SUZUKI

VITARA

ADDITIONAL SERVICE MANUAL
1.9 T.D. INTERCOOLER MODEL

USE THIS MANUAL IN ADDITION TO THOSE INDICATED IN THE PREFACE OF THIS PUBLICATION

SUZUKI
Customer Service
SANTANA MOTOR, S.A.
00000A01356E

IMPORTANT

WARNING/CAUTION/NOTE

Kindly read this manual and follow the instructions carefully. The words **WARNING, CAUTION** and **NOTE** highlight important information and have very specific significance. Please pay great attention to the messages emphasised in these terms of indication.

WARNING:
Indicates a potential danger which could result in personal injuries or death.

CAUTION:
Indicates potential danger which could damage the vehicle.

NOTE:
Provides special information to facilitate maintenance or clarify instructions.

WARNING:
This service manual has been produced solely for authorised Suzuki dealers and for specialised service mechanics. It is possible that inexperienced mechanics or those not equipped with appropriate tools and equipment might not be able to perform the servicing outlined in this manual. Badly carried out repairs might cause personal injury to the mechanic and also result in the vehicle being unsafe for both driver and passengers.

WARNING:
For vehicles equipped with Supplementary Air Bag System:

- **Servicing which has to be carried out on or around Components or the Air bag Wiring System must be performed by an authorised Suzuki dealer. Please observe all WARNINGS and CAUTIONS IN SERVICING in Section 9J, in the "Vehicle Servicing" chapter and Air Bag System Components and Wiring System outline in Section 9J before performing any service work on or around Air Bag System Components or Wiring.**
  Failure to respect WARNINGS could result in accidental inflation of the Air Bag or render the Air Bag inoperative, either of which could cause serious injury.

- **When the Air Bag system and another vehicle system both need to be repaired, Suzuki recommends prior repair of the Air Bag system to avoid involuntary inflation of the Air Bag.**

- **Do not alter the steering wheel, glove compartment or any other Air Bag system component (on or around Air Bag system, components or wiring). Any modification could adversely affect effectiveness of the Air Bag system and cause personal injury.**

- **If the vehicle has to be exposed to temperatures exceeding 93°C, 200°f (during paint drying oven process for example), to avoid damage to components or accidental inflation remove Air Bag system components first.**

PREFACE

This Manual is a supplement to the Vitara (SE-416) Service Manual Ref.: 99500-60A10-01E and to Supplementary Service Manuals Ref.: 99501-60A70-01E, 99501-61A10-01E, 00000A01251E, 00000A01271E.

This manual describes the differences between the Vitara 1.9 TD. INTERCOOLER model and the Vitara 1.9 TD.

To look up information, consult the Vitara 1.9 TD. INTERCOOLER manual initially. If the information cannot be found in this Supplement, consult the Service Manual and Supplements previously mentioned.

When servicing always use tools and products recommended by Santana Motor S.A.

There may be some discrepancies between specifications, information, figures etc. that appear in this Manual (available at time of publication) and those incorporated in vehicles currently manufactured.

This Service Manual is applicable to vehicles with chassis numbers: VSEETW03VNX2 00001 and onwards.

RELATED SERVICE MANUALS:

- SERVICE MANUAL (SE-416) (99500-60A10-01E).
- SUPPLEMENTARY SERVICE MANUAL FOR 5P MODEL (99501-60A70-01E).
- SUPPLEMENTARY SERVICE MANUAL (99501-61A10-01E).
- SUPPLEMENTARY SERVICE MANUAL FOR 1.9 TD MODEL AND FREE WHEEL MECHANISM (00000A01251E).
- SUPPLEMENTARY SERVICE MANUAL MY. 97/98 (00000A01271E).

CONTENTS	SECTION
GENERAL INFORMATION	
General Information	0A
Maintenance and lubrication	0B
BRAKING SYSTEM	
Brakes	5
ENGINE	
General information and diagnosis	6
Engine repair	6 A 1
Cooling system	6 B
Engine and emissions control	6 E 3
TRANSMISSION	
Gear box	7 A
Clutch	7 C
Transfer box	7 D
Differential (front and rear)	7 E
ELECTRICAL SYSTEM	
Chassis electrical system	8
Vehicle immobilizing system	8B
TECHNICAL INFORMATION	10
ELECTRICAL DIAGRAMS	

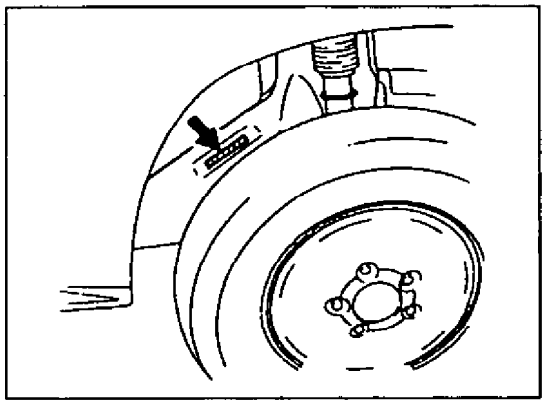
SECTION 0A

0A

GENERAL INFORMATION

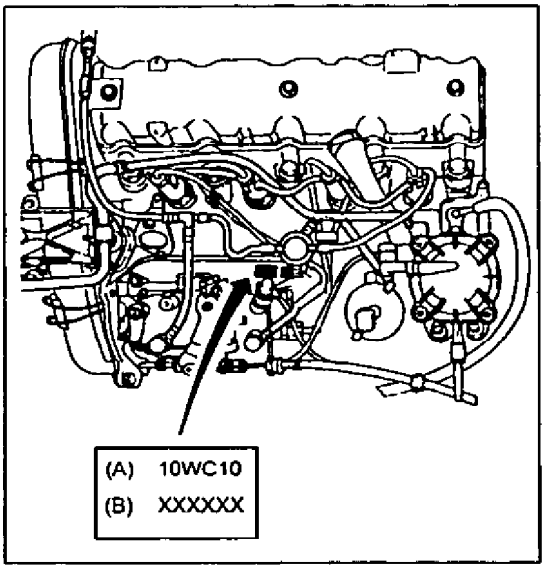
LIST OF CONTENTS

GENERAL INFORMATION



CHASSIS NUMBER IDENTIFICATION

The chassis number is engraved on the front right-hand side, as shown in the figure.



IDENTIFICATION OF ENGINE NUMBER

The engine number is engraved on the plate indicated on the left-hand side, as shown in figure.

A: ENGINE TYPE

B: SERIAL NO.

SECTION 0B

0B

MAINTENANCE AND LUBRICATION

NOTE:
For points not covered in this section please refer to relevant section in Service Manual outlined in INTRODUCTION.

TABLE OF CONTENTS

MAINTENANCE PROGRAMME

MAINTENANCE IN NORMAL DRIVING CONDITIONS

Interval: This interval must be measured by reading mileometer, or by months, whichever comes first.	This table includes programmed servicing up to 90,000 Km. (54,000 miles), subsequently at regular intervals						
	Km x 1,000	15	30	45	60	75	90
	Milles x 1,000	9	18	27	36	45	54
	Months	12	24	36	48	60	72
1.- ENGINE							
1.1.- Drive belt	Vee	I	R	I	R	I	R
	Multi Vee	-	-	I	-	-	R
1.2.- Camshaft timing belt	Replace every 80,000 Km. (50,000 miles)						
1.4.- Engine oil and filter	CD, CE or CF-4	Replace every 10,000Km (6,000 miles) or 8 months					
1.5.- Coolant		-	-	R	-	-	R
1.6.- Exhaust system (except catalyst)		-	I	-	I	-	I
1.7.- Intercooler		I	I	I	I	I	I
1.8.- Oil cooler		I	I	I	I	I	I
2.- IGNITION							
2.3.- Glow plugs		-	-	-	-	I	-
3.- FUEL SYSTEM							
3.1.- Air filter element	Asphalt road	-	R	-	R	-	R
3.2.- Fuel types and connections		-	I	-	I	-	I
3.3.- Fuel filter	Replace first after 10,000 Km (6,000 miles) and subsequently every 20,000 Km (12,000 miles)						
3.4.- Purging fuel filter water	Every 10,000 Km (6,000 miles)						
3.5.- Fuel tank		-	-	I	-	-	I
6.- CHASSIS AND BODY							
6.1.- Clutch		-	I	-	I	-	I
6.2.- Brake discs and pads (front)		I	I	I	I	I	I
Brake drums and shoes (rear) brake block (rear)		-	I	-	I	-	I
6.3.- Brake hoses and lines		-	I	-	I	-	I
6.4.- Brake fluid		-	R	-	R	-	R
6.5.- Hand brake lever and cable (just one service after 15,000 Km)		I	-	-	-	-	-
6.6.- Tyres		I	I	I	I	I	I
6.7.- Wheels and free wheeling hubs (if fitted)		I	I	I	I	I	I
6.8.- Suspension system		-	I	-	I	-	I
6.9.- Propeller shafts		-	-	I	-	-	I
6.10.- Transmission oil		I	-	R	I	-	R
6.12.- Transfer case oil		I	-	I	-	I	-
6.13.- Differential oil (to be changed only after first 15,000 Km)		R or I	-	I	-	I	-
6.14.- Steering		-	I	-	I	-	I
6.15.- Power assisted		I	I	I	I	I	I
6.16.- All locks and hinges		-	I	-	I	-	I

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

MAINTENANCE IN SEVERE DRIVING CONDITIONS

If the vehicle is driven in any of the code of severe conditions outlined below, it is recommended that servicing be performed at the specific intervals indicated in the tables below.

Code of severe conditions.

A- Short frequent journeys.
B- Driving on muddy surfaces.
C- Driving on dusty surfaces.
D- Driving in extremely cold climates and/or salted surfaces.
E- Short frequent journey in extremely cold climates.
G- Use in town/Trailer tow/Driving at high speed/At temperatures over 40ºC/Low quality lubricants or fuel.
H- TrailerTow.

Severe conditions code	Maintenance	Maintenance operation	Service interval
-BCD---	Drive belts	I	Every 15,000 Km (9,000 miles) or 12 months
		R	Every 45,000 Km (27,000) or 36 months
A-CDEG-	Camshaft belts	R	Every 60,000 Km (36,000 miles) or 48 months
A-CDE-H	Engine oil and oil filter	R	Every 5,000 Km (3,000 miles) or 4 months
-B-----	Exhaust pipes and fittings	I	Every 15,000 Km (9,000 miles) or 12 months
--C----	Air filer element *1	I	Every 2,500 Km (1,500 miles)
		R	Every 30,000 Km (18,000 miles) or 24 months
--C--G-	Fuel filter	R	Every 10,000 Km (6,000 miles) or 8 months
AB-D--H	Universal joints	I	Every 15,000 Km (9,000 miles) or 12 months
-B--E-H	Gear box, transfer and differential oil	I	Every 15,000 Km (9,000 miles) or 12 months
		R	Every 30,000 Km (18,000 miles) or 24 months
-B-----	Suspension nuts and bolts	T	Every 15,000 Km (9,000 miles) or 12 months
-BCD--H	Wheel bearings	I	Every 15,000 Km (9,000 miles) or 12 months
-BC----	Intercooler/air radiator	I	Every 5,000 Km (3,000 miles) or 4 months
-BC----	Cooling system oil radiator	I	Every 5,000 Km (3,000 miles) or 4 months

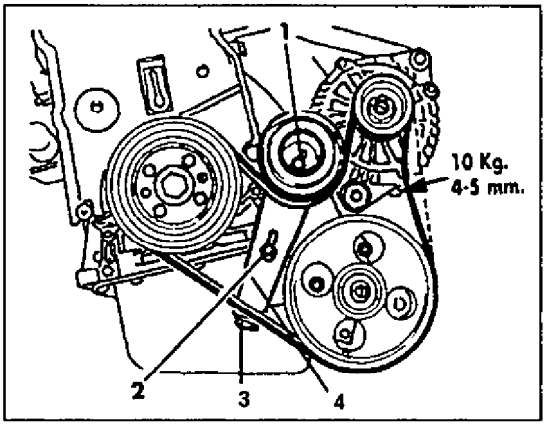
NOTE:
"R": Replace or change.
"T": Tighten as specified.
"I": Inspect or correct or lubricate if necessary.
***1: Inspect or replace more frequently if necessary.**

MAINTENANCE SERVICES

ENGINE

POINT 1-1

WARNING:
All inspection and replacement work must be carried out with the engine off and the battery disconnected.



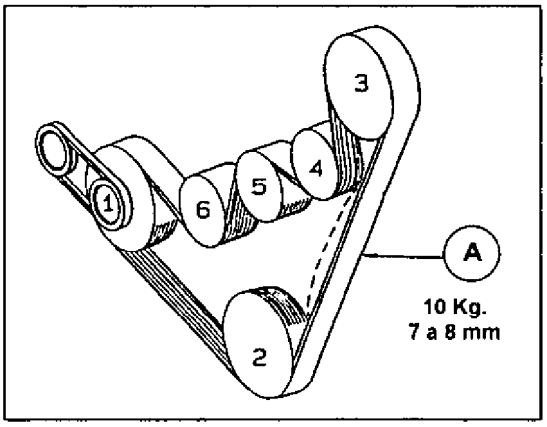
Drive belt.

Inspection:

1) Inspect drive belt to check it is not split, distorted, worn, dirty, etc.

2) In engines without A/C compressor adjust belt tension with a deflection of 4 to 5mm.

   Belt tension deflection 4 to 5 mm. with pressure of: 10 Kg. (100 N).



3) In engines with A/C compressor adjust drivebelt tension with deflection of 7 to 8 mm. in relation to point (A) (belt centre).

   Belt tension deflection 7 to 8 mm. with pressure of: 10 Kg. (100 N).

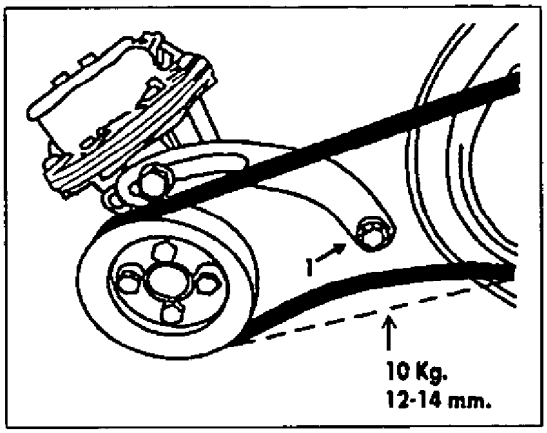
4) If the belt needs to be adjusted, slacken bolts (1) and (2) and tighten adjuster before tightening bolts (1) and (2) once more.

Replacement:

1) Remove lower protective/soundproofing plate.
2) Remove depressor belt
3) Slacken accessory belt with idler belt pulley (4).
4) Remove used belt, fit new one and adjust bolt (3) to tension desired.
5) Tighten bolts (1) and(2). Adjust to final tension with compressor idler pulley.

   Idler pulley bolt torque specifications: 2.2 Kg-m (22 Nm).

6) Continue assembly reversing disassembly order, assemble and tense depressor belt according to instructions next.



Depressor control belt

Inspect for wear, damage, excess or insufficient tension.

Depressor control belt tension: 12 to 14 mm. with pressure of 10 Kg. (100 N).

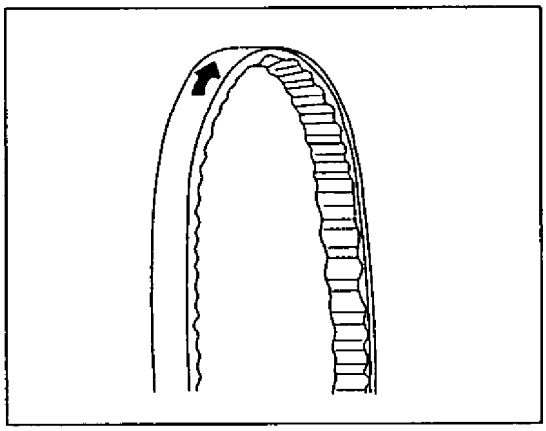
Replacing depressor belt

1) Remove lower protective/soundproof plate.
2) Slacken bolts fixing depressor to bracket and that of idler pulley.
3) Move depressor inwards to remove belt.
4) Fit new belt.
5) Move depressor outwards until right tension is obtained.
6) Tighten bolts attaching depressor to bracket as well as idler pulley bolt.

   Depressor bolts torque specifications : 1.8 to 2.8 Kg-m (18 to 28 Nm).

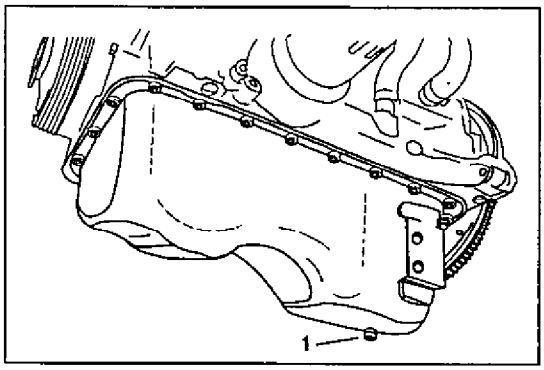
   Idler pulley bolt torque specifications (1): 1.8 to 2.3 Kg-m (18 to 23 Nm).

7) Fit lower protective/soundproofing plate.



POINT 1-2

Camshaft timing gear.
To replace timing belt, please refer to 6 A1-11.



POINT 1-4

Engine oil and filter.

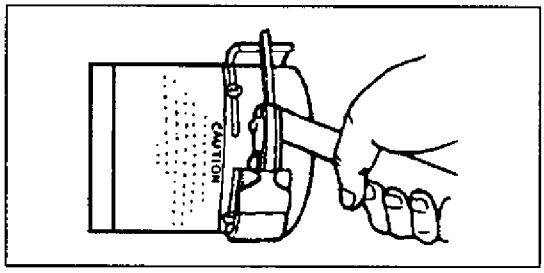
Replacement.

NOTE:
This should be effected with engine oil hot.

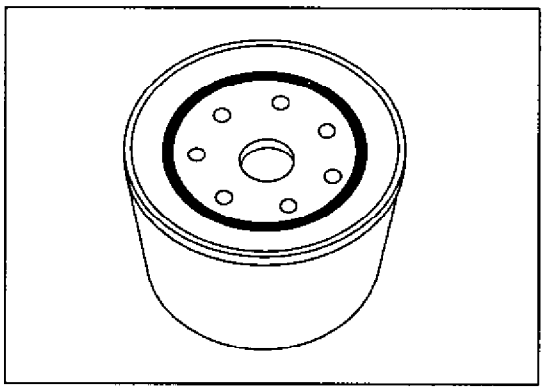
Before draining oil inspect engine to check for leaks. If this is the case, repair defective part before continuing.

1) Remove lower protective/soundproofing plate.
2) Extract motor oil through oil-pan drain plug (1).
3) After draining oil, clean drain plug. Fit once more with new sealing washer and tighten to specified torque.

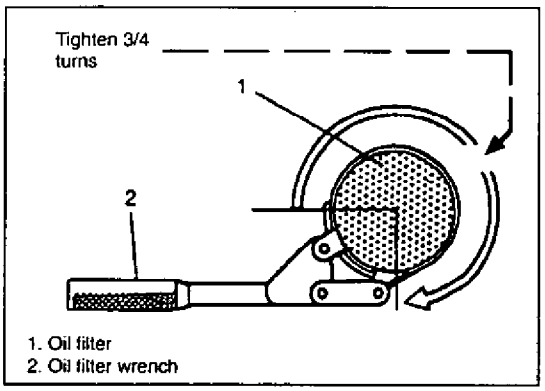
Plug torque specifications: 3 a 3.5 Kg-m (30 to 35 Nm).



4) Slacken filter using filter wrench.
5) Apply engine oil to rubber gasket of oil filter..
6) Screw new filter manually onto its support until rubber gasket touches surface of assembly.

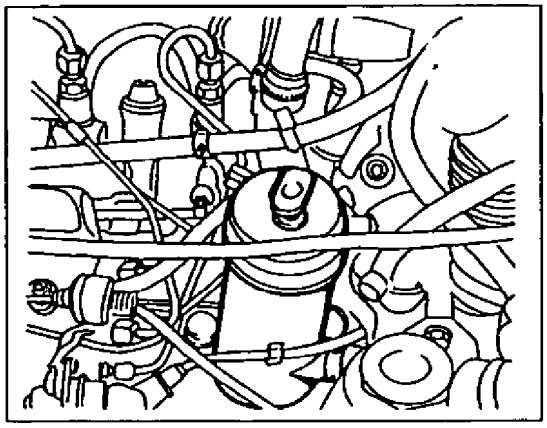


CAUTION:
To tighten oil filter, the position in which the rubber gasket makes contact with sealed surface must be identified.

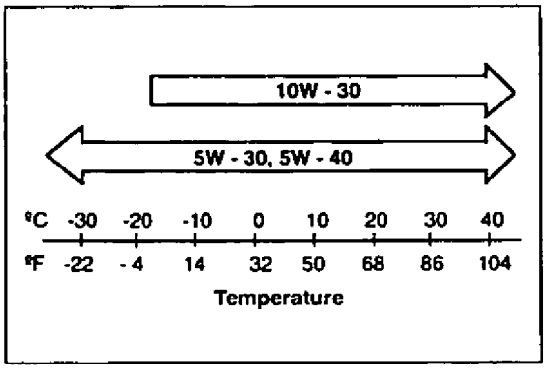


7) Using an oil filter wrench (2), tighten filter (1) finally by specified number of turns or to torque specifications, starting at point where rubber gasket surface and filter support meet.

Tightening: 3/4 turns or 1.4 Kg-m (14 Nm)



8) The filler tube and dip stick are located on the left-hand side of engine.

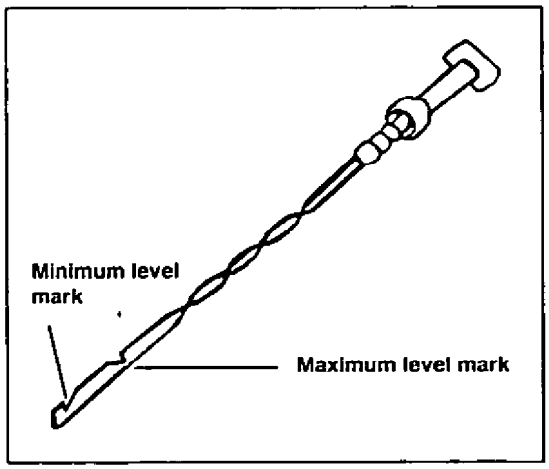


9) Select appropriate CD, CE or CF-4 type oil in accordance with viscosity chart. Use of 20 W-50 oil is only indicated in those countries where 10 W-40 is not available.

Engine lubricating system oil capacity.

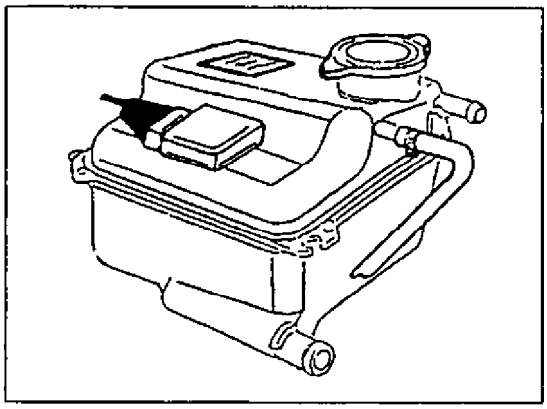
TOTAL SYSTEM CAPACITY	6.15 litres
Engine capacity only	5.00 litres
Filter capacity	0.50 litres
Cooling system capacity	0.65 litres

10) Engine lubricating system capacities are indicated in previous table. When filling, observe the following:
- If filter has not been changed and oil cooling system has not been disassembled, put in 5 l.
- If filter has been changed and oil cooling system has not been disassembled, put in 5.5 l.



11) Adjust oil level with vehicle horizontal, run engine for 3 mins., switch it off , leave it to settle for 3 mins. and check level with dipstick. Oil level indicated should be at maximum. If it is not, apply small quantities of oil until it reaches maximum.

NOTE:
Point 11 must be carried out in a well-ventilated place.



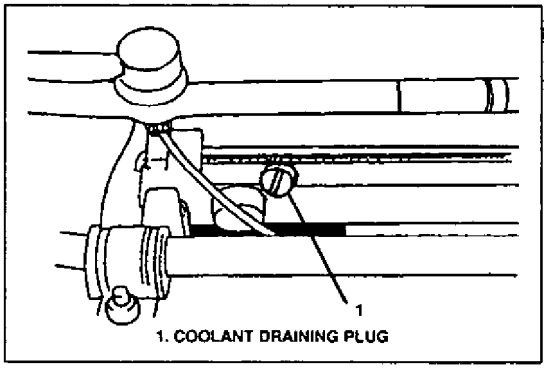
POINT 1-5

Engine coolant.

Replacement

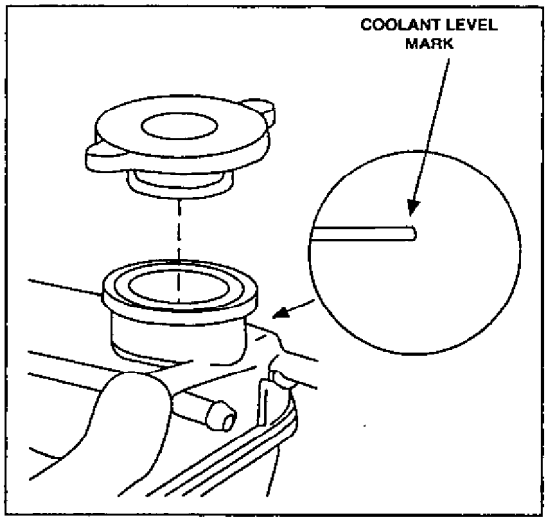
WARNING:
To avoid danger of burns, the expander reservoir plug must not be open when engine and radiator are hot. If plug is opened too soon high temperature liquid and vapours could come out.

1) Open expansion reservoir plug after engine has cooled down.
2) Remove lower protective/ soundproofing plate.

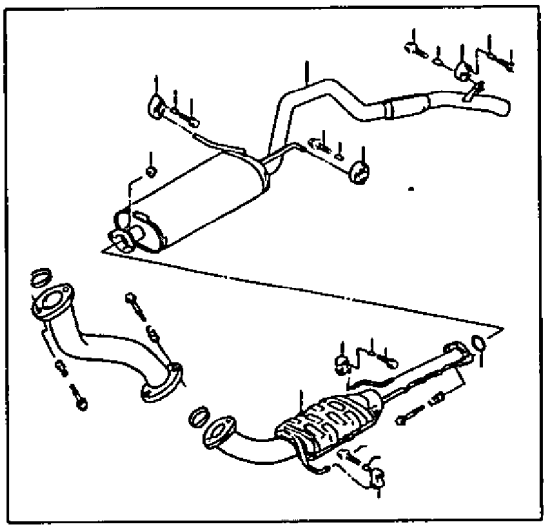


1. COOLANT DRAINING PLUG

3) Slacken radiator drain plug, let all oil in system come out and then tighten plug securely once more.
4) Remove expansion reservoir, drain and fit once more.
5) Turn on heating controls located inside vehicle.
6) Add fluid to expansion reservoir and start up engine.
7) Add fluid to reservoir as level is reduced.
8) Wait until engine is completely warmed up and continue adding fluid until expansion reservoir level is at maximum. Fit lower protective/soundproofing plate.



CAUTION:
For cooling system use a mix of 50% DINAGEL-9103 (Dynamic) and 50% distilled or demineralized water. This will provide protection in temperatures of around -30º. The coolant mix must be used in both summer and winter, since it provides anticorrosive and lubricating protection.



POINT 1-6

Exhaust system (except catalyst).

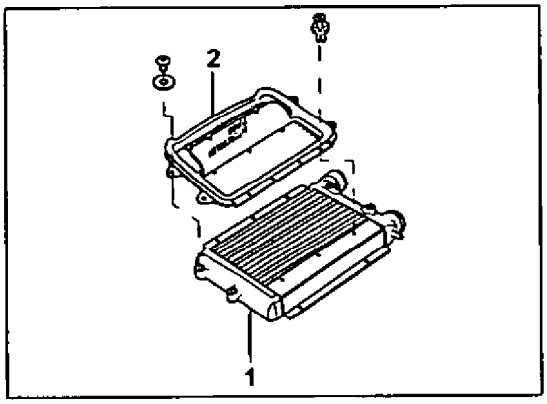
Inspection:

> **WARNING:**
> **To avoid danger of burns, do not touch exhaust system when hot.**

In periodic maintenance work, always inspect exhaust system in following order:

- Inspect rubber silent blocks for damage, wear or faulty positioning.
- Inspect exhaust system for leaks, weak connections, dents and damage. If nuts and bolts are loose, tighten to specified levels.
- Inspect body exterior for broken or incorrectly situated parts, open seams, holes, loose connections or other defects which may cause exhaust fumes to enter vehicle interior.
- Check that exhaust system components are separate from lower part of vehicle, thereby ensuring that latter does not overheat and damage floorpan lining and mats.
- All defects must be repaired immediately.

Changing silent blocks.
Change exhaust pipe silent blocks periodically.

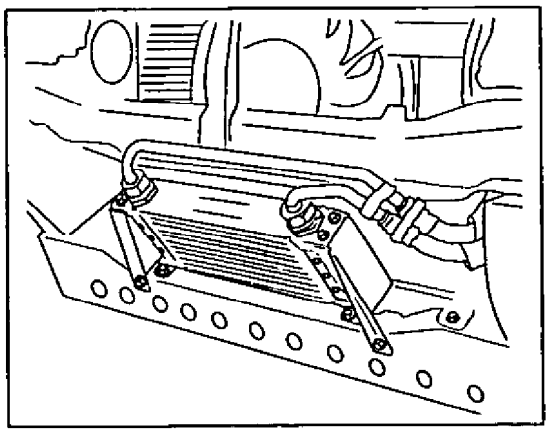


POINT 1-7

Intercooler.

Cleaning

1) If the air radiator/intercooler cooling system is excessively dirty, separate cooling line (2) and proceed to clean externally using compressed air and an unsharpened tool, to remove ingrained dirt in the cooling system fins.



POINT 1-8

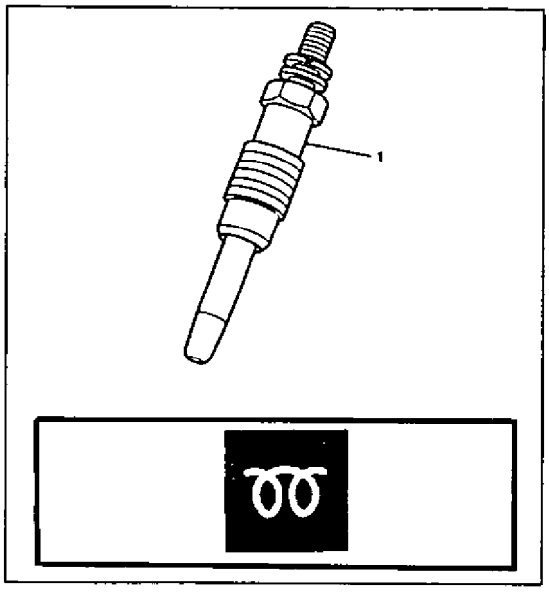
Oil cooling.

Inspection

1) Check radiator hose connections and make sure there are no leaks or distortions.
2) Check radiator and make sure there is no exterior dirt, leaks, distortions or cracks.

Exterior cleaning of oil radiator.

1) Carry out cleaning with compressed air and an unsharpened tool, so as to remove exterior dirt.

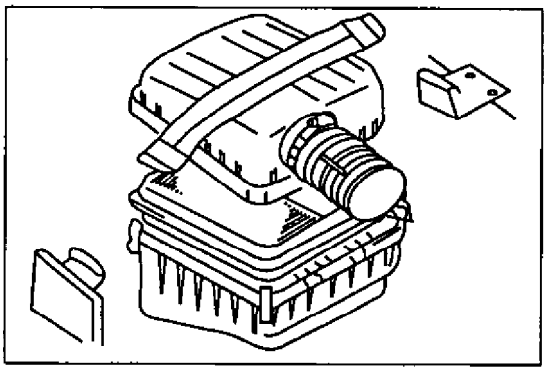


IGNITION SYSTEM

POINT 2-3

Glow plugs.

Inspection
1) Check the glow plugs' functioning visually by observing dashboard panel controls.
2) Observe engine running from a cold start. Any difficulty in starting cold could be a result of problems with glow plug heating system.

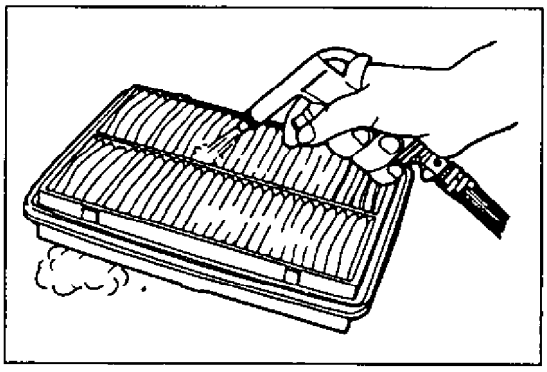


FUEL SYSTEM

POINT 3-1

Air filter Element.

Inspection
1) Release air filter anchoring strap.
2) Release four clips securing upper housing and extract filter.
3) Blow compressed air to clean dust, on outflow side of element.



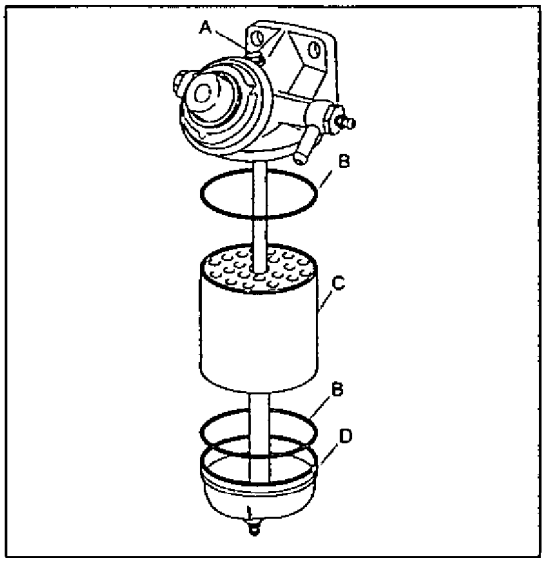
Replacement
1) Release air filter anchoring belt.
2) Release four anchoring clips on upper housing and extract element.
3) Install new element in air filter housing.

NOTE:
Replace more frequently in dusty working conditions. Consult for maintenance in severe driving conditions (OB-3) for correct replacement interval.

POINT 3-2

Types of fuel and connections

Inspection
1) Visually inspect fuel inlet and fuel return lines to make sure there are no distortions or friction liable to cause cracks.
2) Check that connections are not damaged and that hose clamps are securely fastened.



POINT 3-3

Fuel filter.

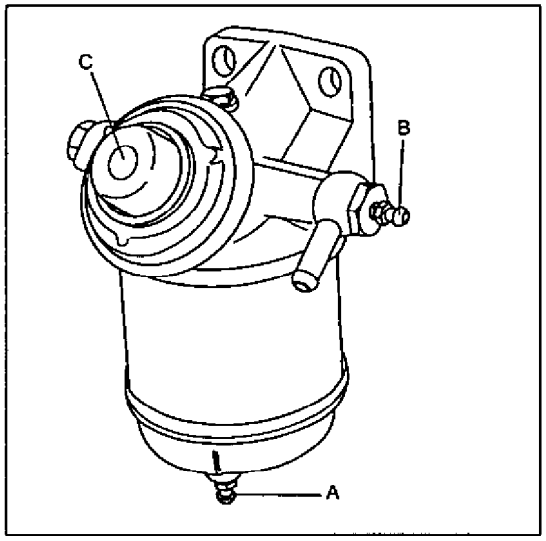
Replacement

WARNING:
This work must be carried out in a well ventilated place away from naked flames or heat.

1) Loosen the filter bolt (A), remove case (D), element (C) and gaskets (B)
2) Clean case with diesel oil and fit filter and new seals. Tighten (A) as specified.

Filter bolt torque specifications:
1.5 Kg-m (15 Nm)

NOTE:
The fuel filter is located on the left-hand side of the engine compartment, attached to the dashboard.



POINT 3-4

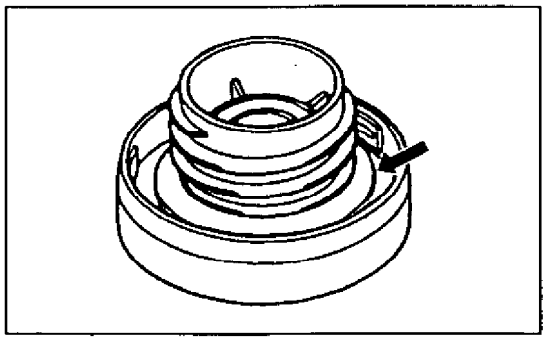
Fuel filter bleed.

Air bleed

NOTE:
This operation should be performed as frequently as indicated in the maintenance chart 0B-2 and when the situation demands following an intake of air due to lack of diesel oil with the subsequent difficulties in starting.

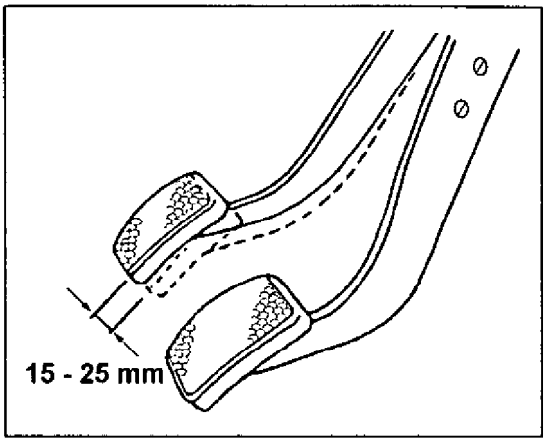
1) Make sure there is sufficient fuel in tank.
2) Slacken bleeder (B). Pump several times pressing button (C) until air ceases to come out of the bleeder. Tighten air escape when fuel with no air content comes out and when the button stiffens on pumping.

Water and residue bleed.
1) Slacken bleeder (A) and tighten it when water and residue cease to come out.



POINT 3-5

Fuel tank.
1) Visually inspect fuel tank filler cap seal for damage, distortion or excessive stiffness. If damaged, change it for a new one.
2) Check tank fuel lines and hoses, making sure they are securely fastened and there are no leaks. Change hoses or pipes damaged in any way.



CHASSIS AND BODY.

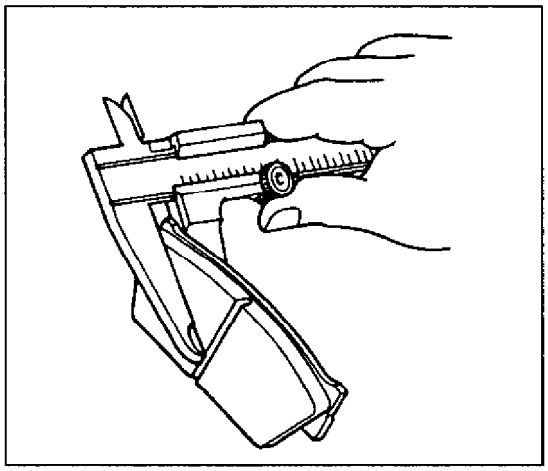
POINT 6-1

Clutch.

1) Inspect freeplay of clutch pedal.
2) In left-hand drive vehicles the clutch pedal should be 5 mm (0.2 ins.) higher than the brake pedal.

Clutch pedal freeplay	**15 – 25 mm (0.6 – 1.0 in)**

For more information, please refer to section 7C.



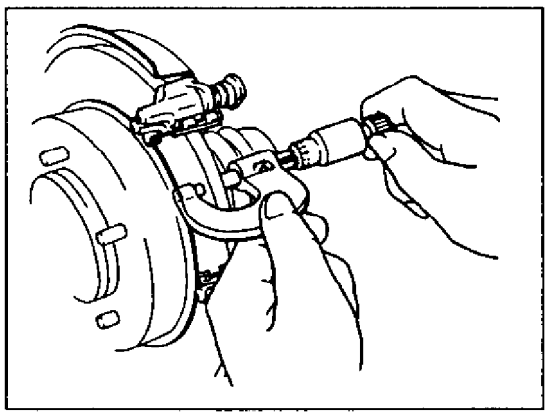
POINT 6-2

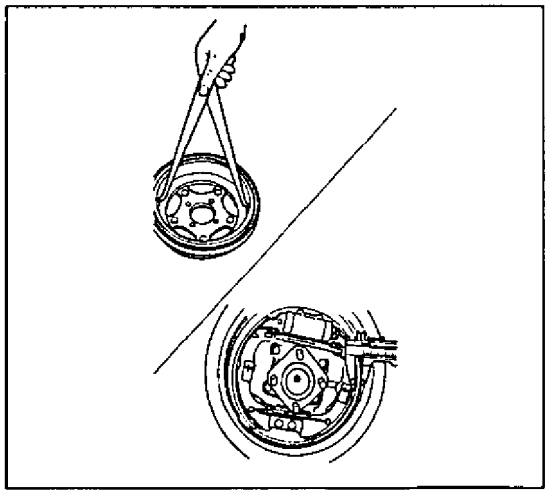
Brake discs and pads (front).
Brake drums and shoes (rear).

Brake discs and pads

1) Remove wheel and brake clamp without disconnecting brake hose
2) Inspect brake pads and discs for excessive wear, damage or distortion.

Replace any parts necessary.
Tighten fastening elements as specified.
For more information, please refer to section 5 of Service Manual 99500-60A10-01E.





Brake drums and shoes.

1) Remove wheel and brake drum.
2) Check brake drums and brake shoe linings for excessive wear and damage.
3) Check wheel cylinders for leaks, condition of dust covers, etc.

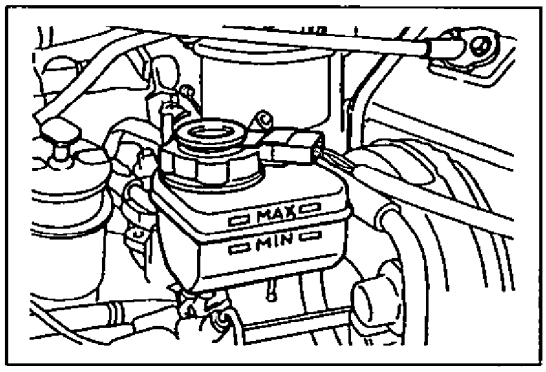
Replace parts in bad condition.
For more information, please refer to section 5 of Service Manual 99500-60A10-01E.

POINT 6-3

Brake lines and hoses

1) Check and brake pipes and hoses for installation problems, leaks, cracks, splits and other damage.

CAUTION:
After changing any pipe or hose, bleed areas in question.



POINT 6-4

Brake fluid

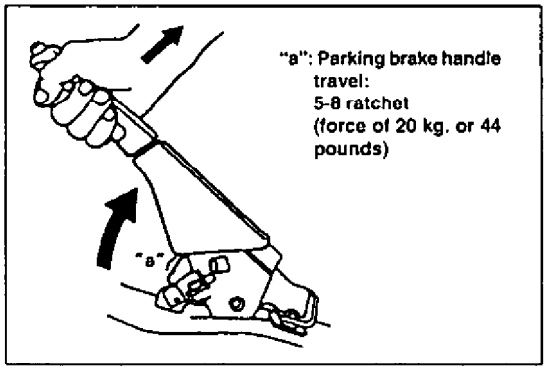
Inspection

1) Inspect master cylinder and reservoir area for fluid leaks. Repair any leaking area.
2) Inspect fluid level.
   If fluid level is below reservoir minimum, fill to correct level using specified brake fluid.

CAUTION:
Owing to the fact that this vehicle's brake system has been filled in the factory with glycol based brake fluid, do not use or mix other types of liquid when filling as you could damage braking system. Do not use old or used brake fluid, or fluid from an unsealed container.

Changing

Replace brake fluid in the following way:
Drain all braking system fluid and fill system with a recommended fluid before bleeding. For more information please refer to section 5 of Service Manual 99500-60A10-01E.



POINT 6-5

Handbrake lever and cable.

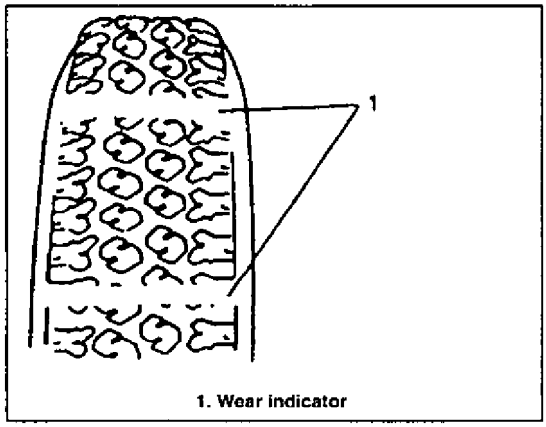
Handbrake lever

1) Inspect points of ratchet teeth for any damage or wear. If damaged or worn, replace lever assembly.
2) Check that brake lever functions correctly and rises to correct height. Adjust if necessary.

Handbrake cable

Carefully inspect brake cable for damage.
Replace if damaged.

For more information, please refer to section 5 of Service Manual 99500-60A10-01E.

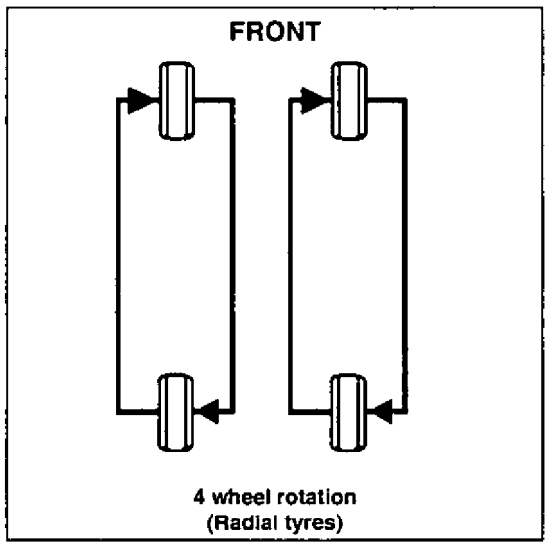


1. Wear indicator

POINT 6-6

Tyres

1) Inspect tyres for any uneven, excessive wear or damage. Replace if defective.
2) Inspect air pressure in each tyre and adjust to specified pressure if necessary.



4 wheel rotation
(Radial tyres)

NOTE:

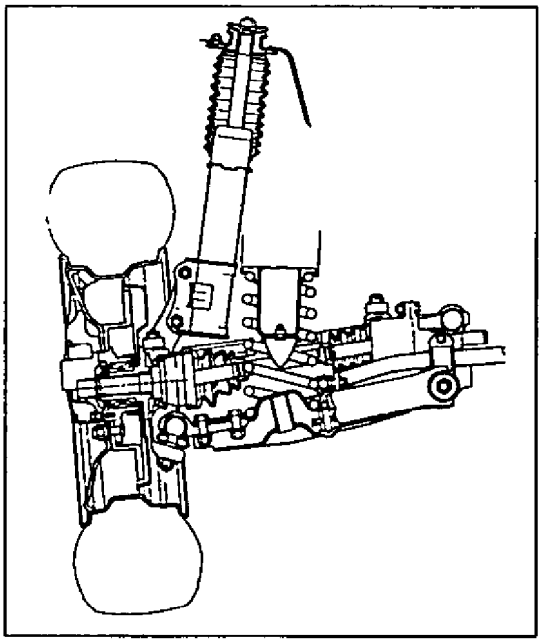
- **Inspect tyre pressure when cold.**
- **Specific air pressure is indicated in owner's manual.**
- **Change tyres at recommended intervals.**

For more information on previous subject, please refer to section 3F of Service Manual 99500-60A10-01E.

POINT 6-7

Wheels and free wheeling hubs (if fitted).

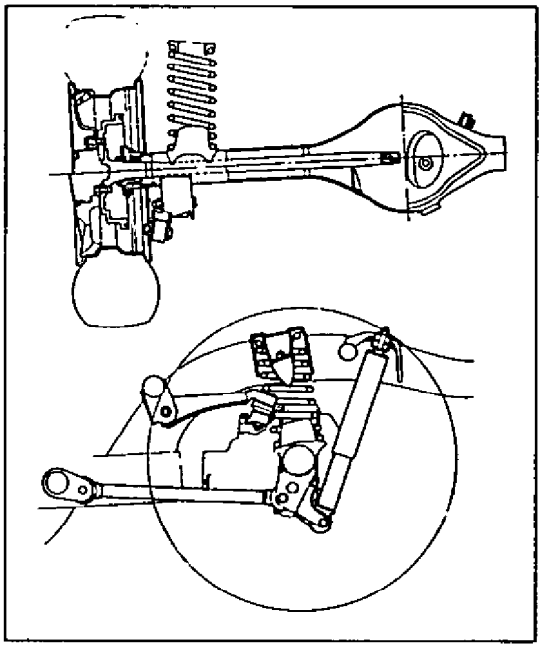
Inspect each disc for dents, distortions or cracks. A disc with any of the above defects should be replaced.



POINT 6-8

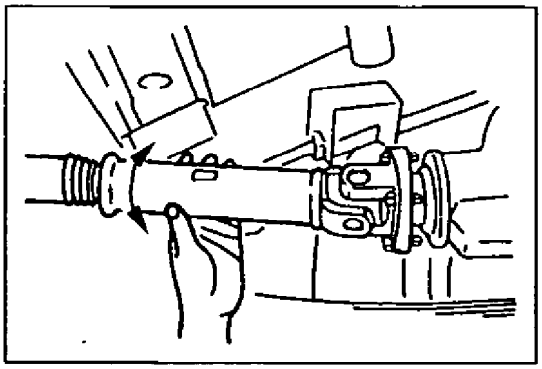
Suspension system.

- Inspect shock absorbers for oil leaks, dents or other damage in washers and inspects anchoring ends for wear.
  Change shock absorbers if necessary.
- Inspect front rods for leaks, dents or other damage.
- Inspect front control arms, balljoint dust covers, oil loss, loose or broken parts.
  Replace damaged or malfunctioning parts.



- Inspect driveaxle boot dust covers (wheel side and differential side) for cracks or other damage .
  Change boots if necessary.
- Inspect suspension system for damaged, loose or missing parts, also change any parts that show signs of wear or lack of lubrication.
  Repair or change defective parts if necessary.
- Check torque of suspension nuts and bolts and tighten if necessary.
  Repair or change any defective parts.

NOTE:
For more information on points to check, please refer to SPECIFICATIONS chart in Service Manual SECTIONS 3D and 3E 99500-60A10-01E.

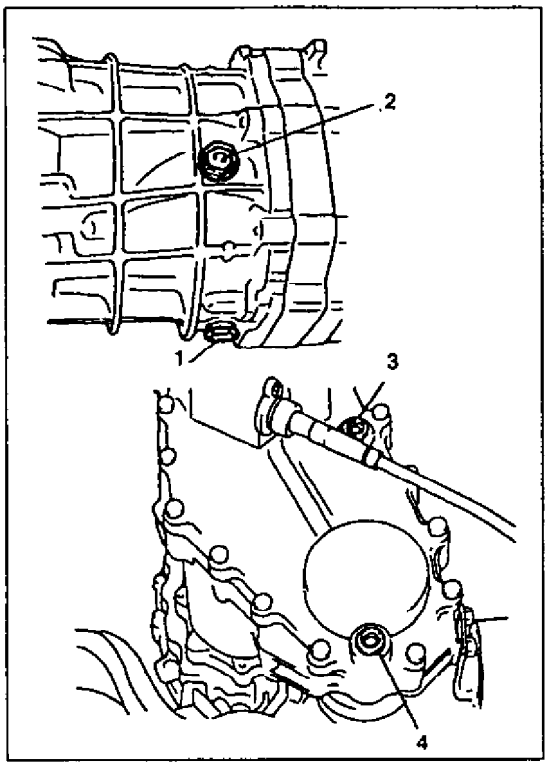


POINT 6-9

Driveaxle

1) Inspect universal joint and axle shaft knurling for any looseness or knocking when functioning.
   If any of the above anomalies are detected, change the defective part.
2) Check tightness of nuts and bolts which attach clamps.

Attaching nuts torque specifications: 5.5 Kg-m (55 Nm).



POINT 6-10

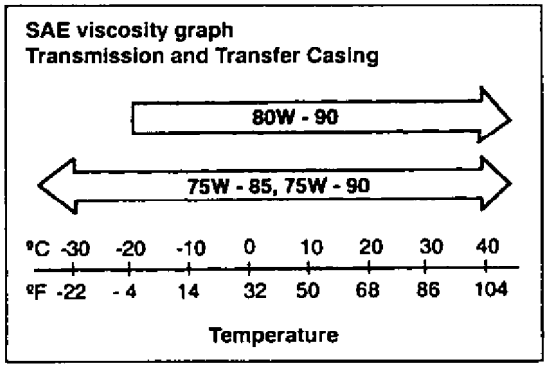
Transmission oil

Inspection
1) Inspect transmission for possible oil leaks.
2) Park vehicle on horizontal ground before checking level.
3) Remove plug (2) to check oil level. The level is correct if a small amount of oil seeps over the of edge of the hole on removing plug. If no oil comes out, add the necessary amount.

Oil change
1) With vehicle horizontal, drain oil from transmission (1).
2) Clean oil on plug and housing and apply sealer 99000-31110 on thread. Replace plug and tighten as specified. Fill in the oil to reach level and put on filler plug (2) tightening as specified.

Torque specifications:

Plug (1)	**4.5 Kg-m (45 Nm).**
Plug (2)	**3.8 Kg-m (38 Nm).**
Plug (3 and 4)	**2.3 Kg-m (23 Nm).**

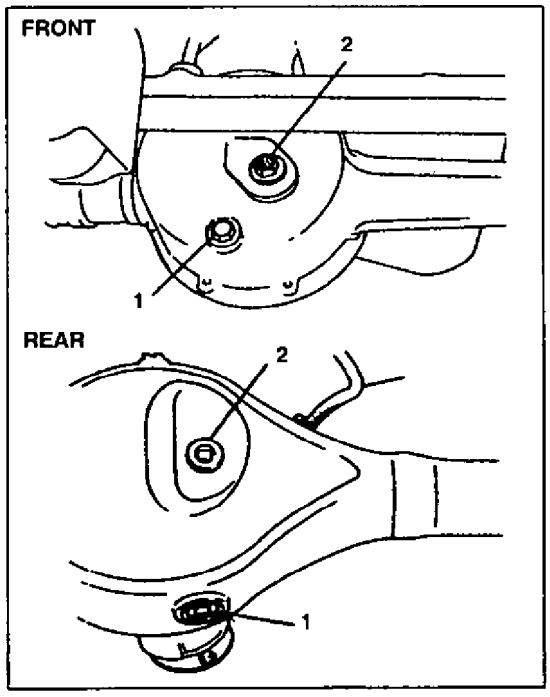


Use of gear oil 75 W - 90, type API GL 4 is strongly recommended

Oil capacity:
Transmission: 2.6 litres.
Transfer case: 1.7 litres.

POINT 6-12
Transfer case oil.

NOTE: Proceed as for transmission (previous point), removing oil level (3) and drain (4) plugs.



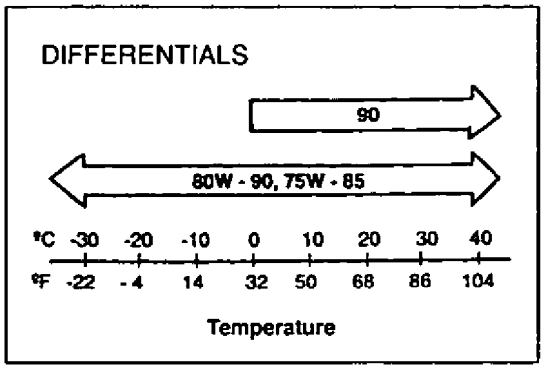
POINT 6-13

Differential oil.

Inspection
1) Make sure vehicle is situated on horizontal ground.
2) Remove oil level and filler plug (2).

If level is correct, a small amount of oil should seep out of the hole.
If no oil comes out, add the necessary amount.

Oil change
1) With the vehicle situated horizontally, drain oil by removing plug (1).
2) Clean oil from plug (1) and housing, apply sealer 99000-31110 to thread, fit plug to specified torque. Pour in necessary quantity of oil to reach level and put on filler plug (2), applying sealer indicated as specified.



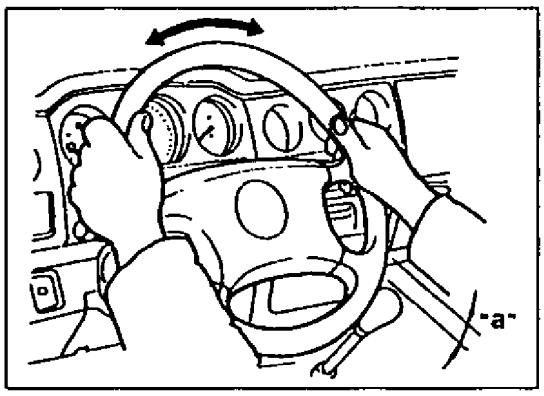
Torque specifications:

Front plug (1)	**2.3 Kg-m (23 Nm).**
Rear plug (1)	**2.2 Kg-m (22 Nm).**
Front plug (2)	**4.0 Kg-m (40 Nm).**
Rear plug (2)	**4.3 Kg-m (43 Nm).**

Use hypoid gear oil 80 W - 90, type API / GL 5.

Oil capacity:

Front axle : 1.0 litres.
Rear axle: 2.2 litres.



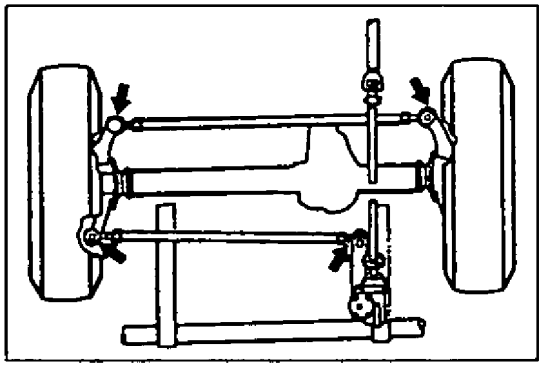
POINT 6-14

Steering system.

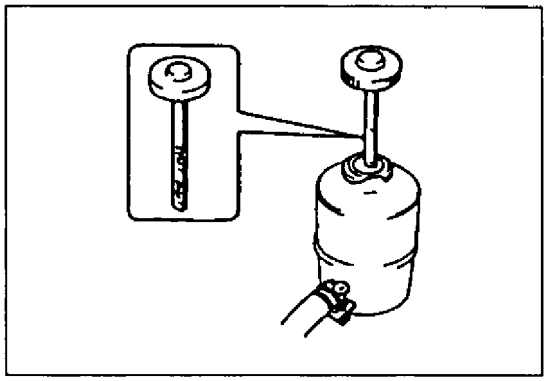
1) Inspect steering wheel for play, noise or looseness while vehicle is maintained on the ground with wheels pointing forward.

   Steering wheel free play: 10 – 30 mm (0.4 – 1.1 ins.).

2) Inspect universal joints on steering axis for noise, looseness or damage. If any problem exists, replace defective part for new one.



3) Check nuts and bolts are well tightened and tighten again if necessary.
4) Inspect steering fluid draining mechanism for any oil leaks. If there are, inspect oil level in gear mechanism.
5) Inspect steering linkage dust covers for damage (leaks, loose elements, breaks, etc.). Any damaged dust covers should be replaced.
6) Inspect wheel alignment.



POINT 6-15

Power assisted steering.

1) Visually check power steering system for liquid leaks and damaged hoses. Replace or change any defective parts.
2) Unscrew filler cap and check level marked by dipstick, which should be between MAX and MIN levels. If it is below MIN level, fill up to MAX level.

NOTE:

- **Ensure P/S, DEXRON-II or equivalent is used.**
- **Fluid level should be checked when cold.**

3) Visually inspect vane pump belt for cracks or wear.
4) Check belt tension. For further information on this subject, please refer to section 3B3 of Power Steering System Service Manual 99500-60A10-01S. Adjust or replace belt if necessary.

POINT 6-16

All locks and hinges.

Lubricate door hinges for correct functioning.

FINAL INSPECTION

Carry out a driven test in a safe place.

WARNING:
When carrying out driven tests, make sure they are in a safe place with no passing pedestrians or vehicles. This will reduce the possibility of accidents.

1) **Starting engine.**
   Check that engine runs without problem.

2) **Clutch and clutch cable.**
   Check the following points with engine running.
   - Test the six gears and ensure they all change without difficulty or scraping.
   - In 4th gear, engage the hand brake, accelerate a little and try to slowly release the clutch pedal. The engine should stall and the vehicle remain stationary. This means the clutch does not slip. If on releasing the clutch the engine tries to keep running, then the clutch is slipping.

3) **Brakes.**
   Check the following points when driving.
   - There are no abnormal noises when braking.
   - The same brake power is applied to all the wheels.
   - The vehicle does not tend to veer one way when brakes are applied firmly.
   - Wheels do not lock.

4) **Hand brake**
   Check hand brake functioning by stopping vehicle on pronounced slope and with only the hand brake fully engaged.

5) **Engine.**
   - Check that it responds quickly in all gears.
   - Check that engine does not produce abnormal noise or vibration.

6) **Body, wheels and transmission system.**
   Check body, wheels and transmission system do not produce abnormal noise or vibration.

7) **Meters and indicators**
   Check speedometer, mileometer, fuel gauge, temperature gauge, etc. for correct functioning.

8) **Oil pressure and charge lights.**
   Check these lights go off when engine is running. If any come on, with the engine running, there is some problem with the engine lubrication system or the charging system.

9) **Safety belt.**
   Inspect safety belt system, including belts, buckles, latch plates, retractors, anchoring, etc.

10) **Body.**
    Check the following points with the vehicle stationary:
    - Bonnet catch.
    - Door closure.
    - Seat gliding and reclining.
    - Battery electrolyte level.
    - Windscreen wipers.

RECOMMENDED FLUIDS

ENGINE OIL	Multigrade 10 W/40 API CD, CE or CF-4
ENGINE COOLANT	DINAMIC – DINAGEL – 9103
BRAKE FLUID	DOT – 3 or SAE J – 1703
TRANSMISSION	API GL4 SAE 75 W – 90
TRANSFER CASE	API GL4 SAE 75 W – 90
DIFFERENTIALS	API GL5 SAE 80 W-90
POWER ASSISTED STEERING	Equivalent to DEXRON - II

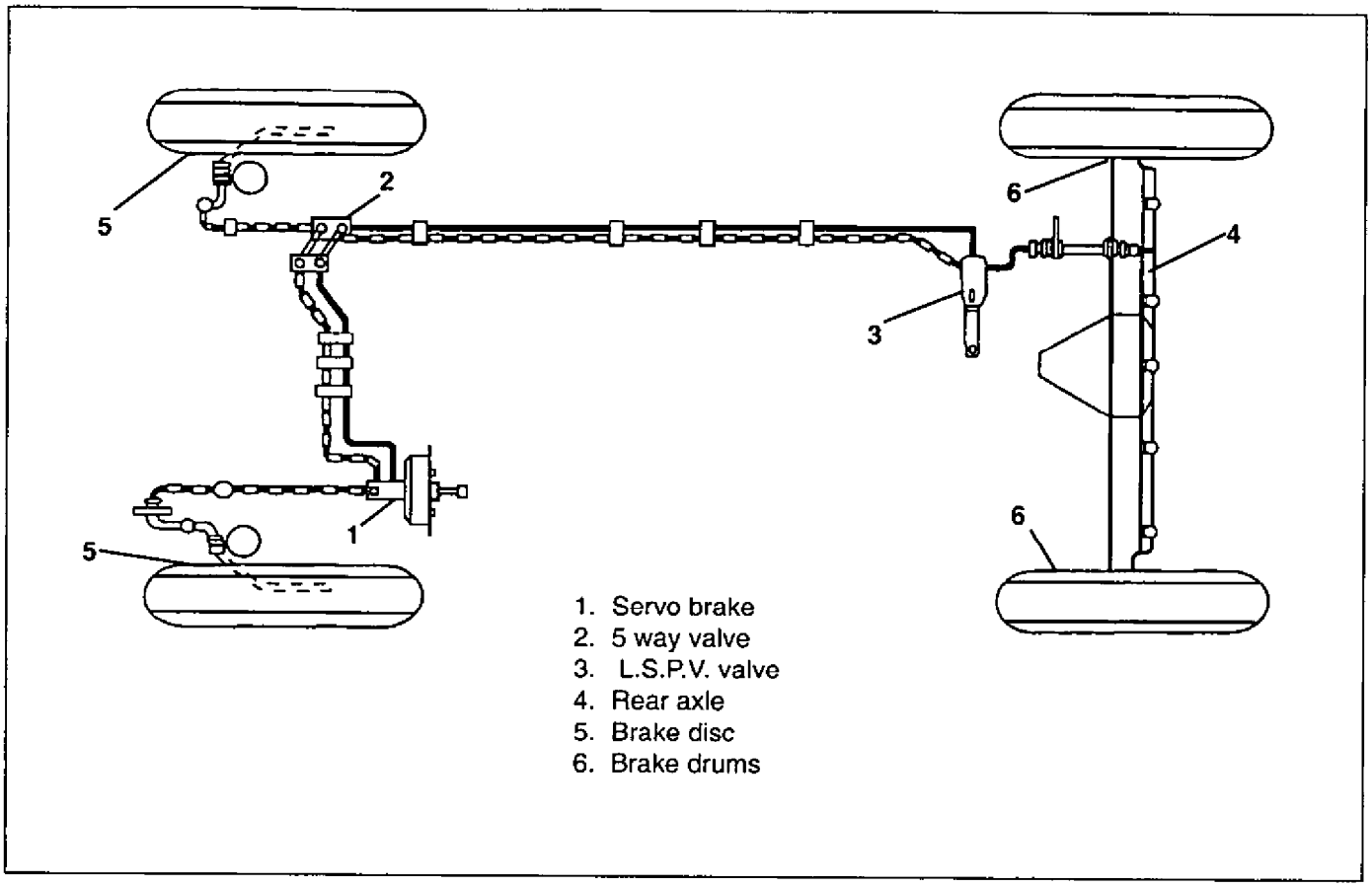
SECTION 5

BRAKES

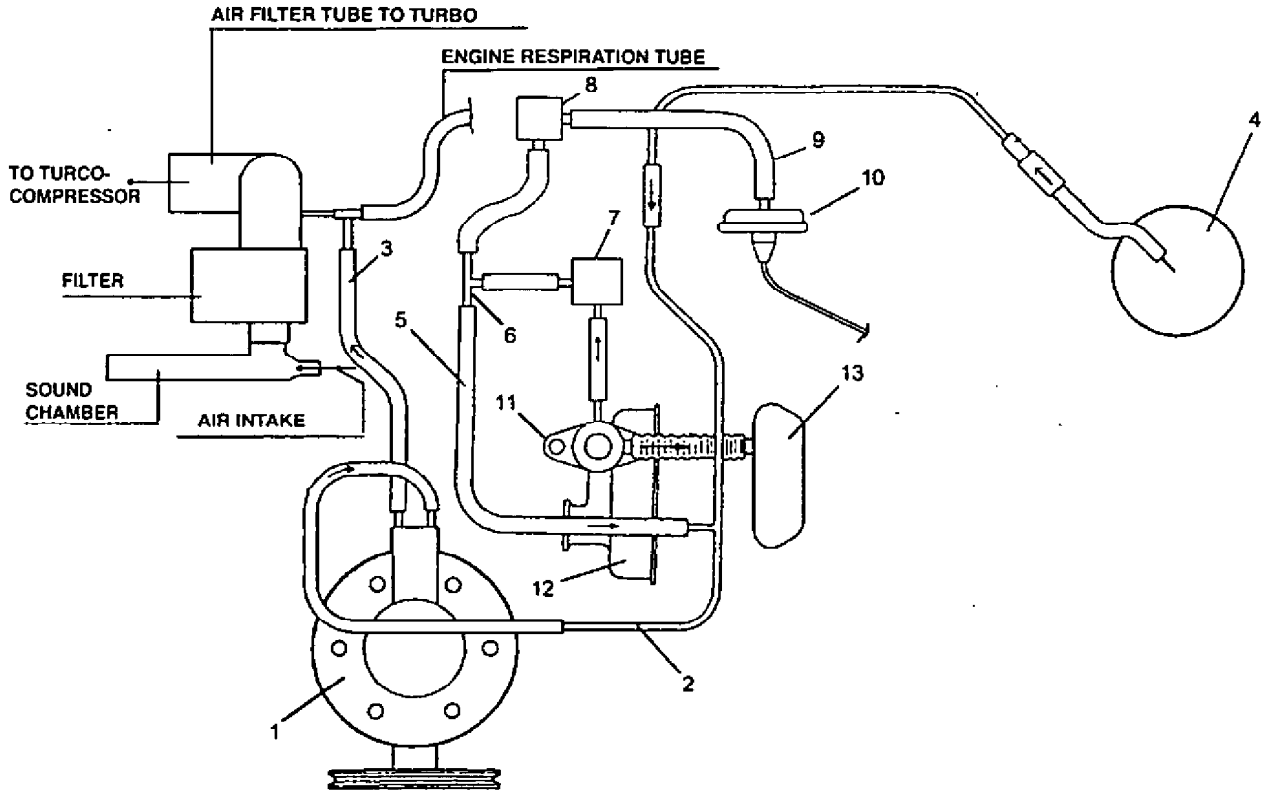
NOTE:
For points not covered in this section, please refer to corresponding Service Manual sections listed in the INTRODUCTION to this Manual.

LIST OF CONTENTS

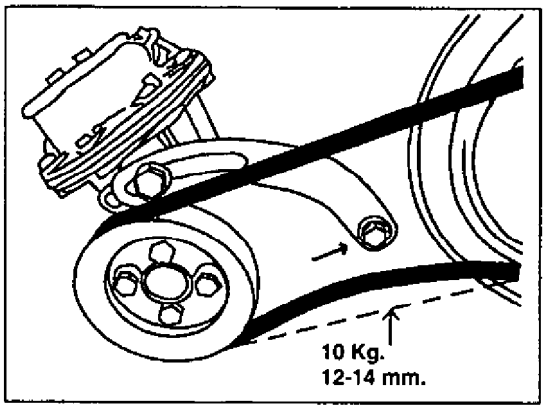
GENERAL OUTLINE



VACUUM CIRCUIT



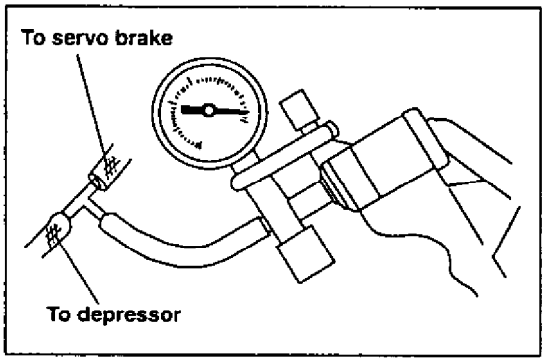
1. DEPRESSOR
2. SERVO BRAKE VACUUM LINES
3. DEPRESSOR EXPULSION LINES
4. SERVO BRAKE
5. ELECTRIC VALVE VACUUM LINES
6. VACUUM "T" JOINT
7. EGR ELECTRIC VALVE
8. FAST IDLE ELECTRIC VALVE
9. FAST IDLE VACUUM LINE
10. FAST IDLE
11. EGR VALVE
12. EXHAUST MANIFOLD
13. INTAKE MANIFOLD



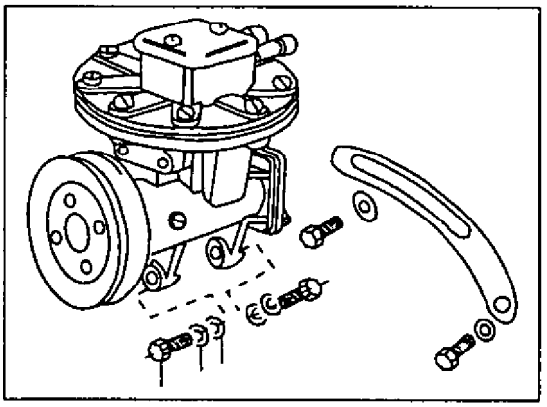
CHECKING THE DEPRESSOR

Inspection

1) Remove lower soundproofing plate of engine.
2) Make sure that belt is correctly tensioned.
3) Check, with engine running, that braking aid is sufficient.



4) If braking aid is not satisfactory, remove suction lines connecting servo brake with depressor and install a bypass vacuum gauge.
5) Rev engine to 1000 rpm and check that vacuum level is close to 570 hg. mm.
6) If it is not, check for:
   - Possible leaks from suction lines.
   - Possible obstruction of depressor outlet hose.



REPLACING THE DEPRESSOR

Removal

1) Remove lower soundproofing plate of engine.
2) Remove suction and outlet lines.
3) Slacken depressor tension and attaching bolts.
4) Rock depressor towards engine and remove belt.
5) Remove bolts and dismount depressor.

Installation

1) Install by reversing order of above operations.
2) Tense depressor belt and tighten bolts attaching.

- **Belt tension: 12-14 mm. deflection with pressure of 10 Kg.**
- **Attaching depressor bolts torque specifications: 1.8-2.8 Kg-m (18 a 28 Nm).**
- **Idler pulley-engine attachment bolt torque specifications: 1.8-2.3 Kg-m (18 a 23 Nm).**
- **Idler pulley-depressor torque specifications: 1.8-2.8 Kg-m (18 a 23 Nm).**
- **Depressor-bracket-block bolt torque specifications: 3.0 a 4.0 Kg-m (30 a 40 Nm).**

SECTION 6

ENGINE

LIST OF CONTENTS

GENERAL INFORMATION

CLEANING INSTRUCTIONS AND POINTS OF CAUTION

When repairing the engine please pay attention to the following points:

- Order of injection in cylinders is 1,3,4,2.
  Cylinder no. 1 is situated at rear of engine and no. 4 at the front next to the radiator.
- Before carrying out any general repair work, perform a diagnosis of the engine (compression measure, leaks, tune up timing, pump setting and fitting, turbocompressor functioning, etc.), this will help you isolate the problem and proceed to a general inspection only when justified.
- In the event of any anomaly in engine running due to electronic components, carry out general check of electronic components using DIAG 2000 analyser.
- You should as a general rule disconnect negative battery cable, this will help prevent short circuits.
- All operations related to fuel system, must be carried out in well ventilated areas and adopting the appropriate safety measures.
- During disassembly/assembly or when storing parts, protect cylinder heads holes cylinder head, cylinder block, jet pump, turbocompressor, intercooler, etc to prevent accidental entry of impurities and foreign material.
- On removing engine components, please keep in order so that they are placed in original position when effecting reassembly.
- Components like the turbocompressor cannot be repaired and the whole unit must be substituted. The injection pump must be serviced at an Official Bosch Servicer.
- During installation, lubricate surfaces exposed to friction with engine oil to protect engine during initial functioning.
- When removing electrical connectors do not pull on cables, remove locking clamps first and pull at both ends.

NOTE:

- **Unless otherwise stated, measurements are expressed in mm. and degrees centigrade.**
- **Unless otherwise stated measurements are expressed in Kg-m. and Nm.**

ENGINE DIAGNOSIS

RECOMMENDATIONS:

In the event of any anomaly in engine running due to electronic components, carry out general check of electronic components using DIAG 2000 analyser.

Symptom	Probable reason	Correction
Engine does not turn over when attempting to start	**Defective electrical system**	
	• Defective starter motor	Repair
	• Defective ignition key	Replace
	• Defective connections in cable package	Check/repair
Engine does not start (engine turns over correctly)	**Defective fuel system**	
	• Lack of fuel in tank	Refit
	• Dirty fuel filter	Replace
	• Water or air in fuel	Replace/remove
	• Dirty or blocked tank and fuel lines	Clean
	• Poor quality fuel	Replace
	Jet pump	
	• Defective jet pump	Replace
	• Defective jet pump adjustment	Adjust
	Defective electronic components in injection system	**Check with DIAG 2000 analyser**
	• Defective needle lift pick-up	Replace
	• Defective engine rate pick-up	Replace
	• Defective fuel shutdown solenoid	Replace
	• Defective pre/post heating glow plug relay	Replace
	• Fault in coded ignition mechanism	Check mechanism functioning, locking, unlocking and act accordingly
	Defective air intake system	
	• Air inlet lines distorted or blocked	Replace/Clean
	• Blocked air filter	Replace
	• Intercooler blocked (internally)	Clean
	Other	
	• Defective pre/post heating glow plug system	Repair/Replace
	• Blocked exhaust pipe	Clean
	• Timing belt broken	Replace/repair valves
	• Defective heater or cable package connections	Replace/repair
	• Defective injector (and pick-up)	Replace

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
Engine starts with difficulty	**Defective fuel system**	
	• Dirty fuel filter	Replace
	• Water or air in fuel	Replace/Remove
	• Dirty or blocked tank and pipes	Clean
	• Poor quality fuel	Replace
	Jet pump	
	• Defective jet pump	Replace
	• Defective jet pump adjustment	Adjust
	Defective electronic components in injection system	**Check with DIAG 2000 analyser**
	• Defective water temperature sensor	Replace
	• Pre/post heating glow plug relay defective	Replace
	• Fault in coded ignition mechanism	Check mechanism functioning (locking, unlocking), and act accordingly
	Defective air intake system	
	• Air flow pipes distorted or blocked	Replace/Clean
	• Air filter blocked	Replace
	• Intercooler blocked internally	Clean
	Low compression	
	• Incorrect valve play	Adjust
	• Loss of compression through valve seat	Polish seat
	• Valve plunger stuck	Correct or replace
	• Valve springs damaged or worn	Replace
	• Loss of compression through cylinder head gasket	Repair or replace
	• Segments stuck or damaged	Replace
	• Piston, segment or cylinder worn	Repair
	Other	
	• Defective pre/post heating system	Repair/Replace
	• Blocked exhaust pipe	Clean/Replace
	• Defective glow plugs or cable packages	Replace/Repair
	• Defective injector (and pick-up)	Replace

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
Engine idles erratically	**Defective fuel system**	
	• Lack of fuel in tank	Refit
	• Dirty fuel filter	Replace
	• Water or air in fuel	Replace/Remove
	• Dirty or blocked tank and hoses	Clean
	Jet pump	
	• Defective jet pump	Replace
	• Defective jet pump adjustment	Adjust
	• Idle speed badly adjusted	Adjust
	• Loose jet pump clamps	Tighten
	• Defective throttle cable adjustment	Adjust
	• Air intake	Correct
	Injection lines	
	• Cracked fuel lines	Replace
	• Fuel leaks at connections	Tighten/Repair
	Injectors	
	• Pressure measurement incorrect	Adjust
	• Needle stuck in one or more nozzles	Replace
	• Incorrect positioning of one or more nozzles in nozzle-holder	Repair
	• Injector lock washers incorrectly fitted	Repair
	• Injector (and pick-up) in bad condition	Replace
	Defective electronic components in injection system	**Checking with DIAG analiser 2000**
	• Defective needle lift pick-up	Replace
	• Idle speed control valve	Replace
	Defective air intake system	
	• Air flow pipes distorted or blocked	Replace/Clean
	• Air filter blocked	Replace
	• Intercooler blocked (internally)	Clean
	Other	
	• Valve clearance incorrect	Adjust
	• Low compression	See point above
	Engine overheating	See (subsequent) overheating section

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
Juddering, jerky engine	**Defective fuel system**	
	• Dirty fuel filter	Replace
	• Blocked lines or connections	Clean or Replace
	• Poor quality fuel	Replace
	• Water or air in fuel filter	Clean/Replace
	Engine overheating	See (subsequent) overheating section
	Defective electronic components in injection system	**Checking with DIAG 2000 analyser**
	• Incorrect functioning of EGR electric valve	Replace
	• Defective or badly connected cable package connections	Check/Repair
	• Defective solenoid fuel shut-down	Replace
	Defective air intake system	
	• Air flow lines distorted or blocked	Replace/Clean
	• Intercooler blocked	Clean
	• Air filter blocked	Replace
	Injection lines	
	• Cracks	Replace
	• Leaks from connections	Tighten/Repair
	Injectors	
	• Pressure measurement incorrect	Adjust
	• Needle stuck in nozzle	Replace nozzle
	• Injector dripping	Replace
	• Lock washers incorrectly fitted	Repair
	• Injector (and pick-up) in bad condition	Replace
	Jet pump	
	• Loose pump clamps	Tighten
	• Defective pump adjustment	Adjust
	• Air intake	Repair
	• Defective jet pump	Replace
	• Idling speed incorrectly adjusted	Adjust
	• Throttle cable incorrectly adjusted	Adjust
	Low compression	Outlined above
	Others	
	• Incorrect valve adjustment	Adjust
	• Loose engine mounts	Tighten
	• Timing belt not tensed correctly	Adjust

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
	• Defective turbocompressor (black fumes)	Check functioning and proceed accordingly
	• EGR electric valve lines inverted	Check and correct
	• Chocked exhaust system	Repair or replace
Engine accelerates by itself on idle running	**Defective fuel system**	
	• Fuel system blocked	Check/Clean
	• Low fuel level	Refit
	• Fuel filter blocked	Replace
	• Intake of air in circuit	Correct
	• Poor quality of fuel	Replace
	Lubrication	
	• Oil level too high	Correct
	• Blockage in fuel vapour recycling system	Check/Clean
	Defective electronic components in injection system	**Check with DIAG 2000 analyser**
	• Defective water temperature sensor	Replace
	• Defective idle speed control valve	Replace
	Jet pump	
	• Defective jet pump	Replace
Engines stalls when decelerating	**Defective fuel system**	
	• Fuel circuit blocked	Check/Clean
	• Low fuel level	Refit
	• Fuel filter blocked	Replace
	• Poor quality fuel	Replace
	Defective electronic components in injection system	**Check with DIAG 2000 analyser**
	• Defective electric system (pump control module)	Replace
	• Defective idle control speed valve	Replace
	• Cable package	Check/Repair
	• Defective water temperature sensor	Replace
	Jet pump	
	• Idle speed incorrectly adjusted	Adjust
	• Incorrect cold idling adjustment	Adjust
	• Defective jet pump	Replace
Engine crawls Erratic running	**Defective fuel system**	
	• Dirty fuel filter	Replace
	• Pipes or connections blocked	Clean or Replace
	• Poor quality fuel	Replace

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
	Defective electronic components in injection system	**Check with DIAG 2000 analyser**
	• Defective lead electric valve	Replace
	• Throttle lever potentiometer	Replace
	Jet pump	
	• Incorrect adjustment of idle speed	Adjust
	• Defective setting	Adjust
	• Defective jet pump	Replace
	Injectors	
	• Injection line leaks	Correct
	• Defective injectors	Replace
	• Incorrectly fitted lock washers	Correct
	• Injector (and pick-up) defective	Replace
	Low compression	Outlined above
	Other	
	• Valve play incorrect	Adjust
Excessive oil consumption	**Defective air intake system**	
	• Air filter element blocked	Replace
	• Air intake line blocked	Repair
	• Intercooler blocked	Clean
	Lubricating System	
	• Excessive oil level	Adjust
	• Crankcase ventilation blocked	Repair
	Turbocompressor	
	• Fuel drain lines blocked	Repair
	• Defective turbocompressor	Check/Replace
	Oil cooling	
	• Broken radiator or leaks from hoses or connections	Correct/Replace
	Other	
	• Plungers or guides worn	Replace
	• Valve guide retainers worn	Replace
	• Piston, segments or cylinders worn	Replace
Excessive fuel consumption	**Defective fuel system**	
	• Fuel leaks in tank, pipes, etc..	Correct
	• Blocked fuel filter	Replace
	Jet pump	
	• Defective	Adjust
	• Idle speed too high	Adjust

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
	Injectors	
	• Incorrect pressure measurement	Adjust
	• Nozzles stuck	Replace
	• Incorrect installation of nozzles in holder	Repair
	• Fuel leak from nozzle needle	Replace
	Defective air intake system	
	• Air filter blocked	Replace
	• Intercooler blocked (internally)	Clean
	Low compression	Outlined above
	Other	
	• Incorrect valve seating	Grind valves
	• Brakes lock up	Repair
	• Low tyre pressure	Adjust
	• Clutch slips	Replace
	• Defective functioning of EGR system	Repair
Blue fumes when hot, idling or decelerating	**Defective electronic components in injection system**	**Check with DIAG 2000 analyser**
	• Defective EGR electric valve	Replace
	Defective fuel system	
	• Dirty fuel filter	Replace
	• Pipes or connections blocked	Clean or replace
	• Poor quality fuel	Replace
	Lubrication	
	• Excessive level of engine oil	Adjust
	• Crankcase ventilation system blocked	Clean/Repair
	Turbocompressor	
	• Fuel drain lines blocked	Repair
	• Defective turbocompressor	Check/Replace
	Defective air intake system	
	• Air filter element blocked	Replace
	• Air intake line blocked	Repair
	• Intercooler blocked (internally)	Clean
	Jet pump	
	• Incorrect jet pump adjustment	Adjust
	• Defective jet pump	Replace
	Injectors	
	• Defective or incorrectly fitted injector gaskets	Replace
	• Defective injectors	Replace
Lack of power (Black smoke)	**Defective electronic components in injection system**	**Check with DIAG 2000 analyser**
	• Defective engine water temperature sensor	Replace

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
	• Engine pick-up defective	Replace
	• Defective throttle lever potentiometer	Replace
	• Defective EGR electric valve	Replace
	Defective fuel system	
	• Dirty fuel filter	Replace
	• Low fuel level	Refit
	• Pipes or connections blocked	Clean or replace
	• Poor quality fuel	Replace
	• Air in circuit	Check/Eliminate
	Defective air intake system	
	• Distorted or blocked air flow lines	Replace
	• Air filter blocked	Replace
	• Intercooler blocked (internally or externally)	Clean
	• Leaks from hoses or intercooler	Correct
	Jet pump	
	• Defective pump adjustment	Adjust
	• Defective jet pump	Replace
	Injectors	
	• Defective injectors	Replace
	• Squashed feed lines(connections over tight)	Replace
	Compression	
	• Incorrect compression (low)	Check and repair engine if necessary
	Turbocompressor, intercooler, manifolds and hoses	
	• Turbocompressor or intercooler hose blocked	Repair or replace
	• Intercooler hose blocked	Repair or replace
	• Air leak from turbocompressor to intercooler or from intercooler to manifold.	Repair or replace
	• Leaks from intake manifold gaskets	Repair
	• Gas leaks between exhaust manifold and turbo	Repair
	• Gas leaks from exhaust manifold	Repair
	• Gas leaks from turbocompressor	Replace
	• Malfunctioning of relief valve	Replace oil and filter.
	• Dirty turbocompressor turbine	Replace turbocompressor
	• Defective turbocompressor	Replace
	Other	
	• Valve play incorrect	Adjust
	• Incorrect timing adjustment	Adjust
	• EGR electric valve hoses inverted	Repair
	• Exhaust pipe blocked	Repair or replace
Lack of power (no black fumes and abnormal symptoms)	**Jet pump**	
	• Lack of travel in throttle cable	Adjust
	• Maximum revolutions stop bolt incorrectly adjusted	Adjust
	• Defective jet pump	Replace

ENGINE DIAGNOSIS

Symptom	Probable reason	Correction
Low oil pressure	**Fuel system**	
	• Inadequate oil viscosity	Change viscosity
	• Defective pressure switch	Replace
	• Insufficient oil	Refit
	• Oil pan pickup tubes blocked	Clean
	• Defective oil pump	Replace
	• Pressure relief valve stuck	Repair
	• Excessive wear in engine parts	Replace defective parts
	• Oil loss from connections, hoses or the actual radiator	Repair/Replace
Noises in engine. **Before checking noises in engine, ensure that:** • Pump is correctly fitted • Injector pressure measurement is correct. • Correct fuel is used Correct oil is used	**Noises from valves**	
	• Inadequate valve clearance	Adjust
	• Valve plungers and guides worn	Repair
	• Valve springs weak or deteriorated	Replace
	• Valve warped or bent	Refit
	Piston,segments and cylinder noise	
	• Excessive wear in pistons, segments or cylinders	Replace affected parts
	Connecting rods	
	• Rod bearings worn	Repair
	• Connecting rod pins worn	Repair
	• Connecting rod nuts loose	Repair
	• Low oil pressure	Outlined above
	Crankshaft noise	
	• Low oil pressure	Outlined above
	• Engine bed bearings worn	Repair
	• Crankshaft pins worn	Repair
	• Engine bedplate bolts loose I	Repair
	• Excessive crankshaft end play	Repair
Noises in turbocompressor	**Defective air intake system**	
	• Air intake blocked or leaking	Repair
	• Turbocompressor-intercooler or intercooler-manifold hoses blocked	Repair
	• Intake manifold blocked or leaking	Repair
	• Intercooler blocked (internally) or leaking	Repair
	Exhaust system	
	• Exhaust system blocked	Repair
	• Gas leak from exhaust manifold	Repair
	Turbocompressor	
	• Gas leak from exhaust manifold/exhaust manifold connection	Repair
	• Gas leak from turbocompressor elbow/exhaust pipe	Repair
	• Defective turbocompressor	Replace Check,
	• Lack of lubrication in turbocompressor	Repair or Replace

ENGINE DIAGNOSIS

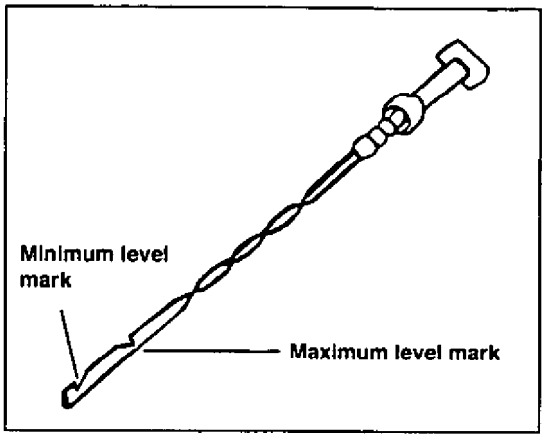
Symptom	Probable reason	Correction
Overheating Before checking reasons proceed as follows: • Correctly tune up jet pump • Check electronic components in injection system with DIAG 2000 analyser	**Cooling system** • Front grill plugged • Radiator thermo sensor defective • Insufficient coolant • Thermostat not working or working incorrectly • Water pump functioning defective • Radiator blocked externally, internally or leaks **Electrical system** • Electric fan relays defective • Electric fans defective **Lubrication system** • Insufficient engine oil • Inadequate engine oil grade • Oil filter blocked • Defective functioning of oil pump • Oil radiator blocked internally or externally • Hoses blocked or folded or connections blocked **Other** • Brake drag • Defective cylinder head gasket • Air filter blocked	 Eliminate obstacles Replace Refill Replace Replace Clean, repair or replace Replace Replace Refit/See reason Replace Replace Replace Clean, repair or replace Repair or replace Repair Replace Replace

SECTION 6A1

ENGINE REPAIR

6A1

LIST OF CONTENTS

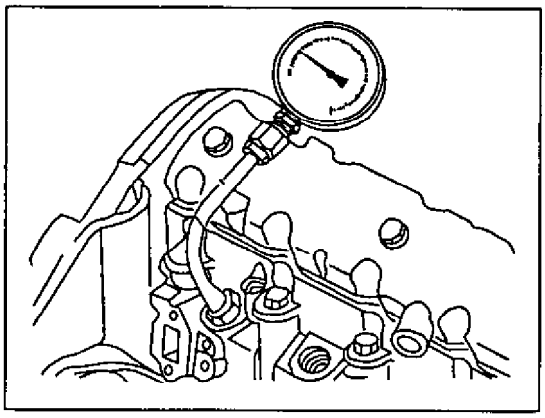


IN THE VEHICLE

OIL LEVEL

1) Ensure that vehicle is on a horizontal surface.
2) Start up engine and wait until it reaches a normal functioning temperature. Stop vehicle and wait 3 minutes.
3) Take out dipstick and check that oil is between maximum and minimum levels.
4) Add any oil if necessary.

NOTE:
The difference between maximum and minimum level is 1.5 litres (approximately).



COMPRESSION MEASURE

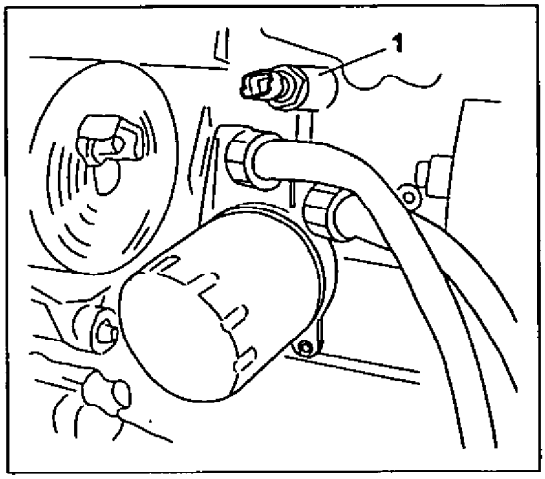
1) Ensure that battery is fully charged.
2) Start up engine and wait until it reaches a normal functioning temperature and then switch it off.

   NOTE:
   The compression measure can be carried out from injector housing or heater housing, and for which a compression gauge adaptor must be used to attach to one or the other housing.
   The compressor gauge must have a scale of at least 0-40 Kg/cm².

3) Remove intercooler, please refer to 6A1-4.
4) Remove all heaters and injectors and attach compression gauge to first cylinder.
5) Do not introduce ignition code.
6) Activate ignition directly, without going through heater position and observe compression levels on gauge.
7) Repeat this operation in every cylinder.
   The correct level should be between the maximum and minimum indicated.

   Maximum compression 30 Kg/cm²
   Minimum compression 25 Kg/cm²
   Maximum difference between cylinders 5 Kg/cm²

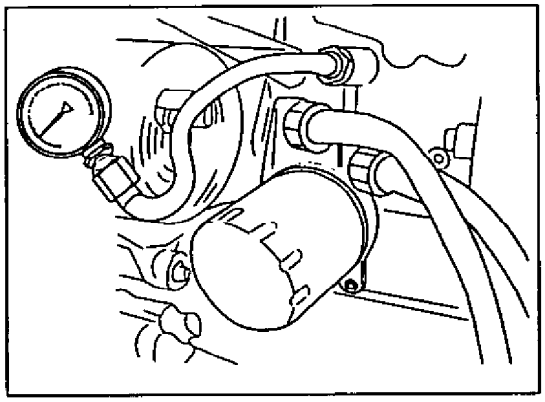
8) If compression in one or more cylinders is low, add a small quantity of engine oil to the cylinder and repeat the test.
   1. If the compression level rises when repeating the test, the piston, segments or the cylinders are defective.
   2. If the compression level does not alter, the valve seats or valve play adjustments are defective.
   3. If the compression is low in adjoining cylinders, the cylinder head gasket might be defective, or the cylinder head distorted.



CHECKING OIL PRESSURE

NOTE:
Before checking oil pressure, examine the following:
- **Level of oil in oil pan, which should be between maximum and minimum marks.**
- **Quality of oil.**
- **Renew oil if discoloured or in deteriorated condition.**
- **Repair if oil leaks observed.**

1) Remove oil pressure switch (1) from cylinder block.
2) Fit pressure gauge with a scale of at least 0-10 Kg/cm².
3) Start up engine and heat up to normal functioning temperature.

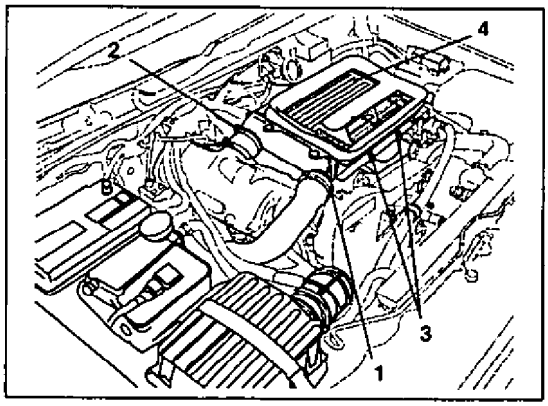


Oil pressure specifications	**At 750 rpm - 2 Kg/cm²**
	At 2000 rpm - 3.5 Kg/cm²
	At 4000 rpm - 4.5 Kg/cm²

4) After checking oil pressure, remove pressure gauge and fit pressure switch with new gasket tightened as specified.

Pressure switch torque specifications: 3 Kg-m (30 Nm)

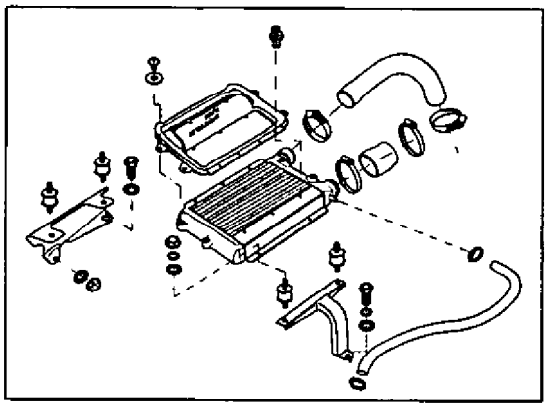
WARNING:
Be careful working when engine is hot, high temperatures can cause burns.



REMOVAL AND INSPECTION OF INTERCOOLER

Removal

1) Disconnect negative battery.
2) Slacken hose clamp (1) joining intercooler to turbocompressor and disconnect it.
3) Slacken hose clamp (2) joining intercooler to intake manifold.
4) Remove four bolts (3) attaching intercooler to brackets and remove intercooler (4).



Revision

1) Ensure there are no distortions or blockages in intercooler and that hoses are not distorted, cracked or broken.
2) Eliminate with compressed air any impurities inside or outside intercooler.

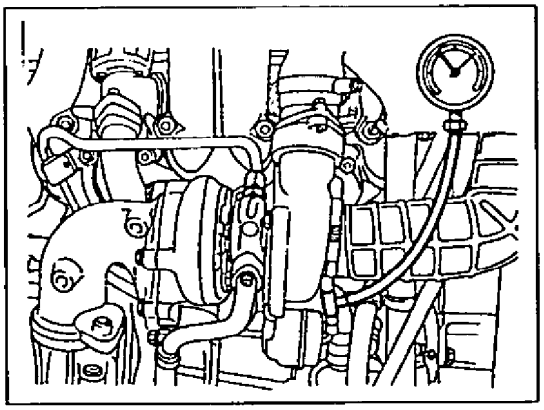
Assembly

1) Reverse order for operations in disassembly.

Examination

- Check there are no leaks in connections between turbocompressor and intercooler and between intercooler and intake manifold.

NOTE:
When cleaning intercooler exterior, protect inflow and outflow lines with appropriate caps.



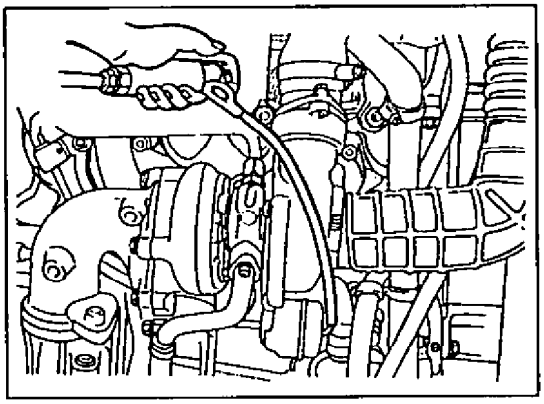
CHECKING TURBOCOMPRESSOR AND RELIEF VALVE FUNCTIONING

Turbocompressor

1) Remove upper air filter cap and union between filter and turbocompressor.
2) Connect bypass to pipes joining intercooler with relief valve, as shown in figure, and attach pressure gauge.
3) Fit air filter and suction hose assembly.
4) Set transmission in neutral and warm engine up to normal functioning temperature.
5) Start engine and ascending a slope check that pressure on gauge corresponds to indicated levels.

At 2.880 r.p.m. ..... 1.03 BAR
At 3.420 r.p.m. ..... 1.02 BAR
At 3.900 r.p.m. ..... 1.00 BAR
At 4.000 r.p.m. ..... 0.99 BAR

6) If pressure is below specified levels, check the following:
   - Leaks from connection between turbocompressor and exhaust manifold.
   - Air leaks from union between admission turbine and intercooler.



Relief valve

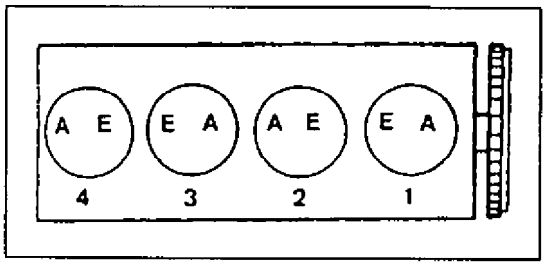
1) Carry out indicated operation (1) for checking turbocompressor functioning.
2) Disconnect lines joining intercooler with relief valve and attach a tool to supply pressure as shown in figure.
3) Apply pressure up to maximum of 1.03 bars. Observe that relief valve rod terminates travel when pressure is approximately 10.3 bars.

NOTE:

- **Never exceed 1.03 bars of pressure.**
- **If pressure blown is insufficient or relief valve functioning is incorrect, replace turbocompressor, please refer to 6A1-27.**

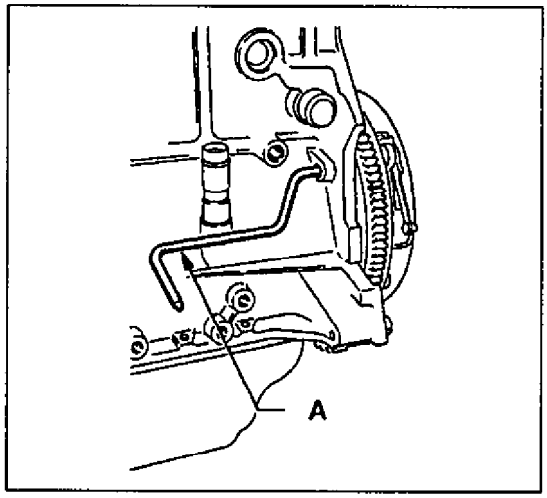
VALVE PLAY (CHECKING)

1) Disconnect negative battery cable.
2) Disassemble the following components:
   - Intercooler assembly, please refer to 6A1-4.
   - Turbocompressor and intercooler union.
   - Components inherent in rocker arm cover.
   - Rocker arm cover.

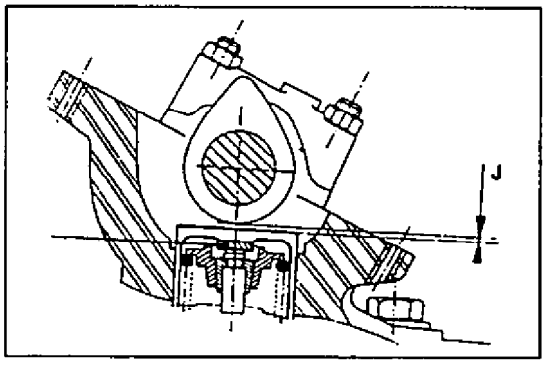


NOTE:
- **Valve play should be checked with engine cold. Cooling time is approximately 2 hours.**
- **Cylinder no. 1 is situated in the rear part of engine.**
- **Protect with appropriate caps the inlets and outlets to intercooler and turbocompressor.**

3) Turn engine in normal rotational direction until valves of cylinder no. 4 are crossed (cylinder no. 1 compressed).



4) Lock engine flywheel with tool (A) **Ref. 00000V02008.** In this position, check intake valve play on cylinders no.1 and 2 and exhaust valves for cylinders no. 1 and 3.
5) Rotate crankshaft 360º (one complete turn) and lock engine flywheel with a tool. **Ref. 00000V02008.** At this moment cylinder no. 1 is crossed and no. 4 compressed.
   Check intake valve play in cylinders no. 3 and 4, and exhaust valves for cylinders no. 2 and 4.



CROSSED	A4	E4	A1	E1
CONTROL	A1 A2	E1 E3	A4 A3	E4 E2

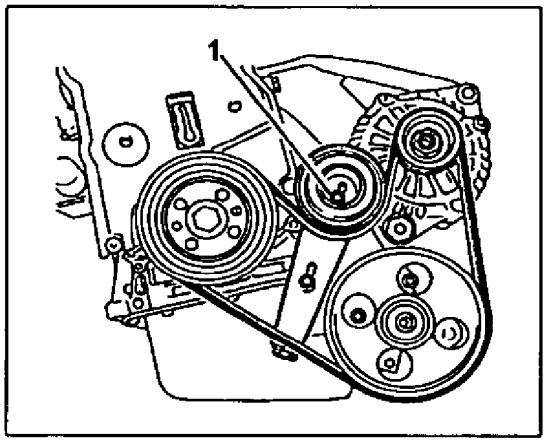
Valve play (J):

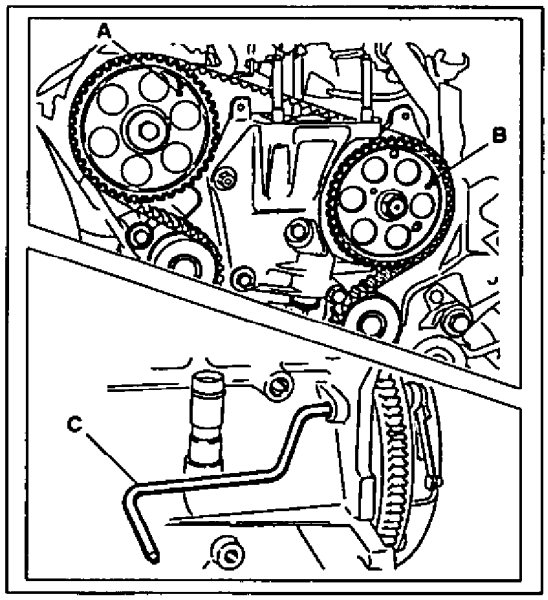
Intake	A	0.15 mm.
Exhaust	E	0.30 mm.
Tolerance	T	0.07 mm.

VALVE PLAY(ADJUSTMENT)

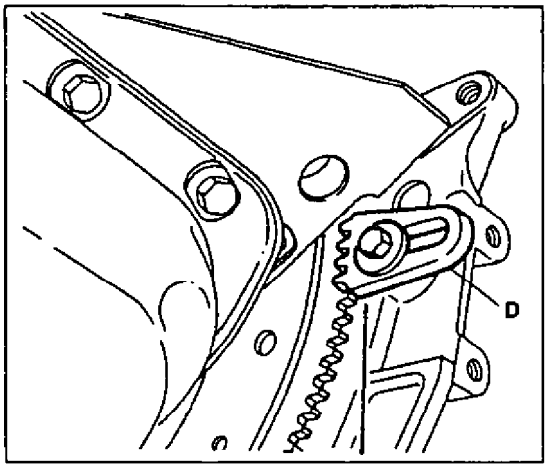
NOTE:
- **Check valve play as indicated in 6A1-6.**
- **Before adjusting valve play, the play should be checked and the levels noted down.**

Disassembly
1) Disconnect negative battery cable.
2) Remove rear electric fan from water radiator so as to give access to the timing. please refer to 6B-9 (REPLACEMENT OF REAR ELECTRIC FAN).
3) Remove lower engine plate.
4) Slacken depressor tensioner and remove belt.
5) Slacken tensioner (1) and remove alternator drive belt, the hydraulic pump and A/C compressor, if fitted.
6) Remove upper bracket of A/C compressor, if fitted.
7) Remove upper timing covers.

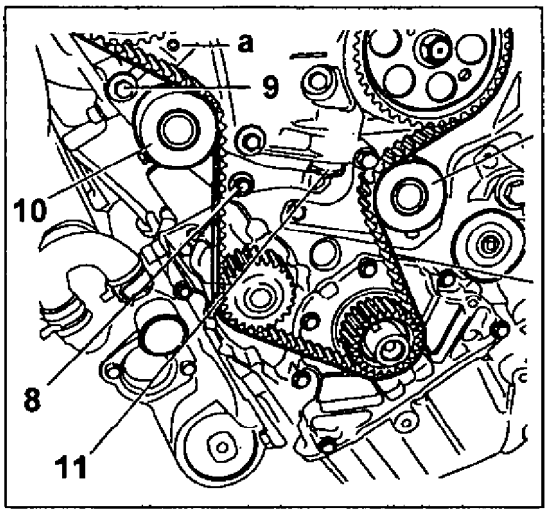




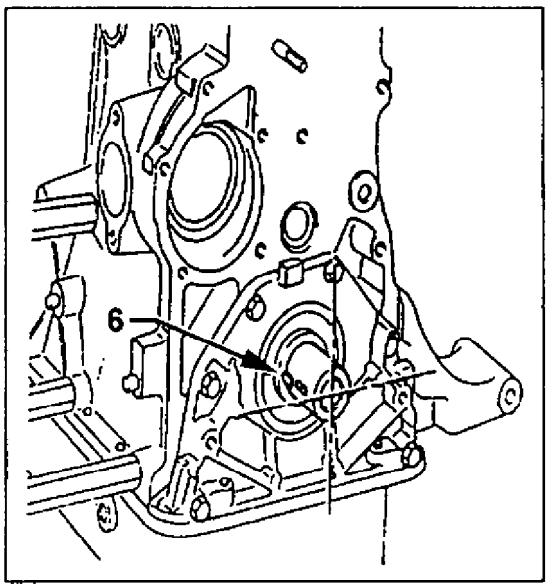
8) Rotate crankshaft using tool (C) until camshaft pinions and jet pump are aligned at points (A) and (B) and the engine flywheel in position TDC. **Tool Ref. 00000V02008.**
Lock camshaft pinion in position (A) using bolt TYPE M8 x 125 x 35.
Lock jet pump pinion in position (B) using bolts TYPE M8 x 125 x 35.



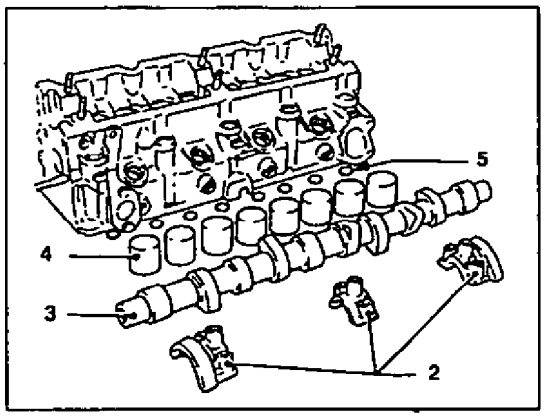
9) Retain engine flywheel using retaining tool (D) **Ref. 09916-96510**, remove attaching bolt from crankshaft pulley and remove pulley using puller. **Ref. 00000V02021.** Remove retaining tool (D).



10) Remove lower timing cover, slacken nut (8) and bolt (9) of tensioner pulley mounting (10).
11) Apply force to mounting plate (a), compress piston (11) to detense belt and tighten bolt (9) again with piston compressed.
12) Remove timing belt and dismount camshaft pinion.



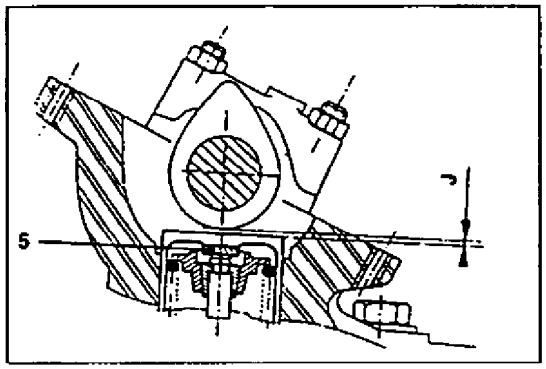
13) Remove engine flywheel locking tool **Ref. 00000V02008** .and turn engine flywheel round until crankshaft keyway (6) is at 9 o'clock position.



14) Remove the following components and place them in the same order for assembly:
- Camshaft covers (2)
- Camshaft (3)
- Blockholes(4)
- Plates (5)

Checking

1) Taking the play obtained into account, and after checking clearance (please refer to 6A1-6) and measuring thickness of each plate removed, determine the above thickness by using the following example:



EXAMPLE

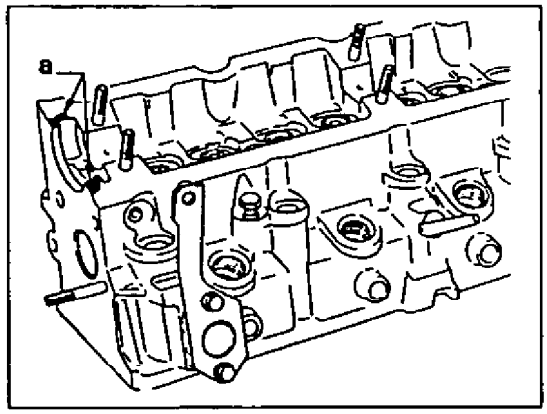
INTAKE VALVE

Clearance allowed	**0.15**
Clearance measure (J)	**0.45**
Difference	**+ 0.30**
Existing plate	**2.425**
Plate to be fitted	**2.725**
Play obtained	**0.15**

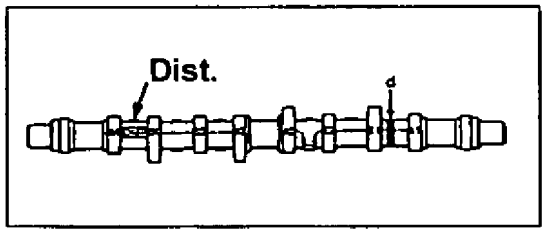
2) Fit plates (5) in blockholes previously selected.

NOTE:
55 types of plate exist, thickness varying between 0.025 and 0.025 mm.

After work on cylinder head (camshaft replacement, blockholes, valves or valve honing), plates of 2.425 mm. thickness should be fitted first.

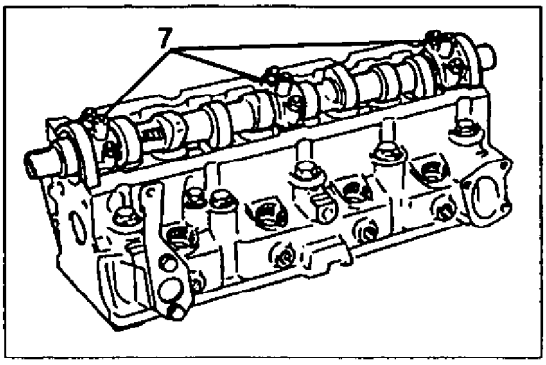


Apply MOLIKOTE G. PLUS RAPID to camshaft covers and recommended products for sealing in front and rear areas (a).



Fitting

1) Fit camshaft with DIST label facing towards timing, or likewise with camshaft keyway pinion facing towards timing.

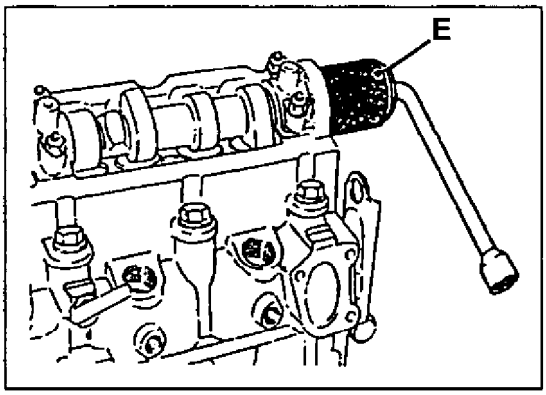


2) Fit support covers (7) with label facing towards flywheel side (backwards).

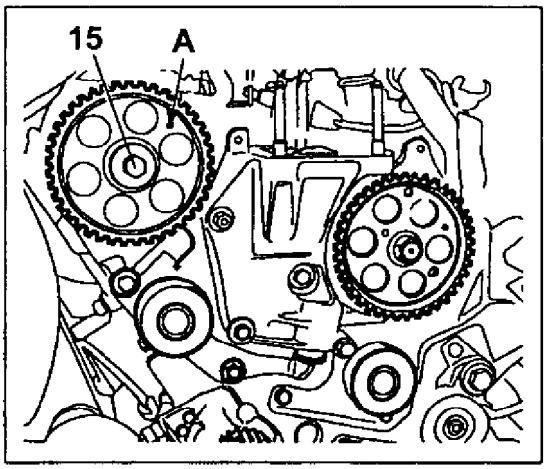
3) Fit locking elements and progressively tighten as specified.

Camshaft supports torque specifications: 2.0 Kg-m (20 Nm).

4) Apply film of recommended sealing product in retainer housing.



5) Fit new retainer on tool (E) **Ref. 00000V02007** positioning it at end where interior is deepest. Place front and rear retainers in housing, tightening tool with camshaft pinion bolt.



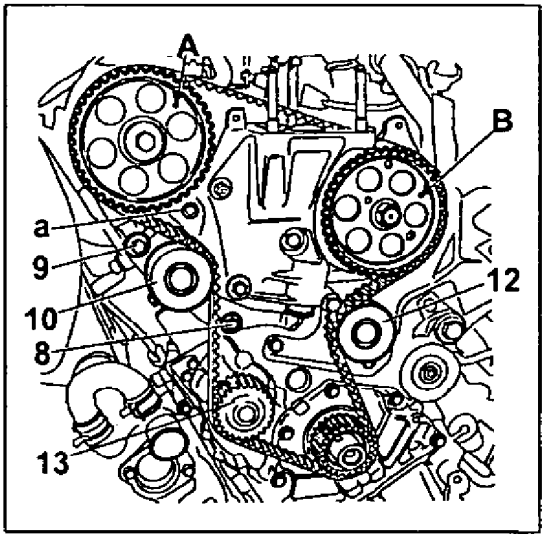
6) Fit camshaft pinion key, install pinion and retain it with bolt (15) without tightening to maximum.

7) Lock camshaft pinion at adjustment position (A) using a bolt type M8 x 125 x 35 and tighten as specified (15).

Camshaft pinion bolt torque specifications: 4 Kg-m (40 Nm).

8) Continue assembly and timing adjustment as indicated in 6A1-11 (TUNING UP TIMING).

9) Fit rest of components in reverse order to disassembly.



TUNING UP TIMING

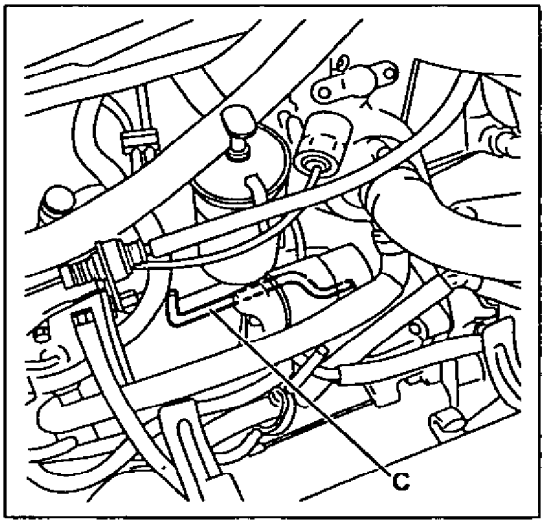
(Replacement of belt and revision of tensioner pulleys and water pump)

Prior disassembly

1) Carry out disassembly stages 2 to 10. Please refer to 6A1-7 (VALVE PLAY ADJUSTMENT)

Prior adjustments

1) Ensure camshaft pinions and jet pump are locked in positions (A) and (B) using bolts type M8x125x35.



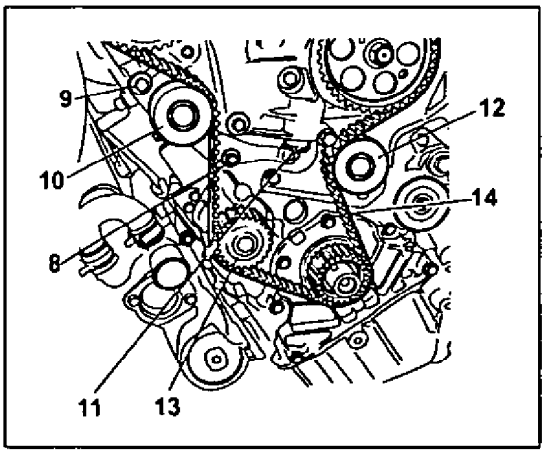
2) Ensure engine flywheel is locked in position by using tool (C) **Ref. / 00000 V02008**.

Disassembly

1) Slacken tensioner pulley (10) support nut (8) and bolt (9).
2) Apply force to (a) to detension belt and tighten bolt (9) again once in this position.
3) Remove timing belt.

Revision

1) Ensure that tensioner pulley (10), fixed pulley (12) and water pump pinion (13) function correctly. (They should turn freely and without looseness).



Assembly

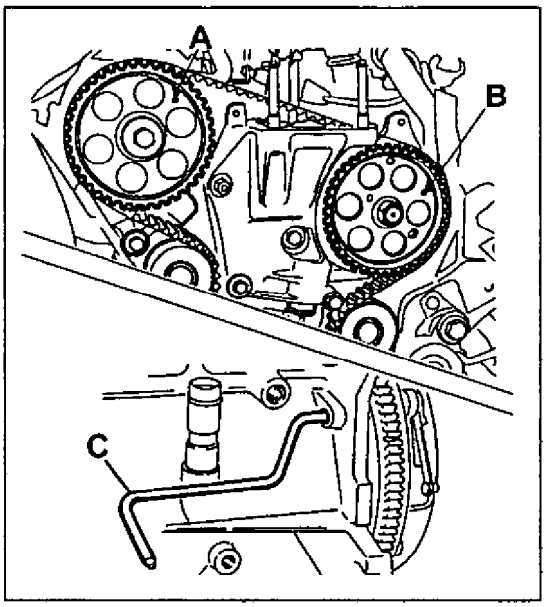
1) Assemble new timing belt, well tensioned (14) and in the following order:
   - Crankshaft pinion.
   - Fixed pulley (12).
   - Jet pump pinion.
   - Camshaft pinion.
   - Tensioner pulley (10).
   - Water pump pinion (13).
2) Slacken bolt (9) and make sure that piston (11) works freely in housing and that pulley (10) tenses belt without forcing it.

3) Remove bolts locking camshaft pinions and jet pump and remove tool locking engine flywheel.

Checking timing adjustment

- Rotate crankshaft two turns in normal functioning direction.

NOTE:
Do not turn crankshaft in direction opposite to normal functioning one.



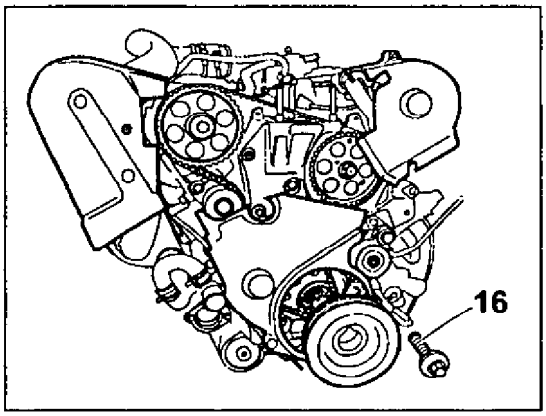
- Check that camshaft pinion and jet pump adjustment points (A) and (B) are correctly aligned using M8x125x35 bolts. Also check engine wheel alignment using locking tool (C). **Ref. 00000V02008.**

NOTE:
If a perfect alignment is not achieved in the three points outlined above, the belt will have to be fitted again.

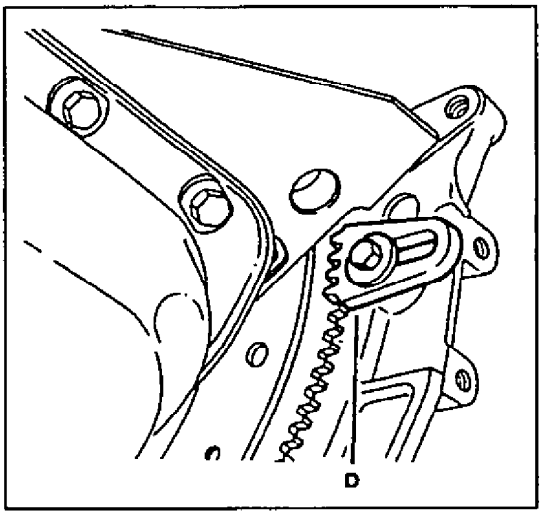
4) Having first checked timing, tighten tensioner pulley nut (8) and bolt (9) as specified.

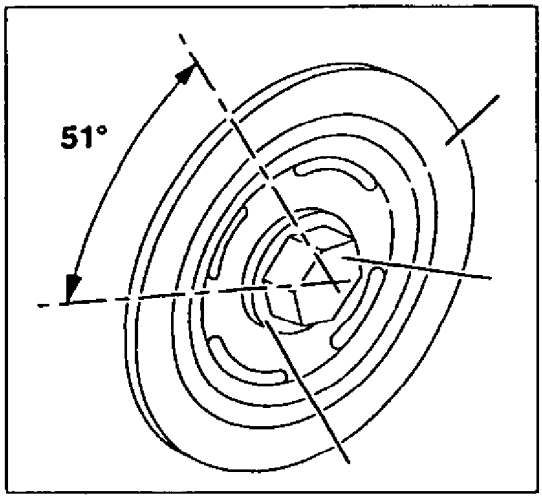
   Tensioner pulley nut and bolt torque specifications: 1.8 Kg-m (18 Nm).

5) Remove camshaft and jet pump pinion bolts.
6) Remove tool (c) locking wheel for retuning.



7) Fit three timing covers and crankshaft pulley.
8) Clean and degrease pulley lock bolt (16).
   Apply **Loctite FRENETANCH** to thread and area of friction on the washer.
   Slew bolt in crankshaft and bring together.

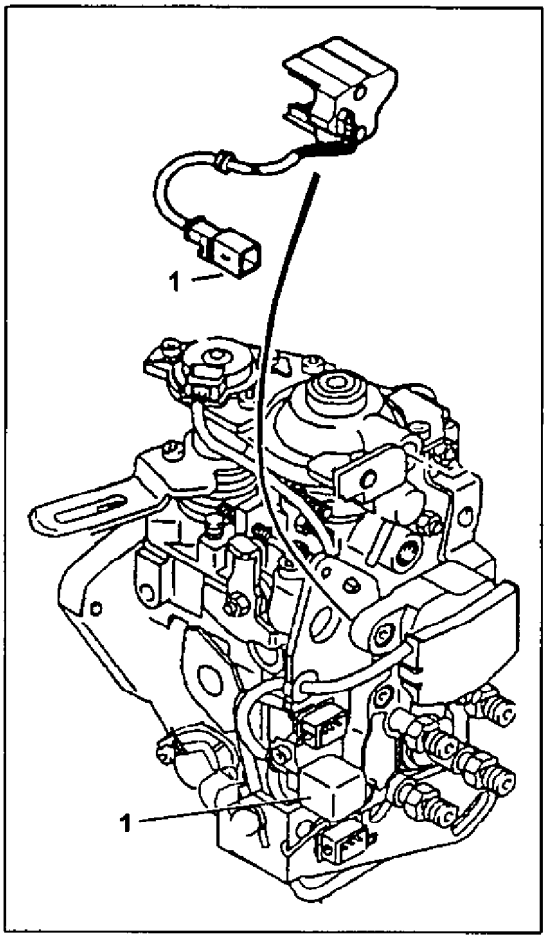




9) Fit retaining tool (D) **Ref.09916-96510** to prevent wheel turning and tighten pully lock as specified.

Crankshaft pulley lock bolt torque specifications:
4 Kg-m + 51º (40 Nm + 51º).

10) Remove retaining tool (D).
11) Continue assembly operations in reverse order to disassembly.

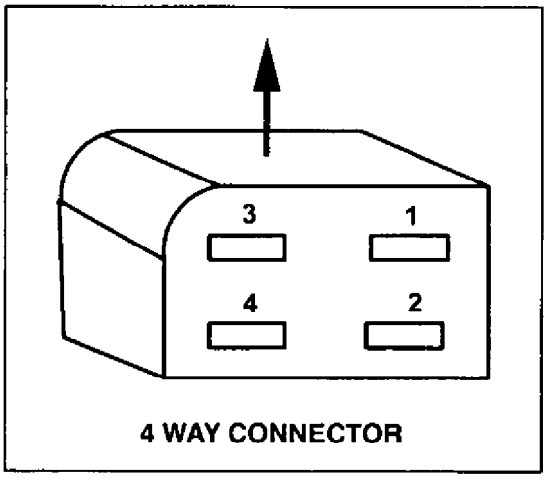


JET PUMP REPLACEMENT AND UNBLOCKING CODED ANTITHEFT IMMOBILISING SYSTEM.

Unlock CODED ANTITHEFT IMMOBILISING system as indicated below:

1) If factory code (1111) has been modified, proceed as follows:
   - Enter customer code (green light on)
   - Press key (C)
   - Enter code (1111) (4 beeps)
   - Press key (C) to validate operation (green light on keypad will flash 4 times)
   - Switch off
   - Open and close driver's door
   - Wait 30 seconds
   - Red light on keypad will light up for 10 seconds and flash
   - Switch on (red light on keyboard will light up)
   - Enter code (1111) (green light on keyboard will light up)
   - Switch off
   - Close driver's door

2) When the code is validated (1111), proceed as follows to deactivate coded antitheft immobilizing system connector (4 way, black).
   - Unlock doors
   - Enter vehicle
   - Close driver's door
   - Open driver's window and bonnet of engine
   - Switch on (red light on keypad will light up)
   - Enter code (1111) (green light on keypad will light up)
   - Exit vehicle
   - Close driver's door
   - Do not open or close driver's door
   - Disconnect battery
   - Deactivate jet pump control system (4 way, black)



4 WAY CONNECTOR

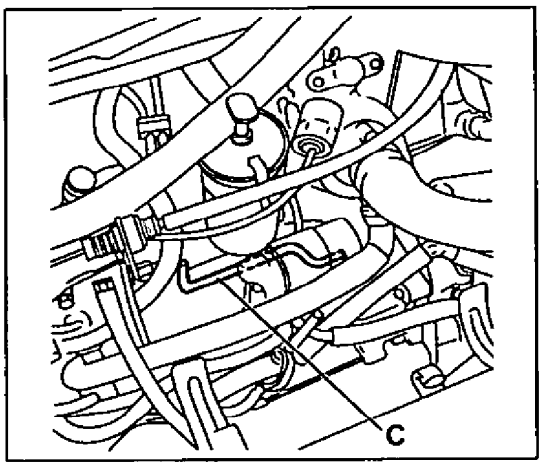
Checking jet pump on test bench.
With module unblocked the jet pump system can function after electric valve has been powered via 4 way connector (1) (BLACK).

Power:
(Path 1) — + 12V
(Path 4) — to ground

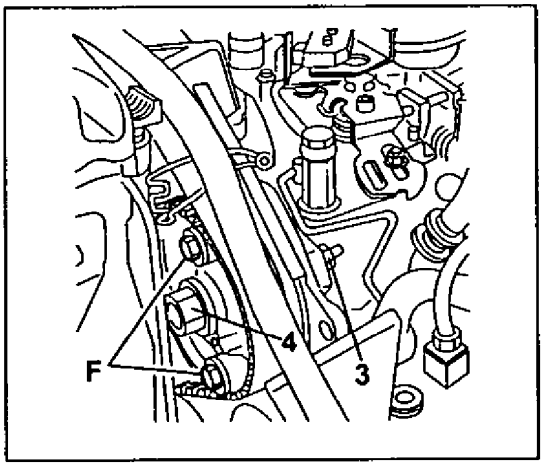
JET PUMP DISASSEMBLY AND ASSEMBLY

Disassembly

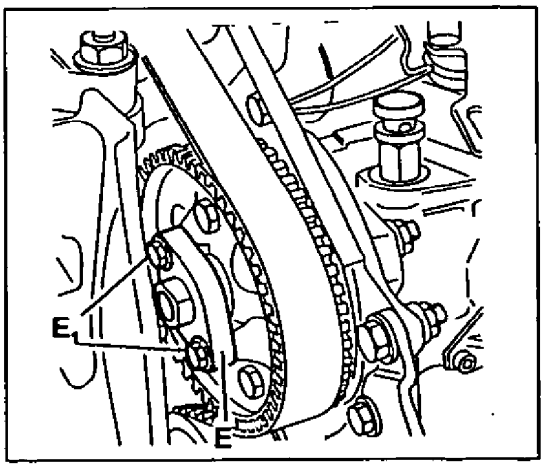
2) Disconnect or remove the following components:
   - Negative battery cable.
   - Intercooler unit, 6A1-4
   - Fuel feed and overflow lines.
   - Connectors, cable packages and unions inherent in jet pump, separating them from the latter.
   - Injection lines, tool **Ref. 09912-56520**
   - Throttle cable.
   - Fast idle cable.
   - Depressor, alternator and hydraulic pump drive belts, etc.
   - Front cover on jet pump side.



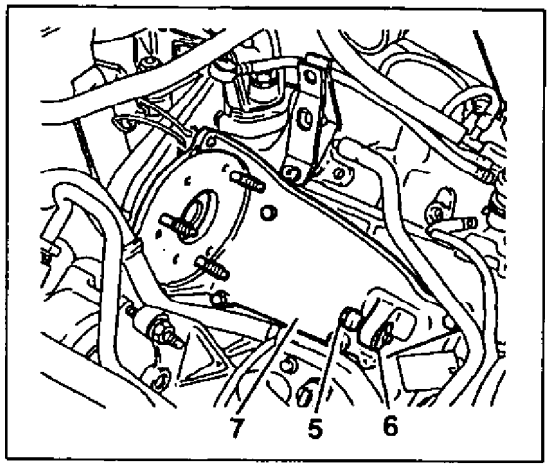
3) Rotate crankshaft until position is fixed with tool (C) **Ref. 00000V02008** and it is possible to lock jet pump pinion with two bolts (F) type M8x125x35.



4) Remove nuts and washers (3) fastening jet pump (using tool **Ref. 09912-56520** to slacken lower nut). Also remove pump attaching rear bolt.
5) Turn jet pump towards engine exterior (maximum backwards position)



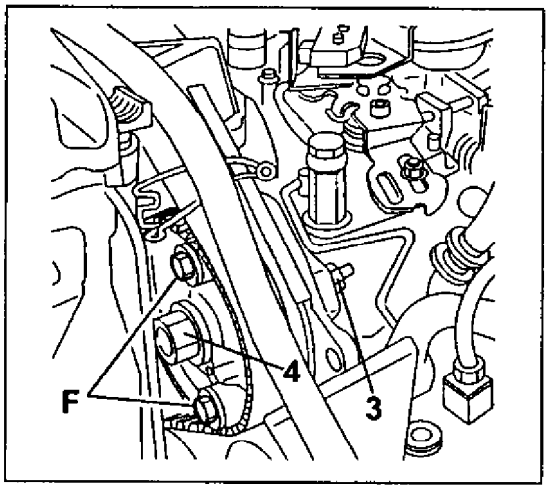
6) Fit puller tool (E) **Ref. 00000 V02010** in manner indicated and unfasten or move jet pump by tightening tool bolts (E1) and slackening nut (4).
7) Reove the tool (E) when notice the pump can be extracted.
8) Remove jet pump.



Assembly

1) Check bolt (5) and washer (6) fitting on jet pump bracket (7).
2) Fit pump turned to engine exterior, to facilitate insertion. (Maximum delay position).

NOTE:
Ensure that key is correctly fitted in pinion keyway.
Use a mirror if necessary.



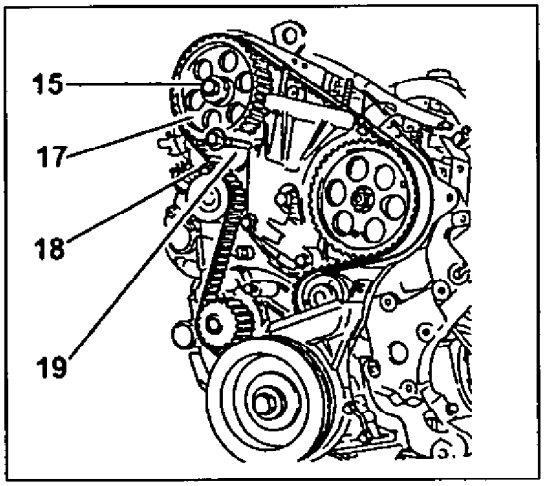
3) Fit nut (4) to fix pinion to pump and tighten as specified.

Pinion to jet pump lock nut torque specifications: 5 Kg-m (50 Nm).

4) Fit nuts and washers (3) fastening jet pump (without tightening) and remove bolts (F) locking pump pinion.

NOTE:
To remove and fit jet pump it is not necessary to overhaul timing.

5) Overhaul jet pump and make necessary adjustments, please refer to 6E3.
6) Carry out assembly in reverse order to disassembly.
7) Bleed system, start engine and check for fuel leaks.

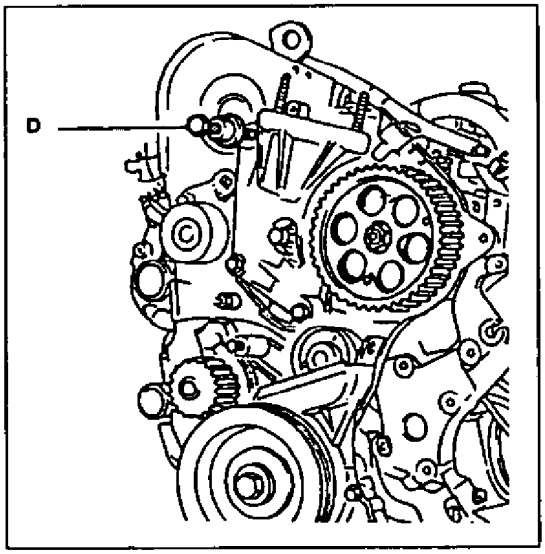


CYLINDER HEAD GASKET REPLACEMENT.

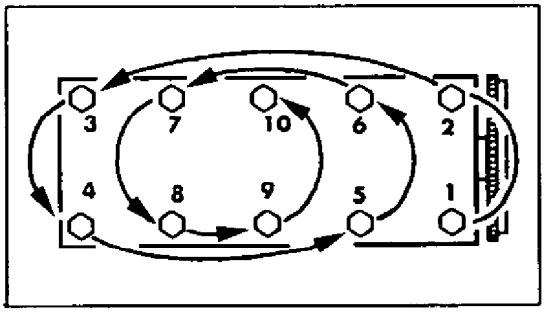
Disassembly

NOTE:
Before proceeding with disassembly extract coolant and engine oil.

1) Carry out operations 1 to 7, please refer to 6A1-25 (INTAKE SYSTEM REVISION).
2) Carry out operations 1 to 11, please refer to 6A1-7 (VALVE PLAY, ADJUSTMENT).
3) Remove camshaft pinion fastening bolt, (15), timing belt, pinion (17) and bolts (18)and (19).

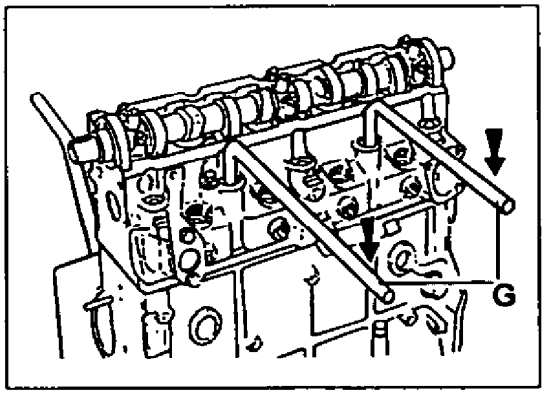


4) Remove cylinder head centering component, using tool (D) **Ref. 00000V02019**
5) Disconnect, unbridle and separate hoses and pipes adjoining cylinder head.
6) Disconnect depressor vacuum lines and general fuel return lines.
7) Disconnect (high pressure) fuel injection lines.
8) Disconnect injector fuel return line.
9) Disconnect fast idle actuator cable.
10) Remove rocker arm cover and gasket.



11) Progressively slacken cylinder head bolts and remove them. Use tools **Ref. 00000V02015 and 00000V02016.**

NOTE:
Remember that to remove cylinder head bolts, the engine must be completely cold.



12) Using two levers (G), or similar, tilt cylinder head to unfasten it from cylinder block.
13) Extract cylinder head and gasket.

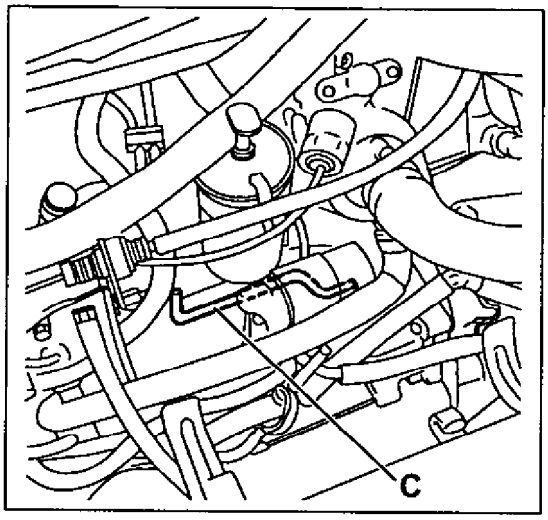
Revision and repair:

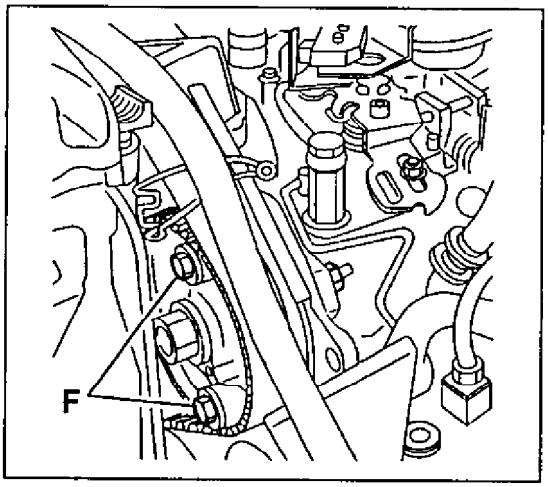
1) Please refer to 6A1-39 and 6A1-41 (CYLINDER HEAD EXAMINATION AND REPAIR).

NOTE:
Once cylinder head and attaching bolts have been checked, and a new gasket selected, proceed to assembly.

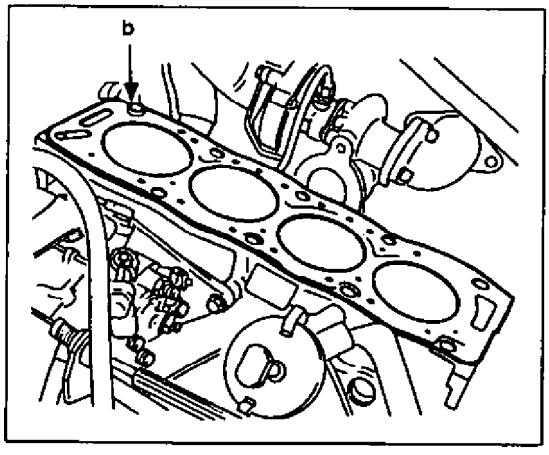
Assembly

1) Turn crankshaft until it is secured by the tool (C) **Ref. 00000 V02008.**



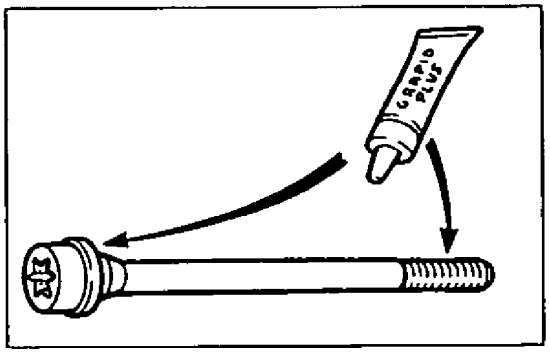


2) Fasten jet pump pinion locked with two screws (F) de M8x125x35.



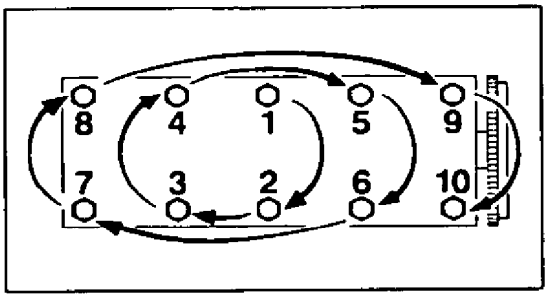
3) Fit new cylinder head gasket in position indicated with reference to permanent one (b).

NOTE:
To select gasket thickness, please refer to 6A1-52 (CYLINDER BLOCK ASSEMBLY).



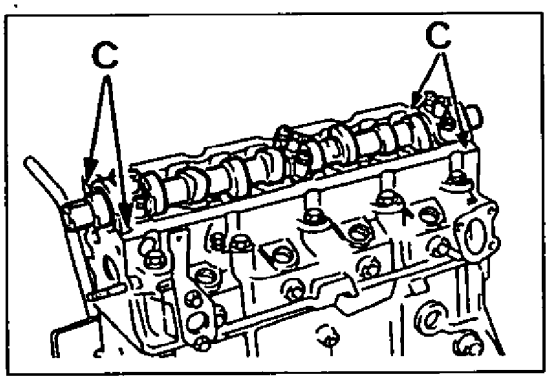
4) Fit new washers on gasket screws and apply **MOLICOTE G PLUS RAPID** on threads and washers.

NOTE:
To check screw stretch, please refer to 6A1-53 (CYLINDER BLOCK ASSEMBLY).
Fit gasket having previously installed camshaft pinion and placing it in position using screw type M8x125x35.



5) Tighten gasket using tools **Ref. 00000V02015 y 00000 V02016.** Apply as specified in sequence indicated.

- **Initial torque specifications: 2 Kg-m (20 Nm).**
- **Subsequent torque specifications: 6 Kg-m (60 Nm).**
- **Angular specification: 220º with FACOM D360 tool type.**

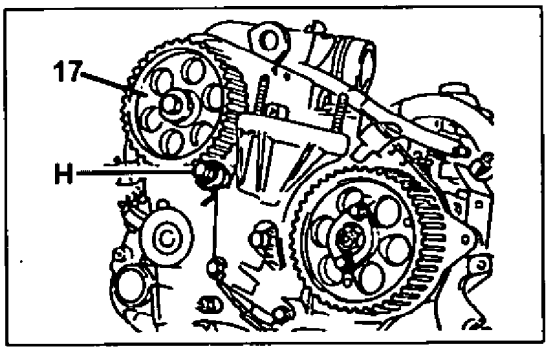


6) Apply sealer to indicated points (c).

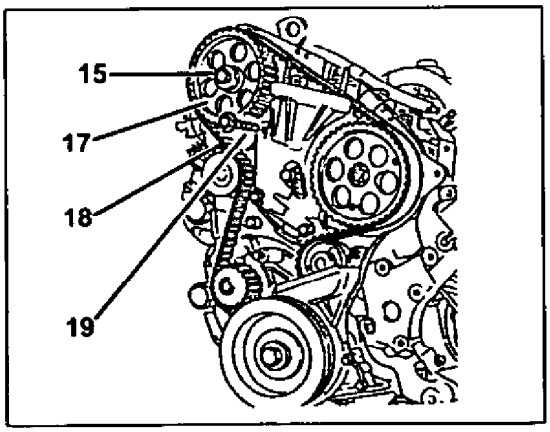
Recommended sealant SUZUKI BOND No. 1207C, Ref. 99000-31150.

7) Fit rocker arm cover and tighten lock screws as specified:

Rocker arm cover lock screws torque specifications: 1 Kg-m (10 Nm).



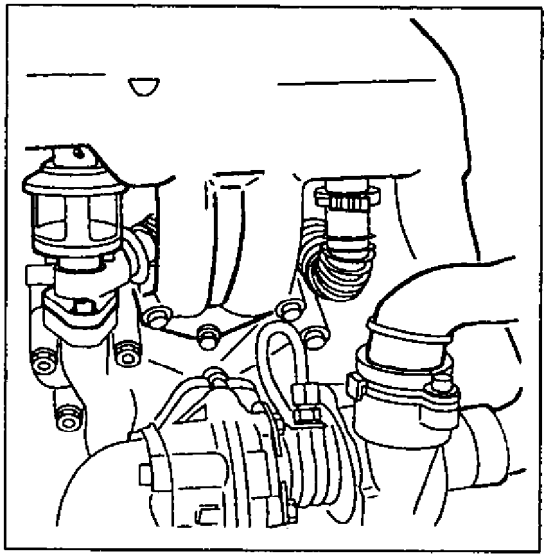
8) Fit cylinder head centre part using tool (H) **Ref. 00000V02020**
9) Ensure camshaft pinion is situated in adjusted position and fixed in position with M8x12x35 bolt, tightened by hand.



10) Fit bolts (15), (18) and (19) as specified:

Bolt (15) 4 Kg-m (40 Nm)
Bolt (18) 2 Kg-m (20 Nm)
Bolt (19) 2 Kg-m (20 Nm)

11) Fit timing belt, please refer to 6A1-11.



12) Fit intake manifold by tightening nuts and bolts to, please refer to 6A1-26.

Attaching bolts torque specifications: 1.5 Kg-m (15 Nm).
Attaching nuts torque specifications: 2.5 Kg-m (25 Nm).

13) Fit turbocompressor on intake manifold and tighten bolts as specified.

Turbocompressor attaching bolts torque specifications: 3 Kg-m (30 Nm)

14) Fit exhaust manifold and turbocompressor assembly and tighten nuts as specified, please refer to 6A1-27.

Torque specifications for exhaust manifold attaching nuts: 2.5 Kg-m (25 Nm)

15) Fit EGR valve with new gasket and tighten bolts as specified, please refer to 6A1-27.

Torque specifications for EGR valve attaching bolts: 1Kg-m (10 Nm).

NOTE:
Tighten a second time as specified in points 12, 13 and 14.

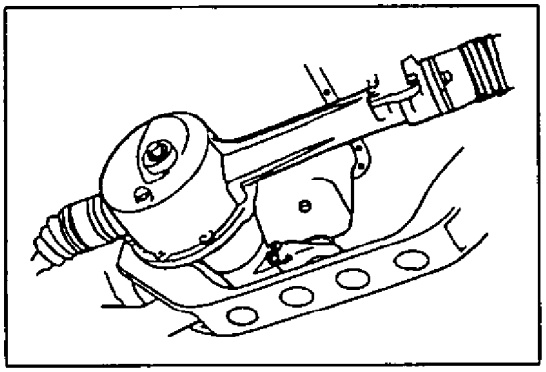
16) Continue assembly in reverse order to disassembly.
17) Bleed fuel system.
18) Fill and bleed cooling system.
19) Fill with recommended lubricant to maximum level indicated on dipstick. Start up and turn off engine. Check again three minutes after switching off and refill if necessary.

CAUTION:
- **When starting up engine, the following precautions must be taken:**
  - **Do not enter vehicle immobilizing code.**
  - **Engage starter motor until engine oil pressure light goes off.**
  - **Enter vehicle immobilizing code.**
  - **Start engine and let it idle for about 30 seconds.**
  - **Ensure all various connections, air and water hoses, manifolds and exhaust pipe fittings are correctly sealed.**

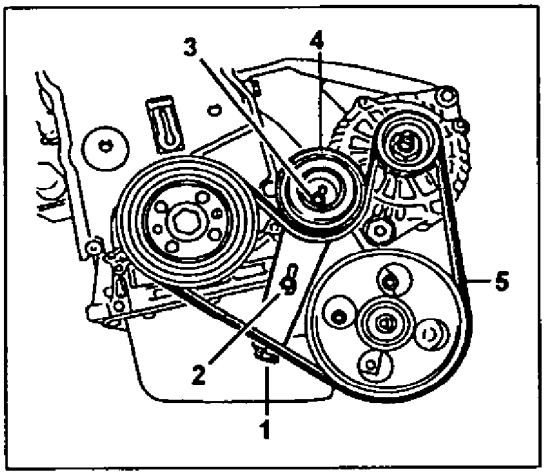
OIL PAN, SUCTION LINE AND OIL PUMP

Disassembly

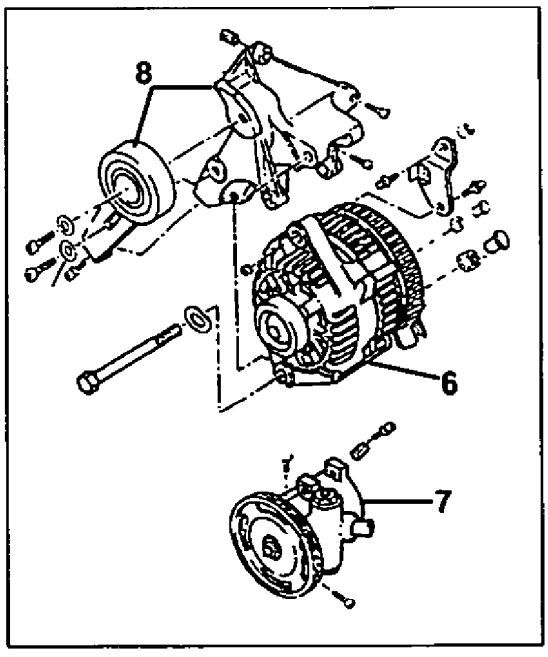
1) Situate vehicle in appropriate work area, bearing in mind that the front axle will have to be removed.
2) Disconnect negative battery cable.
3) Remove lower engine cover.



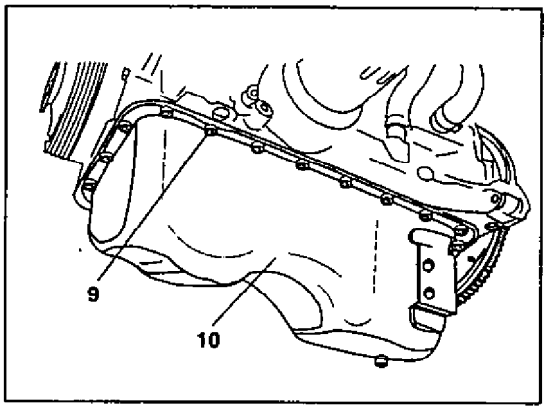
4) Drain oil sump and proceed to disassemble front axle assembly, please refer to section 4 of Service Manual 99500-60A10-01E.
5) Remove steering drag rod, please refer to section 3B2-5 of Service Manual 3B2-5 99500-60A10-01E.
6) Disconnect clutch cable at connection with engine oil pan housing.
7) Disconnect depressor, mounting and belt.



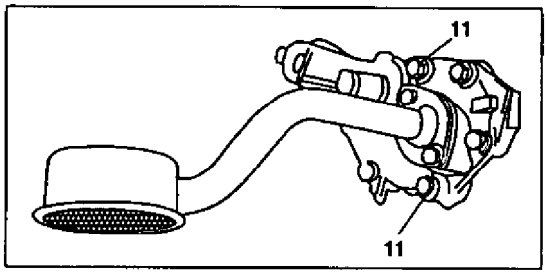
8) Loosen bolts (2) y (3) of tensioner pulley (4). Tighten bolt (1) to maximum in order to detension belt.
9) Remove belt. (5).



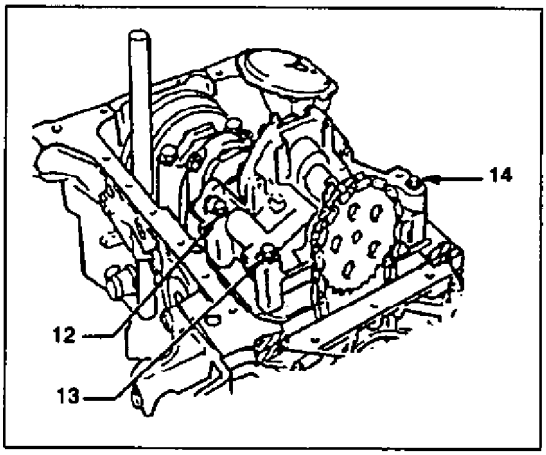
10) Remove alternator (6), power steering hydraulic pump (7), mounting and tensioner (8).



11) Extract engine oil.
12) Take out attaching bolts (9) and remove the oil pan(10).



13) Take out two attaching bolts (11) and remove suction line.



14) Remove three oil pump attaching bolts (12, 13 and 14) bearing in mind that bolt (12) is different and serves to centre pump.
15) Extract pump.
16) Remove oil baffle attaching bolts and extract if necessary.

Assembly

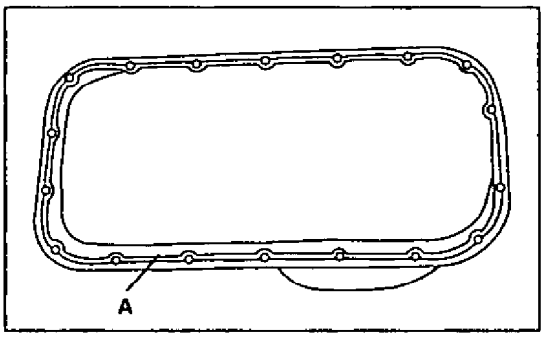
1) Fit oil baffle and fasten with its four corresponding bolts.
2) Couple drive pinion on transfer chain and attach pump with bolts, (12) (13) y (14) tightened as specified.

NOTA:
Bolt 12 is different and serves to centre pump.

Torque specifications for oil pump attaching bolts:
2 Kg-m (20 Nm).

3) Connect suction line and attach with two bolts (11), tightened as specified.

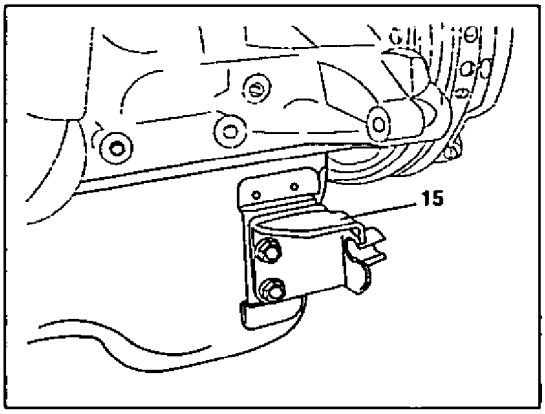
Torque specifications for suction line attaching bolts:
1.8 Kg-m (18 Nm).



4) Clean mating face of oil pan and in area (A) apply film of AUTO JOINT BLEU to edges of bolt housing.
5) Tighten oil pan attaching bolts (9) as specified.

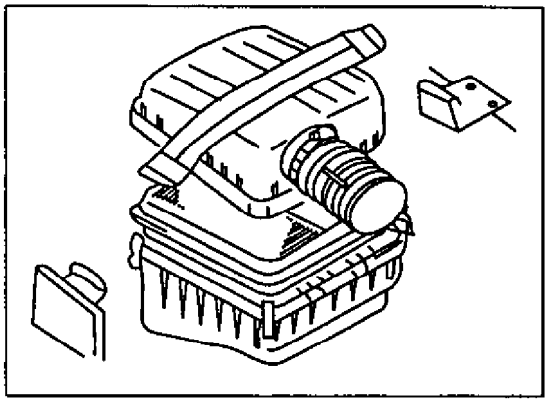
Torque specifications for oil pan attaching bolts:
2 Kg-m (20 Nm).

6) Fit alternator, power steering hydraulic pump, depressor and tensioner.
7) Fit belts and tension, please refer to 0B-4 y 0B-5.



8) Fix clutch cable to oil pan plate (15). Adjust as indicated in section 7C-2.
9) Fit front axle, please refer to section 4 of Service Manual 99500-60A10-01E.
10) Fit steering drag rod, please refer to 3B2 of Service Manual 99500-60A10-01E.
11) Continue assembly in reverse order to disassembly.

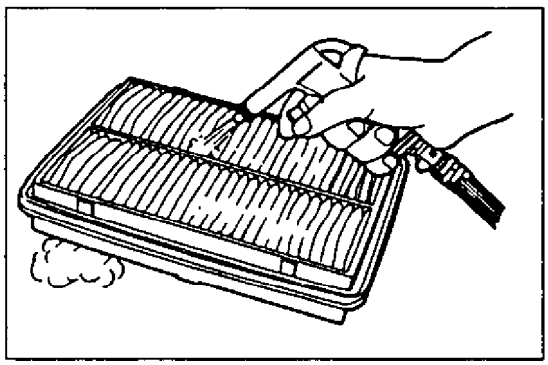
NOTE:
For filling engine with oil please refer to 0B-6.



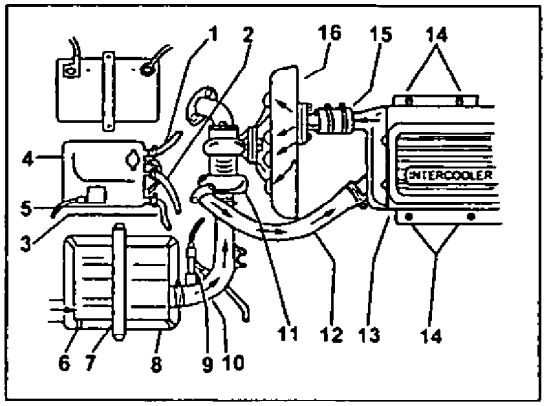
AIR FILTER

Examination, cleaning and replacement

1) Release air filter. Release attaching strap.
2) Disconnect four attaching clips of upper body and extract filter.



3) Observe condition of filter element. If in good condition, blow with compressed air on air outlet side so as to remove dust.
4) If filter element is distorted, broken, damp, full of oil etc., replace it with a new one.



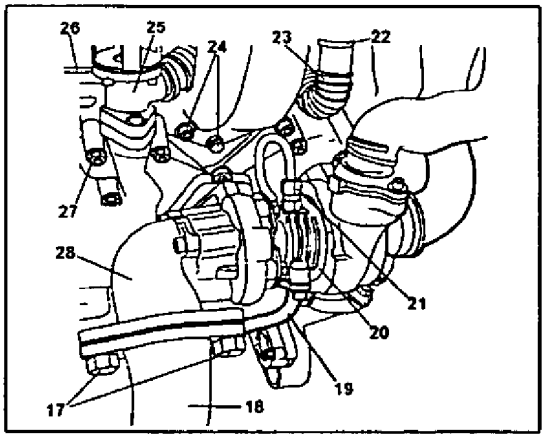
REVISION OF AIR INTAKE SYSTEM

Disassembly

1) Disconnect or remove.
   - Disconnect positive and negative battery cables, remove fastening elements around battery and take out.
   - Disconnect flow lines (1) (2) and (3) from connection with cooling system expander reservoir (4).
   - Disconnect connector (5), remove expander reservoir attaching fittings and remove fastening elements.
   - Disconnect hose (12) at connection to turbine(11).
   - Slacken hose clamp (15) joining intercooler (13) and intake manifold (16).
   - Remove four nuts (14) fastening intercooler and remove along with connecting joints.
   - Disconnect bypass connection with hose (10).
   - Disconnect hose (10) from union with turbine (11).
   - Remove elastic strap (7), the four clips (6) and air filter cover (8), together with outlet hose (10).
   - Remove filter element.

   NOTE:
   Protect intake and outflow lines of intercooler, turbocompressor, intake manifold and pipes with the appropriate caps.

2) Disconnect or separate all lines and supports inherent to intake manifold and EGR and fast idle electric valves.



3) Remove EGR (25) valve support, disconnect vacuum line (26), open clamp (22) (at joint between pitgtail and intake manifold), separate hose (23) and extract EGR valve/pigtail assembly and pigtail.
4) Remove bolts (17) attaching first section of exhaust pipe (18) to turbocompressor gas outflow elbow (28) and separate this section.
5) Remove turbocompressor oil line (21) and oil drain line (19) from union with turbocompressor.

   NOTE:
   Protect intakes and outflow lines to turbocompressor and turbocompressor fuel lines with the appropriate caps.

6) Remove six nuts and bushings (27) which attach the exhaust manifold and extract this at union with turbocompressor (20).
7) Remove nuts, bolts and washers (24) attaching intake manifold and extract it along with the gaskets.

Revision

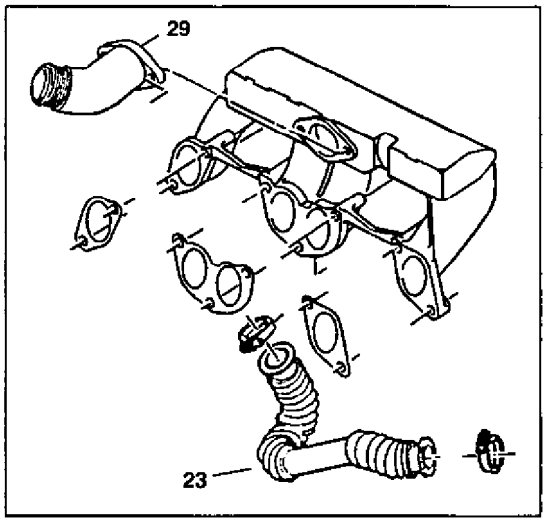
1) Check the condition of air flow hoses.
2) Check there are no distortions in intercooler and clean thoroughly using compressed air.

   NOTE:
   When cleaning intercooler exterior protect intake and outflow lines with the appropriate caps.

3) Eliminate dirt from filter element by blowing compressed air on the outlet side of element.
4) Check evenness of surfaces where intake manifold is coupled to cylinder head, replacing if necessary (**Maximum distortion 0.30 mm**).
5) Renew gaskets, ensuring that no pieces of used ones remain on mating surfaces.

Assembly.

1) Assemble in reverse order to disassembly, following specified torque specifications and following recommendations given.

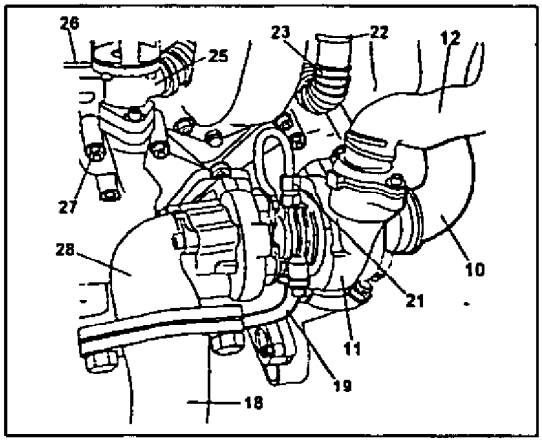


NOTE:

- **Use clamp bolts for fixing EGR valve pigtail (23).**
- **If intake manifold flange (29) has been removed, clean surfaces and apply recommended sealant before assembling.**
- **Always install new gaskets.**
  - **Torque specifications for intake manifold bolts: 1.5kg-m (15 Nm).**
  - **Torque specifications for intake manifold nuts: 2.5kg-m (25 Nm).**
  - **Torque specifications for exhaust manifold nuts: 2.5kg-m (25 Nm).**
  - **Torque specifications intake manifold flange nuts: 1.5kg-m (15 Nm).**
  - **Torque specifications for turbocompressor drain pipe bolt: 1.5kg-m (15 Nm).**
  - **Torque specifications for first exhaust pipe section union with turbocompressor gas outflow elbow: 1. 8 - 2. 8 kg-m (18-28 Nm).**
- **Tighten manifolds indicated a second time.**

CAUTION:

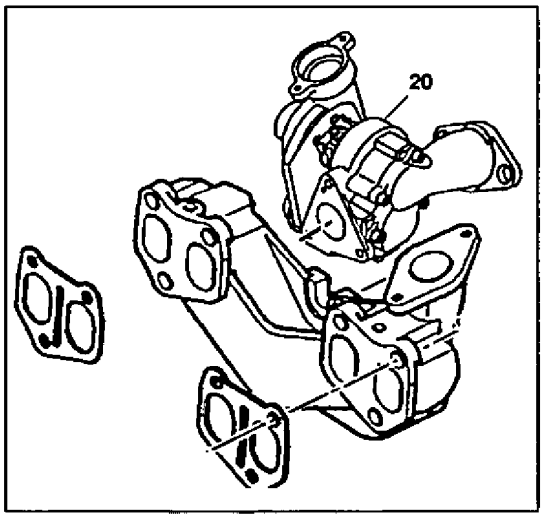
- **When starting up engine the following precautions must be taken:**
  - **Do not introduce vehicle immobilizing code.**
  - **Switch on until oil pressure light goes off.**
  - **Enter vehicle immobilizing code.**
  - **Start up engine and allow to idle for some 30 seconds.**
  - **Ensure that the different connections, air and water hoses, manifolds and exhaust pipe couplings are all correctly sealed.**



EXHAUST PIPE REVISION
REPLACING TURBOCOMPRESSOR AND EGR VALVES.

Disassembly

1) Remove battery, coolant expander reservoir and air filter assembly.
2) Disconnect hoses (10) and (12) from union with turbocompressor turbine (11).
3) Remove turbocompressor fuel line (21) and disconnect oil drain pipe (19) (at join with turbocompressor).
4) Disconnect EGR valve vacuum pipe (26), open pigtail (23) clamp (22) and remove EGR valve (25).
5) Disconnect first section (18) of exhaust pipe where it is joined to turbocompressor gas outlet elbow (28).
6) Remove six nuts and bushings (27) attaching exhaust manifold and turbocompressor assembly. Remove this assembly and gaskets.

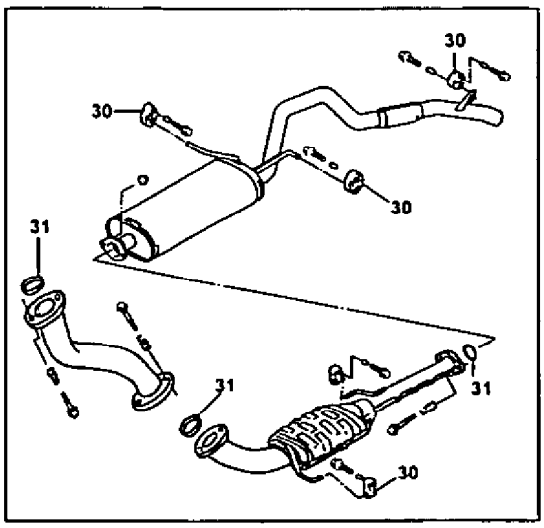


Revision

1) Check functioning of EGR valve (please refer to 6E3-11) and replace it if necessary.
2) Separate turbocompressor (20) and exhaust manifold.
3) If turbocompressor is defective, please refer to 6A1-5 and replace it.
4) Check evenness of exhaust manifold mating surfaces and replace if necessary.

   Maximum distortion 0.30 mm

5) Renew gaskets, ensuring there are no remains of used ones on mating surfaces.



6) Check condition of elastic supports (30), ensuring they are not broken or cracked.
7) Check the three sections of exhaust pipe to ensure there are no splits, chips, dents, leaks, etc.
   Replace any component with aforementioned defects.

Assembly

Carry out assembly in reverse order to disassembly, tighten as specified and following recommendations given.

NOTE:

- **Use bolt clamps for attaching EGR valve pigtail.**
- **If any section of exhaust pipe has been removed, renew fit seal rings (31).**
- **It is vitally important to fit new nuts at exhaust manifold union with turbocompressor.**
- **Always fit new gaskets.**
  - **Torque specifications for turbocompressor exhaust manifold union: 3 Kg-m (30 Nm).**
  - **Torque specifications for exhaust manifold nuts: 2.5 Kg-m (25 Nm).**
  - **Torque specifications turbocompressor drain pipes bolts: 1,5 Kg-m (15 Nm).**
  - **Torque specifications for oil intake connection to turbocompressor: 1.5 Kg-m (15 Nm).**
  - **Torque specifications for EGR valve bolts: 1 Kg-m (10 Nm).**
  - **Torque specifications for first exhaust pipe section union to turbocompressor gas outlet elbow: 1.8 – 2.8 Kg-m (18 – 28 Nm).**
- **Tighten manifolds and turbocompressor a second time according to torque specifications.**

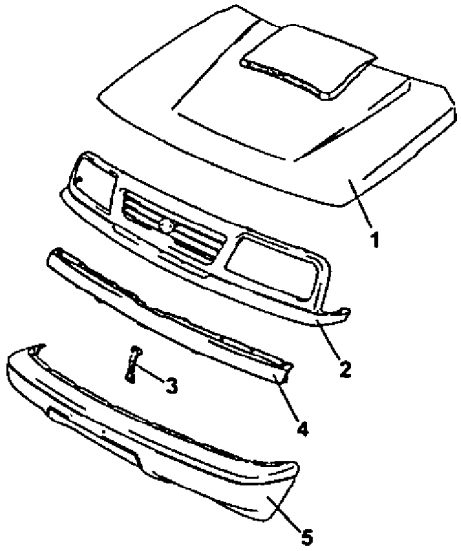
CAUTION:

- **When starting up engine, the following precautions must be taken:**
  - **Do not introduce vehicle immobilizing code.**
  - **Switch on until engine oil pressure light goes off.**
  - **Introduce vehicle immobilizing code.**
  - **Start up engine and allow to idle for some 30 seconds.**
  - **Ensure that connections air and water hoses, manifolds and exhaust pipe couplings are correctly sealed.**

EXTRACTION OF ENGINE BLOCK

Disassembly of body parts

1) Disconnect negative battery cable.
2) Remove the following components from body:
   - Engine bonnet(1).
   - Lower engine cover.
   - Front grille (2).
   - Vertical reinforcement (3).
   - Upper panel (4) and disconnected bonnet lock.
   - Front bumpers (5).



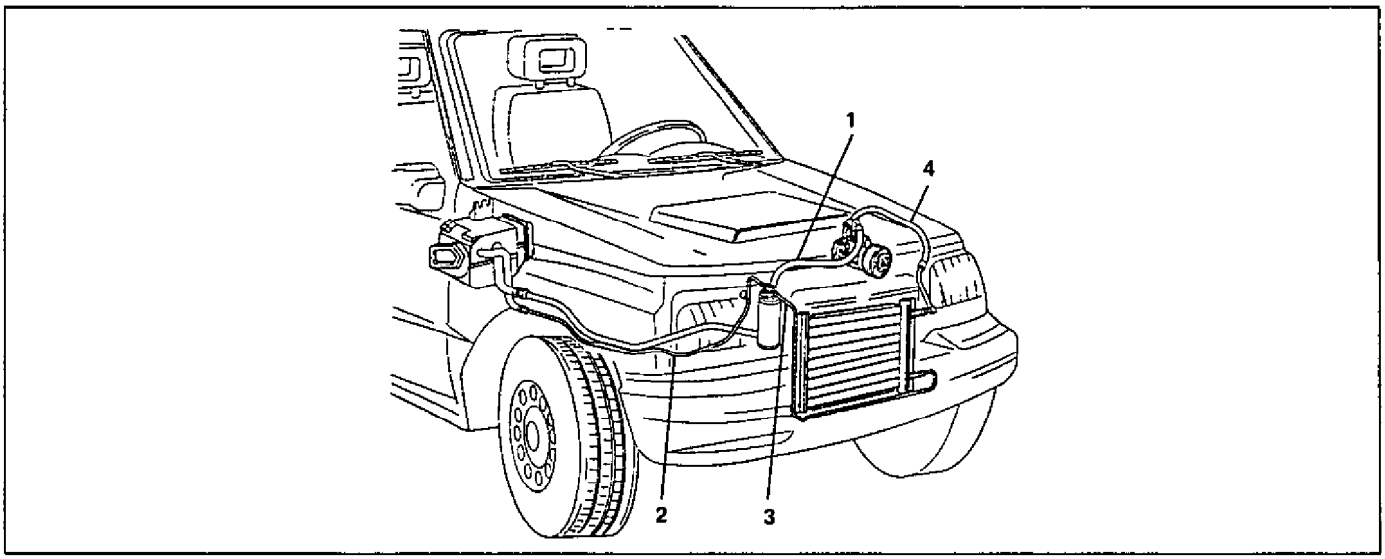
3) Extract the following cooling and lubricating fluids:
   - Engine coolant fluid.
   - Engine lubricating oil.
   - Power assisted steering hydraulic oil.
   - Air conditioning assembly fluid/gas.

WARNING:
Extraction of fluid/gas from air conditioning unit must be performed with appropriate equipment. This operation must in any case be performed with the utmost care, protecting both eyes and hands.

NOTE:
If liquid/gas is extracted by slackening pipe connections, ensure this is done slowly so that oil from compressor is not extracted.

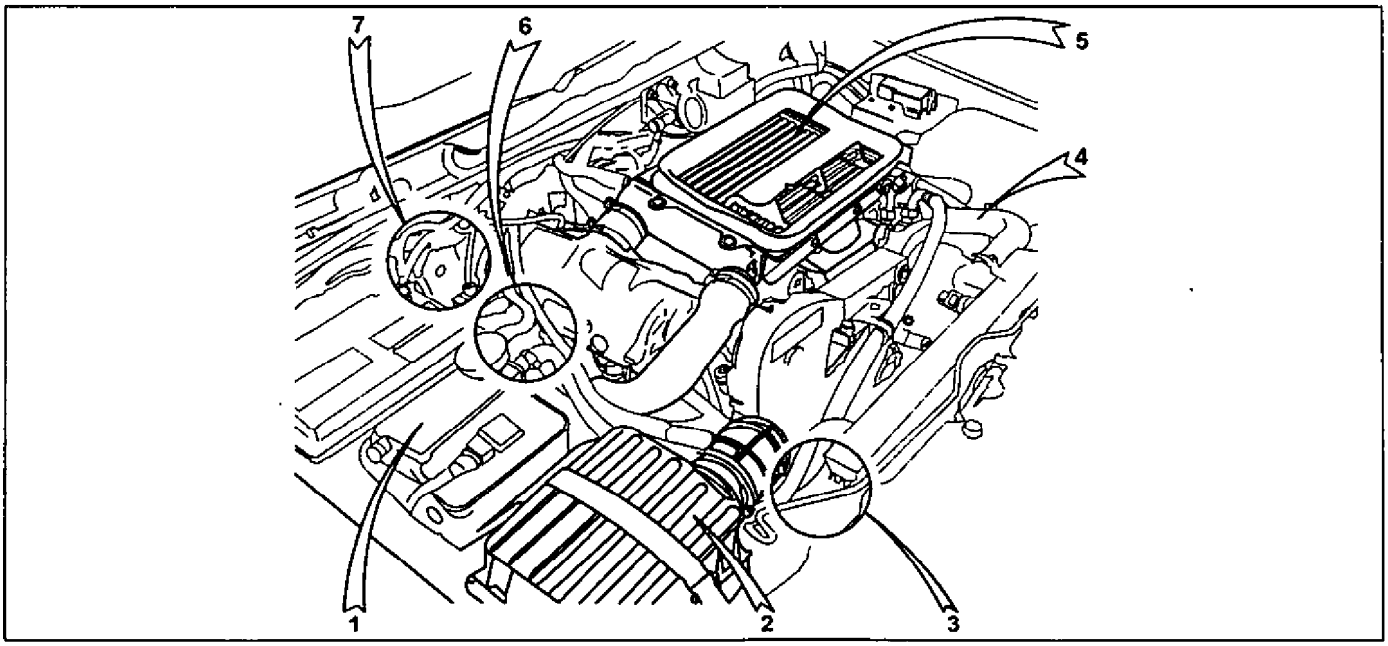
Vehicles with A/C

1) In vehicles equipped with air conditioning disconnect the following pipes and hoses:
   - Compressor/evaporator connecting hose and (1) (at union with compressor).
   - Evaporator and drier filter connection lines (2).
   - Drier filter/condenser connecting lines (3) (at b).
   - Hose (4) connecting condenser and compressor (at union with compressor).

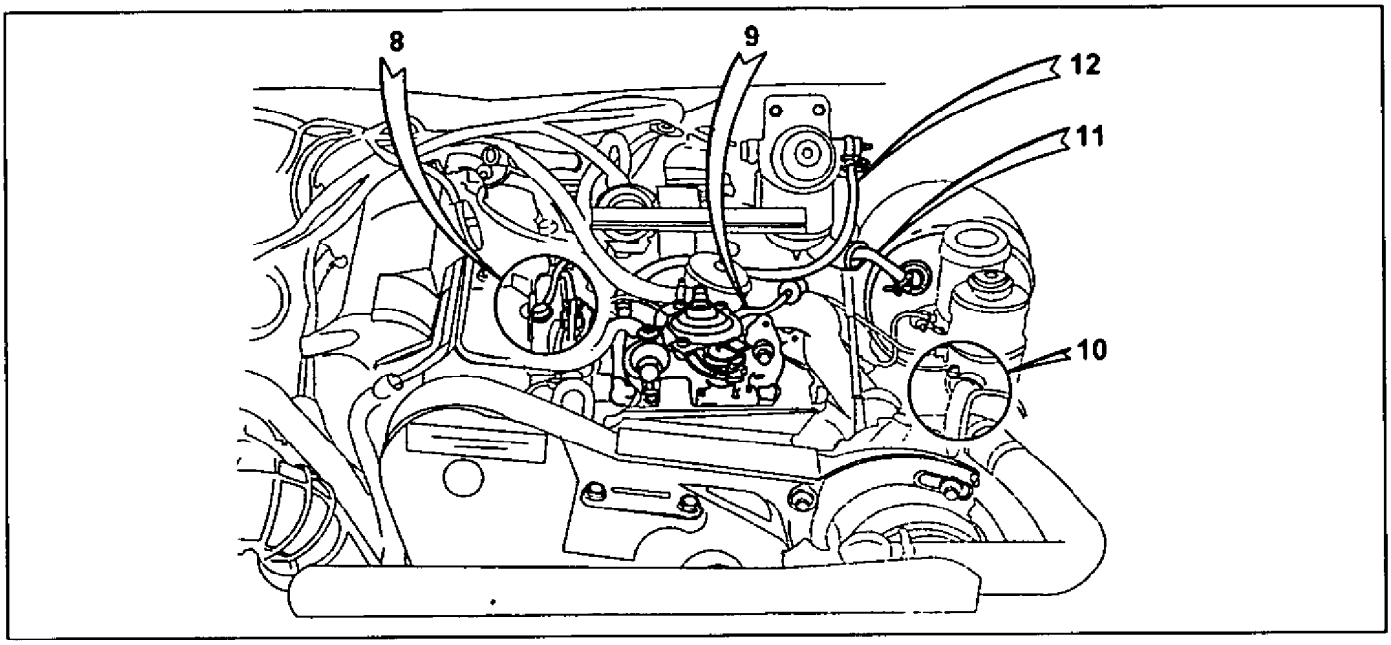


Disconnecting engine

1) Disassemble air filter assembly (2).at connection to turbocompressor if possible.
2) Disconnect expander reservoir pipes (1). Remove support attached to battery Disassemble and remove.
3) Disassemble intercooler assembly (5) together with connections to turbocompressor and intake manifold. Disassemble intercooler air radiator mounts (advisable).
4) Remove first section of exhaust pipe (area 6, lower part).
5) Disconnect lower radiator hose. (area 3).
6) Disconnect clutch cable from its coupling with actuator lever and support.
7) Remove clutch housing dust cover plate.
8) Remove upper radiator hose (4).
9) Disconnect water intake and outflow lines to heating (area 7).
10) Disconnect supply lines and fuel return (area 7).

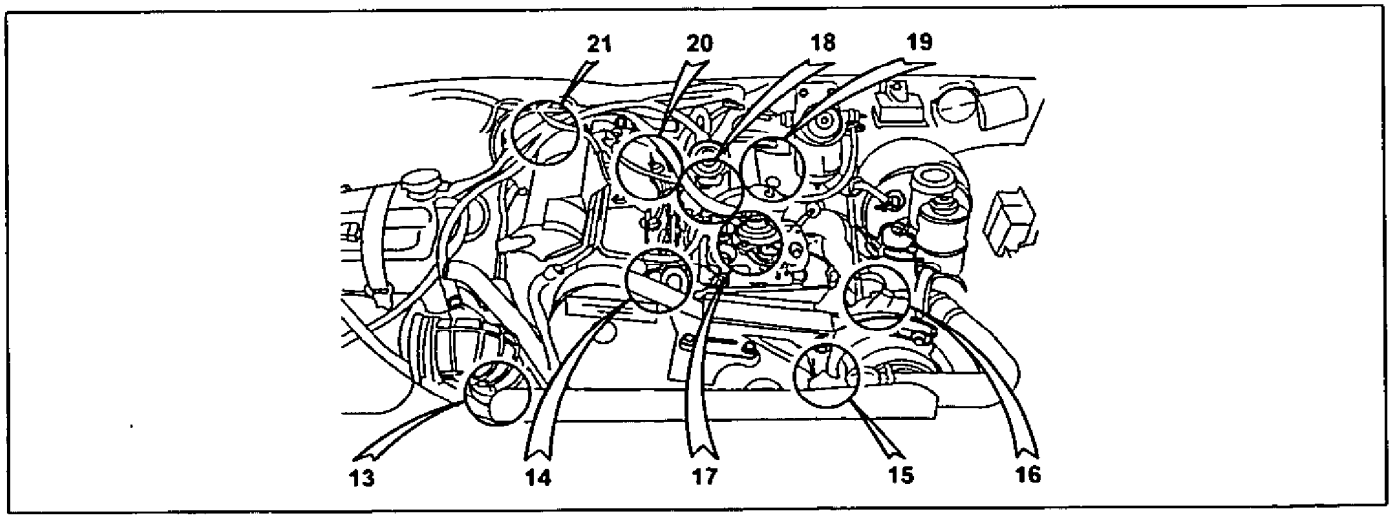


11) Disconnect power brake depressor tube (11) at connection with engine pigtail.
12) Disconnect hydraulic pump pipes (area 10 pump and steering housing connection).
13) Disconnect oil intake and outflow to cooler (area 8, at union to filter adaptor)
14) Disconnect oil suction pipe (12) from connection to jet pump.
15) Disconnect throttle cable (9) from connection to jet pump.

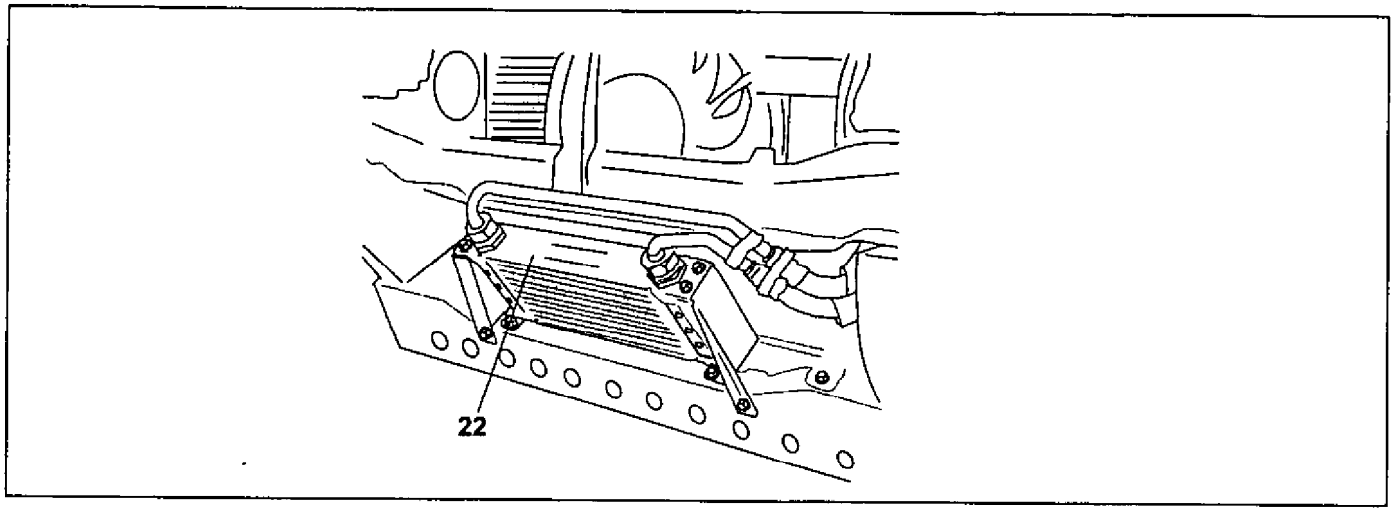


NOTE:
Protect intake and outflow lines to A/C condenser, drier filter, pipes, hose turbocompressor, radiator (intercooler), intake manifold etc.

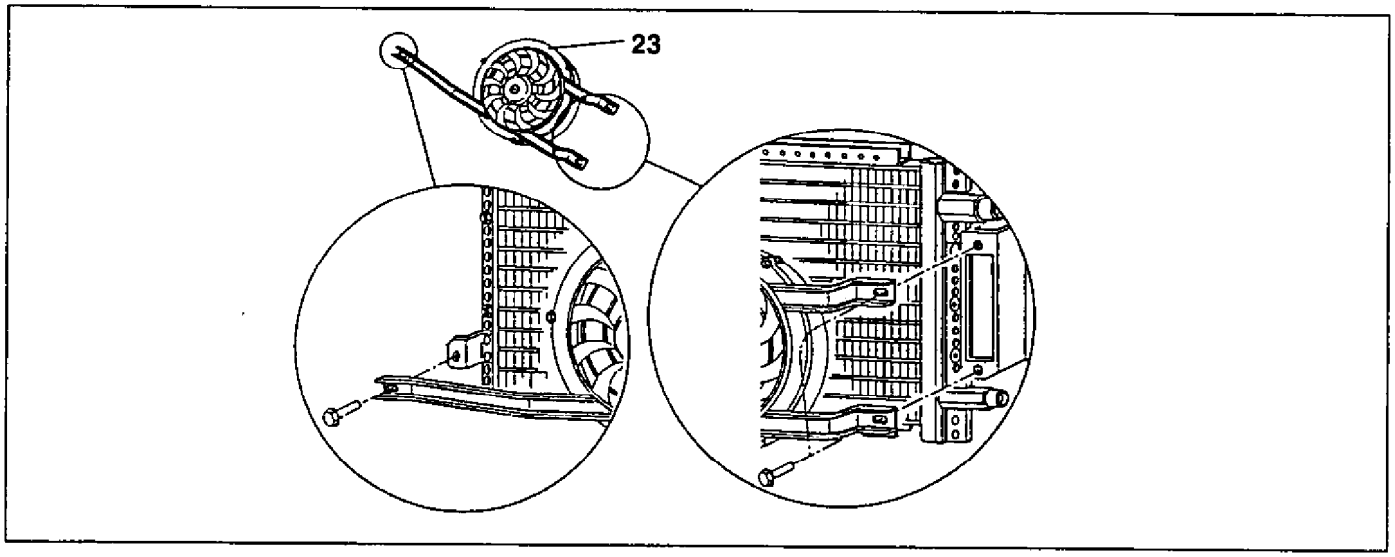
16) Disconnect the following electrical couplings:
- Air conditioning drier filter connector, if fitted (area 13).
- Water radiator temperature sensor connector, electric valve connectors (area 15).
- Sensor control connector of 3rd injector needle lift (area 14).
- Connectors controlling power load lever, module control and traction control (area 17 jet pump).
- A/C magnetic compressor clutch (if fitted) connectors and alternator connector (area 16).
- The three thermo resistance and thermocontact connectors in thermostat housing (area 19).
- Heater power supply current connection (area 20 union with heater no.1).
- Engine rpm sensor connector and E.C.M rpm sensor. (area 20).
- Oil presistor connector (area 18).
- Starter motor connections (area 19, lower part).
- EGR electric valve connectors and fast idle electric valve (area 21). Remove fast idle electric valve to avoid obstruction when taking out engine.



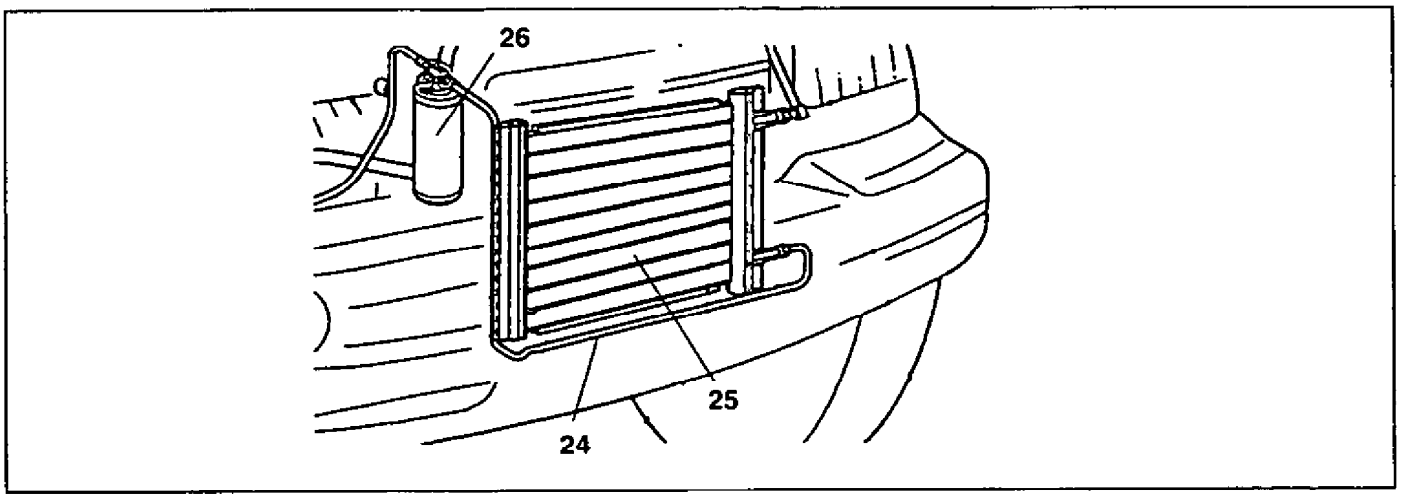
17) Remove oil cooler (22) from hoses.
18) Remove front claxon.



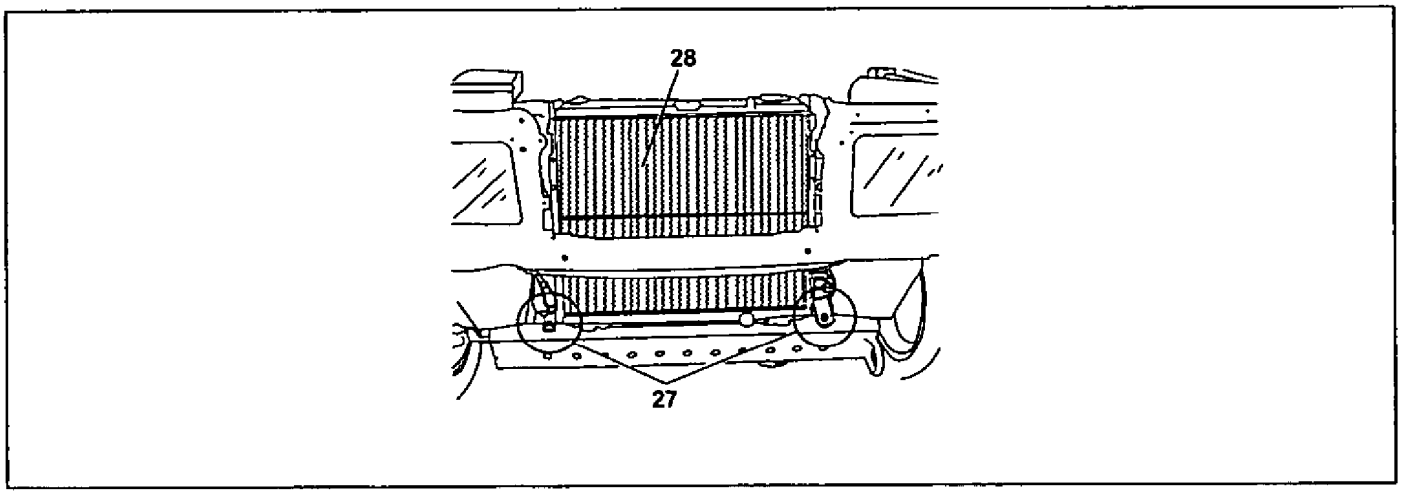
19) Remove front electric fan bracket support elements (23) and take out electric fan assembly.



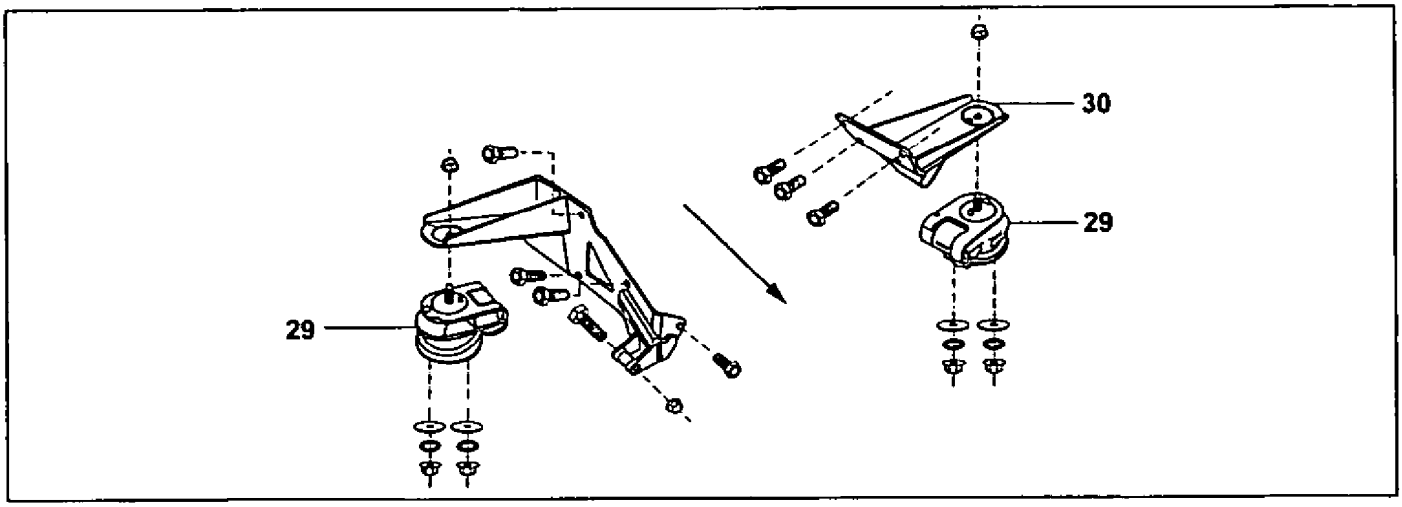
20) Remove pipes (24) connecting condenser and drier filter (if A/C fitted).
21) Remove condenser (25) and drier filter and bracket (26) (if A/C fitted).



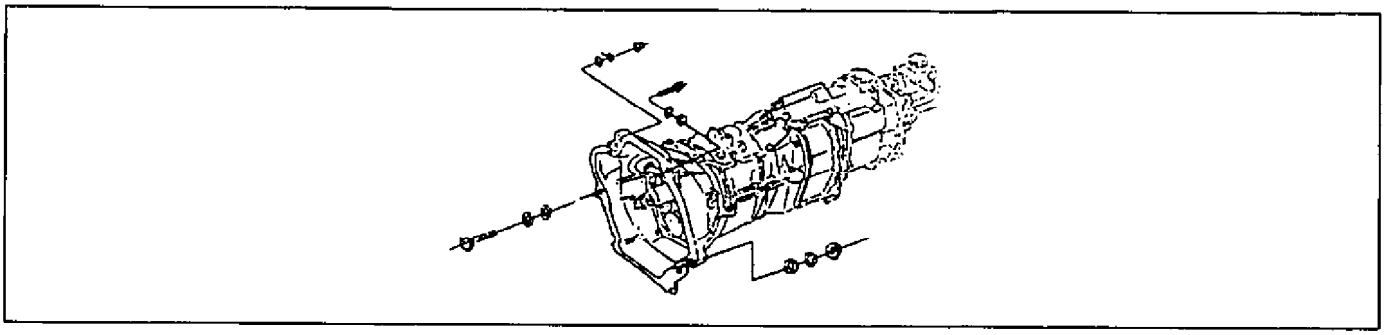
22) Remove water radiator attachments (28), disconnect left hand lateral from radiator and take out. Remove water radiator where connected to rear electric fan.
23) Remove starter motor and disconnect engine ground cable.
24) Fit lifting mechanism to engine extraction rings and tense slightly.



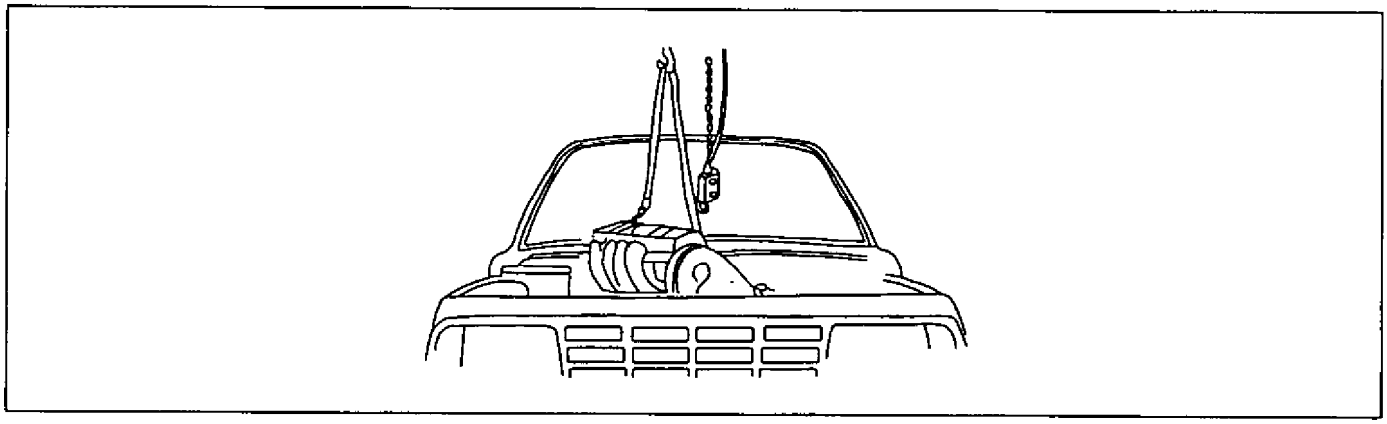
25) Remove silentblock fastening elements on both sides (29). remove left-hand side support (30) and silent block. Continue lifting engine until silent block can be removed from right-hand side.



26) Lower engine sufficiently to be able to reach transmission/engine connecting bolts on upper part and disconnect breather tube at strap which connects it to engine.
27) Remove elements connecting transmission and engine on upper side.
28) Lift engine to extraction position, remove elements connecting transmission and engine on lower part.



29) Ensure no elements remain connected to engine, they could interfere with extraction.
30) Extract engine with help of another person.



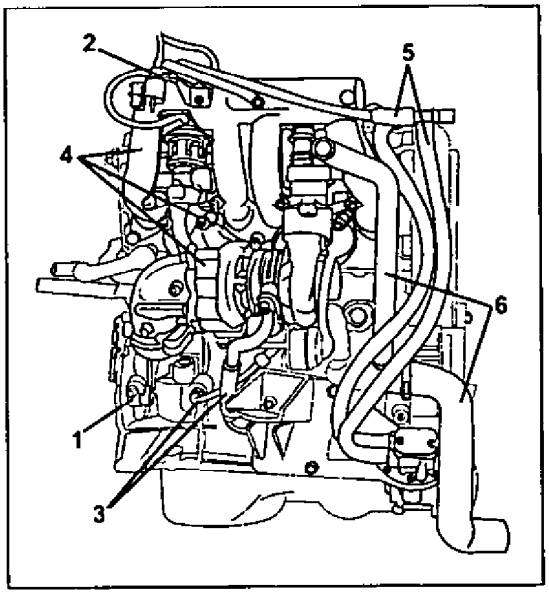
Assembly

1) Carry out assembly in reverse order to disassembly and following the recommendations given:

- Apply torque specifications in table at end of this section.
- Use recommended oil and fluids.
- When coupling electrical connections, pay attention to colour, current condition, and locking system.
- Connect correctly and securely pipes and hoses in general and remember to check there are no leaks in these connections when the respective circuits are functioning.
- Fill, examine level and bleed the following circuits if appropriate: cooling circuit, engine lubricating system, fuel supply circuit and power steering hydraulic circuit, please refer to 0B.
- In vehicles equipped with air conditioning, charge circuit following manufacturer's instructions and using appropriate, recommended means for this work.
- Fit clutch control mechanism and adjust cable. Please refer to 7C-2.
- Fit throttle cable and adjust. Please refer to 6E3-5.
- Adjust bonnet opening cable, ensuring that on activating interior opening lever the bonnet is held by latch and does not open completely. Ensure that bonnet closes securely.

PRECAUTION:

• When starting up engine, the following precautions must be taken:
- Do not introduce vehicle immobilizing code.
- Switch on until engine oil light goes off.
- Enter vehicle immobilizing code.
- Start up engine and allow to idle for some 30 seconds.
- Ensure various connections, air and water hoses, manifolds and exhaust pipes are correctly sealed.



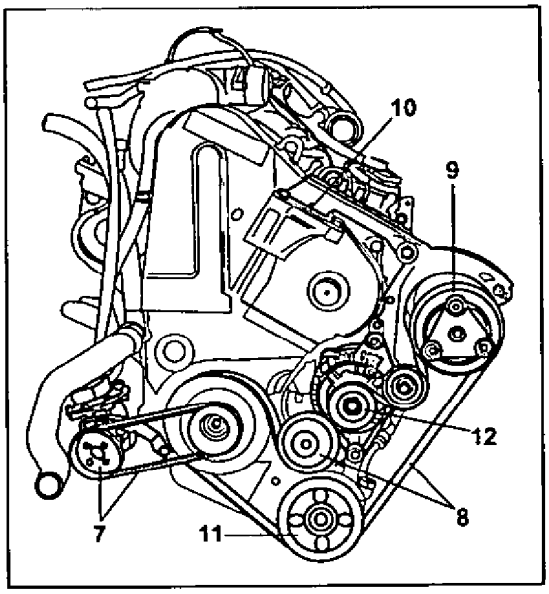
ENGINE PACK REPAIR.

ENGINE DISASSEMBLY

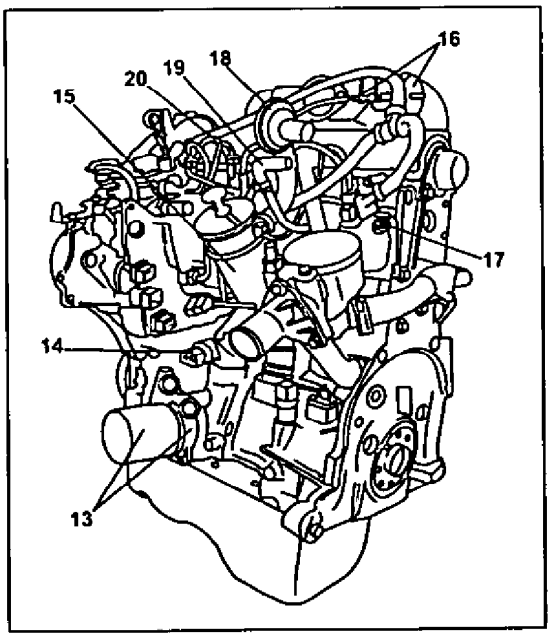
Exterior components.

1) Remove from right-hand side.
   - Rpm sensor (1).
   - EGR electric and fast idle valves (2).
   - Turbocompressor fuel lines and drain outlets (3).
   - Intake manifold assembly together with turbocompressor(4).
   - Vacuum lines (5).
   - Lower radiator and filler hoses (6).

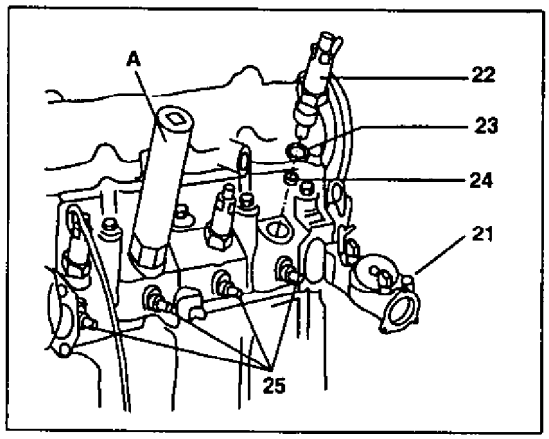
NOTE:
Adequately protect inlets and outlets to turbocompressor, manifold couplings to cylinder head, oil gallery, etc.



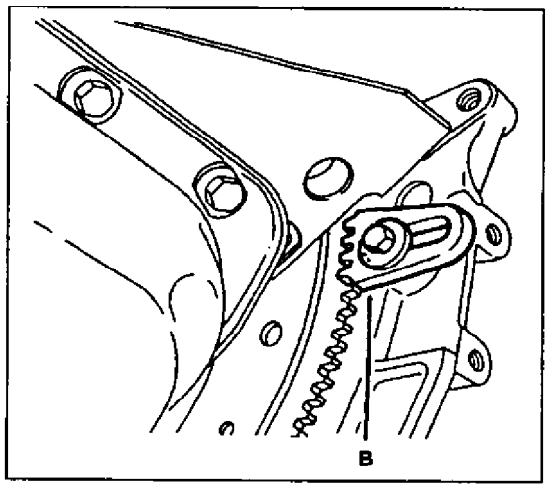
2) Remove from front.
   - Belt and depressor (7).
   - Accessory belt tensioner mechanism and belt (8).
   - A/C compressor (if fitted) and upper mounting bracket (9).
   - Lower mounting bracket (10).
   - Hydraulic pump (11).
   - Alternator (12).



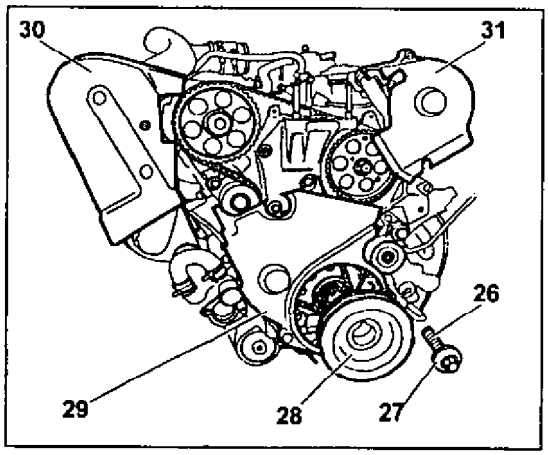
3) Remove from left side of engine the following parts:
   - Oil filter (13) and oil cooler lines adaptor.
   - Oil pressure switch (14).
   - Oil filling lines, gas lines (15).
   - Fast idle control and control lever(16).
   - Glow plugs cables (17).
   - PCV system regulator (18).
   - Fuel return lines and pump intake (19).
   - Pressurised fuel injector lines (20).



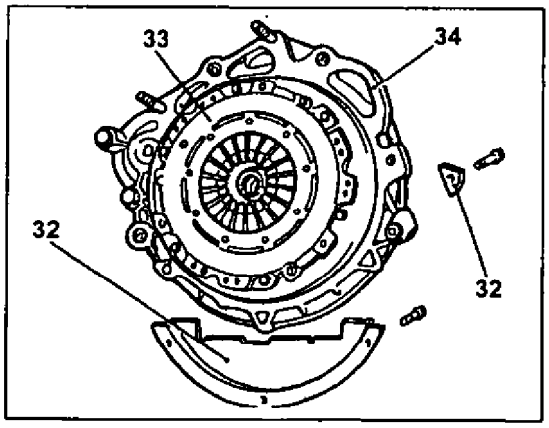
4) Remove thermostat housing (21).
5) Remove injectors (22) using tool (A) **Ref. 00000V02001** and extract sealing washers (23) and fire cutoff (24).
6) Remove glow plugs (25).



7) Immobilise engine wheel using detent tool (B) **Ref.09916-96510** and remove the following parts:

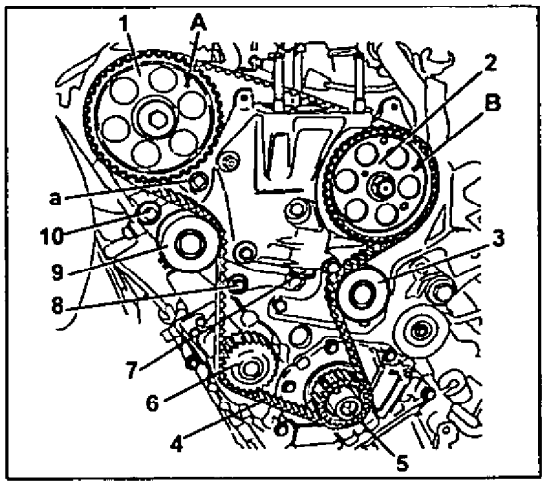


- Crankshaft attaching bolt (26) and washer (27).
- Crankshaft pulley (28) using tool **Ref. 00000V02021**.
- Timing covers (29), (30) y (31).



- Engine flywheels protective plates (32).
- Pressure plate and clutch disc (33).

8) Remove engine flywheel bolts, take off detent (B) and extract wheel.
9) Remove flywheel case. (34)



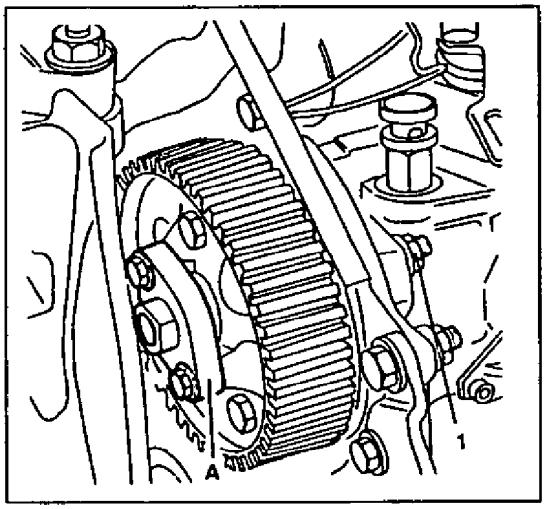
Timing belt, crankshaft pinion, water pump, tensor belt and sprocket.

1) Provisionally fit bolt and washer at crankshaft end so as to rotate it.
2) Rotate crankshaft until camshaft pinion (1) is aligned in position (A) and jet pump in position (B).
3) Lock pinions in these positions using bolts type M8x125x35.

NOTE:
Bolts should be tightened by hand.

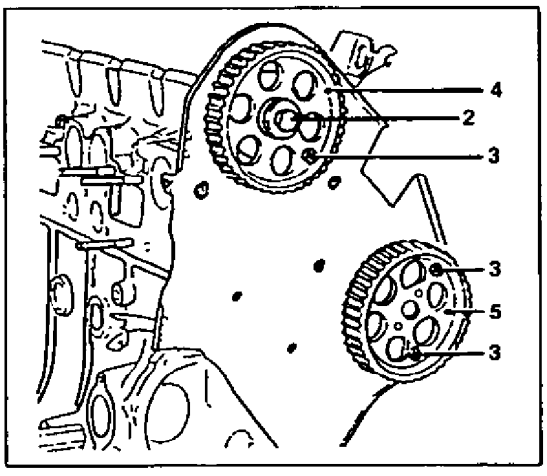
4) Slacken nut (8) and bolt (10), detension belt (4) and remove.
5) Remove pinion (5), sprocket (3), tensioner (9), piston tensioner (7) and water pump (6).

NOTE:
Be careful not to mislay crankshaft cotters.



Removal of jet pump, camshaft pinion and jet pump pinion.

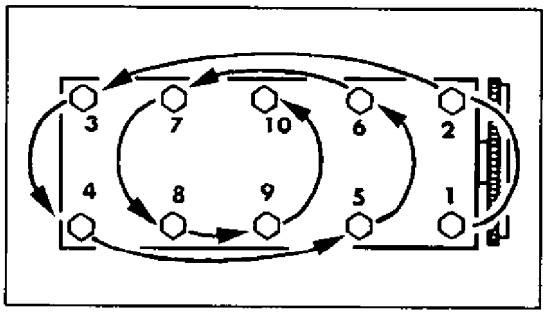
1) Fit tool (A) **Ref. 00000V02010** to extract jet pump.
2) Remove attaching elements and rear fitting of jet pump, extract jet pump and withdraw tool (A).
3) Remove jet pump support.



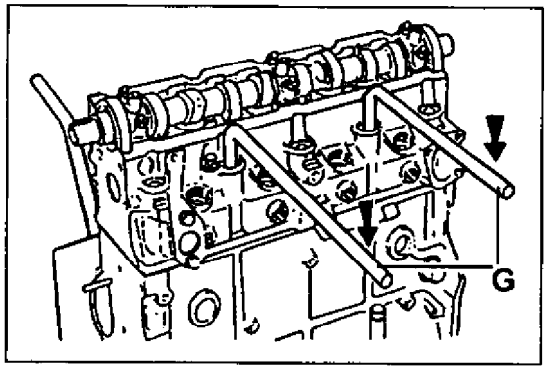
4) Remove bolt (2) joining camshaft to pinion.
5) Remove locking bolts (3) and withdraw camshaft pinions (4) and jet pump (5).

Cylinder head removal.

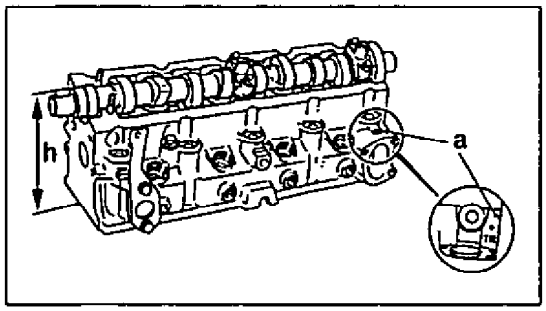
1) Remove front attaching bolts of cylinder head and centre part using tool **Ref. 000005V020019**.



2) Remove rocker arm cover, slacken and progressively remove cylinder head bolts in order indicated.



3) Extract cylinder head from block using two levers (G) or similar.
4) Remove cylinder head and take out gasket.



CYLINDER HEAD INSPECTION

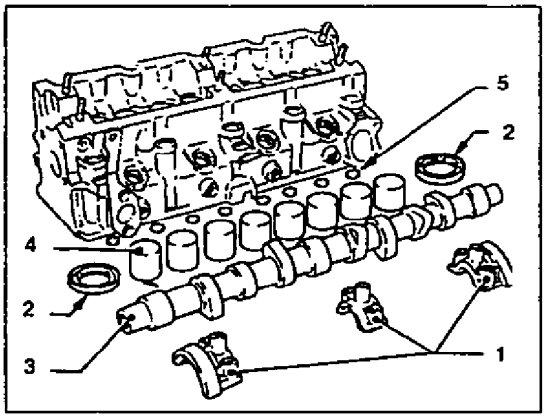
1) Measurement of cylinder head height should be carried out with camshaft in position and secured by two bedplate covers, (h) measurement being taken of the retainer diameter (the larger diameter).

   (h). nominal: from 157.40 to 157.75 mm.

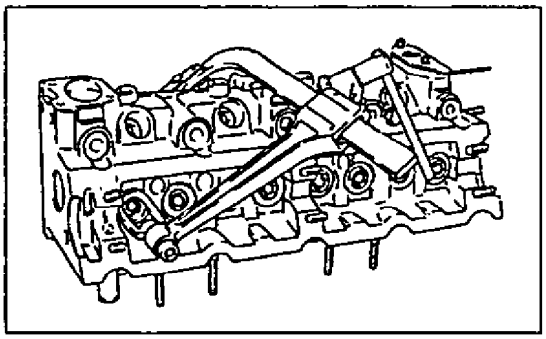
2) The maximum distortion admitted for the camshaft is **0.07 mm**, (the camshaft should turn freely on cylinder head).
3) Maximum admitted rectification of cylinder head seat face is **0.4 mm**. with respect to nominal height measure (h).
4) Rectified cylinder heads should be marked by stamping an **R** in the area (a).
5) When the flat side of the cylinder head gasket is rectified the following operations should be carried out:

   - Rectify valve seats to ensure they are correctly levelled.
   - Replace turbulence canisters with oversize canisters and level up correctly.
   - Fit compensating washers of **.4 mm** below valve springs.

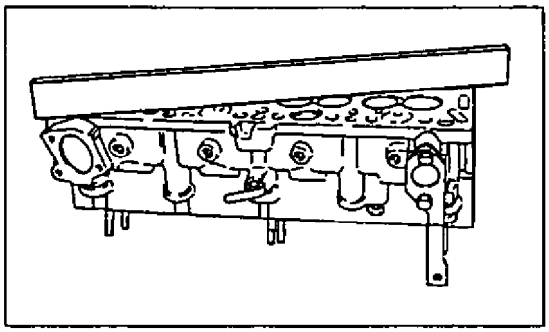
6) Cylinder heads with flanged camshaft lines **(+0.5)** are marked with a (1) in the area indicated (a).



7) Remove the following components from cylinder head and place them in same order as that for assembly.
   - Camshaft covers (1).
   - Retainers (2).
   - Camshaft (3).
   - Blockholes (4).
   - Adjustment pads (5).



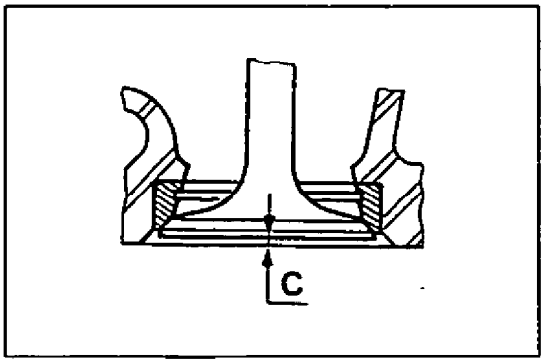
8) With the aid of a valve extractor, remove the following components from cylinder head:
   - The 8 valves, springs and retaining plates.
9) Remove canisters.
10) Clean cylinder head using **DECAPLOC 88.**



11) Check cylinder head distortion.

Maximum distortion = 0.07 mm

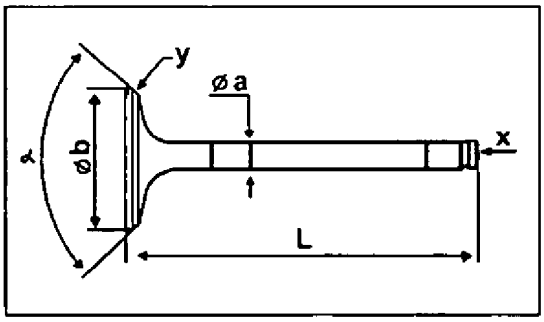
12) Check condition as indicated in section on cylinder head repair:
- Valve seats and guides.
- Valves.
- Valve springs.
- Turbulence canisters.
- Camshaft.
- Camshaft supports.
- Threads.



CYLINDER HEAD REPAIR

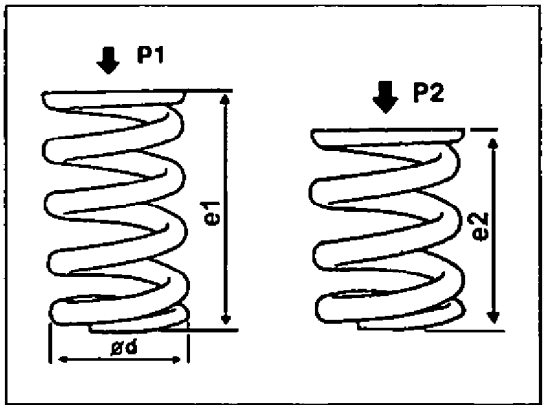
1) If after checking the cylinder head is level, rectifications have to be made, it should be borne in mind that it is necessary in any case to check valve depth after rectification and rectify seats to establish correct depth.

Valve depth (contour c)
Intake 0.5 a 1.05 mm.
Outflow 0.9 a 1.45 mm.



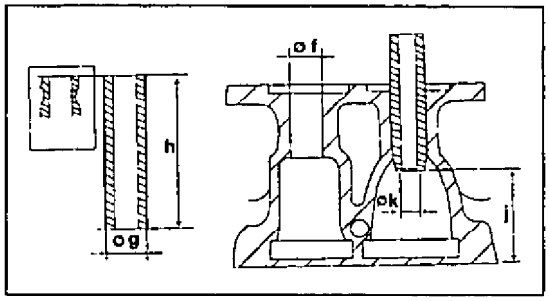
2) Checking valves.

	Intake	Outflow
L mín.	112.5	
Øa + 0 – 0.015	8.005	7.985
Øb +/- 0.1	38.5	33
Angle	90º	90º



3) Checking valve springs.

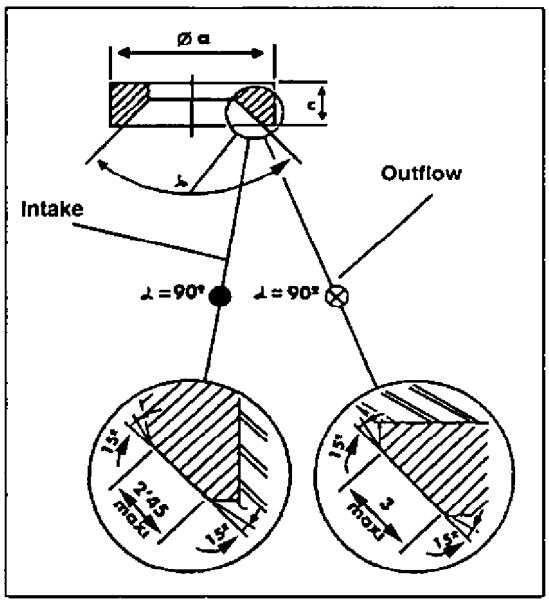
DIAMETER d: 29	
P1: Kg/N	18/180
e1	42.4
P2: Kg/N	45/450
e2	33.3



4) Valve guides.
When valve guides are removed, the oversize guides are inserted, so housing in cylinder head must be rectified.

	Ø:g	Ø:f	h	j	Ø:k
Tolerance	0	0.032	0.25	0.5	0
	-0.011	0	-0.25	-0.5	+0.2
Value Original	14.02	13.981	52.00	36.5	8.02
	14.13	14.051			
1st Repair	14.29	14.211			
2nd Repair	14.59	14.511			

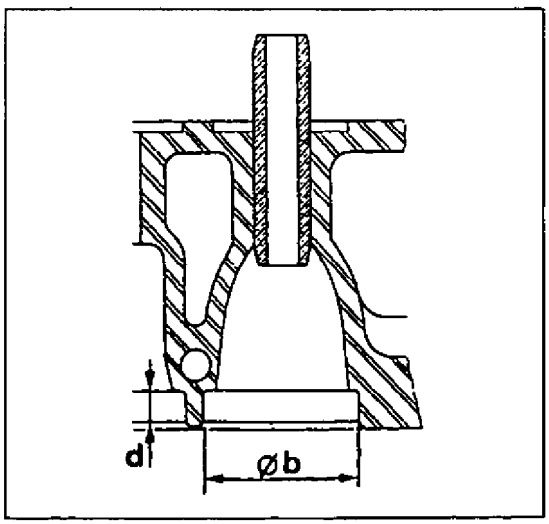
NOTE:
Value Ø:k is achieved once guides have been fitted on cylinder head.



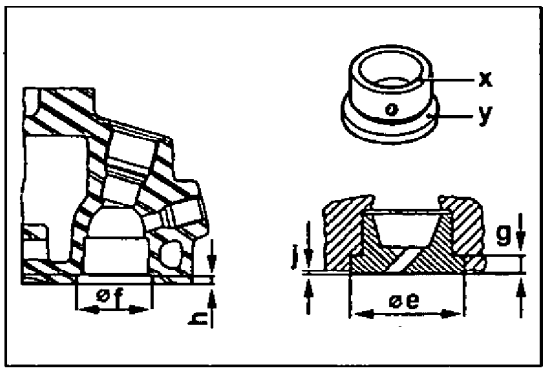
5) Valve seats.
When valve seats are removed, the housing must be rectified to insert a new oversize seat.

The rectifying measurements are shown in the tables and figures.

	INTAKE			
	Ø:a	Ø:b	c	d
Tolerance	0	+/-0.025	0	+/-0.15
	-0.025		-0.01	
Value	40.161	40	6.25	8.267
Original	40.361	40.2	6.45	8.467
1st Repair	40.461	40.3	6.45	8.467
2nd Repair	40.661	40.5	6.45	8.467



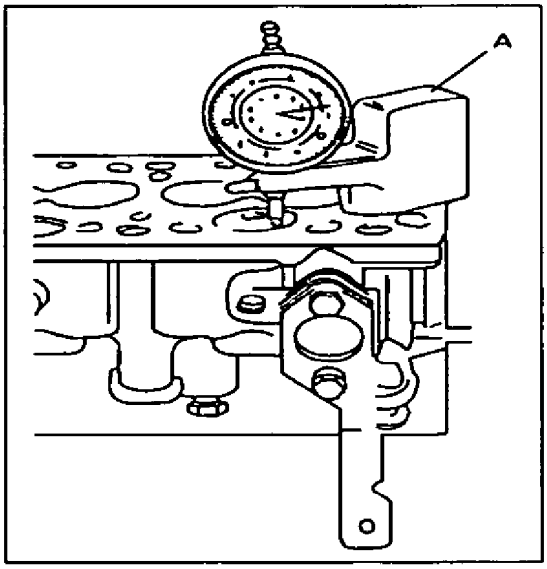
	OUTFLOW			
	Ø:a	Ø:b	c	d
Tolerance	0	+/-0.025	0	+/-0.15
	-0.025		-0.01	
Value	34.137	34	6.05	8.15
Original	34.337	34.2	6.25	8.35
1st Repair	34.437	34.3	6.25	8.35
2nd Repair	34.637	34.5	6.25	8.35



6) Turbulence canisters.
When it is necessary to level the cylinder head, it is important to remove the fuel canisters first. The new ones should be oversize, it being necessary to machine the housing and rectify new canisters in areas (x) and (y) so that they are level with the cylinder head.

Rectifiction of canister housing.

	Ø:e	Ø:f	g	h
Tolerance	0.099	0.039	0.02	0.02
	-0.06	0	-0.025	-0.04
Value	32.05	32	4.00	3.90
Original	32.25	32.2	4.1	4.0
1st Repair	32.45	32.4	4.2	4.1
2nd Repair	32.65	32.6	4.3	4.2

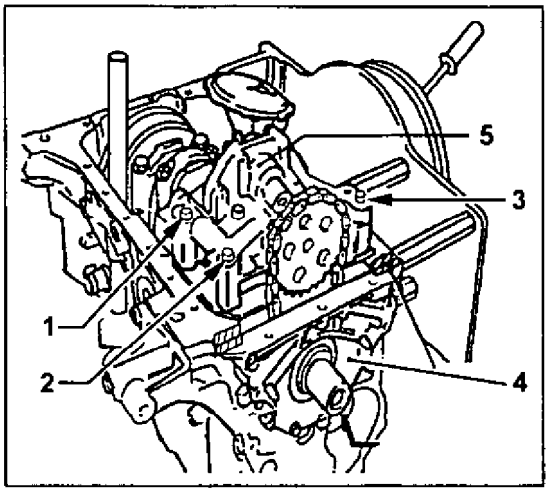


Canister levelling: de 0.015 ± 0.015 mm above cylinder head surface. Measured with dial indicator and support (A) Ref.00000V02009.

NOTE:
When major fissures (over 2 mm.) are noted in canister window, this should be replaced.

7) Assembling cylinder head.
Fit on cylinder head the valves, springs, new valve guide retainers (using tool) **Ref.00000V02009**), tappets, adjustment plates and camshaft.

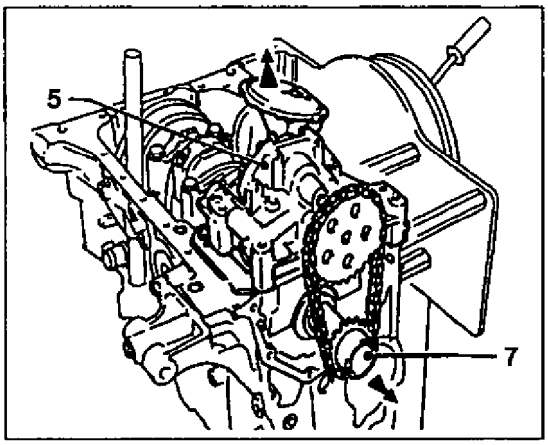
NOTE:
To adjust valves please refer to 6A1- 6 Y 6A1-7



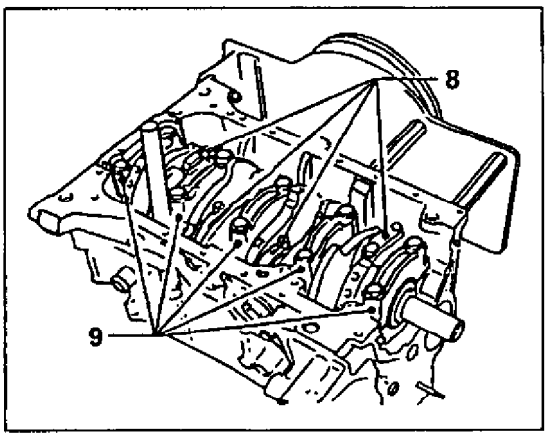
ENGINE BLOCK DISASSEMBLY

From the lower part of engine remove the following components:
1) Oil pan.
2) Pump pickup tube.
3) Oil pump (5) bolts (1), (2) and (3) (5) and retainer holder (4).
4) Oil baffle.

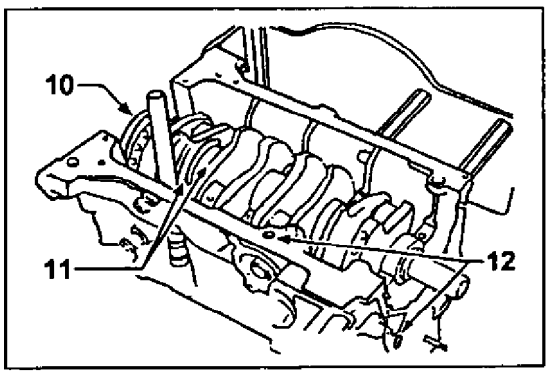
NOTE:
Bolt no. 1 is special since it serves to centre the pump.



5) Raise pump (5) and remove with chain and crankshaft pinion (7). Be careful not to mislay the cotters.

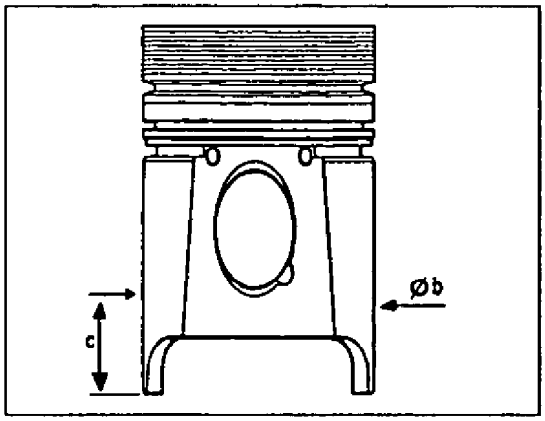


6) Remove the following components:
   - Piston rod caps (8), marking them to keep them in order.
   - Bedplate covers (9), marking them to keep in order.
   - Gauges adjusting end play installed in support no. 2.



   - Retainer (10) and gauges adjusting end play (11).
   - Crankshaft, bedplate, bedplate bushings and piston rod assemblies.

7) Unfasten piston rods by releasing brakes.
8) Remove oil gallery caps. (12).

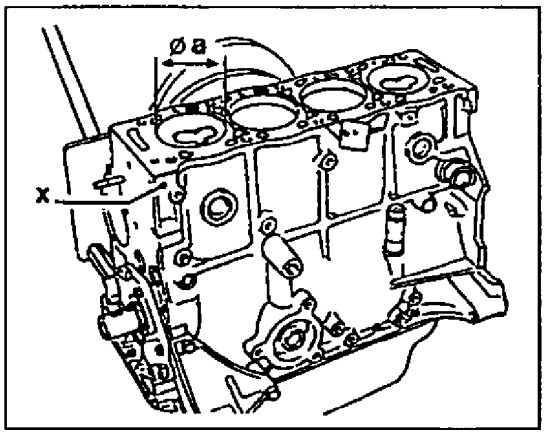


CYLINDER BLOCK REPAIR

1) Matching up cylinder and piston.
Measure internal diameter of cylinders and external one for pistons and in accordance with the following table determine the rectification that is necessary. The piston diameter (b) must be measured at a contour (c) from the base.

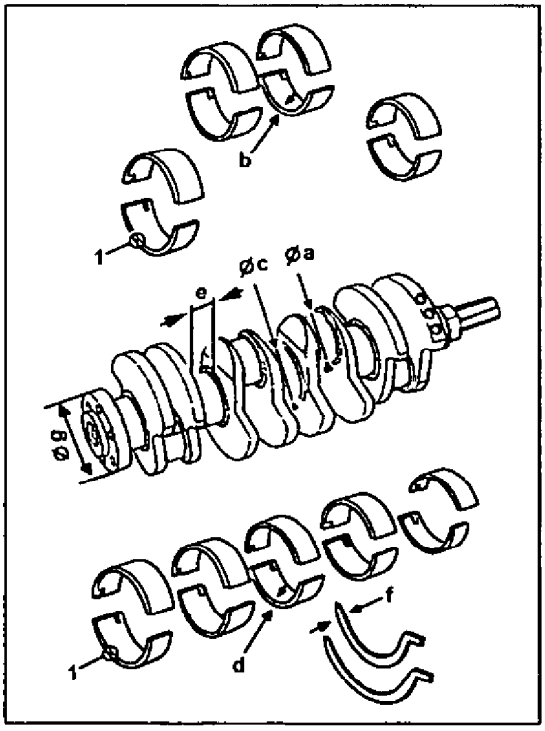
Contour (c)= 25mm.

The rectifying mark (R1, R2 or R3) should be scribed on indicated area on block (x).



		CYLINDER		PISTON	
	Mark (x)	Diameter (a)	Tolerance	Diameter (b)	Tolerance
Value	No	83		82.93	
Original	A1	83.03	+0,018	82.96	+0.009
1st Repair	R1	83.2	-0	83.13	-0.009
2nd Repair	R2	83.5		83.43	
3rd Repair	R3	83.8		83.73	

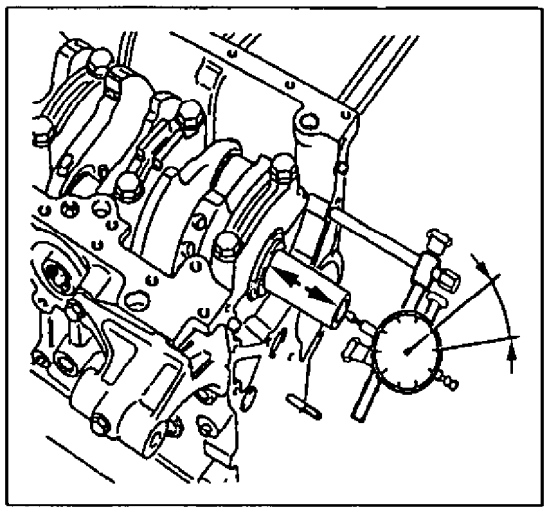
Diameter of piston bolt: 28 mm.



2) Repairing bedplate pins and piston rod.
Measure bedplate pins and piston rod and rectify if necessary. When rectifying (see table) oversize bushings identified with white paint (1) must be used.

	Ø:a	b	Ø:c	d
Tolerance	0	0.003	0	0.003
	-0.016	-0.003	-0.019	-0.003
Original	50	1.827	60	1.842
1st Repair	49.7	1.997	59.7	1.992

NOTE:
Piston rod and bedplate bushings in first repair should be identified with a white paint marking on the edges.



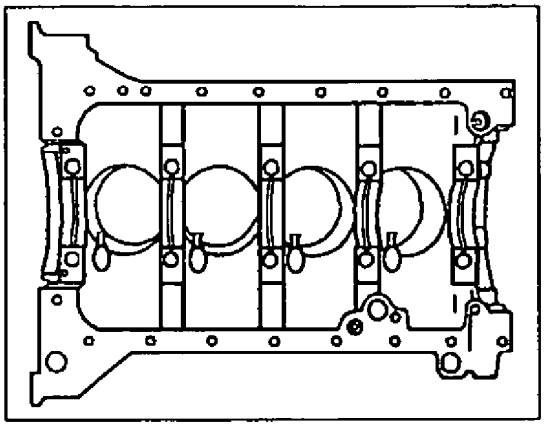
3) End play adjustment.
Crankshaft end play should be between **0.07** and **0.32 mm**. It is secured by four crescents, two located on the block and two on the same side of bedplate no.2. They should be fitted with copper area facing towards crankshaft.

	Bedplate support No. 2		Axial washer Thickness	
	e	Tolerance	f	Tolerance
Value original	26.6		2.305	
1st Repair	26.8	+0.05	2.405	+0.025
2nd Repair	26.9	-0	2.455	-0.025
3rd Repair	27		2.505	

4) Rear retainer seat.
Check diameter of crankshaft wrist pin (g) and rectify if necessary.

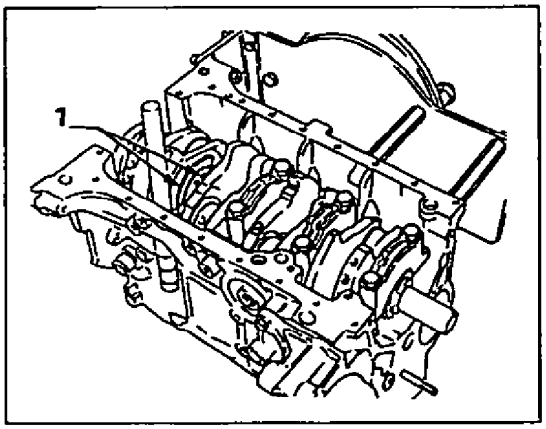
Contour	Ø = g	Tolerance
Value original	90	+ 0
1st Repair	89.80	-0.087

5) Cleaning block and crankshaft.
Clean with degreasing product, inserting a rammer in internal grooves of cylinder block and crankshaft.

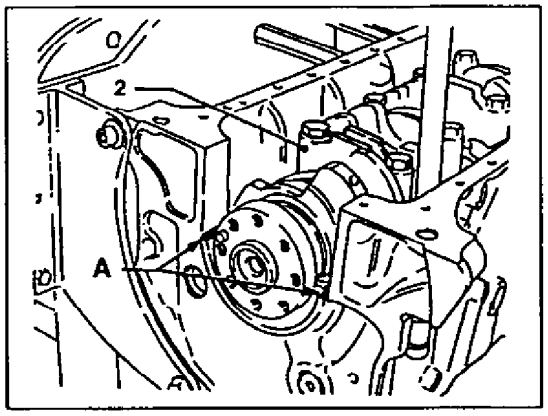


CYLINDER BLOCK ASSEMBLY

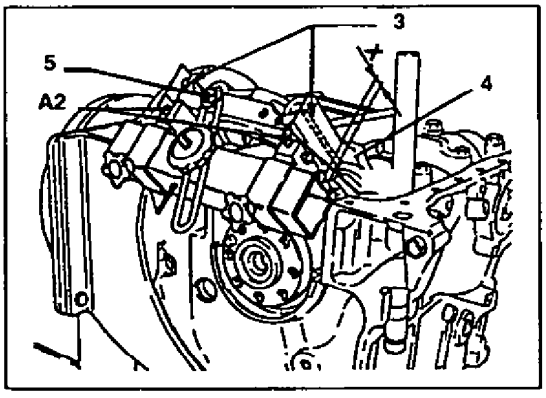
1) Crankshaft assembly.
   - Place fuel line caps on cylinder block once greased with **LOCTITE FRENETANCH.**
   - Fit cooling injectors inside pistons.
   - Fit bedplate bushings selected previously.
   - Position crankshaft and bedplate covers nos.3, 4 and 5.



- Fit 2 end play washers (1) facing towards crankshaft with mating surfaces covered with antifriction material.



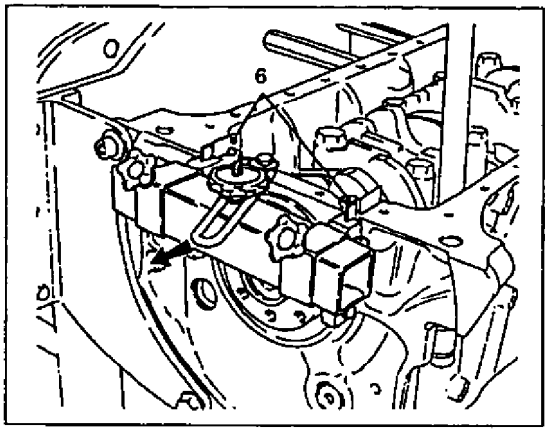
- Fit bedplate cover no. 2 snug with end play washers and with antifriction covered mating faces facing crankshaft.
- Apply recommended sealant to points (A).



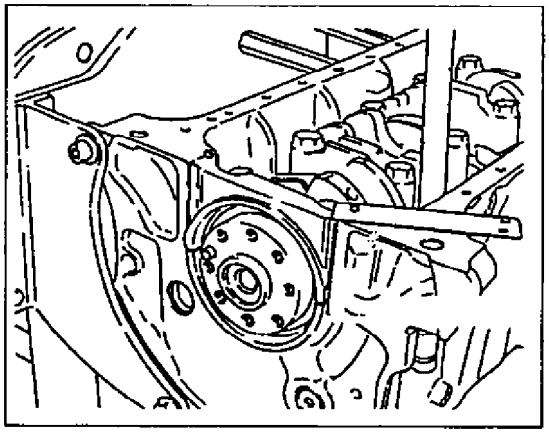
- Fit two new lateral seals (3) to bedplate cover no.1.
- Fix tool **Ref. 00000V02002** equipped with metal centering plates **A2 Ref. 00000V02005**, to bedplate cover no. 1 (4), by means of a bolt and washer (5).
- Adjust height (x) of metal centering plates.
- Grease metal plates and housing.

NOTE:
So as not to elongate lateral seals, fit bedplate cover as indicated below.

- Insert in housing at an inclination of 45º.
- Straighten up once inserted.
- Slowly lower.

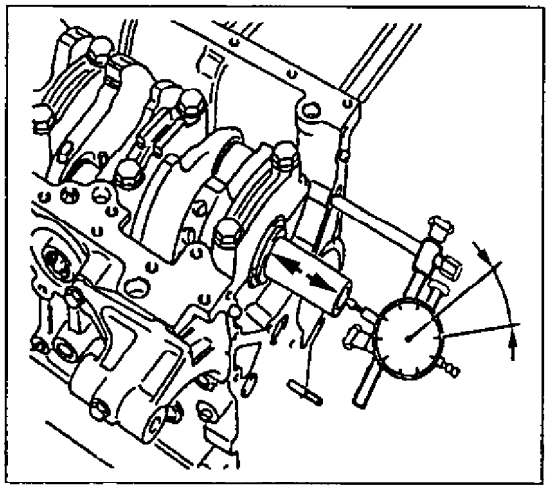


- Tighten bedplate cover bolts (6) as specified.



- Remove tool horizontally.
- Cut lateral seals so they stick out 2 mm.
- Tighten all bedplate cover bolts to specified torque.

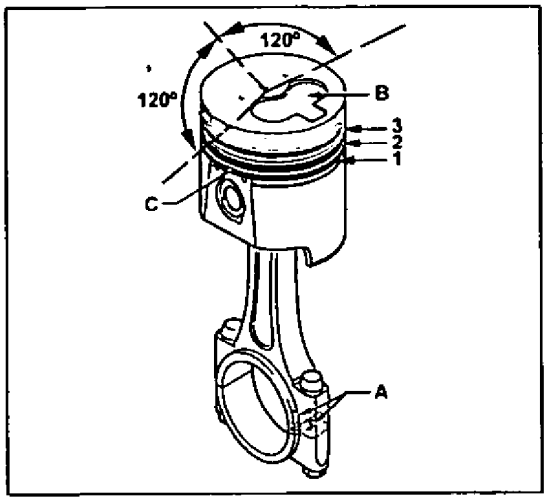
Bedplate bolts torque specifications: 7 Kg-m (70 Nm).



2) Checking end play.
   - Fit dial indicator as indicated.

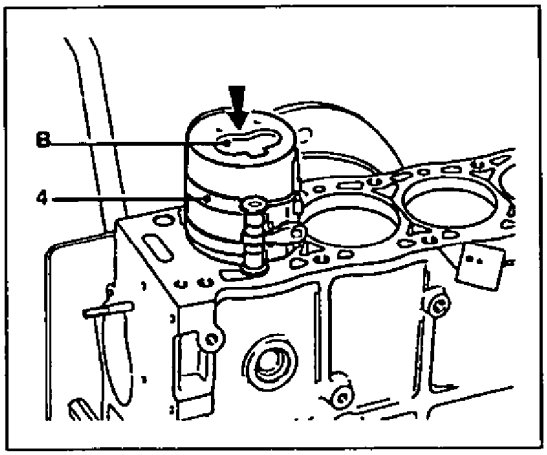
Crankshaft end play: 0.07 to 0.32 mm.

NOTE:
To adjust end play please refer to table, point 3 (Adjustment of end play, page 6A1-46).



3) Installation of connecting rods and pistons.
   - Assemble connecting rods and pistons pointing the connecting rod notches (A) towards the pocket (B) of the piston.
   - Fit segments using expander, in the following order:
     (1) Lubricated segment.
     (2) Cone shaped segment.
     (3) Chrome/convex segment.

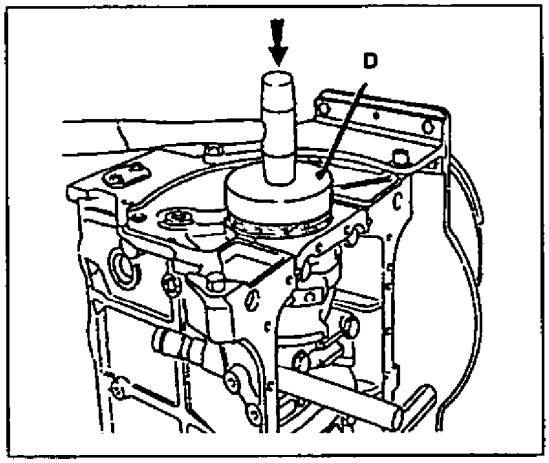
NOTA:
The side marked (TOP) of the cone shaped segment should face the combustion chamber (upwards).



- Lubricate piston and segments.
- Point segments at 120º, taking the clearance (c) of lubricated segment for reference. In this position compress the segments with a compressor (4).
- Remove connecting rod caps, install selected bushings (if new) or the same ones that were fitted before (if used).
- Fit pistons in block, respecting the marks made during disassembly and pointing the pocket (B) of the piston towards the oil filter. Apply abundant lubrication to crankshaft wrist pin and bushings, fit caps and tighten to specified torque.

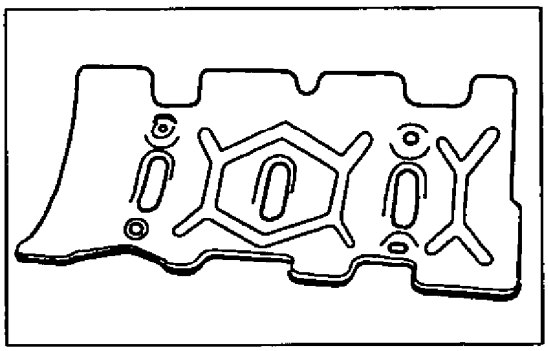
Connecting rod caps torque specifications: 2 Kg-m + 70º ± 5º (20 Nm + 70º ± 5º)

NOTE:
For selection of connecting rod bushings please refer to 6A1-45 (REPAIR OF CYLINDER BLOCK) POINT-2.

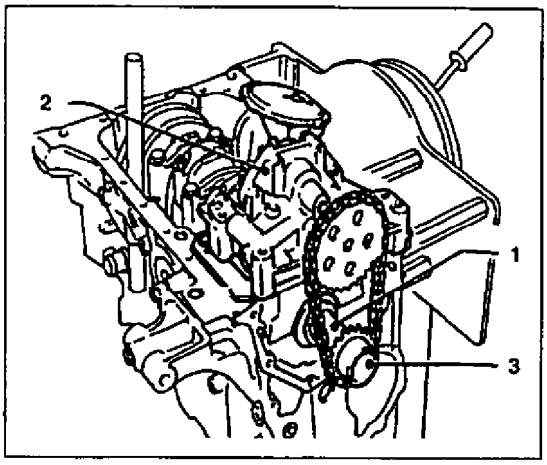


- Fit new retainer on tool (D) **Ref.00000V02004**.
- Insert retainer by hitting with a mallet until it fits snug.
- Rotate tool to remove.
- Check that retainer lip is correctly positioned.

NOTE:
- **Before fitting retainer ensure that both adjusting wrist pin of crankshaft as well as retainer lips are clean.**
- **Before fitting retainer, apply oil in wrist pin seal area.**

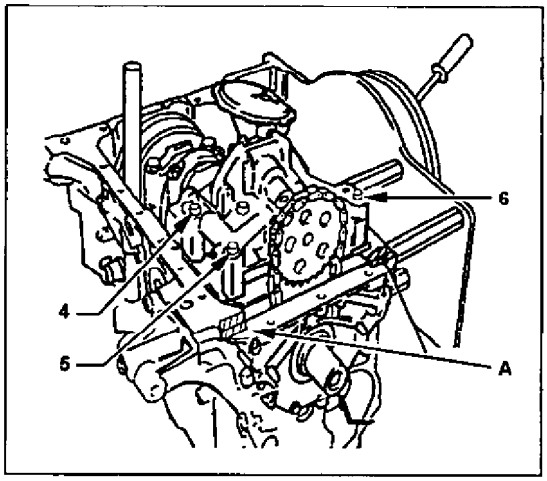


- Fit oil decanter with 4 attaching bolts.



4) Assembly of oil pump and pan.

Install components in following order:
- Cotters (1).
- Pump assembly (2), chain and pinion (3).



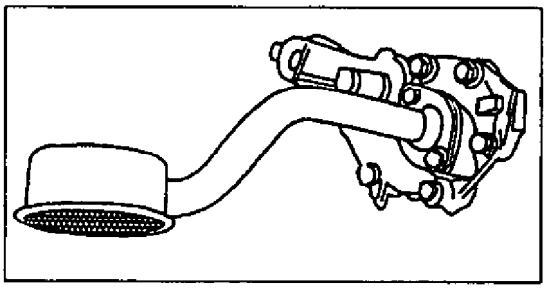
NOTE:
Bolt no. 4 is special and serves to center pump.

- Tighten to specified torque pump bolts numbers (4), (5) and (6).

Torque specifications for bolts: 2 Kg-m (20 Nm)

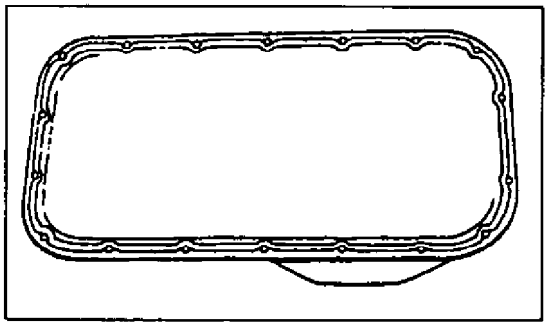
- Fit a new front retainer on tool **Ref.00000A02006** and insert in housing by knocking with a mallet until it is snug.
- Tighten attaching cover bolts as specified.
- Cut overhanging parts of lateral seals leaving 2mm protruding.

Torque specifications for cover bolts:
1.5 Kg-m (15 Nm)

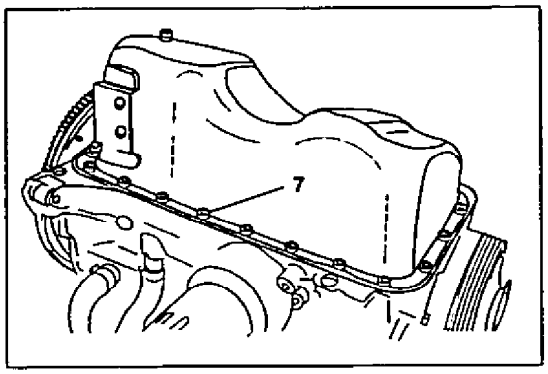


- Install oil pickup tube and attach with two bolts to specified torque.

Oil pickup tube bolts torque specifications:
1.5 Kg-m (15 Nm)



- Apply line of **AUTO JOINT BLEU** sealant to edges of bolt housing in oil pan.

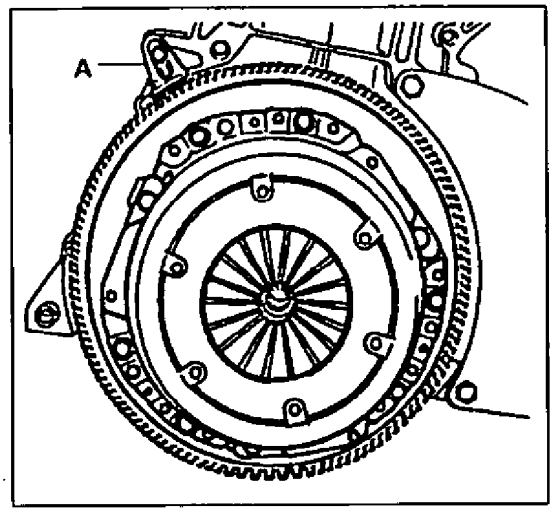


- Fit oil pan on engine and tighten bolts (7) to specified torque.

Torque specifications for oil pan attaching bolts:
2 Kg-m (20 Nm)

- Fit engine flywheel case and tighten four bolts to specified torque.

Torque specifications for flywheel case attaching bolts:
4-6 Kg-m (40-60 Nm)



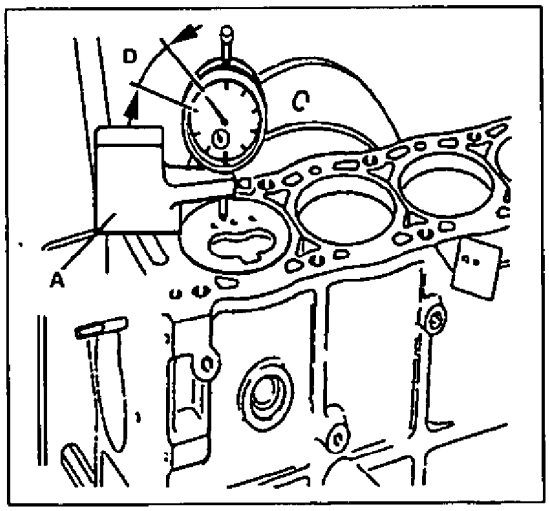
5) Clutch assembly installation.
   - Fit engine flywheel and insert bolts smeared with **LOCTITE FRENETANCH.**
   - Install engine flywheel detent tool (A) **Ref. 09916-96510** and tighten attaching bolts to specified torque.

Engine flywheel attaching bolts torque specifications:
5 Kg-m (50 Nm)

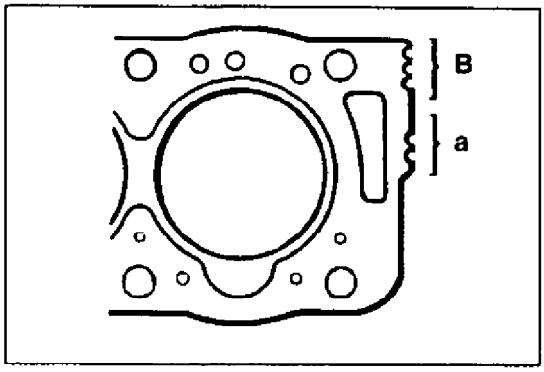
   - Fit clutch disc and pressure plate and attach both with bolts without tightening.
   - Center clutch disc using an input shaft or similar and tighten bolts to specified torque.

Torque specifications for pressure plate bolts:
2.5 Kg-m (25 Nm)

   - Remove detent tool from engine flywheel.



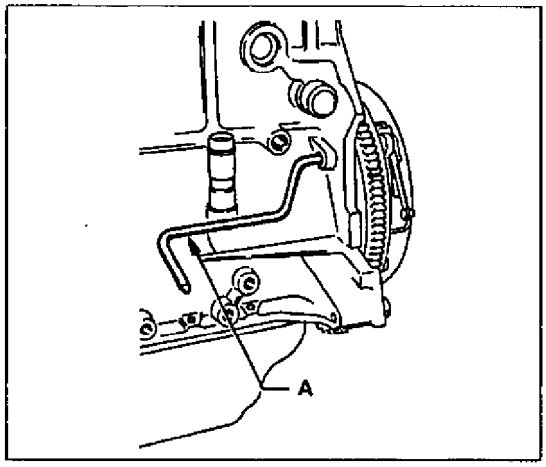
6) Choosing cylinder head gasket.
   - Fit dial indicator on support (A) **Ref. 00000V02003** and set to zero on flat surface (marble or similar).
   - Turn crankshaft until pistons no. 1 and 4 are at T.D.C. using detent tool **Ref.00000V02008**.
   - Remove locking tool and obtain exact T.D.C from the dial indicator.
   - Obtain the difference (D) (piston elevation), measured between piston head and supporting side of gasket. Measure this difference in each cylinder and note it down.



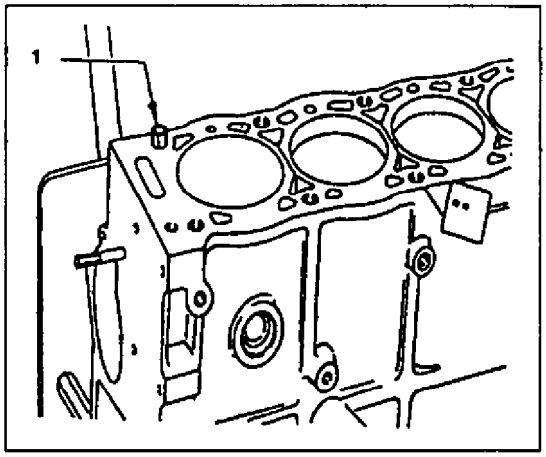
- With measurements obtained (D), choose gasket thickness (B) identified by notches (see table below).

Measurement (D)	Thickness (B)
0.56 to 0.67 mm	1 notch(es)
0.68 to 0.71 mm	2 notch(es)
0.72 to 0.75 mm	3 notch(es)
0.76 to 0.79 mm	4 notch(es)
0.80 to 0.83 mm	5 notch(es)

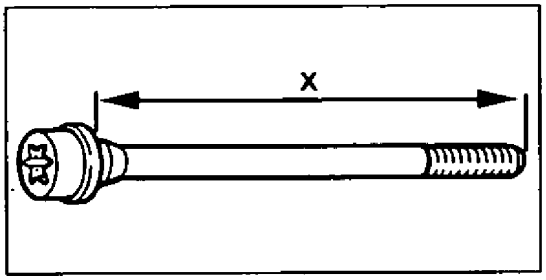
Identification notches (Engines XUD 9BTF)
(a) = 3 notches (engine type marks).
(B) = 1 to 5 notches (thickness marks).



7) Installing cylinder head.
- Place pistons 1 and 4 in T.D.C position using locking tool (A) **Ref.00000V02008**.



- Clean drills with M.12x150 tap.
- Fit fixed component (1) on engine block and install gasket dry taking the fixed one as reference point.
- Situate gasket on block.

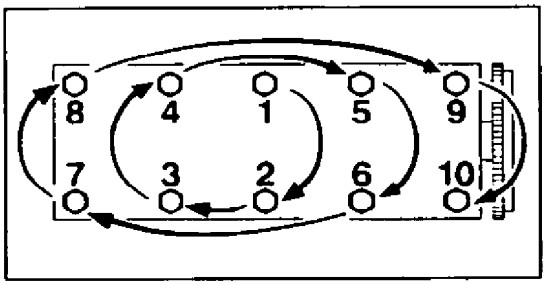


- Check screws for stretch, measuring the contour (x) without washers.

Maximum length (x) 146.8 mm (without washer)

NOTE:
Screws longer than indicated measurement should not be used.

- Clean screw threads and replace washers with new ones.
- Apply MOLIKOTE G RAPID to screw threads and washer contact surfaces.

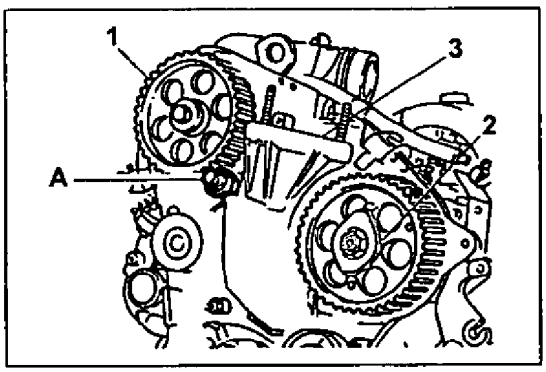


- Tighten cylinder head screws in order indicated and to specified torque, following the steps below:

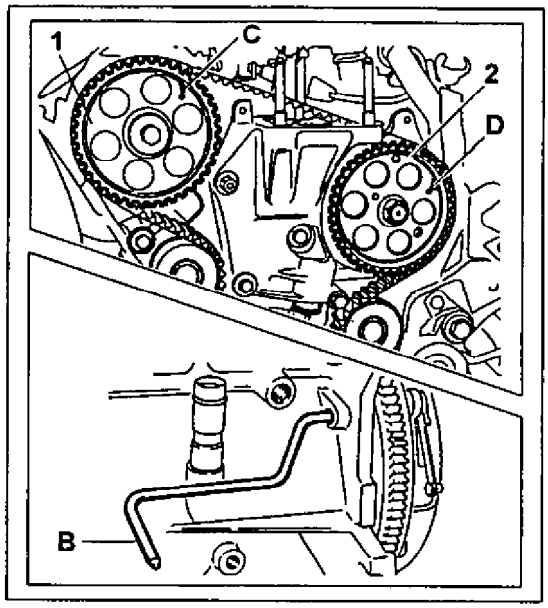
  - Initial tightening: 2 Kg-m (20 Nm)
  - Subsequent tightening: 6 Kg-m (60 Nm)
  - Final angular tightening: 220º

NOTE:
For installation of camshaft please refer to 6A1-7, (VALVE PLAY ADJUSTMENT).

8) Timing installation
   - Fit timing plate.
   - Fit jet pump support and pump.

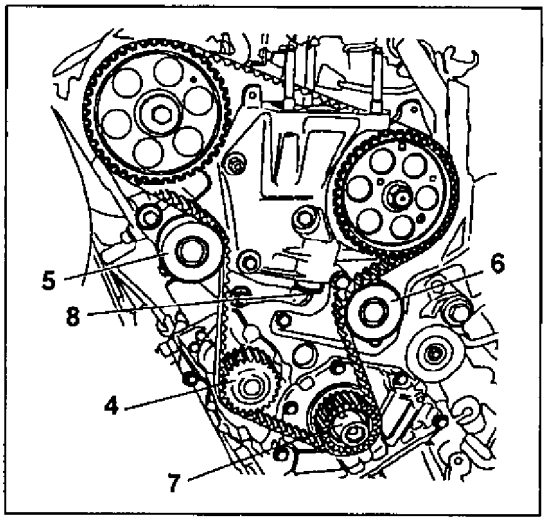


- Fit centering part, using tool(A) **Ref. 00000V02020** and remove tool and stud.
- Fit camshaft pinion (1) with attaching bolt and pump pinion (2) fastened with its nut.
- Mount support (3).



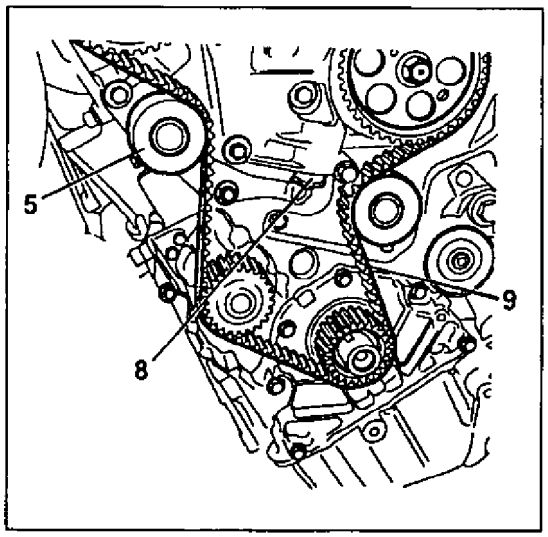
- Lock engine flywheel in T.D.C. position using tool (B) **Ref. 00000V02008**. Place camshaft pinions and jet pump in adjustment position (C) and (D) and attach with M8x125x35 bolts tightened by hand.
- Tighten as specified the bolt connecting pinion (1) to camshaft and nut connecting pinion (2) to jet pump.

Torque specifications for camshaft pinion attaching bolt: 4 Kg-m (40 Nm).
Torque specifications for nut attaching pinion to jet pump: 5 Kg-m (50 Nm).



- Install and tighten as specified fittings of following parts or assemblies to specified torque:
  - Water pump (4).
  - Sprocket and tensioner support(5).
  - Piston and tensioner support(8).
  - Fixed sprocket (6).
  - Crankshaft pinion (7), paying attention to the positioning of cotter.

Torque specifications for piston tensioner support attaching bolts: 2 Kg-m (20 Nm).
Torque specifications for tensioner nut and bolt and fixed sprocket: 1,8 Kg-m (18 Nm).



- Check correct functioning of tensioner (5) and piston (8). Maintain piston compressed during installation of belt.
- Install timing belt as shown, ensuring a perfect fit with pinions and correctly adjusted. tension (9).
- Release sprocket (5) and piston (8), ensuring that the belt is well tensioned and tighten to specified torque the nut and bolt attaching the tensioner plate.
- Remove tool and bolts locking in position the engine flywheel and the pinions from the camshaft and jet pump.

Adjusting timing:

- Rotate crankshaft twice in normal functioning direction.

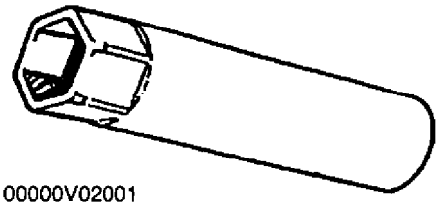
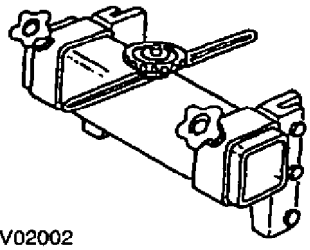
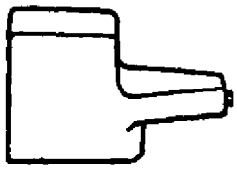
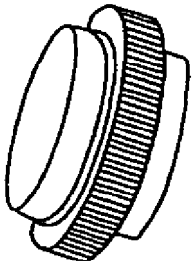
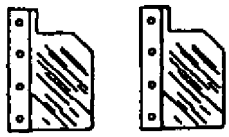
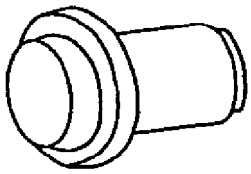
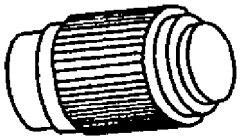
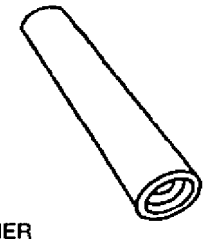
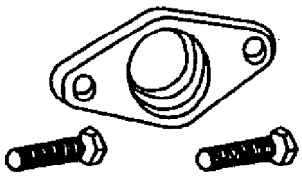
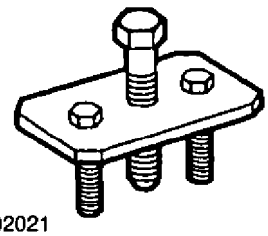
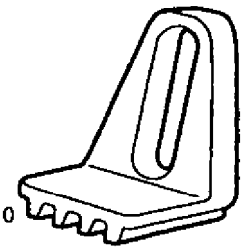
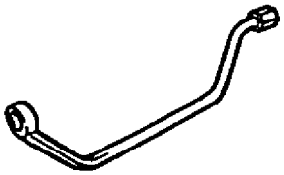
  NOTE:
  Do not turn crankshaft in direction other than that of normal functioning.

- Check that engine flywheel and pinions are correctly aligned. Please refer to (B), (C) and (D). Check with tool **Ref. 00000V02008** and two bolts type M8x125x35.

  NOTE:
  If three above points are not perfectly aligned in previous operation, readjust the belt once more.

- Once the timing belt has been correctly adjusted remove engine flywheel locking tool and pinion locking bolts.
- Continue assembly as in 6A1-11 (TUNING UP TIMING).
- For overhaul and adjustment of jet pump please refer to 6E3-3.

SPECIAL TOOLS

 00000V02001 INJECTOR EXTRACTOR WRENCH	 00000V02002 BEDPLATE COVER MOUNT	 00000V02003 DIAL INDICATOR SUPPORTS
 00000V02004 RETAINER MOUNT	 00000V02005 CENTERING PLATES	 00000V02006 FRONT RETAINER MOUNT
 00000V02007 CAMSHAFT RETAINER MOUNT	 00000V02008 P.M.S. ATTACHING ELEMENT	 00000V02009 VALVE RETAINER INSTALLATION TUBE
 00000V02010 INJECTION PUMP FLANGE	 00000V02015 SOCKET	 00000V02016 HEXAGONAL SOCKET
 00000V 02017 SEMI CIRCLE WRENCH	 00000V02021 CRANKSHAFT PULLEY EXTRACTOR	 09916-65510 MOTOR WHEEL RETAINER
 09912-56520 INJECTION PUMP ATTACHING NUTS WRENCH	 00000V02019 CYLINDER HEAD CENTERING GROUP EXTRACTOR	 00000V02020 CYLINDER HEAD CENTERING GROUP INSTALLER

TORQUE SPECIFICATIONS

SYSTEM	COMPONENT		SPECIFICATIONS	
			Kg-m	Nm
ENGINE	Camshaft cover locknuts		2	20
	Bedplate attaching bolts		7	70
	Connecting rod nuts		2 + 70°	20 + 70°
	Oil pump attaching bolts		2	20
	Front retainer mount plate		1.5	15
	Oil pan attaching bolt		2	20
	Engine flywheel case attaching bolts		4 - 6	40-60
	Clutch disc pressure plate bolts		2,5	25
	Engine flywheel bolts		5	50
	Camshaft pinion attaching bolts		4	40
	Jet pump/pinion locknut		5	50
	Spring tensioner support/cylinder head attaching bolts		2	20
	Timing tensioner attaching nut and bolt		2	20
	Lower timing cover support fittings		1	10
	Left timing cover attaching fittings		1	10
	Right timing cover attaching bolt		1	10
	Right timing cover locknut		0.5	5
	Crankshaft pulley attaching bolt		4 + 51°	40 + 51°
	Injectors (attachment to cylinder head)		9	90
	Fuel injection lines locknuts		2.5	25
	BOSCH injector mount nut		7.5	75
	Jet pump fuel intake line attaching bolt		2.5	25
	Jet pump fuel return line attaching bolt		2.5	25
	Jet pump support locknut		2	20
	Glow plugs		2.2	22
	Thermostat attaching bolt		1.5	15
	Fuel filter fitting		1.5	15
	Rocker arm cover fitting		0.8	8
	Oil pressure switch		3	30
	Alternator tensioner attaching bolts		2.2	22
	Engine mounts attaching bolts		4 - 5	40 - 50
	Engine silentblock/support union		4 - 6	40 - 60
	Oil pan drain plug bolt		3 -3.5	30 - 35
	Fuel lines/filter fitting (intake and outflow)		3 - 4	30 - 40
	Power assisted steering pressure pump lines		5 - 7	50 -70
	Engine/transmission union		4 - 6	40 - 60
	Power assisted steering pump supports and alternator/engine block fittings		1.8 - 2.8	18 - 28
	Depressor/mount fitting/engine block		3 - 4	30 - 40
	Depressor/mount attaching bolts		1.8 - 2.8	18 - 28
	Depressor tensioner		1.8 - 2.8	18 - 28
	Depressor tensioner (engine block side)		1.8 - 2.3	18 - 23
	Oil pickup tube bolts (oil pump)		1.5	15
	E.G.R. valve attaching bolts		2	20
	Intake manifold connections - first section		1.8 - 2.8	18 - 28
	Starter motor fitting		2 - 3	20-30
	Intake manifold locknuts		2.5	25
	Intake manifold attaching bolts		1.5	15
	Intake manifold locknuts		2.5	25
	Turbocompressor attaching bolts		3	30
	Intake distribution flange locknuts		1.5	15
	Turbocompressor drain pipe attaching bolts		1.5	15
	Fuel intake connection to turbocompressor (union with block)		3	30
	Fuel intake connection to turbocompressor (union with turbocompressor)		1.5	15
	Cylinder head bolts	1st tightening	2	20
		2nd tightening	6 + 220°	60 + 220°

SECTION 6B

COOLING SYSTEM

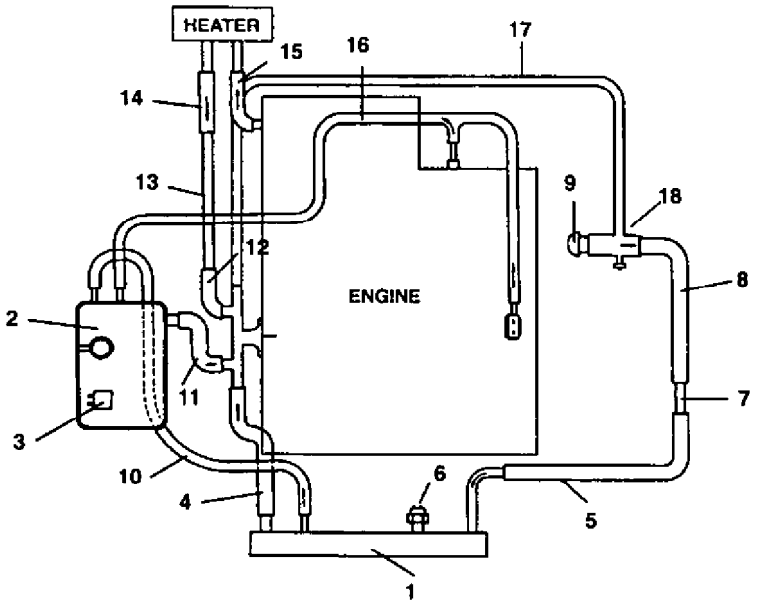
NOTE:
For points not covered in this section, please refer to corresponding sections of Service Manual outlined in INTRODUCTION to this Manual.

CONTENTS

GENERAL OUTLINE

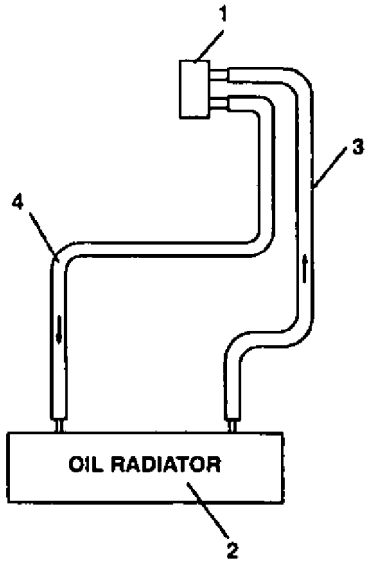
The cooling system includes the following elements: radiator, degassing reservoir, coolant level sensor, oil coolant, thermostat, chaffern, thermo sensor for driving the electric fan relay and electric fans.

ENGINE COOLING SYSTEM

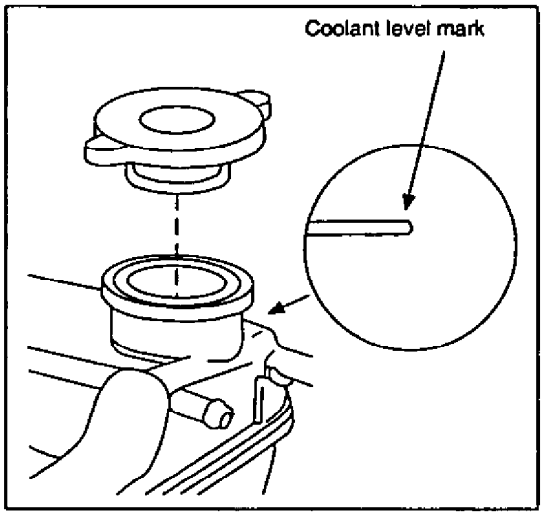


1. Radiator
2. Degassing reservoir
3. Coolant level sensor
4. Outlet hose-radiator
5. Intake hose-radiator (no. 1)
6. Thermo sensor
7. Interconnecting hose
8. Intake hose-radiator (no. 2)
9. Thermostat
10. Radiator degassing hose
11. Filler hose
12. Heater outlet hose (no. 2)
13. Heater outlet lines
14. Heater outlet hose (no. 1)
15. Heater intake hose
16. Engine degassing hose
17. BY-PASS hose
18. Thermostat housing

ENGINE OIL COOLING SYSTEM



1. Engine adaptor
2. Oil radiator
3. Radiator outlet hose
4. Radiator intake hose



MAINTENANCE

COOLANT LEVEL

Remove coolant degassing reservoir upper cover and check coolant is reaching upper part.

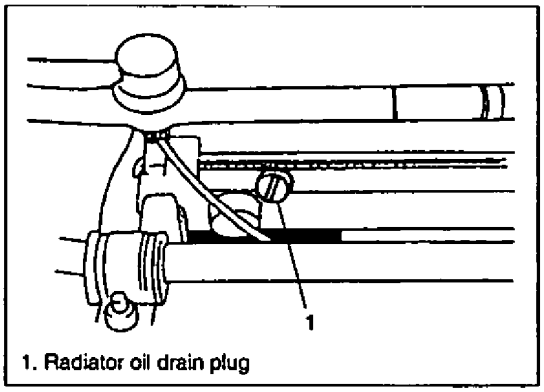
WARNING:
To avoid the possible risk of burns do not remove cap whilst engine and radiator are hot, pressurised vapour and boiling water could come out.

If coolant level is low, fill with coolant to maximum level.

NOTE:
Ensure that filler cap is totally closed.

COOLANT REPLACEMENT

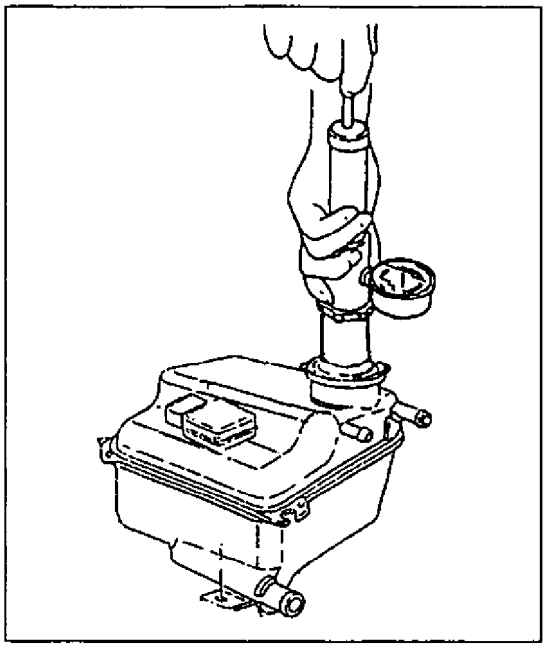
1) Remove lower engine soundproofing plate.
2) With engine cold, unscrew degasser filler cap.



1. Radiator oil drain plug

3) Open draining plug in lower part of radiator until all fluid has flown out.
4) Close draining plug.
5) Add coolant to degasser reservoir, until it reaches upper part.
6) Turn on heater controls and start up engine.
7) Continue adding coolant as reservoir level reduces, until the engine is completely warmed up.
8) Ensure that coolant stabilises at maximum level in degasser reservoir.
9) Fit cap on coolant degasser reservoir.
10) Fit lower engine soundproofing plate.

NOTE:
Cooling system capacity is 8 litres.
Use a mix of 50% DINAMIC DYNAGEL 9103 antifreeze and 50% distilled or demineralized water.



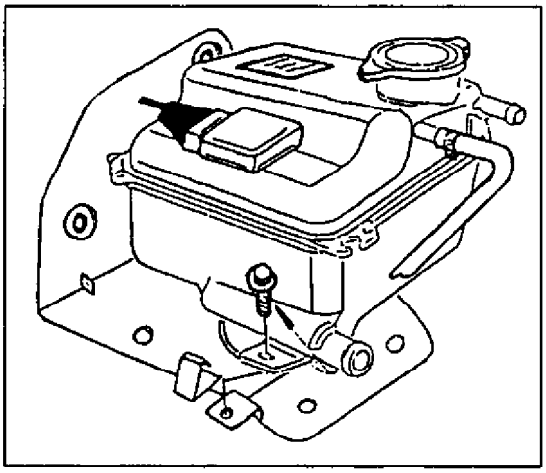
INSPECTION AND CLEANING

Inspection.

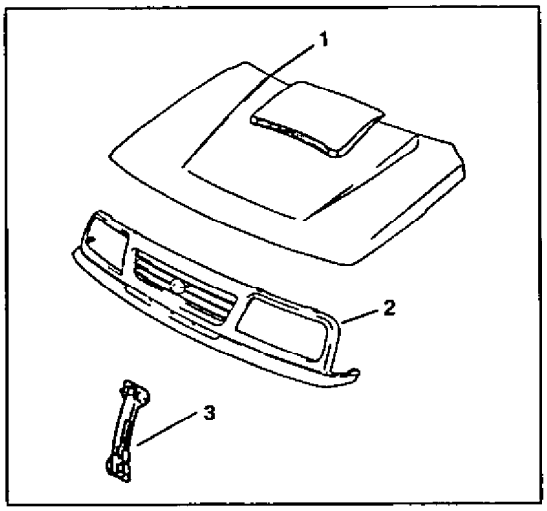
1) Remove upper cover of coolant degasser reservoir.
2) Fit pressure gauge and set pressure of 1.4 Kg/cm².
3) Check that pressure does not fall from above level. If it does, check for existence of leaks and correct if necessary.

Cleaning.

1) Remove lower engine soundproofing plate.
2) Remove coolant degasser reservoir cap.
3) Start up engine and run until thermostat outlet hose is warm.
4) Turn off engine and remove radiator draining plug, thereby evacuating coolant.
5) Fit filler cap and wait for engine to cool down.
6) Add water to coolant degasser reservoir and wait again for engine to warm up until proceeding to drain.
7) Repeat this operation 3 or 4 times until water coming out of drain hole is almost transparent.



8) Remove and eliminate interior dirt.
9) Fit once more and securely tighten radiator draining plug.
10) Fill system with mixture of water and antifreeze, as outlined above.

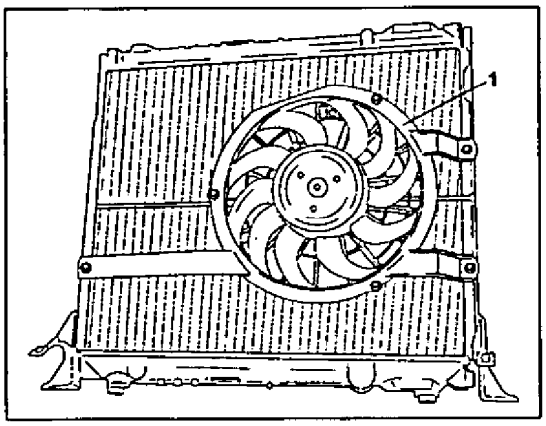


IN THE VEHICLE

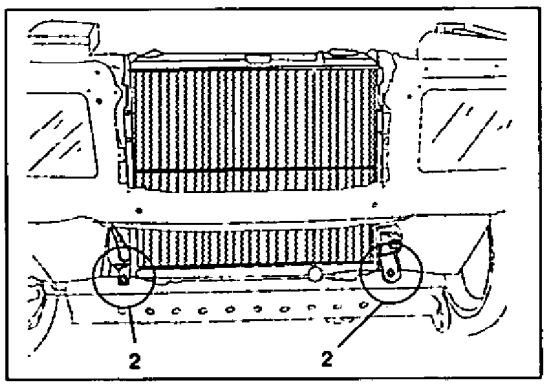
COMPONENTS REVISION AND REPLACEMENT

Radiator removal (Standard Vehicle)

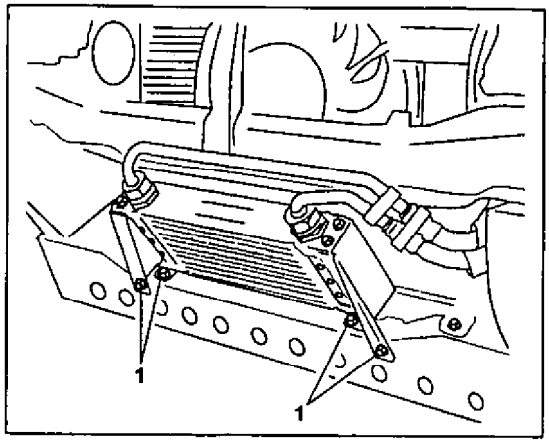
1) Disconnect negative battery cable.
2) Remove the following components from body:
   - Engine bonnet(1).
   - Front grille (2).
   - Vertical reinforcement(3).
   - Lower engine protective plate.
3) Drain radiator by removing coolant degasser reservoir and radiator draining plug.
4) Fit and tighten radiator draining plug.
5) Disconnect lower and upper radiator hoses.
6) Uncouple electrical connectors of electric fans and thermistor.



7) Remove front electric fan and supporting bracket (1).



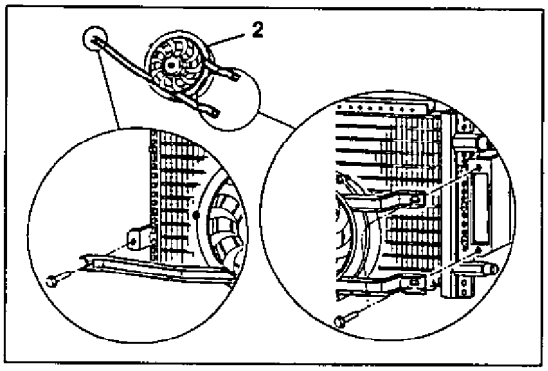
8) Remove radiator support fittings (2), disconnect right-hand side and extract radiator together with rear electric fan.



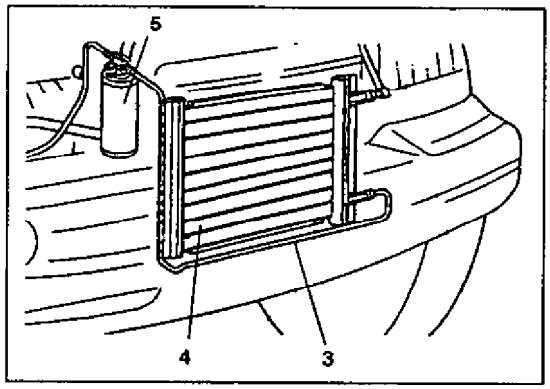
Radiator removal in vehicles with air conditioning.

NOTE:
Proceed as for standard vehicles until point 6.

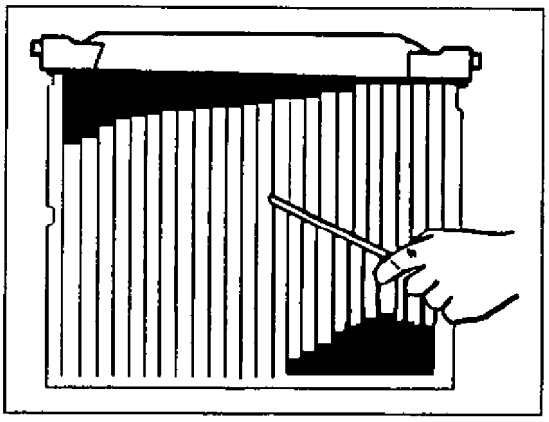
1) Remove front bumper.
2) Disconnect oil cooling system, remove bolts (1) and put to one side.



3) Remove front electric fans (2) together with supporting bracket.

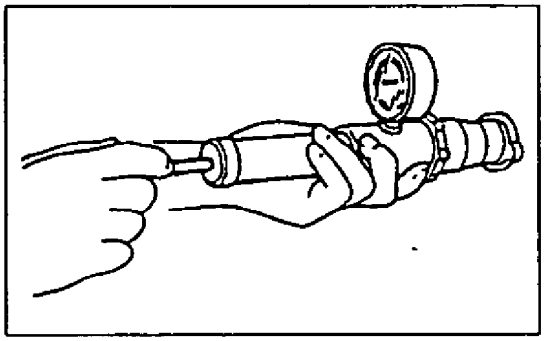


4) Extract fluid/gas from air conditioning system and remove lines (3) connecting condenser and A/C drier filter.
5) Remove condenser (4) and drier filter(5) and support bracket.
6) Remove water radiator as indicated above for standard vehicles.



Radiator inspection
1) Check there are no cracks or distortions in cooling blades, hose connections etc. Repair or replace if necessary.

NOTE:
Be careful not to damage radiator blades if cleaning them.

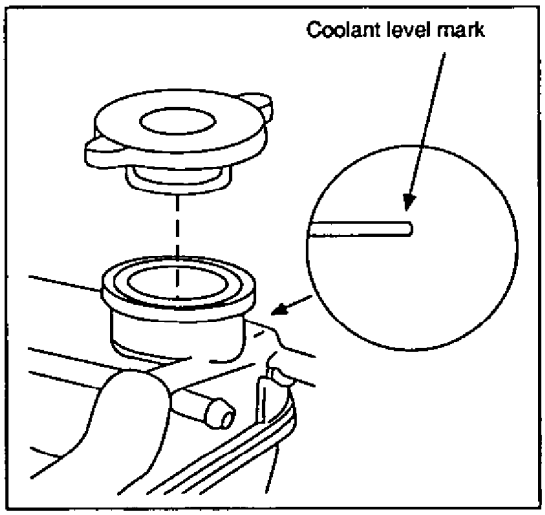


Inspection of coolant degasser reservoir cap

1) Clean cap.
2) Install inspection tool and apply pressure of approximately 1.4 Kg/cm², this pressure should be maintained for at least 10 s. If not the cap should be replaced.

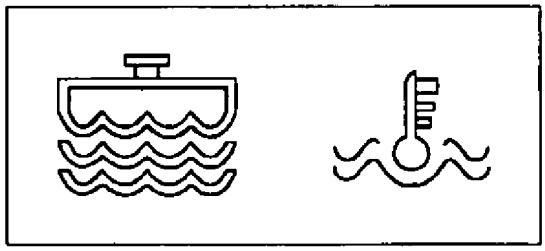
Radiator assembly.

1) Carry out disassembly operations in reverse order.
2) Fill and bleed system as outlined above.
3) Fit lower engine soundproofing plate, fit battery, start up engine and ensure there are no coolant leaks.

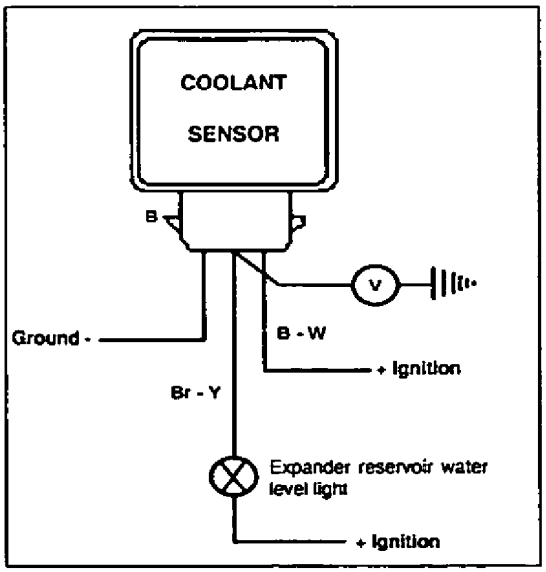


Coolant temperature sensor.

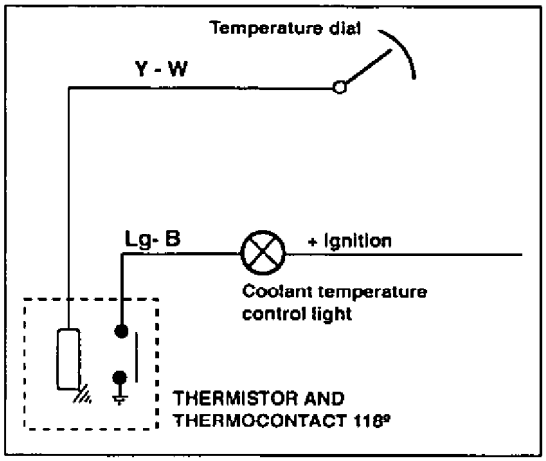
1) Ensure that coolant reaches upper part of coolant degasser reservoir.



2) Check that on engaging starter motor before starting up engine, the coolant level temperature indicators light up and that these go off once the vehicle starts up.
3) If lights remains on after starting up, check:
   - Condition of diodes on instrument panel, replacing if defective.

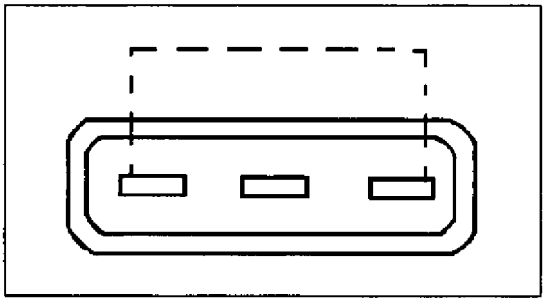


   - Connect voltmeter between coolant sensor terminal Br-Y and ground. When engine is running the reading should be similar to battery voltage. If not, check for possible grounding fault in the above circuit. If no defect is found, replace sensor.
   - Connect voltmeter between coolant sensor cable B-W and ground When engaging starter motor the reading should be similar to battery voltage. If not, check possible grounding fault of above cable.
4) If lights do not come on when engaging starter motor:
   - State of bulbs.
   - State of diodes.
   - Release coolant sensor connector, start up engine and ground cable Br-Y. The indicating light for coolant level should come on. If not, check continuity of above cable and state of bulb.



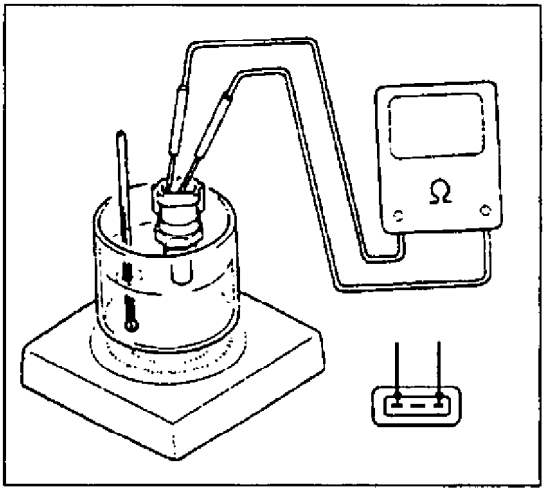
Revision of thermistor and thermo sensor (temperature sending unit)

- Release light blue thermistor connector (1) situated in thermostat housing and ground temperature gauge thermo sensor cable Lg-B. The light should come on, if not check continuity of above cable and state of bulb.
- Between thermistor terminal and ground, check that resistance corresponds to indicated levels:
  - With water at ≃ 20°C, R ≃ 3,2 KΩ
  - With water at ≃ 80°C, R 170 Ω ≤ 200 Ω



Revision of electric fans.

1) Set ignition key in ON position.
2) Release thermo sensor connector and link connector ends with a wire. Check that both fans work.
3) If they do not, check electrical fitting, fuses, relays and electric fans.

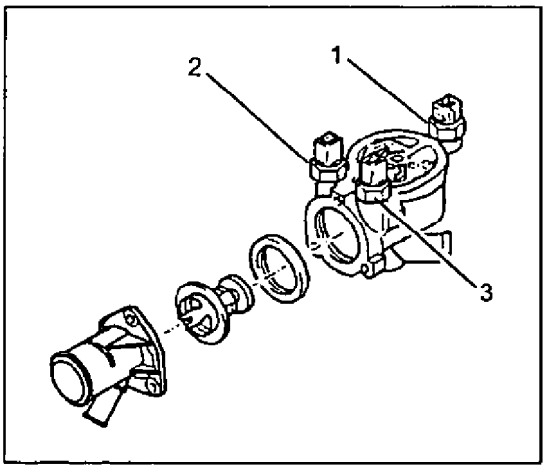


Revision of electric fans thermo sensor.

1) Remove radiator thermo sensor.
2) Insert it in a container with water and a thermometer.
3) Check that on reaching a temperature of approximately 95° there exists continuity between the terminals at the ends. Check that when temperature drops to 86° (aprox.) no continuity exists. Replace thermo sensor if necessary.

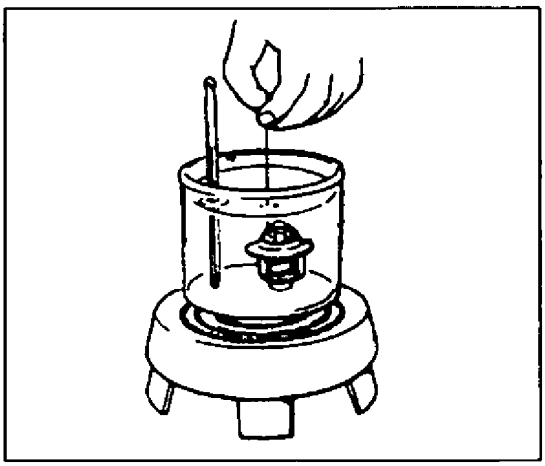
Revision of thermostat.

1) Release hose attaching radiator to thermostat housing.
2) Remove rear thermostat cover and extract thermostat.



Identification of thermistors situated in thermostat housing.

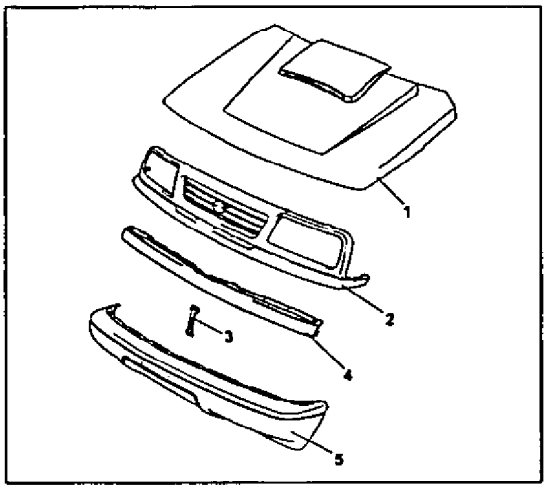
(1) Thermistor-thermo sensor light blue:
Corresponds to water temperature dial on control panel and water temperature control light.
(2) Thermistor-thermo sensor dark blue:
Corresponds to water temperature control for ECM computer.
(3) Thermistor dark blue:
Corresponds to water temperature control for air conditioning.



3) Place thermostat in a container with water and heat up, check that at beginning and end of aperture the following values show:

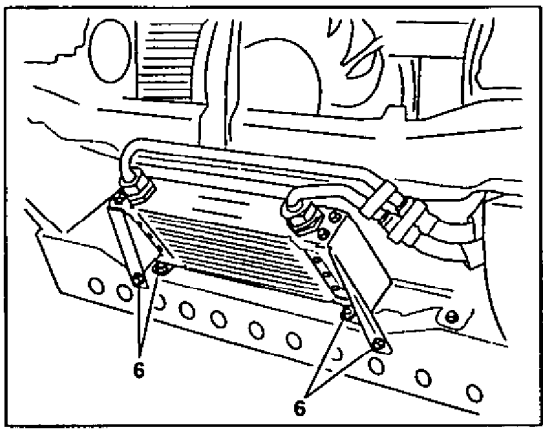
Beginning of aperture: 86°
End of aperture: 95°
Movement: 7.5 mm

Replace thermostat if it does not correspond to these values.

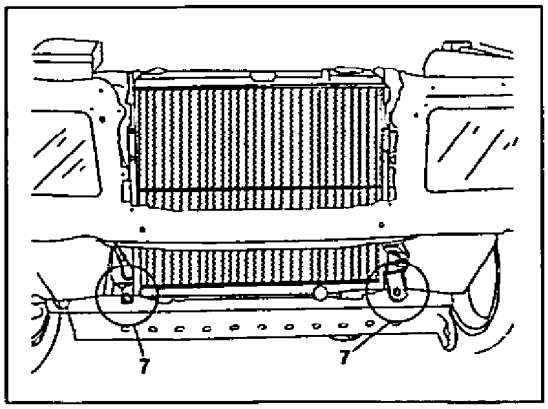


Replacement of rear electric fan

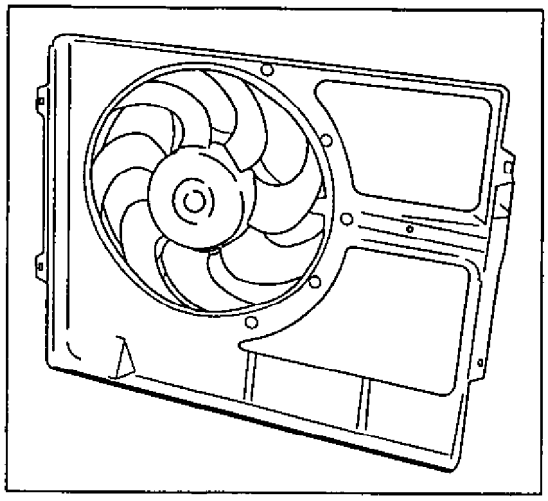
Removal:
1) Disconnect negative battery cable.
2) Remove the following components from body:
   - Engine bonnet (1).
   - Front grille (2).
   - Vertical reinforcement (3).
   - Upper panel (4) and disconnected bonnet lock.
   - Front bumpers (5).
3) Unfasten electric connector from rear electric fan and water radiator thermistor.



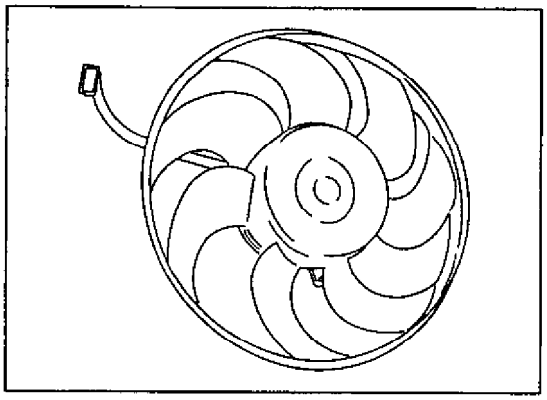
4) Disassemble oil radiator fittings (6) and extract outwards if possible.



5) Remove fittings of columns (7) supporting radiator.
6) Move radiator and columns forward, taking care not to damage it. Movement on left side should be greater.



7) With radiator moved proceed to remove fittings of rear electric fan hood, extract hood unit and electric fan.



8) Disconnect electric fan cable from clips holding hood.
9) Remove electric fan fittings and separate from hood.

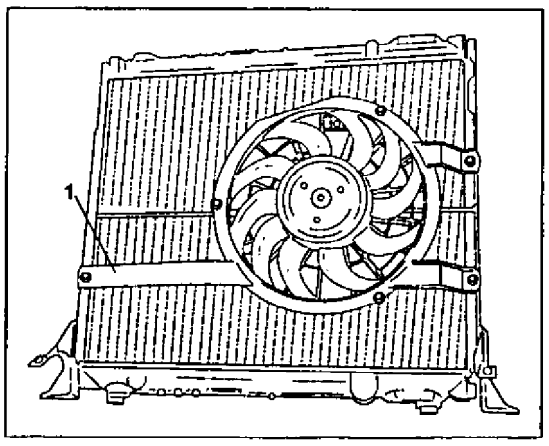
NOTE:
If vehicle has air conditioning fitted, be careful on moving radiator not to distort the rigid A/C condenser hoses.

Assembly:
1) Proceed in reverse order to disassembly.

NOTE:
On tightening supporting radiator, do so pushing upper part of radiator towards front of vehicle.

Replacement of front electric fan

Disassembly:
1) Disconnect negative battery cable.
2) Unfasten front electric fan connector.
3) Remove front grill and vertical reinforcement.



4) Remove three bolts attaching electric fan and remove support (1) and electric fan.
5) Remove three nuts attaching electric fan to support and separate them.

Assembly:
1) Proceed in reverse order to disassembly.

SECTION 6E3

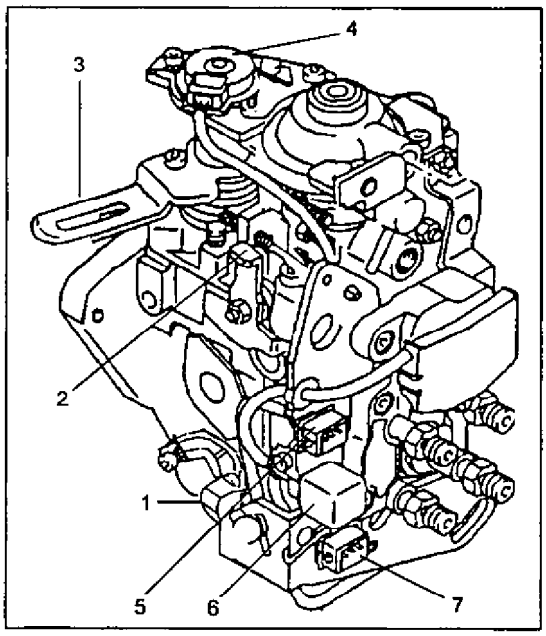
ENGINE AND EMISSIONS CONTROL SYSTEM

LIST OF CONTENTS

CHARACTERISTICS AND IDENTIFICATION OF BOSCH JET PUMP

CHARACTERISTICS

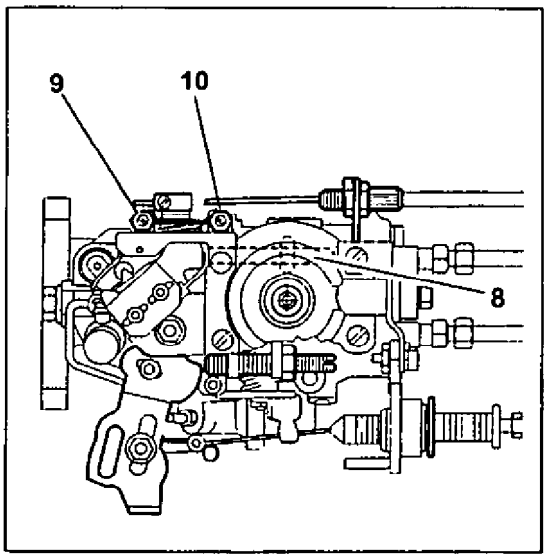
ENGINE	XUD9BTF
Pump type	VE4/9F2250R601
Adjustment at top dead centre	0.57 mm
Idle speed (r/mn)	800 (± 100)
Idle speed (r/mn) – with air conditioning	850 (+0 -50)
Maximum idle speed (r/mn)	5100 ± 80
Fast idle (r/mn)	950 ± 50
Setting gauge (mm)	1
Engine rate (r/mn)	+ 20 a + 50



IDENTIFICATION

BOSCH equipment

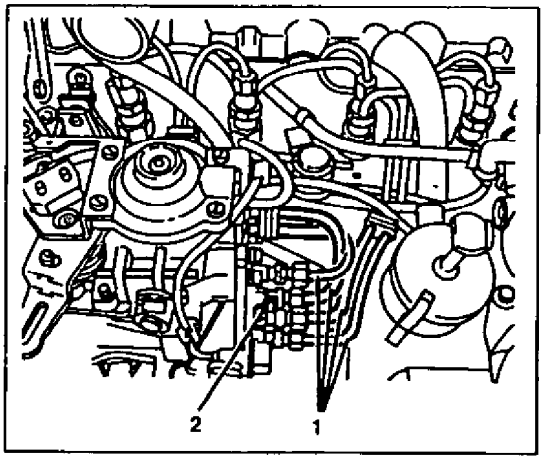
(1) = Advance mechanism
(2) = Stop lever (hand lever)
(3) = Throttle control lever
(4) = Throttle control lever position potentiometer
(5) = Potentiometer connector for throttle control lever position (3 way)
(6) = Electrical ignition control module connector coded (4 way, black)
(7) = Advance control connector mechanism (2 way)



(8) = Residual flow adjusting bolt
(9) = Fast idle adjusting bolt
(10) = Idle speed adjusting bolt

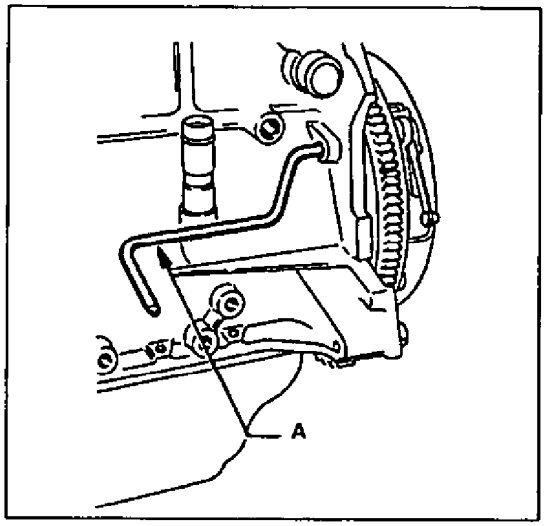
IN THE VEHICLE

NOTE:
Interior adjustments and repairs to pump must be carried out at an official Bosch servicer.

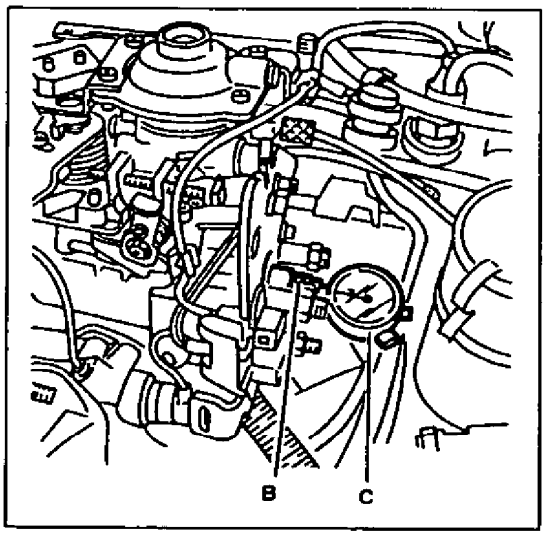


JET PUMP OVERHAUL

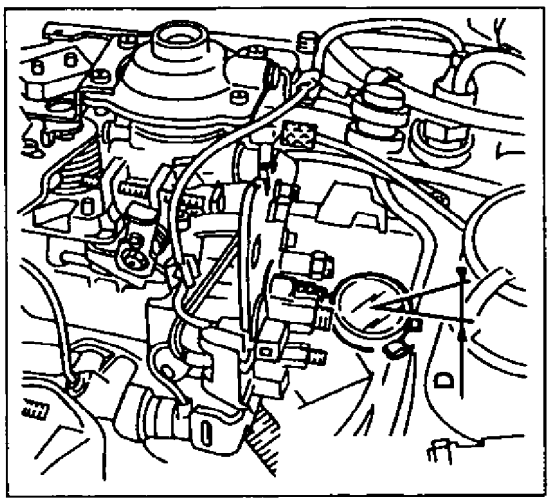
1) Disconnect negative battery cable and unfasten electric connectors from jet pump.
2) Remove injection lines (1) and port cap (2).
3) Remove glow plugs to enhance crankshaft rotation.
4) Remove jet pump fuel intake hose to avoid fuel dripping when turning crankshaft. Put to one side and cover hose.



5) Set wheel in TDC position using locking tool (A) **Ref. 00000V02008**. Ensure piston of cylinder no. 1 is crossed and consequently no.4 compressed.



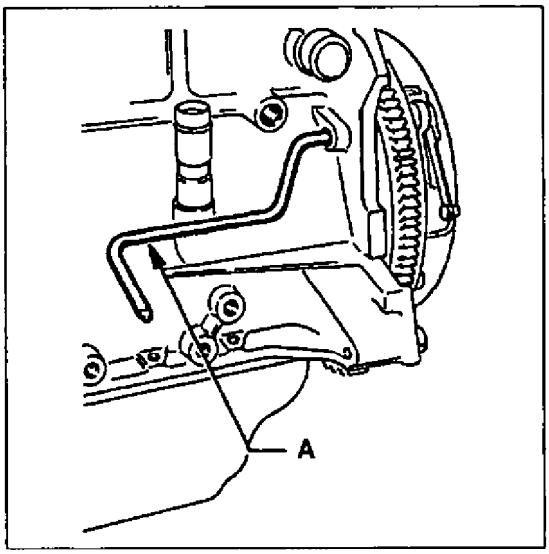
6) Install supporting tool - testing spike (B) **Ref. 00000V02011** and dial indicator (C) **Ref. 00000V02012.**
7) Slacken nuts fixing jet pump using tool key **Ref. 09912-56520** and situate far back and rotate outwards.
8) Remove tool from engine flywheel and turn crankshaft in opposite direction to rotation until bottom dead centre position on jet pump piston is reached, (dial indicator needle steadies).
9) Set dial indicator to zero **(0)**.
10) Turn crankshaft in normal rotating direction, slowly, until wheel is locked by tool **Ref. 00000V02008**.
11) Slowly turn jet pump in advance direction (towards engine), until dial indicator shows travel of **0.57 ± 0.01 mm**, equivalent to jet pump piston travel.



12) In this position tighten jet pump attaching bolts to specified torque.

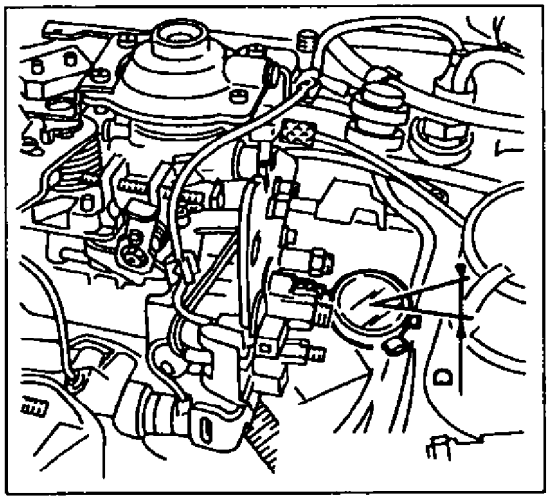
Torque specifications for jet pump/cover locknuts: 2 Kg-m (20 Nm).

NOTE:
If when trying to adjust value (0.57 ± 0.01 mm) this measure is exceeded, go back again to 0.57 mm and try to locate value once more(D).



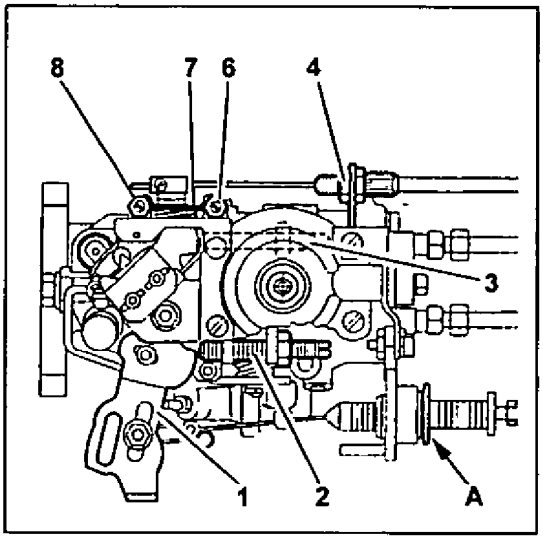
CHECKING AND ADJUSTMENT

1) With the engine in the situation described above, follow the steps below:
   - Remove tool (A) locking engine flywheel. Ref.: 00000V02008.
   - Turn crankshaft a quarter turn in direction opposite to direction.
   - Turn crankshaft again, in rotating direction until locking it with tool (A) Ref.: 00000V02008.



   - In this position the dial should show a reading of 0.57 ± 0.01 mm. This reading corresponds to jet pump piston travel with respect to its bottom dead centre.

2) Remove tools.
3) Proceed to fit all components in reverse order to disassembly.
4) Proceed to bleed fuel system and adjust idle speed.



ADJUSTING JET PUMP

Throttle cable adjustment:

1) Press accelerator pedal maximum amount.
2) Check that lever (1) makes contact with end of stop bolt (2). If it does not, modify position of fork until it makes contact.
3) Ensure that in idle position, the lever (1) butts the end of bolt (3).

NOTE:
Prior conditions:

- **Engine warmed up, or similarly two electric fans functioning.**
- **Bolt (6) making contact with lever stop (7).**

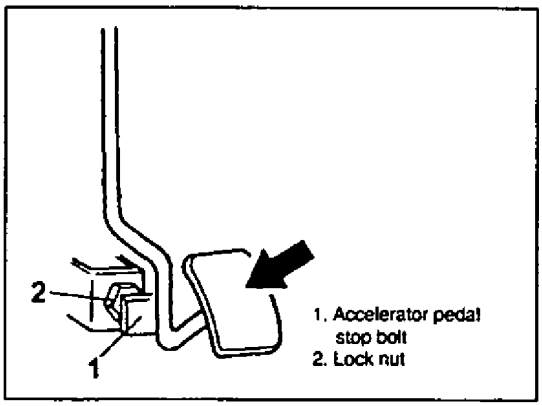
Idle speed adjustment (engine warmed up):

1) Slacken screw 3) until it ceases to make contact with lever (1).
2) Adjust idle revolutions by turning screw (6) (apply pressure on lever (7) to guarantee contact with screw (6).
   Idle speed r.p.m. (with air conditioning) 850^{+0}_{-50}.
   Idle speed r.p.m. (without air conditioning) 800 ± 100.

Adjustment gauge:

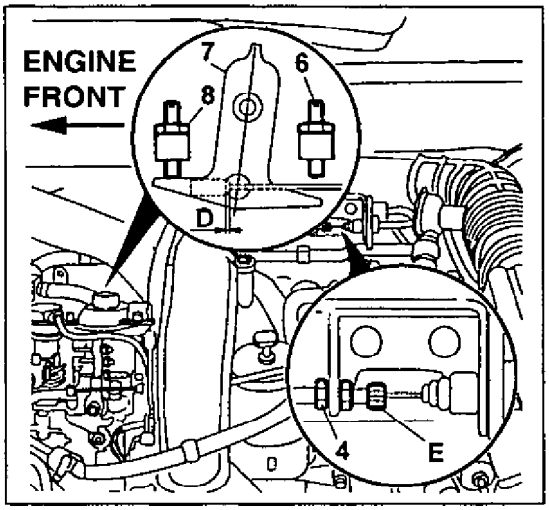
1) Set a gauge of 1 mm between throttle control lever (1) and adjuster nut and bolt (3).
2) Adjust idle speed revolutions by turning screw (3).
   Idle r.p.m (with air conditioning) 885 ± 15
   Idle r.p.m (without air conditioning) 835 ± 15

NOTE:
Any alteration or movement of screw involves adjustment to dashpot.



Accelerator pedal adjustment:

1) With gauge set at 0.5 mm between lever (1) and bolt (2) (maximum revolutions bolt) adjust pedal height in the following way:
   - With pedal pushed down maximum amount move stop bolt (1) until it makes contact with pedal.
   - Tighten nut (2) to fix stop bolt position.



Adjusting fast idle cable
(engine totally cold or vacuum hose disconnected from actuator)

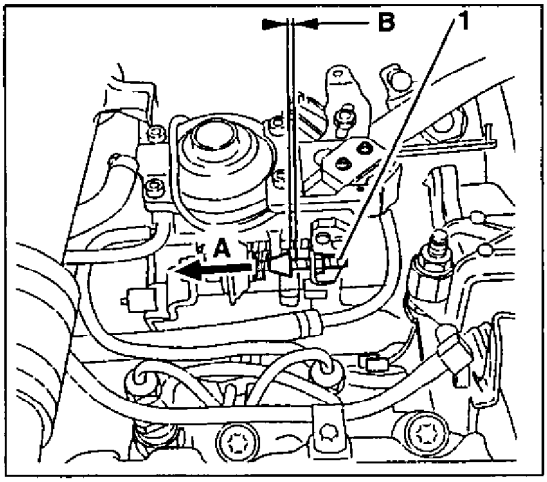
1) Ensure that lever (7) makes contact with bolt (8)
2) If lever does not make contact with bolt (8), proceed as follows:
   - Slacken lock nut (4) and turn adjuster (E) until freeplay is achieved (D = 1mm on cable).
   - Tighten locknut.

NOTE:
With engine totally cold the fast idle control cable should be untensed.

Fast idle adjustment (cold engine)

1) Apply pressure to lever (7) and ensure that it makes contact with screw (8).
2) Adjust screw (8) to obtain fast idle rate.

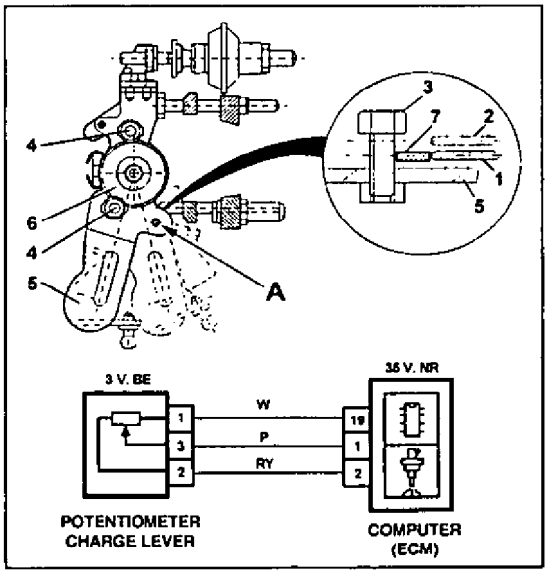
Fast idle r.p.m: 950 ± 50



Control and adjustment of dashpot.

NOTE:
Engine warmed up and control cables adjusted.

1) Press plastic shoe of dashpot in direction(A).
2) Adjust bolt (1) to obtain clearance of 1 mm.



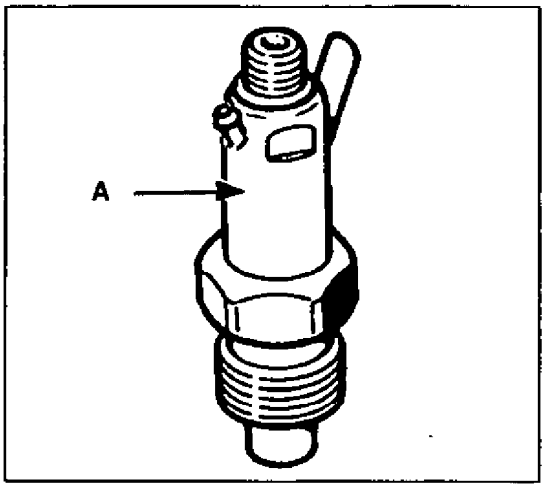
Throttle control lever potentiometer
(if potentiometer has been adjusted or replaced).

NOTE:
The bolts (1) and (2) cannot be adjusted, their position is unalterable.

1) Fit screw (3) M6 x 25 for adjustment.
2) Fit a measured stopper (7) of 16 mm between screw (3) and (1) (lever (5) moved to the right).

   NOTE:
   Keep lever in this position until setting is established.

3) Fit potentiometer (6) and hold it gently with bolts (4).
4) Fasten potentiometer electric connector (3V.BE), activate and check pressure between terminals 2 and 19º of ECM (35v.NR).
5) Turn potentiometer until a reading of 2 volts is obtained. In this position finally fit potentiometer (6) to its bolts(4).
6) Remove adjusting screw (3) and stopper (7).
7) Check functioning of potentiometer with DIAG 2.000 analyser and remove defects.



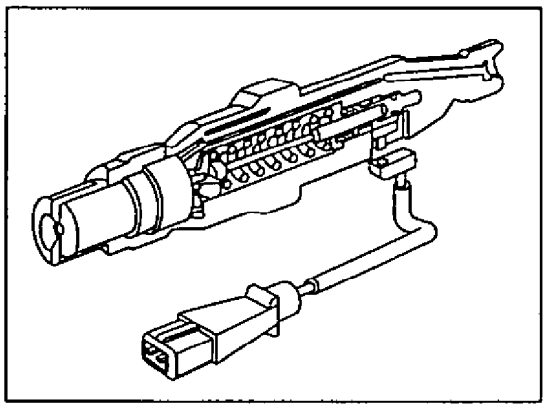
CHARACTERISTICS AND IDENTIFICATION OF BOSCH INJECTORS

CHARACTERISTICS

	Engine XUD9BTF
Injector holder	KCA17S42
Injector	DNOSD299C
Bar measurement	175
Colour mark	Green

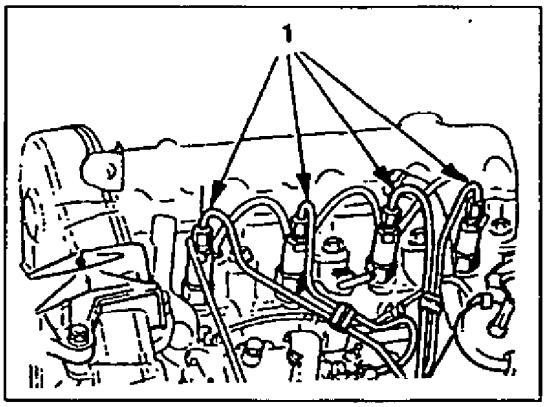
IDENTIFICATION

1) Green colour mark (A) on injector holder.
2) Injector no. 3 is equipped with needle left pick-up to control dynamic advance.



FUNCTIONING OF INJECTOR NO. 3 NEEDLE LIFT PICK-UP.

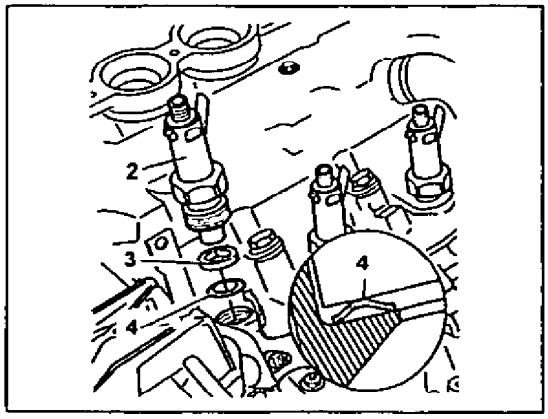
Injector no.3 is equipped with a needle lift pick-up that permits continual correction of dynamic advance.
The injector needle extends through the spring via a plunger.
The pick-up is permanently fed by a current of constant intensity, when the injector opens the needle moves with the plunger which in turn moves the pick-up, thereby modifying induction of the coil.
The computer thus receives information from the aperture of the injector needle.



REPLACEMENT OF INJECTORS

Disassembly
1) Disconnect negative battery cable.
2) Remove injector and fuel return lines (1).
3) With tool **Ref. 00000V02001**, remove injectors (2).
4) Extract washers (3) and (4).

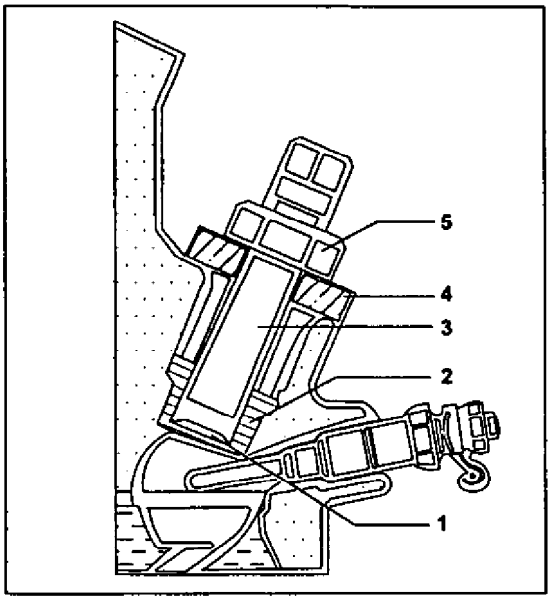
NOTE:
In any injector disassembly always replace fire cut off (4) and sealing washers (3).



Assembly
1) Insert fire cutoff washer in housing (4) with convex area facing outwards.
2) Fit a new sealing washer (3).
3) Fit injectors and tighten to specified torque with tool **Ref. 00000V02001**.

   Torque specifications for injector: 9 Kg-m (90 Nm).

4) Fit injection lines.
5) Check they are not blocked and fit injector fuel return lines.
6) Connect battery, start up engine and check for leaks.



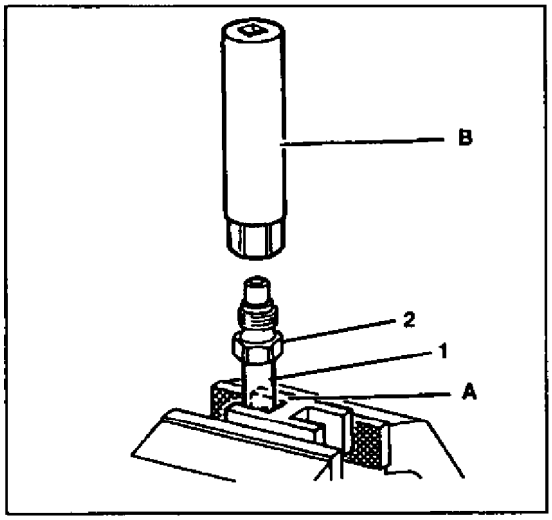
REPLACEMENT OF INJECTOR HOLDER

Inspection:

1) Check the condition of injector holders (2) replace any which are defective, damaged or present great difficulty in changing fire cutoff washers.

Method:

1) Block injector cover (1) hole with grease.
2) Unscrew injector cover with tap (3) type 16 x 150. Rest washer (4) on cylinder head, screw nut (5) and extract injector cover by tightening nut.
3) Clean injector cover housing and fit again with used injector. Carry out this operation without fitting fire cutoff or sealing washer.

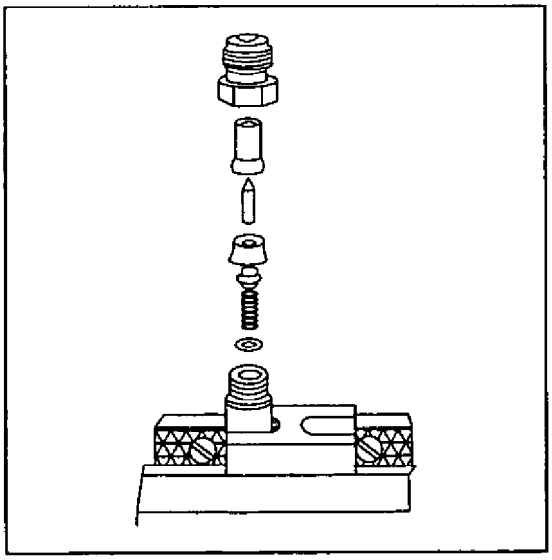


REPAIRING INJECTORS

1) Remove injectors, referring please to REPLACEMENT OF INJECTORS operation.
2) Fit appropriate tool support in vice (A).
3) Position injector assembly (1) on support, remove nut (2) using tool (B) **Ref. 00000V02001** and extract all composite parts.

   NOTE:
   Keep in pairs and position all assembly parts.

4) Place all parts in research fluid, clean with pressurised air, lubricate with clean research fluid and reassemble in same order as for disassembly.

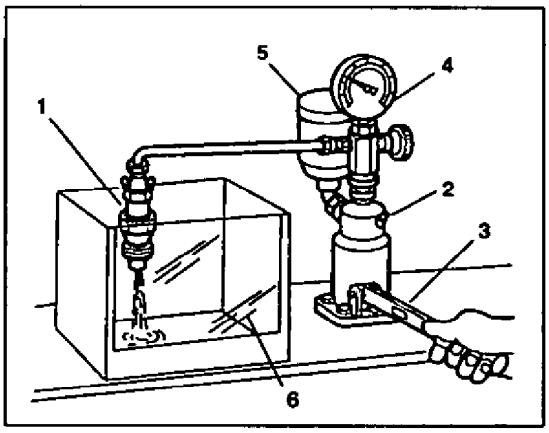


5) Torque specifications for retaining nut:
   7.5 Kg-m (75 Nm).

REVISION OF INJECTORS

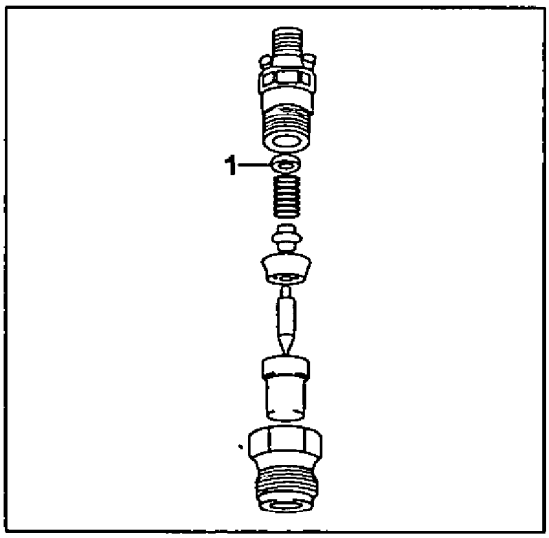
NOTE:
Use appropriate research fluid.

WARNING:
Never expose hands to jet, since there is risk of injury and serious blood intoxication, it is also highly inflammable.



1) Prior preparation.
   - Install injector assembly in injector tester (2), equipped with manual pressure pump (3), pressure gauge (4), research fluid tank and atomized fluid reception container (6). The last one equipped with gas extractor, if possible.
2) Sealing test
   - Keep pressure gauge connected during this test.
   - Dry injector nozzle end.
   - Work pump lever until a pressure of approximately **165 bars** is obtained.
   - Maintain this pressure for at least 30 seconds, during which no drips should come out of injector nozzle end.
3) Injector jet and sound test
   - Maintain pressure gauge disconnected during this test.
   - Press pump lever quickly and sharply, the injector should produce a fine uniform spray.
   - With a frequency of one or two injection bumps per second, the injector should produce a soft, sharp sound. With a faster rate the sharp sound will be muffled and almost disappear.
4) Pressure measurement control.
   - Disconnect pressure gauge and pump several times quickly and continuously to purge the system.
   - Connect pressure gauge for rest of test.
   - Work pump lever slowly and note down pressure reached at moment of atomization, or injector aperture.

   Pressure measurement 175 bars



5) Setting pressure measurement
   - Pressure measurement is set by using washers (1)
   - A change in thickness of **0.10 mm** in washer measured (1), means a pressure measurement variation of **10 bars**.

NOTE:
If when disassembling injector with pick-up no.3 any defective parts are found, it will be necessary to replace the injector assembly. Replacement of the injector alone is prohibited.

ENGINE AND EMISSION CONTROL

E.G.R. SYSTEM (COMPOSITION)

The E.G.R. system is designed to reduce pollution levels. This is why it allows a certain amount of exhaust gases to enter in certain engine operating conditions. It's made up of the following components.

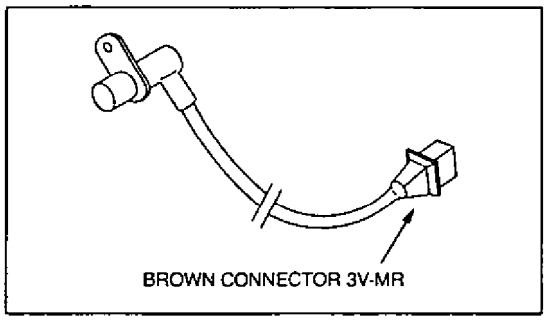
- **E.C.M. computer**
  Its function consists, among other things, of co-ordinating activation and deactivation of E:G.R. according to information received from system components

- **Water temperature sensor**
  (information for E.C.M computer)
  NTC type resistance. As water temperature rises, the resistance value falls. this information is sent to the E.C.M. computer which effects activation of E.G.R. when water temperature rises above 60°C. The E.C.M calculator also uses this information to determine duration of pre-post heating.

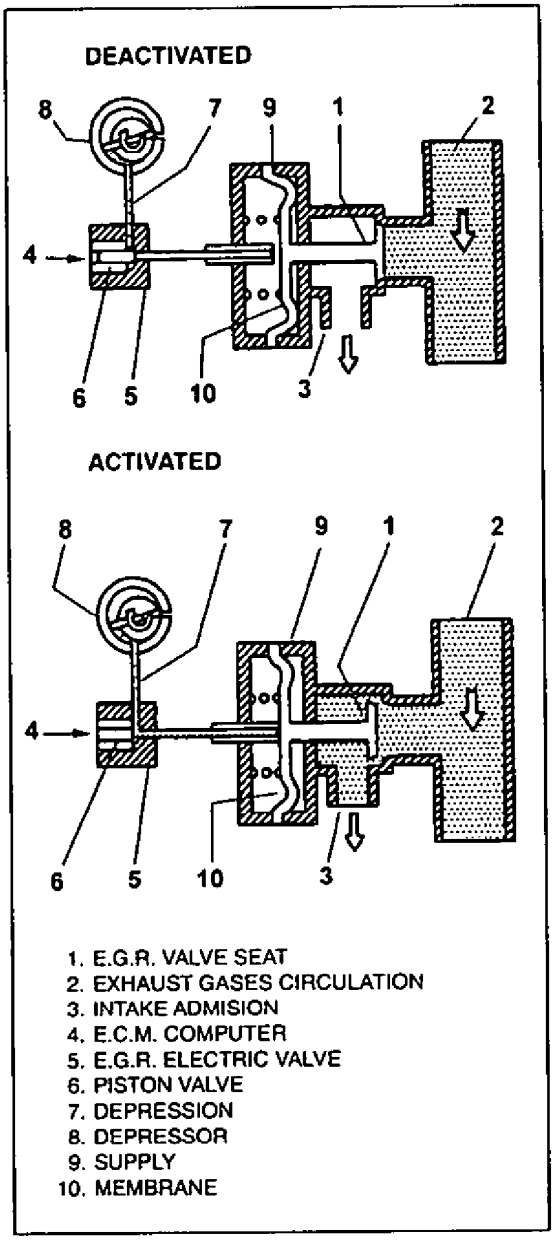
- **Throttle control lever sensor**
  This mechanism has a potentiometer incorporated in the throttle control lever. Resistance varies according to position of throttle control lever. This situation is transmitted to the computer which sends a deactivation order to the E.G.R. valve once other influencing parameters have been analysed.

- **E.G.R. electric valve**
  This receives a signal from the calculator. On being activated it allows a vacuum to pass to E.G.R. valve.

- **E.G.R. valve**
  This is activated by means of vacuum generated by the depressor, its activity depending on orders transmitted by computer via the E.G.R. electric valve. Once activated it allows a certain amount of gas to pass from exhaust to intake lines.



- **Engine r.p.m. pick-up**
  (signal transmission to E.C.M. computer)
  This is permanently sending information about engine revolutions to the E.C.M calculator. The calculator effects activation of the E.G.R. when engine temperature exceeds 60°C and revolution signal is between 750 r.p.m. and 3.250 r.p.m. To check please refer to 6E3-25 (TESTS REPAIR AND ADJUSTMENT).



1. E.G.R. VALVE SEAT
2. EXHAUST GASES CIRCULATION
3. INTAKE ADMISION
4. E.C.M. COMPUTER
5. E.G.R. ELECTRIC VALVE
6. PISTON VALVE
7. DEPRESSION
8. DEPRESSOR
9. SUPPLY
10. MEMBRANE

FUNCTIONING OF E.G.R. SYSTEM
(Exhaust gases recycling)

1) Deactivated
Whilst the coolant temperature is lower than 60ºC, the seated valve (1) remains closed, preventing exhaust gases (2) from passing through to the intake line (3).

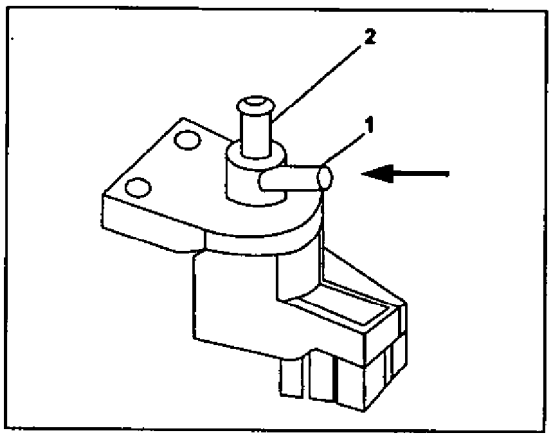
2) Activated
When the coolant temperature exceeds 60ºC, and engine r.p.m. is between 750 and 3.250 the computer (4), depending on a series of variable factors such as atmospheric pressure, advance, position of potentiometer, etc., activates the electric valve (5). The piston valve (6) opens and the depression (7) generated by the depressor (8) activates the E.G.R. This causes the membrane to be displaced and consequently the opening of the seated valve (1). With the E.G.R. valve activated, a certain number of exhaust gases (2) penetrate the intake manifold (3) and produce a reduction in pollution levels as a result of the recycling of gases.

E.G.R. SYSTEM (INSPECTIONS)

NOTE:
Before carrying out uncoordinated inspections of E.G.R. system components, carry out a test with the DIAG 2000 analyser, please refer to 6E3-25 (TESTS, REPAIR AND ADJUSTMENT).

If the E.G.R. system does not work, the driver will not notice the fault, but pollution levels will increase and could damage the catalyst. If the E.G.R. system functions incorrectly or permanently. the level of fumes will increase and engine performance will be affected, which is why functioning of the above should be checked regularly in the following way:

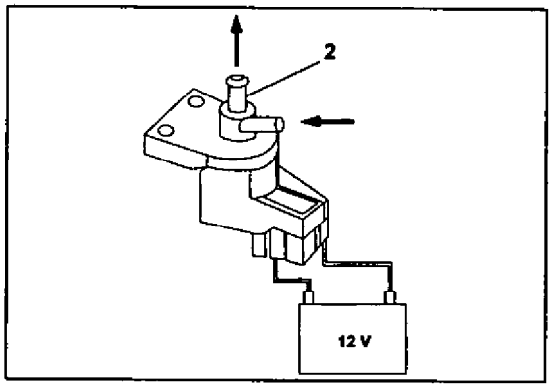
Water temperature sensor (thermistor)
This sends information about engine water temperature to E.C.M. computer so that this may effect activation of the E.G.R., duration and operation of pre-post heating system, etc. To check its functioning please refer to 6E3-25 (TESTS, REPAIR AND ADJUSTMENT).

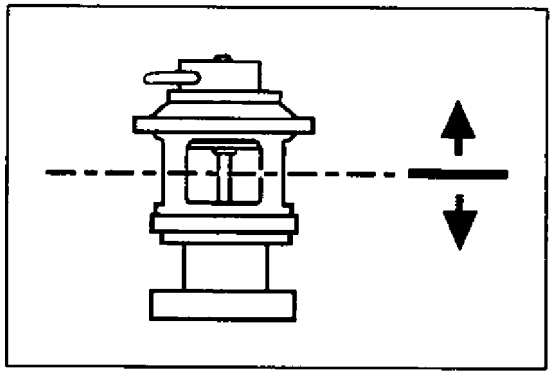


E.G.R. electric valve (functioning)

1) Blow in the lateral (1) vacuum intake and check that no air comes out of (2).
2) Feed electric valve with source of 12v and check that air exits from opening (2).
3) Check resistance of electric valve at 20°C.
   Resistance at approximately **20°C: 30 Ohm.**

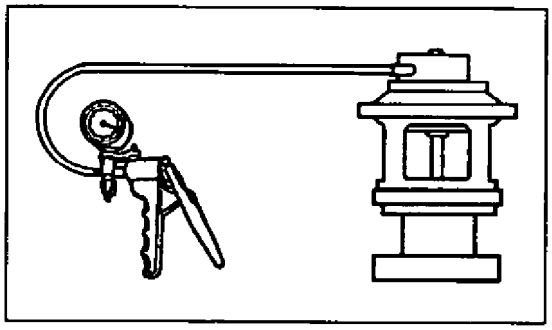
NOTE:
When fitting electric valve to vehicle connect upper duct to depressor and lateral duct to E.G.R. valve. Any change in the position of these will cause engine malfunctioning.





Checking E.G.R. valve (in vehicle)

1) Check that with the engine cold (at temperature below 60°C) the E.G.R. membrane does not move, regardless of the throttle control lever position.
2) Ensure that engine temperature is higher than 60°C and check that when idling the E.G.R. membrane functions.
3) If all the E.G.R. system functions correctly, on disconnecting the upper vacuum lines when the engine is idling the sound of the engine will change slightly.

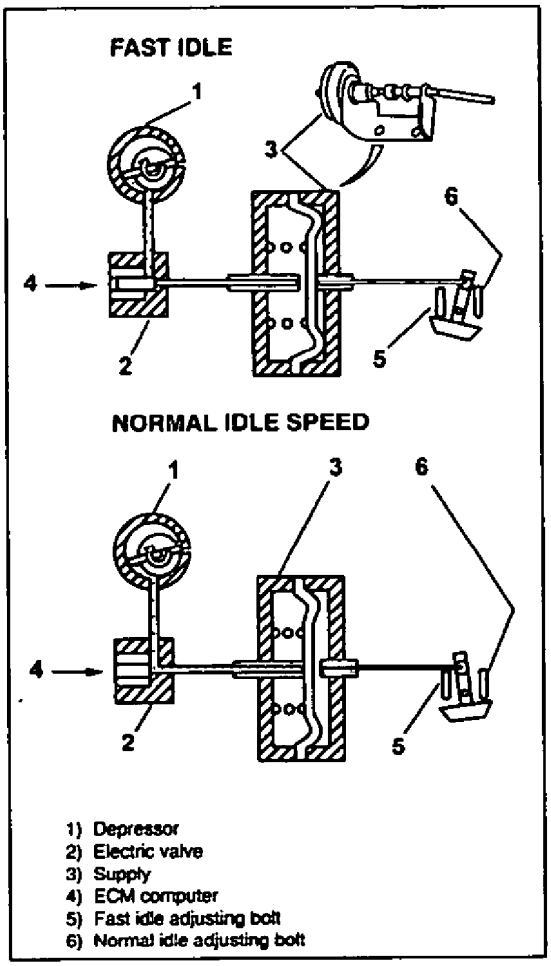


Revision of E.G.R. valve (removed)

1) Check that valve is closed.
2) Check that valve opens. Maintain vacuum for 10 seconds with vacuum gauge and ensure that reading does not drop.

Relays

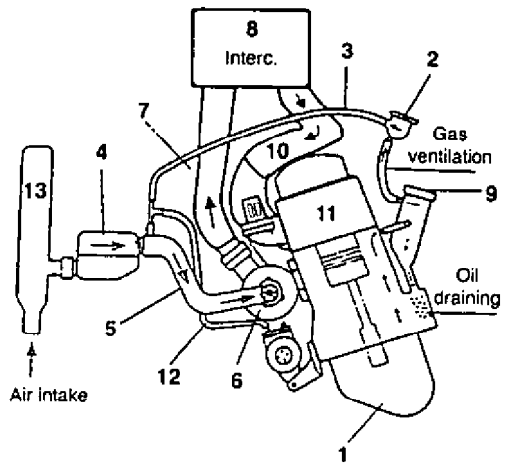
Carry out test with DIAG 2.000, please refer to 6E3-19.



FAST IDLE CONTROL SYSTEM

1) Fast idle position (engine cold). The jet pump fast idle control is activated by a cable. When still, up to 60°C, engine revolutions increase to **950 (± 50) r.p.m.**
2) Normal idle position: When the engine reaches a functioning temperature higher than 60°C, the computer sends a signal to the system's electric valve. The electric valve is activated and allows a vacuum to pass. The movement of the membrane, effected by the vacuum, pulls the cable connected to the idle adjustment lever, reducing additional idle acceleration to **850$^{+0}_{-50}$ r.p.m.**

NOTE:
Please refer to figure to appreciate functioning details.



TURBO DIESEL INTERCOOLER INTAKE SYSTEM

1) Oil pan
2) Valve
3) Engine ventilation hose
4) Air filter
5) Air filter/turbocompressor hose
6) Turbocompressor
7) Turbocompressor hose
8) Intercooler
9) Oil fill hole
10) Intercooler/Intake manifold lines
11) Admission collector
12) Depressor outflow lines
13) Air intake, resonator

POSITIVE CRANKSHAFT VENTILATION (PCV) SYSTEM

FUNCTIONING

1) The gases generated in the oil sump rise up through the induction lines to the valve. They continue as far as the air filter outlet and are sucked up by the turbocompressor. This sends them to the intercooler where they arrive at the intake manifold and subsequently to the cylinders where they are burnt off during normal engine functioning.

MAINTENANCE

1) Check or replace valve whenever the following are observed:
   - Bluish exhaust fumes.
   - Excess pressure in the crankcase which could cause oil loss through front and rear crankshaft retainers.

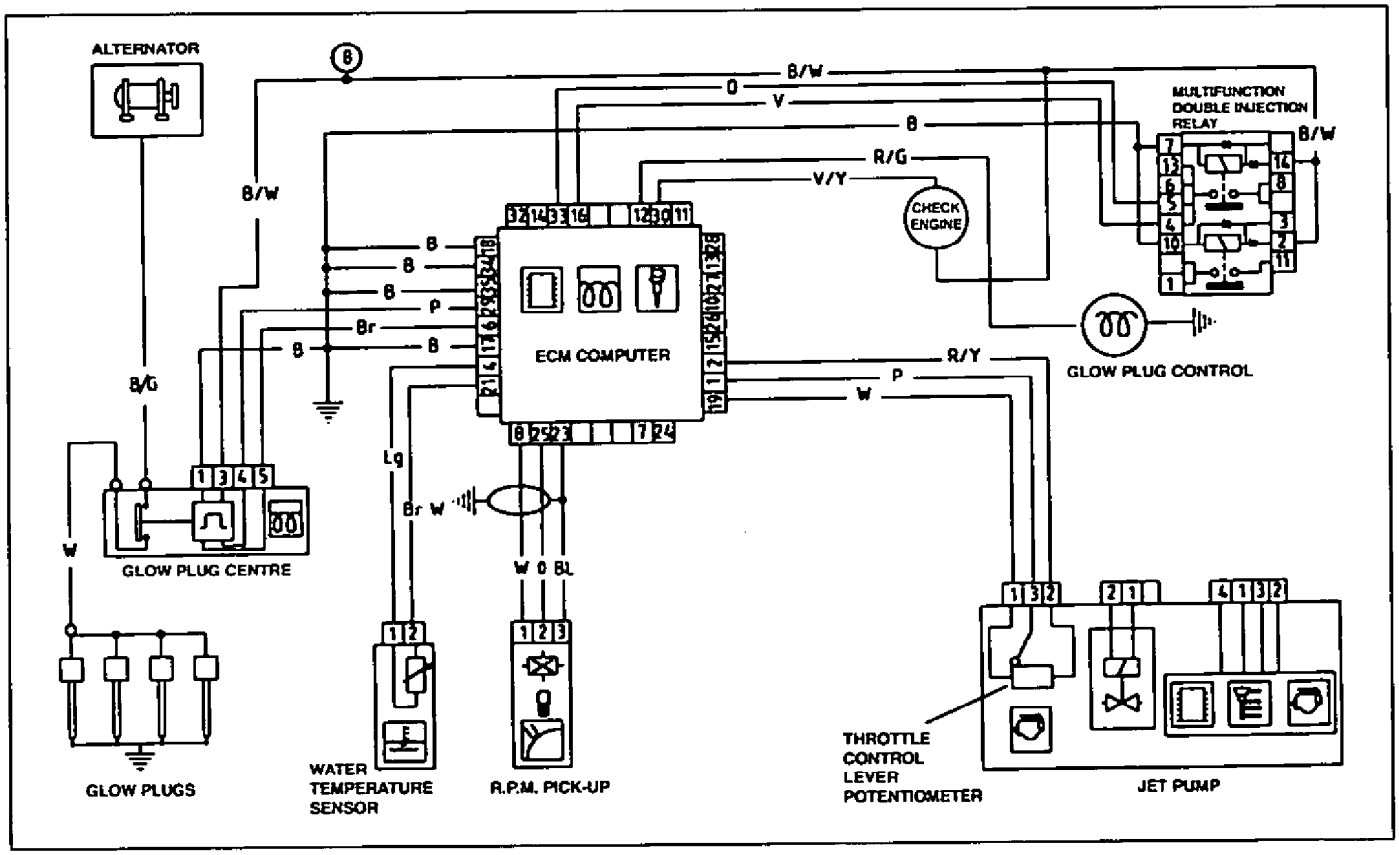
PRE-POST HEATING SYSTEM

GENERAL

- The pre-post heating system assures functioning in two phases: one of pre-heating and warning lights and one of post-heating.
- The pre-heating phase and warning light activation depend on water temperature in the engine (temperature sensor).
- The post-heating phase lasts a maximum of 3 minutes after warning light has gone off, with engine running and engine temperature lower than 60º (equivalent to engine water temperature of between 60ºC and 70ºC).This phase can be interrupted by certain engine functioning conditions which will be explained later.

NOTE:
When water temperature in engine is over 80ºC. pre-heating warning lights and glow plugs are not being powered.

OUTLINE OF PRE-POST HEATING SYSTEM

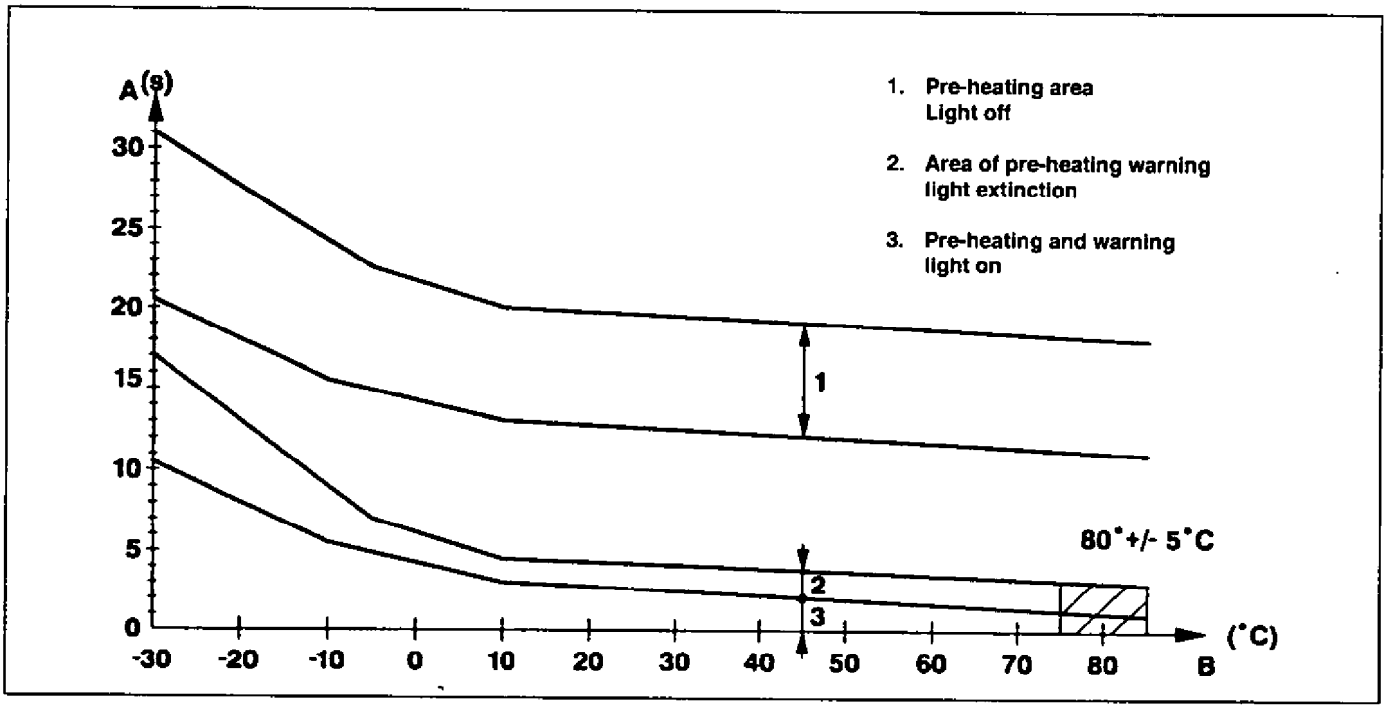


COMPONENTS FUNCTIONS AND PRE-POST HEATING SYSTEM

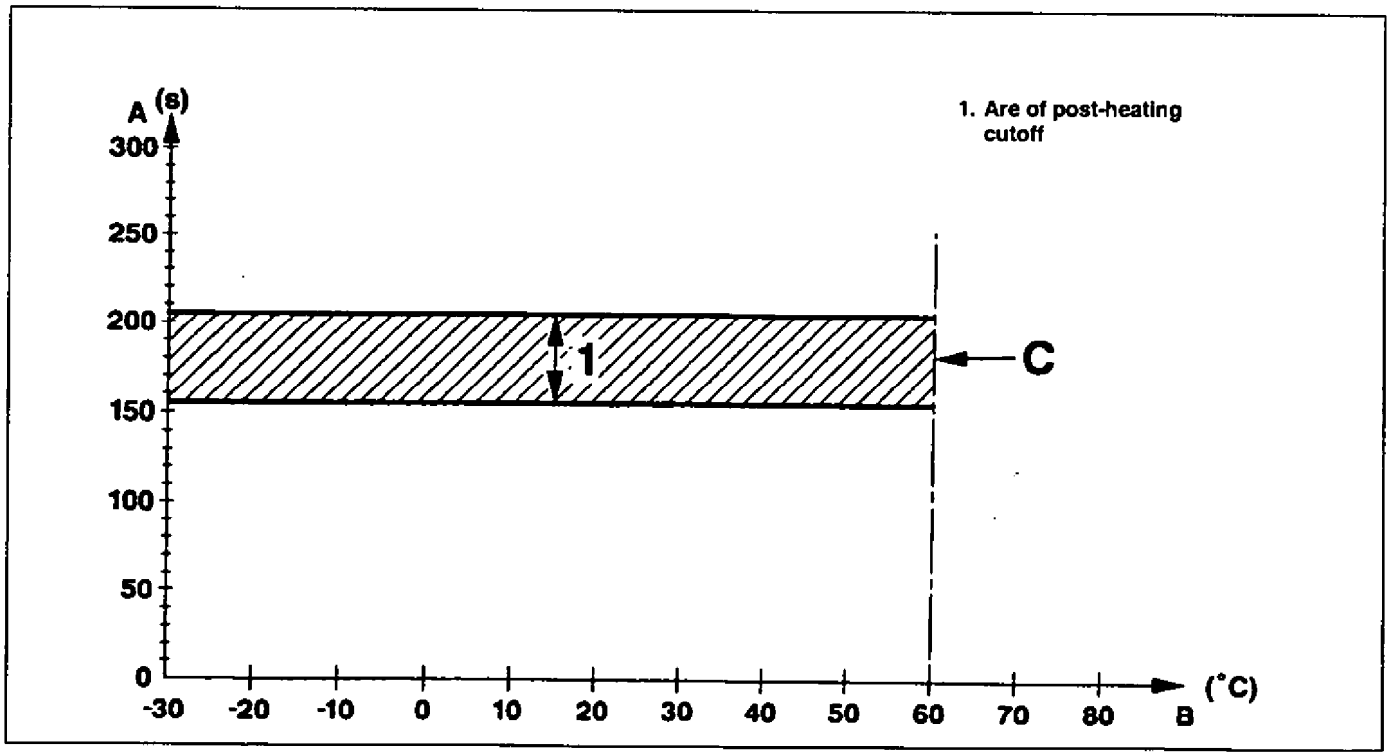
1) The heating control unit ensures the electricity supply which feeds the pre-post heating glow plugs, as well as facilitating diagnosis.
   - In its diagnosis function the ECM computer sends the signal to the heater control until to power the glow plugs. The return of a wound current from the heater control unit confirms the command to the ECM computer, (glow plugs powered). If not, the ECM computer generates a defect code which remains in its memory until the defect has been repaired and erased.
2) The ECM computer charts out the pre-heating, post-heating and warning light time. If any fault occurs in the heater control unit, the ECM computer registers a code defect. Once the defect has been put right, the code registered is erased from the ECM's memory, so that it can be retained for tests with DIAG 2000.
3) The glow plugs receive sufficient power from the heater control unit to effect pre-post heating of combustion chamber. This heating helps to produce self igniting of fuel injected in the combustion chamber. The electrical connection of the four glow plugs occurs simultaneously.

4) The engine water temperature sensor (with starter motor on) permanently sends information to ECM computer about temperature of water in engine cooling system. According to this information the ECM computer determines:
   - If pre-post heating function is necessary or not.
   - The time for which the warning light should remain on.
   - Duration of pre-heating.
   - Interruption of post-heating.

PREHEATING AND PRE-HEATING WARNING LIGHT CURVE



POSTHEATING CURVE



4.1) Dependence of post-heating according to engine temperature:
- Post-heating limited to 3 minutes with an engine temperature lower or equal to 60º.
- Post-heating suppressed with water temperature in engine above 70ºC.

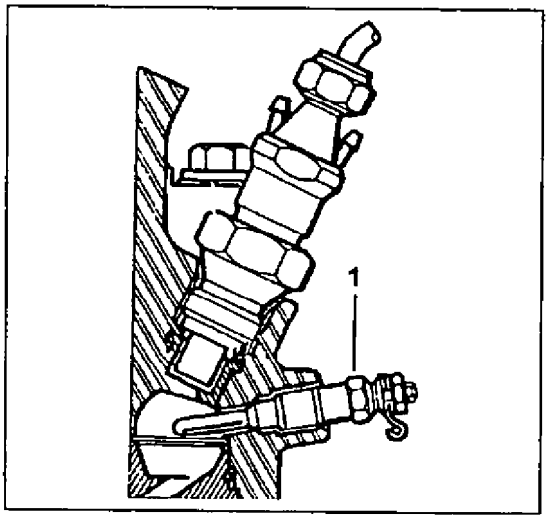
5) The R.P.M. engine pick-up (with engine running) permanently sends information to ECM computer about revolutions per minute at which engine is running. According to this information, the ECM computer determines, among other things, if it should or should not interrupt post-heating function.
6) The potentiometer of the jet pump throttle control lever (with engine running) sends the ECM computer the signal of post-heating cut off when the throttle control lever adopts a certain position (capacity greater than 50 mgrs/per knock).

NOTE:
Post-heating may be interrupted by:
- **Engine rate over 3500 r.p.m. (pick-up rate and ECM computer).**
- **A jet pump capacity higher than 50 mgrs/knock (throttle control lever and ECM calculator potentiometer).**
- **Engine water temperature over 70ºC (temperature sensor and ECM calculator).**

CHECKING FUNCTIONING (GLOW PLUG PRE-POST HEATING SYSTEM)

Checking overall functioning of glow plug system should be carried out with DIAG 2000 analyser, please refer to PROCEEDINGS FOR USING DIAG 2.000 ANALYSER (6E3-19).

Individual tests are contained in TESTS, REPAIRS AND ADJUSTMENT, please refer to 6E3-25.



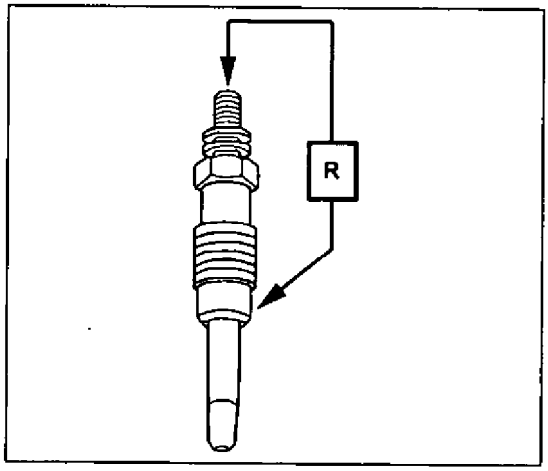
GLOW PLUGS

GENERAL

Glow plugs are auxiliary components which facilitate starting of a cold engine. The glow plugs (1) are installed in the cylinder head (one for each cylinder). One end (an electrode) is inserted in the turbulence canister. The high temperatures this electrode reaches help to produce the popback of fuel injected into the combustion chamber.

INSPECTION

1) Check there are no distortions, breaks or dents.
2) Check rigidity and general good condition of current terminal.



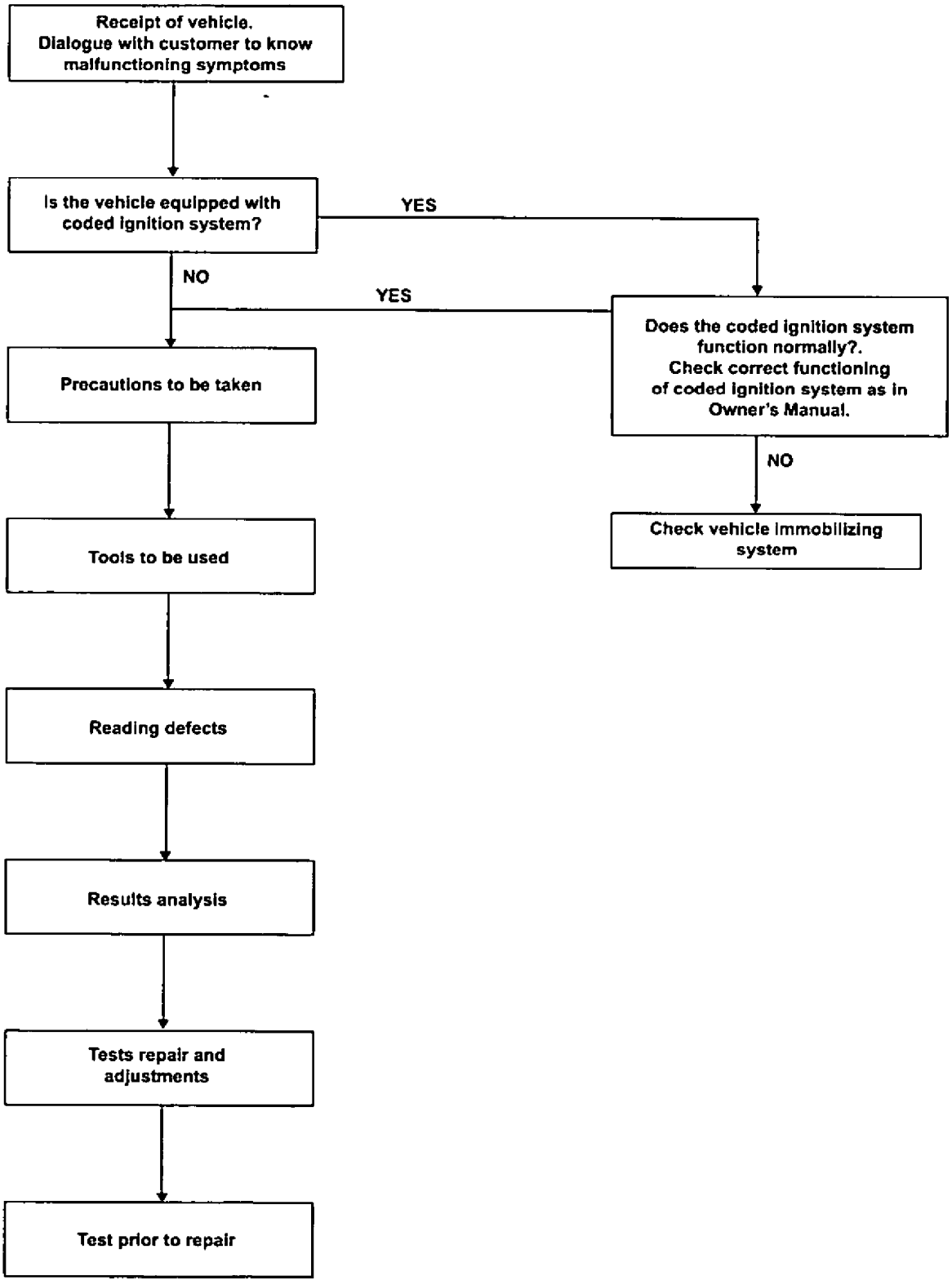
CHECKING (glow plug cold)

Measure resistance (R):
R= 0.5 to 1Ω, the glow plug is correct.
R= 199.9 K Ω, the glow plug is cut off.

PROCEEDINGS FOR USE OF DIAG 2000 ANALYSER

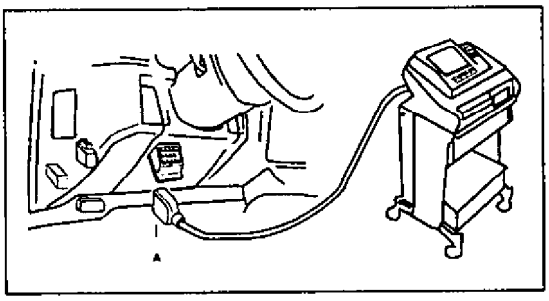
PROCEEDINGS IN REPAIRS TO INJECTION SYSTEM

Note:
When searching for faults in this system, respect the following order:



PRECAUTIONS TO BE TAKEN WHEN REPAIRING INJECTION SYSTEM

1) Do not disconnect battery with engine running, nor the computer with starter motor operated.
2) Before unfastening a connector, check:
   - The condition of different contact points (for distortion, rust etc...).
   - Make sure seals are tight.
   - Ensure tap-jack lock is in good condition.
3) During electrical tests ensure:
   - The battery is correctly charged.
   - Voltage higher than 16 v. is never used.
   - Never use pilot lamps.



USE OF TOOLS

DIAG 2000 PORTABLE ANALYSER

1) Its characteristics enable tests to be carried out when the vehicle is stationary or on the road.
2) The connection is made at 16 way black diagnosis connector (A).
3) It facilitates:
   a) Actuator tests:
      allow functioning of certain components to be checked, such as the E.G.R. system.
   b) Measurement of parameters:
      In the parameter measure screen instant functioning of variable engine functioning factors can be observed, such as r.p.m., engine temperature, accelerator potentiometer pressure, pump advance, etc. The readings can be memorized to be analysed later, allowing a total of up to 5 recordings.
   c) Erasing defects:
      Defects can be erased, either to normalise operating conditions of E.C.M. calculator after correcting a fault, or to carry out further tests.
   d) Identification of E.C.M.:
      On identifying computer, the number and serial number of manufacturer and computer is shown on the screen.
   e) Reading defects:
      The different defects appear on the screen when this mode is selected, indicating if they are permanent or temporary.

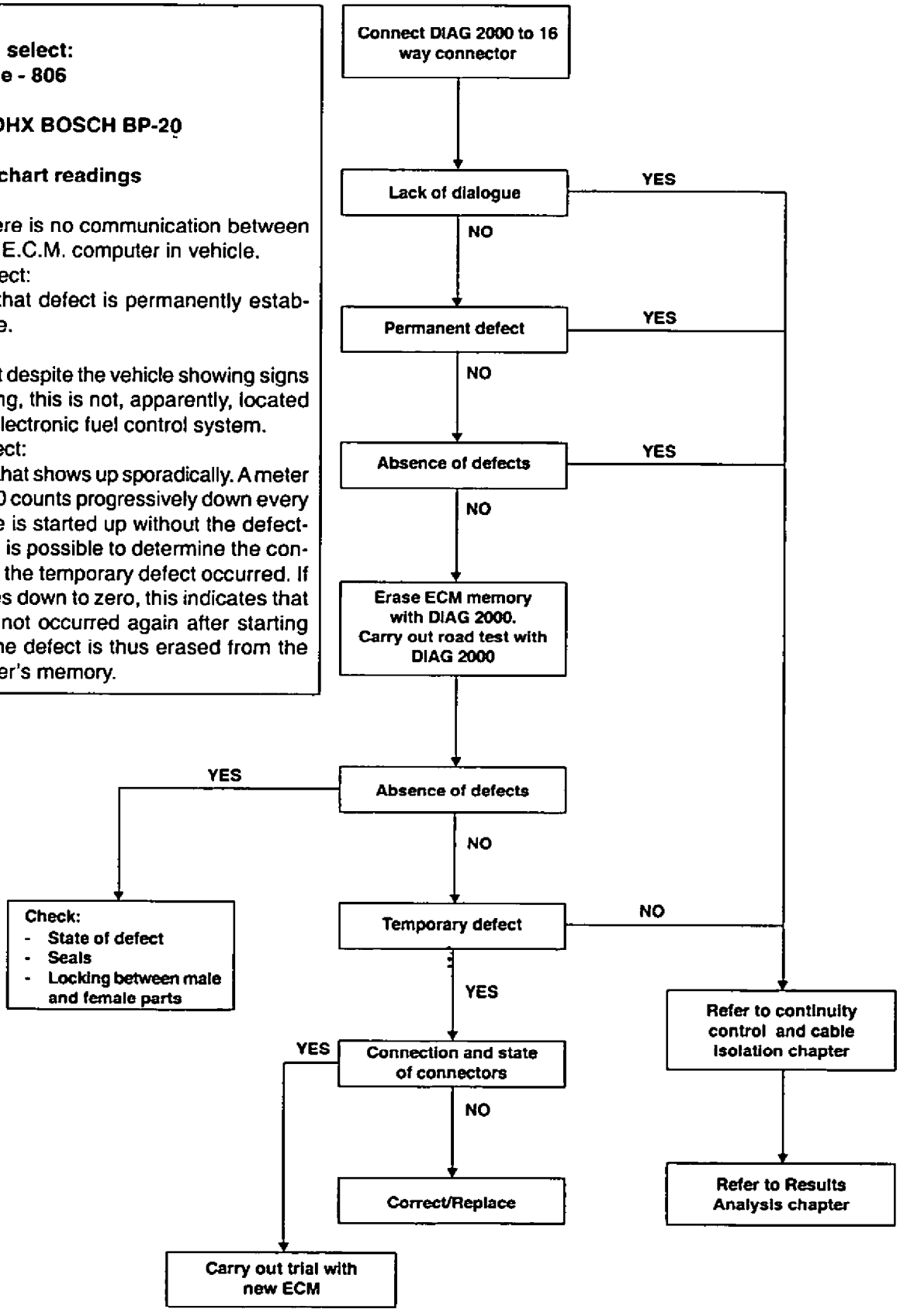
Note:
Diag 2000 can also be used as polymeter, frequency meter and oscillograph.

READING DEFECTS

Following the instructions that appear on the screen, we can proceed to functions test.

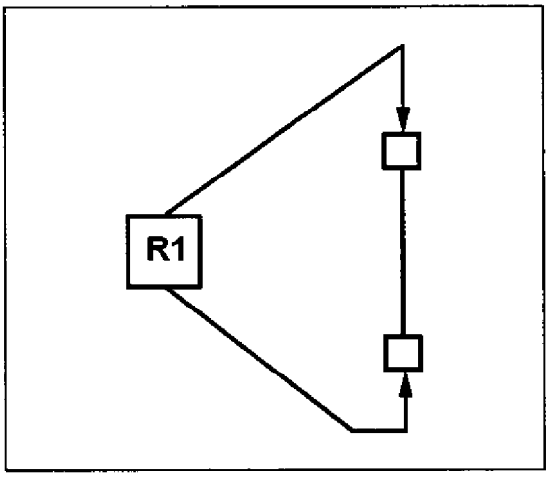
Note:
It is necessary to select:
- **Model of vehicle - 806**
- **Diesel**
- **Injection type DHX BOSCH BP-20**

Interpretation of chart readings
- No dialogue:
  This means there is no communication between Diag 2000 and E.C.M. computer in vehicle.
- Permanent defect:
  This indicates that defect is permanently established in vehicle.
- No defects:
  This means that despite the vehicle showing signs of malfunctioning, this is not, apparently, located in the electric/electronic fuel control system.
- Temporary defect:
  This is the type that shows up sporadically. A meter that begins at 40 counts progressively down every time the vehicle is started up without the defecting occurring. It is possible to determine the conditions in which the temporary defect occurred. If the counter goes down to zero, this indicates that the defect has not occurred again after starting up 40 times. The defect is thus erased from the E.C.M. computer's memory.

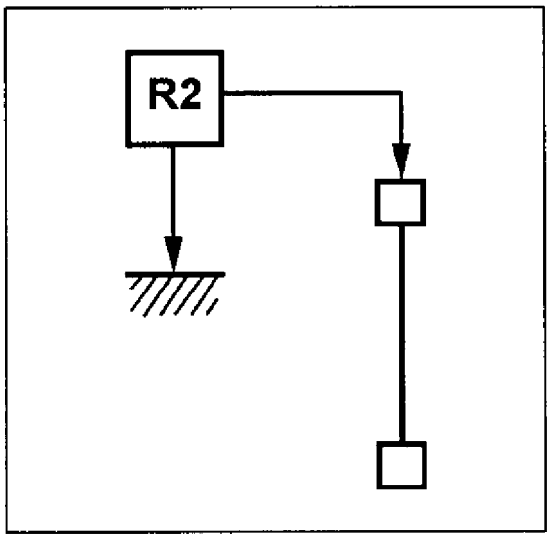


CONTINUITY CONTROL AND ISOLATION OF CABLES

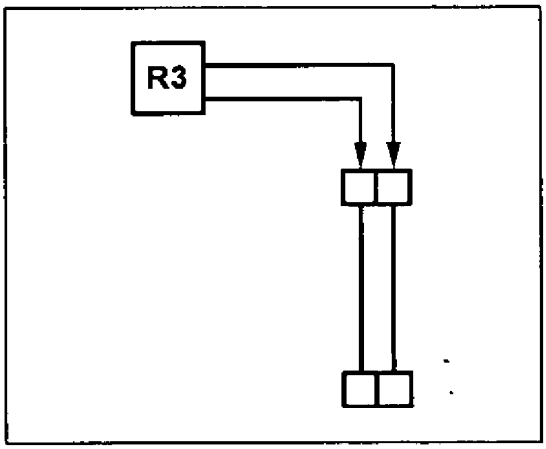
Note:
Resistance measurement is effected with connectors unattached.



1) Searching for incomplete circuit.
Measure resistance R1:
- R1 ≤ 1W: cable is not shorted.
- R1 = 199,9KW cable is completely shorted.

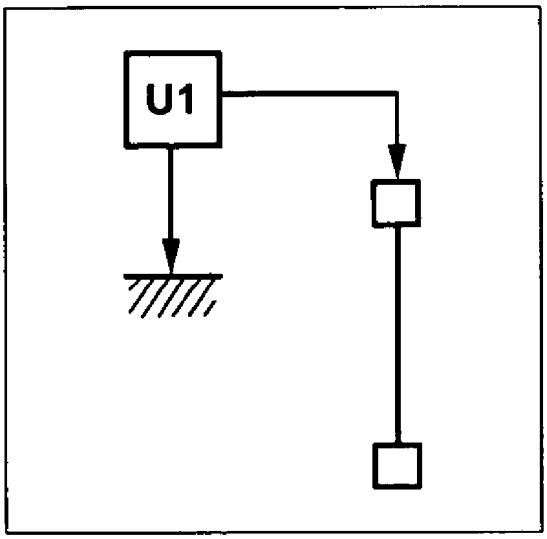


2) Searching for short to ground:
Measure resistance:
- R2 = 199.9 KW: cable is not shorted to ground.
- 1W ≤ R2 ≤ 199.9 KW: cable is partially shorted to ground.
- R2 ≤ 1W: cable is completely shorted to ground.



3) **Searching for short circuit between two cables:**
Measure resistanceR3:
- R3 = 199.9 KΩ: cables are not shorted cables.
- 1W ≤ R3 ≤ 199.9 KΩ: cables are partially shorted cables.
- R3 ≤ 1Ω: cables are completely shorted.

4) **Searching for positive short circuit (sc+):**
Activate starter motor.
Connect possible shorted receivers with cable considered.
Measure voltage:
- U1 = 0V: cable is not positively shorted.
- U1 different from 0V: cable is positively shorted.



RESULTS ANALYSIS

Note:
Detection of defects is carried out with ECM computer. The self-diagnosis effected with Diag 2000 indicates what function is defective. The fault may be in the component affected, in its connection or in the actual calculator.

1) **Defects:**
- Relay pre-heating function(M).
- Engine water thermistor function.
- Glow plug warning light function.
- EGR electric valve function.
- Fast idle electric valve function.
- Warning light diagnosis function.
- Engine pick-up speed function.
- Electric valve function (M).
- Traction regulation function (M).
- Battery voltage.
- ECM calculator injection function (M).
- Glow plug pre-post heating function.
- Needle lift pick-up function (M).

Note:
- **M = Major fault.**
- **A major fault warning light will appear, CHECK ENGINE, and will only go off when the fault has been solved and the codes erased. Constant repetition of temporary codes or several different temporary codes simultaneously can be interpreted as a permanent fault and cause the CHECK ENGINE warning light to come on.**

2) Control of associated variable factors.

Associated variable factors are parameters related to a defect.

When the ECM calculator detects a fault:

- It memorises two parameters at the same time.
- Reduces the reading on meter which starts at number 40.

The reading on this meter corresponds to number of counts under pressure on ECM calculator without fault reappearing.

Example:

- Meter 40 (fault has just appeared).
- Meter 38 (fault has not reappeared in two counts under pressure)

After 40 counts under pressure, if the fault has not reappeared the counter drops to 0.

This supplementary information helps the mechanic look for the defect.

3) Associated variable factors memorized on appearance of defect.

For all defects:

- Engine rate (r.p.m.) (except pick-up rate)
- Defect appearance meter.

According to defect:

- Engine water temperature (degrees).
- Throttle control lever potentiometer voltage.
- Actual capacity (miligrams per knock).

4) Associated faults display(DIAG 2000).

Access to associated variable factors

- Select menu: defect reading.
- Temporary or permanent defect reflected on screen. Use descending key on DIAG 2000 to see associated variable factors reappear.

5) Lack of dialogue.

Check:

- Diagnosis line (connector of DIAG 2000 to ECM).
- ECM power supply is permanently positive (+).
- ECM power supply positive after starter motor engaged.
- Functioning of self diagnosis mechanism.
- ECM ground.

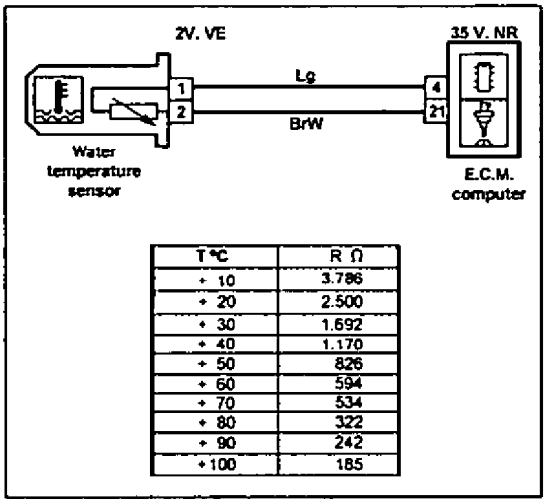
6) Lack of defects.

- No defects are memorised by ECM computer.
- For each flaw recorded, please refer to section 6 (diagnosis) in this Manual.

TESTS REPAIRS AND ADJUSTMENTS

CAUTION:
Do not use the Ohmeter to measure connectors in ECM computer, nor at any point on circuit charged.

NOTE:
To measure ECM terminals when connected, fit the SPECIAL TEST CONNECTOR (please refer to last figure in this section).

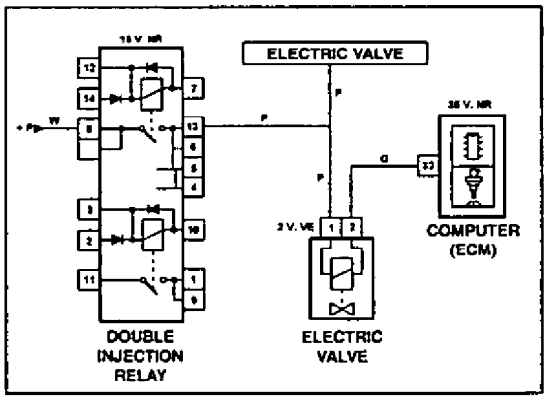


T °C	R Ω
+ 10	3.786
+ 20	2.500
+ 30	1.692
+ 40	1.170
+ 50	826
+ 60	594
+ 70	534
+ 80	322
+ 90	242
+100	185

1) Control of coolant thermistor function.
Identification:
- Short to ground.
- Open circuit positive or short circuit positive.

Tests to be performed with Diag 2000:
- Actuator test - no
- Parameter measure - yes

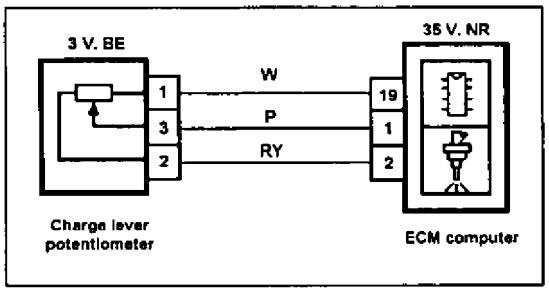
Conditions in which fault was detected	Starter motor on - engine off - engine running
Control conditions / controls	
1) ECM disconnected: depending on temperature, Does value R correspond to that shown in table? Between connector cable packages 4 and 21 (35V NR): • Continuity and isolation of cables Lg, BrW. If correct, check: • ECM connected, with temperature sensor disconnected and starter motor on. On connector terminal 1 (2V Ve) and ground, 5v. If not, check with new ECM	



2) EGR Electric valve Function Control
Identification:
- Positive short circuit.
- Open short circuit or short to ground.

Tests to be performed with Diag 2000:
- Actuator test - yes
- Parameter measure - yes

Conditions in which fault was detected	Engine running: - Press accelerator pedal (accelerator off/fully engaged)
Control conditions / controls	
1) Starter motor engaged, connector (2V VE) disconnected between terminals 1 and 2 = 12v. If not, check that: • Between terminal 1 and ground = 12 v, if correct, check continuity of cable G. If this last test is correct, the ECM is defective. • If there is no voltage between terminal 1 and ground, check continuity and isolation of cable P, and injection relay feed at point 8. If all correct, do a test with a new relay. 2) Contact cut and connector (2V VE) disconnected. Check that: • Between terminals 1 and 2 of electric valve resistance is 23 Ω ≤ R ≤ 33 Ω. If it is not, the electric valve may be defective.	



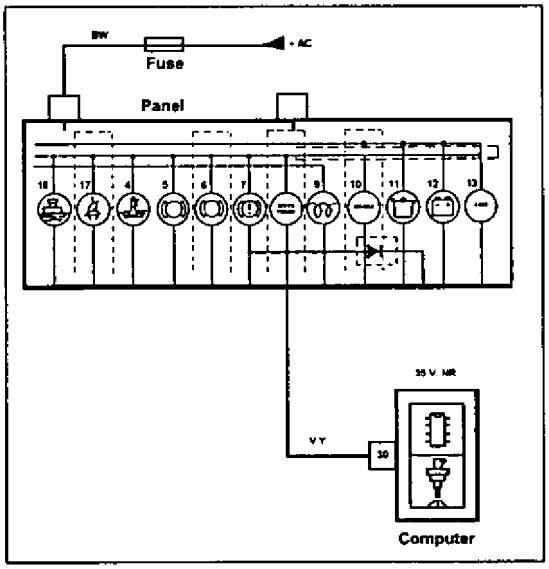
3) Control of potentiometer lever function
Identification:
- Positive open circuit or positive short circuit.
- Short to ground.

Tests to be performed with Diag 2000:
- Actuator test - no.
- Parameters measure - yes.

Conditions in which fault was detected	Starter motor on: - engine off - engine running - on pushing accelerator pedal: (accelerator lifted/ fully engaged)

Control conditions / controls

1) Check throttle control cable adjustment.
2) Starter motor engaged, computer connected (use SPECIAL TEST CONNECTOR). Check presence of 5v between terminal 1 of special connector and ground. If result is not correct, test with new ECM computer.
3) If previous test is correct, cut off contact, disconnect ECM and on cable package connector (35V NR), check between terminals 1 and 19 R ≅ 1.7 KΩ.
On the same connector, on terminals 2 and 19 (accelerator not engaged), check for R ≅ 1,3 KΩ
On same connector, on terminals 2 and 19 (accelerator fully engaged) check for R ≅ 1.9 KΩ
4) If any tests on point (3) are not correct, release potentiometer connector (3v BE) and perform tests at point (3) on potentiometer terminals (1 and 3) and (2 and 1).
If the result is satisfactory, replace cable package.
If the result is not satisfactory, replace potentiometer (please refer to 6E3-6).

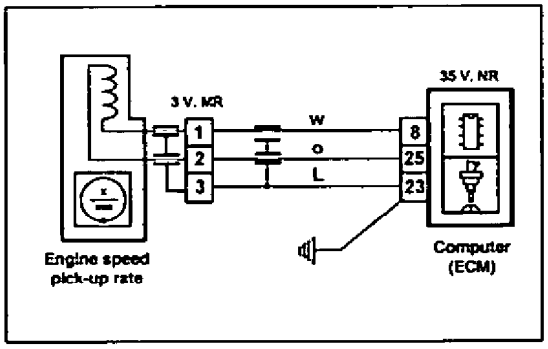


4) Warning light diagnosis.
Tests to be performed 2000:
- Parameters measured - no.
- Actuator test - yes.

Conditions in which fault was detected	Starter motor engaged: - engine off - engine running

Control conditions / controls

1) With ECM calculator disconnected and starter motor on, check cable package connector (3V NR) for presence of 12v between terminal 30 and ground.
If it is not, ECM calculator could be defective.
If test is positive, continue with point (2).
2) Check in this order:
- Cable VY continuity.
- Condition of diagnosis warning light on instrument panel.
- Power in cable BW on instrument panel.

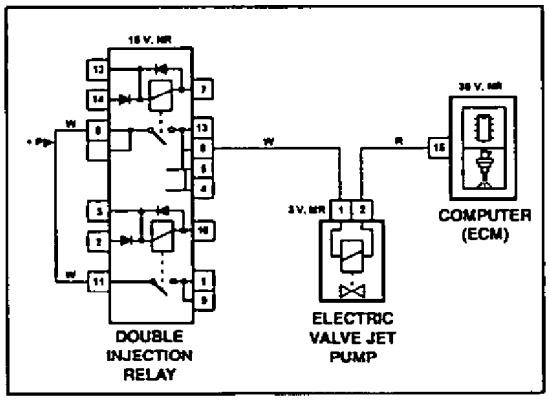


5) Engine pick-up rate function (ECM):
DIAG 2000:
- Parameters test - yes.
- Actuator test - no.

Conditions in which fault was detected	Starter motor engaged
Control conditions / controls	
1) ECM disconnected, engage starter and check: Between terminals 8 and 25 of cable package connector (35V NR) for presence of 2v ≤ 6v. If this test is correct, the problem could be the ECM. If not correct, continue with test (2). 2) ECM disconnected, starter disengaged, check that: Between terminals 8 and 25 of cable package connector (35V NR) there is resistance of 315 Ω ≤ R ≤ 405 Ω. If not, release connector (3v MR) on pick-up and repeat previous check between terminals 1 and 2 on pick-up. If this test is correct cable (W), or cable (O) is defective. 3) If the tests are correct, attach ECM connector, disengage starter, and check for ground in terminal 3. If not correct, measure continuity of cable L, if continuity is correct, check for ground in point 23 of ECM. If not correct, replace the ECM.	

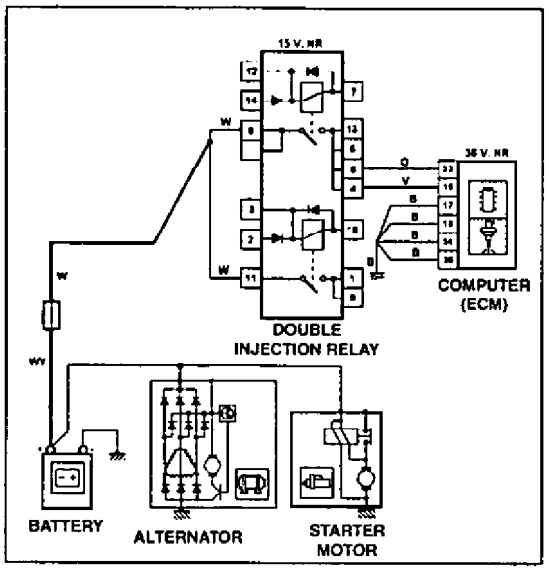
6) Advance regulation test.
DIAG 2000:
- Actuator test - no.
- Parameters measure - yes.

Conditions in which fault was detected	Engine running
Control conditions / controls	
Check: - The initial setting of jet pump.	



7) Electric advance valve function.
- Parameters measure - yes.
- Actuator test.

Conditions in which fault was detected	- Starter motor engaged - Engine off
Control conditions / controls	
1) Disconnect electric advance valve and check terminals 1 and 2, resistance R ≅ 16 Ω. If the resistance does not correspond to that specified, replace electric valve. If correct, continue with test. (2). 2) Attach electric valve connector, unfasten ECM calculator connector (35V NR) from cable package and ground, checking for presence of 12v . If the test is correct, the ECM may be defective. If not correct, check continuity and isolation of cables (R) and (W) as well as power in injection relay (W). Lastly, if all is correct, replace injection relay.	

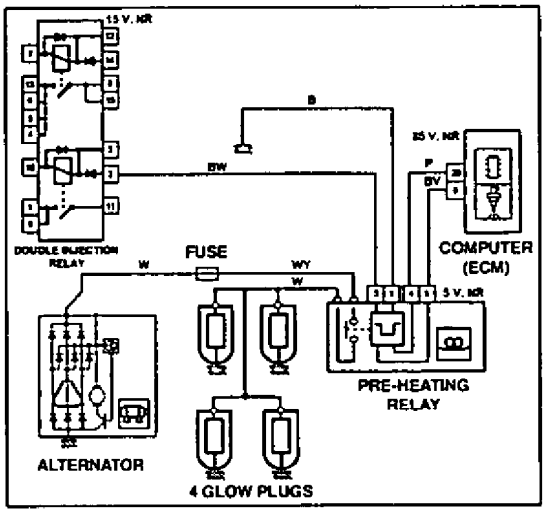


8) Battery voltage test
DIAG 2000:
- Parameters measure - yes.
- Actuator test - no.

Conditions in which fault was detected	Starter motor engaged: - engine off - engine running
Control conditions / controls	
1) Check battery voltage and condition of charging circuit. 2) Check: - Condition of different contact points (for distortion or rust) - Pressure and state of seal on connectors' mechanical lock. 3) Connect Diag 2000 to vehicle with SPECIAL TEST CONNECTOR, activated and check that: 3.1.-There are 12v between terminals 16 and 33 of test connector. 3.2.-Disengage starter motor and check for absence of voltage at points 16 and 33 of test connector. 3.3.-In the same conditions as in point (3.2), check for ground in terminals 17, 18, 34 and 35 of special connector. 4) If any of above check are incorrect, check: - Continuity of cables O,V and W, as well as state of relay if test reveals absence of voltage (3.1). - If voltage is not cut off in test (3.2) check the state of the relay. - Continuity of cable B, if test (3.3) .	

9) Injection calculator function.
DIAG 2000:
- Parameters measure - no (no dialogue exists)
- Actuator test - no (no dialogue exists)

Conditions in which fault was detected	Starter motor engaged: - engine off - engine running
Control conditions / controls	
1) Check battery voltage on starting engine. If voltage is very low (less than 8.5 v), replace battery with new one and repeat the test. 2) If it remains impossible to start engine, replace ECM calculator with new one.	

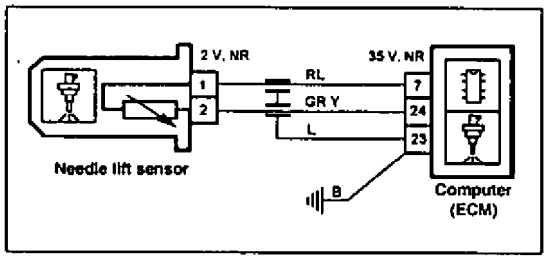


10) Pre-heating relay information test.
DIAG 2000:
- Parameters measure - yes.
- Actuator test - yes.

Conditions in which fault was detected	Battery voltage ≥ 9V. - starter engaged - engine running - engine cold - starting engine
Control conditions / controls	
1) Check: - State of glow plugs. - State of pre-post-heating relay. If two tests are correct, continue as follows: 2) With engine cold, connect Diag 2000 to vehicle with SPECIAL TEST CONNECTOR, engage starter and check: - Presence of 12v in terminal 6 of special test connector. - Presence of ground in terminal 29 of same connector. 3) With engine warmed up (higher than 70 ° C) and in the same situation as in test (2), check for: - Absence of voltage in terminal 6 of special test connector after glow plug warning light goes off. 4) If previous tests are incorrect, check continuity and isolation of cables BW, B, P, BV, W, and WY.	

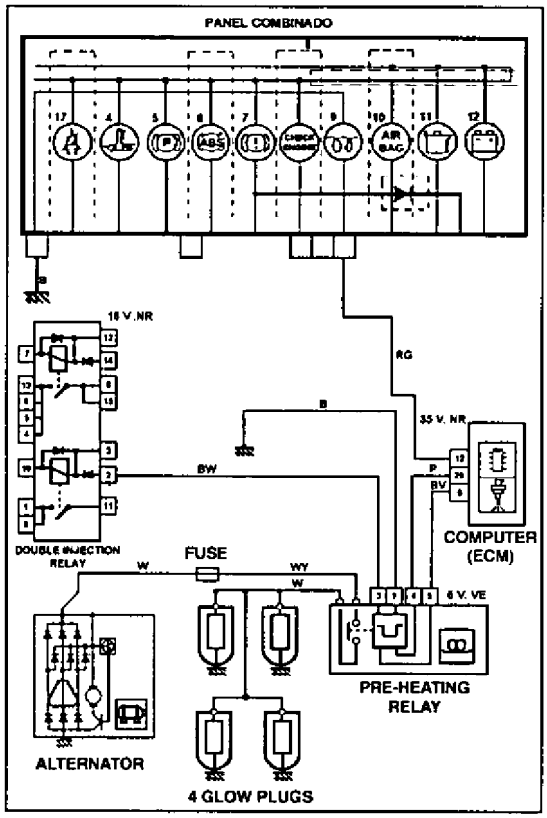
11) Atmospheric pressure pick-up test.
DIAG 2000:
- Parameters measure - yes.
- Actuator test - no.

Conditions in which fault was detected	Starter motor engaged: - engine off - engine running
Control conditions / controls	
Replace ECM calculator (pick-up incorporated in calculator)	



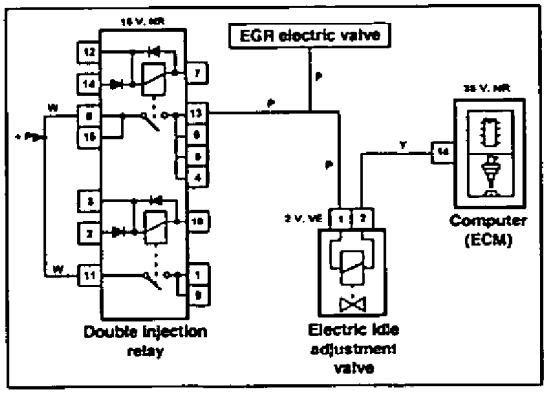
12) Needle lift sensor function test.
DIAG 2000:
- Parameters measure - no.
- Actuator test - no.

Conditions in which fault was detected	Engine running
Control conditions / controls	
1) With ECM calculator disconnected and starter disengaged, check terminals 7 and 24 of cable package connector (35V NR) and that resistance is 100 Ω ≤ R ≤ 130 Ω. 2) If the result of test (1) is not correct, unfasten connector (2V NR) from needle pick-up sensor and repeat the test (1) on sensor terminals 1 and 2. If the results are correct, the wiring is incorrect. If the results are incorrect, replace complete assembly (needle lift sensor and injector). 3) If tests (1) and (2) are correct, check continuity and isolation of cable L, if it is correct, carry out test with new ECM.	



13) Glow plug pre-heating warning light.
DIAG 2000:
- Parameters measure - no.
- Actuator test - yes.

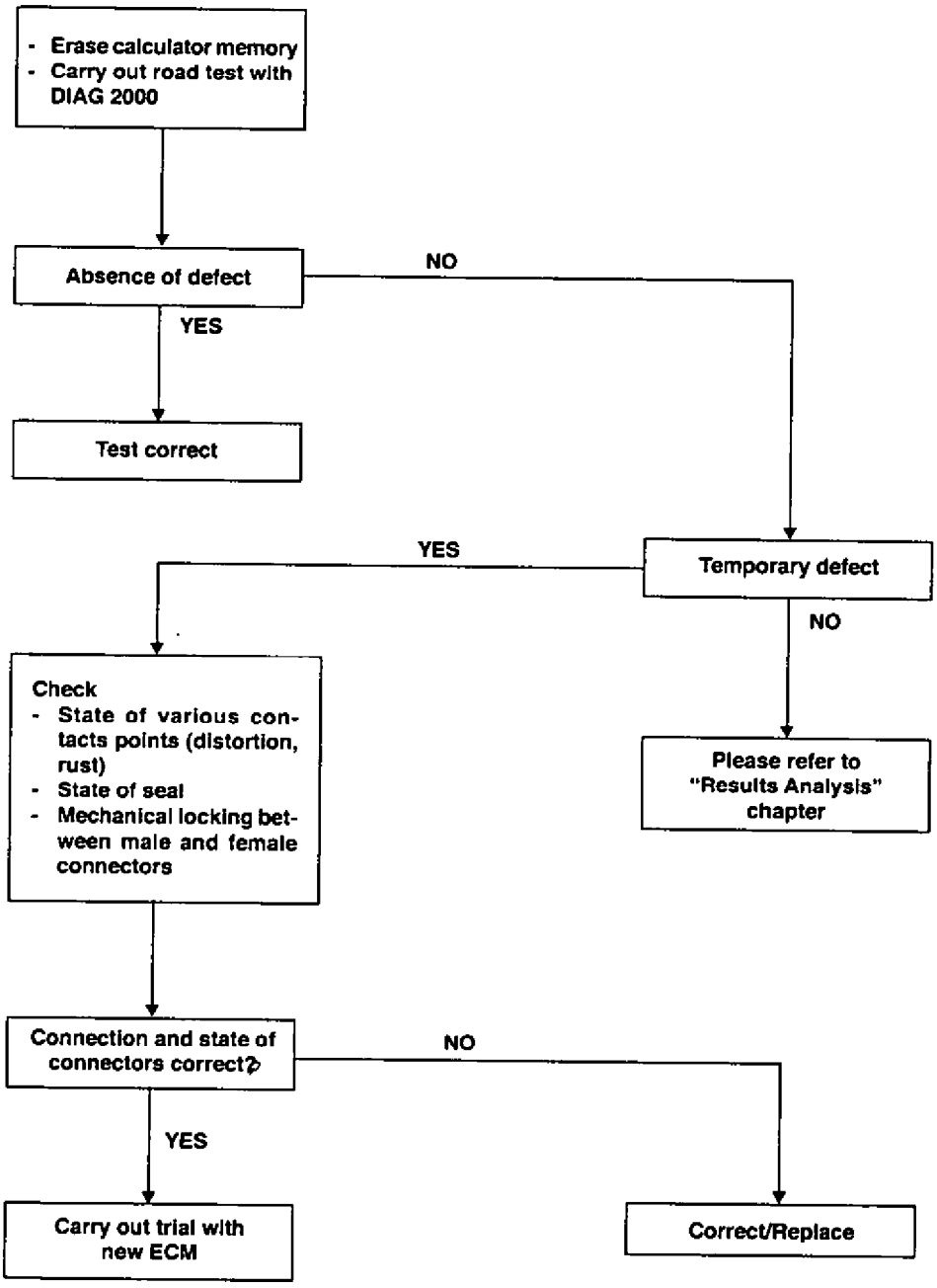
Conditions in which fault was detected	- Battery voltage ≥ 9V. - starter engaged - engine cold
Control conditions / controls	
1) With engine cold, connect DIAG 2000 to vehicle, with SPECIAL TEST CONNECTOR. Connect voltmeter between terminal 12 and ground. Check that voltage on engaging starter is 12v (the same as battery). If it is not there could be a fault with the ECM calculator. 2) If previous test is correct, check continuity and isolation of cables RG and B (ground on instrument chart). also check state of pre-post heating warning light.	



14) Fast idle electric valve function.
DIAG 2000:
- Parameters measure - yes.
- Actuator test - yes.

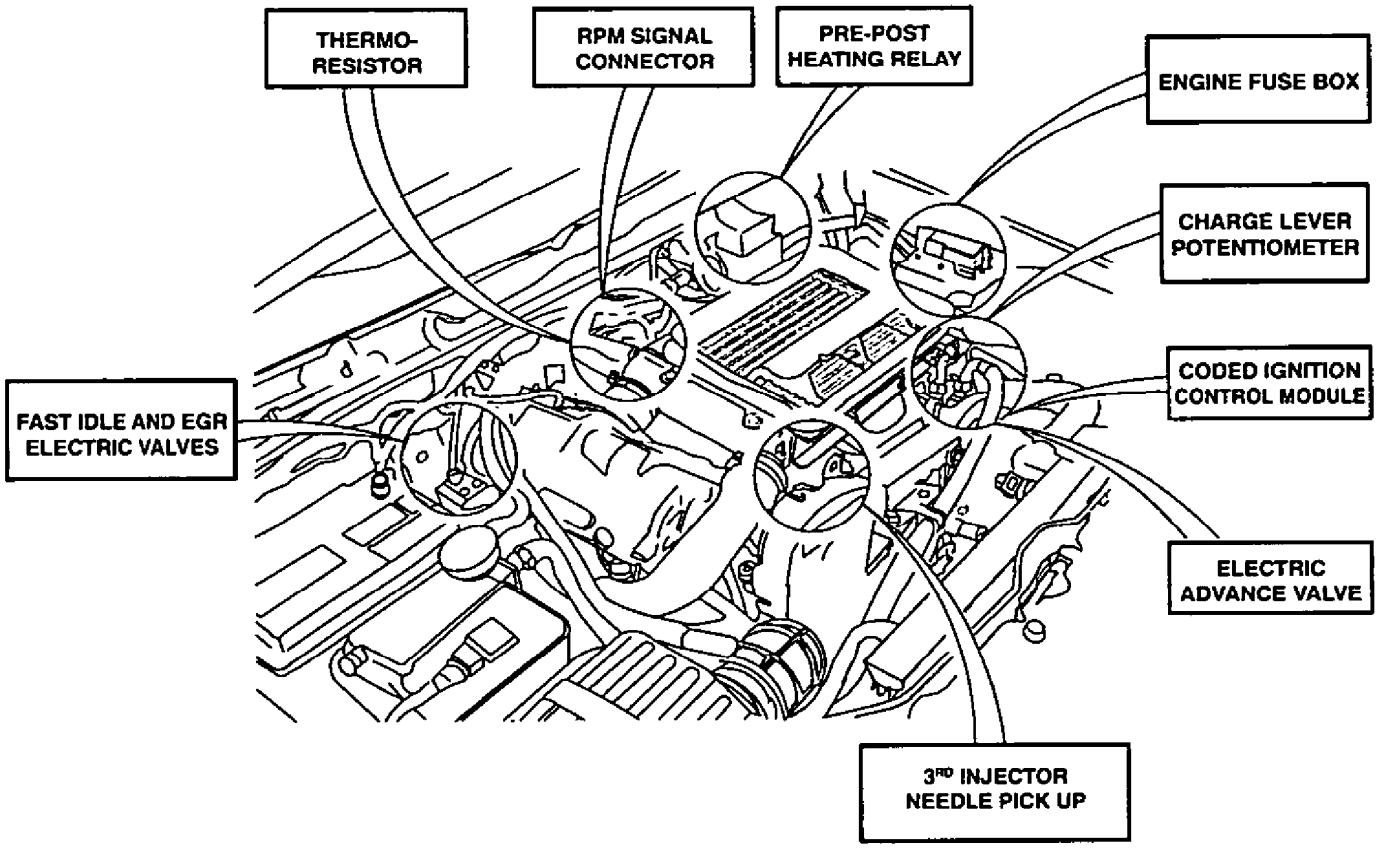
Conditions in which fault was detected	Starter motor engaged: - engine off - engine running
Control conditions / controls	
1) Starter engaged, connector (2V VE) unfastened. Between terminals 1 and 2 there should be 12v. If this is correct check resistance of electric valve between terminals 1 and 2 = 25 Ω ≤ R ≤ 38 Ω. If resistance is not between these values, replace the electric valve. 2) If there is no voltage between terminals 1 and 2 (test 1), check in this order: - Continuity and isolation of cables W, Y and P and state of injection relay. - If everything is correct test with new ECM.	

TESTS PRIOR TO REPAIR

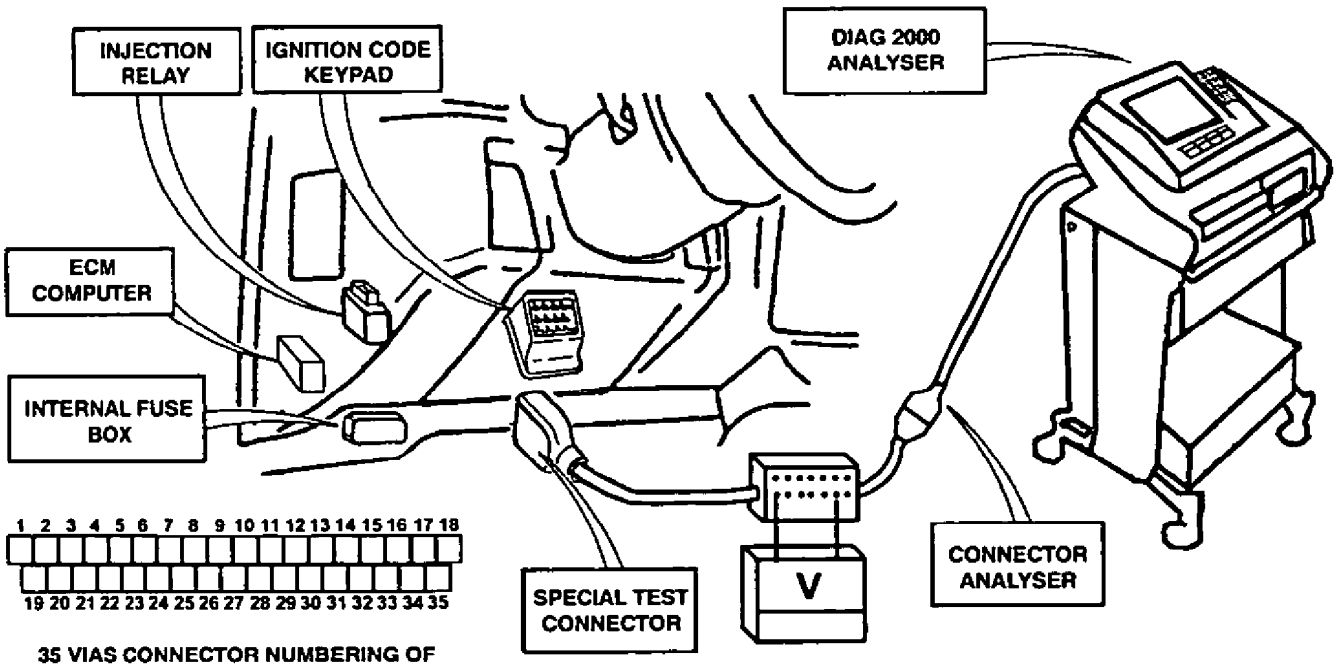


LOCATION OF COMPONENTS RELATED TO DIAG 20000 TEST

ENGINE ROOM

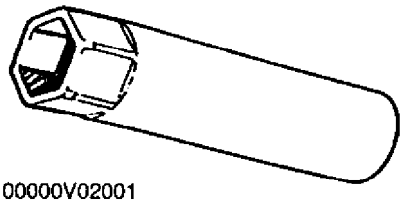
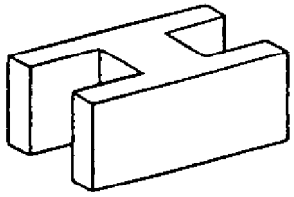
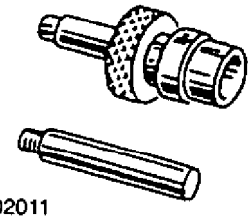
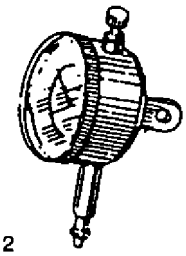


LOWER LEFT SIDE OF INSTRUMENT PANEL



35 VIAS CONNECTOR NUMBERING OF THE ECM CALCULATOR

SPECIAL TOOLS

 00000V02008 P.M.S. FITTER	 09912-56520 LOCKNUT WRENCH	 00000V02013 ELECTRIC VALVE WRENCH
 00000V02017 CRESCENT WRENCH	 00000V02001 INJECTOR PULLING WRENCH	 09913-16520 INJECTOR FLANGE SUPPORT
 00000V02011 JET PUMP DIAL INDICATOR SUPPORT	 00000V02012 DIAL INDICATOR	

TORQUE SPECIFICATIONS

SYSTEM	COMPONENT	Kg-m	Nm
ENGINE AND EMISSIONS CONTROL	Jet pump/support attaching nuts.	2	20
	Jet pump shaft/pinion attaching nut.	5	50
	Top right timing cover attaching screw.	1	10
	Top right timing cover attaching nut.	0.5	5
	Fuel injection lines attaching nuts.	2.5	25
	Jet pump fuel intake attaching bolt.	2.5	25
	Fuel return hose and jet pump attaching bolt.	2.5	25
	Injector assembly attachment to cylinder head.	9	90
	Injector cover nut.	7.5	75
	EGR valve.	1.0	10

SECTION 7A

TRANSMISSION

WARNING:
For vehicles equipped with AIR BAG system (inflatable air mattress protection system) observe the following precautions:
- **90 seconds must pass after disconnecting ignition, moving switch to "LOCK" position and disconnecting battery, before beginning work on components that could accidentally activate the AIR BAG system..**
- **If in doubt, consult SECTION 9J before carrying out work around components that could activate AIR BAG system accidentally.**

7A

LIST OF CONTENTS

GENERAL OUTLINE

The transmission is made up of the input shaft, main shaft, countershaft and reverse gear, installed in a cast iron case.

It has five forward gears, permanently meshed and synchronized, and a reverse gear.

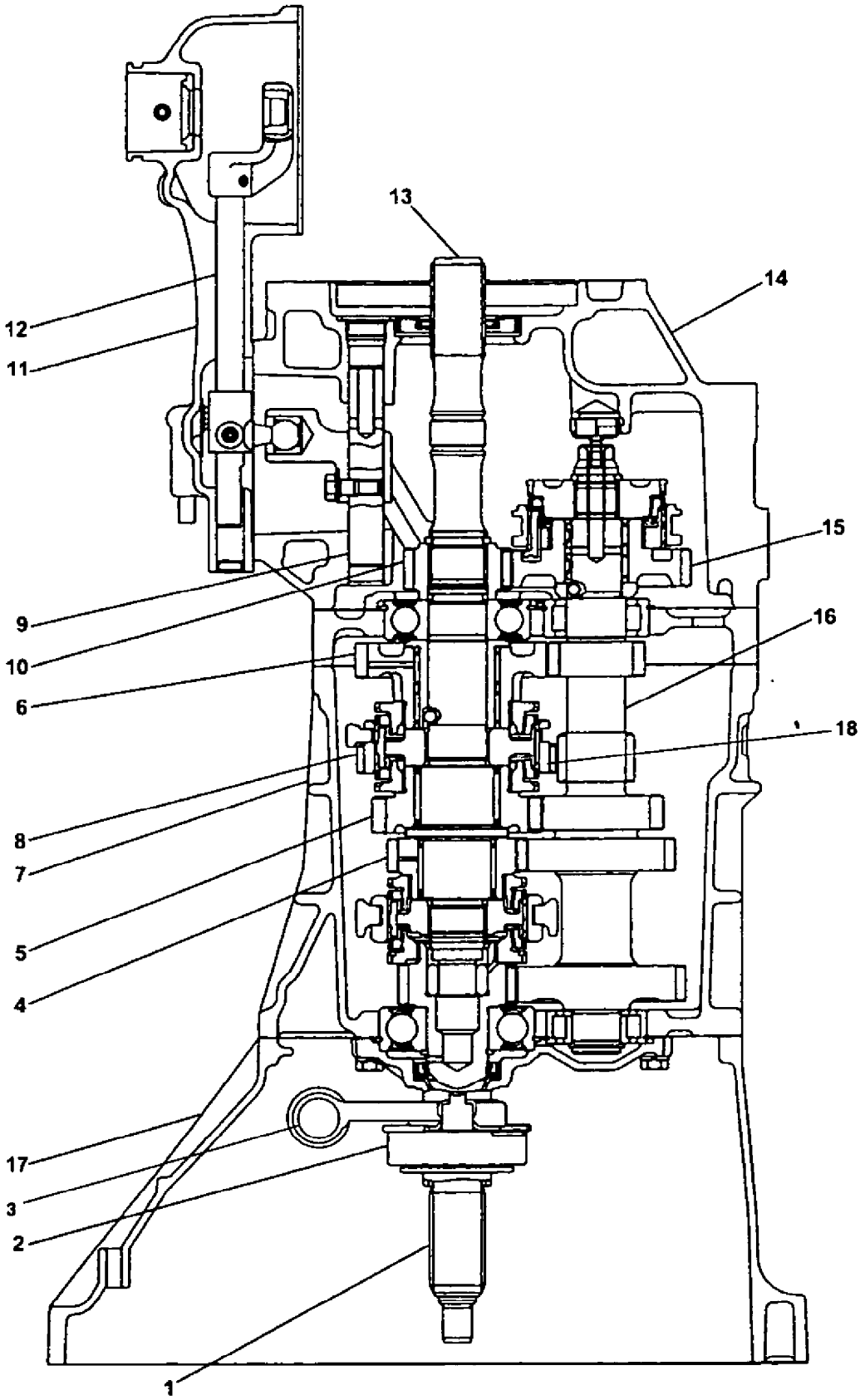
The main shaft gears rotate on needle bearings and each one forms an assembly made up of timing rings, sleeve, bushing and the actual gear.

The gear shift lever is located in the upper part behind the transmission and has a cam that prevents change of gear from 5th directly to reverse.

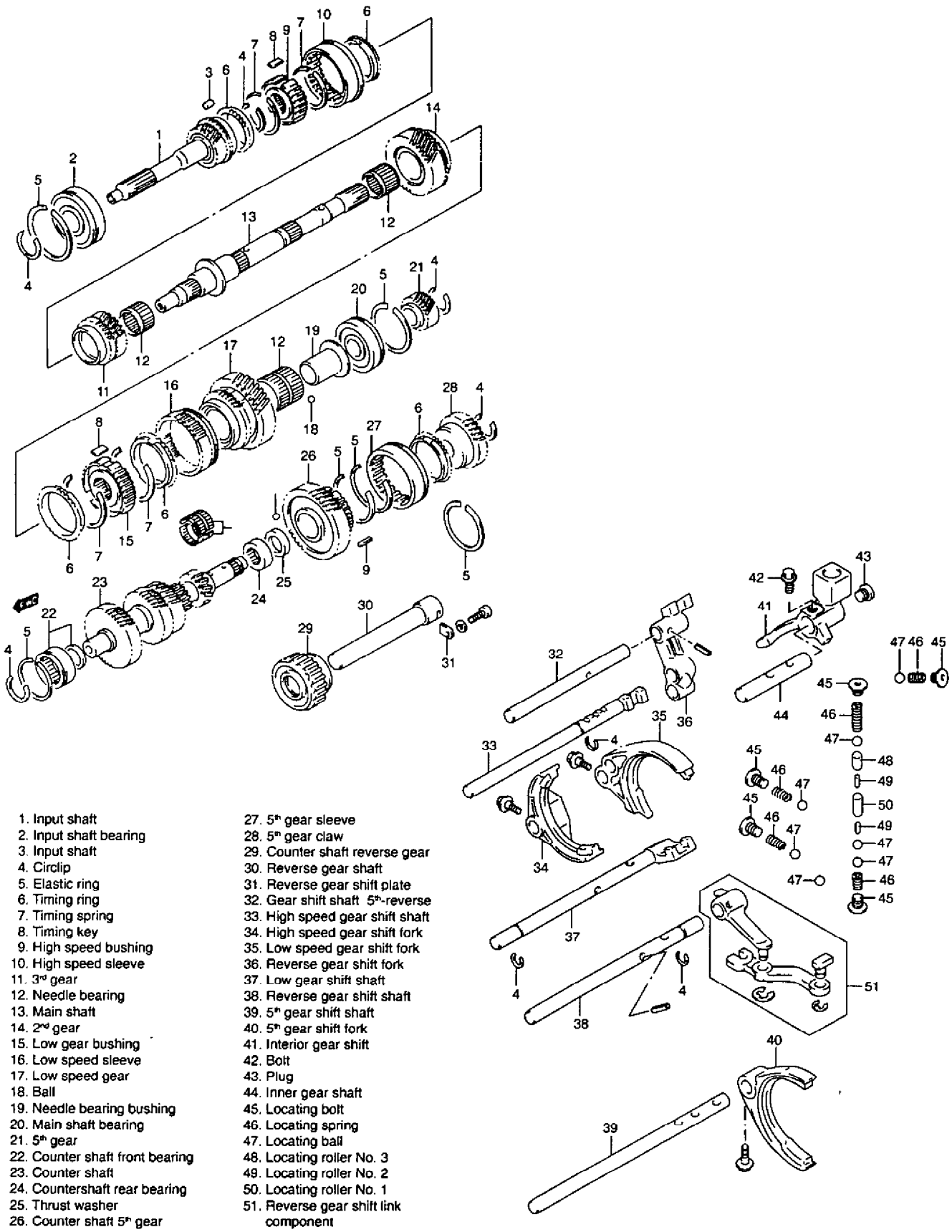
The cast aluminium cases are sealed with liquid type packing, it is thus necessary to use a master seal or the equivalent on mating surfaces when assembling them.

The bolts attaching the cases must be tightened with a torque wrench to the specified level, avoiding over or under-tightening.

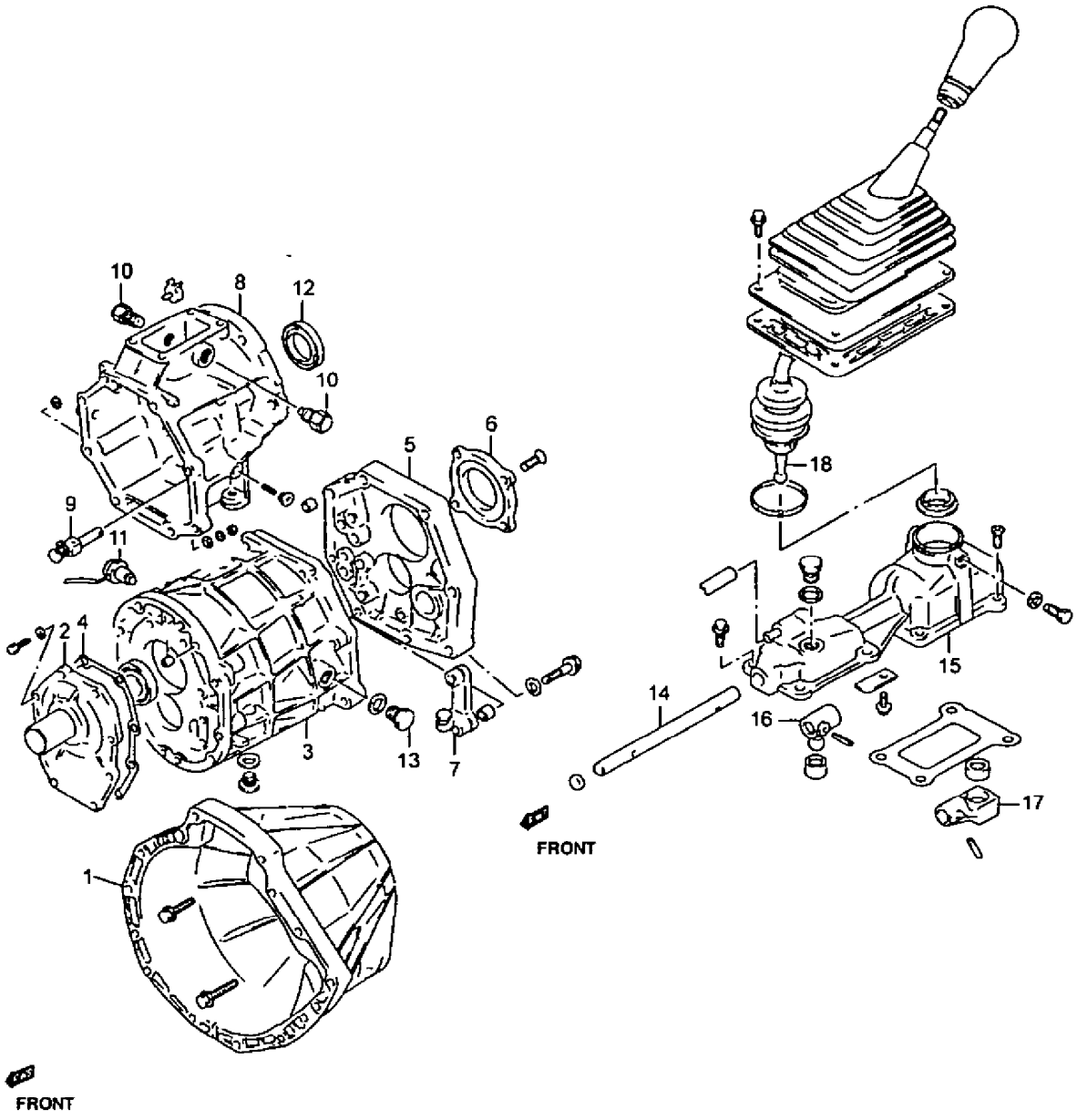
The transfer case is connected to the transmission, although they are totally independent for maintenance purposes. For all matters related to its repair please refer to section 7D.



1.- Input shaft and 4th gear.
2.- Thrust bearing.
3.- Clutch release fork and shaft.
4.- Main shaft 3rd gear.
5.- Main shaft 2nd gear.
6.- Main shaft 1st gear.
7.- Front case.
8.- Main shaft reverse gear.
9.- Selector shafts.
10.- Main shaft 5th gear.
11.- Gear shift lever case.
12.- Gear shift rod.
13.- Main shaft.
14.- Rear case.
15.- Counter shaft fifth gear.
16.- Counter shaft.
17.- Clutch housing.
18.- Reverse gear.



1. Input shaft
2. Input shaft bearing
3. Input shaft
4. Circlip
5. Elastic ring
6. Timing ring
7. Timing spring
8. Timing key
9. High speed bushing
10. High speed sleeve
11. 3rd gear
12. Needle bearing
13. Main shaft
14. 2nd gear
15. Low gear bushing
16. Low speed sleeve
17. Low speed gear
18. Ball
19. Needle bearing bushing
20. Main shaft bearing
21. 5th gear
22. Counter shaft front bearing
23. Counter shaft
24. Countershaft rear bearing
25. Thrust washer
26. Counter shaft 5th gear
27. 5th gear sleeve
28. 5th gear claw
29. Counter shaft reverse gear
30. Reverse gear shaft
31. Reverse gear shift plate
32. Gear shift shaft 5th-reverse
33. High speed gear shift shaft
34. High speed gear shift fork
35. Low speed gear shift fork
36. Reverse gear shift fork
37. Low gear shift shaft
38. Reverse gear shift shaft
39. 5th gear shift shaft
40. 5th gear shift fork
41. Interior gear shift
42. Bolt
43. Plug
44. Inner gear shaft
45. Locating bolt
46. Locating spring
47. Locating ball
48. Locating roller No. 3
49. Locating roller No. 2
50. Locating roller No. 1
51. Reverse gear shift link component



1. Clutch housing
2. Thrust bearing cap
3. Front case
4. Thrust bearing cap seal
5. Transmission intermediate plate
6. Bearing plate
7. Reverse gear lever link
8. Transmission rear case
9. Interconnection cam
10. Lever releases
11. Reverse gear switch
12. Main shaft rear seal
13. Filler/check plug
14. Selector shaft
15. Gear shift lever case
16. Finger shift selector
17. Shift arm
18. Gear shift lever

DIAGNOSIS

State	Possible cause	Correction
Slips out of gears	• Gear shift fork shaft worn • Gear shift fork or synchroniser sleeve worn • Locating spring bent or damaged • Input or main shaft bearings worn • Chamfered teeth in sleeve or gear worn • Circlips missing or unfastened	Replace. Replace. Replace. Replace. Replace sleeve and gears. Install.
Difficulty in engaging gear	• Synchroniser spring bent or broken • Gear shift shaft or fork distorted	Replace. Replace
Harshness in changing gear	• Inadequate free play on clutch pedal • Clutch disc broken or distorted • Clutch pressure plate damaged • Synchroniser ring worn • Chamfered teeth in sleeve or gear worn • Gear shift distorted	Adjust. Replace. Replace clutch cover. Replace. Replace sleeve and gears. Replace.
Noise	• Incorrect or insufficient lubricant • Bearing(s) damaged or worn • Gear(s) damaged or worn • Synchroniser ring damaged or worn • Chamfered teeth in sleeve or gears damaged or worn.	Fill. Replace. Replace. Replace. Replace.

SERVICING THE VEHICLE

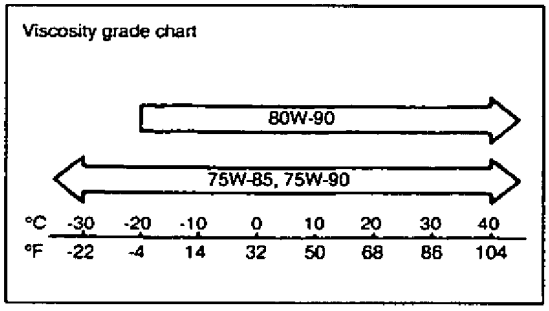
(TRANSMISSION AND TRANSFER CASE)

MAINTENANCE SERVICE

Oil change

1) Before changing or inspecting the oil, ensure the engine is switched off and vehicle is horizontal.
2) Check oil level and for leaks. Any leaks should be corrected or repaired.
3) Extract used oil and fill with specified new oil in quantity indicated (up to gauge hole).

NOTE:
- **Use of SAE-75W-90 gear oil is recommended**
- **Whenever the vehicle is raised for any servicing other than oil change, check for oil leaks too and the state of the breather tubes.**
- **If there is water or rust mixed with the oil extracted, inspect transmission and transfer case dust covers.**

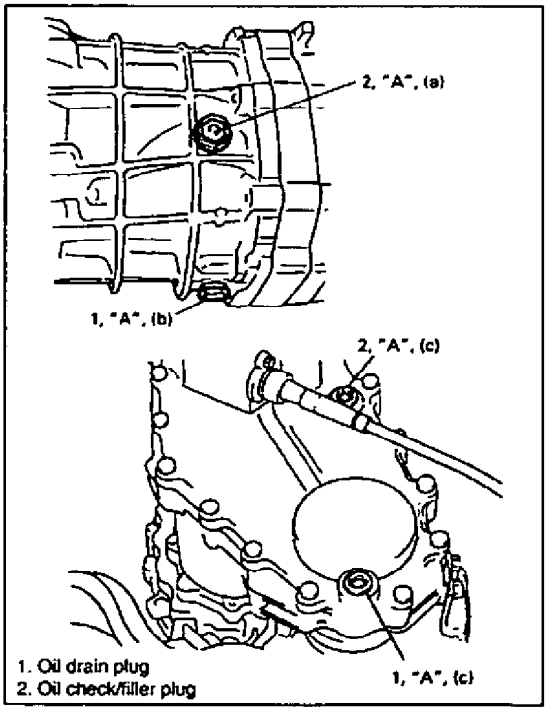


Gear oil specifications:

Oil grade: API GL-4
Viscosity: SAE 75W-85, 75W-90 u 80W-90

Oil capacity:

Transmission 2.6 litres.
Transfer case 1.7 litres.

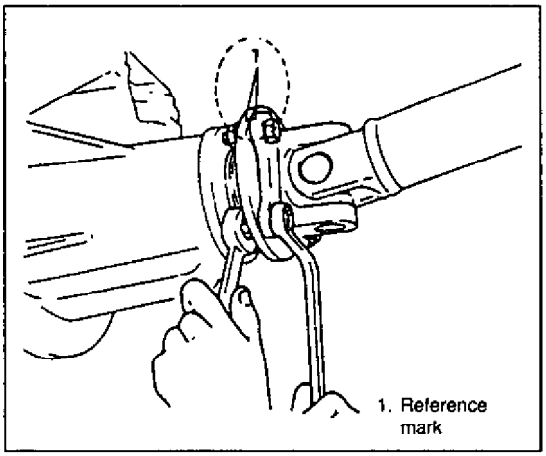


4) Tighten draining and filling plugs to specified torque after applying sealant to thread.

CAUTION:
- **Transmission oil should not be poured on gearshift control lever.**
- **Do not slacken or remove gear reverse gear shaft bolt.**

Sealant "A": 99000-31110

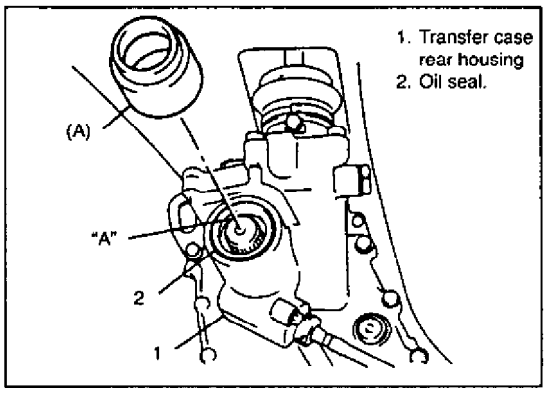
Torque specifications
(a): 3.8 kg-m (38 Nm)
(b): 4.5 kg-m (45 Nm)
(c): 2.3 kg-m (23 Nm)



TRANSFER CASE OIL SEALS

Transfer case rear housing oil seal:

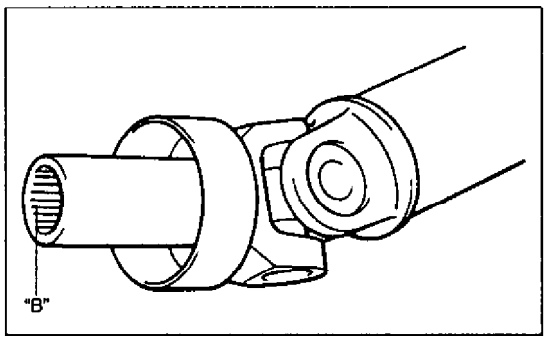
1) Raise vehicle horizontally .
2) Make reference marks on the propeller shaft connecting flange, as shown in figure.
3) Remove bolts from rear propeller shaft flange and remove propeller shaft.
4) Use a screwdriver to remove oil seal.



5) Use the special tool (A) and plastic hammer to fit the new oil seal in its housing.
Apply grease to oil seal rim.

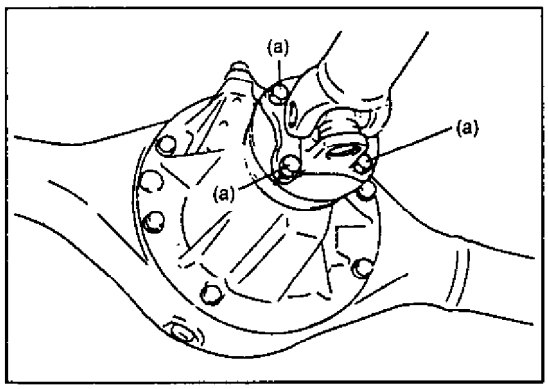
"A": Grease 99000-25010

Special tool
(A): 09940-53111



6) Clean and inspect sliding part of front end of propeller shaft (where it comes into contact with oil seal) before installing and, even if there is only a small dent or scratch, correct and clean once more. Apply grease inside propeller shaft grooves.

"B": Grease99000-25010



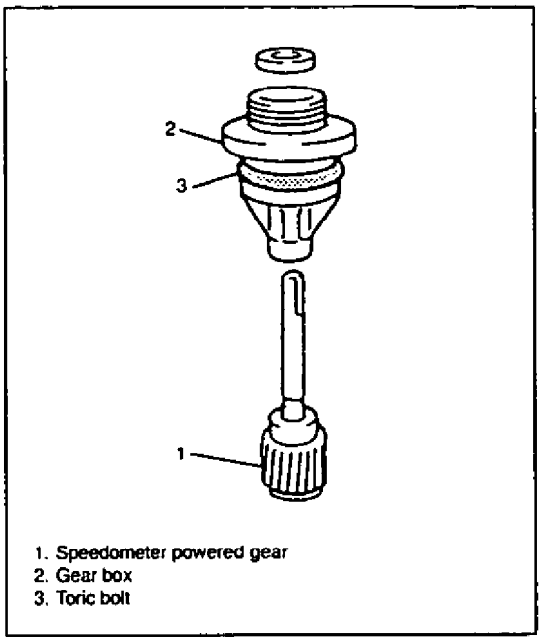
7) Install propeller shaft and tighten bolts of universal joint flange to specified torque.

CAUTION:
Only use attaching bolts, nuts and washers specified for universal joint .

Torque specifications
(a): 5.5 Kg-m (55 Nm)

Centre case oil seal (front side)
It is necessary to drain and fill the transfer case with gear oil. Please refer to page 7A-7 for specifications.

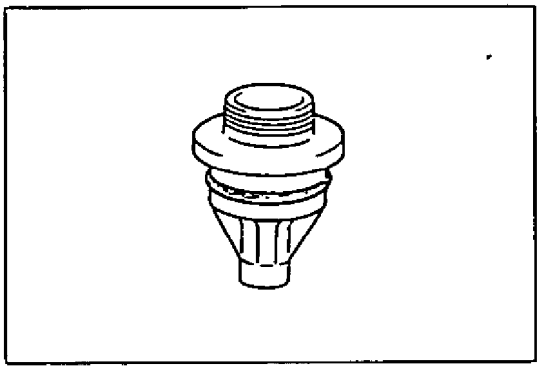
SPEEDOMETER POWERED GEAR



1. Speedometer powered gear
2. Gear box
3. Toric bolt

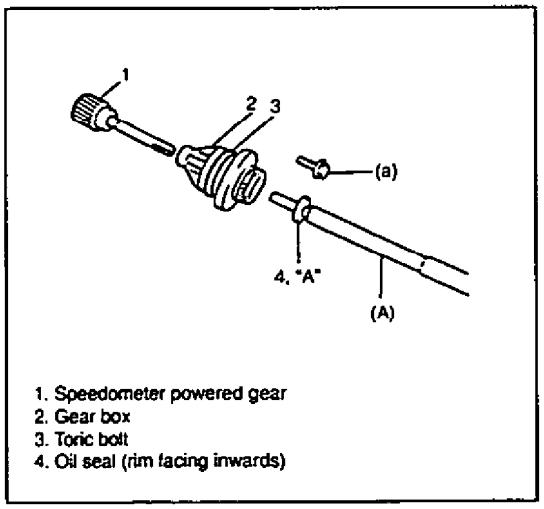
Removal

1) Lift vehicle horizontally.
2) Disconnect cable from transfer case speedometer.
3) Remove bolt and remove gear box from transfer case.
4) Remove speedometer powered gear.



5) Remove oil seal from case.

NOTE:
Use a small L type lever to remove oil seal.



1. Speedometer powered gear
2. Gear box
3. Toric bolt
4. Oil seal (rim facing inwards)

Installation

1) Ensure that toric bolt and case are not damaged.
2) Apply grease at the edges of the new oil seal and install snugly. A special tool (A) can be used for installation.

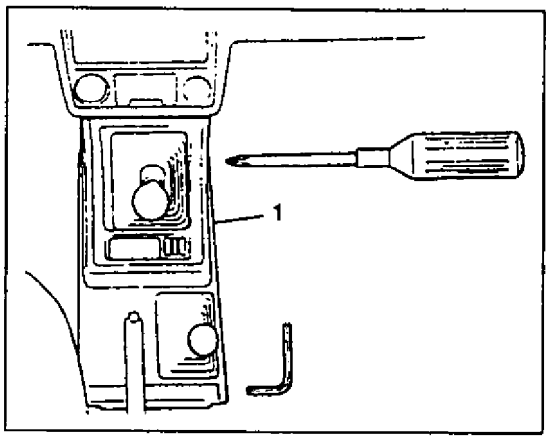
   "A": Grease 99000-25010

   Special tool
   (A): 09916-46010

3) Inspect speedometer powered gears for abnormal wear on teeth or bent parts to shaft and replace if necessary.
4) Insert powered gear in case and ensure it turns without problems.
5) Install transfer case assembly and connect cable as it previously was.

   Torque specifications
   (a): 1.0 Kg-m (10 Nm)

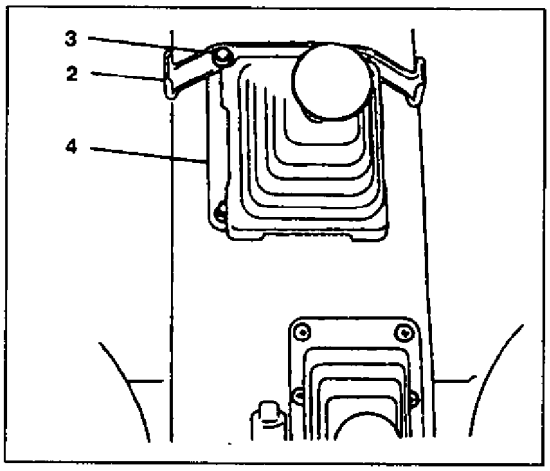
6) Ensure that oil level is that indicated.



GEAR SHIFT LEVER AND TRANSFER CASE LEVER

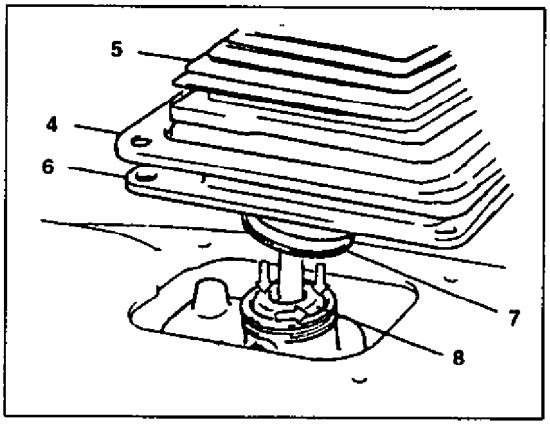
Removal of gear shift lever and transfer case lever

1) Remove two front bolts from console (1), the two rear clips and take out console.



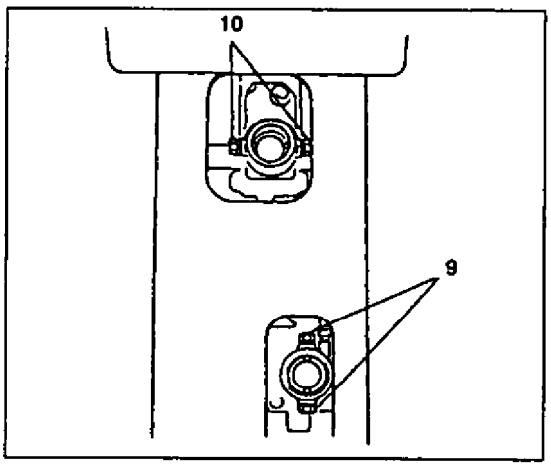
2) Remove bridge (2) and bolts (3) from retaining plate (4).
3) Move dust covers (5 and 6) and retaining plate (4) upwards.
4) Remove dust cover clamp (7) and separate it upwards.
5) Apply pressure to the housing cover whilst turning it leftwards and extract gear shift lever assembly.

NOTE:
Remove transfer case lever in the same way.



Inspection

1) Inspect for any wear in zones exposed to friction and support for levers and. Correct or replace if necessary.
2) Inspect dust covers for breaks and replace if necessary.

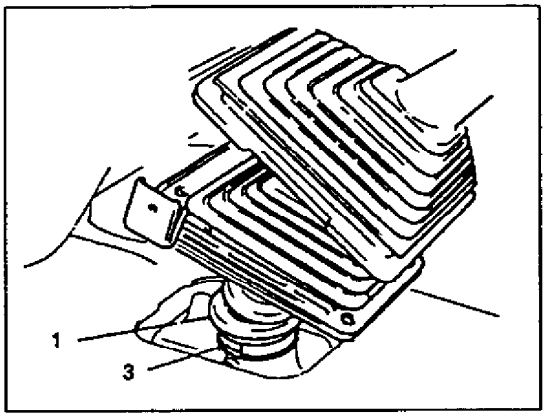


3) Check wear on pivot bolts (9 and 10) and replace them if necessary.
4) If the tools (9 and 10) are replaced apply a recommended sealant to the thread.

Thread sealant 99000-32020

Torque specifications:

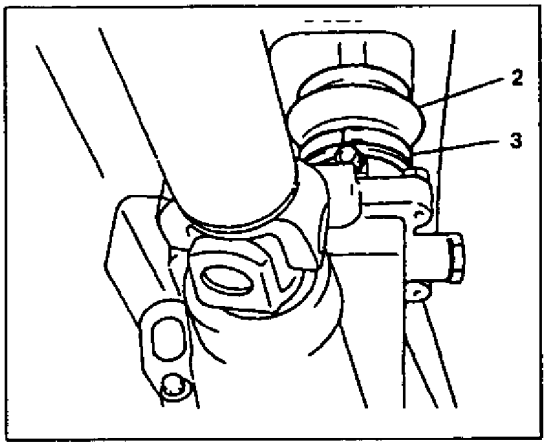
Bolts (9) 1.7 Kg-m (17 Nm).
Bolts (10) 2.3 Kg-m (23 Nm).

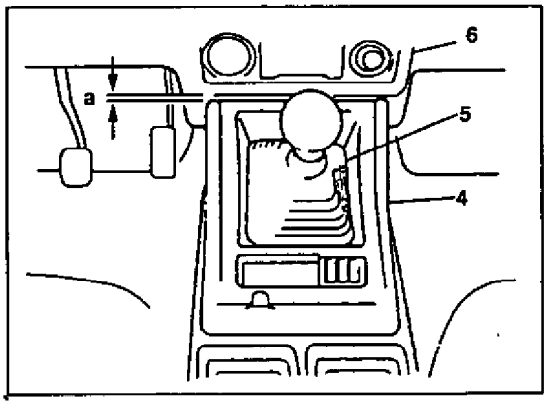


Installation

1) Apply 9900-25010 grease in areas of both levers.
2) Install dust covers (1) (transmission) and (2) (transfer case), with new clamps (3) and firmly tightened.
3) Install the rest of the components in the reverse order to disassembly.

Torque specifications for plate bolts:
0.6 Kg-m (6 Nm)





4) Install the console (4) ensuring that the cover (5) fits and that the console remains separate from the instrument panel (6).

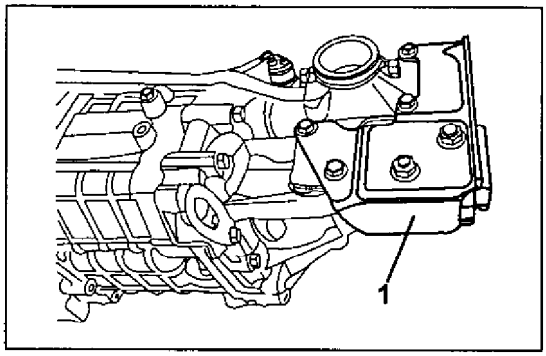
Clearance (a): 2 mm.

REMOVAL AND DISASSEMBLY OF TRANSMISSION AND TRANSFER CASE ASSEMBLIES.

Removal

In the cab

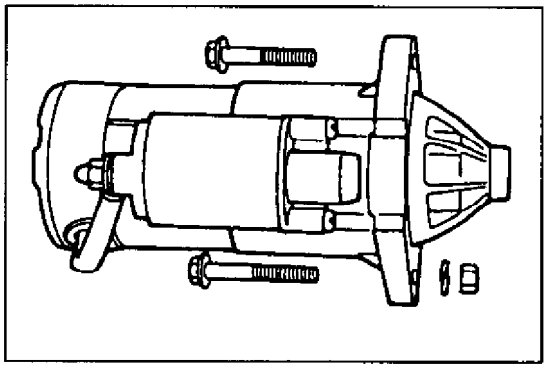
1) Remove gear shift lever and transfer case assemblies, please refer to section 7A-9 of this supplement.



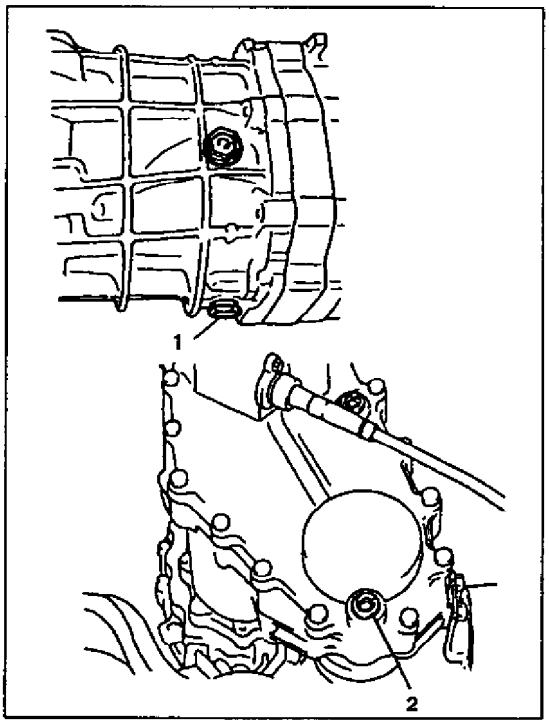
2) Remove damper (1) to facilitate extraction of assembly.

Engine compartment

1) Remove engine bonnet.
2) Remove battery.
3) Remove intercooler assembly, please refer to 6A1-4.
4) Unfasten engine traction pick-up electric connector.



5) Disconnect electricity supply from starter motor, remove attaching elements and extract starter motor.
6) Remove bolts attaching engine to upper part of transmission.

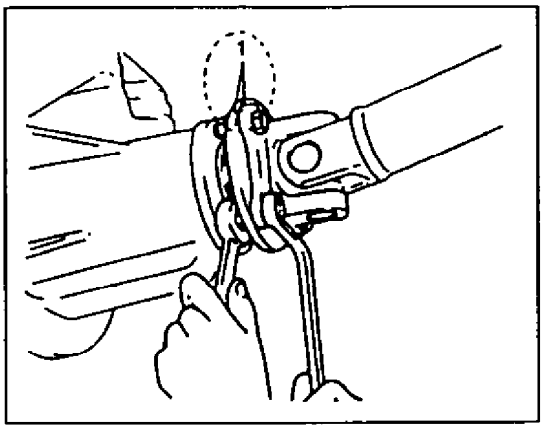


Lower part

1) Drain oil from transmission plug (1), and the plug (2) from the transfer case.
2) Clean oil from plug threads and apply sealant 9900-31110 to threads, fit plugs and tighten to specified torque.

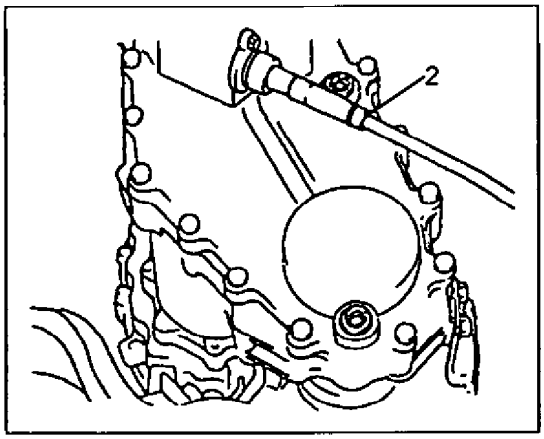
Torque specifications:

Plug (1): 4.5 Kg-m (45 Nm).
Plug (2): 2.3 Kg-m (23 Nm).

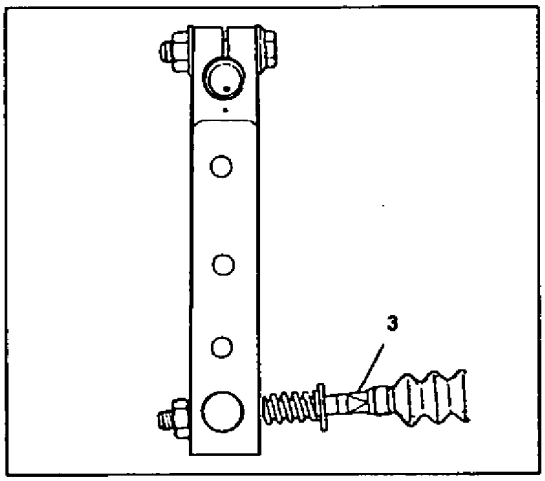


3) Before removing the propeller shafts, make reference marks (1) so as to be able to fit later in the same position.
4) Remove attaching elements and extract front and rear propeller shafts.
5) Remove lower engine protective/soundproofing plate.
6) Remove exhaust pipe sections no. 1 and no. 2.

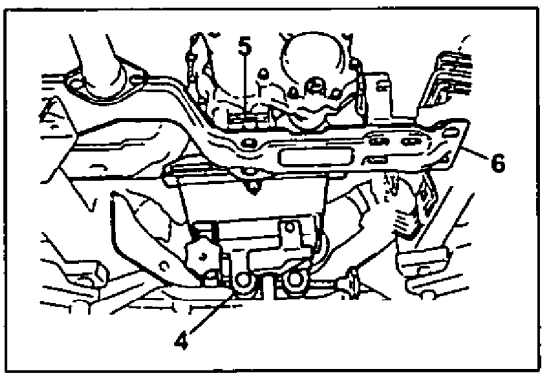
WARNING:
Never work on the exhaust system when it is hot.



7) Disconnect speedometer cable (2) and ground cable.



8) Disconnect clutch cable (3) from its connection to lever (clutch release).



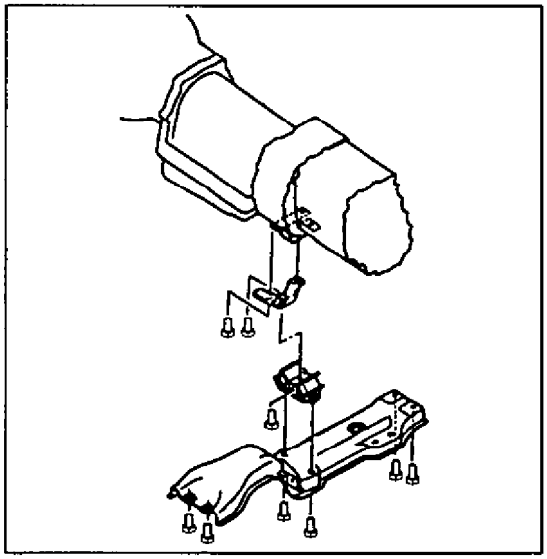
9) Place jack or lifting mechanism (4) in lower part of 5th gear housing (reinforced area), and if possible screw the plate to the housing's threaded wrist pins.
10) Tense lifting mechanism without forcing.
11) Remove bolts attaching elastic support (5) to crossmember (6).
12) Remove the four bolts attaching crossmember (6) to chassis and take out.
13) Lower transmission and transfer case assembly from rear part to a position from which it can be extracted.

14) Unfasten reverse gear electric connector and that of double traction, disconnect electric branch from flange and breather tubes at rear part of engine.
15) Remove the other bolts attaching engine to transmission and transfer case assembly.
16) Separate transmission and transfer case assemblies by 10 mm, approximately, from the engine and turn assembly approximately 80° to the left (in reverse direction to indicator needles). In this position extract the assembly taking care not to damage the diaphragm pressure plate.

NOTE:
If you consider it necessary to incline or lower the transmission and transfer case assemblies more to facilitate extraction, the front part of the engine can be raised using a hydraulic jack. This operation will lower the rear part of the transmission and transfer case assembly.

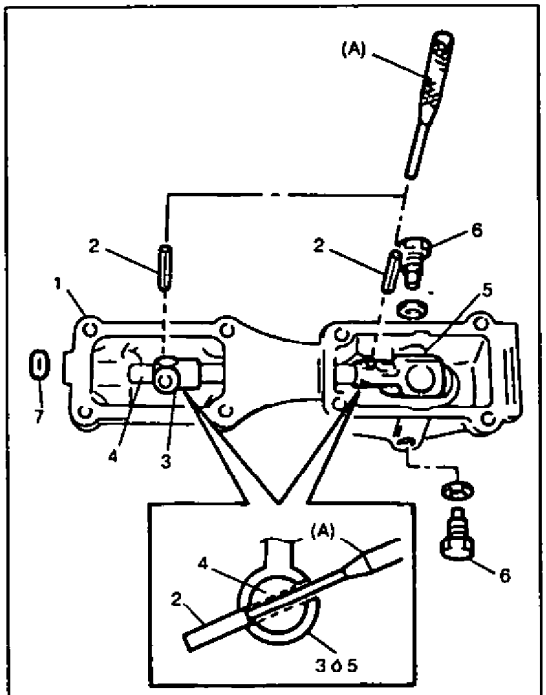
CAUTION:
This operation must be carried out with precaution, ensuring that no component is damaged or forced, and disconnecting any component that may be damaged.

WARNING:
Use of a jack or lifting mechanism is recommended for extracting transmission and transfer case assembly.



Installation
Installation is carried out in the reverse order to removal, following the recommendations given and applying the corresponding torque specifications.

- Apply a film of grease, SUZUKI SUPER GREASE, at the end and in the input shaft serration.
- Rock transmission and transfer case assembly, keeping the assembly turning 80° to the left approximately.
- Position the transmission and transfer case assembly in normal position (turned to the left) when they are 10 mm from complete attachment.
- Fasten cables with clamps and firmly fasten to electric connectors.
- Replace elastic support from transmission and transfer case if any cracks or distortions are observed.
- Adjust clutch cable free play according to 7C-2, CLUTCH.
- Fill with oil to level indicated in OB, MAINTENANCE AND LUBRICATION.
- Check functioning and for leaks.



1. Gear lever case
2. Elastic cotter pin
3. Gear shift lever
4. Gear shaft
5. Gear shift arm
6. Lever locating screw
7. Cap

GENERAL OVERHAUL AND REPAIR

GEAR SHIFT LEVER CASE

Disassembly

1) Remove case plate.
2) Fasten case with soft vice grip and remove locating pivots of lever.

NOTE:
Use aluminium plates between vice grips and case to protect case.

3) Use a special tool to insert cotter pin in sift arm until the position in figure is obtained.

CAUTION:
When inserting cotter pin, be careful not to damage gear shift lever case.

Special tool
(A): 09922-85811

4) In the same way, insert cotter pin in gear shift lever case to position in figure.

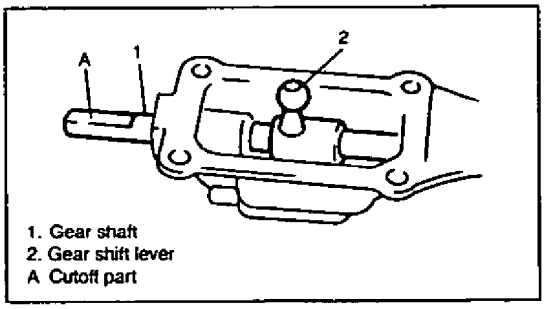
CAUTION:
When inserting cotter pin, be careful not to damage gear shift lever case.

Special tool
(A): 09922-85811

5) Remove housing cap.
6) Remove selector shaft and dismount gear shift lever.

Inspection and reassembly

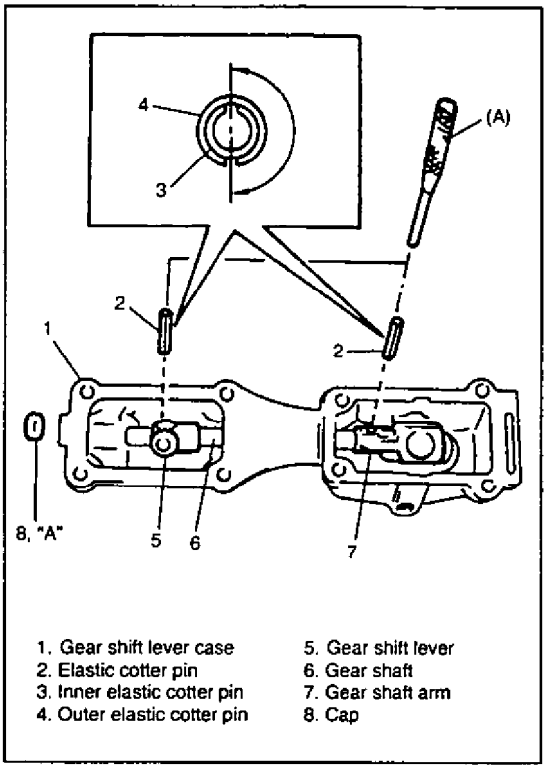
1) Clean, inspect and replace parts if necessary.
   Study point outlined below and correct necessary points using a reamer, whetstone or similar, wash thoroughly and install again.
   The point to inspect is the slight slipping of the gear shaft in case.



1. Gear shaft
2. Gear shift lever
A Cutoff part

2) Install selector shaft as in figure, ensuring that lower parts are facing in the right direction.

NOTE:
- **The cutaway in the selector shaft should face downwards when installed.**
- **The gear shift lever should be installed simultaneously.**



1. Gear shift lever case
2. Elastic cotter pin
3. Inner elastic cotter pin
4. Outer elastic cotter pin
5. Gear shift lever
6. Gear shaft
7. Gear shaft arm
8. Cap

3) Insert cotter pin in finger selector and shift arm.

NOTE: To insert, position slots in the opposite direction, at 180° ± 30°.

Special tool
(A): 09925-78210

4) Apply sealant to new case cap and insert it in housing.

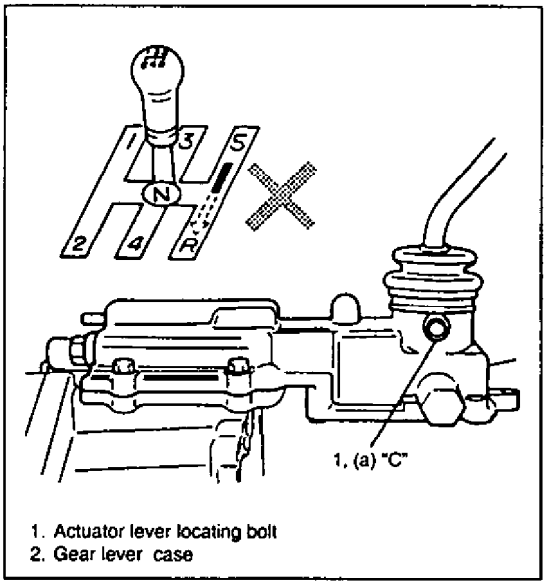
"A": Sealant 99000-25010

5) Clean mating surfaces of gear shift lever case and apply sealant uniformly on connecting surface.

"A": Sealant 99000-31110

6) Tighten to specified torque.

Torque specifications
(b): 0.6 Kg-m (6 Nm)



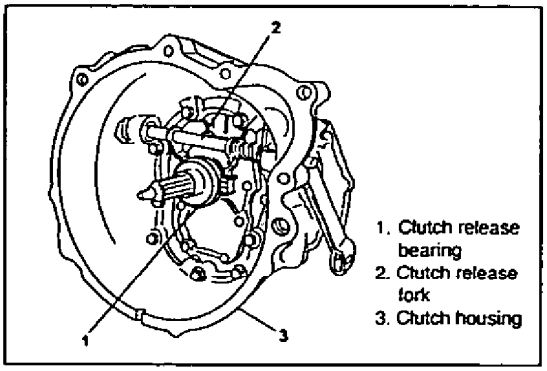
1. Actuator lever locating bolt
2. Gear lever case

7) Install gear shift lever case in transmission without using sealant, so as to inspect functioning.
8) Install gear shift lever and ensure that it moves gently as gear model in figure.

NOTE:
- **Apply sealant to pivot bolts on gear shift lever when you tighten them again.**
- **Ensure that sealant is applied on mating surfaces of gear shift lever case in final installation.**

"C": Sealant 99000-32020

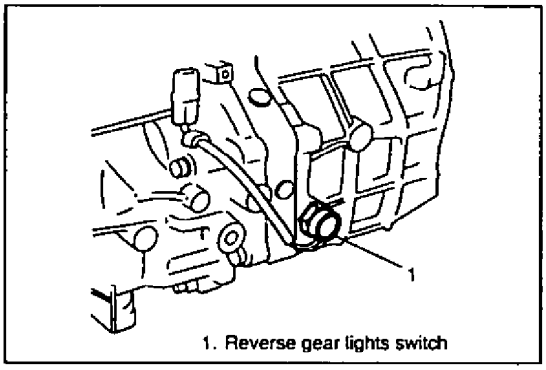
Torque specifications
(a): 2.3 Kg-m (23 Nm)



1. Clutch release bearing
2. Clutch release fork
3. Clutch housing

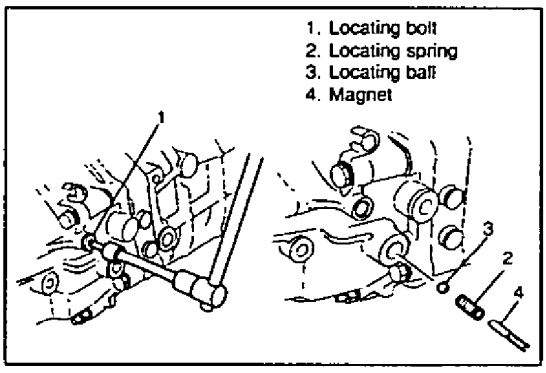
DISASSEMBLY

1) Remove clutch bearing, fork, clutch shaft and clutch housing, please refer to 7C-3.



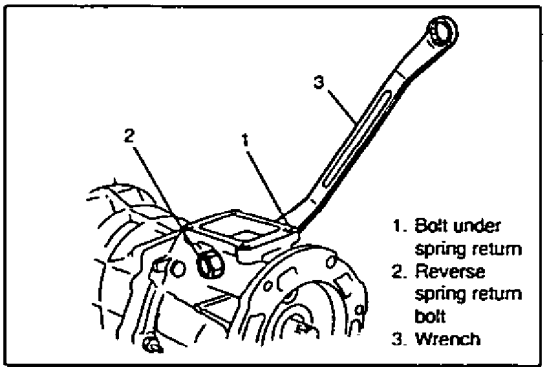
1. Reverse gear lights switch

2) Remove reverse gear light switch.



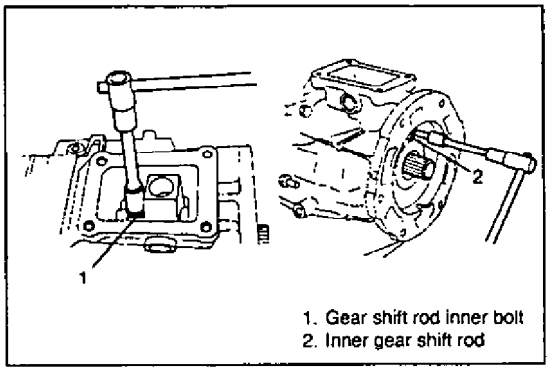
1. Locating bolt
2. Locating spring
3. Locating ball
4. Magnet

3) Remove locating spring bolt and ball as in figure.



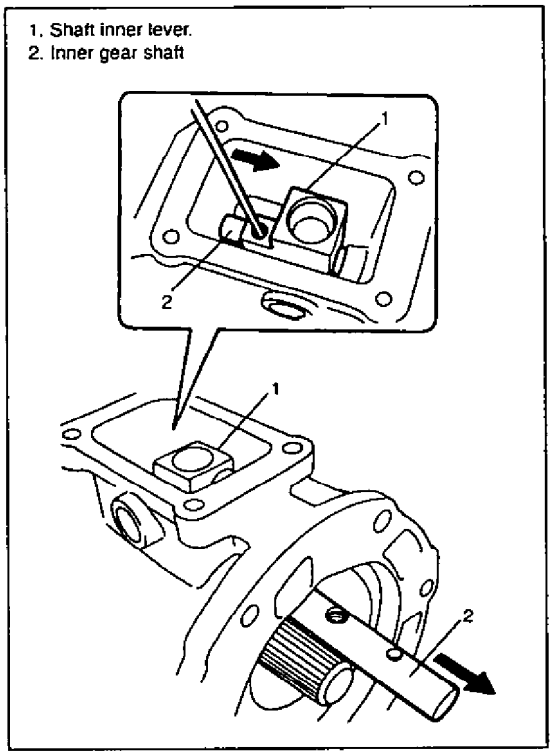
1. Bolt under spring return
2. Reverse spring return bolt
3. Wrench

4) Remove bolts/return spring.



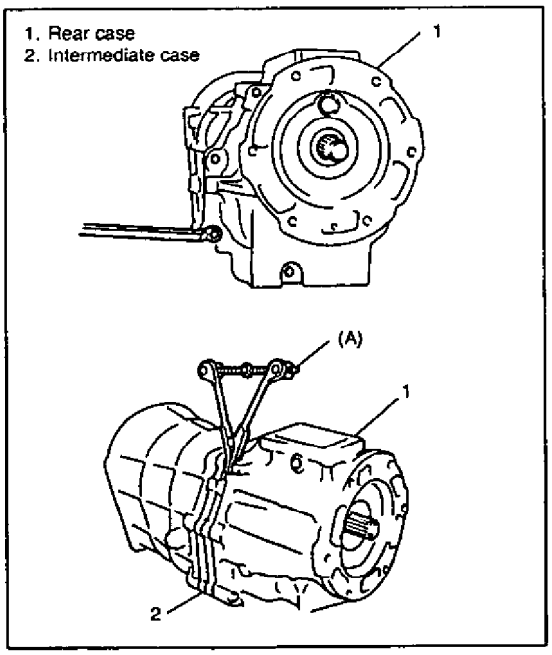
1. Gear shift rod inner bolt
2. Inner gear shift rod

5) Remove inner gear shaft cap.



1. Shaft inner lever.
2. Inner gear shaft

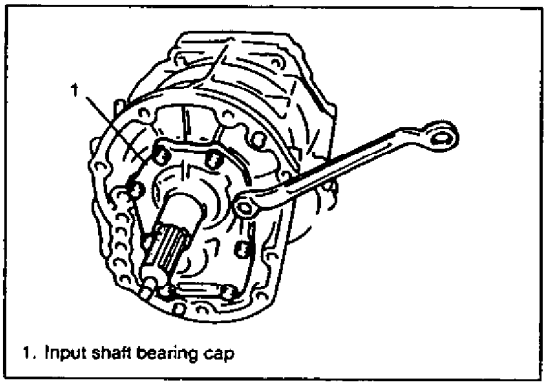
6) Use bolt hole to pull inner gear shaft and remove selector shaft inner lever.



1. Rear case
2. Intermediate case

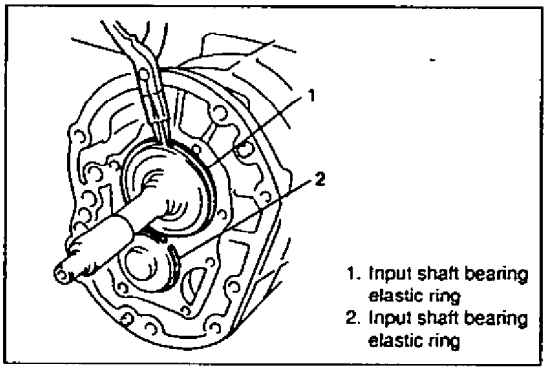
7) After removing bolts/nuts from transmission, unfasten rear case from intermediate case.

(A): 09912-34510



1. Input shaft bearing cap

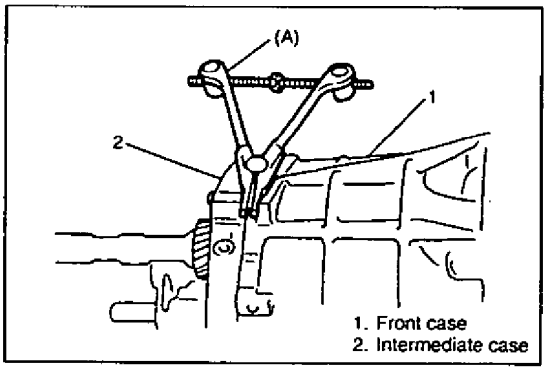
8) Remove thrust bearing cover and seal.



1. Input shaft bearing elastic ring
2. Input shaft bearing elastic ring

9) Remove elastic rings on input shaft bearing and front countershaft bearing.

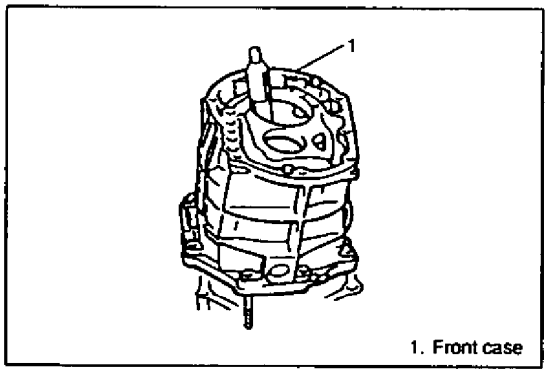
Special tool
(A): 09900-06107



1. Front case
2. Intermediate case

10) Use a special tool to separate front case and intermediate case in the transmission.

Special tool
(A): 09912-34510

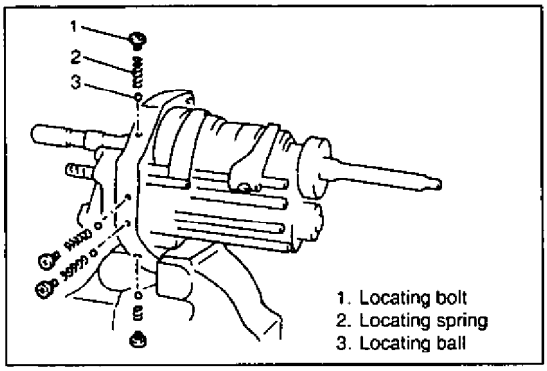


1. Front case

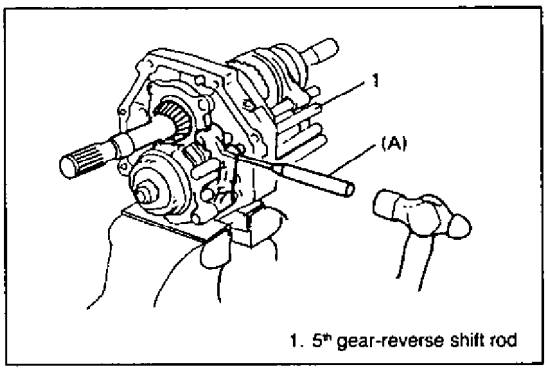
11) Place transmission on test bench and remove front case.

NOTE:
To remove front case of transmission, incline it as shown in figure.

12) Fix intermediate case securely in a vice.

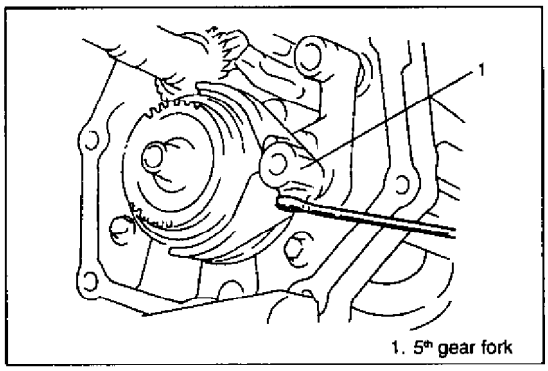


13) Remove bolts, locating springs and ball as in figure.

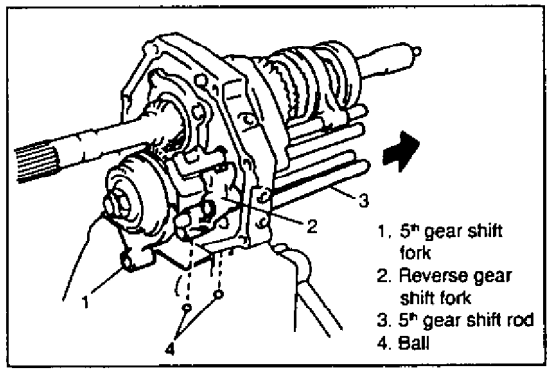


14) Use a special tool to remove cotter pin and remove gear shift shaft for 5th - reverse gear.

Special tool
(A): 09922-85811

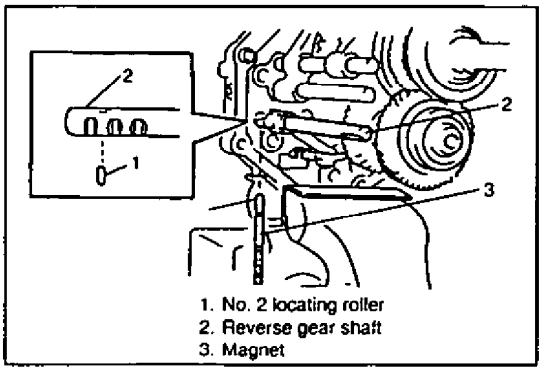


15) Remove bolt from 5th gear fork.



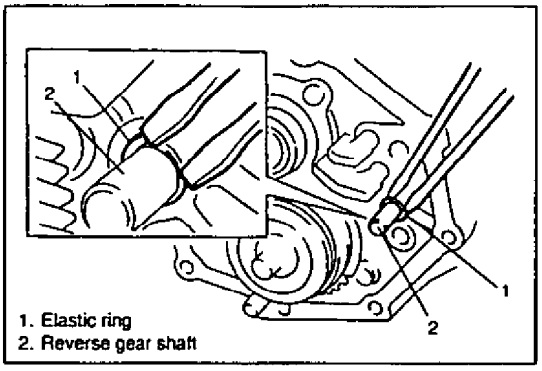
16) Remove 5th gear fork, 5th gear shift shaft and reverse gear fork.

NOTE:
When pulling on 5th gear shaft, position your hand so that it can catch balls that fall from reverse gear fork and intermediate plate.



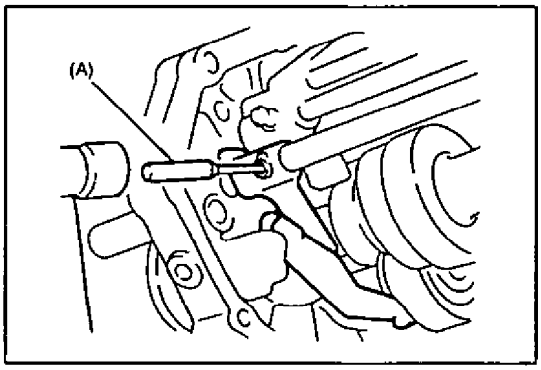
1. No. 2 locating roller
2. Reverse gear shaft
3. Magnet

17) Remove roller no. 2 from reverse gear shaft using a magnet.



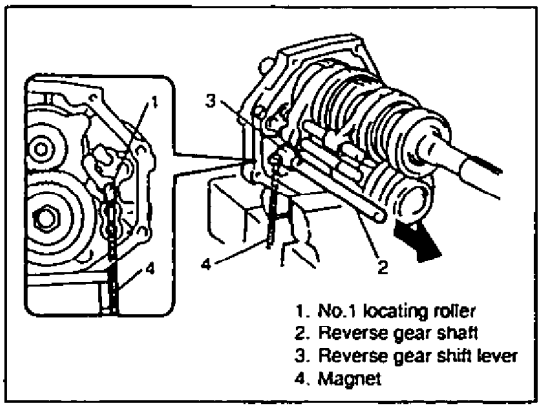
1. Elastic ring
2. Reverse gear shaft

18) Remove circlip from reverse gear shift shaft as shown in figure.



19) Remove cotter pin from part linking reverse gear shift.

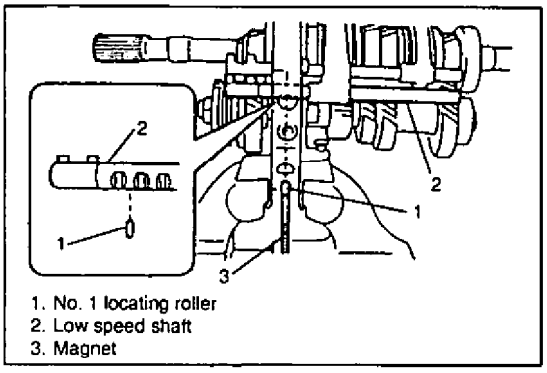
Special tool
(A): 09922-85811



1. No.1 locating roller
2. Reverse gear shaft
3. Reverse gear shift lever
4. Magnet

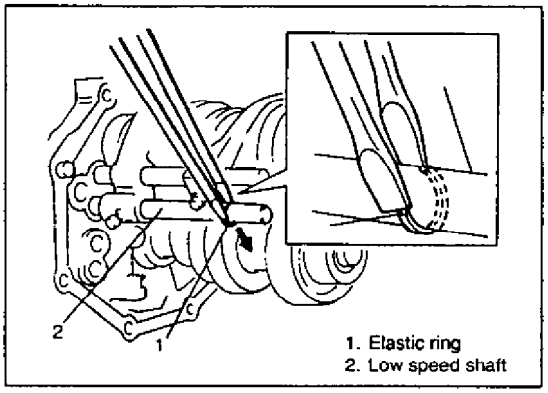
20) Remove reverse gear shaft, roller no. 1 and reverse gear lever.

NOTE:
When pulling the gear shift shaft, secure roller no. 1 with a magnet to prevent it from falling.



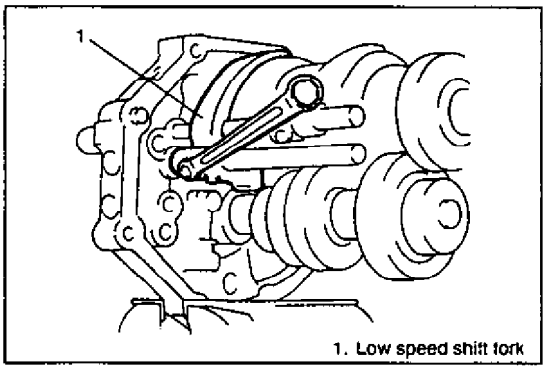
1. No. 1 locating roller
2. Low speed shaft
3. Magnet

21) Disassemble component linking reverse gear by removing E ring.
22) Remove roller No. 2 in low gear shaft gear by using a magnet.



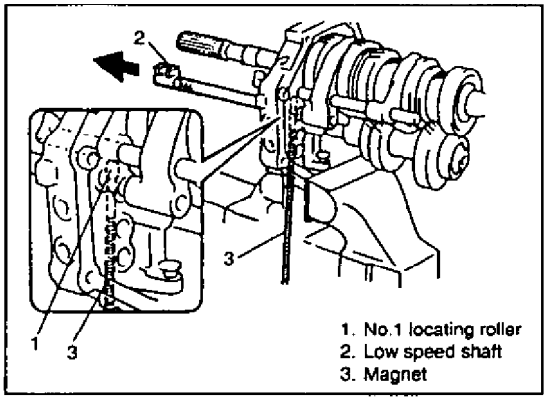
1. Elastic ring
2. Low speed shaft

23) Remove circlip from low gear shaft as in figure.



1. Low speed shift fork

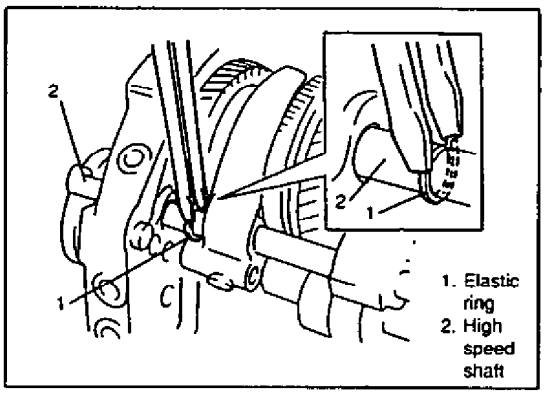
24) Remove bolt from low gear fork.



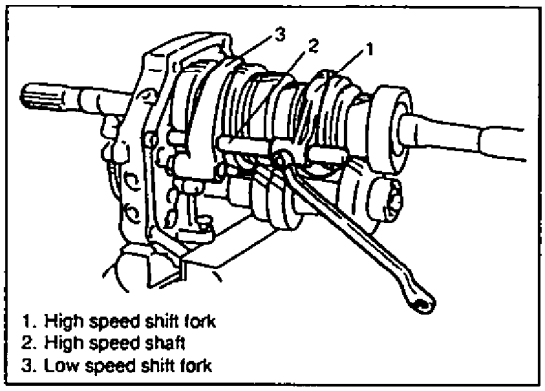
1. No.1 locating roller
2. Low speed shaft
3. Magnet

25) Remove low gear shaft and locating roller No. 1.

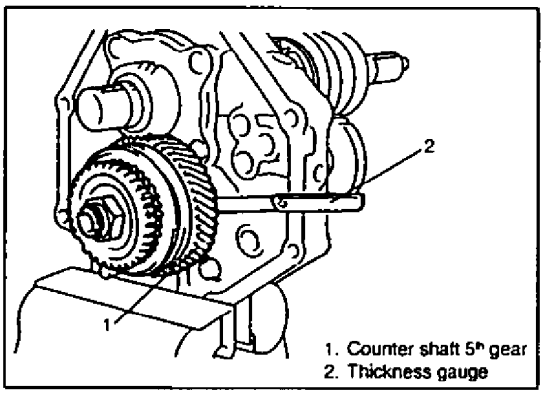
NOTE:
When pulling gear shift shaft, secure roller No. 1 with a magnet to prevent it falling.



26) Remove high speed gear shaft circlip as in figure.

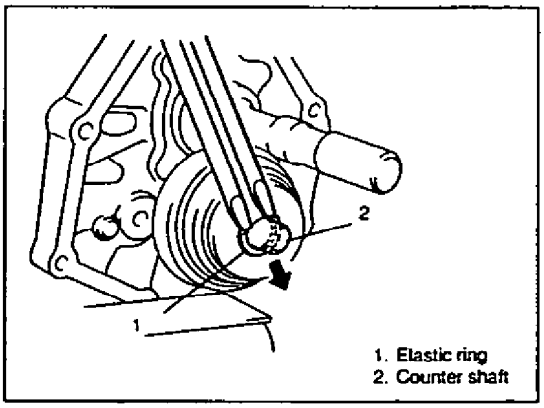


27) Remove high speed gear fork bolt.
28) Remove high speed gear shaft, high speed gear fork and low speed gear fork.

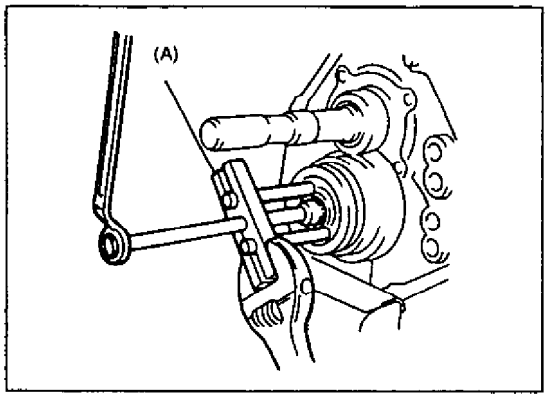


29) Check thrust clearance of counter shaft 5th gear using a thickness gauge.

Normal: 0.10-0.30 mm (0.0040-0.0118 ins.)



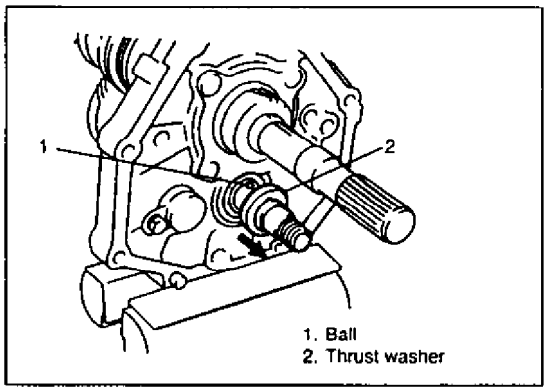
30) Remove countershaft circlip from counter shaft as shown in figure.



31) Remove 5th gear synchronizer claw using the special tool.

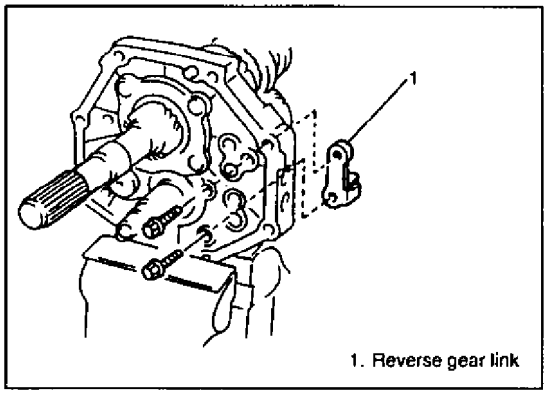
Special tool
(A): 09944-84510

32) Remove countershaft synchronizer ring, 5th gear bearing and needle bearing.



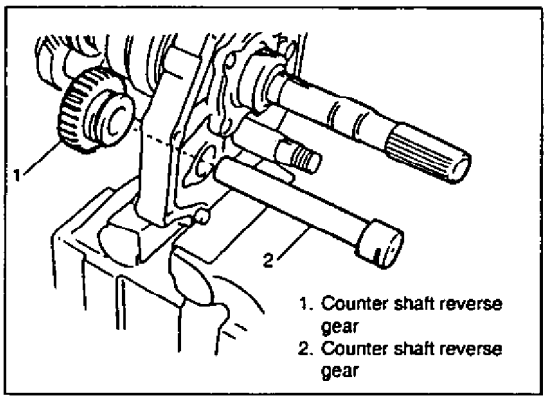
1. Ball
2. Thrust washer

33) Remove thrust washer and ball.



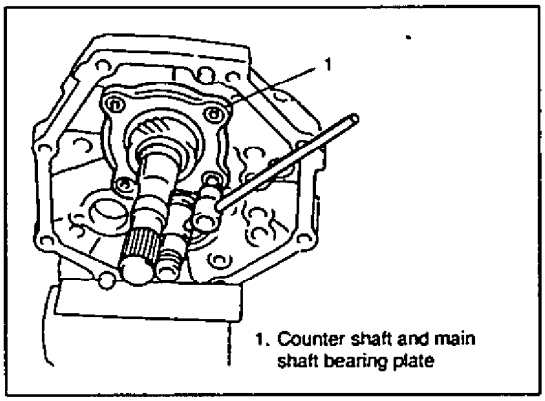
1. Reverse gear link

34) Remove reverse gear lever from counter shaft case.

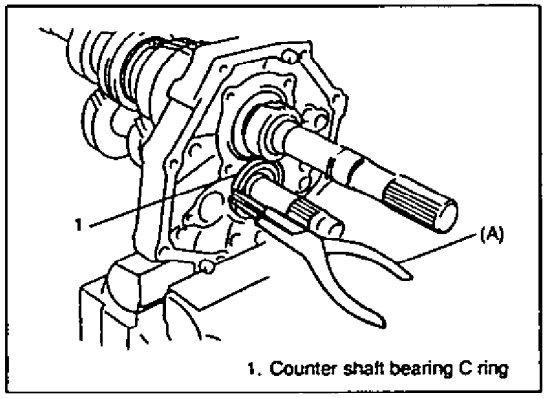


1. Counter shaft reverse gear
2. Counter shaft reverse gear

35) Remove counter shaft and reverse gear.

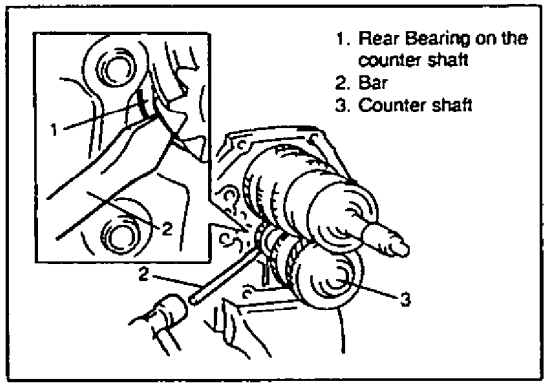


36) Remove main shaft and counter shaft bearing plates.



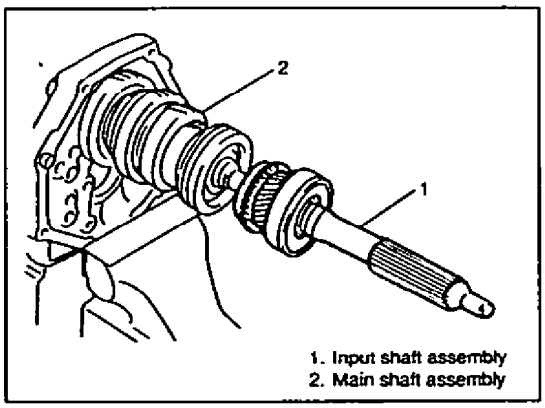
37) Remove elastic ring from counter shaft rear bearing.

Special tool
(A): 09900-06107



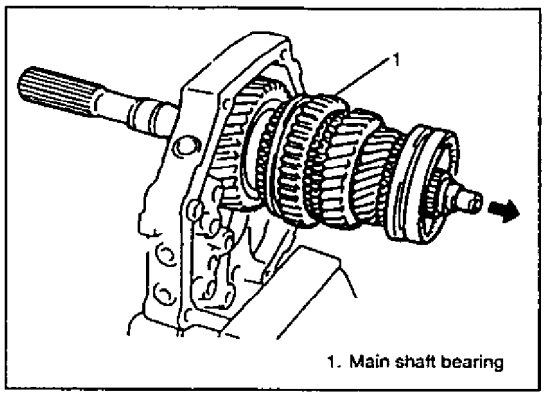
38) Use a hammer and bar to remove counter shaft and its rear bearing.

NOTE:
2 people are necessary for removing these parts. One should hold the countershaft and the other remove the bearing with a hammer and bar.



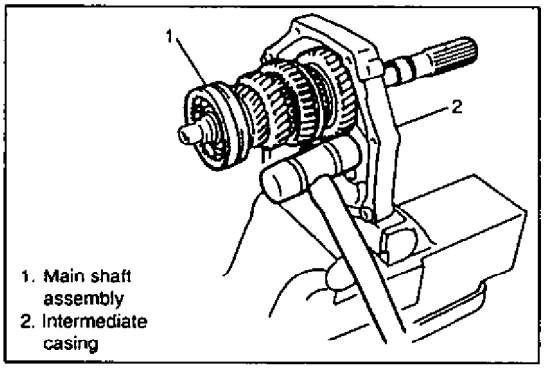
39) Remove input shaft assembly and synchronizer ring of main shaft.

NOTE:
When removing the input shaft be careful not to drop the needle bearing.



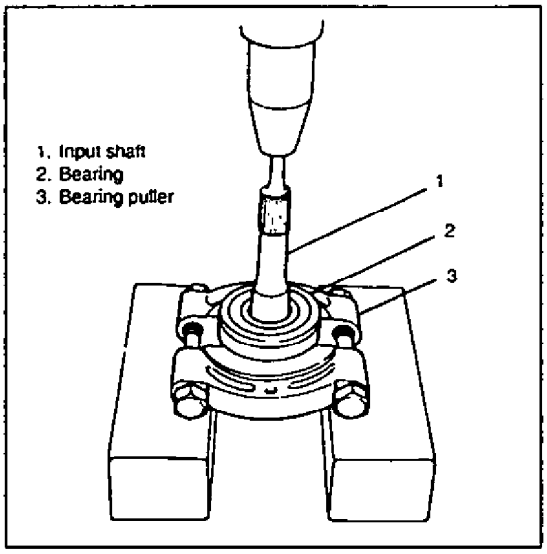
1. Main shaft bearing

40) Remove elastic ring from main shaft and take out main shaft.



1. Main shaft assembly
2. Intermediate casing

NOTE:
If the intermediate case is firmly fixed with bearing, gently hit the front of the countershaft case with a hammer, this will enable the main shaft assembly to come out forwards.

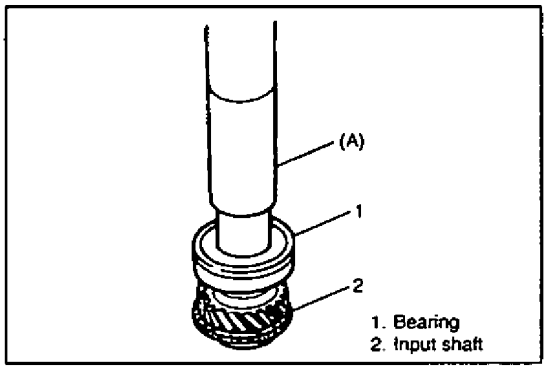


INPUT SHAFT ASSEMBLY

Disassembly

Remove elastic ring from input shaft and take off bearing with a puller and a press.

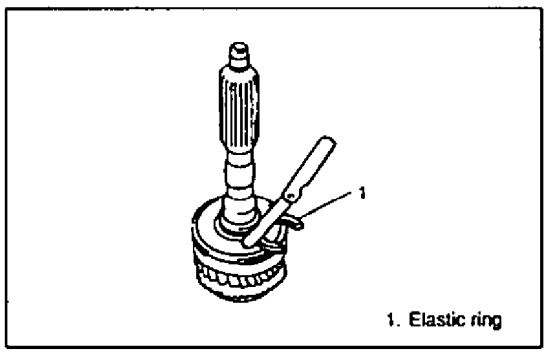
NOTE:
Do not wash the sealed bearing. Replace it with a new one if necessary.



Assembly and inspection

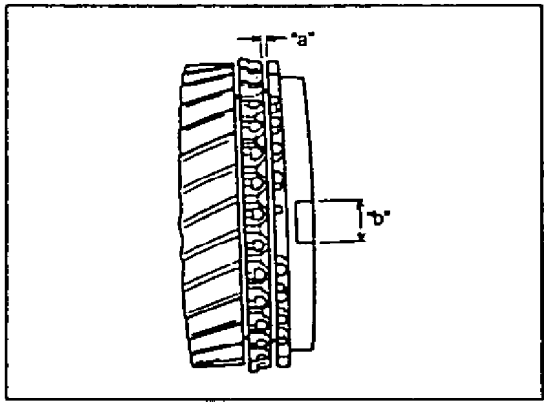
1) Position the bearing in such a way that the slot for the elastic ring is forward facing and can be pressed into position using a special tool and a press.

Special tool
(A): 09940-51710



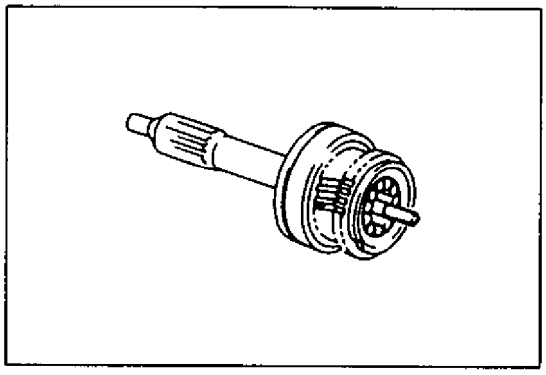
2) Select an elastic ring that sets the bearing's thrust clearance at 0.1 mm (0.0039 ins.) or less.

ID mark	Elastic ring thizkness	ID mark	Elastic ring thizkness
0	2.05 - 2.10 mm (0.807 - 0.0826 In.)	3	2.20 - 2.25 (0.0867 - 0.0885 in.)
1	2.10 - 2.15 mm (0.0827 - 0.0846 In.)	4	2.25 - 2.30 (0.0886 - 0.0905 in.)
2	2.15 - 2.20 mm (0.0847 - 0.0866 In.)	5	2.30 - 2.35 (0.0906 - 0.0925 in.)



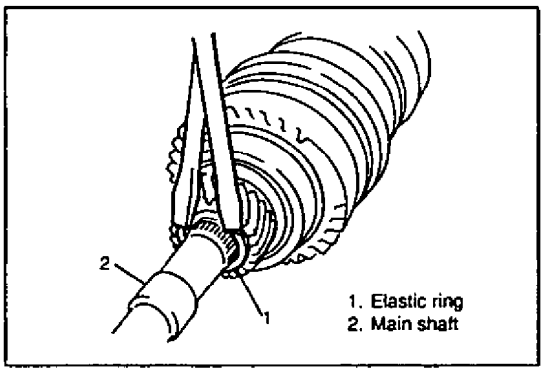
3) Check clearance "a" between synchronizer ring and gear, width "b" of the keyway in the synchronizer ring and that of every chamfered gear tooth and synchronizer ring and renew if necessary. Inspect the gear teeth too.

Clearance "a"	Normal: 1.0-2.0 mm (0.039-0.078 in.)
	Servicing limit: 0.8 mm (0.032 in.)
Slot width "b"	Normal 10.0-10.2 mm (0.394-0.401 In.)
	Servicing limit: 10.45 mm (0.411 in.)



4) Apply grease to needle bearing and install in input shaft.

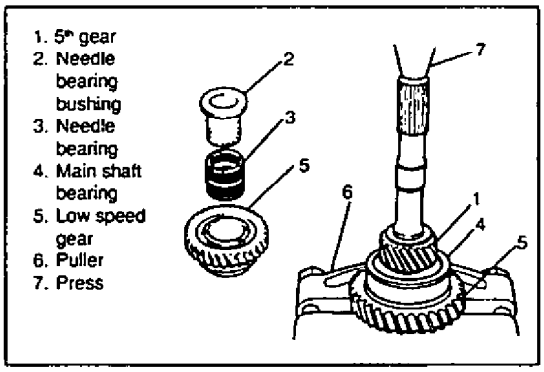
Grease: 99000-25010



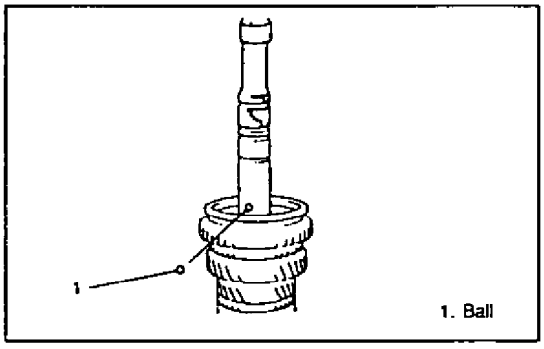
MAIN SHAFT ASSEMBLY

Disassembly

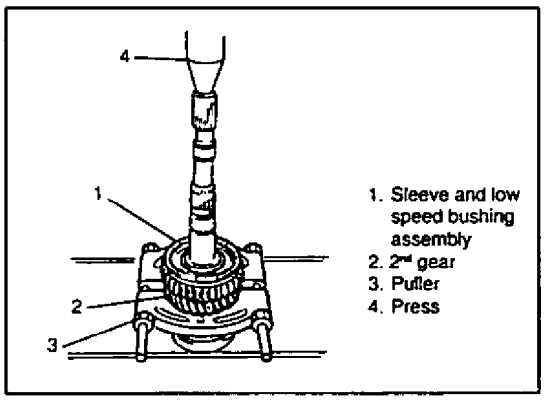
1) Remove the elastic ring from the main shaft as shown in figure.



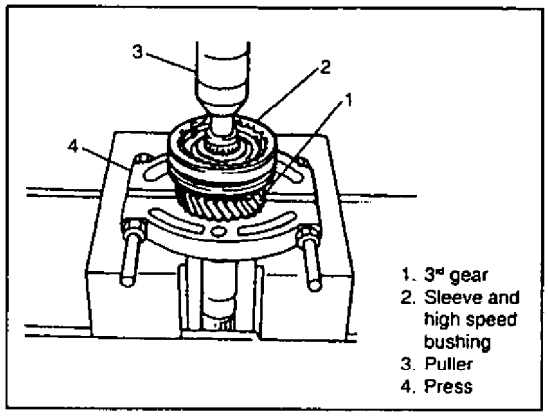
2) Extract the 5th gear, needle bushing, needle bearing, main shaft bearing and low speed gear with a puller and a press.



3) Remove the synchronizer ring and the ball.

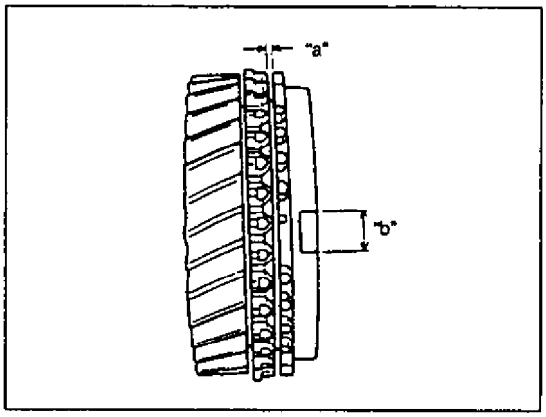


4) Extract synchronizer ring from low speed sleeve/bushing, needle bearing and main shaft 2nd gear.
5) Take out springs/keys from synchronizer and low speed bushing sleeve.



1. 3rd gear
2. Sleeve and high speed bushing
3. Puller
4. Press

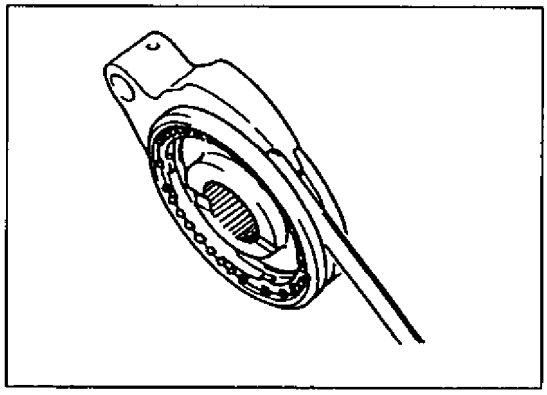
6) Remove elastic ring from front part of main shaft and extract 3rd gear, needle bearing, synchronizer key and high speed sleeve/bushing.



Inspection

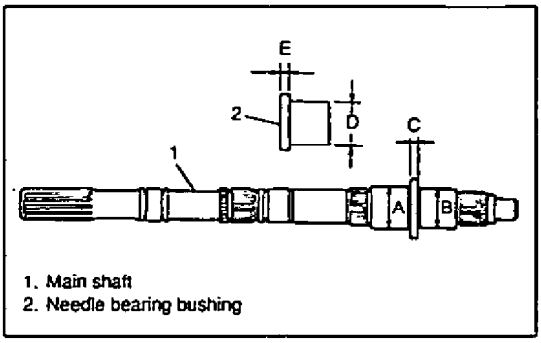
Check clearance "a" between synchronizer key and gear, width "b" of keyway in synchronizer ring and each chamfered tooth on the gear and the synchronizer key and renew if necessary. Also inspect gear tooth.

Clearance "a"	**Normal 1.0-2.0 mm (0.039-0.078 in.)** **Servicing limit: 0.8 mm (0.032 in.)**
Slot width "b"	**1st., 2nd** **Normal 12.2-12.4 mm (0.481-0.488 in.)** **Servicing limit: 12.65 mm (0.498 in.)**
	3rd. **Normal 10.0-10.2 mm (0.394-0.401 in.)** **Servicing limit: 10.45 mm (0.411 in.)**



- Check clearance between fork and sleeve. If clearance exceeds the limit, replace fork and sleeve.

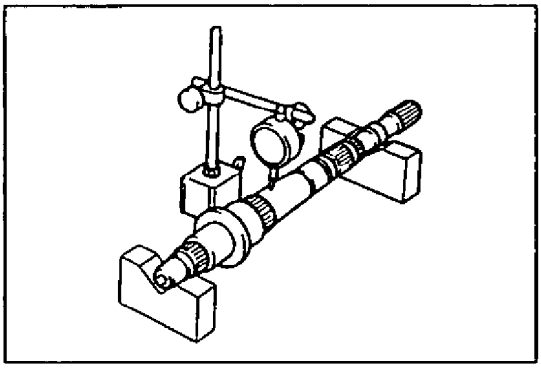
  Normal: 0.15-0.35 mm (0.006-0.013 in.)
  Limit :1.0 mm (0.039 in.)



1. Main shaft
2. Needle bearing bushing

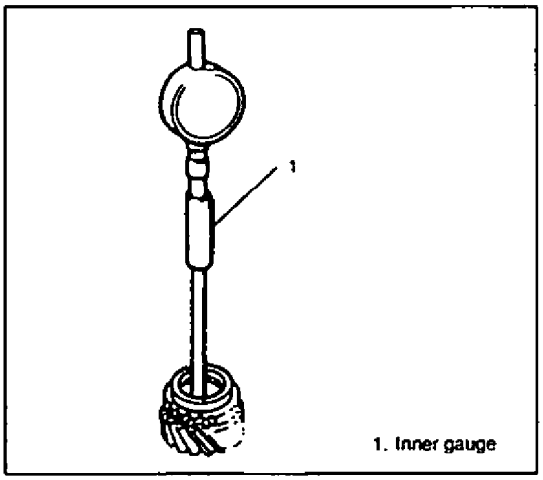
- Check needle bearing bushing of main shaft and thickness of main shaft bushing flanges as shown in figure. If value measured is beyond that specified, then replace part.

Measured Section	Normal
A	37.984 - 38.000 mm (1.4955 - 1.4960 in.)
B	34.984 - 35.000 mm (1.3774 - 1.3779 in.)
C	4.80 - 5.20 mm (0.1840 - 0.2047 in.)
D	38.985 - 39,000 mm (1.5348 - 1.5354 in.)
E	3.955 - 4.195 mm (0.1558 - 0.1651 in.)



- Use two V blocks and a dial indicator and measure oval curve. If oval curve is above the limit below replace the main shaft.

Oval curve limit: 0.06 mm (0.0023 in.)

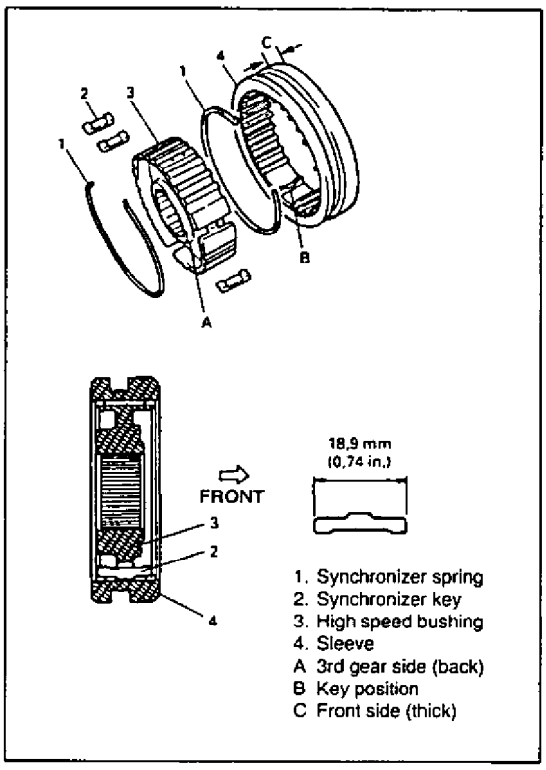


1. Inner gauge

- Use a dial indicator and an internal gauge to check internal diameter of each gear.
  If diameter exceeds specified limit, replace.

	Normal
1st	44.015-44.040 mm (1.7329-1.7338 in.)
2nd	
3rd	

- Inspect chamfered part of every sleeve for damage or excessive wear and replace if necessary.
- Inspect each sychronizer key and spring and replace if necessary.
- Inspect serrated parts and replace parts if excessively worn.

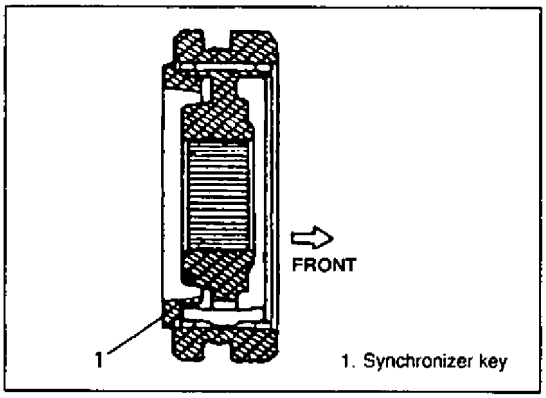


Assembly and inspection

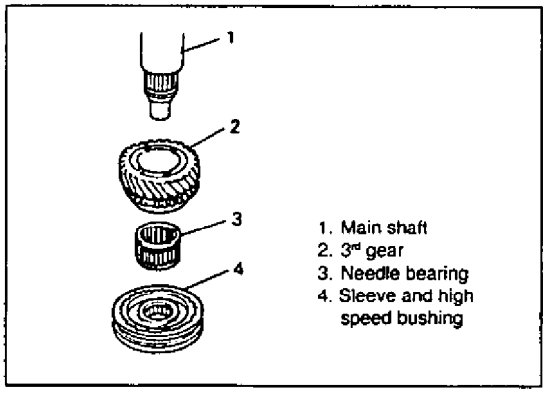
NOTE:

- **Before installing, wash each part and apply specified gear oil to sliding parts of bearings and gears.**
- **Use new elastic rings on shaft to be installed, do not use old ones again.**

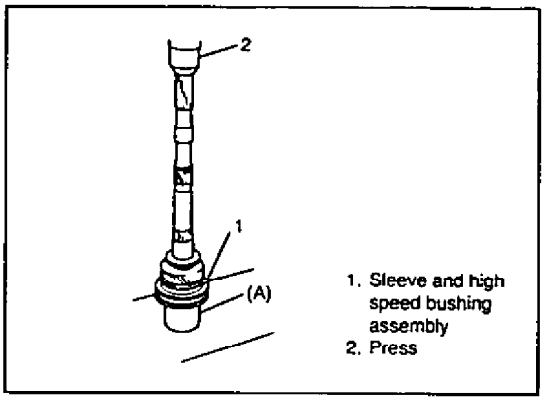
1) Fit high speed sleeve and bushing, fix the 3 synchronizer keys and adjust synchronizer springs as shown in figure.
None of the sleeves or keys have to be installed in a specific direction.



2) Install synchronizer ring, lining up the key slots with the keys.



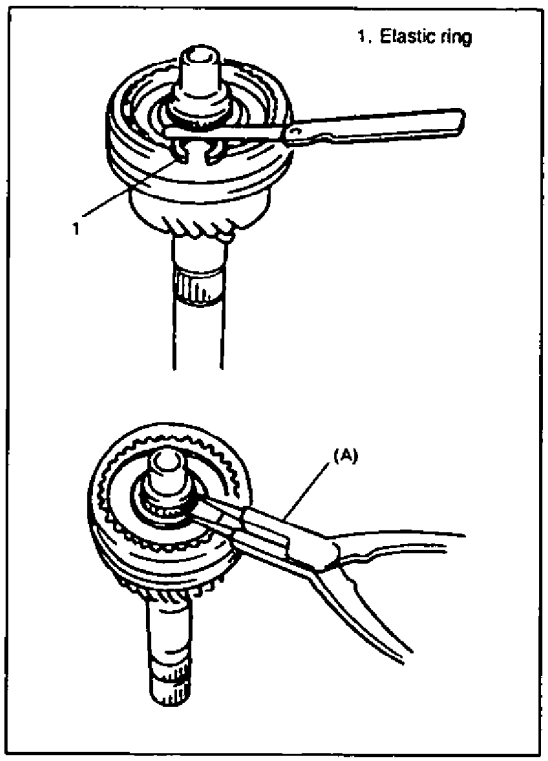
3) Place the 3rd gear, needle bearing and high speed sleeve and bushing assembly with the synchronizer ring in the main shaft.



1. Sleeve and high speed bushing assembly
2. Press

4) Using a special tool and a vice press the high speed sleeve and bushing into position.

Special tool
(A): 09940-53111

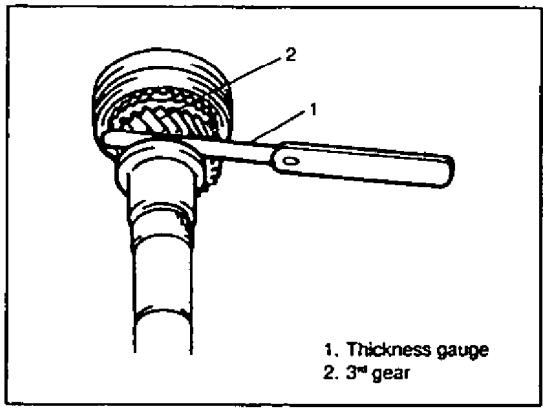


5) Select elastic ring to ensure that bushing thrust clearance is at least 0.1 mm. (0.0039) and install.

ID mark	Elastic ring thizknezz	ID mark	Elastic ring thizknezz
C -1	1.75 - 1.80 mm (0.0689 - 0.0708 in.)	E -1	1.95 - 2.00 mm (0.0768 - 0.0787 in.)
D	1.80 - 1.85 mm (0.0709 - 0.0728 in.)	F	2.00 - 2.05 mm (0.0788 - 0.0807 in.)
D - 1	1.85 - 1.90 mm (0.0729 - 0.0748 in.)	F - 1	2.05 - 2.10 mm (0.0808 - 0.0826 in.)
E	1.90 - 1.95 mm (0.0749 - 0.0767 in.)		

Special tool
(A): 09900-01607

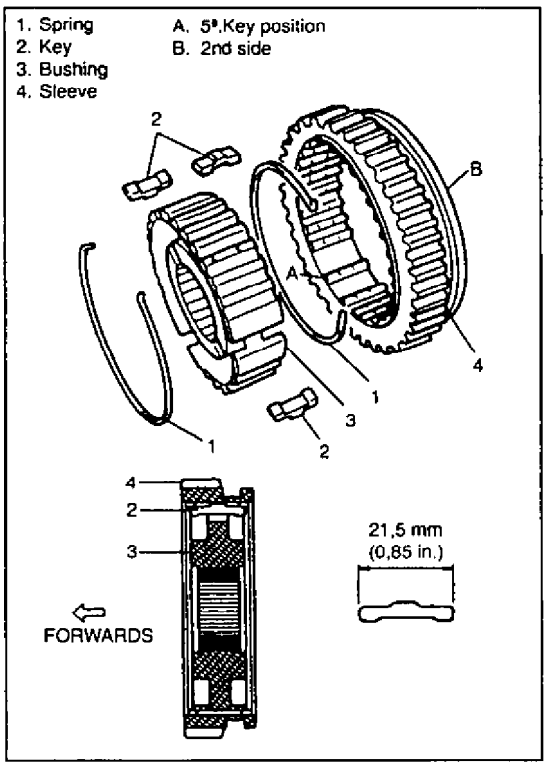
6) After installing the elastic ring, check that third gear turns slightly.



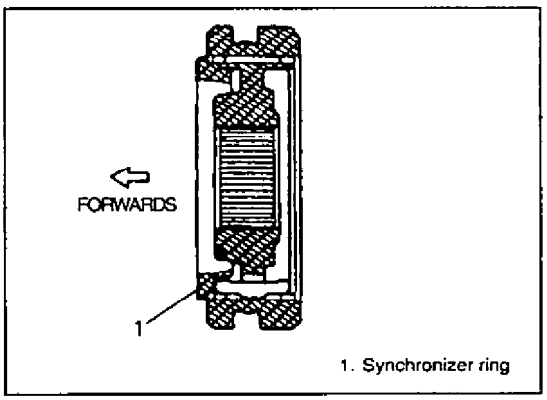
1. Thickness gauge
2. 3rd gear

7) Inspect 3rd gear thrust clearance using a thickness gauge. If the clearance is outside specified limit replace it.

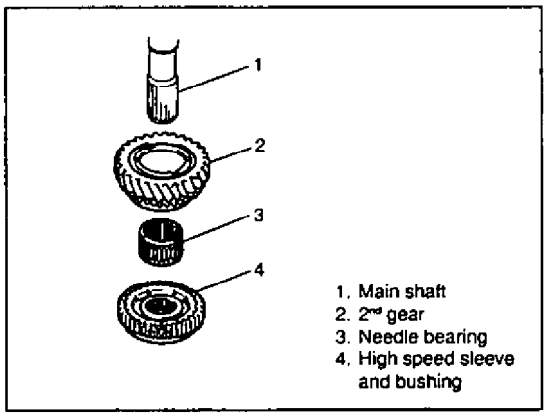
Normal: 0.10-0.25 mm (0.004-0.009 in.)



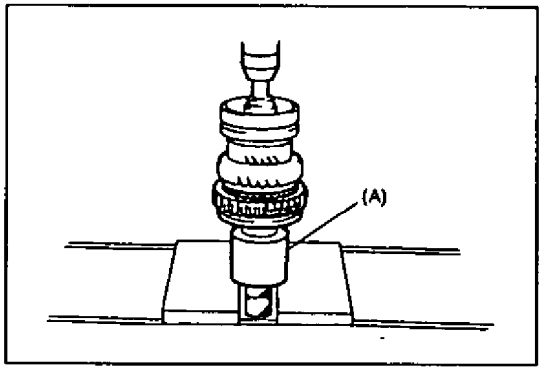
8) Fit sleeve and three synchronizer keys in low speed bushing and install synchronizer springs. Please refer to figure for correct installation direction of sleeve and springs.



9) Install synchronizer ring, lining up slots with keys.

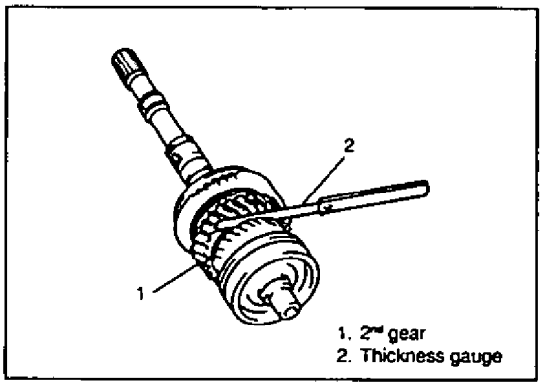


10) Install 2nd gear, needle bearing and low speed sleeve and bushing assembly together with the synchronizer ring.



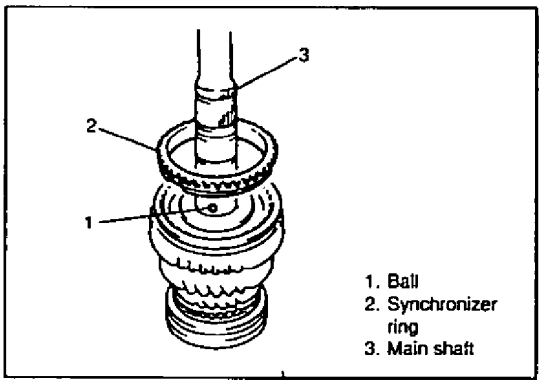
11) Press low speed sleeve and bushing assembly into position using special tool and press.

Special tool
(A): 09940-53111

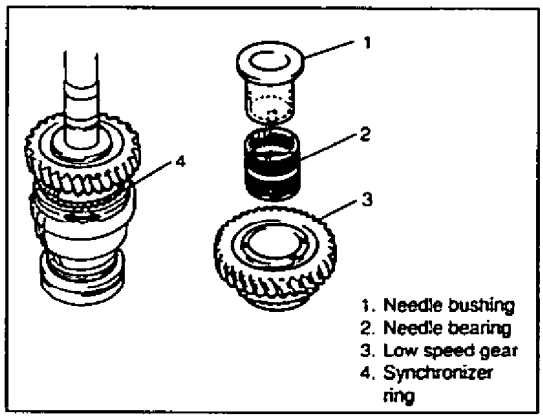


12) Check 2nd gear thrust clearance using a thickness gauge. If the clearance is outside specified limit, press into position again or replace defective part.

Normal: 0.10-0.25 mm (0.004-0.009 in.)

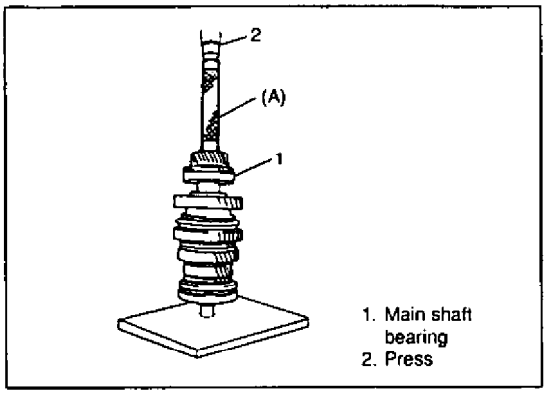


13) Apply grease to ball and place it in main shaft casing.
14) Install synchronizer ring.



15) Install needle bearing, low speed gear and main shaft needle bearing.

NOTE:
- **Check that needle bushing cut and ball are intermeshed.**
- **Following installation check that synchronizer ring moves in same direction as its circumference.**

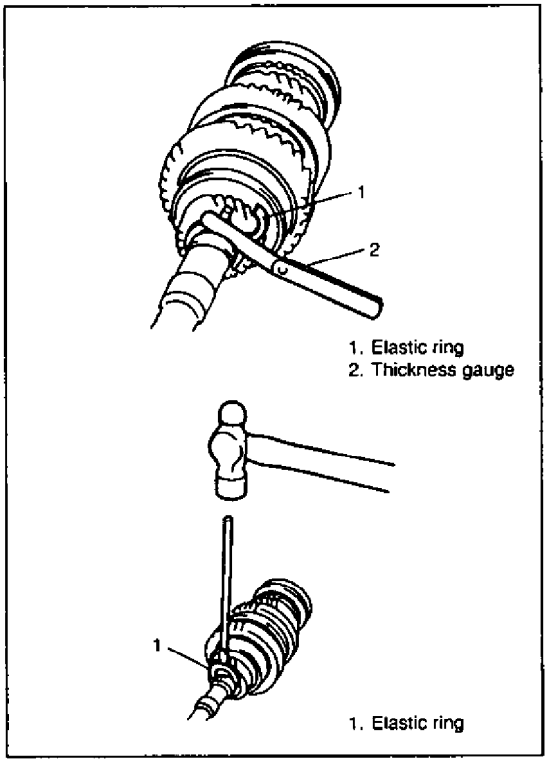


1. Main shaft bearing
2. Press

16) With special tool and press force main shaft bearing and 5th gear into place.

NOTE:
Move bearing so that elastic ring slot faces backwards.

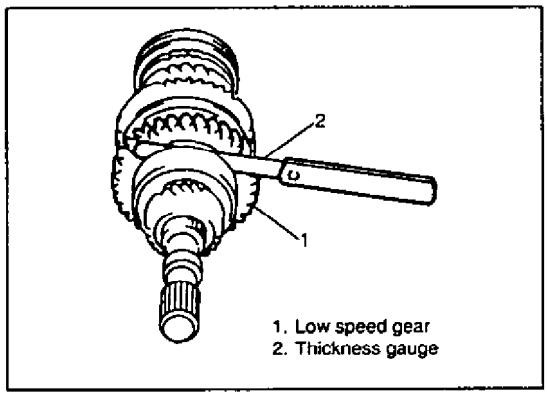
Special tool
(A): 09940-51710 o 09925-18010



1. Elastic ring
2. Thickness gauge
1. Elastic ring

17) Select elastic ring so that thrust clearance is 0.1 mm (0.039 in) or less and install.

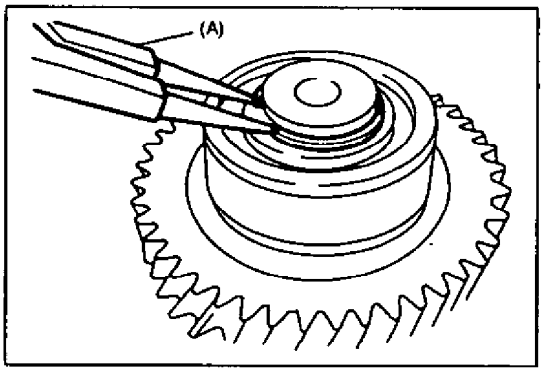
ID mark	Elastic ring thizkness	ID mark	Elastic ring thizkness
A	2.67 - 2.72 mm (0.1052 - 0.1070 in.)	G	3.03 - 3.08 mm (0.1193 - 0.1212 in.)
B	2.73 - 2.78 mm (0.1075 - 0.1094 in.)	H	3.09 - 3.14 mm (0.1217 - 0.1236 in.)
C	2.79 - 2.84 mm (0.1099 - 0.1118 in.)	J	3.15 - 3.20 mm (0.1241 - 0.1259 in.)
D	2.85 - 2.90 mm (0.1123 - 0.1141 in.)	K	3.12 - 3.26 mm (0.1264 - 0.1283 in.)
E	2.91 - 2.96 mm (0.1146 - 0.1165 in.)	L	3.27 - 3.32 mm (0.1288 - 0.1307 in.)
F	2.97 - 3.02 mm (0.1170 - 0.1188 in.)		



1. Low speed gear
2. Thickness gauge

18) Inspect low gear thrust clearance using a thickness gauge. If the clearance is outside specified limit, press into position or replace main shaft bearing and 5th gear.

Normal: 0.10-0.25 mm (0.004-0.009 in.)

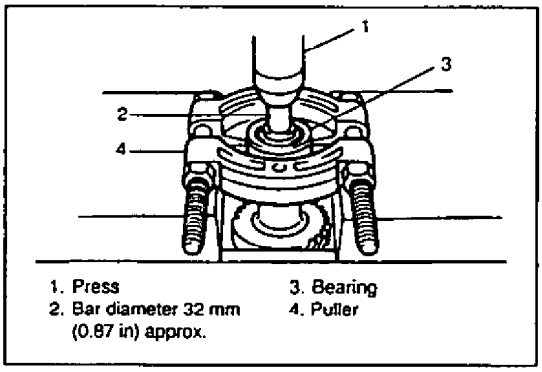


COUNTER SHAFT AND REVERSE GEAR

Disassembly

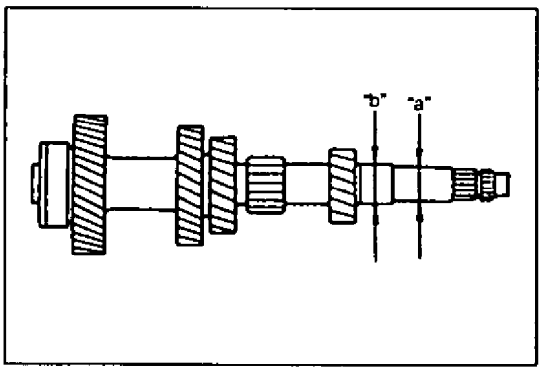
1) Remove elastic ring from counter shaft.

Special tool
(A): 09900-01607



1. Press
2. Bar diameter 32 mm (0.87 in) approx.
3. Bearing
4. Puller

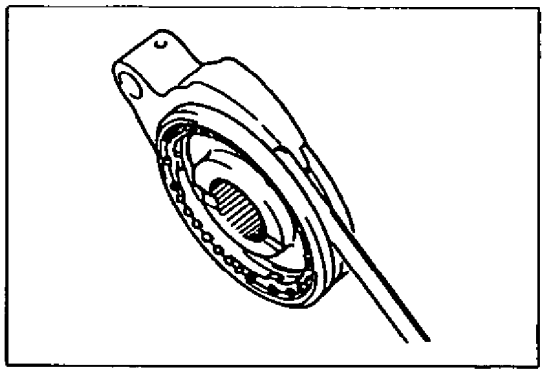
2) Remove counter shaft bearing with a puller, press and metal bar (diameter 22 mm. (0.87 in) approx.).



Inspection

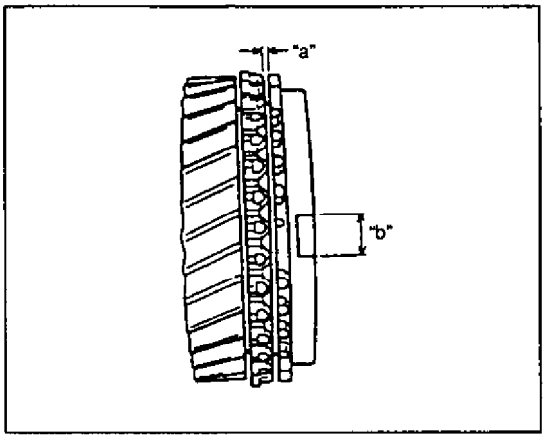
- Use a micrometer to check diameter of counter shaft, as shown in figure. If the value measured is outside specified limit, replace it.

	"a"	"b"
Normal	25.986 - 26.00 mm (1.0231 - 1.0236 in.)	30.957 - 30.972 mm (1.2188 - 1.2193 in.)



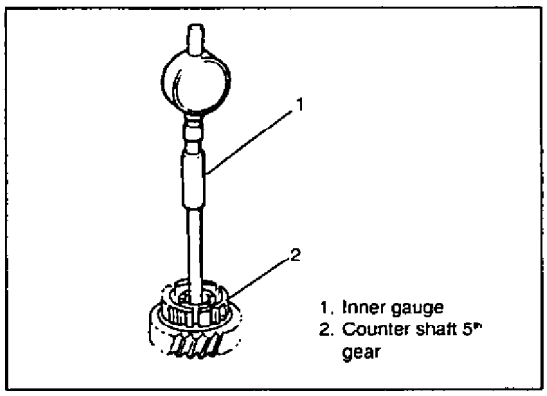
- Check clearance between fork and sleeve. If clearance exceeds limit, replace fork and sleeve.

Normal: 0.15-0.35 mm (0.006- 0.013 in.)
Limit :1.0 mm (0.039 in.)



- Check clearance "a" between synchronizer ring and gear, the width of the key slot "b" in the synchronizer ring and each chamfered gear tooth and synchronizer ring and renew if necessary. Also inspect the gearing teeth.

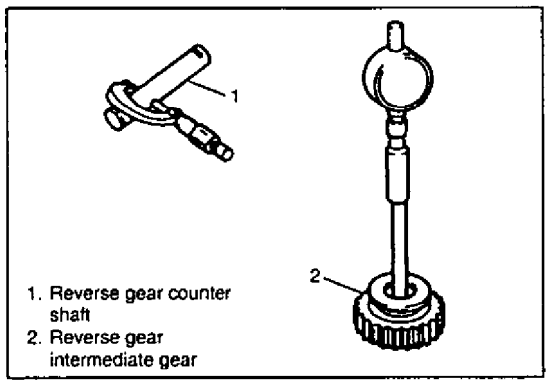
Clearance "a"	**Normal 1.0-2.0 mm (0.039-0.078 in.)** **Service Limit: 0.8 mm (0.032 in.)**
Width of the key slot "b"	**Normal 10.0-10.2 mm (0.394-0.4015 in.)** **Service Limit:: 10.45 mm (0.411 in.)**



1. Inner gauge
2. Counter shaft 5th gear

- Use internal gauge and dial indicator and check internal diameter of counter shaft 5th gear. If the measure obtained exceeds that specified, replace gear.

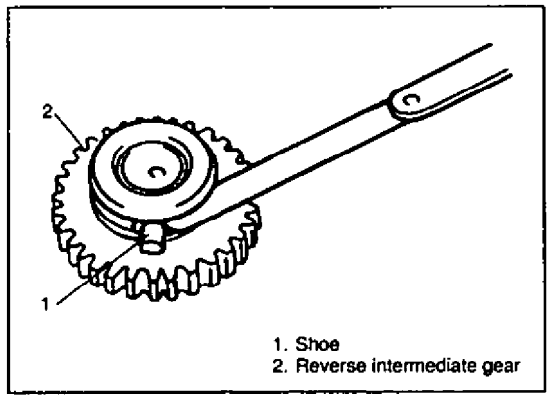
Normal: 33.015-33.040 mm (1.2999-1.3007 in.)



1. Reverse gear counter shaft
2. Reverse gear intermediate gear

- Check clearance between reverse gear and shaft, measuring the internal gear diameter and the shaft diameter and calculating the clearance.
If the clearance exceeds the limit, replace gear and shaft.

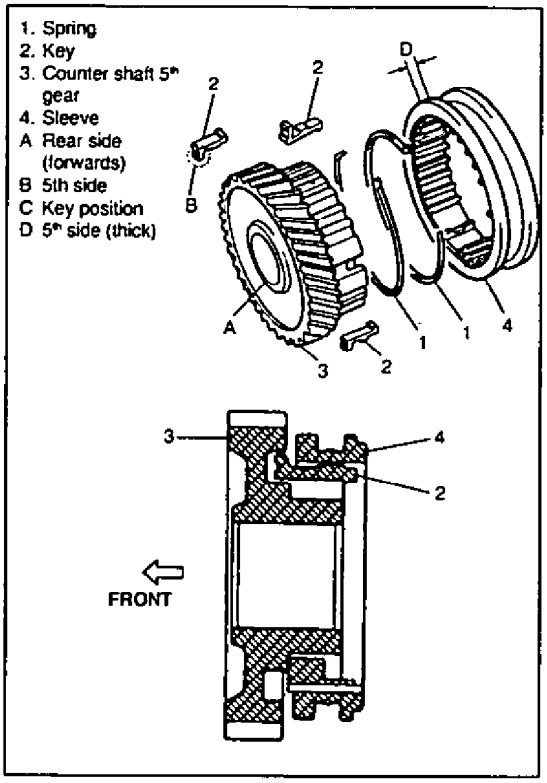
Normal: 0.040-0.082 mm (0.0016-0.0032 in.)
Limit : 0.13 mm (0.005 in.)



1. Shoe
2. Reverse intermediate gear

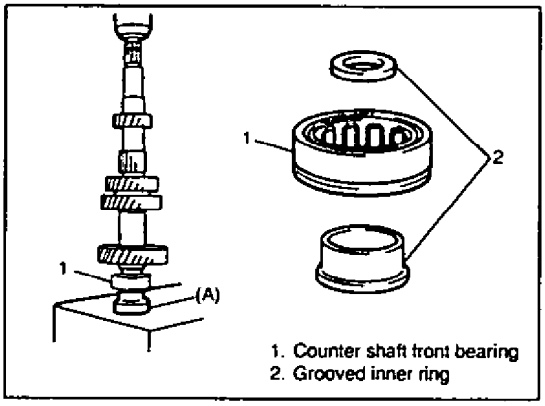
- Inspect the clearance between reverse gear and linking shoe. If clearance exceeds the limit, replace the shoe.

Normal: 0.05 mm-0.28 mm (0.002-0.011 in.)
Limit: 0.5 mm (0.019 in.)



Assembly

1) Install sleeve in counter shaft 5th gear, insert the synchronizer keys and install synchronizer springs, Please refer to figure for correct direction for gear, sleeve and spring installation. Take into account too that the key should be installed in a specific direction.

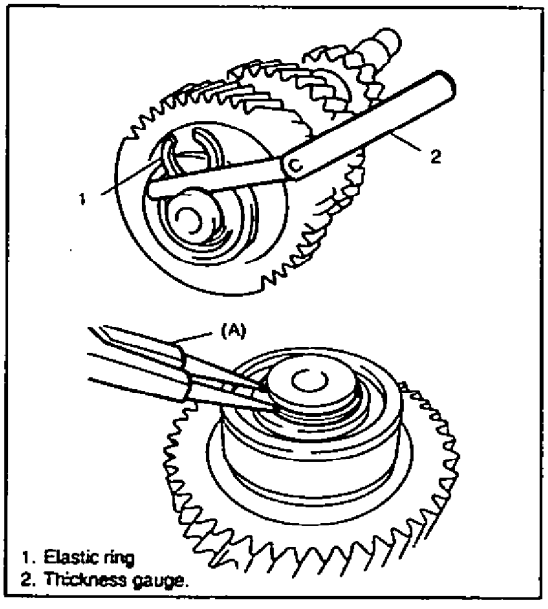


Assembly

1) Insert bushing and washer in counter shaft front bearing and press in bearing using a press and special tool.

NOTE:
When installing bearing, have the elastic ring slot forward facing.

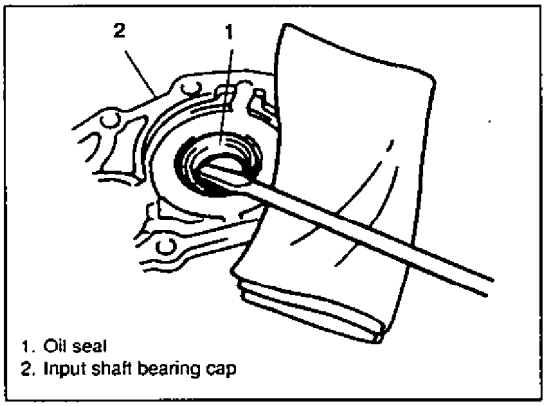
Special tool
(A): 09940-54950



2) Select an elastic ring which enables thrust clearance to be 0.1 mm (0.039 in.) or less and install.

ID mark	Circular clip thizkness	ID mark	Circular clip thizkness
1	2.05 - 2.10 mm (0.0807 - 0.0826 in.)	4	2.20 - 2.25 mm (0.0867 - 0.0885 in.)
2	2.10 - 2.15 mm (0.0827 - 0.0846 in.)	5	2.25 - 2.30 mm (0.0886 - 0.0905 in.)
3	2.15 - 2.20 mm (0.0847 - 0.0866 in.)	6	2.30 - 2.35 mm (0.0906 - 0.0925 in.)

Special tool
(A): 09900-06107

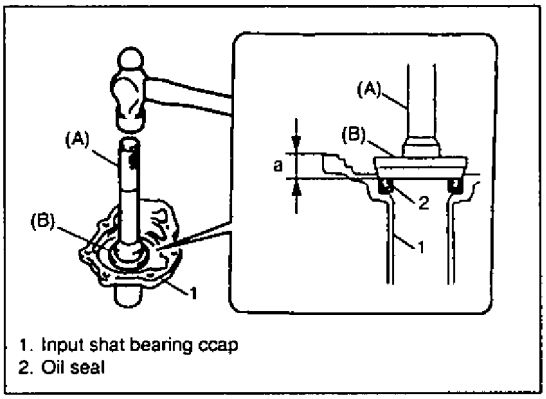


1. Oil seal
2. Input shaft bearing cap

OIL SEAL AND FRONT CASE OF INPUT SHAFT BEARING

Removal
Remove oil seal from bearing cover using a metal bar or similar as shown in figure.

NOTE:
Unless the oil seal leaks or the rim is very hard, it is not necessary to change it.



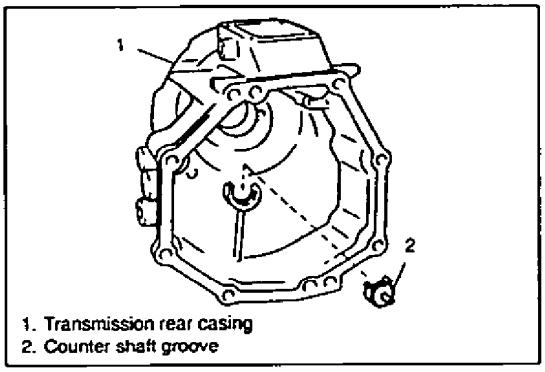
1. Input shat bearing ccap
2. Oil seal

Installation
Install new oil seal in bearing cover using the special tool shown in the figure. Apply grease to the oil seal rim.

Grease "A": 99000-25010

Special tool
(A): 09913-75821
(B): 09924-84510-004

"a": 12.2-13.2 mm (0.49-0.51 in.)



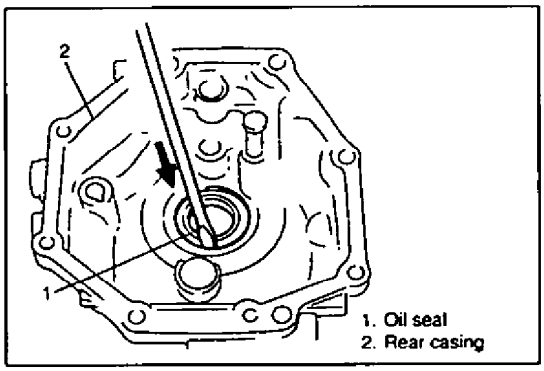
1. Transmission rear casing
2. Counter shaft groove

FRONT, INTERMEDIATE AND REAR TRANSMISSION CASING

Rear casing

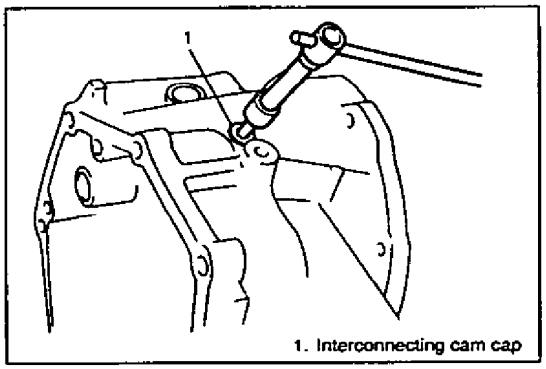
Disassembly:

1) Remove counter shaft channel.



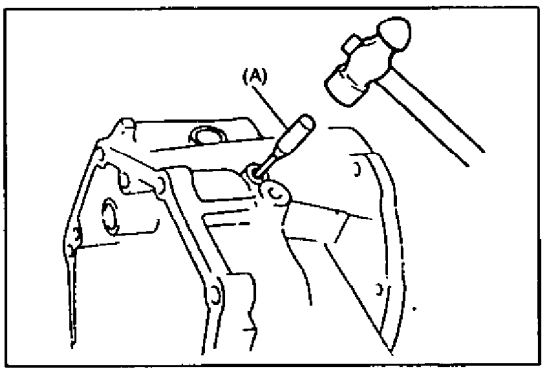
1. Oil seal
2. Rear casing

2) Remove rear casing oil seal.



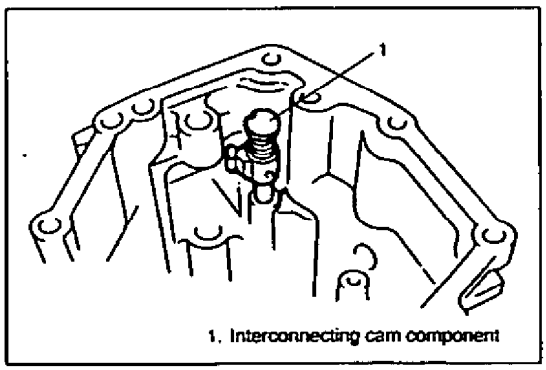
1. Interconnecting cam cap

3) Remove cap from interlocking cam.



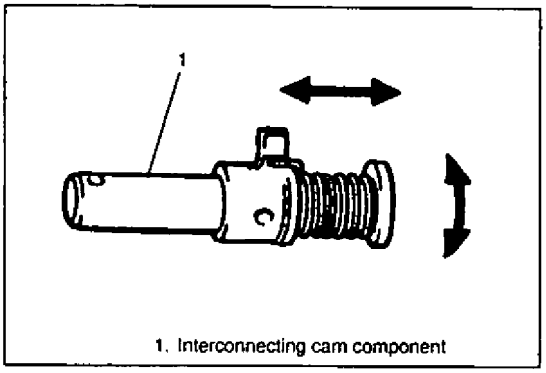
4) Remove cotter pin with special tool.

Special tool
(A): 09922-85811



1. Interconnecting cam component

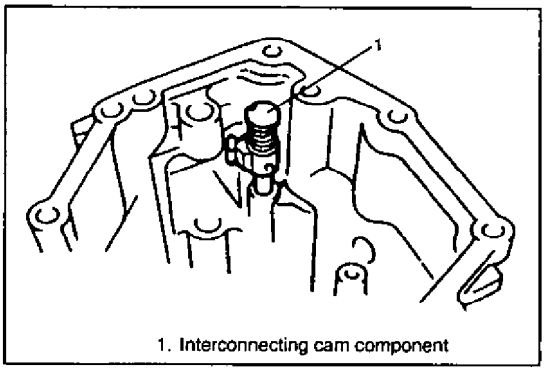
5) Remove interlocking cam.



1. Interconnecting cam component

Inspection

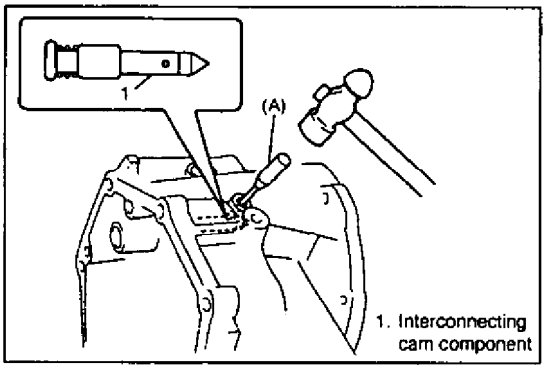
- Check that interconnecting cam component turns without problem in both directions and slides in the right direction.



1. Interconnecting cam component

Assembly

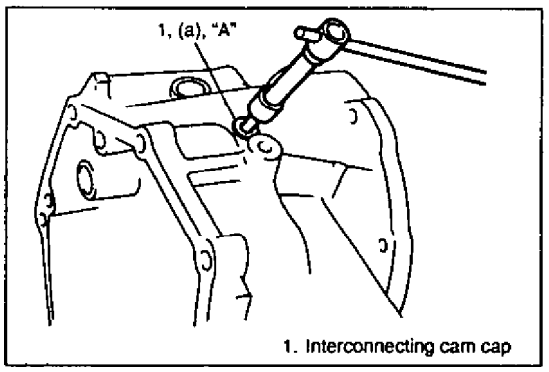
1) Insert interconnecting cam component in rear casing.



1. Interconnecting cam component

2) Position interconnecting cam component as shown in the figure and insert cotter pin using special tool.

Special tool
(A): 09922-85811

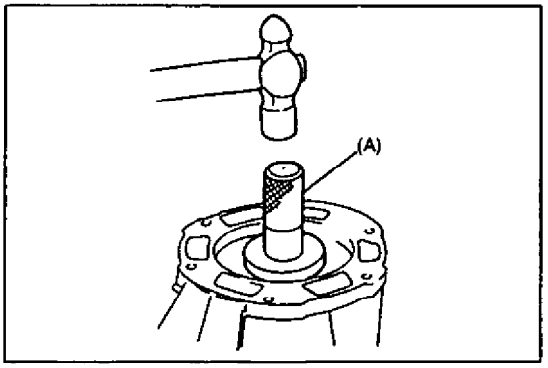


1. Interconnecting cam cap

3) Apply sealant to interconnecting cam and tighten as specified.

"A": Sealant 99000-32020

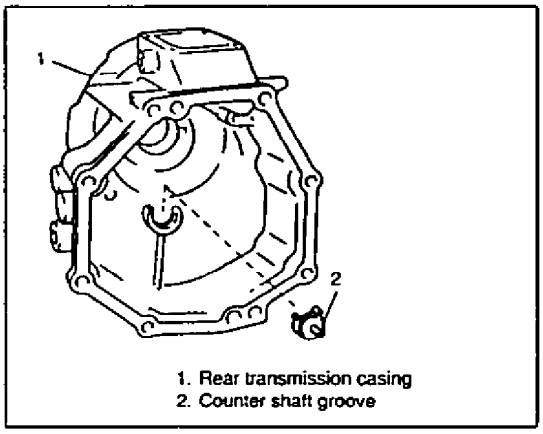
Torque specifications (a): 1.9 Kg-m (19 Nm)



4) Install oil seal in rear casing so that oil seal surface is behind entrance surface. Apply grease to oil seal rim.

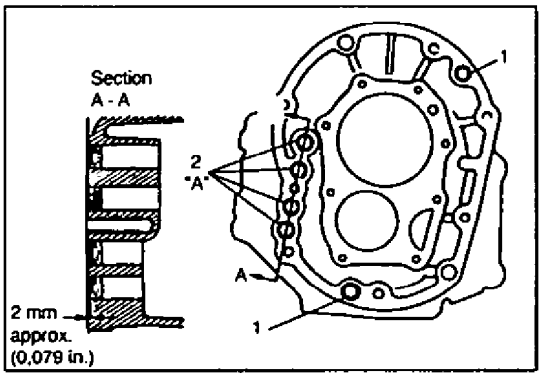
Grease: 99000-25010

Special tool:
(A): 09913-77510



1. Rear transmission casing
2. Counter shaft groove

5) Install channel in counter shaft.

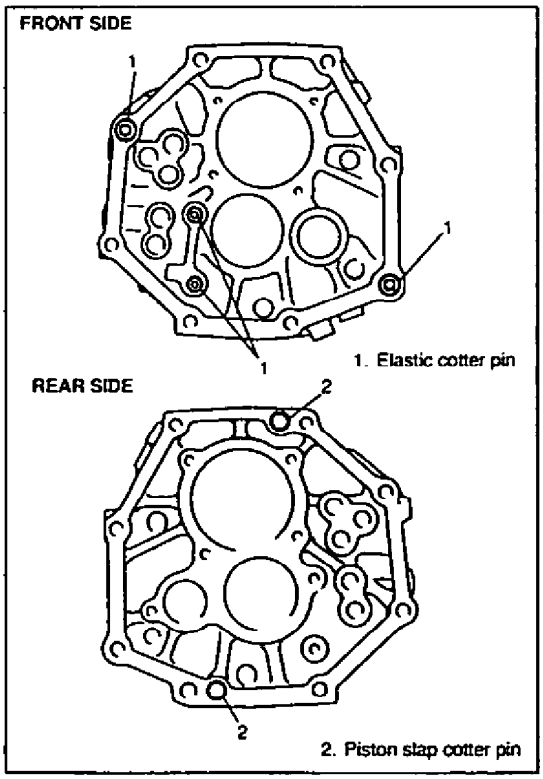


Front and rear casing

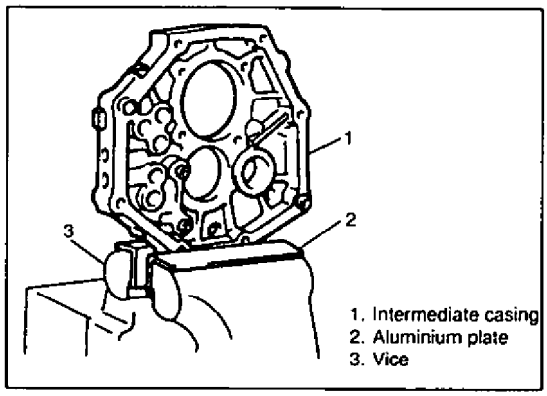
Location of piston slap pin and cap

- Install piston slap pin and cap (with sealant) in front casing as shown in figure.

  "A": Sealant 99000-31110



- Install piston slap pin/elastic cotter pin as shown in figure.

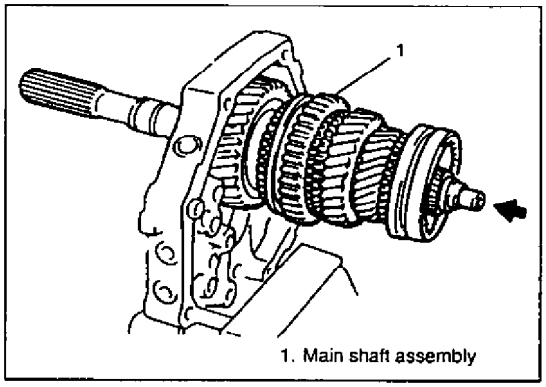


1. Intermediate casing
2. Aluminium plate
3. Vice

ASSEMBLY

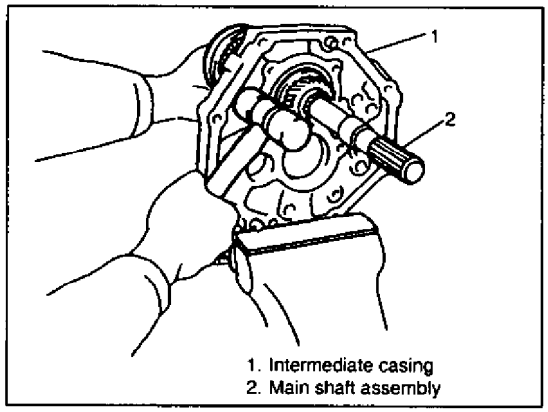
NOTE:
- **Before installing, wash each part and apply specified gear oil to sliding surfaces of bearing and gear.**
- **Use new elastic rings for assembly. Do not use old ones again.**

1) Put counter shaft casing in a vice. Clean both mating surfaces.



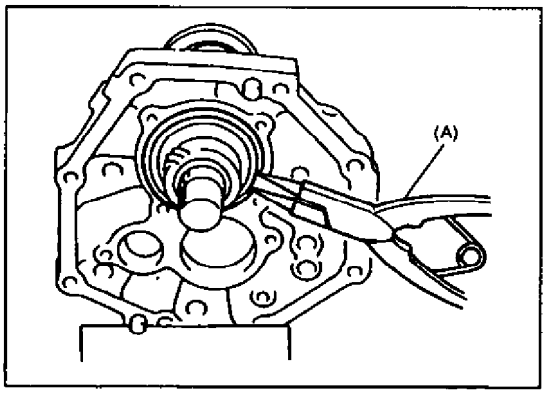
1. Main shaft assembly

2) Install main shaft assembly in intermediate casing.



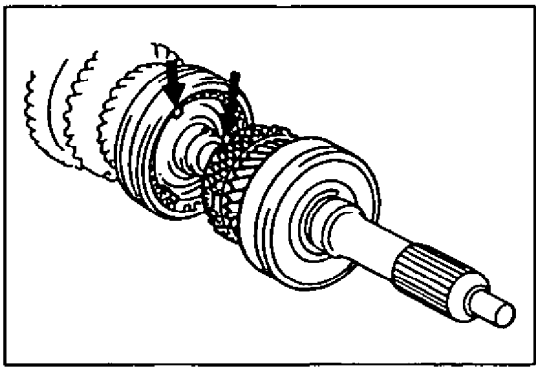
1. Intermediate casing
2. Main shaft assembly

NOTE:
When there is a great deal of obstruction between intermediate casing and bearing, gently hit the rear side with a plastic hammer so that bearing is correctly installed in main shaft.



3) Fix bearing position with its elastic ring using the special tool.

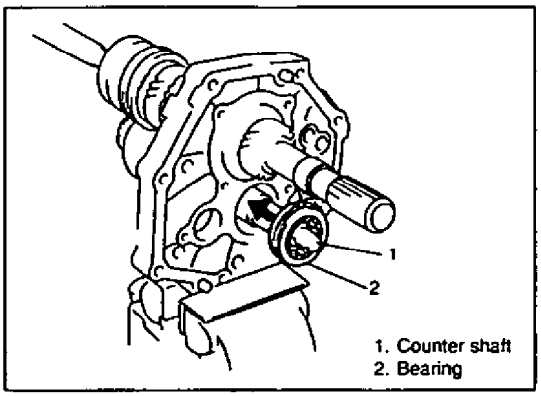
(A): 09900-06107



4) Line up synchronizer ring key slots and the sychronizer keys and assemble input shaft and main shaft assemblies.

5) Fix counter shaft rear bearing with elastic ring.

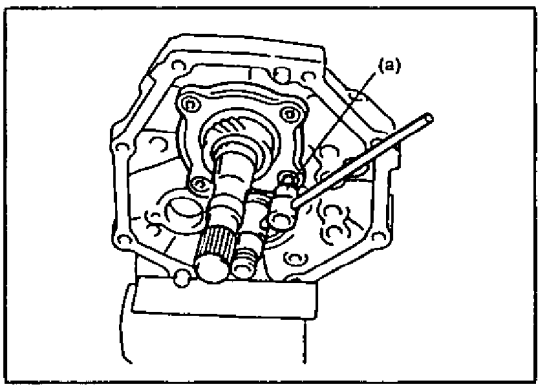
Special tool
(A): 09900-01607



1. Counter shaft
2. Bearing

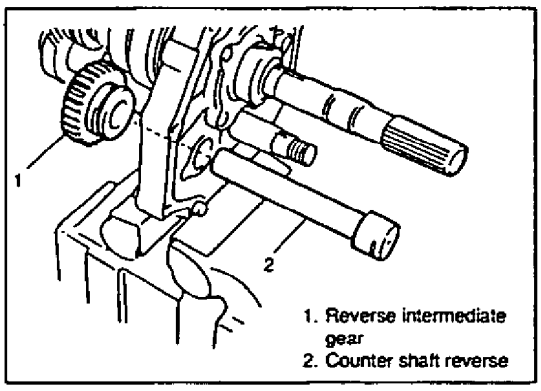
6) Install counter shaft and rear bearing in intermediate casing.

NOTE:
- **When installing the bearing, do it in such a way that the elastic ring side is facing the rear side of the intermediate casing.**
- **When there is a great deal of obstruction between the intermediate casing and the bearing, gently and uniformly hit the grooved exterior ring of the bearing.**



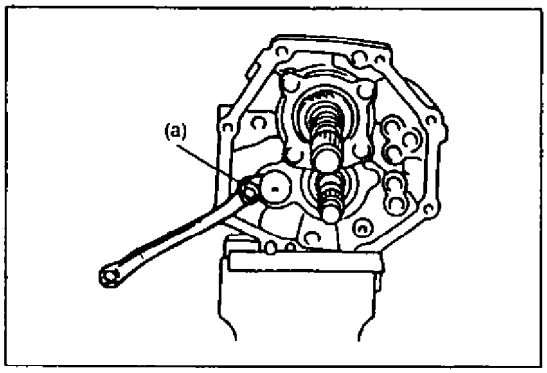
7) Install rear bearing plate of main shaft.

Torque specifications
(a): 1.9 Kg-m (19 Nm)



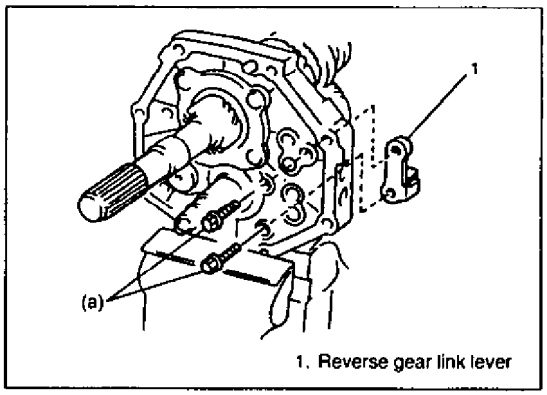
1. Reverse intermediate gear
2. Counter shaft reverse

8) Install intermediate reverse gear and shaft.



9) Tighten bolt as specified.

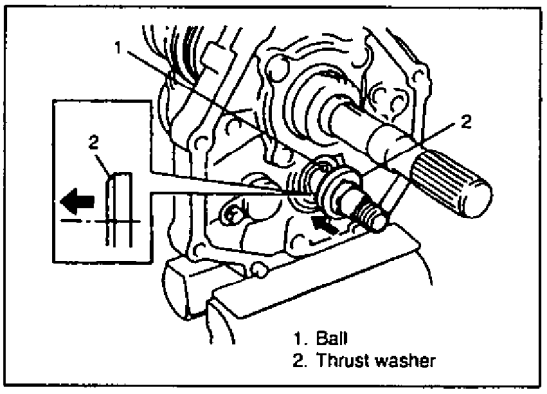
Torque specifications
(a): 1.8 Kg-m (18 Nm)



1. Reverse gear link lever

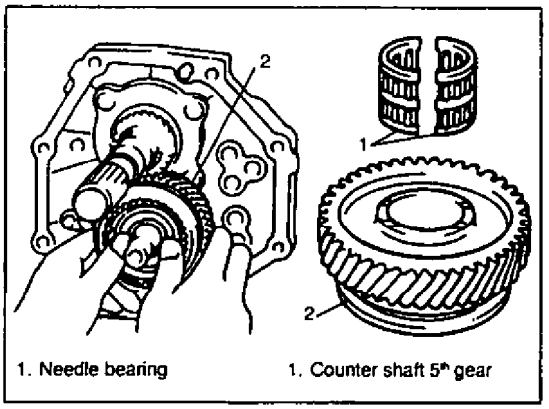
10) Install linking reverse gear lever.

Torque specifications
(a): 1.9 Kg-m (19 Nm)



1. Ball
2. Thrust washer

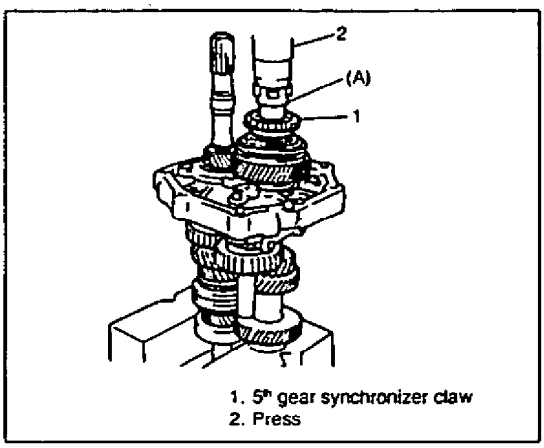
11)Place ball and thrust washer in housing in countershaft.



1. Needle bearing
1. Counter shaft 5th gear

12) Install needle bearing, counter shaft 5th gear and sychronizer ring.

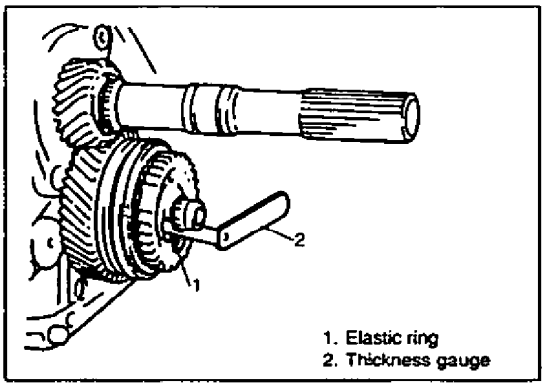
NOTE:
When installing the synchronizer ring in 5th gear sleeve, line up synchronizer key slot with key.



1. 5th gear synchronizer claw
2. Press

13) Press 5th gear synchronizer claw into position in counter shaft using a press and the special tool.

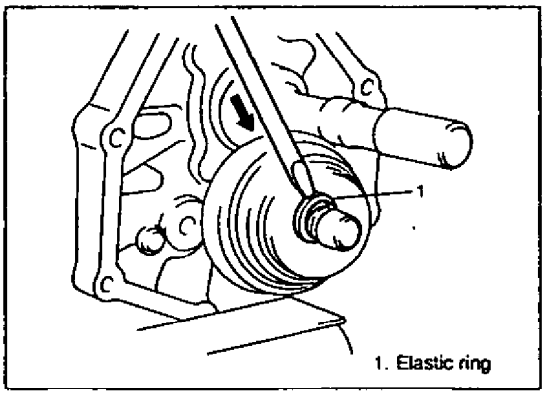
Special tool
(A): 09927-08220



1. Elastic ring
2. Thickness gauge

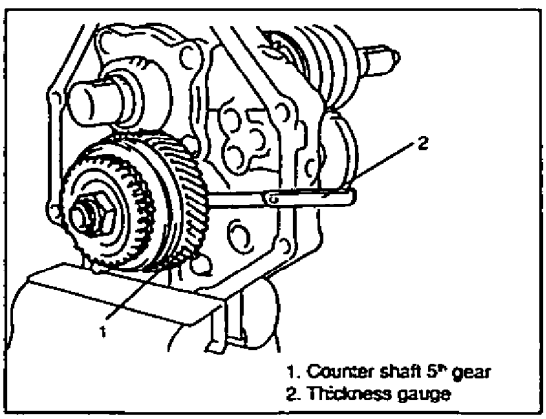
14) Select an elastic ring that allows clearance in the slot of 0.1 mm (0.039 ins) or less.

ID mark	Circular clip thizkness	ID mark	Circular clip thizkness
A	2.80 - 2.85 mm (0.1103 - 0.1122 in.)	E	3.00 - 3.05 mm (0.1182-0.1200 in.)
B	2.85 - 2.90 mm (0.1122 - 0.1141 in.)	F	3.05 - 3.10 mm (0.1201 - 0.1220 in.)
C	2.90 - 2.95 mm (0.1142 - 0.1161 in.)	G	3.10 - 3.15 mm (0.1221 - 0.1240 in.)
D	2.95 - 3.00 mm (0.1162 - 0.1181 in.)		



1. Elastic ring

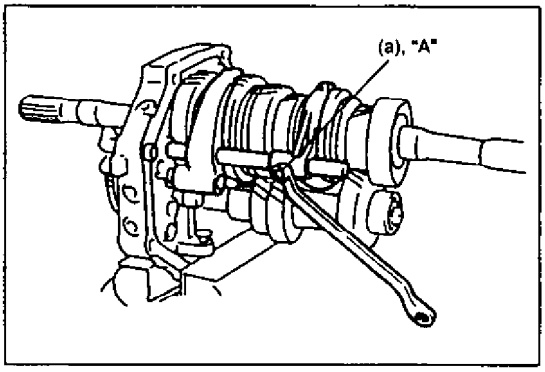
15) Fit elastic ring as shown in figure and check that counter shaft 5th turns without problem.



1. Counter shaft 5th gear
2. Thickness gauge

16) Check thrust clearance of countershaft 5th gear using a thickness gauge.

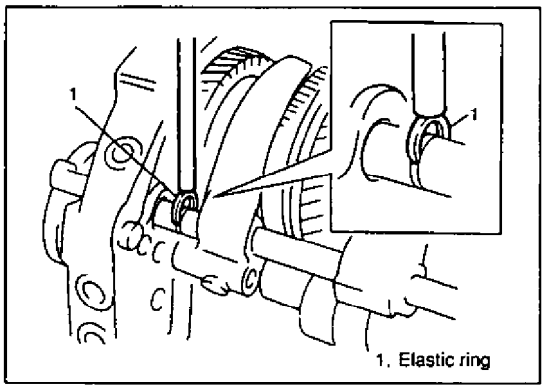
Normal: 0.1-0.3 mm (0.0040-0.0118 in.)



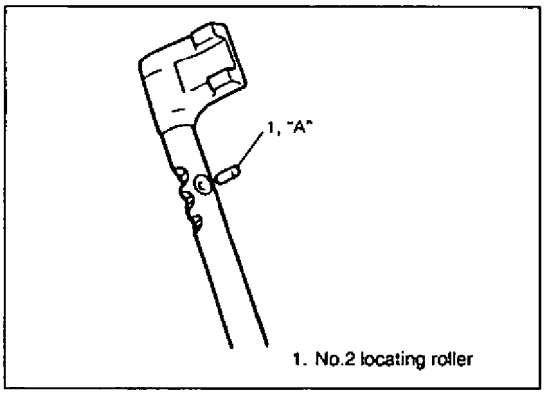
17) Install low speed fork, high speed gear fork and shaft.
18) Apply sealant to fork screw threads and tighten as specified.

"A": Sealant: 09900-32020

Torque specifications (a): 2.0 Kg-m (20 Nm)

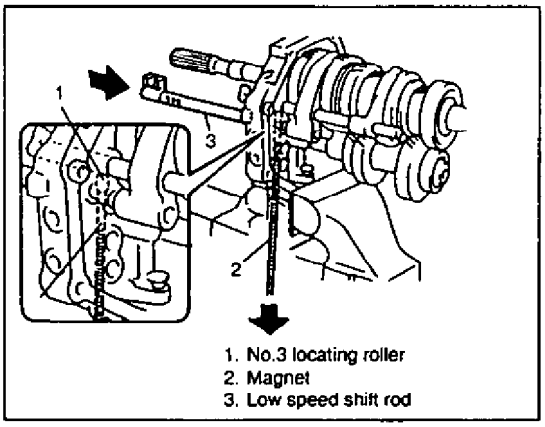


19) Attach the new elastic ring in high speed shaft using lever or similar and a hammer.

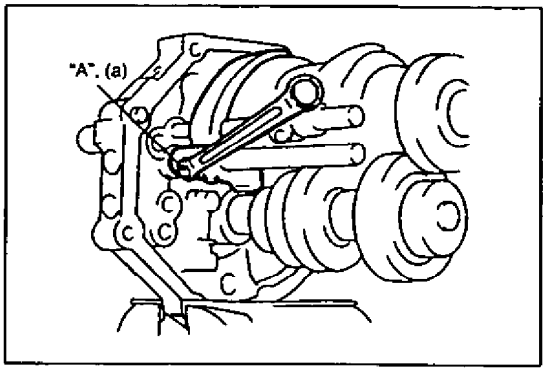


20) Apply grease to locating roller no. 2 and install in high speed gear shaft.

"A": Grease: 99000-32020



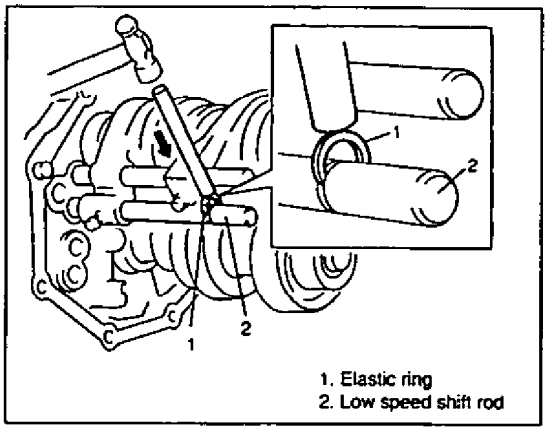
21) Hold with a magnet, inset low speed gear shaft in intermediate casing and low speed fork.



22) Apply sealant to fork screw threads and tighten screw as specified.

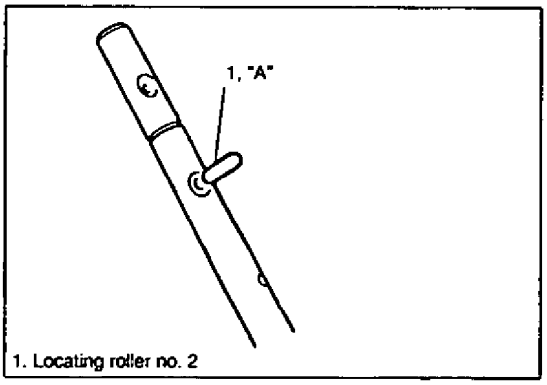
"A": Sealant: 09900-32020

Torque specifications
(a): 2.0 kg. m (20 Nm)



1. Elastic ring
2. Low speed shift rod

23) Attach a new elastic ring to low speed shaft using a lever or similar and a hammer.

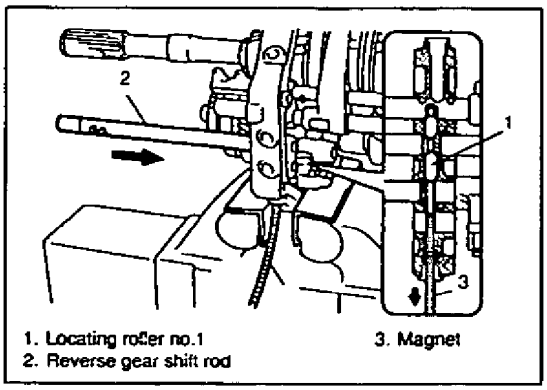


1. Locating roller no. 2

24) Apply grease to locating roller no. 2 and install in reverse gear shaft.

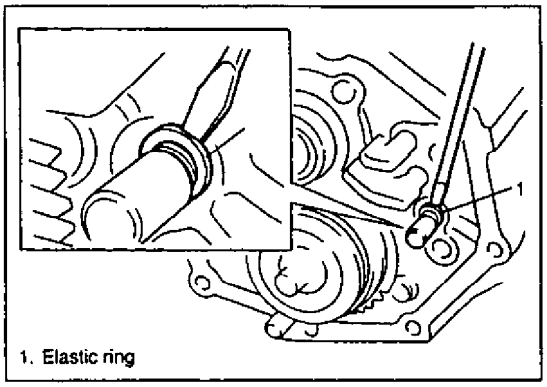
"A": Grease: 99000-32020

25) Assemble reverse gear link fitting.



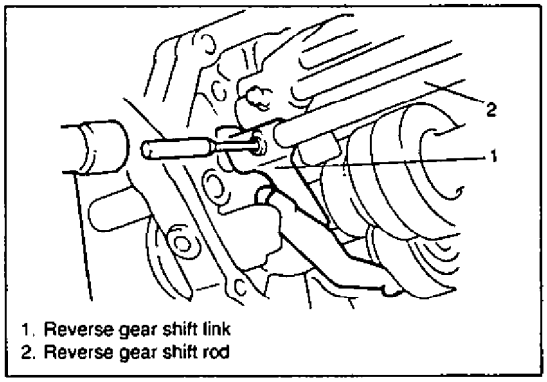
1. Locating roller no.1
2. Reverse gear shift rod
3. Magnet

26) Place reverse gear shaft in reverse gear link assembly.
27) Hold locating roller no. 1 with a magnet, insert reverse gear shaft in reverse gear link and rear casing.



1. Elastic ring

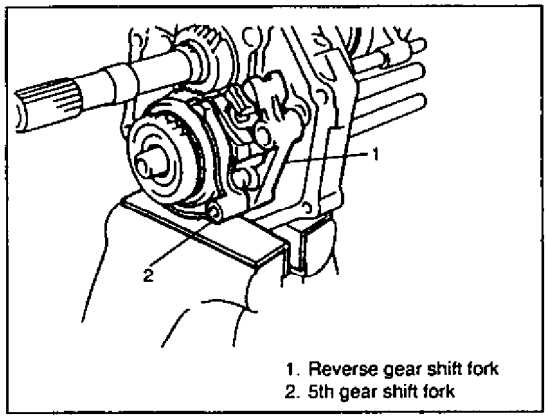
28) Fit reverse gear shaft with elastic ring using a metal bar or similar and a hammer.



1. Reverse gear shift link
2. Reverse gear shift rod

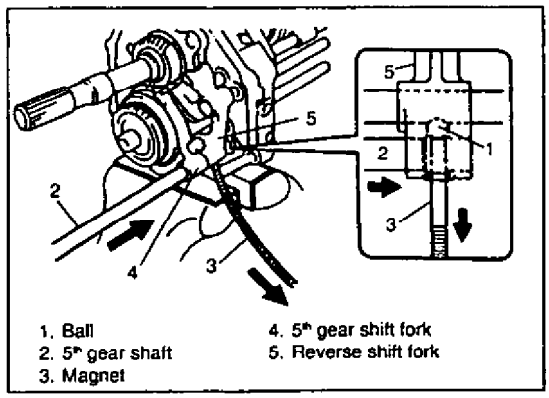
29) Place cotter pin in low gear shift link and shaft using the special tool.

Special tool
(A): 09922-85811



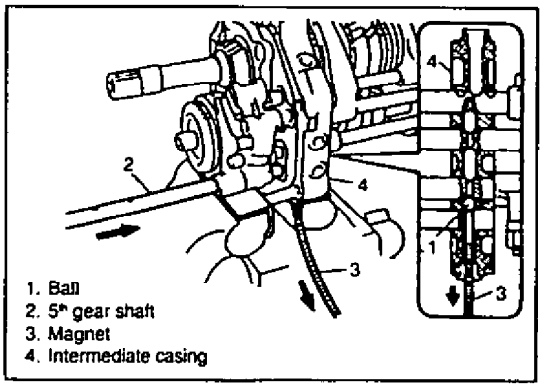
1. Reverse gear shift fork
2. 5th gear shift fork

30) Install reverse gear selector fork and 5th gear selector fork as shown in figure.

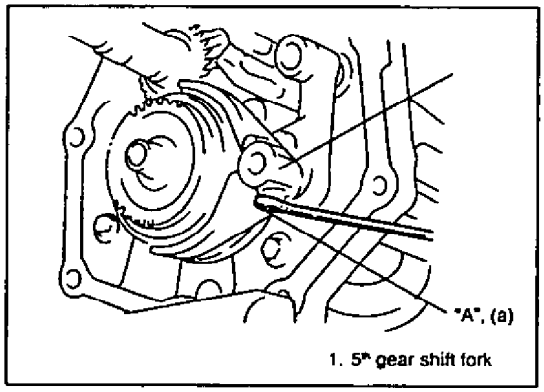


1. Ball
2. 5th gear shaft
3. Magnet
4. 5th gear shift fork
5. Reverse shift fork

31) Secure ball with magnet as in figure, place 5th gear shaft in 5th gear fork and reverse gear fork.



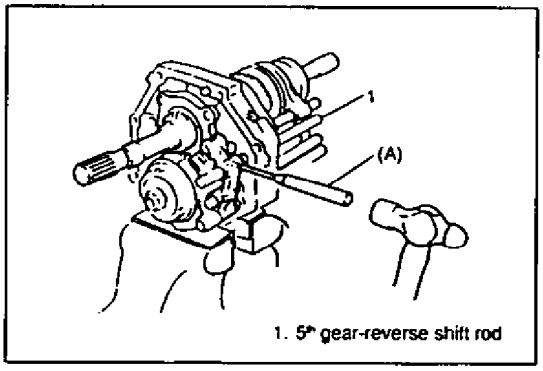
32) Secure ball with a magnet as shown in figure and install 5th gear shaft in intermediate casing.



33) Apply sealant to fork screw threads and tighten screw to specified torque.

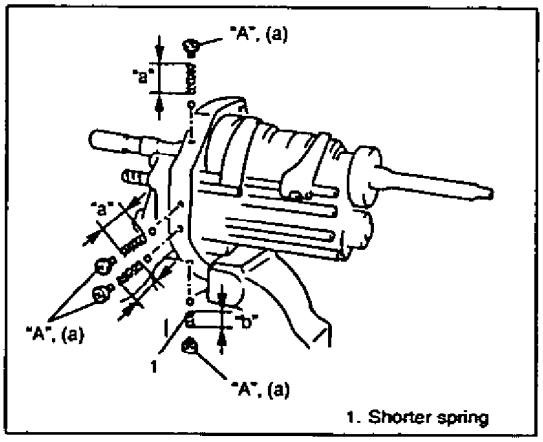
"A": Sealant: 09900-32020

Torque specifications
(a): 2.0 kg. m (20 Nm)



34) Insert 5th gear shaft in reverse gear selector fork and insert cotter pin in shaft and fork.

Special tool
(A): 09922-85811



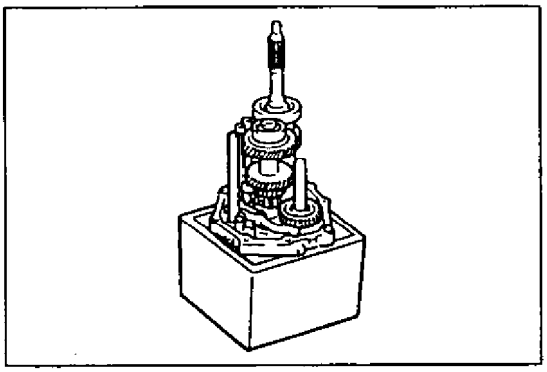
35) Fit locating balls, springs and locating bolt after checking uncompressed length of locating springs.

	Normal	Limit
"a"	31.0 mm (1.22 in.)	30.1 mm (1.19 in.)
"b"	20.2 mm (0.79 in.)	19.6 mm (0.77 in.)

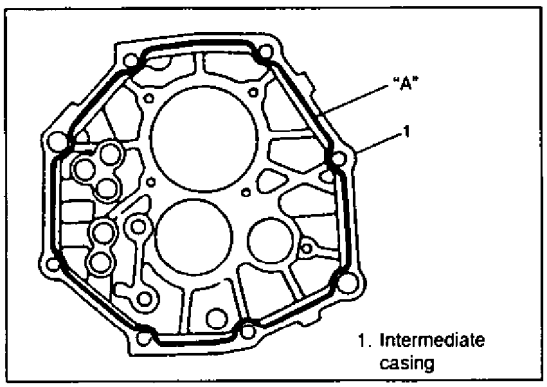
NOTE:
For 5th gear locating spring use the shortest one.

"A": Sealant: 99000-32020

Torque specifications
(a): 1.9 Kg-m (19 Nm)



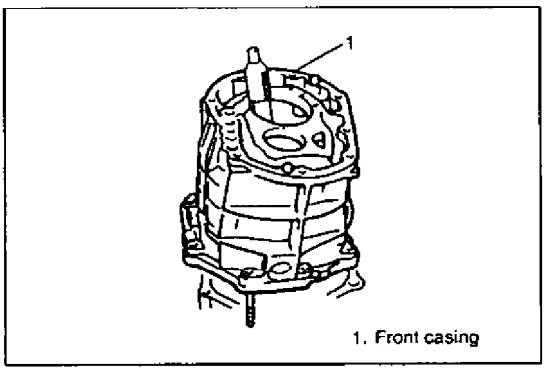
36) Install intermediate casing assembly vertically as shown in figure and using a workshop bench or similar.



1. Intermediate casing

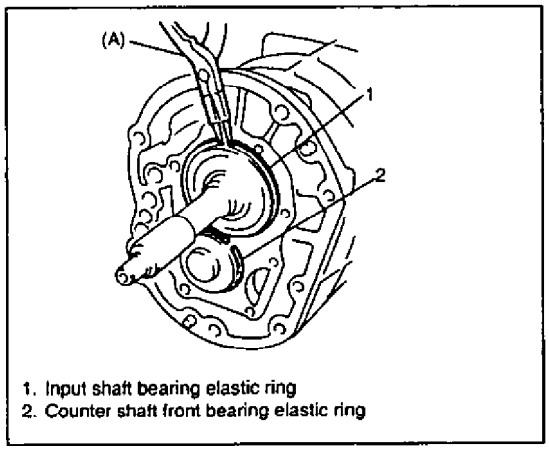
37) Apply uniform film of sealant to intermediate casing on seal where front casing is to be installed, as shown in figure.

"A": Sealant: 99000-31110



1. Front casing

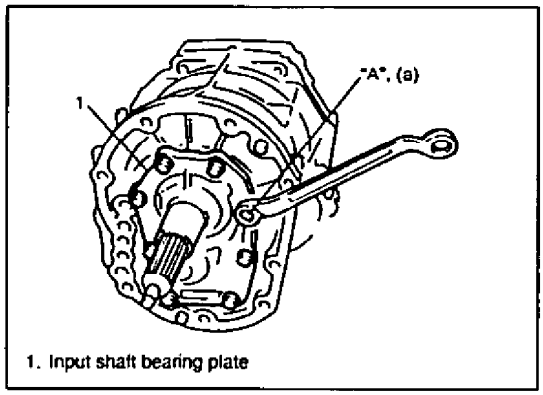
38) Clean mating surfaces of front casing and install in intermediate casing.



1. Input shaft bearing elastic ring
2. Counter shaft front bearing elastic ring

39) Fit elastic rings on bearings as shown in figure.

Special tool
(A): 09900-01607

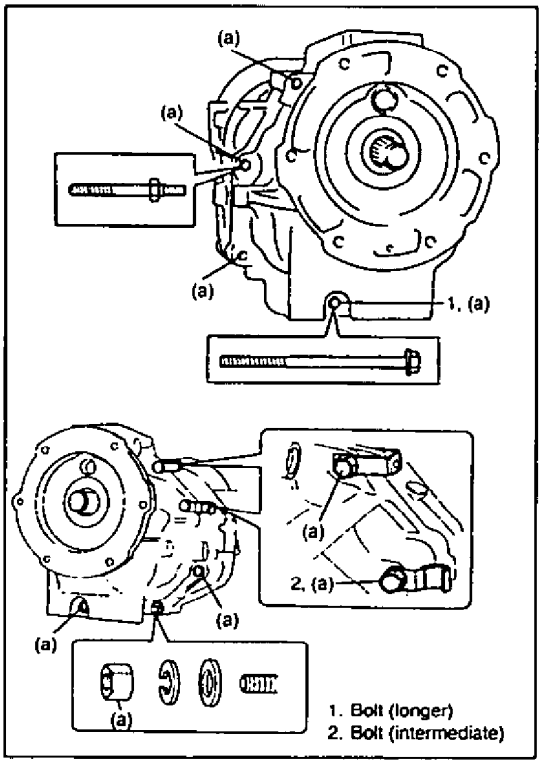


1. Input shaft bearing plate

40) Apply sealant to bolts on housing cover of input shaft bearing, install plate on new bearing, retainer and bolts.

"A": Sealant: 99000-32020

Torque specifications
(a): 1.7 Kg-m (17 Nm)



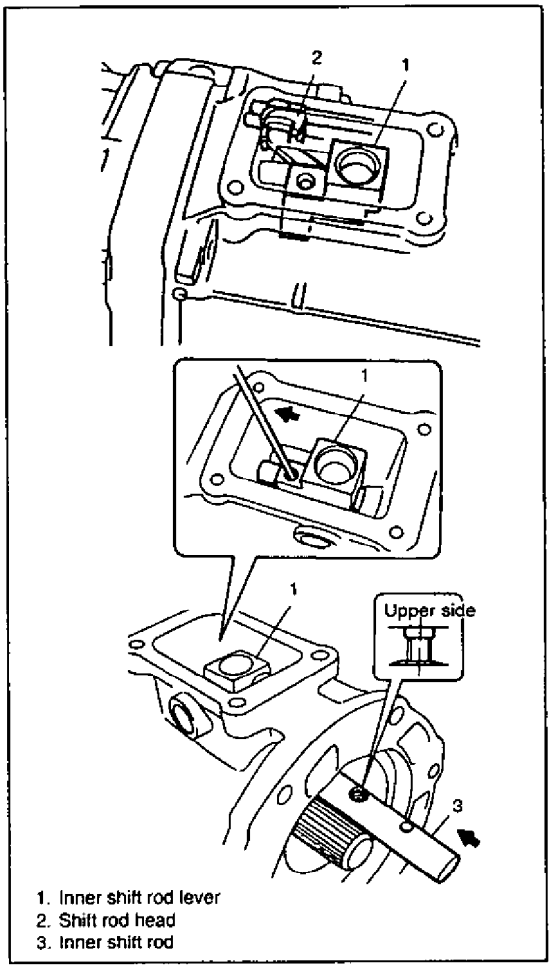
1. Bolt (longer)
2. Bolt (intermediate)

41) Clean mating surfaces of rear and intermediate casing and apply a uniform film of sealant to mating faces.

Sealant: 99000-31110

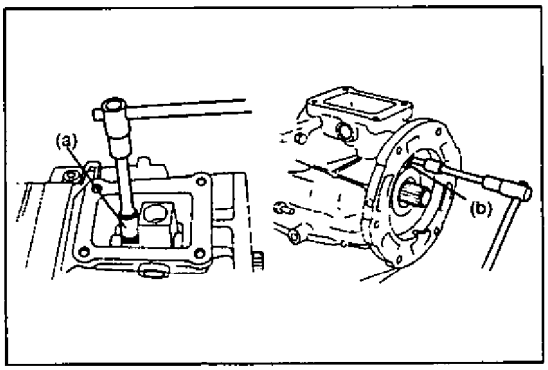
42) Install rear casing in intermediate casing.

Torque specifications
(a): 3.5 Kg-m (35 Nm)



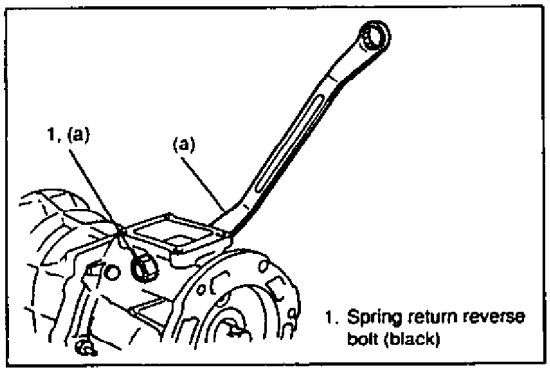
1. Inner shift rod lever
2. Shift rod head
3. Inner shift rod

43) With the end of the inner shift shaft lever hooked on the shaft head, insert internal shift shaft in lever, positioned as indicated in figure.



44) Apply sealant to inner shift shaft and tighten to specified torque.

Torque specifications
(a): 1.9 Kg-m (19 Nm)
(b): 3.9 Kg-m (39 Nm)

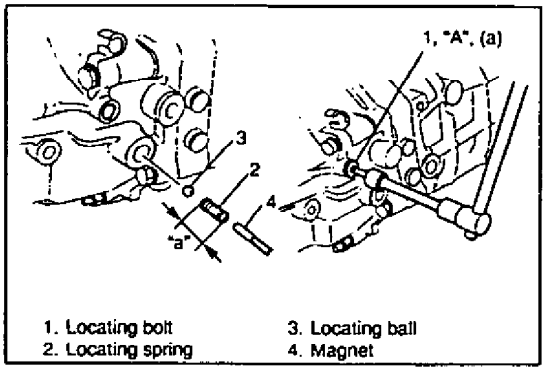


1. Spring return reverse bolt (black)

45) Tighten return spring bolt and reversing bolt (black coloured).

NOTE:
Fit return spring reversing bolt (black) in left side of casing.

Torque specifications
(a): 2.8 Kg-m (28 Nm)

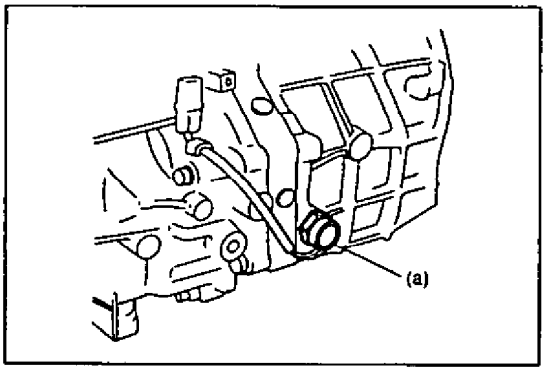


46) Apply sealant to locating ball, locating spring and rear casing bolt.

"A": Sealant: 99000-32020

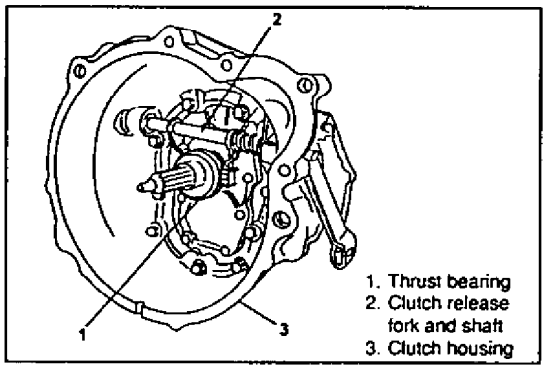
Torque specifications
(a): 1.9 Kg-m (19 Nm)

"a" Locating spring uncompressed length
Normal: 22.1 mm (0.87 in.)
Limit: 21.4 mm (0.83 in.)



47) Install reverse gear light switch and a new sealant.

Torque specifications
(a): 4.5 Kg-m (45 Nm)



48) Install clutch housing and tighten bolts to specified torque.

Torque specifications
(a): 8.5 Kg-m (85 Nm)

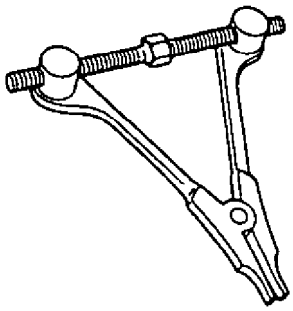
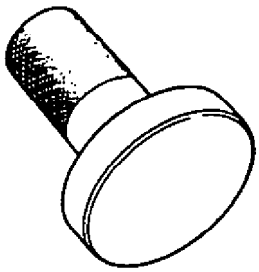
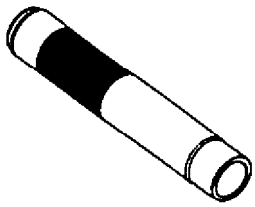
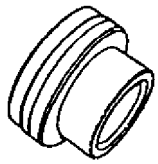
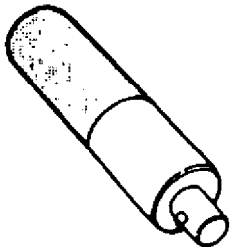
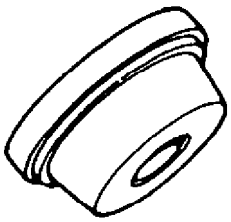
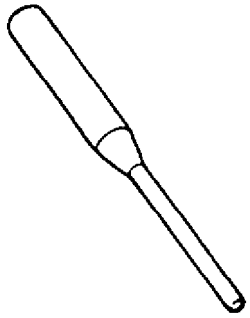
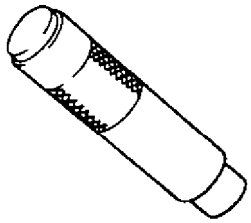
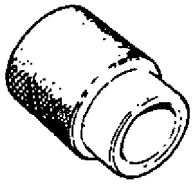
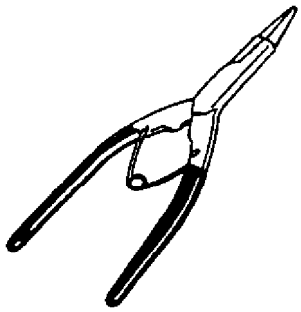
TORQUE SPECIFICATIONS

SYSTEM	COMPONENT	VALUES	
		kg-m	Nm
IN VEHICLE	Transfer case oil drain and filler/check plugs	2.3	23
	Transmission filler/check plug	3.8	38
	Transmission oil drain plug	4.5	45
	Gear shift lever dust cover screws.	0.6	06
	4WD switch	2.0	20
	Speedometer driven gear case bolt.	1.0	10
	Reverse light switch	4.5	45
GEAR SHIFT LEVER	Gear shift lever locating pivot bolts	2.3	23
	Gear shift lever case plate bolts	0.6	06
	Gear shift lever case bolts	2.3	23
TRANSMISSION CASE	Interconnecting cam cap	1.9	19
	Main shaft and counter shaft bearing plate bolts	1.9	19
	Reverse gear shaft bolt	1.8	18
	Reverse gear link lever	1.9	19
	Selector fork bolts	2.0	20
	Locating spring bolts	1.9	19
	Bolts for input shaft bearing housing	1.7	17
	Rear casing/intermediate casing bolts	3,5	35
	Inner shift rod bolt	1.9	19
	Inner shift rod cap	3.9	39
	Return spring reversing bolt	2.8	28
	Clutch housing bolts	8.5	85
	Transmission and transfer case bolts	5.0	50
	Propeller shaft bolts and locknuts	5.5	55
	Transfer case lever pivot bolts	1.7	17
	Damper attaching bolts	1.8	18
	Starter motor attaching bolts	2.3	23
	Exhaust pipe sections 1 and 2 attaching bolts	1.8 - 2.8	18 - 28
	Rear bridge and elastic support bolts	5.0	50
	Engine/transmission bolts	4.6	46

MATERIALS REQUIRED FOR SERVICING

MATERIALS	PRODUCT RECOMMENDED BY SUZUKI	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal rims • Selector return system • Gear shift • Needle bearings • Locating rollers
Sealing clamping bolt	THREAD LOCK CEMENT SUPER 1333B (99000-32020)	• Gear shift lever locating bolts • Selector fork bolts • Input shaft casing bolts
Sealer	SUZUKI BOND Nº1215 (99000-31110)	• Oil filler/check and drain plugs • Gear shift lever connection • Casing or housing connecting surfaces • Front casing caps • Gear shift shaft/selector shaft cap • Front casing cap

SPECIAL TOOLS

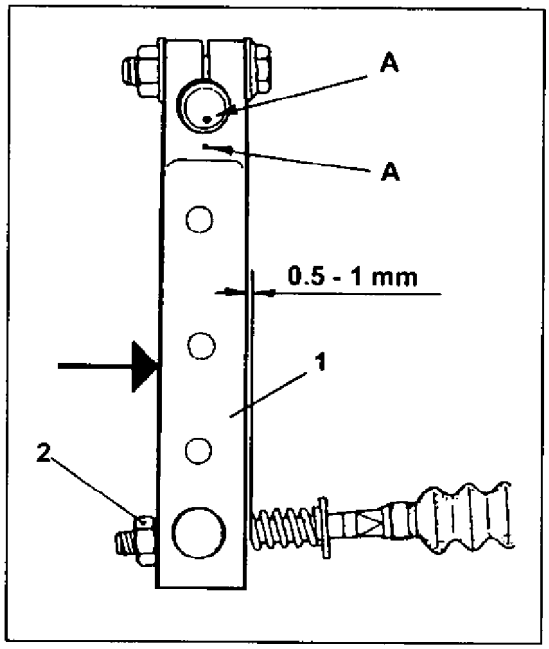
 09912-34510 Case separator	 09913-75510 (Outer diameter 70.5 mm) Bearing installer	 09940-51710 Bearing installer	 09940-54950 Bearing installer accessory
 09913-75821 Installer accessory	 09924-84510-004 Bearing installer adaptor(C)	 09925-78210 (6 mm) 09922-85811 (4.5 mm) Elastic cotter pin puller	 09925-18010 Installer accessory
 09927-08220 Shaft puller	 09940-53111 Bearing installer	 09900-06107 Elastic ring pliers	

SECTION 7C

CLUTCH

NOTE:
For points not covered in this section, please refer to corresponding sections in Service Manual outlined in INTRODUCTION to this Manual.

LIST OF CONTENTS



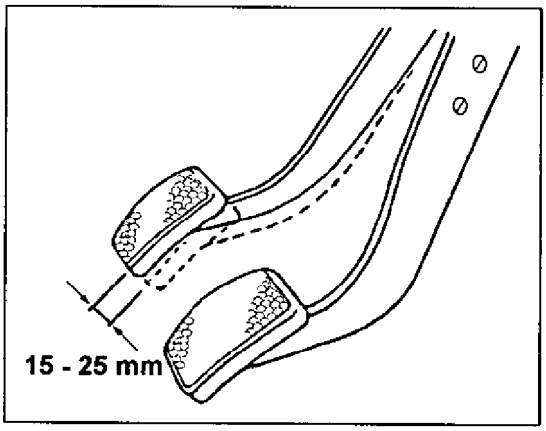
IN THE VEHICLE

ADJUSTMENT OF CLUTCH CABLE

1) Ensure that centre punch marks coincide (A).

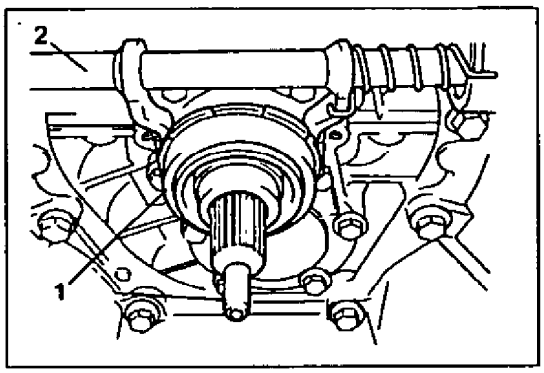
2) Press lever (1) to release adjusting nut (2).

3) Slacken or tighten nut (2) until freeplay on the lever of 0.5 to 1 mm is achieved, equivalent to clutch pedal freeplay of 15 to 25 mm.



4) Measure clutch pedal free play, if it does not adjust to specified measurement turn adjusting bolt located on upper part of pedal to modify height and adjust nut (2) once more, if necessary.

Clutch release lever freeplay 0.5 a 1 mm.
Clutch pedal freeplay 15 a 25 mm.
Clutch pedal height: 5 mm above brake pedal.

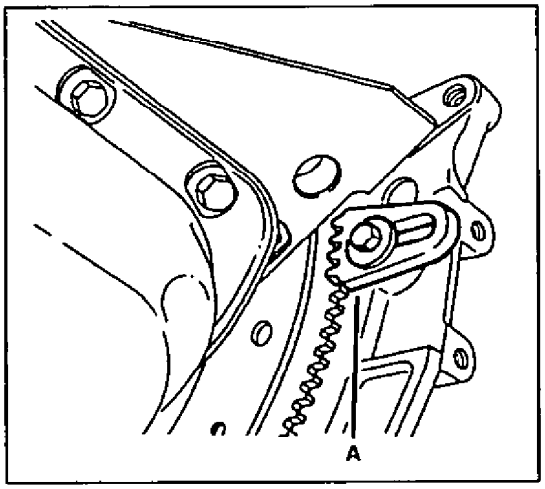


GENERAL REPAIR OF ASSEMBLY

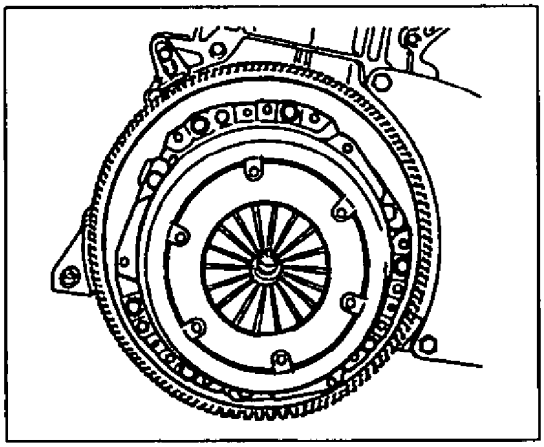
CLUTCH DISC, PRESSURE PLATE, THRUST BEARING AND FLYWHEEL.

Disassembly

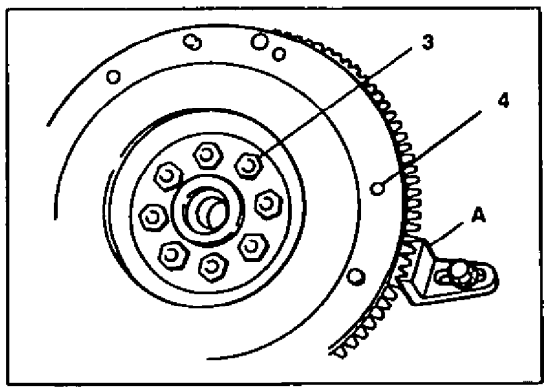
1) Remove transmission and transfer case assemblies from vehicle, please refer to 7A.
2) Disconnect thrust bearing (1) from fork (2) and remove.



3) Pressure plate and clutch disc (on engine):
   - Lock flywheel with tool (A) **Ref. 09916-96510.**



   - Progressively slacken and extract bolts fastening pressure plate.
   - Remove pressure plate and clutch disc.

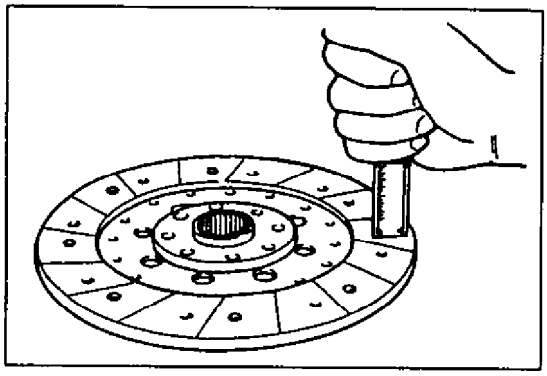


4) Flywheel
   - With flywheel locked with tool (A), remove attaching bolts (3).
   - Remove locking tool and extract flywheel (4).

Inspection

1) Thrust bearing
   - Check that thrust bearing turns freely without noise, bumping or clearance.

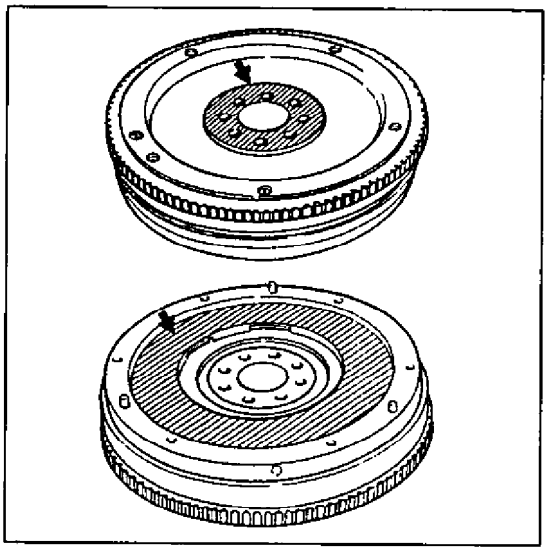
NOTE:
Do not wash thrust bearing, it could cause leaks of grease and consequently damage the bearing.



2) Clutch disc
   - Check depth of clutch disc rivets with respect to surface of friction.

   Normal depth 1.6 mm (0.06in)
   Depth limit 0.5 mm (0.02in)

3) Pressure plate
   - Inspect diaphragm spring fingers for abnormal wear, damage or distortion.
   - Inspect thrust plate face for wear, marks or overheating.

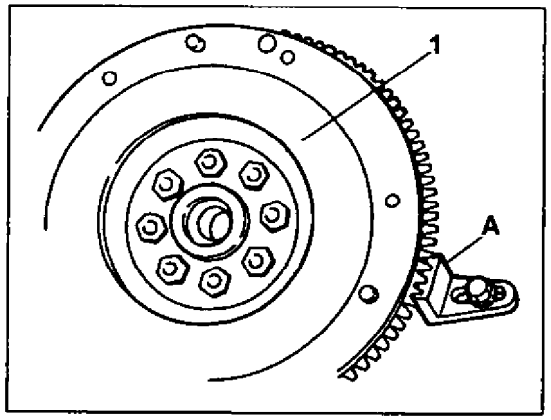


4) Flywheel
   - Inspect mating surface between flywheel and crankshaft for corrosion.
   - Inspect friction side of clutch disc for corrosion, wear, marks or overheating.

NOTE:
If any of the above defects appear in the parts inspected, replace the whole assembly.

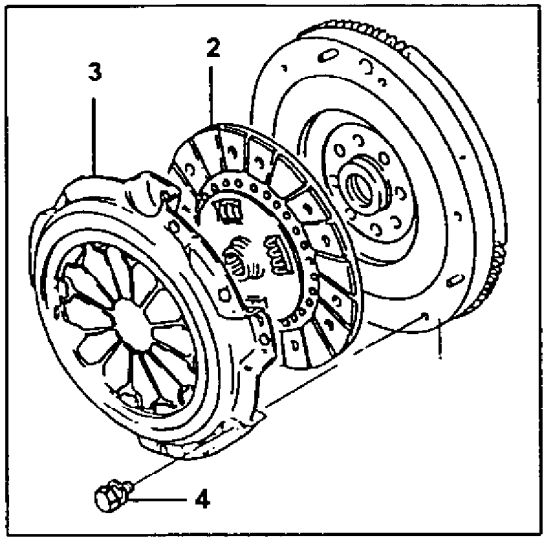
Installation

NOTE:
Carefully clean all mating faces before installing.



1) Place flywheel (1) in position on crankshaft and fasten with bolts. Lock flywheel with tool (A) and tighten bolts to specified torque.

   Torque specifications for flywheel attaching bolts
   5Kg-m (50 Nm).

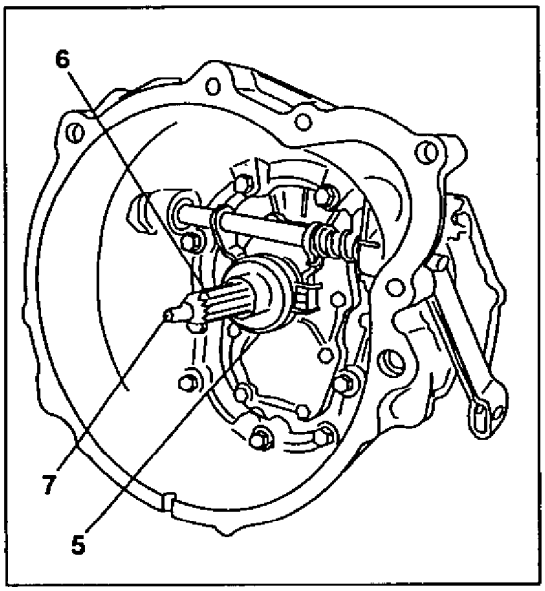


2) Install clutch disc (2) and pressure plate (2) centred with fittings. Fit pressure plate bolts (4) on and push them in place with your hand.
3) With the flywheel blocked, centre the clutch disc with a transmission input shaft or appropriate tool and tighten pressure plate bolts to specified torque.

Torque specifications for pressure plate bolts: 2.5 Kg-m (25 Nm)

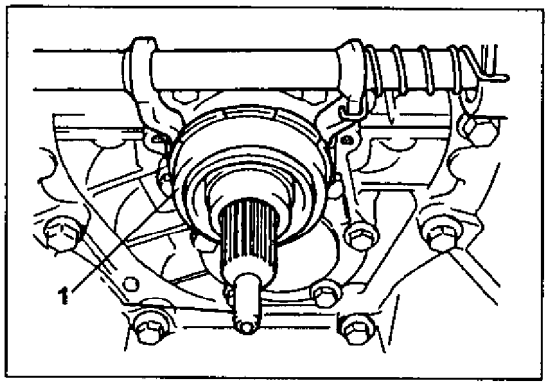
NOTE:
Progressively tighten pressure plate bolts.

4) Remove tool locking flywheel.



5) Install thrust bearing (5) and link it up to the clutch fork using one of the fittings on the bearing.
6) Apply a light film of recommended grease at end and in serration (6) of input shaft, as well as inside the thrust bearing (5).
7) Fit transmission and transfer case assemblies in vehicle, please refer to 7A.
8) Adjust clutch cable as indicated in this section.

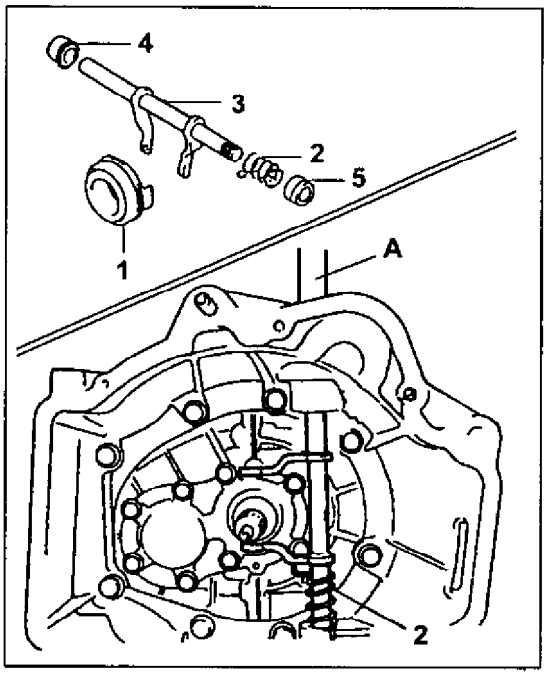
Recommenced grease: SUZUKI SUPER GREASE.



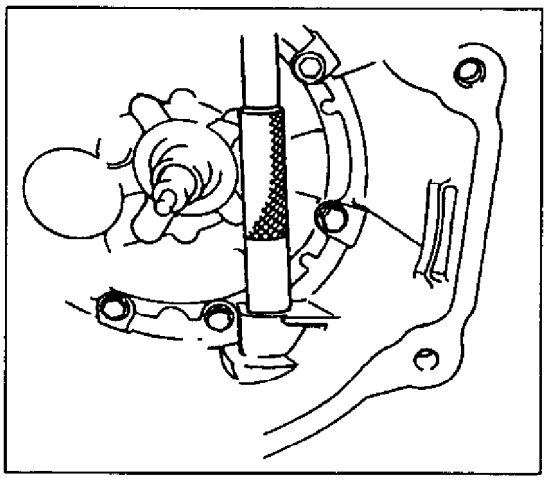
DISASSEMBLY OF UNIT

Removal

1) Remove transmission and transfer case assemblies, please refer to 7A-12.
2) Remove thrust bearing (1).



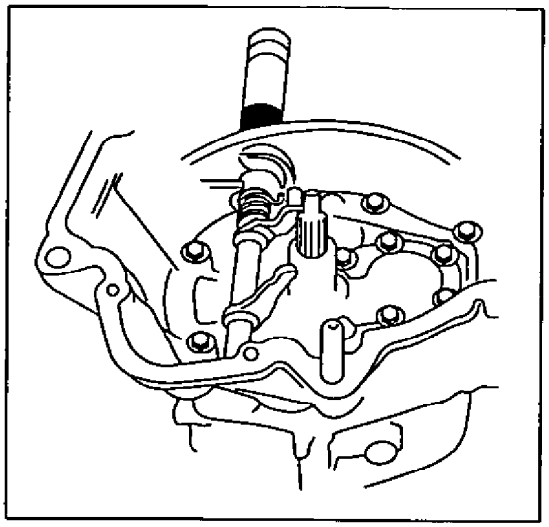
3) Disconnect return spring (2) and move release shaft (3) towards opposite side of spring.
4) Push right hand side bushing down (4) with a tappet until both shaft and bushing are removed from housing.
5) Remove bushing from right hand side (4) and remove release shaft (3).



6) Remove bushing from left-hand side (5) tapping it from outside.

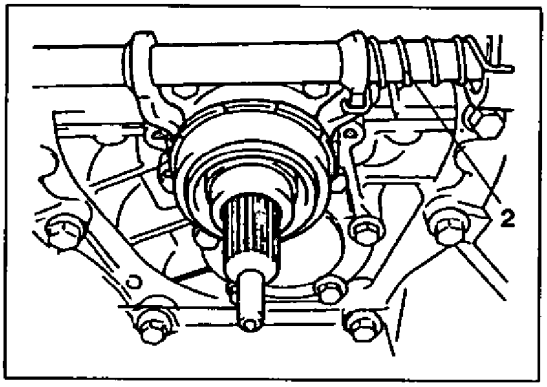
Inspection

1) Check that thrust bearing turns gently without noise, bumping or clearance.



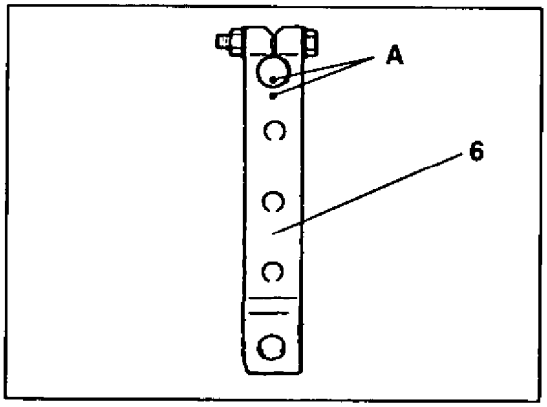
Assembly

1) Install in housing until right-hand bushing fits snug, applying grease to interior.
2) Install selector shaft in left-hand side of release shaft housing with spring.
3) Install right end of shaft in its corresponding bushing.
4) Apply grease to inside of left-hand bushing and insert it in its housing with lowered part facing inwards, the rim being level with the casing surface.



5) Position the spring ends (2), one on the casing and the other on the fork.

NOTE:
Do not wash the clutch release bearing as this could cause grease to leak and consequently damage the bearing.



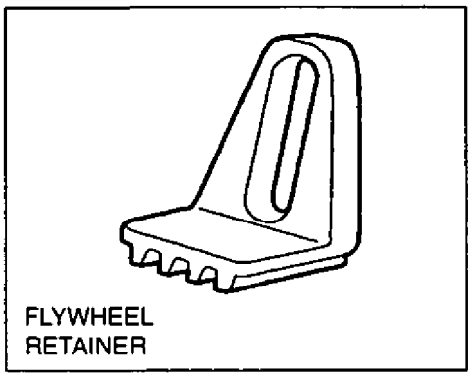
6) Fit clutch release lever (6) so that it coincides with centre punch marks (A), fit lever to the shaft with nut and bolt tightened to specified torque.

Torque specifications for lever locknut: 1 to 1.6 Kg-m (10 a 16 Nm)

7) Apply a light film of grease to inside of thrust bearing and fit it after checking that it is correctly fitted in the fork.
8) Fit transmission and transfer case assemblies, please refer to 7A-12.
9) Adjust clutch cable as indicated in this section.

Recommended grease: SUZUKI SUPER GREASE.

SPECIAL TOOLS


FLYWHEEL
RETAINER

TORQUE SPECIFICATIONS

SYSTEM	COMPONENT	VALUES	
		Kg-m	Nm
CLUTCH	Flywheel locking bolts	5	50
	Pressure plate locking bolts	2,5	25
	Clutch release lever/shaft locknut	1-1.6	10-16

SECTION 7D

TRANSFER CASE

WARNING:
For vehicles equipped with AIR BAG system (inflatable protective mattress system), please take the following precautions:

- **90 seconds must have passed after disengaging the starter motor, set the switch in LOCK position and disconnected the battery, before starting work in areas where the AIR BAG system could be accidentally activated.**
- **If in doubt, consult section 9J before carrying out work around components that could accidentally activate the AIR BAG system.**

7D

LIST OF CONTENTS

GENERAL OUTLINE

The transfer case, made of aluminium, is directly connected to the rear part of the transmission and houses the input gear, counter gear, output rear shaft, output low gear and output front shaft (for front wheel drive), being connected by a transfer chain.

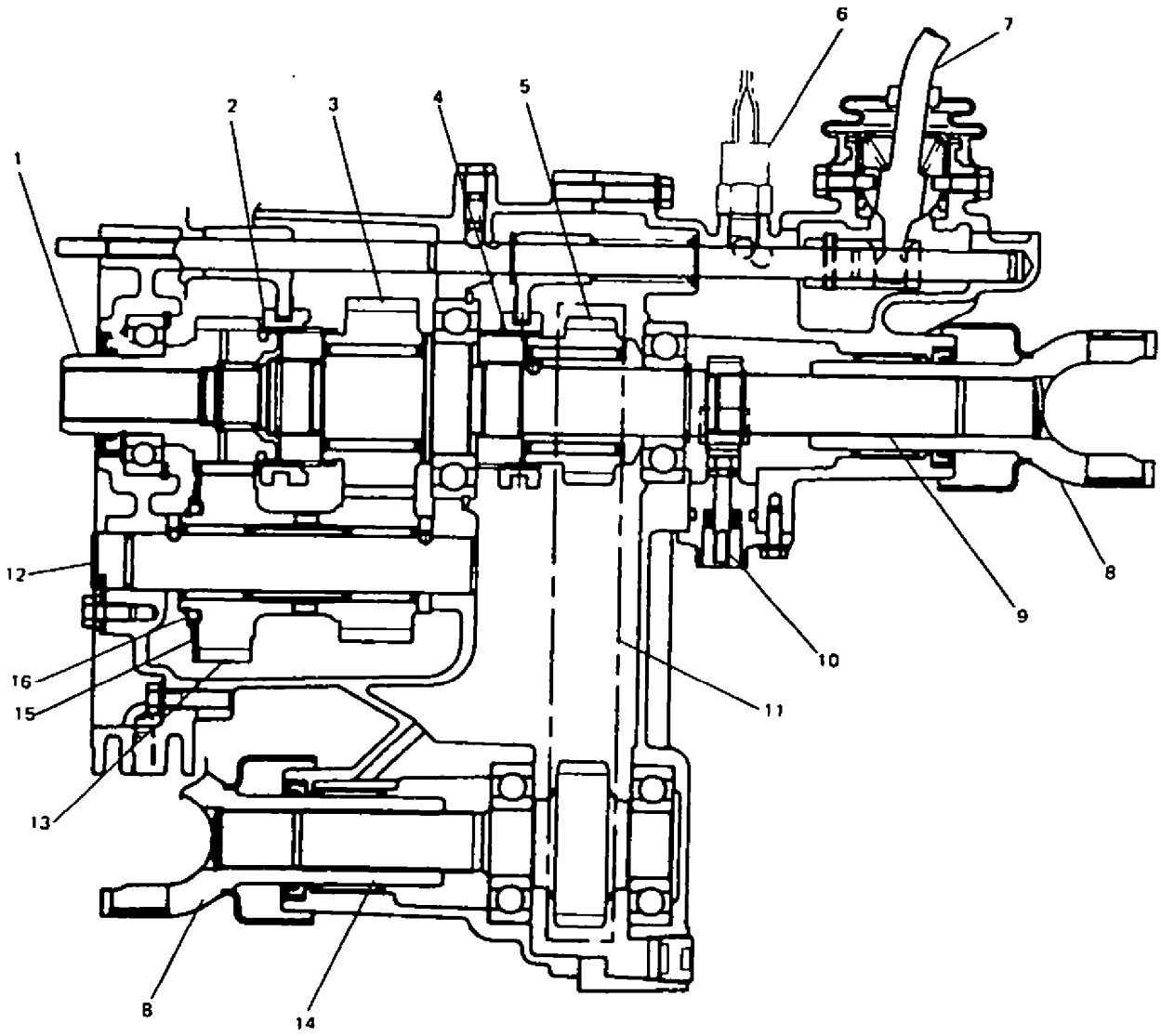
The transfer case is equipped with a selector mechanism so that the gear shift lever can select between high speed (directly connected to transfer case output: the main shaft), low speed (reduction of speed by mean of input gear, counter gear and output low gear) or neutral by means of the reduction shift sleeve provided between the input gear and output low gear, in addition to selecting two wheel drive (only for high speeds) or four wheel drive/high or low speeds) by means of the front selector drive sleeve located in the centre of the output rear shaft.

The front drive fork is equipped with an auxiliary spring to allow a gentle switch from 4WD to 2WD.

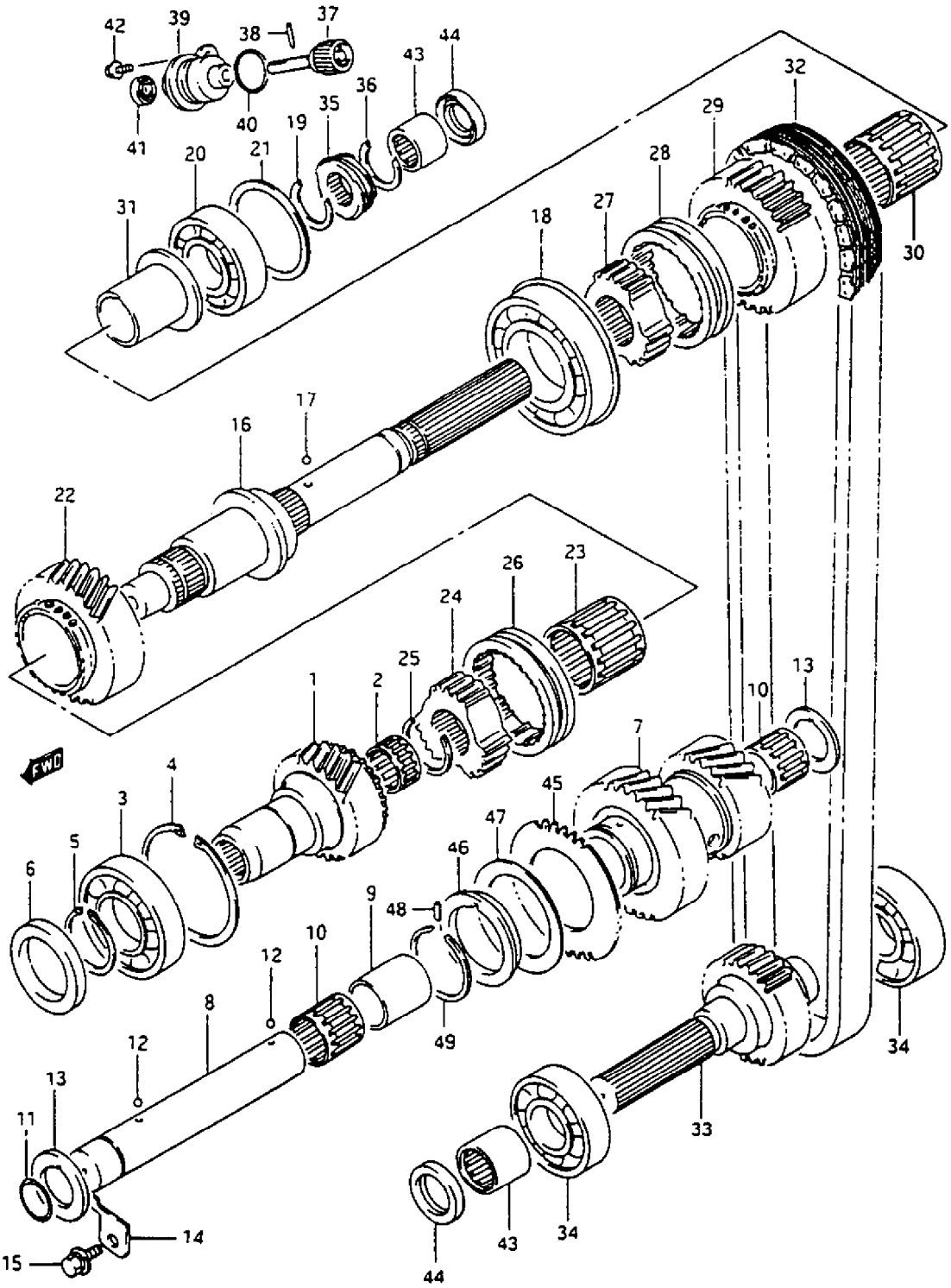
As with the transmission, on reassembling the transfer case after service it is necessary to use a recommended sealant for sealing the case and to tighten bolts to the specified torque using a dynamometer. It should also be noted that the case is equipped with a groove of oil to provide adequate lubrication in severe functioning conditions.

When towing the vehicle for repair or similar, place the gear shift lever in position N and follow the towing instructions in the OWNER'S MANUAL.

For diagnosis please refer to Section 7A.



1. Transfer case input gear
2. Reduction shift sleeve
3. Low gear
4. Front wheel drive selector sleeve
5. Drive pinion
6. 4WD switch
7. Transfer case gear shift lever
8. Sliding fork
9. Output rear shaft
10. Speedometer driven gear
11. Drive chain
12. Counter shaft
13. Counter gear
14. Output front shaft
15. Friction gear
16. Retaining elastic ring



1. Input gear
2. Needle bearing
3. Input gear bearing
4. Input bearing circlip
5. Input gear circlip
6. Oil seal
7. Counter shaft
8. Counter shaft
9. Spacer
10. Needle bearing
11. Toric ring
12. Ball
13. Washer
14. Plate
15. Screw
16. Output rear shaft
17. Ball
18. No.1rear shaft bearing
19. Circlip
20. No.2 rear shaft bearing
21. Adjusting washer
22. Output low gear
23. Needle bearing
24. Reduction sleeve inner bushing
25. Circlip
26. Reduction shift sleeve
27. Front wheel drive sleeve inner bushing
28. Front wheel drive selector sleeve
29. Drive sprocket
30. Needle bearing
31. Needle bearing bushing
32. Ransfer chain
33. Output front shaft
34. Bearing
35. Speedometer powered gear
36. Circlip
37. Speeedometer powered gear
38. Elastic cotter pin
39. Powered gear casing
40. Toric ring
41. Oil seal
42. Screw
43. Needle bearing
44. Oil seal
45. Friction gear
46. Friction gear retainer
47. Friction gear spring washer
48. Cotter pin
49. Elastic retaining ring

DIAGNOSIS

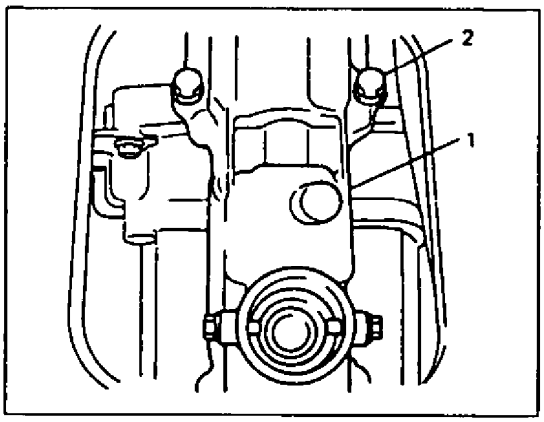
Please refer to section7A-6 of this Manual.

SERVICING THE VEHICLE

Please refer to 7A-7 of this Manual.

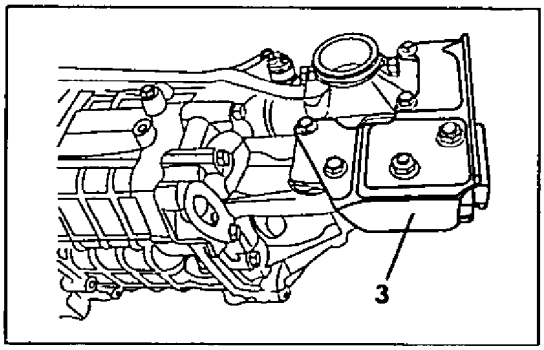
TRANSFER CASE DISASSEMBLY AND ASSEMBLY

Disassembly and assembly of the transfer case and transmission as one single assembly is described in section 7A-12. It is nevertheless possible to disassemble and assemble the transfer case independently, as outlined below.



Disassembly

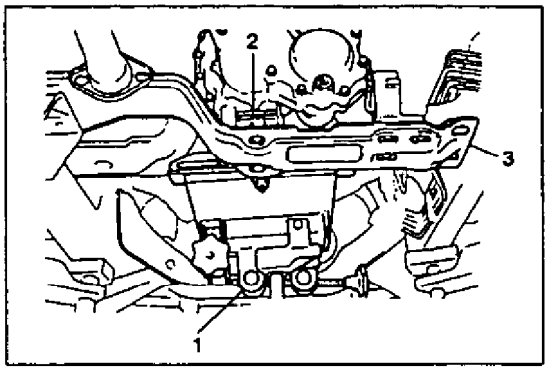
1) Remove negative battery cable.
2) Remove console and transfer case shift lever, please refer to 7A-10.
3) Remove four bolts (2) attaching the gear shift lever case (1) and remove the case.



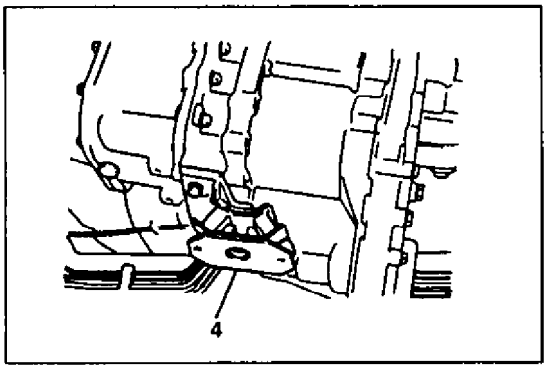
4) Remove the two bolts securing the damper (3)and remove.

Lower part

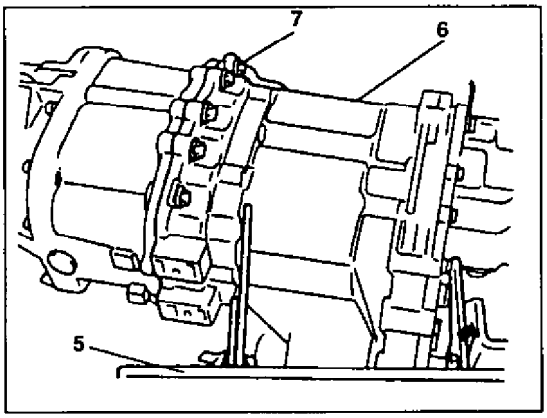
1) Proceed in the same way as for TRANSMISSION AND TRANSFER CASE DISASSEMBLY (lower part), please refer to 7A-12.
   - Drain oil from transfer case and transmission.
   - Remove front and rear propeller shafts.
   - Remove section no.2 of exhaust pipe.
   - Disconnect speedometer cable.
   - Disconnect ground cable.



2) Install lifting device or hydraulic jack (1) in lower part of 5th gear case (reinforced area), and if possible screw plate to threaded wrist pins in case.
3) Tension lifting mechanism without forcing.
4) Remove the bolts attaching the elastic support (2) to the crossmember (3).
5) Remove four bolts attaching crossmember (3), remove and lower the assembly to a position from where it can be extracted.



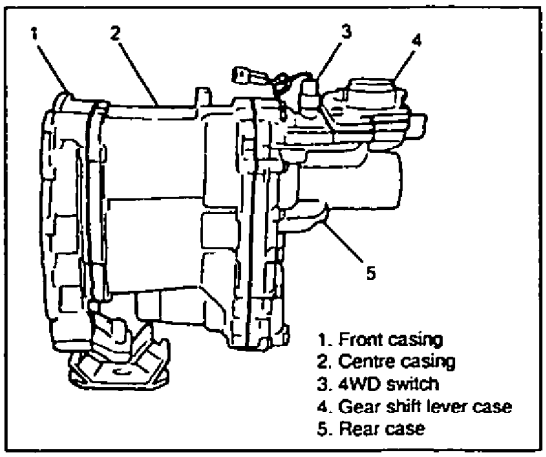
6) Remove elastic support (4).



7) Position jack (5) so that it is supporting transfer case assembly (6).
8) Uncouple two-wheel drive connector, electric branch and ventilating tubes.
9) Remove bolt (7) attaching transmission to transfer case on lower and upper parts.
10) Extract transfer case by sliding it backwards.

Assembly

1) Effect assembly in the reverse order to disassembly, bearing in mind the following:
   - Tighten to specified torque.
   - Securely couple electric connectors and ventilating tubes and secure electric branches with their coiled clamps.
   - Fill and check oil as indicated in 0B. MAINTENANCE AND LUBRICATION.
   - Check functioning and ensure there are no leaks.

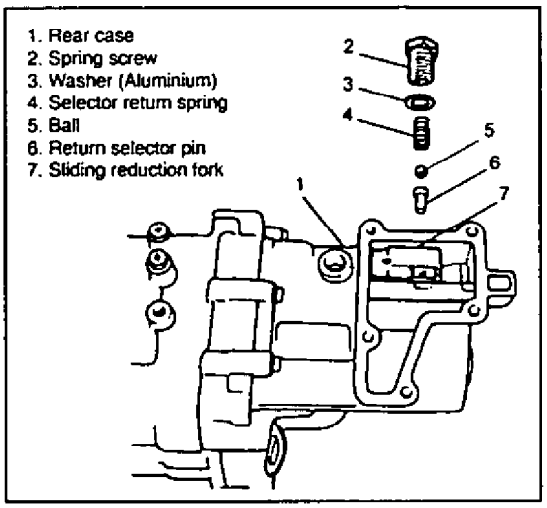


1. Front casing
2. Centre casing
3. 4WD switch
4. Gear shift lever case
5. Rear case

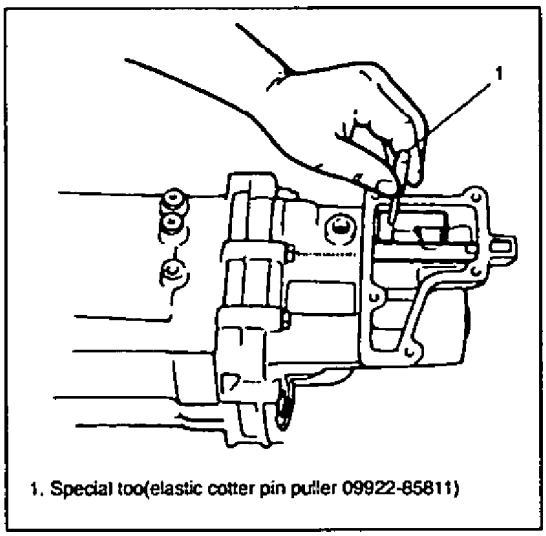
GENERAL REVISION AND REPAIR OF ASSEMBLY

DISASSEMBLY

1. Remove 4WD switch and extract metal ball.
2. Remove five bolts and then remove gear shift lever case.



3. After removing selective return system, extract metal ball and cotter pin.

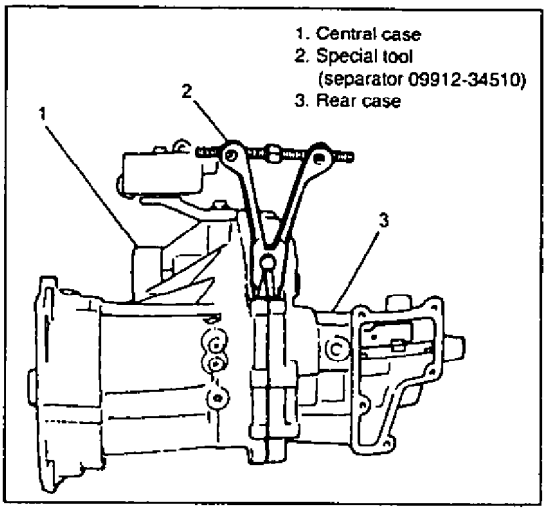


1. Special too(elastic cotter pin puller 09922-85811)

4. Extract elastic cotter pin from reduction gear fork by hitting it with a special tool.

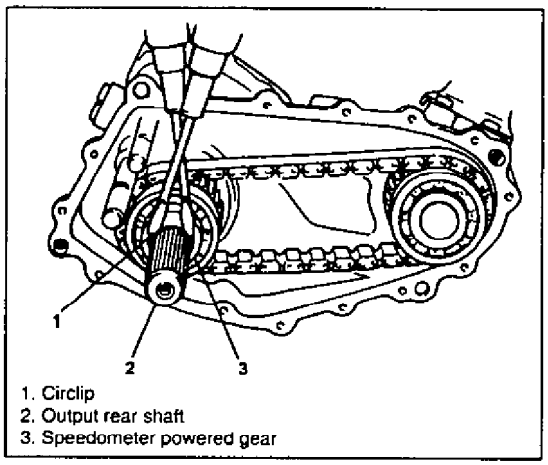
NOTE:

- **As the cotter pin could fall in the case on extracting, remove it when the case is disassembled.**
- **After extracting the elastic cotter pin, the fork can be removed easily.**

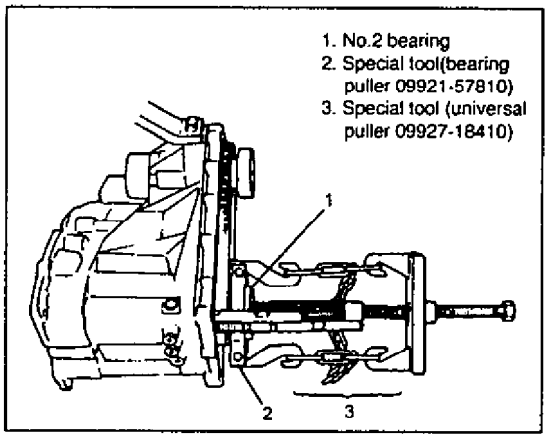


5. Remove the 15 bolts from the rear case and then separate the case using the special tool.

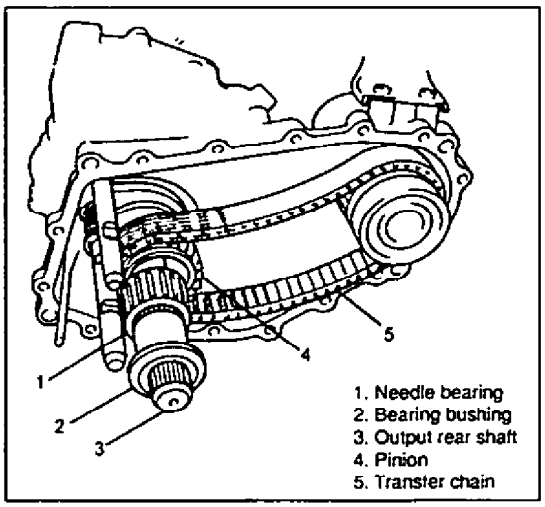
NOTE:
To separate the case use a special tool on the four points, one by one, so as to obtain a wider more uniform opening.



6. Remove the circlip using screwdrivers and a hammer, and extract speedometer gear drive.



7. Remove the retaining circlip from the bearing and extract bearing no.2 using a combination of the special tools.

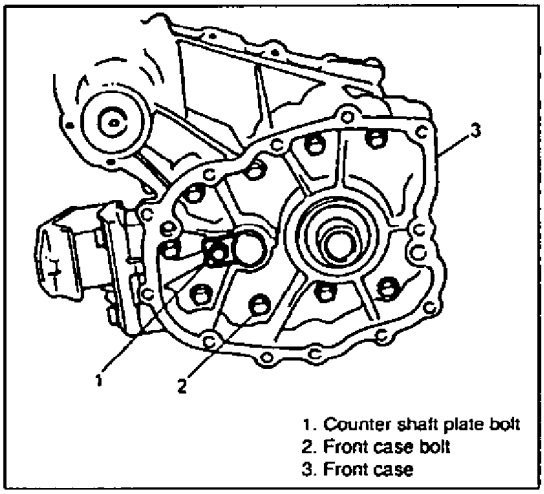


1. Needle bearing
2. Bearing bushing
3. Output rear shaft
4. Pinion
5. Transfer chain

8. Extract output rear shaft, bearing bushing and needle bearing.

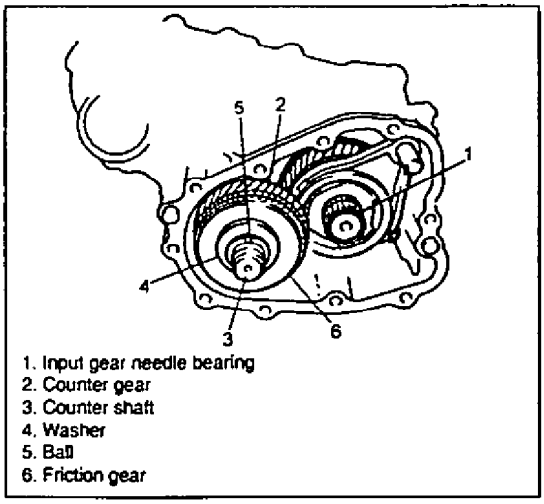
NOTE:
Be careful not to mislay metal ball that comes out of the shaft on extracting bushing.

9. Remove pinion and then the transfer chain.



1. Counter shaft plate bolt
2. Front case bolt
3. Front case

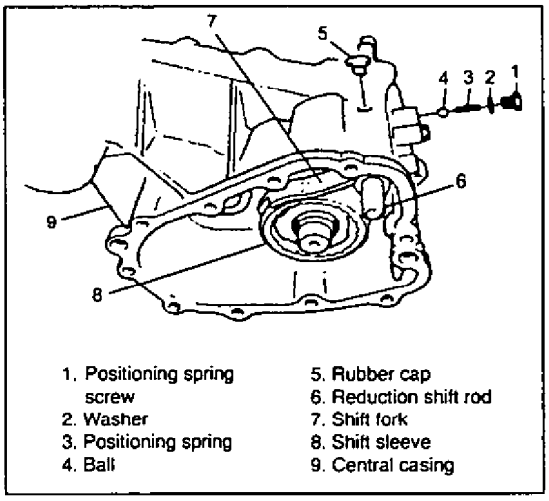
10. Remove countershaft plate bolt from front case so as to be able to extract plate from countershaft.
11. Remove front case by taking out the 9 bolts.



1. Input gear needle bearing
2. Counter gear
3. Counter shaft
4. Washer
5. Ball
6. Friction gear

12. Remove needle bearing from input gear, the counter shaft washer and the metal ball. If necessary, remove the toric ring from the counter shaft.

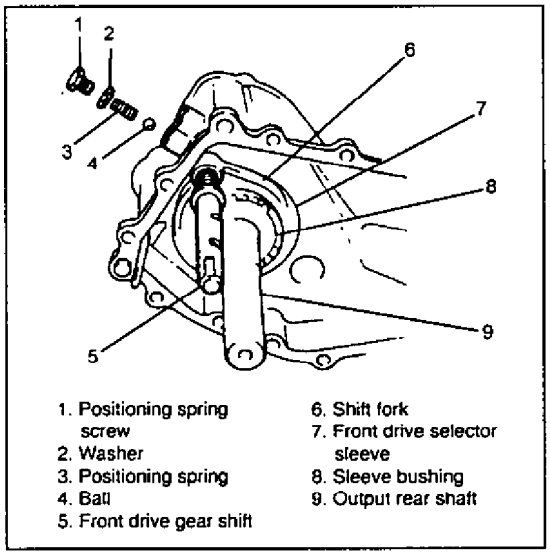
NOTE:
Be careful not to lose the metal balls that come away between the shaft and the washers (front and rear).



1. Positioning spring screw
2. Washer
3. Positioning spring
4. Ball
5. Rubber cap
6. Reduction shift rod
7. Shift fork
8. Shift sleeve
9. Central casing

13. Remove elastic seal ring, friction retainer, friction gear spring washer, friction gear and cotter pin in that order.
14. Remove positioning spring bolt, with spring washer and ball for reduction shift. Also remove the rubber cap.
15. Remove reduction shift rod together with the fork and sleeve.

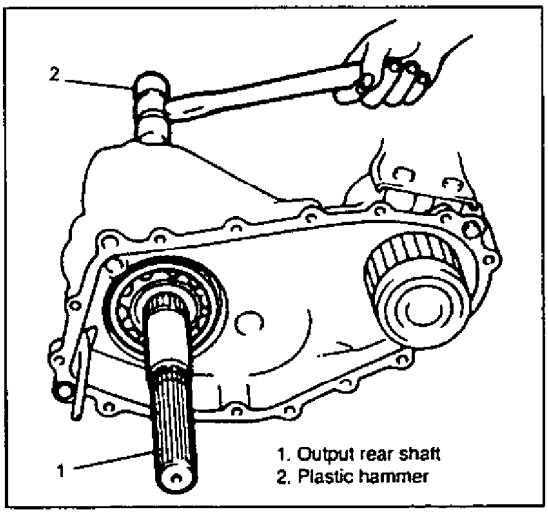
NOTE:
When disassembling, be sure to place the front drive fork shaft in the 4 WD position.



1. Positioning spring screw
2. Washer
3. Positioning spring
4. Ball
5. Front drive gear shift
6. Shift fork
7. Front drive selector sleeve
8. Sleeve bushing
9. Output rear shaft

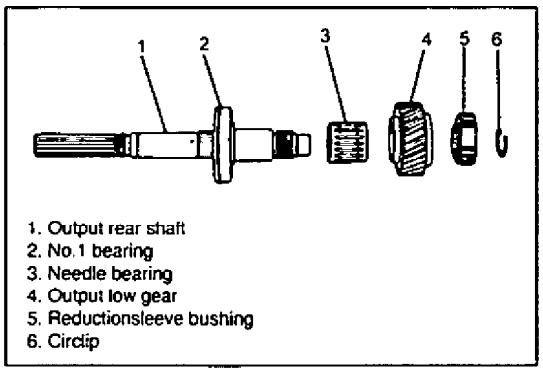
16. Remove spring positioning bolt, washer, spring and the ball for front wheel drive.
17. Extract the front drive fork and shaft, the selector sleeve and the bushing together.

NOTE:
Be careful not to mislay metal locking ball that comes away between the two shift rods. If it cannot be extracted, remove the rubber cap first.



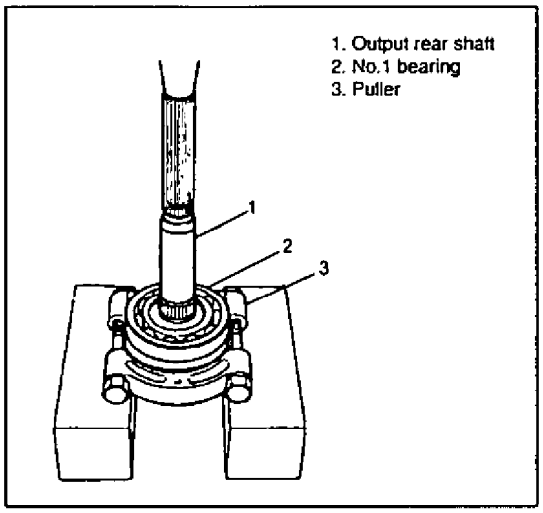
1. Output rear shaft
2. Plastic hammer

18. Using a plastic hammer, extract the output rear shaft and the bearing. The output low gear and the reduction sleeve bushing will also come off, since they are installed in the shaft.



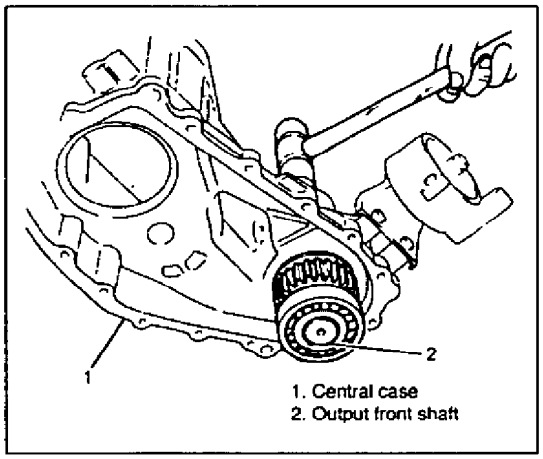
1. Output rear shaft
2. No.1 bearing
3. Needle bearing
4. Output low gear
5. Reductionsleeve bushing
6. Circlip

19. Remove the circlip from the shaft and remove the bushing from the reduction sleeve, output low gear and needle bearing.



1. Output rear shaft
2. No.1 bearing
3. Puller

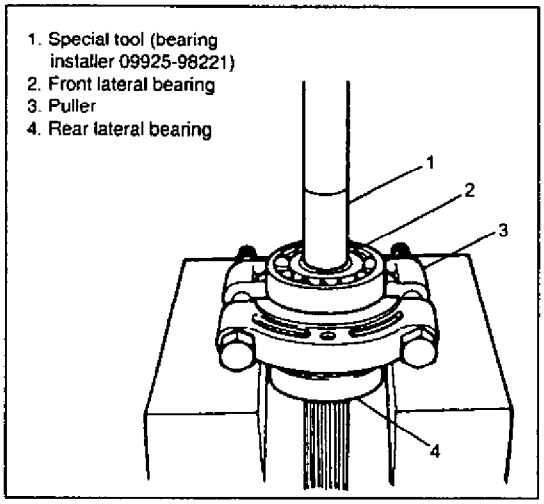
20. Using a puller or a press, remove shaft no.1 bearing.



1. Central case
2. Output front shaft

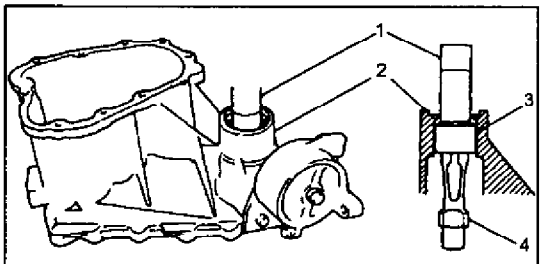
21. Remove oil seal from central case.
22. Using a plastic hammer, extract the output front shaft together with the bearings.

CAUTION:
If the oil seal is kept inside the front case, be careful when knocking so as not to damage the oil seal. Use a tappet for knocking.



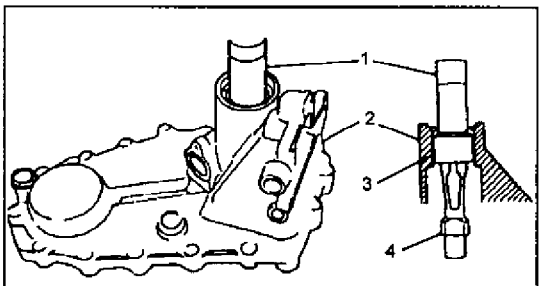
1. Special tool (bearing installer 09925-98221)
2. Front lateral bearing
3. Puller
4. Rear lateral bearing

23. Remove the bearings from the shaft using a press and an extractor. removal of the bearing from the front side requires the additional use of a special tool, as indicated below.



1. Special tool (bearing installer 09913-84510)
2. Central case
3. Needle bearing
4. Special tool (bearing puller 09941-64511)

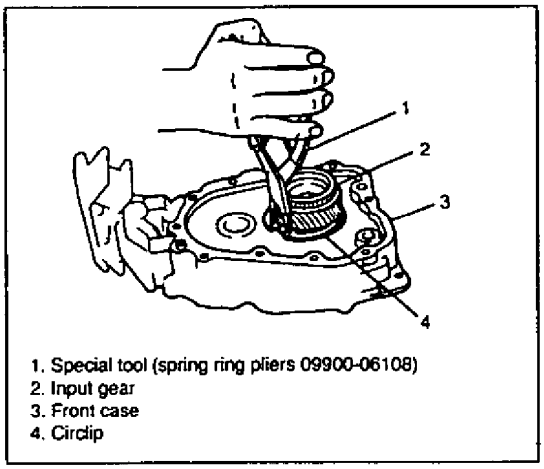
24. To remove the needle bearing from the central case, combine the special tools as indicated in the figure and press.



1. Special tool (bearing installer 09913-84510)
2. Central case
3. Needle bearing
4. Special tool (bearing puller 09941-64511)

25. Remove the oil seal from the rear case. Then, using the same special tools and the press as before, extract the needle bearing from the rear case.

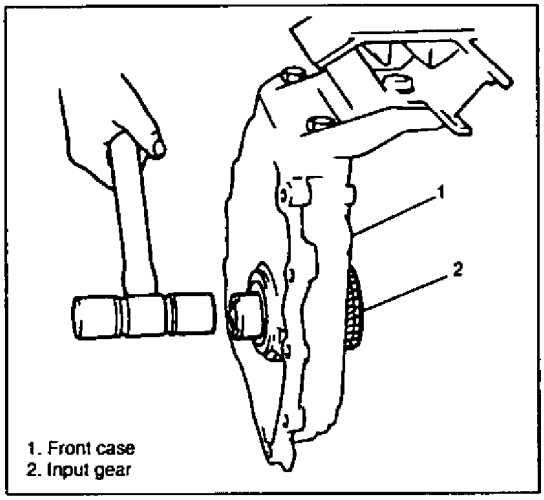
CAUTION:
Be careful not to damage the oil seal, if it is kept in the rear case.



1. Special tool (spring ring pliers 09900-06108)
2. Input gear
3. Front case
4. Circlip

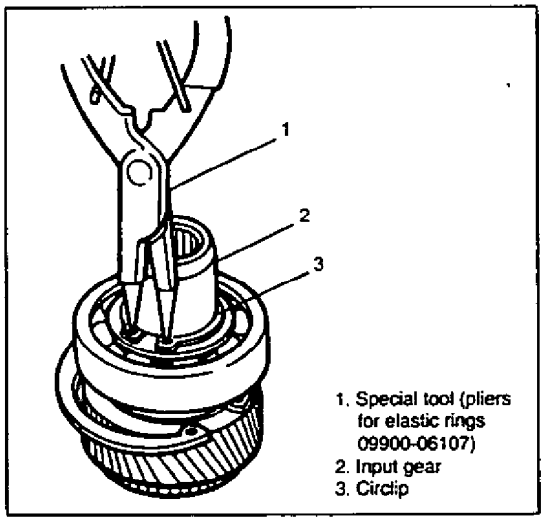
26. Using the special tool, remove the circlip from the input gear bearing.

NOTE:
Ensure that the correct tools are used for the work.



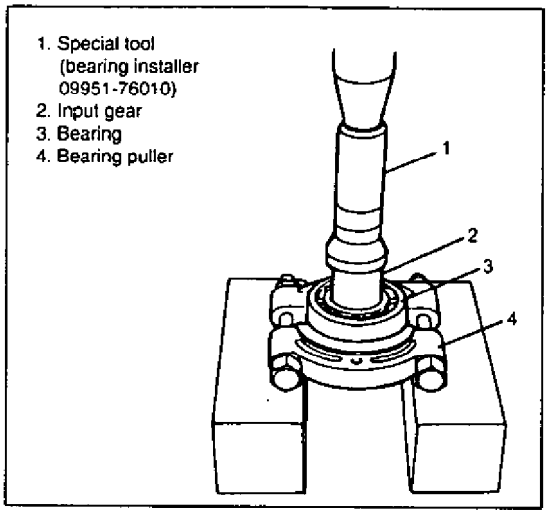
1. Front case
2. Input gear

27. Using a plastic hammer, extract the gear from the case.



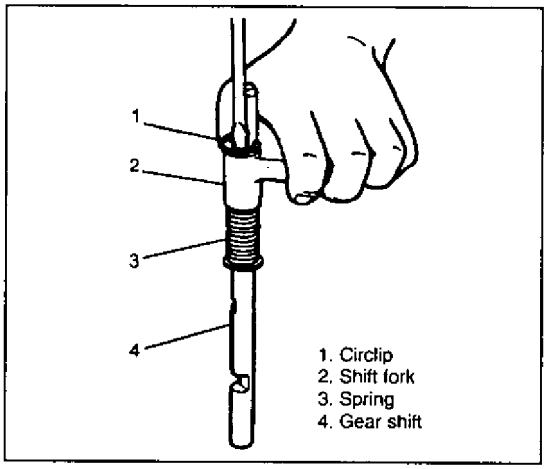
1. Special tool (pliers for elastic rings 09900-06107)
2. Input gear
3. Circlip

28. Remove the input gear circlip using a special tool.

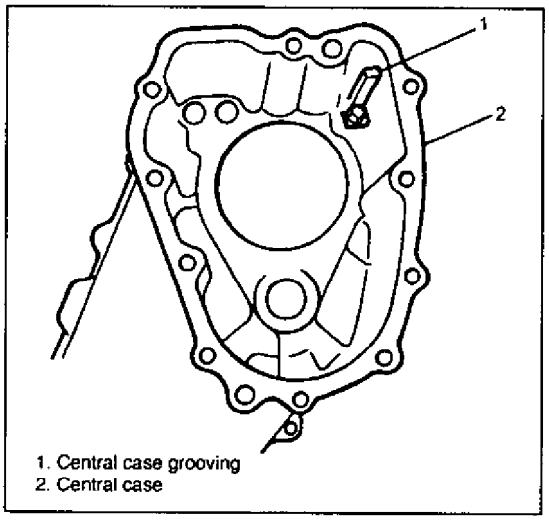


29. Remove the bearing using the puller and press.

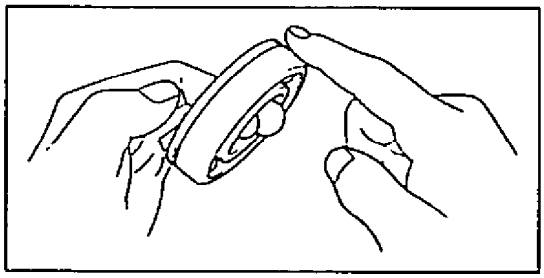
NOTE:
For this operation use a soft metal protector to avoid damage to gear serrations.



30. With the spring of the front selector fork shaft compressed, removed the circlip and then remove the fork and spring.

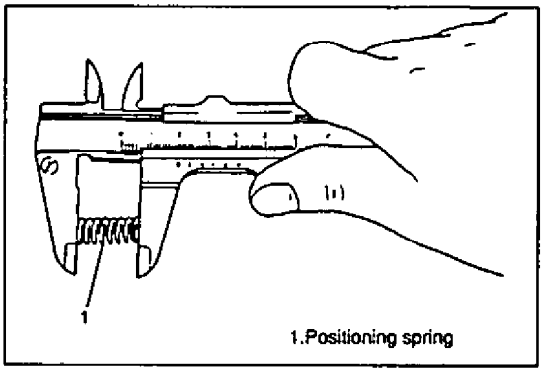


31. Remove oil groove with a wrench.



INSPECTION

1. Check that each ball bearing turns gently. Replace if necessary.
2. Check the needle bearing and bearing mating surface for sign of damage. Replace if necessary.
3. Check the gear teeth surfaces and the gear shift mechanism in the same way as for the transmission. Correct or replace if necessary.

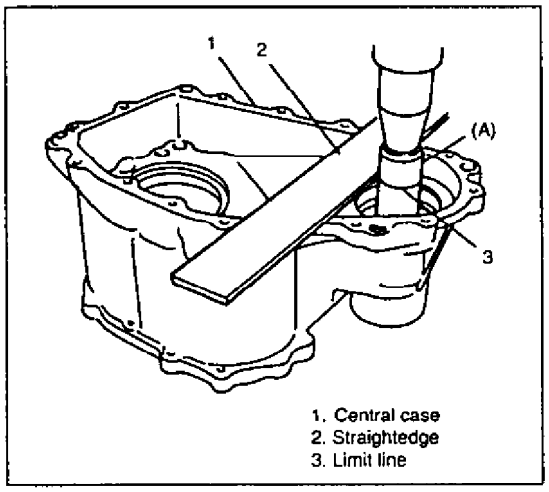


1.Positioning spring

4. Check each spring to detect any distortion or breaks and renew if necessary. In the case of the positioning springs especially, measure the free length and replace if they exceed the service limit.

	Standard	Service limit
Positioning spring free length	**19.5 mm 0.768 in.**	**18.0 mm 0.709 in.**

5. Check the transfer chain and pinions to detect for wear or abnormal damage. replace if necessary.
6. Check for leaks in the oil seal and for excessive hardening of the rim. Replace if defective. Also check the mating surface of the shaft with the oil seal. Correct or replace if defective.



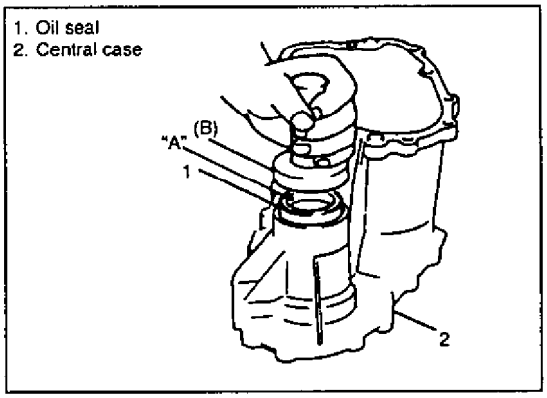
1. Central case
2. Straightedge
3. Limit line

ASSEMBLY

1) Use a press and a special tool and press the bearing into the central case. As indicated in the figure, place a straightedge on the upper surface of the central case and proceed to install until the end of the special tool is aligned with the lower side of the straightedge (the surface of the case).

NOTE:
- **Fit the needle bearing in the same way as in the previous operation and so that it is 3 mm from the bottom of the case.**
- **Once it has been pressed to the bottom of the case it is difficult to remove.**

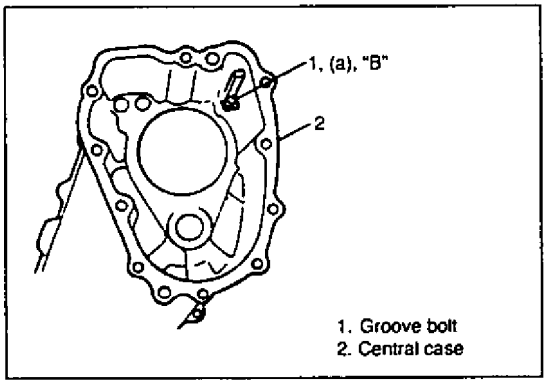
Special tool
(A): 09951-76010



2) Use a special tool and a hammer to insert the oil seal in the central case until it is at the level of the case surface. Apply grease to the oil seal rim.

"A": Grease 99000-25010

Special tool
(B): 09913-75520

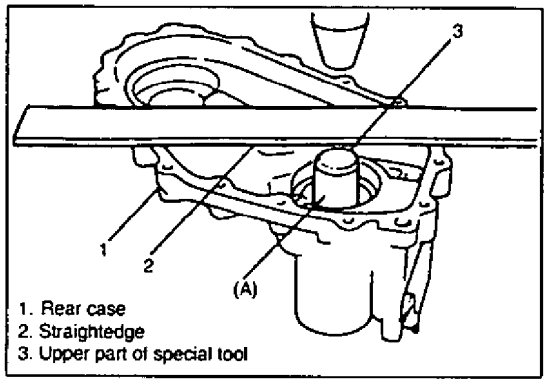


1. Groove bolt
2. Central case

3) Install the oil channel and tighten screw with sealant applied to the thread.

Torque specifications
(a): 0.6 Kg-m (6 Nm)

"B": Sealant 99000-32020

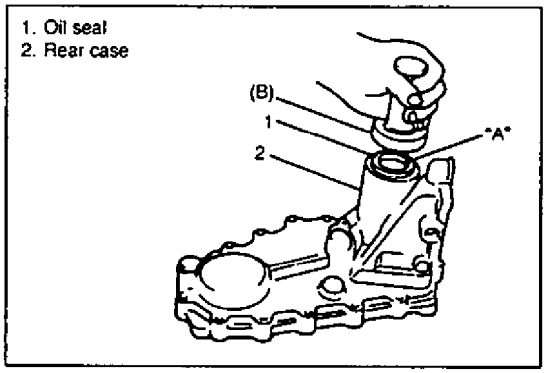


1. Rear case
2. Straightedge
3. Upper part of special tool

4) Use the special tool and a press to install the needle bearing in the rear case as shown in the figure, place a straightedge on the surface of the case and press until the upper part of the special tool is aligned with the lower surface of the straightedge (the surface of the case).

NOTE:
As with the needle bearing in the centre case, installation results in the bearing being 3 mm from the bottom of the case.

Special tool
(A): 09951-76010

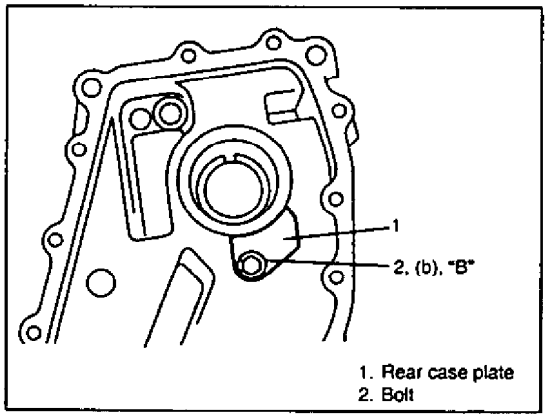


1. Oil seal
2. Rear case

5) Use the special tool and a hammer to install the oil seal in the rear case until it is at the same level as the surface of the case. Apply grease to the oil seal rim.

"A": Grease 99000-25010

Special tool
(B): 09913-75520



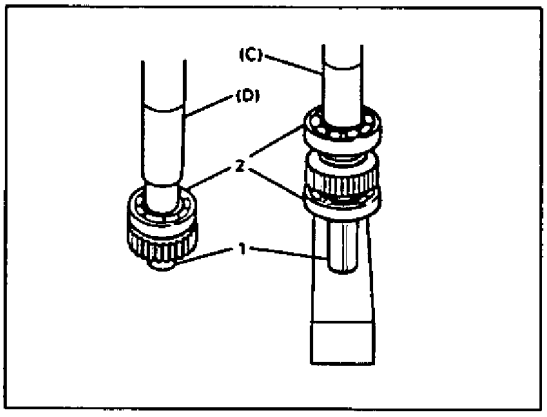
1. Rear case plate
2. Bolt

6) Install the rear case plate and the screw with sealant applied to the thread.

NOTE:
It is not necessary, normally, to remove the rear case plate, If it is removed or replaced, however, the screw should be installed by applying sealant to the thread.

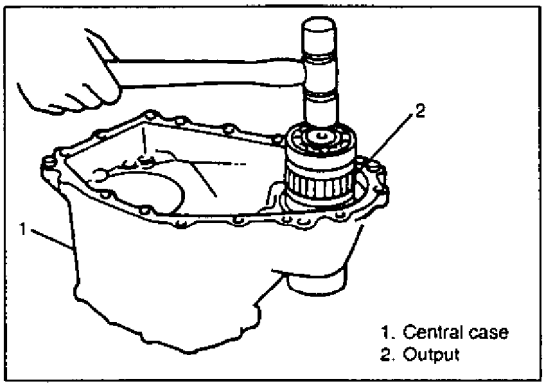
"B": Sealant 99000-32020

Torque specifications:
(b): 0,6 Kg-m (6 Nm)

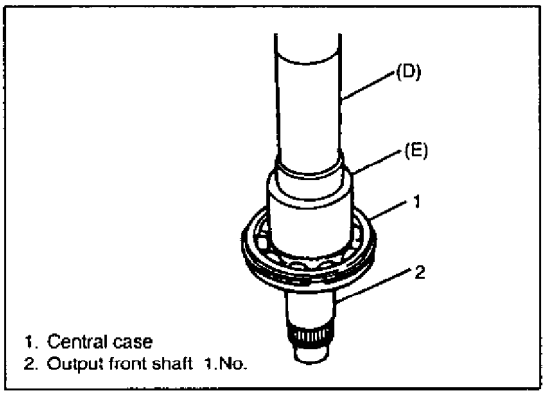


7) Use a press and the special tools to install the bearings on the front shaft.
The bearings for the front and rear sides are the same.

Special tool
(C): 09913-84510
(D): 09925-18010

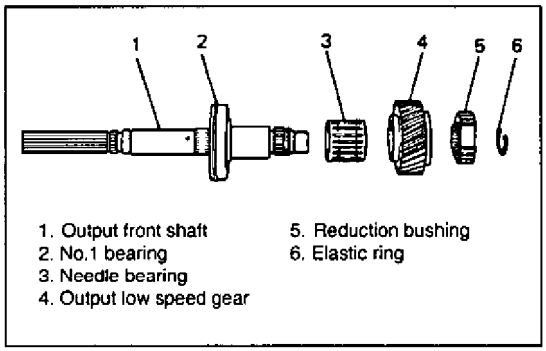


8) Use a plastic hammer to insert the front shaft in the centre case.

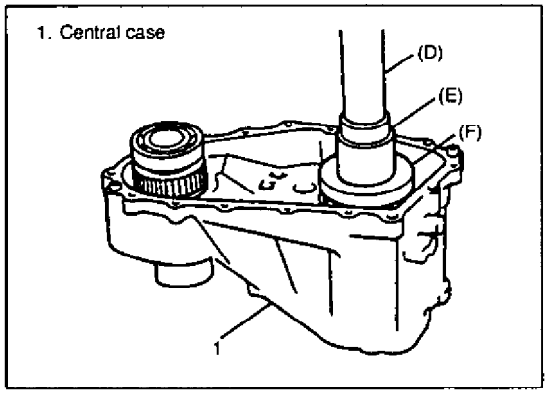


9) Use a press and the special tools to install no. 1 bearing on the output rear shaft. Place the bearing's elastic ring in the upper part as shown in he figure.

Special tool
(D): 09925-18010
(E): 09940-53111



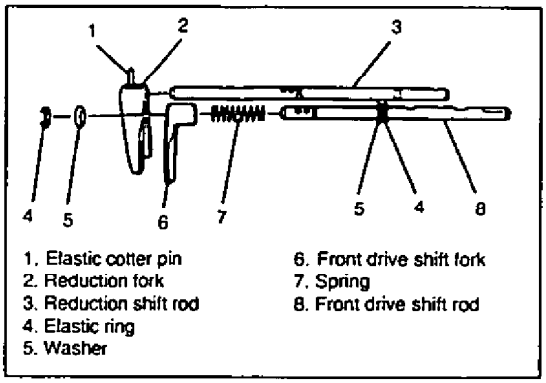
10) Install the needle bearing, output low gear and reduction sleeve bushing on the output rear shaft.
The bushing does not have a specific installation direction.



11) Combine the special tools and press the output rear shaft in the central case.

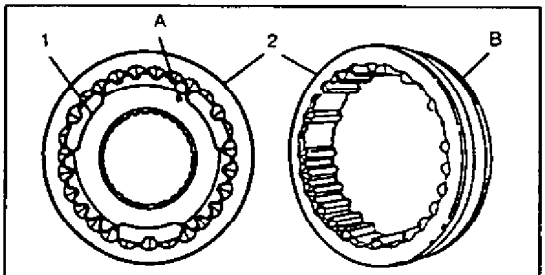
NOTE:
Use the special tool (F) with the lower cut side facing downwards (towards the bearing).

Special tool
(D): 09925-18010
(E): 09940-53111
(F): 09951-26010



1. Elastic cotter pin
2. Reduction fork
3. Reduction shift rod
4. Elastic ring
5. Washer
6. Front drive shift fork
7. Spring
8. Front drive shift rod

12) Install the fork in the corresponding shift rod.

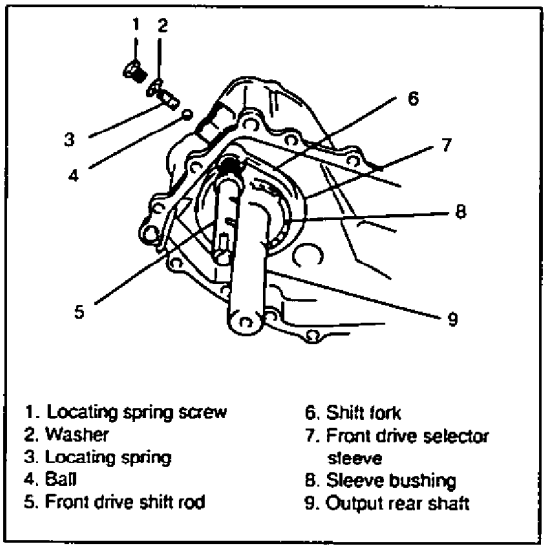


1. Front drive selector sleeve bushing
2. Front drive selector sleeve
A. Centre dotted mark (rear outlet)
B. Groove (front inner)

13) As shown in the figure, fit the bushing and the front wheel drive selector sleeve.

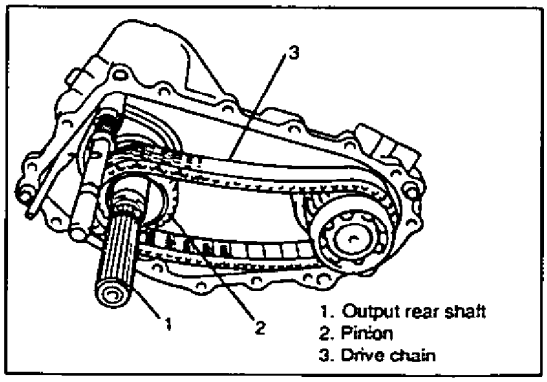
NOTE:

- **The sleeve with straight knurling does not have a specific installation direction. It is recommendable, however to install it so that the circumferential slot is facing inwards, as it originally was.**
- **For the bushing, the side with the centre dotted mark should face the rear of the vehicle (so it can be seen).**



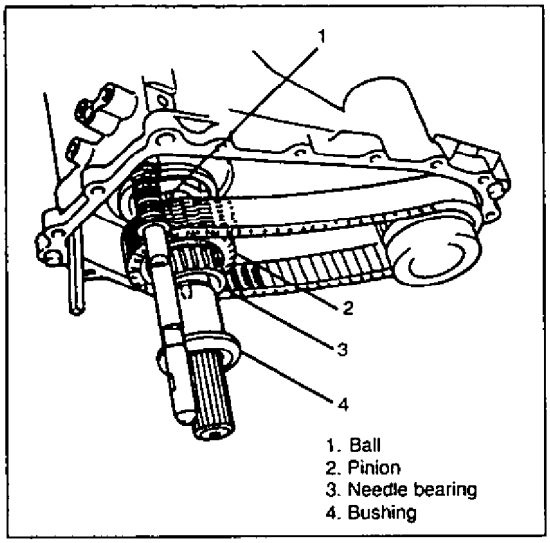
1. Locating spring screw
2. Washer
3. Locating spring
4. Ball
5. Front drive shift rod
6. Shift fork
7. Front drive selector sleeve
8. Sleeve bushing
9. Output rear shaft

14) Install the front wheel drive selector fork shaft assembly, the sleeve and bushing together in the centre case, simultaneously. Put the ball and locating spring in the case too and install the bolt untightened.



1. Output rear shaft
2. Pinion
3. Drive chain

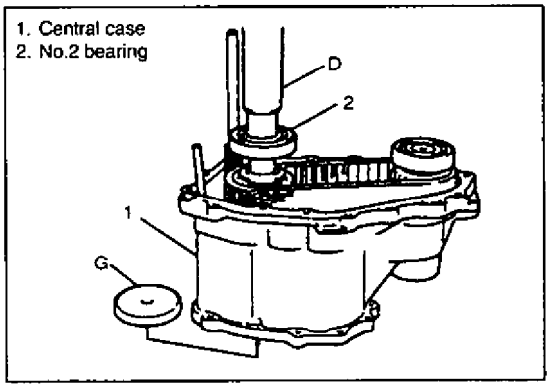
15) Install the pinion in the output rear shaft and couple up the drive chain.



1. Ball
2. Pinion
3. Needle bearing
4. Bushing

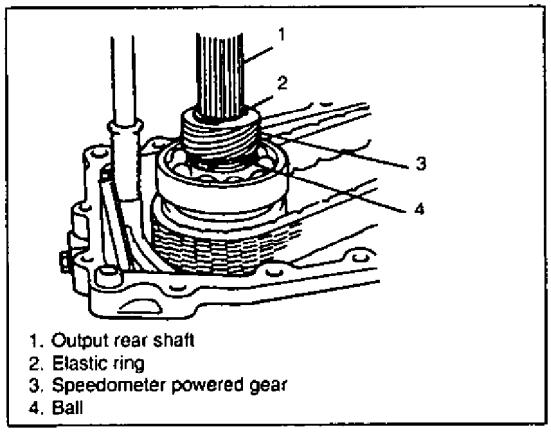
16) Install the needle bearing and the pinion. Also install the metal ball.

NOTE:
- **The point which serves as a mark on the output rear shaft, between the positions of no. 2 bearing and the speedometer driven gear, indicates the location of the ball at the front.**
- **The point serving as a mark on the bushing flange also indicates the position where the ball is located.**



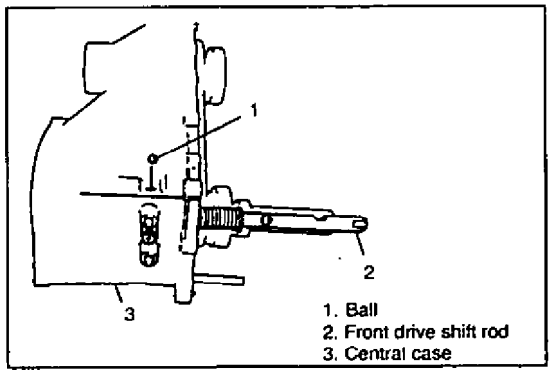
17) Use the special tool to press the no. 2 bearing into the output rear shaft. It is necessary to install the support base on the lower end of the shaft.

Special tool
(D): 09925-18010
(G): 09926-68310



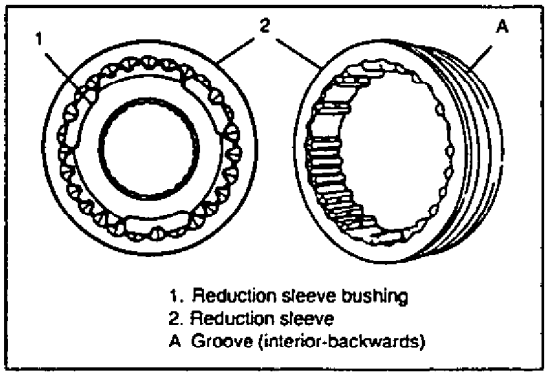
1. Output rear shaft
2. Elastic ring
3. Speedometer powered gear
4. Ball

18) After installing an elastic ring, install the ball and the speedometer driven gear. Secure with a smaller elastic ring.



1. Ball
2. Front drive shift rod
3. Central case

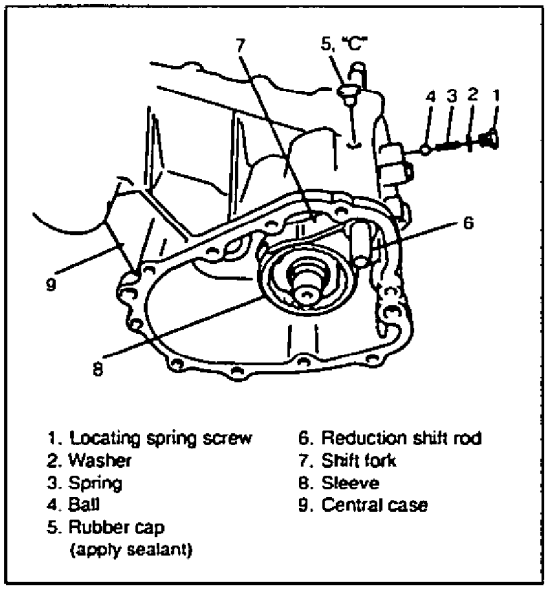
19) Install the interconnecting ball.



1. Reduction sleeve bushing
2. Reduction sleeve
A Groove (interior-backwards)

20) Fit the bushing and reduction sleeve.

NOTE:
- **The sleeve used is identified by conical serrations which distinguish it from the front wheel drive selector sleeve.**
- **The circumferential slot mark (on the side of the thick furrow which acts as a gear shift detent), should face inwards (backwards).**
- **The bushing does not have a specific installation direction.**

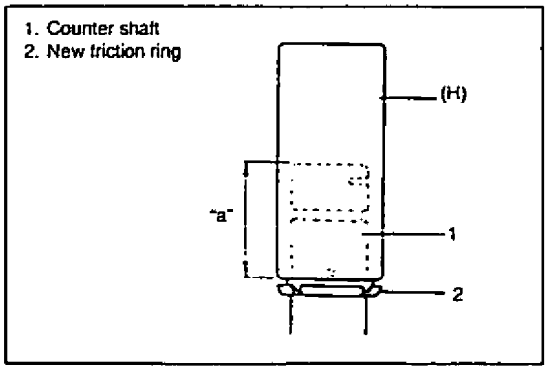


1. Locating spring screw
2. Washer
3. Spring
4. Ball
5. Rubber cap (apply sealant)
6. Reduction shift rod
7. Shift fork
8. Sleeve
9. Central case

21) Join the sleeve and bushing with the reduction shift rod assembly and install them in the central case. Put the locating spring ball in the case too and install the untightened bolt.
22) Apply sealant to the rubber cap and insert it in its hole in the case.

NOTE:
When the reduction shift rod is installed, the drive shift rod should be in the 4WD position.

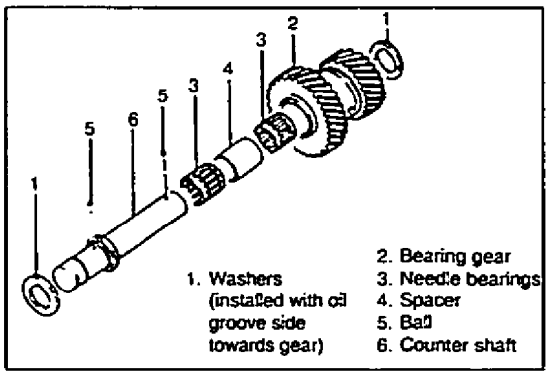
"C": Sealant 99000-31110



23) If the friction ring has been removed from the counter shaft, press a new one onto the shaft, being careful to install in the right direction and in the position shown in the figure.

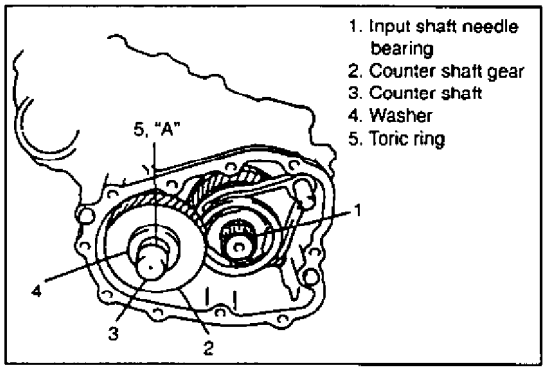
Special tool
(H): 09913-80112

Installation position "a": 39.5 mm (1.56 in.)



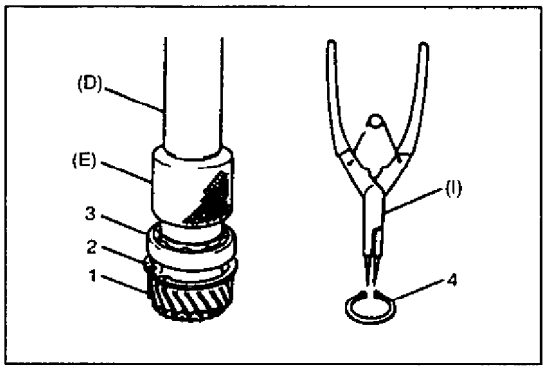
1. Washers (installed with oil groove side towards gear)
2. Bearing gear
3. Needle bearings
4. Spacer
5. Ball
6. Counter shaft

24) Install the needle bearing, spacer, counter shaft gear, balls and washers on the shaft.



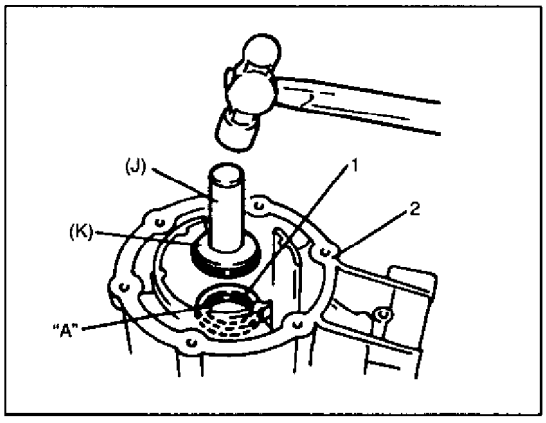
25) Install the counter shaft assembly in the case. If the toric bolt has been removed, install a new one in the shaft and apply grease.
Also install the low speed gear needle bearing.

"A": Grease 99000-25010



26) With the elastic ring installed on the input gear, press on the input gear bearing.
27) Fit the bearing with the elastic ring.

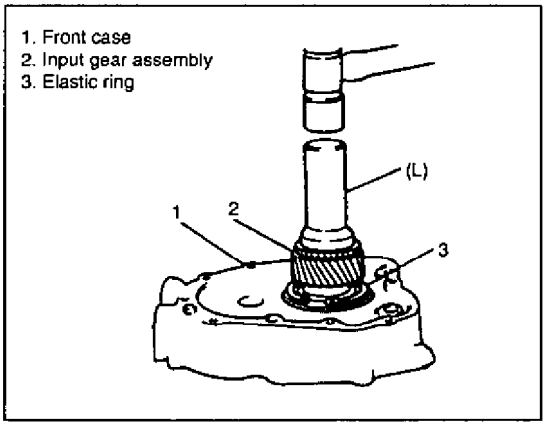
Special tool
(D): 09925-18010
(E): 09949-53111
(I): 09900-06107



28) Install the oil seal in the front case so that its surface is at the same level as the case. Apply grease to the rim of the oil seal.

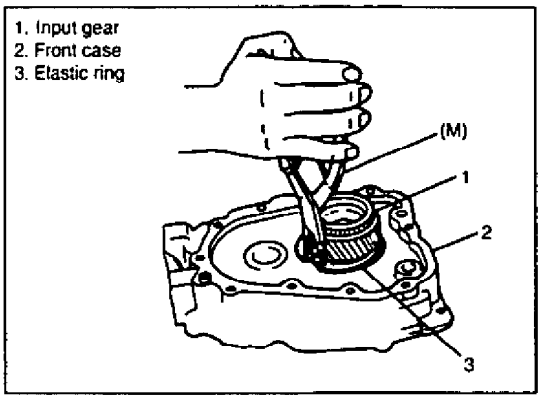
"A": Grease 99000-25010

Special tool
(J): 09924-74510
(K): 09944-68210



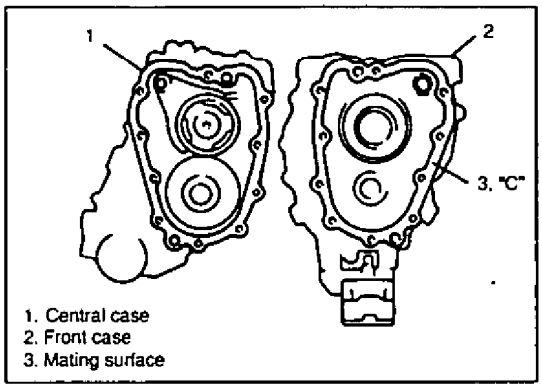
29) Use the special tool to install the input gear in the front case.

Special tool
(L): 09951-16080



30) Fit the elastic ring using pliers.

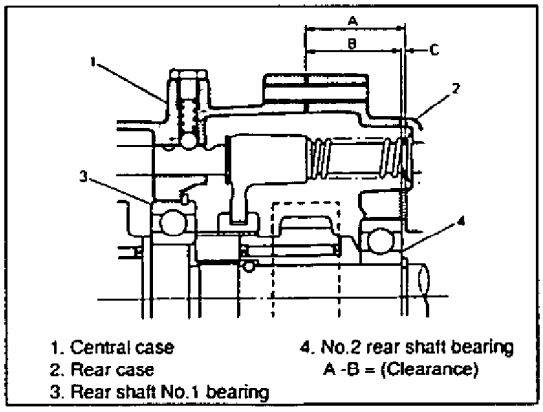
Special tool
(M): 09900-06108



31) Lubricate rotating parts and clean mating surfaces on the centre and front cases.
32) Apply a uniform film of sealant to the mating surface of the front case and join the cases together.

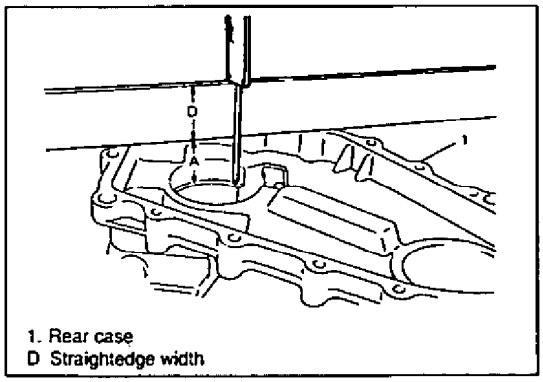
NOTE:
- **For correct installation of the front case, apply grease to the toric bolt in the counter shaft.**
- **When the front case is in place, ensure that the input gear intermeshes with the counter shaft gear first.**

"C": Sealant 99000-31110

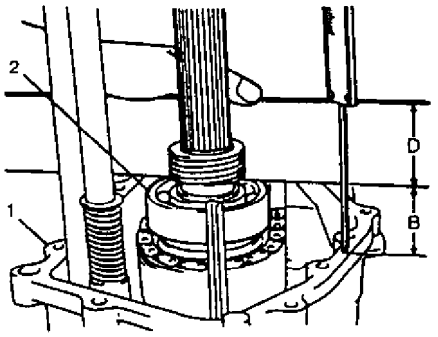


33) Before assembling the rear case, it is necessary to calculate the thickness of the adjusting washers.

Continue as follows.



① Measure contour A of the rear case (from the mating surface to the bottom of the resting bearing), using a straightedge and scale callipers.
Contour A + D is thus obtained.



1. Central case 2.No.
2 Rear shaft bearing
3. Straightedge width

② Securely install a straightedge in no. 2 bearing and measure bearing height B (from the surface of the central case connection to the lower part of no. 2 bearing). Contour B + D is obtained.

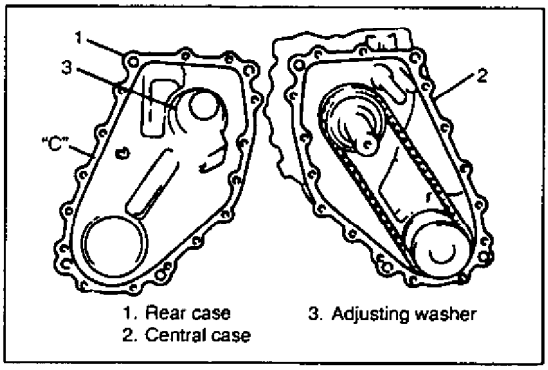
CAUTION:
Do not join the straightedge between no. 2 bearing and the output front shaft since the measurement will be defective.

③ Obtain clearance C from the following equation.
C=(A+D)-(B+D)

④ Select a shim from the following sizes available and install in the bearing housing in the rear case.

CAUTION:
Installation of an oversize shim, above the specifications in the following table, could cause the rear shaft to rotate too tightly and considerably damage the bearing.

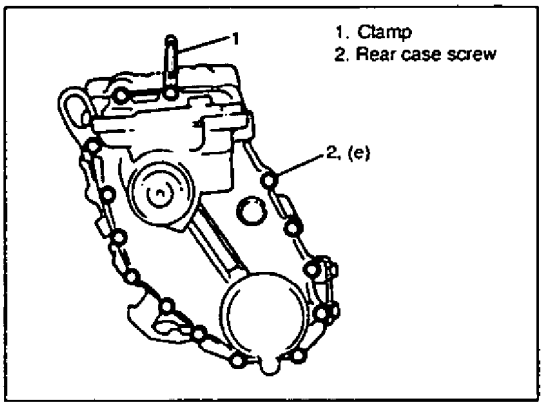
Clearance C	Adjusting washer size
0 - 0.13 mm 0 - 0.005 in	UNNECESSARY
0.13 - 0.23 mm 0.005 - 0.009 in	0.1 mm 0.004 in
0.23 - 0.33 mm 0.009 - 0.013 in	0.2 mm 0.008 in
0.33 - 0.43 mm 0.013 - 0.017 in	0.3 mm 0.012 in
0.43 - 0.53 mm 0.017 - 0.021 in	0.4 mm 0.016 in
0.53 - 0.58 mm 0.021 - 0.023 in	0.5 mm 0.020 in



1. Rear case
2. Central case
3. Adjusting washer

34) Also clean the mating surfaces of the centre and rear cases, apply sealant to the mating surface of the centre case and join them.

"C": Sealant 99000-31110

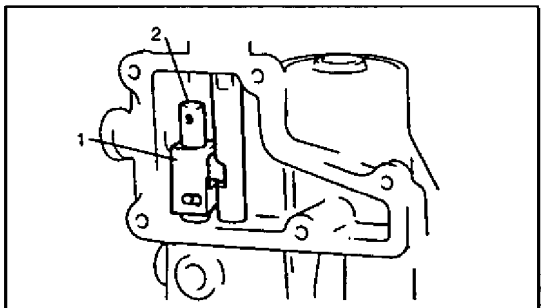


1. Clamp
2. Rear case screw

35) Tighten bolts linking rear and centre cases to specified torque.

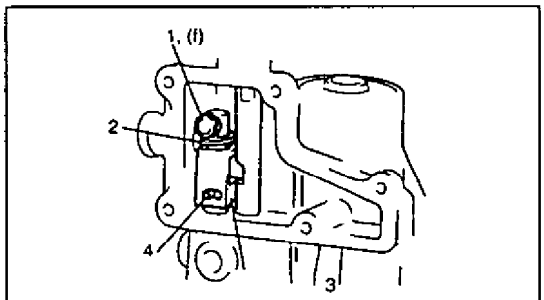
NOTE:
After tightening bolts, provisionally install the universal joint flange on the rear shaft and check that the shaft turns without problems.

Torque specifications
(e): 2.3 Kg-m (23 Nm)



1. Reduction shift fork
2. Reduction shift fork

36) Install the reduction shift fork in position shown in figure. Then fix the centre case to the rear case, inserting the shift in the fork.



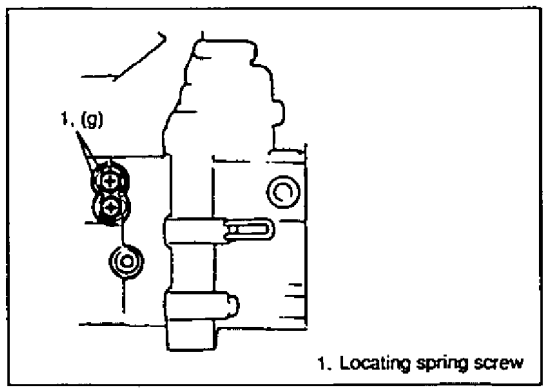
1. Spring return bolt of transfer selector
2. Transfer selector spring return
3. Reduction shift fork
4. Elastic cotter pin

37) Fit the reduction shaft fork with the elastic cotter pin.

NOTE:
Be careful not to let the cotter pin fall.

38) Place the selector return spring of the transfer case in the position in the figure and fit with bolt.

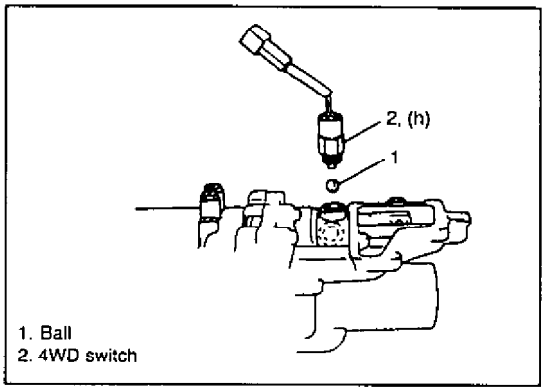
Torque specifications
(f): 0.55 Kg-m (5.5 Nm)



1. Locating spring screw

39) Tighten locating spring bolts of selectors to specified torque.

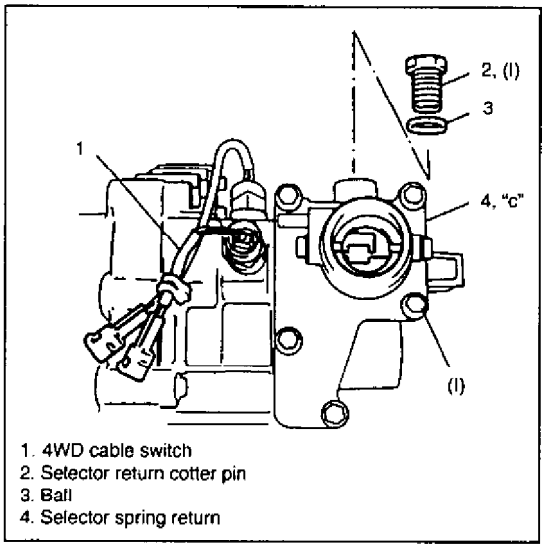
Torque specifications
(g): 2.6 Kg-m (26 Nm)



1. Ball
2. 4WD switch

40) Install ball and 4WD switch.

Torque specifications
(h): 2.0 Kg-m (20 Nm)



1. 4WD cable switch
2. Selector return cotter pin
3. Ball
4. Selector spring return

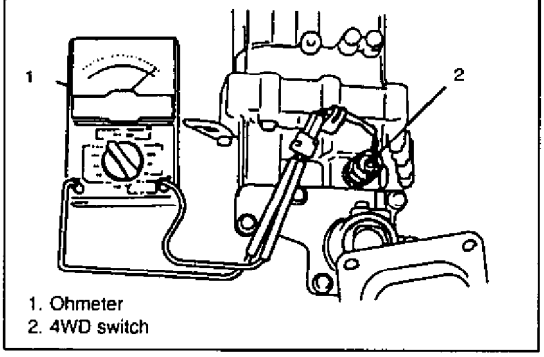
41) Fit 4WD switch cable with clamp.
42) Apply grease to selector return system parts and install them. The tighten selector return bolt to specified torque.
43) Clean mating surfaces of gear shift lever case and rear case, and with sealant applied to these surfaces join the two cases.

"C": Sealant 99000-31110

44) Tighten the gear shift lever case bolts to specified torque.

Torque specifications:
(i) 3.5 Kg-m (35 Nm)
(j): 1.3 Kg-m (13 Nm)

Por 4WD switch



1. Ohmeter
2. 4WD switch

45) Provisionally install the gear shift lever and check that all gears can be engaged without problems. Also check rotation of the shaft.
46) Confirm that 4WD switch has been connected in 4WD position (4H and 2H).
47) After completing the previous inspections, remove the gear shift lever.

TRANSFER CASE AND TRANSMISSION CONNECTION

Please refer to 7D-5 in this Supplement.

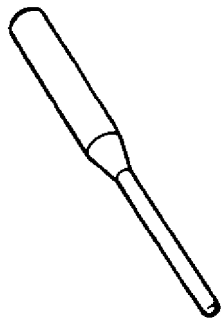
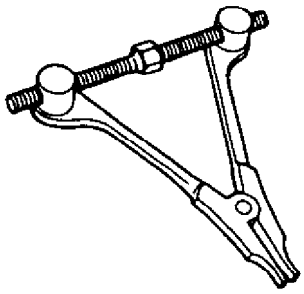
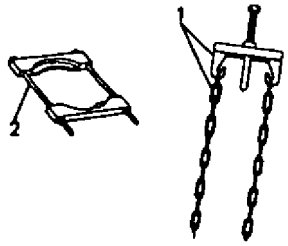
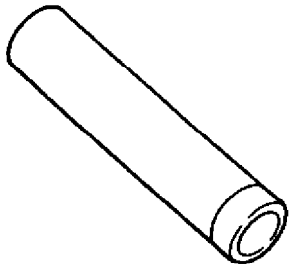
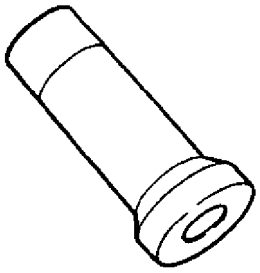
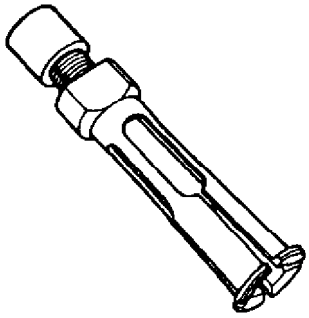
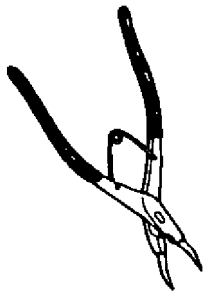
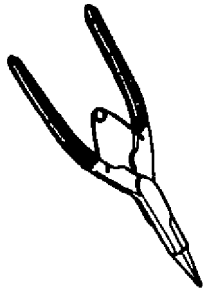
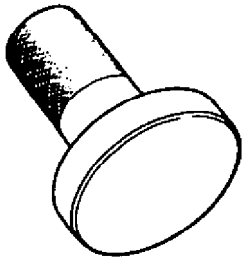
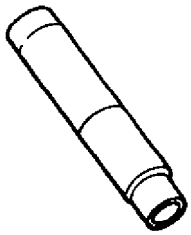
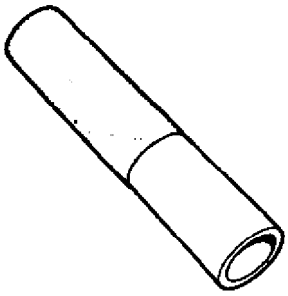
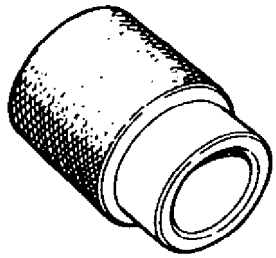
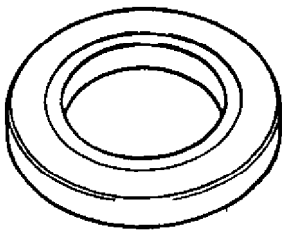
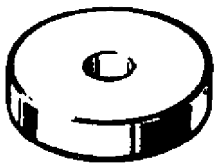
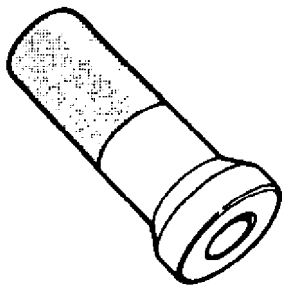
TORQUE SPECIFICATIONS

SYSTEM	COMPONENT	VALUES	
		Kg-m	Nm
TRANSFER CASE	Gear shift lever case bolts	1.3	13
	Rear case lever bolts	0.6	6
	Rear case/front case bolt	2.3	23
	Transfer case/transmission bolt	5	50
	4WD switch	2.0	20
	Selector spring return bolt	0.55	5.5
	Locating selectors retaining spring bolts	2.6	26
	Oil channel bolts	0.6	6
	Damper bolts	1.8	18
	Transfer case plug	2.3	23
	Transmission drain plug	4.5	45
	Transfer case filler/check plug	2.3	23
	Transmission filler/level plug	3.8	38
	Exhaust pipe 2nd section bolts	1.8 - 2.8	18 - 28
	Propeller shaft flanges nuts and bolts	5.5	55
	Rear bridge bolts, elastic support and bracket	5.0	50
	Gear shift case bolts	2.3	23

MATERIALS REQUIRE FOR SERVICING

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips. • Selector return system. • Gear shift lever.
Thread cement	THREAD LOCK CEMENT SUPER 1333B (99000-32020)	• Control lever bolt. • Centre case groove bolt. • Rear case plate bolt. • Counter shaft plate bolt.
Sealant	SUZUKI BOND Nº 1215 (99000-31110)	• Oil drain/level plugs. • Front case coupling surface. • Rear case coupling surface. • Mating surface on gear shift lever case. • Positioning spring bolt.

SPECIAL TOOLS

 09922-85811 Elastic cotter pin puller	 09912-34510 Separator	 1. 09927-18410 Universal puller 2. 09921-57810 Bearing puller	 09925-98221 Bearing installer
 09951-76010 Bearing installer	 09941-64511 Bearing puller	 09900-06108 Pliers for elastic rings (Locking type)	 09900-06107 Pliers for elastic rings (Opening type)
 09913-75520 Bearing installer	 09925-18010 Bearing installer	 09913-84510 Bearing installer	 09940-53111 Bearing installer
 09951-26010 Bushing puller plate	 09926-68310 Bearing installer	 09951-16080 Bearing installer	

SECTION 7E

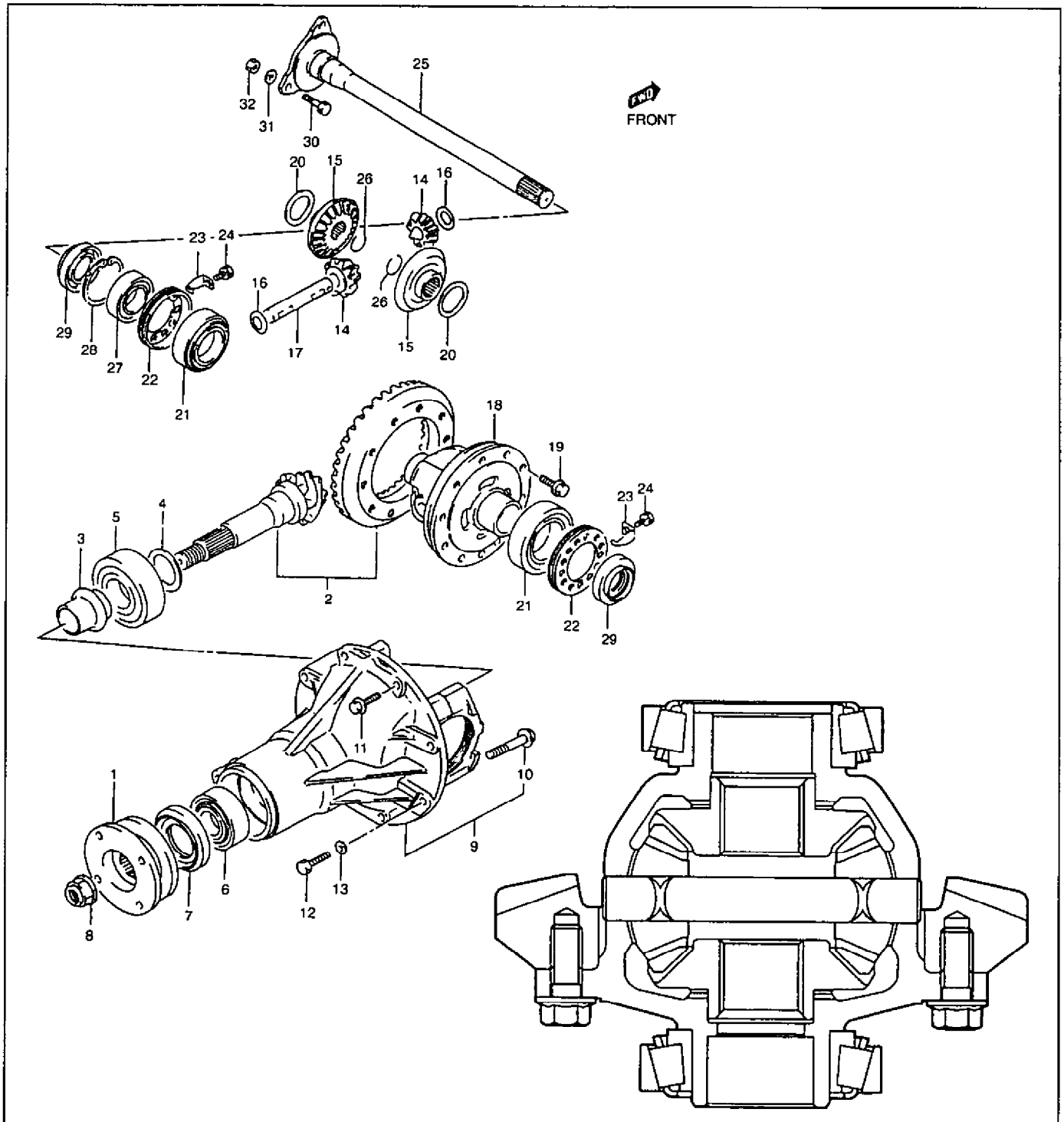
DIFFERENTIAL (FRONT AND REAR)

NOTE:
For points not covered in this section, please refer to corresponding section in Service Manuals, outlined in INTRODUCTION to this Manual.

LIST OF CONTENTS

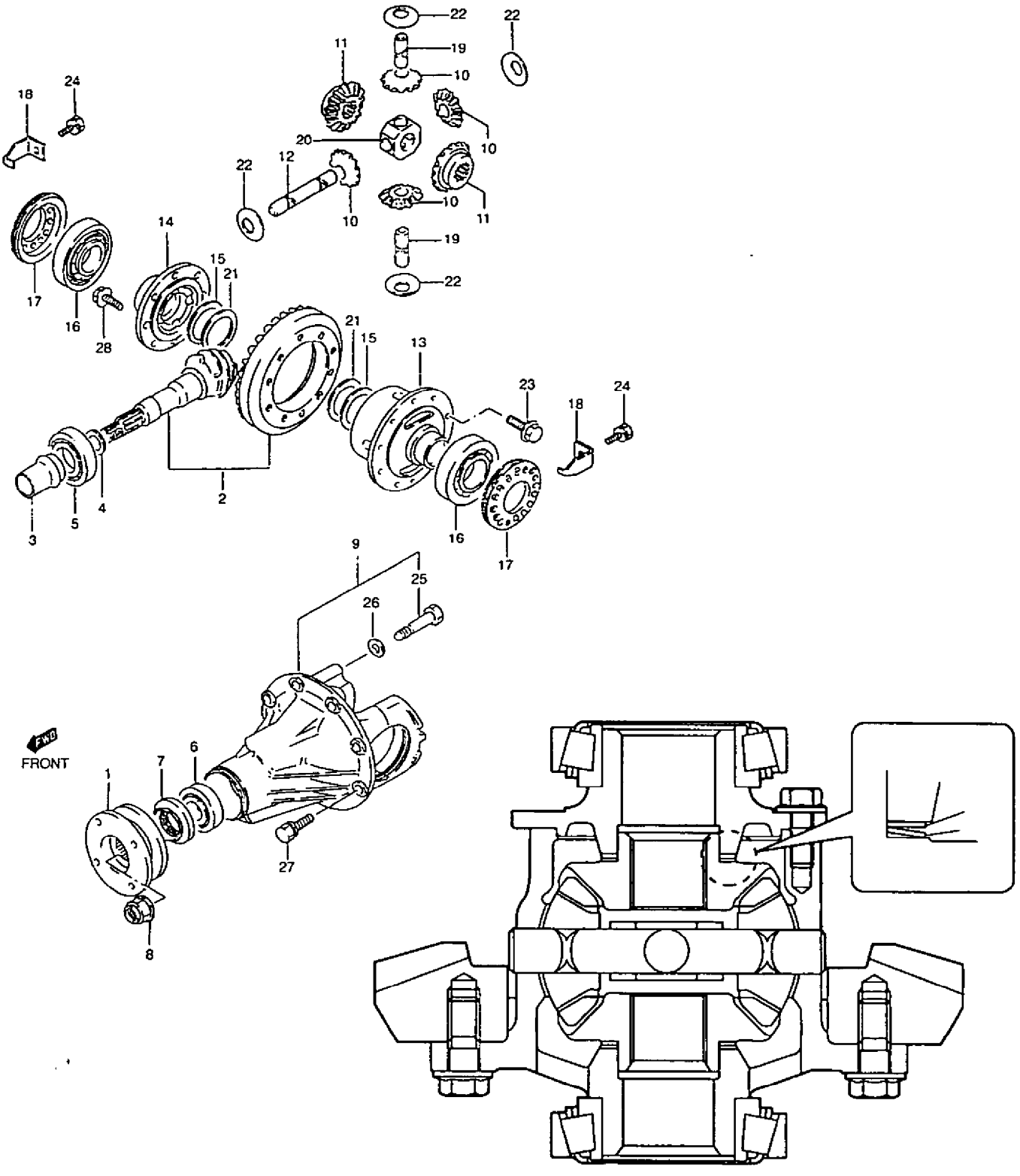
GENERAL OUTLINE

FRONT DIFFERENTIAL



1. Universal joint flange
2. Bevel pinion gear
3. Bevel pinion spacer
4. Adjusting washer
5. Rear bearing
6. Front bearing
7. Oil seal
8. Automatic locking nut
9. Front differential carrier assembly
10. Bolt
11. Bolt
12. Bolt
13. Lock washer
14. Differential pinion
15. Differential gear
16. Washer
17. Pinion shaft
18. Differential housing
19. Bevel gear bolt
20. Thrust washer
21. Differential lateral bearing
22. Bearing adjuster
23. Attaching plate
24. Bolt
25. Front drive axle
26. Elastic ring
27. Bearing
28. Elastic ring
29. Oil seal
30. Bolt
31. Lock washer
32. Nut

REAR DIFFERENTIAL



1. Universal joint flange
2. Bevel pinion gear
3. Bevel pinion spacer
4. Shim washer
5. Rear bearing
6. Front bearing
7. Oil seal
8. Automatic locking nut
9. Front differential carrier assembly
10. Differential pinion
11. Differential gear
12. No. 1 pinion shaft
13. Left-hand differential housing
14. Right-hand differential housing
15. Thrust washer
16. Differential lateral bearing
17. Bearing adjuster
18. Locking plate
19. No. 2 pinion shaft
20. Pinion union
21. Spring washer
22. Washer
23. Bevel gear bolt
24. Bolt
25. Bolt
26. Lock washer
27. Bolt
28. Differential housing bolt

SERVICING THE VEHICLE

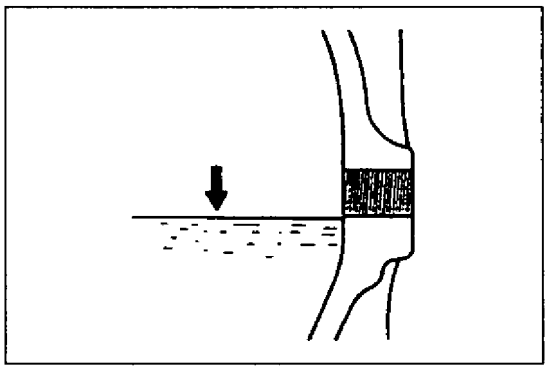
MAINTENANCE SERVICE

NOTE:
- **When driving in wet conditions, inspect immediate to see if water has entered differential (if water has entered, the oil will be cloudy and should be changed immediately).**
- **When lifting the vehicle for any other work other than an oil change, also check for oil leaks and the state of the breather tubes.**

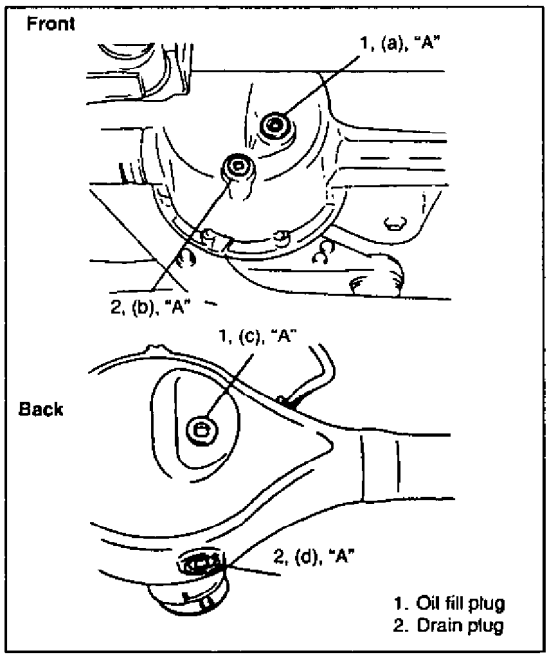
Oil change

NOTE:
- **Always use hypoide gear oil for differential.**
- **The use of SAE-80W-90 viscosity grade is recommended.**

1) Before changing the oil or on inspection, turn off the engine and raise the vehicle horizontally.



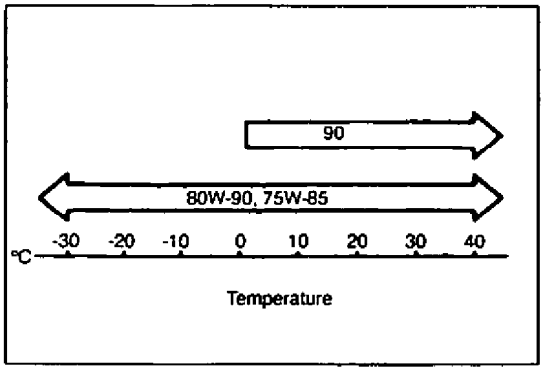
2) Inspect the oil level for leaks. Correct the cause of any leaks.
3) Extract used oil and pour in the correct quantity of gear oil as specified below (up to filler hole).



4) Apply sealant to oil drain plugs and tighten filler/check plugs to specified torque threads.

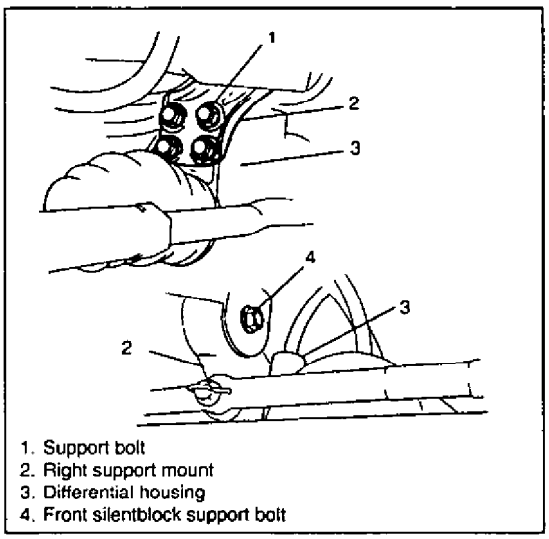
"A": Sealant 99000-31110

Torque specifications
(a): 4.0 Kg-m (40 Nm)
(b): 2.3 Kg-m (23 Nm
(c): 4.3 Kg-m (43 Nm)
(d): 2.2 Kg-m (22 Nm)



Specified gear oil:
Hypoide gear oil API GL-5
SAE 75W-85,90 or 80W-90
For oil viscosity grade, see chart on left.

Oil capacity	**Front** **1.0 litres (2.1/1.8 US/Imp. pt.)** **Back** **2.2 litres (4.6/3.9 US/Imp. pt.)**

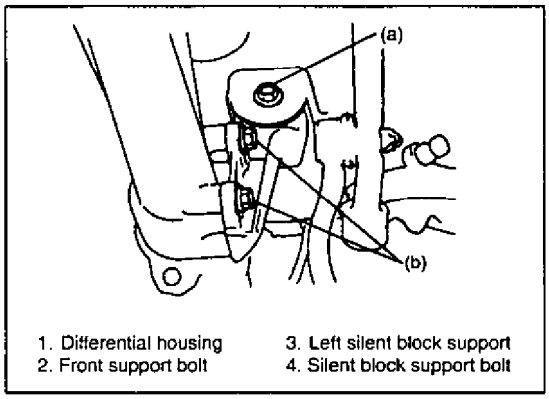


1. Support bolt
2. Right support mount
3. Differential housing
4. Front silentblock support bolt

FRONT DIFFERENTIAL SUPPORTS

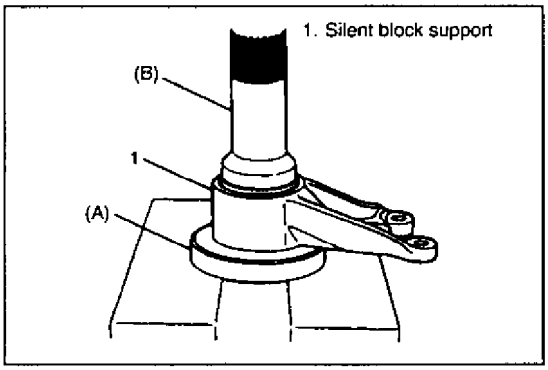
Right and left side supports

1) Lift vehicle and turn steering wheel completely to the right.
2) Separate the right support from the differential housing, removing bolts from lower part.
3) Remove right support by taking out front supporting bolt from upper part.



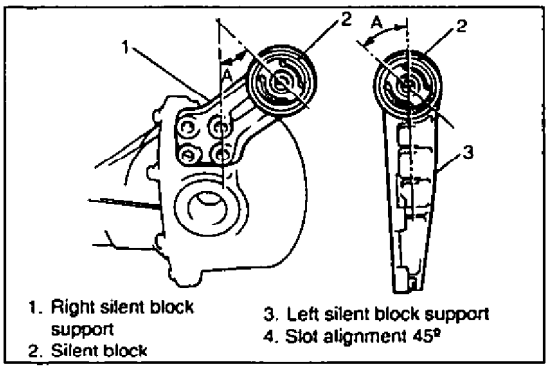
1. Differential housing
2. Front support bolt
3. Left silent block support
4. Silent block support bolt

4) Remove left-hand silent block support by removing upper and lower attaching bolts.



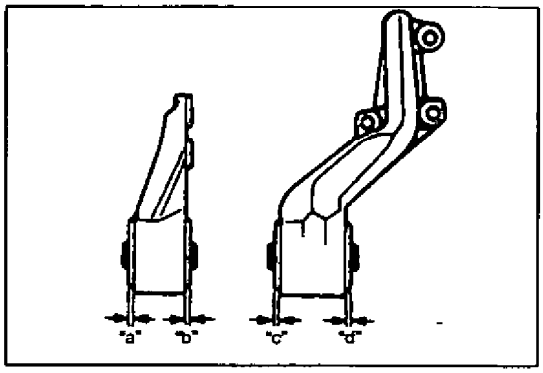
5) Inspect the state of each silentblock. If they are damaged or worn, extract with special tools and press in on replacement.

Special tool
(A): 09951-26010
(B): 09951-16080



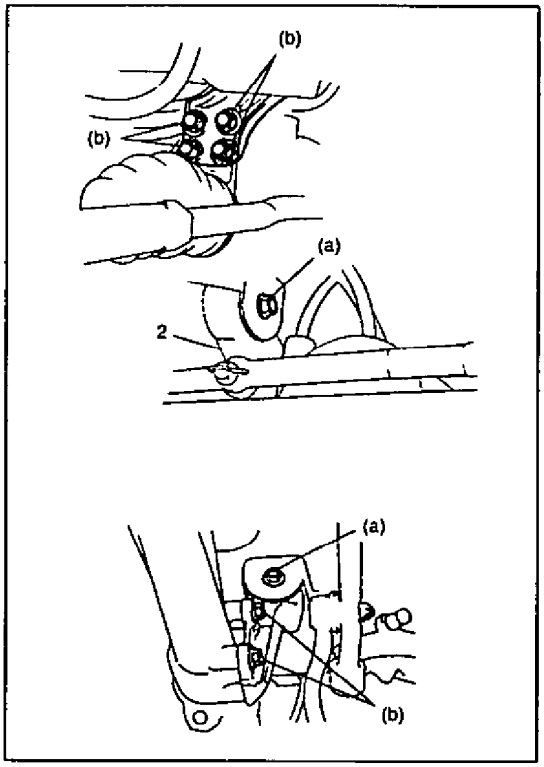
1. Right silent block support
2. Silent block
3. Left silent block support
4. Slot alignment 45°

6) Position the groove in each silentblock as shown when fitted.



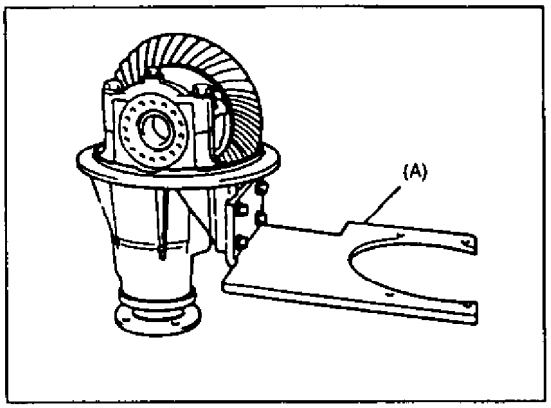
7) Install each silentblock on its support as indicated.

length **"a": 4.0 mm (0.16 in.)**
"b": 4.0 mm (0.16 in.)
"c": 0.0 mm (0.00 in.)
"d": 0.0 mm (0.00 in.)



8) Tighten to specified torque.

Torque specifications
(a): 8.5 Kg-m (85 Nm)
(b): 5.0 Kg-m (50 Nm)



GENERAL REVISION AND REPAIR OF ASSEMBLY

FRONT DIFFERENTIAL

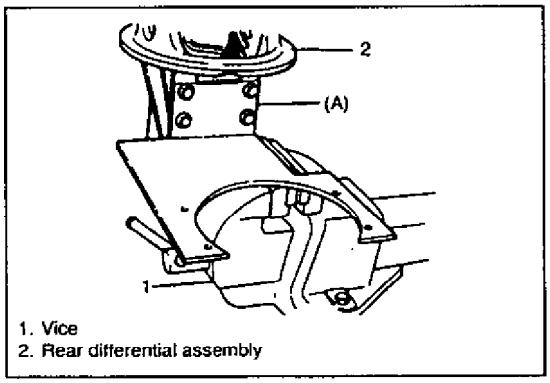
For general revision of front differential, please refer to enlarged image on page 7E-2 and the same section in the VITARA (99501-61A10-01S) supplementary service manual.

REAR DIFFERENTIAL (DISASSEMBLY, INSPECTION , ADJUSTMENT AND ASSEMBLY)

DISASSEMBLY:

1) Secure differential assembly with special tool (A) as shown in figure.

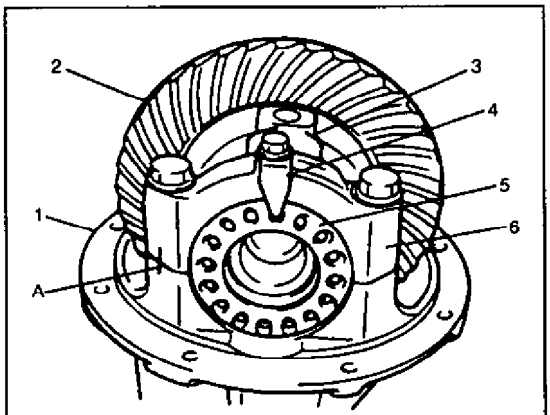
Special tool
(A): 09944-76010



1. Vice
2. Rear differential assembly

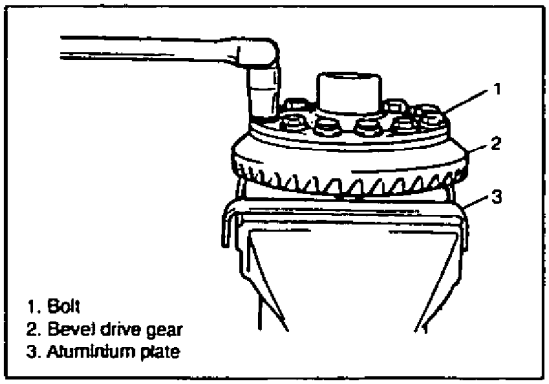
2) Install the special tool (A) firmly with the differential assembly in a vice.

Special tool
(A): 09944-76010



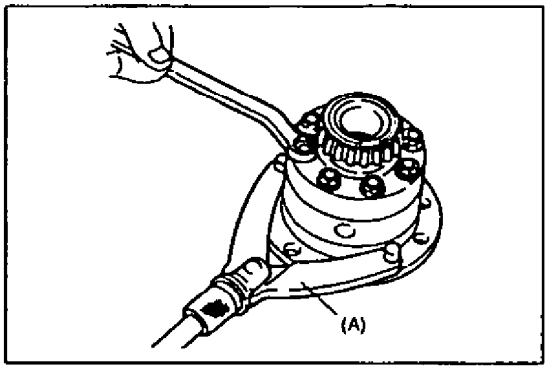
1. Differential carrier
2. Bevel drive gear assembly
3. Lateral bearing fastening plat
4. Lateral bearing support plate
5. Bearing adjuster
6. Bearing cover
A. Identification mark

3) Make reference marks on the lateral bearing covers of the differential.
4) Remove the attaching plates of the differential lateral bearing and remove bearing adjusters, grooved exterior rings of the lateral bearing and bevel drive gear with differential housing.



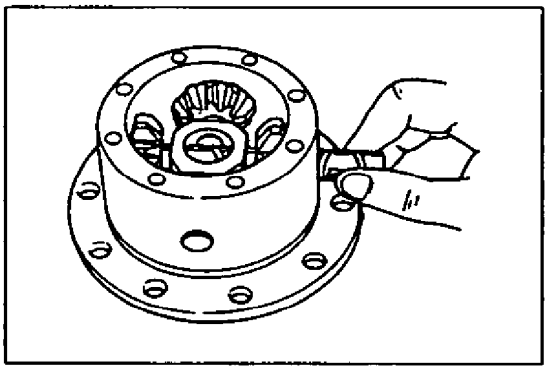
1. Bolt
2. Bevel drive gear
3. Aluminium plate

5) Place the aluminium plates in the vice jaws and tighten the differential housing to remove the bevel pinion, once the bolts have been removed.

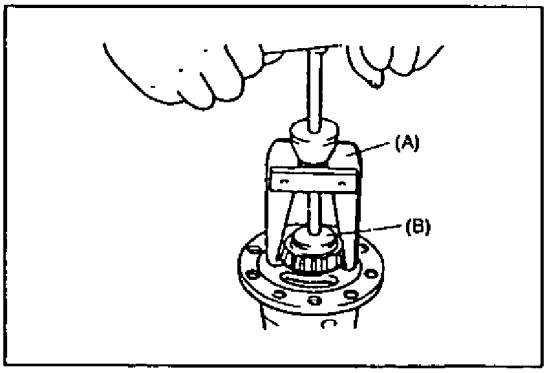


6) There are 8 bolts securing the two halves of the differential housing. Remove these bolts to release the differential housing.

Special tool
(A): 09930-40113

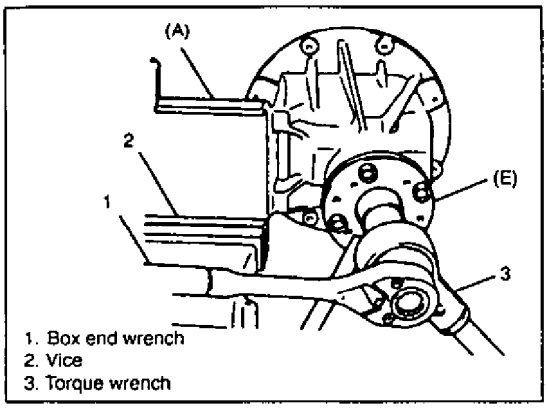


7) Remove the pinion shaft, lateral gears, washers, differential pinions, spring washers and thrust washers.



8) Use the special tools to extract the lateral bearing from each half of the differential housing.

Special tool
(A): 09913-61510
(B): 09913-85230



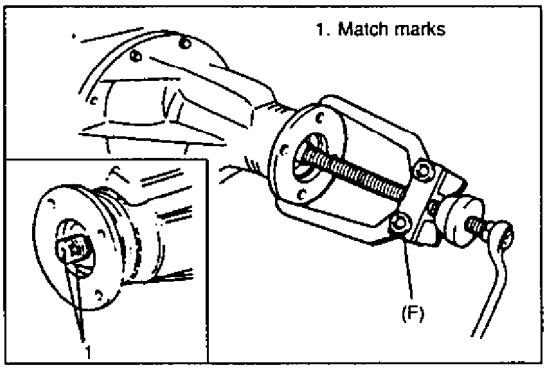
1. Box end wrench
2. Vice
3. Torque wrench

9) Remove the bevel pinion.
- Rotate the differential assembly 90° with the special tool (A) and secure once more in a vice.

Special tool
(A): 09944-76010

- Secure the universal joint flange with the special tool (E) and remove the automatic locking nut with a torque wrench.

Special tool
(A): 09922-66020

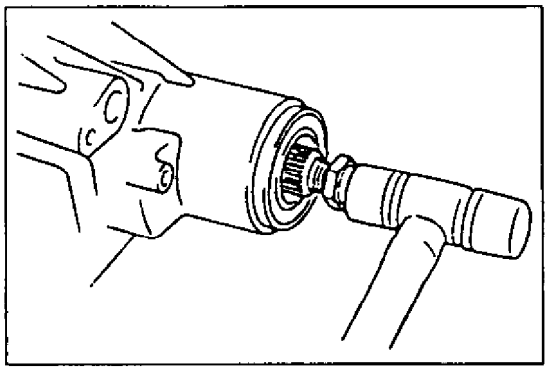


- Make match marks on the bevel drive pinion and the pinion flange.

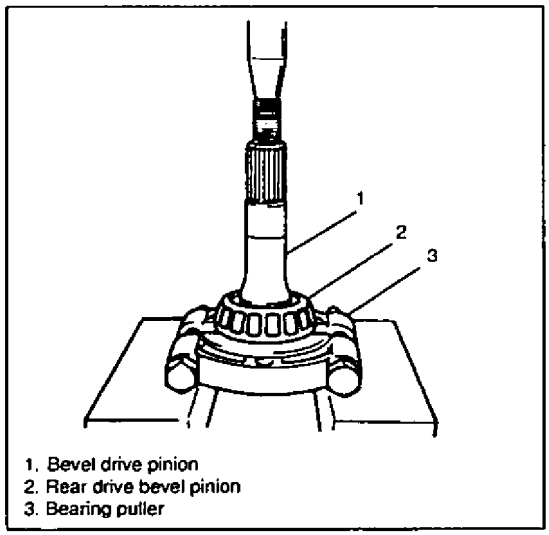
> **CAUTION:**
> **Do not make match marks on the flange coupling surface.**

- Remove the pinion flange. Use the special tool if it cannot be removed easily.

Special tool
(F): 09913-65135

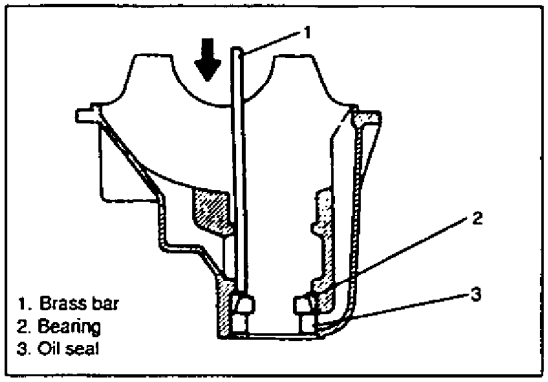


- Remove the bevel pinion with the rear bearing, adjusting washer and spacer.
  If it cannot be removed easily, screw an old nut on the gear and hit the nut with a plastic hammer, ensuring the gear is not struck.



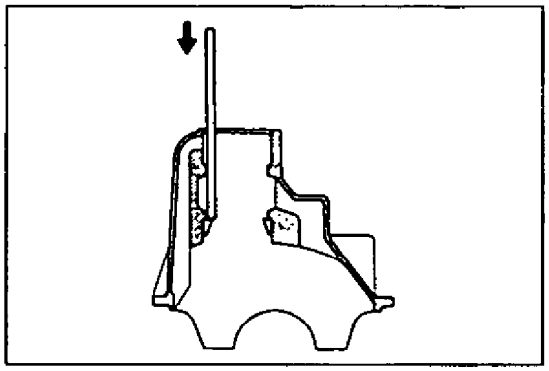
1. Bevel drive pinion
2. Rear drive bevel pinion
3. Bearing puller

- Remove the bevel pinion rear bearing with a bearing puller and a press.



1. Brass bar
2. Bearing
3. Oil seal

10) Use a hammer and a brass bar to remove the front bearing outer race with the bearing and the oil seal.



11) Remove outer rear bearing race in the same way as in point 10.

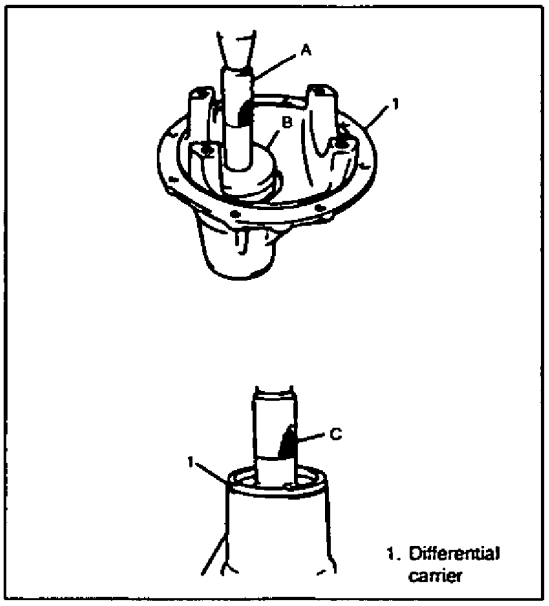
INSPECTIONIN:

- Inspect pinion flange for wear or damage.
- Inspect bearings for wear or colour fading.
- Inspect differential carrier for cracks.
- Inspect bevel drive gear and bevel pinion for wear or cracks.
- Inspect lateral bearings, outer pinions and pinion shaft for wear or damage.
- Inspect lateral gear knurling for wear or damage.

ADJUSTMENT AND ASSEMBLY

Depending on the fault encountered before disassembly and that found during visual inspection of bearing and gear teeth, etc. after disassembly, prepare replacement parts and assemble according to the following indications:

CAUTION:
- **The bevel pinion and gear should be replaced as a unit when one of them needs to be replaced.**
- **When replacing the bearing bevel roller, also replace the inner and outer race assemblies.**



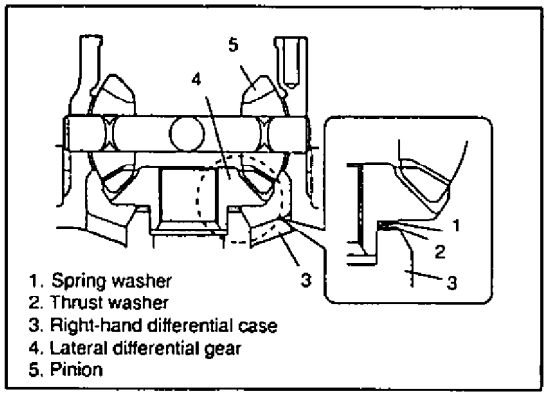
1. Differential carrier

Differential carrier assembly

To press into position the outer races of the bevel pinion bearing, use the special tools shown in the figure.

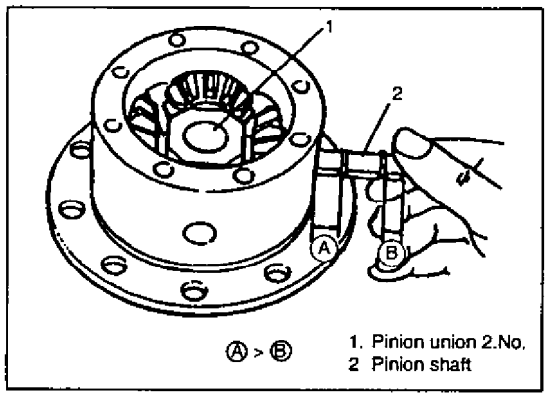
CAUTION:
Fit the races by pressing, taking care they are not slanted.

Special tool
(A): 09924-74510
(B): 09926-68310
(C): 09913-75510



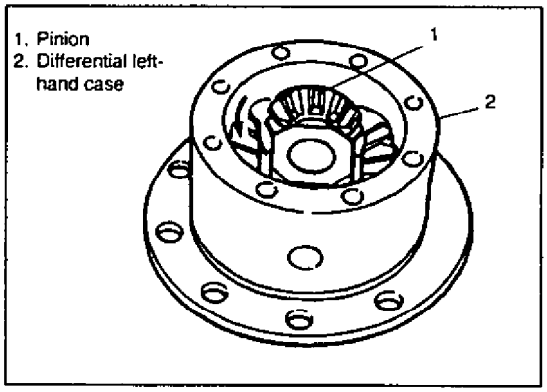
Differential case

1) After applying differential oil to the lateral gear, pinions, pinion shafts, washer, thrust washer and spring washer, install them in the left -hand housing case. To fit thrust washer and spring washer in the correct direction, please refer to figure.

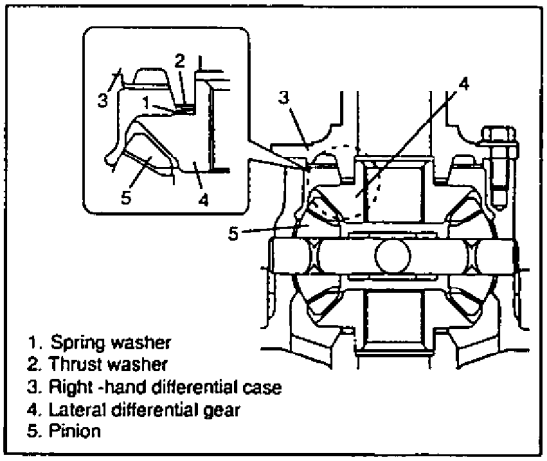


2) When installing no. 2 pinion shaft (shorter one) in the differential housing, insert side Ⓐ in the pinion seal.

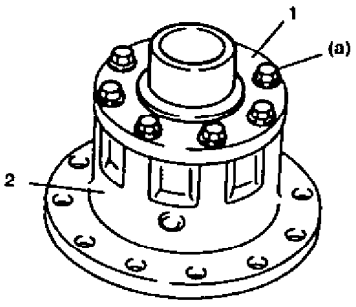
NOTE:
Ⓐ is longer than Ⓑ, (Ⓐ > Ⓑ)



3) Inspect the pinions intermesh by gently rotating.



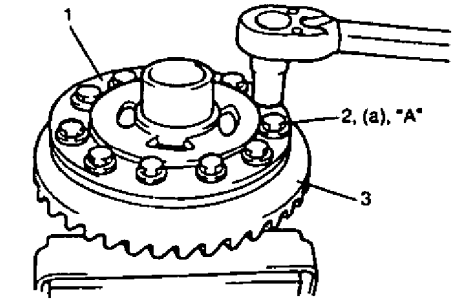
4) In the same way as in point 1), install the thrust washer, spring washer and lateral gear.



1. Right-hand differential case
2. Left-hand differential case

5) Install the right-hand casing of differential housing and tighten to specified torque.

Torque specifications
(a): 4.1 Kg-m (41 Nm)



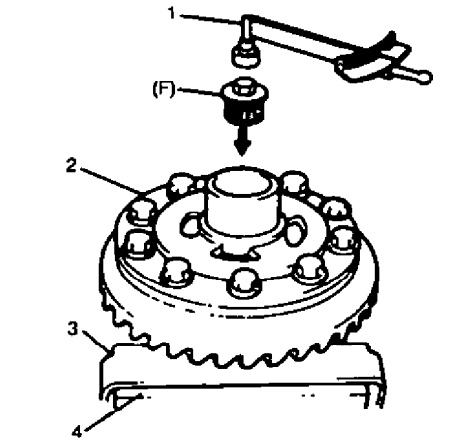
1. Differential case
2. Bolt
3. Bevel gear

6) Install bevel gear in the differential housing case and tighten bolts to torque specified.
Use thread bonding cement on bolts.

CAUTION:
Only specified bolts should be used.

"A": Sealant 99000-32020

Torque specifications
(a): 8.5 Kg-m (85 Nm)

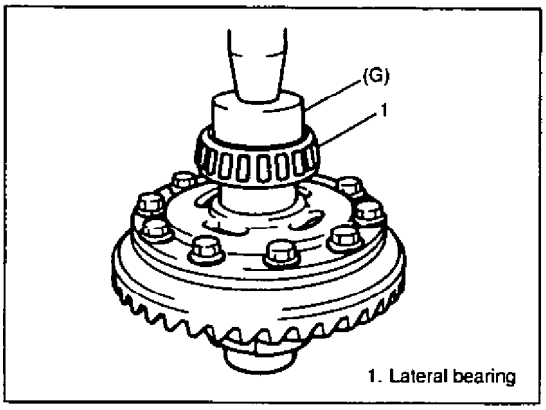


1. Torque wrench
2. Differential case assembly
3. Aluminium plate
4. Vice

7) Install the special tool (F) in the differential housing assembly and check that pre-load corresponds to that specified below. If pre-load exceeds this level inspect for foreign material or damaged gears.

Special tool
(F): 09928-06010-002

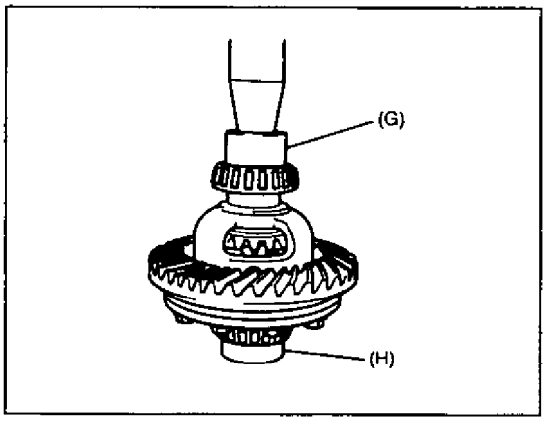
Lateral gear pre-load: Max. 2.0 kg-cm



Lateral differential bearing

1) Press lateral bearing into position with special tool (G) and a press.

Special tool
(G): 09944-66020



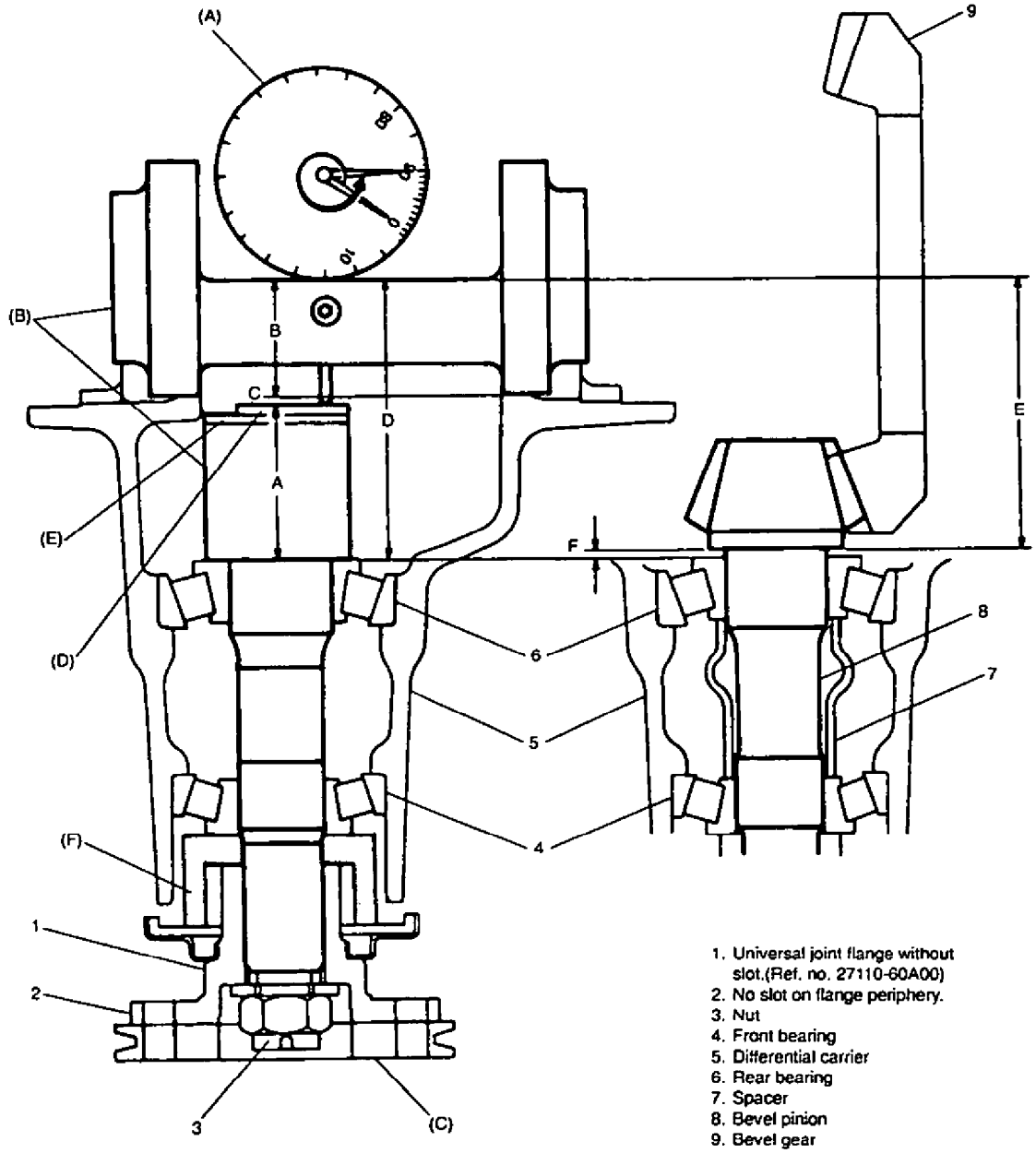
2) Install a special stop bolt (H) in bearing fitted in point 1, and install bearing on other side.

NOTE:
Ensure stop bolt (H) is used to protect the lower bearing.

Special tool
(G): 09944-66020
(H): 09951-16060

Bevel drive pinion

To correctly intermesh the bevel pinion and gear, it is necessary to have previously installed the bevel pinion in the differential carrier using the adjusting washer as indicated in the following pages. The figure shows the relative positions of the bevel gear, carrier and assembly fixture.

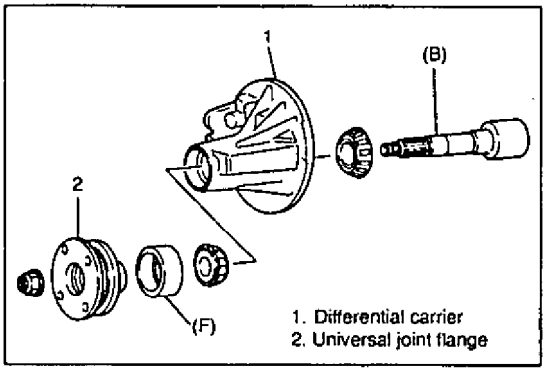


1. Universal joint flange without slot.(Ref. no. 27110-60A00)
2. No slot on flange periphery.
3. Nut
4. Front bearing
5. Differential carrier
6. Rear bearing
7. Spacer
8. Bevel pinion
9. Bevel gear

A: Pinion fixture height + accessory height
B: Shaft fixture radius.
A+B: Assembly fixture size 102.00 mm / 2.01575 ins.
C: Measured dimension
D: Distance of assembly from differential carrier (A+B+C)
E: Distance of assembly from bevel pinion (marked on shaft in mm)
F: Adjuster washer size for adjusting assembly distance (D-E)

Special tool

(A): 09900-20606
(B): 09926-78311
(C): 09922-75222
(D): 09951-16070
(E): 09922-77250
(F): 09951-46010

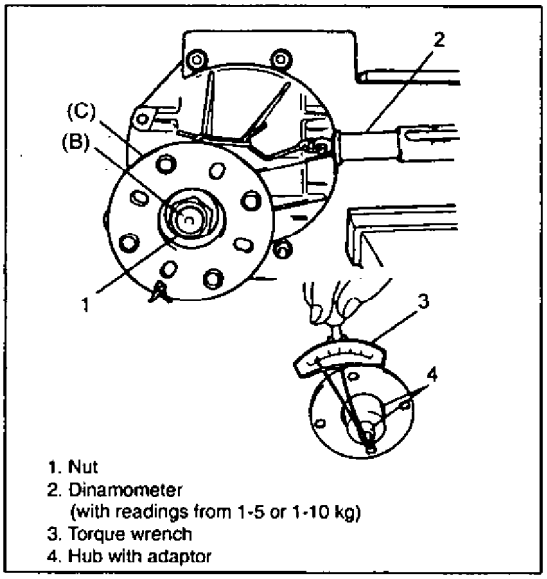


1. Differential carrier
2. Universal joint flange

1) Install special tools with bearings and universal joint flange in the differential carrier assembly.

NOTE:
- **This installation requires universal joint flanges without slots on the flange periphery.**
- **This installation does not need spacer or oil seal.**

Special tool
(B): 09926-78311
(F): 09951-46010



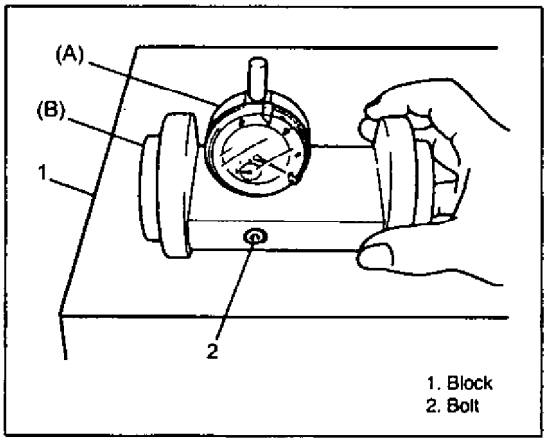
1. Nut
2. Dinamometer
(with readings from 1-5 or 1-10 kg)
3. Torque wrench
4. Hub with adaptor

2) Tighten flange nut to obtain specified bearing pre-load.

NOTE:
Before measuring with the dinamometer or torque wrench, check rotation with hand and apply a small amount of oil to the bearings.

Special tool
(B): 09926-78311
(C): 09922-75222

Pinion bearing pre-load: 9.0 - 17.0 Kg-cm
Special tool torque specifications: 1.8 - 3.4 kg

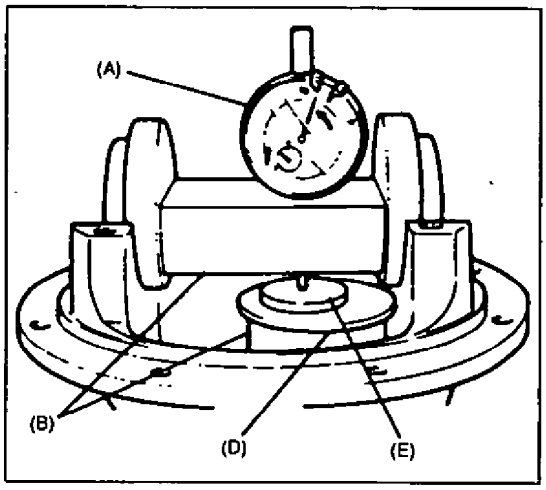


1. Block
2. Bolt

3) Place dial indicator in bevel pinion assembly fixture and adjust to 0 (zero) on a measuring block.

NOTE:
- **When installing dial indicator A in the assembly fixture, gently tighten the screw. Be careful not to over tighten and damage the dial indicator.**
- **With the dial indicator installed, turn assembly fixture backwards and forwards by hand a couple of times and adjust accurately to 0 (zero).**
- **The short needle should preferably indicate more than 2 mm when the long one is at 0 (zero).**

Special tool
(A): 09900-20606
(B): 09926-78311



4) Install assembly fixture adjusted to zero, and with dial indicator installed in pinion assembly, measure between zero position and point measured on dial indicator.

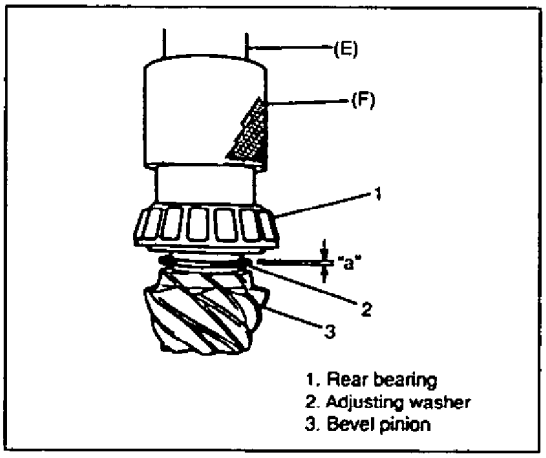
NOTE:
- **Turn assembly fixture back and forwards several times and measure the exact distance as far as the pinion assembly fixture.**
- **The amount measured may exceed 1 mm. It is therefore necessary to determine the short needle reading.**

Special tool
(A): 09900-20606
(B): 09926-78311
(D): 09951-16070
(E): 09922-77250

5) Washer thickness is obtained taking the value measured by the dial indicator (represented by C on page 7E-15) in the following equation.

Necessary washer thickness (F)	= 102 +	Amount measured on dial indicator (C)	−	Measure printed on pinion (E)

102 in the previous equation is A + B in assembly fixture (special tool (B) as in figure on page 7E-15).



1. Rear bearing
2. Adjusting washer
3. Bevel pinion

6) Select adjusting washer closest to measure calculated between available sizes and put in position, the rear bearing pressed in place.

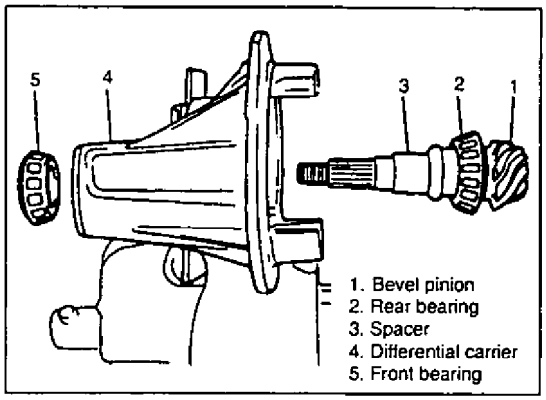
NOTE:
One or more adjusting washers may be used.

CAUTION:
If the special tool (F) is obstructed by the upper area of the lower bearing race, press rear bearing in by installing an old spacer between the special tool (F) and the rear bearing.

Adjusting washer thicknesses available	1.12, 1.15, 1.18, 1.12, 1.24, 1.27, 1.30 y 0.03 mm 0.044, 0.045, 0.046, 0.047, 0.048, 0.049, 0.050 y 0.012 in.

"a": Closest to value F (calculated)

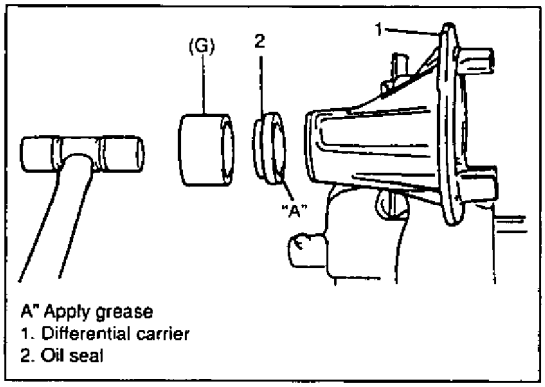
Special tool
(E): 09925-18010
(F): 09940-53111



1. Bevel pinion
2. Rear bearing
3. Spacer
4. Differential carrier
5. Front bearing

7) With new pinion spacer installed as shown in figure, insert front bearing in differential carrier.

NOTE:
- **Use a new spacer for installation.**
- **Apply oil to bearings.**

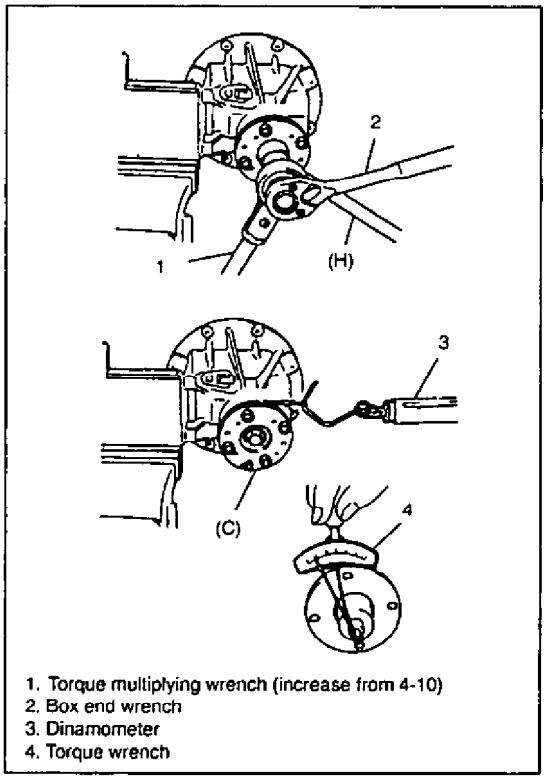


A" Apply grease
1. Differential carrier
2. Oil seal

8) Use special tool and plastic hammer to insert oil seal in differential carrier, until it is at the same level as the end of the differential carrier.
Apply grease to oil seal rim.

"A": Grease 99000-25010

Special tool
(G): 09951-18210



1. Torque multiplying wrench (increase from 4-10)
2. Box end wrench
3. Dinamometer
4. Torque wrench

9) Whilst gradually tightening the automatic locknut with the special tool (H) and the torque wrench, adjust pinion preload to level specified.

NOTE:
- **Before measuring with the dinamometer or the torque wrench inspect gently rotating by hand.**
- **The approximate bearing pre-load can be measured by taking the rotating angle of the pinion obtained from the weight of the flange support arm inside the flange. Please refer to the following page for further information.**
- **Gradually and carefully tighten until the initial torque specification is obtained. Avoid turning to excessively slacken tightened flange nuts.**

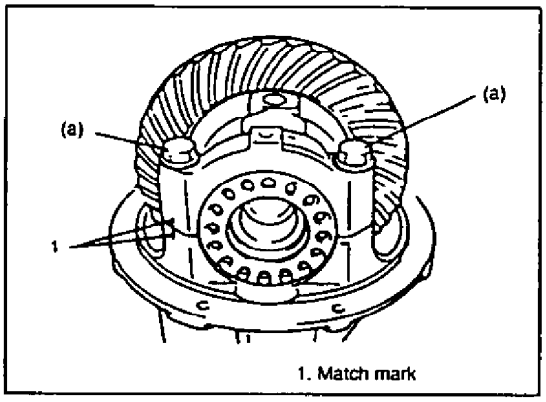
Pinion bearing pre-load: 9.0-17.0 kg-cm

Torque specifications for special tool: 1.8-3.4 kg

Special tool
(C): 09922-75222
(H): 09922-66020

ASSEMBLY

1) Install outer bearing races in corresponding bearings. The used right and left outer races are not interchangeable.
2) Install housing case assembly in carrier.
3) Install lateral bearing adjusters in their respective carrier, ensuring that adjusters are correctly screwed.



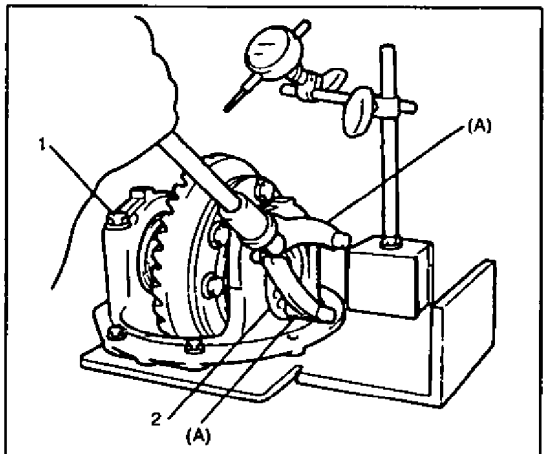
1. Match mark

4) Align match marks on cap and carrier. Screw the two bolts on the lateral bearing cap two or three times and press bearing cap by hand.

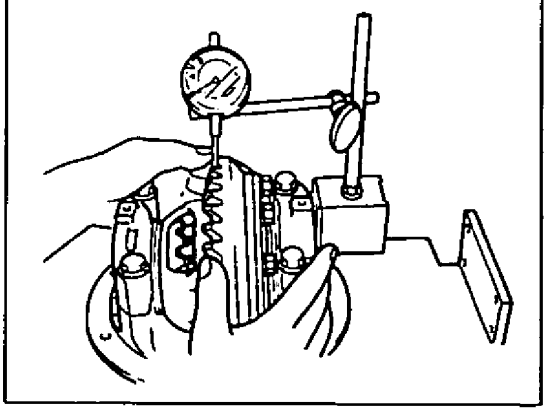
NOTE:
If the bearing cap does not fit securely on the carrier, the lateral bearing adjuster is not screwed on correctly. Install adjuster again.

Tighten cap bolts.

Provisional torque specifications
(a): 1.5 kg-m (15 Nm)



1. Bearing cover bolt
2. Bearing adjuster

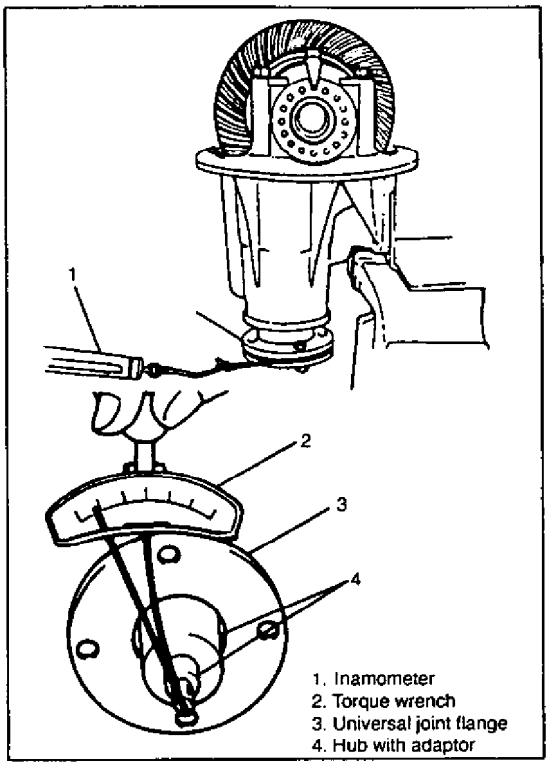


5) Tighten both bearing adjusters to obtain specified gearing clearance and at the same time obtain the pre-load of the lateral bearing.

NOTE:
- **Ensure that the dial indicator measuring needle is applied at a straight angle to the convex tooth side..**
- **As a practical measure, the following is recommended to obtain the specified lateral bearing clearance and preload at the same time.**
  1. **To obtain specified clearance turn both adjusters inwards gently.**
  2. **Tighten both adjusters a notch at a time.**
- **Measure at least 4 points on outside of bevel drive gear.**

Normal clearance 0.13-0,18 mm (0.005-0.007 in.)

Special tool
(A): 09930-40120
(B): 09930-40113



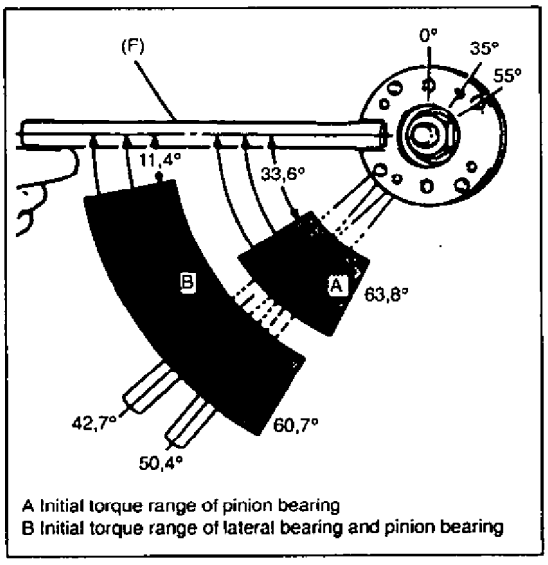
1. Inamometer
2. Torque wrench
3. Universal joint flange
4. Hub with adaptor

6) Measure pinion pre-load with the dinamometer or torque wrench and check combined preload of pinion bearing and lateral bearing.

NOTE:
- **Normal pre-load is shown in the diagram on the following page and should be read in the following way.**

Example:
When the bevel pinion pre-load is 2.6 kg (26 N), the combined pre-load of both pinion and lateral bearing should be between 2.8 y 3.2 kg (28 and 32 N.).

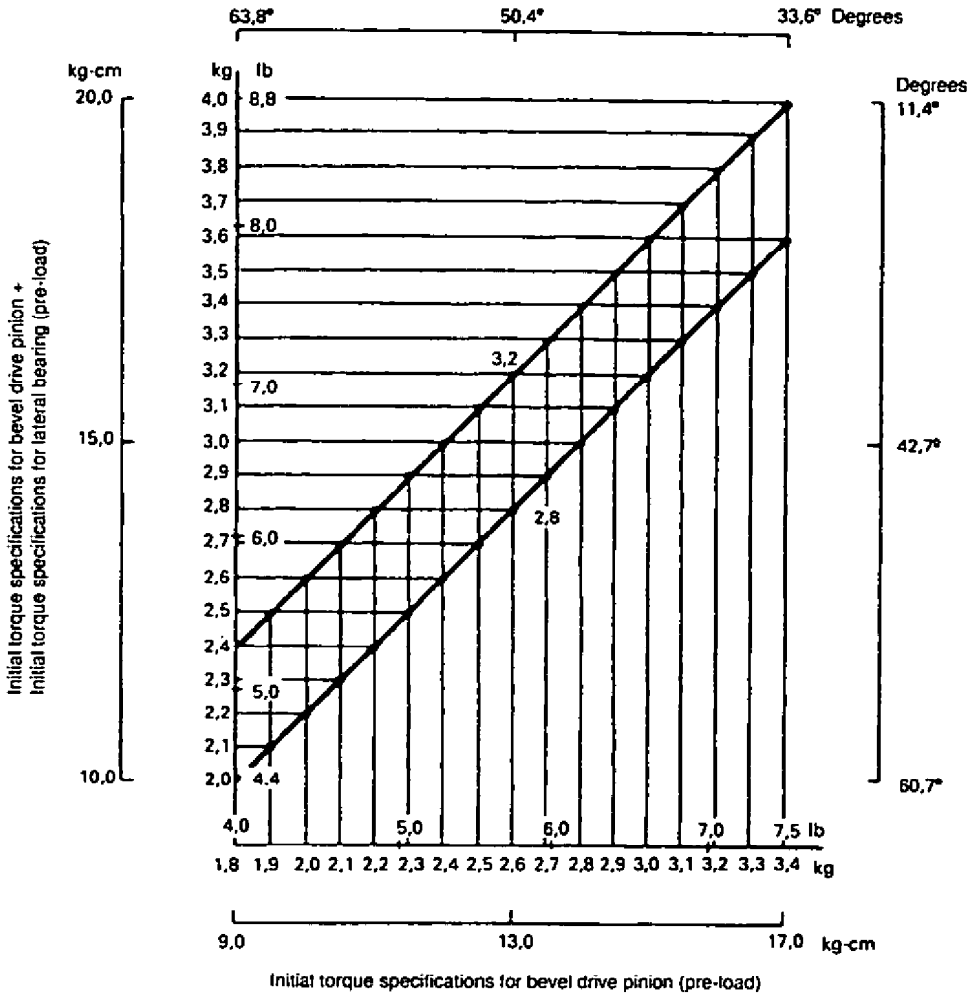
Special tool
(C): 09922-75222

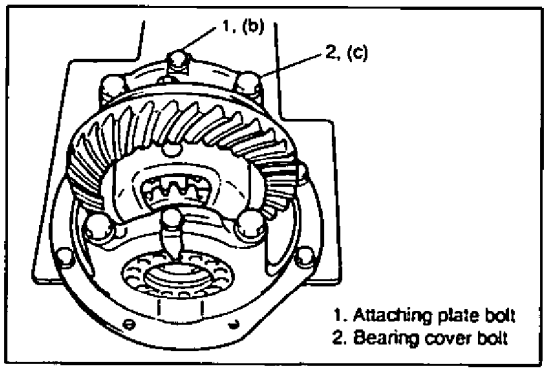


A Initial torque range of pinion bearing
B Initial torque range of lateral bearing and pinion bearing

- **Bearing pre-load can be checked approximately using a flange support as in the figure on the left. In this measurement, the support arm itself acts as dinamometer and an angle measurement is used instead of torque. The flange should however, rotate slowly, supporting the arm with its hand so that it does not turn excessively through inertia.**
- **Repeat adjustment of the lateral bearing until gear clearance and pre-load are compatible with specifications.**

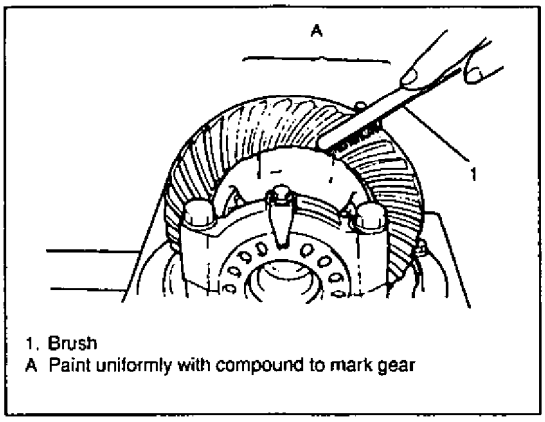
Special tool
(F): 09922-66020





7) Tighten bearing cap bolts as specified and install bearing plates.

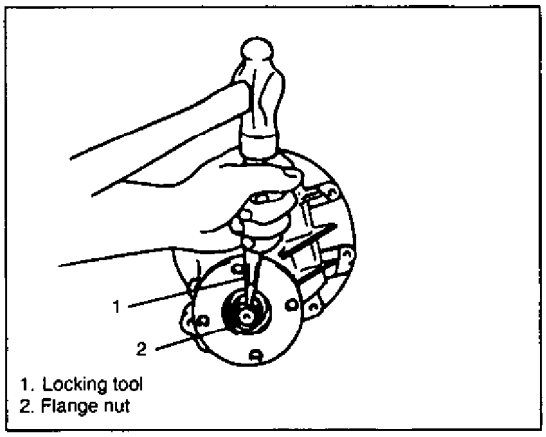
Torque specifications
(b): 1.2 kg-m (12 Nm)
(c): 8.5 kg-m (85 Nm)



1. Brush
A Paint uniformly with compound to mark gear

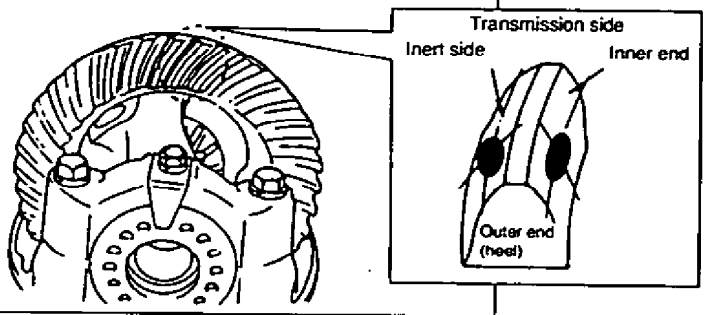
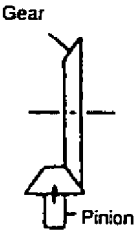
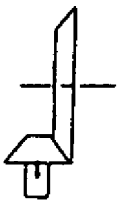
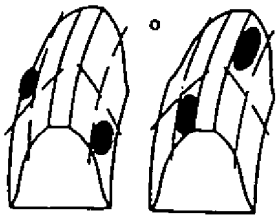
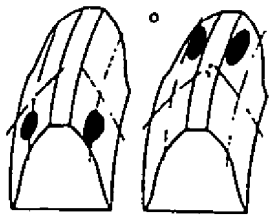
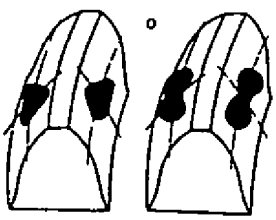
9) Finally, inspect gear teeth contact in the following way:
- After cleaning 10 bevel gear teeth, mark gears uniformly with paint, using a brush or sponge, etc.
- Turn the gear so that the painted part intermeshes with the bevel pinion and can be rotated back and forwards by hand to repeat contact.
- Move the painted part upwards to check contact pattern. (please refer to the following table). If contact pattern is not normal, readjust or replace as necessary in accordance with instructions on the table.

NOTE:
Be careful not to turn bevel gear more than one turn since it will prevent an accurate check.



1. Locking tool
2. Flange nut

10) Once gear teeth contact in point 9 has been checked, lock the flange nut with appropriate tool and hammer.

GEAR TEETH CONTACT PATTERN	DIAGNOSIS AND SOLUTION
	NORMAL
	HEAVY CONTACT The pinion is too far from centre of transmission bevel gear. 1. Increase pinion thrust washer thickness and position pinion as close to the centre of the gear as possible. 2. Adjust transmission bevel gear to specified torque. 
	LIGHT CONTACT The pinion is too far from the centre of transmission bevel gear. 1. Reduce pinion thrust washer vertical thickness and position the pinion further from the centre of the gear. 2. Adjust transmission bevel gear clearance as specified. 
	If adjustment is not possible, replace differential carrier.
	1. Inspect bevel gear seat or the differential casing (inspect bevel gear to see if it is off centre). 2. If adjustment is not possible, replace the bevel drive gear and the pinion set or differential carrier.
	Replace the control conic gear and the pinion play or differential case.

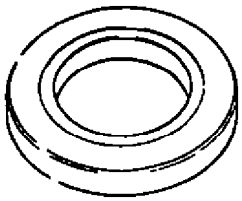
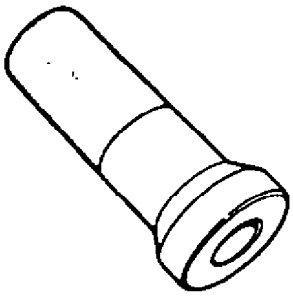
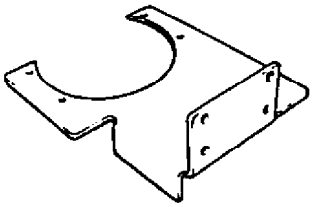
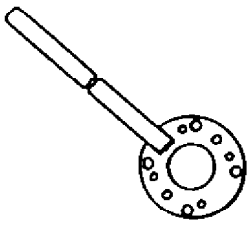
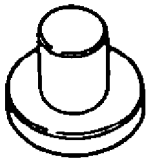
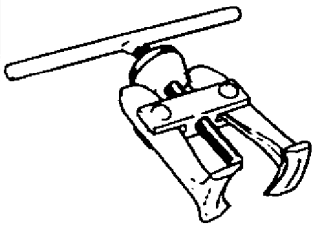
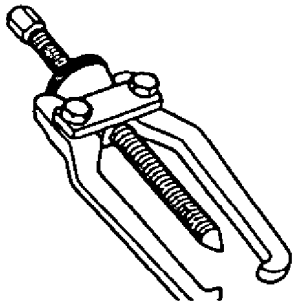
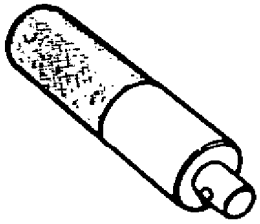
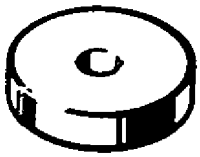
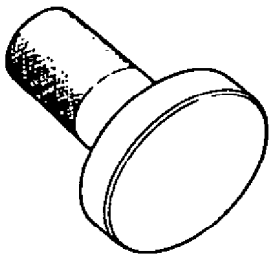
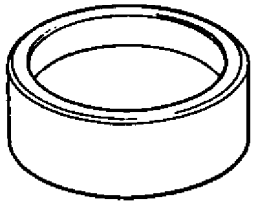
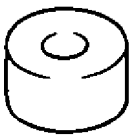
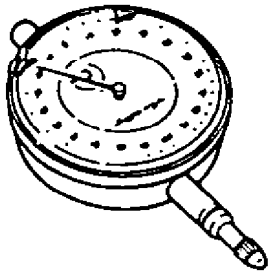
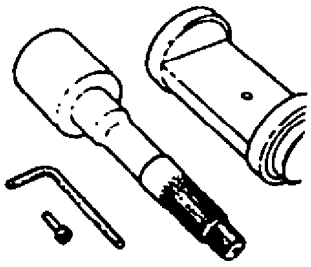
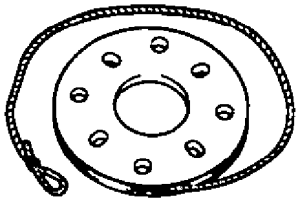
PARES DE APRIETE

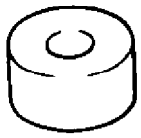
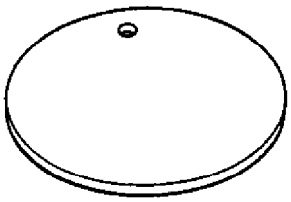
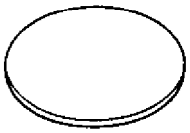
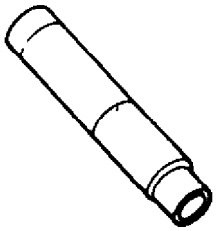
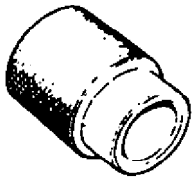
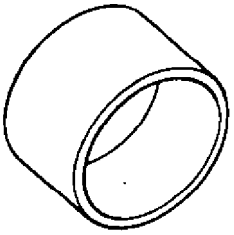
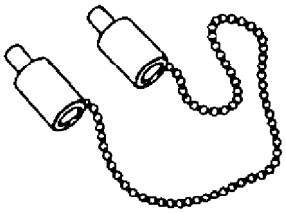
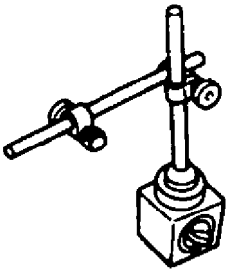
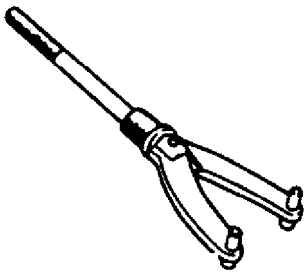
SYSTEM	COMPONENT	VALUES	
		Torque Specifications	
		Kg-m	Nm
FRONT AND REAR DIFFERENTIAL	Front differential oil fill/check plug	4.0	40
	Rear differential oil fill/check plug	4.3	43
	Front differential oil drain plug	2.3	23
	Rear differential oil drain plug	2.2	22
	Front differential silent block bolts	8.5	85
	Front differential silent block bolts	5.0	50
	Rear differential casing bolts	4.1	41
	Rear differential bevel gear bolts	8.5	85
	Rear differential bearing caps	8.5	85
	Rear differential attaching plate bolt	1.2	12

REQUIRED SERVICE MATERIALS

MATERIALS	PRODUCT RECOMMENDED BY SUZUKI	USE
Thread lock	THREAD LOCK CEMENT SUPER 1333B (99000-32020)	Bevel gear bolts
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal rims Sealant
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Differential oil fill/check plug • Differential housing mating surfaces

SPECIAL TOOLS AND INSTRUMENTS

 09951-26010 Bushing puller plate	 09951-16080 Bearing installer	 09944-76010 Differential carrier support	 09922-66020 Flange support
 09913-85230 Bearing pulling accessory	 09913-61510 Bearing puller	 09913-65135 Bearing puller	 09924-74510 Installer accessory
 09926-68310 Bearing installer	 09913-75510 Bearing installer	 09928-06010-002 Differential torque inspection tool	 09944-66020 Bearing installer
 09951-16060 Inner arm bushing puller	 09900-20606 Dial indicator	 09926-78311 Bevel pinion assembly fixture	 09922-75222 Pre-load adjuster

 09951-46010 Drive shaft oil seal installer	 09951-16070 Accessory	 09922-77250 Accessory	 09925-18010 Bearing installer
 09940-53111 Bearing installer	 09951-18210 Oil seal puller and no. 2 installer	 09930-40120 Accessory	 09900-20701 Magnetic support
 09930-40113 Rotor support			

SECTION 8

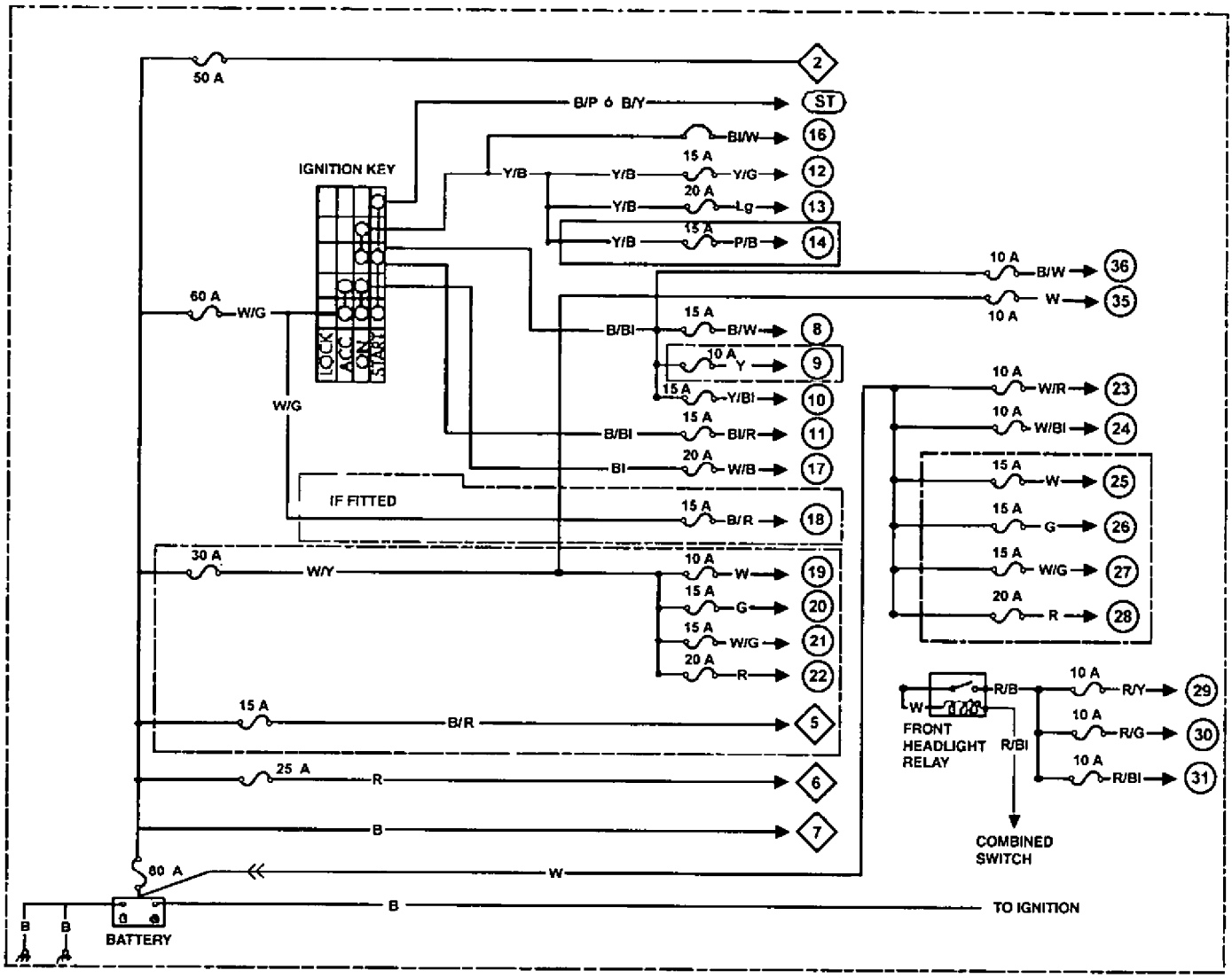
ELECTRICAL SYSTEM

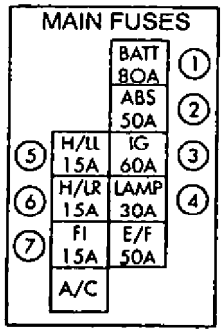
NOTE:
For points not covered in this section please refer to corresponding section in Service Manuals outlined in INTRODUCTION to this Manual.

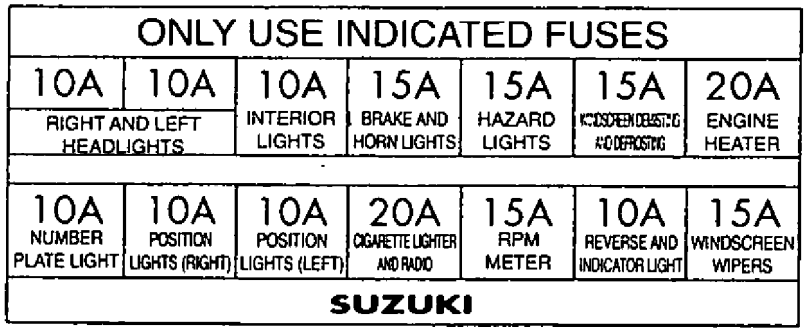
LIST OF CONTENTS

CHASSIS ELECTRICAL SYSTEM

FUSES

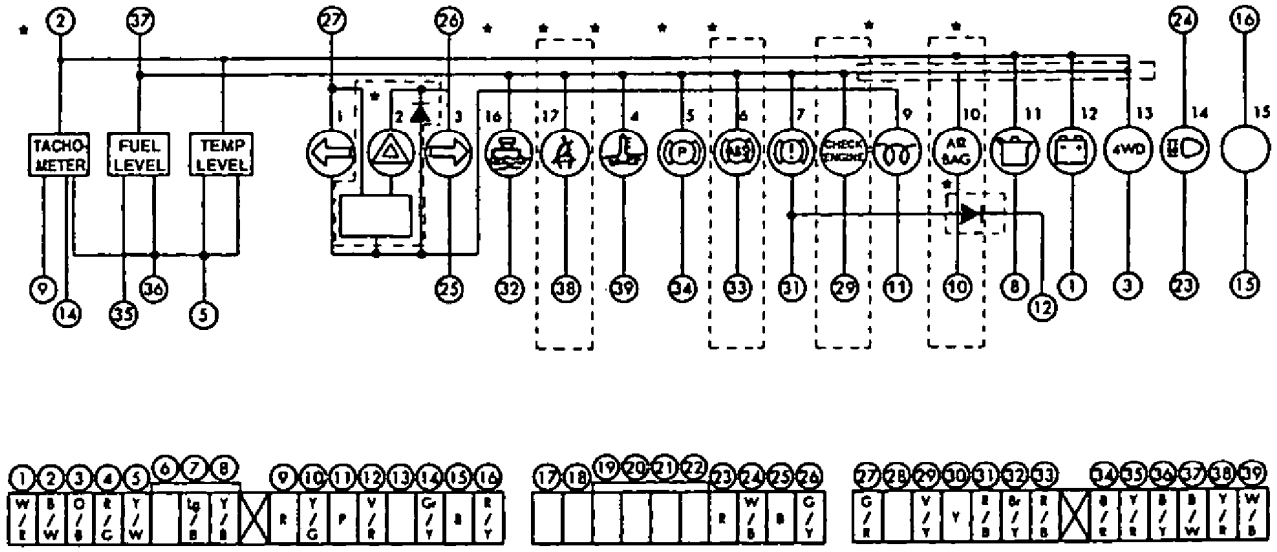






INSTRUMENTS AND DIALS

INSTRUMENT PANEL



1. Turn signal dial (left side)
2. Hazard light
3. Turn signal (right side)
4. Temperature gauge
5. Parking light
6. ABS light (if fitted)
7. Brake wear warning light
8. Electronic injection system
9. Heater light
10. I "AIR BAG" light
11. Oil pressure gauge
12. Alternator charge gauge
13. 2WD light
14. Road lamp
15. Instrument panel light
16. Coolant warning
17. Seat belt warning lamp (if fitted)

(1)	To alternator	White/Red
(2)	To ignition	Black/White
(3)	To 4WD switch	Orange/Black
(5)	To water temperature sensor	Yellow/White
(8)	To pressure switch	Yellow/Black
(9)	To r.p.m.	Brown/White
(10)	To AIR BAG unit	Yellow/Green
(11)	Heaters relay	Pink
(12)	To ignition	Violet/Red
(15)	To light key	Black
(16)	To light relay	Red/Yellow
(23)	To headlamps switch	Red
(24)	To fuse box	White/Blue
(25)	To ground	Black
(26)	To indicator light (left side)	Green/Yellow
(27)	to indicator light (right side)	Green
(29)	Check Engine	Violet/Yellow
(31)	To Brake fluid level switch	Red/Black
(32)	To cooling level switch	Light green/Red
(33)	To ABS control unit	Red/Blue
(34)	To parking brake switch	Black/Red
(35)	To fuel gauge	Yellow/Red
(36)	To ground	Black/Yellow
(37)	To ignition	Black/White
(38)	To seat belt switch	Yellow/Red
(39)	To temperature switch	White/Black

SECTION 8B

CODED VEHICLE IMMOBILIZER

NOTE:
For points not covered in this section, please refer to the corresponding section in Service Manuals outlined in INTRODUCTION to this Manual.

LIST OF CONTENTS

GENERAL OUTLINE

The code vehicle immobilizing system is a mechanism designed to lock the fuel injection system, as long as the access code established by the owner is not entered. It consists of the following components.:

- **Engine control module (ECM)**
- **Injection relay**
- **Coded immobilizing keypad**

It functions in the following way:

STARTING THE ENGINE

When the ignition key is entered and turned to ON position:

- If the green light on keypad comes on, the engine can be started directly.
- If the red light on keypad comes on, the immobilizing system is activated and it is necessary to enter the personal access code.

To start up the engine with the red light on, it is necessary to key in your personal four digit number. The green light will come on and the red light will go off.

On leaving the Factory all vehicles have the code 1111 entered, which the customer may use if they do not wish to change it.

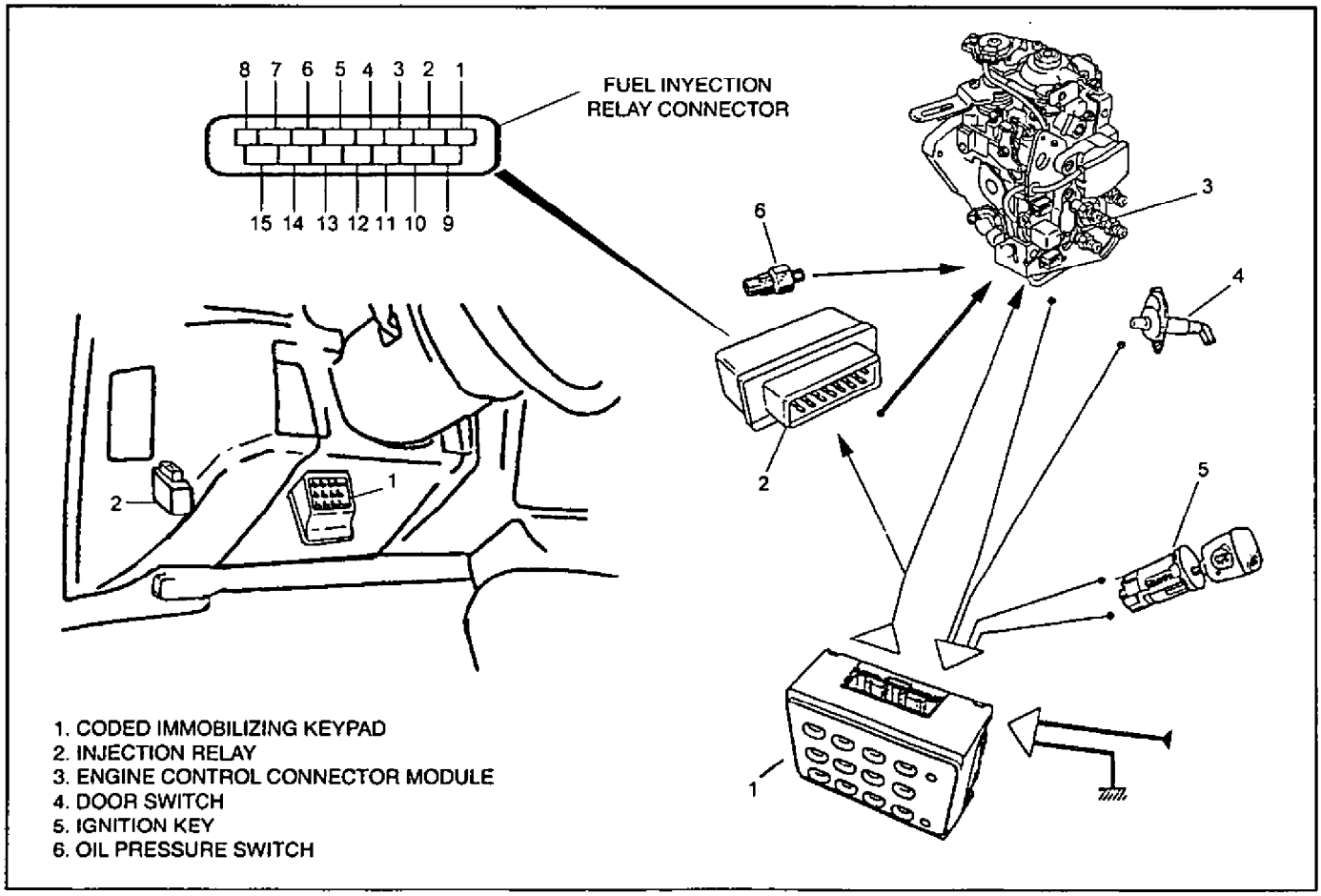
If you key in the wrong number, key in the correct four digit code again. Each time a key is pressed a "beep" is heard.

If an error is made on entering a code or in the process for changing a code, this is signalled by a two second warning sound.

With the ignition on, a "beep" sound is made if an attempt is made to start the engine up with the immobilizing system activated, permanent if the engine continues running.

NOTE

If the incorrect code is entered three times in succession, the keypad is rendered immobilized for thirty minutes.



ENTERING PERSONAL CODE FOR FIRST TIME

This should be effected in the following way:

1). Turn ignition key to ON position.
2). Enter code 1111.
3). Press key C.
4). Enter a personal four digit code.
5). Press key C to validate operation. this operation is confirmed by four green flashes and four "beeps".

MODIFYING PERSONAL CODE

This operation should be effected in the following way:

1). Turn the ignition key to ON position.
2). Enter memorized code.
3). Press key C.
4). Enter new four digit code.
5). Press key C to validate operation. This operation is confirmed by four green flashes and four "beeps".

SECURITY MEASURES

The two codes (the old one preserved or new one validated) remain present until one of them is used, automatically anulling the other.
If the code is not confirmed, take out the key, enter once more and repeat the operation.
Simultaneous flashing of red and green lights indicates an incorrect operation or a malfunction. If this occurs, wait for approximately a minute, switch off and then on again. If the problem persists, a diagnosis of the fault should be effected as indicated below.

SETTING IN SERVICE MODE

This process allows the customer to let a garage or another person use the vehicle without knowing their personal code (four digits).
This operation should be effected in the following way:

1. Enter personal code and press S
2. Enter service code (the code 1111 is recommended) and press S.

Six green flashes accompanied by six "beep" sounds confirm the operation.
The service code is automatically anulled when the personal code is entered again, it being unnecessary to go through the code modification process again.

LOCKING SYSTEM

Locking is effected automatically on switching off in the following cases.

1. Thirty seconds after opening and closing of driver's door.
2. Ten minutes after switching off.

NOTE:
The oil pressure gauge switch is responsible for informing the engine control module, if the engine is off or running.
If the driver leaves the vehicle without turning off the engine, on opening the door the latter's switch sends a locking signal via the engine control module keypad. At the same time, the oil pressure gauge sends another signal to the running engine. This signal reaches the coded immobilizing module control so that the order received from door switch to lock doors is not effected.

IDENTIFICATION OF SYSTEM

System locking can be checked after thirty seconds by observing the red keypad light. This light comes on for ten seconds after system locking and then flashes until the starter motor is engaged again.

NOTE
In the event of a malfunction or the battery current being cut off, the personal code remains in the memory.. In the event of the personal code being lost, it is necessary to replace the coded ignition engine control module.

DIAGNOSIS

INTRODUCTION

To effect a correct diagnosis and repair of the coded immobilizing mechanism the following steps should be taken:

1) Dialogue with customer to know defective functioning symptoms of system and the conditions in which they have occurred.
2) Closely read the "General Outline" chapter in this section to gain thorough knowledge of the system.
3) Please refer to flow charts for each of the defects detected (see defect analysis).
4) Carry out repair to corresponding mechanism.
5) Perform test to confirm correct repair.

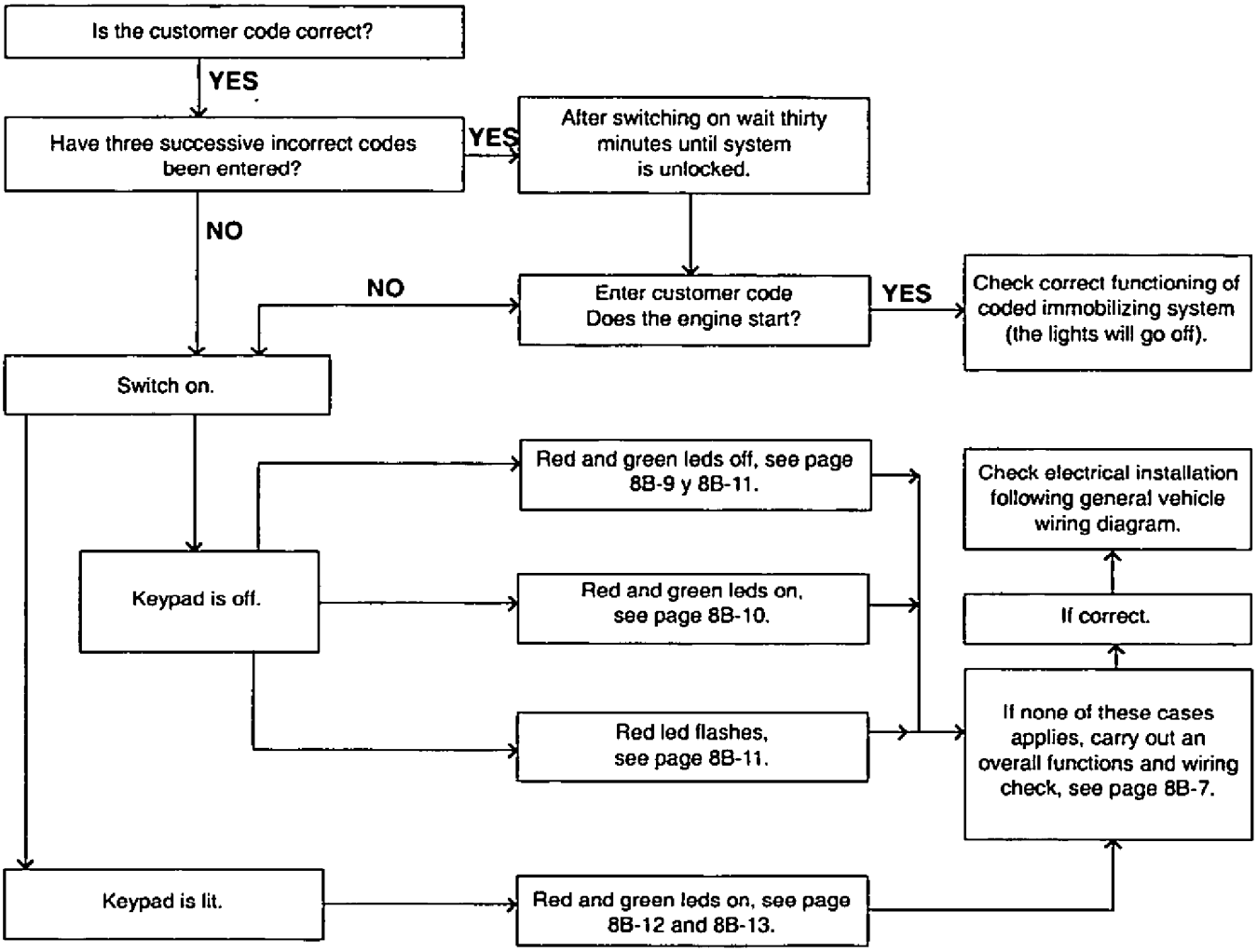
PRECAUTIONS ON DIAGNOSING MALFUNCTIONS

1) Do not disconnect :
   - The battery with the engine running.
   - The E.C.M. relay or keypad after switching on.
2) Ensure that the battery is completely charged and that voltage is not lower than 12 v nor higher than 16 v.
3) The majority of intermittent problems are a result of.
   - Bad condition of cables or connections.
   - Incorrect power supply of terminals, or loose on lower part.
   - Terminals badly conformed or damaged.
   - Oxidized terminals.
   - Faulty connection between terminal and cable.

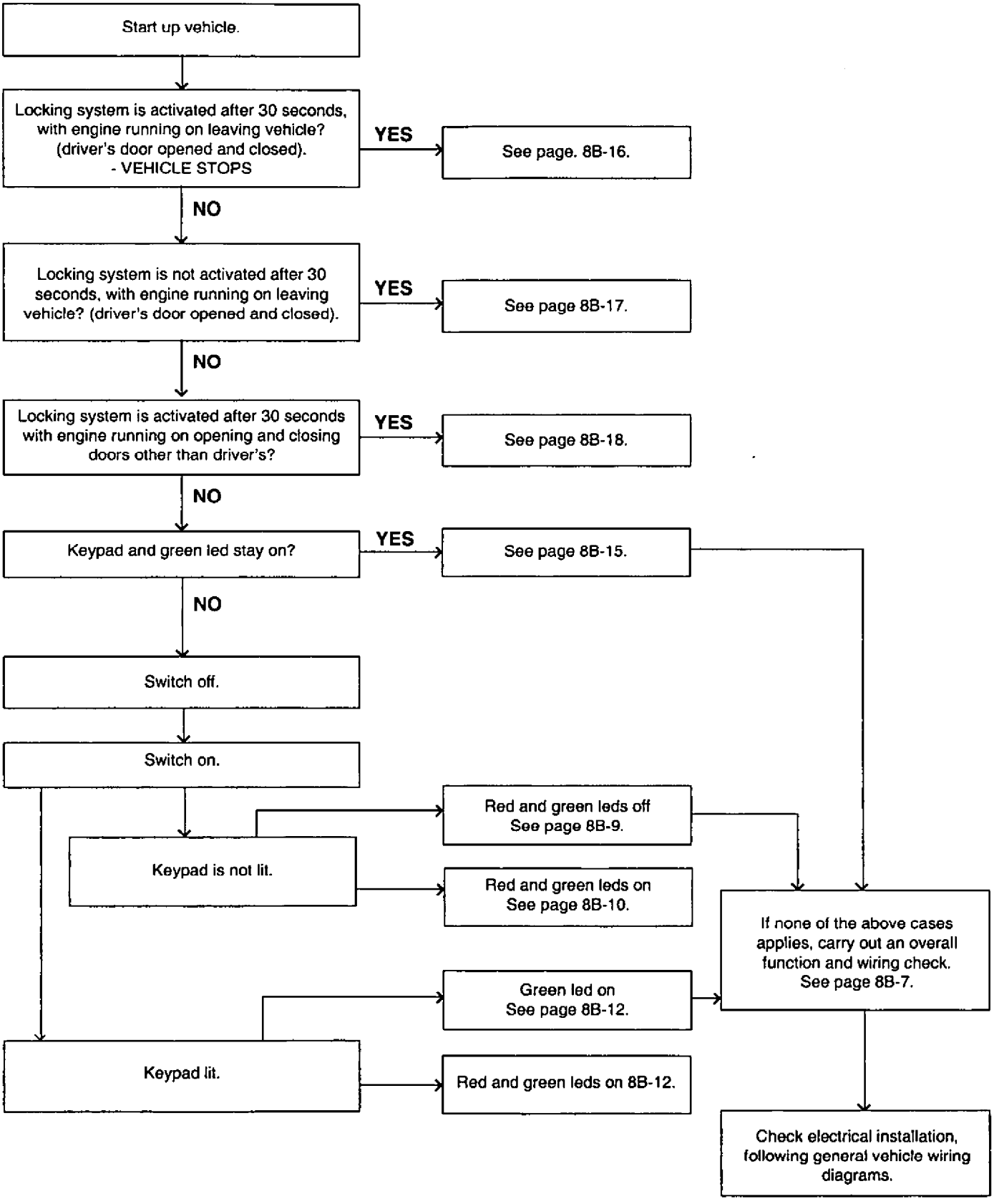
   Ensure these faults are repaired before continuing with diagnosis.
4) Do not use a pilot lamp or go over an electric arc with a wire to check continuity of a circuit.

DEFECT ANALYSIS

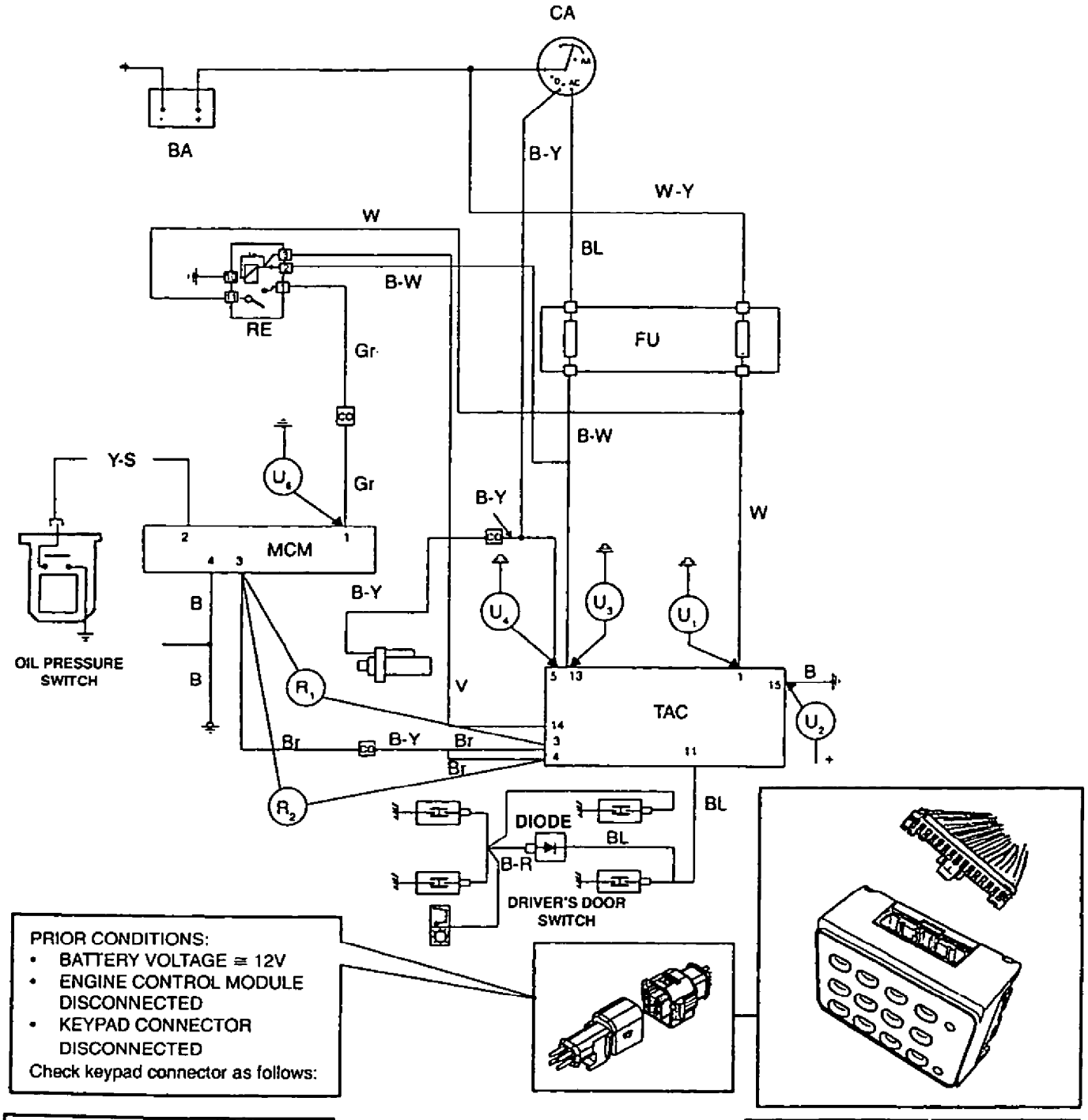
A-1 ENGINE DOES NOT START



A-2 ENGINE STARTS



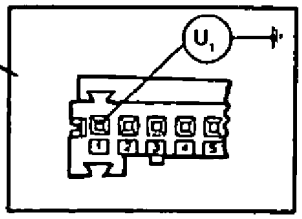
TEST WIRING



PRIOR CONDITIONS:
- BATTERY VOLTAGE ≅ 12V
- ENGINE CONTROL MODULE DISCONNECTED
- KEYPAD CONNECTOR DISCONNECTED

Check keypad connector as follows:

U_1 ≅ 12V — NO → Check keypad feed, see page 8B-9.



U_2 ≅ 12V — NO → Check keypad ground, see page 8B-10.

See following page.

Continued from previous page.

Switch on.

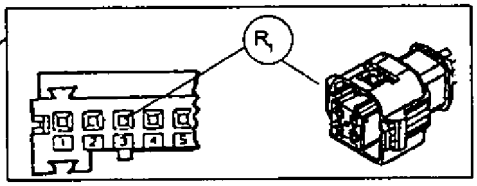
$U_3 \cong 12V$ — NO → Check keypad feed + after switching on See 8B-11.

YES

Start up engine $U_4 \cong 10V$ — NO → Check ignition information to keypad. See page 8B-15.

YES

Switch off.



$R_1 \leq 1\Omega$ — NO → Check keypad connection to engine control module, coded ignition. See page 8B-12.

YES

$R_2 \leq 1\Omega$ — NO → Check connection of engine control module, coded ignition. See page 8B-12.

YES

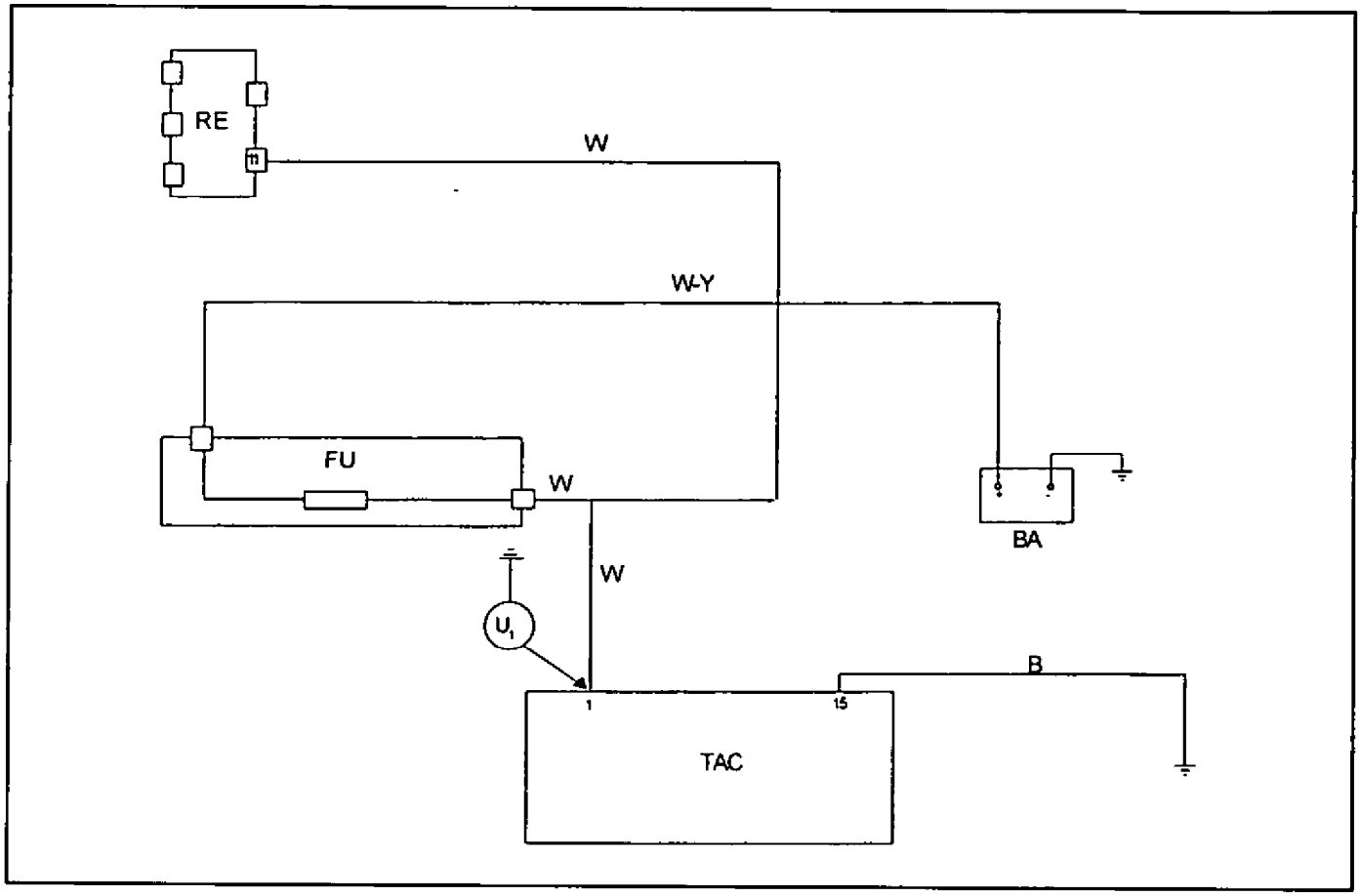
Switch on.

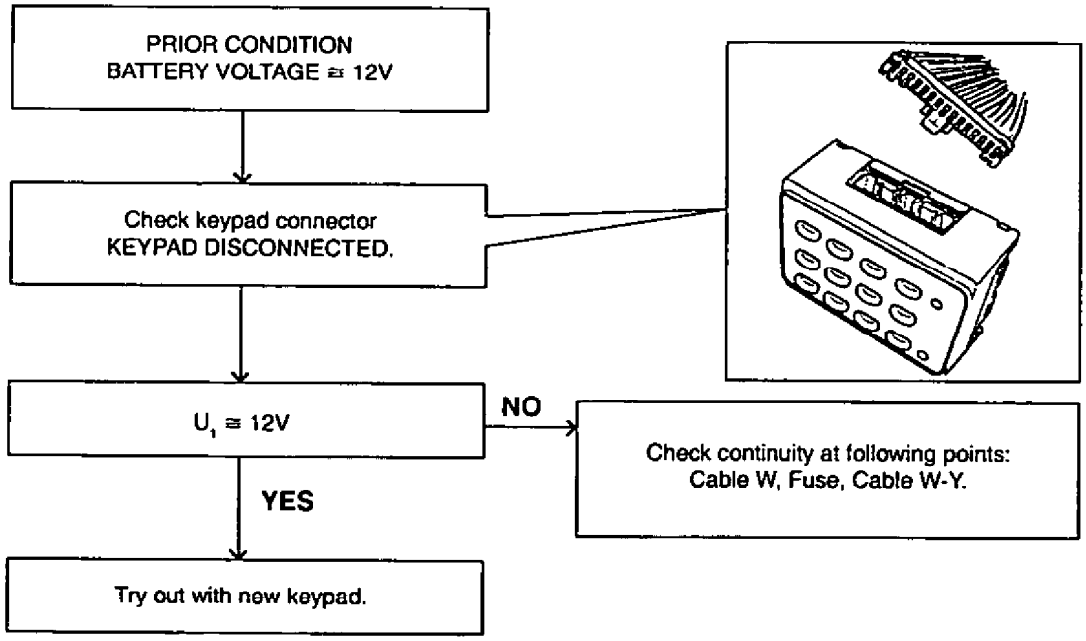
$U_5 \cong 12V$ — NO → Check engine control module feed, coded ignition + after switching on. See page 8B-12.

YES

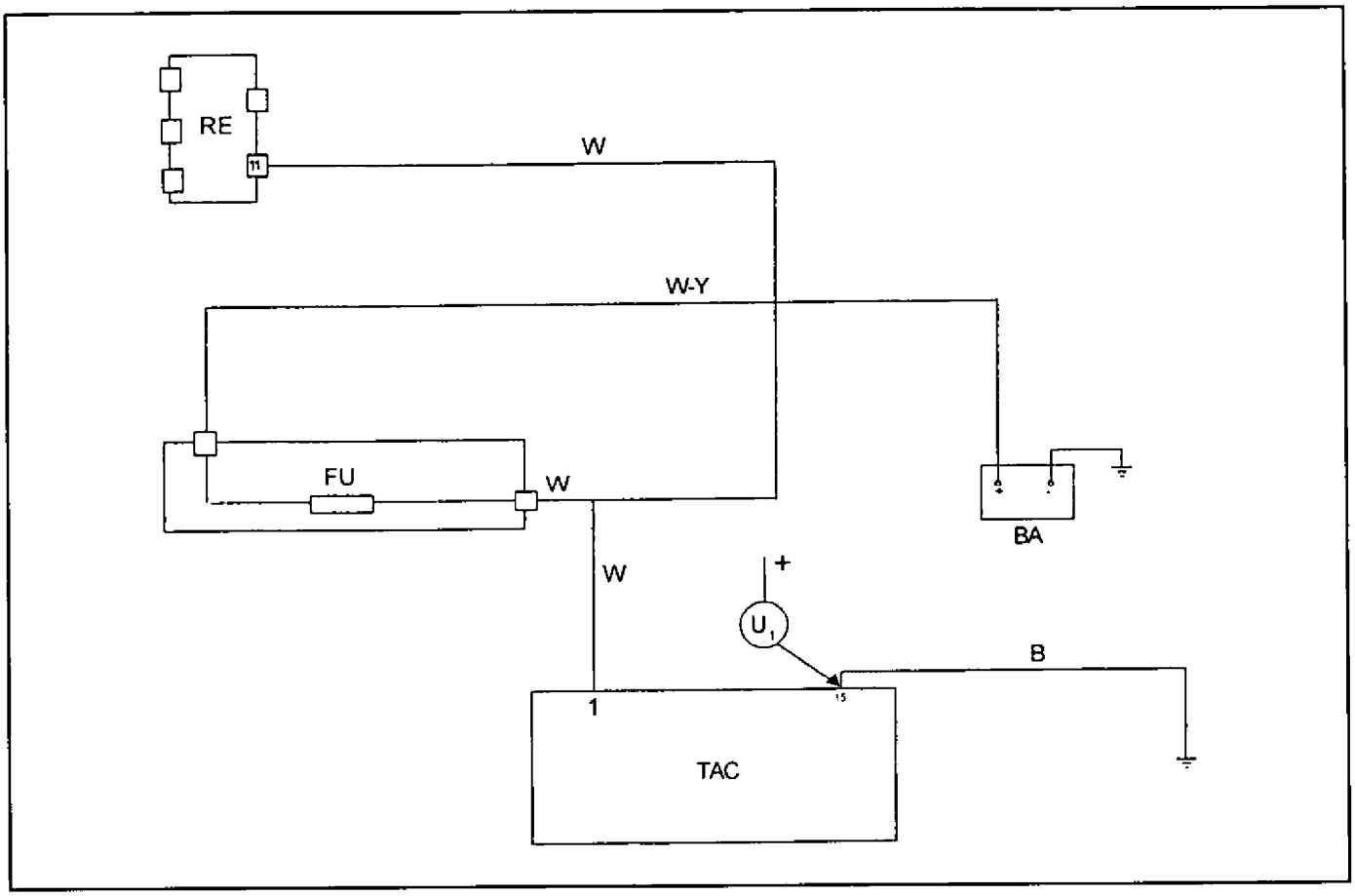
Carry out test with new keypad.

KEYPAD FEED CONTROL. + BATTERY



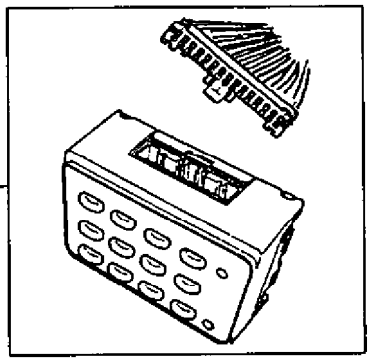


TESTING KEYPAD GROUND



PRIOR CONDITION
KEYPAD VOLTAGE SUPPLY
(SEE 8B-9).
U ≅ 12V

Check keypad connector
KEYPAD DISCONNECTED.



U_1 ≅ 12V

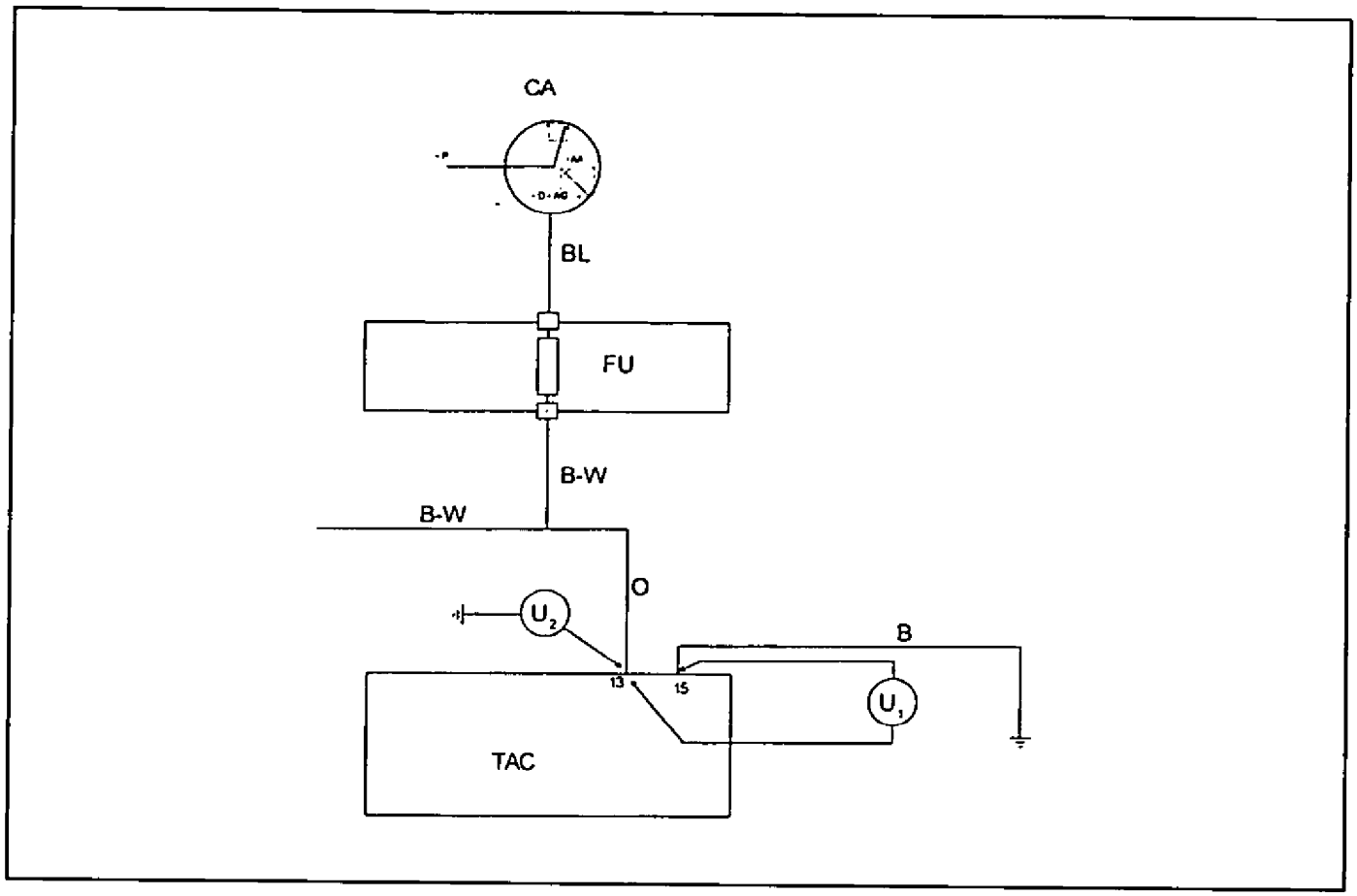
NO

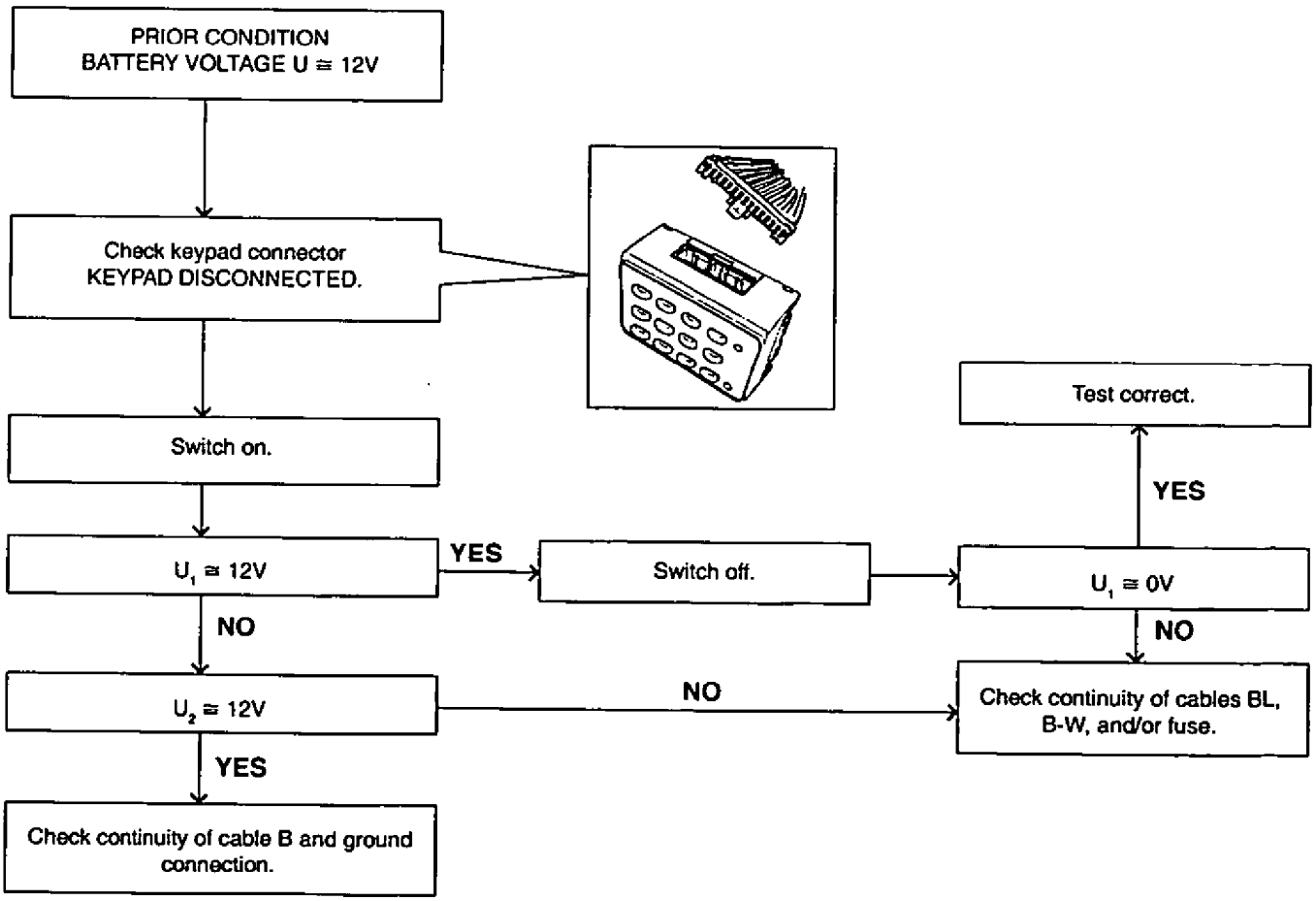
Check cable continuity of ground B and ground connection.

YES

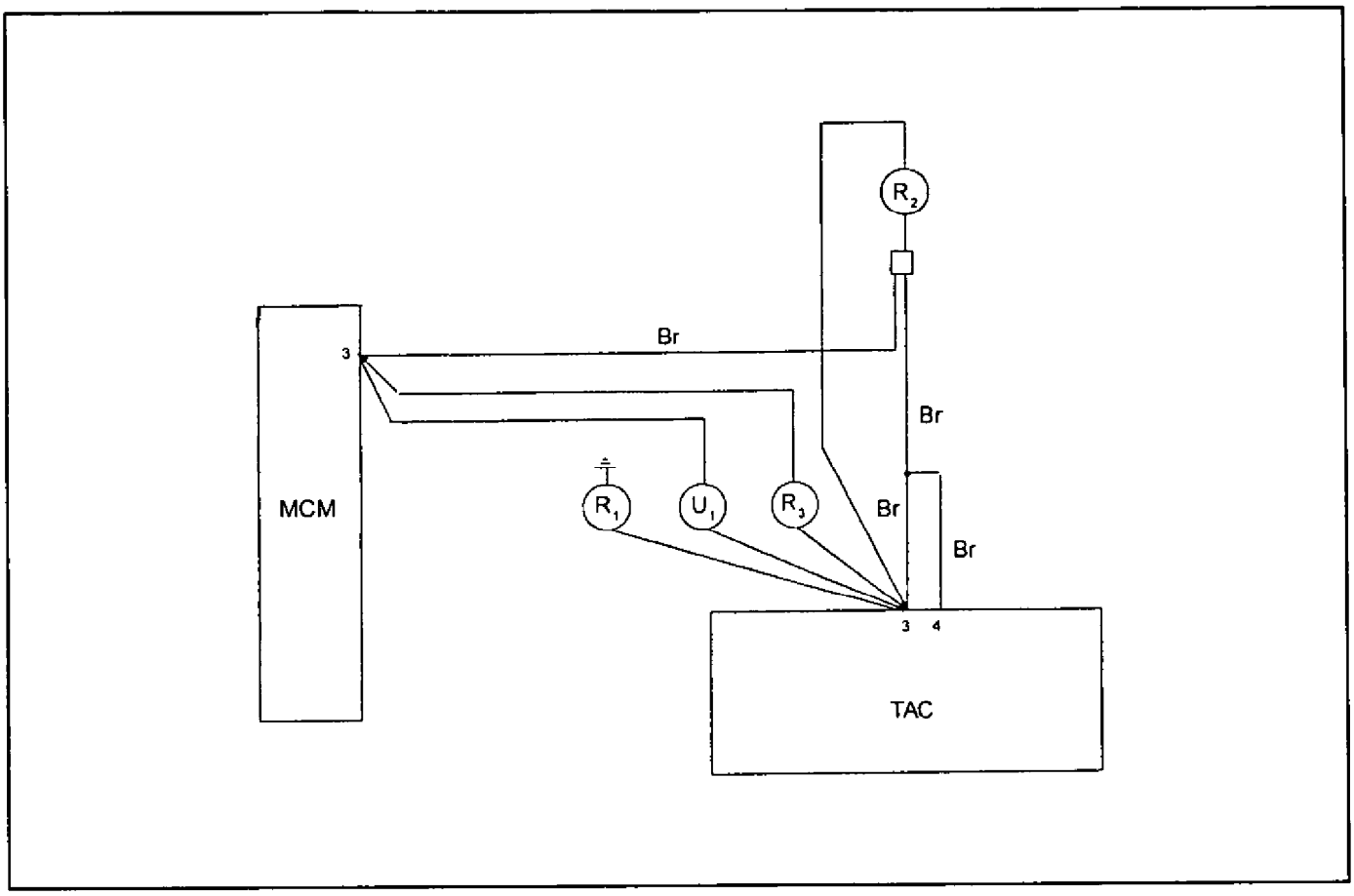
Try out with new keypad.

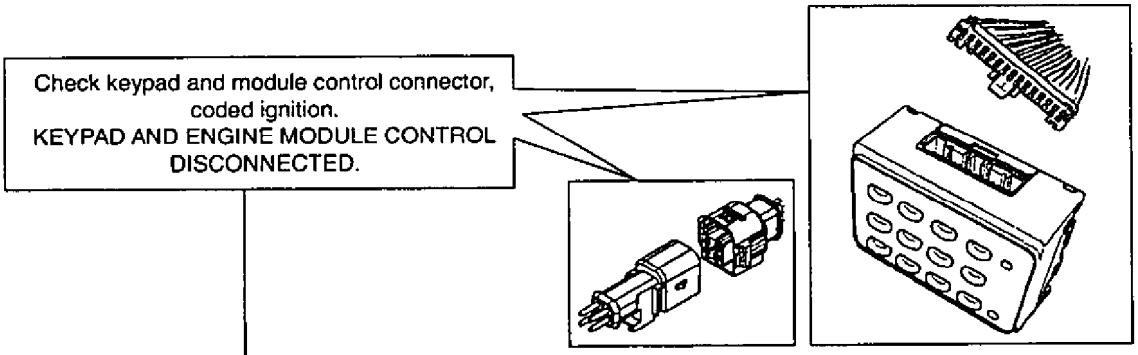
KEYPAD FEED CONTROL: + AFTER SWITCHING ON





TESTING KEYPAD CONNECTION TO ENGINE CONTROL MODULE





Check keypad and module control connector, coded ignition.
KEYPAD AND ENGINE MODULE CONTROL DISCONNECTED.

$U_1 \cong 0$ — NO → Cable Br, in different sections, shorted to battery +.

YES

$R_1 > 199{,}9\ K\Omega$ — NO → Cable Br, in different sections, grounded.

YES

$R_2 \leq 1\ K\Omega$ — NO → Cable Br, up to connector, cut off.

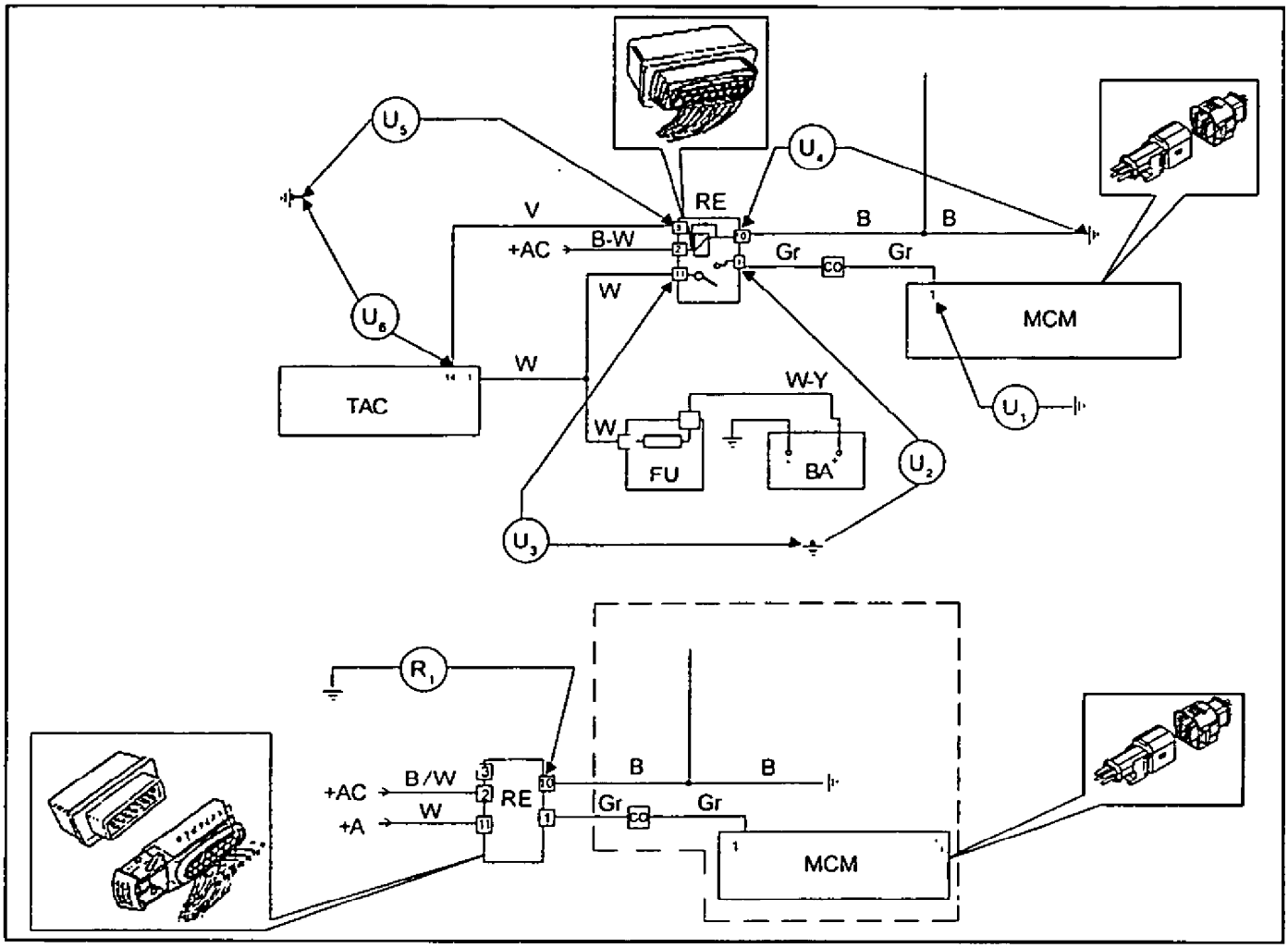
YES

$R_3 \leq 1\ K\Omega$ — NO → Cable Br, in different sections.

YES

Test correct.

TESTING ENGINE CONTROL MODULE FEED SUPPLY. POSITIVE AFTER SWITCHING ON



PRIOR CONDITION
KEYPAD FEED CORRECT
(SEE 8B-11).

Check engine control module connector, coded ignition. (Connector not joined up)

Switch on.

$U_1 \cong 12V$

YES

Switch off.

$U_1 \cong 0V$

YES

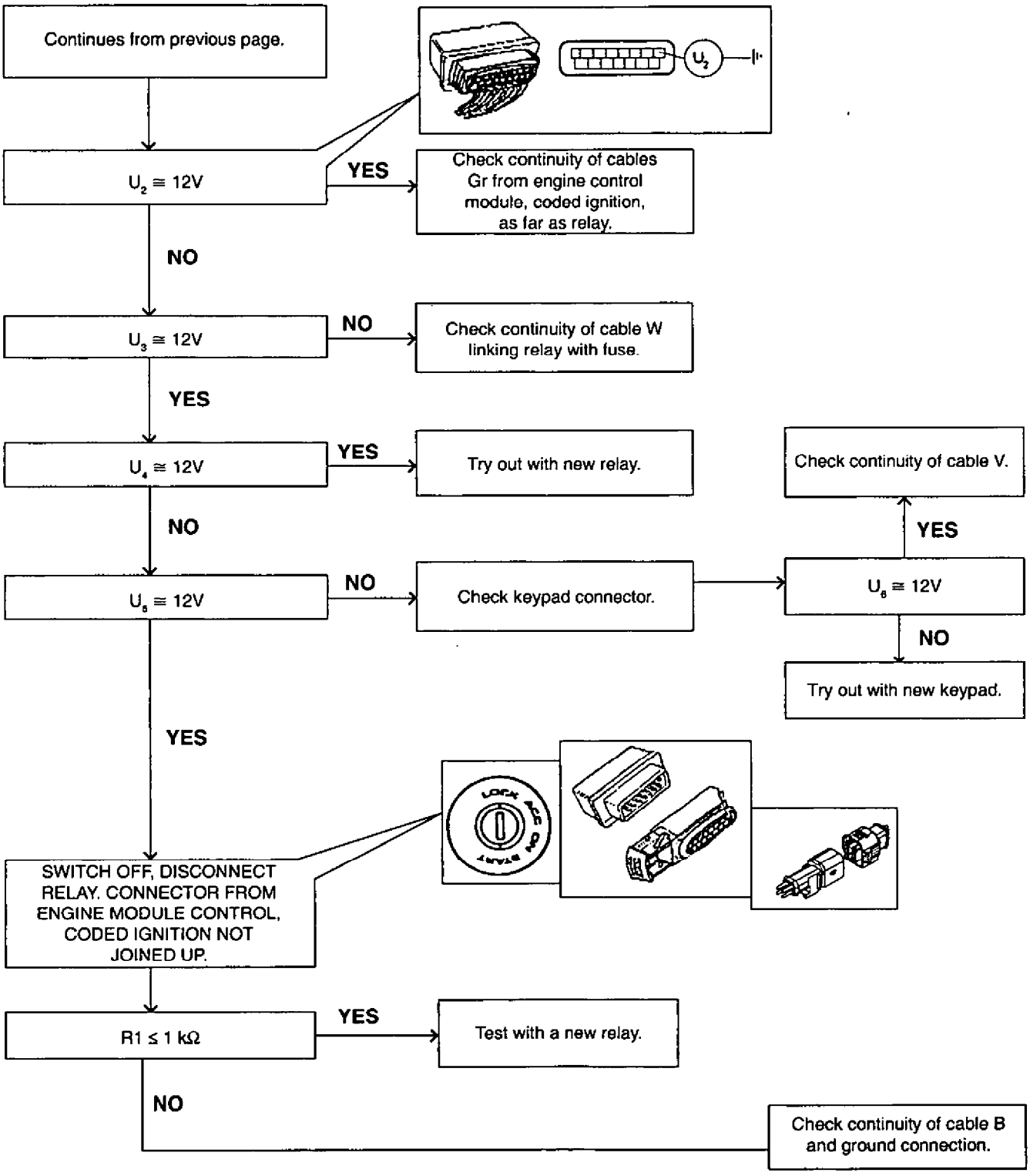
Test correct.

NO

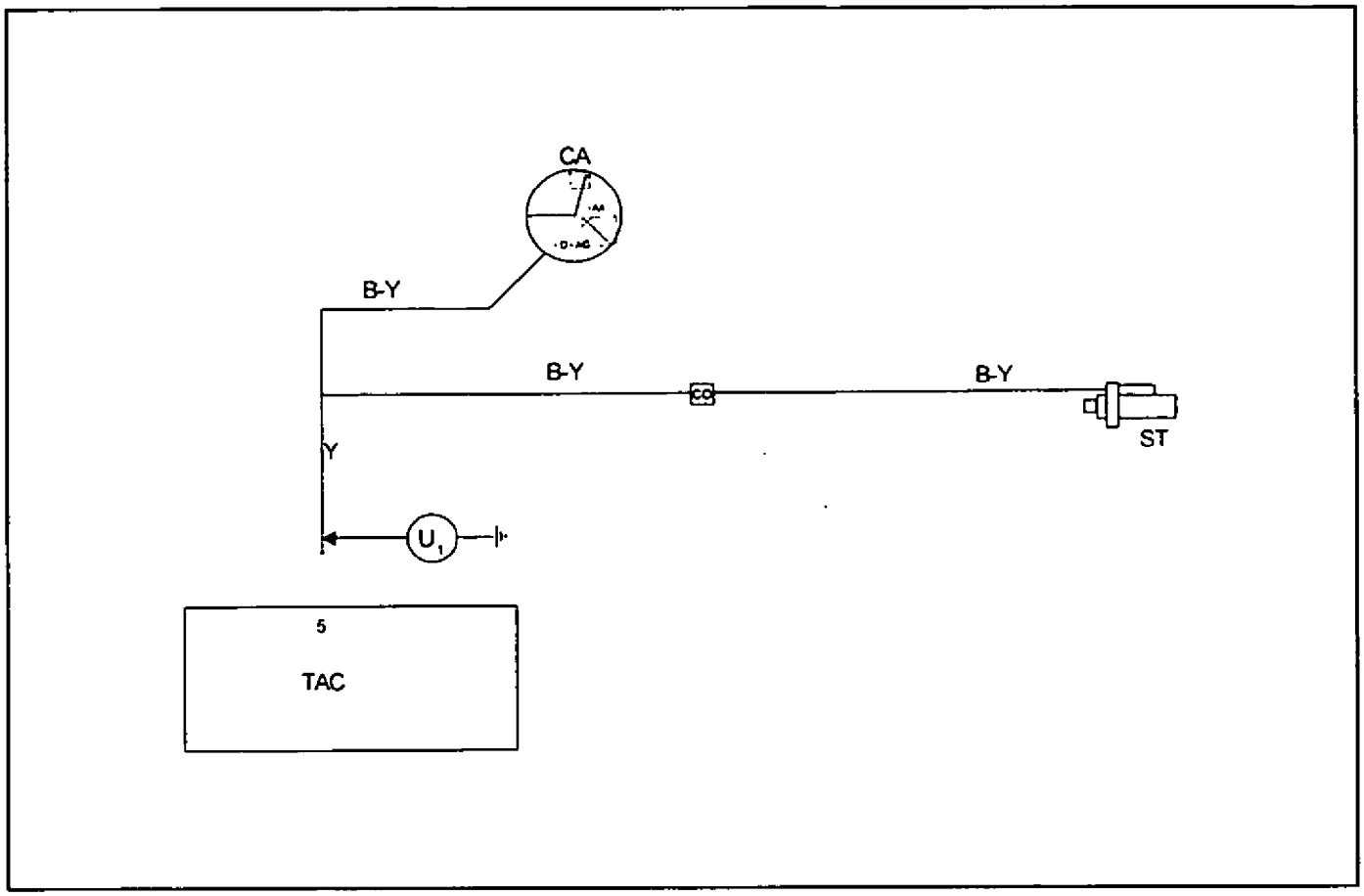
Check continuity of cables Gr, before and after connector.

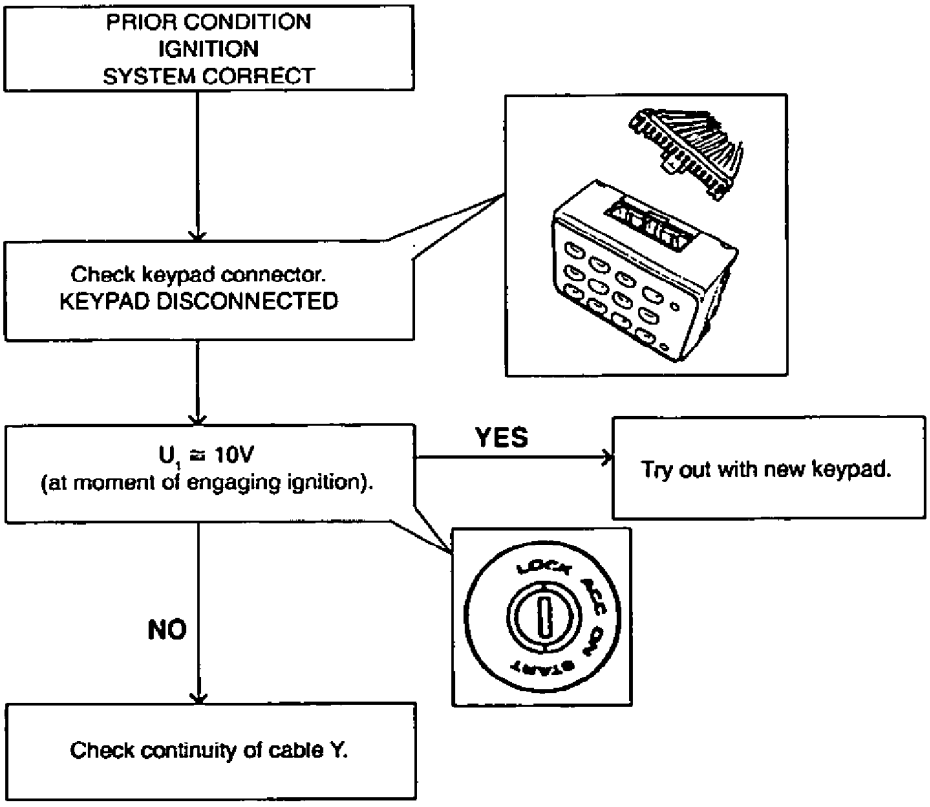
NO

See following page.

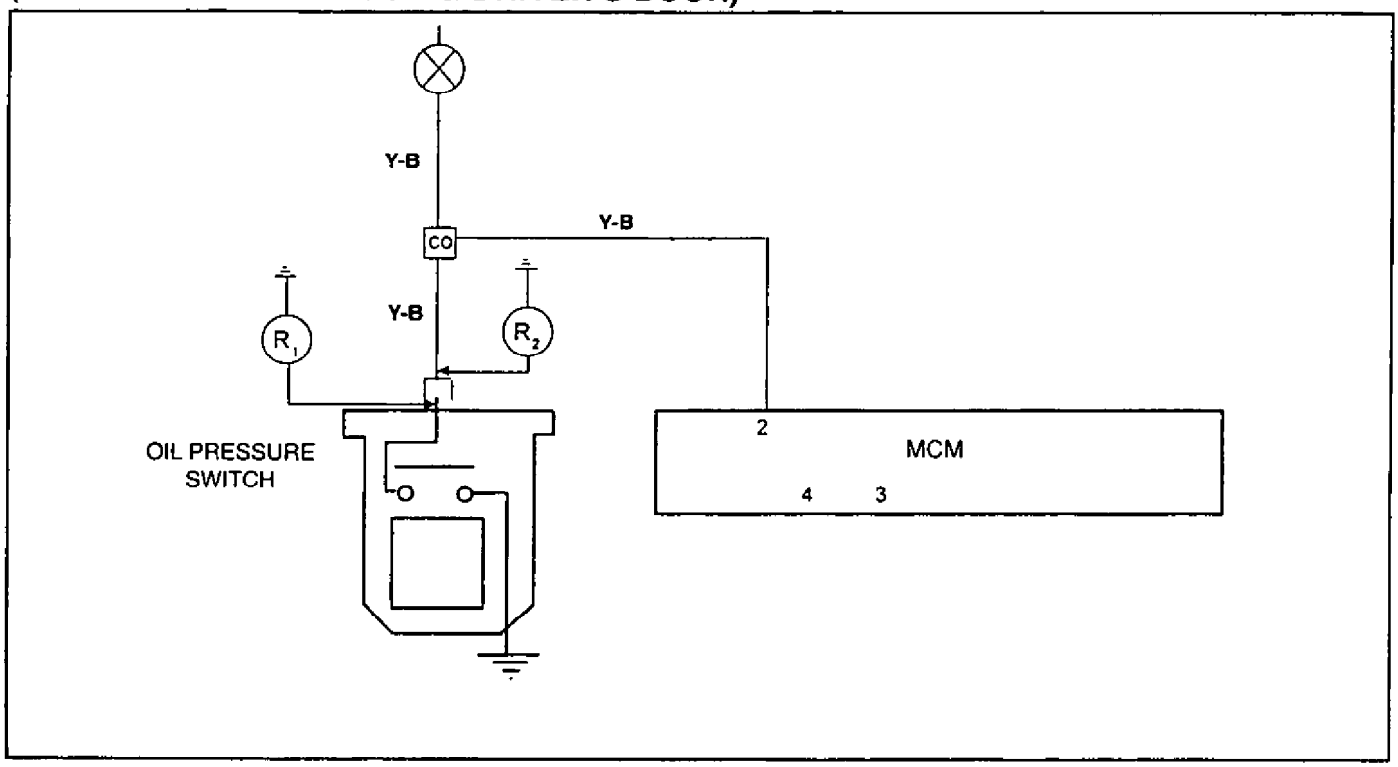


TESTING IGNITION INFORMATION TO KEYPAD





ACTIVATING LOCKING WITH ENGINE RUNNING (ON OPENING AND CLOSING DRIVER'S DOOR)



The oil pressure light comes on when the engine is running?

NO → Cable Y-B from engine control module to connector, broken and grounded.

YES

Check engine oil level and grade.

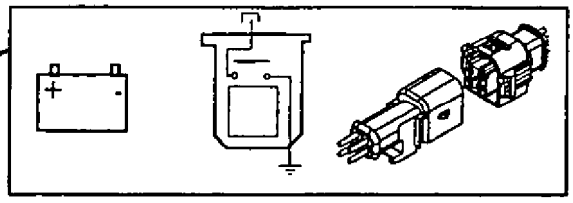
Correct.

Remove pressure switch cable. Check for $R_1 \cong \infty$ with engine running and R1 ≤ 1Ω with engine off.

→ Replace oil pressure switch.

NO

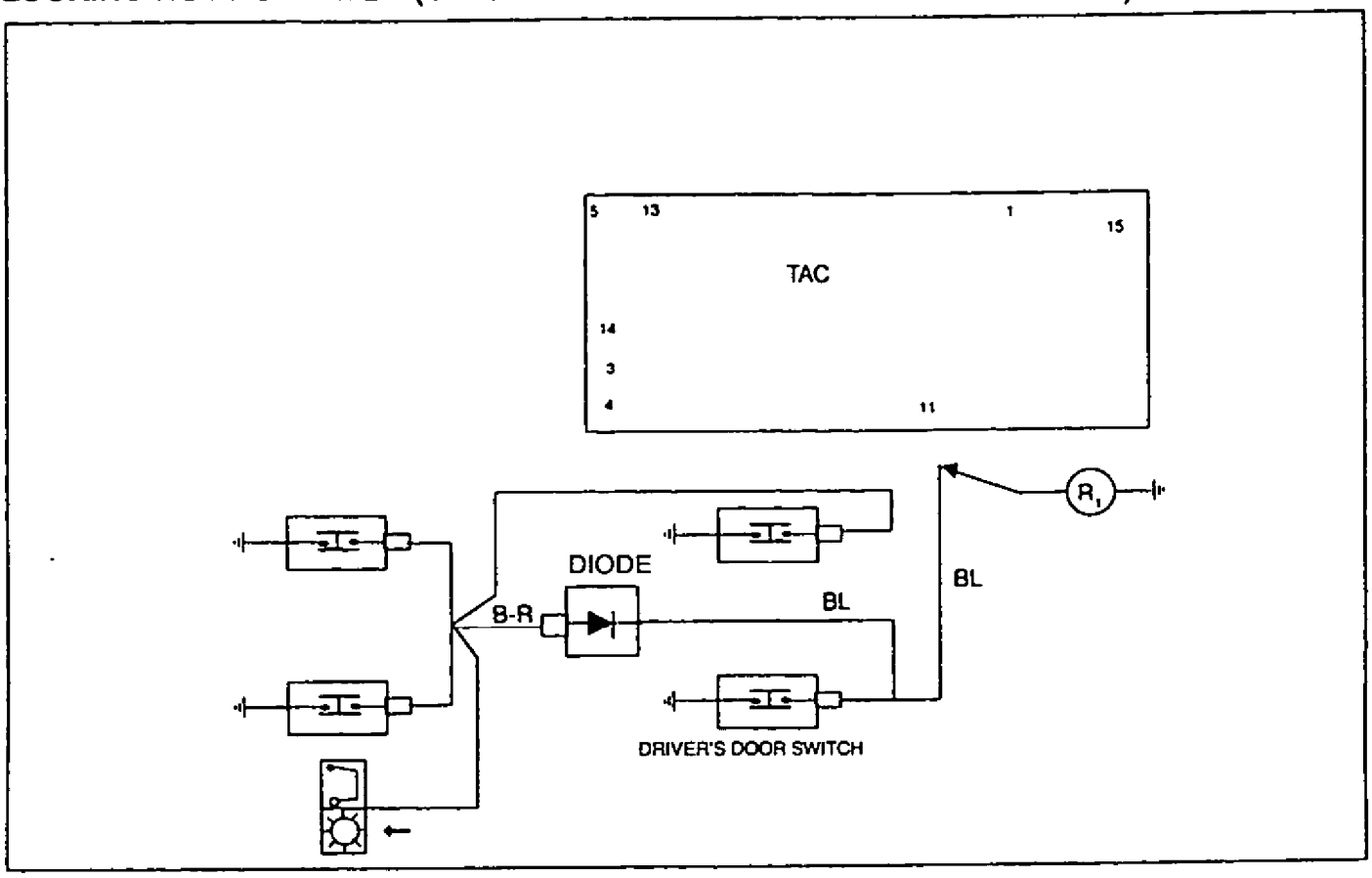
DISCONNECT BATTERY
Release E.C.M. and pressure switch connection.
Check resistance R_2 on cable Y-B.



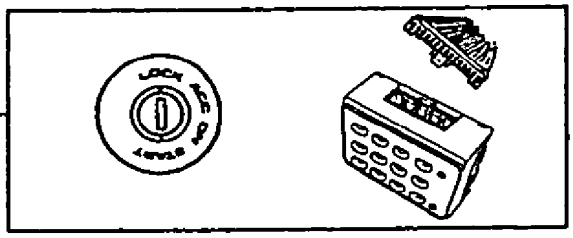
$R_2 \leq 1\Omega$
Wiring Y-B grounded.

$R_2 \cong \infty$
Correct.

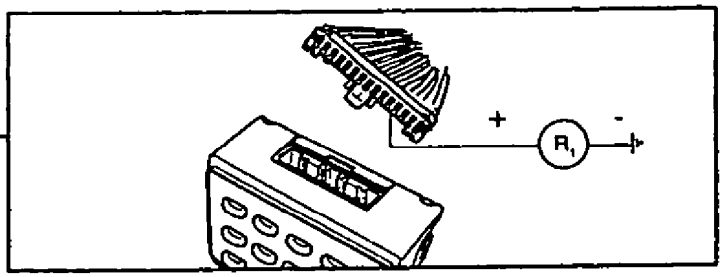
LOCKING NOT ACTIVATED (ON OPENING AND CLOSING DRIVER'S DOOR)



PRIOR CONDITION
IGNITION KEY IN OFF POSITION
KEYPAD CONNECTOR RELEASED.



Connect ohmeter
(positive connection to terminal 11 in wiring and grounding negative).
ALL DOORS CLOSED.



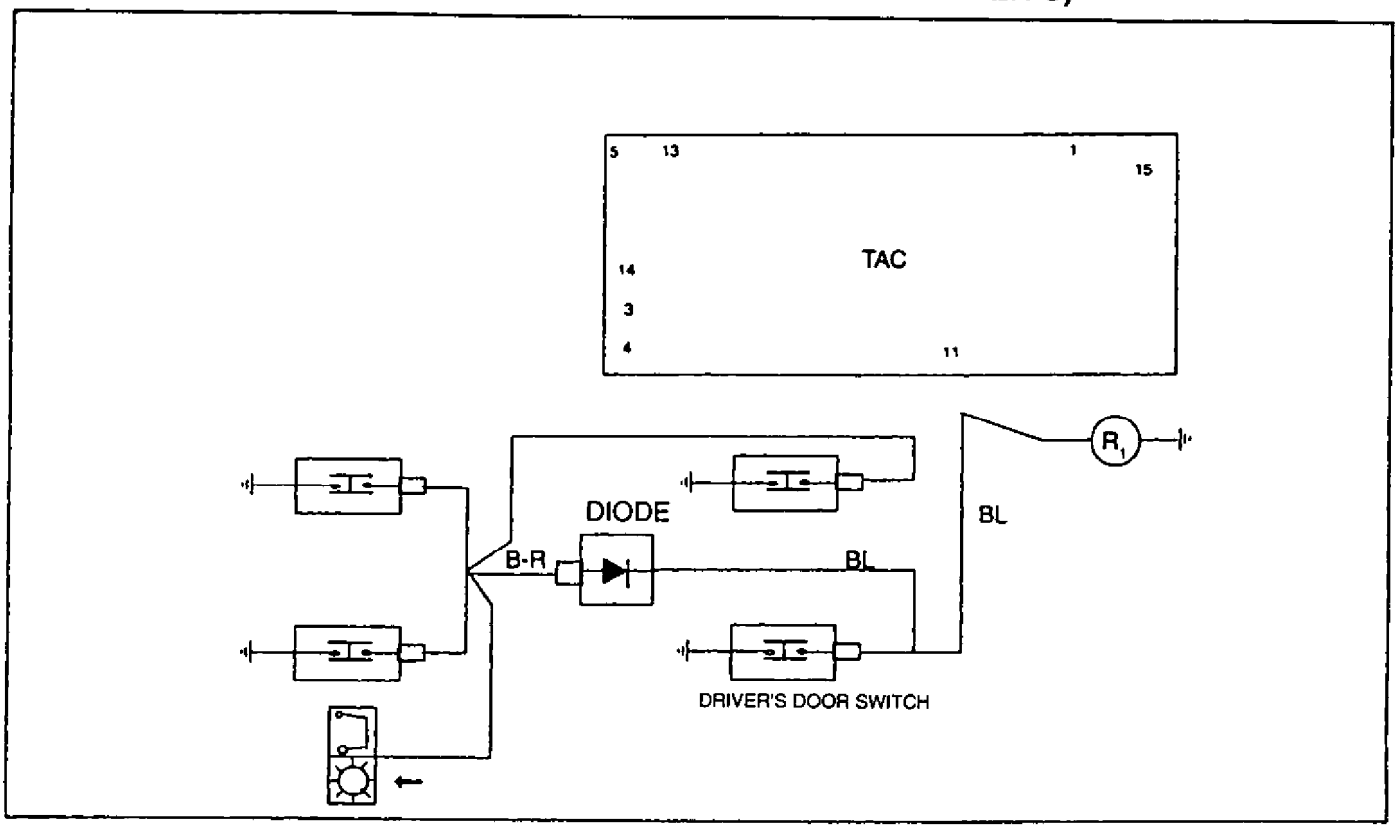
$R_1 \cong \infty$ — NO → Installation of defective doors Grounded.

YES

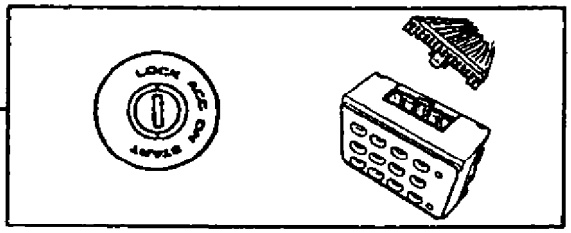
Open driver's door.

$R_1 \leq 1\Omega$ — NO → Door switch defective. — NO → Defective ground in door switch.

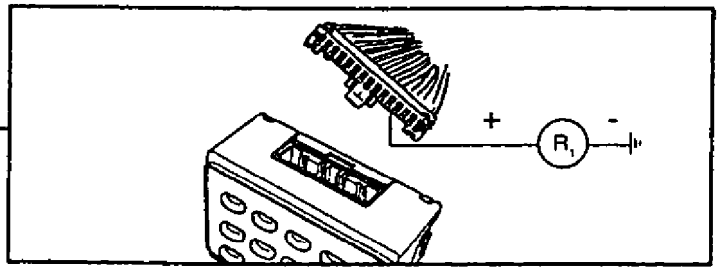
ACTIVATING LOCKING
(ON OPENING AND CLOSING A DIFFERENT DOOR FROM DRIVER'S)



PRIOR CONDITION
IGNITION KEY IN OFF POSITION
KEYPAD CONNECTOR RELEASED.



Connect an ohmeter (positive connection to terminal 11 in wiring and grounding negative).
ALL DOORS CLOSED.



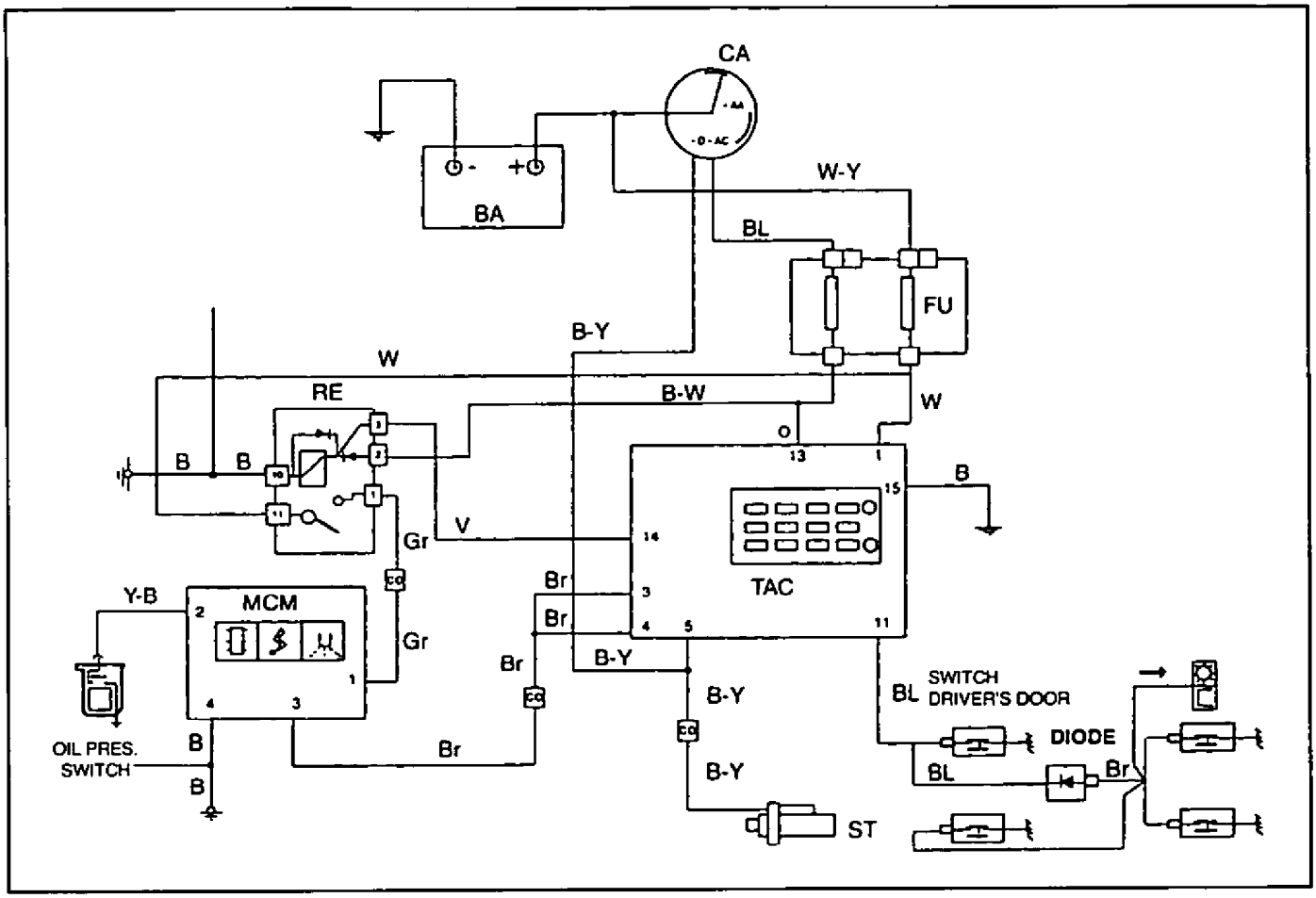
$R_1 \cong \infty$ — NO → Installation of defective doors Grounded.

Open every door except driver's.

$R_1 \cong \infty$ — NO → Defective diode in door installation.

Correct.

WIRING DIAGRAM. IDENTIFICATION OF SYMBOLS



COMPONENTS

BA.- BATTERY
AA.- ANTITHEFT ASSEMBLY (IGNITION KEY)
FU.- FUSES
CO.- WIRING CONNECTOR
RE.- INJECTION FEED RELAY
E.C.M.- ENGINE CONTROL MODULE
A.K.- ANTITHEFT KEYPAD
S.M.- STARTER MOTOR

WIRING COLOURS

B.- BLACK
BW.- BLACK-WHITE
BY.- BLACK - YELLOW
BL.- BLUE
Br.- BROWN
Gr.- GREY
O.- ORANGE
V.- VIOLET
YB.- YELLOW – BLACK

SECTION 10

TECHNICAL INFORMATION

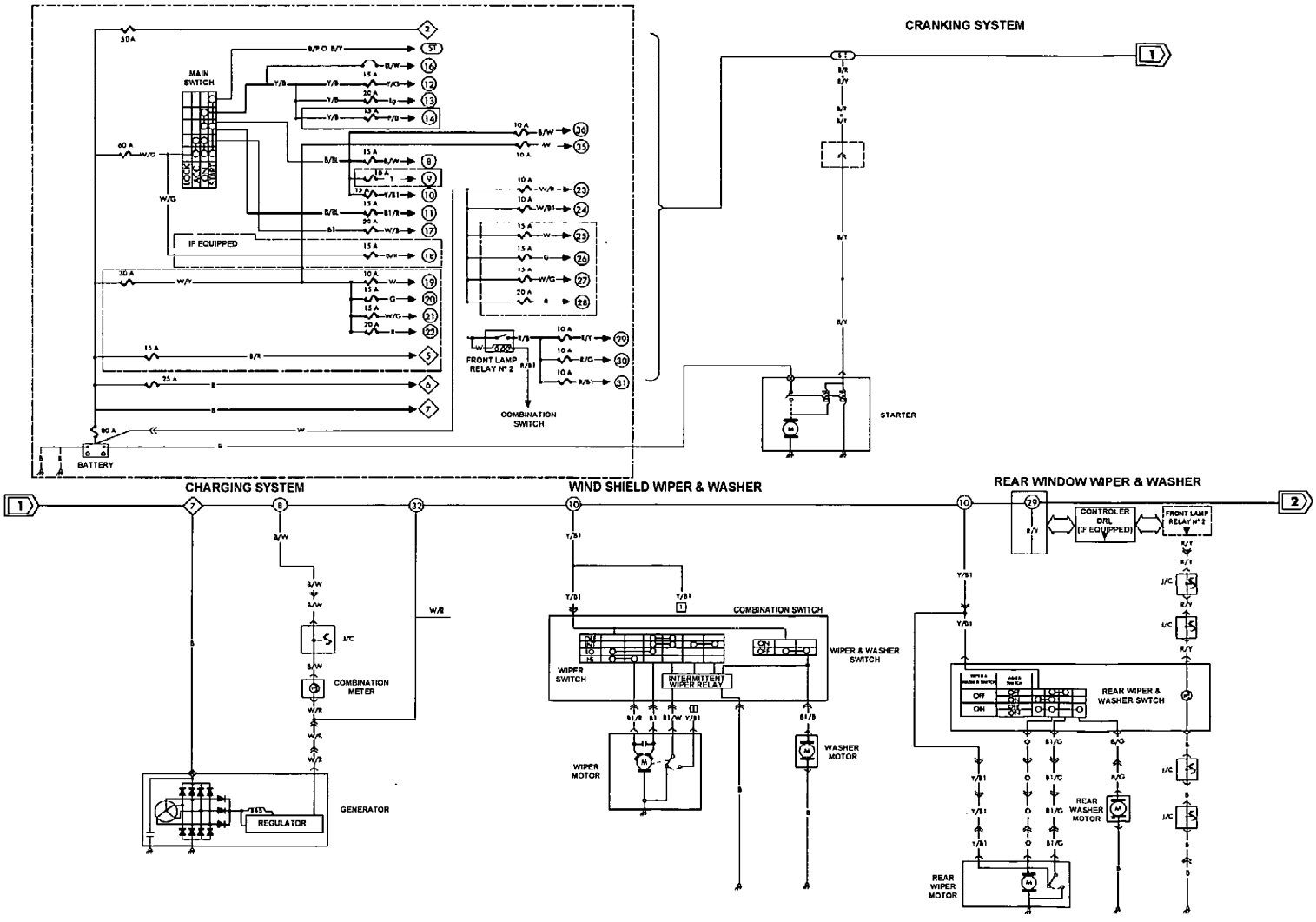
NOTE:
For points not covered in this section, please refer to corresponding section in Service Manuals outlined in INTRODUCTION to this manual.

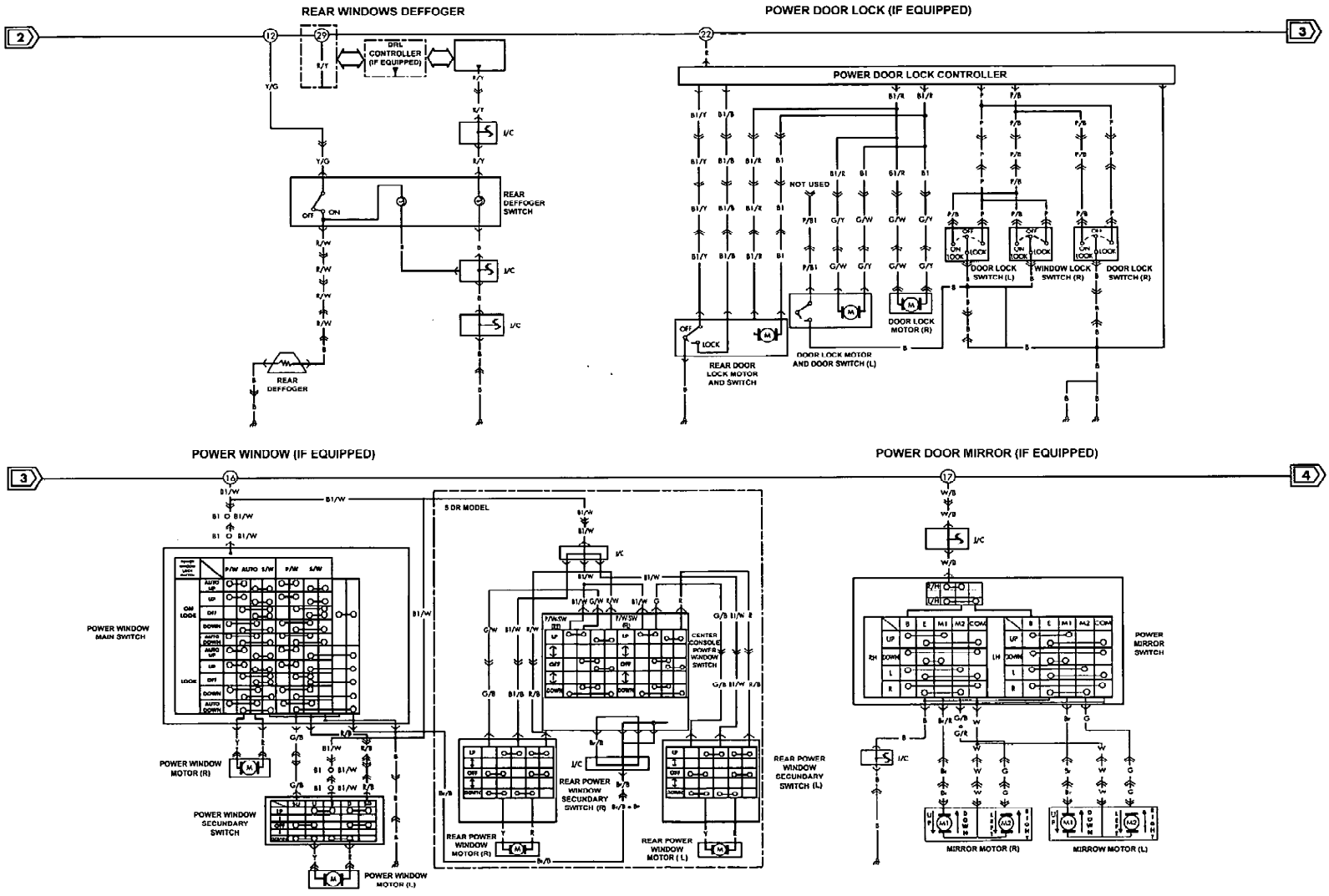
LIST OF CONTENTS

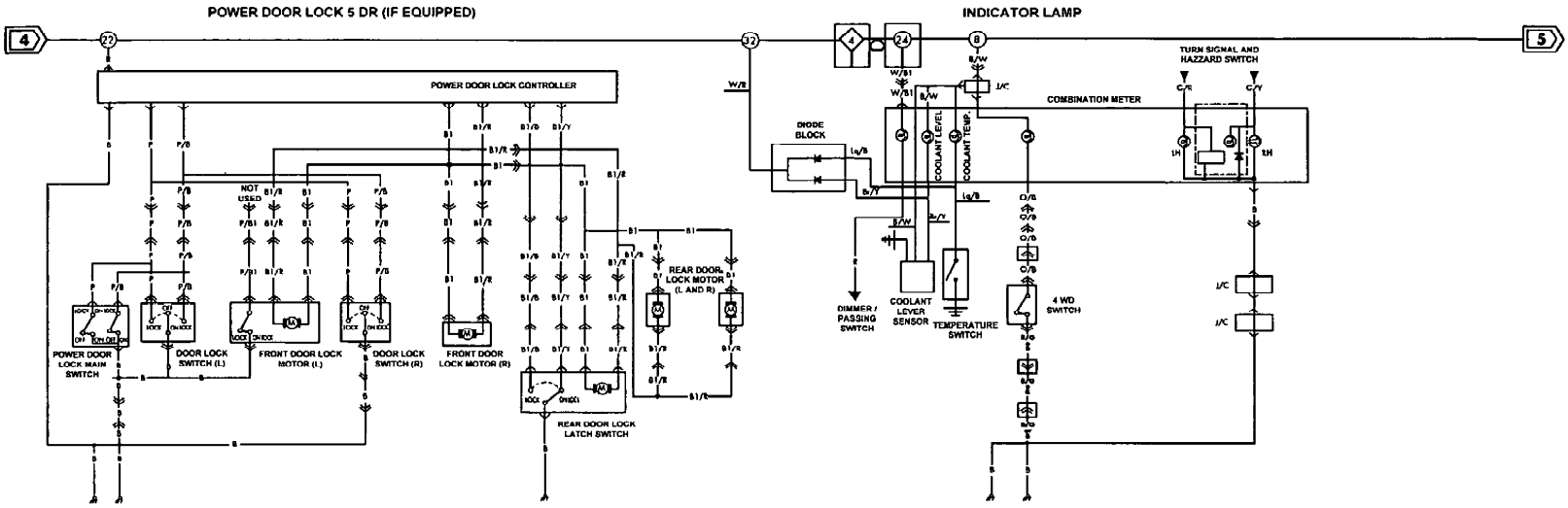
ENGINE		
Number of cylinders and arrangement		4 in line
Fuel firing order		1 - 3 - 4 - 2
Timing		OHC Belt actuated
Diameter and stroke		83 x 88
Cylinder capacity		1.905 cm³
Compression ratio		21.8:1
Compression engine warmed up	Maximum	30 Kg/cm²
	Minimum	25 Kg/cm²
	Max. Difference	5 Kg/cm²
Maximum power		66 Kw (4.000 r.p.m.)
Maximum torque		196 Nm (2.250 r.p.m.)
Maximum rotation		5.100 r.p.m. ± 160 r.p.m.
Injection type		Indirect
Intake type		Turbo compressor intercooler
Injector pressure measurement		175 bares
Maximum thermostat aperture		93°
Fuel system pressure	Idling	2 Kg/cm²
	at 2.000 r.p.m.	3.5 Kg/cm²
	at 4.000 r.p.m.	4.5 Kg/cm²
Pressure switch measurement		0.8 Kg/cm²
TRANSMISSION AND TRANSFER CASE		
Type		Manual Transmission
Transmission rate	1st Gear	3.704
	2nd Gear	2.020
	3rd Gear	1.369
	4th Gear	1.000
	5th Gear	0.802
	Rev.	4.473
Transfer case transmission rate	High	1.000
	Low	1.816
Differential groups		4.300

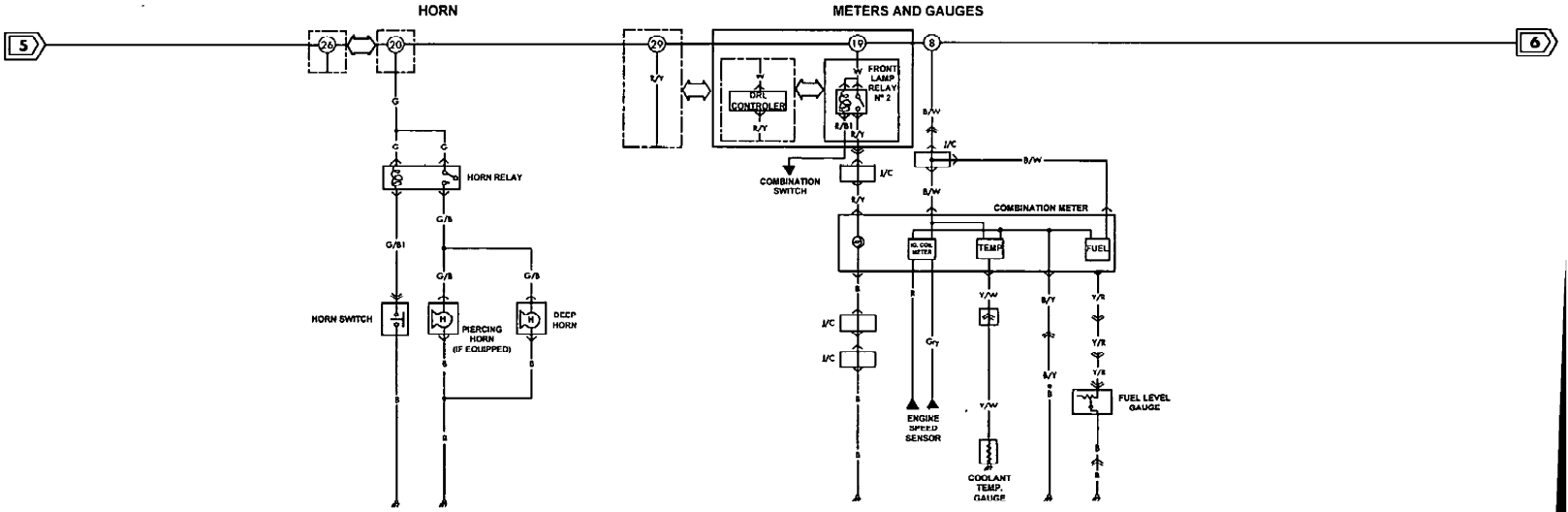
	5 Doors
MEASUREMENTS	Metal roof
Length(mm)	4.030
Width (mm)	1.635
Height (mm)	1.700
Distance between axles (mm)	2.480
Front track width (mm)	1.395
Rear track width (mm)	1.400
Headroom (mm)	200
Turning radius (m)	5.4
WEIGHTS	
Kg. empty.	1.417
Kg. with max. load	1.850

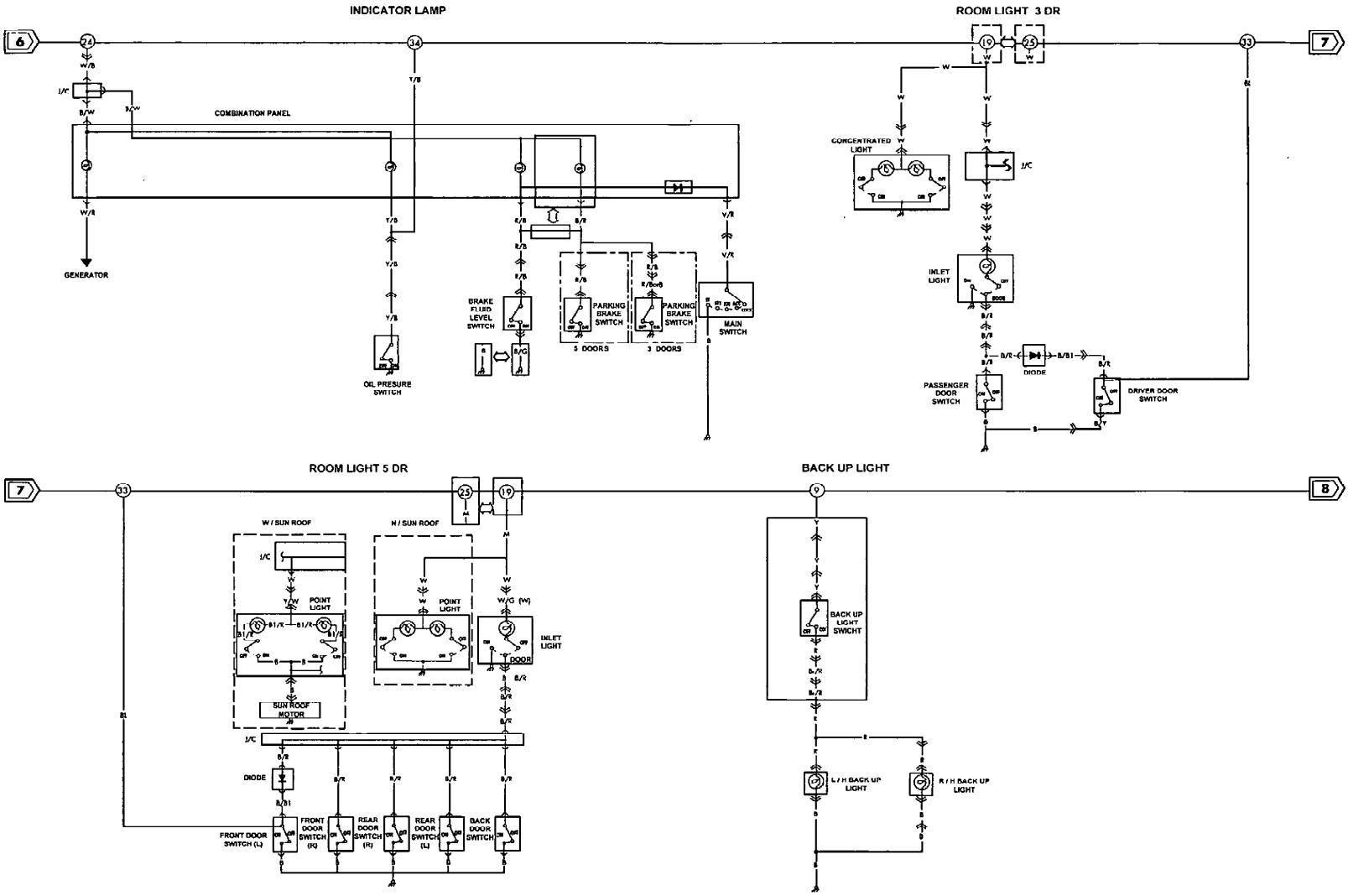
WIRING DIAGRAMS

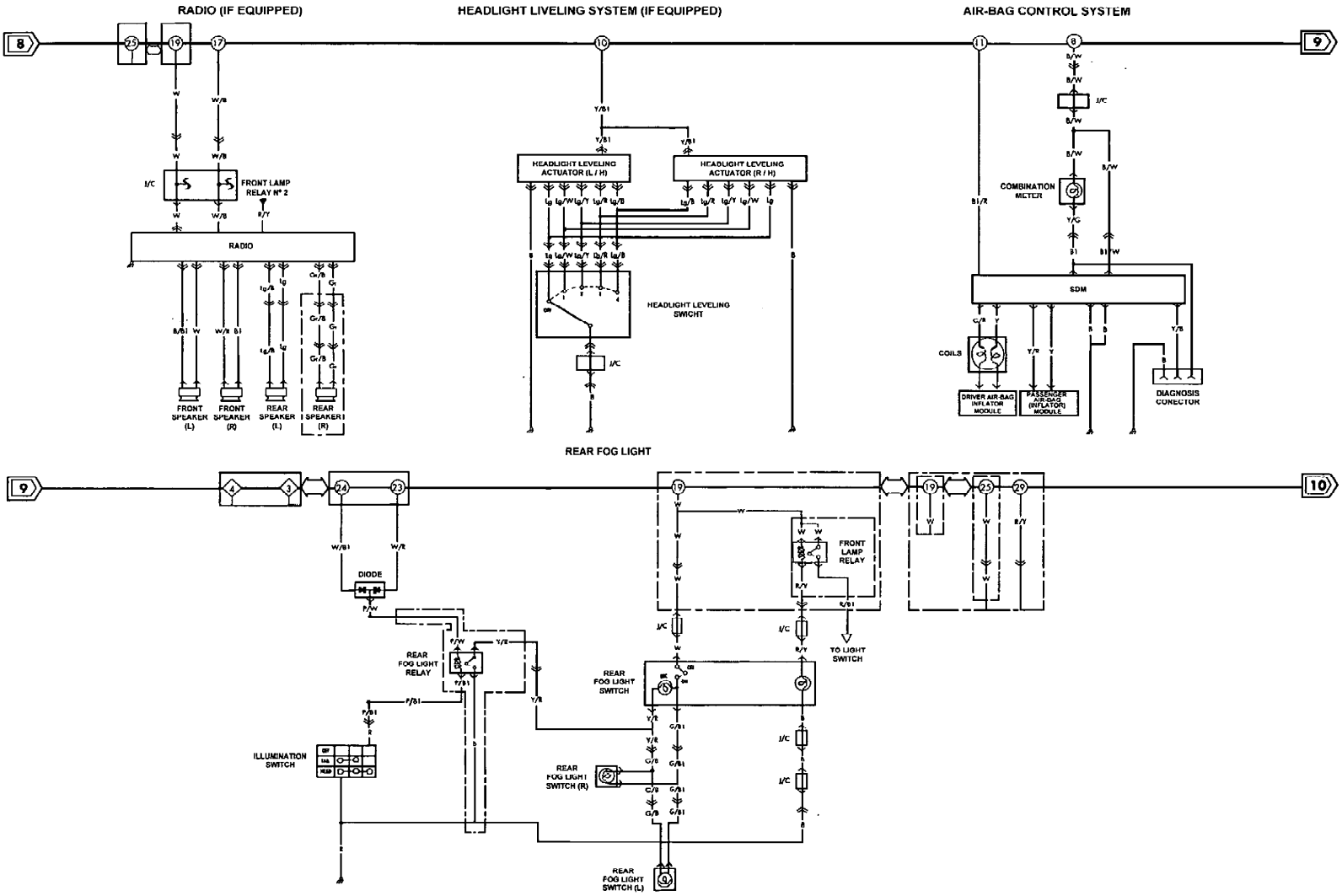


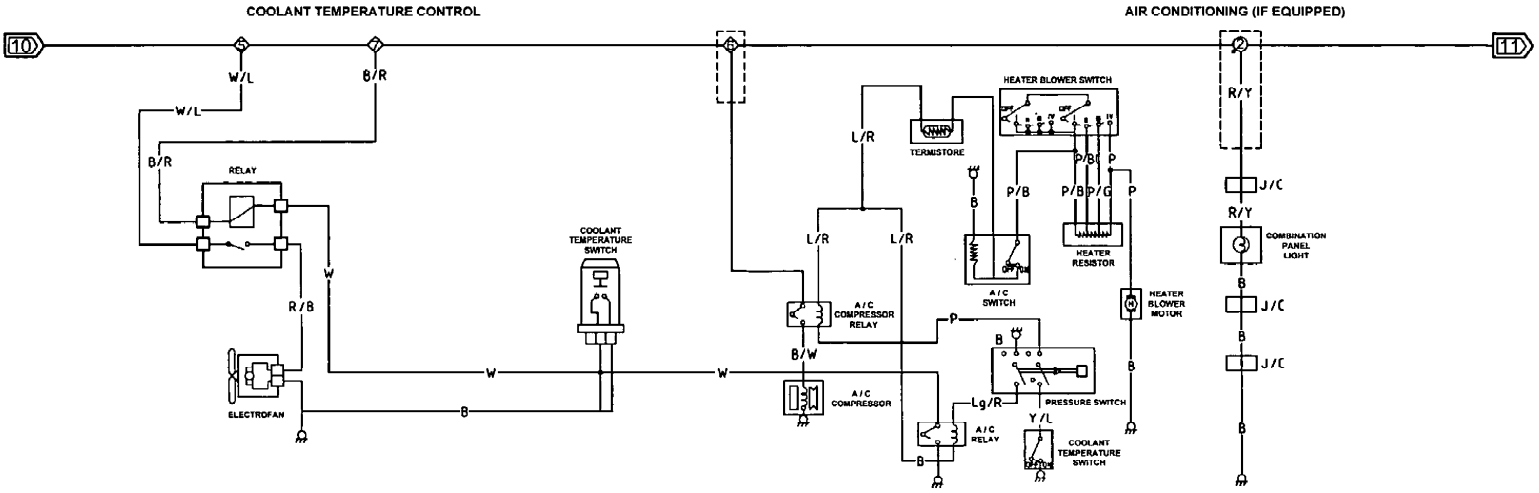




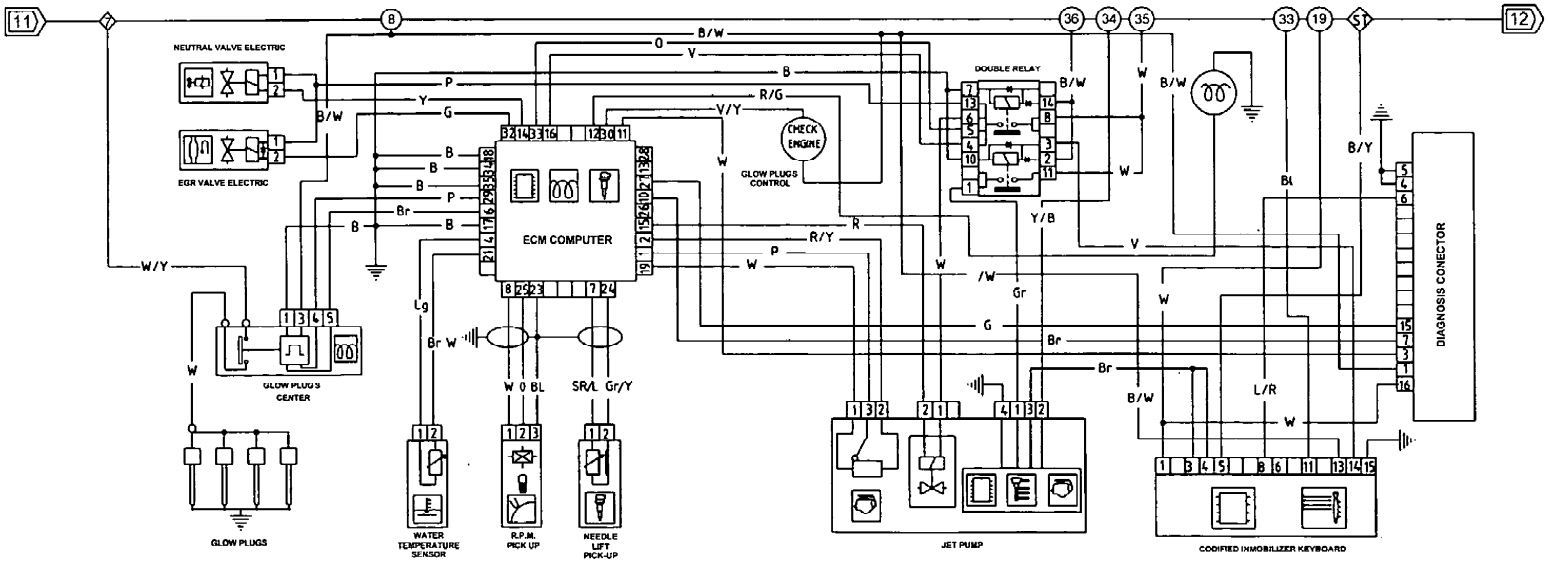




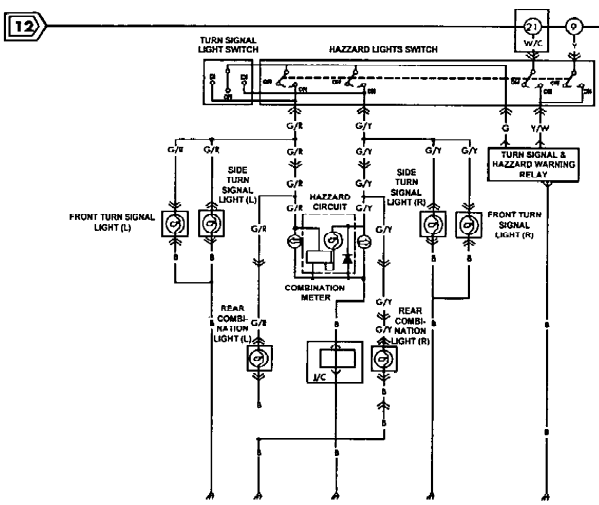




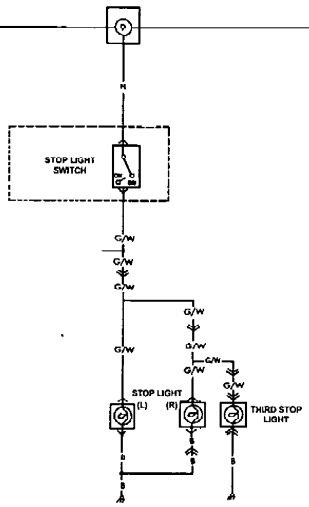
PRE-POST HEATING SYSTEM AND CODIFIED INMOBILIZER SYSTEM



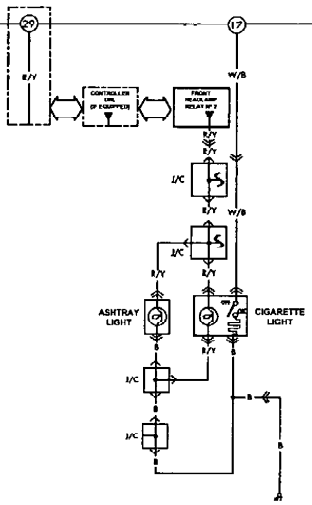
TURN SIGNAL AND HAZZARD LIGHTS



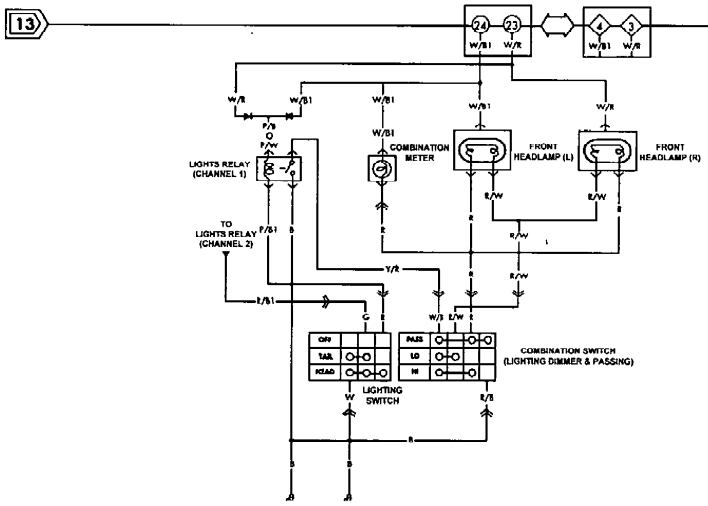
STOP LIGHT



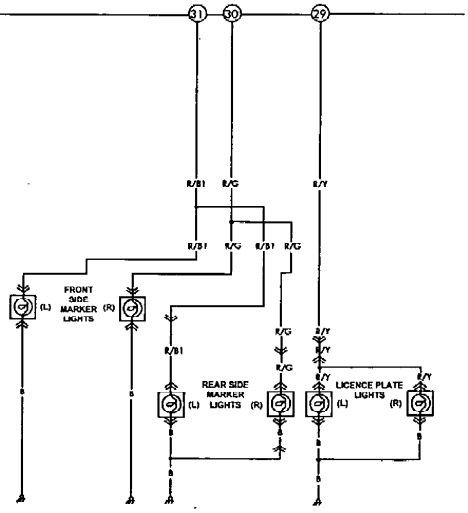
CIGARETTE LIGHTER



LIGHT SIGNAL SYSTEM



SIDE AND LICENCE PLATE LIGHTS



Prepared by

SANTANA MOTOR, S.A.

After-Sales Department

1st Ed. December 1999

Printed in Spain

Ptinting: December 1999

Printed in Spain