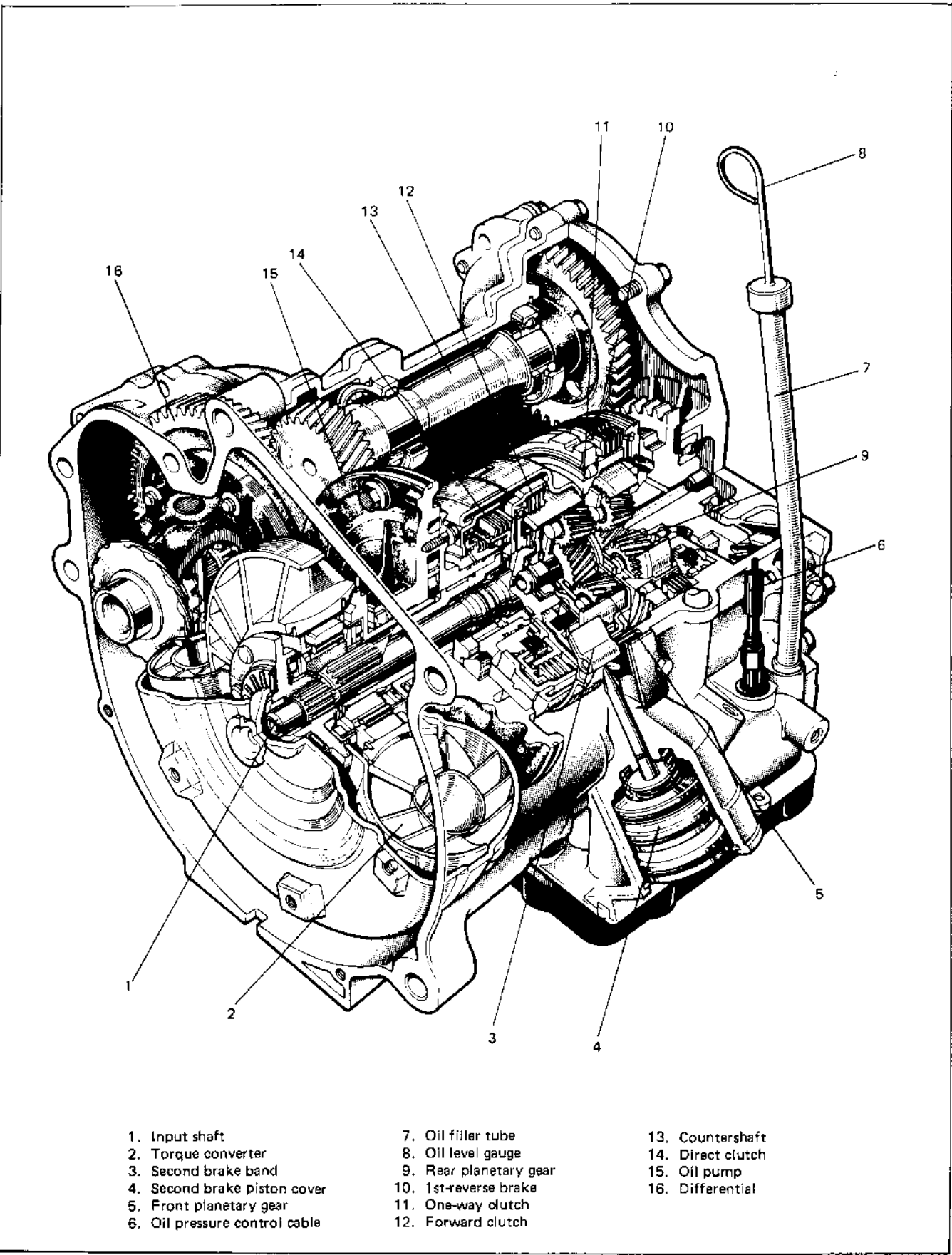


Fig. 7B-94 Automatic Transmission Construction

DISMOUNTING

1. Take down engine with transmission referring to Section 6A.
2. Remove torque converter (clutch) housing lower plate.
3. Remove drive plate bolts.  
To lock drive plate, engage a minus screwdriver with the drive plate gear.

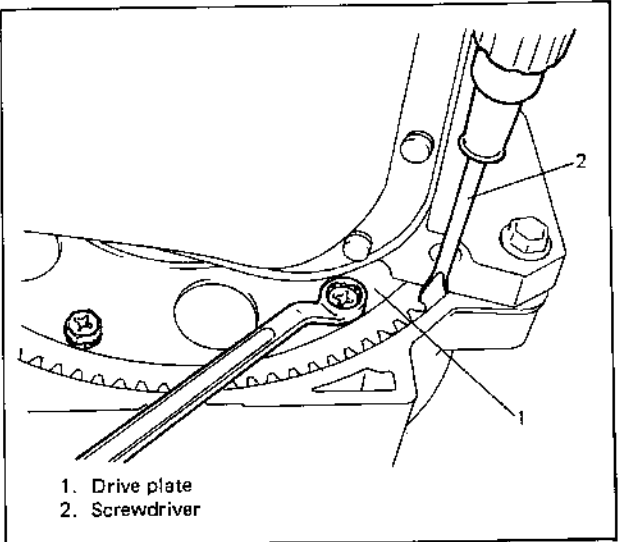


Fig. 7B-95 Removing Drive Plate Bolts

4. Remove starter motor.
5. Remove transmission stiffener.
6. Remove bolts and nut fastening engine and transmission, and remove transmission from engine.

NOTE:

When removing transmission from engine, move it in parallel with crankshaft and use care so as not to apply excessive force to drive plate and torque converter.

WARNING:

Be sure to keep transmission with torque converter horizontal or facing up throughout the work. Should it be tilted with torque converter down, converter may fall off and cause personal injury.

REMountING

Reverse dismounting procedure. The important steps in installation are as follows.

- Before installing transmission:
  - a) Apply grease around the cup at center of torque converter (Fig. 7B-96).
  - b) Measure the distance A shown in Fig. 7B-96. The distance should be more than 21.4 mm (0.85 in). If it is less than 21.4 mm (0.85 in), it means that the torque converter is improperly installed. Therefore, in such a case, remove the torque converter, and then, reinstall it for proper installation.

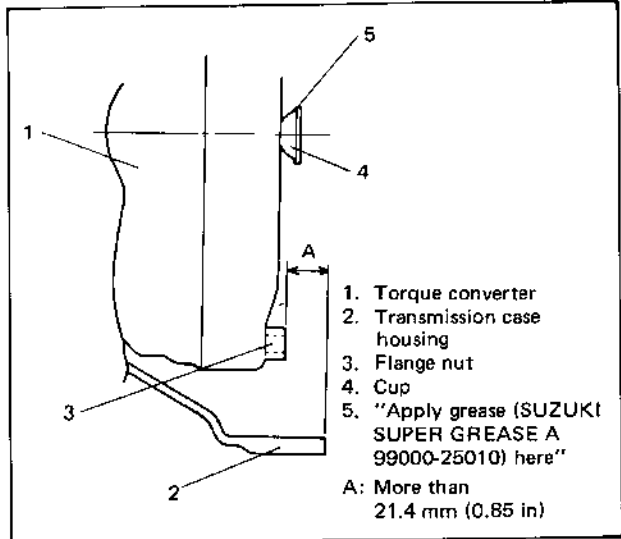


Fig. 7B-96 Installing Torque Converter

- Tighten drive plate bolts to specified torque.

| Tightening torque of drive plate bolts | N-m     | kg-m      | lb-ft       |
|----------------------------------------|---------|-----------|-------------|
|                                        | 18 - 19 | 1.8 - 1.9 | 13.0 - 14.0 |

- Remount engine with transmission according to procedure described in Section 6A.

## COOLER LINE FLUSHING

In a major transmission failure, where particles of metal have been carried with the fluid throughout transmission, it will be necessary to flush out oil cooler and connecting lines thoroughly.

## TORQUE CONVERTER DIAGNOSIS

### STATOR ASSEMBLY FREEWHEELS

If the stator roller clutch becomes ineffective, the stator assembly freewheels at all times in both directions. With this condition, the vehicle tends to have poor acceleration from a standstill. If poor acceleration problems are noted, what to be checked first are that the exhaust system is not blocked, the engine is running properly and the transmission is in 1st gear when starting out.

### STATOR ASSEMBLY REMAINS LOCKED UP

If the stator assembly remains locked up at all times, the engine rpm and car speed will tend to be limited or restricted at high speeds. The car performance when accelerating from a standstill will be normal. Engine overheating may be noted. Visual examination of the converter may reveal a blue color from the overheating that will result.

Under above conditions, if the converter has been removed from the transmission, the stator roller clutch can be checked by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. The inner race should turn freely clockwise, but be heavy to turn counterclockwise.

### NOTE:

- Converter placed with its flange upright does not fit for this inspection.
- For proper checking, position converter with its flange horizontal.
- Turn stator inner race clockwise as quickly as possible with finger, then turn reversely at the same speed and feel difference of inertia.

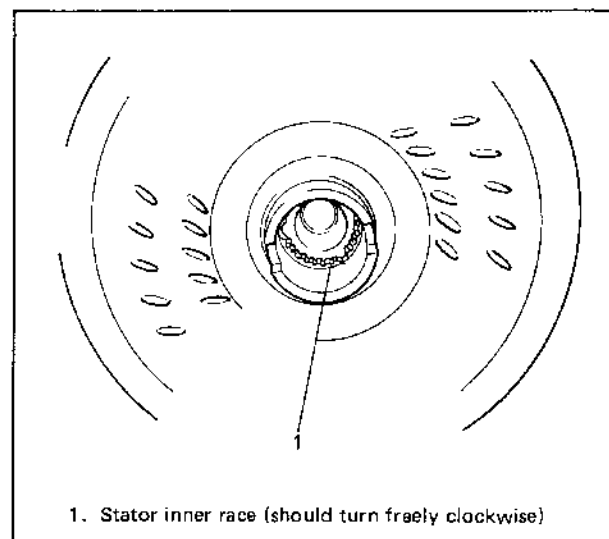


Fig. 7B-97 Checking Stator

### DO NOT REPLACE CONVERTER FOR FOLLOWING CONDITIONS:

1. The fluid has an odor, is discolored, and there is no evidence of metal particles. There is no indication of existence of internal damage, or oil pump damage. Dump out as much fluid as possible from the converter and replace only the oil pump screen in the pan.
2. A small amount of wear (sometimes referred to as fretting wear) appears on the hub where the oil pump drive gear is located. A certain amount of such wear is normal for both the hub and oil pump gear. Neither the converter nor the oil pump assembly should be replaced.

## DISASSEMBLY

### CAUTION:

- Thoroughly clean transmission exterior before overhauling it.
- Keep working table, tools and hands clean while overhauling.
- Use special care to handle aluminum parts so as not to damage them.
- Do not expose removed parts to dust. Keep them clean always.

1. Torque converter.

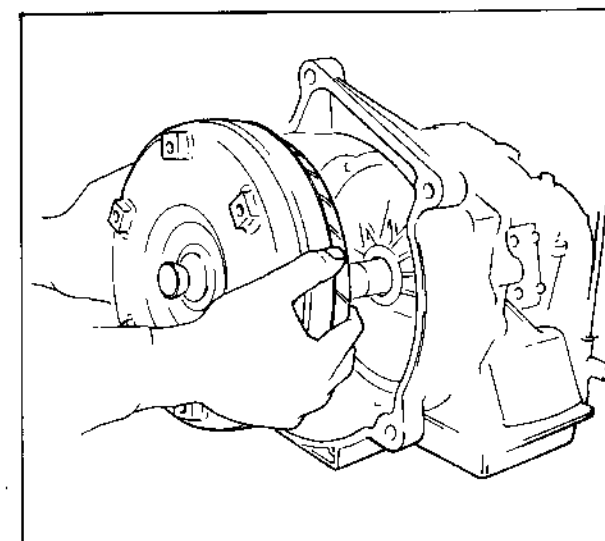


Fig. 7B-98 Removing Torque Converter

2. Engine mounting LH bracket.
3. Oil level gauge and oil filler tube.

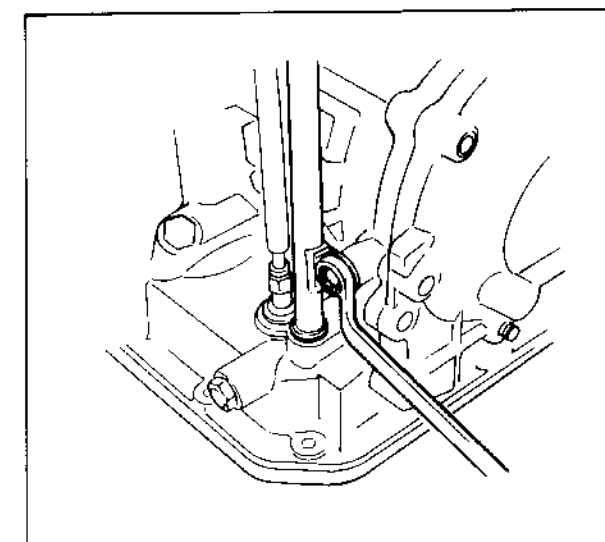


Fig. 7B-99 Removing Oil Filler Tube

4. Drain transmission fluid.  
To drain fluid better, tilt transmission in various directions.
5. Oil pan and oil pan gasket.

### NOTE:

- For removal of oil pan, do not turn transmission over as this will contaminate valve body with foreign matters in the bottom of oil pan.
- When removing oil pan, tap around it lightly with a plastic hammer. Do not force it off by using a screwdriver or the like.

6. Couplers of direct clutch and 2nd brake solenoids.

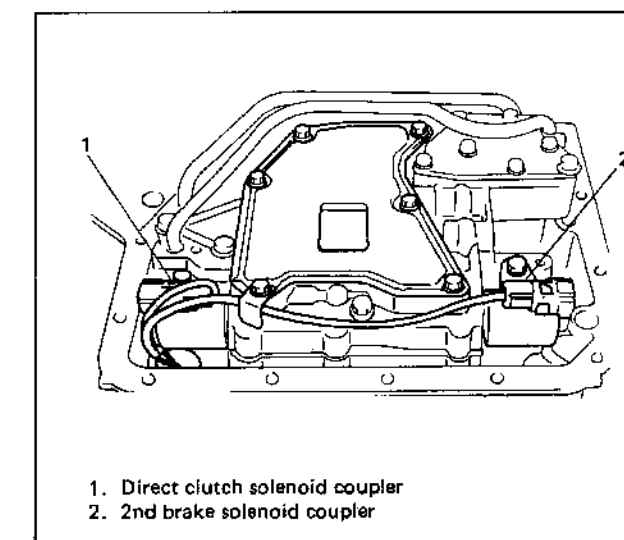


Fig. 7B-100 Removing Solenoid Couplers



7. 2 oil tubes from lower valve body.  
Remove them by pulling up tube end with a screwdriver.

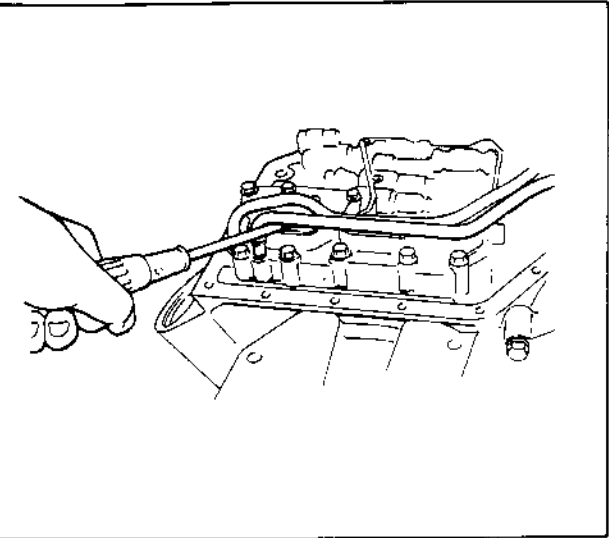


Fig. 7B-101 Removing Oil Tubes

8. Oil pressure control cable from throttle valve cam and then cable.

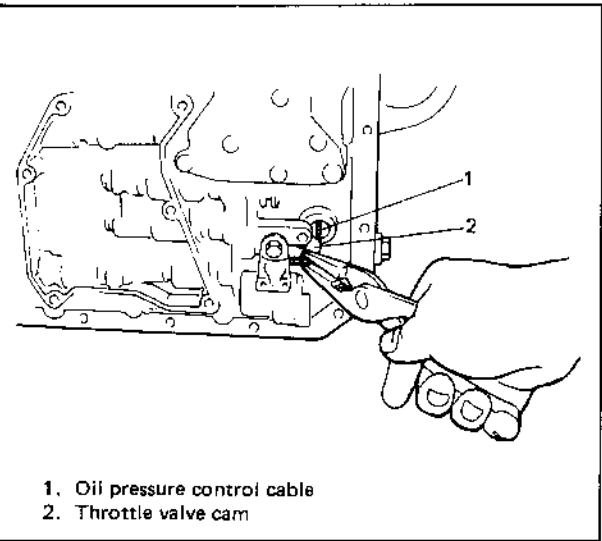


Fig. 7B-102 Removing Oil Pressure Control Cable

9. Oil strainer and lower valve body.  
For removal of lower valve body, remove 11 bolts shown in figure.

**CAUTION:**  
Be careful not to let manual valve fall off when removing valve body assembly.

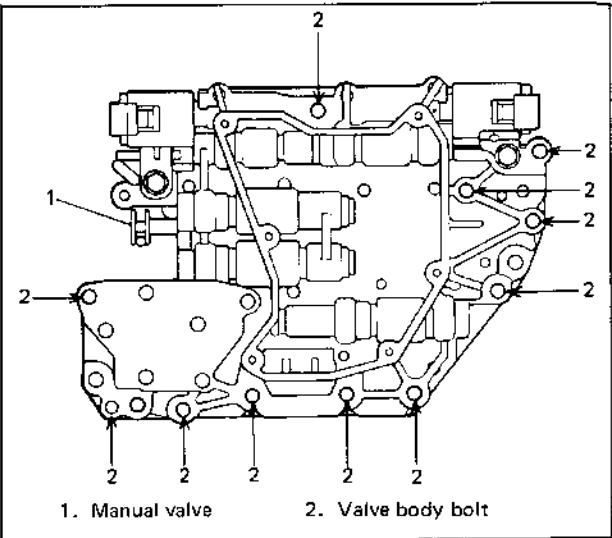


Fig. 7B-103 Removing Lower Valve Body

10. Accumulator pistons and spring.  
Position a rag on pistons to catch each piston. To remove pistons, force low-pressure compressed air (1 kg/cm<sup>2</sup>, 15 psi, 100 kPa, max) into hole as shown, and pop each piston into the rag.

**NOTE:**  
Do not push accumulator pistons with fingers or anything before removing them. Pushing them may cause compressed fluid in accumulator to spew out of hole at face and clothes.

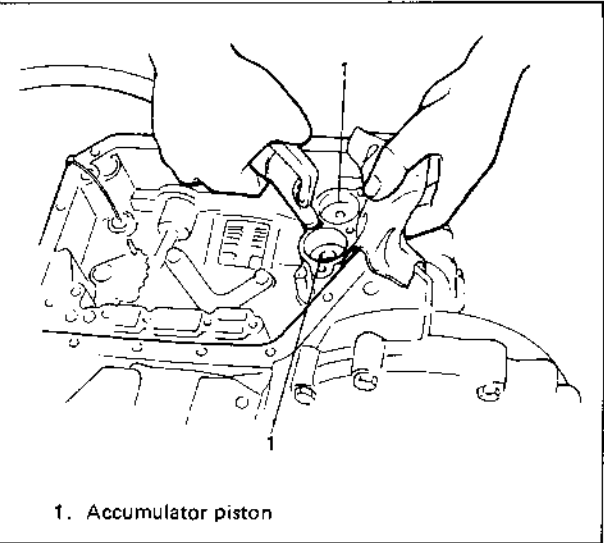


Fig. 7B-104 Removing Accumulator Pistons

11. Second brake band cover and gasket.  
12. After removing second brake band cover, check second brake piston stroke as follows.  
1) Scribe mark on piston rod as shown in below figure.  
2) Blow air into oil hole and measure rod stroke.  
3) If stroke is out of specification, replace piston rod with the one of different length or replace second brake band.  
2nd brake piston rod of 2 different lengths are available as spare parts.

| Available piston rod | Piston rod length  | Identification mark |
|----------------------|--------------------|---------------------|
|                      | 121.3 mm (4.77 in) | Unmarked            |
|                      | 122.7 mm (4.83 in) | Marked              |

|                                  |                                |
|----------------------------------|--------------------------------|
| Second brake piston rod stroke B | 1.5 – 3.0 mm<br>0.06 – 0.11 in |
|----------------------------------|--------------------------------|

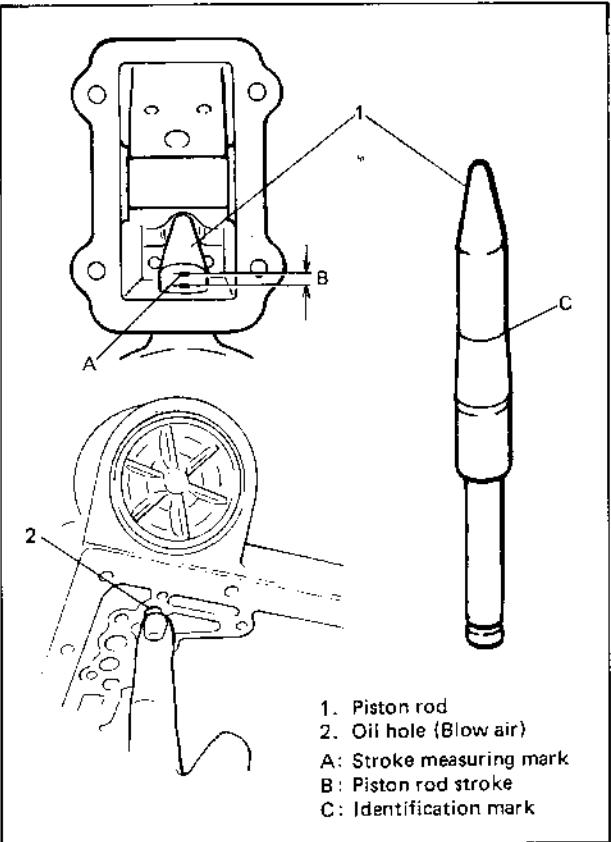


Fig. 7B-105 Measuring Piston Rod Stroke

13. Second brake piston.  
1) Install 17 mm socket with 8 mm bolt.  
2) Apply valve lifter as illustrated and push in piston cover.  
3) Remove snap ring by using screwdriver(s) or the like.  
4) Remove tools and take out 2nd brake piston cover and piston. Tap cover head lightly to pull out cover.

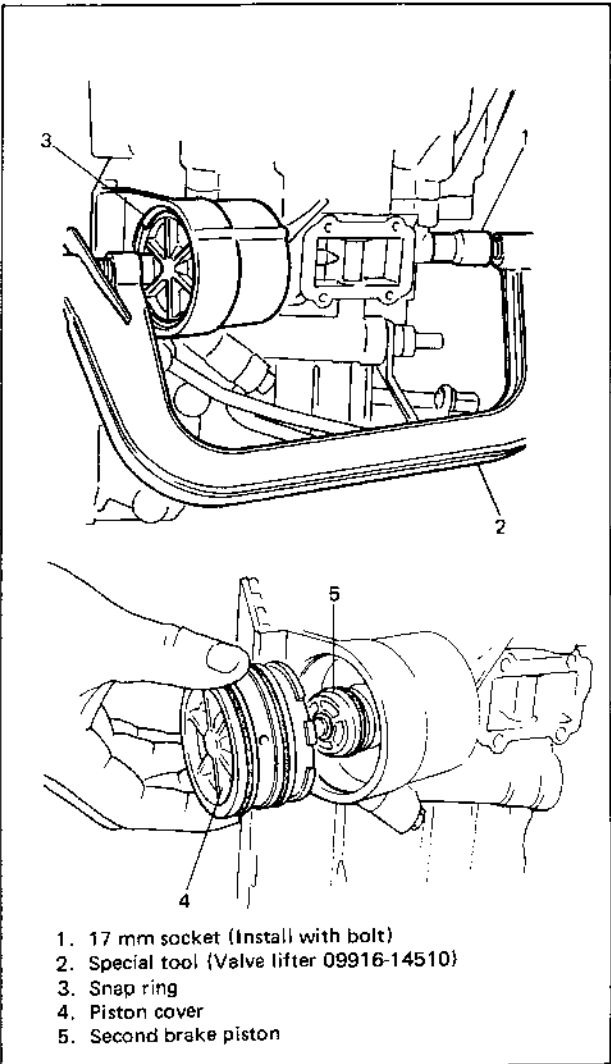


Fig. 7B-106 Removing Second Brake Piston

## 14. Solenoid wire harness.

- 1) Remove wire hold plate securing nut.
- 2) Remove 2 wire clamps on transmission and pull out solenoid wire.

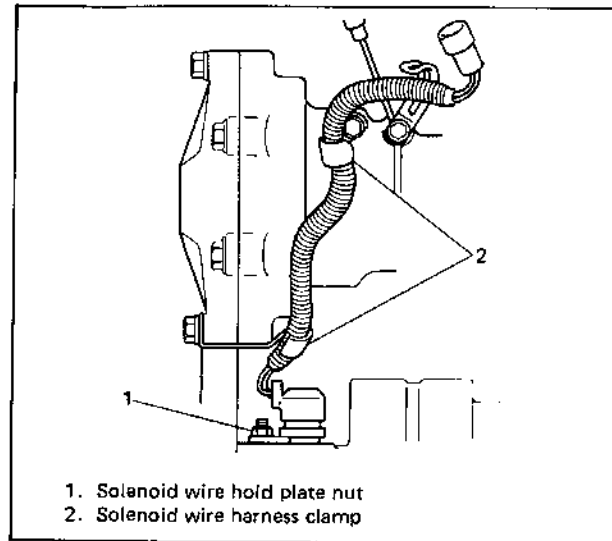


Fig. 7B-107 Removing Solenoid Wiring Harness

## 15. Oil pump.

- 1) Remove 6 oil pump securing bolts.
- 2) Remove oil pump by using special tool.

**CAUTION:**

Make sure that 2nd brake piston and piston rod have been removed before oil pump removal. If not, they may cause breakage of 2nd brake band.

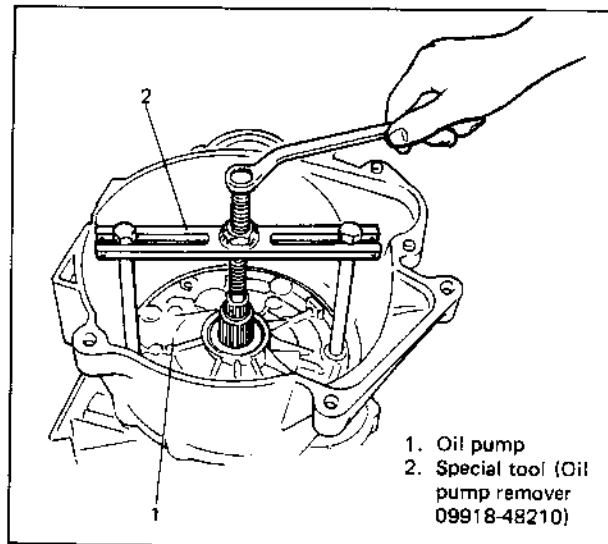


Fig. 7B-108 Removing Oil Pump

## 16. Transmission case housing.

- 1) Remove housing internal bolts and external bolts.
- 2) Remove housing while tapping around it lightly with a plastic hammer.

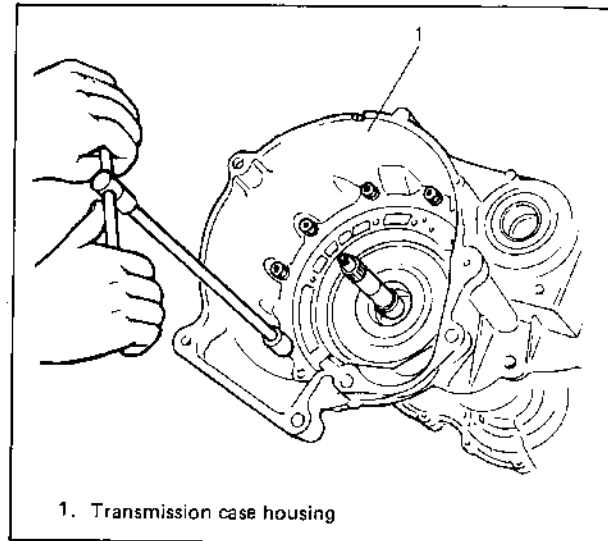


Fig. 7B-109 Removing Transmission Case Housing

## 17. Second brake band pin.

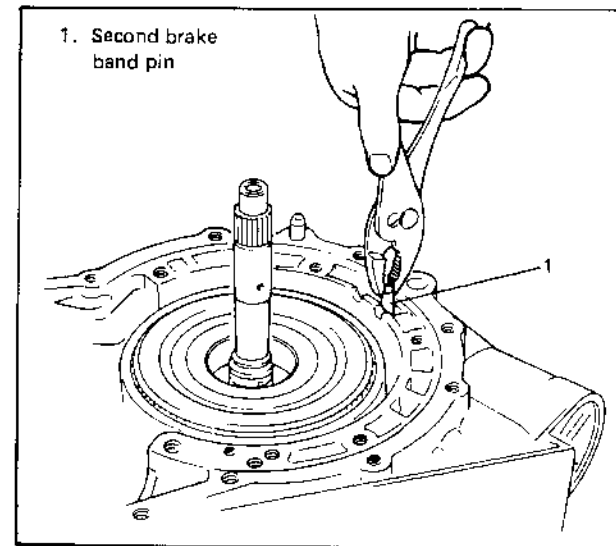


Fig. 7B-110 Removing Second Brake Band Pin

18. Direct clutch and forward clutch at the same time while holding input shaft.

**NOTE:**

Be careful not to loose ring gear race and bearing which may sometimes stick to input shaft.

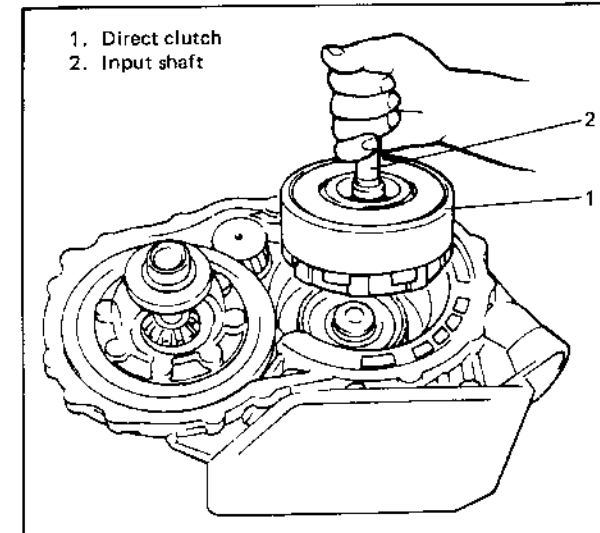


Fig. 7B-111 Removing Direct Clutch &amp; Input Shaft

## 19. Direct clutch assembly from input shaft.

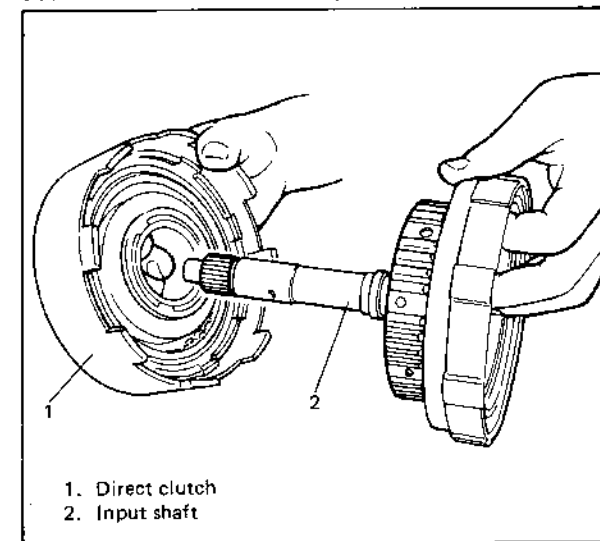


Fig. 7B-112 Removing Direct Clutch

## 20. Second brake band.

21. Front planetary ring gear and ring gear bearing.

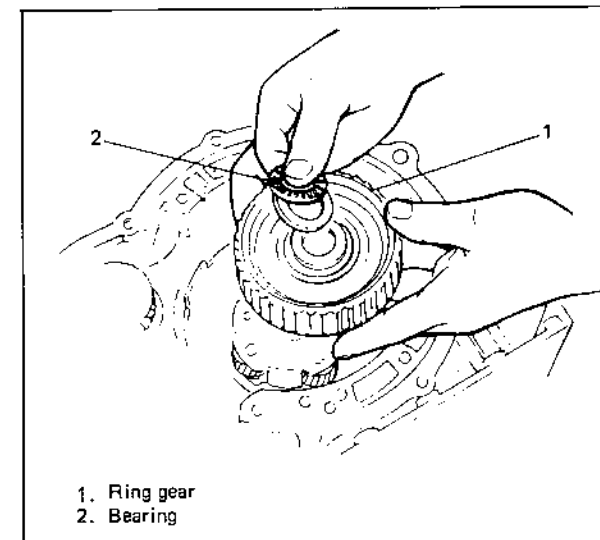


Fig. 7B-113 Removing Front Planetary Ring Gear &amp; Bearing

## 22. Front planetary gear assembly.

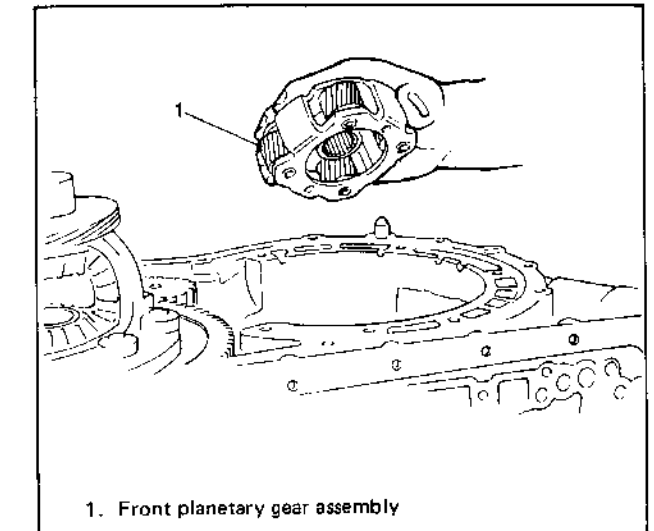


Fig. 7B-114 Removing Front Planetary Gear

## 23. Planetary sun gear and front planetary gear bearing.

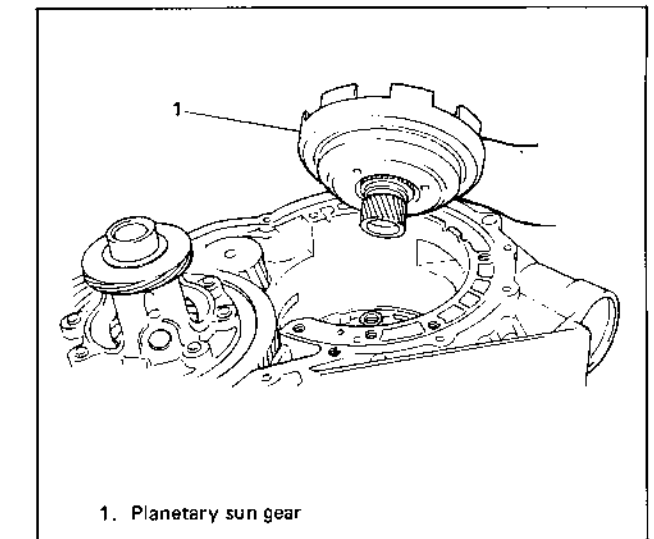


Fig. 7B-115 Removing Planetary Sun Gear



24. One way clutch snap ring by using a screwdriver.

**NOTE:**  
Use care not to damage transmission case when removing snap ring.

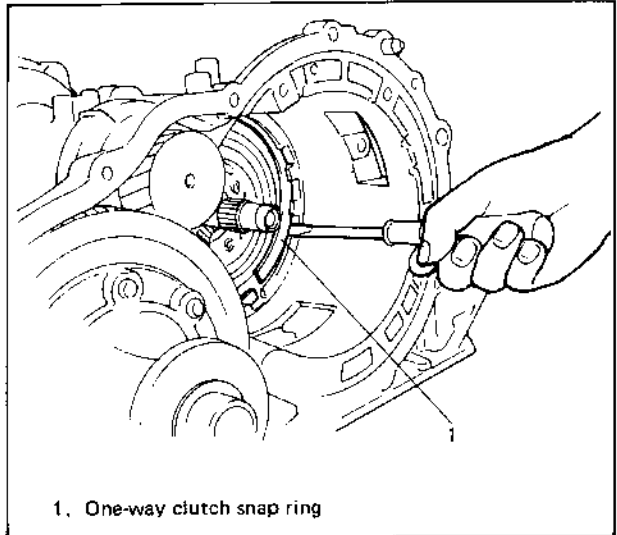


Fig. 7B-116 Removing One-way Clutch Snap Ring

25. One way clutch and rear planetary gear.

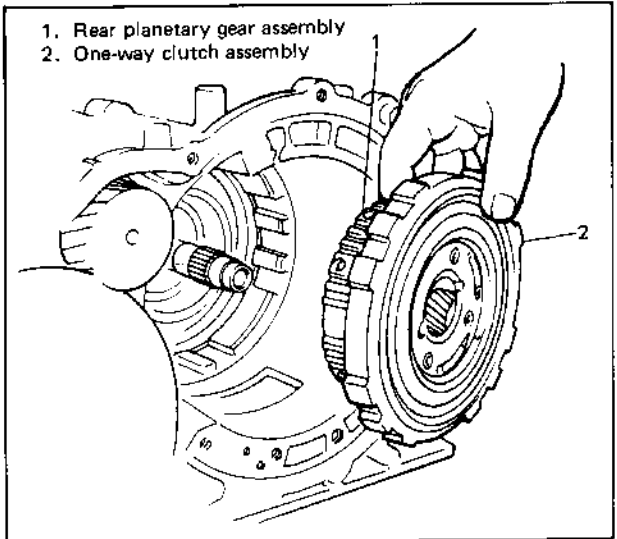


Fig. 7B-117 Removing One-way Clutch

26. Rear planetary ring gear, ring gear bearing and washers.

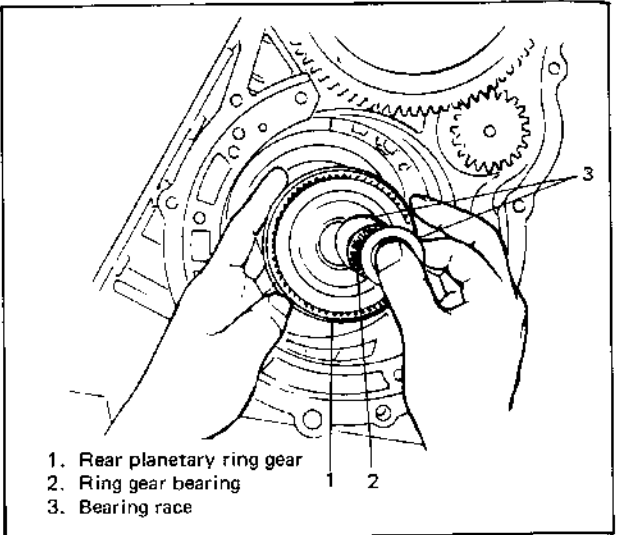


Fig. 7B-118 Removing Rear Planetary Ring Gear

27. Check 1st-reverse brake clearance.  
Measure clearance between snap ring and flange with feeler gauge. If out of specification, replace 1st-reverse brake discs or plates.

|                             |                                    |
|-----------------------------|------------------------------------|
| 1st-reverse brake clearance | 0.58 – 1.92 mm<br>0.023 – 0.075 in |
|-----------------------------|------------------------------------|

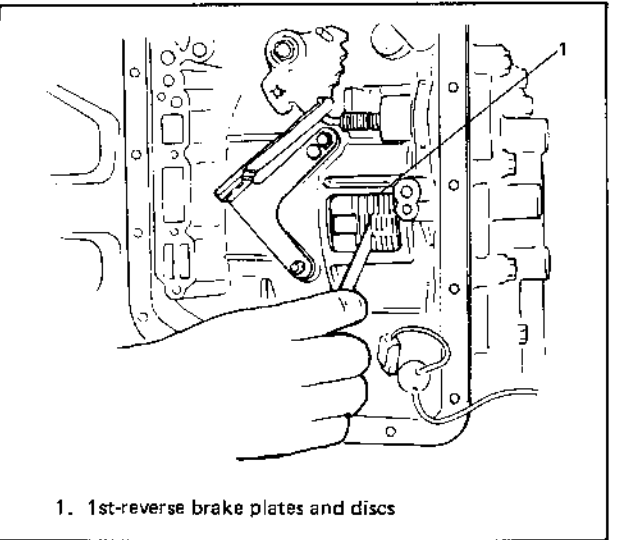


Fig. 7B-119 Measuring 1st-reverse Brake Clearance

28. 2 snap rings by using a flat tip screwdriver.

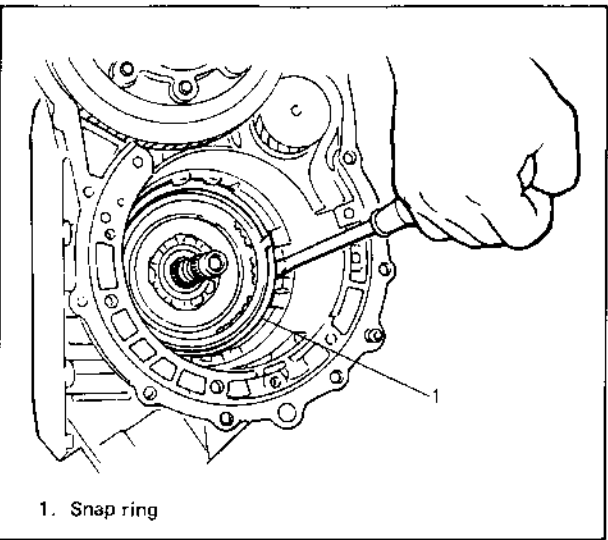


Fig. 7B-120 Removing Snap Rings

29. 1st-reverse brake flange, discs, plates and damper plate.

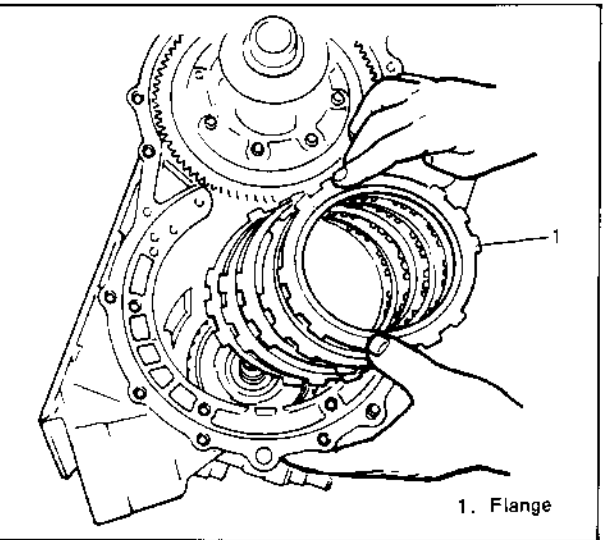


Fig. 7B-121 Removing 1st-reverse Brake

30. Differential gear assembly.  
31. Rear cover.  
1) Remove 10 bolts and 2 nuts.  
2) Remove rear cover by tapping A with plastic hammer shown in following figure.

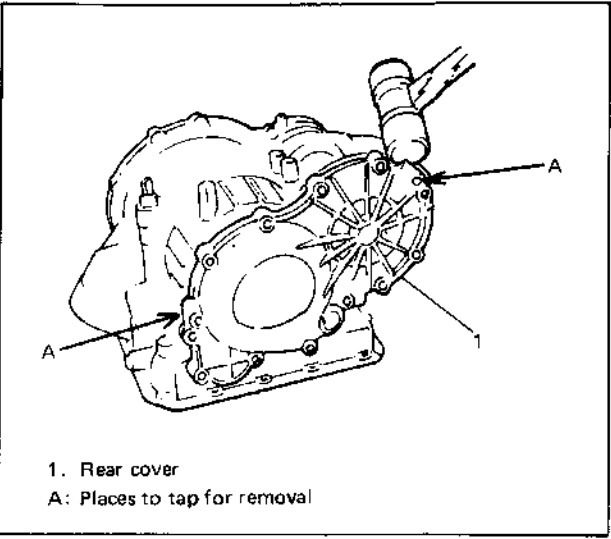


Fig. 7B-122 Removing Rear Cover

32. Reduction driven gear nut.  
1) Undo caulking.  
2) Shift manual shift lever to P so that output shaft is locked.  
3) Loosen nut.

**CAUTION:**  
Calmly apply torque to loosen nut so as not to damage reduction gear or parking lock pawl.

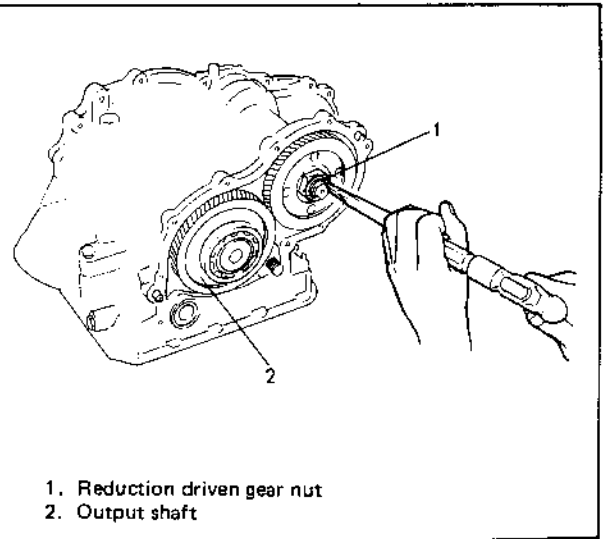


Fig. 7B-123 Uncaulking Reduction Driven Gear Nut

33. Pull out reduction driven gear.

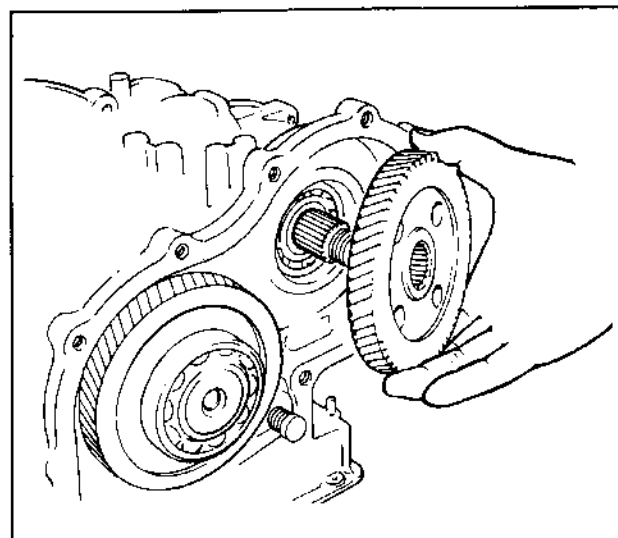


Fig. 7B-124 Removing Reduction Driven Gear

34. Drive countershaft out with a plastic hammer.

**CAUTION:**

To avoid unnecessary damage of speed sensor due to contact with countershaft gear, it should be removed previously.

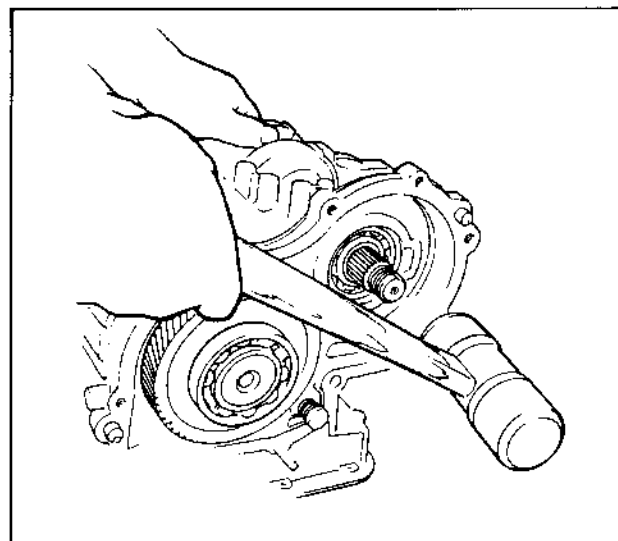


Fig. 7B-125 Removing Countershaft

35. Output shaft.

Remove output shaft by pushing outer race of internal output shaft bearing with special tools from inside of transmission case.

**CAUTION:**

- Do not hit output shaft or shaft end will be damaged.
- Hold special tools by hand while hitting them and avoid their bounce.

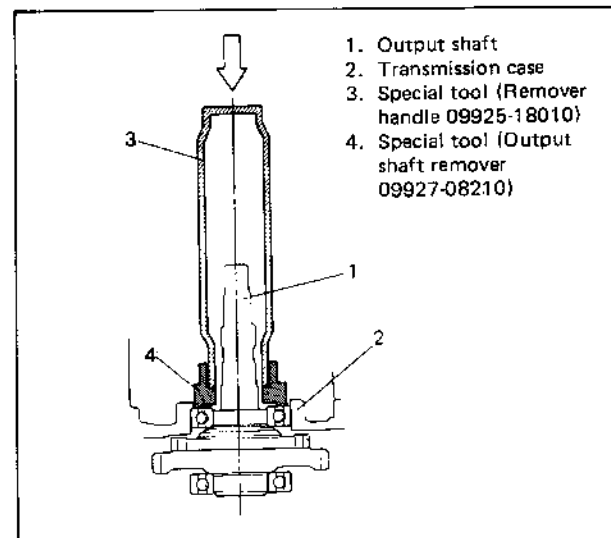


Fig. 7B-126 Removing Output Shaft

36. Parking lock pawl, pawl shaft and sleeve, etc.

- 1) Pull out parking lock pawl shaft and spring.
- 2) Remove parking lock pawl.

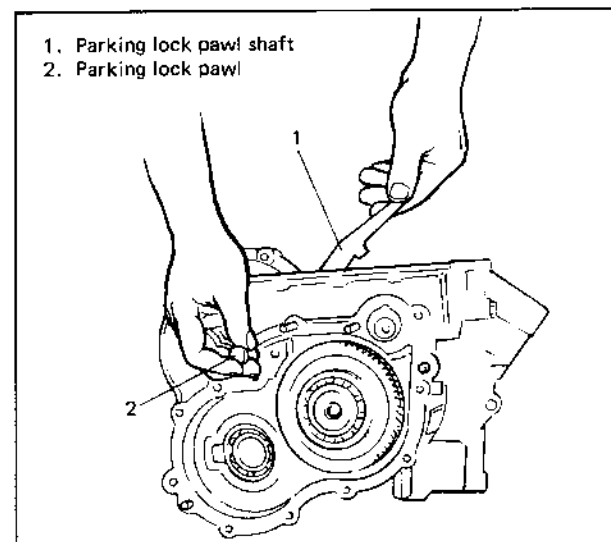


Fig. 7B-127 Removing Parking Lock Pawl

3) Pull out parking lock pawl sleeve.

4) Manual detent spring assembly and manual shift shaft.

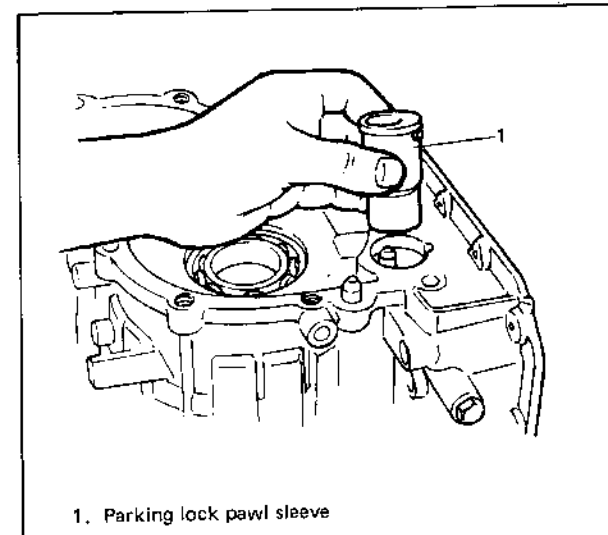


Fig. 7B-128 Removing Parking Lock Pawl Sleeve

37. 1st-reverse brake piston.

- 1) Push down return spring assembly and remove snap ring.

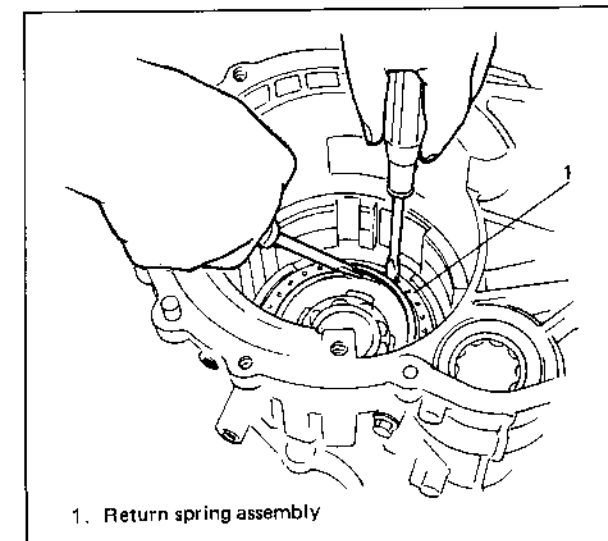


Fig. 7B-129 Removing Snap Ring

2) Take out return spring assembly.

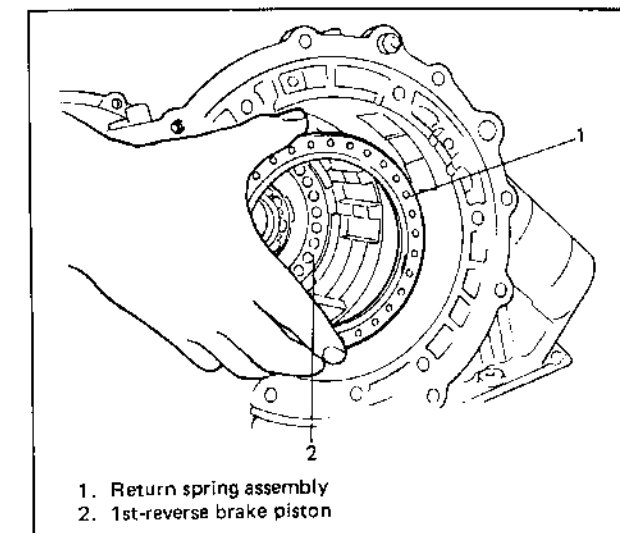


Fig. 7B-130 Removing Return Spring Assembly

3) By blowing air, push out 1st-reverse brake piston.

**CAUTION:**

- Blow air very carefully, or outer O ring will be damaged.
- Pull out piston by using long nose pliers, if failed to remove it by air blow.
- Without replacing O rings prepared, do not attempt to remove piston.

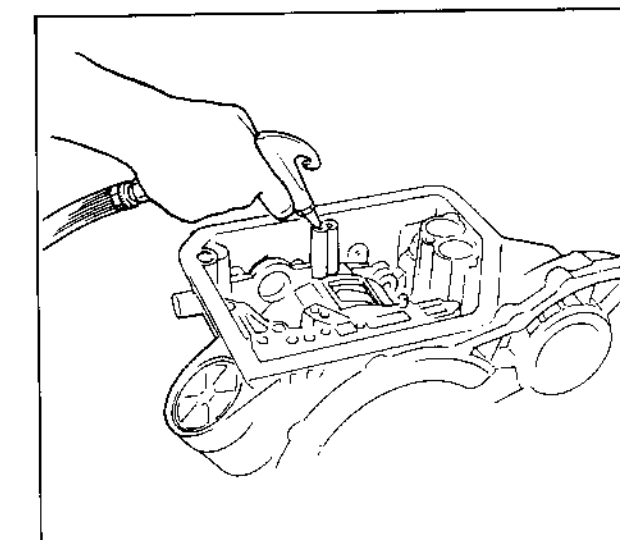


Fig. 7B-131 Removing 1st-reverse Brake Piston

## CLUTCH AND BRAKE PARTS DIAGNOSIS

### SYMPTOMS

#### Clutch Discs and Brake Band

Dry and inspect them for pitting, flaking, wear, glazing, cracking, charring and chips or metal particles imbedded in lining. If discs or brake band show any of the above conditions, replacement is required.

#### Clutch Steel Plates

Dry plates and check for discoloration. If plate surface is smooth and even color smear is indicated, the plate should be reused. If severe heat spot discoloration or surface scuffing is indicated, the plate must be replaced.

#### Clutch or Brake Return Spring Assembly

Evidence of extreme heat or burning in the

area of clutch may have caused springs to take a heat set and would require their replacement.

### POSSIBLE CAUSES OF BURNING

#### Forward and Direct Clutch Discs

- Stuck or leak in check ball in clutch piston.
- Damaged clutch piston seals.
- Worn or broken seal rings.
- Obstruction in solenoid valves or shift valves.
- Disconnected speed sensor, solenoid or controller.
- Leak in valve body gaskets.
- Low line pressure.

#### 1st/REV Brake Discs and 2nd Brake Band

- Damaged piston seals.
- Obstruction in solenoid valves or shift valves.
- Leak in valve body gaskets.
- Low line pressure.

## SUB ASSEMBLY SERVICE

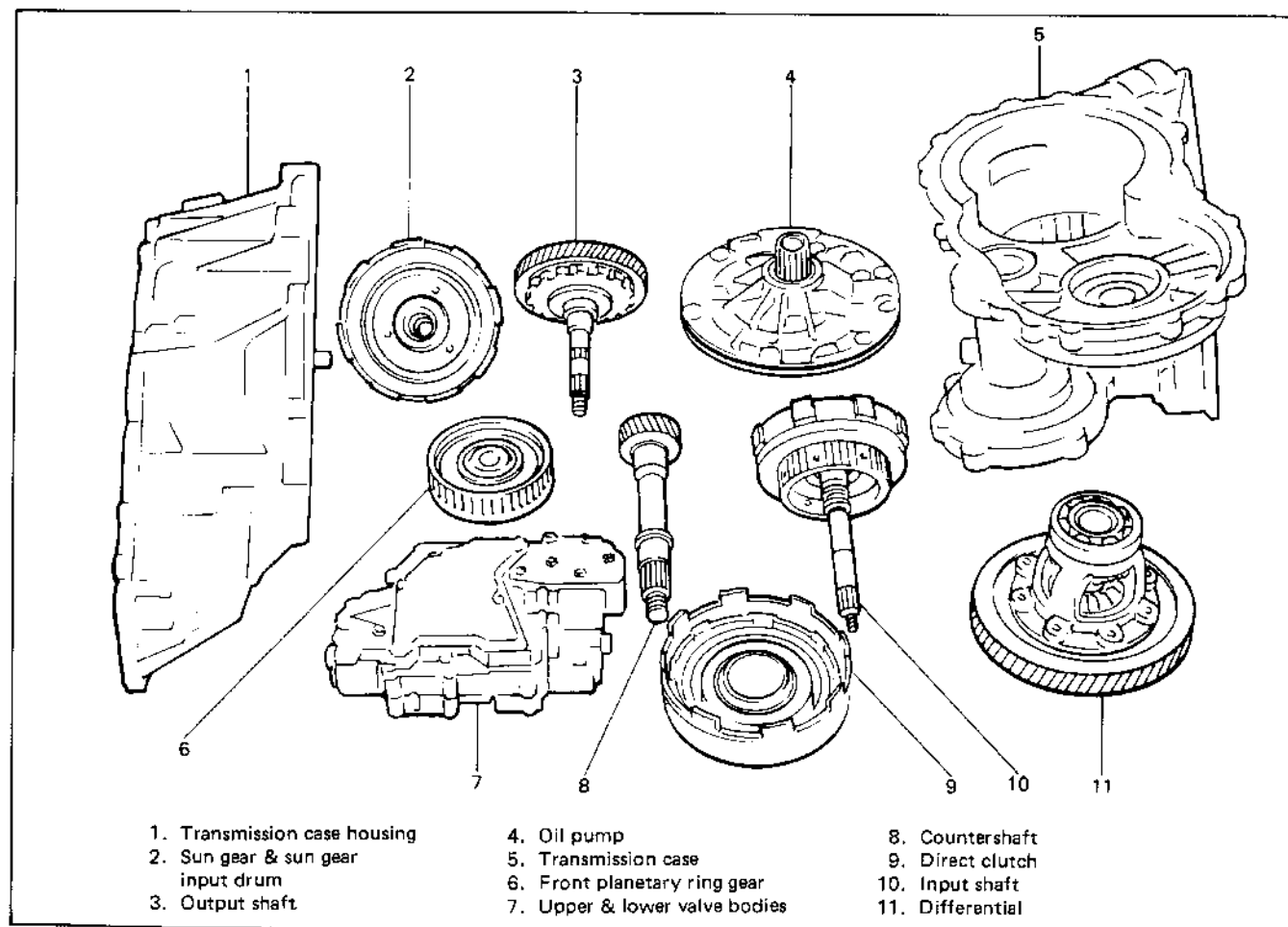


Fig. 7B-132 Sub Assemblies

### CAUTION:

- Keep component parts in group for each sub assembly and avoid mixing them up.
- Clean all parts with cleaning solvent thoroughly and air dry them.
- Use kerosene or automatic transmission fluid as cleaning solvent.
- Do not use wiping cloths or rags to clean or dry parts.
- All oil passages should be blown out and checked to make sure that they are not obstructed.
- Keep face and eyes away from solvent spray while air blowing parts.
- Check mating surface for irregularities and remove them, if any, and clean it again.
- Soak new clutch discs and brake band in

transmission fluid for 2 hours or more before assembly.

- Replace all gaskets and O rings with new ones.
- Apply automatic transmission fluid to all O rings except oil pump cover seal.
- When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.
- Replace oil seals that are removed and apply grease to their lips.
- Before installing, be sure to apply automatic transmission fluid to sliding, rolling and thrusting surface of all component part. Also after installation, make sure to check each part for proper operation.
- Always use torque wrench when tightening bolts.

## OIL PUMP

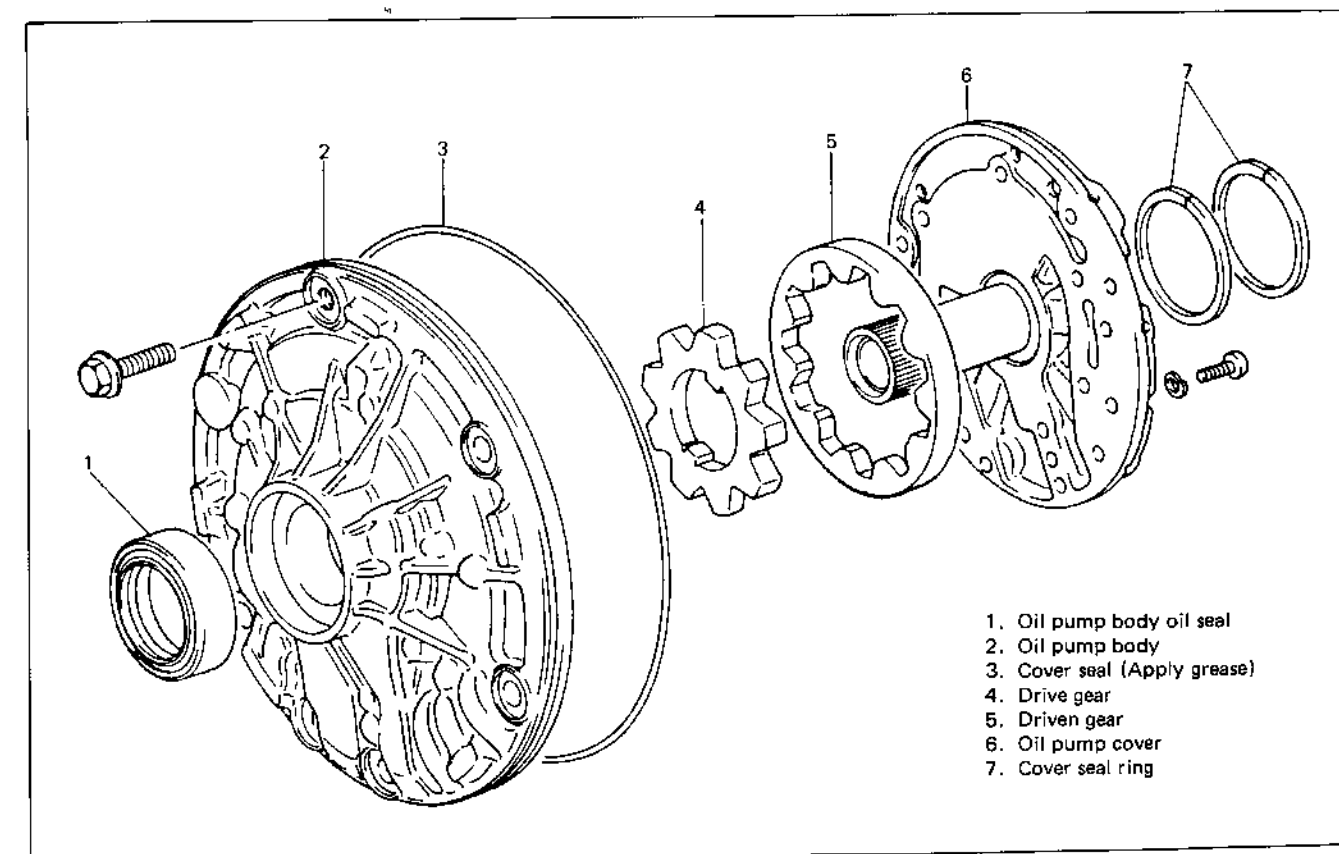


Fig. 7B-133 Oil Pump Components

Removal

- 1. 2 oil pump cover seal rings.
- 2. Oil pump cover seal (O ring).
- 3. 11 bolts.
- 4. Oil pump cover.

Inspection

- 1. Pump body oil seal.  
Check for wear, damage or cracks.  
Replace oil seal if necessary and apply grease to its lip portion slightly when it is installed.
- 2. Body clearance of driven gear.  
Push driven gear to one side of body. Using a feeler gauge, measure clearance between driven gear and body.  
If clearance exceeds its limit, replace driven gear.

| Driven gear-to-body clearance | Standard                             | Limit              |
|-------------------------------|--------------------------------------|--------------------|
|                               | 0.07 – 0.15 mm<br>0.0028 – 0.0059 in | 0.3 mm<br>0.011 in |

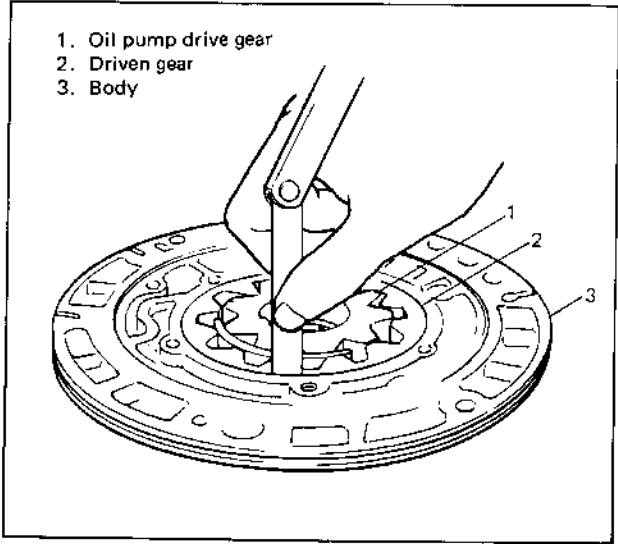


Fig. 7B-134 Checking Gear-to-Body Clearance

- 3. Tip clearance of both drive and driven gears.  
Measure radial clearance between gear tooth and crescent.  
If clearance exceeds its limit, replace gear.

| Gear tooth tip clearance | Standard                             | Limit              |
|--------------------------|--------------------------------------|--------------------|
|                          | 0.11 – 0.14 mm<br>0.0043 – 0.0055 in | 0.3 mm<br>0.011 in |

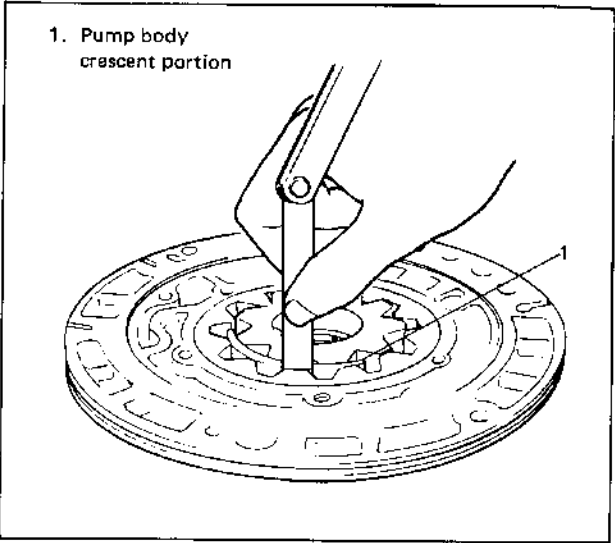


Fig. 7B-135 Checking Gear Tip Clearance

- 4. Side clearance of both gears.  
Using a straightedge and a feeler gauge, measure side clearance between gear and pump body.

| Gear side clearance | Standard                             | Limit               |
|---------------------|--------------------------------------|---------------------|
|                     | 0.02 – 0.05 mm<br>0.0008 – 0.0019 in | 0.1 mm<br>0.0039 in |

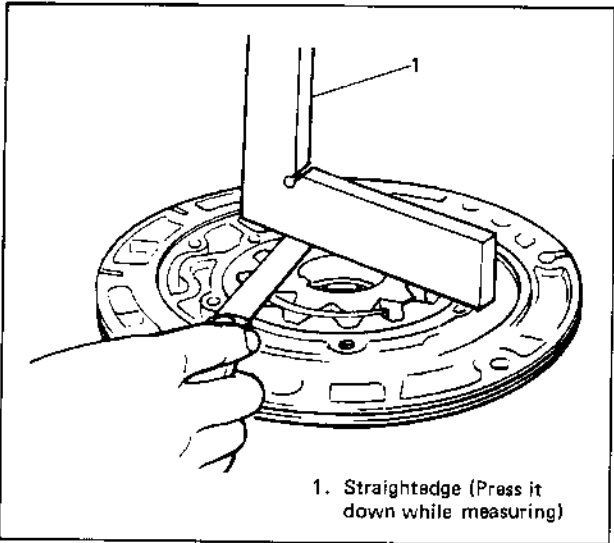


Fig. 7B-136 Checking Side Clearance

Installation

- 1. Pump body oil seal.  
Use special tool and hammer to install it, and then apply grease to its lip portion.
- 2. Driven gear and drive gear to pump body after applying fluid to gears.
- 3. Pump cover to pump body and tighten 11 pump cover bolts to specification.

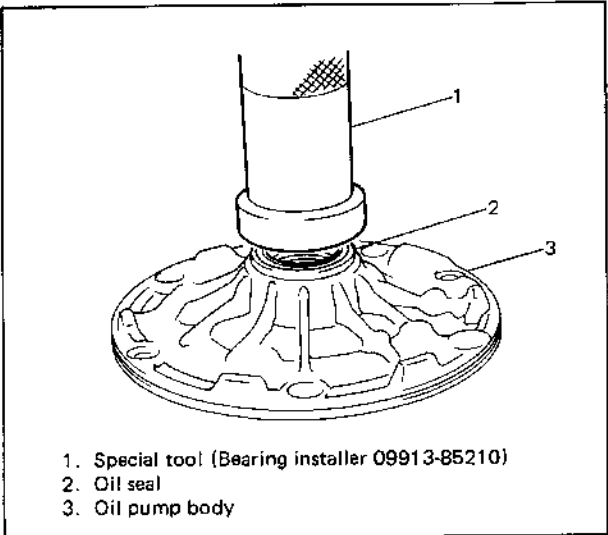


Fig. 7B-137 Installing Pump Body Oil Seal

- 4. 2 oil pump cover seal rings.
- 5. Apply transmission fluid to oil pump bushes and 2 seal rings.
- 6. Oil pump cover seal (O ring).  
Install cover seal applied with grease and make sure that it is not twisted or extruded.
- 7. Check drive gear for smooth rotation.

| Tightening torque for pump cover bolt | N-m    | kg-m      | lb-ft     |
|---------------------------------------|--------|-----------|-----------|
|                                       | 8 – 12 | 0.8 – 1.2 | 6.0 – 8.5 |

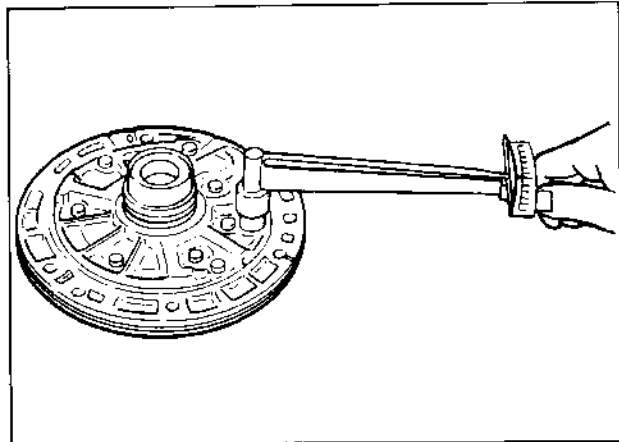


Fig. 7B-138 Tightening Pump Cover Bolts

DIRECT CLUTCH

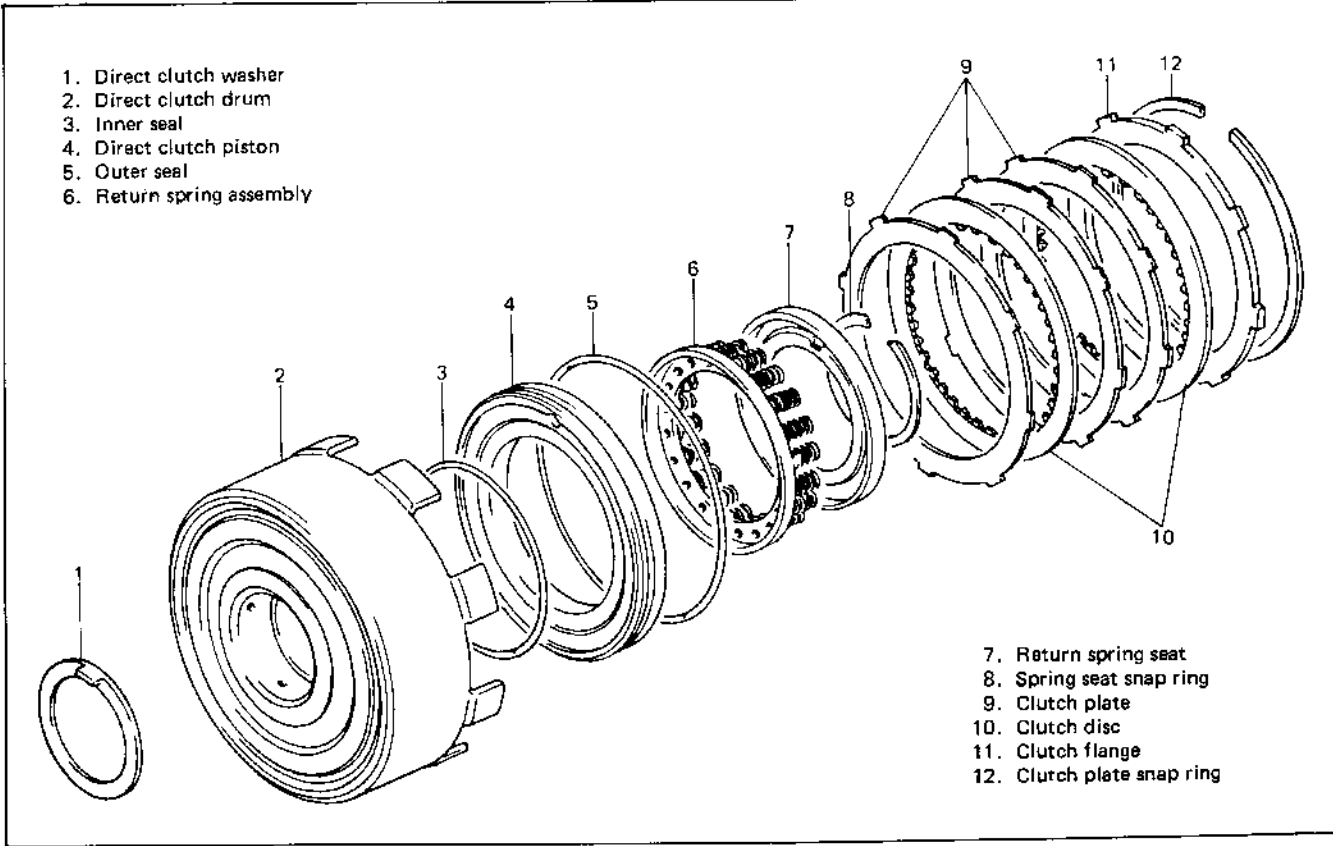


Fig. 7B-139 Direct Clutch Components

**Preliminary Check**

Check direct clutch clearance before disassembly. For checking clearance, measure height between snap ring and clutch flange by using vernier as shown in figure. If height is within specification, it means that clutch clearance is within specification. If height is out of specification, replace clutch discs or plates with new ones.

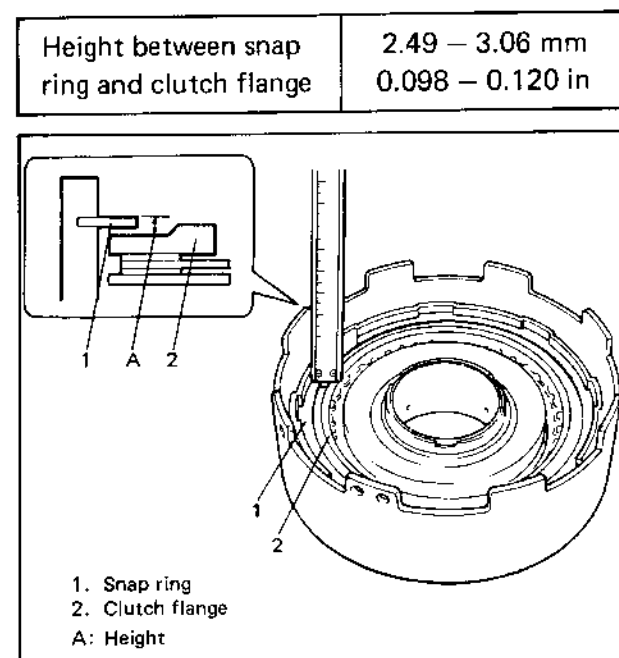


Fig. 7B-140 Measuring Direct Clutch Clearance

**Removal**

1. Clutch plate snap ring.
2. Clutch flange, discs and plates.

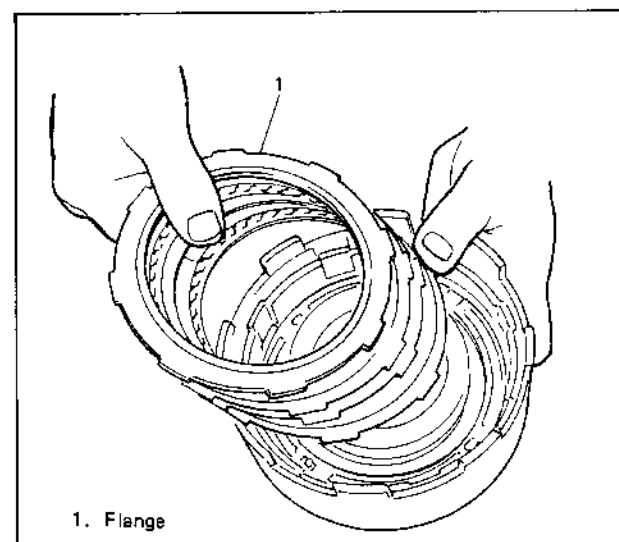


Fig. 7B-141 Removing Flange, Discs and Plates

3. Spring seat snap ring.

Compress piston return springs by using special tool and then remove snap ring.

**CAUTION:**

Do not compress spring seat too much. Excessive compression may cause to spring seat to become distorted.

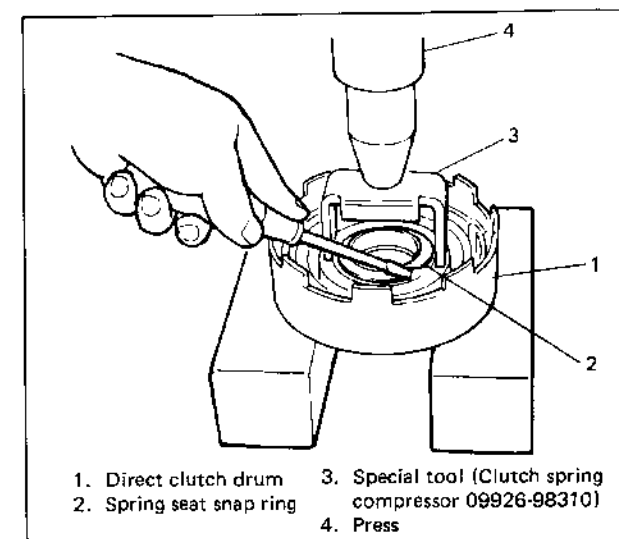


Fig. 7B-142 Removing Snap Ring

4. Spring seat and return spring assembly.
5. Direct clutch piston.

Blow compressed air through drum oil hole to remove piston. If piston does not pop out, take out piston with long nose pliers.

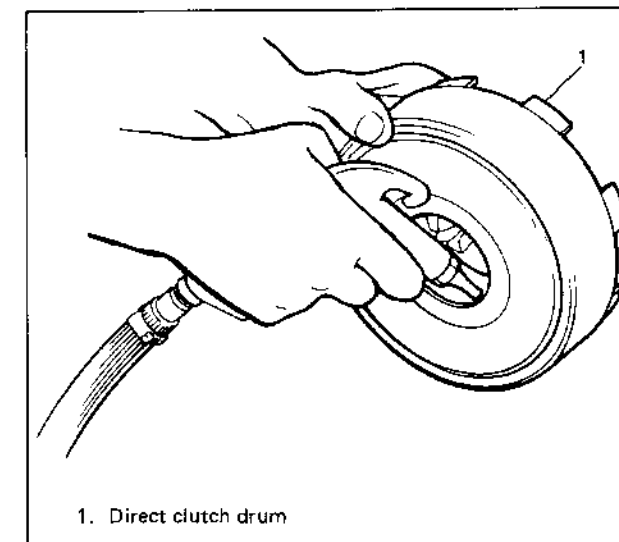


Fig. 7B-143 Removing Direct Clutch Piston

6. Inner seal from drum.
7. Outer seal from piston.

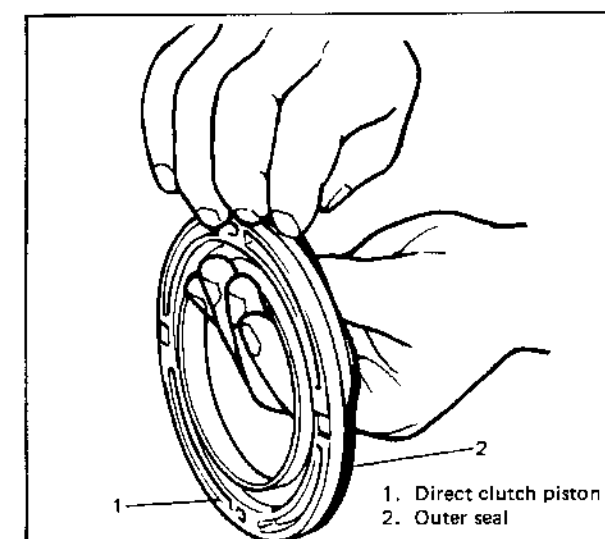


Fig. 7B-144 Removing Outer Seal

**Inspection**

1. Check valve (steel ball) for free movement in piston.
  2. Check valve for leakage by using low pressure air.
- If found faulty, replace piston.

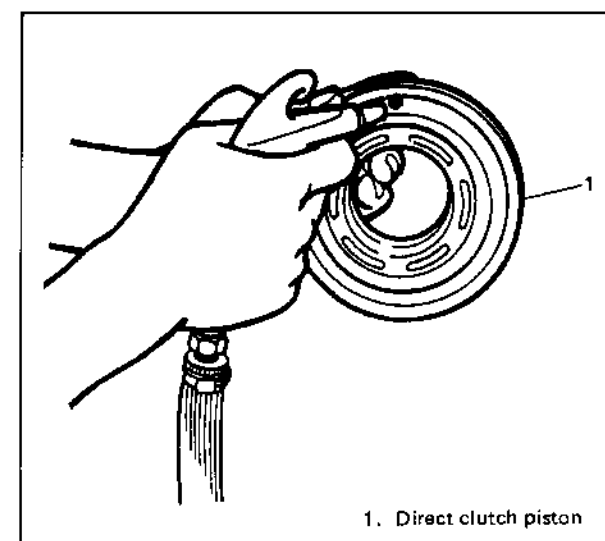


Fig. 7B-145 Checking Check Ball Leakage

**Installation**

1. Inner seal (O ring).  
Apply transmission fluid to inner seal and fit it in drum. Use new inner seal.
2. Outer seal (O ring).  
Apply transmission fluid to outer seal and fit it to piston. Use new outer seal.
3. Piston into drum.  
Be careful so that seals (O rings) do not get twisted or caught.

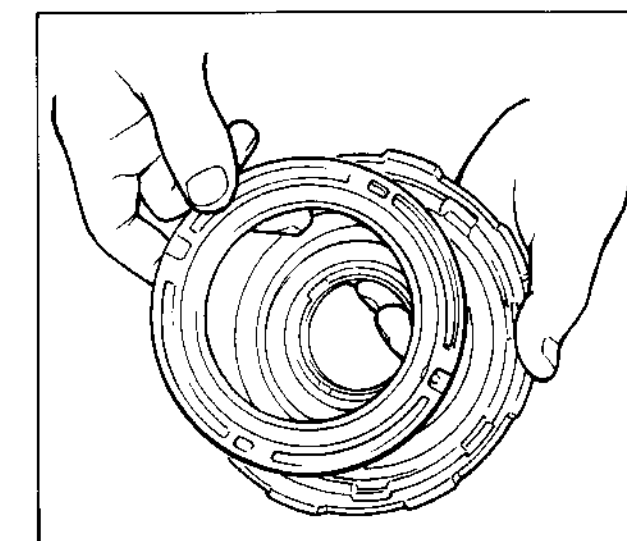


Fig. 7B-146 Installing Piston to Drum

4. Clutch return spring assembly.
5. Spring seat.

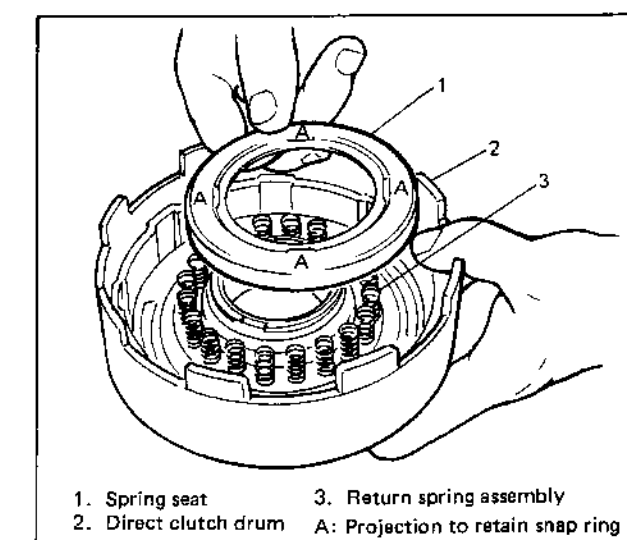


Fig. 7B-147 Installing Spring Seat

## 6. Snap ring.

Compress return springs and install spring seat snap ring in groove. Place special tool (clutch spring compressor) on spring seat and compress springs with press, and then, install snap ring using a screwdriver.

**CAUTION:**

- Check to make sure that snap ring is securely fitted in 4 projections A of spring seat.
- Do not compress return spring more than necessary.

## 7. Discs, plates and flange.

Install the following in that order.

- ① Plate → ② Disc → ③ Plate → ④ Plate →  
⑤ Disc → ⑥ Flange

**NOTE:**

If new clutch discs are installed, soak them in automatic transmission fluid for 2 hours or more before assembly.

## 8. Clutch plate snap ring.

9. After installing clutch plate snap ring, measure height between snap ring and clutch flange as previously outlined.

If height is out of specification even when new clutch discs and plates are installed, install flange of different thickness. Following 2 types of clutch flanges are available as spare parts.

|                                            |                                      |
|--------------------------------------------|--------------------------------------|
| Height between snap ring and clutch flange | 2.49 – 3.06 mm<br>0.098 – 0.120 in   |
| Available clutch flange size (thickness)   | 3.00 mm/0.118 in<br>3.37 mm/0.132 in |

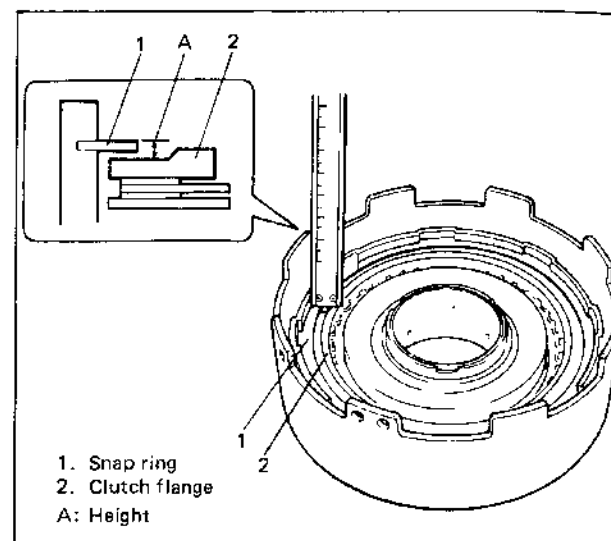


Fig. 7B-148 Measuring Direct Clutch Clearance

10. Check piston for movement by blowing air through oil hole in drum.

**CAUTION:**

Apply only low pressure air for checking movement. Excessive air pressure may cause damage to spring seat.

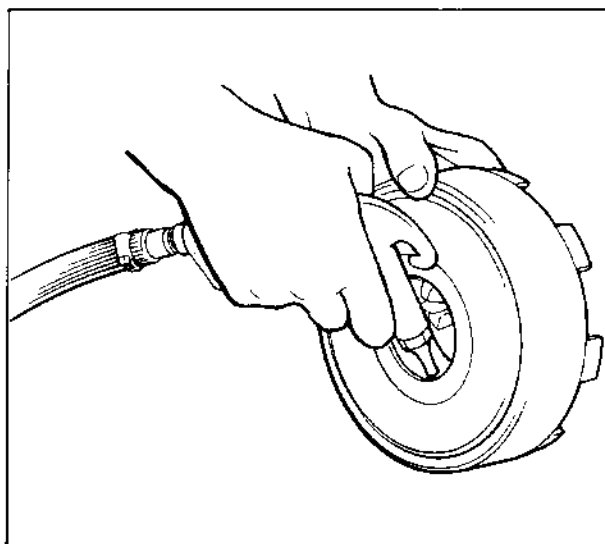


Fig. 7B-149 Checking Piston for Movement

## FORWARD CLUTCH

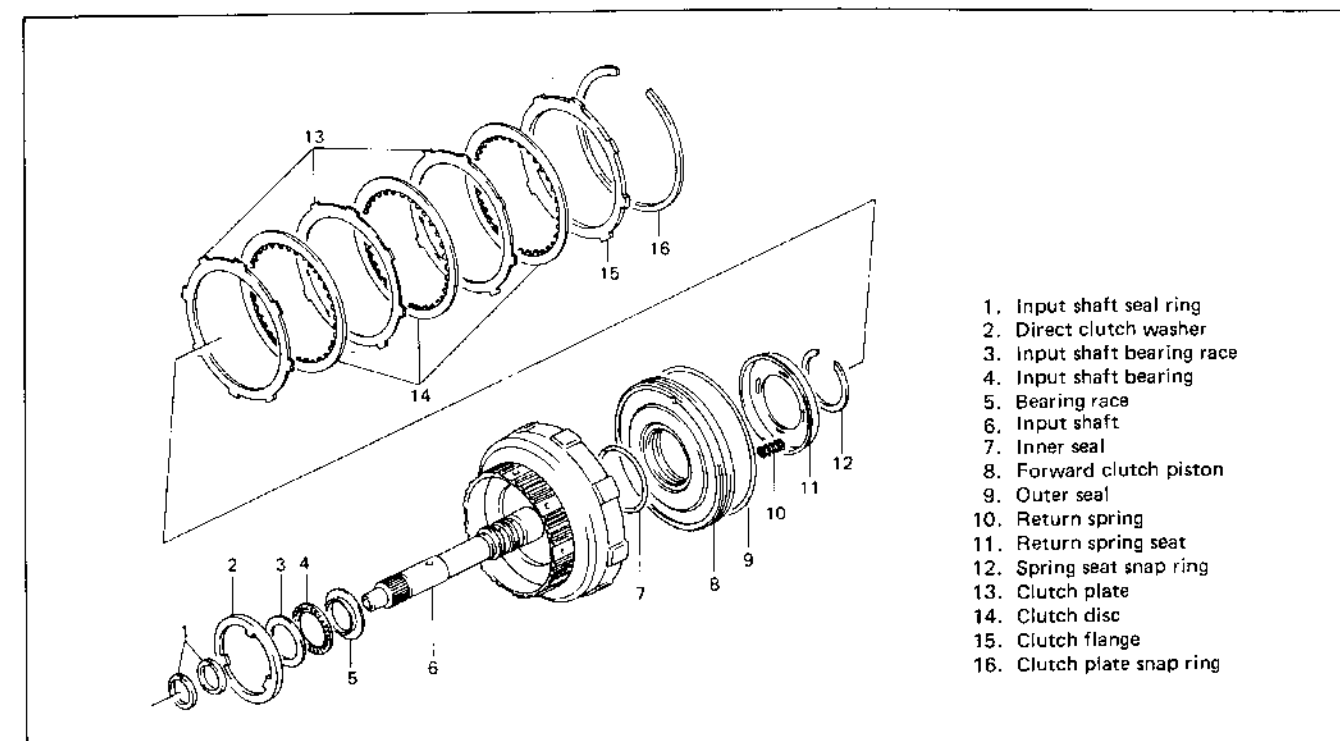


Fig. 7B-150 Exploded View of Forward Clutch

**Preliminary Check**

Check forward clutch clearance before disassembly.

For checking clearance, measure height between snap ring and clutch flange by using vernier as shown in figure. If height is within specification, it means that clutch clearance is within specification. If height is out of specification, replace clutch discs or plates with new ones.

|                                            |                                    |
|--------------------------------------------|------------------------------------|
| Height between snap ring and clutch flange | 2.01 – 2.68 mm<br>0.079 – 0.105 in |
|--------------------------------------------|------------------------------------|

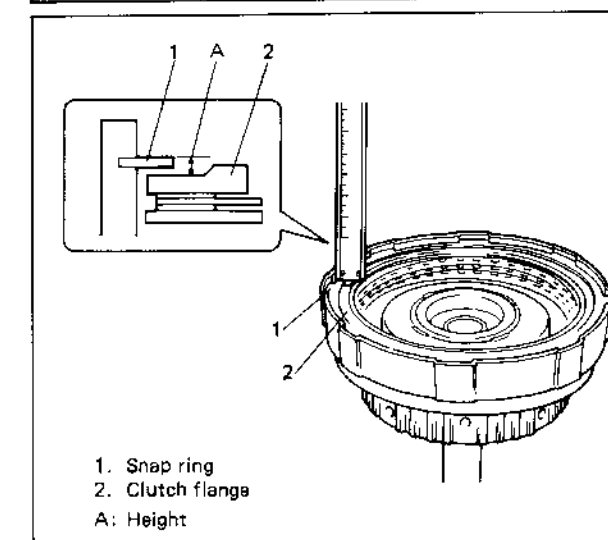


Fig. 7B-151 Measuring Forward Clutch Clearance

**Removal**

1. Clutch plate snap ring.
2. Flange, discs and plates.

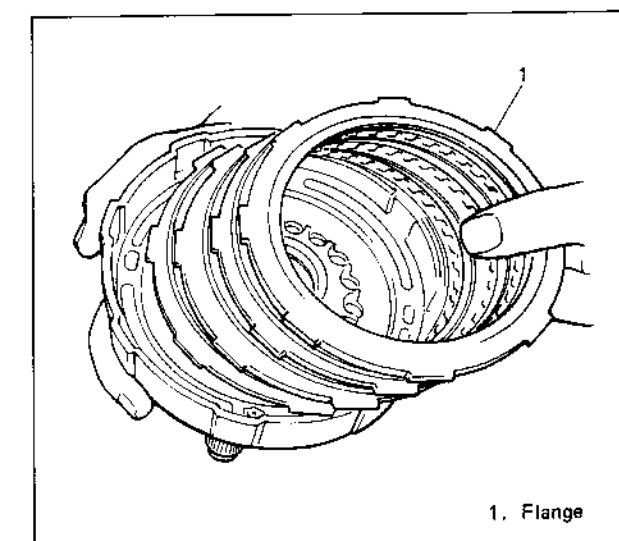


Fig. 7B-152 Removing Flange, Discs &amp; Plates



## 3. Spring seat snap ring.

Compress piston return springs and remove snap ring. Place special tool (clutch spring compressor) on spring seat and compress spring with a press, and then, remove snap ring, using a screwdriver.

**CAUTION:**

Do not push down return spring more than necessary.

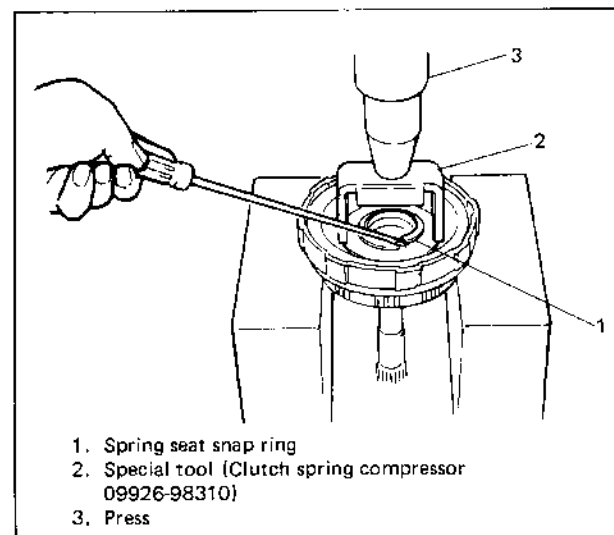


Fig. 7B-153 Removing Spring Seat Snap Ring

## 4. Spring seat and springs.

## 5. Forward clutch piston.

Blow compressed air through input shaft oil hole to remove piston. If piston does not pop out, take it out with long nose pliers.

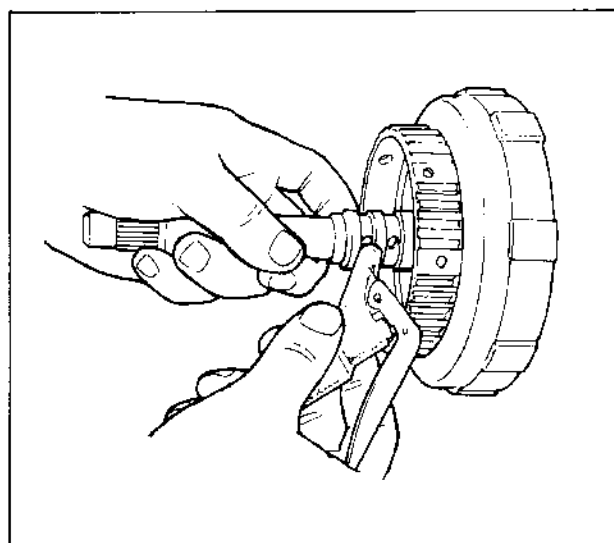


Fig. 7B-154 Removing Clutch Piston

## 6. Inner and outer seals (O rings) from piston.

**Inspection**

1. Check valve (ball) for free movement in clutch piston.
2. Check valve for leakage by using low pressure air. If found faulty, replace clutch piston.

**Installation**

1. Inner and outer seals (O rings) to clutch piston. Apply transmission fluid to them and fit to piston. Use new seals.
2. Piston into input shaft drum. use care so that seals do not get twisted or caught.
3. 18 piston return springs and spring seat.

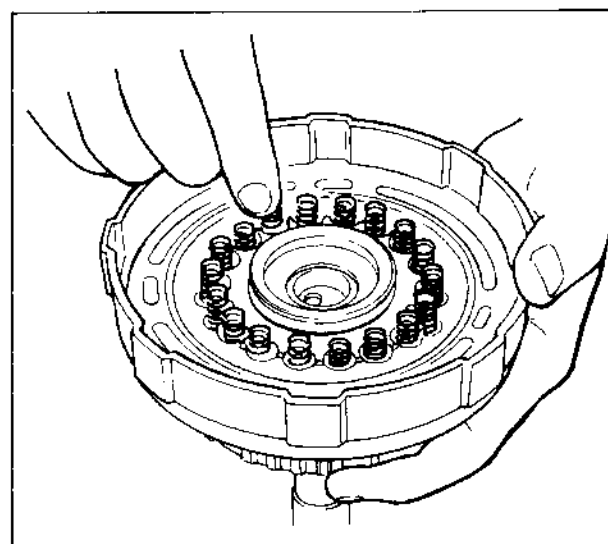


Fig. 7B-155 Installing Piston Return Springs

## 4. Spring seat snap ring.

Compress return springs and install snap rings in groove by using a screwdriver. Place special tool (clutch spring compressor) on spring seat and compress springs with a press.

**CAUTION:**

- Check to make sure that snap ring is securely fitted in 4 projections of spring seat.
- Do not compress return spring more than necessary.

## 5. Install discs, plates and flange.

Install them in following order.

- ① Plate → ② Disc → ③ Plate → ④ Disc →  
⑤ Plate → ⑥ Disc → ⑦ Flange

**NOTE:**

Before assembly, new discs should be soaked in automatic transmission fluid for 2 hours or more.

## 6. Clutch plate snap ring.

7. After installing clutch plate snap ring, measure height between snap ring and clutch flange as previously outlined.  
If discs and plates are new and yet out of above specification, install flange of different

thickness. Following 2 types of clutch flanges are available as spare parts.

|                                            |                                      |
|--------------------------------------------|--------------------------------------|
| Height between snap ring and clutch flange | 2.01 – 2.68 mm<br>0.079 – 0.105 in   |
| Available clutch flange size (thickness)   | 3.00 mm/0.118 in<br>3.37 mm/0.132 in |

8. Check clutch piston for movement by blowing air through input shaft oil hole.

**CAUTION:**

Apply only low pressure air, or spring seat may be damaged.

## VALVE BODY

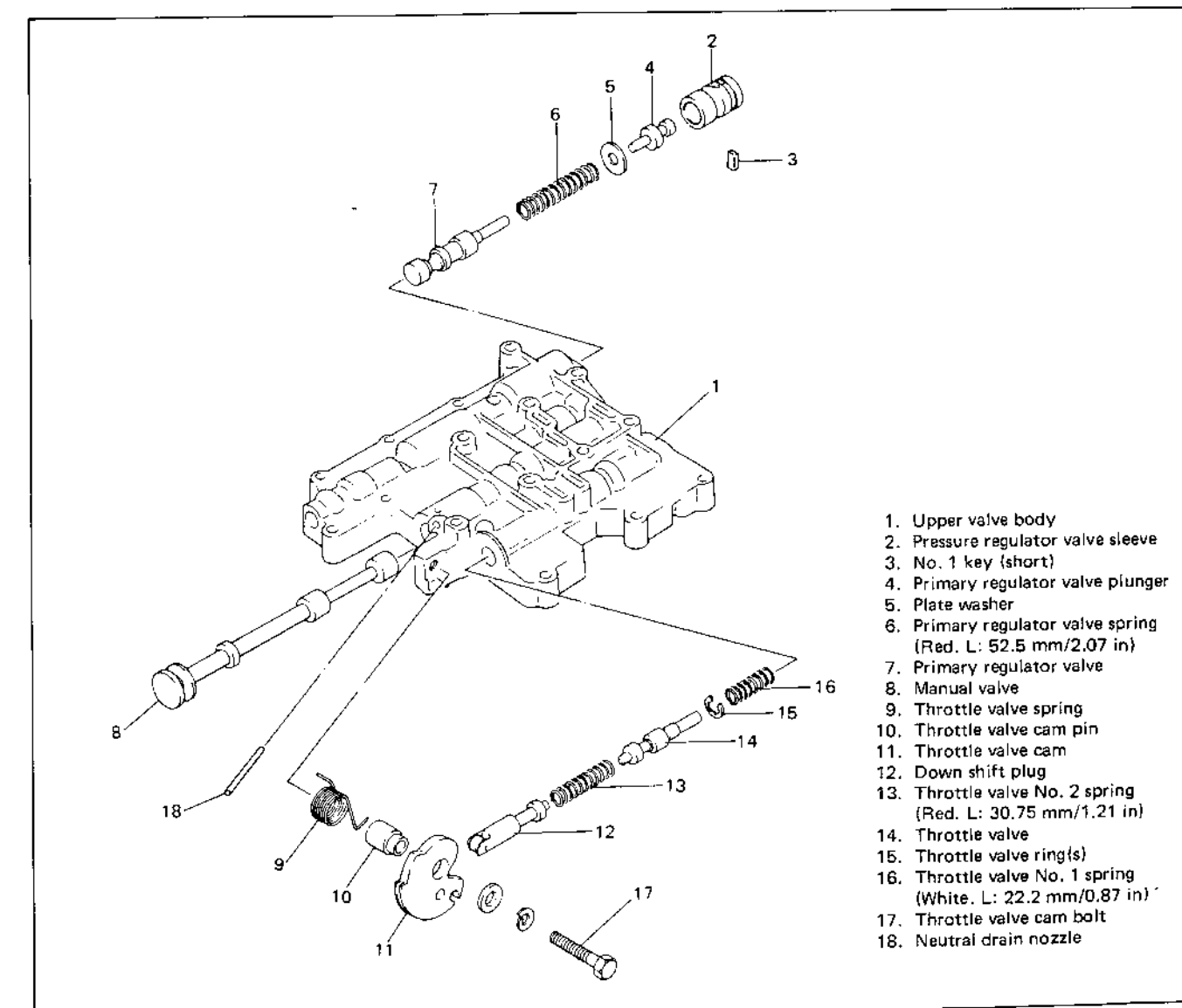


Fig. 7B-156 Upper Valve Body Components

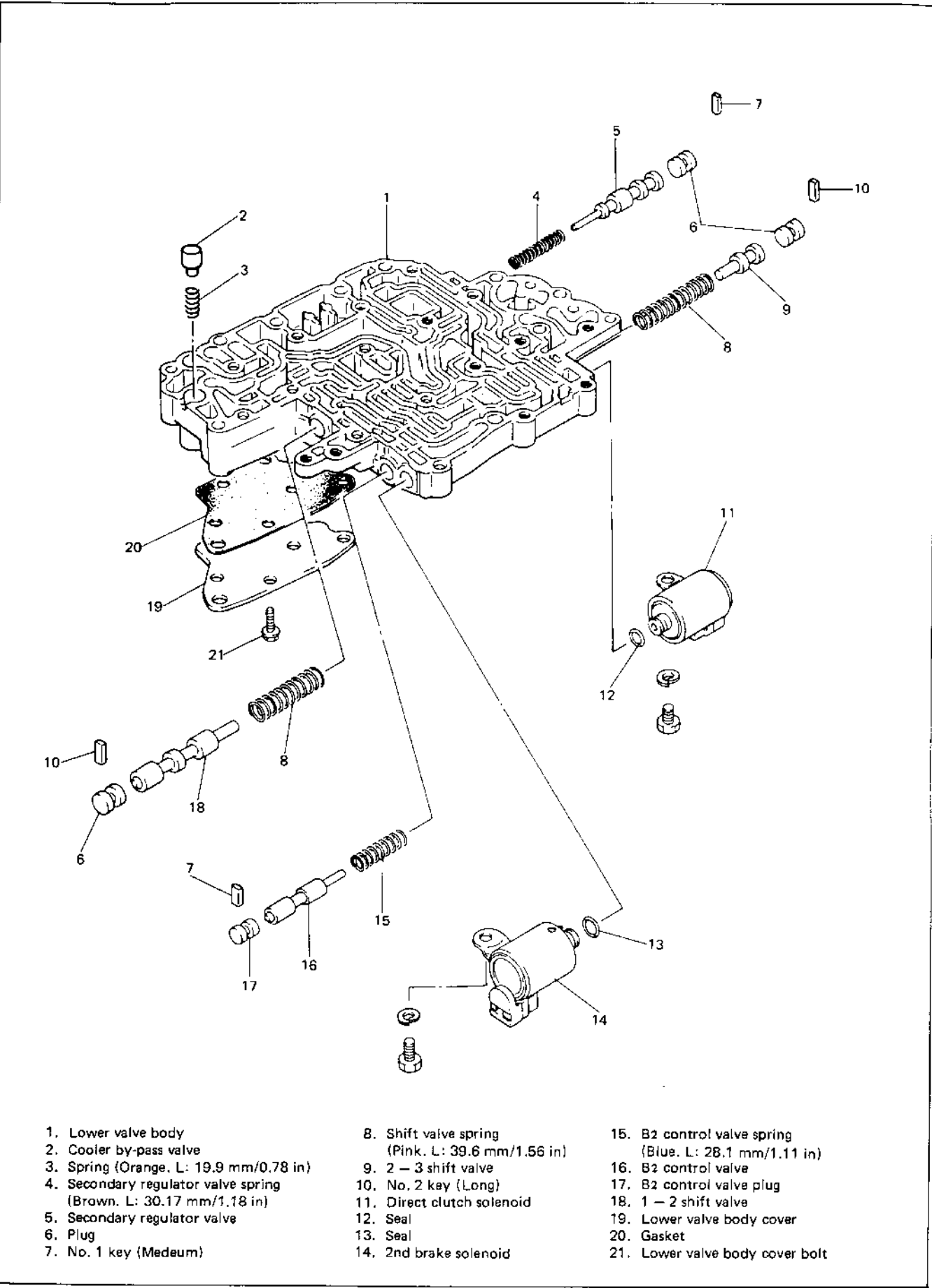


Fig. 7B-157 Lower Valve Body Components

**Important Steps in Disassembly and Reassembly of Valve Bodies**

- When disassembling valve body, be sure to keep each valve together with its corresponding spring.
- When removing upper valve body from lower one, be careful not to let 4 steel balls shown in figure fall off.
- When assembling, install these four (4) steel balls in such in upper valve body as shown in figure.

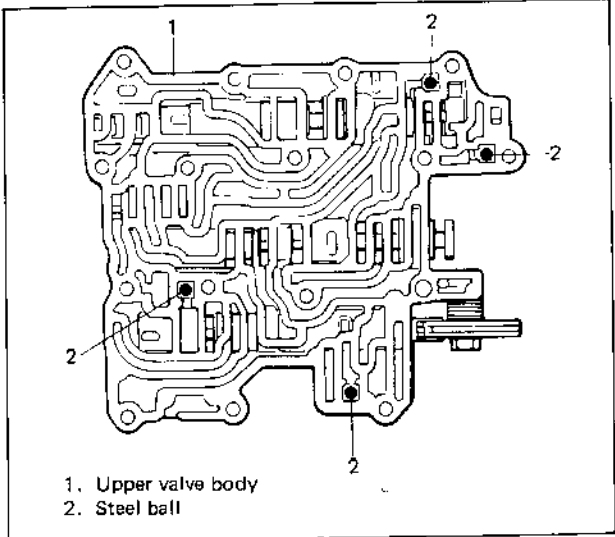
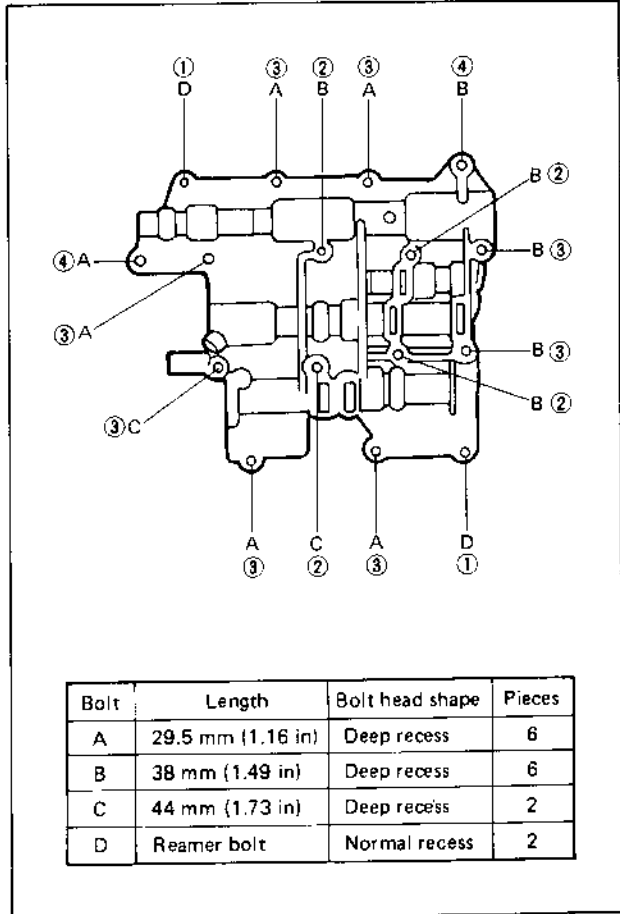


Fig. 7B-158 Installing Four (4) Steel Balls

- Replace each gasket with new one. Make sure that new gasket is the same as old one before installation.
- When installing each valve to valve body, use special care for proper installing direction.
- Several of throttle valve rings are used at throttle valve in upper valve body. Be sure to install the same number of throttle valve rings as those used before disassembly.
- When installing lower valve body cover and gasket to lower valve body, tighten lower valve body bolts to specification.
- Tighten throttle valve cam bolt to specification.
- When installing upper valve body to lower one, install 16 upper valve body bolts and tighten them to specified torque.

- 1) - Lightly install 2 reamer bolts (positioning bolts) to D.
- 2) - Install all other 14 bolts.
- 3) - Tighten 4 bolts ② to specification.
- 4) - Tighten 8 bolts ③ to specification.
- 5) - Tighten 2 bolts ④ and 2 reamer bolts ① to specification.

| Tightening torque            | N-m   | kg-m      | lb-ft     |
|------------------------------|-------|-----------|-----------|
| Lower valve body cover bolts | 4 - 6 | 0.4 - 0.6 | 3.0 - 4.0 |
| Throttle valve cam bolt      | 6 - 9 | 0.6 - 0.9 | 4.5 - 6.5 |
| Upper valve body bolts       | 5 - 6 | 0.5 - 0.6 | 4.0       |



| Bolt | Length            | Bolt head shape | Pieces |
|------|-------------------|-----------------|--------|
| A    | 29.5 mm (1.16 in) | Deep recess     | 6      |
| B    | 38 mm (1.49 in)   | Deep recess     | 6      |
| C    | 44 mm (1.73 in)   | Deep recess     | 2      |
| D    | Reamer bolt       | Normal recess   | 2      |

Fig. 7B-159 Installing Upper Valve Body Bolts



## COUNTERSHAFT AND OUTPUT SHAFT

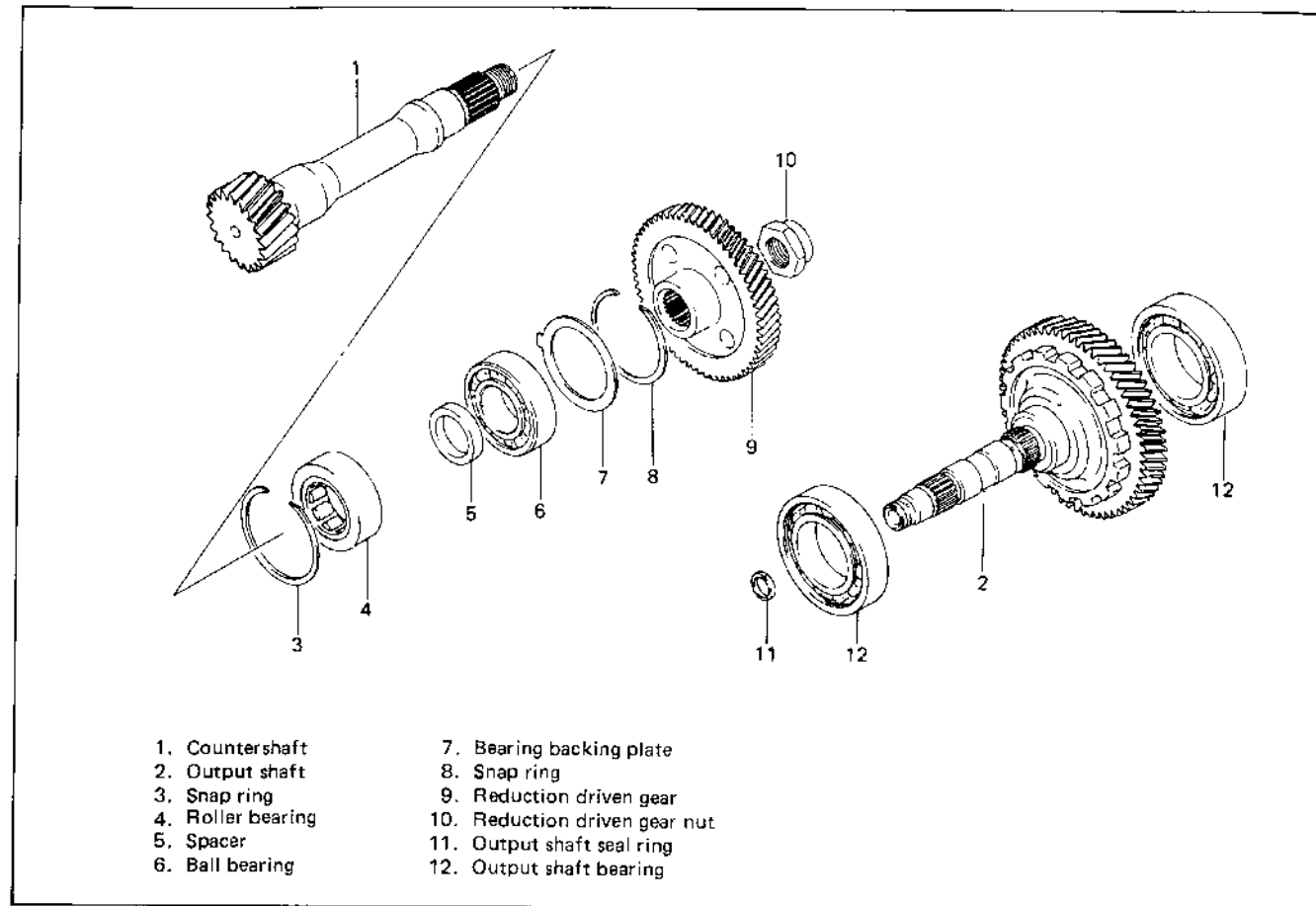


Fig. 7B-160 Countershaft and Output Shaft

## Countershaft Bearings

## Removal

1. Snap rings by using a screwdriver.

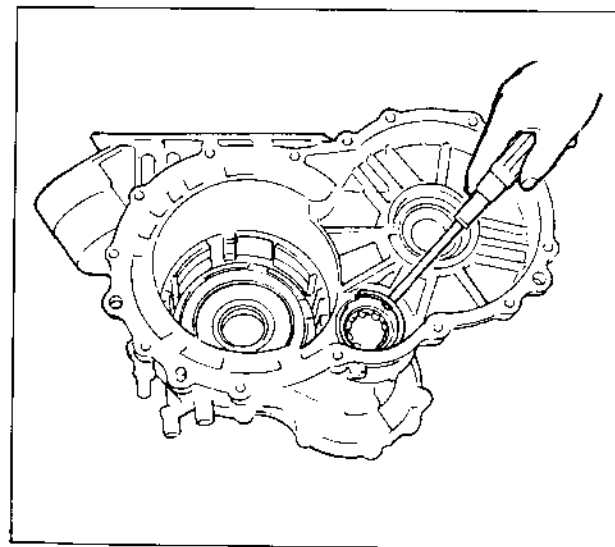


Fig. 7B-161 Removing Snap Ring

2. Backing plate (rear cover side).
3. Front and rear counter shaft bearings.
  - 1) Using special tools (Bearing remover and sliding shaft), remove bearing.
  - 2) Remove other side of bearing in the same way.

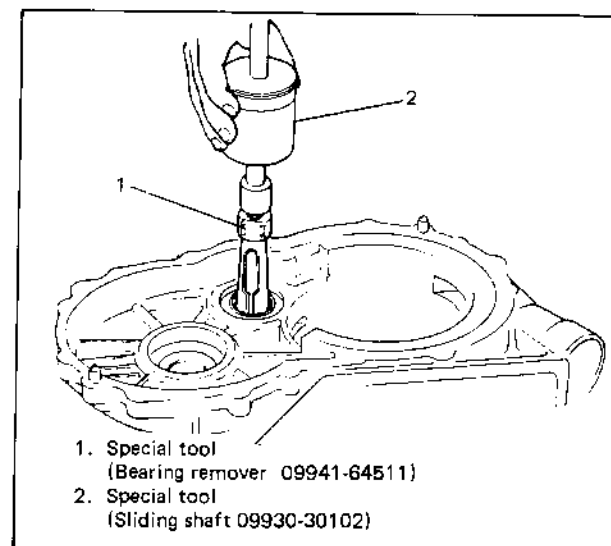


Fig. 7B-162 Removing Bearing

## Installation

1. Countershaft bearing (Roller bearing) to case.  
Use special tools (Bearing installer attachment and installer handle).  
The bearing installer attachment has two sides.  
Use small side A for installation of counter shaft bearings.

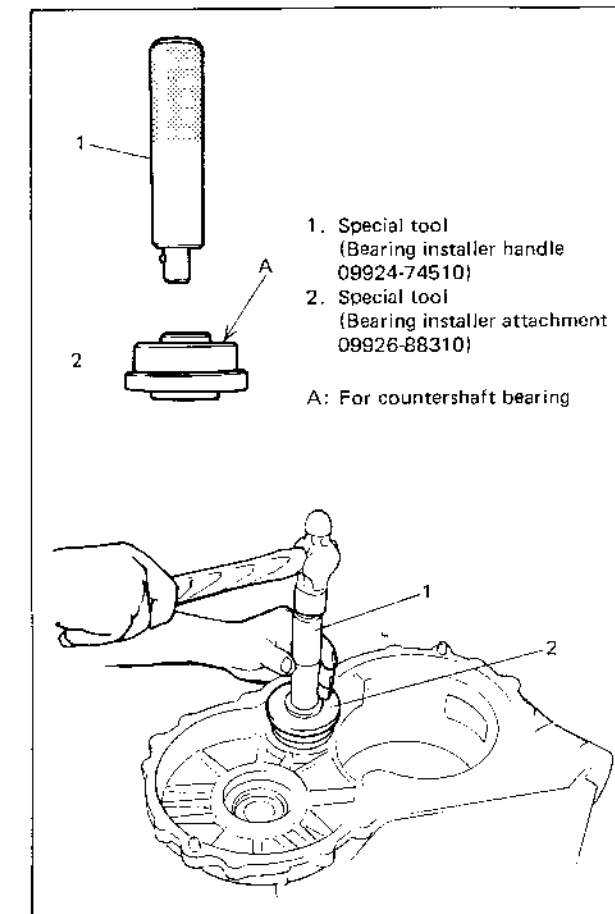


Fig. 7B-163 Installing Countershaft Bearing

2. Snap ring.
3. Countershaft spacer to case.
4. Another countershaft bearing (ball bearing) to case.  
Use special tools (Bearing installer attachment and installer handle).

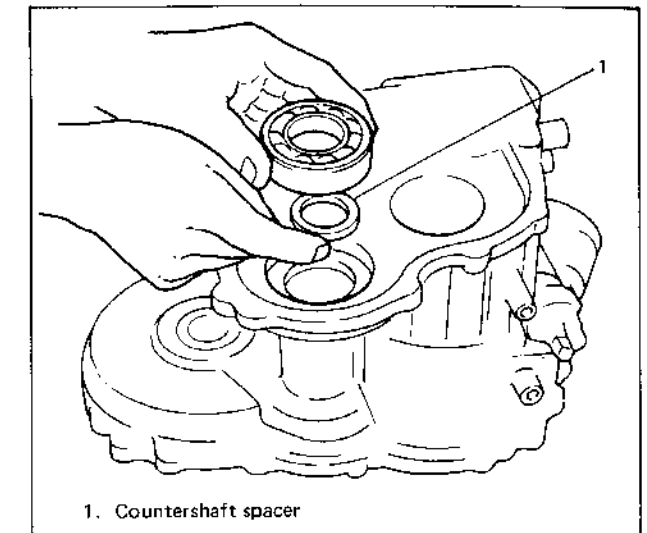


Fig. 7B-164 Installing Countershaft Spacer

5. Bearing backing plate and snap ring.

## Output Shaft Bearings

## Removal

1. Cover side bearing.  
Hold output shaft with soft jawed vise and remove bearing by using bearing puller.

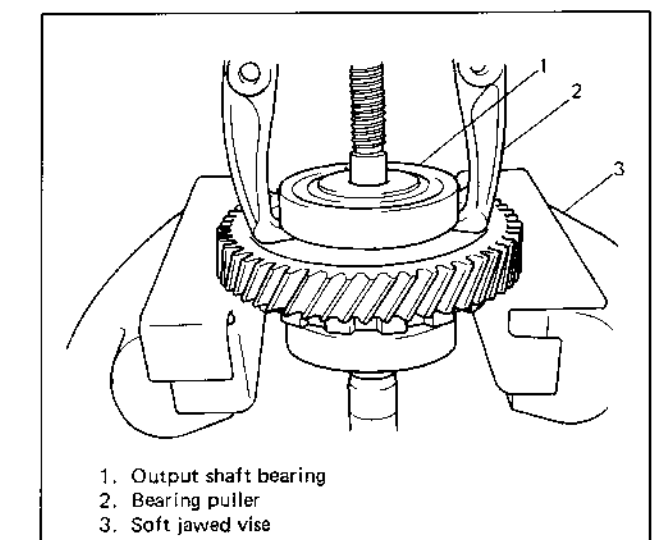


Fig. 7B-165 Removing Output Shaft Bearing

## 2. Inside bearing.

Hold bearing by using bearing puller and drive out shaft with press.

**CAUTION:**

Never hit shaft end where seal ring is installed so as not to distort ring slit.

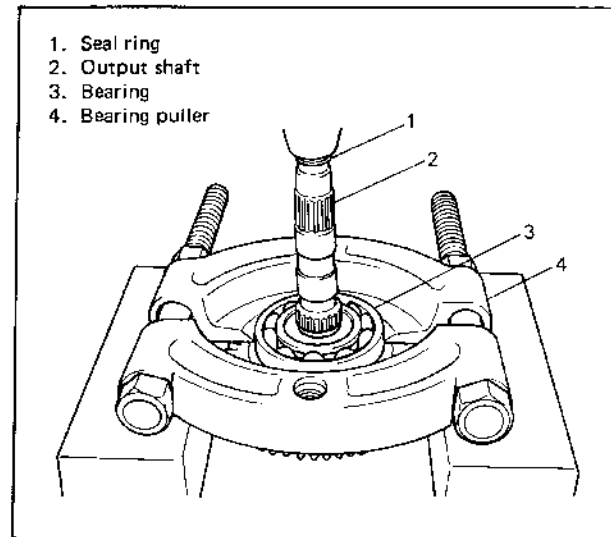


Fig. 7B-166 Removing Output Shaft Bearing

**Installation**

## 1. Inside bearing.

Use special tool with press.

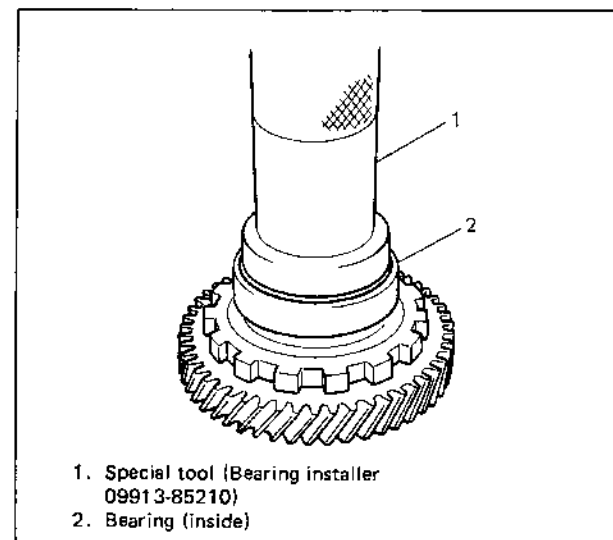


Fig. 7B-167 Installing Output Shaft Bearing

## 2. Cover side bearing.

Hold shaft at parking lock gear and press-fit bearing by using special tool with press.

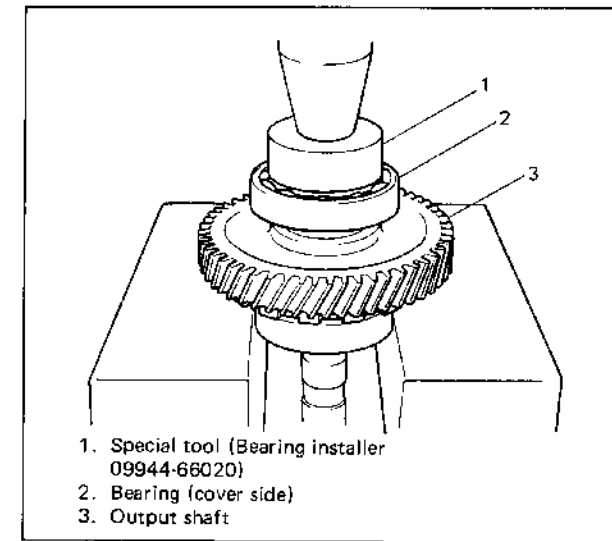
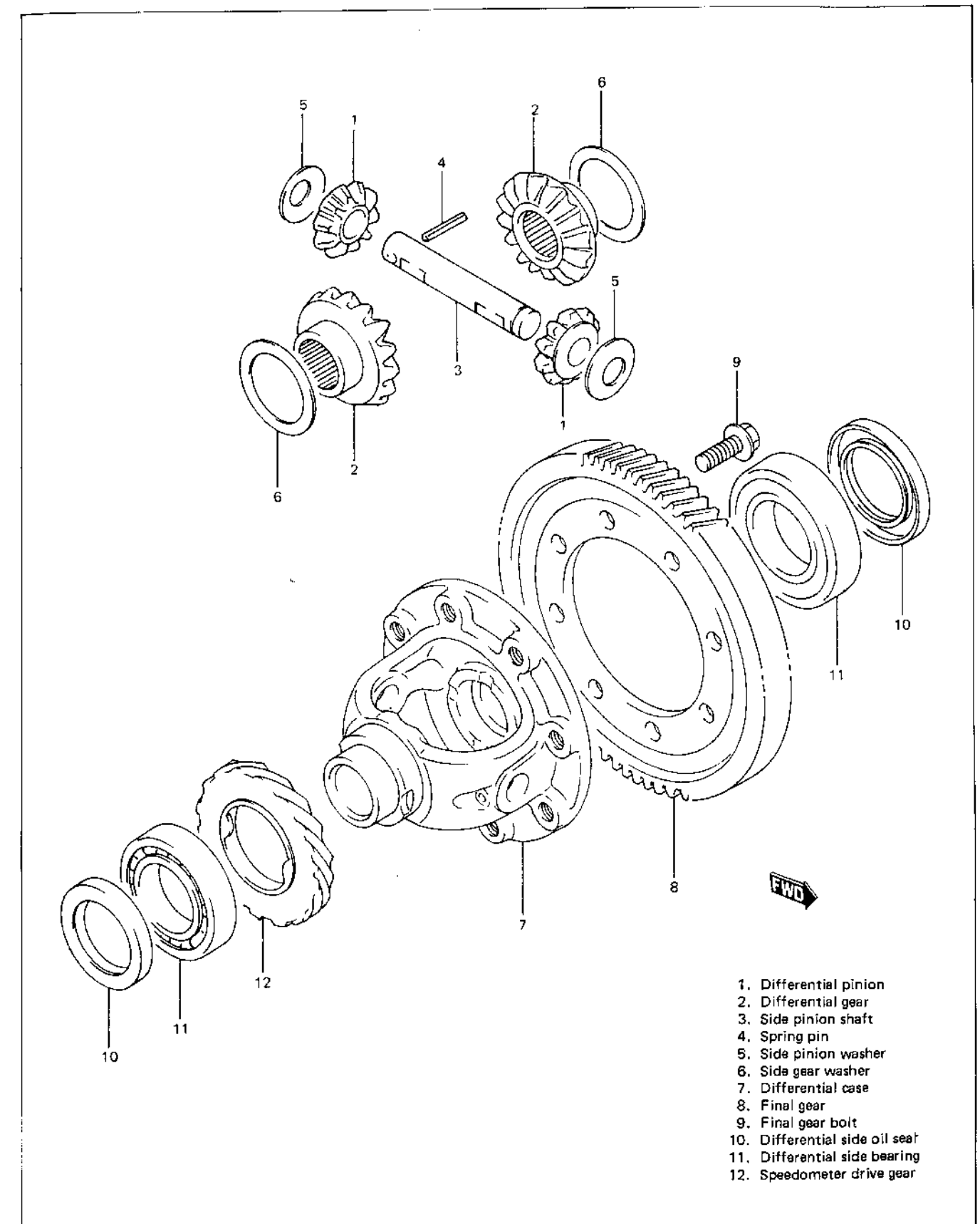


Fig. 7B-168 Installing Output Shaft Bearing

**DIFFERENTIAL ASSEMBLY**

Servicing procedure for differential assembly is

similar to that for manual transmission. Refer to p. 7A-28 for further information.



1. Differential pinion
2. Differential gear
3. Side pinion shaft
4. Spring pin
5. Side pinion washer
6. Side gear washer
7. Differential case
8. Final gear
9. Final gear bolt
10. Differential side oil seal
11. Differential side bearing
12. Speedometer drive gear

Fig. 7B-169 Differential Gear Components

**Disassembly****1. Diff. side bearing (L).**

Use special tool and puller for its removal.

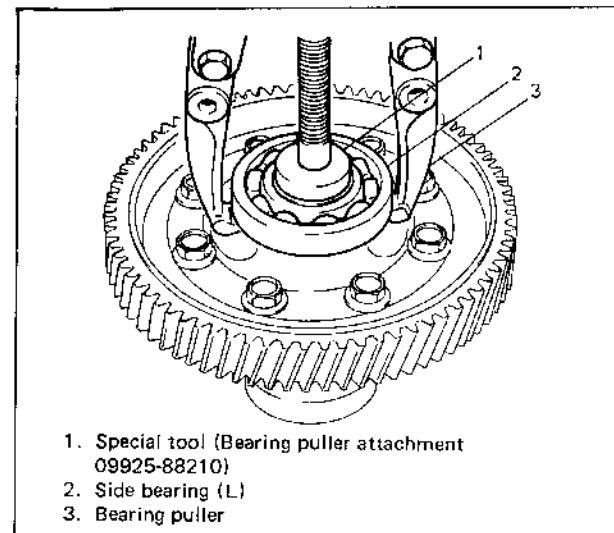


Fig. 7B-170 Removing Differential Side Bearing (L)

**2. Final gear.**

Hold diff. case with soft jawed vise and remove 8 bolts then take out final gear.

**3. Diff. side bearing (R).**

Drive it out by using special tool, bearing puller and press.

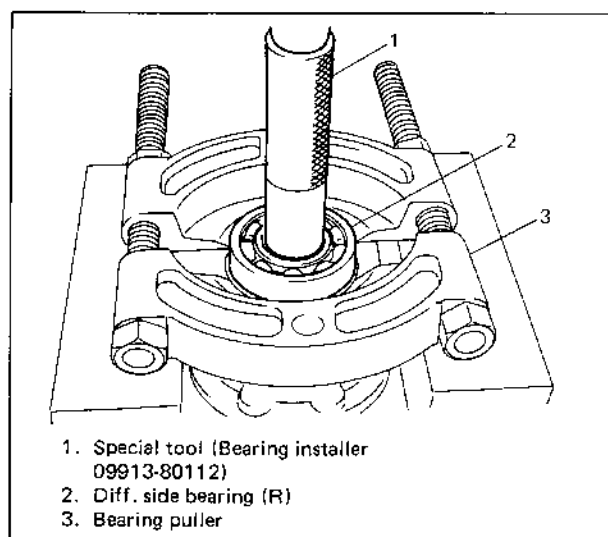


Fig. 7B-171 Removing Differential Side Bearing (R)

**4. Speedometer drive gear.****5. Side pinion shaft pin.**

Use special tool (Spring pin remover 4.5 mm 09922-85811) and hammer for its removal.

**6. Side pinion shaft, differential pinions with each washer, differential gears with each washer.****Adjustment and Reassembly**

Prepare replacing parts as required and proceed to reassembly. Make sure that all parts are clean.

**1. Differential gears.**

Measure and adjust thrust play referring to p. 7A-28, and then assemble them with suitable thrust washers.

**2. Side pinion shaft pin.**

Drive in spring pin from right side till it is flush with diff. case surface.

**3. Diff. side bearing (L).**

Face its seal side inward (diff. case side) and press-fit by using the same special tool with right hand bearing in step 5.

**4. Speedometer drive gear.****5. Diff. side bearing (R).**

Face its seal side inward and press-fit it by using special tool with copper hammer. While press-fitting, support diff. assembly as illustrated so that left hand bearing is floating.

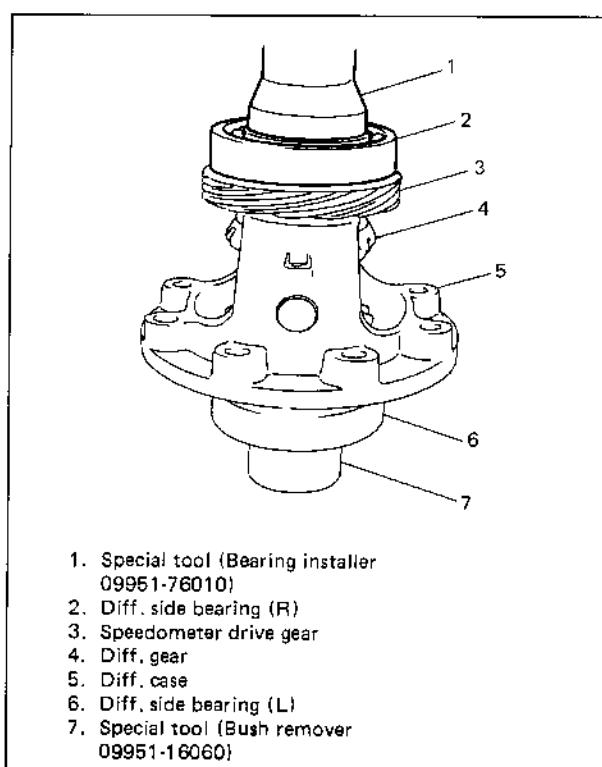


Fig. 7B-172 Press-fitting Differential Side Bearings

**6. Final gear.**

Hold differential assembly with soft jawed vise, install final gear and then tighten it with 8 bolts to specified torque.

**NOTE:**

Place offset side of final gear flange toward differential case.

**CAUTION:**

Use of any other bolts than specified ones is prohibited.

| Tightening torque for final gear bolts | N·m     | kg·m      | lb·ft       |
|----------------------------------------|---------|-----------|-------------|
|                                        | 80 - 90 | 8.0 - 9.0 | 58.0 - 65.0 |

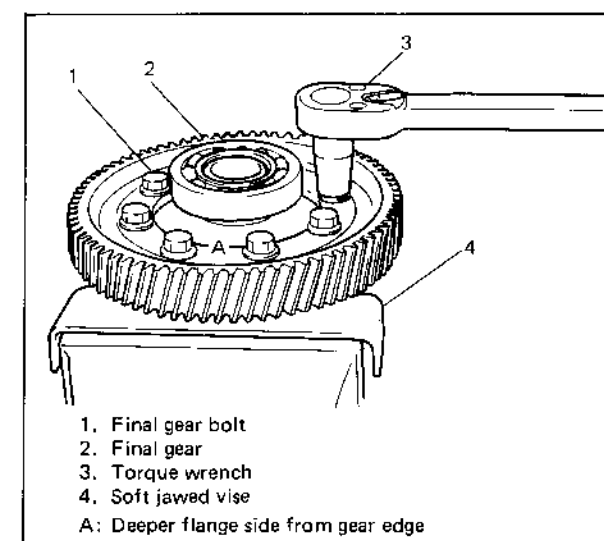


Fig. 7B-173 Tightening Final Gear Bolts

**ASSEMBLING UNIT****CAUTION:**

- Automatic transmission consists of highly precise parts. As even a flaw in a small part may cause oil leakage or decrease in function, check each part carefully before installation.
- Clean all parts with compressed air. Never use wiping cloths or rags.
- Before assembling new clutch discs and brake band, soak them in automatic transmission fluid for at least 2 hours.
- Be sure to use new gaskets and O rings.
- Lubricate O rings with automatic transmission fluid.
- Apply automatic transmission fluid on sliding or rotating surfaces of the parts before assembly.
- Use yellow petrolatum grease or Suzuki super grease C to retain parts in place.
- Be sure to install thrust bearings and races in correct direction and position as shown in right figure.
- Make sure that snap ring ends are not aligned with one of cutouts and are installed in groove correctly.
- Do not use adhesive cements on gaskets and similar parts.
- Be sure to torque each bolt and nut to specification.

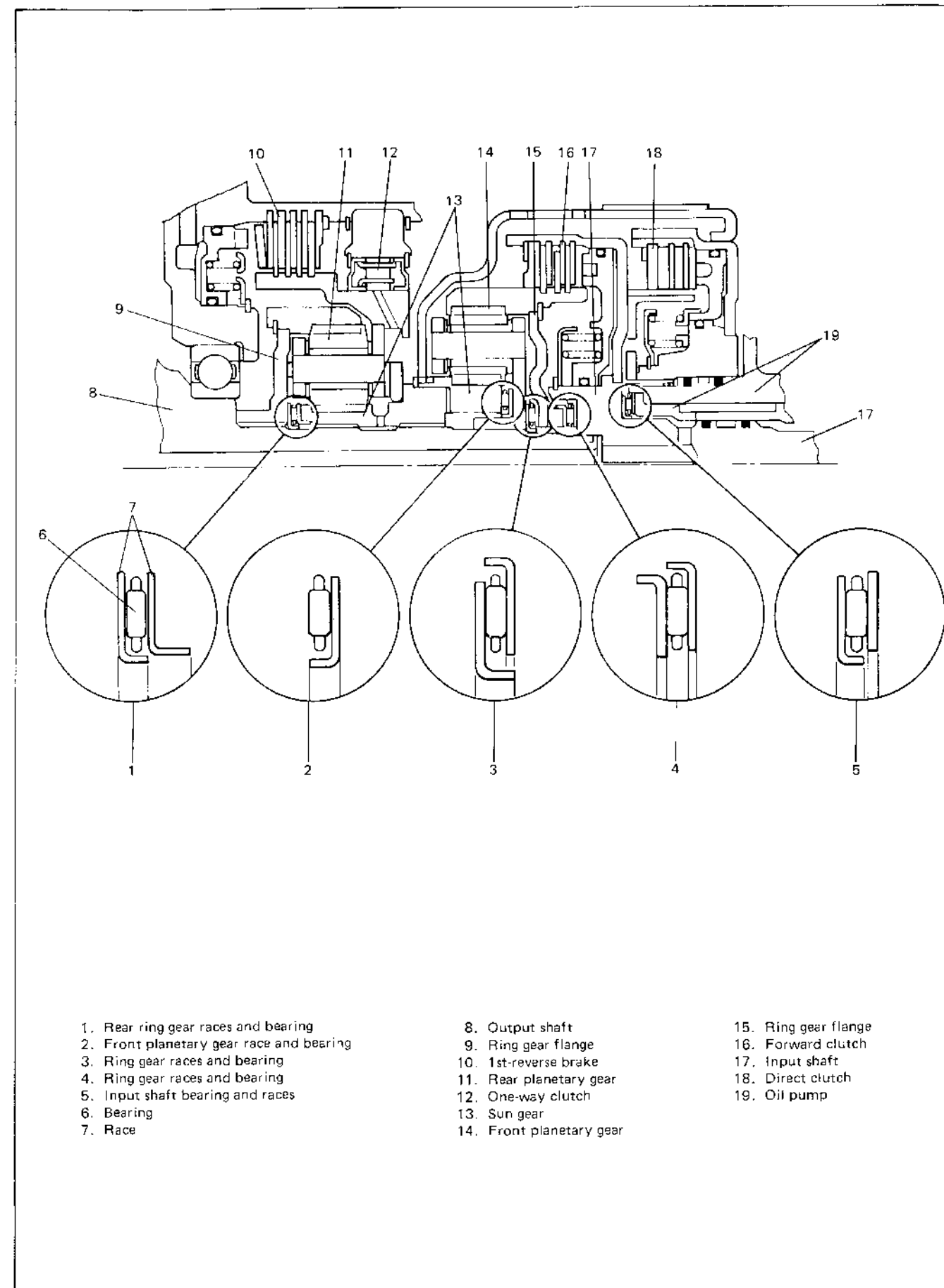


Fig. 7B-174 Thrust Bearings and Races

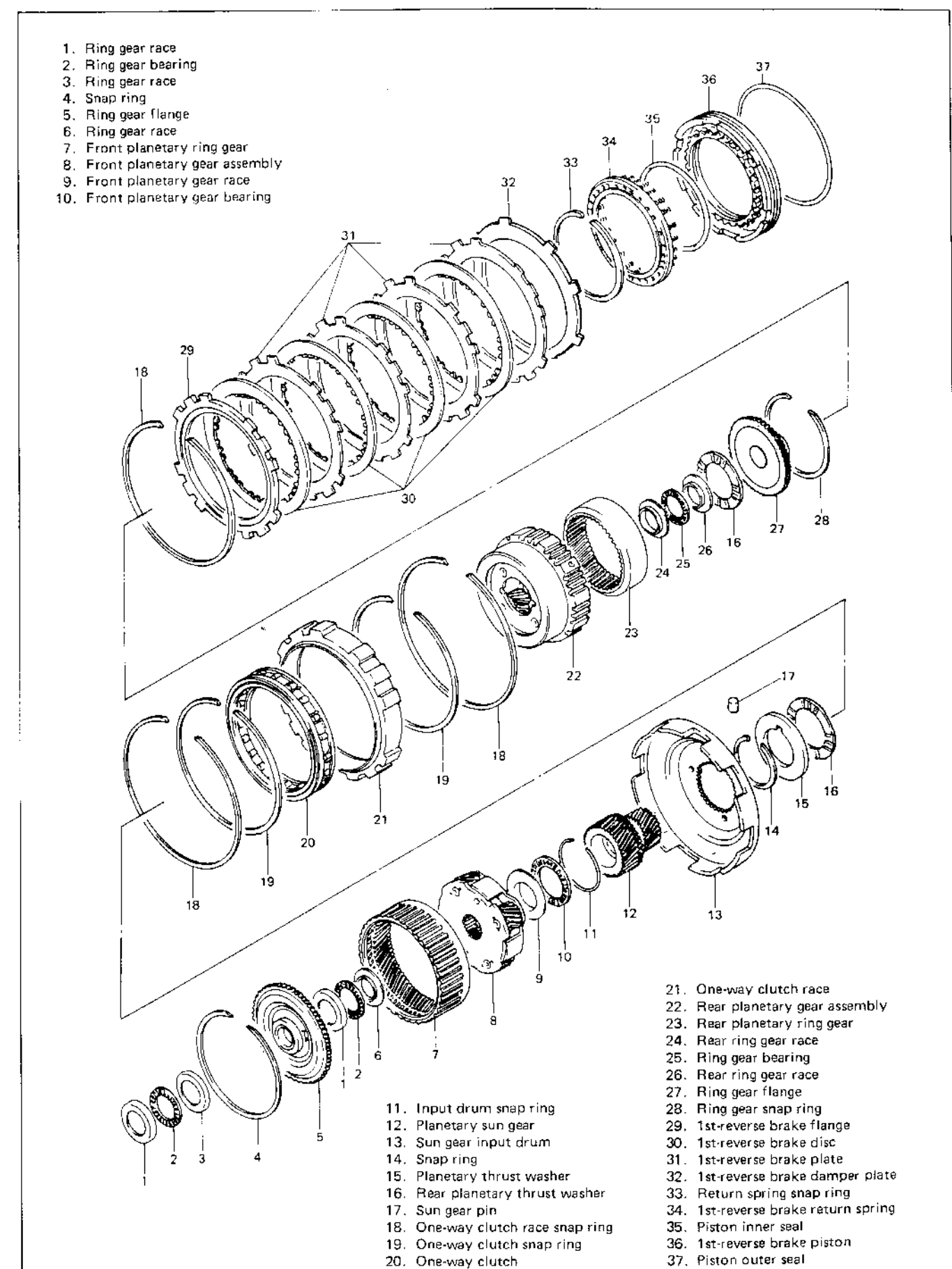


Fig. 7B-175 Planetary Gears and Related Parts

INSTALLATION

1. 2nd brake piston.

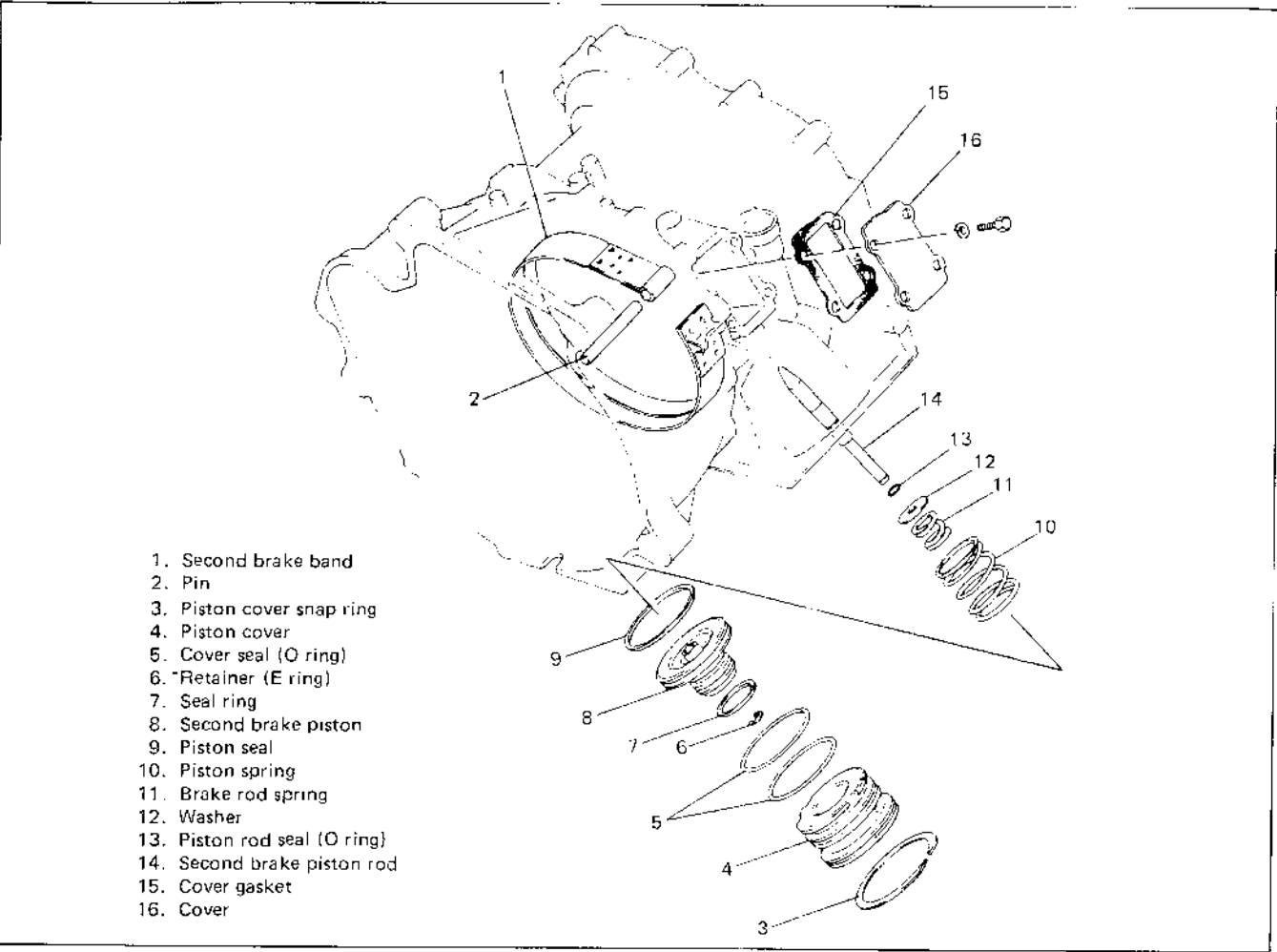


Fig. 7B-176 Second Brake Components

- 1) Put piston spring in transmission case and insert piston assembly into case after applying fluid to piston rod, seal and seal ring.

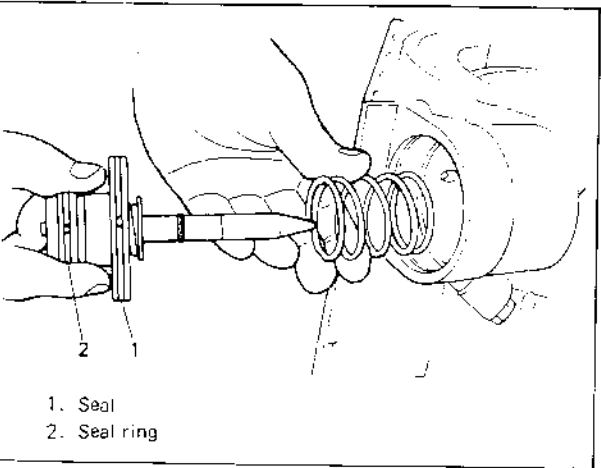


Fig. 7B-177 Installing 2nd Brake Piston

- 2) Piston cover to case after applying fluid to 2 cover seals.  
3) Push down piston cover by using valve lifter with 17 mm socket and install snap ring. Refer to Fig. 7B-106.

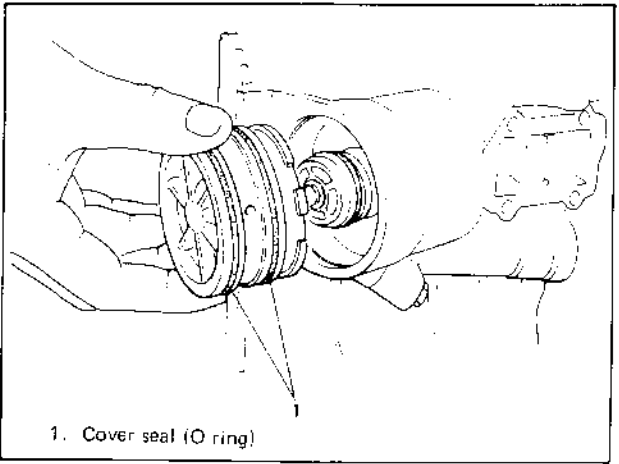


Fig. 7B-178 Installing 2nd Brake Piston Cover

2. Manual shift shaft and parking lock pawl.

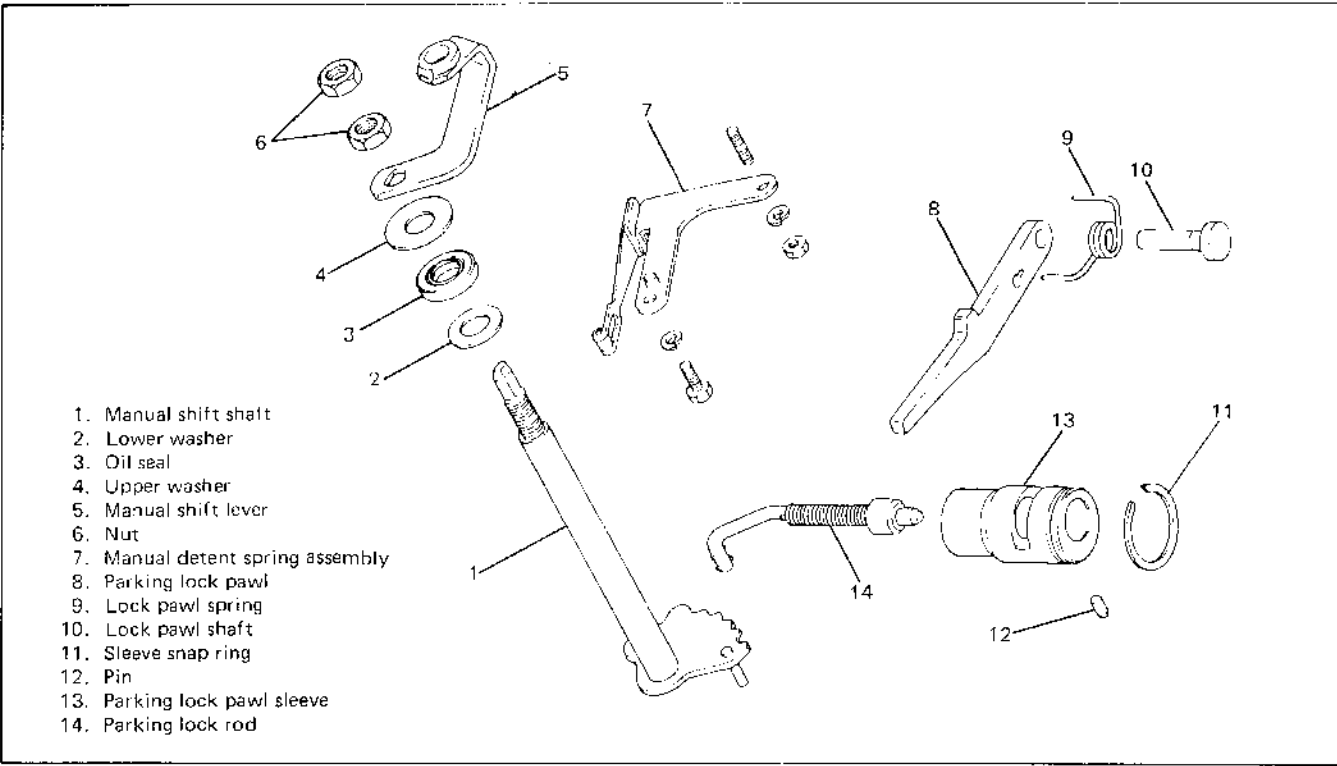


Fig. 7B-179 Manual Shift Shaft, Parking Lock Pawl and Related Parts

- 1) Install lower washer and parking lock rod to manual shift shaft.  
2) Manual shift shaft into transmission case, and then, manual detent spring. Use special care so that manual shift shaft will not damage oil seal lip when passing through it.  
3) Shift shaft upper washer and then manual shift lever to manual shift shaft. Tighten lower nut first and then upper nut.  
4) After tightening nuts, check manual shift shaft for smooth rotation.

| Tightening torque                 | N·m     | kg·m      | lb·ft       |
|-----------------------------------|---------|-----------|-------------|
| Manual detent spring bolt and nut | 8 - 12  | 0.8 - 1.2 | 6.0 - 8.5   |
| • Shift shaft lower nut           | 27 - 33 | 2.7 - 3.3 | 20.0 - 23.5 |
| • Upper nut                       |         |           |             |

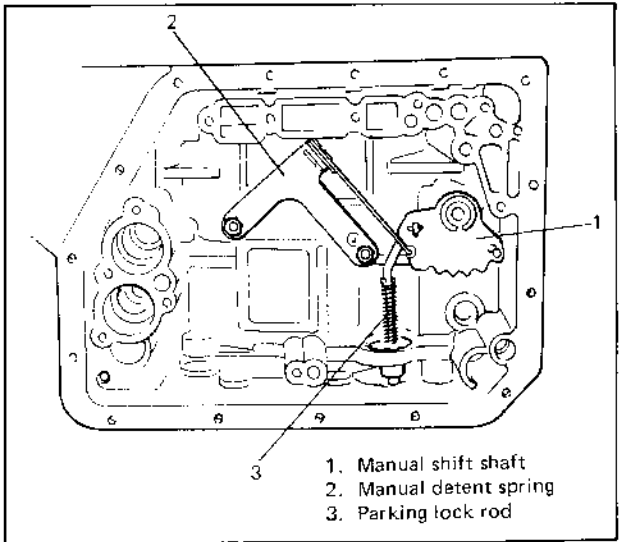


Fig. 7B-180 Installing Manual Shift Shaft and Manual Detent Spring

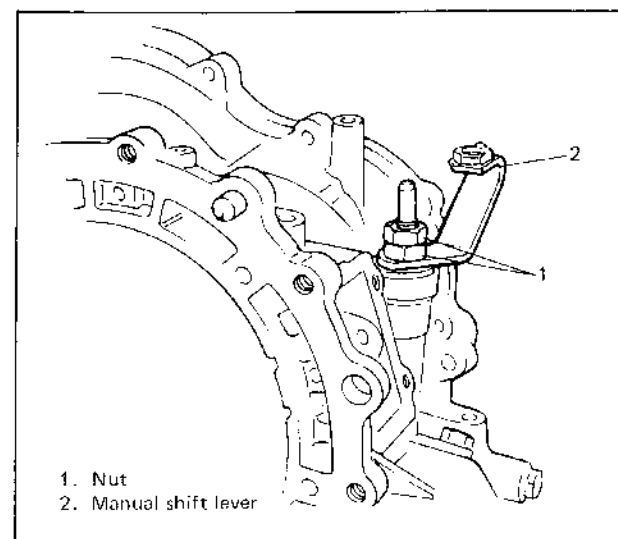


Fig. 7B-181 Upper and Lower Nuts

- 5) Restrictor pin and snap ring to parking lock pawl sleeve and then install to case.

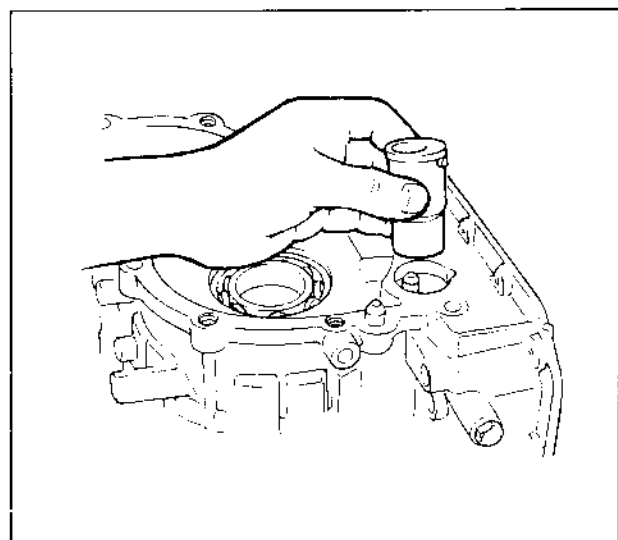


Fig. 7B-182 Installing Parking Lock Pawl Sleeve

- 6) Parking lock pawl.
- Shift manual shift lever to a position other than P.
  - Install parking lock pawl.
  - Install lock pawl shaft and lock pawl spring, and then, check to make sure that parking lock pawl moves smoothly when manual shift lever is moved.

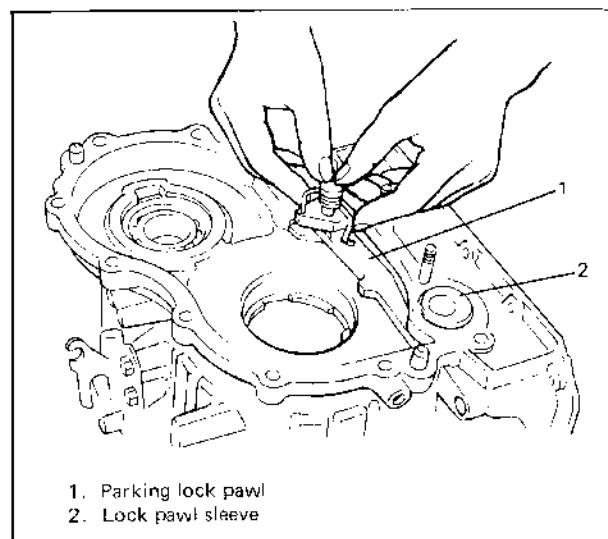


Fig. 7B-183 Installing Lock Pawl Shaft and Lock Pawl Spring

3. 1st-reverse brake piston.
- Apply fluid to inner and outer seals (O rings) and fit them to piston. Use new seals.
  - Insert piston into case in such way that the side with spring holes comes to the top. Make sure that seals are not twisted or caught.
  - Place return spring assembly on piston. Check to make sure that each spring of return spring assembly is fitted securely in spring hole in piston.
  - Push down return spring assembly and install snap ring.

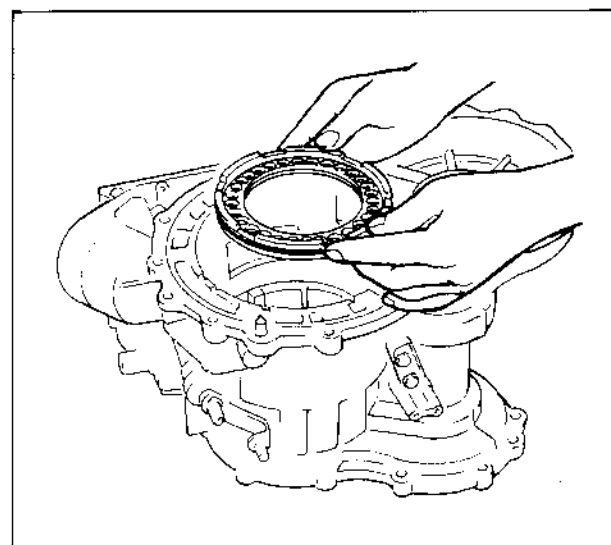


Fig. 7B-184 Installing 1st-REV Brake Piston

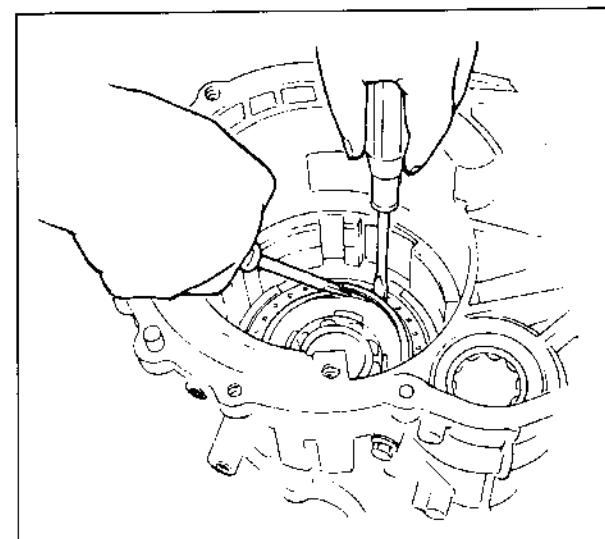


Fig. 7B-185 Installing Snap Ring

#### 4. Countershaft.

Using a special tool (Bearing installer) and a hammer, install countershaft. When inserting countershaft into case, check to make sure that spacer is in such position as shown in figure.

#### CAUTION:

Do not hammer shaft excessively hard, or snap ring and case will be damaged.

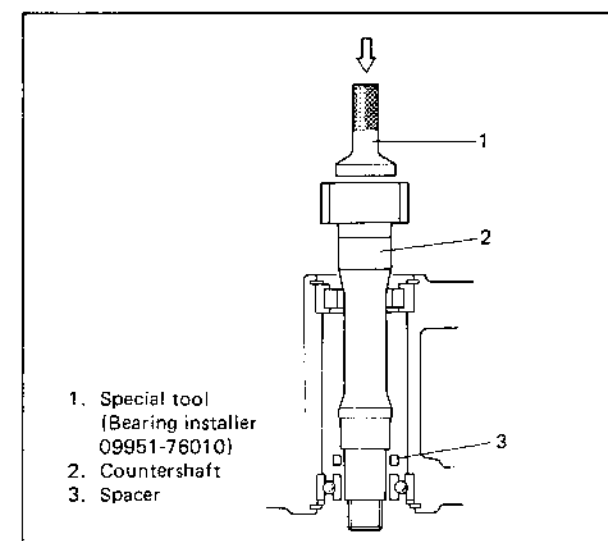


Fig. 7B-186 Installing Countershaft

#### 5. Output shaft.

- Shift manual shift lever to a position other than P.
- Using a special tool (Bearing installer) and hammer, install output shaft.

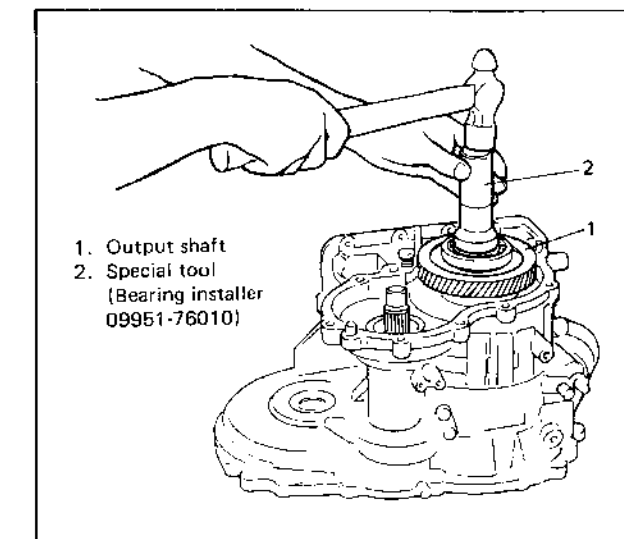


Fig. 7B-187 Installing Output Shaft

#### 6. Reduction driven gear on countershaft.

- Shift manual shift lever to P position so that output shaft is locked and cannot turn.
- Tighten driven gear nut to specification.

#### CAUTION:

- Tighten nut by turning wrench by hand.
- Tightening nut by hammering wrench may cause damage to parking lock pawl, output shaft and reduction gear.

| Tightening torque for driven gear nut | N-m     | kg-m      | lb-ft      |
|---------------------------------------|---------|-----------|------------|
|                                       | 110-150 | 11.0-15.0 | 80.0-108.0 |

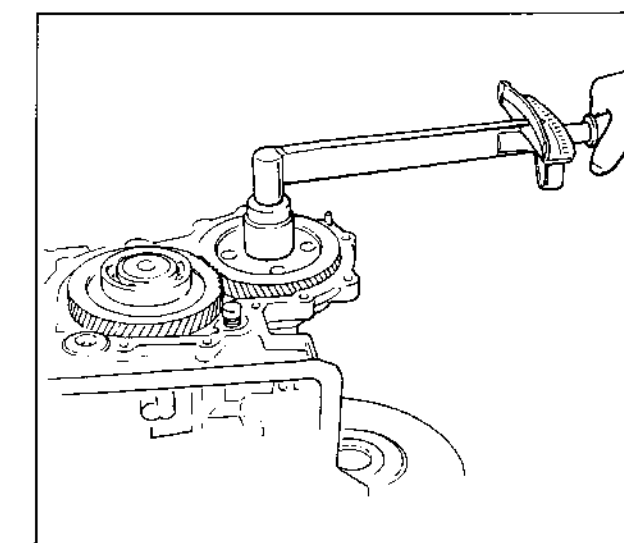


Fig. 7B-188 Tightening Driven Gear Nut



3) Using a chisel and a hammer, caulk driven gear nut at 2 places.

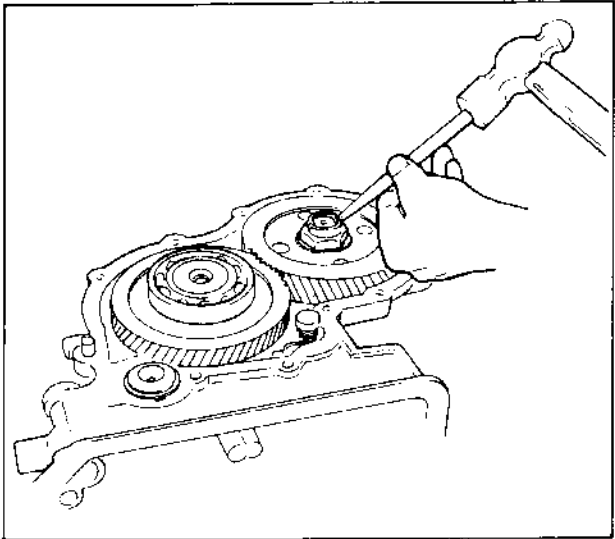


Fig. 7B-189 Caulking Driven Gear Nut

7. Transmission rear cover.  
1) Install rear cover gasket.  
2) Install rear cover.  
Check that output shaft bearing enters to rear cover bearing hole smoothly.  
3) Install 10 bolts and 2 nuts.  
Torque bolts and nuts to following specifications.

**NOTE:**  
Check to make sure that the shafts rotate smoothly without abnormal noise.

| Tightening torque | N·m     | kg·m      | lb·ft       |
|-------------------|---------|-----------|-------------|
| Rear cover bolts  | 16 – 23 | 1.6 – 2.3 | 12.0 – 16.5 |
| Rear cover nuts   | 11 – 15 | 1.1 – 1.5 | 8.0 – 10.5  |

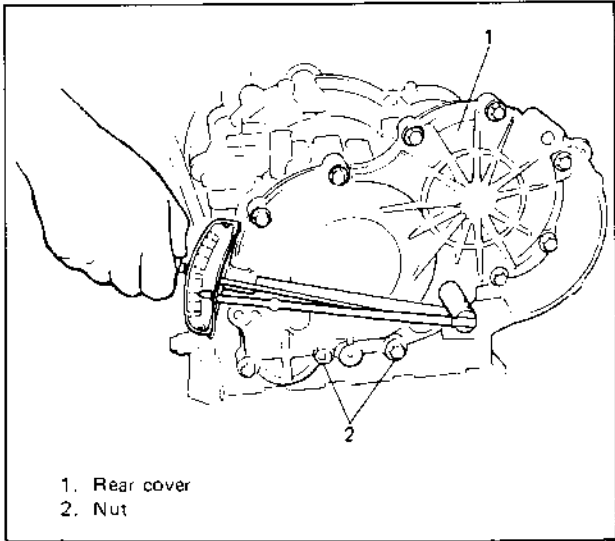


Fig. 7B-190 Installing Rear Cover

8. Using special tools (Output shaft remover and Bearing remover handle), push output shaft against rear cover side.  
1) Fit 4 projections of special tool (Output shaft remover) to 4 notches A in case.  
2) Push bearing and output shaft against rear cover side by tapping special tool (Bearing remover handle) with a hammer lightly.

**CAUTION:**

- Do not hit output shaft directly, or shaft end will be damaged.
- Be careful not to hammer with special tool too hard.

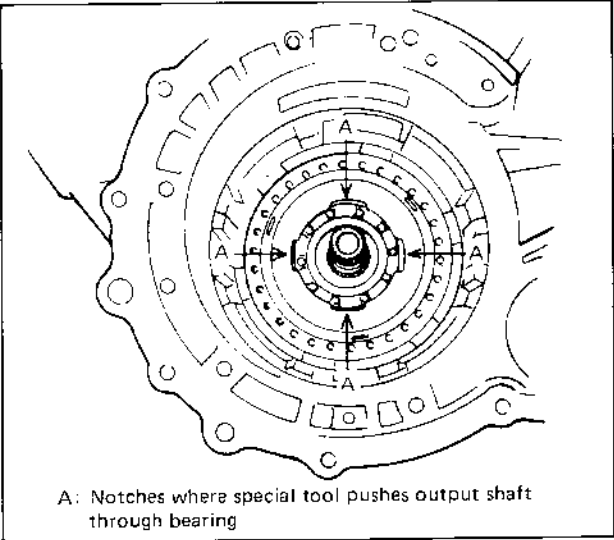


Fig. 7B-191 Notches

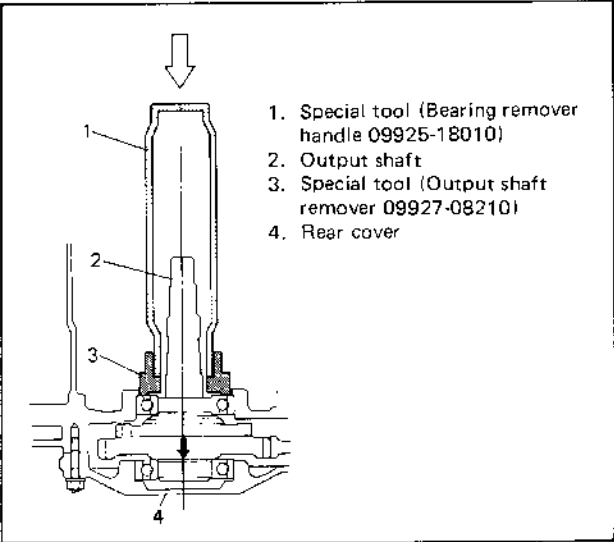


Fig. 7B-192 Seating Output Shaft in Rear Cover

9. Differential gear assembly.  
After engaging teeth of final gear and counter-shaft gear, install differential assembly.

**CAUTION:**

- Be careful not to damage gear tooth by hitting it with other one.
- Make sure that differential assembly is placed on case straightly, while installing it.
- Drive in differential by giving force to side bearing inner race through bearing installer 09951-76010.

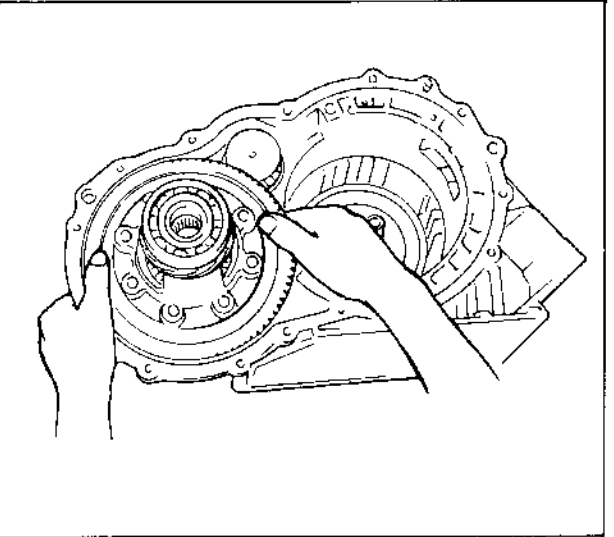


Fig. 7B-193 Installing Differential Gear Assembly

10. 1st-reverse brake parts.  
1) Install damper plate to return spring assembly with convex side upward. Use care not to install in reverse direction.

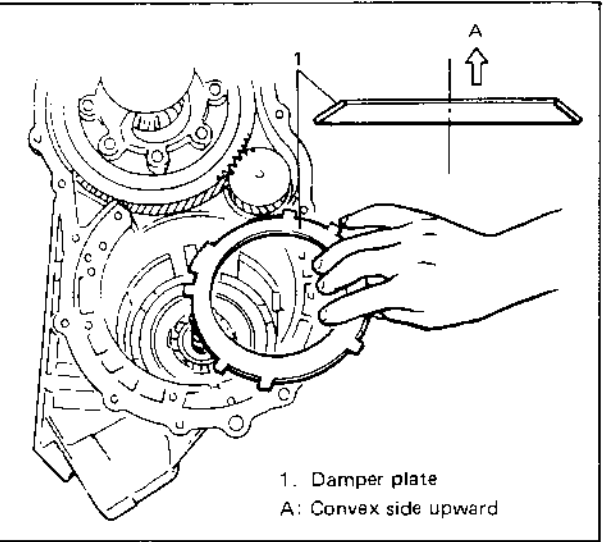


Fig. 7B-194 Installing Damper Plate

2) Install discs, plates and flange. Install in following order:

- ① Plate → ② Disc → ③ Plate → ④ Disc → ⑤ Plate → ⑥ Disc → ⑦ Plate → ⑧ Disc → ⑨ Flange (Flat side down)

**NOTE:**  
When using new discs for installation, soak them in fluid for more than 2 hours before installation.

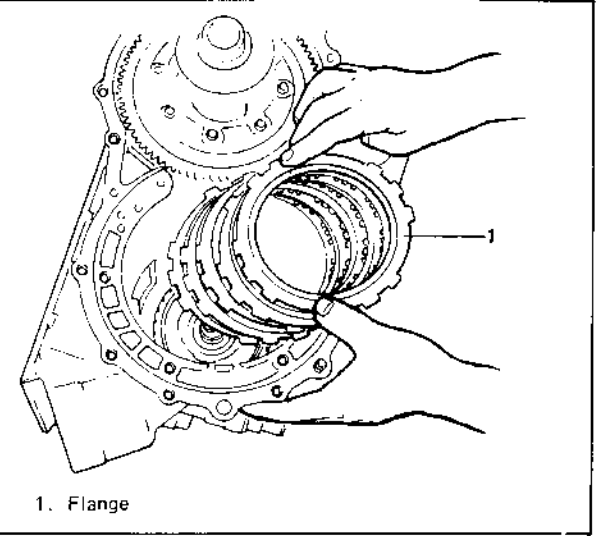


Fig. 7B-195 Installing Discs, Plates and Flange

3) Install snap ring.  
11. Measure 1st-reverse brake clutch clearance.  
Measure clearance between snap ring and flange.

|                                    |                                    |
|------------------------------------|------------------------------------|
| 1st-reverse brake clutch clearance | 0.58 – 1.92 mm<br>0.023 – 0.075 in |
|------------------------------------|------------------------------------|

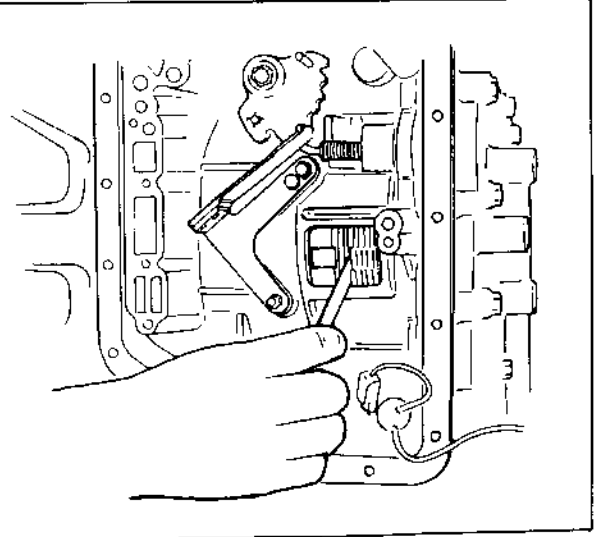


Fig. 7B-196 Measuring 1st-reverse Brake Clutch Clearance

12. Check 1st-reverse brake piston for operation.  
Check for piston movement by blowing air into oil hole.

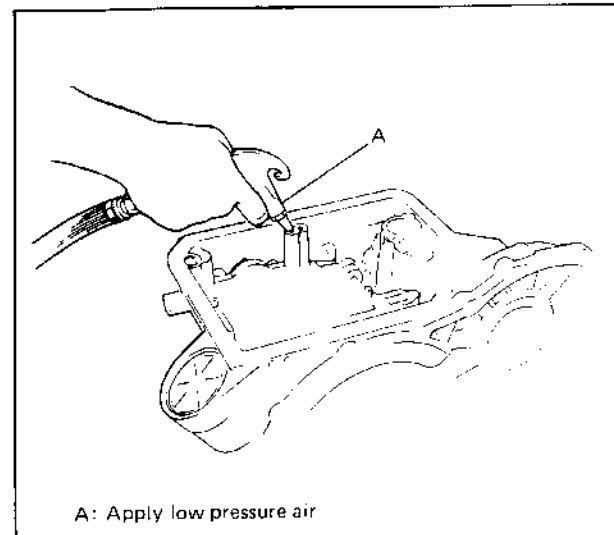


Fig. 7B-197 Checking 1st-reverse Brake Piston Movement

13. Rear planetary ring gear.  
Engage ring gear and output shaft spline, and insert.

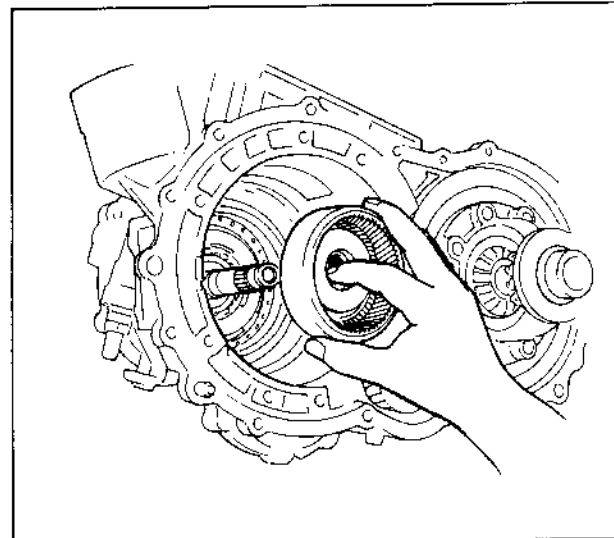


Fig. 7B-198 Installing Rear Planetary Ring Gear

14. Rear planetary ring gear races and bearing.  
Install in following order:

- ① Race (flange side up)
- ② Bearing
- ③ Race (flange side up)

For proper positions and directions of ring gear races installation, refer to p. 7B-88.

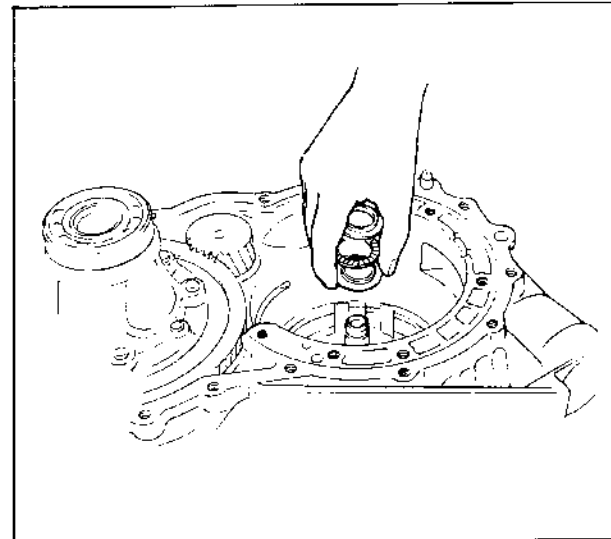


Fig. 7B-199 Installing Rear Planetary Ring Gear Bearing

15. Checking one-way clutch direction.  
Provisionally assemble one-way clutch and rear planetary gear, then turn them by hand. They should rotate freely in arrow direction A but lock in the other way.  
Remove one-way clutch and keep its correct side in mind until it is installed into transmission.

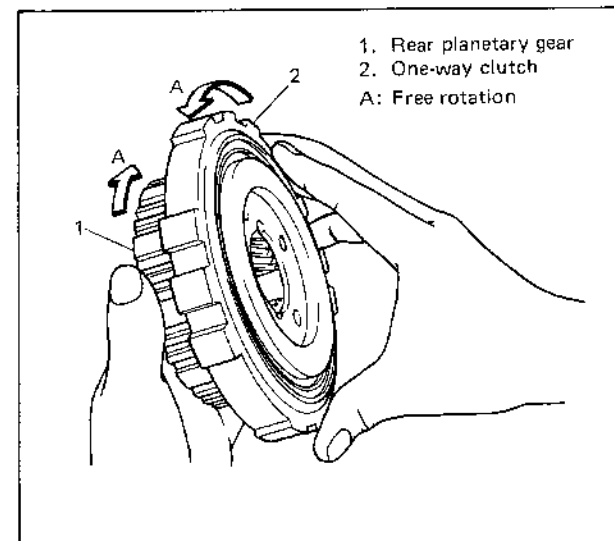


Fig. 7B-200 Checking Free Rotation of One-way Clutch

16. Rear planetary thrust washers on rear planetary gear.

Apply grease to thrust washers and fit them before and behind planetary gear, one each. Make sure that different lug shapes match slots in planetary gear.

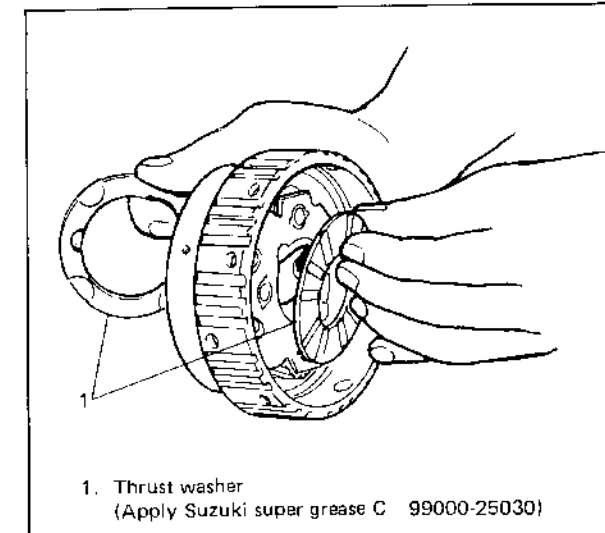


Fig. 7B-201 Installing Rear Planetary Thrust Washers

17. Rear planetary gear.

Install it with teeth of 1st-reverse brake discs aligned.

After installing rear planetary gear, check thrust washers and races for proper installation by moving rear planetary gear up and down lightly by hand. If gear assembly makes clear sound like "Click" when moved up and down, washers and races are installed in place. But if no sound or thick one is heard, it is possible that they are out of place. In such case, remove gear assembly and check.

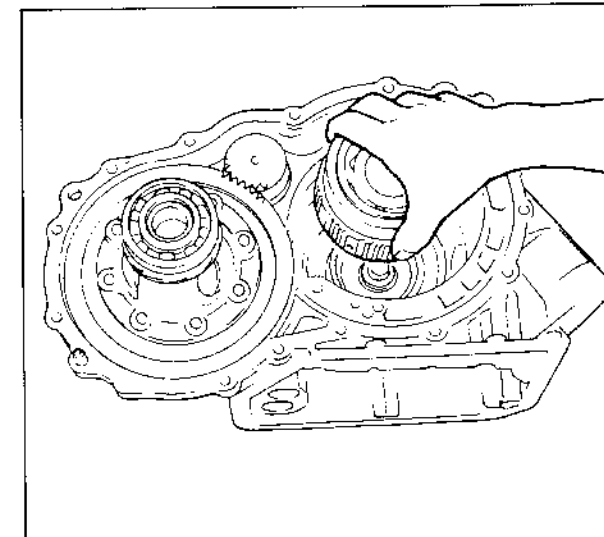


Fig. 7B-202 Installing Rear Planetary Gear Assembly

18. One-way clutch race snap ring into groove of transmission case.  
19. One-way clutch.  
Place one-way clutch on rear planetary gear and while turning planetary gear clockwise by hand, insert one-way clutch to correct position.

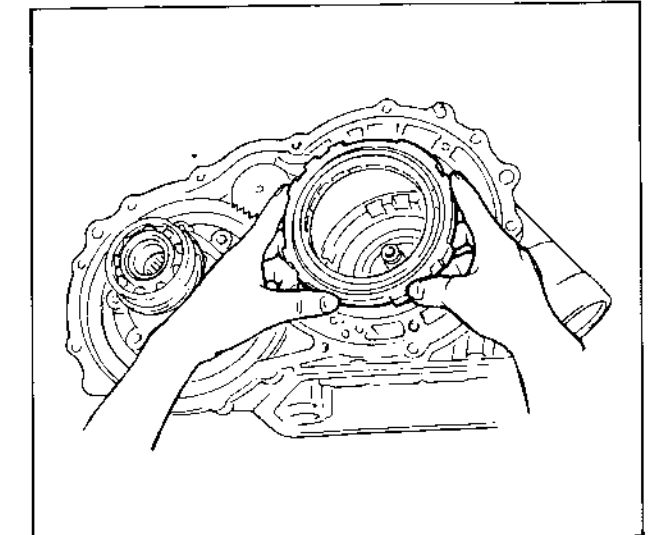


Fig. 7B-203 Installing One-way Clutch

After installing one-way clutch to rear planetary gear, check to confirm that planetary gear turns clockwise but locks in the other way.

**NOTE:**  
Rotation check must be performed without fail.

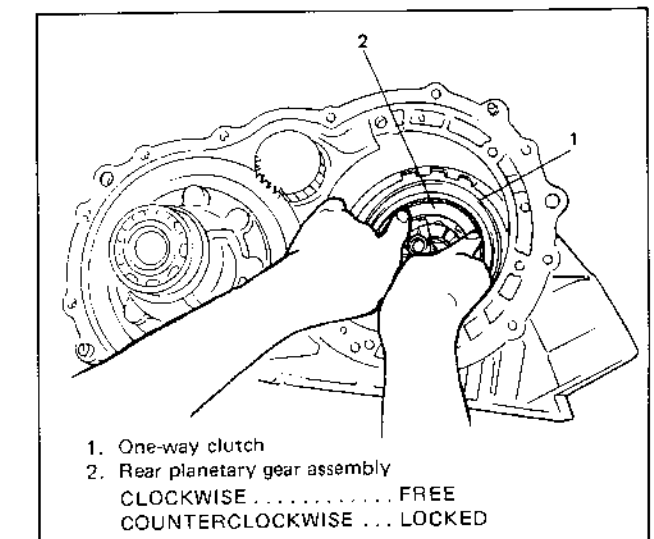


Fig. 7B-204 Checking Rear Planetary Gear Rotation



## 20. One-way clutch race snap ring.

Push snap ring into place by hand. Visually check to make sure that ring is fully seated. Also, make sure that ends of snap ring are between lugs.

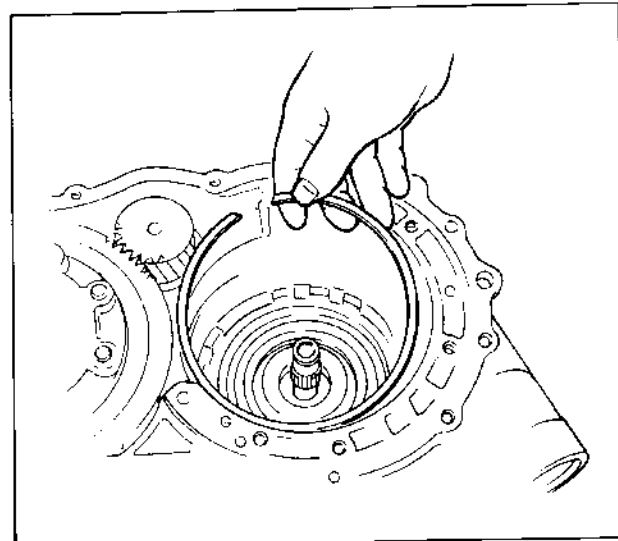


Fig. 7B-205 Installing One-way Clutch Race Snap Ring

## 21. Sun gear pin and thrust washer on sun gear assembly.

Apply grease to thrust washer so that it will not fall off. Check to make sure that pin is fitted in thrust washer notch.

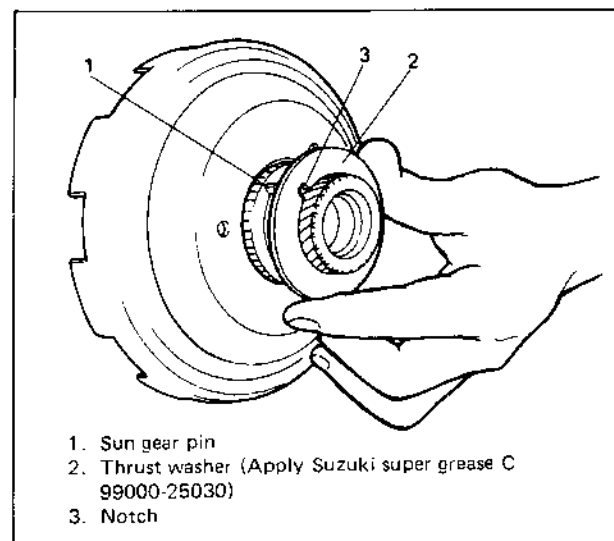


Fig. 7B-206 Installing Sun Gear Pin and Thrust Washer

## 22. Sun gear assembly.

Push in sun gear while engaging it with rear planetary gear. Be careful not to damage

bushing inside sun gear. After installing sun gear, check thrust washers for proper installation by moving sun gear up and down lightly with finger. If sun gear makes clear sound like "Click" when moved up and down, washers are installed in place. But if no sound or thick one is heard, it is possible that they are out of places. In such case, remove sun gear and check.

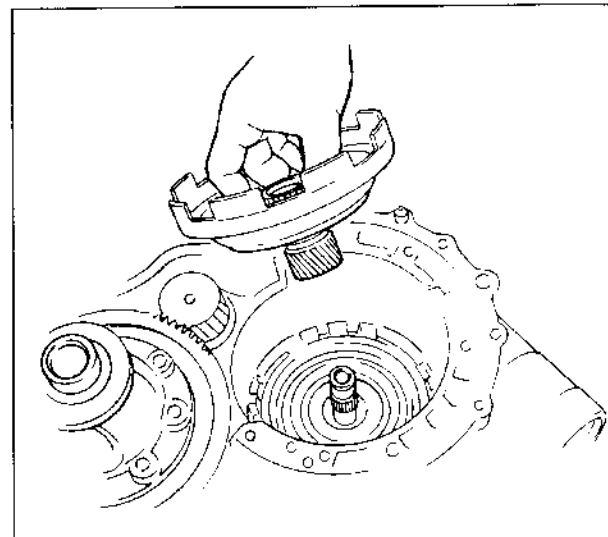


Fig. 7B-207 Installing Sun Gear Assembly

## 23. Front planetary gear bearing and race. Install to sun gear in following order.

- ① Bearing
- ② Race (flange side down)

Refer to p. 7B-88 for installation.

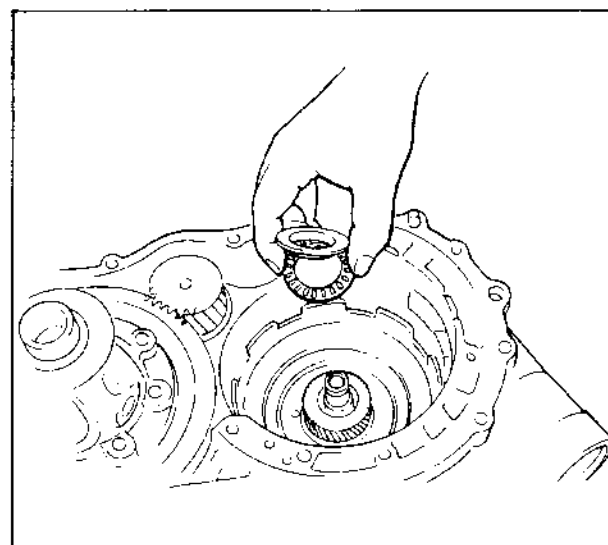


Fig. 7B-208 Installing Front Planetary Gear Bearing

## 24. Front planetary gear assembly.

Install front planetary gear assembly while turning it back and forth.

After installing front planetary gear assembly, check bearing and race installed in step 23 for proper installation by moving planetary gear assembly up and down lightly with finger. If planetary gear makes clear sound like "Click" when moved up and down, bearing and race are installed in place. But if no sound or thick one is heard, it is possible that they are out of place. In such case, remove planetary gear assembly and check.

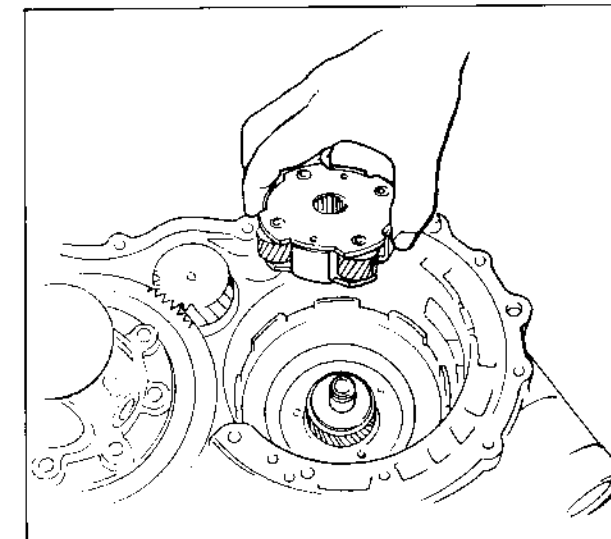


Fig. 7B-209 Installing Front Planetary Gear Assembly

## 25. Ring gear bearing and races on front planetary gear assembly.

Install in following order:

- ① Race (flange side up)
- ② Bearing
- ③ Race (flange side down)

Refer to p. 7B-88 for proper installation.

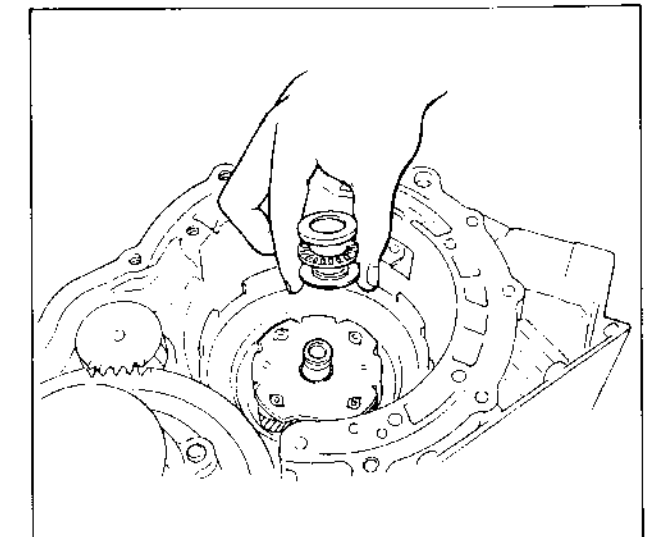


Fig. 7B-210 Installing Ring Gear Races and Bearing

## 26. Front planetary ring gear assembly.

After installing front planetary ring gear assembly, check bearing and races installed in step 25 for proper installation by moving ring gear assembly up and down lightly with finger. If ring gear assembly makes clear sound like "Click" when moved up and down, bearing and races are installed in place. But if no sound or thick one is heard, it is possible that they are out of place. In such case, remove ring gear assembly and check.

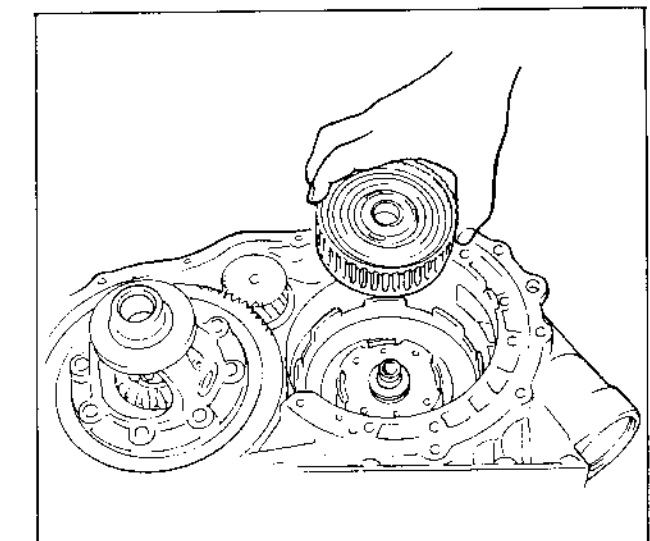


Fig. 7B-211 Installing Front Planetary Ring Gear Assembly

## 27. 2nd brake band.

After making sure for its correct installing direction, install it in case.  
Be careful not to bend it too much or damage it.

**NOTE:**

When installing a new brake band, soak it in transmission fluid for more than 2 hours in advance.

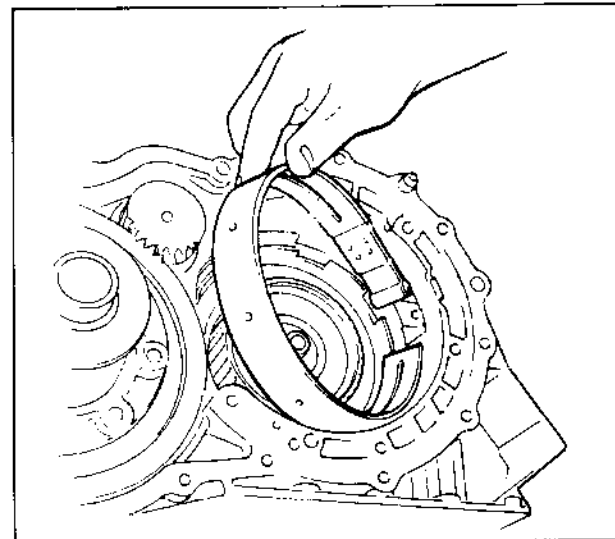


Fig. 7B-212 Installing 2nd Brake Band

28. Inspect output shaft seal ring for wear or damage, and replace if necessary.  
Do not expand seal ring excessively when installing.

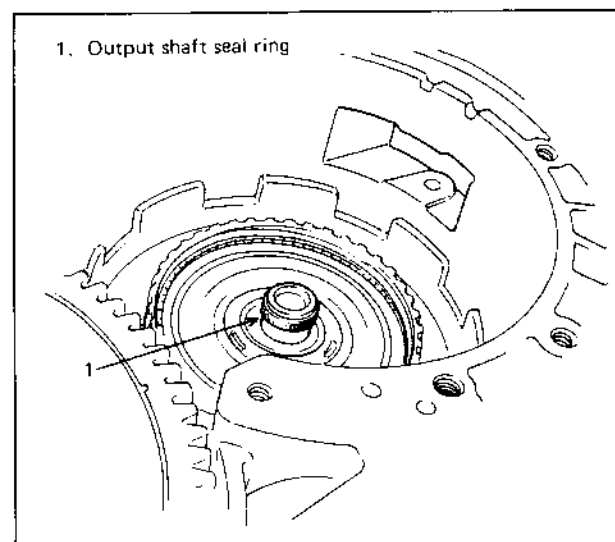


Fig. 7B-213 Checking Output Shaft Seal Ring

29. Input shaft seal rings on input shaft, if replacing is required.

When installing input shaft seal rings, apply grease to grooves in input shaft before installation.

Do not expand seal ring excessively.

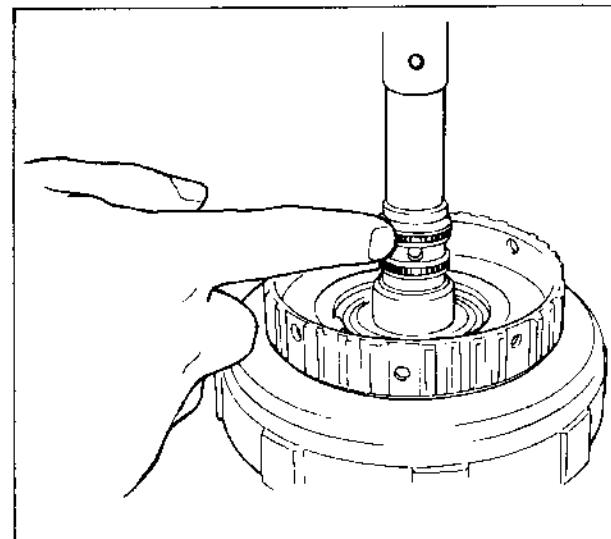


Fig. 7B-214 Installing Input Shaft Seal Rings

30. Direct clutch washer on direct clutch.

Apply grease to washer, and install it on direct clutch with its grooved face outward and aligning washer protrusions to direct clutch drum groove.

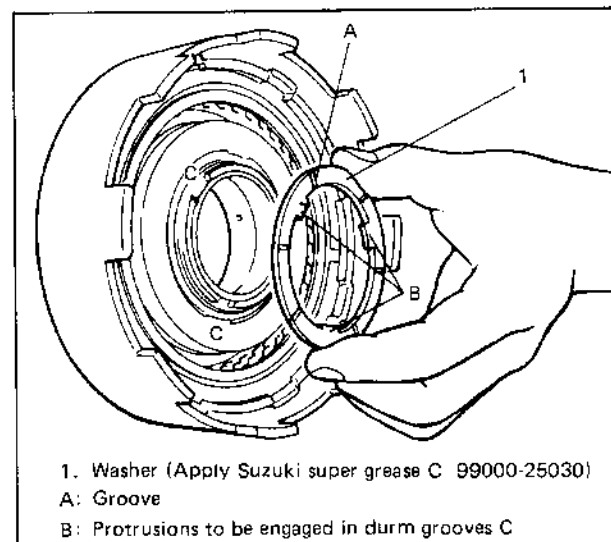


Fig. 7B-215 Installing Direct Clutch Washer

31. Direct clutch on input shaft.

Align teeth of direct clutch discs and then install direct clutch on input shaft.

After installing direct clutch, check it for proper installation by moving it up and down lightly by hand. If direct clutch makes clear sound like "Click" when move up and down, it is installed in place. But if no sound or thick one is heard, it is possible that direct clutch is not installed correctly. In such case, remove direct clutch and reinstall.

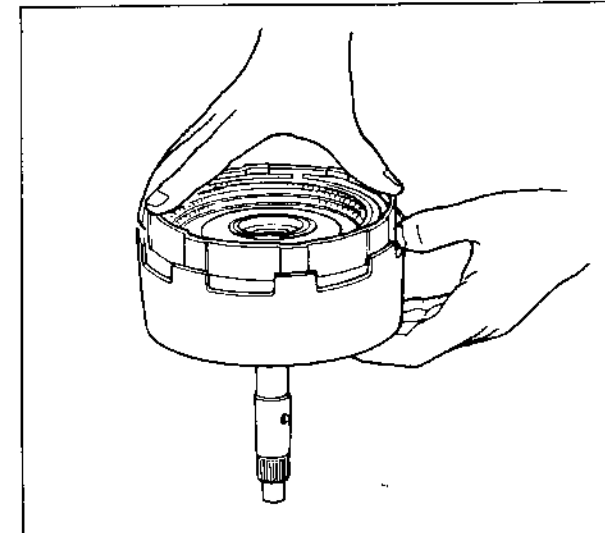


Fig. 7B-216 Assembling Direct Clutch and Input Shaft

32. Ring gear races and bearing.

Apply grease to ring gear races and bearing. Install ring gear race (OD: 35.8 mm/1.41 in) on ring gear with its flange side down. Another ring gear race (OD: 37.9 mm/1.49 in) and bearing are attached on input shaft. Refer to page 7B-88 for proper installation.

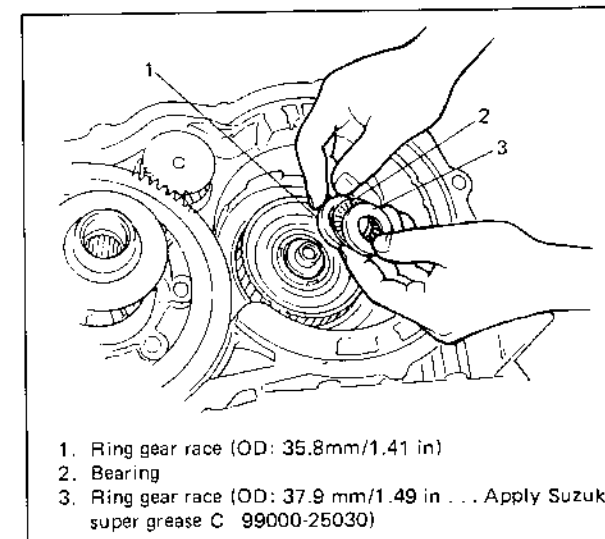


Fig. 7B-217 Installing Ring Gear Bearing

33. Input shaft and forward and direct clutch assemblies.

Hold input shaft with direct clutch installed by hand and while turning it back and forth, insert it into case.

Align teeth of forward clutch discs before installation. When installing input shaft, be careful so that its bearing and race will not fall off.

Be careful not to damage output shaft seal. After installing input shaft, check it for proper installation by moving it up and down lightly by hand. If input shaft makes clear sound like "Click" when moved up and down, it is installed in place. But if it doesn't, try again for proper installation.

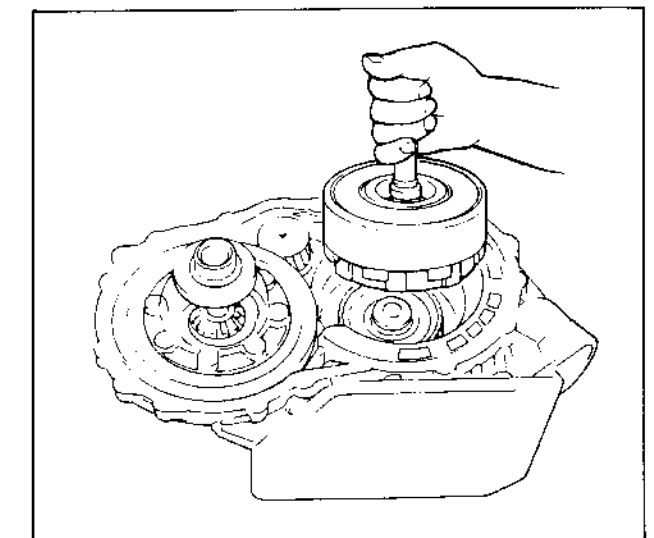


Fig. 7B-218 Installing Input Shaft and Direct Clutch

34. Check for correct installation of each component parts as follows.

After installing input shaft, check to make sure that each component is installed properly according to following description.

Place straightedge on transmission case end surface and measure the distance A by using vernier. For the distance A, subtract the width of straightedge from vernier reading. If measured distance A is within following specification, it means that component parts other than direct clutch are installed properly. If out of specification, remove input shaft with direct clutch and reinstall them properly.

Distance A

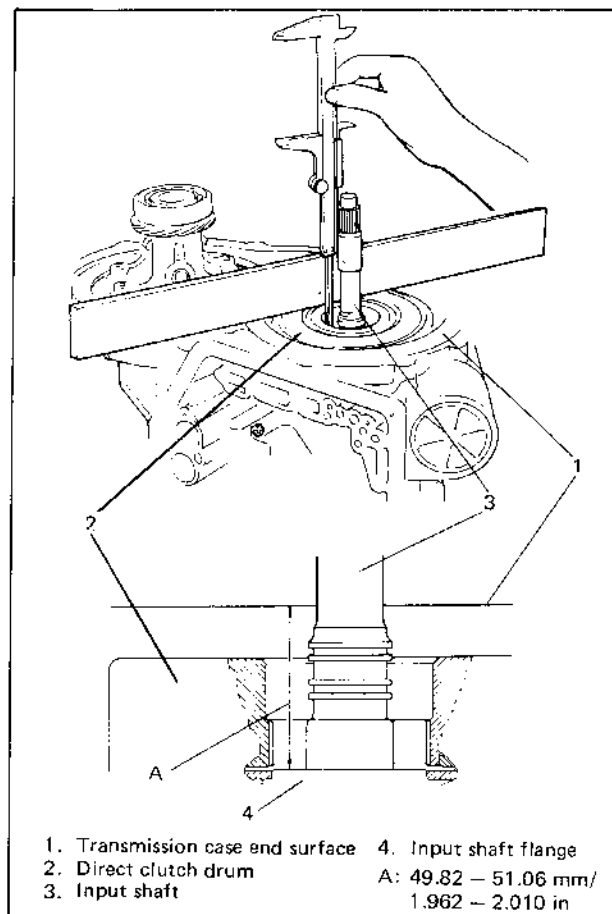
49.82 – 51.06 mm  
1.962 – 2.010 in

Fig. 7B-219 Measuring Distance Between Case End Surface and Input Shaft Flange

## 35. Second brake band pin.

Align hole in second brake band with case pin hole and insert brake band pin.

Apply fluid to brake band pin before installation.

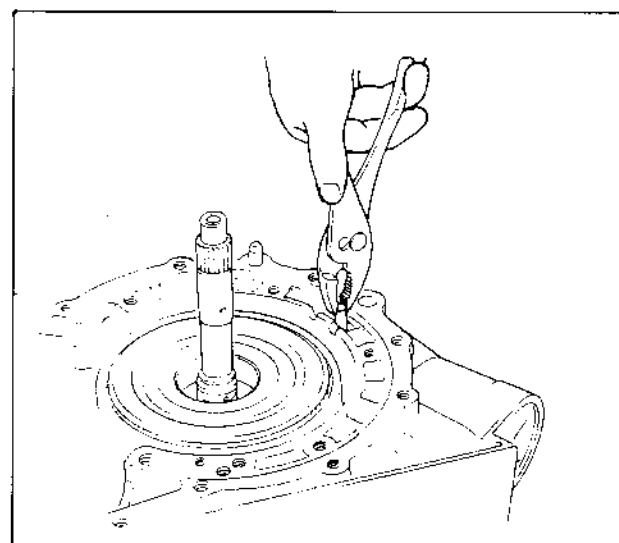


Fig. 7B-220 Installing Second Brake Band Pin

## 36. Case gasket and transmission case housing.

Use new gasket. Install gasket using care so that it will not protrude inside.

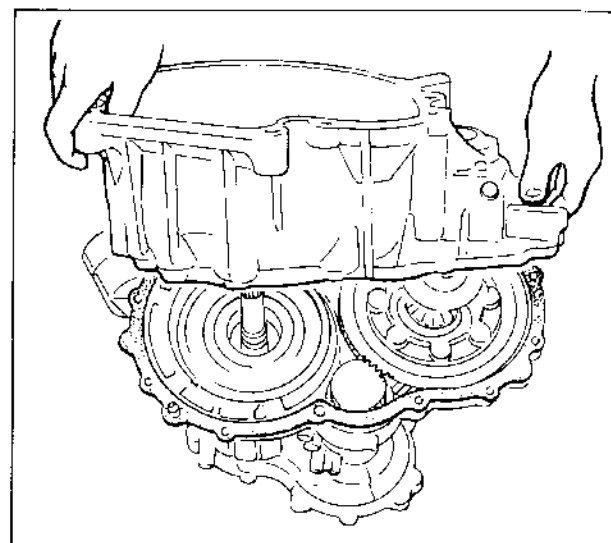


Fig. 7B-221 Installing Gasket and Case Housing

37. Among 14 bolts of case housing bolts, 3 bolts have star-shaped recess in their heads. Install these 3 bolts in such positions as shown by A in figure after applying sealant to their threads. Do not apply thread locking compound to housing bolts. Tighten case housing bolts to specification.

| Tightening torque for case housing bolts | N-m     | kg-m      | lb-ft       |
|------------------------------------------|---------|-----------|-------------|
|                                          | 16 – 23 | 1.6 ~ 2.3 | 12.0 – 16.5 |

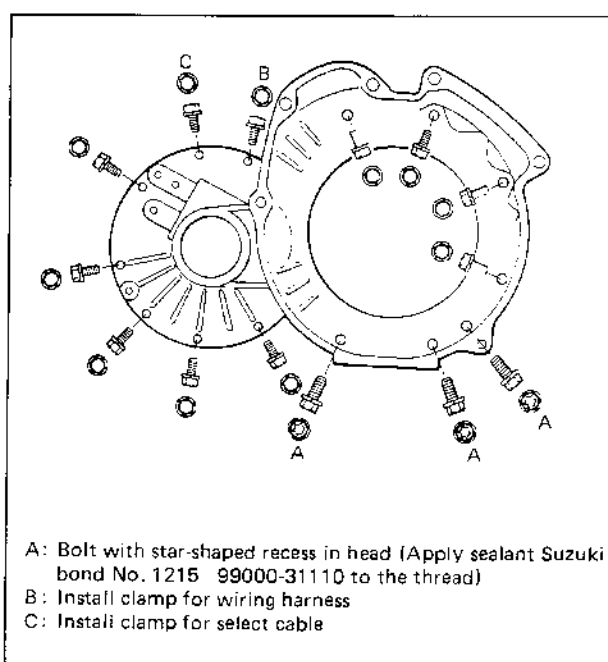


Fig. 7B-222 Installing Case Housing Bolts

## 38. Measure input shaft position.

Seated position of input shaft can also be measured after installing case housing as distance A (Measured dimension – straightedge width B), and it should be 188.37 to 189.91 mm (7.416 to 7.477 in).

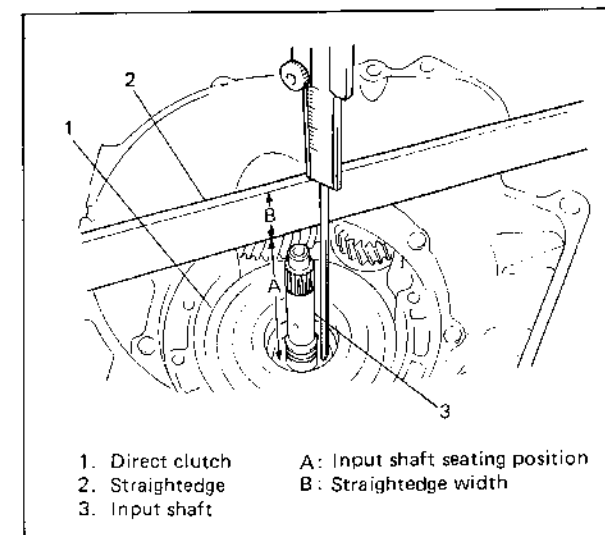


Fig. 7B-223 Measuring Input Shaft Seating Position

## 39. Input shaft bearing race and bearing on input shaft.

Grease bearing race and install it with its flange side outward together with bearing. Install so that bearing does not get on bearing race flange.

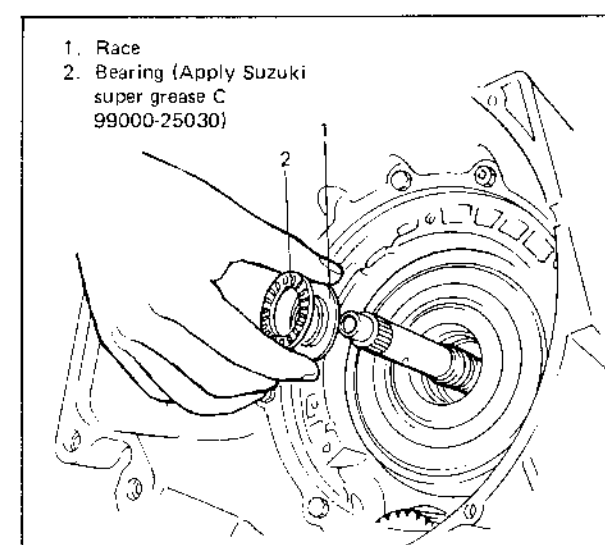


Fig. 7B-224 Installing Input Shaft Bearing

## 40. Another input shaft bearing race on oil pump.

Grease bearing race and attach it to oil pump body.

## NOTE:

- With this bearing race, input shaft thrust play is adjusted. Refer to step 44 for measuring procedure.
- Make sure seal rings are installed in pump cover flange in good condition lubricated with automatic transmission fluid.

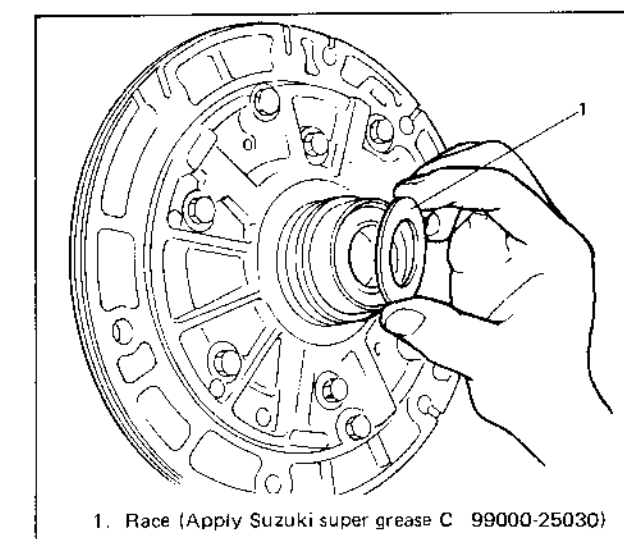


Fig. 7B-225 Installing Another Input Shaft Bearing Race

## 41. Direct clutch washer on oil pump.

Attach greased washer on oil pump.

Fit washer flange into notch of oil pump body.

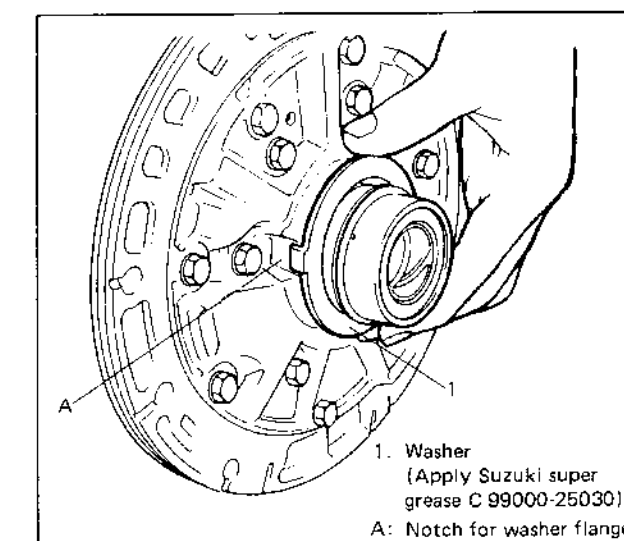


Fig. 7B-226 Installing Direct Clutch Washer

42. New oil pump cover seal (O ring) to oil pump.  
Install greased cover seal in outer groove of oil pump.  
Make sure that cover seal is not twisted or extruded.
43. Oil pump to transmission case.  
Align oil pump bolt hole with case bolt hole and push in pump gently by hand until it contacts case. Use care so that direct clutch washer does not fall off, and input shaft seal rings and pump cover seal rings will not come off or get damaged.  
While making sure smooth rotation of input shaft, tighten 6 oil pump bolts gradually to specification.

| Tightening torque for oil pump bolts | N-m     | kg-m      | lb-ft       |
|--------------------------------------|---------|-----------|-------------|
|                                      | 18 - 27 | 1.8 - 2.7 | 13.5 - 19.5 |

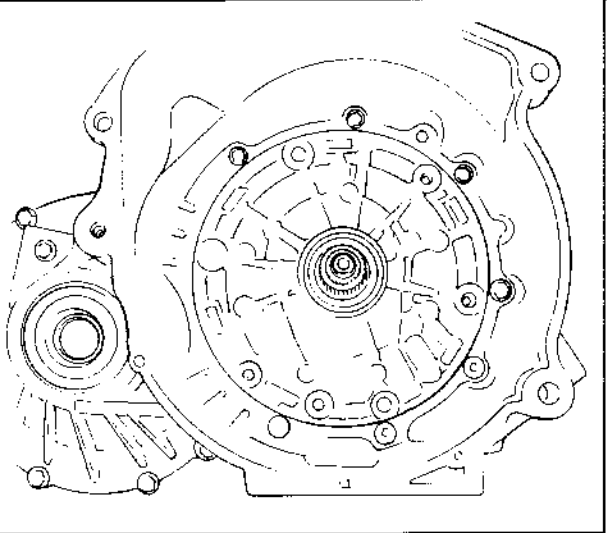


Fig. 7B-227 Installing Oil Pump

44. Check input shaft end play.  
Apply dial gauge onto input shaft end surface and measure thrust play of input shaft.  
If out of specification, remove oil pump and replace input shaft bearing race on oil pump side (Refer to step 40).

**NOTE:**  
Check to be sure that input shaft turns smoothly.

|                         |                                  |
|-------------------------|----------------------------------|
| Input shaft thrust play | 0.3 - 0.9 mm<br>0.012 - 0.035 in |
|-------------------------|----------------------------------|

|                                                              |                                    |
|--------------------------------------------------------------|------------------------------------|
| Available input shaft bearing race (oil pump side) thickness | 0.8 mm/0.031 in<br>1.4 mm/0.055 in |
|--------------------------------------------------------------|------------------------------------|

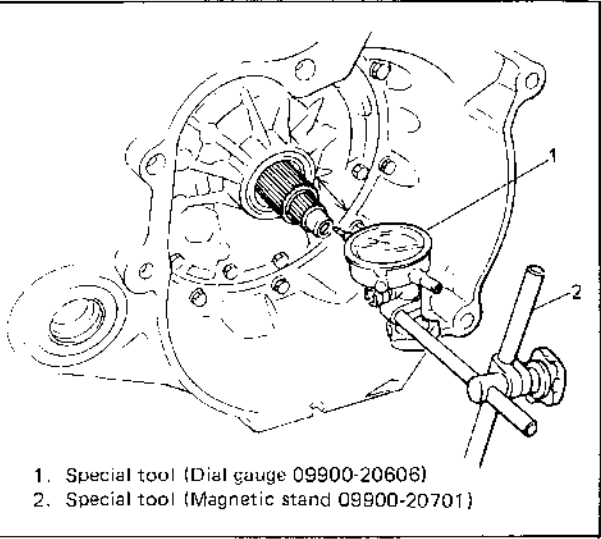


Fig. 7B-228 Measuring Thrust Play of Input Shaft

45. Solenoid wire harness to case.  
1) Insert solenoid wire hold plate in groove in solenoid wire grommet and install it to stud bolt of transmission case.  
2) Secure hold plate with lock washer and nut.  
3) Install solenoid wire clamps to rear cover and case. Secure harness with them.

**NOTE:**  
When inserting grommet into case bore, check to be sure that its O ring is in good condition.

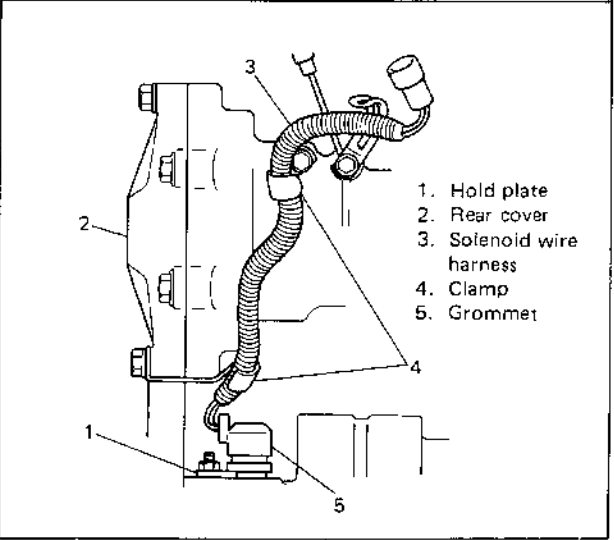


Fig. 7B-229 Installing Solenoid Wiring Harness

46. Check second brake band for proper installation.  
Looking through second brake band cover hole, check that second brake piston rod end is aligned with the center of recess in brake band as shown in figure. If rod end contacts outside of brake band recess, pull up second brake band by inserting thin wire in brake band fitting so that band recess aligns with rod end properly.
47. Check second brake piston stroke as previously described. For checking procedure, refer to p. 7B-63.

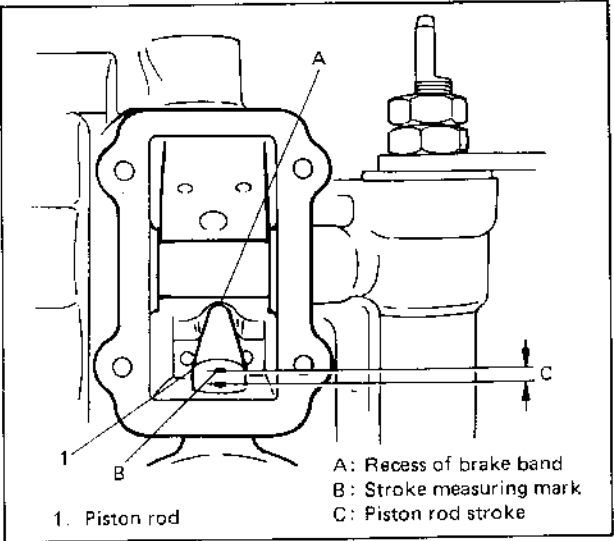


Fig. 7B-230 Checking Second Brake Band Alignment

48. Install second brake band cover with new gasket.

| Tightening torque for second brake band cover bolts | N-m   | kg-m      | lb-ft     |
|-----------------------------------------------------|-------|-----------|-----------|
|                                                     | 7 - 9 | 0.7 - 0.9 | 5.5 - 6.5 |

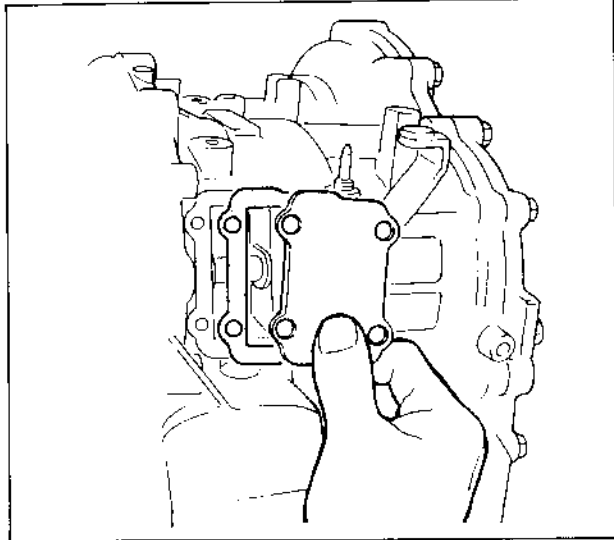


Fig. 7B-231 Installing Second Brake Cover

49. Oil pressure control cable in case.  
50. Accumulator springs and pistons.  
1) Install new seal rings on pistons, if required.  
Be sure to apply automatic transmission fluid to pistons and seal rings.  
2) Insert springs into accumulator bores.  
3) Install pistons into case.

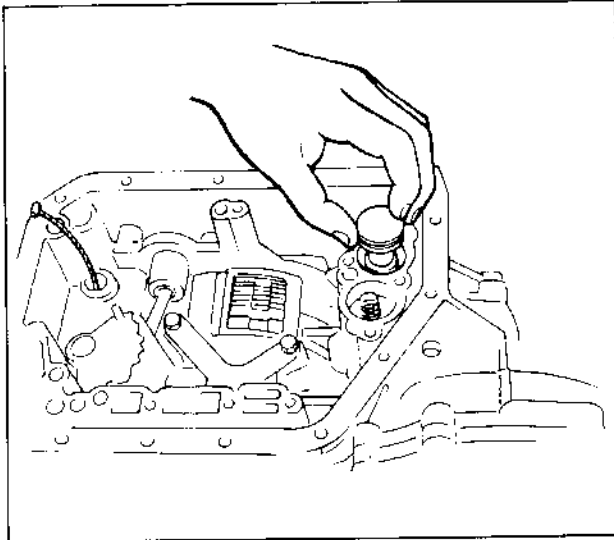


Fig. 7B-232 Installing Accumulator Pistons and Spring

51. Valve body assembly to case.  
Align manual valve with pin on manual shift lever and lower valve body into place.  
Install 11 bolts in lower valve body.  
Each bolt length is given in following figure.  
First, tighten 3 reamer bolts (positioning bolts) C and D lightly. Then tighten all bolts in diagonal order.

**CAUTION:**  
Care should be taken to put manual shift lever pin in between two flanges at end of manual shift valve.

| Tightening torque for lower valve body bolts | N-m    | kg-m      | lb-ft     |
|----------------------------------------------|--------|-----------|-----------|
|                                              | 8 - 12 | 0.8 - 1.2 | 6.0 - 8.5 |

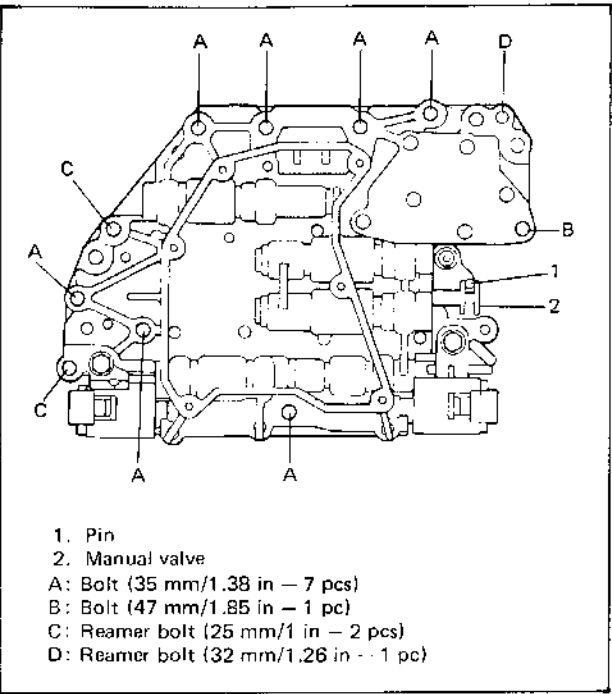


Fig. 7B-233 Installing Valve Body

52. Install oil pressure control cable on throttle valve cam.  
While holding cam down with fingers, slip cable end into slot.

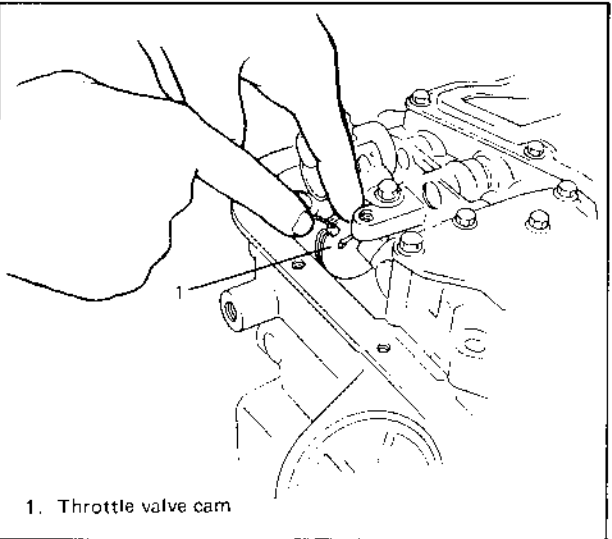


Fig. 7B-234 Connecting Oil Pressure Control Cable

53. Oil tubes to lower valve body.  
First put the end of oil tube without flange about 2 mm (0.08 in) into lower valve body, then insert the one with flange and push both ends of tube by hand. Next, tap them in lightly with a plastic hammer as far as flange position.

- NOTE:**
- Install them horizontally to valve body.
  - Make sure to insert them up to flange position securely.
  - Care should be taken not to deform tubes.

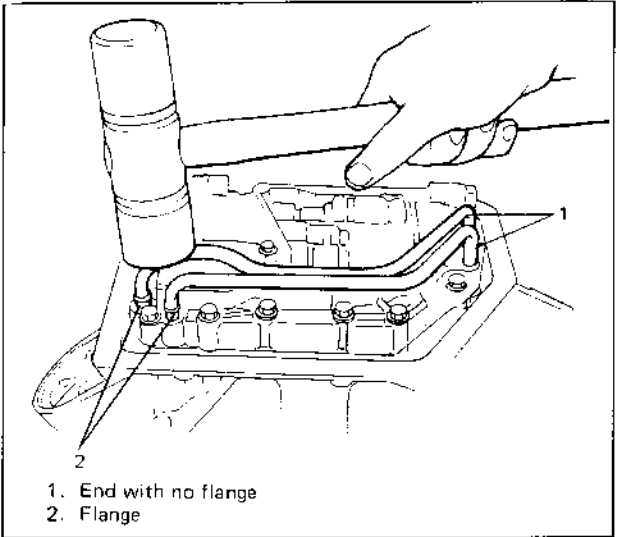


Fig. 7B-235 Installing Oil Tubes

54. 2 solenoid wires; one to direct clutch solenoid and the other to second brake solenoid.

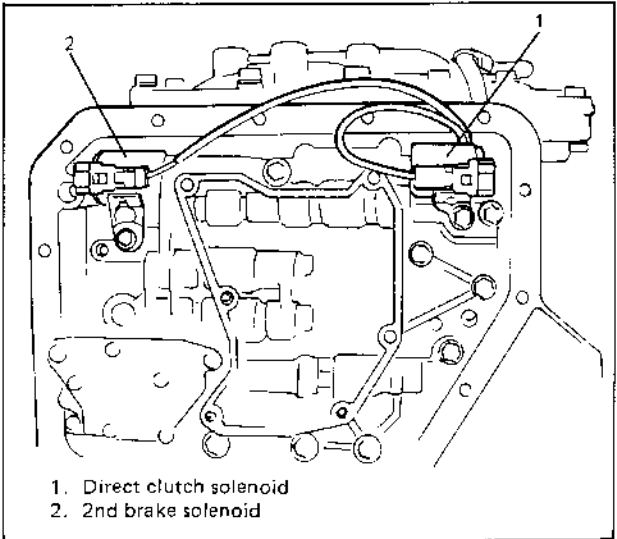


Fig. 7B-236 Connecting Solenoid Wires

55. Oil strainer and solenoid wire clamp.  
Clamp solenoid wire by fastening solenoid wire clamp with oil strainer bolt in the position as shown in figure.

| Tightening torque      | N·m   | kg·m      | lb·ft |
|------------------------|-------|-----------|-------|
| for oil strainer bolts | 5 - 6 | 0.5 - 0.6 | 4.0   |

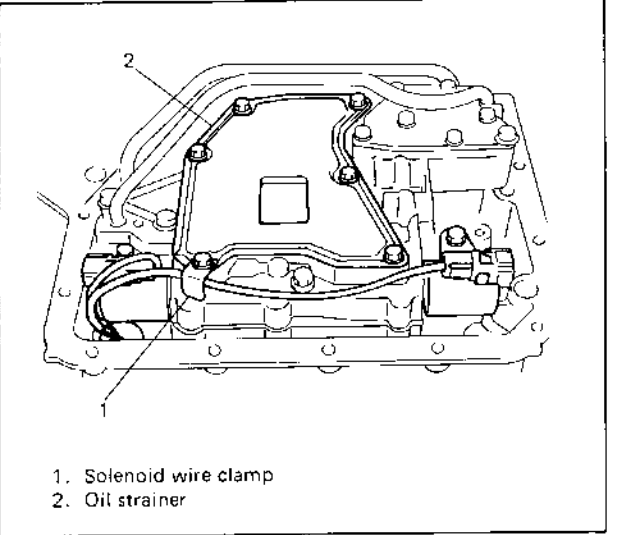


Fig. 7B-237 Installing Oil Strainer

56. Magnet in oil pan and oil pan with new gasket.  
1) Install magnet in oil pan right under oil strainer.

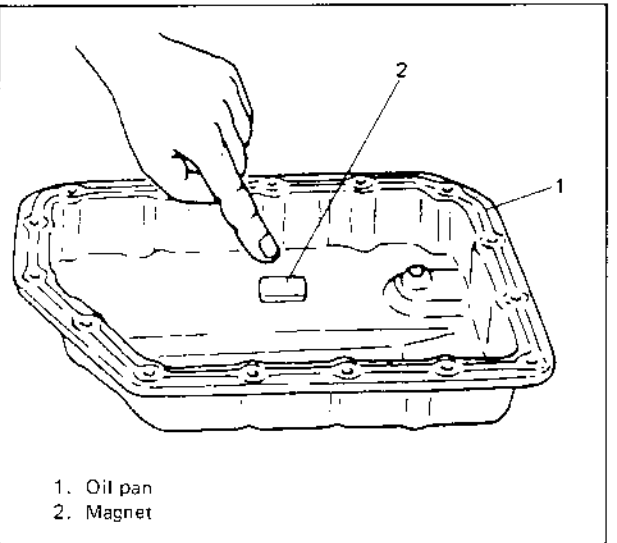


Fig. 7B-238 Installing Magnet in Oil Pan

2) Check to make sure that oil tubes are not in contact with oil pan.  
3) There are 15 oil pan bolts in all and two of them have cross slot in their heads. Mount these two cross slotted bolts in such positions as shown in below figure after applying sealant to their threads.  
Tighten 15 oil pan bolts to specification.  
4) Tighten oil pan drain plug to specification.

| Tightening torque | N·m     | kg·m      | lb·ft       |
|-------------------|---------|-----------|-------------|
| Oil pan bolts     | 4 - 6   | 0.4 - 0.6 | 3.0 - 4.0   |
| Drain plug        | 18 - 23 | 1.8 - 2.3 | 13.5 - 16.5 |

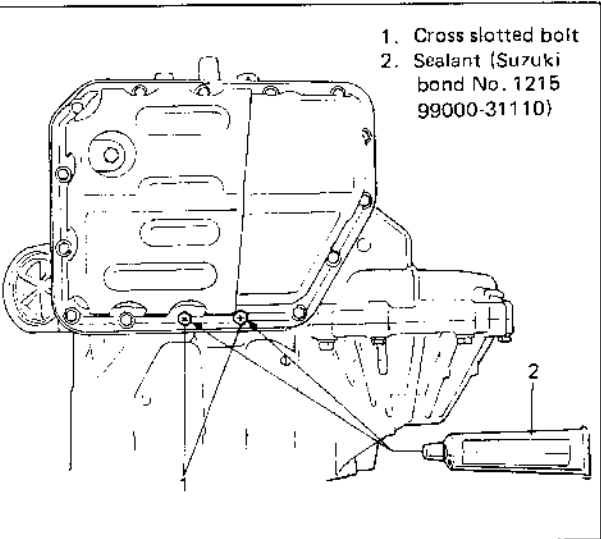


Fig. 7B-239 Installing Oil Pan Bolts

57. Oil pipes.  
1) If oil inlet and outlet pipes have been removed or replaced, tighten them with union bolts with new gaskets to specified torque.  
2) Clamp pipes with oil pipe plate through rubber tubes.  
58. Oil filler tube with O ring.  
Insert oil filler tube in case as far as its flange and tighten with bolt.

**NOTE:**  
Check to make sure that oil filler tube O ring is in good condition.

| Tightening torque    | N·m     | kg·m      | lb·ft     |
|----------------------|---------|-----------|-----------|
| Union bolts          | 11 - 13 | 1.1 - 1.3 | 8.0 - 9.0 |
| Plate bolts          | 8 mm    | 10 - 16   | 1.0 - 1.6 |
|                      | 6 mm    | 4 - 7     | 0.4 - 0.7 |
| Oil filler tube bolt | 4 - 7   | 0.4 - 0.7 | 3.0 - 5.0 |

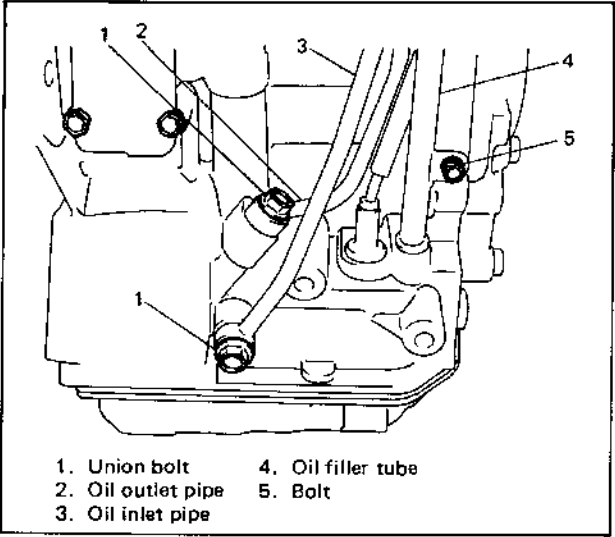


Fig. 7B-240 Installing Oil Filler Tube

59. Engine mounting LH bracket.  
Tighten bolts to specification.

| Tightening torque                | N·m     | kg·m      | lb·ft       |
|----------------------------------|---------|-----------|-------------|
| Engine mounting LH bracket bolts | 50 – 60 | 5.0 – 6.0 | 36.5 – 43.0 |

60. Torque converter to input shaft.
- 1) Install torque converter, using care not to damage oil seal of oil pump.
  - 2) After installing torque converter, check to make sure that distance A is within specification.
  - 3) Check torque converter for smooth rotation.
  - 4) Apply grease around cup at the center of torque converter.

**CAUTION:**

- Before installing converter, make sure that its pump hub portion is free from nicks, burrs or damage which may cause oil seal to leak.
- Be very careful not to drop converter on oil pump gear. Damage in gear, should it occur, may cause a critical trouble.

|                                                |                              |
|------------------------------------------------|------------------------------|
| Distance A:<br>Converter flange to housing end | More than<br>21.4 mm/0.85 in |
|------------------------------------------------|------------------------------|

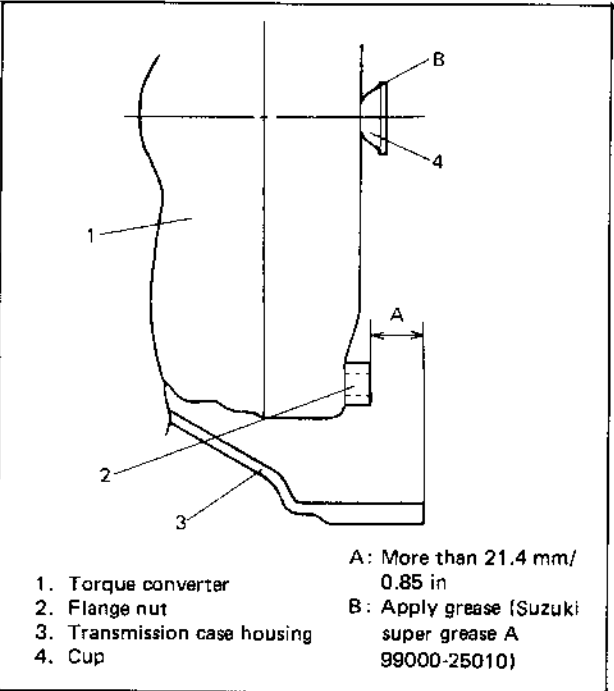


Fig. 7B-241 Installing Torque Converter

**DIMENSION DATA**

| ITEM                         |                                            | DATA                                                 |                                                           |
|------------------------------|--------------------------------------------|------------------------------------------------------|-----------------------------------------------------------|
|                              |                                            | Standard                                             | Limit                                                     |
| Oil pump                     | Driven gear-to-body clearance              | 0.07 – 0.15 mm<br>0.0028 – 0.0059 in                 | 0.3 mm<br>0.011 in                                        |
|                              | Gear tooth tip clearance                   | 0.11 – 0.14 mm<br>0.0043 – 0.0055 in                 | 0.3 mm<br>0.011 in                                        |
|                              | Gear side clearance                        | 0.02 – 0.05 mm<br>0.0008 – 0.0019 in                 | 0.1 mm<br>0.0039 in                                       |
| Planetary gear               | Side clearance                             | 0.2 – 0.5 mm<br>0.008 – 0.019 in                     | 0.7 mm<br>0.027 in                                        |
| Bush bore                    | Oil pump body                              | 38.113 – 38.138 mm<br>1.500 – 1.501 in               | 38.188 mm<br>1.503 in                                     |
|                              | Direct clutch drum                         | 51.520 – 51.545 mm<br>2.028 – 2.029 in               | 51.595 mm<br>2.031 in                                     |
|                              | Planetary sun gear                         | 22.025 – 22.046 mm<br>0.867 – 0.868 in               | 22.096 mm<br>0.870 in                                     |
|                              | Ring gear flange                           | 19.025 – 19.050 mm<br>0.749 – 0.750 in               | 19.100 mm<br>0.752 in                                     |
| Clutch, brake and 2nd piston | Height between snap ring and clutch flange | Direct clutch<br>2.49 – 3.06 mm<br>0.098 – 0.120 in  | 3.26 mm<br>0.128 in                                       |
|                              |                                            | Forward clutch<br>2.01 – 2.68 mm<br>0.079 – 0.105 in | 2.88 mm<br>0.113 in                                       |
|                              | 1st-reverse brake clutch clearance         |                                                      | 0.58 – 1.92 mm<br>0.023 – 0.075 in<br>2.12 mm<br>0.083 in |
|                              | 2nd brake piston rod stroke                |                                                      | 1.5 – 3.0 mm<br>0.06 – 0.11 in<br>—                       |
| Input shaft                  | Thrust play                                | 0.3 – 0.9 mm<br>0.012 – 0.035 in                     | —                                                         |
| Torque converter             | Converter flange to housing end            | More than 21.4 mm<br>0.85 in                         | —                                                         |



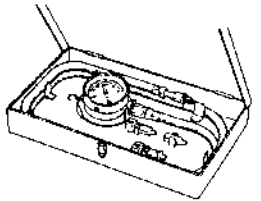
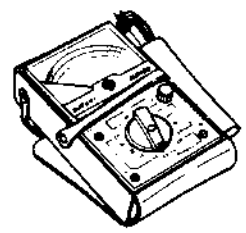
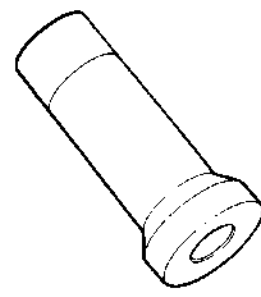
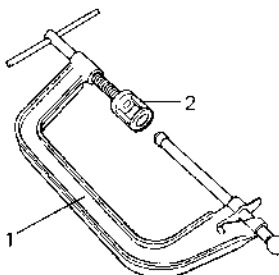
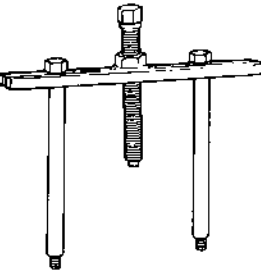
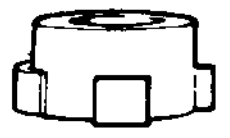
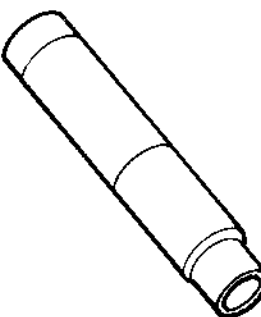
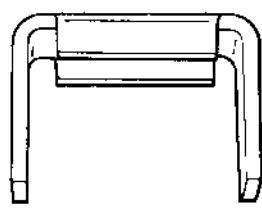
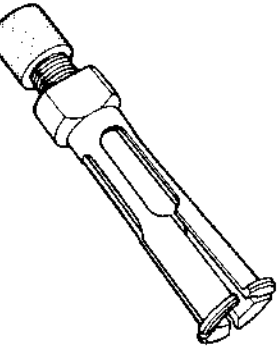
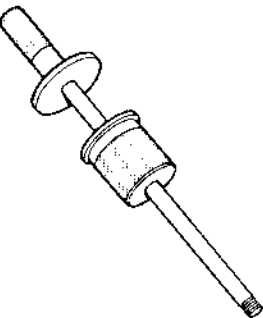
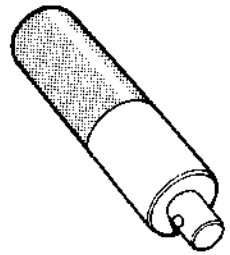
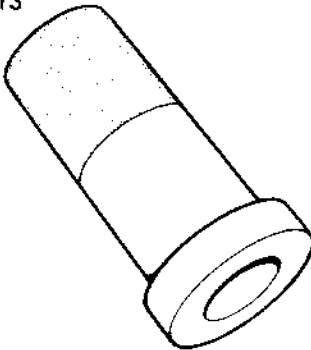
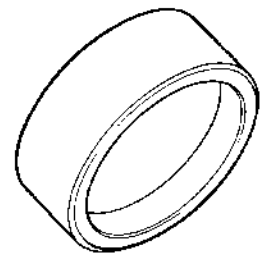
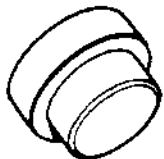
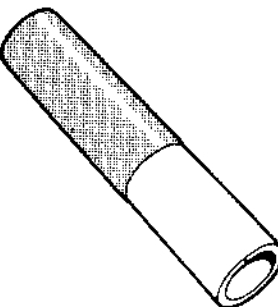
# RECOMMENDED TORQUE SPECIFICATIONS

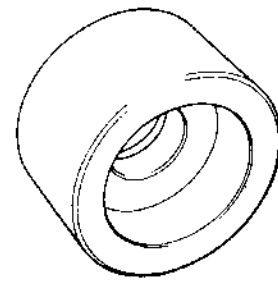
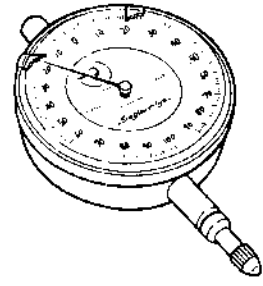
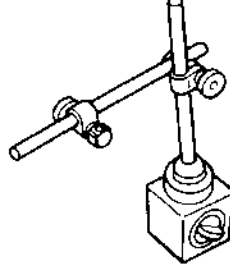
| Fastening portion     |                                          | Tightening torque     |             |              |
|-----------------------|------------------------------------------|-----------------------|-------------|--------------|
|                       |                                          | N·m                   | kg·m        | lb·ft        |
| ON CAR SERVICE        | 1. Transmission case plug                | 6 – 9                 | 0.6 – 0.9   | 4.5 – 6.5    |
|                       | 2. Drain plug                            | 18 – 23               | 1.8 – 2.3   | 13.5 – 16.5  |
|                       | 3. Oil cooler hose clamps                | 1.5                   | 0.15        | 1            |
|                       | 4. Oil pan bolts                         | 4 – 6                 | 0.4 – 0.6   | 3.0 – 4.0    |
|                       | 5. Oil strainer bolts                    | 5 – 6                 | 0.5 – 0.6   | 4.0          |
|                       | 6. Shift solenoid bolts                  | 7 – 9                 | 0.7 – 0.9   | 5.5 – 6.5    |
|                       | 7. Speed sensor bolt                     | 7 – 9                 | 0.7 – 0.9   | 5.5 – 6.5    |
|                       | 8. Shift lever switch bolt               | 13 – 23               | 1.3 – 2.3   | 9.5 – 16.5   |
|                       | 9. Selector lever shaft nut              | 18 – 22               | 1.8 – 2.2   | 13.0 – 15.5  |
|                       | 10. Selector housing nut                 | 10 – 16               | 1.0 – 1.6   | 7.5 – 11.5   |
| MOUNTING              | 1. Transmission to engine bolts and nuts | 40 – 60               | 4.0 – 6.0   | 29.0 – 43.0  |
|                       | 2. Drive plate to converter bolts        | 18 – 19               | 1.8 – 1.9   | 13.0 – 14.0  |
|                       | 3. Engine mounting & bracket bolt & nut  | Refer to Fig. 6A-136. |             |              |
| TRANSMISSION OVERHAUL | 1. Oil pump cover bolts                  | 8 – 12                | 0.8 – 1.2   | 6.0 – 8.5    |
|                       | 2. Lower valve body cover bolts          | 4 – 6                 | 0.4 – 0.6   | 3.0 – 4.0    |
|                       | 3. Throttle valve cam bolt               | 6 – 9                 | 0.6 – 0.9   | 4.5 – 6.5    |
|                       | 4. Upper valve body bolts                | 5 – 6                 | 0.5 – 0.6   | 4.0          |
|                       | 5. Lower valve body bolts                | 8 – 12                | 0.8 – 1.2   | 6.0 – 8.5    |
|                       | 6. Differential final gear bolts         | 80 – 90               | 8.0 – 9.0   | 58.0 – 65.0  |
|                       | 7. Manual detent spring bolt and nut     | 8 – 12                | 0.8 – 1.2   | 6.0 – 8.5    |
|                       | 8. Shift shaft nuts                      | 27 – 33               | 2.7 – 3.3   | 20.0 – 23.5  |
|                       | 9. Reduction driven gear nut             | 110 – 150             | 11.0 – 15.0 | 80.0 – 108.0 |
|                       | 10. Rear cover bolts                     | 16 – 23               | 1.6 – 2.3   | 12.0 – 16.5  |
|                       | 11. Rear cover nuts                      | 11 – 15               | 1.1 – 1.5   | 8.0 – 10.5   |
|                       | 12. Transmission case housing bolts      | 16 – 23               | 1.6 – 2.3   | 12.0 – 16.5  |
|                       | 13. Oil pump bolts                       | 18 – 27               | 1.8 – 2.7   | 13.5 – 19.5  |
|                       | 14. Second brake band cover bolts        | 7 – 9                 | 0.7 – 0.9   | 5.5 – 6.5    |
|                       | 15. Oil pipe union bolts                 | 11 – 13               | 1.1 – 1.3   | 8.0 – 9.0    |
|                       | 16. Oil pipe plate bolts                 | 8 mm                  | 10 – 16     | 7.5 – 11.5   |
|                       |                                          | 6 mm                  | 4 – 7       | 3.0 – 5.0    |
|                       | 17. Oil filler tube bolt                 | 4 – 7                 | 0.4 – 0.7   | 3.0 – 5.0    |

# REQUIRED SERVICE MATERIALS

| MATERIAL                     | RECOMMENDED SUZUKI PRODUCT                    | USE                                                                                                                                                    |
|------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Automatic transmission fluid | DEXRON-II<br>(99000-22760)                    | <ul style="list-style-type: none"> <li>Automatic transmission</li> <li>Parts lubrication when installing</li> </ul>                                    |
| Sealant                      | SUZUKI BOND NO. 1215<br>(99000-31110)         | <ul style="list-style-type: none"> <li>Case housing star-shaped recess bolts (3 pcs only)</li> <li>Oil pan cross slotted bolts (2 pcs only)</li> </ul> |
| Lithium grease               | SUZUKI SUPER GREASE C<br>(99000-25030)        | <ul style="list-style-type: none"> <li>Retaining parts in place when assembling</li> <li>Oil seal lips</li> <li>Oil pump O ring</li> </ul>             |
|                              | SUZUKI SUPER GREASE A<br>(99000-25010)        | <ul style="list-style-type: none"> <li>Cable ends</li> <li>Converter center cup</li> </ul>                                                             |
| Water tight sealant          | SUZUKI SEALING COMPOUND 366E<br>(99000-31090) | Select cable fastening portion with dash panel                                                                                                         |

## SPECIAL TOOLS

|                                                                                                                                        |                                                                                                                                        |                                                                                                                                                    |                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1</p>  <p>09925-37810<br/>Oil pressure gauge</p>   | <p>2</p>  <p>09900-25002<br/>Pocket tester</p>        | <p>3</p>  <p>09951-76010<br/>Bearing installer</p>               | <p>4</p>  <p>1. 09916-14510<br/>Valve lifter (Attachment<br/>2 is included)</p> |
| <p>5</p>  <p>09918-48210<br/>Oil pump remover</p>     | <p>6</p>  <p>09927-08210<br/>Output shaft remover</p> | <p>7</p>  <p>09925-18010<br/>Remover handle</p>                  | <p>8</p>  <p>09926-98310<br/>Clutch spring compressor</p>                       |
| <p>9</p>  <p>09941-64511<br/>Bearing remover</p>    | <p>10</p>  <p>09930-30102<br/>Sliding shaft</p>     | <p>11</p>  <p>09926-88310<br/>Bearing installer attachment</p> | <p>12</p>  <p>09924-74510<br/>Installer handle</p>                            |
| <p>13</p>  <p>09913-85210<br/>Bearing installer</p> | <p>14</p>  <p>09944-66020<br/>Bearing installer</p> | <p>15</p>  <p>09925-88210<br/>Bearing puller attachment</p>    | <p>16</p>  <p>09913-80112<br/>Bearing installer</p>                           |

|                                                                                                                                   |                                                                                                                                 |                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <p>17</p>  <p>09951-16060<br/>Bush remover</p> | <p>18</p>  <p>09900-20606<br/>Dial gauge</p> | <p>19</p>  <p>09900-20701<br/>Magnetic stand</p> |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|



SECTION 7C

CLUTCH

CONTENTS

|                           |       |                               |       |
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| DIAGNOSIS .....           | 7C- 3 | Clutch Cover, Clutch Disc and |       |
| ON-CAR SERVICE .....      | 7C- 4 | Flywheel .....                | 7C- 6 |
| Maintenance Service ..... | 7C- 4 | Clutch Release System .....   | 7C- 8 |
| Clutch Start Switch ..... | 7C- 4 | RECOMMENDED TORQUE            |       |
| Clutch Cable .....        | 7C- 5 | SPECIFICATIONS .....          | 7C-11 |
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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 six 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 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 start 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.

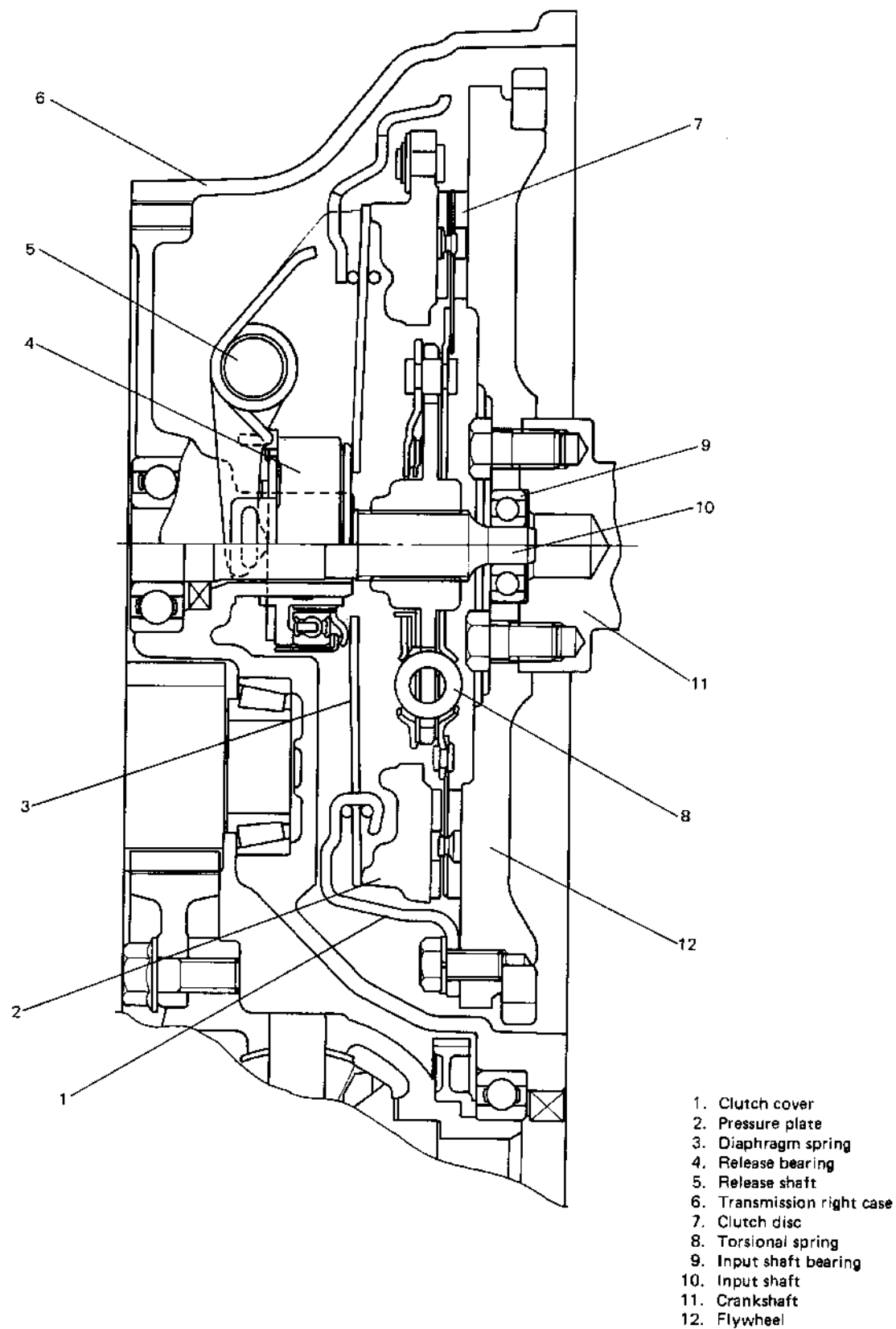


Fig. 7C-1 Clutch Cutaway

DIAGNOSIS

| Condition        | Possible Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Correction                                                                                                                                                                                                                                                  |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slipping         | <ul style="list-style-type: none"><li>• Improper clutch pedal free travel.</li><li>• Worn or oily clutch disc facing.</li><li>• Warped disc, pressure plate or flywheel surface.</li><li>• Weakened diaphragm spring.</li><li>• Rusted clutch cable.</li></ul>                                                                                                                                                                                                                        | <p>Adjust free travel.</p> <p>Replace disc.</p> <p>Replace disc, clutch cover or flywheel.</p> <p>Replace clutch cover.</p> <p>Replace cable.</p>                                                                                                           |
| Dragging clutch  | <ul style="list-style-type: none"><li>• Improper clutch pedal free travel.</li><li>• Weakened diaphragm spring, or worn spring tip.</li><li>• Rusted input shaft splines.</li><li>• Damaged or worn splines of transmission input shaft.</li><li>• Excessively wobbly clutch disc.</li><li>• Clutch facings broken or dirty with oil.</li></ul>                                                                                                                                       | <p>Adjust free travel.</p> <p>Replace clutch cover.</p> <p>Lubricate.</p> <p>Replace input shaft.</p> <p>Replace disc.</p> <p>Replace disc.</p>                                                                                                             |
| Clutch vibration | <ul style="list-style-type: none"><li>• Glazed (glass-like) clutch facings.</li><li>• Clutch facings dirty with oil.</li><li>• Release bearing slides unsmoothly on input shaft bearing retainer.</li><li>• Wobbly clutch disc, or poor facing contact.</li><li>• Weakened torsion springs in clutch disc.</li><li>• Clutch disc rivets loose.</li><li>• Distorted pressure plate or flywheel surface.</li><li>• Weakened engine mounting or loosened mounting bolt or nut.</li></ul> | <p>Repair or replace disc.</p> <p>Replace disc.</p> <p>Lubricate or replace input shaft bearing retainer.</p> <p>Replace disc.</p> <p>Replace disc.</p> <p>Replace disc.</p> <p>Replace clutch cover or flywheel.</p> <p>Retighten or replace mounting.</p> |
| Noisy clutch     | <ul style="list-style-type: none"><li>• Worn or broken release bearing.</li><li>• Input shaft front bearing worn down.</li><li>• Excessive rattle of clutch disc hub.</li><li>• Cracked clutch disc.</li><li>• Pressure plate and diaphragm spring rattling.</li></ul>                                                                                                                                                                                                                | <p>Replace release bearing.</p> <p>Replace input shaft bearing.</p> <p>Replace disc.</p> <p>Replace disc.</p> <p>Replace clutch cover.</p>                                                                                                                  |
| Grabbing clutch  | <ul style="list-style-type: none"><li>• Clutch disc facings soaked with oil.</li><li>• Clutch disc facings excessively worn.</li><li>• Rivet heads showing out of the facing.</li><li>• Weakened torsion springs.</li></ul>                                                                                                                                                                                                                                                           | <p>Replace disc.</p> <p>Replace disc.</p> <p>Replace disc.</p> <p>Replace disc.</p>                                                                                                                                                                         |

ON-CAR SERVICE  
MAINTENANCE SERVICE

CLUTCH PEDAL HEIGHT

Adjust clutch pedal height with adjust bolt located on pedal bracket so that clutch pedal height exceeds brake pedal height by 8 mm (0.3 in.) and tighten lock nut.

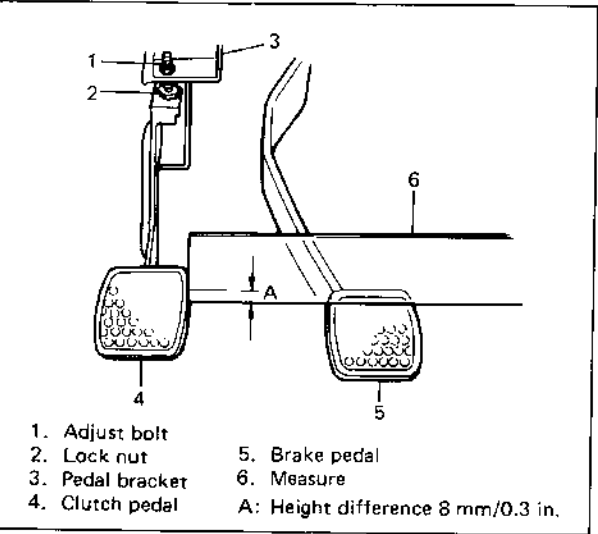


Fig. 7C-2 Adjusting Clutch Pedal Height

CLUTCH PEDAL FREE TRAVEL

1. Depress clutch pedal, stop the moment clutch resistance is felt, and measure distance (clutch pedal free travel). Free travel should be within following specification.

|                          |                             |
|--------------------------|-----------------------------|
| Clutch pedal free travel | 15 – 20 mm<br>0.6 – 0.8 in. |
|--------------------------|-----------------------------|

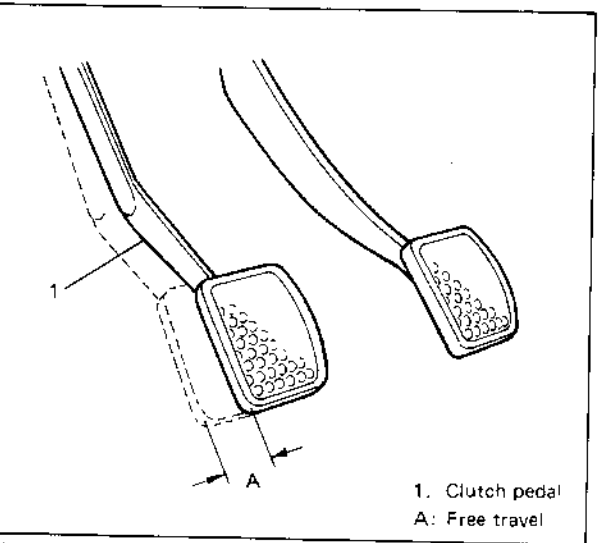


Fig. 7C-3 Checking Clutch Pedal Free Travel

2. If free travel is out of specification, adjust it with cable joint nut.

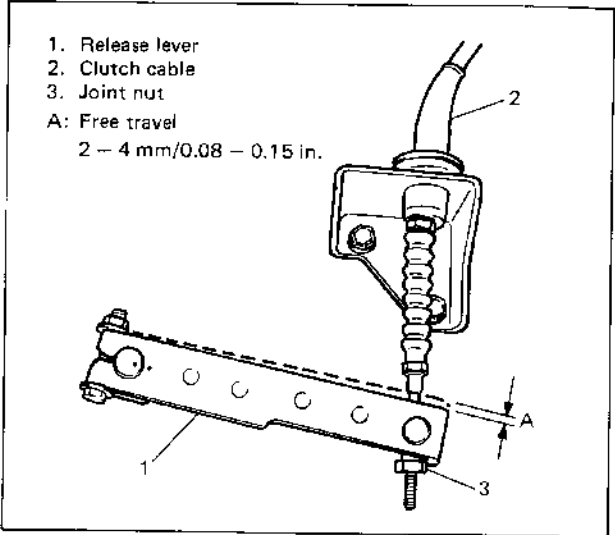


Fig. 7C-4 Adjusting Clutch Pedal Free Travel

3. After checking clutch pedal free travel, also check clutch for proper function with engine running.

CLUTCH START SWITCH  
ADJUSTMENT

1. Apply parking brake firmly and place gear shift control lever in neutral position.
2. Disconnect lead wire coupler beside pedal bracket.
3. Loosen lock nut and remove switch.
4. Depress clutch pedal all the way to the floor, and then let it back 15 – 30 mm (0.6 – 1.2 in.) along its travel from the floor.
5. Connect ohmmeter to switch, and slowly screw in until it is ON. Hold the switch at this position, and tighten lock nut to specification.
6. Remove ohmmeter and connect lead wire.

CAUTION:

When clutch pedal is fully depressed, clearance C (remaining switch stroke) should be 0.5 – 1.0 mm (0.02 – 0.04 in.) with this adjustment. "A" stroke from floor more than 50 mm (2 in.) may cause C to be less than 0.5 mm (0.02 in.).

|                                       |                |                   |                     |
|---------------------------------------|----------------|-------------------|---------------------|
| Tightening torque for switch lock nut | N·m<br>10 – 15 | kg·m<br>1.0 – 1.5 | lb·ft<br>7.5 – 10.5 |
|---------------------------------------|----------------|-------------------|---------------------|

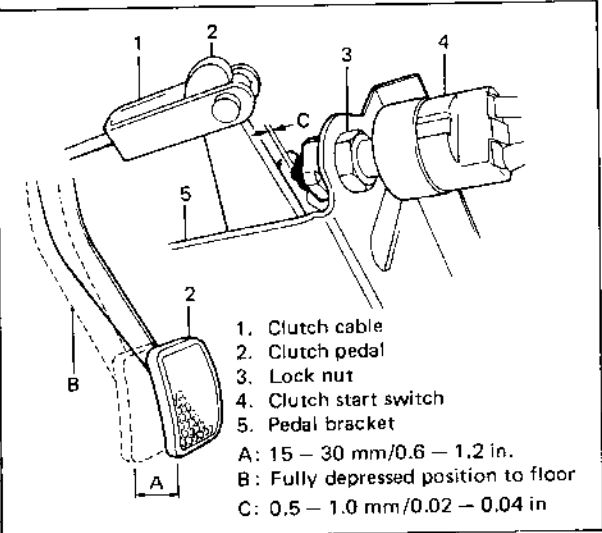


Fig. 7C-5 Adjusting Clutch Start Switch

CLUTCH CABLE  
REMOVAL

1. Remove clutch cable joint nut and disconnect joint pin from inner cable.
2. Remove 2 bolts at dash panel, unhook cable end from pedal top by using screwdriver from engine room, and then take out cable.

INSPECTION

Inspect clutch cable and replace it if any of following conditions exists.

- Excessive cable friction.
- Frayed cable.
- Bent or kinked cable.
- Broken boots.
- Worn end.

INSTALLATION

1. Apply grease to cable end hook and also joint pin before installing cable.
2. Hook cable end with pedal by using screwdriver or long nose pliers from cabin inside, then join inner cable with joint pin in release arm.
3. Apply water tight sealant to mating surface of cable and fasten it with 2 bolts to dash panel.

|                                                |              |                   |                    |
|------------------------------------------------|--------------|-------------------|--------------------|
| Tightening torque for clutch cable outer bolts | N·m<br>4 – 7 | kg·m<br>0.4 – 0.7 | lb·ft<br>3.0 – 5.0 |
|------------------------------------------------|--------------|-------------------|--------------------|

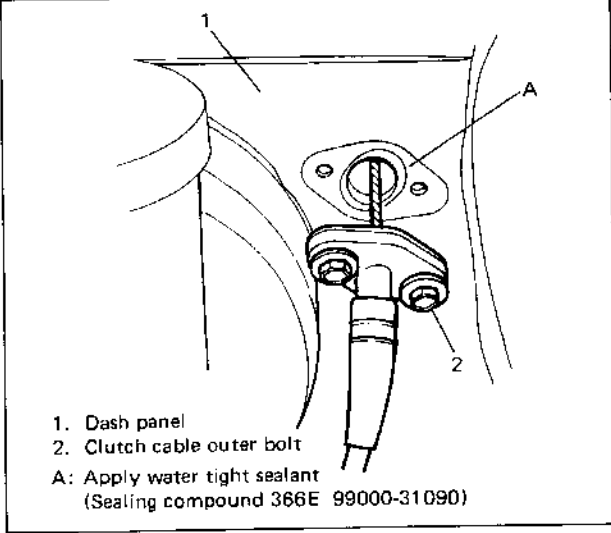


Fig. 7C-6 Fastening Clutch Cable

4. Screw in joint nut and adjust free travel of pedal to specification by turning nut.
5. Check clutch for proper function with engine running.

UNIT REPAIR OVERHAUL

CLUTCH COVER, CLUTCH DISC AND FLYWHEEL

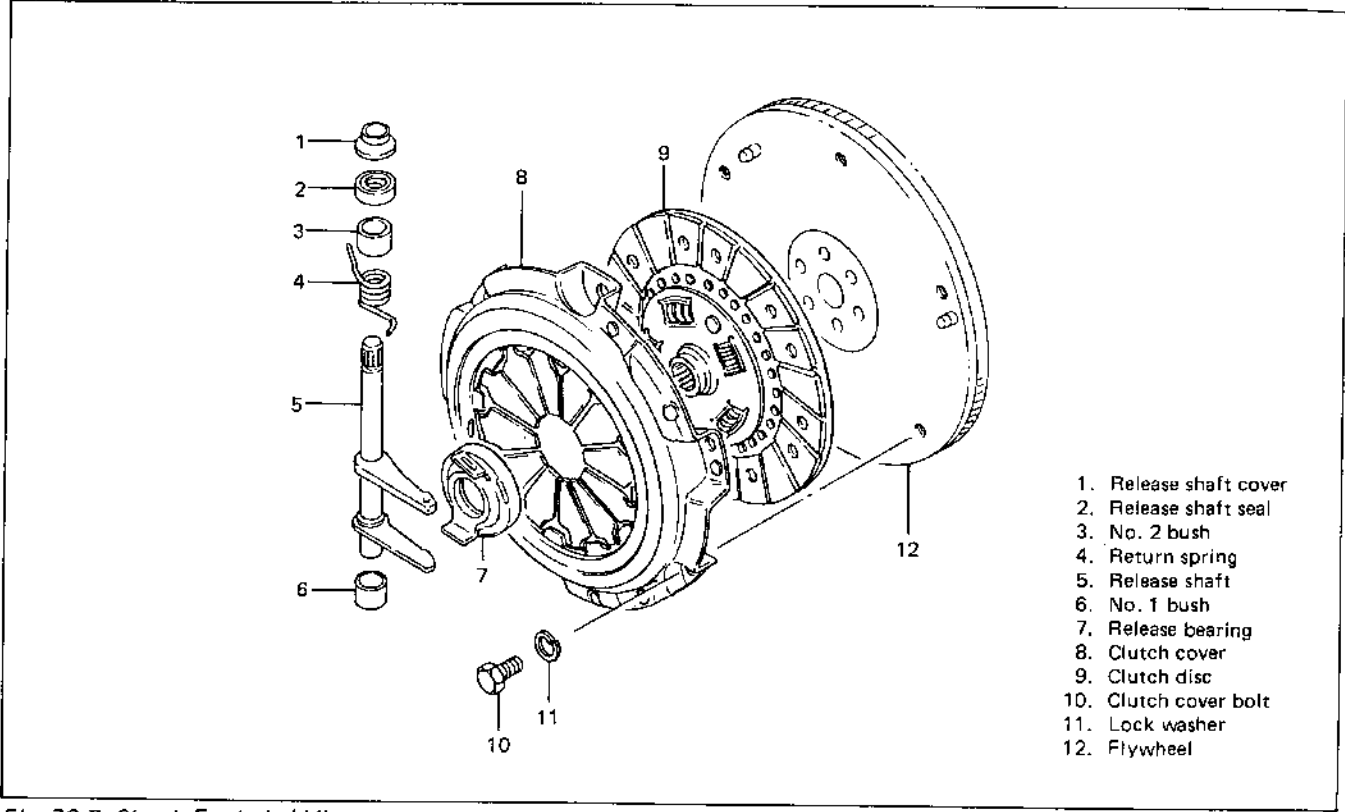


Fig. 7C-7 Clutch Exploded View

DISMOUNTING AND REMOUNTING

Refer to page 7A-12.

REMOVAL

1. Hold flywheel stationary with special tool and remove clutch cover bolts, clutch cover and clutch disc.

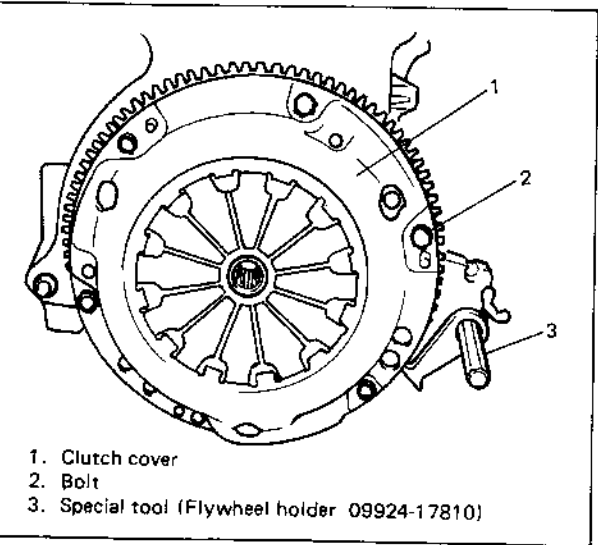


Fig. 7C-8 Removing Clutch Cover

2. Pull out input shaft bearing by using special tool and wrench.

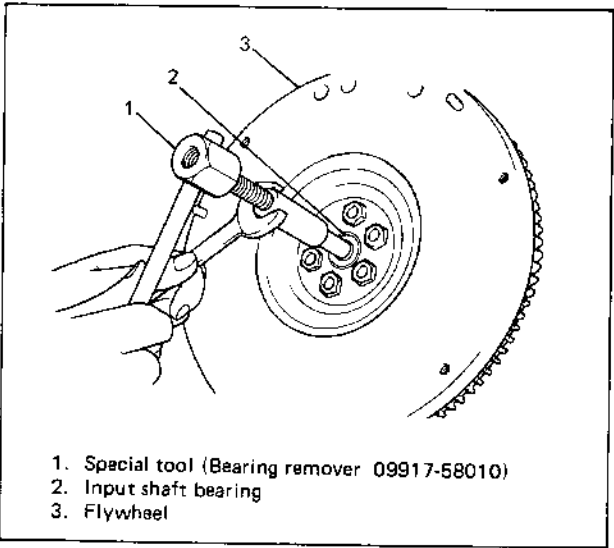


Fig. 7C-9 Removing Input Shaft Bearing

INSPECTION

Input Shaft Bearing

Check bearing for smooth rotation and replace it if abnormality is found.

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           | Service limit      |
|------------------|--------------------|--------------------|
|                  | 1.5 mm<br>0.06 in. | 0.5 mm<br>0.02 in. |

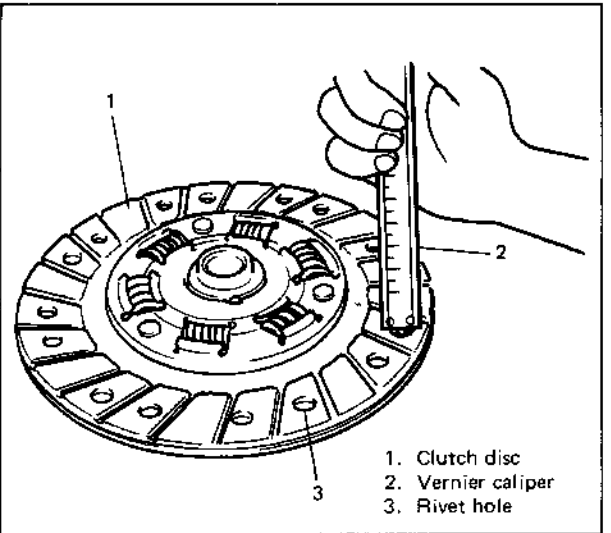


Fig. 7C-10 Measuring Rivet Head Depth

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.

Flywheel

Check surface contacting clutch disc for abnormal wear or heat spots. Replace or repair as required.

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.

| Tightening torque for flywheel bolts | N·m     | kg·m      | lb·ft       |
|--------------------------------------|---------|-----------|-------------|
|                                      | 57 – 65 | 5.7 – 6.5 | 41.5 – 47.0 |

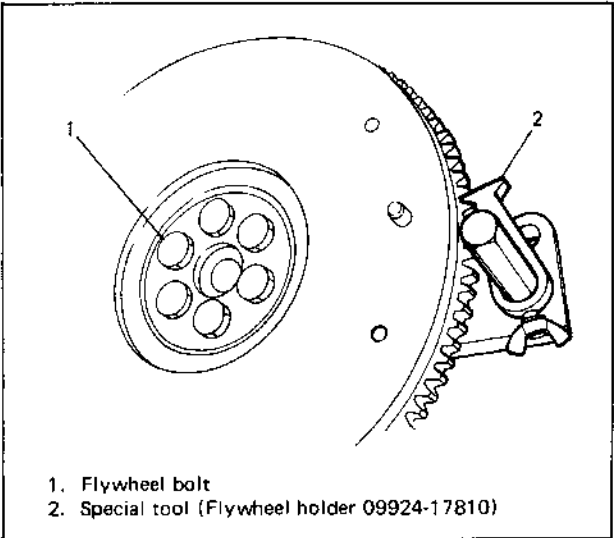


Fig. 7C-11 Installing Flywheel

2. Using special tool, install input shaft bearing to flywheel.

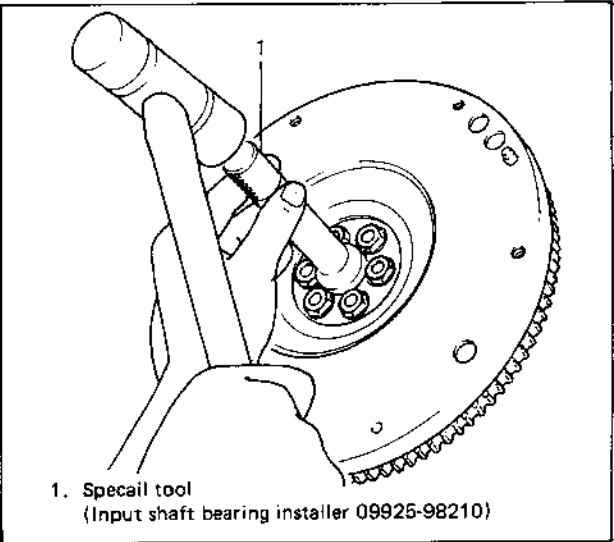


Fig. 7C-12 Installing Input Shaft Bearing

- Aligning clutch disc with flywheel center by using special tool, install clutch cover and bolts. Then tighten bolts to specification.

**NOTE:**

- While tightening clutch cover bolts, compress clutch disc with special tool (clutch center guide) by hand so that disc is centered.
- Tighten cover bolts little by little evenly in diagonal order.

| Tightening torque for clutch cover bolts | N-m     | kg-m      | lb-ft       |
|------------------------------------------|---------|-----------|-------------|
|                                          | 18 - 28 | 1.8 - 2.8 | 13.5 - 20.0 |

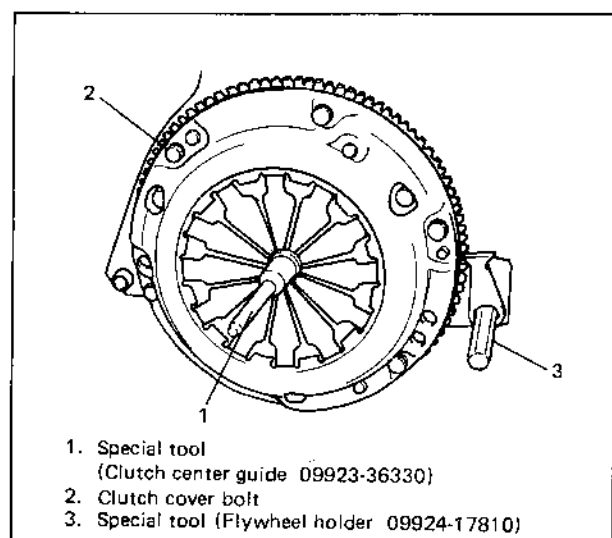


Fig. 7C-13 Installing Clutch Disc and Cover

- Slightly apply grease to input shaft, then join transmission assembly with engine. Refer to p. 7A-13 for remounting procedure.

**NOTE:**

Turn crankshaft a little through flywheel gear while inserting transmission input shaft to clutch disc until splines mesh.

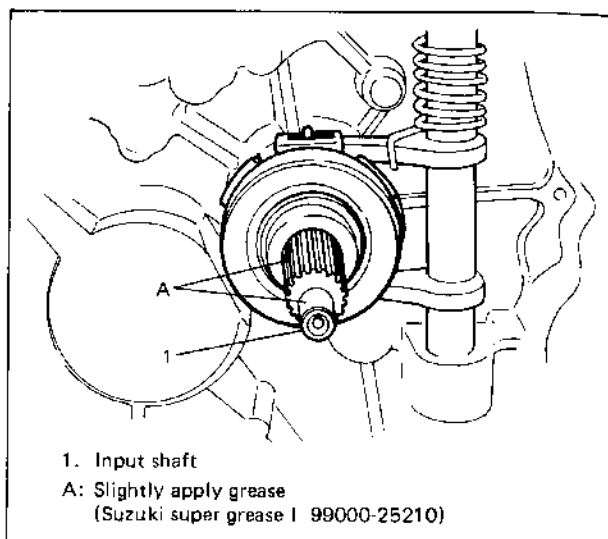


Fig. 7C-14 Lubricating Input Shaft

**CLUTCH RELEASE SYSTEM****REMOVAL**

- Remove release arm by loosening its bolt, and then shaft cover.
- Take out release bearing by turning release shaft.
- Unhook return spring by using pliers.
- Drive out No. 2 bush by using special tool and hammer. Release shaft seal will also be pushed out.

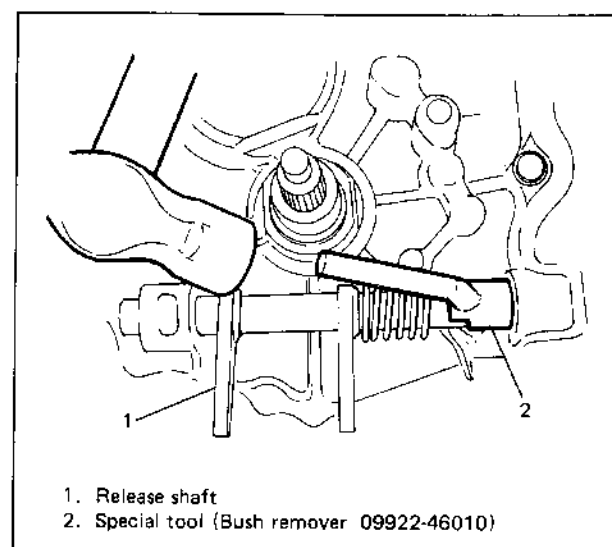


Fig. 7C-15 Removing Release Shaft Bush No. 2

- Remove release shaft.
- For removal of No. 1 bush, tap it by using M16 x 1.5 tap.

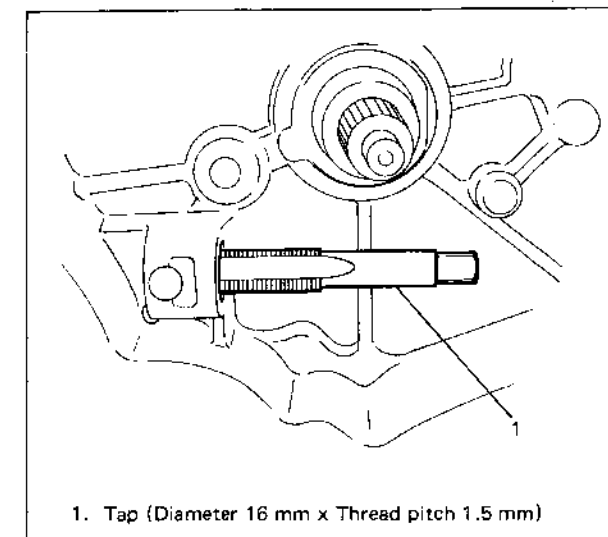


Fig. 7C-16 Tapping Bush No. 1

- Leaving tap in No. 1 bush, screw in joint pipe over tap, join sliding shaft with joint pipe, and then drive out bush.

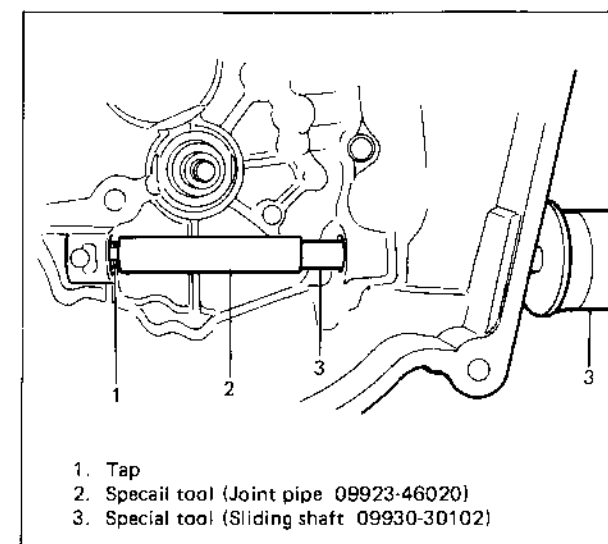


Fig. 7C-17 Removing Bush No. 1

**INSPECTION**

- Check clutch release bearing for smooth rotation.
- Inspect smoothness of release bearing retaining portion of transmission case and correct or replace right case as necessary.

**CAUTION:**

Do not wash release bearing. Washing may cause grease leakage and consequential bearing damage.

**INSTALLATION**

- Drive in a new No. 1 bush by using adequate drive handle and hammer and then apply grease to bush inside.

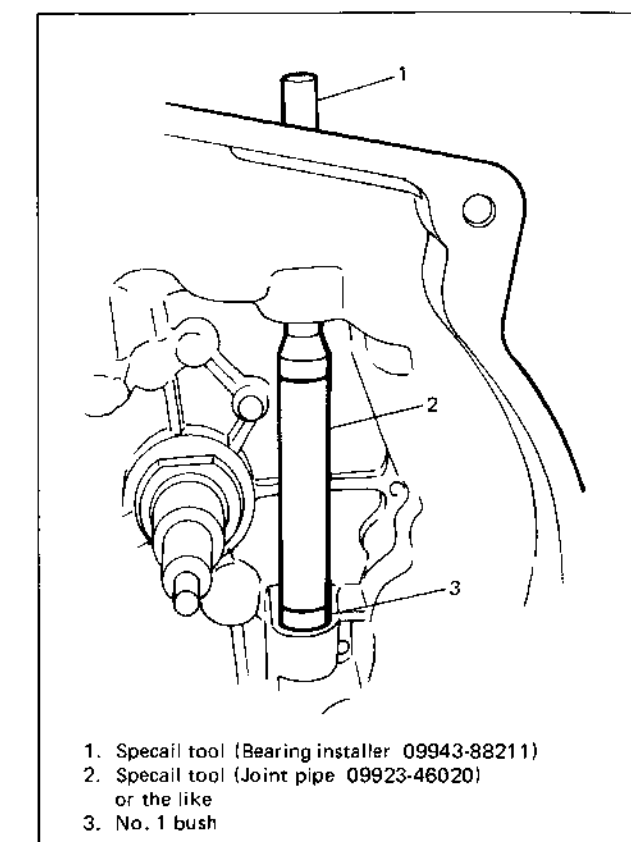


Fig. 7C-18 Installing Bush No. 1

- Install release shaft with return spring applied to it.
- Apply grease to No. 2 bush inside and press-fit it by using the same special tool as in removal.
- Coat grease to shaft seal and then install it till it is flush with case surface. Use special tool for this installation and face seal lip downward (inside).
- Caulk seal at A by using caulking tool and hammer.

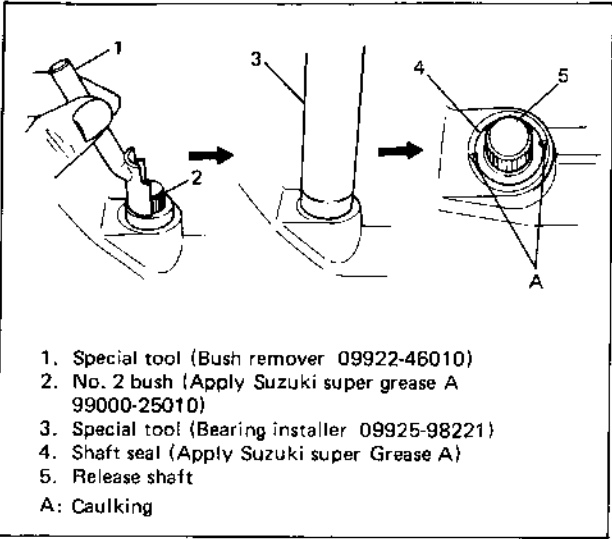


Fig. 7C-19 Installing Bush No. 2 and Shaft Seal

6. Hook return spring.  
7. Apply grease to release bearing inside and release shaft arm, then set bearing.  
8. Apply small amount of grease to input shaft spline and front end as well.

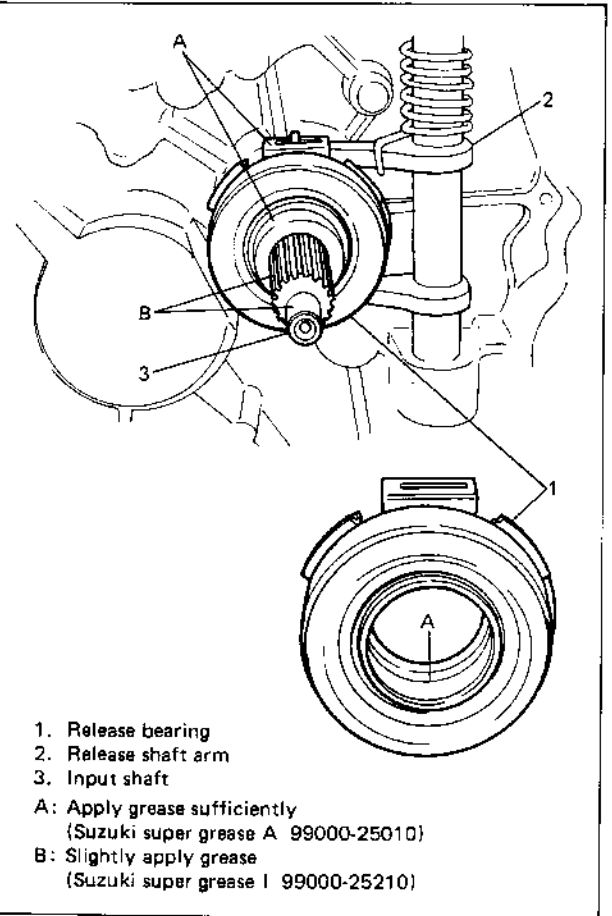


Fig. 7C-20 Lubricating Release System and Input Shaft

9. Install release shaft cover.  
10. Set release arm to release shaft aligning their punch marks, then tighten bolt.  
11. If clutch cable bracket has been removed or replaced, install it with 2 bolts.

| Tightening torque   | N·m     | kg-m      | lb-ft       |
|---------------------|---------|-----------|-------------|
| Release arm bolt    | 10 – 16 | 1.0 – 1.6 | 7.5 – 11.5  |
| Cable bracket bolts | 18 – 28 | 1.8 – 2.8 | 13.5 – 20.0 |

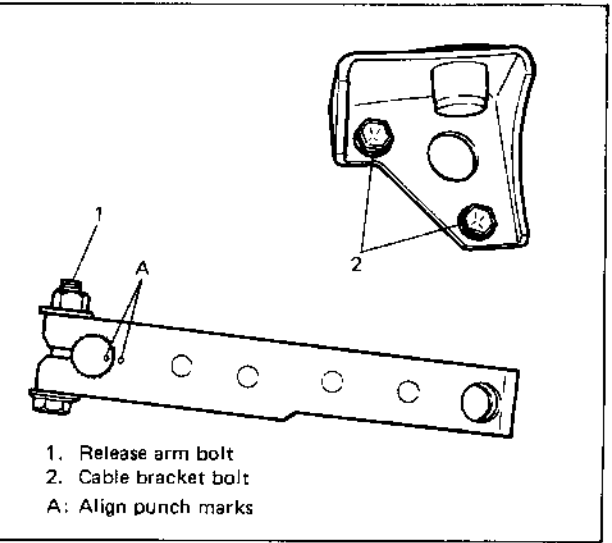


Fig. 7C-21 Installing Clutch Release Arm

## RECOMMENDED TORQUE SPECIFICATIONS

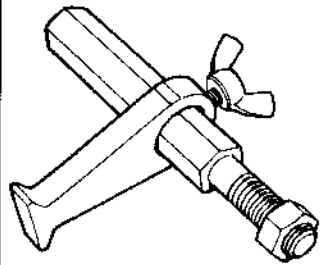
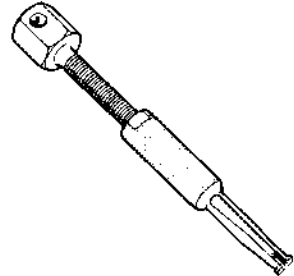
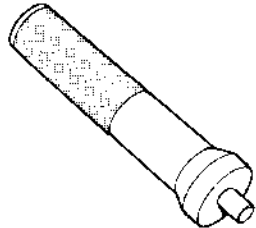
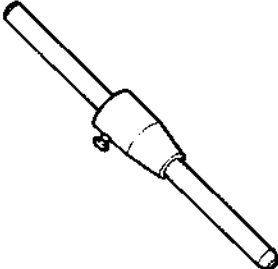
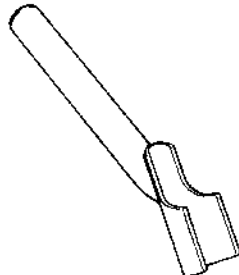
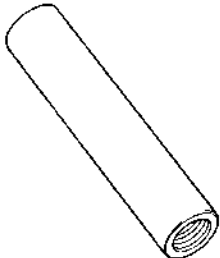
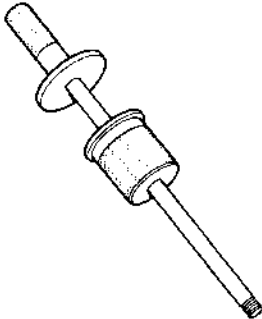
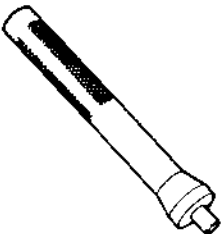
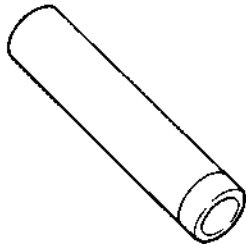
| Fastening portion           | Tightening torque |           |             |
|-----------------------------|-------------------|-----------|-------------|
|                             | N·m               | kg-m      | lb-ft       |
| 1. Switch lock nut          | 10 – 15           | 1.0 – 1.5 | 7.5 – 10.5  |
| 2. Clutch cable outer bolts | 4 – 7             | 0.4 – 0.7 | 3.0 – 5.0   |
| 3. Flywheel bolts           | 57 – 65           | 5.7 – 6.5 | 41.5 – 47.0 |
| 4. Clutch cover bolts       | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |
| 5. Release arm bolt         | 10 – 16           | 1.0 – 1.6 | 7.5 – 11.5  |
| 6. Cable bracket bolts      | 18 – 28           | 1.8 – 2.8 | 13.5 – 20.0 |

## REQUIRED SERVICE MATERIALS

| MATERIAL            | RECOMMENDED SUZUKI PRODUCT                      | USE                                                                                                                    |
|---------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Lithium grease      | SUZUKI SUPER GREASE A (99000-25010)             | • Cable end hook and joint pin.<br>• Release shaft bushes and seal.<br>• Release bearing inside and release shaft arm. |
|                     | SUZUKI SUPER GREASE I (99000-25210)             | Input shaft spline and front end.                                                                                      |
| Water tight sealant | SUZUKI SEALING COM-<br>POUND 366E (99000-31090) | Clutch cable fastening portion with dash panel.                                                                        |



SPECIAL TOOLS

|                                                                                                                                               |                                                                                                                                           |                                                                                                                                                          |                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>1</div>  <div>09924-17810<br/>Flywheel holder</div>     | <div>2</div>  <div>09917-58010<br/>Bearing remover</div> | <div>3</div>  <div>09925-98210<br/>Input shaft bearing installer</div> | <div>4</div>  <div>09923-36330<br/>Clutch center guide</div> |
| <div>5</div>  <div>09922-46010<br/>Bush remover</div>        | <div>6</div>  <div>09923-46020<br/>Joint pipe</div>      | <div>7</div>  <div>09930-30102<br/>Sliding shaft</div>                | <div>8</div>  <div>09943-88211<br/>Bearing installer</div>   |
| <div>9</div>  <div>09925-98221<br/>Bearing installer</div> |                                                                                                                                           |                                                                                                                                                          |                                                                                                                                                 |

SECTION 8

BODY ELECTRICAL SYSTEM

CONTENTS

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GENERAL DESCRIPTION

The body electrical components of this car are designed to operate on 12 volts power supplied by the battery. The electrical system utilizes negative ground polarity.

WIRING

All body low voltage wires are insulated. The insulation is color coded for identification of individual body circuit.

# BODY ELECTRICAL SYSTEM

## FUSES

The main fuse block is located on the fender apron panel in the engine room and junction/fuse block is installed to underside of instrument cover panel.

The designation and location of each fuse are 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 equipments including ignition switch.

## MAIN FUSE BLOCK CIRCUIT

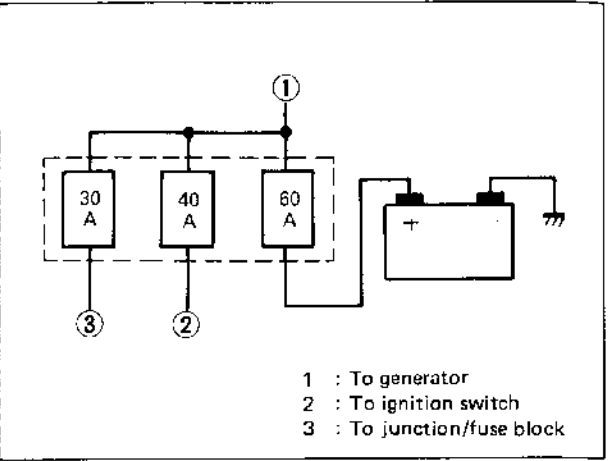


Fig. 8-1 Main Fuse Block Circuit

## JUNCTION/FUSE BLOCK CIRCUIT AND FUSE BLOCK DESIGNATIONS

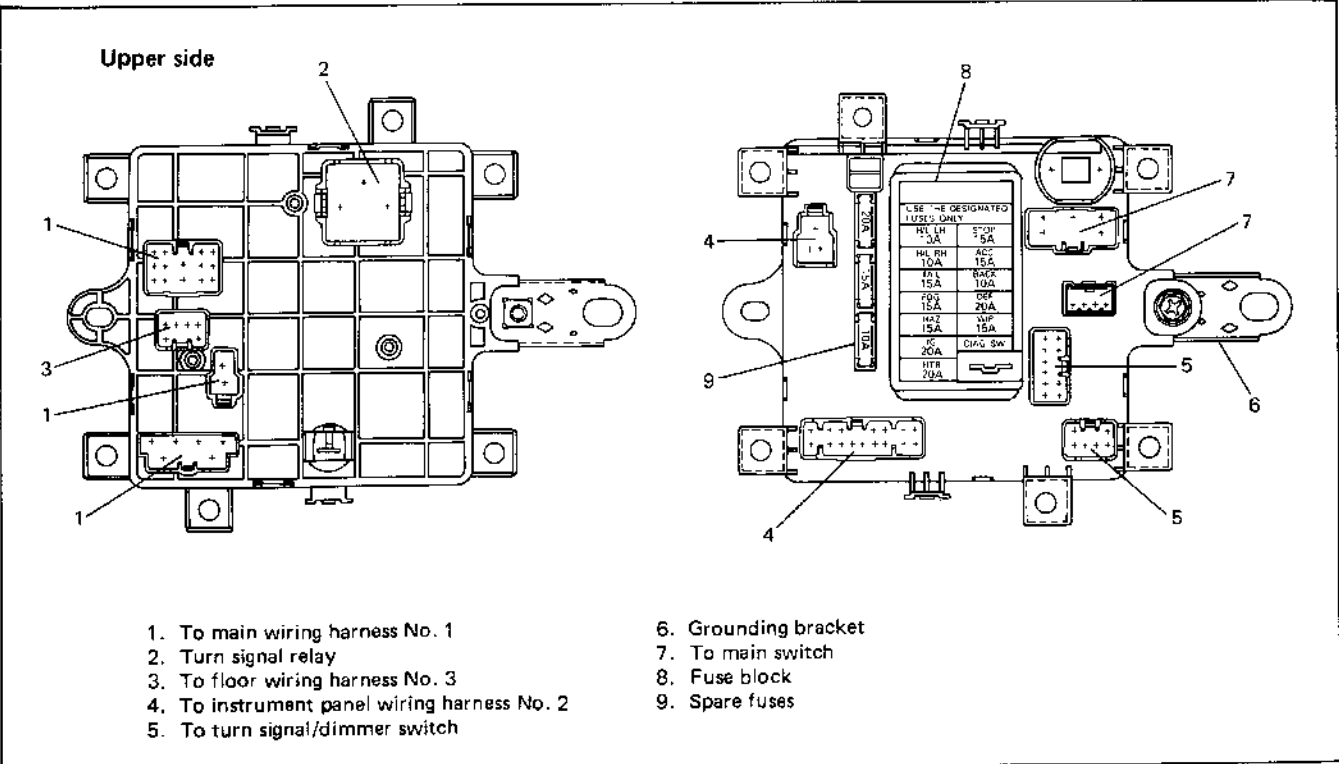


Fig. 8-2

## JUNCTION/FUSE BLOCK CIRCUIT AND COLOR CODES

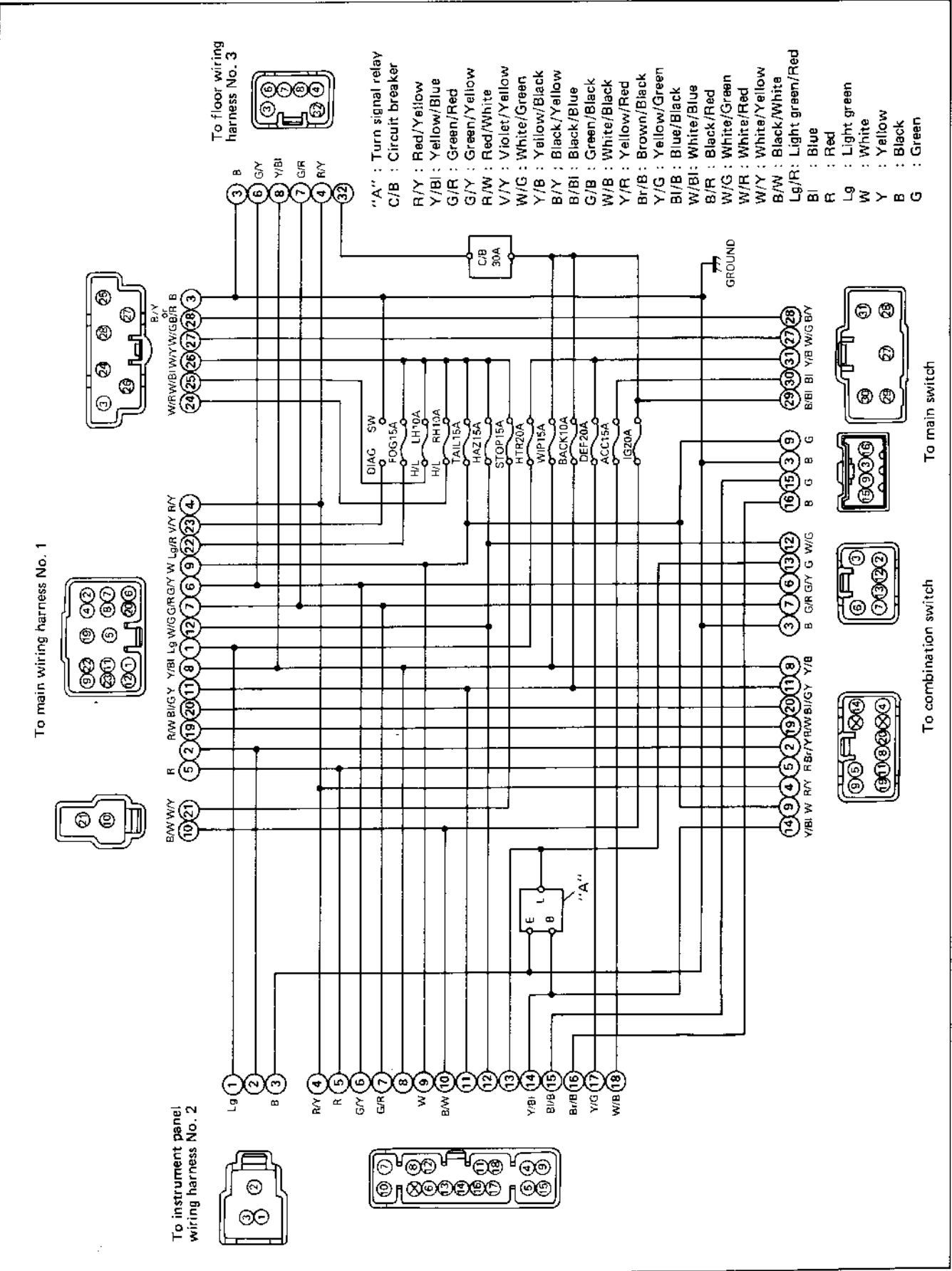


Fig. 8-3



SWITCHES

IGNITION (main) SWITCH

Inspection

Remove or disconnect following parts.

- 1) Battery (—) cable.
- 2) Main switch lead wire connectors from junction/fuse block.

Checking continuity between terminals

Use a circuit tester to check the continuity at each switch position. If any continuity is not obtained, replace main switch.

| Wire color |          | W/G | BI | B/BI | Y/B | B/Y | B | B | G | G |
|------------|----------|-----|----|------|-----|-----|---|---|---|---|
| Key        | Position |     |    |      |     |     |   |   |   |   |
| OUT        | LOCK     | ○   |    |      |     |     |   |   |   |   |
|            | ACC      | ○   | ○  |      |     |     |   |   |   |   |
|            | ON       | ○   | ○  | ○    | ○   |     |   |   | ○ | ○ |
|            | START    | ○   | ○  | ○    | ○   | ○   | ○ |   |   |   |

ACC: Accessory  
B/BI: Black/Blue  
W/G: White/Green  
Y/B: Yellow/Black  
B: Black  
BI: Blue  
B/Y: Black/Yellow  
G: Green

Fig. 8-4 Continuity Check

Removal

Remove steering column referring to Section 3C-3 of this manual. And then remove steering lock/main switch from steering column, referring to Section 3C-3.

Installation

Install steering lock/main switch and steering column referring to Section 3C-3 of this manual.

NOTE:

When installing steering column, special care must be used for tightening sequence and each torque.

COMBINATION SWITCH

Combination switch incorporates lighting, turn signal, hazard warning light, dimmer, passing light and wiper/washer switches.

Inspection

Remove or disconnect following parts.

- 1) Battery (—) cable.
- 2) Combination switch lead wire connectors from junction/fuse block.

Combination switch couplers

|      |   |      |     |   |     |      |     |     |      |      |      |
|------|---|------|-----|---|-----|------|-----|-----|------|------|------|
| Y/BI | — |      |     | R | W   | B    |     | G/Y | BI/W | BI/R |      |
| R/Y  | — | BI/G | Y/B | Y | R/W | Br/Y | W/G | G   | G/R  | BI   | BI/B |

B : Black  
BI : Blue  
BI/B : Blue/Black  
BI/R : Blue/Red  
BI/W : Blue/White  
BI/G : Blue/Green  
Br/Y : Brown/Yellow  
G : Green  
G/Y : Green/Yellow  
G/R : Green/Red  
R : Red  
R/W : Red/White  
R/Y : Red/Yellow  
Y : Yellow  
Y/BI : Yellow/Blue  
Y/B : Yellow/Black  
W : White  
W/G : White/Green

Fig. 8-5

Continuity between terminals

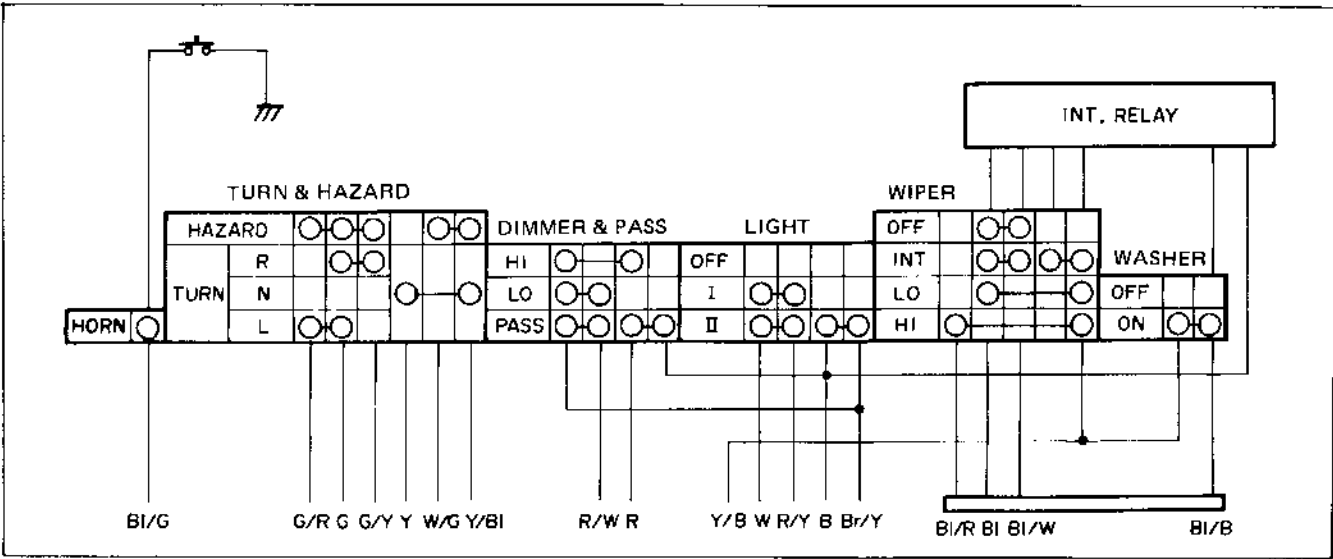


Fig. 8-6

BI/G, horn lead wire, produces no continuity inside turn signal switch.

Removal/Installation

For removal/installation of combination switch, refer to Section 3C-2 of this manual.

NOTE:

Some cars are not provided with INTERMITTENT position depending on specifications.

B: Black  
BI: Blue  
BI/B: Blue/Black  
BI/G: Blue/Green  
BI/R: Blue/Red  
BI/W: Blue/White  
Br/Y: Brown/Yellow  
G: Green  
G/R: Green/Red  
G/Y: Green/Yellow  
R: Red  
R/W: Red/White  
R/Y: Red/Yellow  
W: White  
W/G: White/Green  
Y: Yellow  
Y/B: Yellow/Black  
Y/BI: Yellow/Blue

ILLUMINATION CONTROLLER

Some cars are not provided with this device depending on specifications.

Inspection

Use a bulb to wire as illustrated below.

Make sure that illumination controller knob is turned clockwise to brighten test light and counterclockwise to darken it.

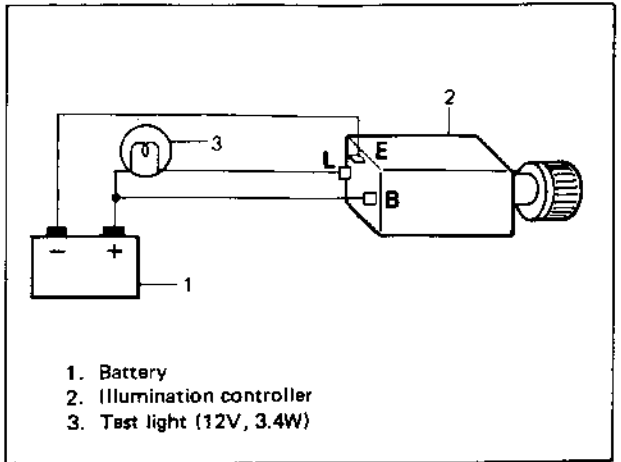


Fig. 8-7

INSTRUMENTS AND GAUGES

COMBINATION METER WIRING

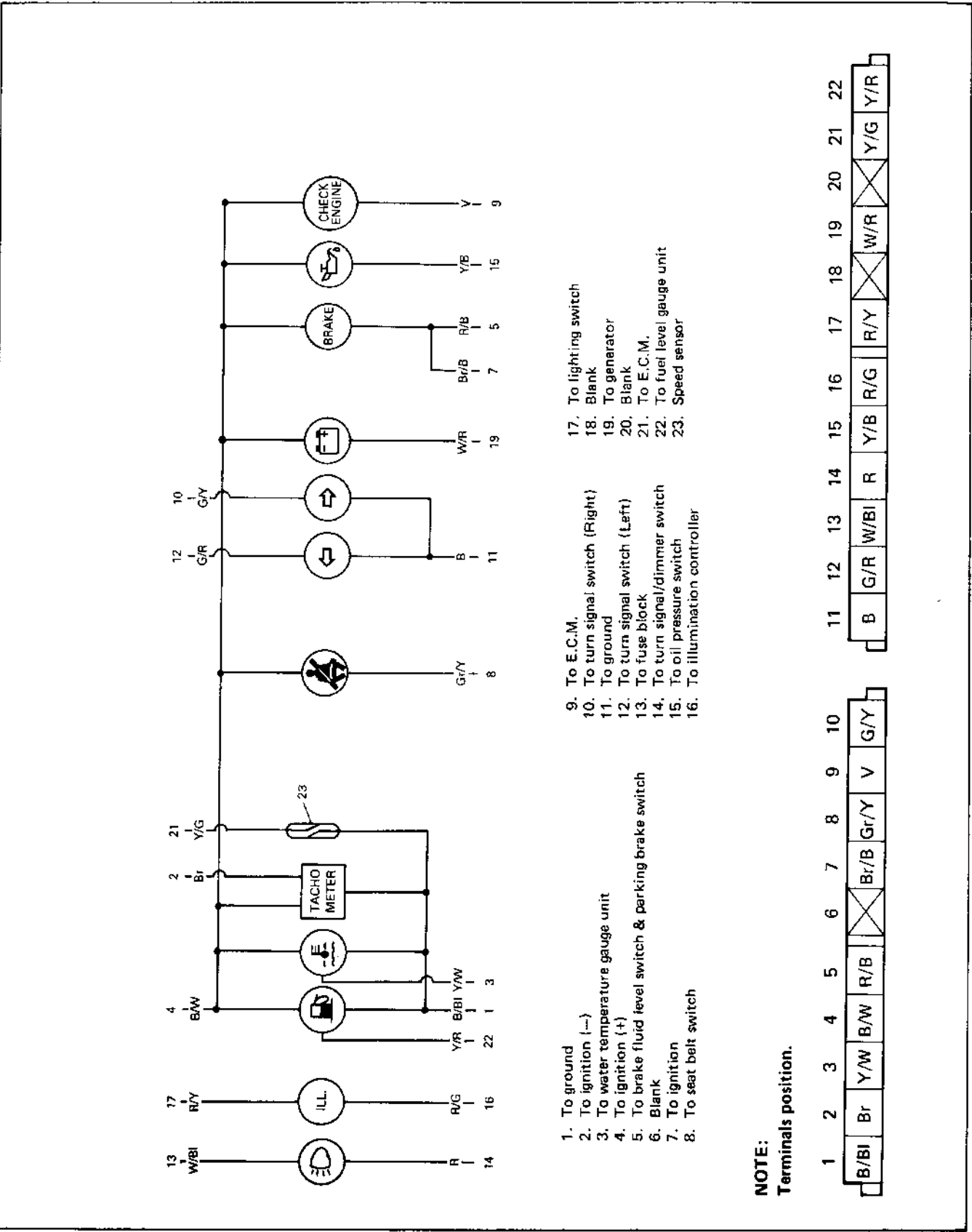


Fig. 8-8 Combination Meter Wiring

TROUBLE DIAGNOSIS

| Trouble                                                                                                     | Possible cause                                                                                                          | Correction                                                                            |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Fuel level meter shows no operation.                                                                        | Meter fuse blown<br>Fuel meter faulty<br>Fuel level gauge unit faulty<br>Wiring or grounding faulty                     | Replace fuse to check for short.<br>Check meter.<br>Check gauge unit.<br>Repair.      |
| Water temperature meter shows no operation.                                                                 | Meter fuse blown<br>Water temperature meter faulty<br>Water temperature gauge unit faulty<br>Wiring or grounding faulty | Replace fuse to check for short.<br>Check meter.<br>Check gauge unit.<br>Repair.      |
| Oil pressure light shows no lighting.                                                                       | Light fuse blown<br>Bulb burnt out<br>Oil pressure switch faulty<br>Wiring or grounding faulty                          | Replace fuse to check for short.<br>Replace bulb.<br>Check switch.<br>Repair.         |
| Brake warning light (parking brake right) shows no lighting.                                                | Light fuse blown<br>Bulb burnt out<br>Brake fluid level switch faulty<br>Wiring or grounding faulty                     | Replace fuse to check for short.<br>Replace bulb.<br>Check warning switch.<br>Repair. |
| Seat belt warning light/buzzer show no lighting/sounding.<br>(Applicable to car equipped with light/buzzer) | Light fuse blown<br>Bulb burnt out<br>Buzzer faulty (no sounding)<br>Wiring or grounding faulty                         | Replace fuse to check for short.<br>Replace bulb.<br>Replace buzzer.<br>Repair.       |
| Main switch key warning buzzer shows no sounding.<br>(Applicable to car equipped with buzzer)               | Buzzer fuse blown<br>Buzzer faulty<br>Wiring or grounding faulty                                                        | Replace fuse to check for short.<br>Replace buzzer.<br>Repair.                        |
| Light warning buzzer shows no sounding.<br>(Applicable to car equipped with buzzer.)                        | Buzzer fuse blown<br>Buzzer faulty<br>Driver side door switch faulty                                                    | Replace fuse to check for short.<br>Replace buzzer.<br>Replace door switch            |

FUEL LEVEL METER AND GAUGE UNIT

DESCRIPTION OF CIRCUIT

The fuel level meter circuit consists of the fuel level meter installed inside the combination meter and the fuel level gauge installed to the fuel tank.

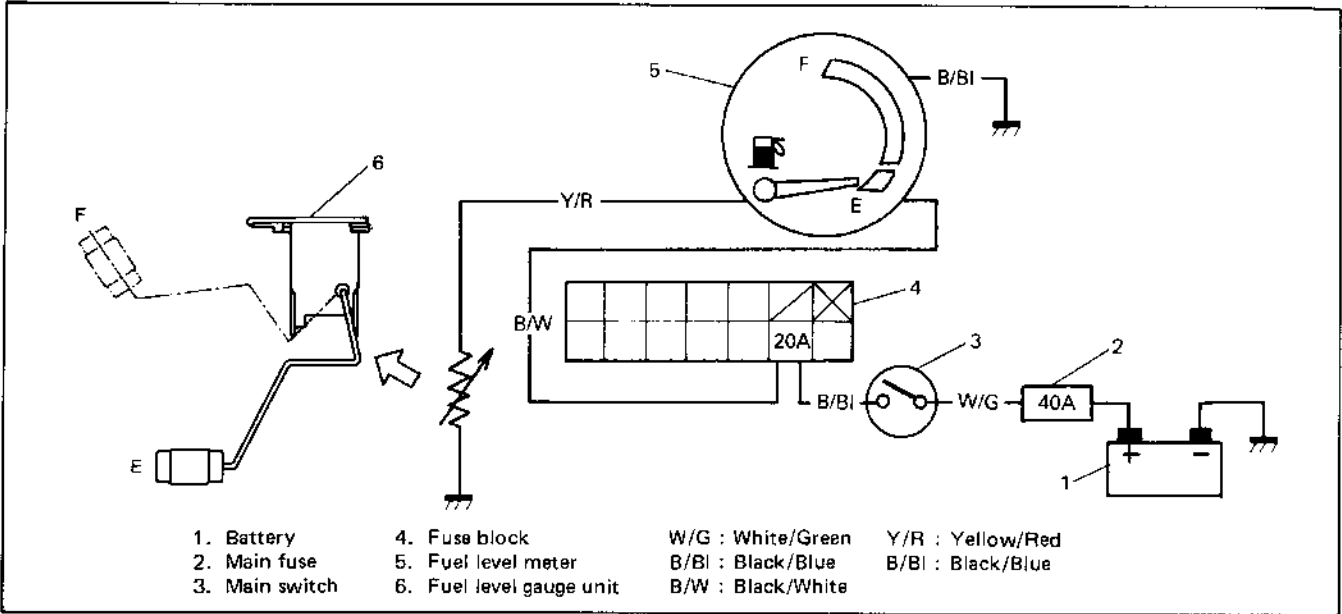


Fig. 8-10

Current flowing through the meter coil is changed to control the meter pointer. That is, when fuel is full, the fuel level gauge unit resistance is decreased with more current flowing into the meter coil, causing the meter pointer to point at the "F" position.

INSPECTION

FUEL LEVEL METER

- 1) Remove rear seat.
- 2) Disconnect Y/R (Yellow/Red) lead wire going to gauge unit.
- 3) Use a bulb (12V 3.4W) in position to ground above lead wire as illustrated.
- 4) Turn ignition switch ON.  
Make sure that bulb is lighted with meter pointer fluctuating several seconds thereafter.  
If meter is faulty, replace.

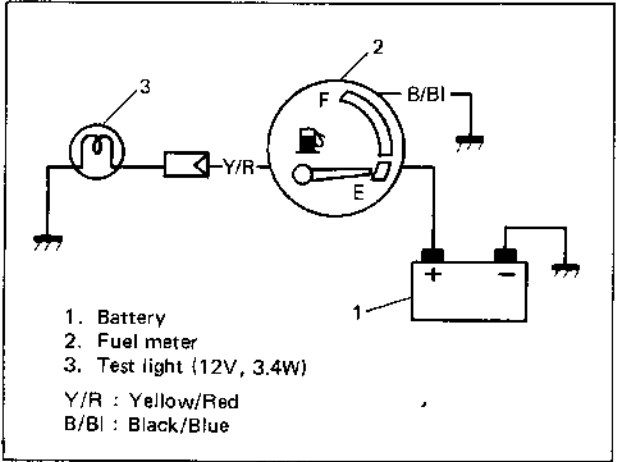


Fig. 8-11 Checking Fuel Level Meter

GAUGE UNIT

Use an ohmmeter to confirm that resistance of level gauge unit changes with change of float position. Float position-to-resistance relationship can be plotted in a graph as shown below.

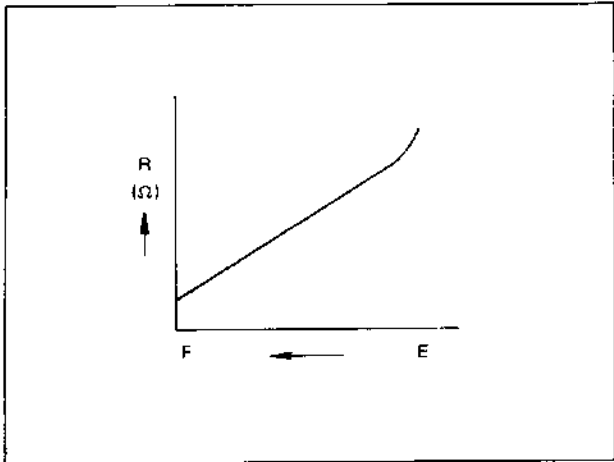


Fig. 8-12 Resistance-Fuel Level Relationship

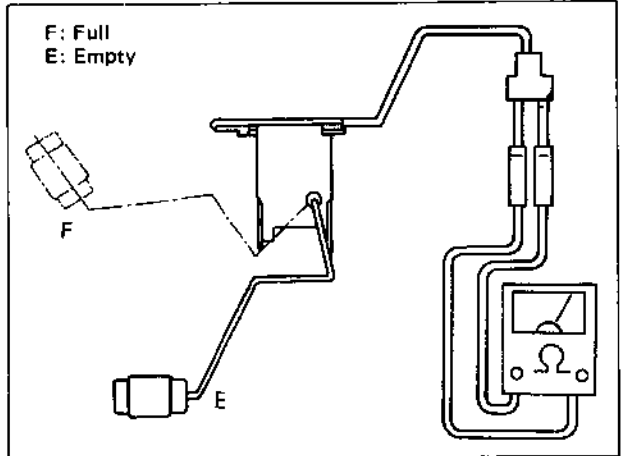


Fig. 8-13 Checking Fuel Gauge Unit

| Position | Resistance |
|----------|------------|
| E        | 120 ± 8 Ω  |
| F        | 3 ± 2 Ω    |
| 1/2      | 32.5 ± 4 Ω |

WATER TEMPERATURE METER AND GAUGE UNIT

DESCRIPTION OF CIRCUIT

The water temperature meter is located in the instrument panel and its gauge unit on the inlet manifold. This circuit is as shown below.

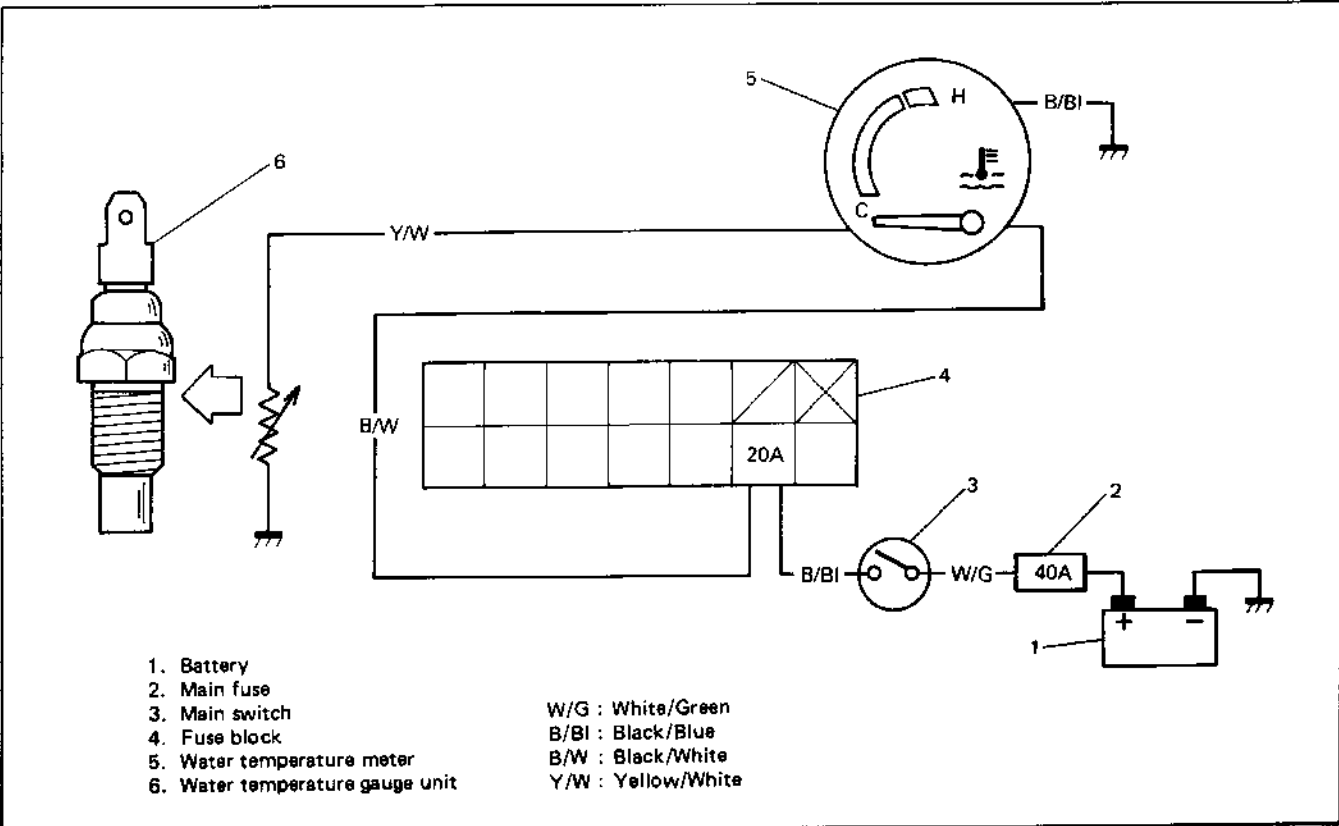


Fig. 8-14 Water Temperature Gauge Circuit

The gauge unit shows different resistance values depending on the coolant temperature. This causes a current flowing through the temperature meter coil to change, controlling the meter pointer. That is, when the coolant temperature rises, the gauge unit resistance is decreased with more current flowing through the meter coil, thus allowing the meter pointer to move away from the "C" position.

**INSPECTION**

**WATER TEMPERATURE METER**

1. Disconnect Y/W (Yellow/White) lead wire going to gauge unit installed to intake manifold.
2. Use a bulb (12V 3.4W) 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.

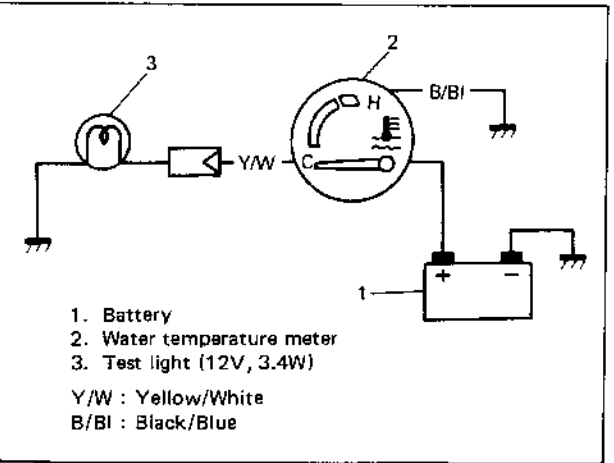


Fig. 8-15 Checking Water Temperature Meter

**GAUGE UNIT**

Warm up gauge unit. Check that its resistance reduces as its temperature rises. Temperature-to-resistance relationship can be plotted in a graph as shown below.

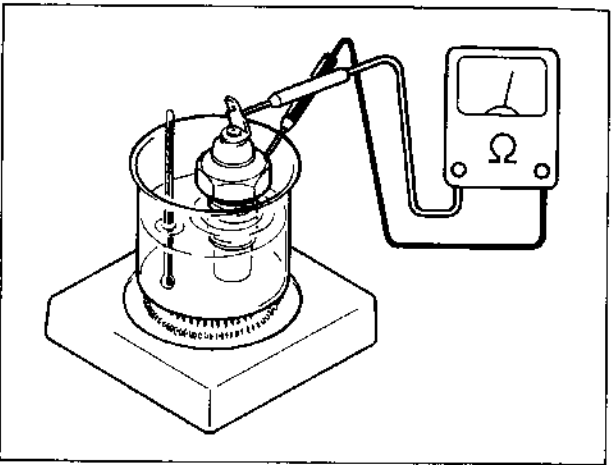


Fig. 8-16 Checking Temperature Gauge Unit

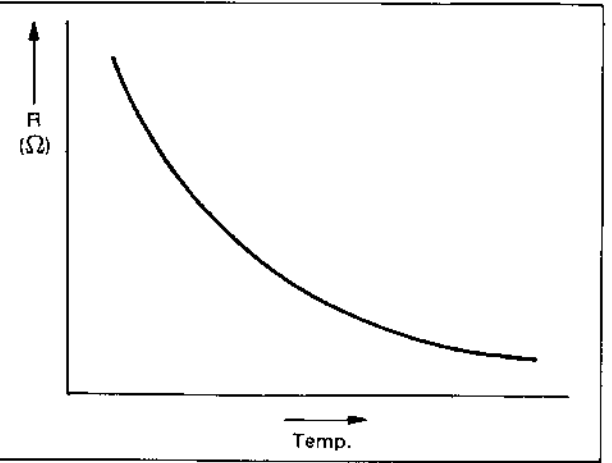


Fig. 8-17 Resistance-Temp. Relationship

| Temperature     | Resistance      |
|-----------------|-----------------|
| 50° C (122° F)  | 133.9 ~ 178.9 Ω |
| 80° C (176° F)  | 47.5 ~ 56.8 Ω   |
| 100° C (212° F) | 26.2 ~ 29.3 Ω   |

**OIL PRESSURE LIGHT**

**DESCRIPTION OF CIRCUIT**

The oil pressure circuit consists of the oil pressure switch installed to the cylinder block and the light (warning light) inside the combination meter.

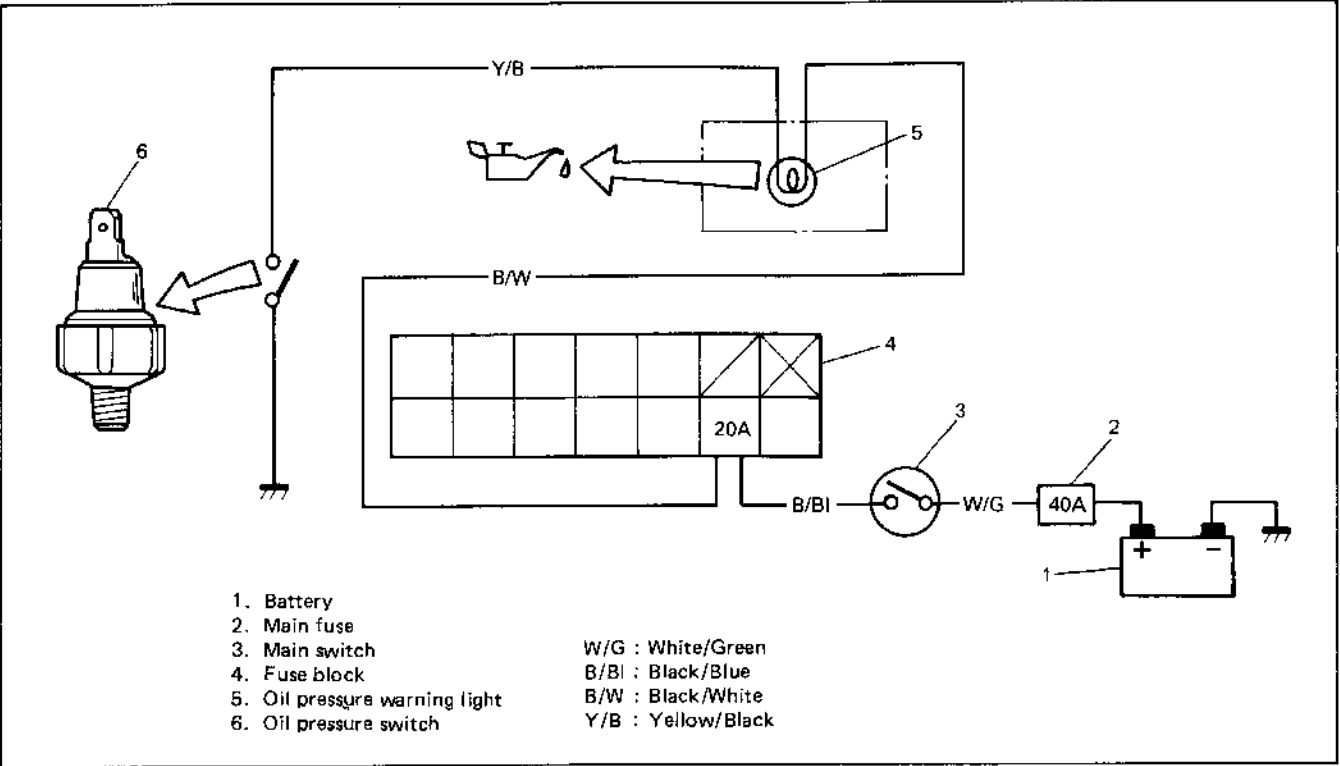


Fig. 8-18 Oil Pressure Switch Circuit

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 (0 Ω)                  |

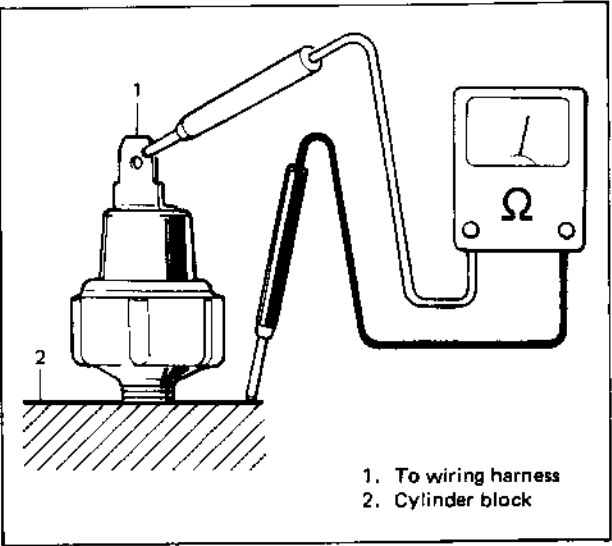


Fig. 8-19 Checking Oil Pressure Switch

## BRAKE FLUID LEVEL WARNING LIGHT

### 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) inside the combination meter. Also, this circuit is additionally provided with the parking brake switch which warns that the parking brake is applied.

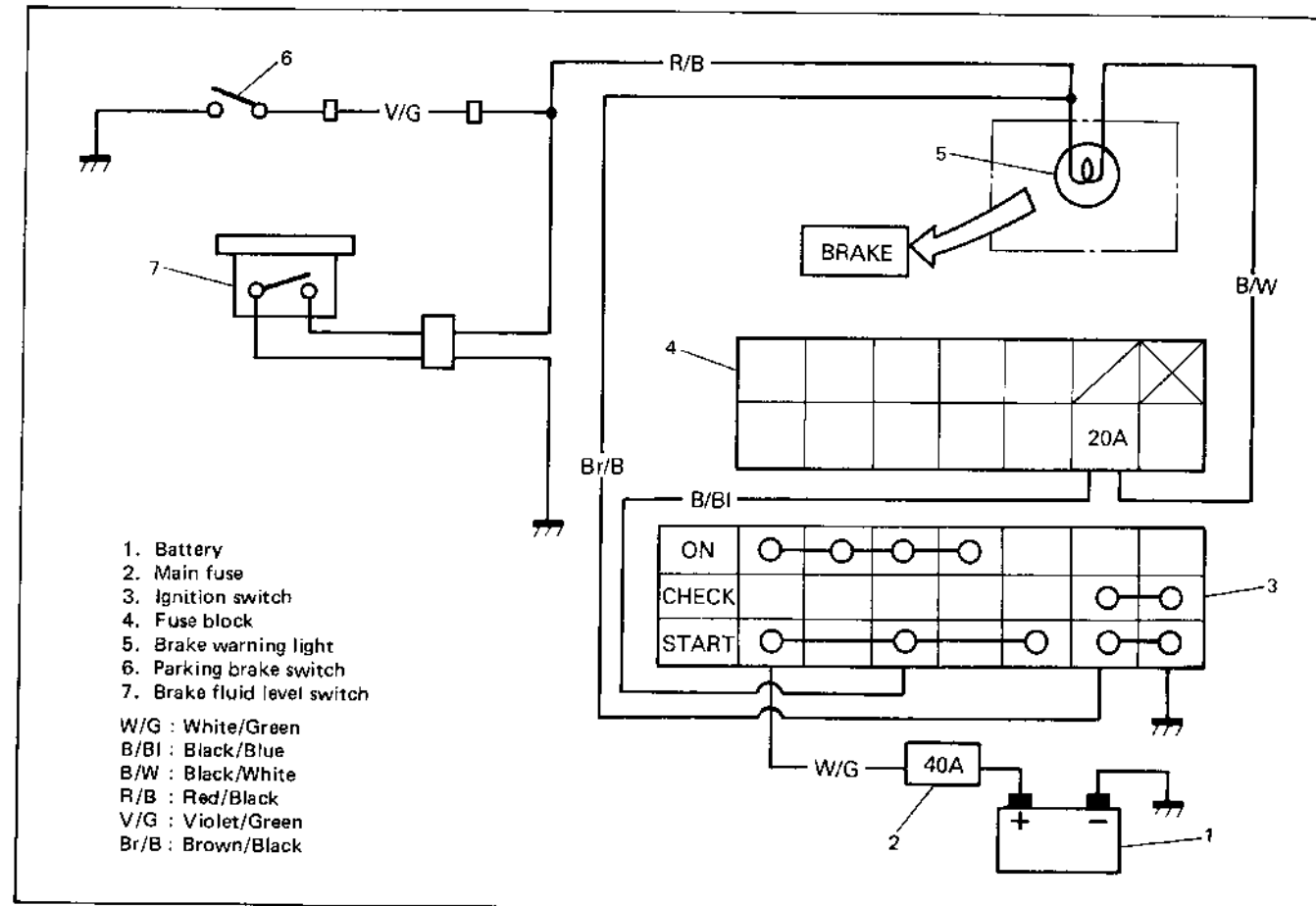


**Fig. 8-20 Brake Warning Circuit**

### OPERATION OF WARNING LIGHT

1. Warning light comes on when engine is stopped while ignition switch is turned on and parking brake is applied.
2. For bulb check, check that warning light comes on briefly during engine start regardless of brake fluid level position and parking brake operation.
3. After starting engine, release parking brake. If light goes off, brake fluid level is adequate.

## INSPECTION

## BRAKE FLUID LEVEL SWITCH

Use an ohmmeter to check switch for continuity.  
If found defective, replace switch.

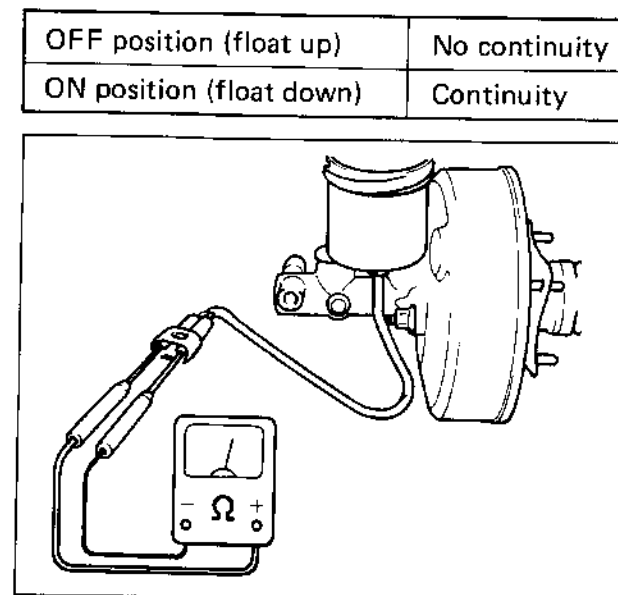


**Fig. 8-21 Checking Fluid Level Switch**

## SEAT BELT WARNING LIGHT/BUZZER

### DESCRIPTION OF CIRCUIT

The seat belt warning light/buzzer circuit is a system to light and sound the light and buzzer respectively for several seconds, urging the driver

to wear his seat belt. After several seconds, the light goes OFF and the buzzer stops sounding whether the seat belt is worn or not.

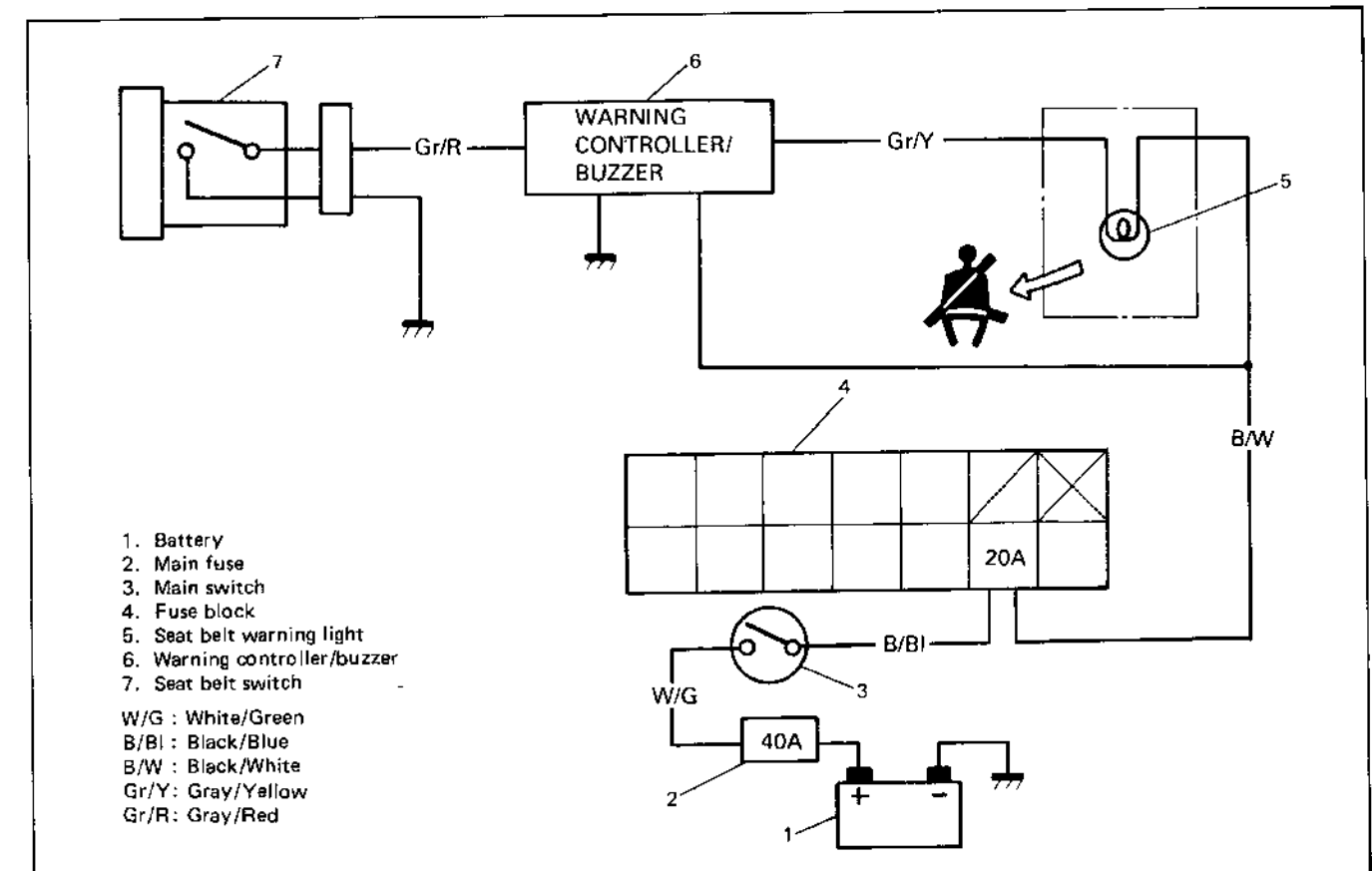


**Fig. 8-22 Seat Belt Warning System Circuit**

## INSPECTION

When warning light/buzzer fails to make lighting/  
sounding, use above circuit diagram as reference  
to check bulb, buzzer, wiring, etc.

## INSPECTION OF WARNING CONTROLLER

Connect negative (-) terminal of battery to terminals ① and ⑦ of controller and positive (+) terminal of battery to terminals ④ and ⑤ of controller and check that buzzer emits buzzing sound for 4 to 8 seconds. Also, it should operate likewise when terminals are disconnected and reconnected. If check result is not satisfactory, replace.

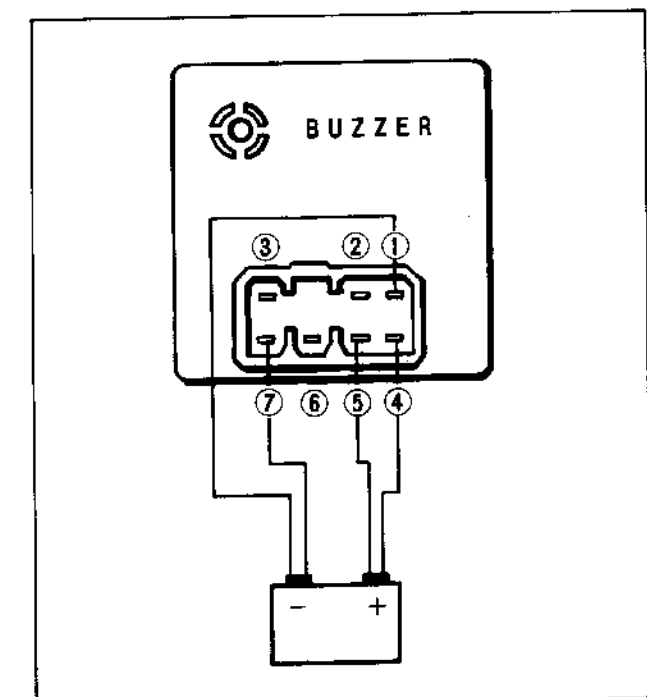


**Fig. 8-23 Checking Warning Controller/Buzzer**

## MAIN SWITCH KEY REMAINDER WARNING BUZZER

### DESCRIPTION OF CIRCUIT

The main switch key remainder warning buzzer circuit is a system to sound the buzzer if the driver leaves the car with the main switch key inserted so as to urge him to take it out.

### INSPECTION

If main switch key remainder warning buzzer does not sound, use its wiring diagram in figure below as reference to check buzzer, wiring, etc.

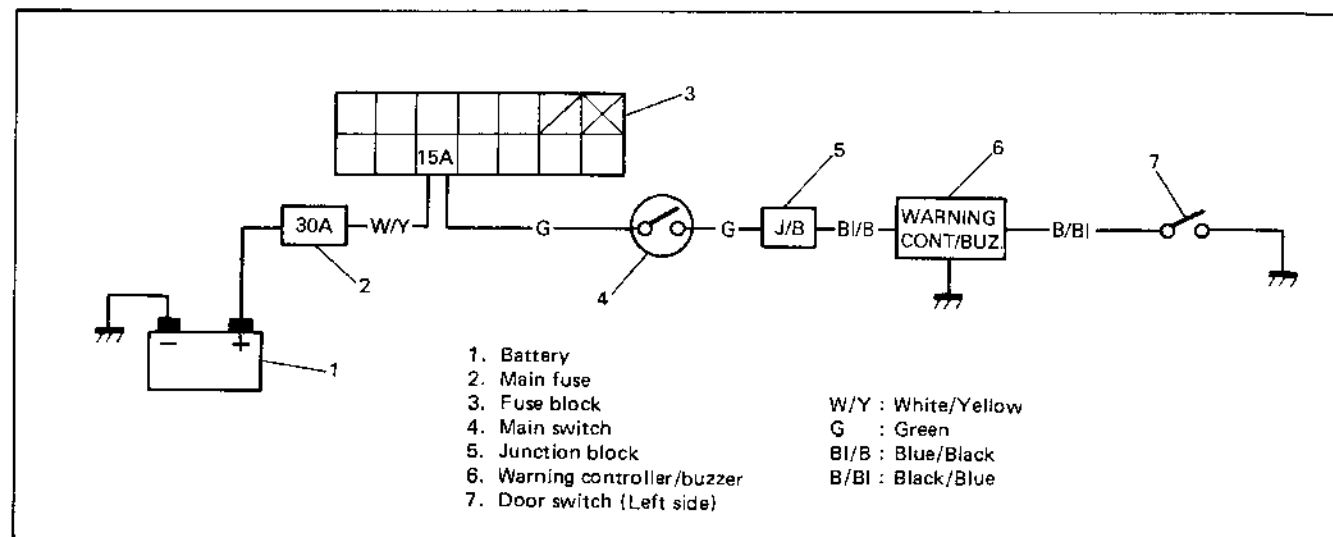


Fig. 8-24 Main Switch Key Warning Buzzer Circuit

### INSPECTION OF WARNING CONTROLLER/BUZZER

With positive (+) terminal of battery connected to terminal ④ of controller and negative (-) one to ⑦, also connect negative (-) one to ⑥ as shown in figure.

If buzzer emits buzzing sound then, controller is in good condition. If not, replace.

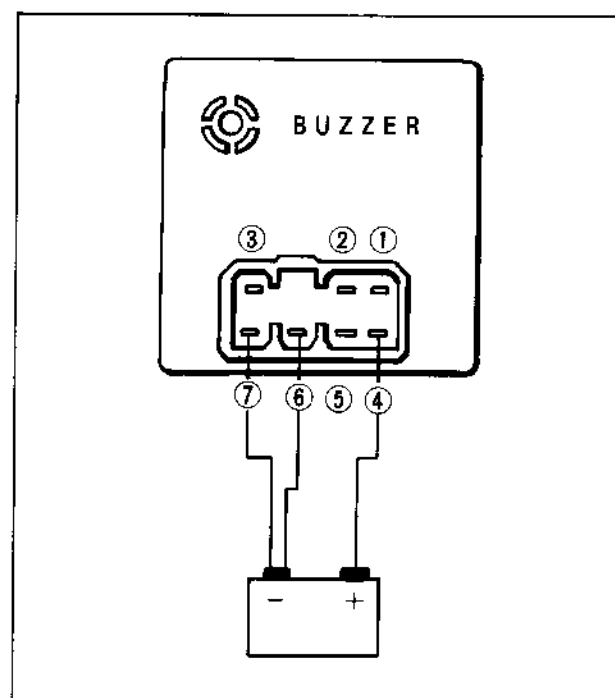


Fig. 8-25 Checking Warning Controller/Buzzer

## LIGHT REMAINDER WARNING BUZZER AND INTERIOR (DOME) LIGHT

The light remainder warning buzzer circuit is a system designed to sound the buzzer if the driver opens the door (driver's side) while the lights (headlight and small light) are still on, warning him to turn off the lights.

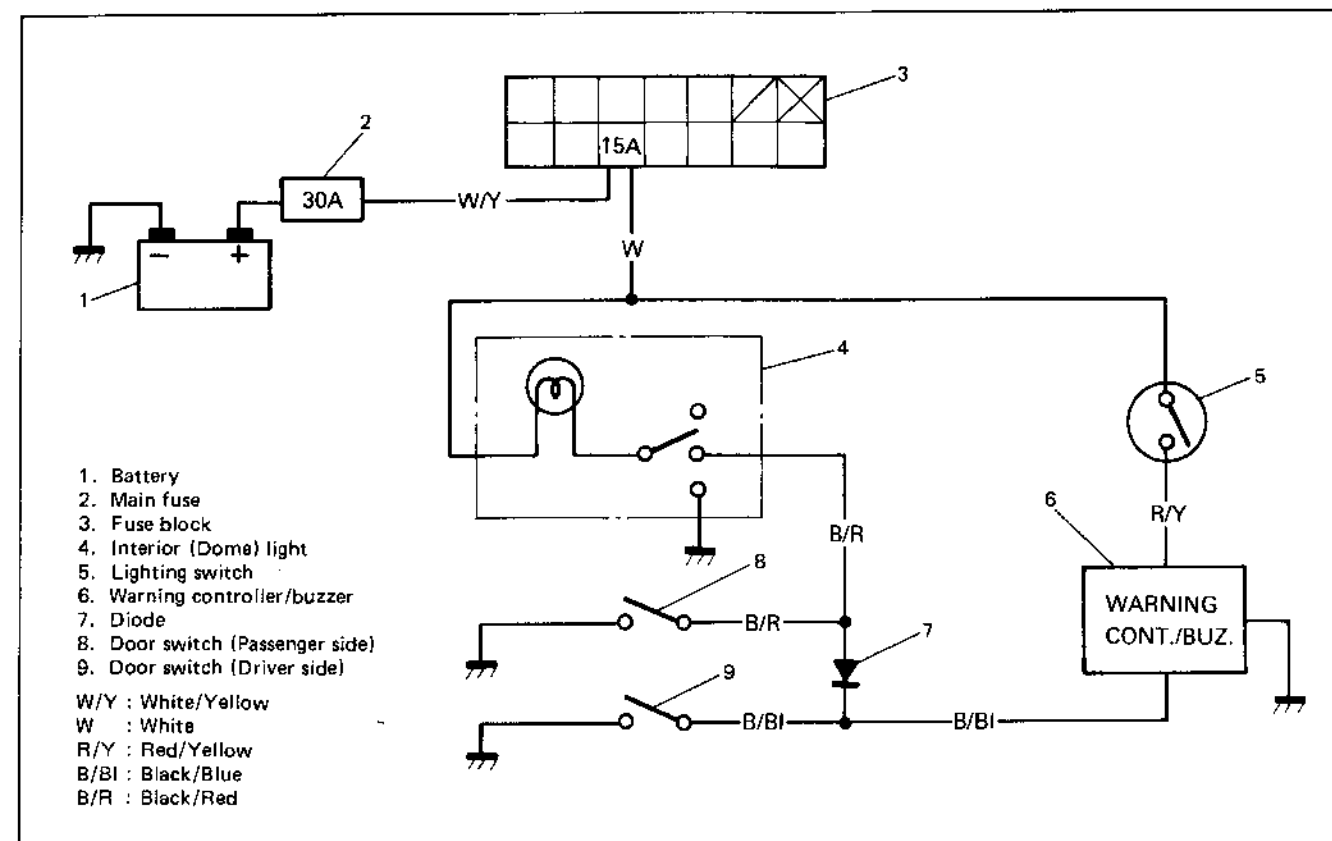


Fig. 8-26 Light Remainder Warning Buzzer and Interior Light Circuit

### INSPECTION

If light remainder warning buzzer does not sound or interior light shows no lighting, use the above circuit diagram as reference to check buzzer, wiring, etc.

### INSPECTION OF WARNING CONTROLLER/BUZZER

First, connect positive (+) terminal of battery to terminals ② and ⑤ of controller and negative (-) one to ⑦ and then disconnect connection to terminal ⑤.

If buzzer emits buzzing sound then, controller is in good condition. If not, replace.

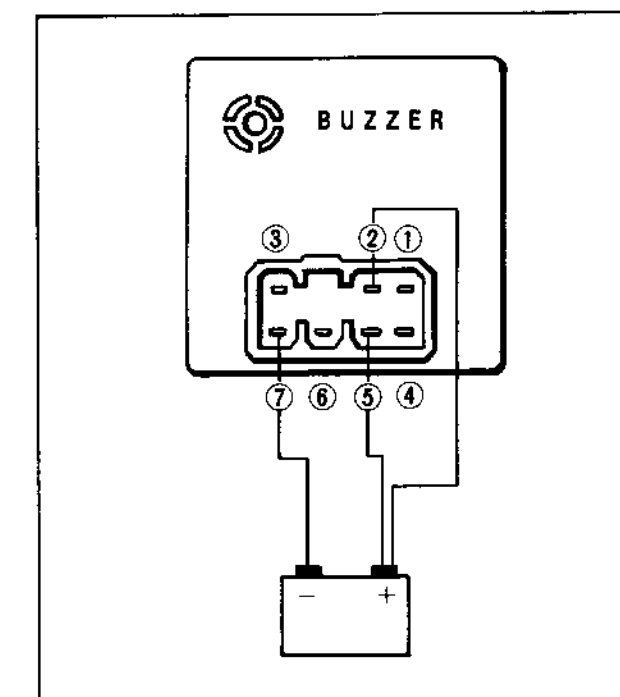


Fig. 8-27 Checking Warning Controller/Buzzer



ON CAR SERVICE

LIGHTING SYSTEMS

HEADLIGHTS

WIRING CIRCUIT

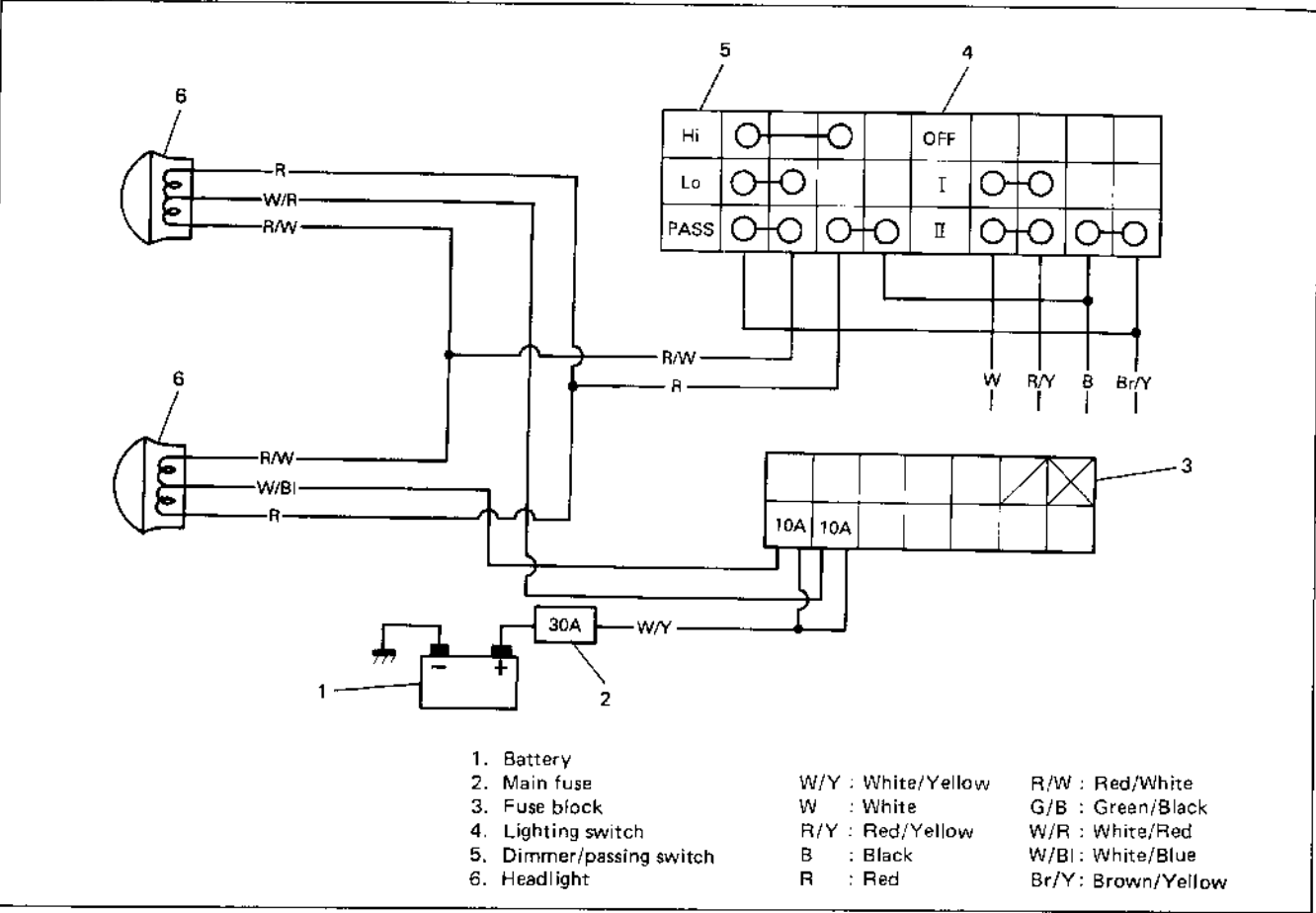


Fig. 8-28 Headlights Circuit

When the headlights are lighted, the clearance light system is also lighted. As for the circuit of the clearance light system, refer to the following pages.

TROUBLE DIAGNOSIS

| Trouble                                      | Possible cause                                                                                    | Correction                                                                                    |
|----------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Only one light does not light.               | Light burnt out<br>Fuse blown<br>Socket, wiring or grounding faulty                               | Replace light.<br>Replace fuse.<br>Repair as necessary.                                       |
| Headlights do not light.                     | Main fuse and/or fuses blown<br>Lighting and dimmer switches faulty<br>Wiring or grounding faulty | Replace main fuse and/or fuses to check for short.<br>Check switches.<br>Repair as necessary. |
| Only one beam ("Hi" or "Lo") does not light. | Lighting or dimmer switch faulty                                                                  | Check switch.                                                                                 |

INSPECTION

- 1) Check lighting and dimmer switches for each terminal-to-terminal continuity. Refer to "SWITCHES" Section.
- 2) Headlight is grounded at right panel, left panel and junction/fuse block.

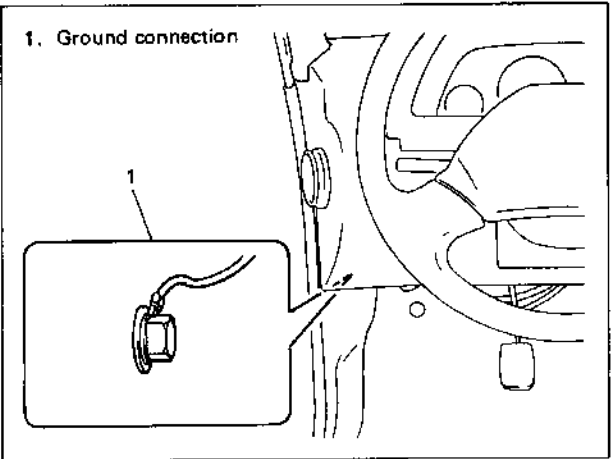


Fig. 8-29

SETTING HEADLIGHT BEAMS (STANDARD PROCEDURE)

Before setting headlight beams, adjust air pressures of four tires to a specified value respectively. Move car up and down by hand to settle its attitude. Then move it over a flat surface. There are some methods for setting headlight beams (e.g., screen method using a focusing tester, etc.). Method described here does not use such tester.

BEAM ALIGNMENT

Unless otherwise obligated by local regulations, align headlight beams according to following procedure. Place a blank wall 7.6 m (25 ft) ahead of car. Check to see if hot spot (high intensity zone) of each main (low) beam axis falls as illustrated below. Beam alignment should be carried out with one driver (68 kg, 150 lb) aboard.

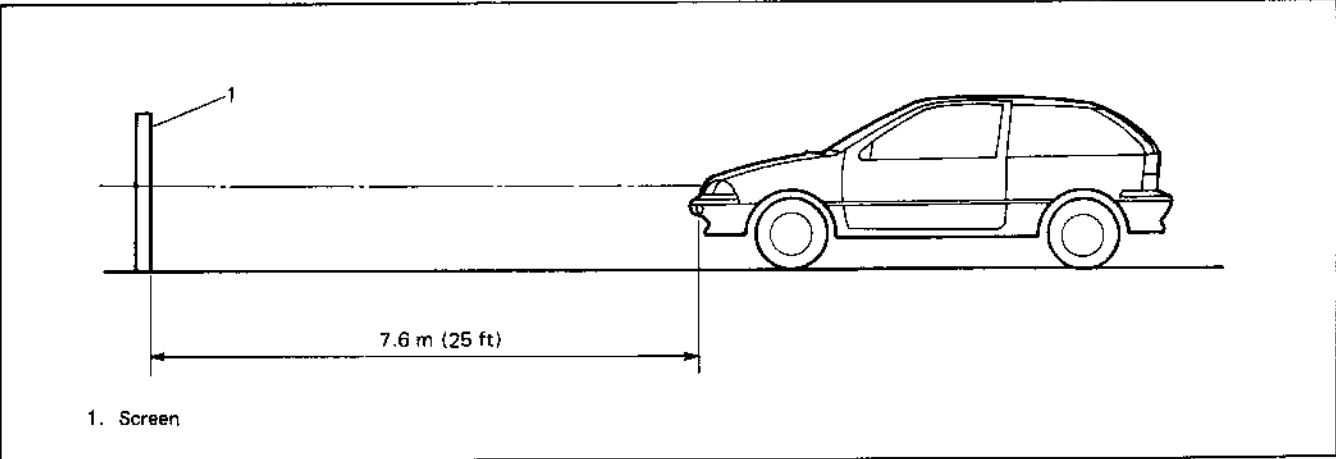


Fig. 8-30

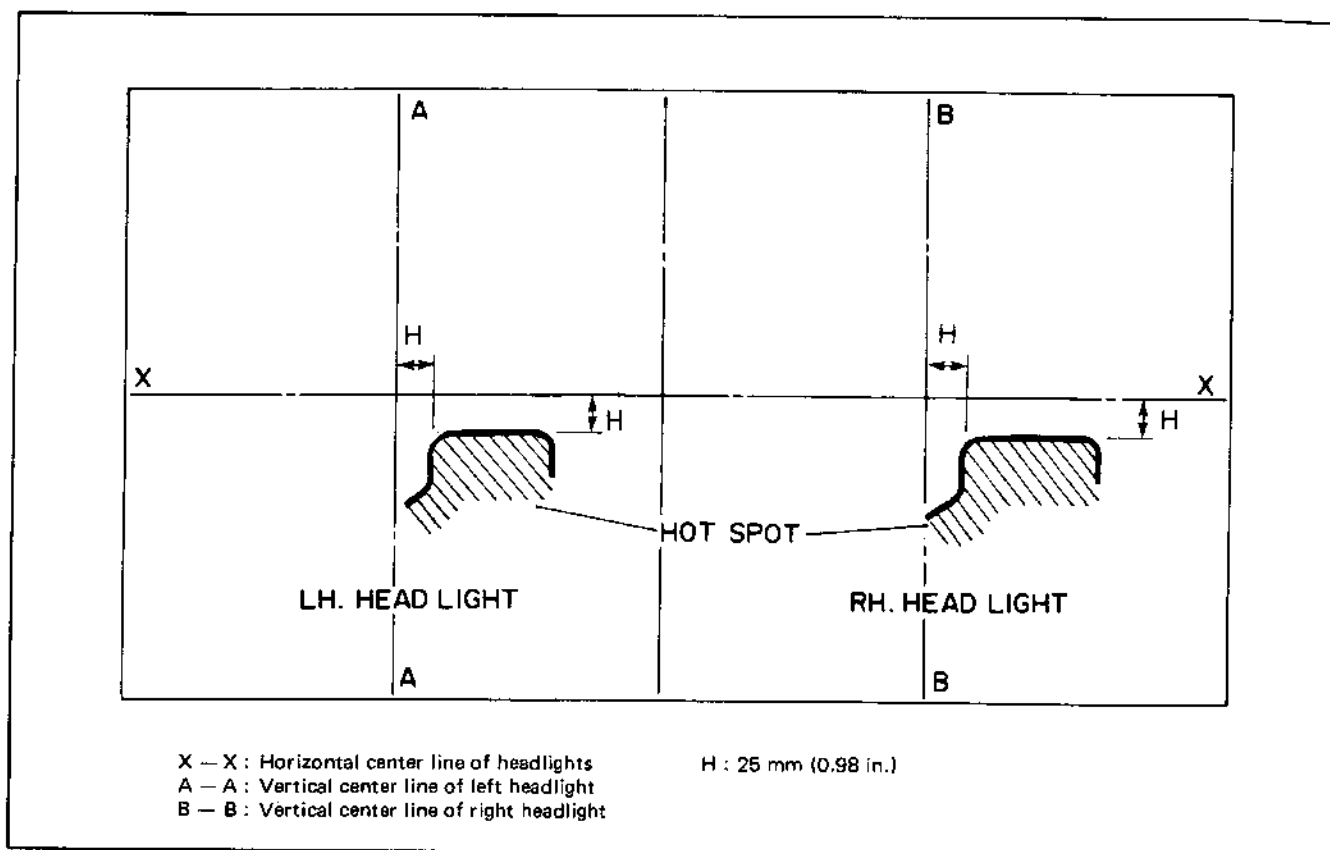


Fig. 8-31

### HEADLIGHT ADJUSTMENT

There are two screws (bolts) which can be used for adjustment.

Use these screws (bolts) to adjust headlight position for vertical and horizontal alignments of each beam.

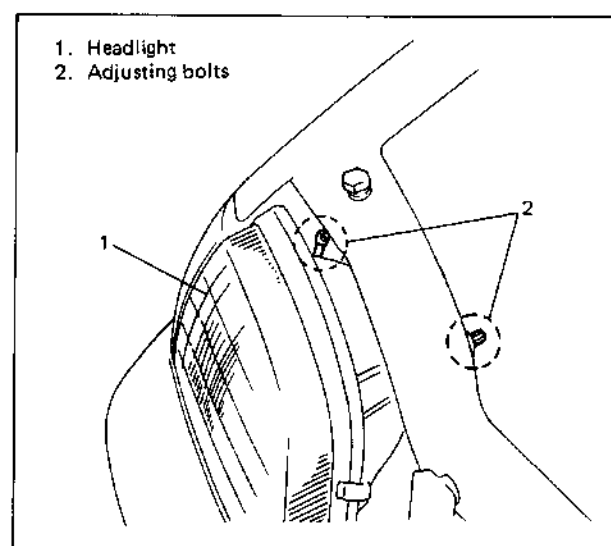


Fig. 8-32

## TURN SIGNAL AND HAZARD WARNING LIGHTS

### WIRING CIRCUIT

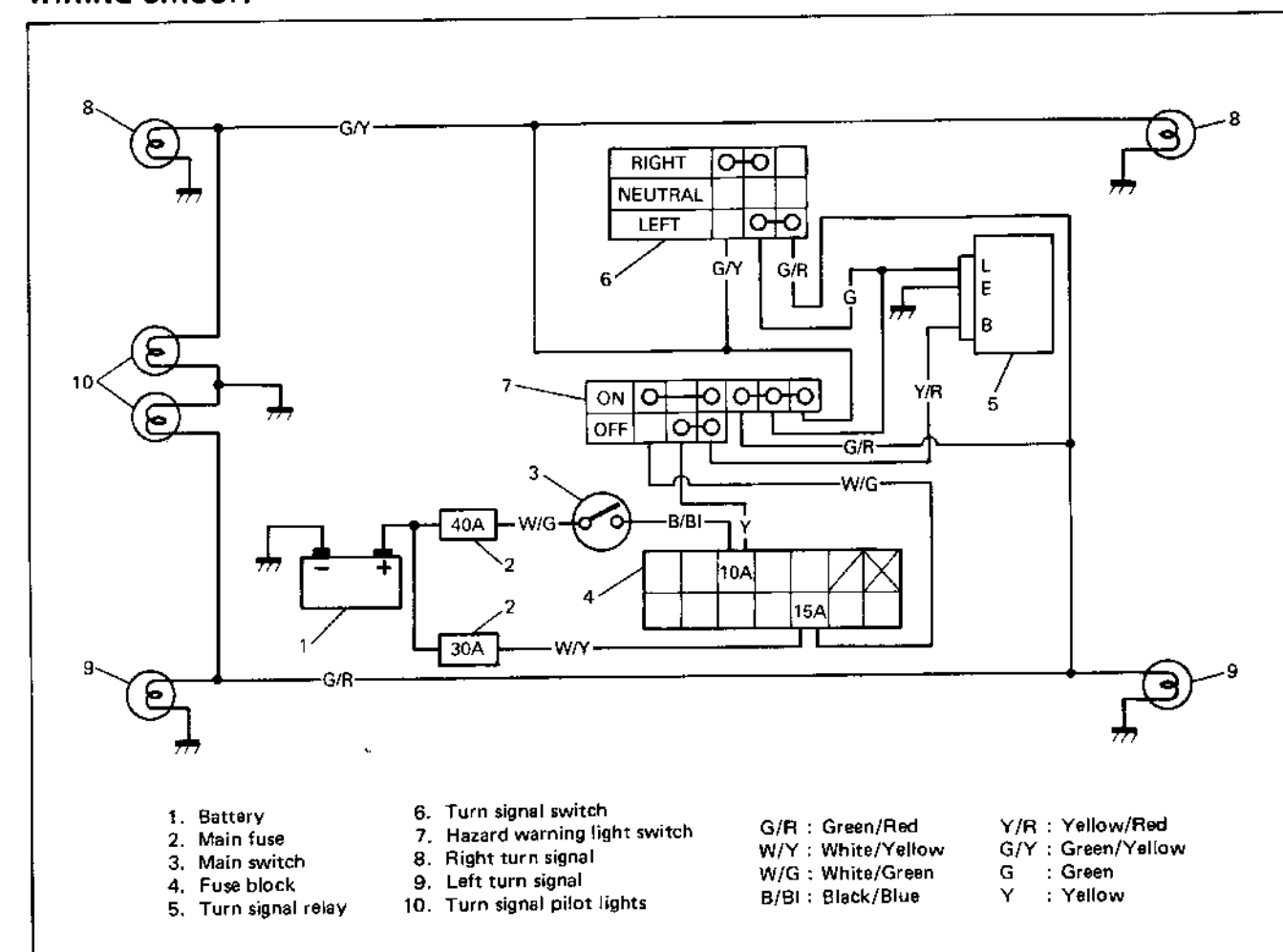


Fig. 8-33



TROUBLE DIAGNOSIS

| Trouble                                  | Possible cause                                                                                                   | Correction         |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------------|
| Flash rate high or one side only flashes | 1. Faulty ground                                                                                                 | Repair.            |
|                                          | 2. Wrong bulb                                                                                                    | Replace.           |
|                                          | 3. One of light bulbs burnt out on right or left side of front or rear side                                      | Replace.           |
|                                          | 4. Defective turn signal-and-hazard warning relay                                                                | Replace.           |
|                                          | 5. Open circuit or high resistance existing between turn signal-and-hazard warning switch and lights on one side | Repair.            |
| No flashing on either side.              | 1. Blown fuse on turn signal-and-hazard warning circuit                                                          | Replace.           |
|                                          | 2. Open circuit or high resistance existing between battery and switch                                           | Repair.            |
|                                          | 3. Defective relay                                                                                               | Replace.           |
| Flash rate too slow                      | 1. Bulbs of smaller wattage than specification used                                                              | Replace.           |
|                                          | 2. One of lights on right or left side of front or rear side grounded poorly                                     | Replace.           |
|                                          | 3. Supply voltage too low                                                                                        | Recharge battery.  |
|                                          | 4. Fuse set loose in place causing poor contact                                                                  | Repair or replace. |
|                                          | 5. Poor metal-to-metal contact in connector                                                                      | Repair.            |
|                                          | 6. Defective relay.                                                                                              | Replace.           |
| Flash rate too fast                      | 1. Bulbs of smaller wattage than specification used                                                              | Replace.           |
|                                          | 2. Defective relay                                                                                               | Replace.           |

INSPECTION

1. Check turn signal-and-hazard warning switch for each terminal-to-terminal continuity. Refer to "SWITCHES" Section.
2. Turn signal should be grounded at each side of front fender apron.

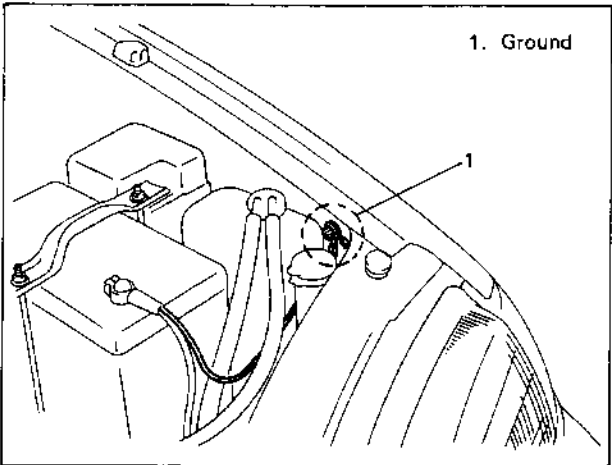


Fig. 8-34

BACK-UP LIGHTS

WIRING CIRCUIT

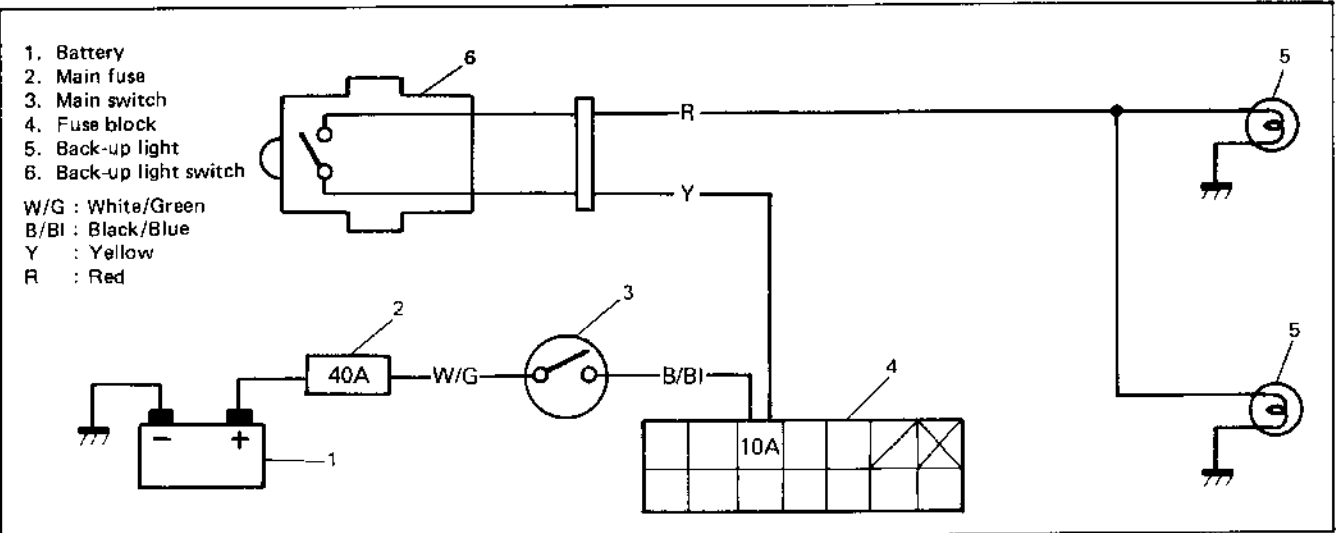


Fig. 8-35-1/2 Back-up Light Circuit (For M/T model)

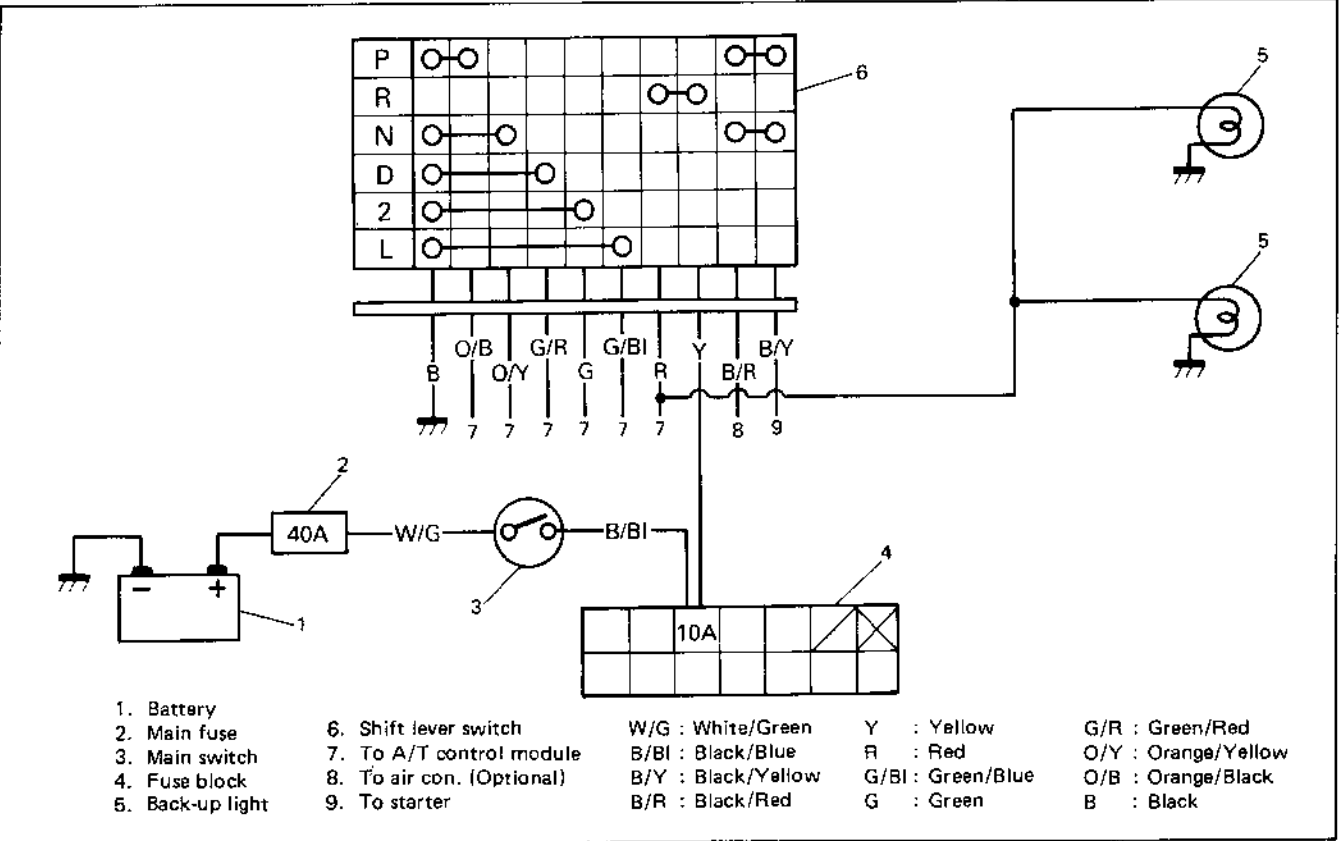


Fig. 8-35-2/2 Back-up Light Circuit (For A/T model)

TROUBLE DIAGNOSIS

| Trouble                      | Possible cause                                    | Correction                       |
|------------------------------|---------------------------------------------------|----------------------------------|
| Back-up lights do not light. | Fuse blown                                        | Replace fuse to check for short. |
|                              | Back-up light switch or shift lever switch faulty | Check switch.                    |
|                              | Wiring or grounding faulty                        | Repair as necessary.             |

STOP LIGHTS  
WIRING CIRCUIT

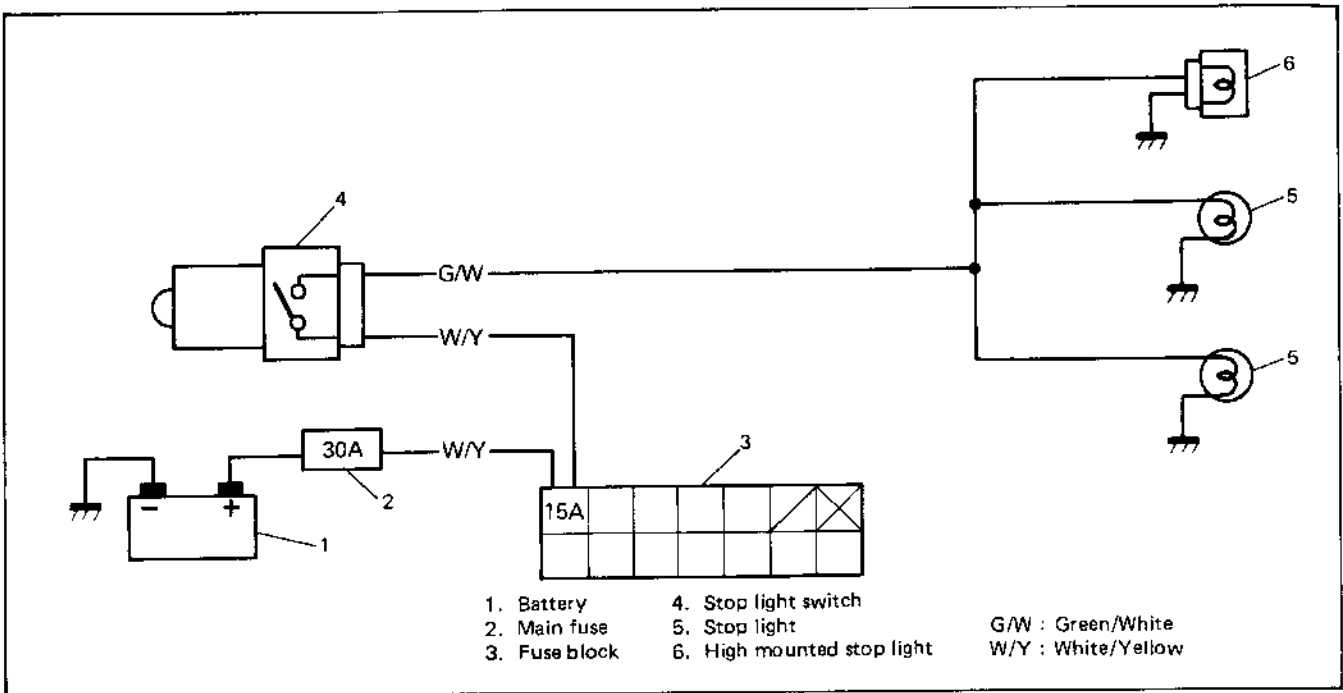


Fig. 8-36

TROUBLE DIAGNOSIS

| Trouble                   | Possible cause             | Correction                       |
|---------------------------|----------------------------|----------------------------------|
| Stop lights do not light. | Fuse blown                 | Replace fuse to check for short. |
|                           | Stop light switch faulty   | Adjust or replace switch.        |
|                           | Wiring or grounding faulty | Repair as necessary.             |
| Stop lights stay on.      | Stop light switch faulty   | Adjust or replace switch.        |

CLEARANCE, TAIL AND LICENSE LIGHT  
WIRING CIRCUIT

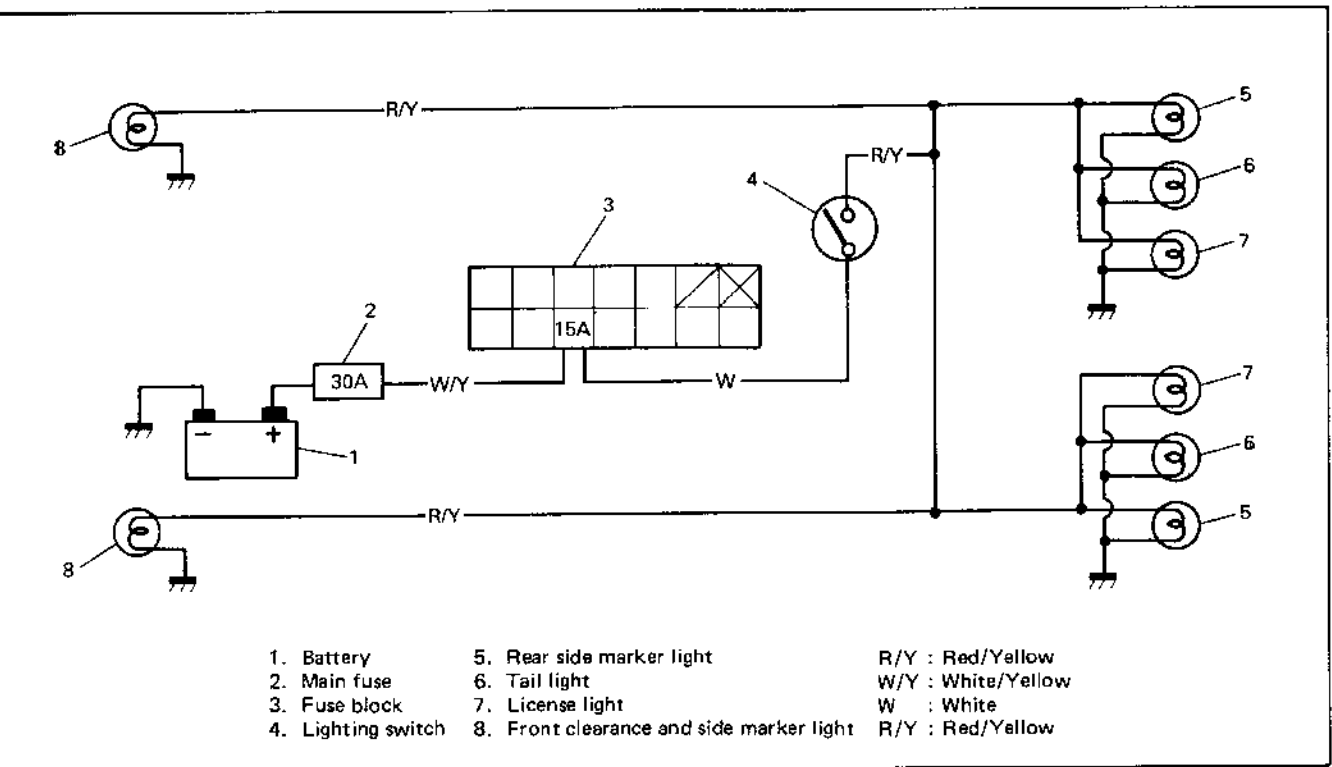


Fig. 8-37

TROUBLE DIAGNOSIS

| Trouble              | Possible cause               | Correction                                            |
|----------------------|------------------------------|-------------------------------------------------------|
| Lights do not light. | Main fuse and/or fuses blown | Replace fusible link and/or fuses to check for short. |
|                      | Lighting switch faulty       | Check switch.                                         |
|                      | Wiring or grounding faulty   | Repair as necessary.                                  |

CIGAR LIGHTER AND RADIO (OPTIONAL)

WIRING CIRCUIT

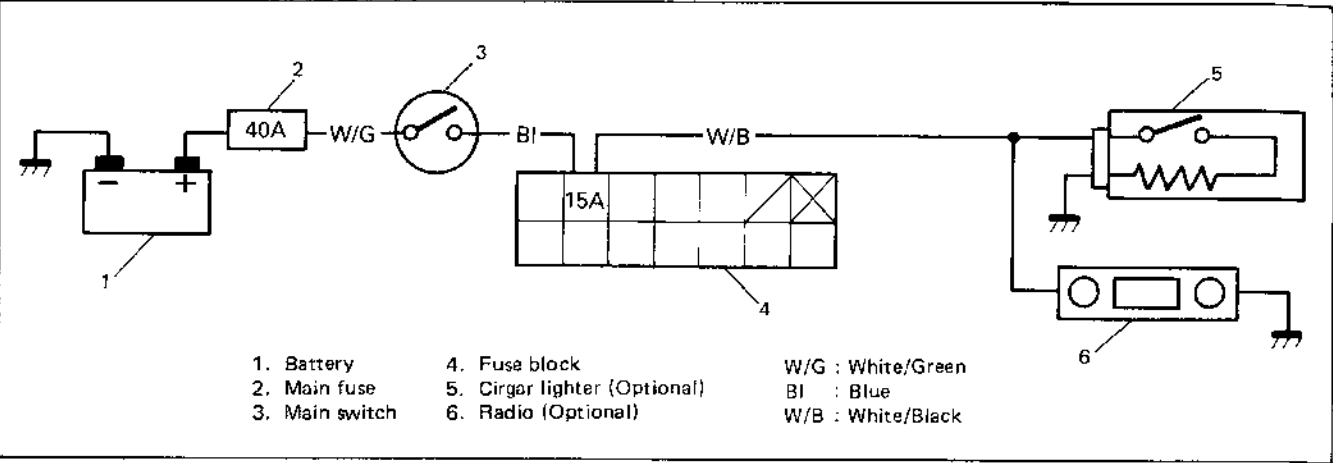


Fig. 8-38

TROUBLE DIAGNOSIS

| Trouble                              | Possible cause                                                 | Correction                                                                |
|--------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------|
| Cigar lighter (radio) does not work. | Fuse blown<br>Main switch faulty<br>Wiring or grounding faulty | Replace fuse to check for short.<br>Check switch.<br>Repair as necessary. |

WINDSHIELD WIPERS (FRONT WIPER) AND WASHER

The windshield wiper is either 2-speed type or 3-speed type, depending on specifications and the windshield washer is equipped with a separate-type washer pump.

The washer tank is located inside of the front part of the left front fender. It has washer pumps for the front and rear respectively.

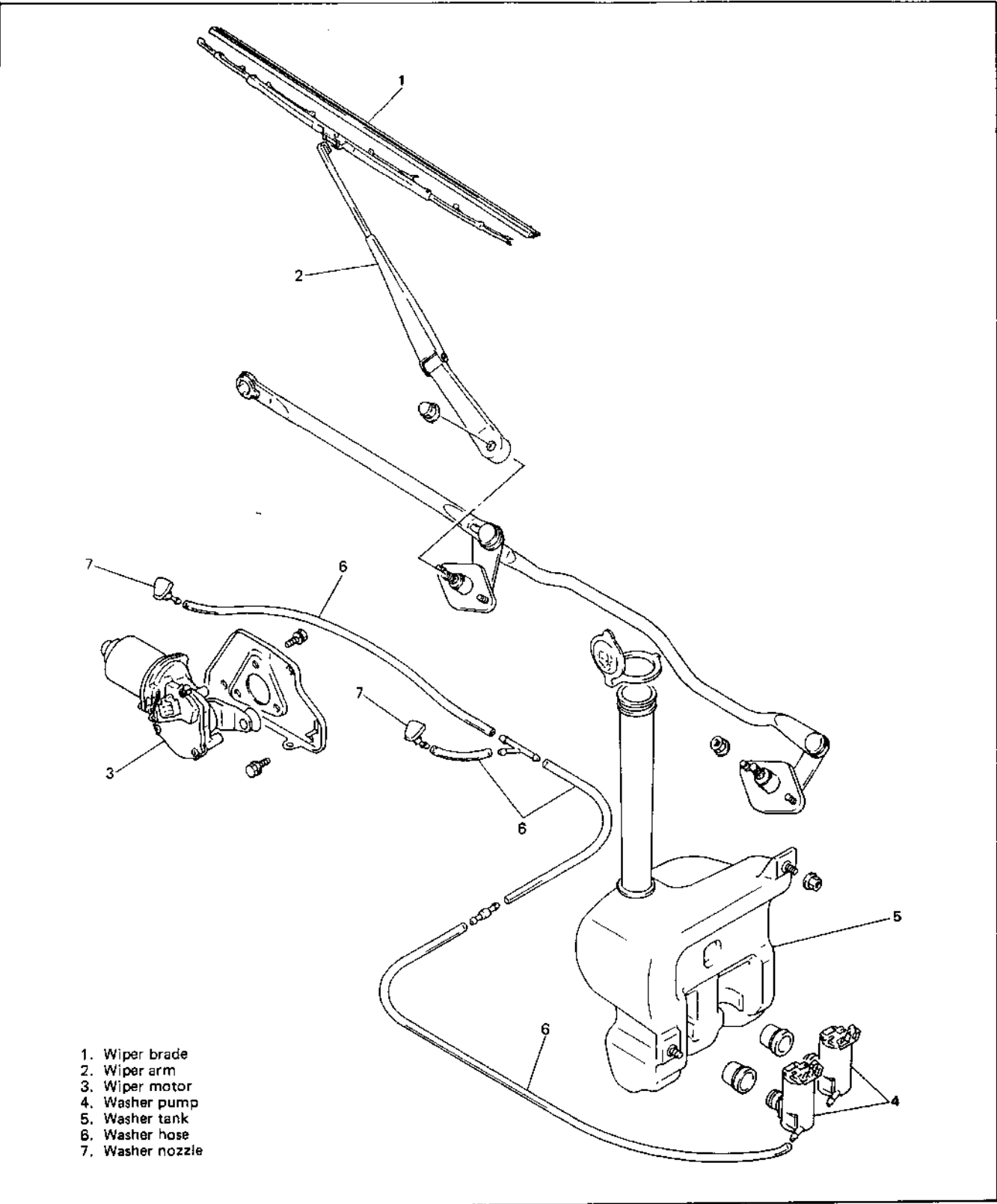


Fig. 8-39 Windshield Wiper and Washer

**DESCRIPTION OF CIRCUIT**  
**WINDSHIELD WIPER CIRCUIT**

The circuit is designed so that when the wiper switch is turned OFF the wiper blades automatically return to their specified level rest positions. In Fig. 8-40, when the wiper switch is turned ON with the ignition switch ON, current is supplied continuously from the battery (via lead Y/B — 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 cam on the shaft of its output gear.

The cam serves to connect the contact  $P_0$  to the contacts  $P_1$ . Although the cam 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 cam 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/B — contact  $P_2$  — contact  $P_0$  — lead BI/W — switch (OFF position) — lead BI or BI/R) to the motor.

Therefore, the motor can still rotate supplied with this intermittent current, causing the blades to return to the rest positions.

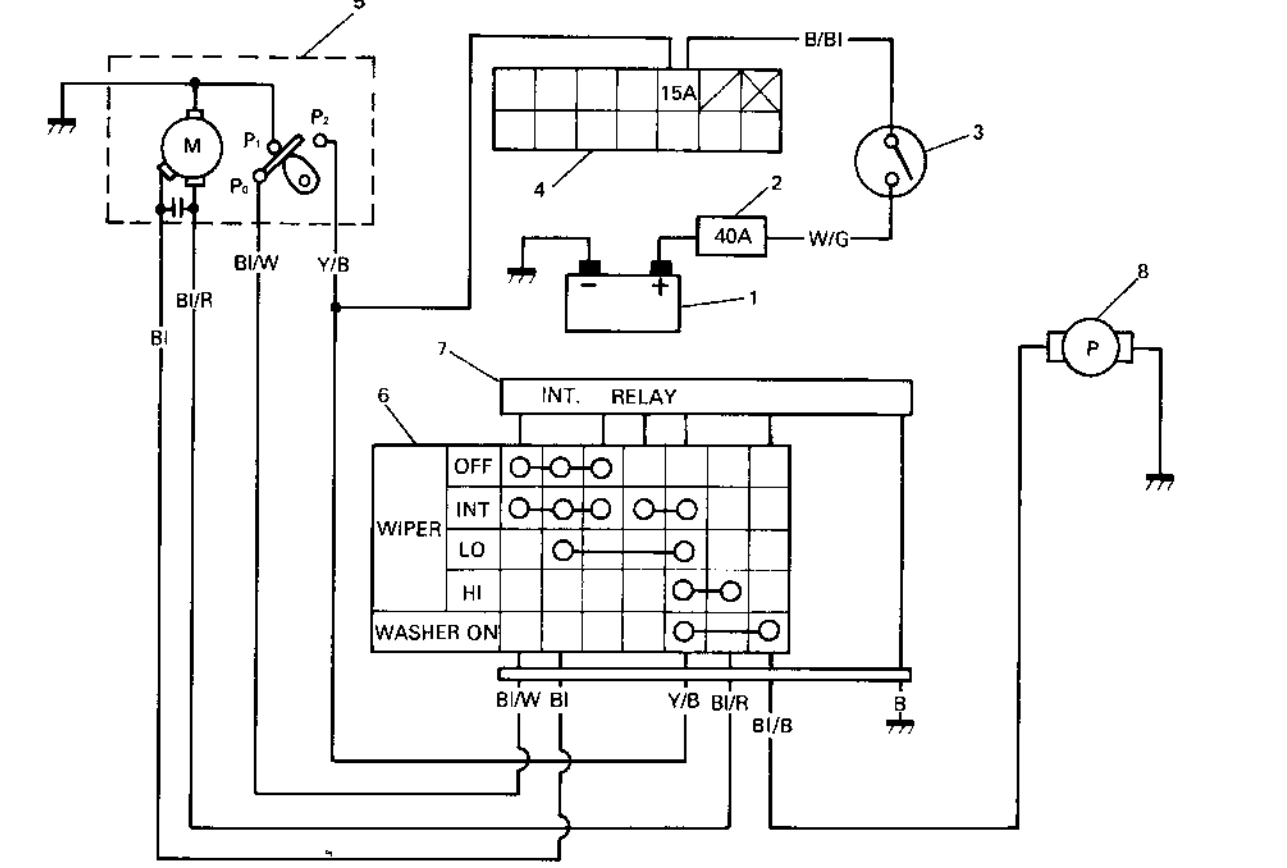
As soon as the blades have returned to their rest positions, the cam connects contact  $P_0$  to contact  $P_1$ , causing current to be shunted around the motor.

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 level rest positions.

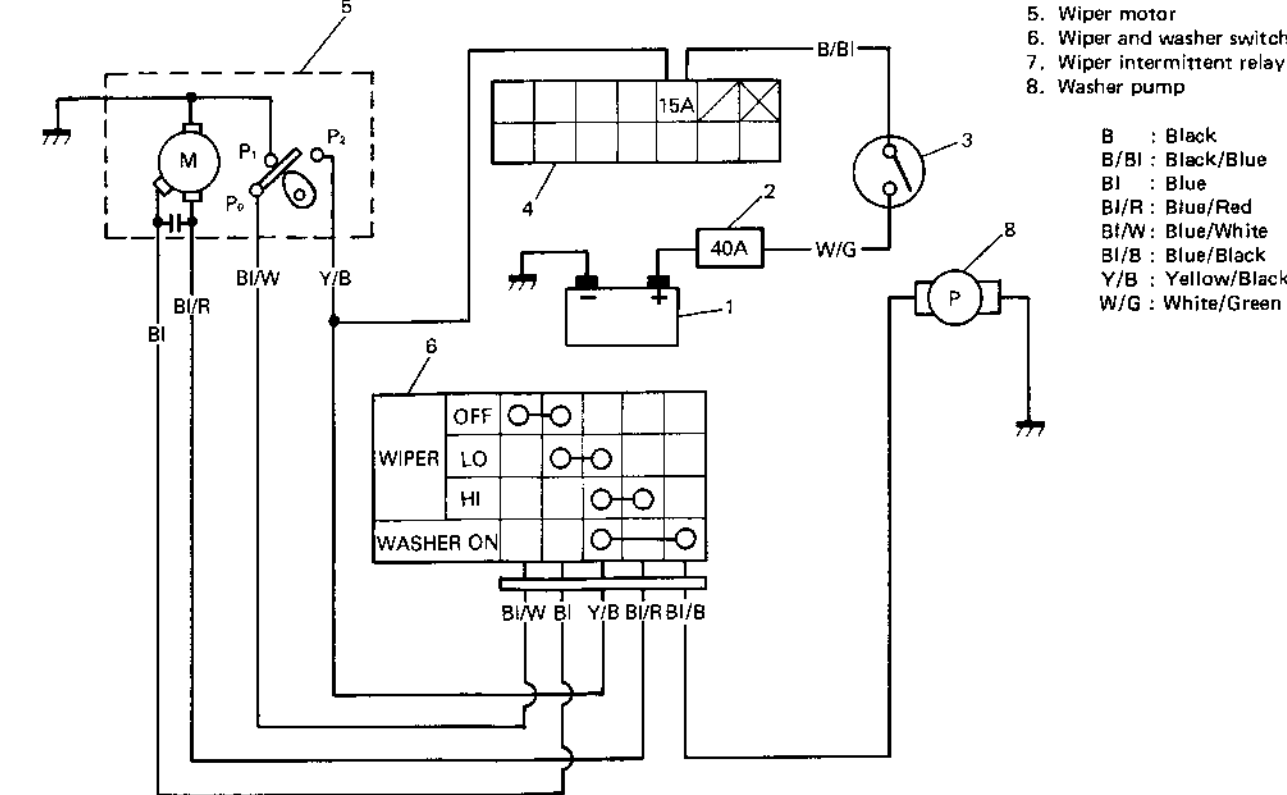
**INTERMITTENT WIPER RELAY CIRCUIT**

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/B 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/B, 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 cam 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.

**3-SPEED TYPE**



**2-SPEED TYPE**



- 1. Battery
  - 2. Main fuse
  - 3. Main switch
  - 4. Fuse block
  - 5. Wiper motor
  - 6. Wiper and washer switch
  - 7. Wiper intermittent relay
  - 8. Washer pump
- B : Black  
B/BI : Black/Blue  
BI : Blue  
BI/R : Blue/Red  
BI/W : Blue/White  
BI/B : Blue/Black  
Y/B : Yellow/Black  
W/G : White/Green

Fig. 8-40 Wiper and Washer Wiring Circuit

TROUBLE DIAGNOSIS

| Trouble                                                     | Possible cause                | Correction                             |
|-------------------------------------------------------------|-------------------------------|----------------------------------------|
| Wiper malfunctions or does not return to original position. | Wiper fuse blown              | Replace blown fuse to check for short. |
|                                                             | Wiper motor faulty            | Check motor.                           |
|                                                             | Wiper control switch faulty   | Check switch.                          |
|                                                             | Wiring or grounding faulty    | Repair.                                |
| Washer malfunctions.                                        | Washer hose or nozzle clogged | Repair.                                |
|                                                             | Washer motor faulty           | Check motor.                           |
|                                                             | Wiper control switch faulty   | Check switch                           |
|                                                             | Wiring faulty                 | Repair.                                |

INSPECTION

A. WIPER/WASHER SWITCH

Use a circuit tester to check switch for each terminal-to-terminal continuity.

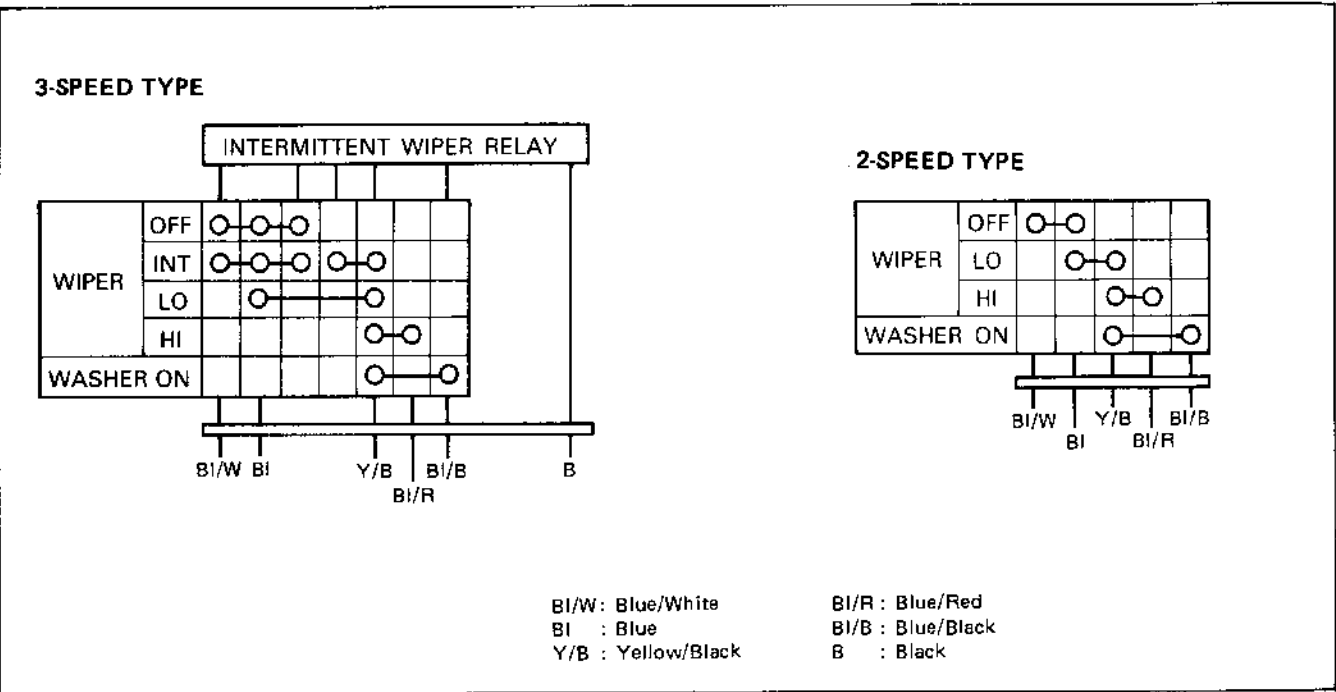


Fig. 8-41

B. WIPER MOTOR

1) As illustrated below, use a 12V battery to connect its (+) terminal to Blue terminal, and its (−) terminal to Black lead wire. Then motor should rotate at a low revolution speed of 45 to 55 rpm. As for high speed check, connect battery (+) terminal to Blue/Red terminal, and its (−) terminal to Black lead wire. Then motor should rotate at a high revolution speed of 68 to 78 rpm.

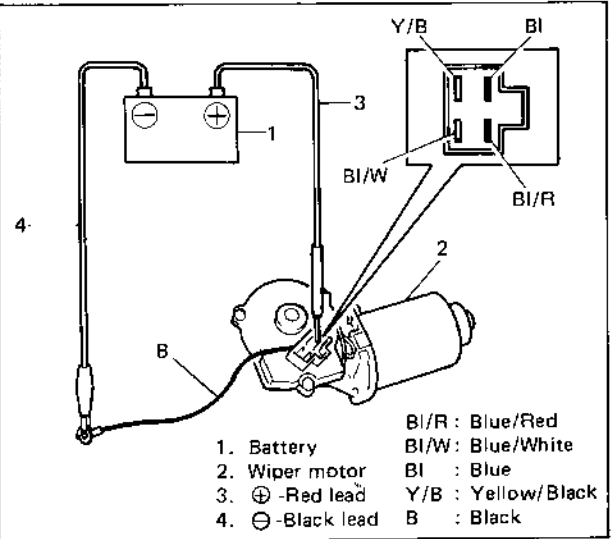


Fig. 8-42 Wiper Motor Test

2) TESTING AUTOMATIC STOP ACTION

Connect battery (+) terminal to motor Yellow/Black terminal, and (−) terminal to Black lead wire 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 coincide with start position. Stop motor again and again by using jumper to confirm that it stops at the same position.

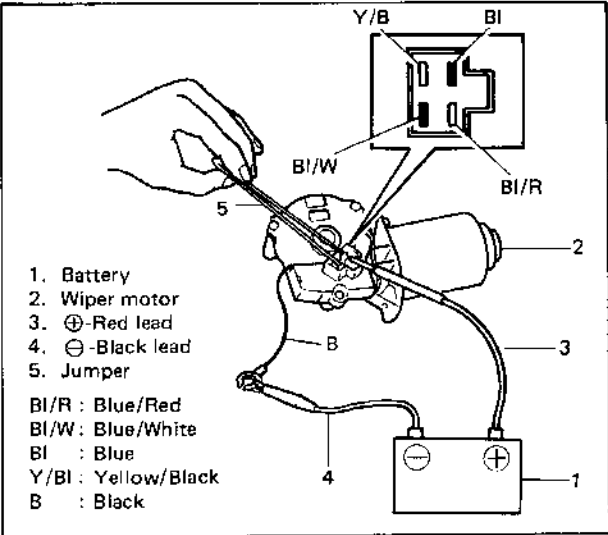


Fig. 8-43 Checking

3) CHECKING BRUSH AND COMMUTATOR

Use a circuit tester to check Blue terminal-to-Black lead wire continuity. If continuity is poor, check brush-to-commutator contact area for proper condition. If that area is fouled, use a cloth damped with gasoline to clean. When surface of the area is coarse or burnt, use a sandpaper to smooth it.

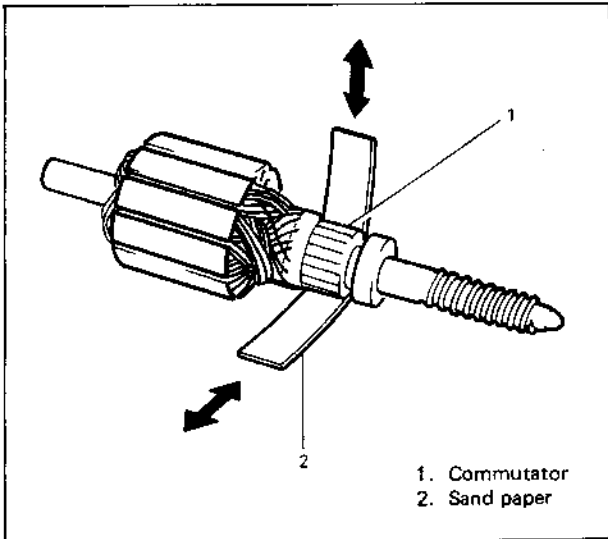


Fig. 8-44 Resurfacing Commutator

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.

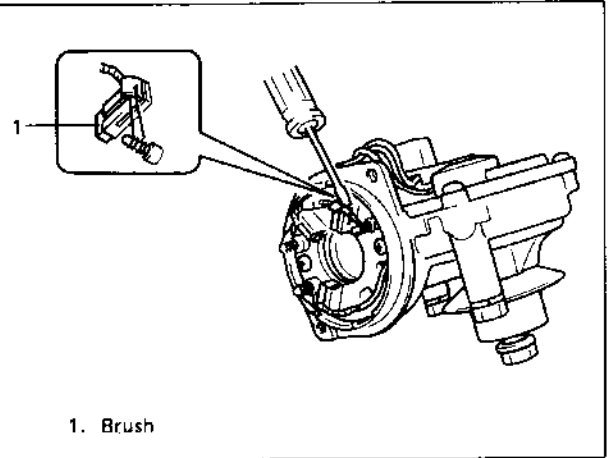


Fig. 8-45 Assembling Brushes

When assembling wiper motor cover, be careful of its notch position which serves as a guide for proper assembly.

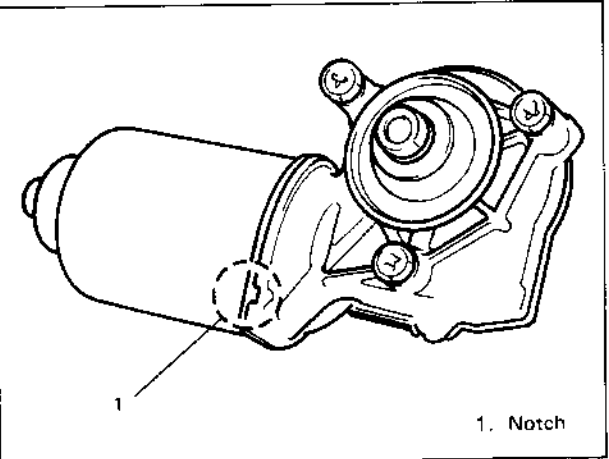


Fig. 8-46

C. WASHER PUMP

Connect battery (+) and (-) terminals to pump (+) and (-) terminals respectively to check pumping rate.

[WASHER PUMP REMOVAL]

- 1) Disconnect battery (-) cable.
- 2) Remove front fender lining (LH).
- 3) Remove washer tank fitting nuts.
- 4) Disconnect pump lead wires and hoses.

- 5) Remove washer tank.
- 6) Remove pump from tank.

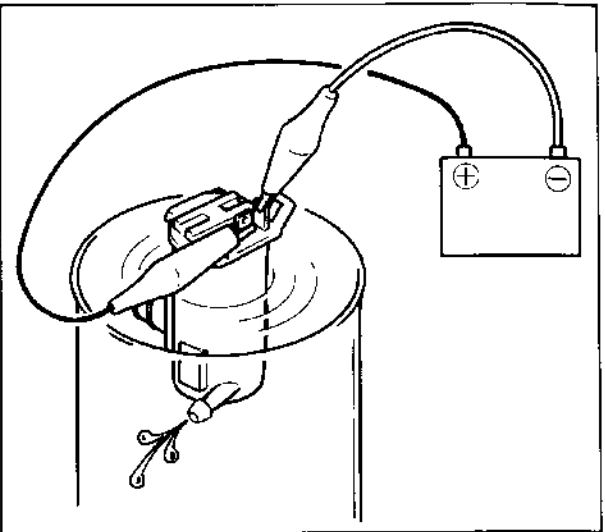


Fig. 8-47 Checking Washer Pump

D. INTERMITTENT WIPER RELAY (Optional)

- 1. Disconnect wiper & washer switch coupler.
- 2) Connect (+) cord and (-) cord of 12V battery to coupler terminals as shown below.
- 3. Turn intermittent switch to "OFF" position. If an operating sound is heard from relay, it is at work properly.

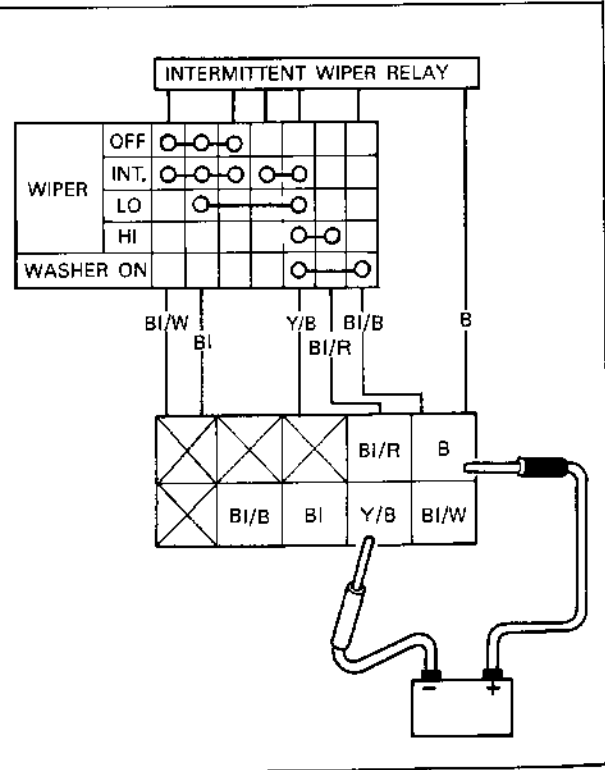


Fig. 8-48 Checking Int. Relay Operation Sound

REAR WINDOW DEFOGGER (If equipped)

The 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.

WIRING DIAGRAM

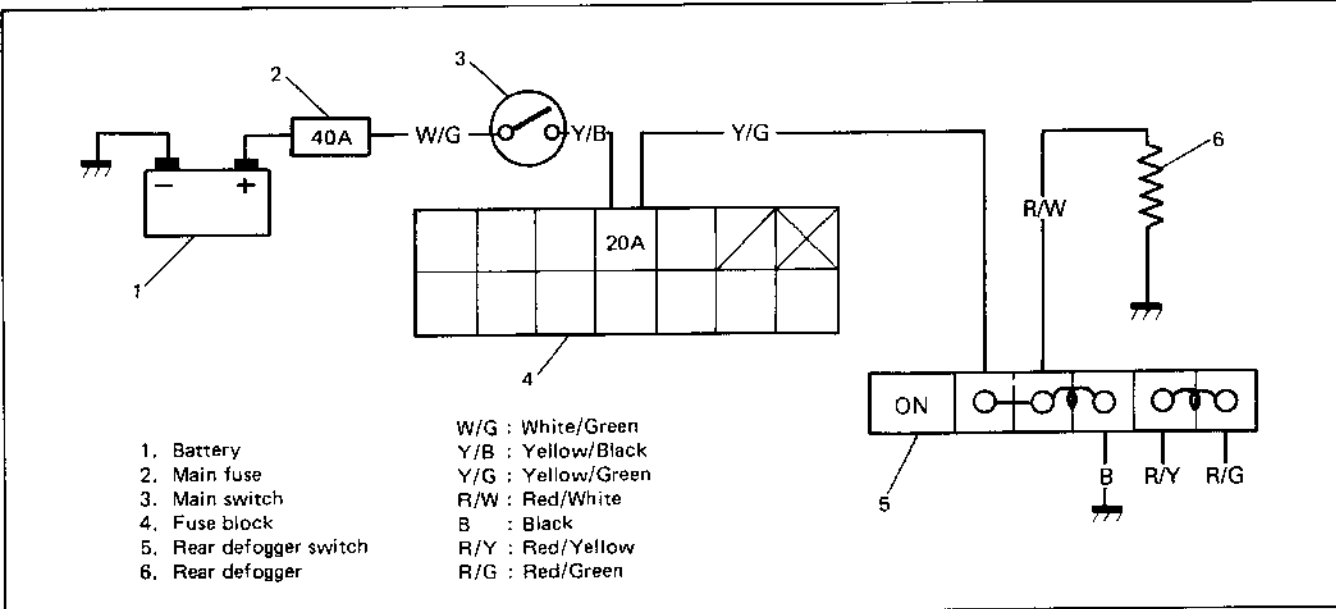


Fig. 8-49

TROUBLE DIAGNOSIS

| Trouble              | Possible cause                                                                    | Correction                                                |
|----------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------|
| Defogger won't work. | Defogger switch faulty<br>Defogger heat wire faulty<br>Wiring or grounding faulty | Check switch.<br>Check heat wire.<br>Repair as necessary. |



**INSPECTION****DEFOGGER SWITCH**

Use a circuit tester to check defogger switch for continuity.

|     | Yellow/<br>Green | Red/<br>White | Black | Black<br>(Red/<br>Green) | Red/<br>Yellow |
|-----|------------------|---------------|-------|--------------------------|----------------|
| OFF |                  | ○             | ○     | ○                        | ○              |
| ON  | ○                | ○             | ○     | ○                        | ○              |

Fig. 8-49-1

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.

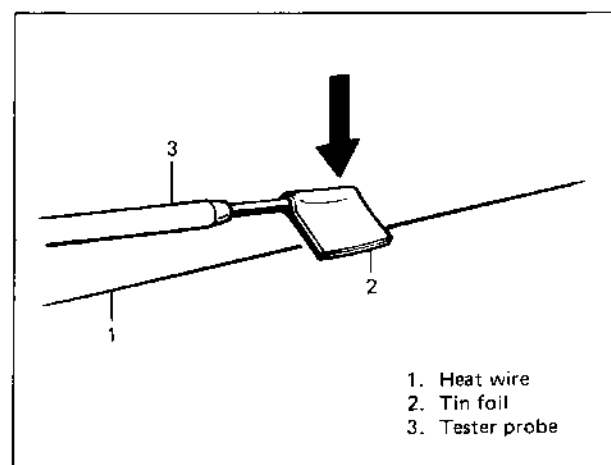


Fig. 8-50

**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 below.

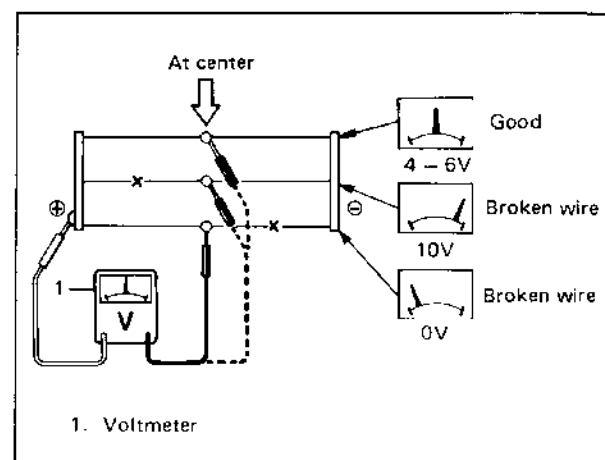


Fig. 8-51

| Voltage           | Criteria                |
|-------------------|-------------------------|
| Approx. 5V        | Good (No break in wire) |
| Approx. 10V or 0V | Broken wire             |

If measured voltage is 10V, 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, then move it along wire to negative terminal end.
- The place where voltmeter fluctuates from zero to several volts is where there is damage.

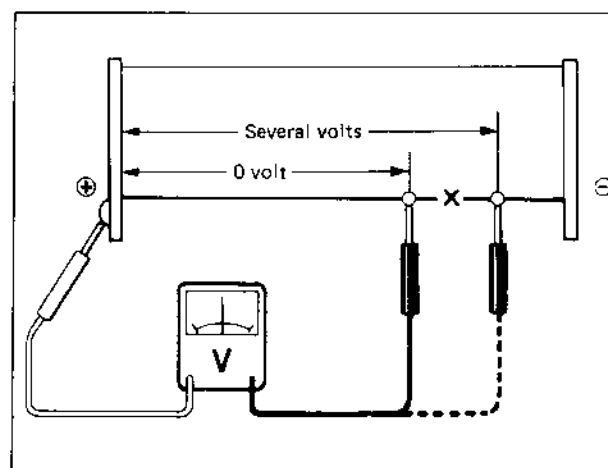


Fig. 8-52

**NOTE:**

If heat wire is free from damage, voltmeter should indicate 12V at heat wire positive terminal end and its indication should decrease gradually toward zero at the other terminal (ground).

**REPAIR****DEFOGGER CIRCUIT**

- Use white gasoline for cleaning.
- Apply masking tape at both upper and lower sides of heat wire to be repaired.

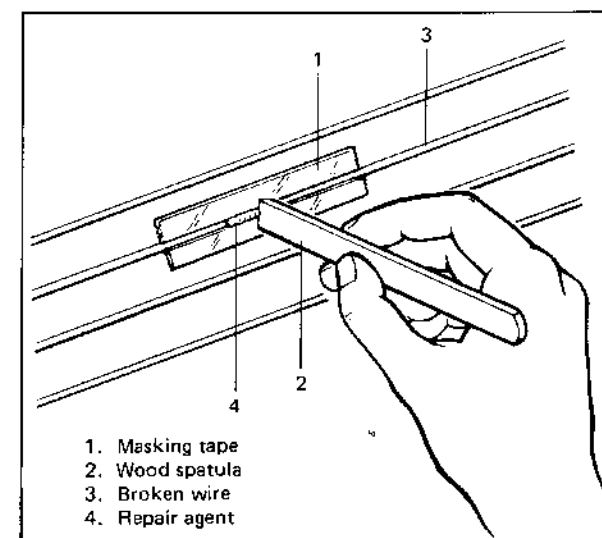


Fig. 8-53

- Apply commercially-available repair agent with a fine-tip brush.
- Two to three minutes later, remove masking tape previously applied.
- Leave repaired heat wire as it is for at least 24 hours before operating defogger again.

**INSTALLATION**

When installing rear window defogger (optional), have following parts available.

- Back window glass
- Defogger switch
- Defogger lead wires (positive and negative wire)

**REMOVAL**

Remove back window glass.

(For removal procedure, refer to Body Service section.)

**INSTALLATION**

Before installing, disconnect negative battery cable.

- Install back window glass.
- Connect lead wires to harness connectors.

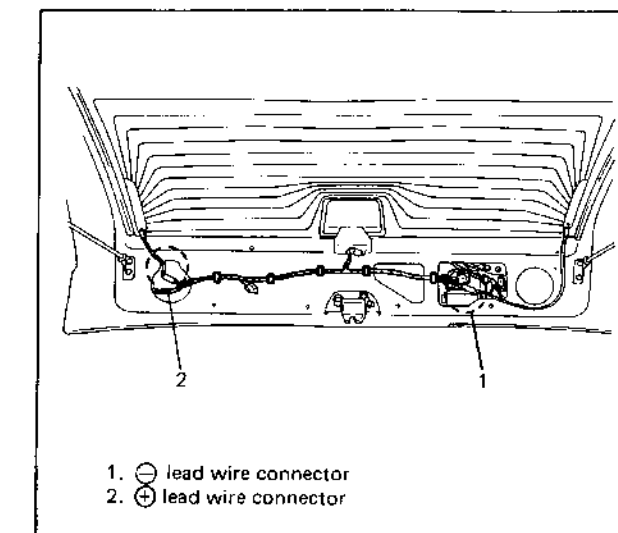


Fig. 8-54

- Install defogger switch on instrument panel and connect switch connector to harness connector.

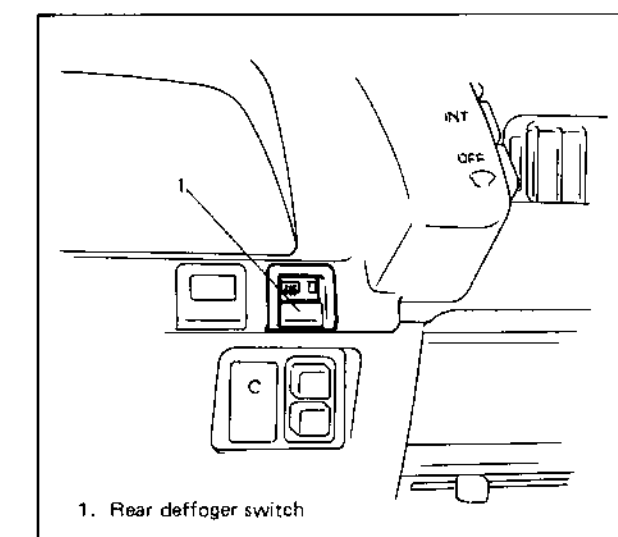


Fig. 8-55

# 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.

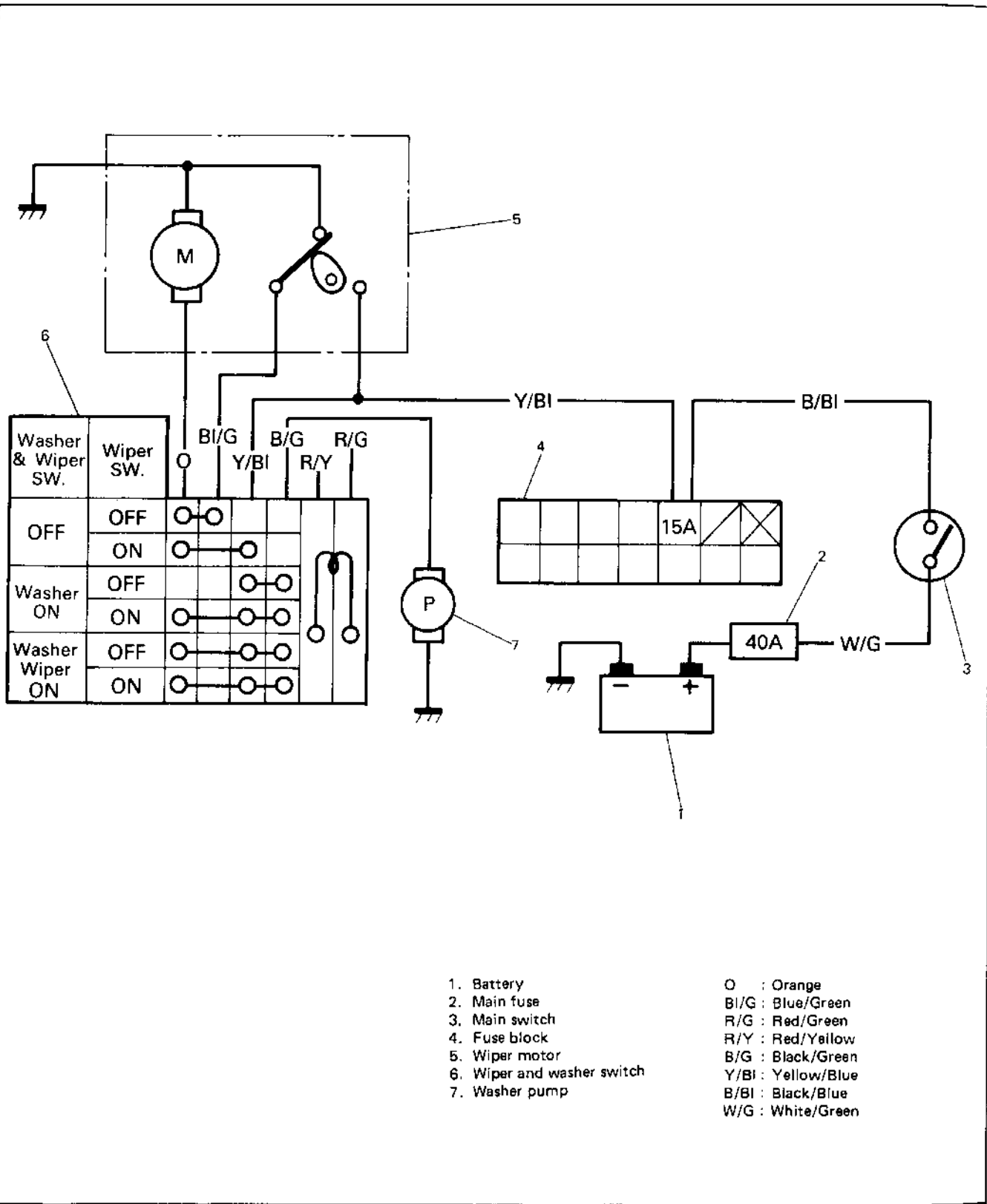


Fig. 8-56 Rear Wiper and Washer Circuit

## DESCRIPTION OF CIRCUIT AND TROUBLE DIAGNOSIS

Refer to "WINDSHIELDS WIPERS" section.

### INSPECTION

#### A. WIPER AND WASHER SWITCHES

##### Rear Wiper Switch Connector

| REAR WIPER & WASHER SWITCH CONTINUITY |  |  |      |
|---------------------------------------|--|--|------|
| O                                     |  |  | B/G  |
| R/Y                                   |  |  | BI/G |

B/G : Black/Green R/G : Red/Green  
Y/BI : Yellow/Blue R/Y : Red/Yellow  
O : Orange

| CONTINUITY BETWEEN TERMINALS |       |                                 |
|------------------------------|-------|---------------------------------|
| Switch Position              |       | Terminal-to-Terminal Continuity |
| Washer & Wiper               | Wiper |                                 |
| OFF                          | OFF   | BI/G - O                        |
|                              | ON    | Y/BI - O                        |
| WASHER ON                    | OFF   | B/G - Y/BI                      |
|                              | ON    | B/G - Y/BI - O                  |
| WASHER & WIPER ON            | OFF   | B/G - Y/BI - O                  |
|                              | ON    | B/G - Y/BI - O                  |

R/G, an illumination light lead wire of lighting switch, produces constant R/G - R/Y continuity.

Continuity Check

#### NOTE:

Rear wiper and washer switch position.

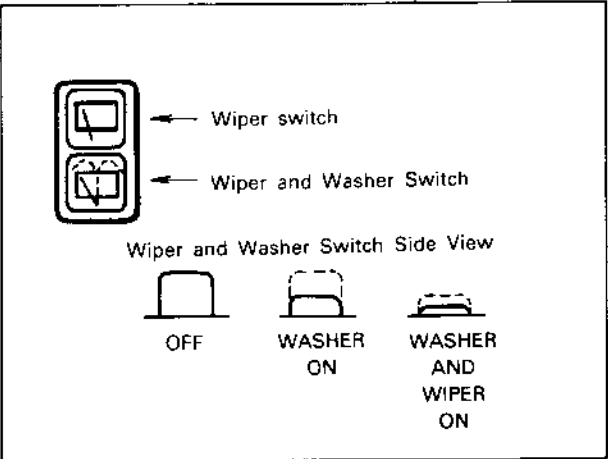


Fig. 8-57

#### B. WIPER MOTOR

1) As shown below, use a 12V battery to connect its (+) and (-) terminals to Orange terminal and Black lead wire respectively. Then motor should rotate at a 38 to 46 rpm.

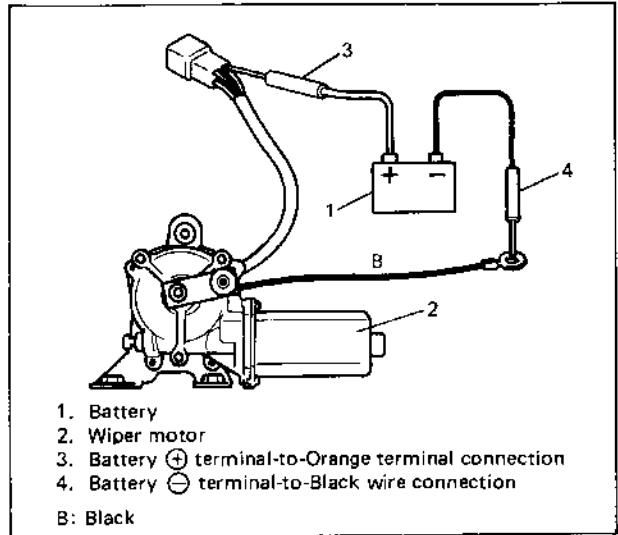


Fig. 8-58

#### 2) TESTING AUTOMATIC STOP ACTION

Connect battery (+) and (-) terminals to motor Yellow/Blue terminal and Black lead wire 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.

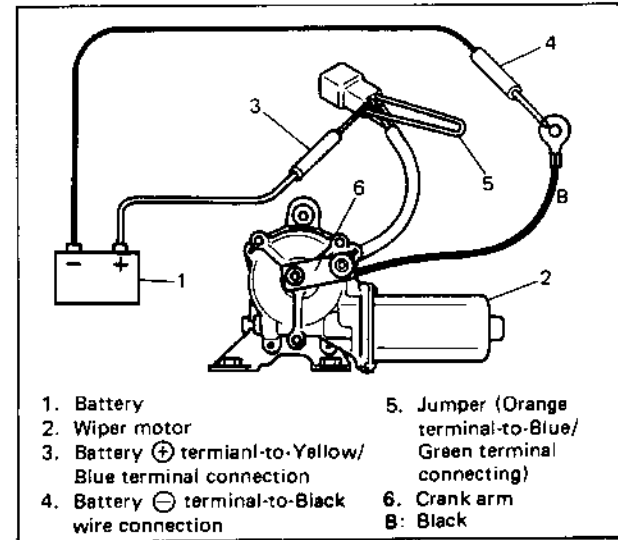


Fig. 8-59 Checking Crank Arm Stop Position



**3) CHECKING BRUSH AND COMMUTATOR**

Use a circuit tester to check Orange-to-Black lead wire continuity. If continuity is poor, check brush-and-commutator area for proper contact condition.

If fouled, clean the area with a cloth damped with gasoline.

If surface of the area is coarse or burnt, smooth it with a sand-paper.

(Refer to "FRONT WIPER MOTOR" section.)

**C. WASHER PUMP**

In the same manner as with the windshield washer pump, check pumping rate.

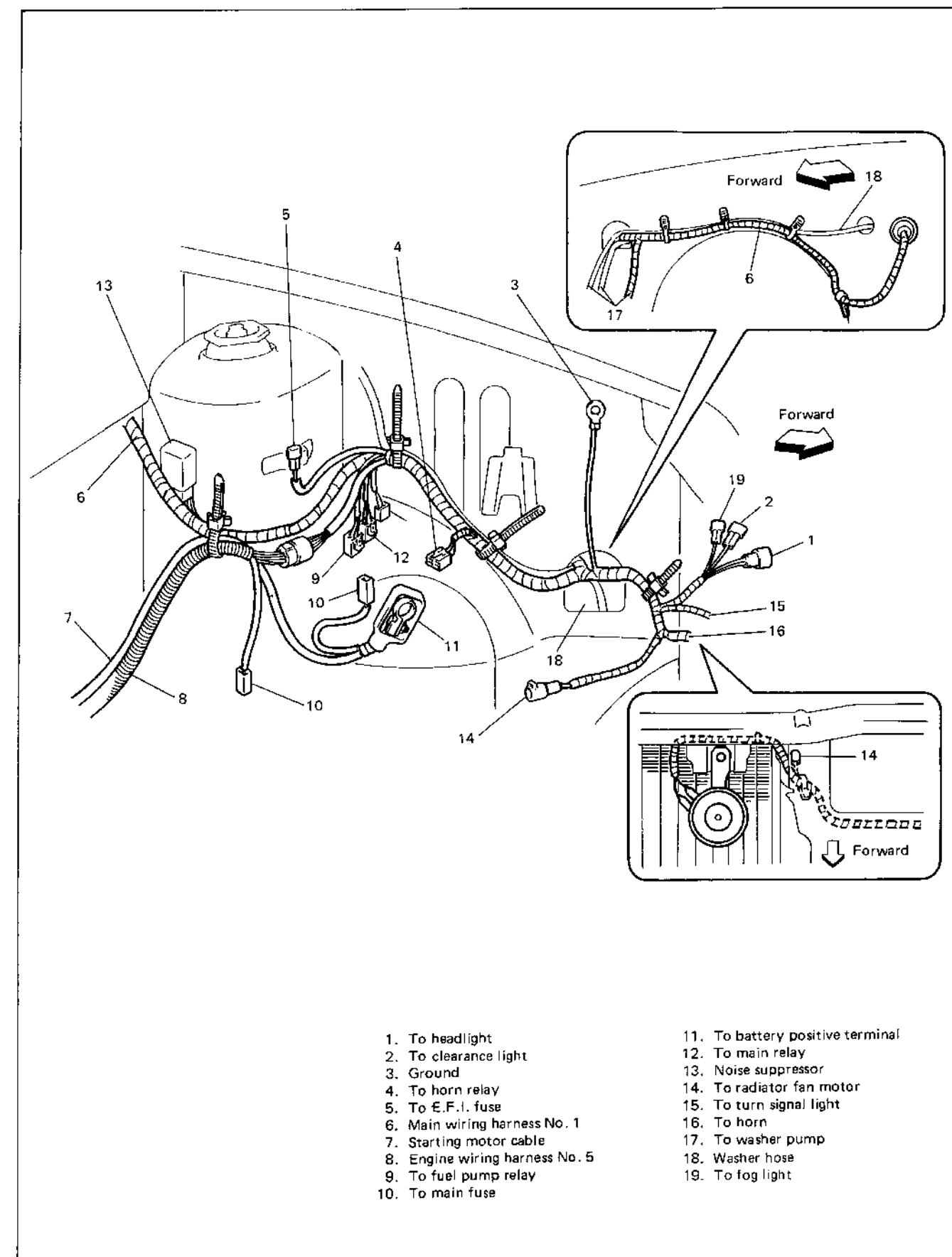
Refer to "WINDSHIELD WIPERS AND WASHERS" section.

**WASHER PUMP REMOVAL**

- 1) Disconnect battery (-) cable.
- 2) Remove front fender lining (LH).
- 3) Remove washer tank fitting screws.
- 4) Disconnect pump lead wires and hoses.
- 5) Remove washer tank.
- 6) Remove pump from tank.

**INSTALLATION**

Reverse the removal sequence to install washer pump.

**WIRING HARNESS ROUTING**

- |                                |                                  |
|--------------------------------|----------------------------------|
| 1. To headlight                | 11. To battery positive terminal |
| 2. To clearance light          | 12. To main relay                |
| 3. Ground                      | 13. Noise suppressor             |
| 4. To horn relay               | 14. To radiator fan motor        |
| 5. To E.F.I. fuse              | 15. To turn signal light         |
| 6. Main wiring harness No. 1   | 16. To horn                      |
| 7. Starting motor cable        | 17. To washer pump               |
| 8. Engine wiring harness No. 5 | 18. Washer hose                  |
| 9. To fuel pump relay          | 19. To fog light                 |
| 10. To main fuse               |                                  |

Fig. 8-60 Left Side Fender Apron Wiring

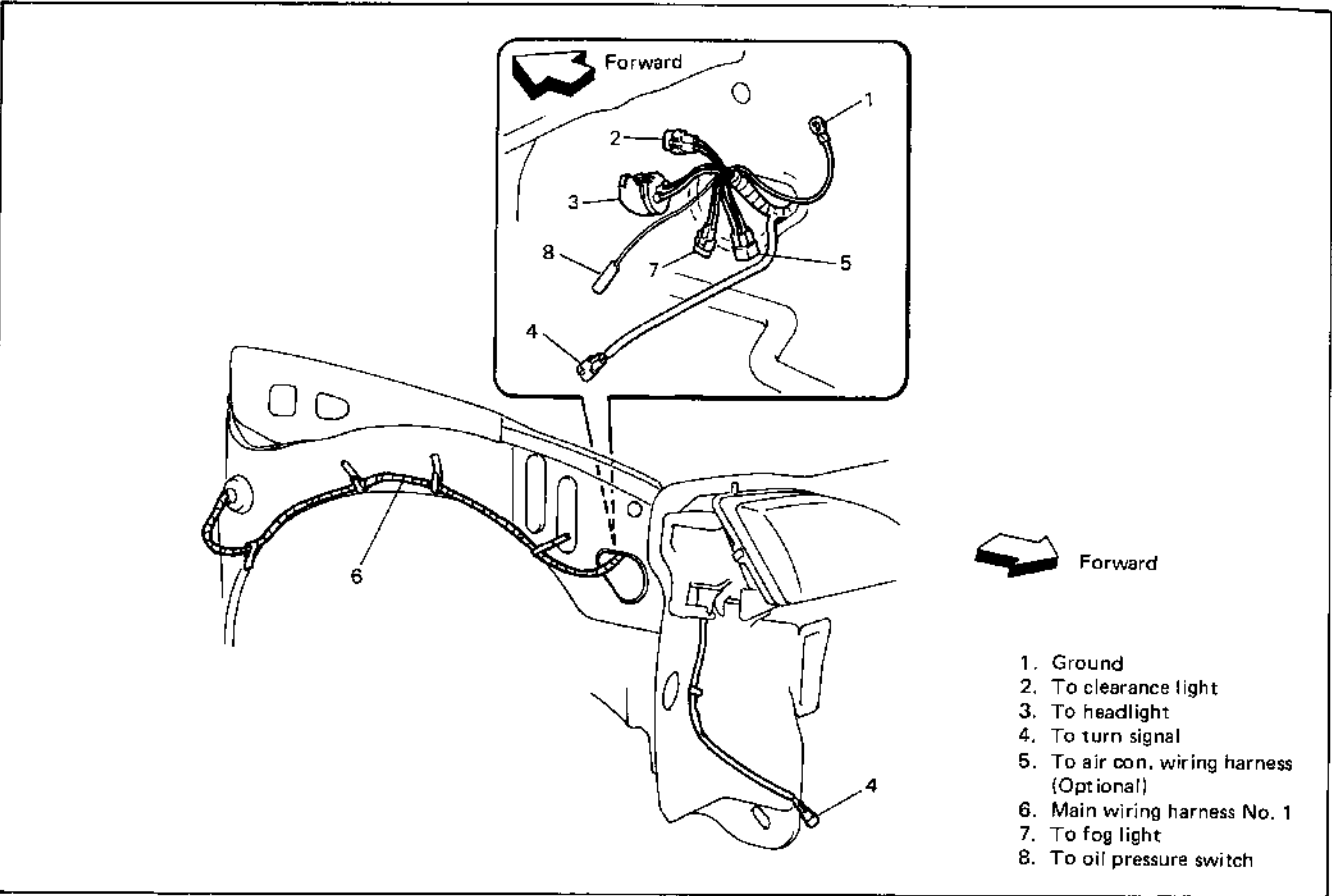


Fig. 8-61 Right Side Inner Fender Wiring

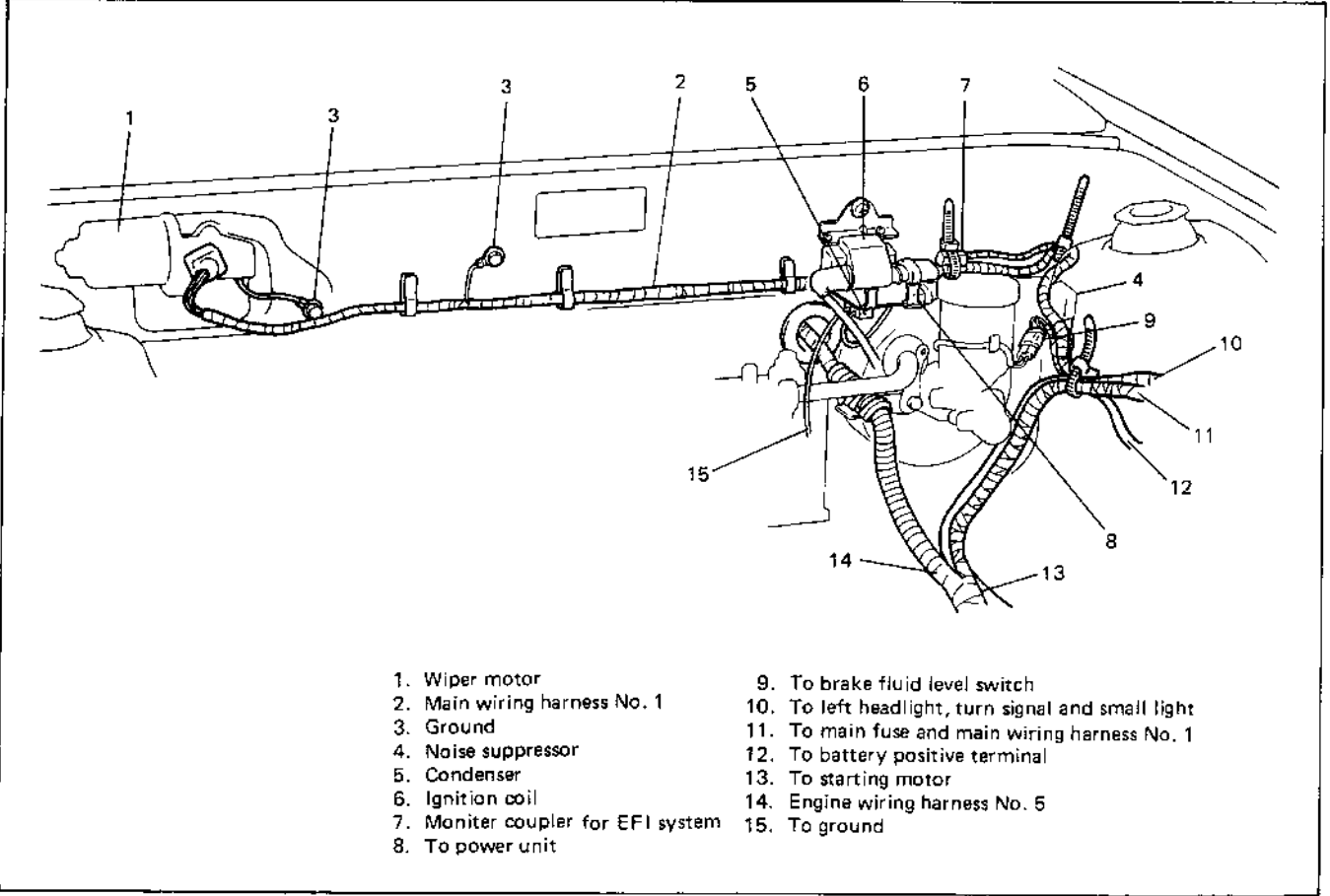


Fig. 8-62 Cowl Top Panel Wiring

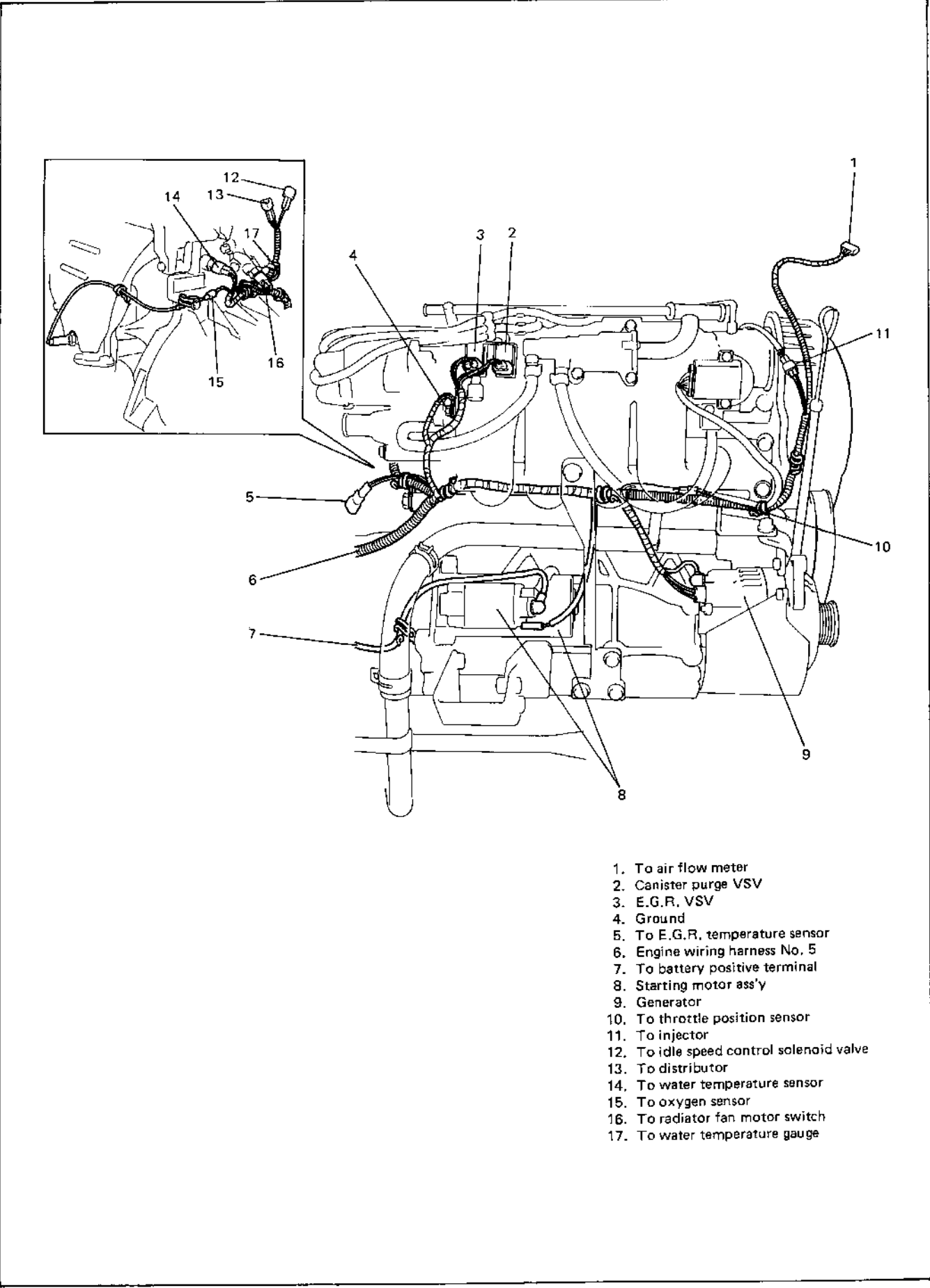


Fig. 8-63 Engine Wiring

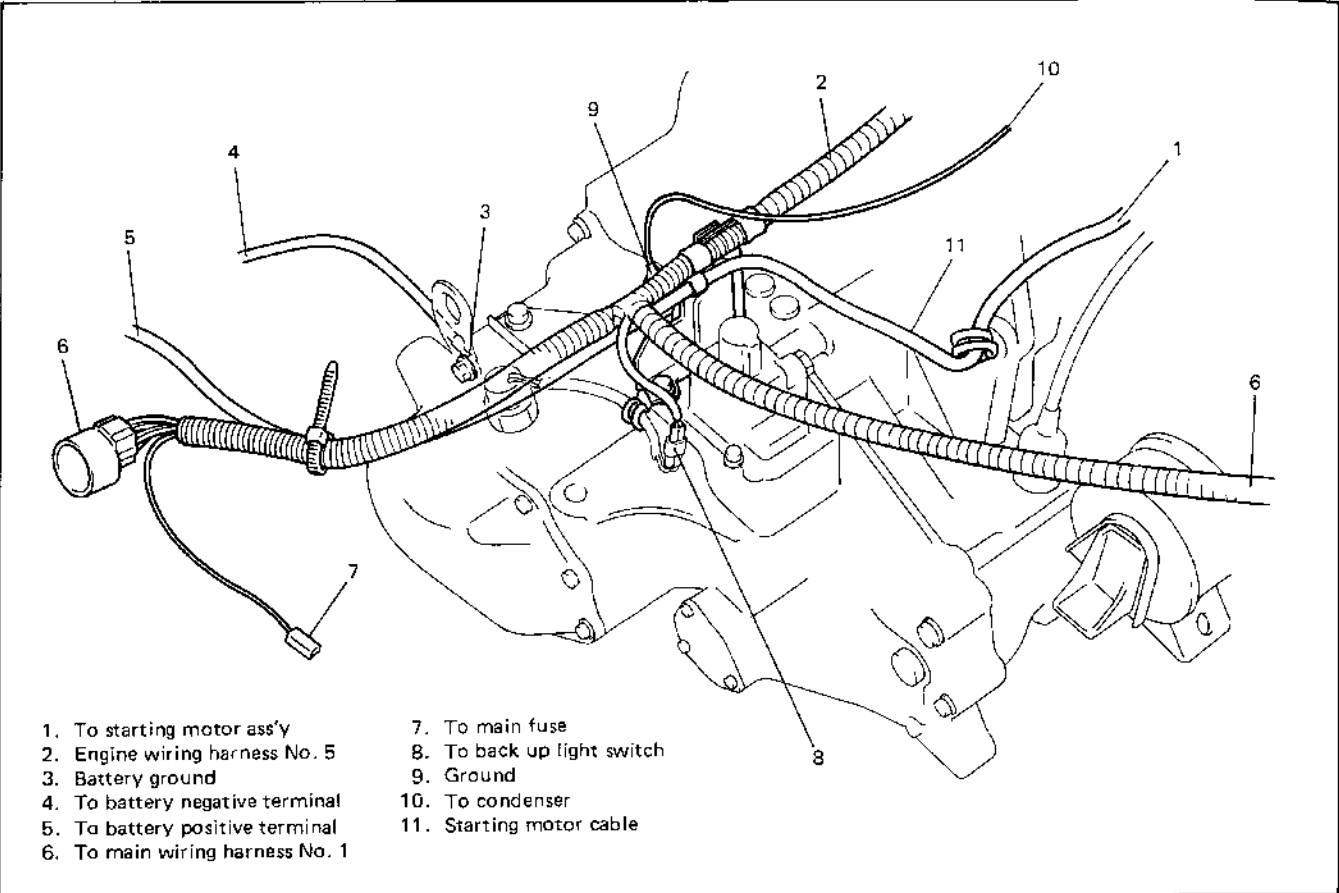


Fig. 8-64 Manual Transmission Wiring

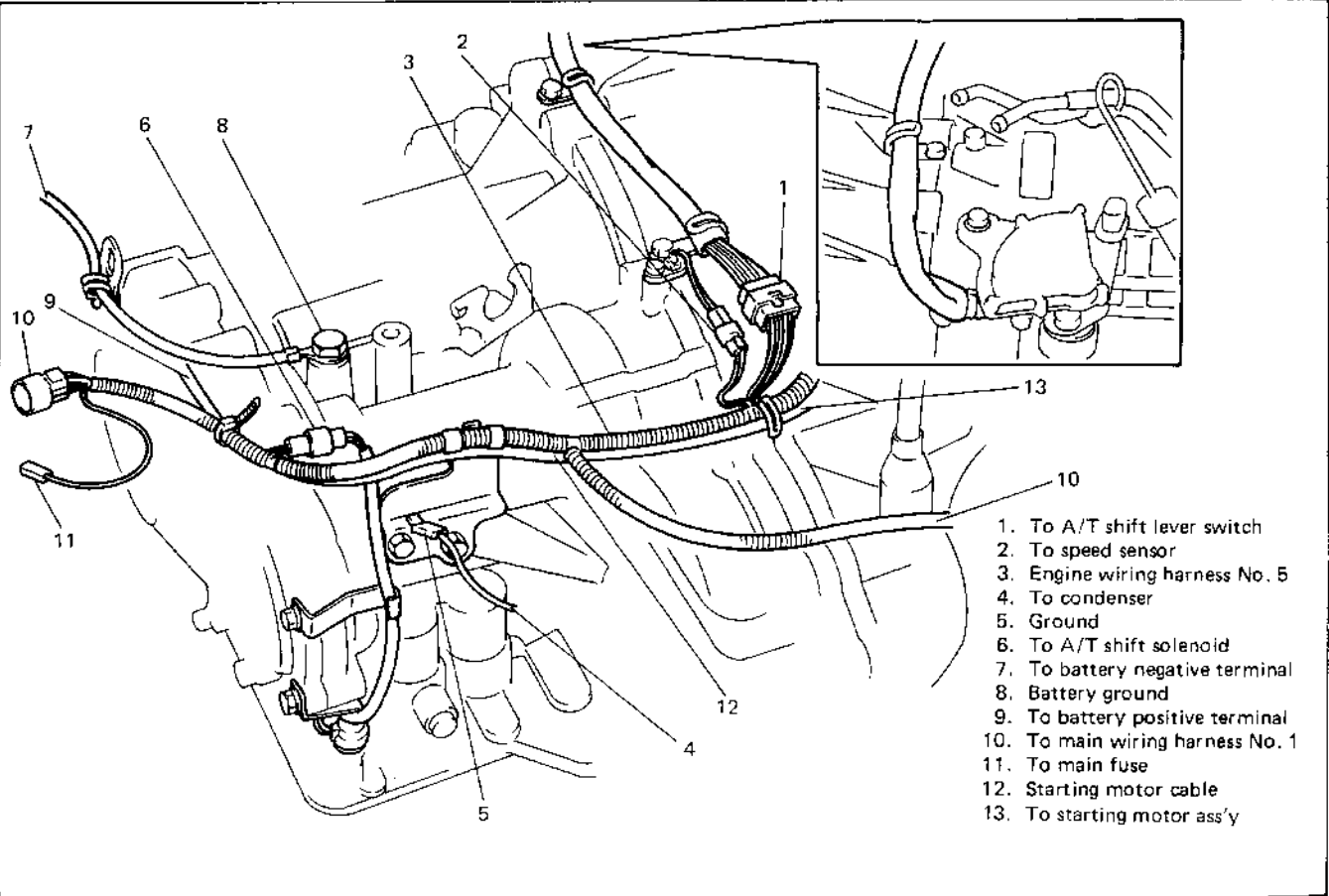


Fig. 8-65 Automatic Transmission Wiring

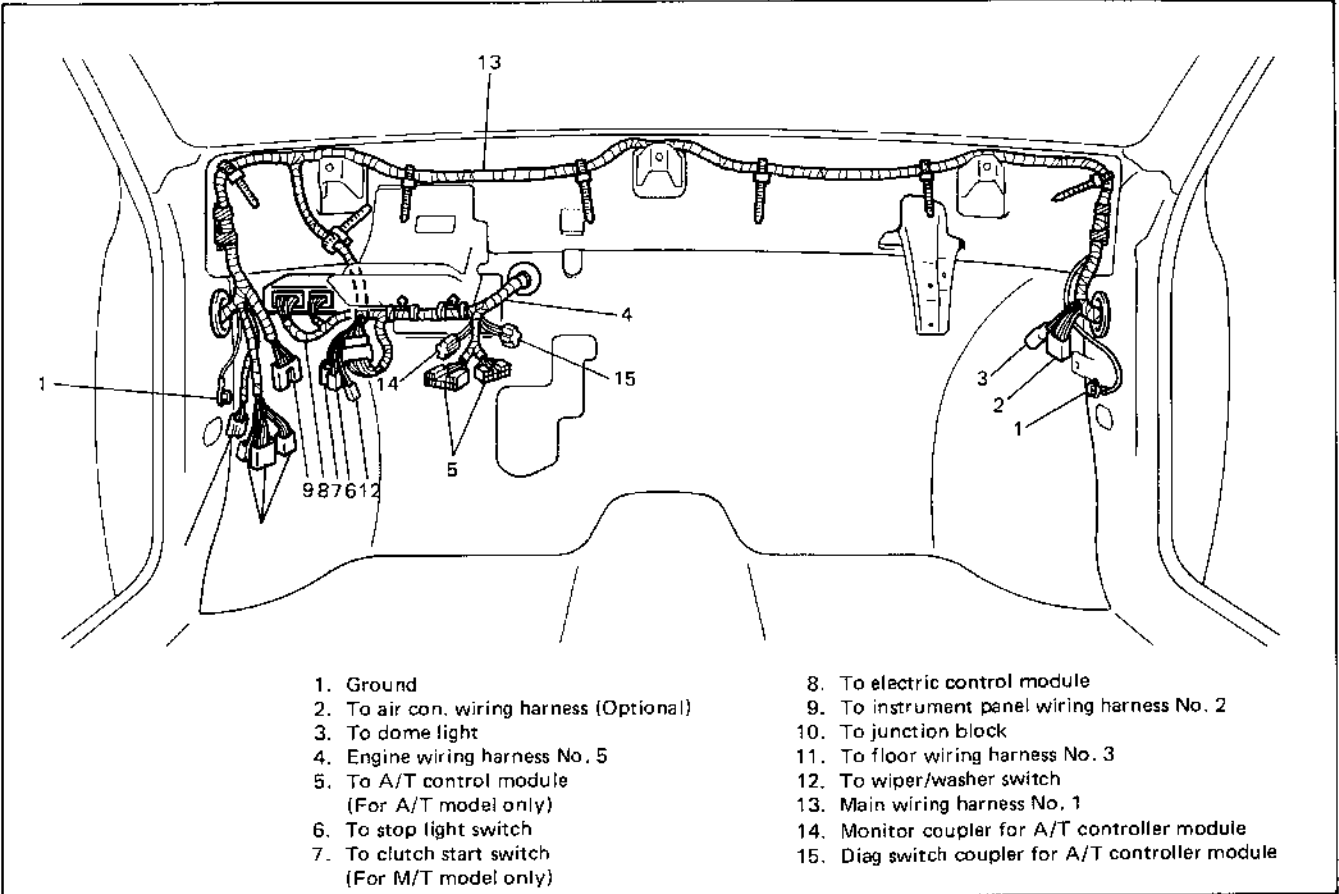


Fig. 8-66 Cowl Upper Wiring

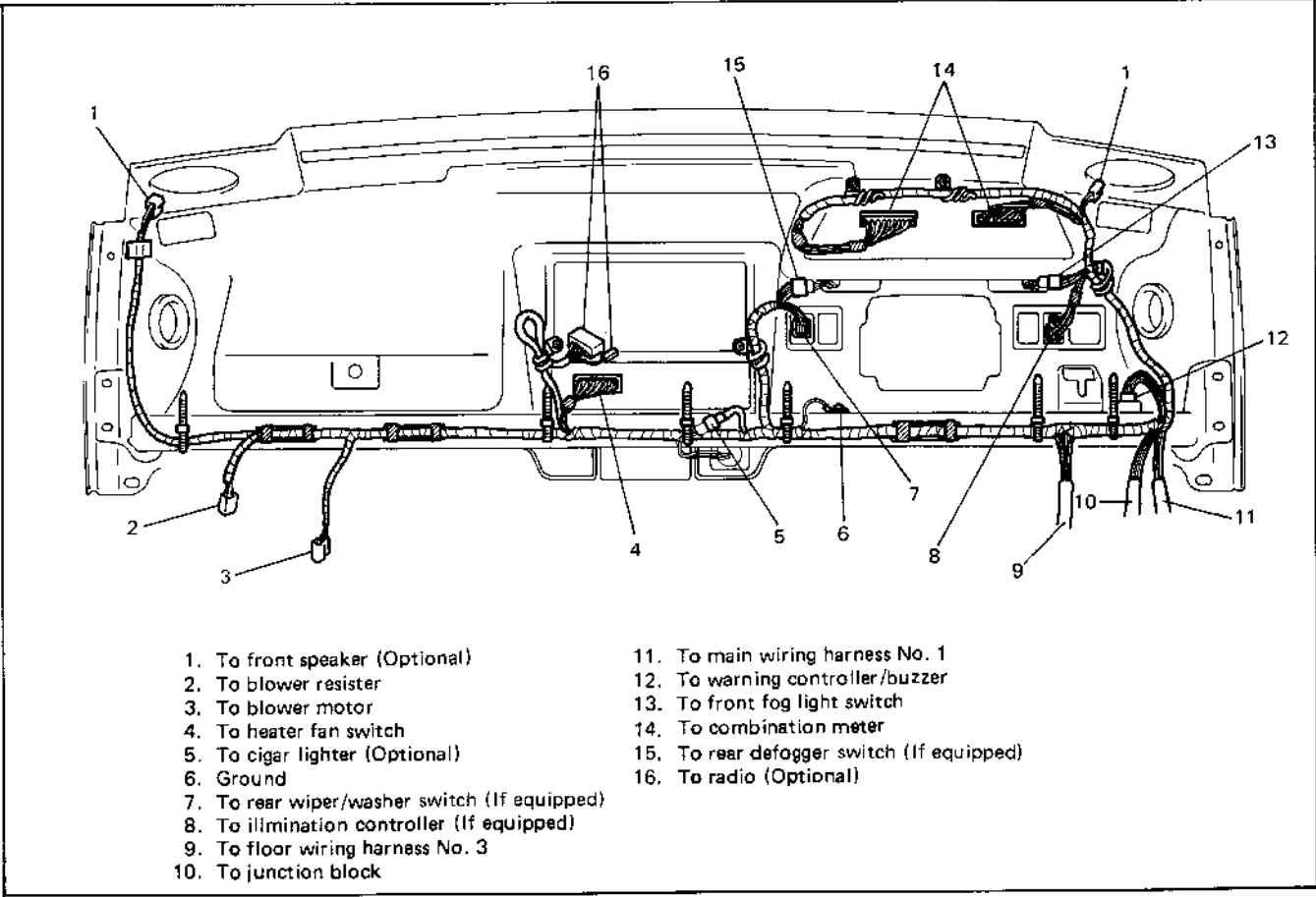


Fig. 8-67 Instrument Panel Wiring

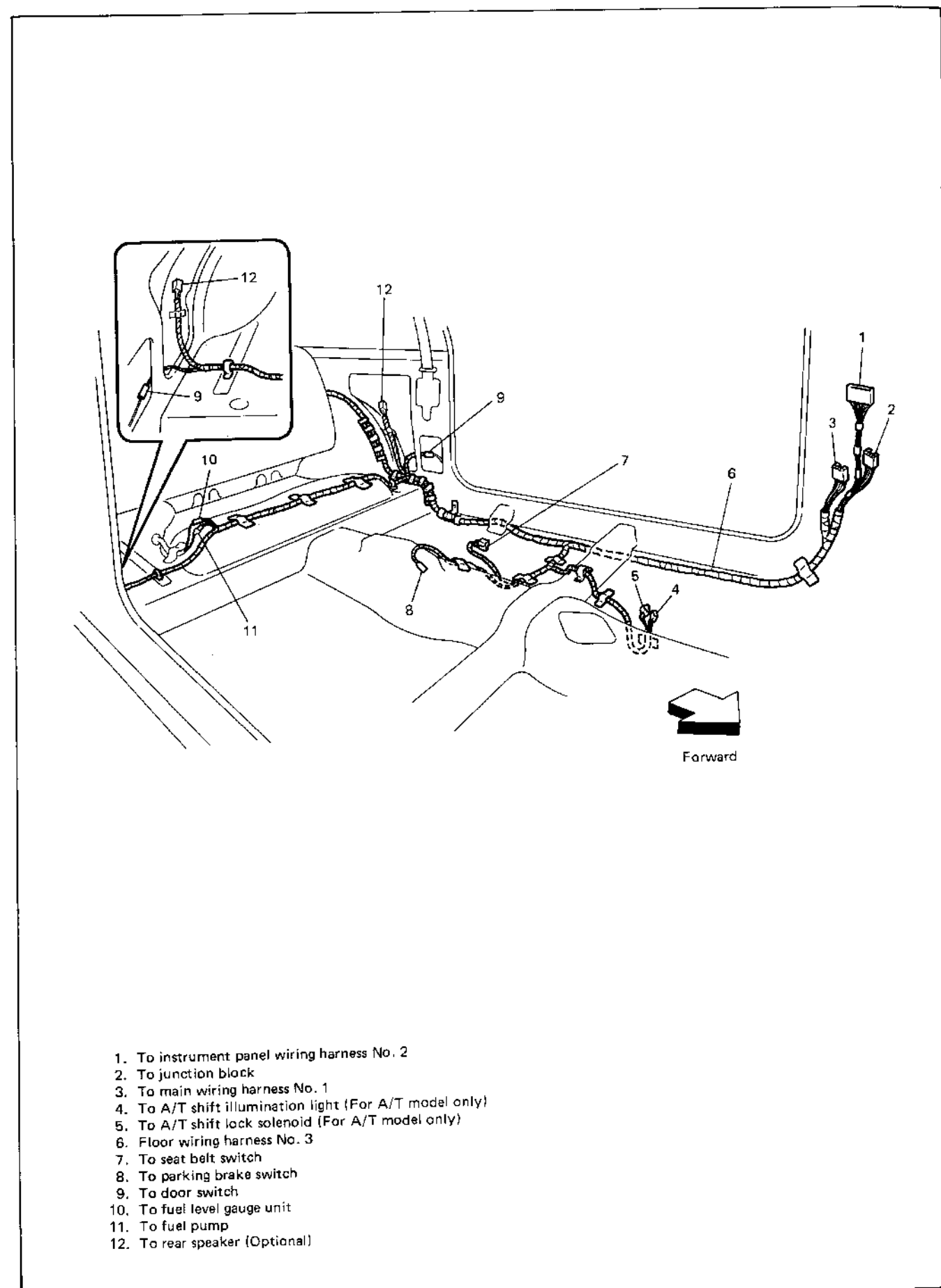


Fig. 8-68 Floor Wiring

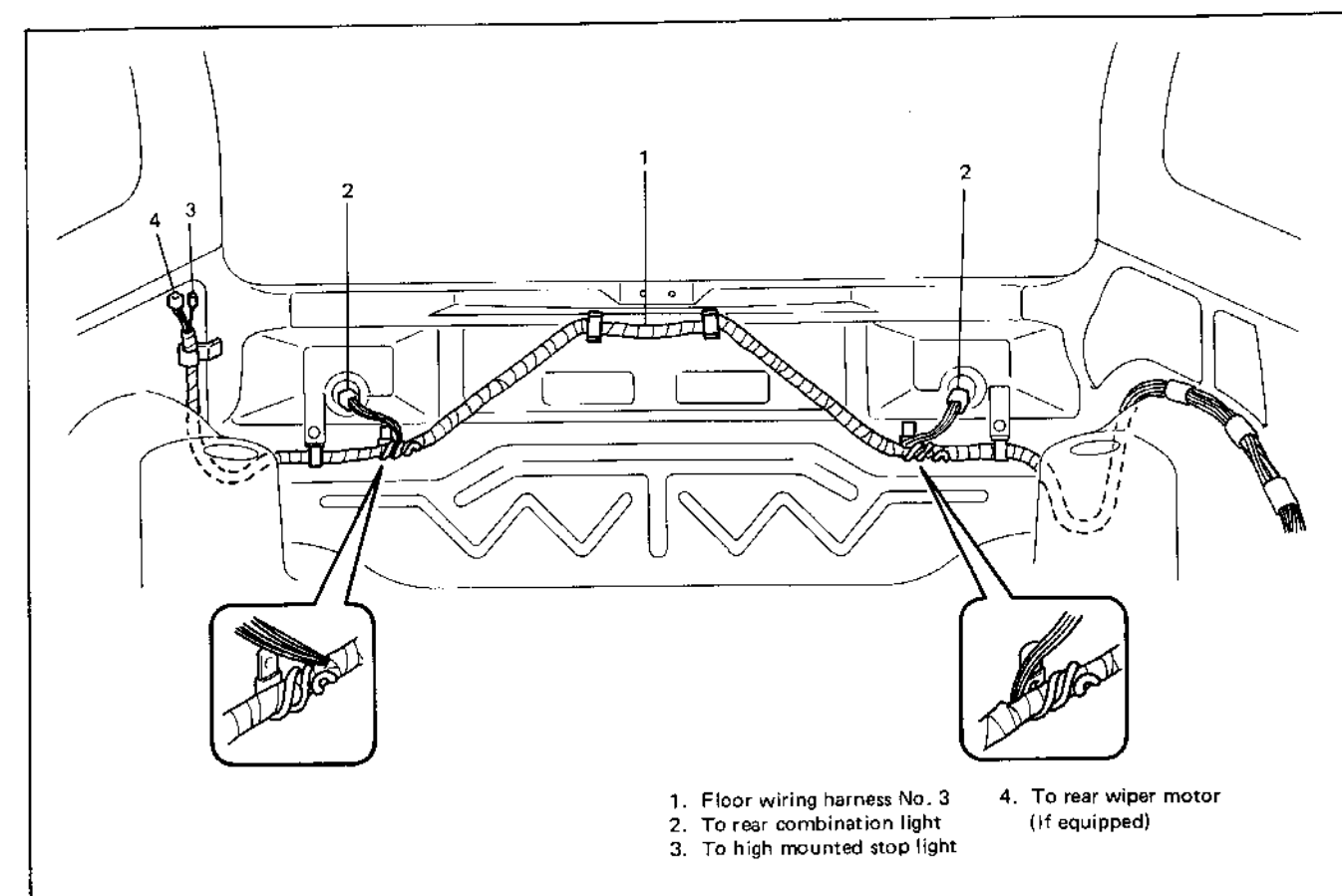


Fig. 8-69 Rear Body Wiring

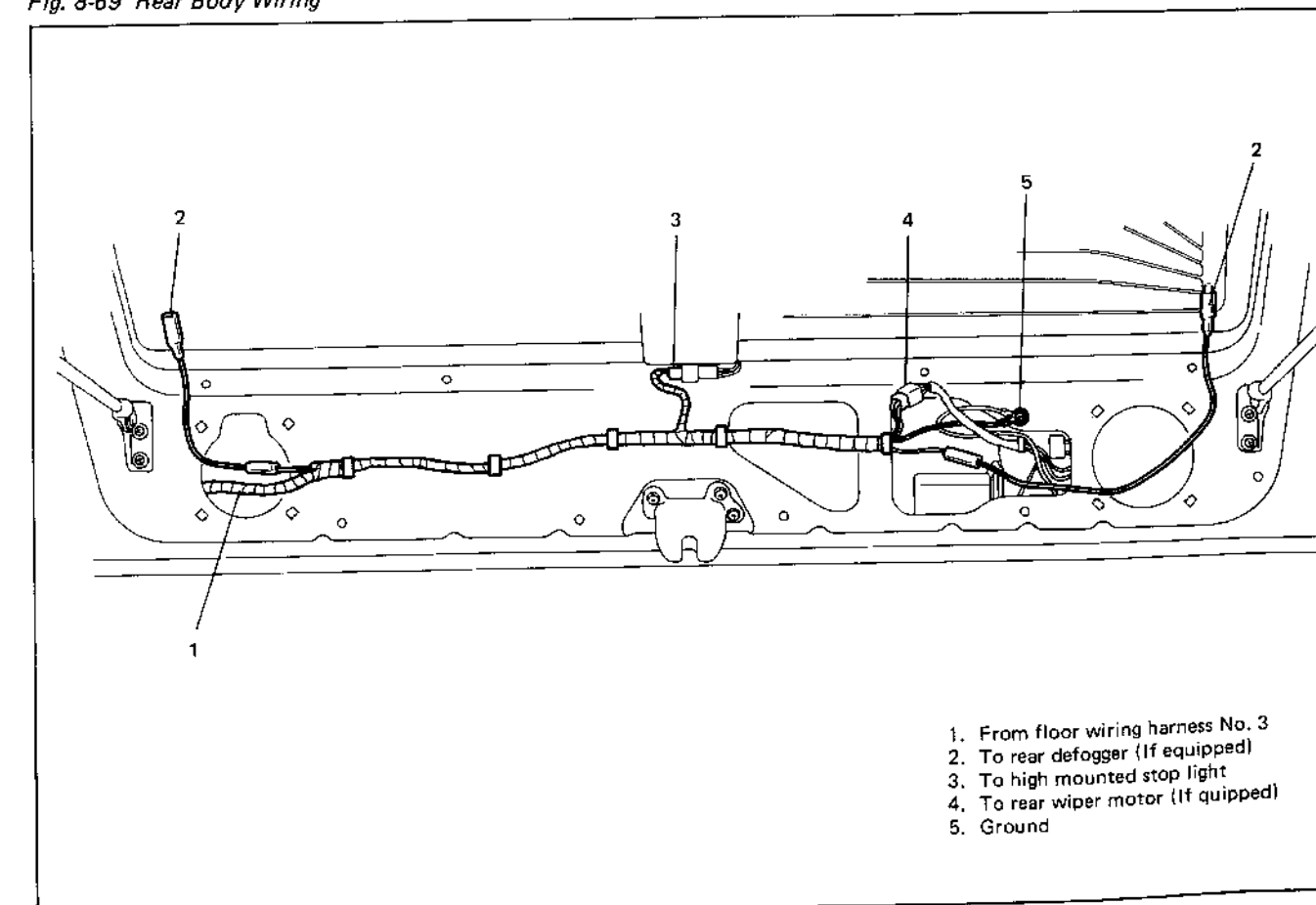


Fig. 8-70 Back Door Wiring

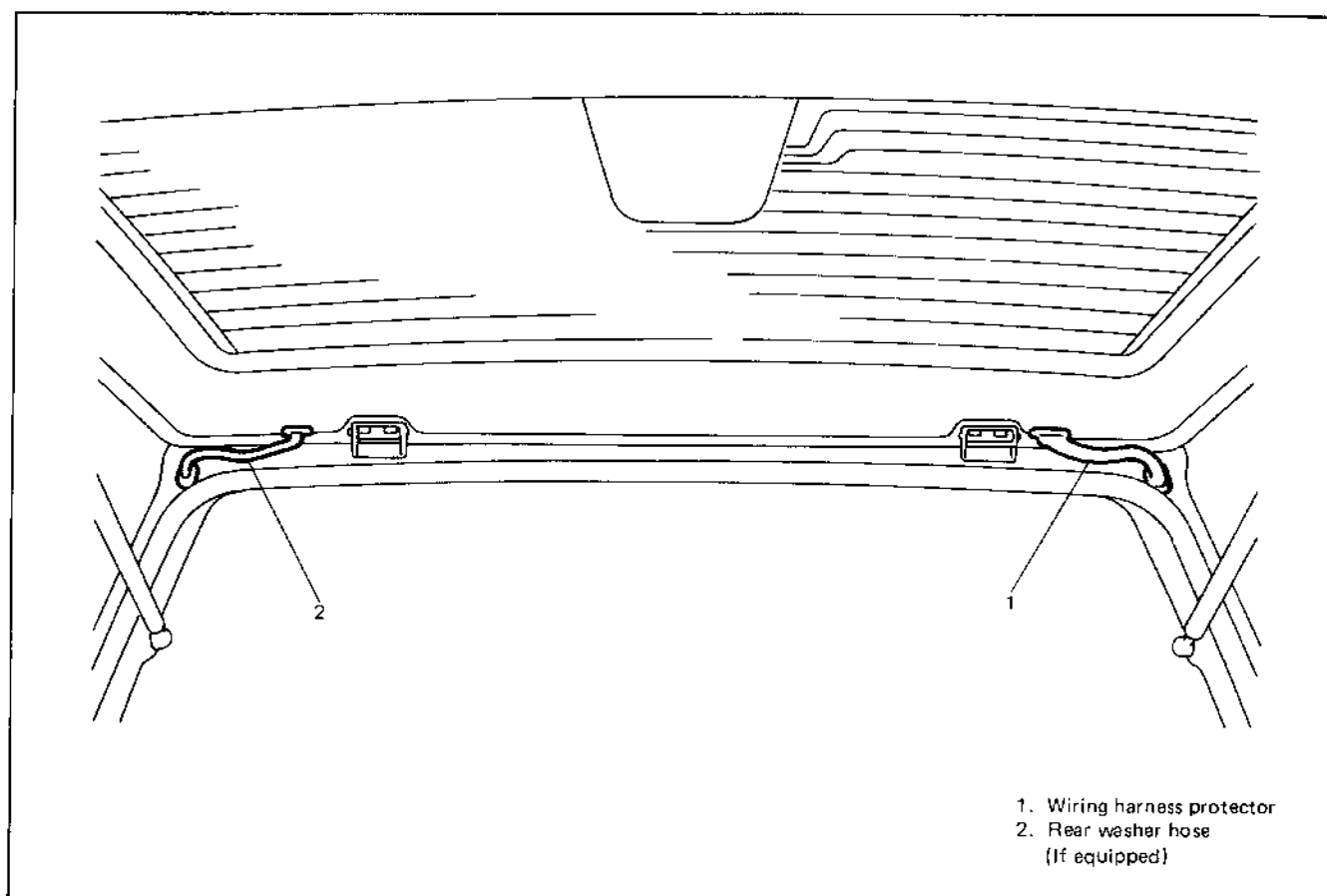


Fig. 8-71 Back Door Wiring Protector

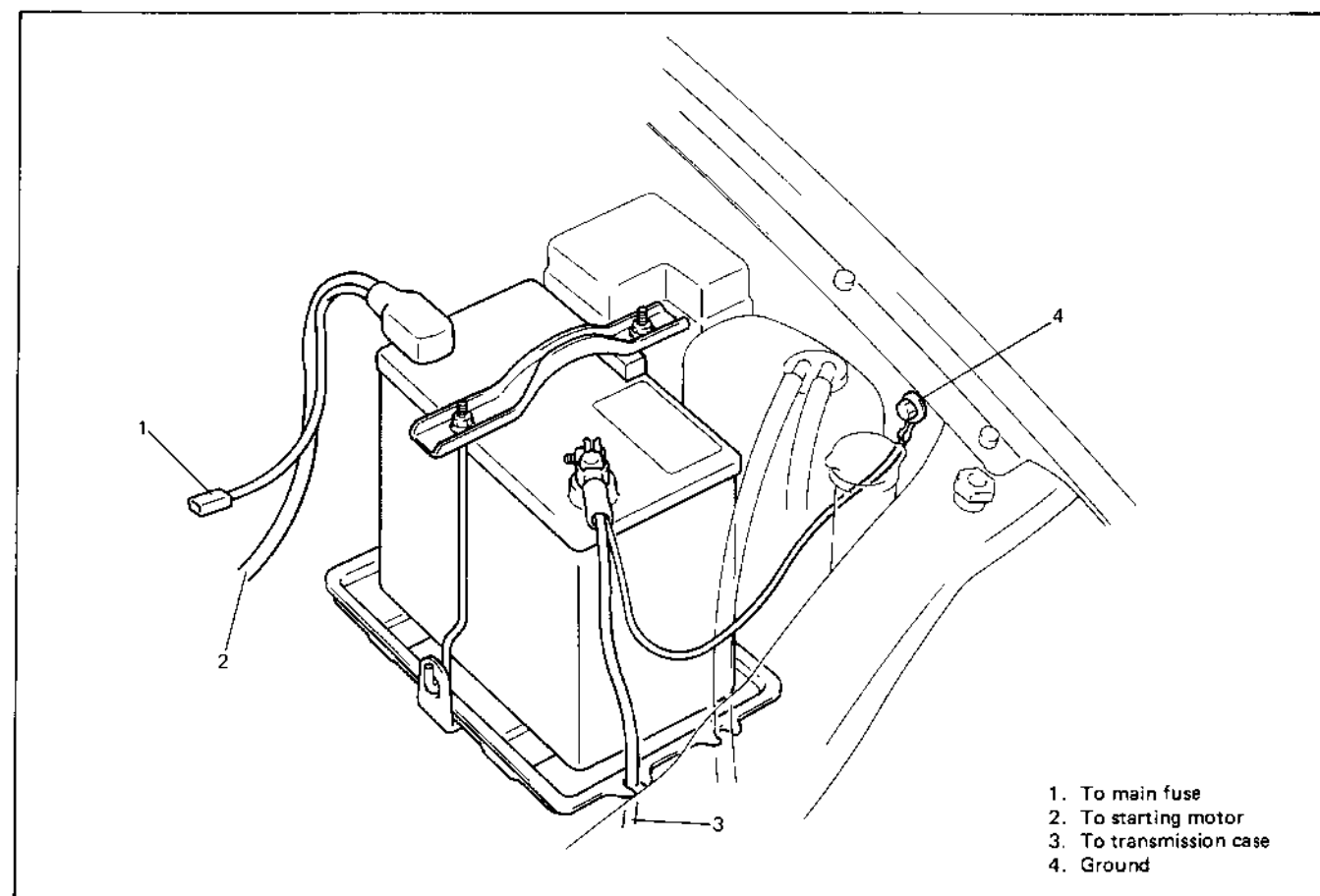
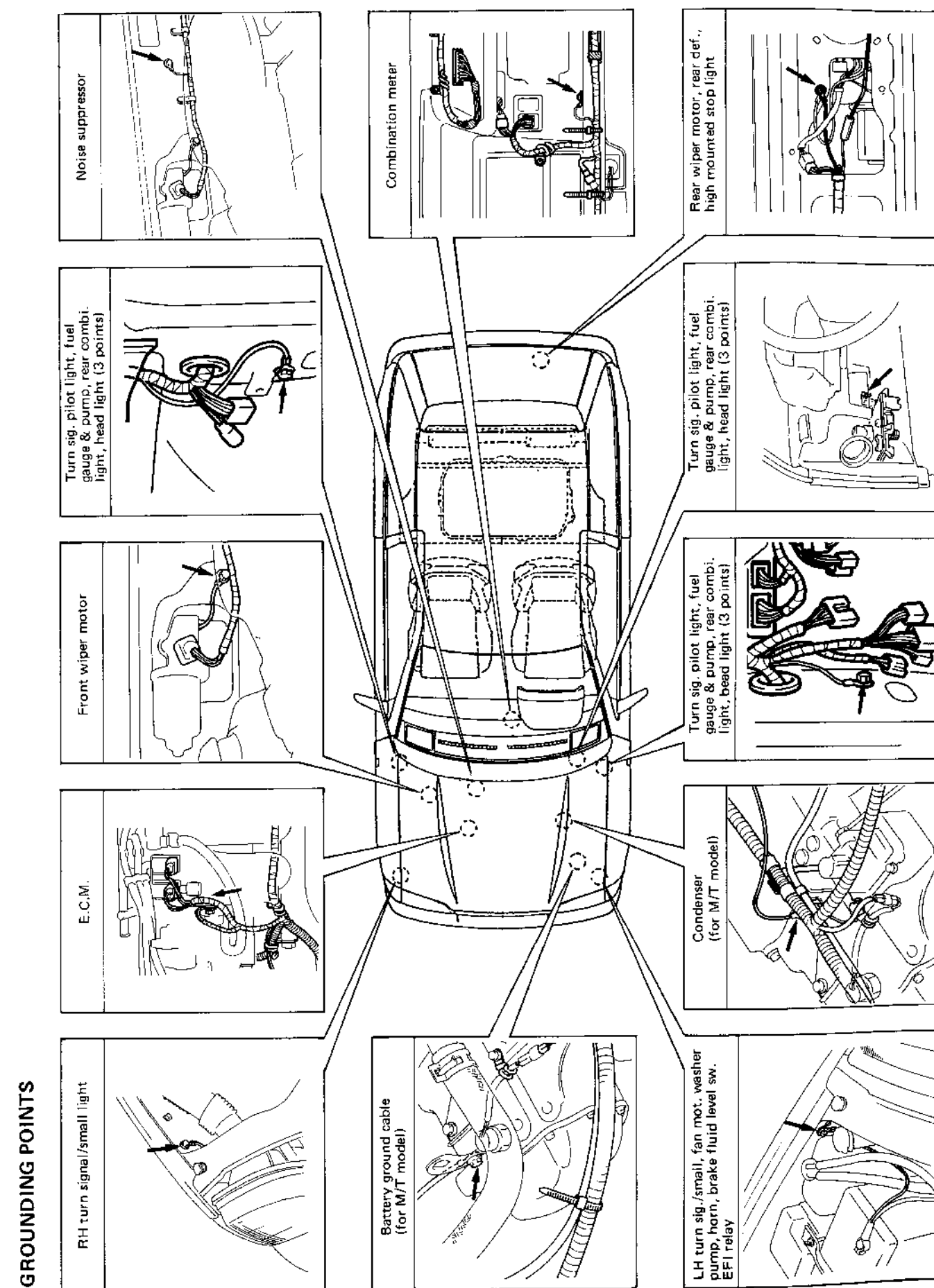


Fig. 8-72 Battery Wiring



## GROUNDING POINTS

Fig. 8-73 Grounding Points

SECTION 9

BODY SERVICE

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## ON-CAR SERVICE

## FRONT DOOR

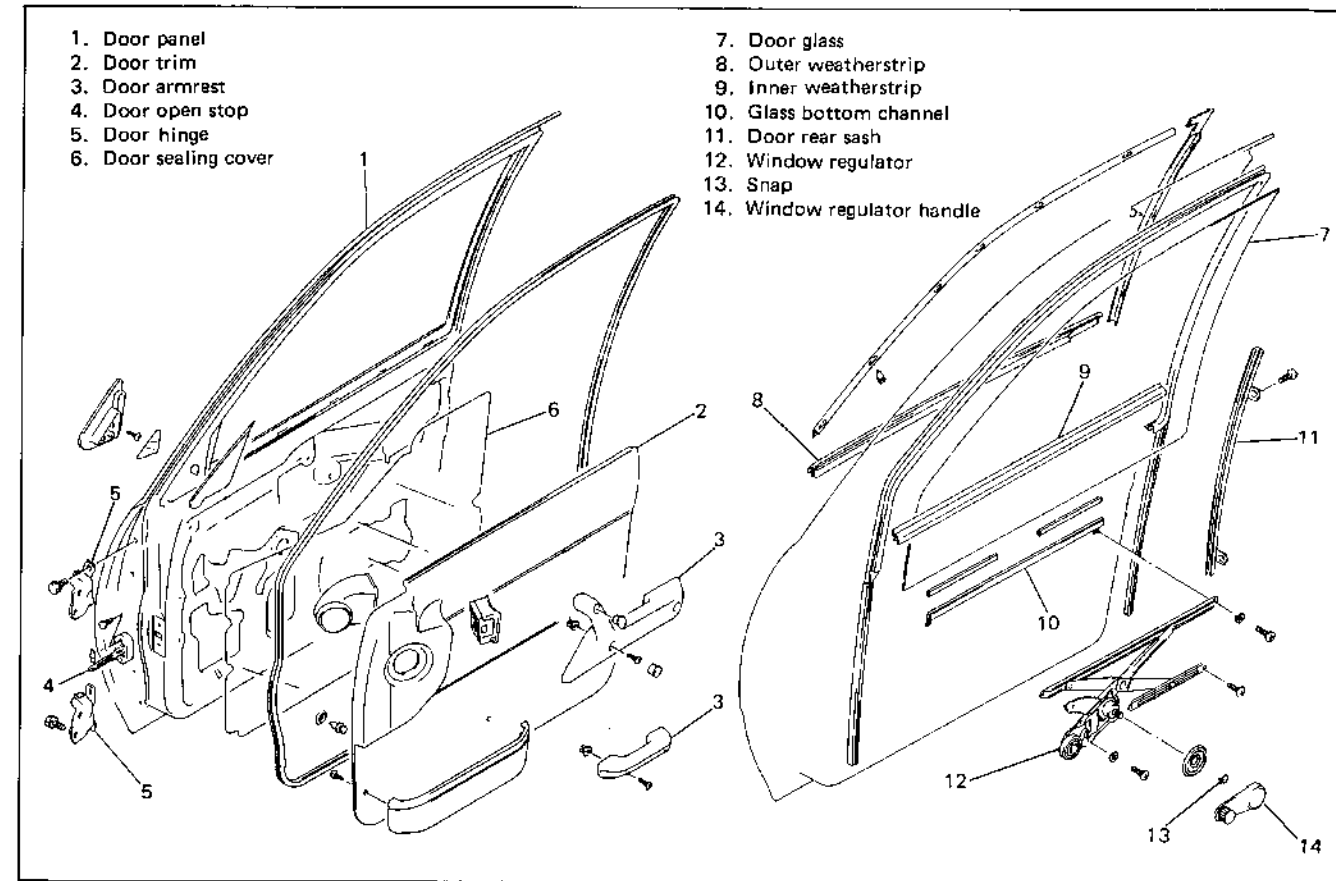


Fig. 9-1 Front Door Assembly

DOOR GLASS  
REMOVAL

Remove following parts.

- 1) Inside handle bezel attaching screw.
- 2) Door armrest.
- 3) Window regulator handle.

For its removal, pull off snap by using a cloth as shown below.

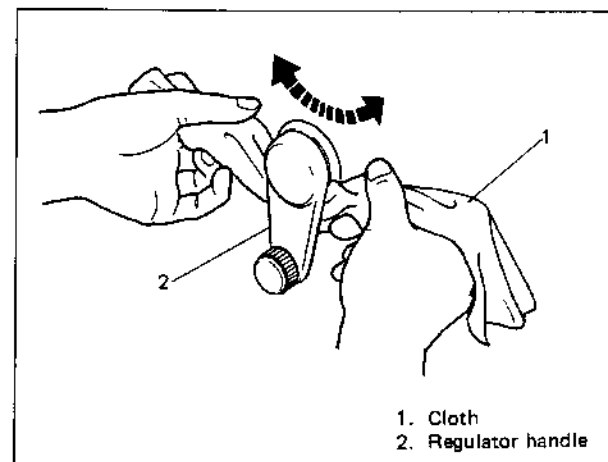


Fig. 9-2

- 4) Door trim with inner weatherstrip.

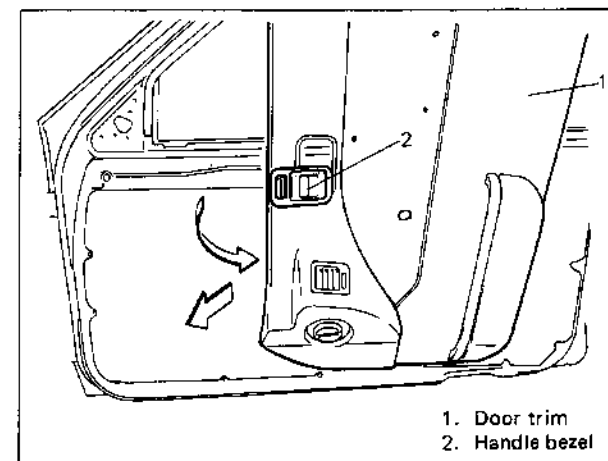


Fig. 9-3 Removing Door Trim

- 6) Door sealing cover.
- 7) Fit inside handle bezel back in position temporarily.

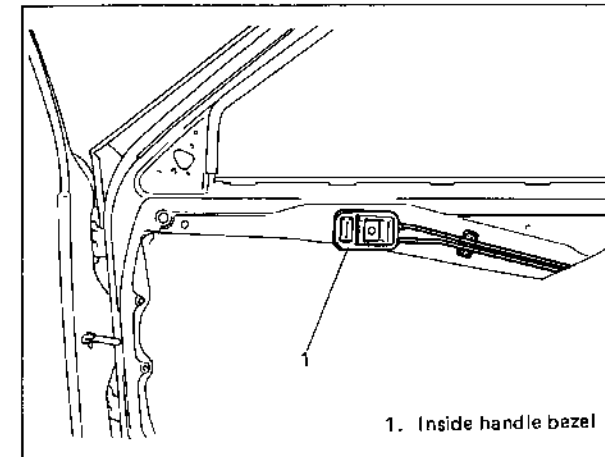


Fig. 9-4

- 8) Door outside weatherstrip.
- 9) Glass bottom channel attaching screws.

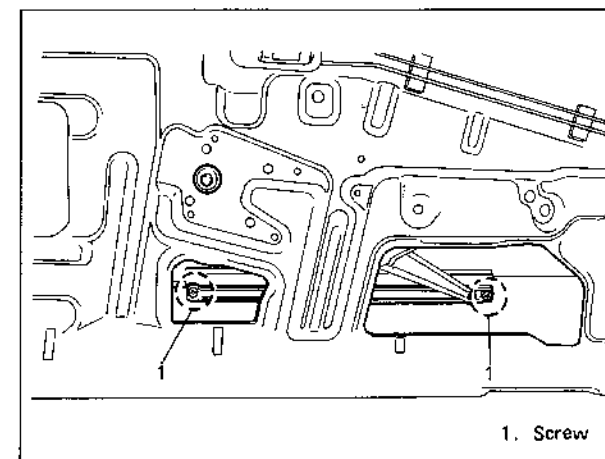


Fig. 9-5

- 10) Take out door glass together with bottom channel.
- 11) Detach glass from bottom channel.

## INSTALLATION

Reverse the removal sequence to install door glass noting the following points:

- 1) When installing glass to bottom channel, coat channel with soap water and tap it with a plastic hammer.
- Glass-fitted position of bottom channel is as shown below.

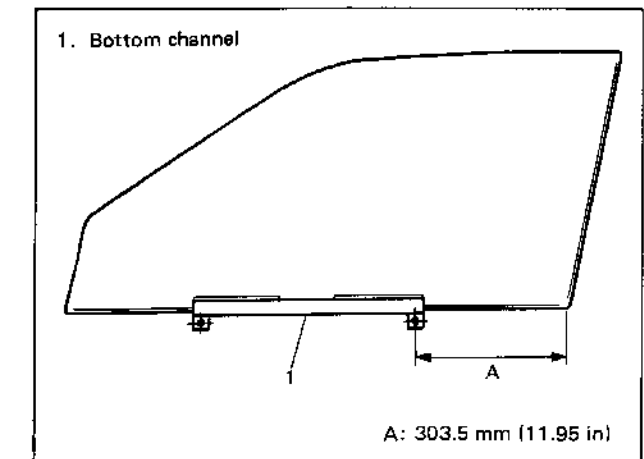


Fig. 9-6

- 2) Adjust equalizer of window regulator so that measurements A and B in Fig. 9-8 are equal to each other.

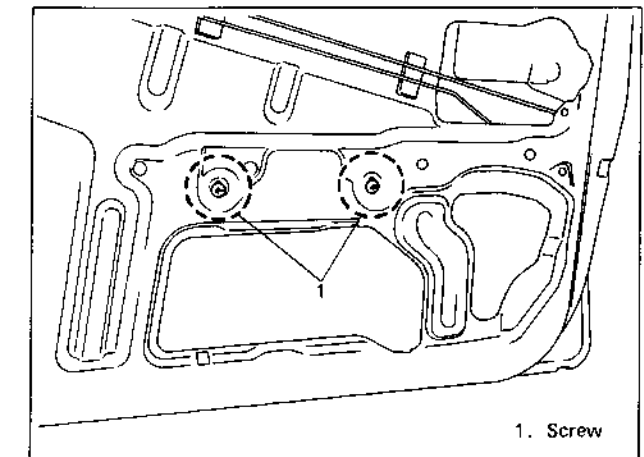


Fig. 9-7 Adjusting Equalizer

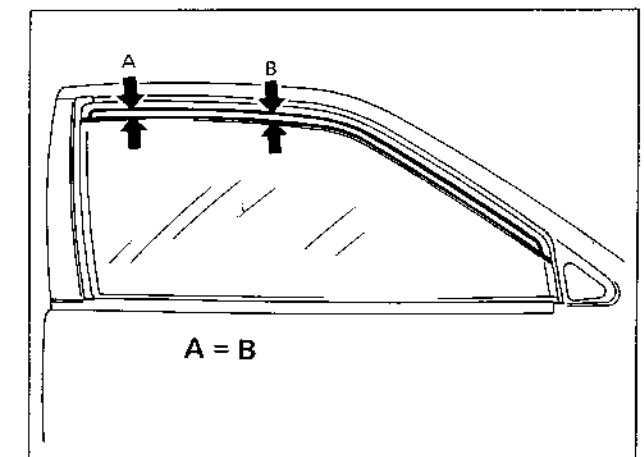


Fig. 9-8

3) Securely seal door sealing cover with adhesive.

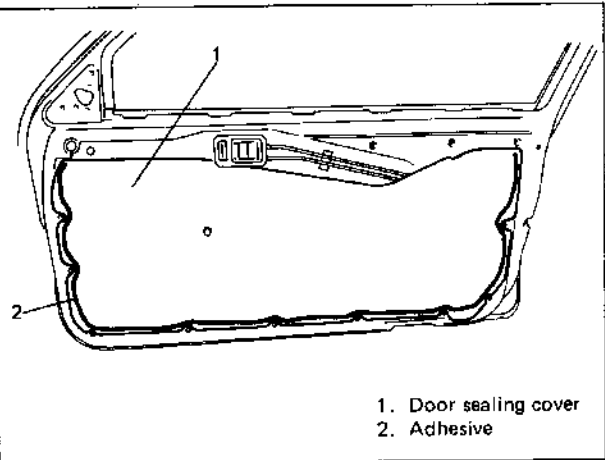


Fig. 9-9

4) Install door window regulator handle so that it has a 45° angle when glass is fully closed, as illustrated below.

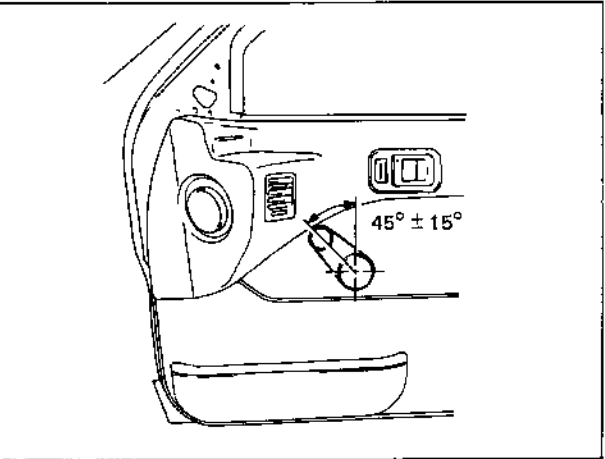


Fig. 9-10

**DOOR WINDOW REGULATOR**

**REMOVAL**

- Remove following parts.
- 1) Door glass. (See previous section.)
  - 2) Door window regulator attaching screws (six pcs.). Loosen 6 screws and take out regulator through hole "A".

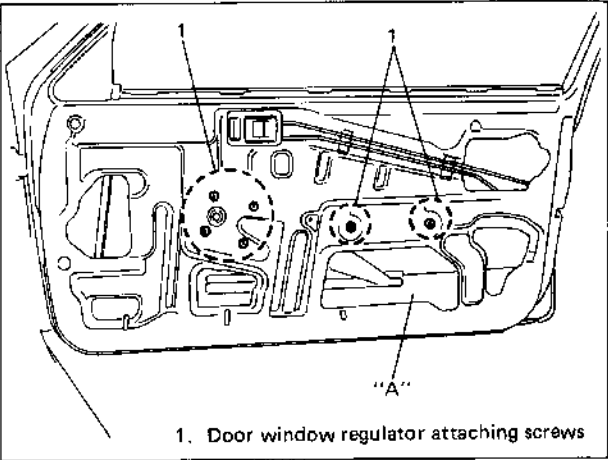


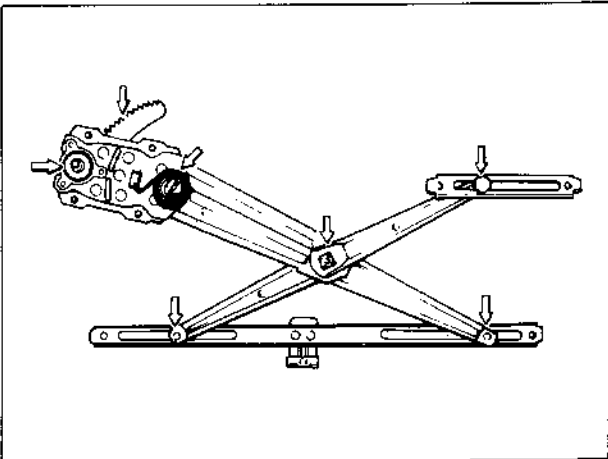
Fig. 9-11

**INSPECTION**

- a. Check gear for wear or damage.
- b. Check spring for weakened condition.

**INSTALLATION**

- Reverse removal sequence to install door window regulator.
- 1) Apply multi-purpose grease to sliding parts.



**FRONT DOOR LOCK**

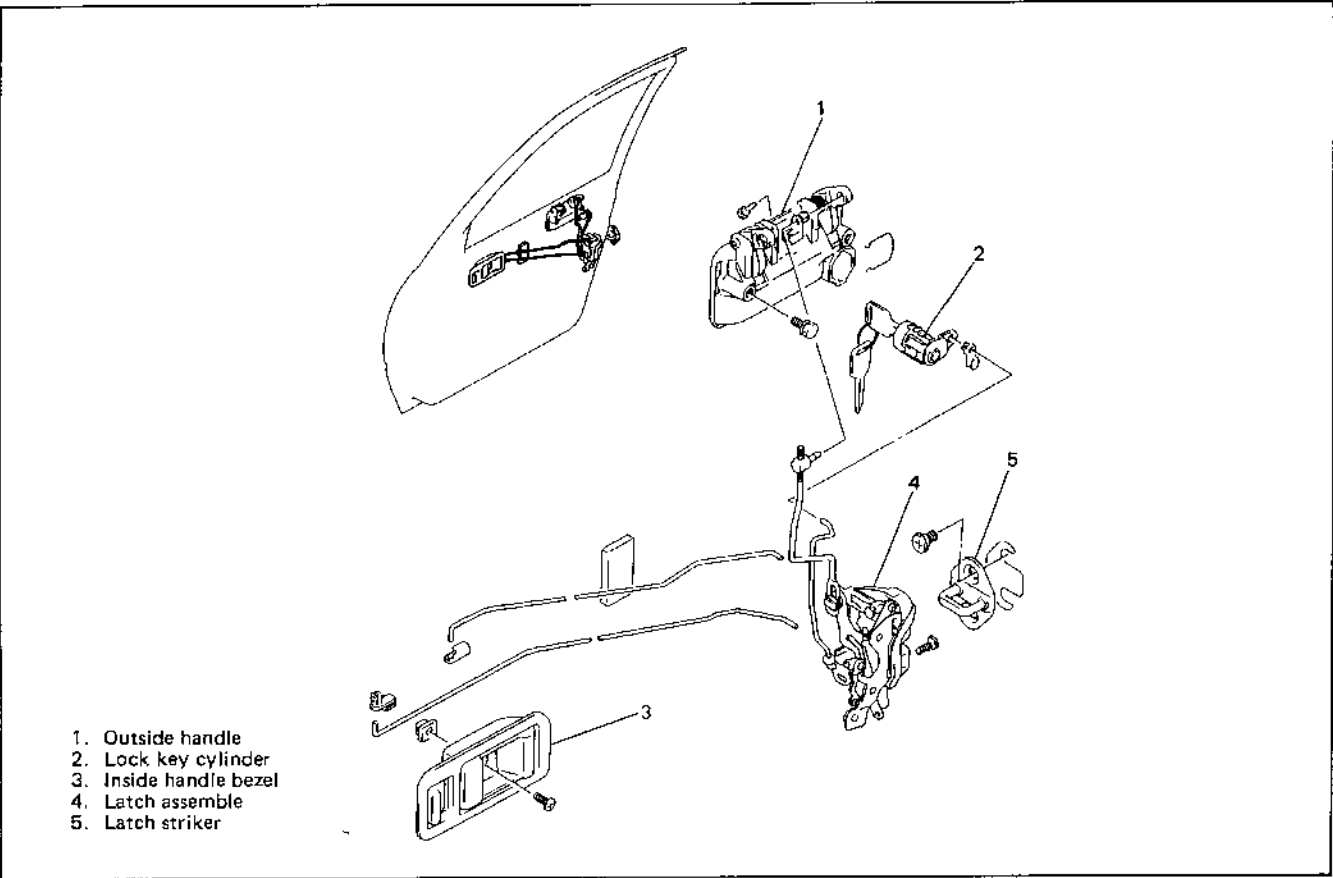


Fig. 9-13 Front Door Lock Assembly

**REMOVAL**

- Remove following parts.
- 1) Inside handle bezel attaching screw.
  - 2) Door armrest.
  - 3) Window regulator handle.
- For its removal, pull off snap by using a cloth as shown below.

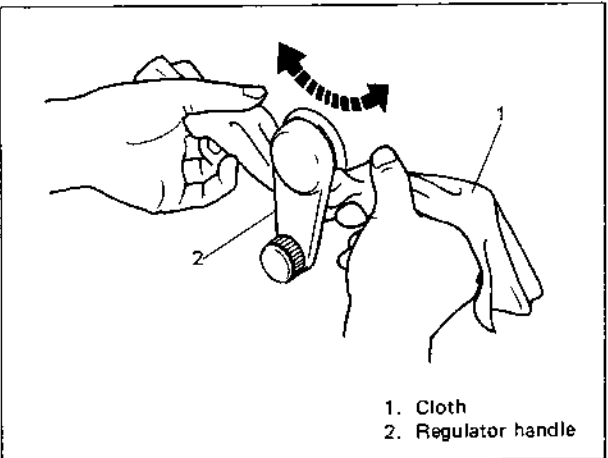


Fig. 9-14

4) Door trim with inner weatherstrip.

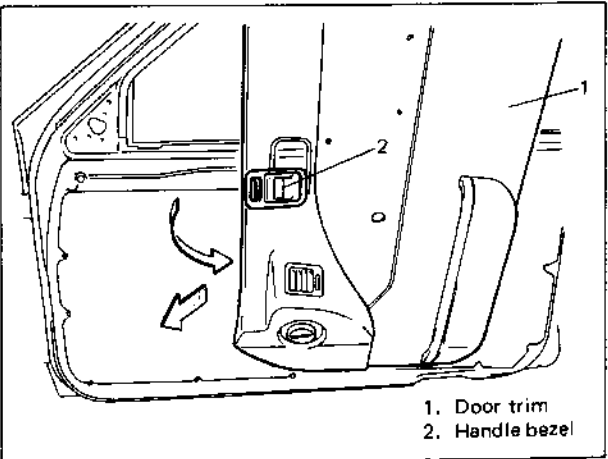


Fig. 9-15 Removing Door Trim



- 6) Door sealing cover.
- 7) Front door rear sash.
- 8) Door inside handle and door latch ass'y.  
After disconnecting each joint of control link, remove door inside handle and door latch ass'y.

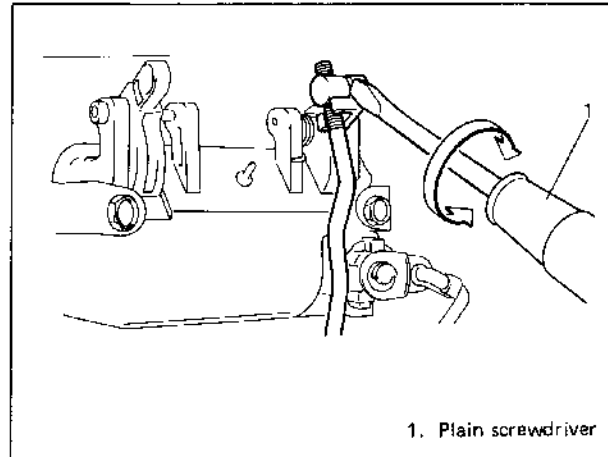


Fig. 9-16 Disconnecting Door Opening Control Link

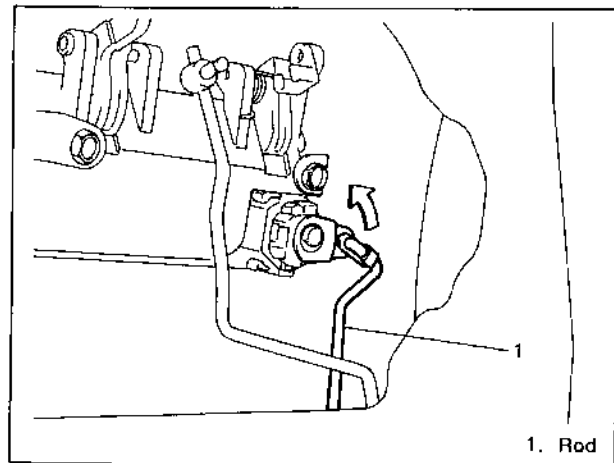


Fig. 9-17 Disconnecting Rod

**INSTALLATION**

Reverse removal sequence for installation while using care for following items.

- 1) Door outside opening rod  
When installing opening rod 1 to outside handle 2, turn joint 3 to adjust distance "A" to 0 to 2 mm (0 to 0.08 in.) as shown below.

**NOTE:**

Do not push down opening link 6 when adjusting and installing opening rod.

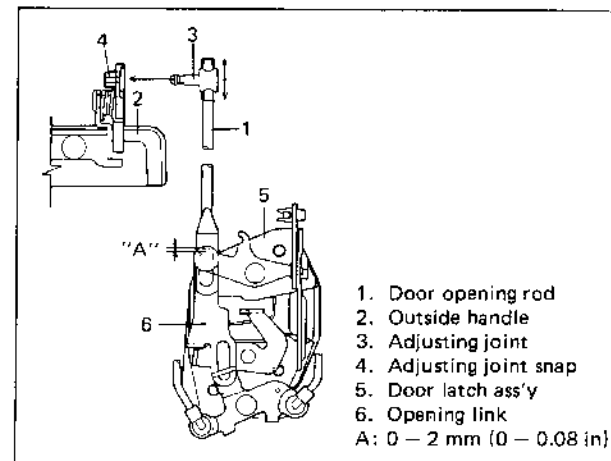


Fig. 9-18

- 2) Door latch striker

Move door latch striker up and down so that its shaft 3 approximately aligns with the center of groove "C" of door latch.

**NOTE:**

Striker should be placed level and moved vertically. Do not adjust door latch.

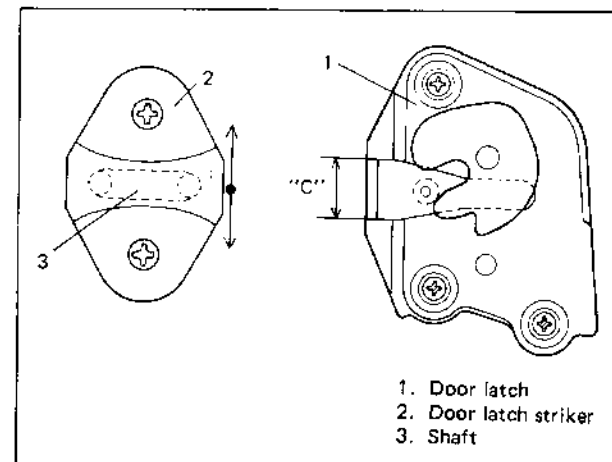


Fig. 9-19

Move door latch striker sideways to adjust to 0 mm (0 in.) the door surface-to-body surface difference with door closed.

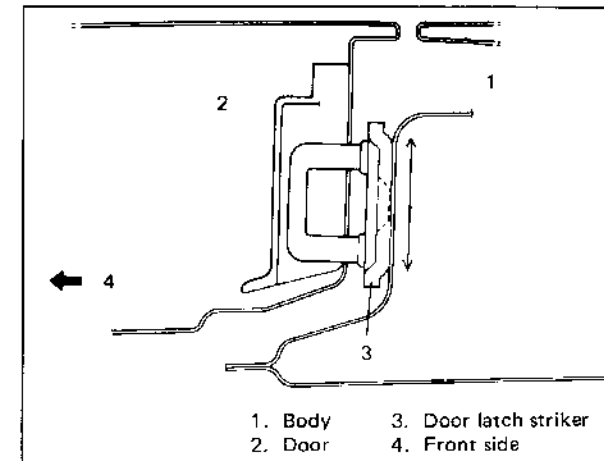


Fig. 9-20

In order to correctly obtain door striker position in fore-and-aft direction, increase or decrease number of spacers inserted between body and striker to adjust it. Dimension "D" should be adjusted to 12.6 to 14.6 mm (0.50 to 0.57 in.).

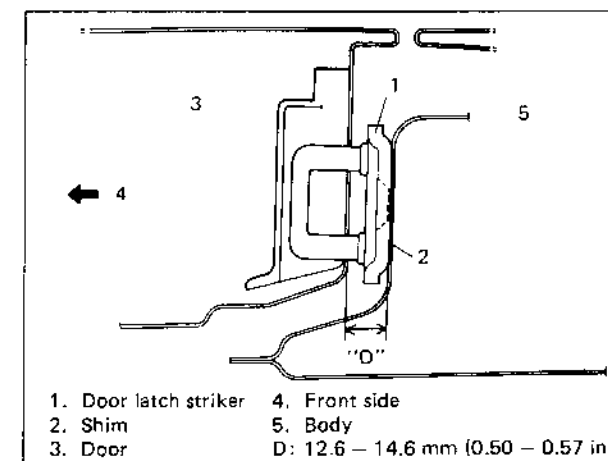


Fig. 9-21

**NOTE:**

Apply oil or grease to striker joints periodically.

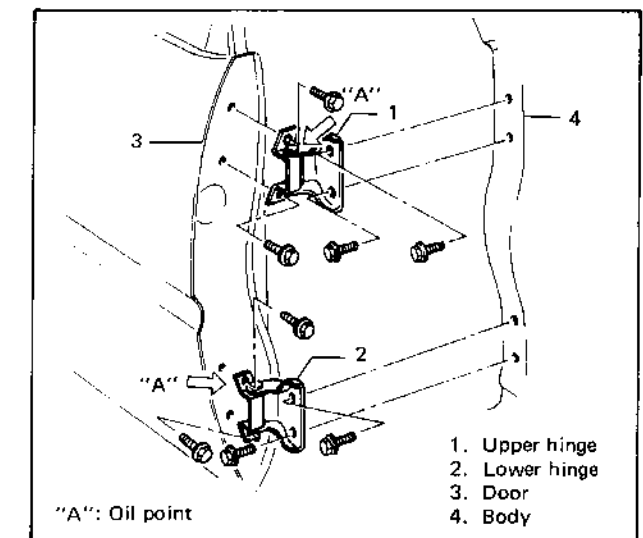
**FRONT DOOR ASSEMBLY**

Fig. 9-22

**REMOVAL**

- 1) Remove stopper pin upward by tapping it with hammer.

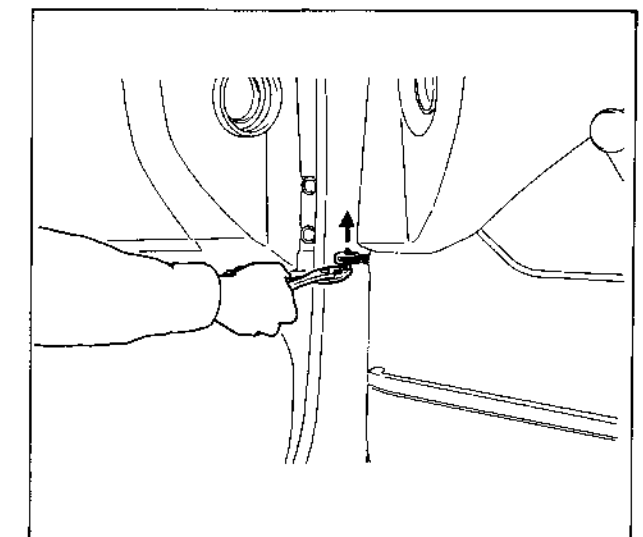


Fig. 9-23

- 2) Using a jack, support door panel with a piece of wood placed between jack and panel.
- 3) Remove door ass'y by loosening hinge mounting bolts.

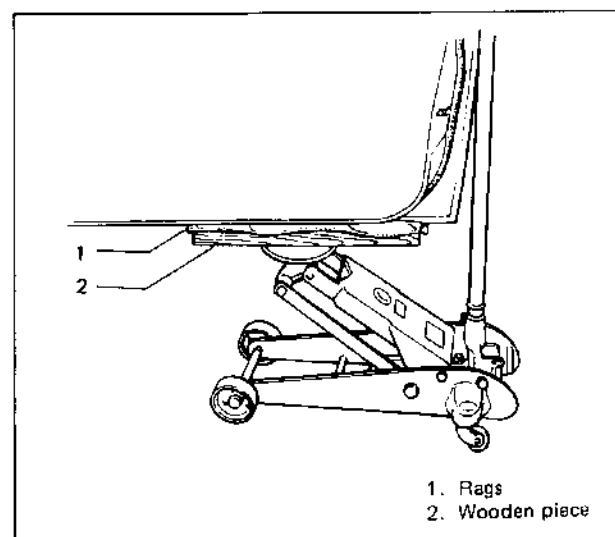


Fig. 9-24

**INSTALLATION**

Reverse removal sequence to install front door.

- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.
- After installing, adjust door latch striker position by referring to FRONT DOOR LOCK INSTALLATION section so that door is positioned correctly.

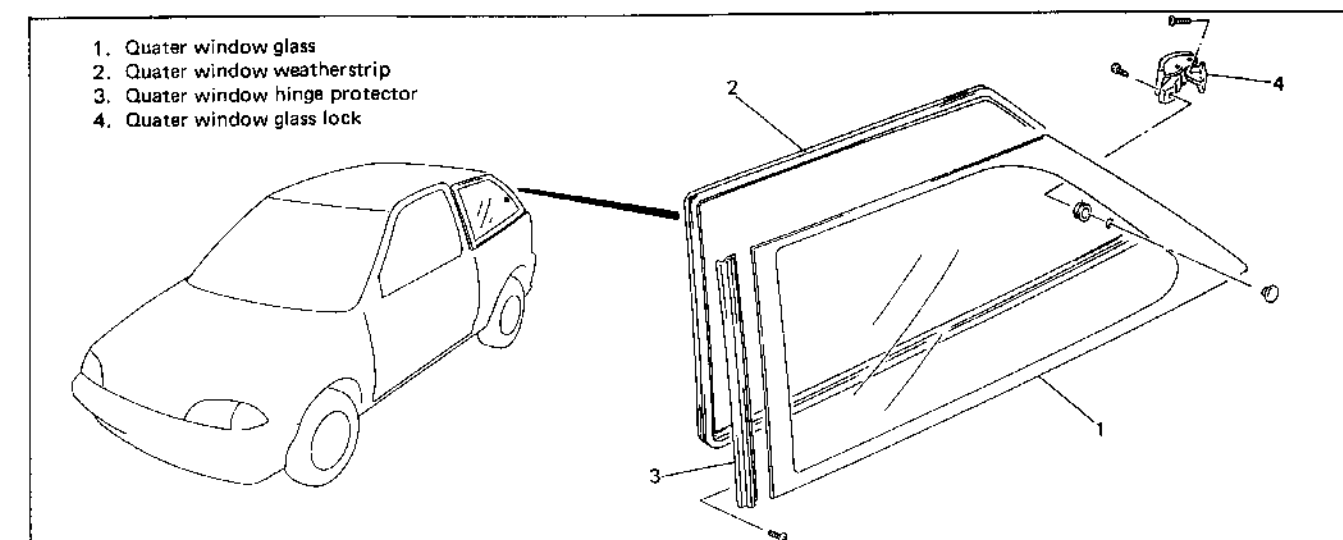
**REAR QUARTER WINDOW**

Fig. 9-25 Quarter Vent Window Assembly

Quarter window is adhered to protector.

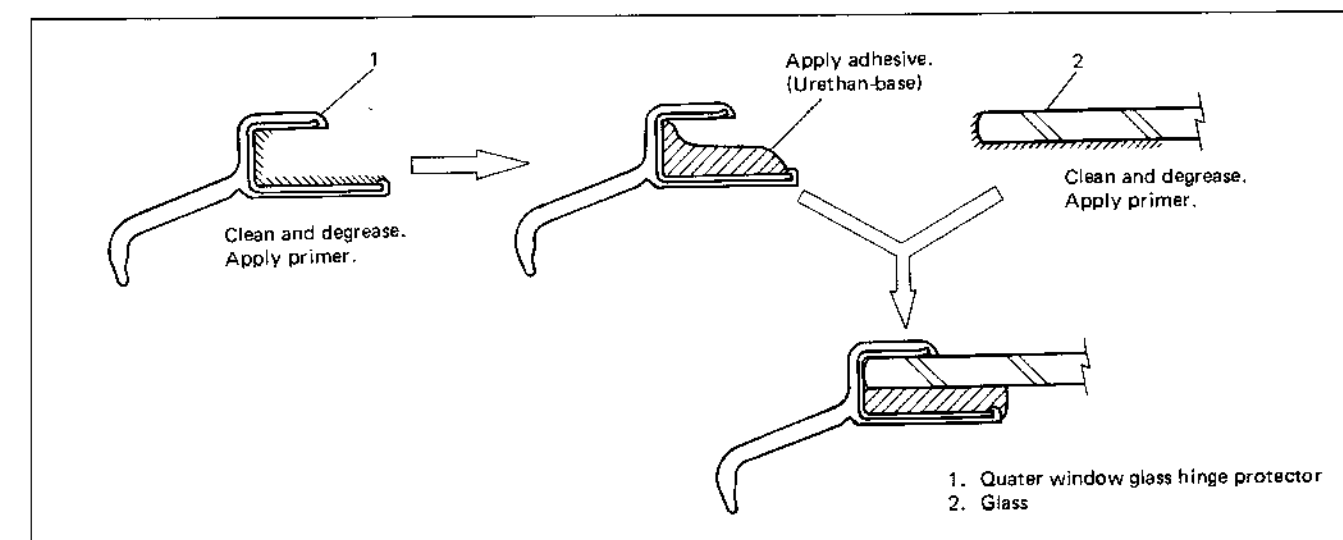
**ADHESIVE PROCEDURE**

Fig. 9-26

**REMOVAL**

- 1) Remove quarter window lock.
- 2) Remove hinge screws.

**INSTALLATION**

Reverse removal procedure.

**NOTE:**

When replacing quarter window glass with new one, be sure to use new hinge protector.

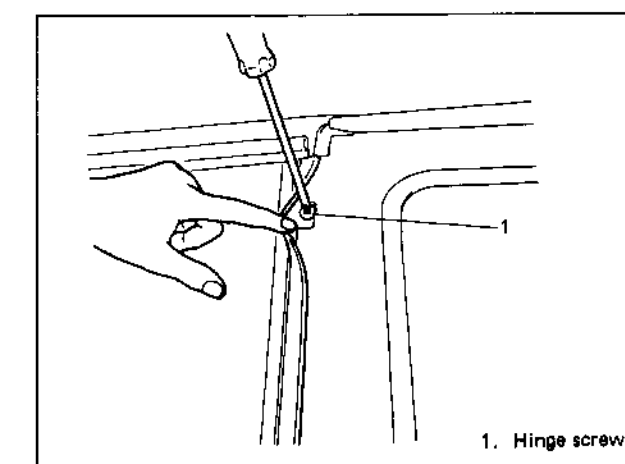


Fig. 9-27

## FRONT WINDOW

The front window is installed by using a special type of adhesive (that is, one component urethane adhesive used with primer). For window glass replacement, it is important to use an adhesive which provides sufficient adhesion strength and to follow the proper procedure.

### CAUTION:

Described here is the glass replacement by using one component urethane adhesive to be used with primer in combination. Each adhesive has its own drying and setting time and must be handled and used in a certain specific procedure. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.

Use an adhesive of above mentioned type which has following property.

|                   |                                                            |
|-------------------|------------------------------------------------------------|
| Shearing strength | 40 kg/cm <sup>2</sup> or more<br>(569 lb/in <sup>2</sup> ) |
|-------------------|------------------------------------------------------------|

Adhesive materials and tools required for removal and installation

- One component urethane adhesive and primers used in combination (For one sheet of window glass).
- Adhesive (600 g (21.2 oz.))
- Primer for glass (20 g (0.7 oz.))
- Primer for body (20 g (0.7 oz.))
- Eyeleteer
- Piano string
- Brush for primer application (2 pcs)
- Knife
- Rubber sucker grip
- Sealant gun (for filling adhesive)
- Putty spatula (for correcting adhered parts)

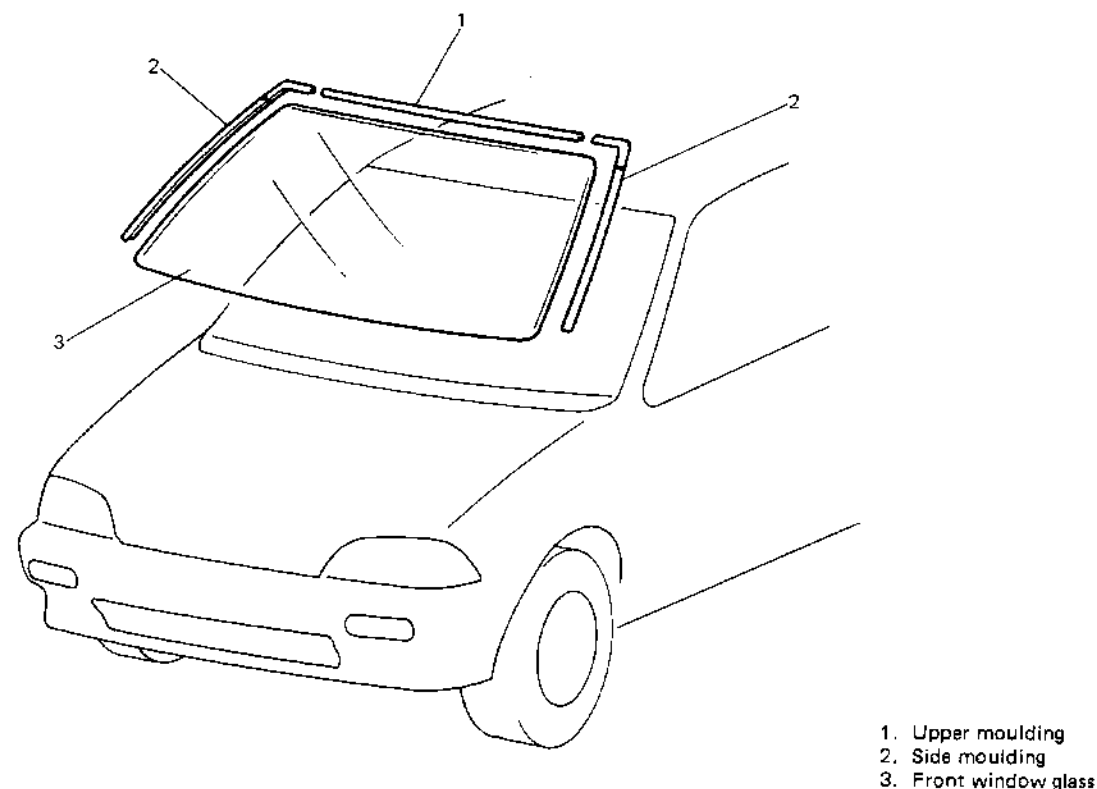


Fig. 9-28 Front Window

### REMOVAL

- 1) Clean both inside and outside of glass and around it.
- 2) Remove wiper arms, garnish and spacers.
- 3) Remove moulding and moulding joints by cutting with knife.
- 4) Using tape, cover body surface around front window glass to prevent any damage.
- 5) Remove room mirror, sunshades, and front pillar trims (right & left).
- 6) Warm up front part of roof lining. Then, remove front side rib of roof lining from between front glass and body.

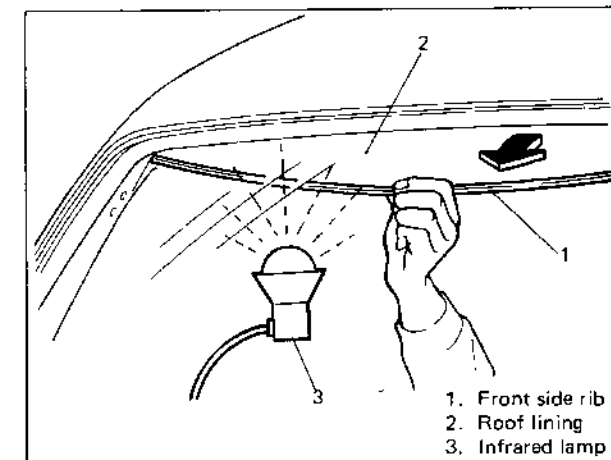


Fig. 9-29

- 7) Drill hole with eyeleteer through adhesive and let piano string through it.

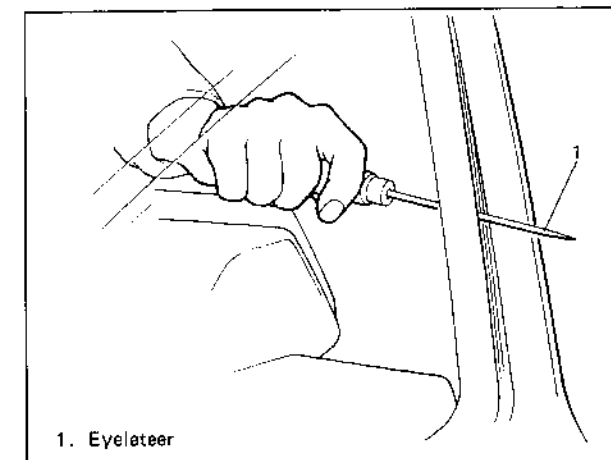


Fig. 9-30

- 8) Cut adhesive all around front glass with piano string.

### NOTE:

Use piano string as close to glass as possible so as to prevent damage to body.

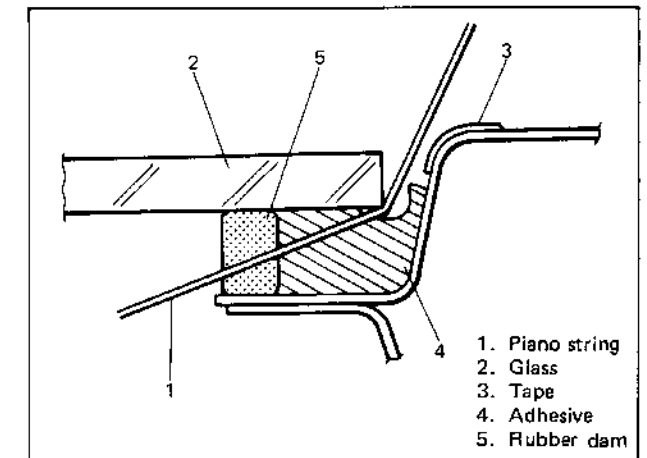


Fig. 9-31

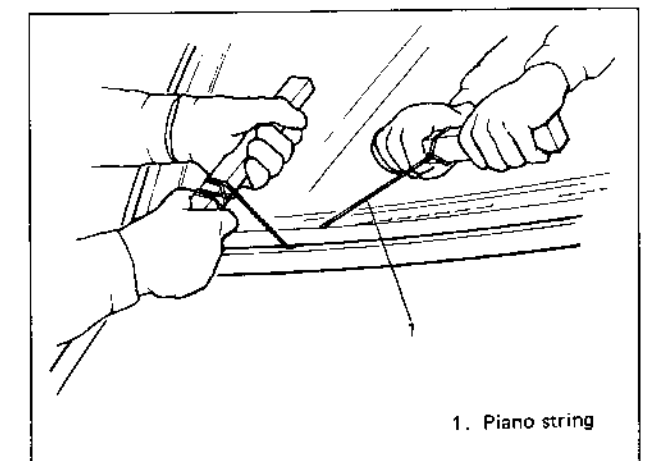


Fig. 9-32

- 9) Using knife, smooth adhesive remaining on body side so that it is 1 – 2 mm thick all around.

### NOTE:

Before using knife, clean it with alcohol or the like to remove oil from it.

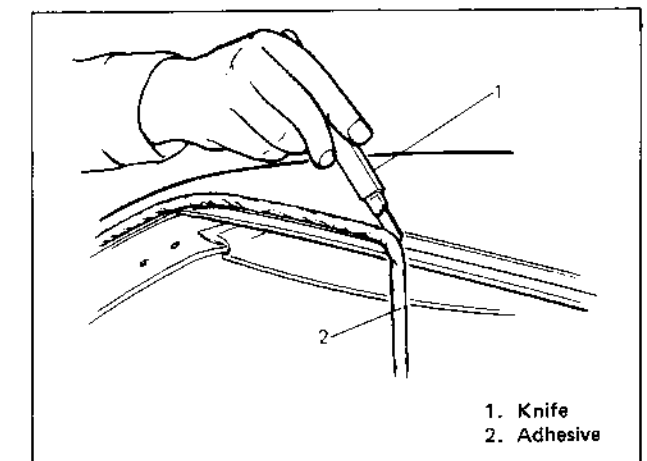


Fig. 9-33

- 10) When re-using glass, remove adhesive from glass, using care not to damage primer coated surface.

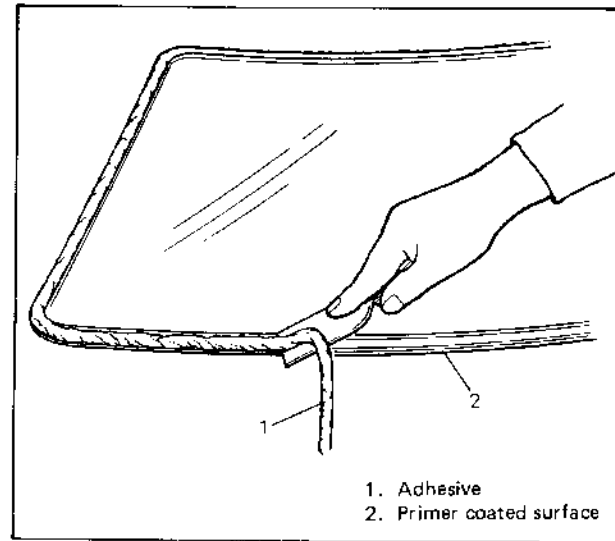


Fig. 9-34

### INSTALLATION

- 1) Using cleaning solvent, clean window edge where window glass is to be adhered. (Let it dry for more than 10 minutes.)
- 2) Peel paper from one side of new rubber dam and attach that side to upper side of window.

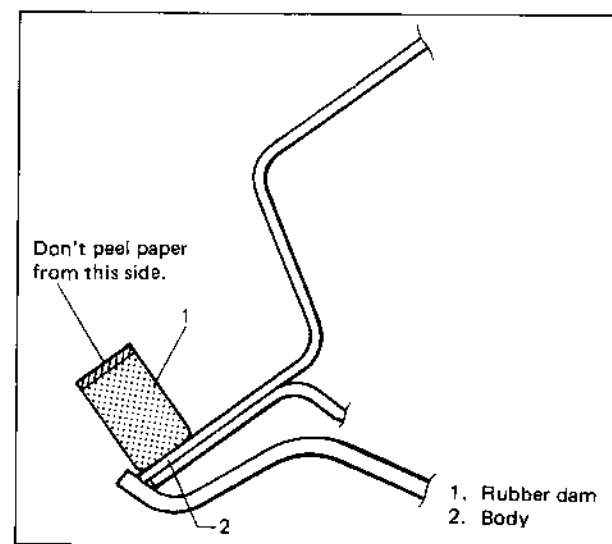


Fig. 9-35

- 3) Install spacers (2 pcs) to lower side of front window.
- 4) To determine installing position of glass to body, position glass against body so that clearance between upper end of glass and body is about 6 mm (0.236 in) and clearances between each side end (right & left) of glass and body are even. Then mark mating marks on glass and body as shown below. Upper clearance can be adjusted by moving stoppers position.

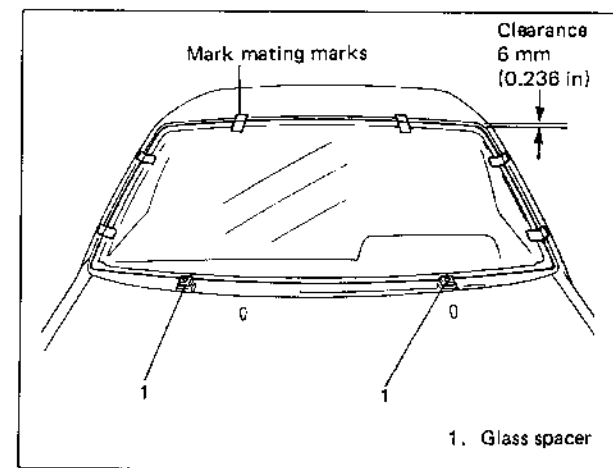


Fig. 9-36

- 5) Using new brush, apply sufficient amount of primer for body along body surface where window is to be adhered.

### NOTE:

Be sure to refer to maker's instruction for proper handling and drying time.

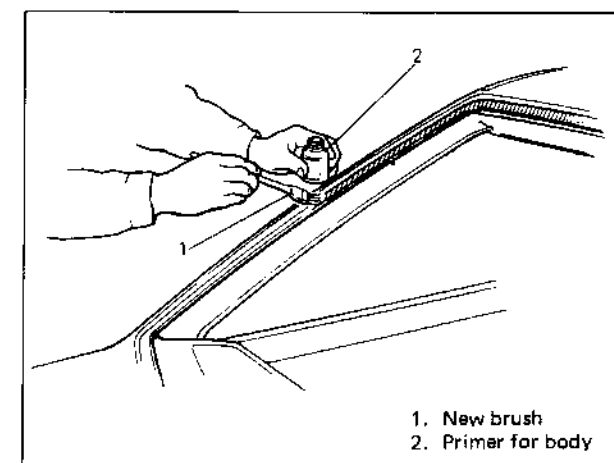


Fig. 9-37

- 6) Clean glass surface to be adhered to window with clean cloth. If cleaning solvent is used, let it dry for more than 10 minutes.
- 7) Install side mouldings to glass.
- 8) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to window.

### NOTE:

- Be sure to refer to maker's instruction for proper handling and drying time.
- Do not touch primer coated surface.

- 9) Apply adhesive referring to Fig. 9-39.

### NOTE:

- Start from bottom side of glass.
- For application of adhesive in detail, refer to Fig. 9-39.
- Be careful not to damage primer.

- Height of adhesive applied to lower side should be higher than that of other three sides.
- Press glass against body quickly after adhesive is applied.
- Use of rubber sucker grip is helpful to hold and carry glass after adhesive is applied.

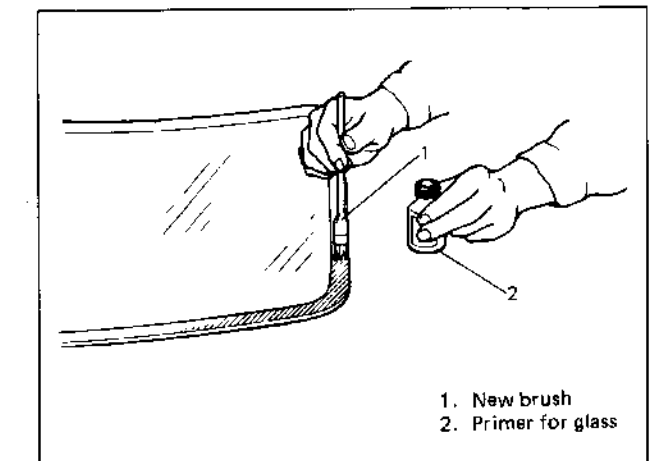


Fig. 9-38

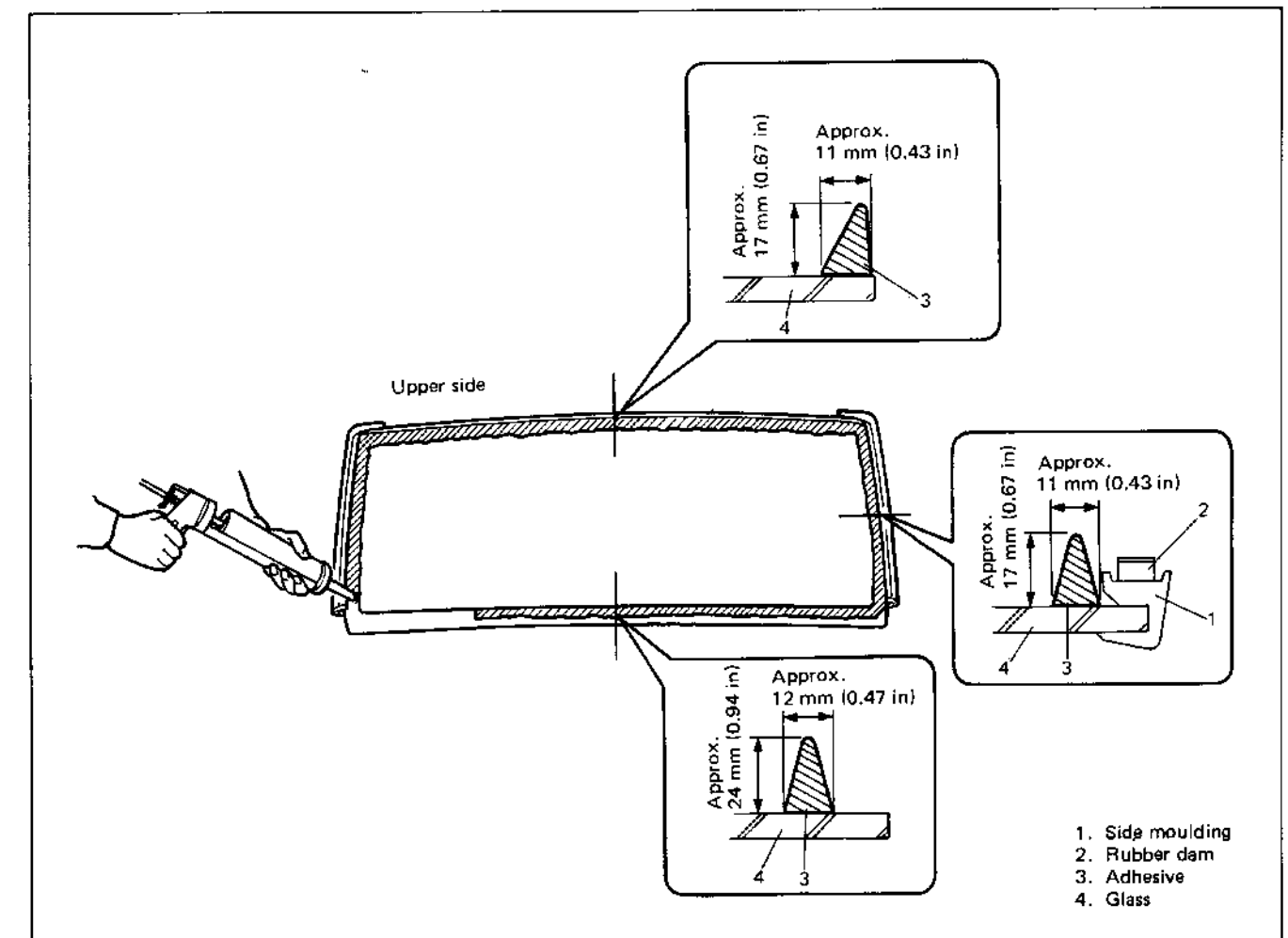


Fig. 9-39 Application of Adhesive

- 10) Peel remaining paper from rubber dam and side molding.
- 11) Holding rubber sucker grips, place glass onto body by aligning mating marks marked in step 4) and press it.

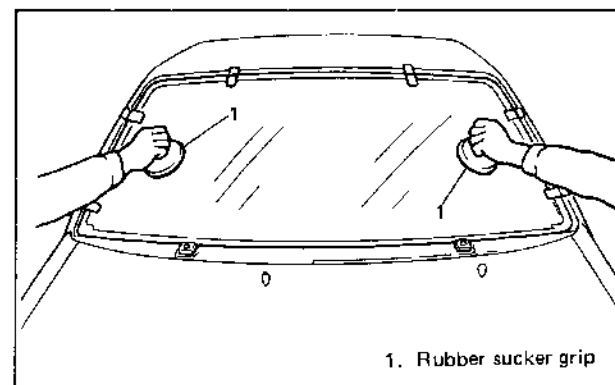


Fig. 9-40

- 12) Replace cartridge nozzle with mending nozzle and fill adhesive into underfilled part of upper section. Where adhesive is overfilled, remove excess. Also, wipe off adhesive on body and glass, if any, with cleaning solvent.

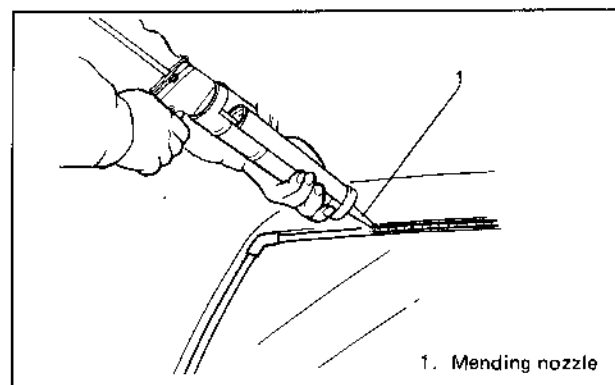


Fig. 9-41

- 13) Fit new upper moulding. Warming moulding for over half an hour at 35°C (95°F) temperature will facilitate work.

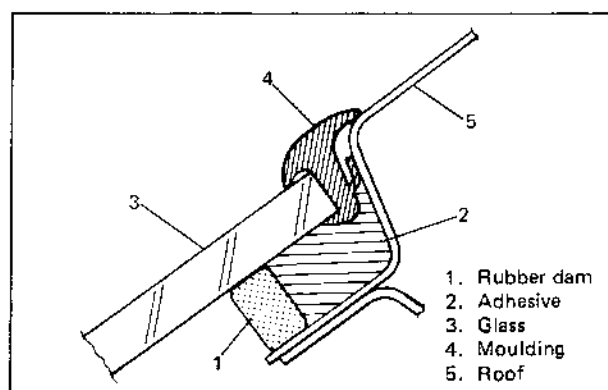


Fig. 9-42

- 14) Check for water leakage by pouring water over window through hose. If leakage is found, dry window and fill leaky point with adhesive. If water still leaks even after that, remove glass and start installation procedure all over again.

**NOTE:**

- Do not use high pressure water.
- Do not blow compressed air directly at adhesive applied part when drying.
- Do not use infrared lamp or the like for drying.

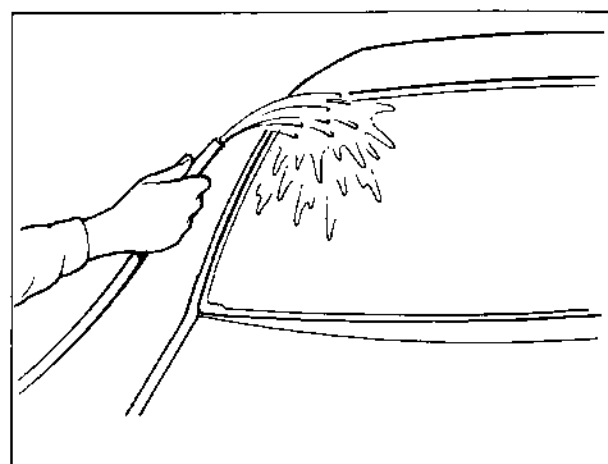


Fig. 9-43

**CAUTION:**

Upon completion of installation, note the following.

- Sudden closing of door before adhesive is completely set may cause glass to become loose or to come off. Therefore, if door is opened or closed before adhesive is completely set, make sure to open all door glasses and use proper care.
- If moulding is not securely in place, hold it down with a tape until adhesive is completely set.
- Each adhesive has its own setting time. Be sure to refer to maker's instruction, check setting time of adhesive to be used and observe precautions to be taken before adhesive is set.
- Refrain from driving till adhesive is completely set so as to ensure proper and sufficient adhesion.

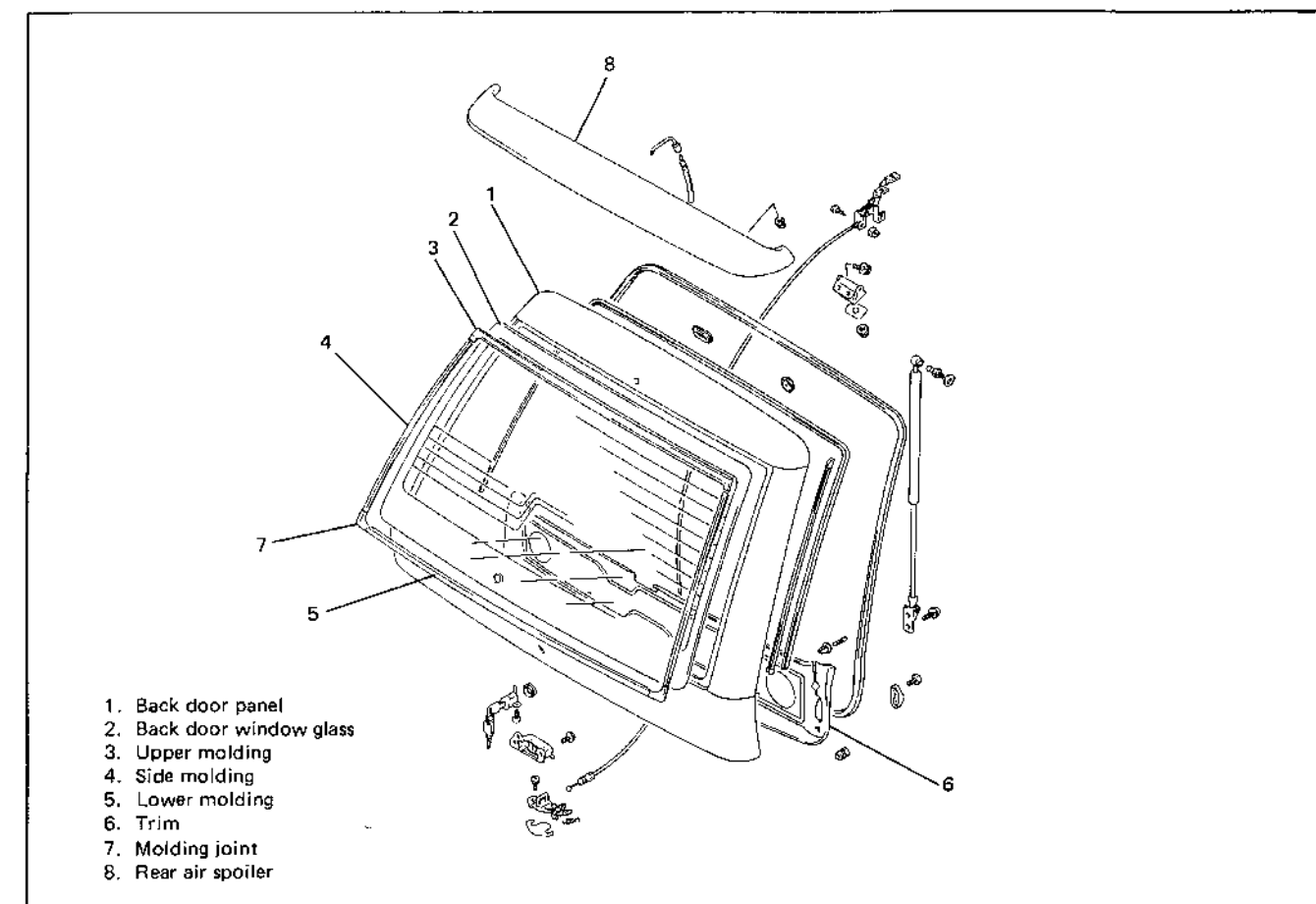
**BACK DOOR**

Fig. 9-44 Back Door Assembly

**REMOVAL**

Remove following parts.

- 1) Back door trim.
- 2) Disconnect wire harness connector inside back door to take it out from door. As to car provided with back window washer, disconnect washer hose.
- 3) Back door balancer lower (door side) fitting screws.
- 4) Door hinge bolts, and then door.

**INSTALLATION**

Reverse removal sequence noting following points.

- 1) Securely clamp wire harnesses.

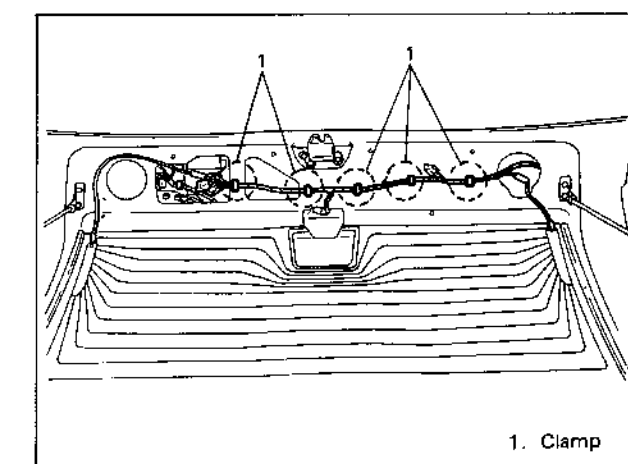


Fig. 9-45

2) Door latch striker

Adjust door latch striker so that striker shaft approximately aligns with the center of groove of door latch.

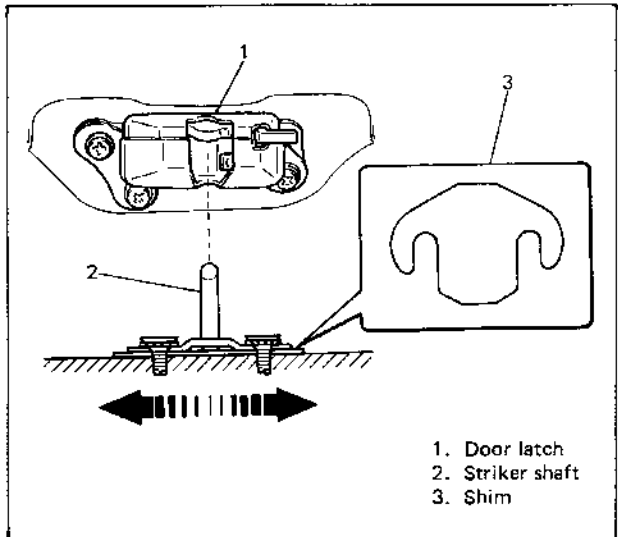


Fig. 9-46

3) To adjust door latch and striker with each other in the door up-and-down direction, insert a proper number of shims under the bottom of striker as shown below.

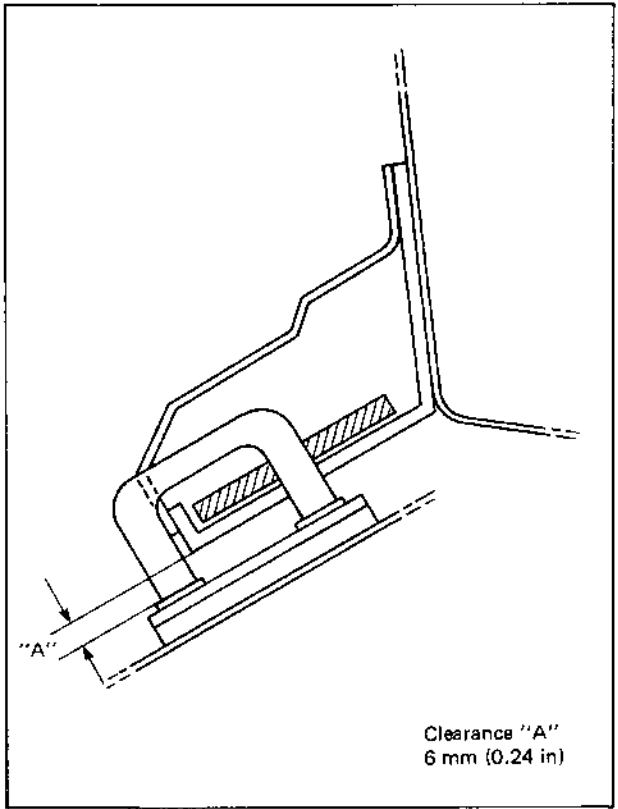


Fig. 9-47

4) Door adjustment by rubber cushion

Rubber cushion installed at each side of back door is of screw-adjustable type. Turn cushion to adjust door for proper position.

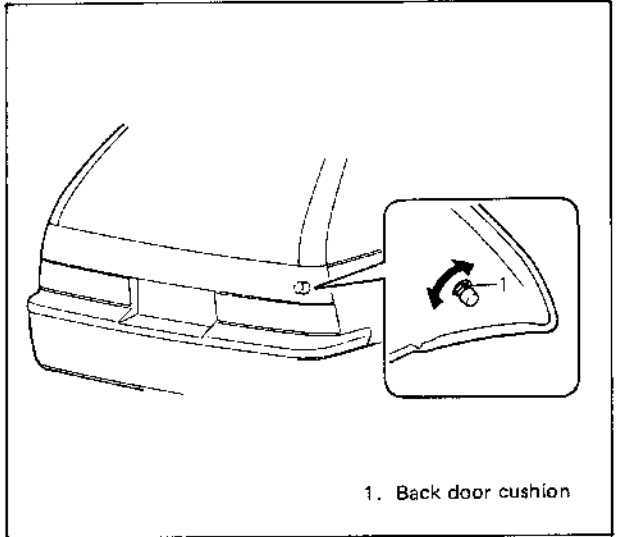


Fig. 9-48

BACK DOOR BALANCER

REMOVAL

- Remove following parts.
- 1) Rear seat belt rear anchor.
  - 2) Quarter window lock screw (body side).
  - 3) Rear pillar trim.
  - 4) Back door balancer (first at its door-side and next at its body-side).

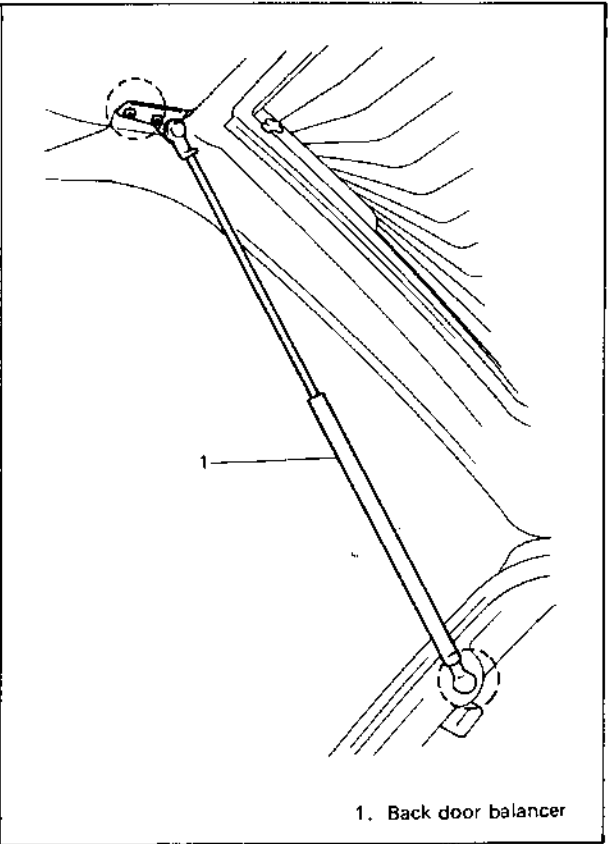


Fig. 9-49

IMPORTANT:

- Handling of Back Door Balancer (Damper)
- Do not disassemble balancer because its cylinder is filled with gas.
  - When discarding removed back door balancer (damper), envelop it, as illustrated with a vinyl bag. Then, use a 2 to 3 mm (0.08 to 0.12 in) drill to make a hole, as shown, from above through vinyl bag into balancer.
  - Handle balancer carefully. Do not scar or scratch exposed surface of its piston rod, and never allow any paint or oil to stick to its surface.
  - Do not turn piston rod with balancer fully extended.

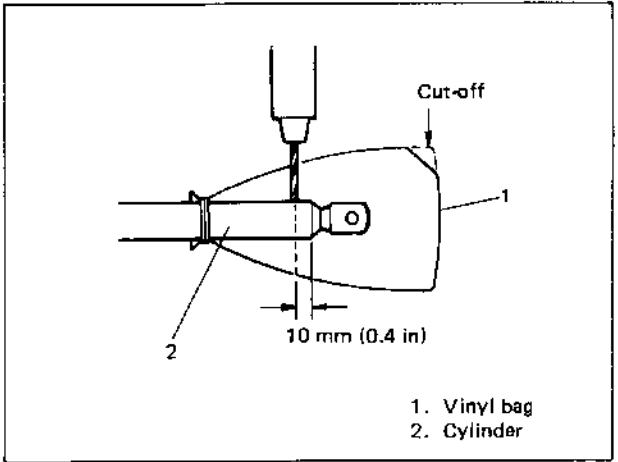


Fig. 9-50

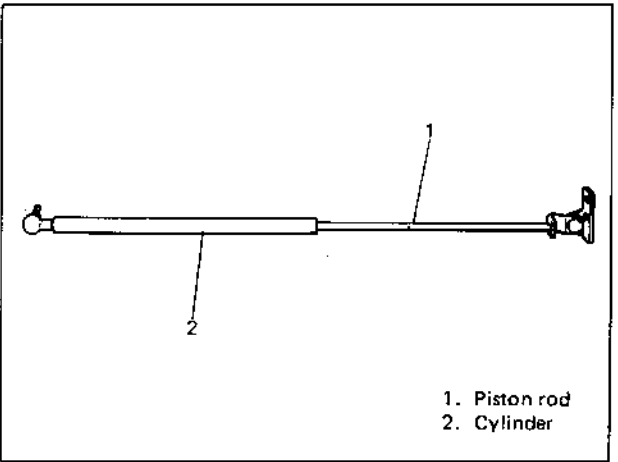


Fig. 9-51

INSTALLATION

Reverse removal sequence to install back door.

|                                                 | N-m     | kg-m      | lb-ft       |
|-------------------------------------------------|---------|-----------|-------------|
| Tightening torque for rear anchor mounting bolt | 40 - 50 | 4.0 - 5.0 | 29.0 - 36.5 |



**BACK DOOR GLASS (Fig. 9-44)**

Back door glass is installed by using a special type of adhesive (that is, one component urethane adhesive used with primer). For back door glass replacement, it is important to use an adhesive which provides sufficient adhesion strength and to follow the proper procedure.

**CAUTION:**

Described here is the glass replacement by using one component urethane adhesive to be used with primer in combination. Each adhesive has its own drying and setting time and must be handled and used in a certain specific procedure. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.

Use an adhesive of above mentioned type which has following property.

|                   |                                                            |
|-------------------|------------------------------------------------------------|
| Shearing strength | 40 kg/cm <sup>2</sup> or more<br>(569 lb/in <sup>2</sup> ) |
|-------------------|------------------------------------------------------------|

Adhesive materials and tools required for removal and installation

- One component urethane adhesive and primers used in combination (For one sheet of window glass).
- Adhesive (410 g (14.5 oz.))
- Primer for glass (20 g (0.7 oz.))
- Primer for body (20 g (0.7 oz.))
- Eyeleteer
- Piano string
- Brush for primer application (2 pcs)
- Knife
- Rubber sucker grip
- Sealant gun (for filling adhesive)
- Putty spatula (for correcting adhered parts)

**REMOVAL**

- 1) Clean both inside and outside of glass and around it.
- 2) Remove wiper arms.
- 3) Remove moulding and moulding joint by cutting with knife.
- 4) Using tape, cover body surface around back door glass to prevent any damage.
- 5) Remove back door trim, rear wiper motor ass'y and high mounted stop lamp.
- 6) Drill hole with eyeleteer through adhesive and let piano string through it.
- 7) Cut adhesive all around glass with piano string (refer to front window section).

**NOTE:**

Use piano string as close to glass as possible so as to prevent damage to body.

- 8) Using knife, smooth adhesive remaining on body side so that it is 1 – 2 mm thick all around.

**NOTE:**

Before using knife, clean it with alcohol or the like to remove oil from it.

- 9) When re-using glass, remove adhesive from glass, using care not to damage primer coated surface.

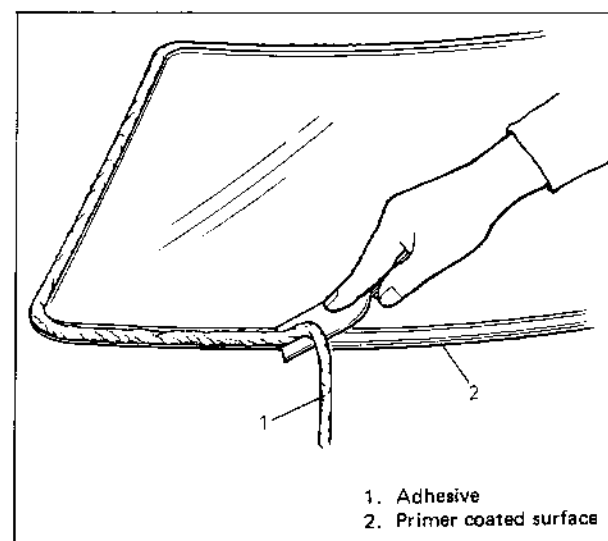


Fig. 9-52

**INSTALLATION**

- 1) Using cleaning solvent, clean window edge where window glass is to be adhered. (Let it dry for more than 10 minutes.)
- 2) Install new back door window trim to window (Don't peel off paper of trim at this stage).
- 3) Using new brush, apply sufficient amount of primer for body along body surface where window is to be adhered.

**NOTE:**

Be sure to refer to maker's instruction for proper handling and drying time.

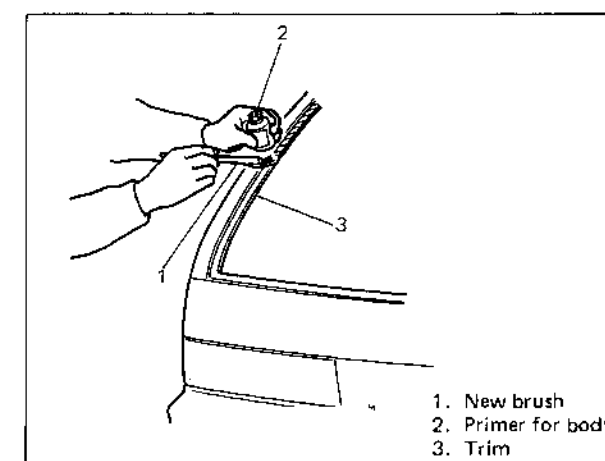


Fig. 9-53

- 4) Clean glass surface to be adhered to window with clean cloth. If cleaning solvent is used, let it dry for more than 10 minutes.
- 5) Install lower moulding to glass (Don't peel off paper of moulding at this stage).

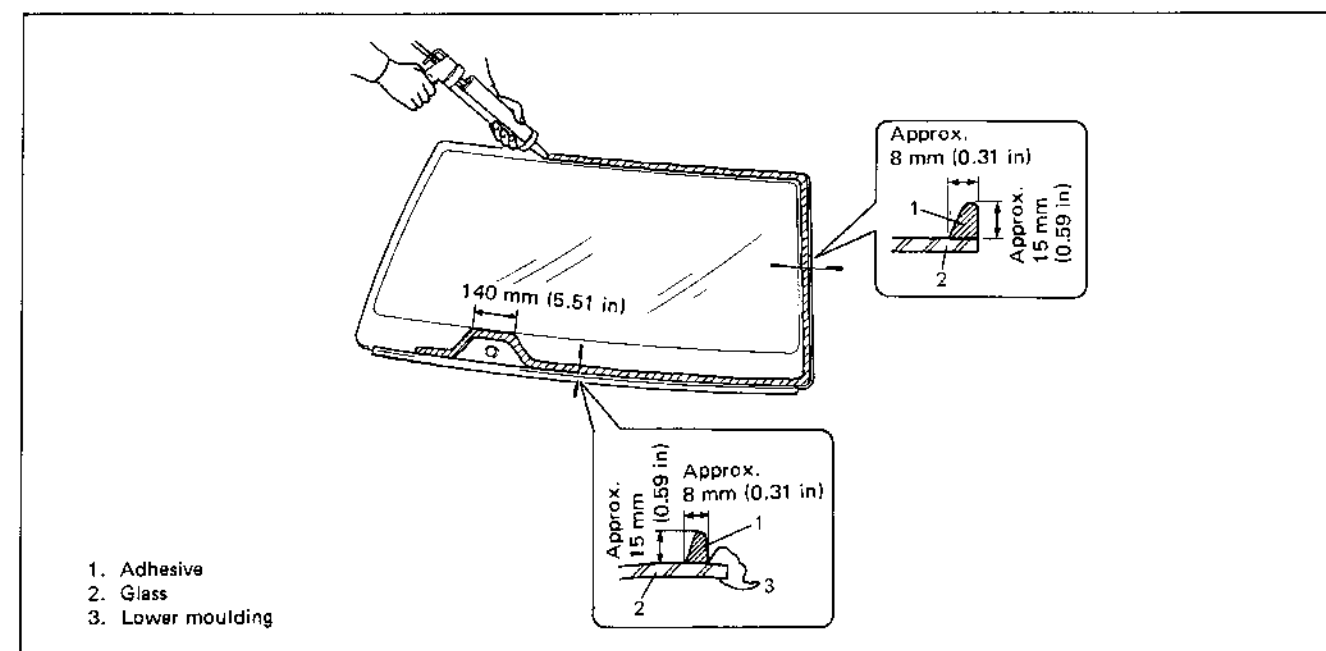


Fig. 9-55

- 6) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to window.

**NOTE:**

- Be sure to refer to maker's instruction for proper handling and drying time.
- Do not touch primer coated surface.

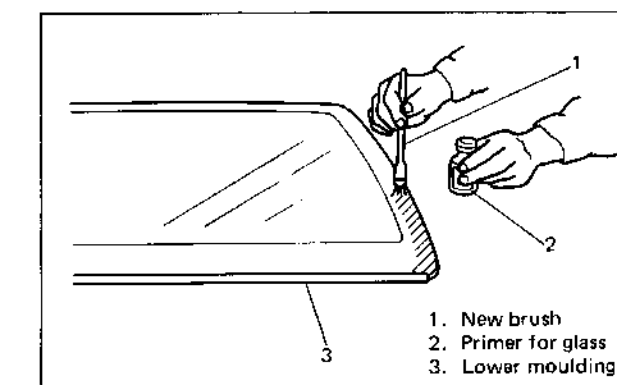


Fig. 9-54

- 7) Apply adhesive along glass edge and lower moulding as shown.

**NOTE:**

- Start from bottom side of glass.
- Height of applied adhesive should exceed that of trim and moulding.
- Adhesive should be applied evenly especially in height.
- Be careful not to damage primer.
- Press glass against body quickly after adhesive is applied.

- Use of rubber sucker grips is helpful to hold and carry glass after adhesive is applied.

8) Peel paper from lower moulding and window trim.

9) Holding rubber sucker grips, press glass against door so that clearances A and B become even.

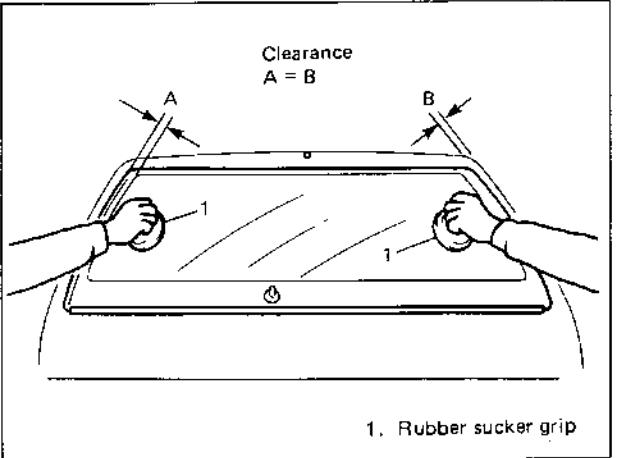


Fig. 9-56

10) Replace cartridge nozzle with mending nozzle and fill adhesive into underfilled part of upper section. Where adhesive is overfilled, remove excess. Also, wipe off adhesive on body and glass, if any, with cleaning solvent.

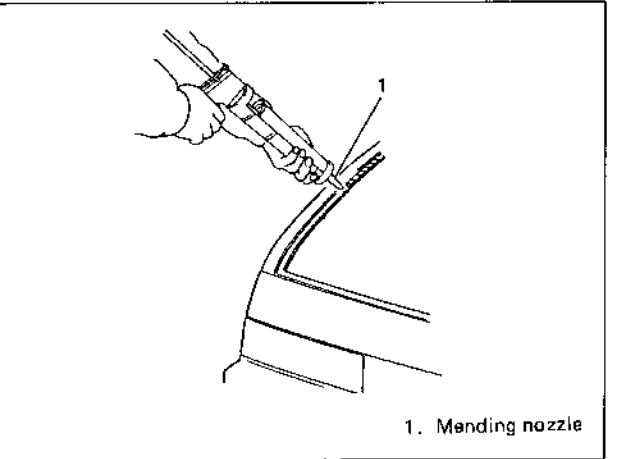


Fig. 9-57

11) Fit new side and upper mouldings. Warming mouldings for over half an hour at 35°C (95°F) temperature will facilitate work.

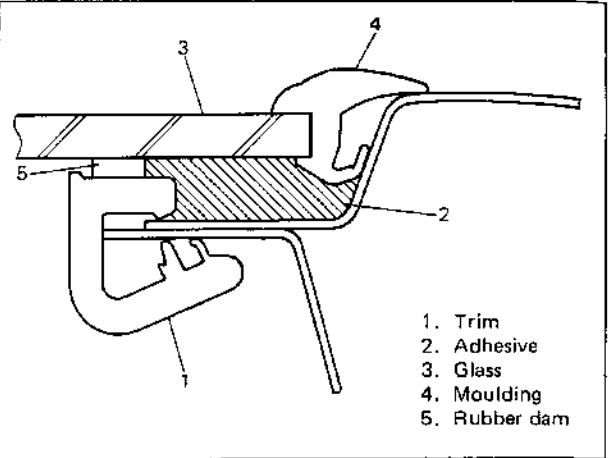


Fig. 9-58

12) Check for water leakage by pouring water over window through hose. If leakage is found, dry window and fill leaky point with adhesive. If water still leaks even after that, remove glass and start the installation procedure all over again.

**NOTE:**

- Do not use high pressure water.
- Do not blow compressed air directly at adhesive applied part when drying.
- Do not use infrared lamp or the like for drying.

**CAUTION:**

Upon completion of installation, note the following.

- Sudden closing of door before adhesive is completely set may cause glass to become loose or to come off. Therefore, if door is opened or closed before adhesive is completely set, make sure to open all door glasses and use proper care.
- If moulding is not securely in place, hold it down with a tape until adhesive is completely set.
- Each adhesive has its own setting time. Be sure to refer to maker's instruction, check setting time of adhesive to be used and observe precautions to be taken before adhesive is set.
- Refrain from driving till adhesive is completely set so as to ensure proper and sufficient adhesion.

# SEATS

## FRONT SEAT

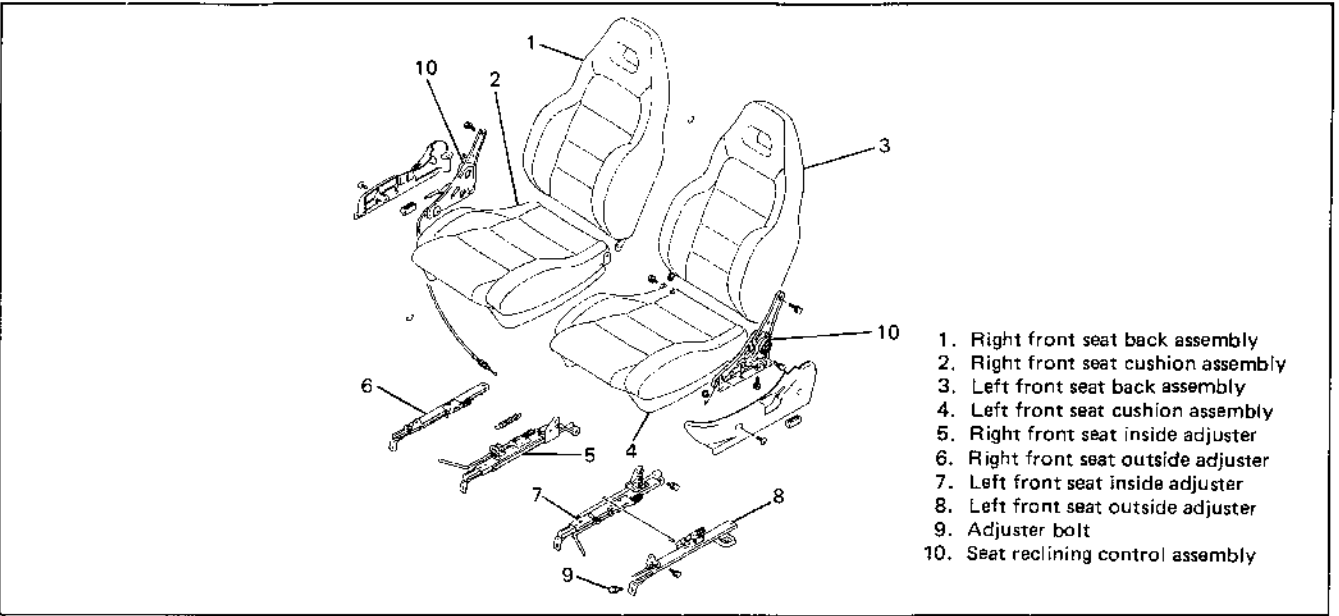


Fig. 9-59 Front Seat Assembly

**REMOVAL**

- 1) Remove five seat rail mounting bolts. Then, remove seat ass'y with seat rail.
- 2) Disassemble and repair seat as necessary.

**INSTALLATION**

Reverse removal procedure to install front seat. Torque to specifications, as given at the right.

| Tightening torque                                 | N-m     | kg-m      | lb-ft       |
|---------------------------------------------------|---------|-----------|-------------|
| • Seat mounting bolt (8 mm)                       |         |           |             |
| • Reclining device tightening bolt and nut (8 mm) | 15 - 20 | 1.5 - 2.0 | 11.0 - 14.0 |
| Seat mounting bolt (10 mm)                        |         |           |             |

## REAR SEAT

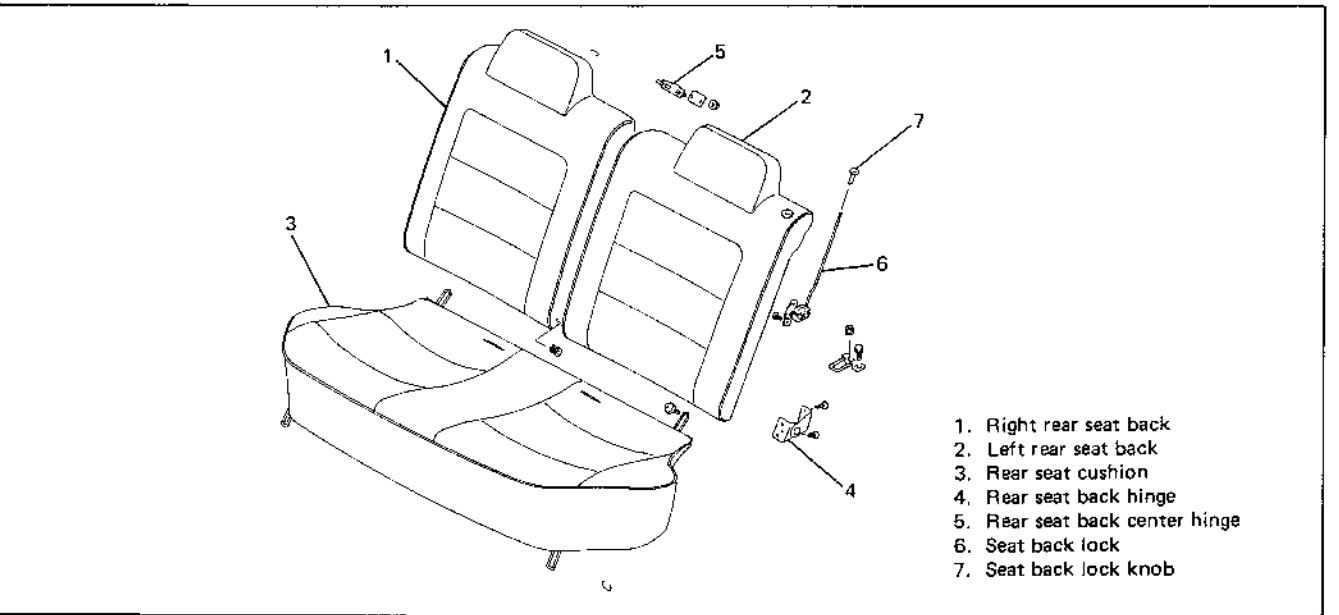


Fig. 9-60 Rear Seat Assembly



REAR SEAT CUSHION

REMOVAL

- 1) Remove seat cushion fitting screws.
- 2) Raise the front portion of seat cushion to remove rear seat cushion.

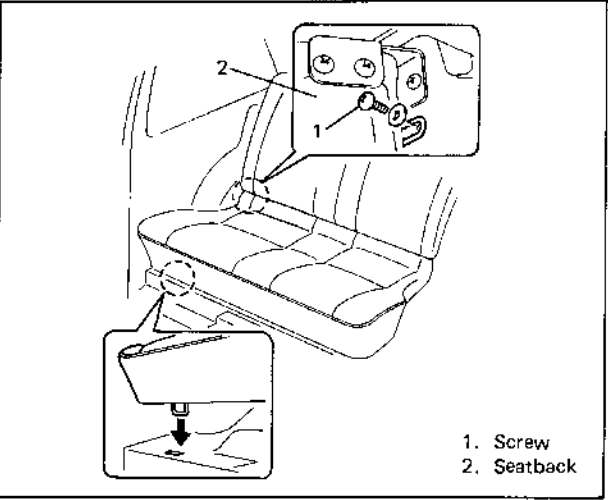


Fig. 9-61 Rear Seat Cushion Removal

INSTALLATION

Reverse removal procedure to install rear seat cushion.

REAR SEATBACK

REMOVAL

- 1) Remove spare tire (separate type seatback).
- 2) Remove seatback by removing its fitting nuts and screws.

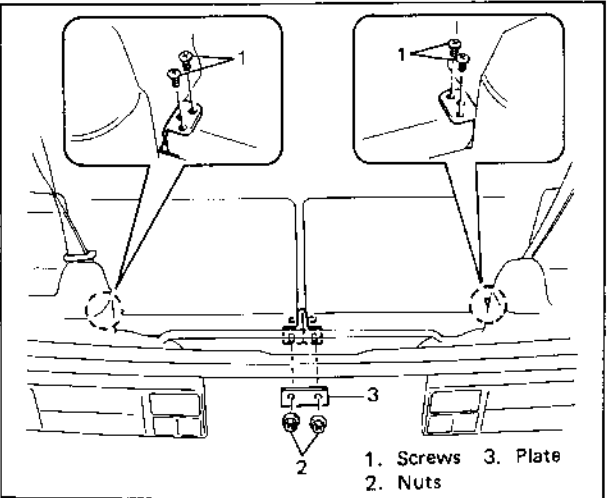


Fig. 9-62

INSTALLATION

Reverse removal procedure to install rear seatback.

SEAT BELTS (Fig. 9-63)

DESCRIPTION

The seat belt for driver's seat is provided with an Emergency Locking Retractor (ELR) and each seat belt for front and rear passenger's seats is provided an Emergency and Auto Locking Retractor (E-ALR, which works as an ELR till its webbing is pulled all the way out and then on as an ALR till it is retracted fully).

**ELR :** Locks the seat belt (to prevent the webbing from being pulled out of the retractor any further) as soon as any one of the following specified conditions is detected. The conditions are the speed at which the webbing is pulled out of the retractor, acceleration or deceleration of the car speed and inclination.

**ALR:** Automatically locks when the webbing is pulled out from the retractor and allowed to retract even a little. Then the webbing can not be pulled out any further, unless it is wound all the way back into the retractor, which releases the lock and allows the webbing to be pulled out.

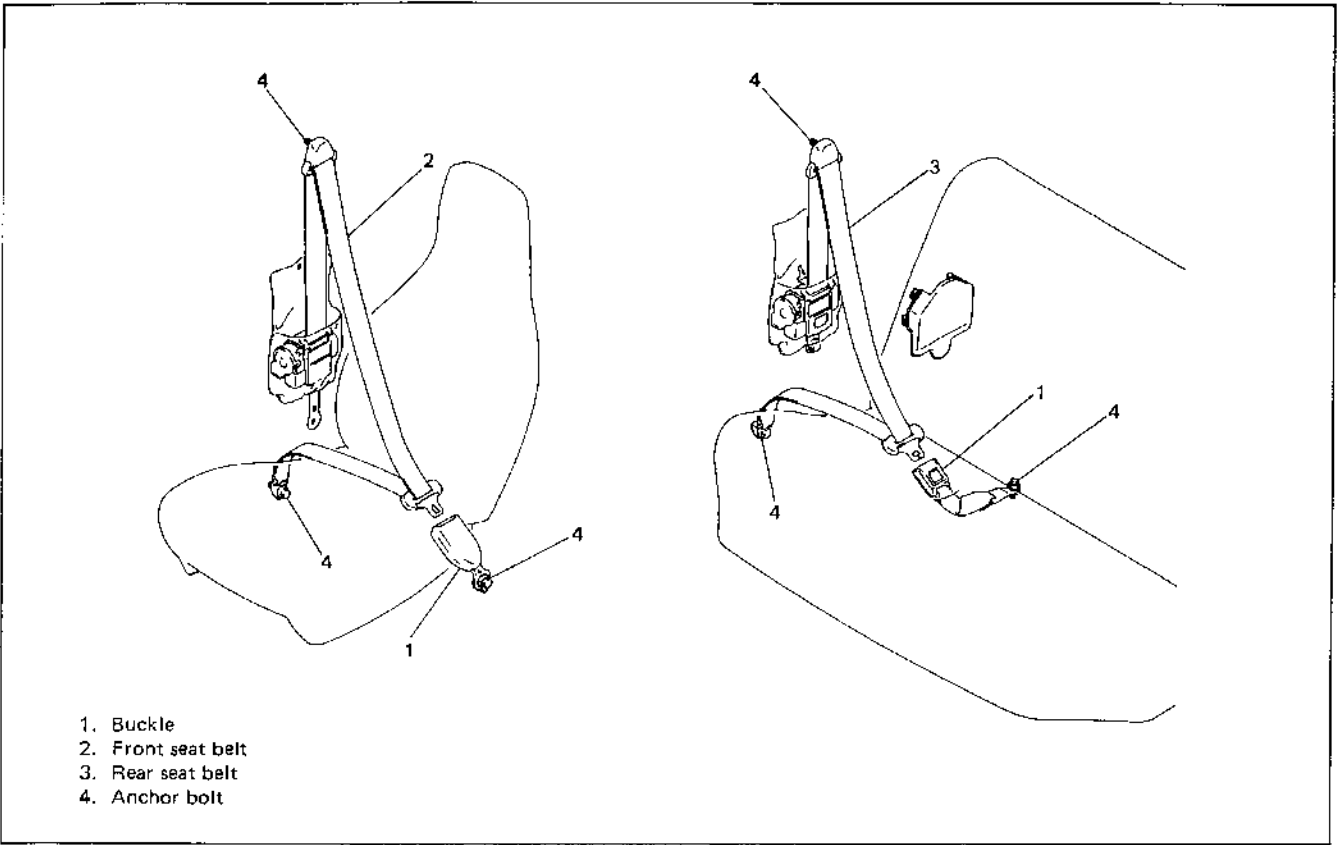


Fig. 9-63 Front and Rear Seat Belt Assemblies

SERVICING SEAT BELTS

Before servicing or replacing seat belts, refer to following precautionary items.

- 1) Seat belts should be normal relative to strap retractor and buckle portions.
- 2) Keep sharp edges and damaging objects away from belts.
- 3) Avoid bending or damaging any portion of belt buckle or latch plate.
- 4) Do not bleach or dye belt webbing. (Use only mild soap and lukewarm water to clean it.)
- 5) When installing a seat belt anchor bolt, start bolt by hand to prevent cross-threading.
- 6) Do not attempt any repairs on retractor mechanisms or retractor covers. Replace defective assemblies with new replacement parts.
- 7) Keep belts dry and clean at all times.
- 8) If there exist any parts in question, replace such parts.
- 9) Replace belts whose webbing is cut or otherwise damaged.
- 10) Do not put anything into trim panel opening which seat belt webbing passes through.

REMOVAL AND INSTALLATION

Refer to above figure to remove and install front and rear seat belts.

NOTE:

Be sure to tighten seat belt anchor bolts to below specified torque. Seat belt anchor bolt should have an unified coarse thread (7/16 – 20 UNF). Under no circumstances should any different sized or metric screw threads be used.

|                                             | N·m     | kg·m      | lb·ft       |
|---------------------------------------------|---------|-----------|-------------|
| Tightening torque for seat belt anchor bolt | 40 – 50 | 4.0 – 5.0 | 29.0 – 36.0 |

**INSPECTION**

Seat belts and attaching parts can affect the vital components and systems of a car.

Therefore, they should be inspected carefully and replaced with genuine parts only.

**1) Seat belt**

Its webbing or strap should be free from damage.

**2) Retractor**

It should lock webbing when pulled quickly.

The front seat belt retractor should pass the above inspection and should lock webbing even when tilted (approx. 15°) toward the fore and aft or right and left directions.

**3) Anchor bolt**

Anchor bolts should be torqued to specification.

**4) Belt latch**

It should be secure when latched.

**5) Warning system**

Check driver's seat belt strap switch.

For the details of seat belt warning system, refer to the section "ELECTRICAL SYSTEM".

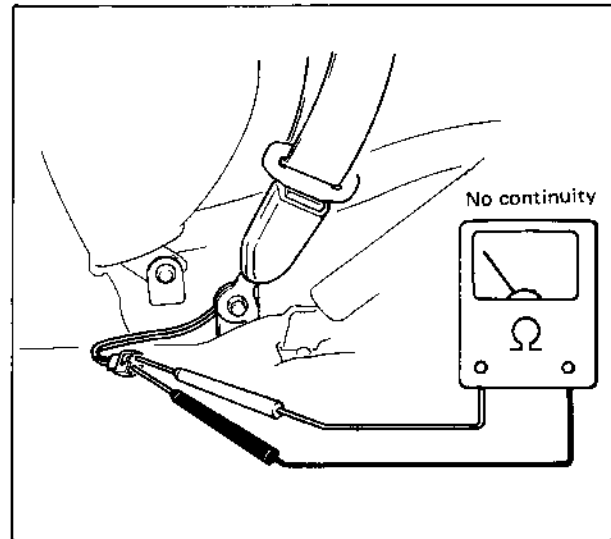


Fig. 9-64 Belt Latch "ON" Check

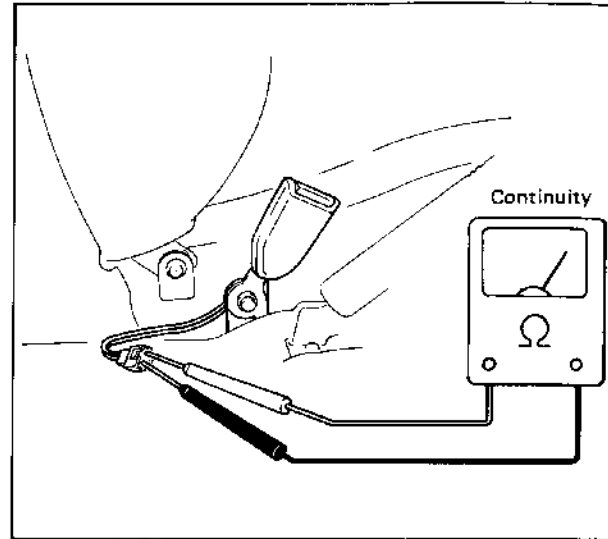


Fig. 9-65 Belt Latch "OFF" Check

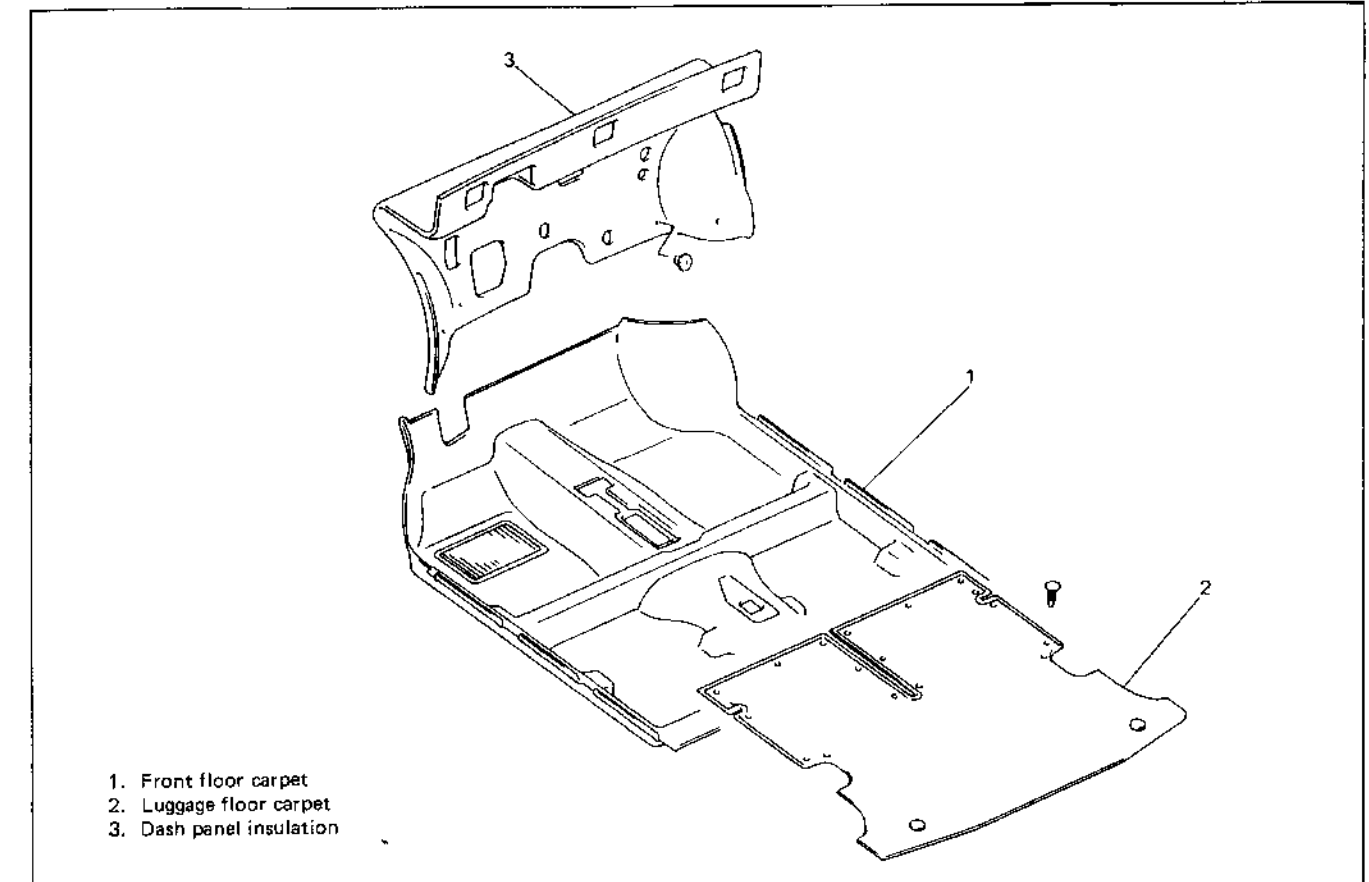
**FLOOR CARPET**

Fig. 9-66 Front and Rear Floor Carpets

**FRONT AND REAR FLOOR CARPETS****REMOVAL**

Remove following parts:

- 1) Front and rear seat cushions.
- 2) Seat belt anchorage hooks.
- 3) Sill scuffs.
- 4) Dash side trims.
- 5) Rear side trims.
- 6) Console box, gear shift lever cover and parking brake lever cover.
- 7) Front and rear floor carpets.

**INSTALLATION**

Reverse removal sequence to install front and rear floor carpets.

**LUGGAGE FLOOR CARPET**

Luggage floor carpet is fixed to floor with clips.

**REMOVAL**

Detach clips, using care not to pull up carpet with force and break clips.

**INSTALLATION**

Reverse removal sequence to install luggage floor carpet.

## HEAD LINING

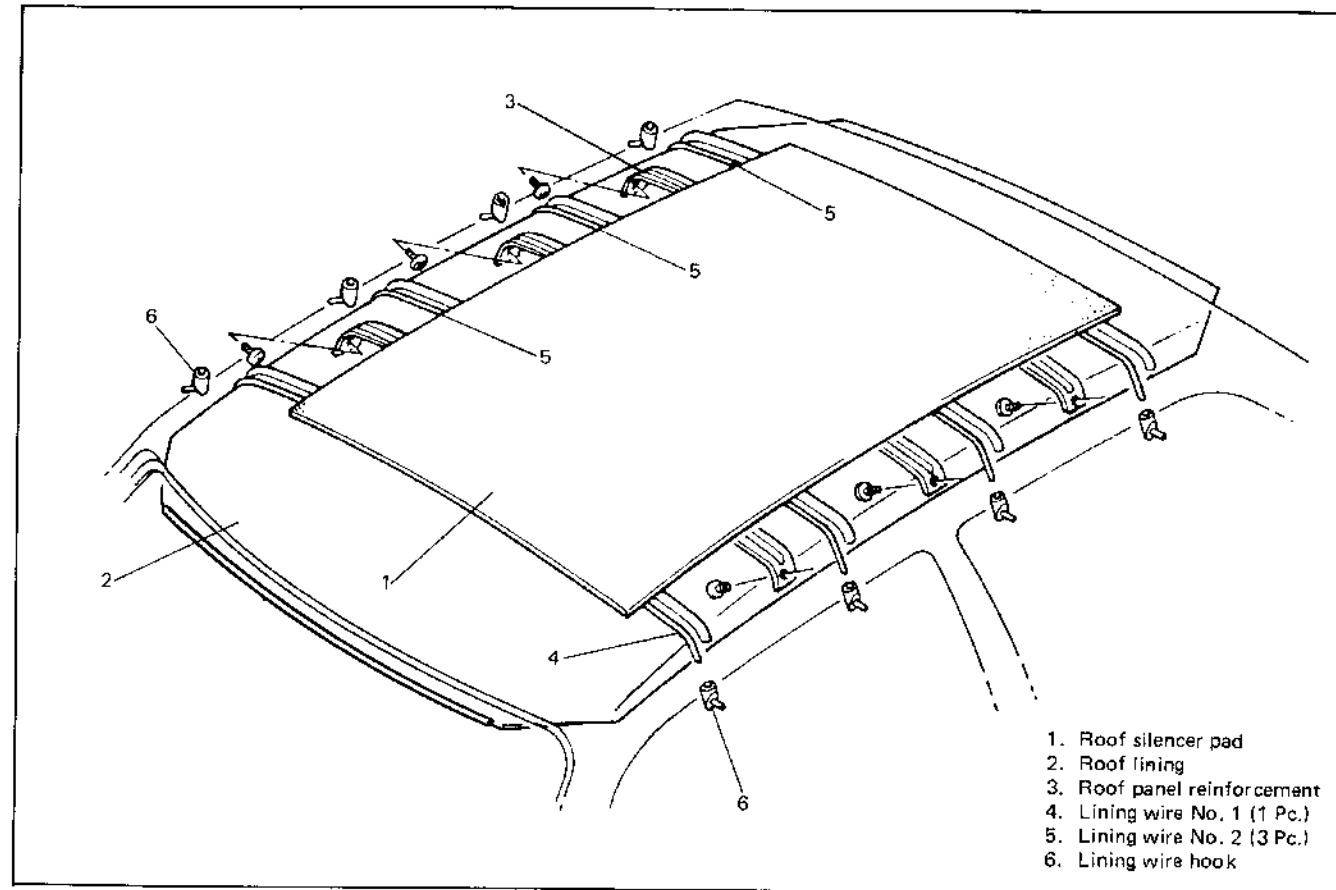


Fig. 9-67 Head Lining Assembly

### REMOVAL

Remove following parts:

- 1) Inside rear view mirror.
- 2) Sunshade assembly.
- 3) Dome lamp.
- 4) Assist grip.
- 5) Door, quarter window, and back window windlances and weatherstrips.
- 6) Pillar trims.
- 7) Head lining.

Adhesive used for securing head lining and roof silencer in place should be cleaned with solvent.

### INSTALLATION

- 1) Affix a two-side bondable tape to upper side of each flange.

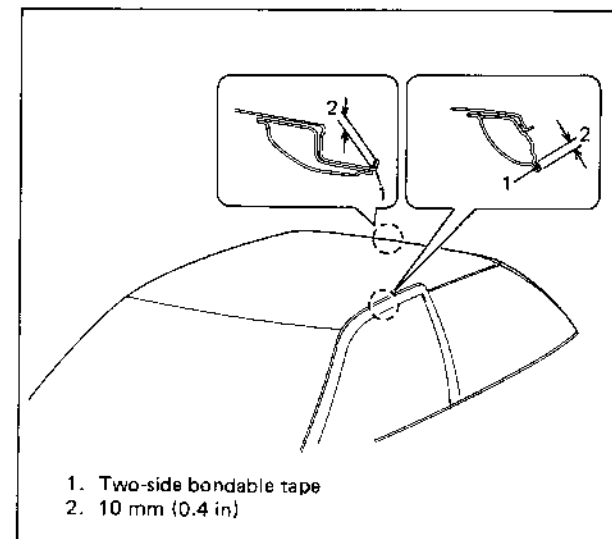


Fig. 9-68 Two-Side Bondable Tape Application

Two-side bondable tape should be affixed no further than 10 mm from the end of flange.

- 2) Take out dome lamp harness lead wire from roof lining hole to the room interior-side.
- 3) Use roof lining's mating mark (roof lining-to-roof panel mating mark) as a guide to pull roof lining backward.
- 4) Pull roof lining at its end so it is free from wrinkles and fix it to adhesive tape (two-side bondable tape) previously affixed to flange portion.
- 5) Use an infrared lamp and warm up roof lining for 30 to 60 seconds to remove wrinkles from it.

### NOTE:

Use infrared lamp for the shortest possible time only.

The assembly in the right-and-left direction should be matched with the above-mentioned assembly in the fore-and-aft direction. Pull the roof lining free from wrinkles and affix it to the adhesive tape (two-side bondable tape) affixed to the flange portion previously.

When fixing roof lining around the center pillar, use care that it is free from slits degrading its appearance.

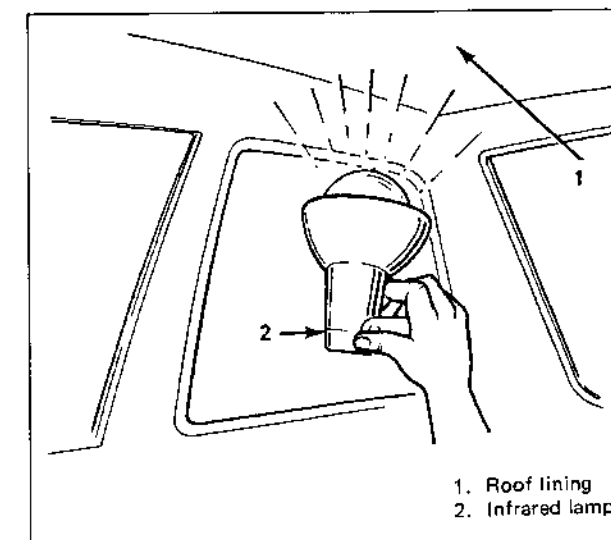


Fig. 9-69 Headlining Wrinkle Removal

### HEAD LINING HEM CUTTING

For each flange portion, roof lining should be cut with width of its bonded hem equal to or less than width of a bonding tape (max. 10 mm). Cutting lining with wider than 10 mm bonded hem adversely affects sealability of weatherstrip, causing water leakage.

Install following parts:

- 1) Weatherstrips (Doors, side windows and windlances back window)
- 2) Assist grip.
- 3) Dome lamp.
- 4) Sunshade assembly.
- 5) Inside rear view mirror.
- 6) Pillar trims.

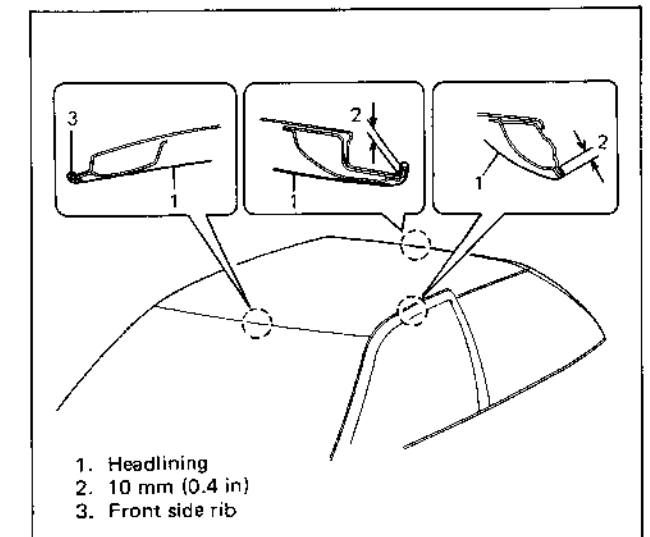


Fig. 9-70 Head Lining to Flange Overhang

## ANTI-CORROSION TREATMENT

Steel sheets used for cars are provided with corrosion resistance on its either side or both sides as rust proof treatment. These corrosion resistance steel sheet materials are called one or two-side galvanized steel sheets. They are selected for their rust protection property and further given various types of treatment depending on where they are used as described below.

- 1) Steel sheets are treated with cathodic electro-primer which is excellent in corrosion resistance.
- 2) Rust proof wax coatings are applied to door, front hood and side sill insides where moisture is liable to stay.
- 3) Vinyl coating is applied to body underside and wheel housing inside.
- 4) Chip resistant material is applied to side sill and door outside bottom areas to protect painted surface from damage due to flying stones.
- 5) Sealer is applied to door hem, engine compartment steel sheet-to-steel sheet joint, and the like portions to prevent water penetration which results in rust occurrence.

When replacing panel or repairing collision damage, leaving related area untreated as it is in any operation which does disturb any rust proof treatment described above will allow corrosion in that area. Therefore, it is important in any repair operation to properly recoat surface of related area.

Accordingly, it is the essential function of any repair operation to correctly recoat the related surfaces of the relevant area.

All metal panels are coated with metal conditioners and primer coating during car production. Following repair and/or replacement parts installation, every accessible bare metal surface should be cleaned and coated with rust proof primer. Perform this operation prior to application of sealer, rust proof wax coating and chip resistant material.

Sealer is applied to specific joints of a car during production. It prevents dust from entering car and serves also as an anticorrosive barrier. Sealer is applied to door and hood hem areas and between panels as well. Correct and reseal originally-sealed joints if damaged. Reseal attaching joints of a new replacement panel and reseal hem area of a replacement door or hood.

Use a quality sealer to seal flanged joints, overlap joints and seams. Sealer must have flexible characteristics and paintability after it's applied to repair areas.

For sealer to fill open joints, use caulking material. Select a sealer according to place and purpose of a specific use. Observe manufacturer's label-stated instructions when using sealer.

In many cases, repaired places require color painting. If so, follow ordinary techniques specified for finish preparation, color painting and undercoating build-up.

Rust proof wax, a penetrative compound, is applied to metal-to-metal surfaces (door, front hood and side sill insides) where it is difficult to use ordinary undercoating material for coating. Therefore, when selecting rust proof wax, it may be one of such penetrative type.

During undercoating (vinyl coating) application, care should be taken that sealer is not applied to engine-related parts and shock absorber mounting or rotating parts. Following undercoating, make sure that body drain holes are kept open.

Use following procedure for application of anticorrosive materials.

- 1) Clean and prepare metal surface.
- 2) Apply primer.
- 3) Apply sealer (all joints sealed originally).
- 4) Apply chip-resistant material (side sill and door outside bottom areas).
- 5) Apply color in areas where color is required such as hem flanges, exposed joints and under body components.
- 6) Apply anticorrosive compound (penetrative wax).
- 7) Apply undercoating (rust proof material).

If original galvanization or other anticorrosive material on interior and underbody panel surfaces is burnt during welding or heating operation, affected surfaces must be cleaned.

Burnt residues should be removed carefully when affected area is in box-type construction or in such shape as to limit access to interior surfaces. Generally, following method works out satisfactorily in removing such residues.

### NOTE:

**Standard shop practices, particularly eye protection, should be followed during performance of above-listed operations to avoid personal injury.**

Scrape any accessible area. If affected area is enclosed by sheet metals and a standard putty knife or scraper cannot reach there, try to use a more flexible scraper. Compressed air can remove most residues and is useful in cleaning enclosed areas. However, this type of operation absolutely requires eye protection.

## METAL REPLACEMENT PARTS FINISHING

Metal replacement parts (or assemblies) are coated with electro-deposition primer. For proper adhesion of paint, following finish process (refinish steps) becomes necessary.

- 1) Use wax or grease-removing solvent to clean each part.
- 2) Use a wet or dry sand-paper (No. 400) to polish panel lightly. Do not polish it forcibly to produce any scratch. Clean each part again.
- 3) If factory-applied primer coating is cut through to bare metal, apply metal conditioner to bare metal exposed to open air. As for the method of use of the metal conditioner, follow directions on its container.
- 4) Apply primer-surfacer to the part completely dry before starting sand-paper polishing. As for drying time, follow directions advised on primer-surfacer container.
- 5) Use a wet or dry sand-paper (No. 400) and water to polish panel lightly.

6) Wash part again.

7) Apply color coating to part.

8) Different paints demand different drying methods. Hence, follow directions advised on pertinent paint container.

9) When laquer coating (quick-drying paint coating) is applied, dry coated surface and polish it with compound.

In the case of 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 surface has dried completely (for approx. two months).

Before replacing exterior parts or assemblies, check paint conditions of all 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 method of use, follow directions advised for respective materials.
- 2) If necessary, wash parts with detergent, rinse, and dry them.
- 3) Before installing exterior body parts, apply anticorrosive compound to all cleaned surfaces of exterior body parts. Also, apply anticorrosive compound to inner surfaces of exterior body parts to be installed.

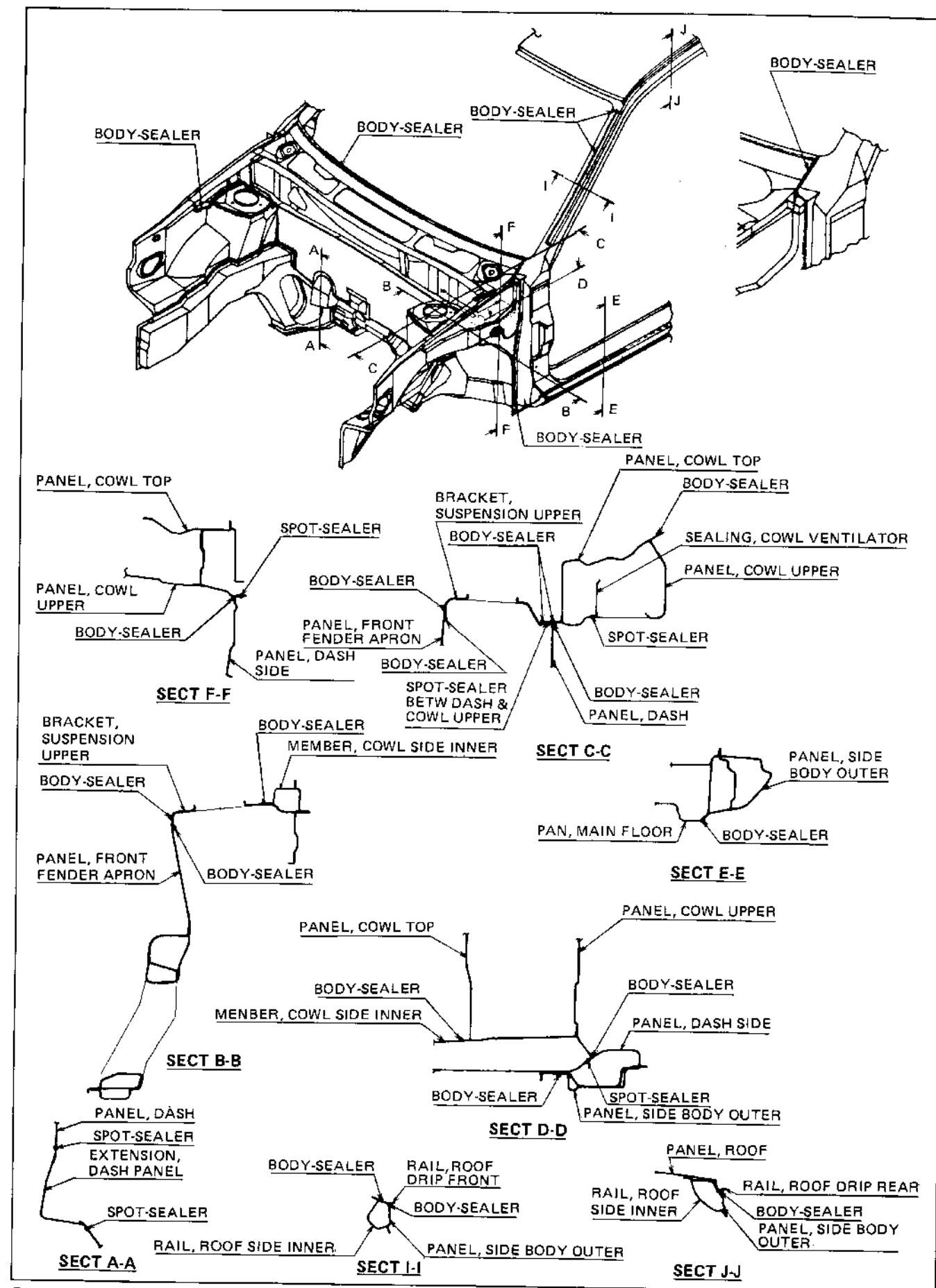


Fig. 9-71 Sealer Application Areas

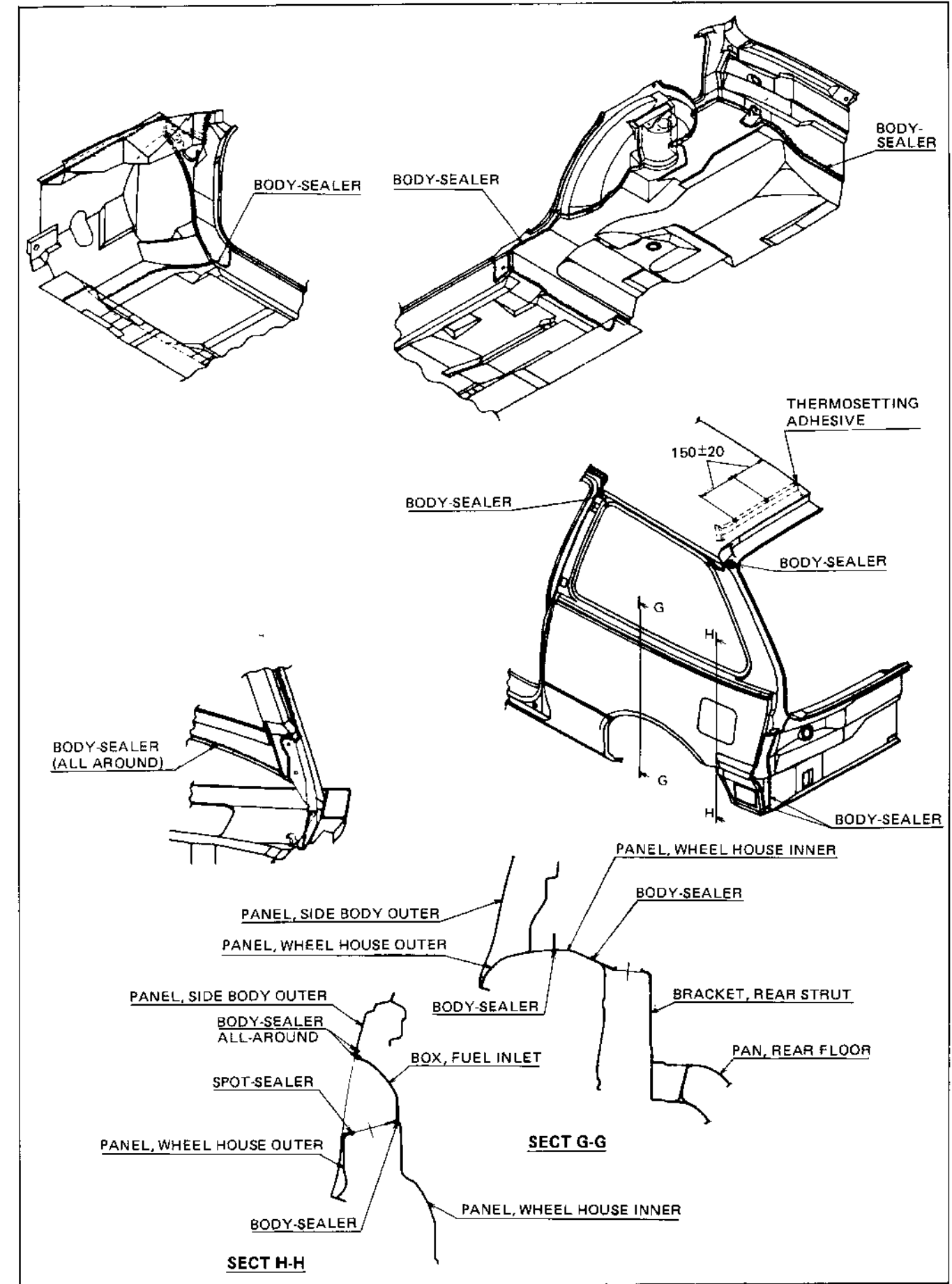


Fig. 9-72 Sealer Application Areas

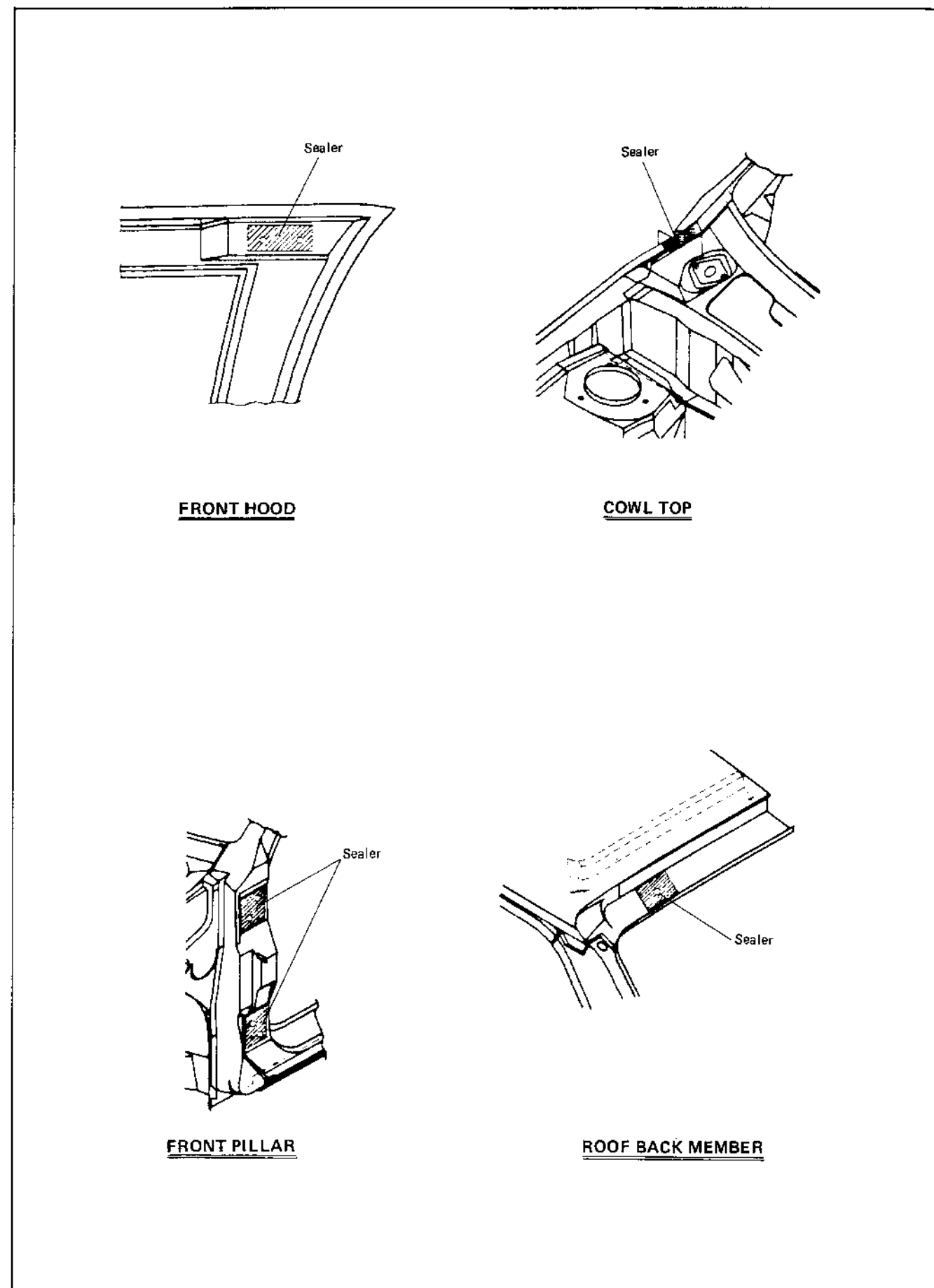


Fig. 9-73 Sealer Application Areas

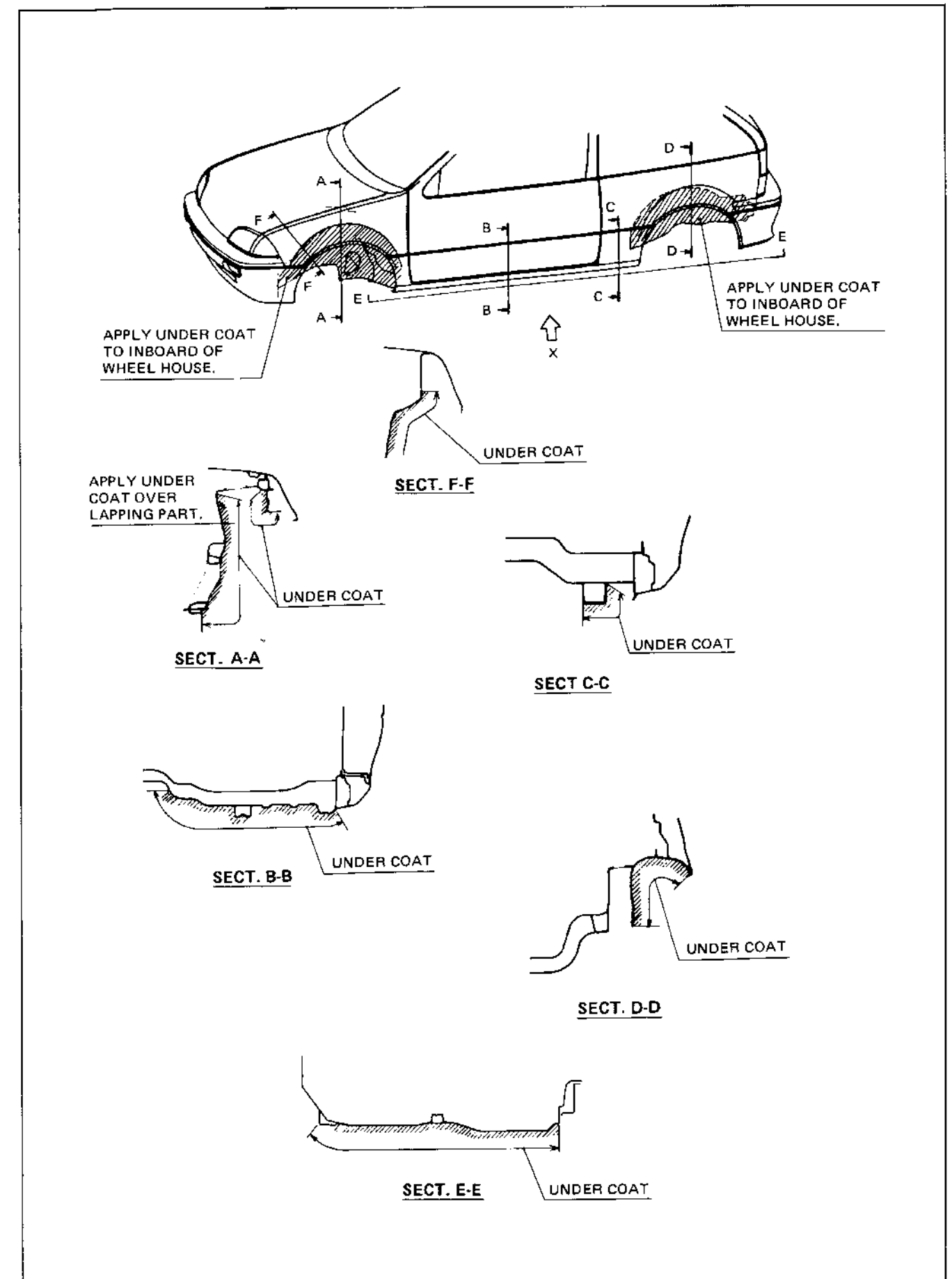


Fig. 9-74 Undercoating Application Areas



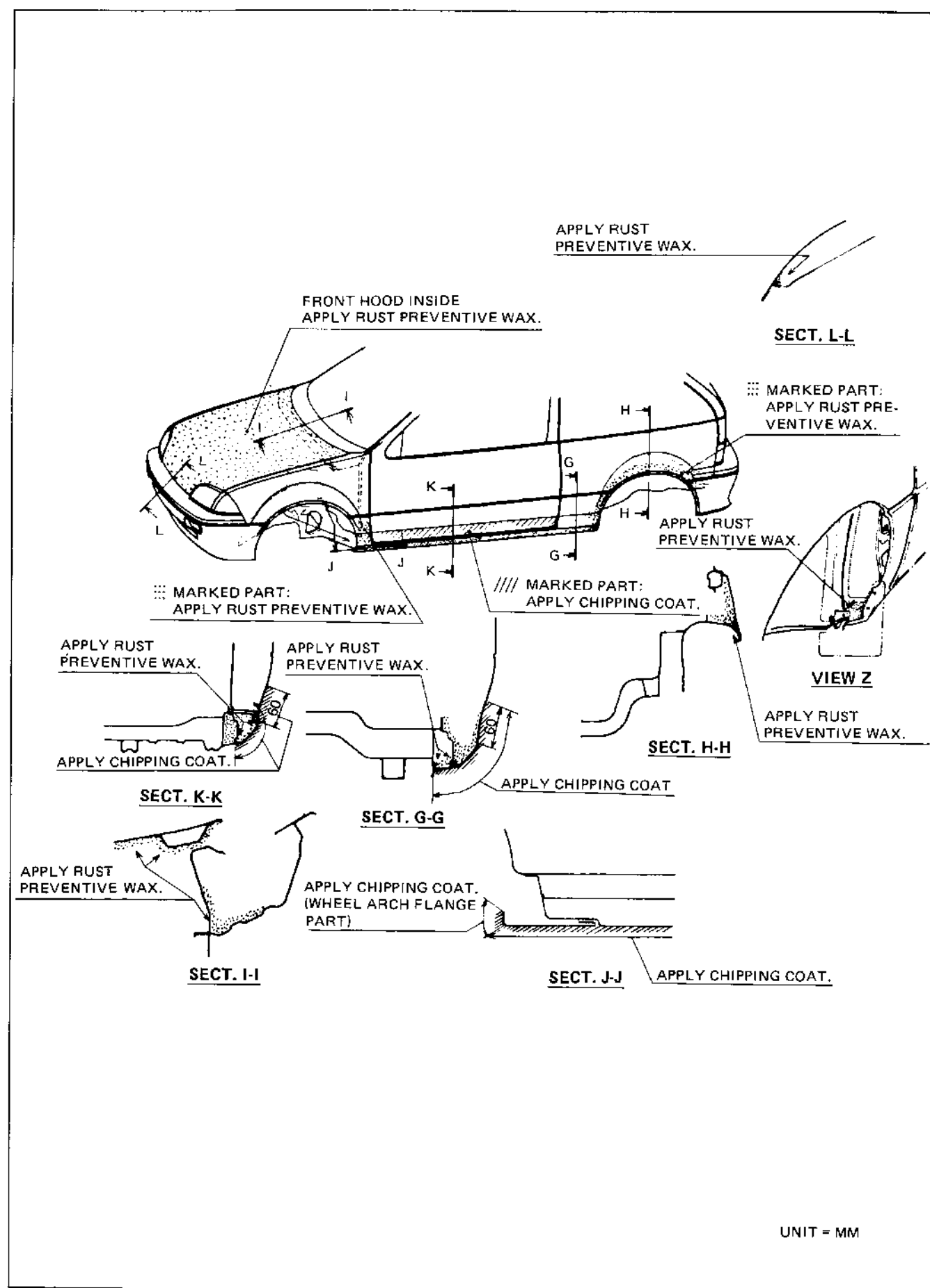


Fig. 9-75 Application of Anti-Corrosion Compound and Chip Resistant Material

## PLASTIC PARTS FINISHING

Paintable plastic parts are ABS plastic parts.

### Painting

Rigid or hard ABS plastic needs no primer coating.

General acrylic lacquers can be painted properly over hard ABS plastic in terms of adherence.

- 1) Use cleaning solvent for paint finish to wash each part.
- 2) Apply conventional acrylic color lacquer to part surface.
- 3) Follow lacquer directions for required drying time. (Proper drying temperature range is 60 to 70°C)

### Reference

Plastic parts employ not only ABS (Acrylonitrile Butadiene Styrene) plastic but also polypropylene, vinyl, or the like plastic. Burning test method to identify ABS plastic is described below.

- 1) Use a sharp blade to cut off a plastic sliver from the part at its hidden backside.
- 2) Hold sliver with pincers and set it on fire.
- 3) Carefully observe condition of the burning plastic.
- 4) ABS plastic must raise readily distinguishable black smoke while burning with its residue suspended in air temporarily.
- 5) Polypropylene must raise no readily distinguishable smoke while burning.

UNDERBODY DIMENSIONS

Each underbody component affects strength of car itself as well as wheel alignment (toe-in, camber, caster). It is essential, therefore, to check underbody carefully and perform welding properly, if necessary for its correction or replacement. When damage is found in sealing or rust proof treatment, it is mandatory to correct it properly. For sealing and rust proof treatment, refer to "ANTI-CORROSION TREATMENT" section.

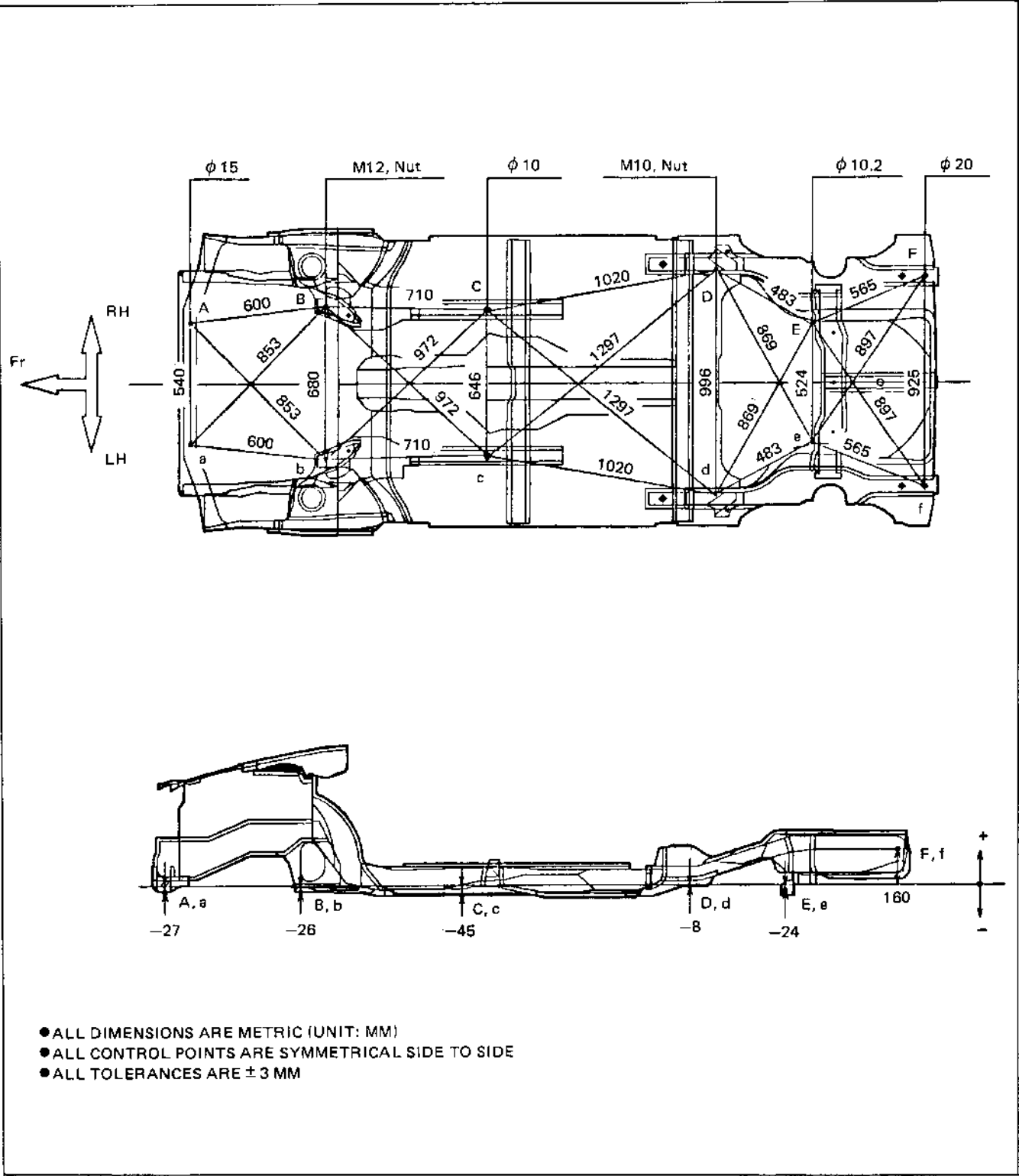


Fig. 9-76 Underbody Dimensions

BODY DIMENSIONS

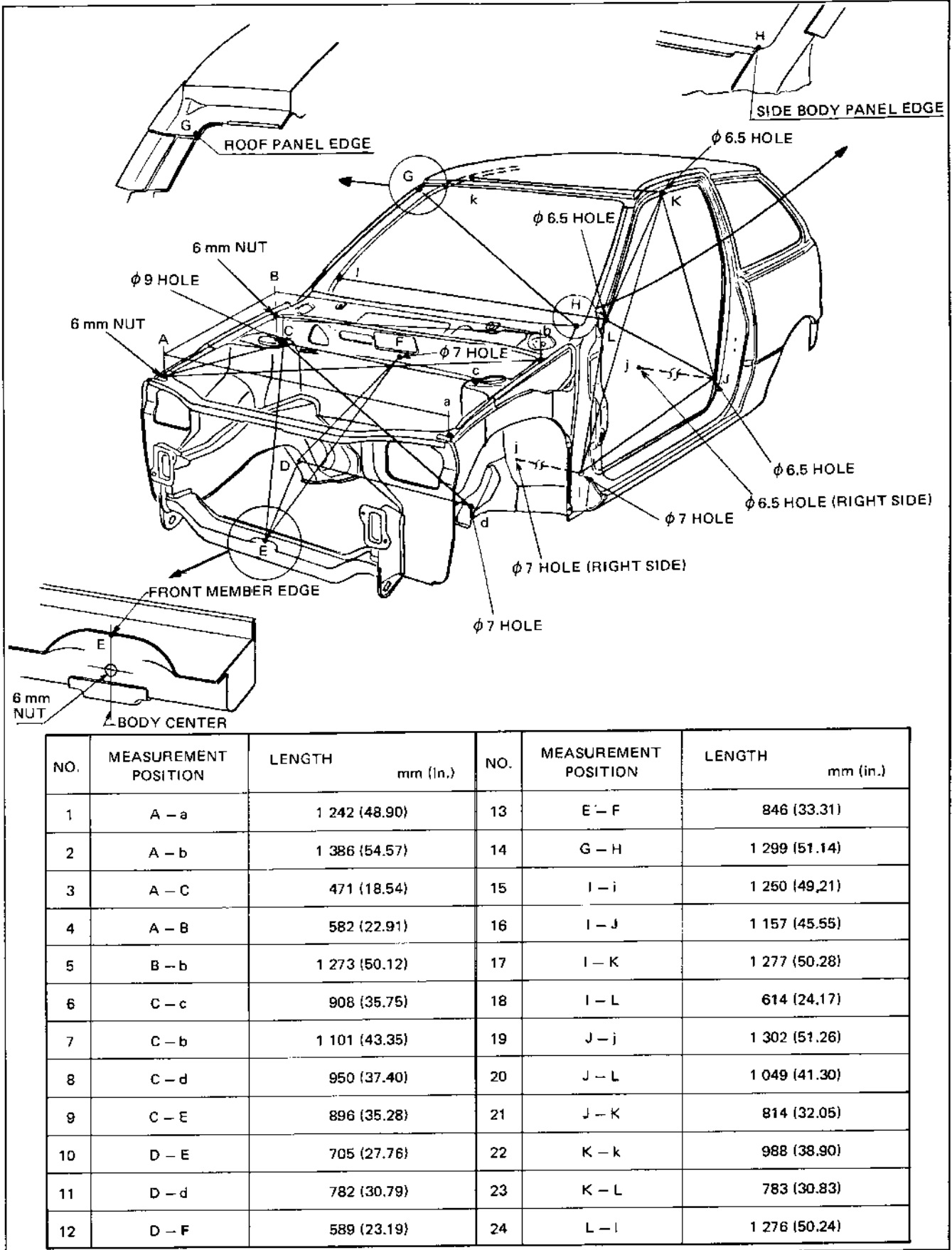


Fig. 9-77 Body Dimensions



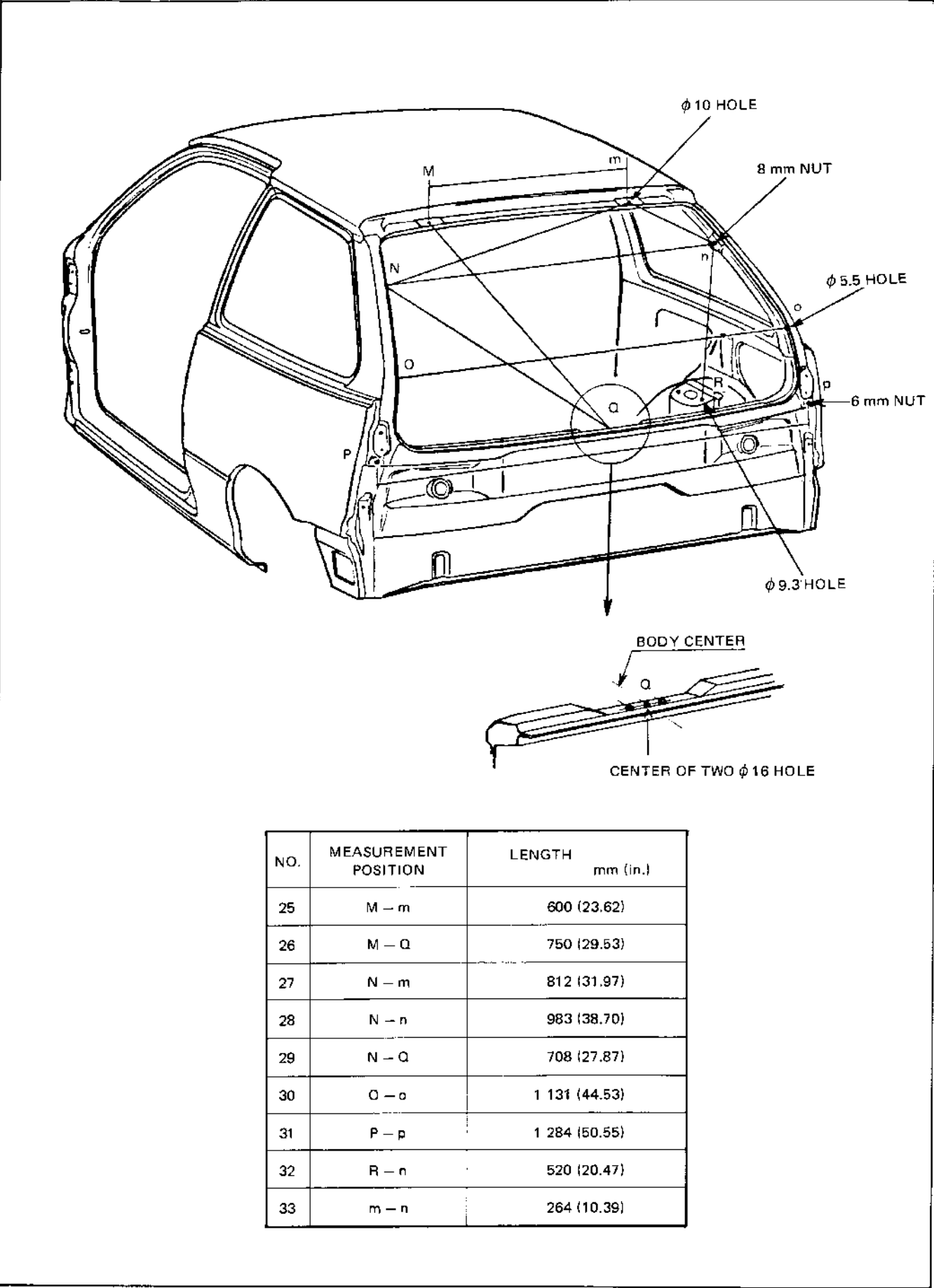


Fig. 9-78 Body Dimensions

SPLASH GUARD

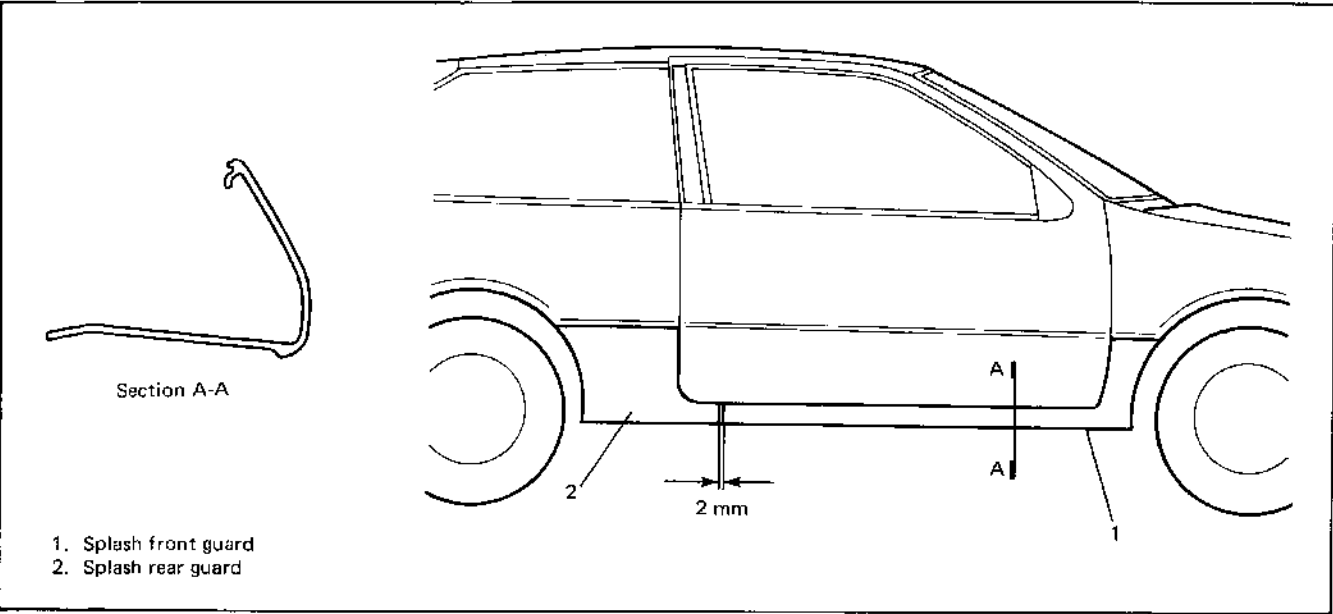


Fig. 9-79 Splash Guard Location

REMOVAL

1. Hoist car.
2. Remove rear wheels.
3. Remove screws fixing each splash guard.
4. Remove splash rear guard as shown below.
5. Remove splash front guard as shown below.

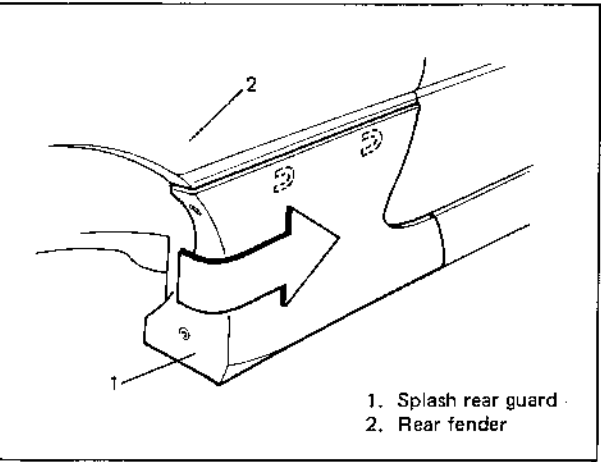


Fig. 9-80 Splash Rear Guard Removal (Right Side)

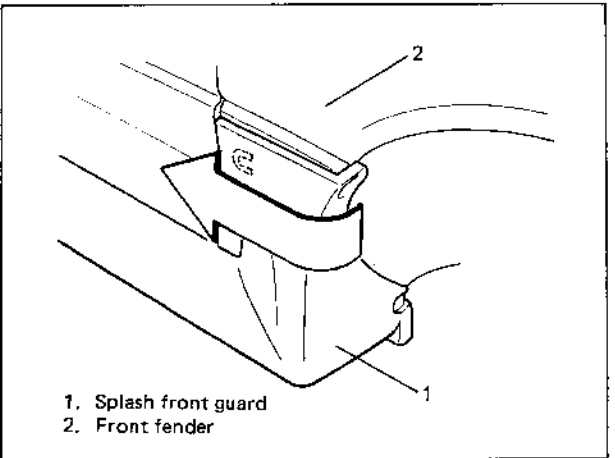


Fig. 9-81 Splash Front Guard Removal (Right Side)

**CAUTION:**  
There is a hook inside of each splash guard. Use care not to break it when removing the splash front/rear guard.

INSTALLATION

- Reverse removal sequence to install splash guard ass'y.
- To install splash front guard, push front fender lining and remove splash guard clip remaining on the body by pushing it iron inside of body. Then put that clip to splash front guard and install it to body.

KEY CODING

KEY USAGE AND IDENTIFICATION

One key is used for ignition, door and trunk lock cylinder. Keys are cut on both edges to make them reversible.

Key identification is obtained from five character key code stamped on key code tag. Using this key code, key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).

If key codes are not available from records or tags, key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.

If original key is available, key code cutting combination can be determined by laying key.

IGNITION SWITCH LOCK CYLINDER

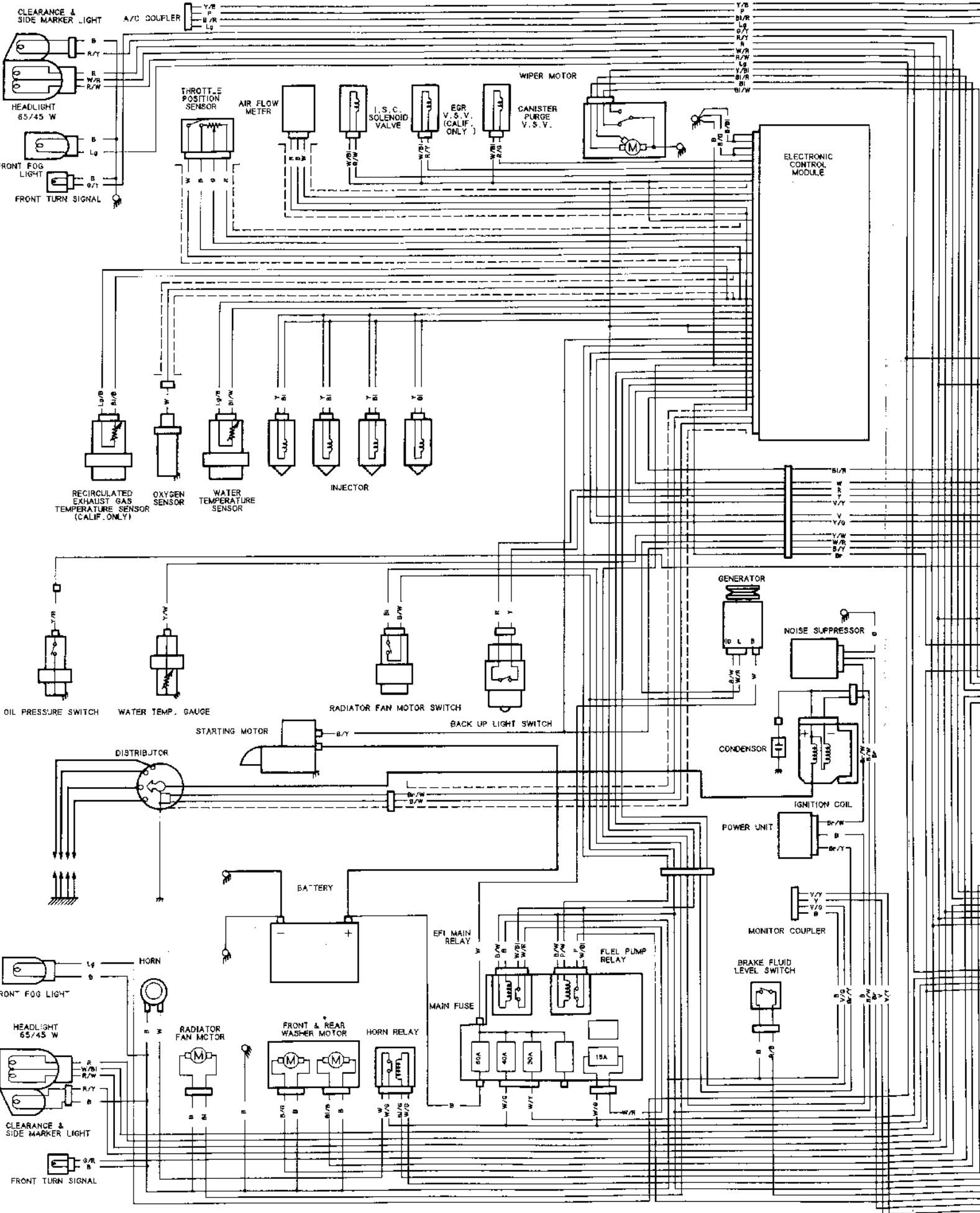
Removal/Installation

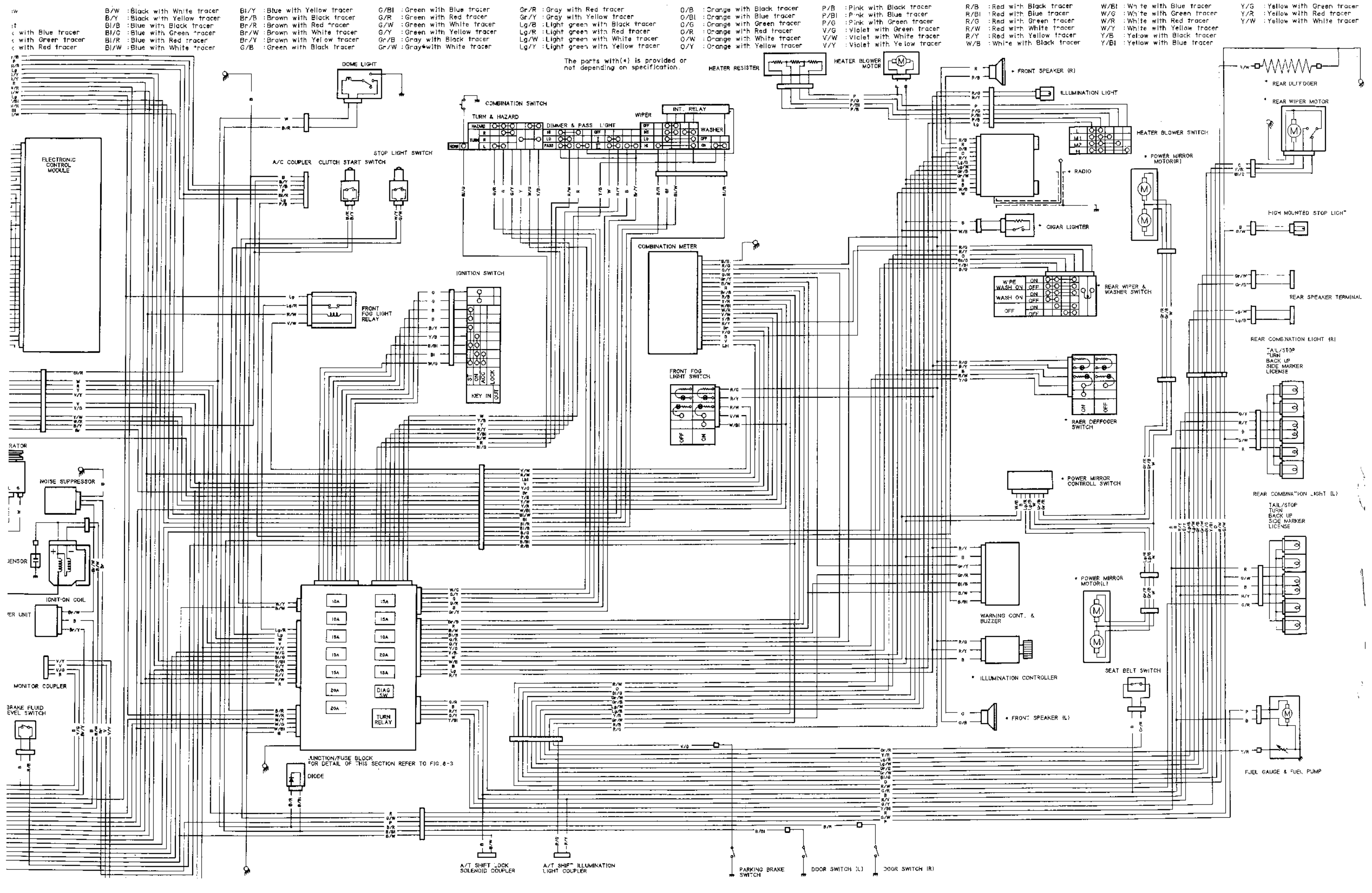
See section 3C, STEERING WHEEL AND COLUMN.

ELECTRICAL DIAGNOSIS

For ignition switch electrical troubleshooting, see Section 8, BODY ELECTRICAL SYSTEM.

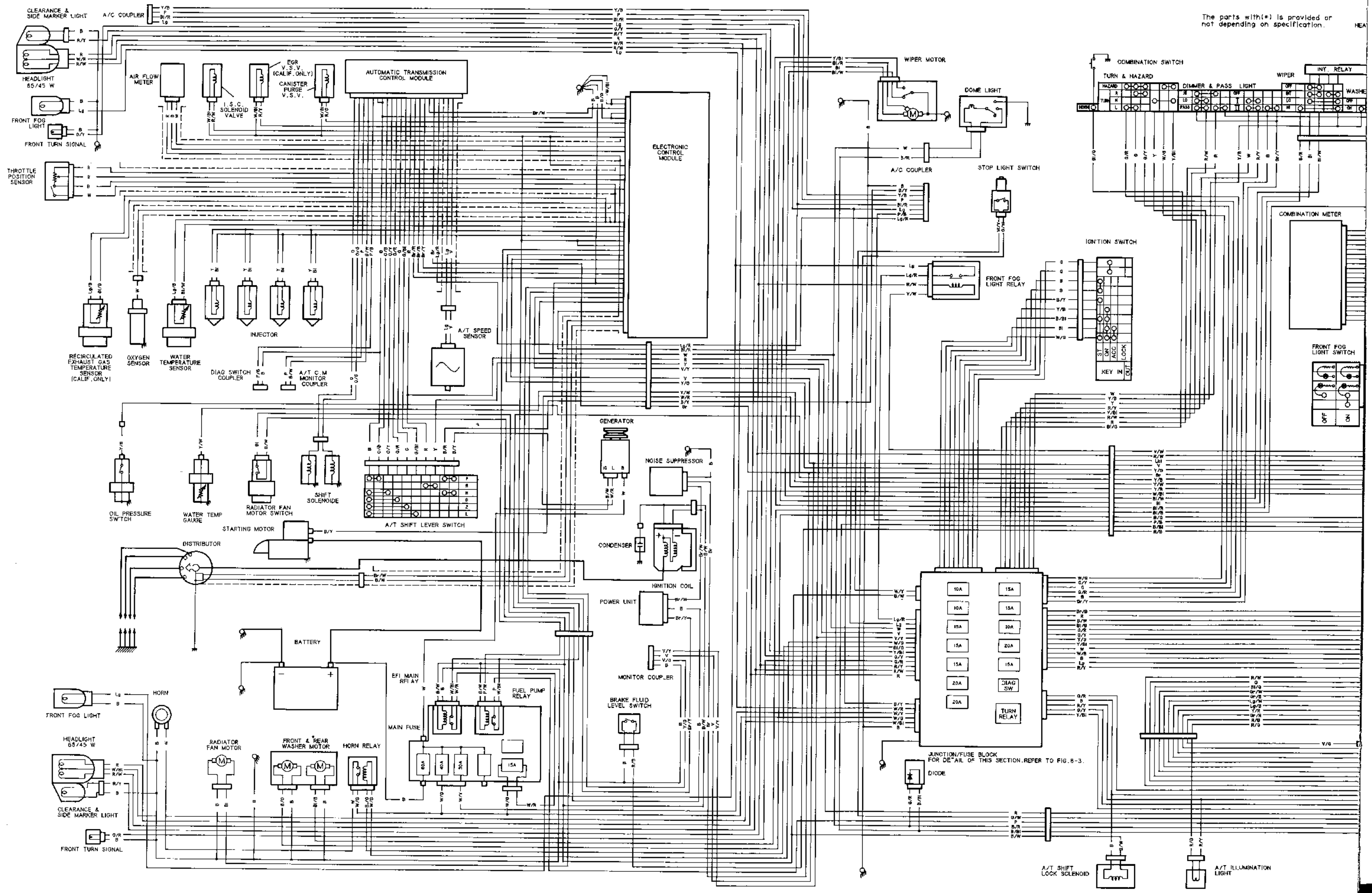
WIRING DIAGRAM  
For car with M/T





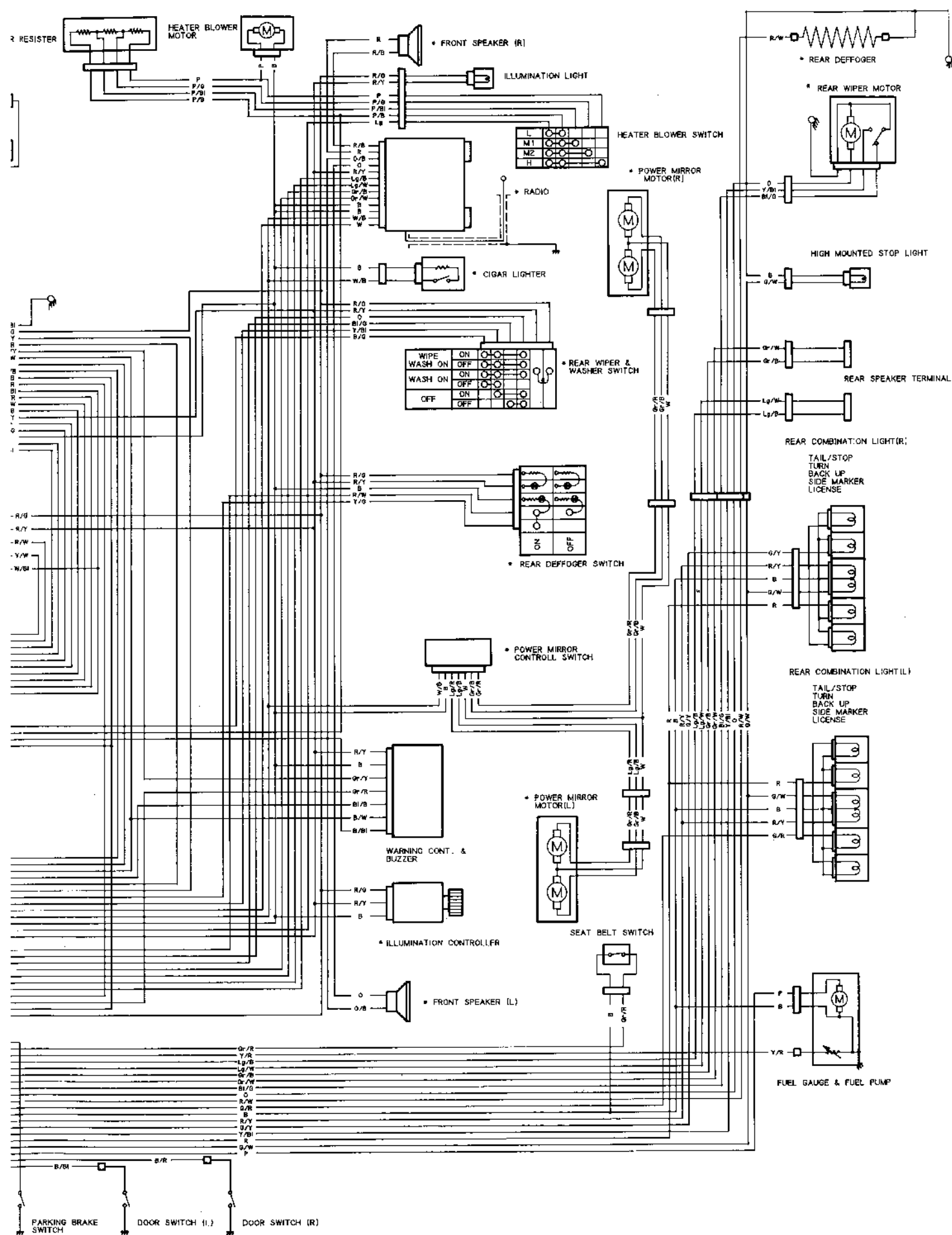
For car with A/T

|            |         |    |               |      |                            |      |                            |      |                            |      |                           |      |                           |      |                           |      |                            |     |                            |
|------------|---------|----|---------------|------|----------------------------|------|----------------------------|------|----------------------------|------|---------------------------|------|---------------------------|------|---------------------------|------|----------------------------|-----|----------------------------|
| WIRE COLOR |         |    |               | LbL  |                            |      |                            | V    |                            |      |                           | Bl/G |                           |      |                           | Br/Y |                            |     |                            |
| B          | : Black | Lg | : Light green | B/B  | : Black with Blue tracer   | Bl   | : Blue                     | Bl/R | : Blue with Red tracer     | G/B  | : Green with Black tracer | Gr/W | : Gray with White tracer  | Gr/R | : Gray with Red tracer    | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |
| Bl         | : Blue  | O  | : Orange      | B/G  | : Black with Green tracer  | Bl/W | : Blue with White tracer   | Bl/W | : Blue with White tracer   | G/Bl | : Green with Blue tracer  | Gr/Y | : Gray with Yellow tracer | Gr/Y | : Gray with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |
| Br         | : Brown | R  | : Red         | B/R  | : Black with Red tracer    | B/Y  | : Black with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/R  | : Green with Red tracer   | Gr/Y | : Gray with Yellow tracer | Gr/Y | : Gray with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |
| G          | : Green | W  | : White       | B/W  | : Black with White tracer  | B/Y  | : Black with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/W  | : Green with White tracer | Gr/Y | : Gray with Yellow tracer | Gr/Y | : Gray with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |
| Gr         | : Gray  | Y  | : Yellow      | B/Y  | : Black with Yellow tracer | B/Y  | : Black with Yellow tracer | Br/Y | : Brown with Yellow tracer | Br/W | : Brown with White tracer | Gr/Y | : Gray with Yellow tracer | Gr/Y | : Gray with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |
|            |         | P  | : Pink        | Bl/B | : Blue with Black tracer   | Bl/B | : Blue with Black tracer   | Br/Y | : Brown with Yellow tracer | Br/W | : Brown with White tracer | Gr/Y | : Gray with Yellow tracer | Gr/Y | : Gray with Yellow tracer | Br/Y | : Brown with Yellow tracer | G/Y | : Green with Yellow tracer |



The parts with (\*) is provided or not depending on specification.

O/B : Orange with Black tracer  
 O/BI : Orange with Blue tracer  
 O/G : Orange with Green tracer  
 O/R : Orange with Red tracer  
 O/W : Orange with White tracer  
 O/Y : Orange with Yellow tracer  
 P/B : Pink with Black tracer  
 P/BI : Pink with Blue tracer  
 P/G : Pink with Green tracer  
 P/Y : Pink with Yellow tracer  
 V/G : Violet with Green tracer  
 V/W : Violet with White tracer  
 V/Y : Violet with Yellow tracer  
 R/B : Red with Black tracer  
 R/BI : Red with Blue tracer  
 R/G : Red with Green tracer  
 R/W : Red with White tracer  
 R/Y : Red with Yellow tracer  
 W/B : White with Black tracer  
 W/BI : White with Blue tracer  
 W/G : White with Green tracer  
 W/R : White with Red tracer  
 W/Y : White with Yellow tracer  
 Y/B : Yellow with Black tracer  
 Y/BI : Yellow with Blue tracer  
 Y/G : Yellow with Green tracer  
 Y/R : Yellow with Red tracer  
 Y/W : Yellow with White tracer



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