SERVICE MANUAL

KORANDO

FOREWORD

This manual includes procedure for maintenance, adjustment, service operation and removal and installation of components.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of manual approval.

The right is reserved to make changes at any time without notice.

DAEWOO MOTOR CO., LTD.

INCHON, KOREA

SECTION INDEX

SECTION 0B

GENERAL INFORMATION

TABLE OF CONTENTS

SPECIFICATIONS

TECHNICAL DATA

Performance-Manual Transaxle

Application	661LA	662NA	662LA	2.0L DOCH	2.3L DOCH	3.2L DOCH
Maximum Speed (Km/h)	140	137	148	154	165	176
Minimum Turning Radius (m)	5.8	5.8	5.8	5.8	5.8	5.8

Performance-Autumatic Transaxle

Application	661LA	662NA	662LA	2.3L DOCH	3.2L DOCH
Maximum Speed (Km/h)	140	137	140	160	170
Minimum Turning Radius (m)	5.8	5.8	5.8	5.8	5.8

GENERAL DESCRIPTION AND SYSTEM OPERATION

GENERAL REPAIR INSTRUCTIONS

- If a floor jack is used, the following precautions are recommended.
- Park the vehicle on level ground, “block” the front or rear wheels, set the jack against the frame, raise the vehicle and support it with chassis stands and then perform the service operation.
- Before performing the service operation, disconnect the negative battery cable in order to reduce the chance of cable damaged and burning due to short-cir cuiting.
- Use a cover on the body, the seats and the floor to protect them against damage and contamination.
- Handle brake fluid and antifreeze solution with care as they can cause paint damage.
- The use of proper tools, and the recommended essential and available tools where specified, are important for efficient and reliable performance of the service repairs.
- Use genuine DAEWOO parts.
- Discard used cotter pins, gaskets, O-rings, oil seals, lock washers and self-locking nuts. Prepare new ones for installation. Normal function of these parts cannot be maintained if these parts are reused.
- Keep the disassembled parts neatly in groups to facilitate proper and smooth reassembly.
- Keep attaching bolts and nuts separated, as they vary in hardness and design depending on the position of the installation.
- Clean the parts before inspection or reassembly.
- Also clean the oil parts, etc. Use compressed air to make certain they are free of restrictions.
- Lubricate rotating and sliding faces of parts with oil or grease before installation.
- When necessary, use a sealer on gaskets to prevent leakage.
- Carefully observe all specifications for bolt and nut torques.
- When service operation is completed, make a final check to be sure service was done properly and the problem was corrected.

Measuring Procedure

1. Warm the engine up to normal operating temperature.
2. Remove the spark plugs.
3. Place the diagram sheet to compression pressure tester.
4. Connect the adaptor to compression pressure tester and install it into the spark plug hole.
5. Crank the engine approx. eight revolutions by using the start motor.
6. Compare the measurements of compression pressure tester with the specifications.
7. Measure the compression pressure of the other cylinders in the same way.
8. If measured value is not within the specifications, perform the cylinder pressure leakage test.

Notice

- Discharge the combustion residues in the cylinders before testing the compression pressure.
- Apply the parking brake before cranking the engine.

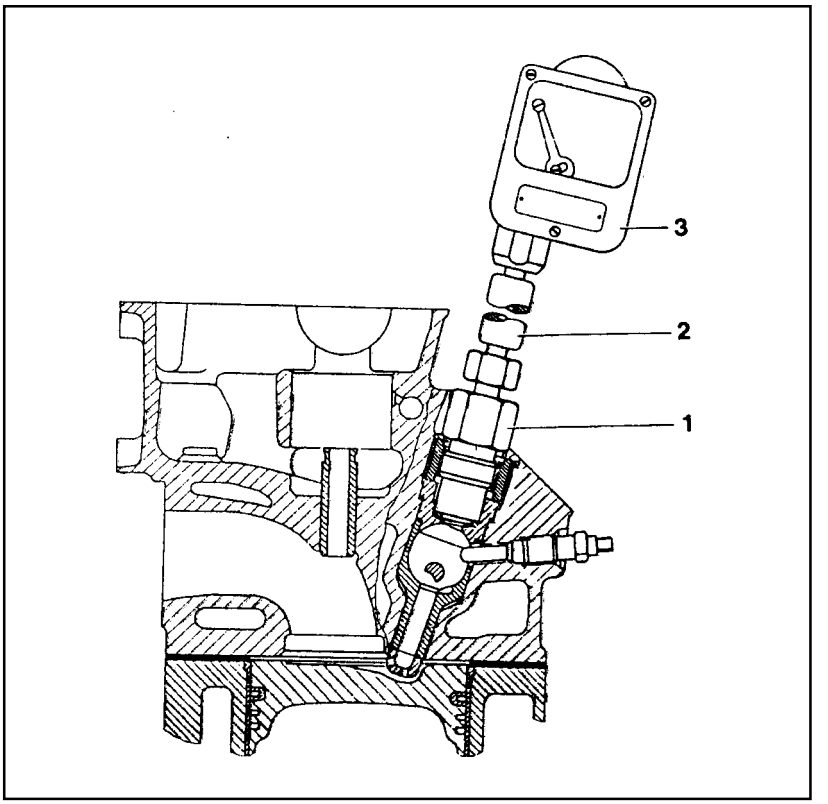
Measuring Procedure

1. Warm the engine up to normal operating temperature.
2. Remove the spark plugs.
3. Place the diagram sheet to compression pressure tester.
4. Connect the adaptor to compression pressure tester and install it into the spark plug hole.
5. Crank the engine approx. eight revolutions by using the start motor.
6. Compare the measurements of compression pressure tester with the specifications.
7. Measure the compression pressure of the other cylinders in the same way.
8. If measured value is not within the specifications, perform the cylinder pressure leakage test.

Notice

- Discharge the combustion residues in the cylinders before testing the compression pressure.
- Apply the parking brake before cranking the engine.

COMPRESSION PRESSURE TEST



1 Test Adapter
2 Flexible Connector
3 Compression Pressure Recorder

Service Data

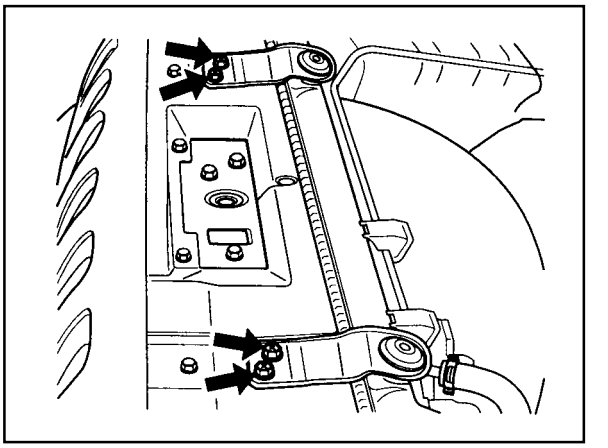
Normal Compression Pressure	28bar
Minimum Compression Pressure	Approx.18bar
Permissible Pressure Difference Between Individual Cylinders	Max. 3bar

●Engine at normal operating temperature of 80°C

Tools Required

000 589 65 09 00 Socket
001 589 73 21 00 Hand Vacuum Pump

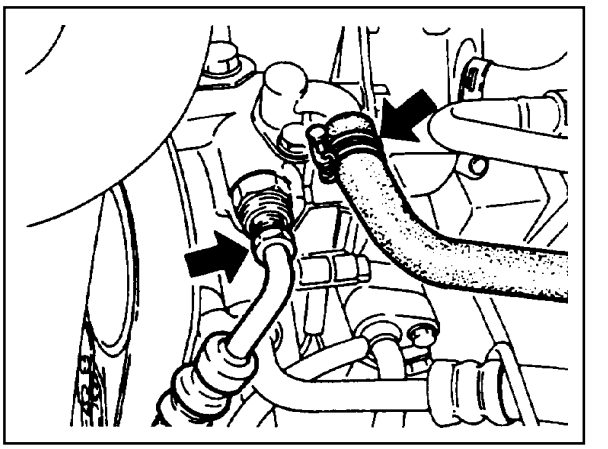
10. Remove the upper mounting bolts of radiator and then remove the radiator.



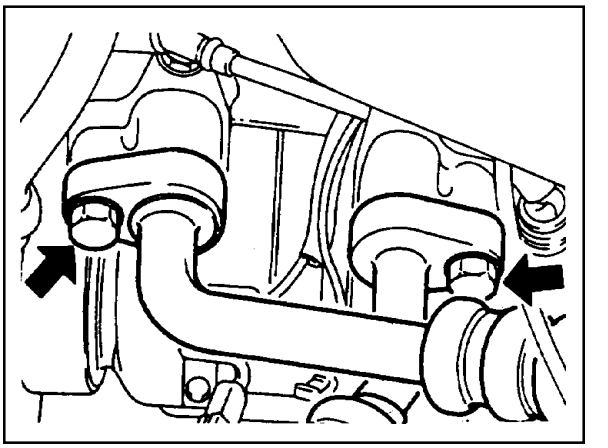
11. Remove the hydraulic pipe of power steering.

    Notice

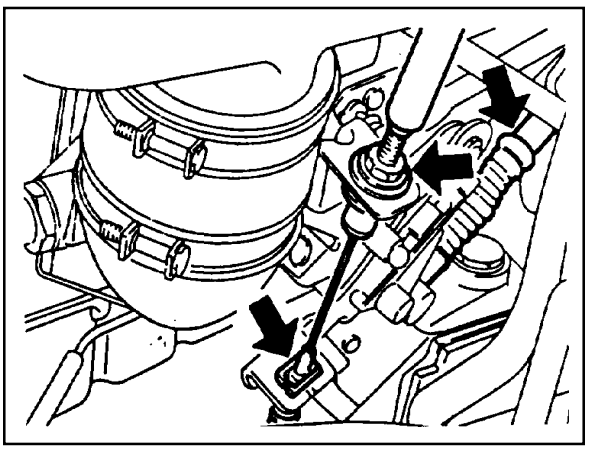
    Completely drain the oil.



12. Discharge the refrigerant from A/C system, and disconnect the discharge pipe and suction pipe from the compressor.

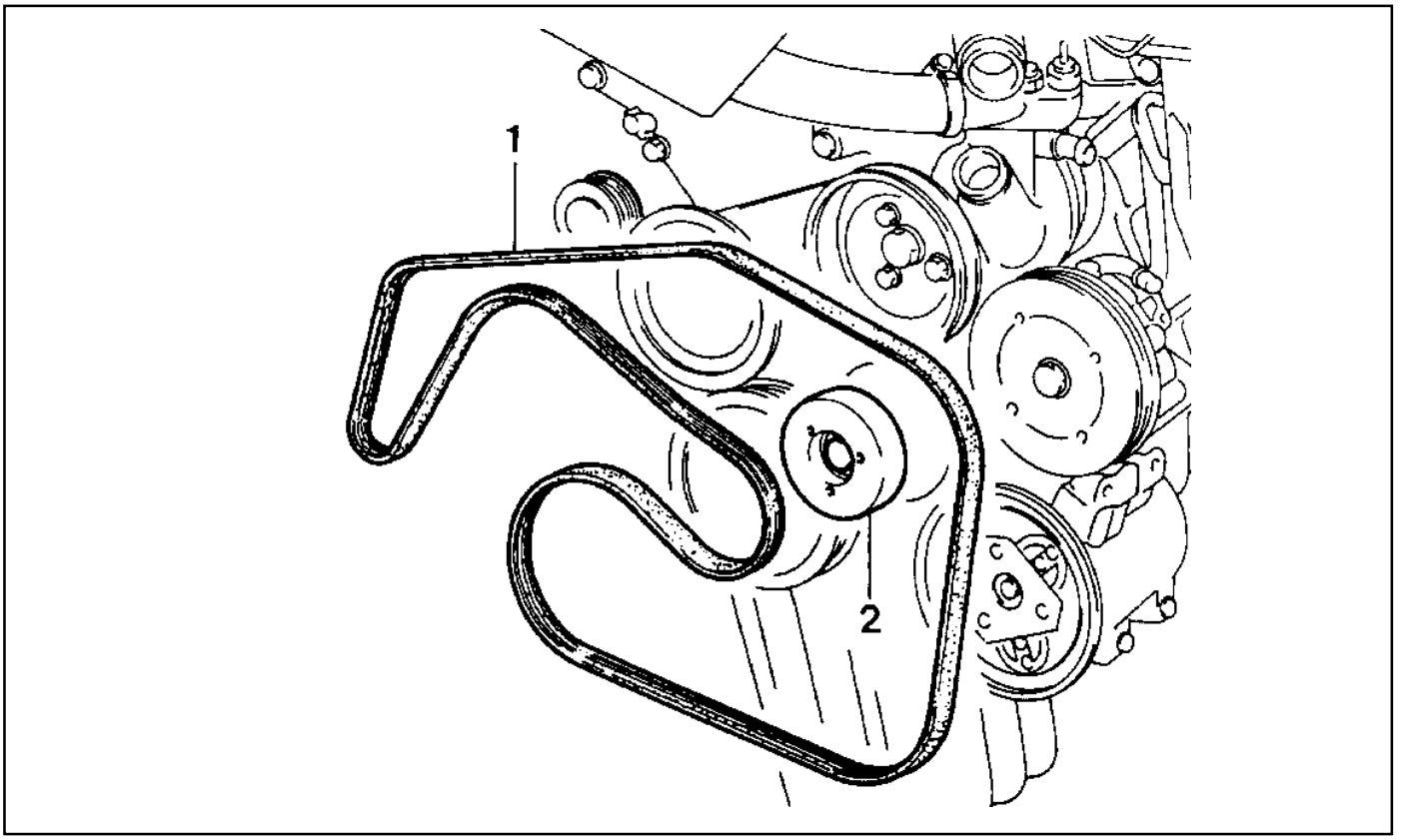


13. Remove the acceleration control cable and automatic transmission pressure cable.



POLY V-BELT

Preceding Work : Removal of cooling fan



1 Poly V-belt

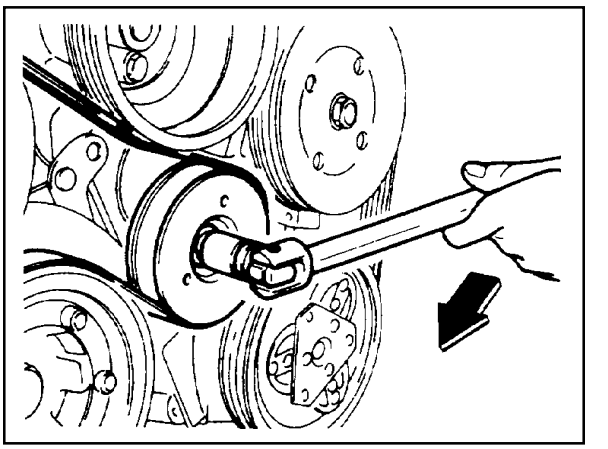
2 Belt Tensioning Pulley

Removal & Installation Procedure

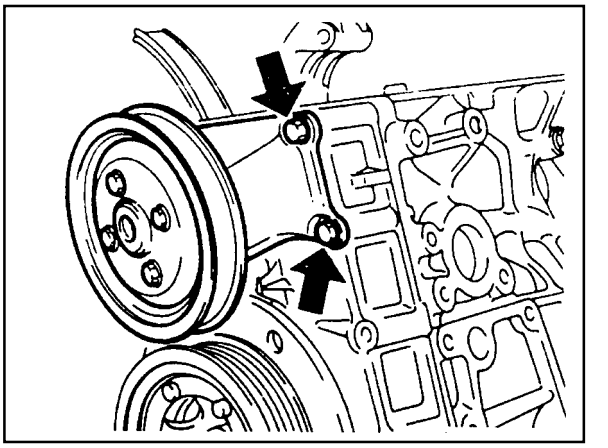
1. Release the belt tension by turning the belt tensioning pulley nut clockwise.
2. Remove the poly v-belt.

   Notice

   Check the belt for damage and tensioning pulley bearing point for wear and replace them if necessary.
3. Install the belt by turning the nut of tensioning pulley clockwise.



3. Remove the cooling fan and the viscous clutch. Unscrew the three bolts from the cooling fan bracket and remove the bracket (arrows).



Installation Notice

Tightening Torque	22.5 - 27.5 Nm

4. Remove the timing gear case cover after unscrewing the bolts (3) and (4) from the timing gear case cover and the bolt (9) from the oil pan.

Notice

Be careful not to damage the oil pan gasket.

Installation Notice

Tightening Torque	Bolt (3,4) 22.5 - 27.5 Nm
	Bolt (9) 9 - 11 Nm

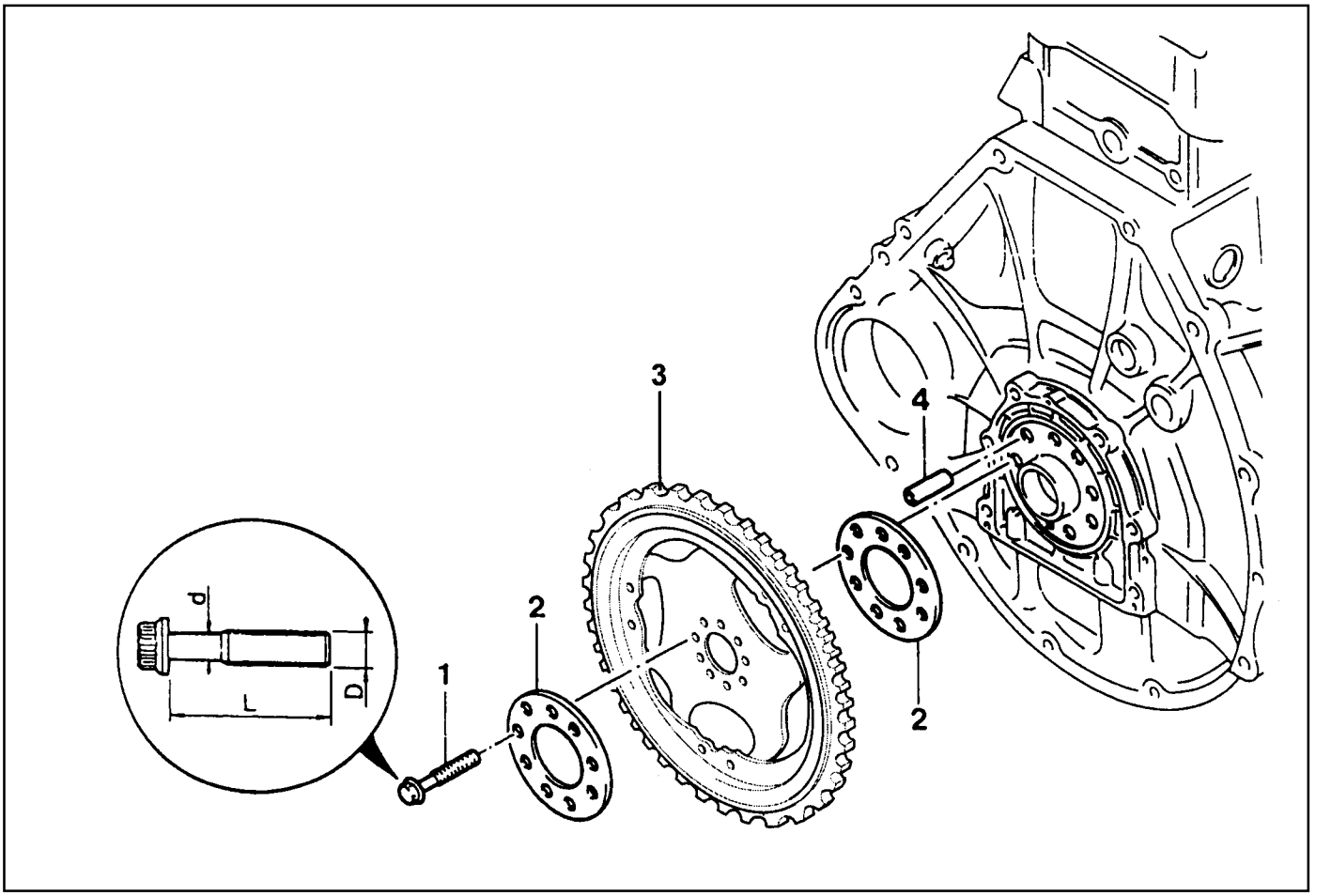
- Apply the sealant after cleaning the timing gear case cover surface.
- Be careful not to stain the oil chamber of chain tensioner with the sealant.

5. Installation should follow the removal procedure in the reverse order.

6. Warm up the engine and check for oil leaks.

FLYWHEEL / DRIVEN PLATE

Preceding Work : Removal of manual or automatic transmission



1 Flywheel Mounting Bolt (M10 x 22, 8 pieces)
..... 1st step 45+5 Nm
2nd step +90° +10°

2 Plate

3 Driven Plate (A/T)

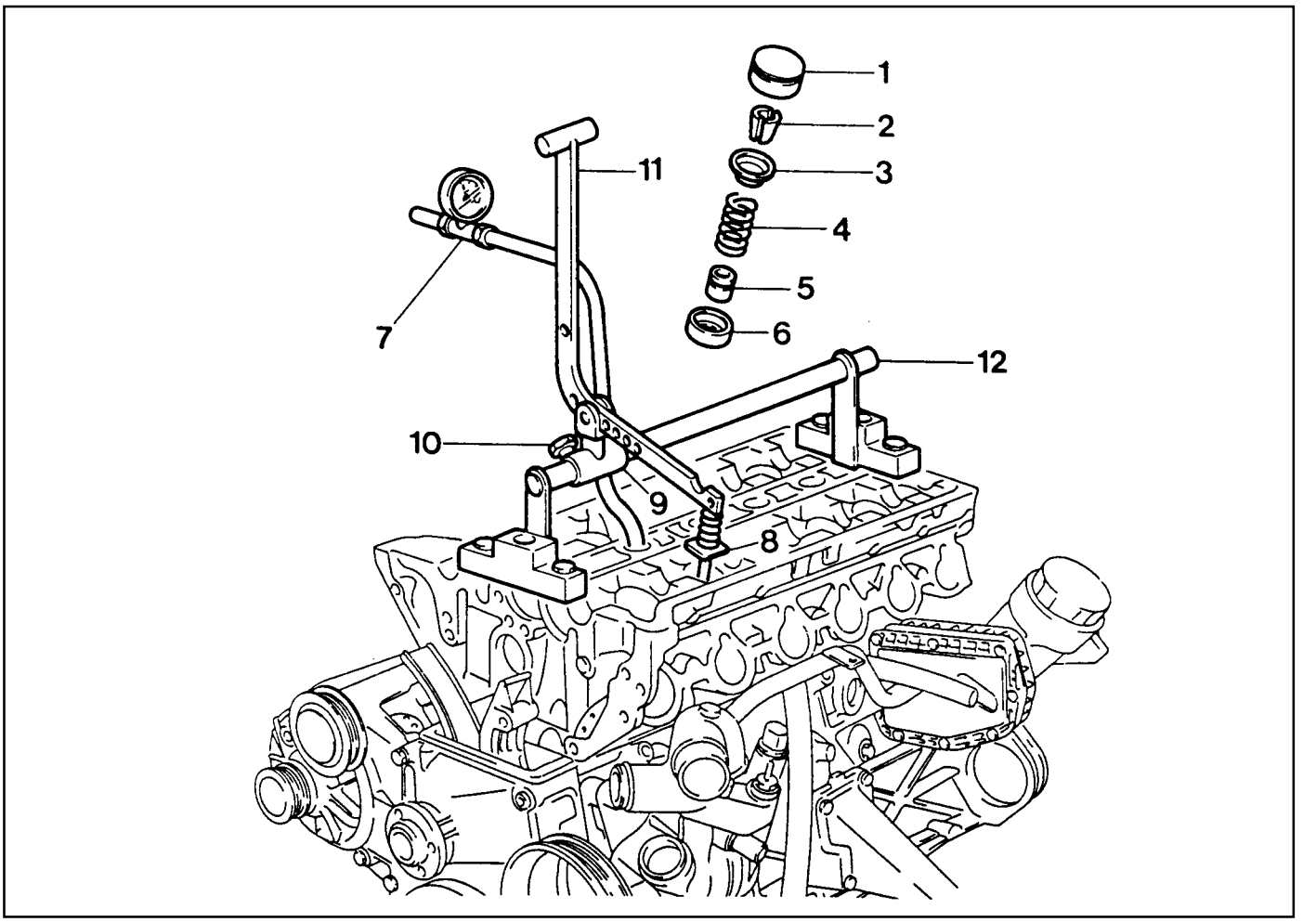
4 Dowel Pin

Service Data Standard (Stretch Bolt)

Nominal Size	D	-	M x 1.5
Stretch Side Diameter	d	When New	8.5 - 0.2 mm
		Min. Diameter	8.0 mm
Bolt Length	L	When New	21.8 - 22.2 mm
Tightening Torque	1st step 50 Nm, 2nd step 90°		

VALVE SPRING

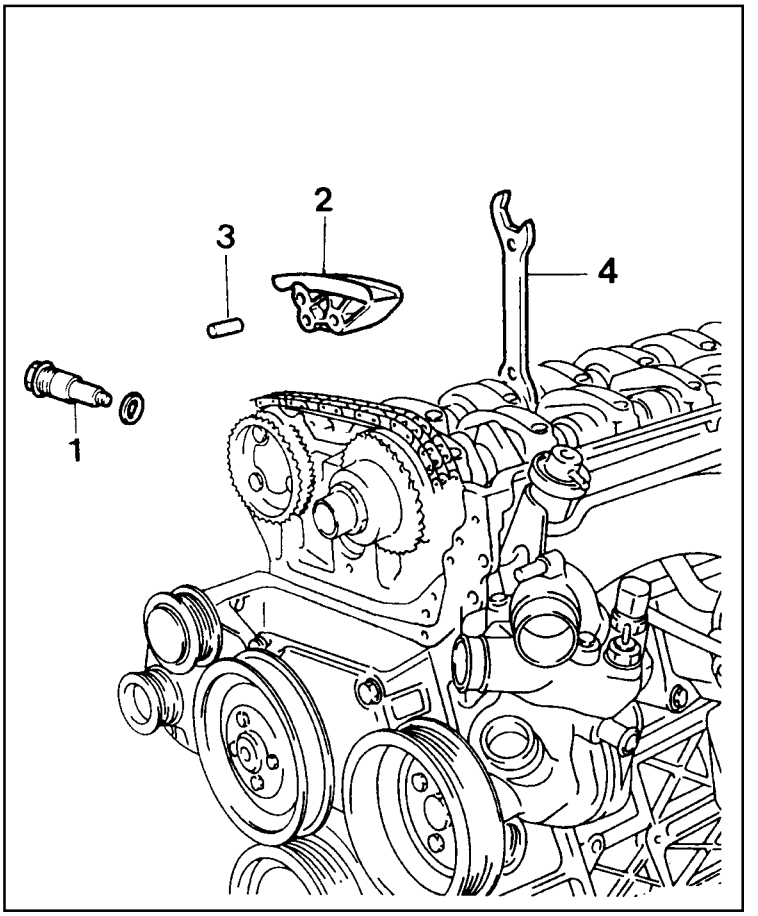
Preceding Work : Removal of camshaft
Removal of spark plug



1 Valve Tappet Assembly
2 Valve Cotter
3 Upper Retainer
4 Valve Spring ..... Check, Replace if necessary
5 Valve Stem Seal
6 Lower Retainer
7 Connecting Hose
8 Thrust Piece
9 Slide
10 Adjust Bolt
11 Lever Pusher
12 Supporting Bar

CYLINDER HEAD GUIDE RAIL

Preceding Work : Removal of cylinder head cover



1 Chain Tensioner
2 Upper Guide Rail
3 Upper Guide Rail Pin
4 Wrench (Special Tool)

Tools Required

104 589 01 01 00 Spanner

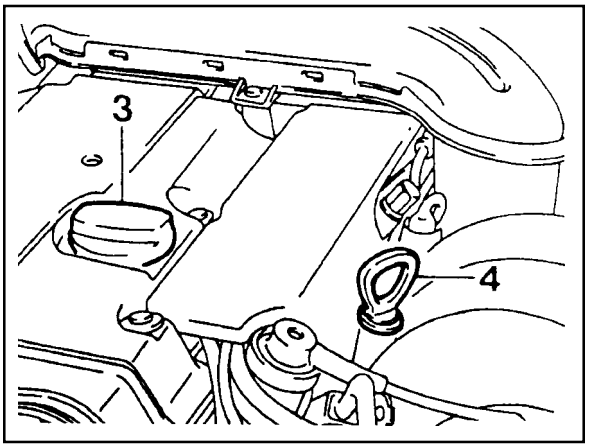
Removal & Installation Procedure

1. Remove the chain tensioner (1).
2. Turn the exhaust camshaft to the camshaft rotating direction using the wrench (4) and loosen the timing chain at upper guide rail (2).
3. Pull out the upper guide rail pin from the guide rail (2).
4. Turn the exhaust camshaft to the opposite direction of rotation using the wrench (4, special tool : 104 589 01 01 00).
5. Check for damages at the upper sliding rail and replace it if necessary. Install the upper guide rail pin.
6. Install the chain tensioner.

Installation Notice

Tightening Torque	Screw Plug	40 Nm
	Tensioner Assembly	72 - 88 Nm

9. Fill up engine oil through the engine oil filler opening (3).
10. Check for oil leaks at normal engine temperature after starting the engine.
11. Stop the engine and wait 5 minutes.
    Check the oil level and fill up as specified if necessary.



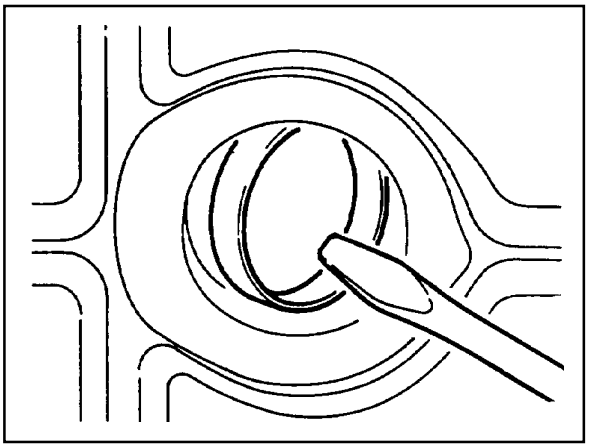
3 Oil Filler Cap
4 Dipstick Gauge

Tools Required

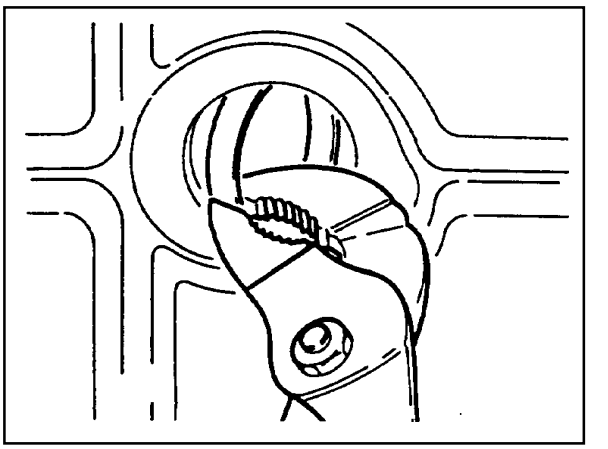
102 589 00 15 00 Drift

Replacement Procedure

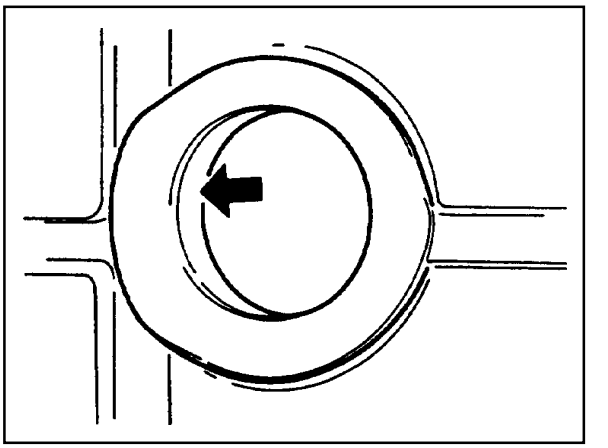
1. Remove the intake and exhaust manifolds.
2. Pull back the core plug until the end of one side comes out using the screw driver.



3. Pull out the plug carefully using a pliers.



4. Clean the sealing surface and apply Loctite 241.

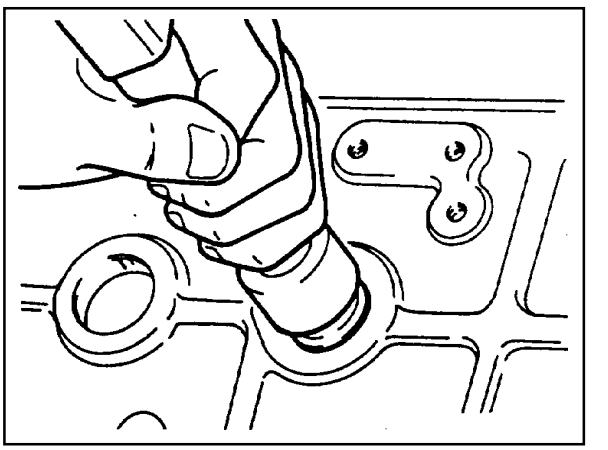


5. Press in new plug using a drift.

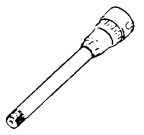
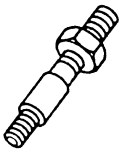
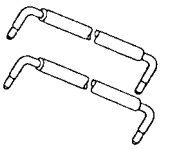
   Notice

   Wait for about 45minutes before filling the coolant so that the Loctite 240 hardens.

6. Warm up the engine and check the coolant for leaks.

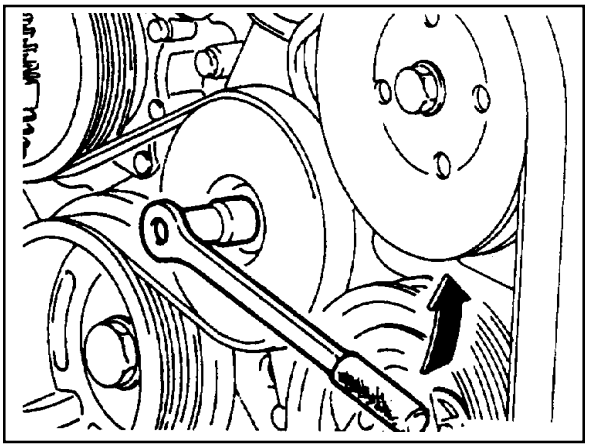


SPECIAL TOOLS TABLE (Cont'd)

	**617 589 00 10 00** **Wrench Socket**		**116 589 01 34 00** **Threaded Bolt**
	**104 589 00 40 00** **Holder**		**111 589 03 15 00** **Insert Pin**

Removal & Installation Procedure

1. Remove the belt pulley after removal of poly v-belt.



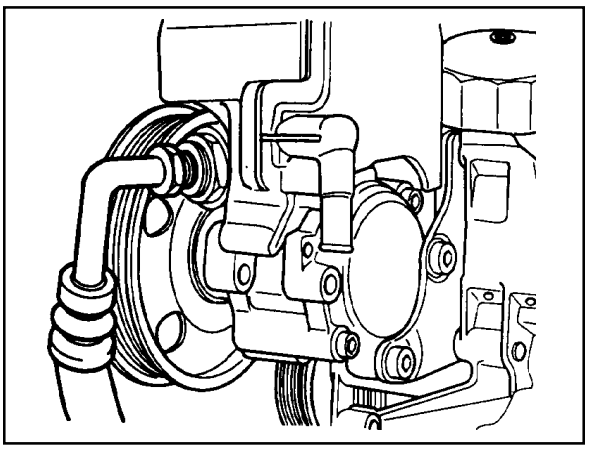
Installation Notice

Tightening Torque	40.5 - 49.5 Nm

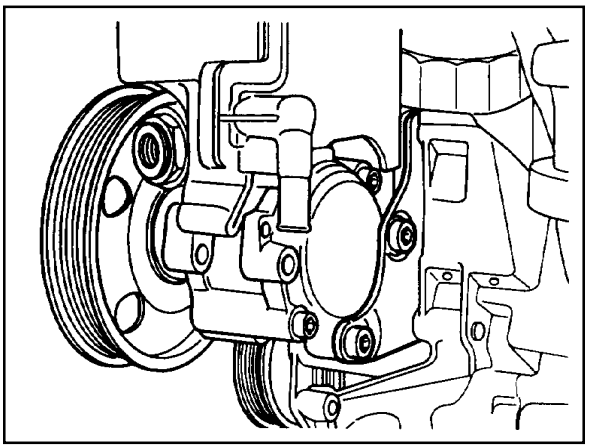
Notice

Pull the tensioning pulley counterclockwise as shown in the figure.

2. Disconnect the hydraulic pipe of the power steering pump and drain the oil.



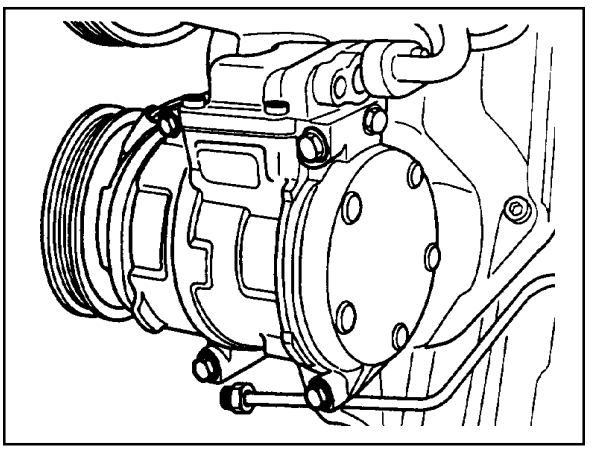
3. Unscrew the bolts (arrows) and remove the steering pump.



Installation Notice

Tightening Torque	22.5 - 27.5 Nm

4. Remove the compressor after disconnecting the wiring connector and refrigerant pipe of A/C compressor.

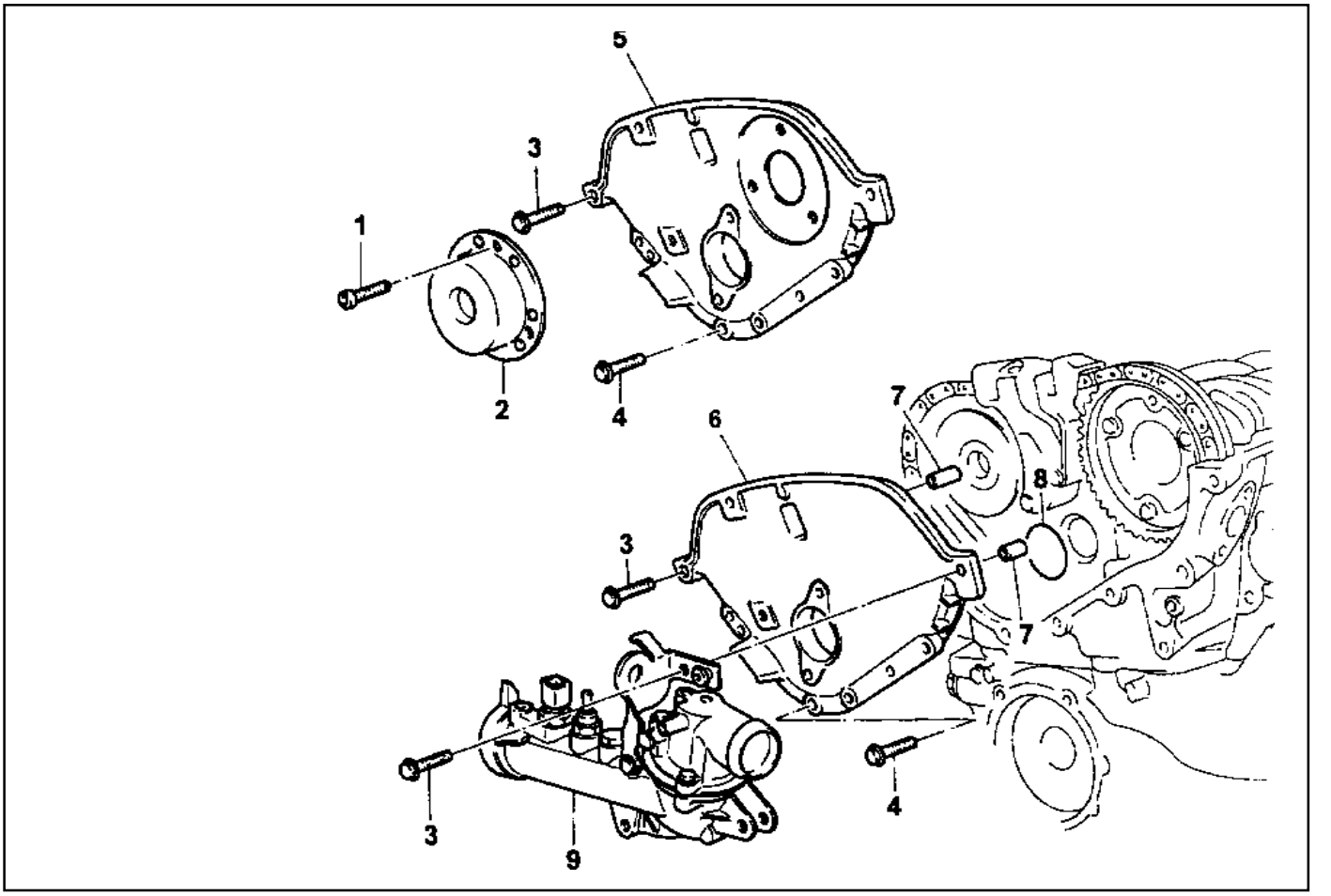


Notice

Discharge all the refrigerant before removing the pipes.

CYLINDER HEAD FRONT COVER

Preceding Work : Removal of cylinder head cover
Removal of thermostat housing assembly
Removal of engine hanger bracket



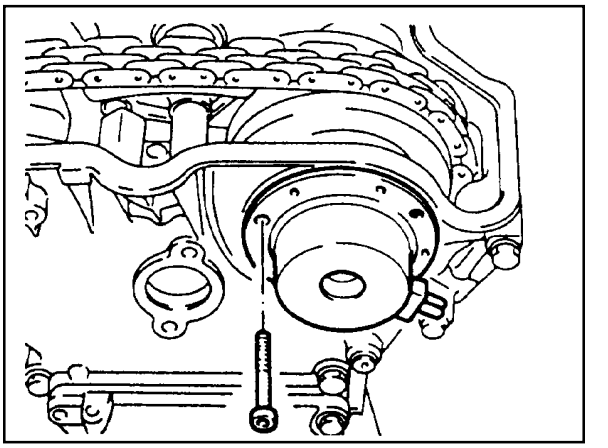
1 Bolt (M6 X 16, 3 pieces) ..... 9-11 Nm
2 Camshaft Adjuster
3 Bolt (M8 X 35, 2 pieces) ..... 22.5-27.5 Nm
4 Bolt (M6 X 22, 6 pieces) ..... 9-11 Nm
5 Front Cover (E23 : M161.970)
6 Front Cover (E20 : M161.940)
7 Sleeve
8 O-ring ..... Replace
9 Thermostat Housing

Removal & Installation Procedure

1. Disconnect the camshaft adjuster connector and remove the camshaft adjuster (E23 engine only).

Installation Notice

Tightening Torque	9 - 11 Nm

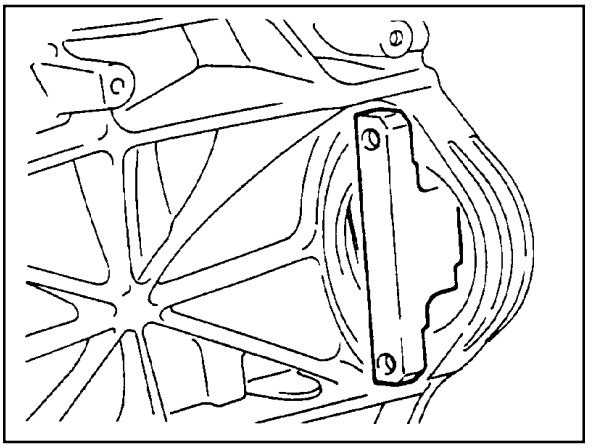


2. Remove the start motor and install the engine lock to the flywheel ring gear.
3. Remove the center bolt.

Installation Notice

Tightening Torque	1st step 180 - 220 Nm 2nd step + 90°

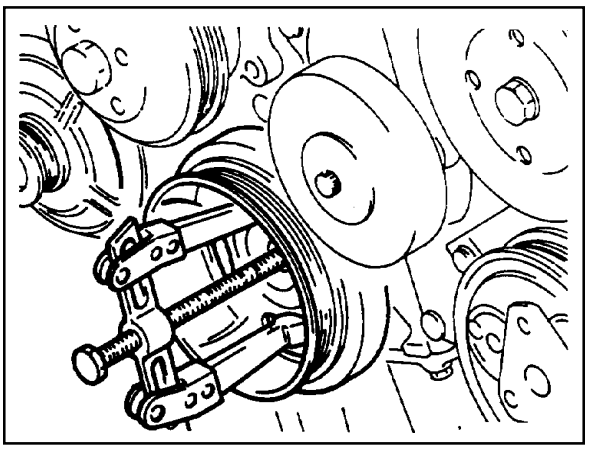
Engine Lock 602 589 00 40 00



4. Remove the vibration damper assembly using the puller.
5. Installation should follow the removal procedure in the reverse order.

Notice

If possible, don't separate the vibration damper and the pulley.



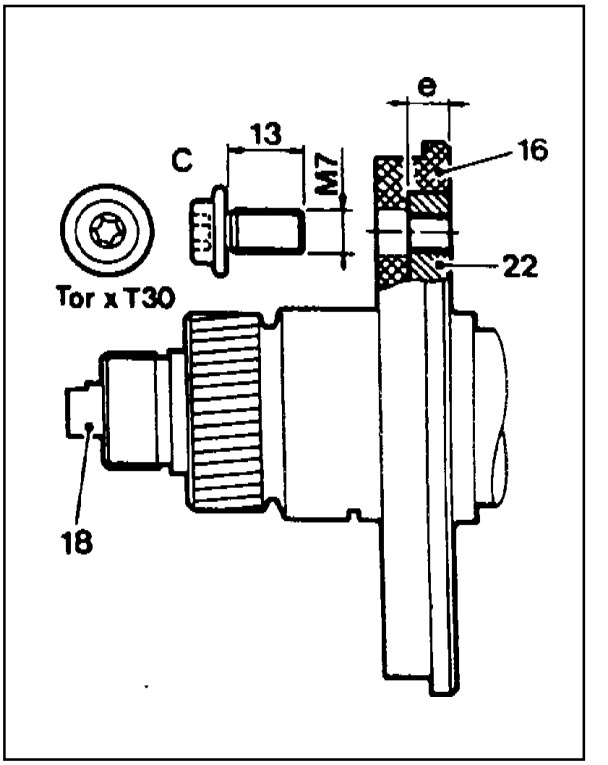
CAMSHAFT SPROCKET BOLT

Intake Flange Shaft Bolt

Tightening Torque	1st step 20 Nm 2nd step + 90°

Notice

The sprocket bolts are designed to be used only once, so always replace with new one.



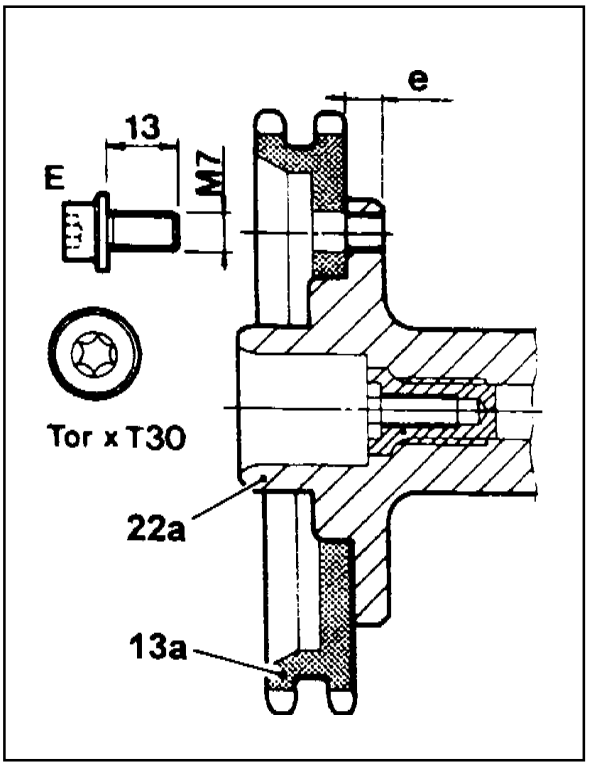
C. M7 x 13 Collar Bolt Torx-T30
e. 6.8 mm
16. Flange Shaft
18. Control Piston
22. Intake Camshaft

Exhaust Camshaft Sprocket Bolt

Tightening Torque	1st step 20 Nm 2nd step + 90°

Notice

The sprocket bolts are designed to be used only once, so always replace with new one.



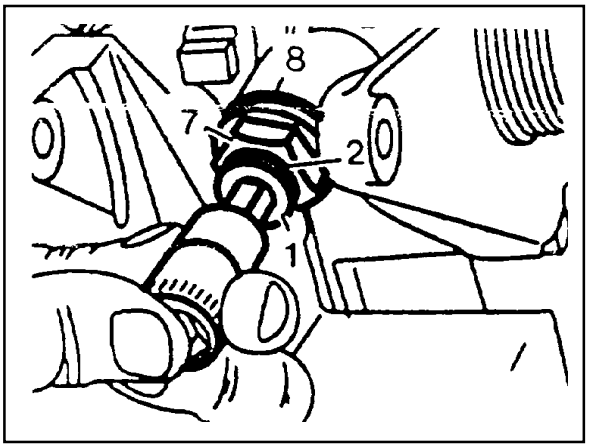
E. M7 x 13 Collar Bolt Torx-T30
e. 6.8 mm
13a. Camshaft Sprocket
22a. Exhaust Camshaft

4. Lightly apply the grease to the seal (2) and install the screw plug (1).

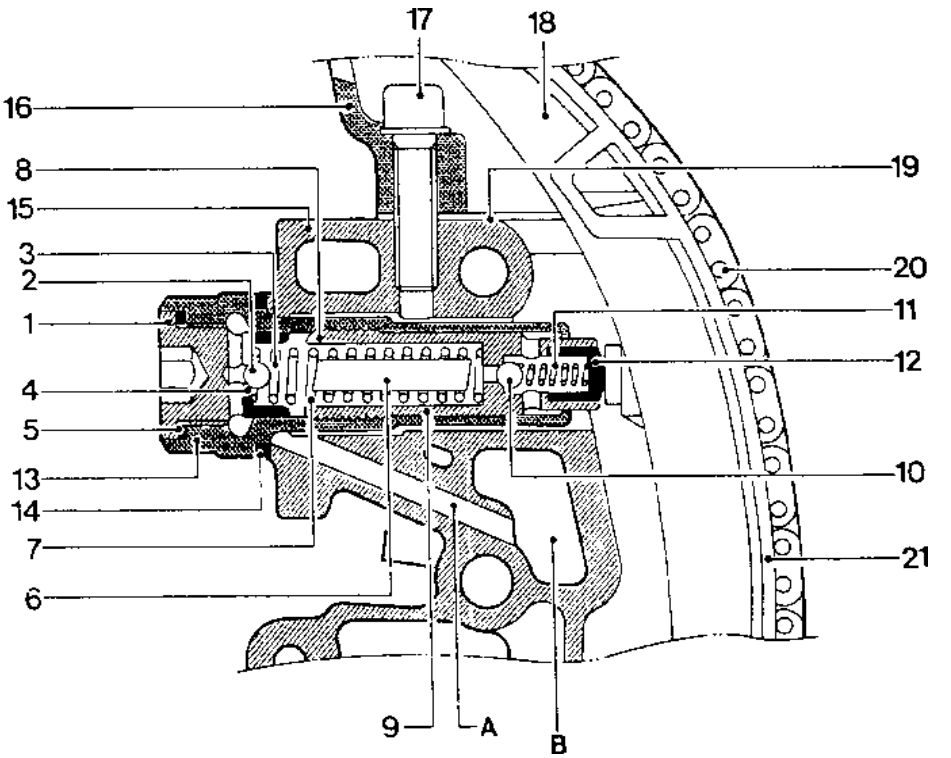
Installation Notice

Tightening Torque	40 Nm

5. Check for leaks by operating the engine.



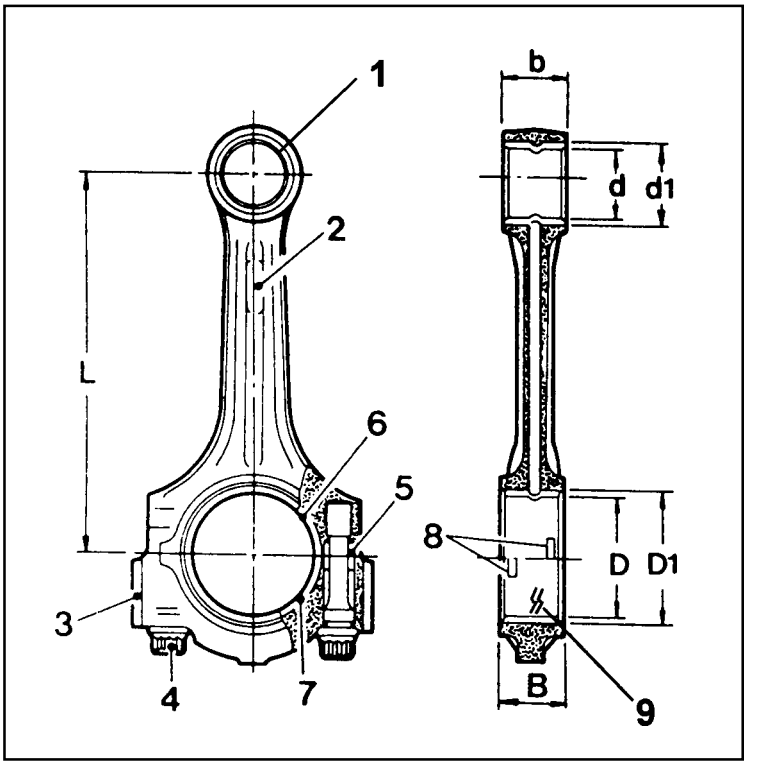
Sectional View



1 Screw Plug
2 Ball (Nonreturn Valve)
3 Compression Spring
4 Ball Guide
5 Seal (Aluminum)
6 Filler Pin
7 Compression Spring
8 Snap Ring
9 Thrust Pin
10 Ball (Nonreturn Valve)
11 Compression Spring
12 Thrust Piece
13 Chain Tensioner Housing
14 Seal
15 Timing Gear Case Cover
16 Cylinder Head
17 Bolt / Washer
18 Tensioning Rail
19 Cylinder Head Gasket
20 Timing Chain
21 Tensioning Rail Base (Sliding Surface)
A Oil Supply Hole
B Chain Tensioner Oil Storage Hole

CONNECTING ROD

Preceding Work : Removal of piston



1 Connecting Rod Bushing
2 Oil Gallery
3 Balance Weight
4 Connecting Rod Bolt
(M9 x 52, 8 pieces) .....1st step 40 Nm
2nd step 90°
5 Fit Sleeve
6 Upper Connecting Rod Bearing
7 Lower Connecting Rod Bearing
8 BearingShell Lug
9 Marking [Indication(//) or Numbers]

Service Data Standard

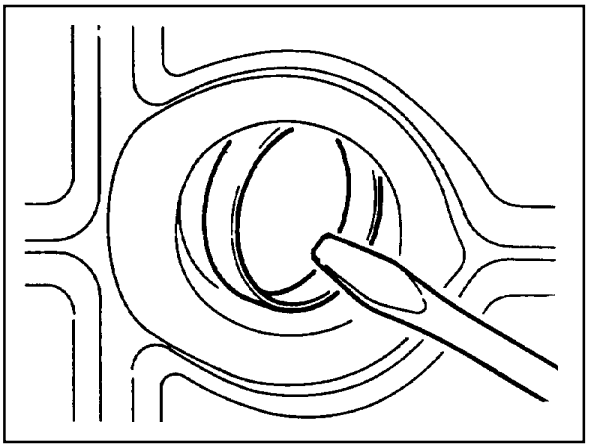
Distance (L) from The Connecting Rod Bearing to Bushing Bore Center	E20 : 154 mm E23 : 149 ± 0.05 mm
Width of The Connecting Rod (B) at Bearing Bore	21.940 - 22.000 mm
Width of The Connecting Rod (b) at Bushing Bore	21.940 - 22.000 mm
Basic Bore at The Bearing Shell (D1)	51.600 - 51.614 mm
Basic Bore at The Bushing (d1)	24.500 - 24.571 mm
Bushing Inner Diameter (d)	22.007 - 22.013 mm
Clearance Between The Piston Pin and The Bushing	0.007 - 0.018 mm
Peak-to-valley Height of Connecting Rod Bushing on Inside	0.005 mm
Permissible Wwist of Connecting Rod Bearing Bore to Connecting Rod Bushing Bore	0.1/100 mm
Permissible Deviation of Axial Paralleism of Connecting Rod Bearing Bore to Connecting Rod Bushing Bore	0.045/100 mm
Permissible Deviation of Axial Paralleism of Connecting Rod Bearing Bore from Concentricity	0.01 mm
Permissible Difference of Each Connecting Rod in Weight	0.4 g

Tools Required

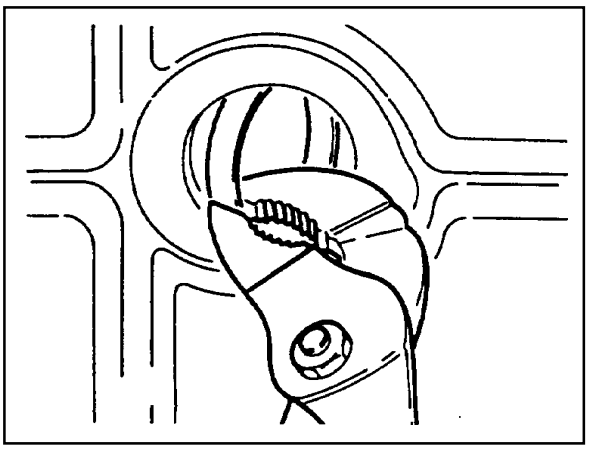
102 589 00 15 00 Drift

Replacement Procedure

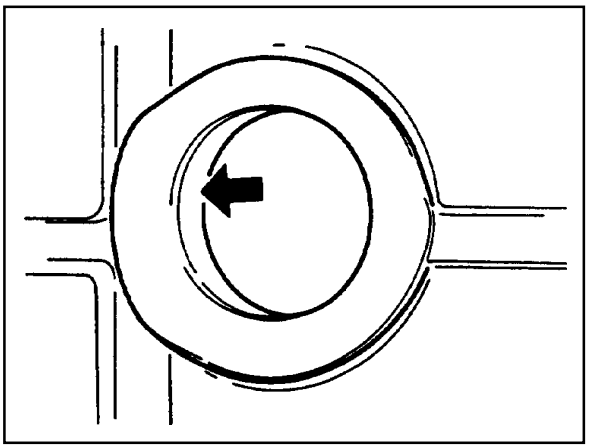
1. Remove the intake and exhaust manifolds.
2. Pull back the core plug until the end of one side comes out using the screw driver.



3. Pull out the plug carefully using a pliers.



4. Clean the sealing surface and apply Loctite 241.

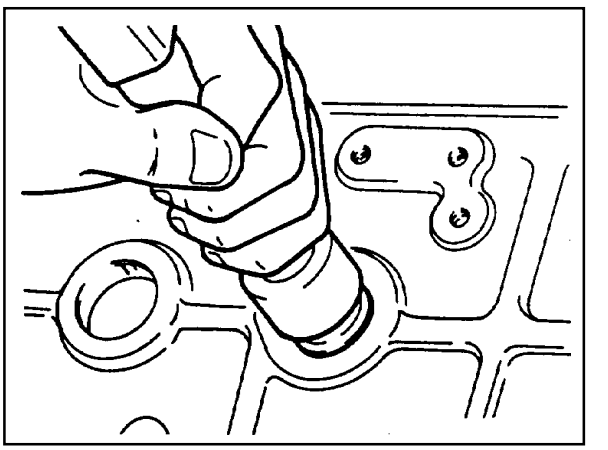


5. Press in new plug using a drift.

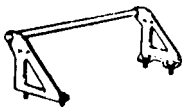
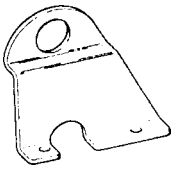
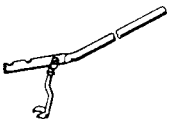
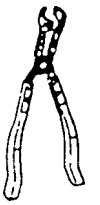
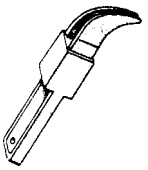
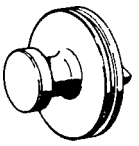
   Notice

   Wait for about 45minutes before filling the coolant so that the Loctite 241 hardens.

6. Warm up the engine and check the coolant for leaks.

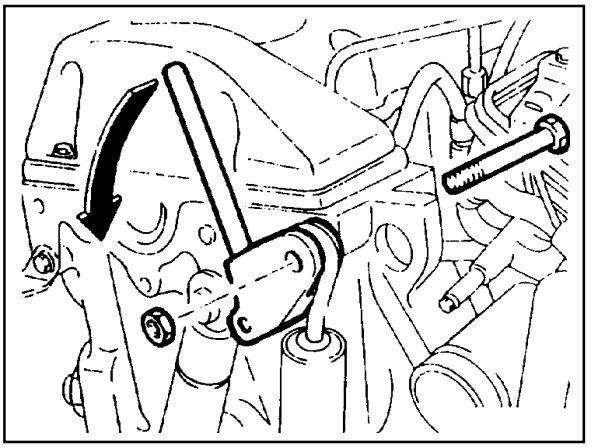


SPECIAL TOOLS TABLE (Cont'd)

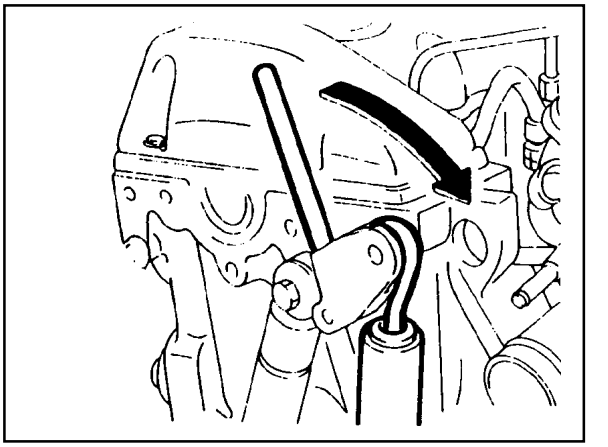
	**601 589 02 59 00** **Supporting Bridge**		**667 584 02 63 00** **Supporting Bar**
	**667 589 00 31 00** **Press Lever**		**104 589 00 37 00** **Pliers**
	**116 589 06 63 00** **Magnetic Finger**		**601 589 02 43 00** **Drift**
	**603 589 01 40 00** **Holding Wheel**		**000 589 10 68 00** **Cylinder Brush**

Removal & Installation Procedure

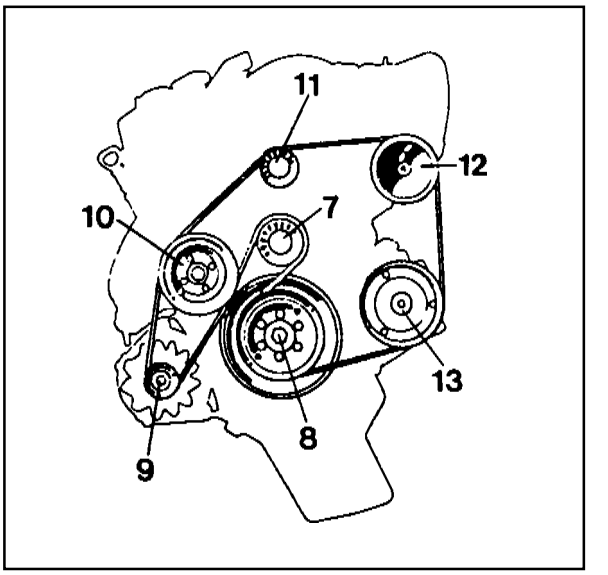
1. Remove the nut.
2. Push the tensioning lever in direction of arrow with a rod (F12 ´ 180mm) and pull out the bolt to the rear.



3. Push back the tensioning lever (arrow direction) to release the spring tension and remove the belt.



4. Install the poly V-belt beginning at the tensioning pulley (7).



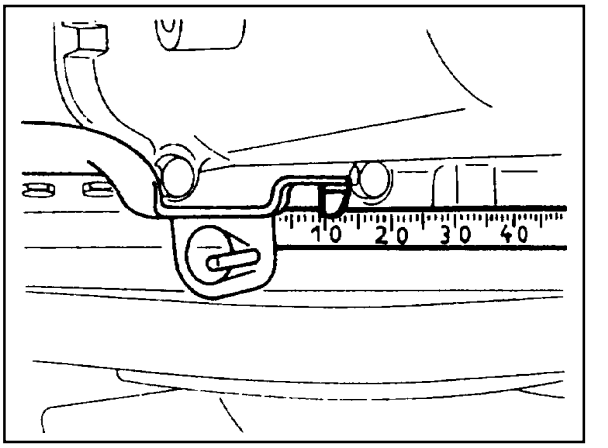
7 Tensioning Pulley
8 Crankshaft
9 Alternator
10 Coolant Pump
11 Guide Pulley
12 Power Steering Pump
13 Aircon. Compressor

Lengthe of Belt

Length (L)	With Air Conditioner	2,100 mm
	Without Air Conditioner	2,040 mm

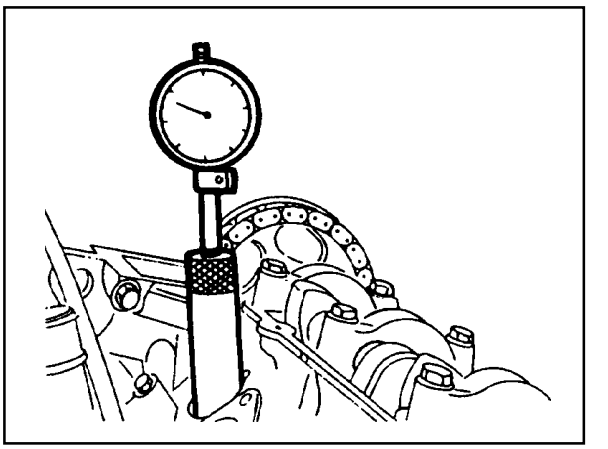
Setting (with cylinder head installed)

1. Remove the prechamber of No. 1 cylinder.
2. Position the piston of No.1 cylinder at BTDC 10.



3. Install the measuring device into the prechamber bore and position the dial gauge with a preload of 5mm.

   Dial Gauge 001 589 53 21 00
   Depth Gauge 601 589 07 21 00



4. Slowly rotate the crankshaft in the direction of engine rotation until the large pointer on the dial gauge stops (TDC position).

   Notice

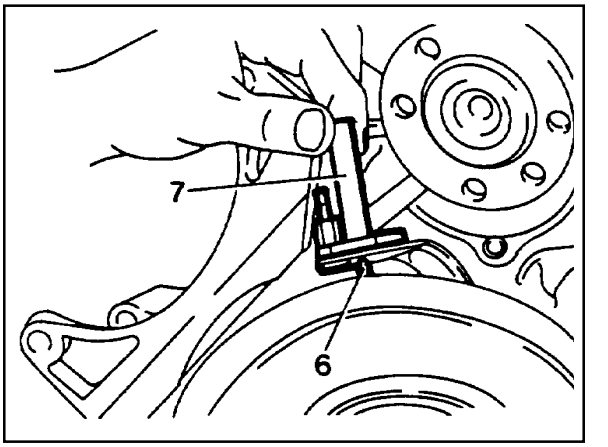
   The position of TDC is when the large pointer on the dial gauge is stopped before moving back.

5. remove the reinstall the measuring device and position the dial gauge scale at '0'.
6. Slowly rotate the crankshaft in the direction of engine rotation until the dial gauge has moved back (counterclockwise) by 3.65mm.

7. Insert fixing device into the sensor bracket.

   Notice

   The pin on the vibration damper must engage into the slot of the fixing device.



Fixing Device 667 589 01 21 00

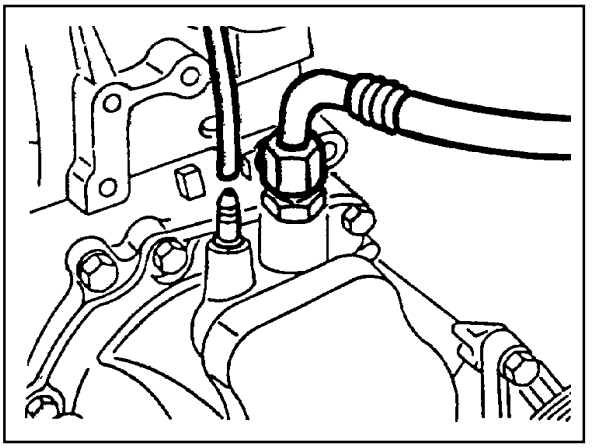
8. If the pin does not engage, adjust the setting of the sensor bracket by removing and tightening of the sensor bracket bolts.

Tightening Torque	10 Nm

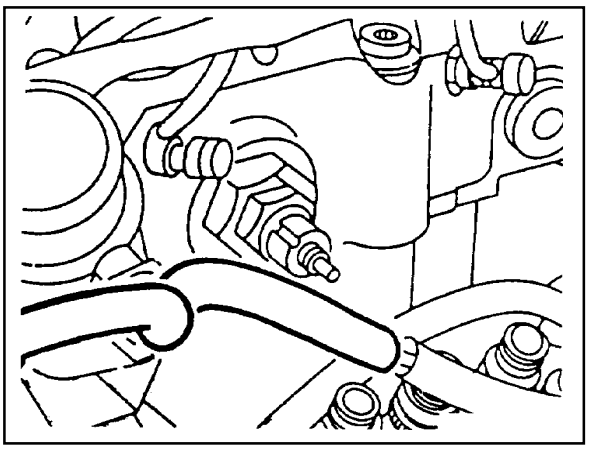
   Notice

   The timing mark on the damper must be positioned at ATDC 20.

45. Remove the vacuum line from the vacuum pump.

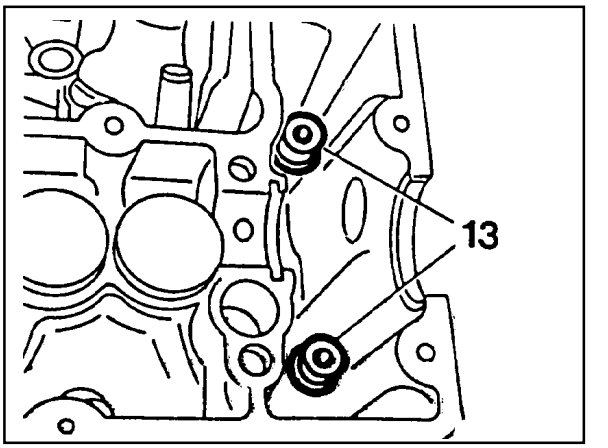


46. Disconnect the vacuum pipe from thermo valve.



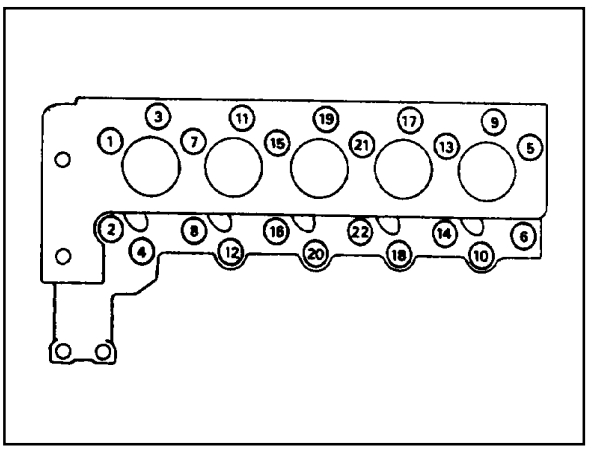
47. Remove the socket bolts(13) of the chain box.

T Type Socket Wrench 116 589 03 07 00
Magnetic Bar 102 589 03 40 00



48. Remove the cylinder head bolts in numerical se-quence.

Cylinder Head Bolt Wrench 601 589 00 10 00



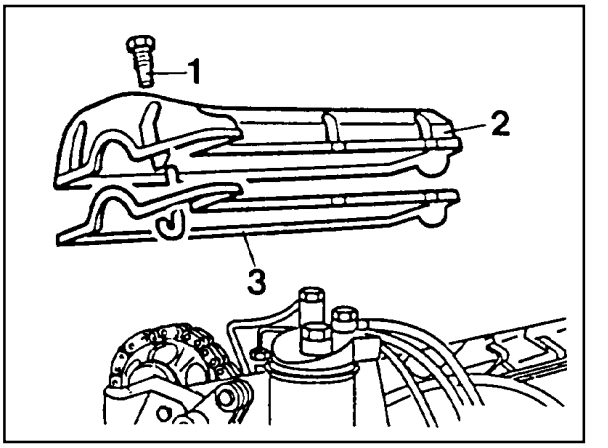
OM 662LA

Tools Required

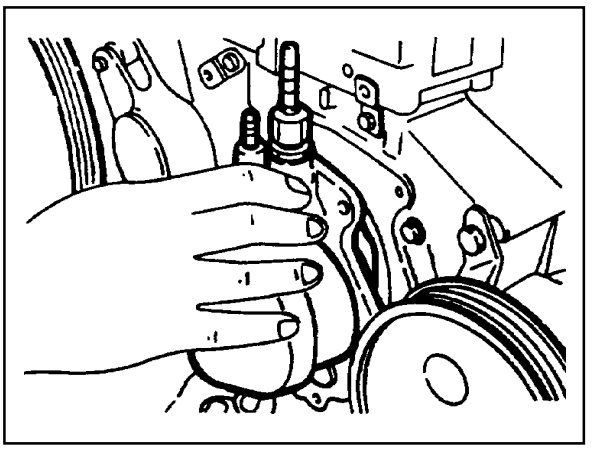
116 589 03 07 00 Socket Wrench

Removal Procedure

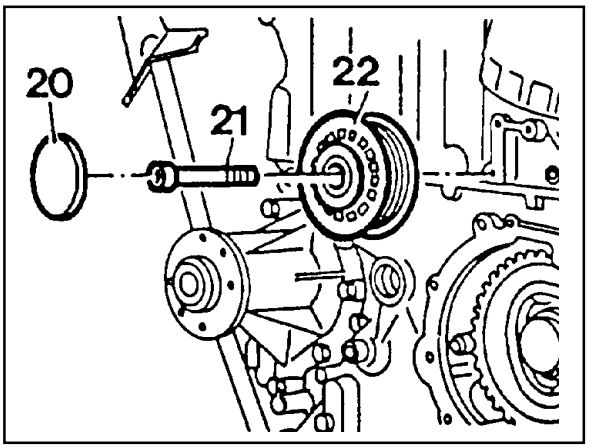
1. Remove the fan clutch and cooling fan belt pulley.
2. Drain the engine oil completely.
3. Remove the oil dipstick tube bracket bolts.
4. Remove the crankshaft pulley.
5. Loosen the bolt (1) and then remove the cylinder head cover (2) and gasket.



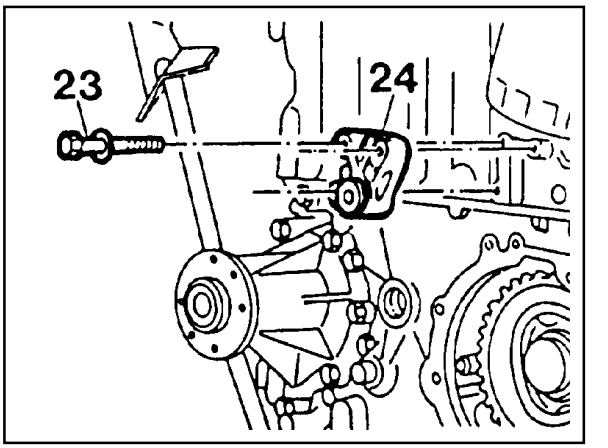
6. Remove the vacuum pump.



7. Detach the closing cover (20). Remove the bolts(21) and then remove the guide pulley (22).



8. Remove the guide pulley bracket (24).

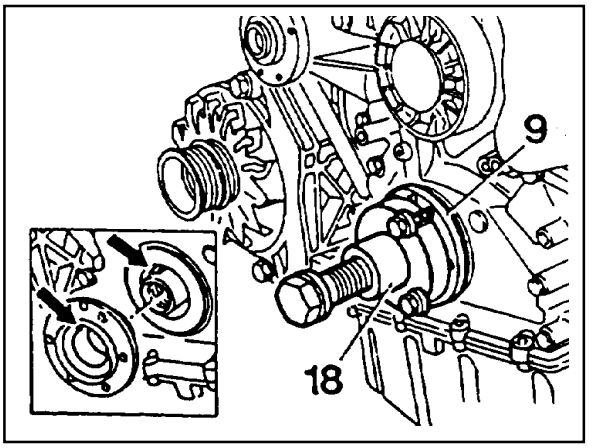


Installation Procedure

1. Install the hub.

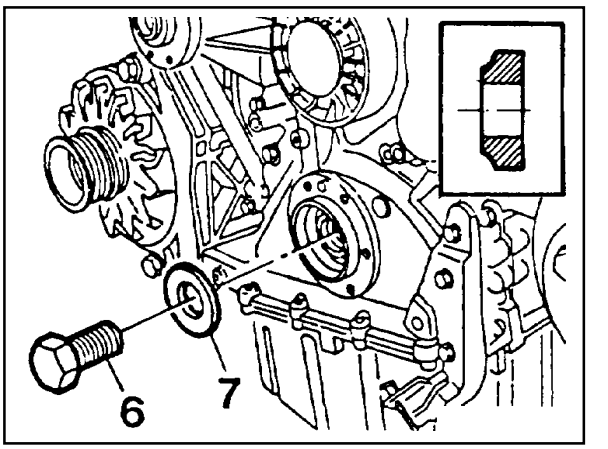
   Notice

   Exactly align the woodruff key and the groove of hub (arrow).



2. Install the washer (7) and tighten the bolt (6).

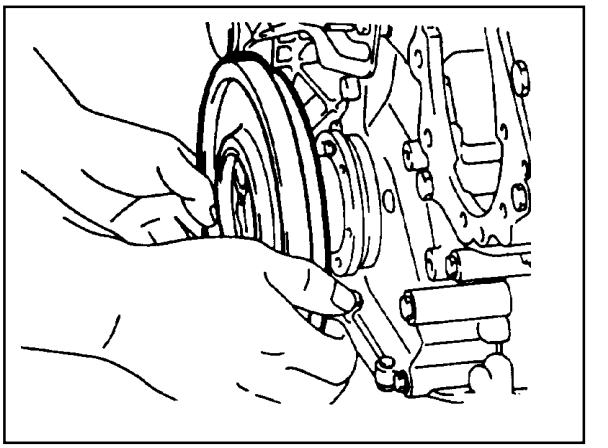
Washer (new) : 1 EA	200 Nm + 90°



3. Install the vibration damper.

   Notice

   Exactly align and insert onto the straight pin.

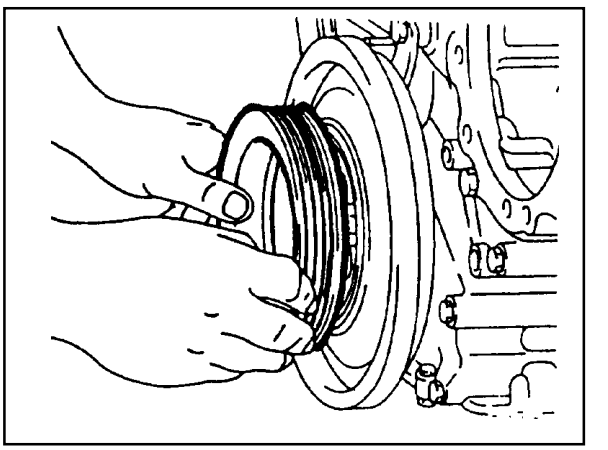


4. Install the belt pulley.

Tightening Torque	25 Nm

   Notice

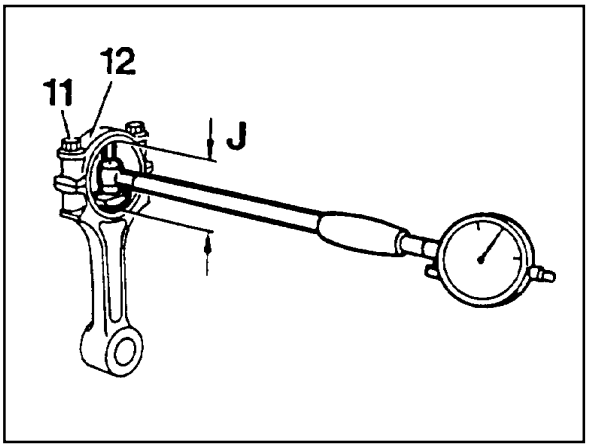
   Align the alignment marks.



24. Insert the new connecting rod bearing shells into the connecting rod and connecting rod bearing cap and tighten the 12-sided stretch bolts (11).

Tightening Torque	40 Nm + 90°

25. Measure inner diameter of connecting rod bearing.



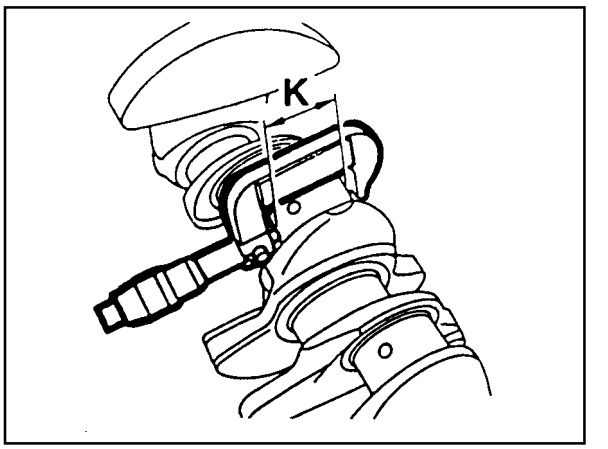
26. Measure connecting rod bearing journal diameter (K).

Notice

Refer to measurement of the crankshaft bearing journal diameter.

27. Measure the radial clearance (L) of the connecting rod bearing.

Example) Measured value 'J' = 47.700mm
Measured value 'K' = 47.653mm
Clearance 'L' = 0.047mm



Radial clearance 'L'	0.026 - 0.068mm

Notice

If the clearance is out of standard, adjust the radial clearance of connecting rod bearing by replacing the connecting rod bearing shells.

28. Remove the connecting rod bearing cap.
29. Install the piston.
30. Rotate the crankshaft by hand and check whether it rotates smoothly.
31. If the bearings are damaged,

- replace the oil presser relief valve.
- clean the oil pump and oil filter housing carefully and replace the hose if necessary.

Notice

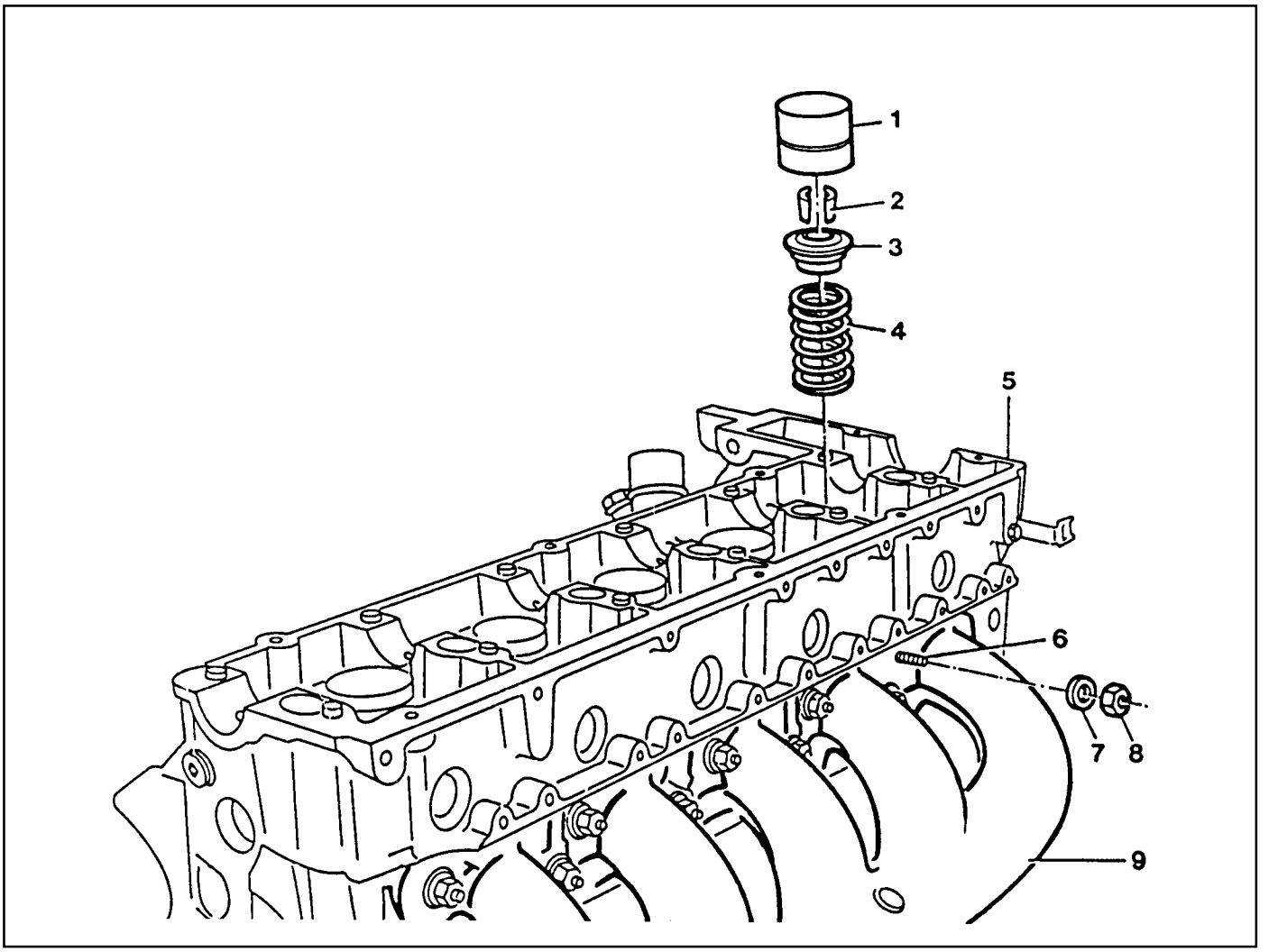
After assembling the engine, check the camshaft timing, adjust the start of fuel injection and check the TDC sensor bracket setting.

32. Fill oil and run the engine and then check the oil pressure and oil level.

Notice

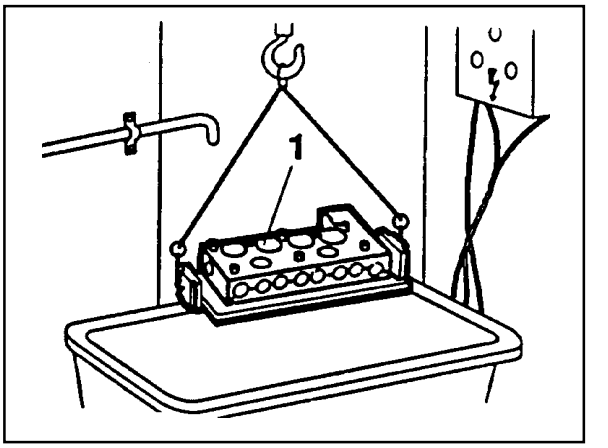
Install the original oil filter element and then change the engine oil and oil filter element after 1,000 - 1,500km.

VALVE SPRINGS (CYLINDER HEAD REMOVED)



1 Valve Tappet
2 Valve Cotters
3 Spring Retainer
4 Valve Spring ..... Check, replace if necessary
5 Cylinder Head
6 Stud Bolt 12Nm
7 Washer
8 Nut ..... Replace, 25Nm
9 Exhaust Manifold

5. Heat the cylinder head (1) in a wear tank to approx. 80°C.

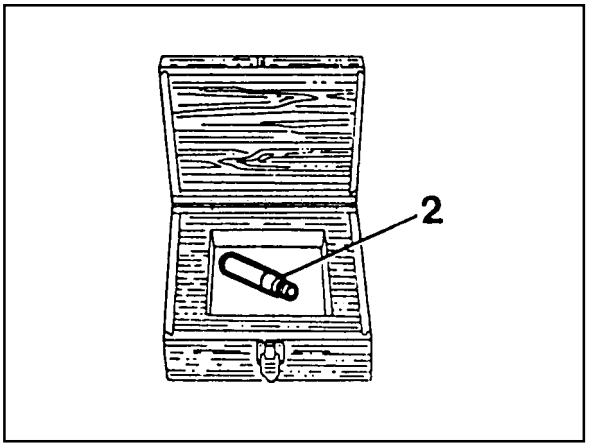


6. Cool down the new valve guide (2) with liquid nitrogen.

Notice

Do not touch the cooled valve guide by hand.

Super Cooling box 346 589 00 63 00

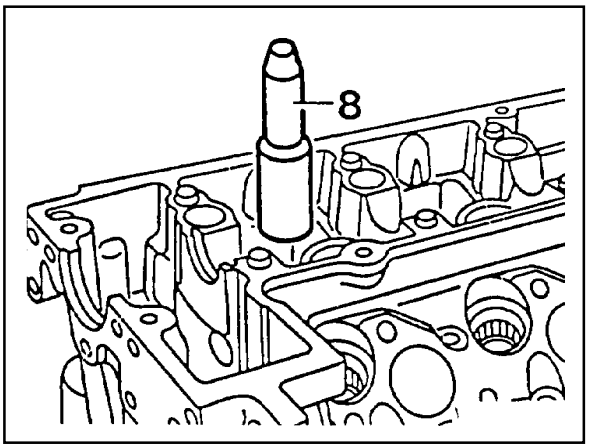


7. Drive in new valve guide with drift (8) until the wire ring makes contact.

Notice

The valve guide must be driven in from the cylinder head cover.

Drift (for Intake) 601 589 05 15 00
Drift (for Exhaust) 601 589 06 15 00



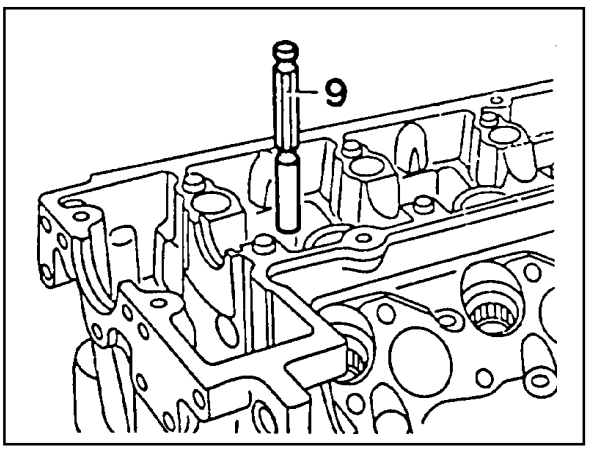
8. Check the valve guide bore with GO / NO GO gauge (9).

The GO side (marked '0') should just still drop. If the GO side cannot be inserted, the bore of valve guide should be reamed.

Notice

Perform the check only on cooled down cylinder head.

GO / NO GO Gauge (for Intake) 102 589 00 23 00
GO / NO GO Gauge (for Exhaust) 117 589 03 23 00

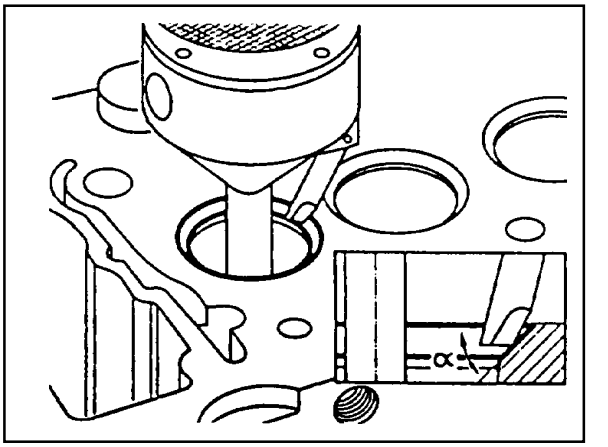


Machining Procedure

Valve machining is required :

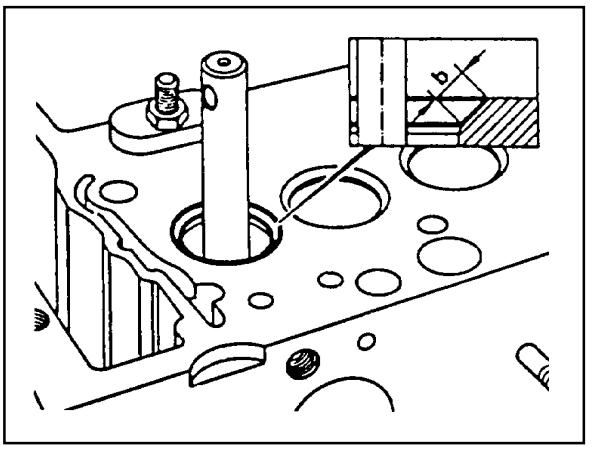
- When the valve is leaking.
- When replacing the valve.
- When replacing the valve guide.
- When replacing the valve seat or valve seat ring.

1. Machine the valve seat (a=45°).

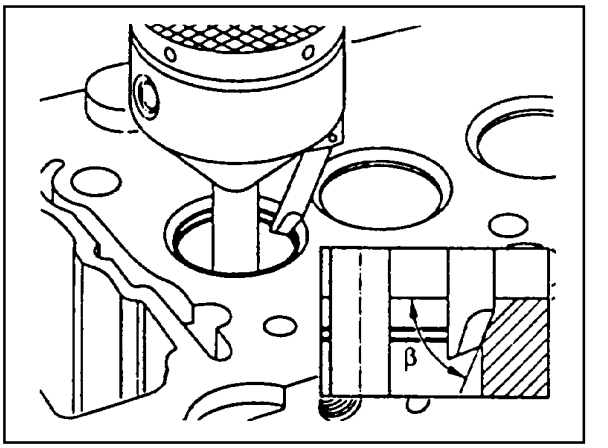


2. Measure valve seat width ‘b’.

Valve seat width ‘b’	Intake	1.2 - 1.7 mm
	Exhaust	1.5 - 2.0 mm

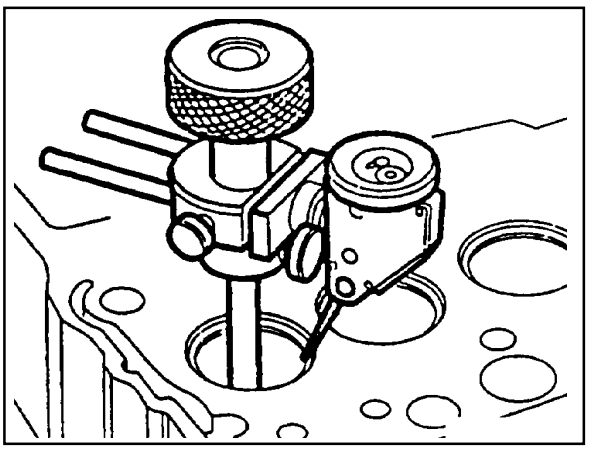


3. If the specification is exceeded, the valve seat width has to be corrected at the lower free angle of ‘b’=65°.



4. Measure radial runout.

Runout	Max. 0.03mm

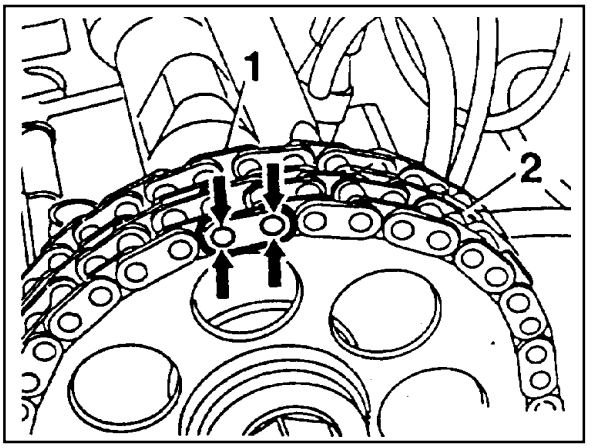


Tools Required

000 589 58 43 00 Chain Assembling Device

Replacement Procedure

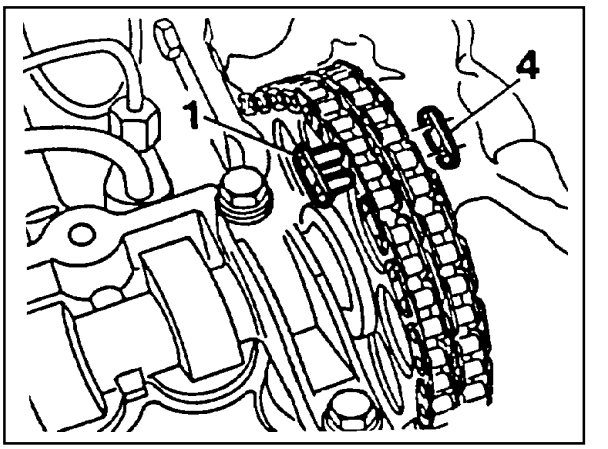
1. Cover over the chain box with cleaning rag and grind off both chain pins (arrow) at a chain link (1) of the timing chain.



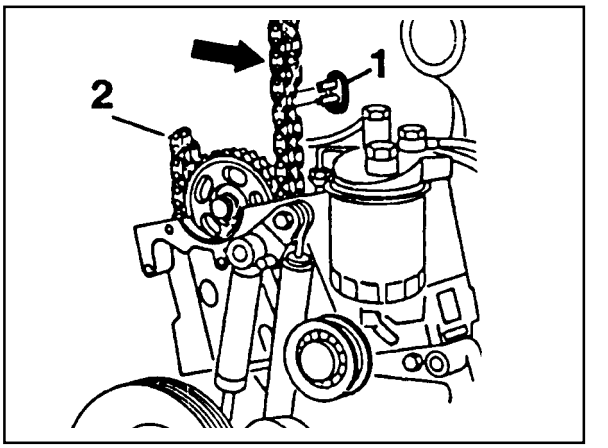
2. Remove the outer plate (4) and chain link (1).

   Notice

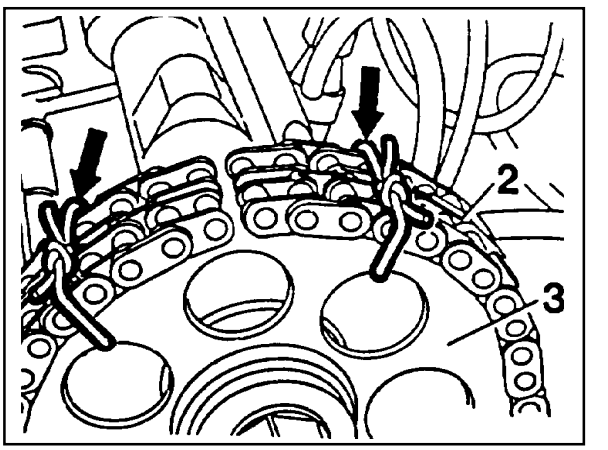
   Ensure that the ends of the timing chain do not drop into the chain box.



3. Loosen the chain tension with approx. 4 turns.
4. Connect the new timing chain (arrow) with chain link (1) to the old timing chain (2).

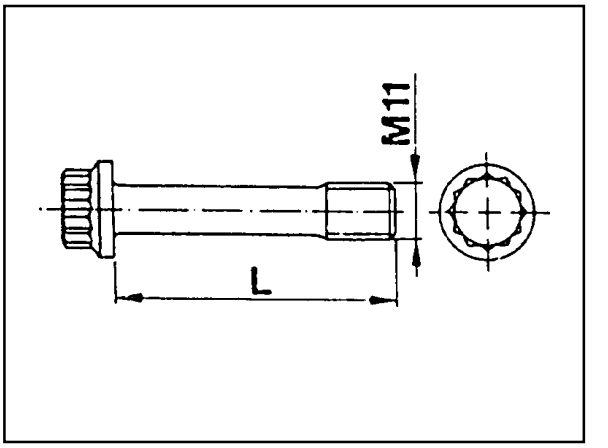


5. By rotating the crankshaft in the of engine rotation, pull out the old timing chain with installing the new timing chain.
6. Remove the old timing chain and hold the ends of the new timing chain to camshaft sprocket (3) with wire (arrow).



Notice

If the max. length 'L' of the stretch bolt exceeds 53.6mm, replace it.

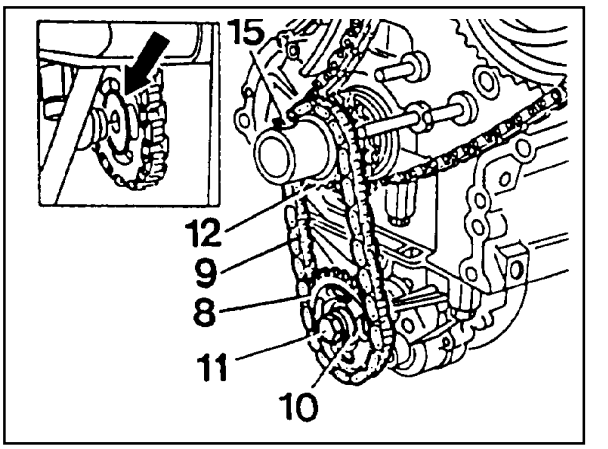


5. Fit the oil pump chain (9) on the crankshaft sprocket (12) and insert the oil pump sprocket (8) into the oil pump chain and then install it on the oil pump.

Notice

The curved side of the oil pump sprocket should face the oil pump.

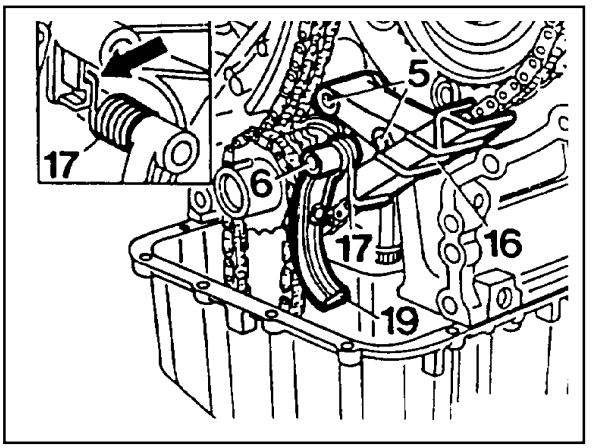
6. Insert the woodruff key (15).



7. Install the guide rail (16). Attach the spring (17) to guide rail and to tensioning lever together onto the bearing pins (5,6).

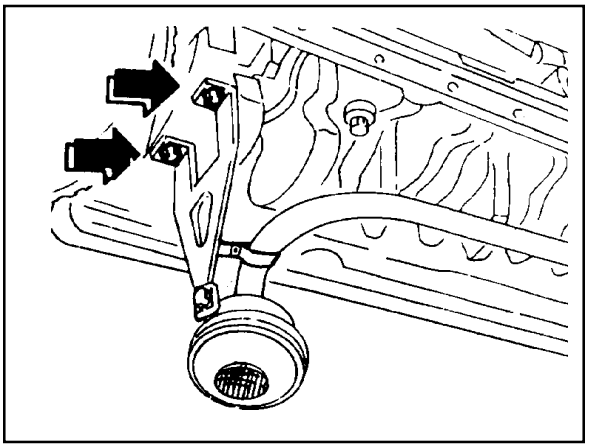
Notice

Ensure that the spring is correctly located in the guide rail (arrow).

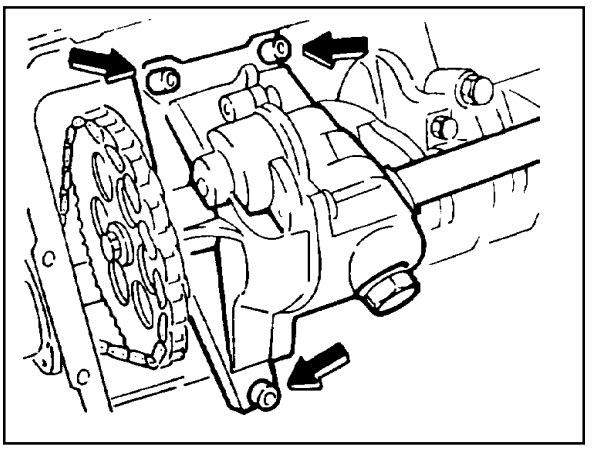


3. Unscrew the oil strainer bracket bolt.

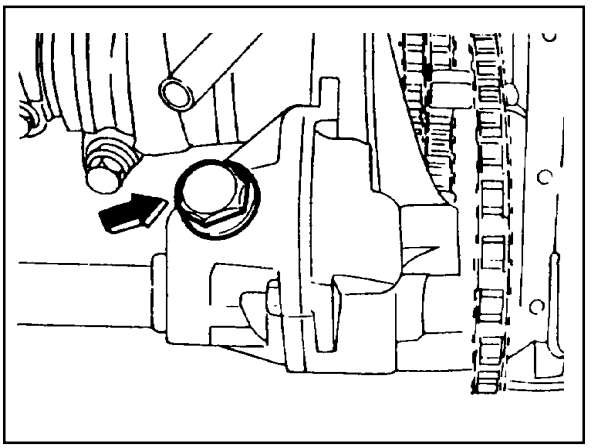
Tightening Torque	10 Nm



4. Remove the oil pump.

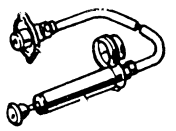
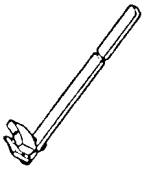


5. Unscrew the screw plug and remove the relief valve.
6. Installation should follow the removal procedure in the reverse order.



SPECIAL TOOLS

SPECIAL TOOLS TABLE

	**124 589 15 21 00** **Tester**		**603 589 00 40** **Counter Holder**

SECTION 1D2

M161 ENGINE COOLING

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

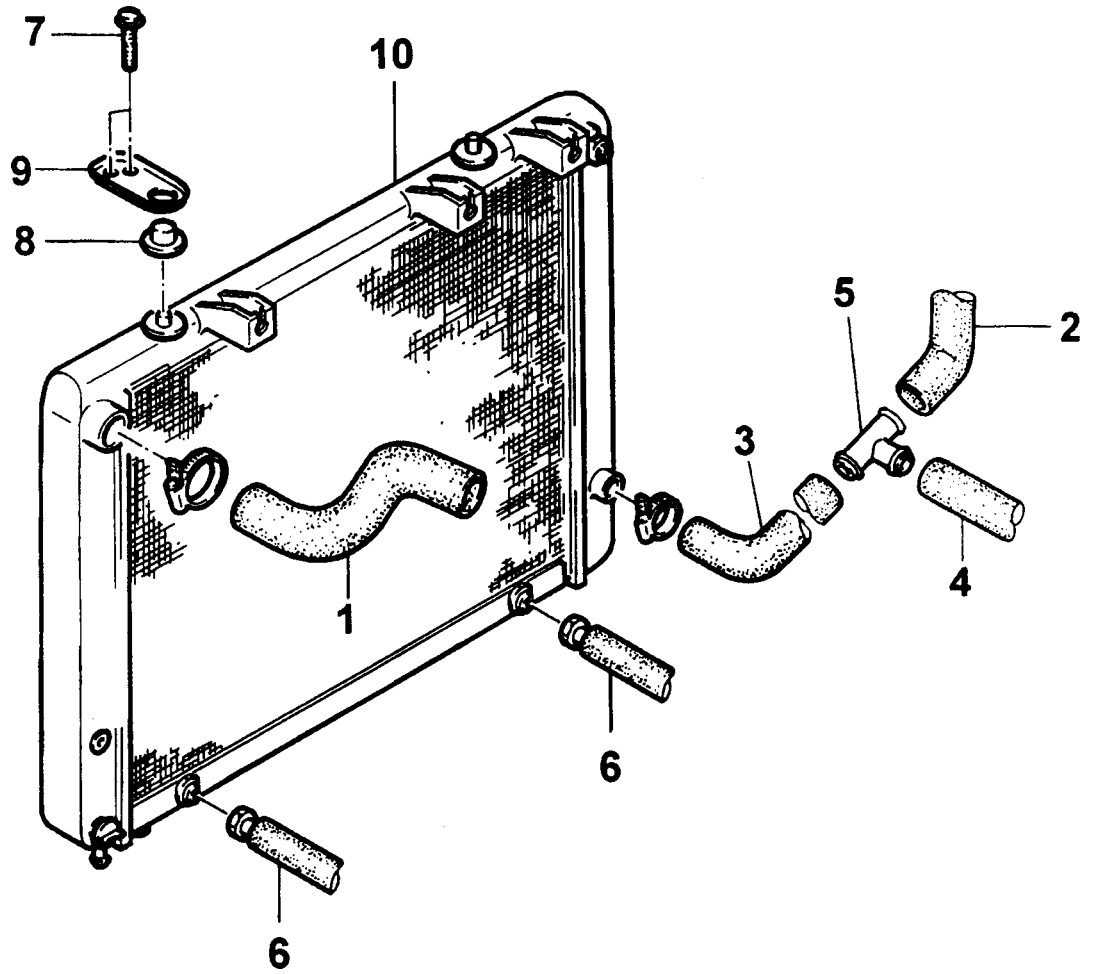
SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Description
Cooling Type		Water Cooling Forced Circulation
Radiator	Circulation Type	Down Flow
	Radiation	61,500 kcal/h
	Capability	58,000 kcal/h
Dimension(Width´Height´Thickeness)		680 x 415 x 25 mm
		680 x 415 x 28 mm
Cooling Fan		*f*460, 9 Blades
Anti-Freeze Agent		ALUTEC-P78, Dragon Power Coolant A
Mixing Ratio of Anti-Freeze Agen with Water (Anti-Freeze Agent : Water)		50 : 50
Coolant Capacity		10.5 L
Reservoir Capacity		3.4 L
Cap Operating Pressure (Reservoir Tank Pressure Cap)		1.4 bar

REMOVAL AND INSTALLATION OF RADIATOR

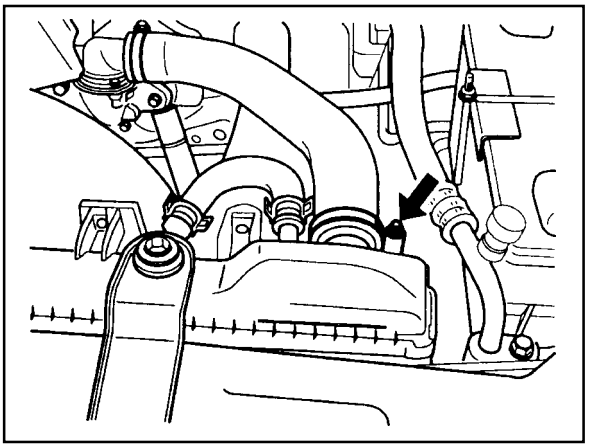
Preceding Work : Removal of cooling fan shroud



1 Inlet Hose
2 Hose (to Engine)
3 Hose (to 3-way Connector)
4 Make-up Hose (to Coolant Reservoir)
5 3-way Connector
6 Automatic Transmission Oil Cooling Hose (A/T Equippend Vehicle)
7 Bolt (M6 X 20, 4 pieces) ..... 3-7 Nm
8 Insulator
9 Radiator Bracket
10 Radiator

Removal & Installation Procedure

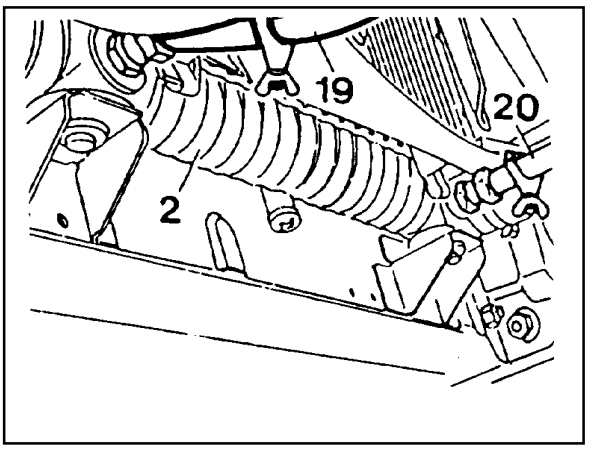
1. Drain coolant from the radiator.
2. Remove the coolant thermoswich connector from radiator.
3. Remove the each coolant hose.



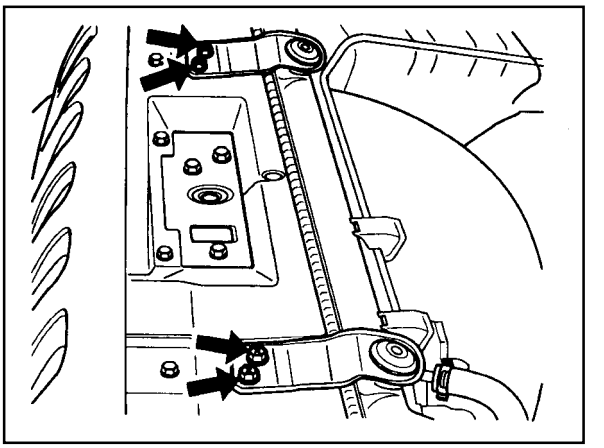
4. Remove the auto T/M oil cooling hose and cooling line.

Installation Notice

Tightening Torque	Hose : 29 - 40Nm

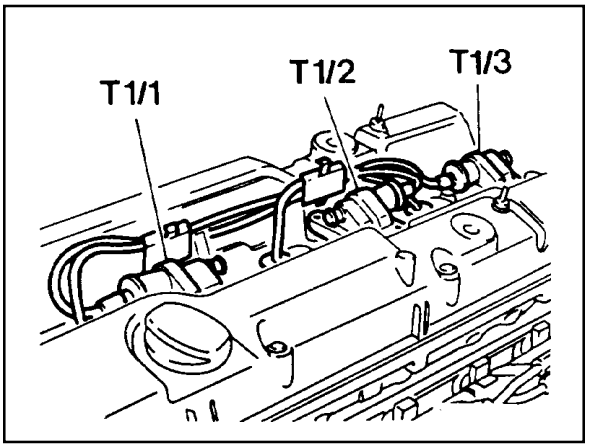


5. Loosen the radiator upper mounting bolt and remove the mounting stopper and insulator.
6. Remove the radiator.
7. Check the radiator pin for crack, leakage and bending and replace it if necessany.
8. Installation should follow the removal procedure in the reverse order.

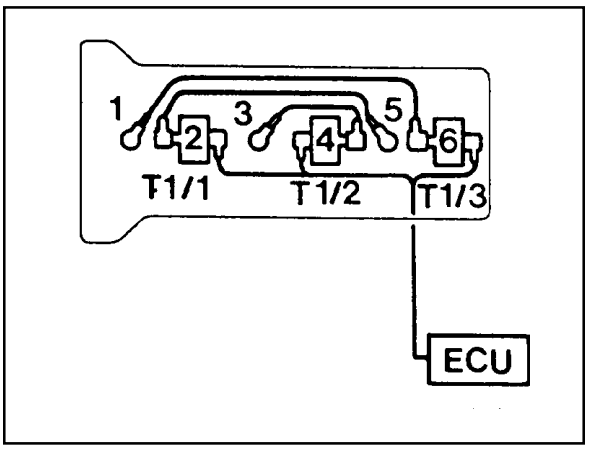


Functions

1. Firing order : 1-5-3-6-2-4
2. The ignition cables are located on the cylinder head cover. Each ignition coil provides the high voltage to two spark plugs simultaneously.
   - T1/1 : cylinder 2 and 5
   - T1/2 : cylinder 3 and 4
   - T1/3 : cylinder 1 and 6



3. The secondary output voltage (5a) is supplied to the No.2 cylinder spark plug through the spark plug connector. The secondary output voltage (5b) is supplied to the No.5 cylinder spark plug through the ignition cable. The guide pin (W) acts as a ground while the ignition cable is operated.



Removal & Installation Procedure

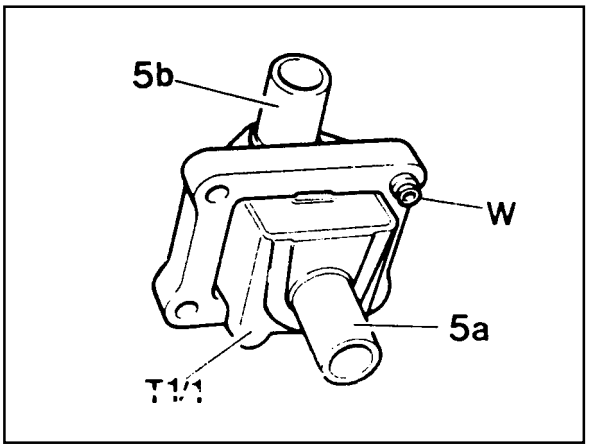
1. Disconnect the negative battery cable (1).
2. Remove the ignition cable connector from the ignition cable.
3. Disconnect the secondary spark plug connectors from the each spark plugs and remove the ignition cable.

Installation Notice

Tightening Torque	5.2 - 8.5 Nm

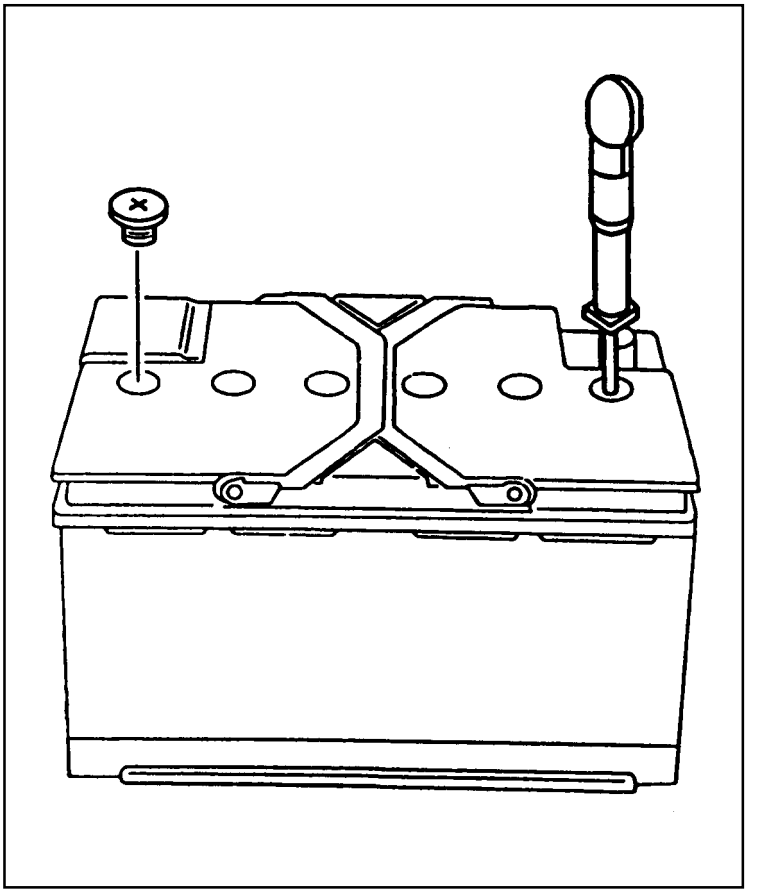
- Make sure that the ignition cables are correctly routed.
- Exactly install the ignition cable guide pin into the vehicle to be grounded.

4. Installation should follow the removal procedure in the reverse order.



UNIT REPAIR

BATTERY



Inspection

Notice

- When charging the battery, do not leave the inflammable objects around it.
- When checking the electrolyte of battery, put on an eye protector and gloves.

1. Inspect the surface of the battery and replace if any defects were found on it.
2. Check if the specific gravity of the electrolyte is within the specified value.

Battery Capacity(Ah)	85
Battery Specific Gravity	³ 1.24
Max. Tolerance between Cells	³ 0.04

Notice

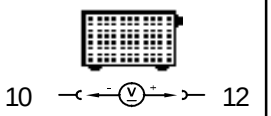
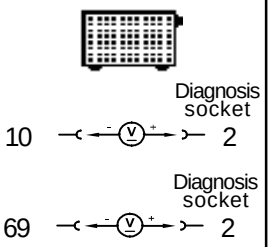
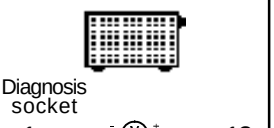
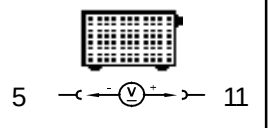
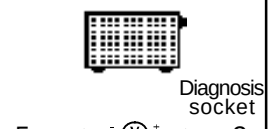
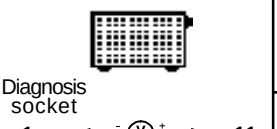
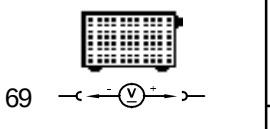
- Replace the battery if the maximum tolerance of the electrolyte between cells is out of the specified value.
- Measure the specific gravity in the approx. 20°C of ambient temperature.

3. Replenish the electrolyte if necessary.

SELF DIAGNOSIS FAILURE CODE

Failure code	Description	Failure code	Description
00	Coolant temperature sensor open	41	Purge valve open/short
01	Coolant temperature sensor short	44	Condenser fan(HI) relay short(PWR)
02	Coolant temperature sensor signal failure	45	Condenser fan(HI) relay short(GND)
03	Intake temperature sensor open	56	No.1 knock sensor signal failure
04	Intake temperature sensor short	57	No.2 knock sensor signal failure
05	Intake temperature sensor signal failure	58	No.1 cylinder synchronization failure
08	Low battery voltage	59	-
09	HFM sensor signal failure	60	-
10	HFM sensor signal failure(Low)	62	Cluster S/W defectave
11	HFM sensor signal failure(High)	64	No ignition voltage output(No.1 ignition coil)
17	Crankshaft position sensor signal failure (no engine revolution signal)	65	No ignition voltage output(No.2 ignition coil)
		66	No ignition voltage output(No.3 ignition coil)
18	Crankshaft position sensor signal failure (rpm > max. value)	67	Crankshaft position sensor adaptation failure
		71	Start signal recognition failure
19	No.1 cylinder recognition failure	72	No.1 injector short(PWR)
20	Crankshaft position sensor signal failure (gab recognition failure)	73	No.1 injector open/short(GND)
		74	No.2 injector short(PWR)
21	Transmission coding failure	75	No.2 injector open/short(GND)
23	CAN communication failure : ASR	76	No.3 injector short(PWR)
24	-	77	No.3 injector open/short(GND)
25	Transponder signal failure	78	No.4 injector short(PWR)
26	CAN communication failure : TCU(A/T only)	79	No.4 injector open/short(GND)
27	CAN communication failure : TOD(E32 only)	80	High oxygen sensor voltage
29	-	81	Low oxygen sensor amplifying voltage
30	-	82	Oxygen sensor operating failure
31	CAN communication failure : communication initialization failure	83	Not excessive lean indication in oxygen sensor(during coasting)
34	Fuel pump relay short(PWR)	86	Oxygen sensor heater short(PWR)
35	Fuel pump relay open/short(GND)	87	Oxygen sensor heater open/short(GND)
40	Purge valve short	89	Low oxygen sensor voltage

IGNITION SYSTEM TEST

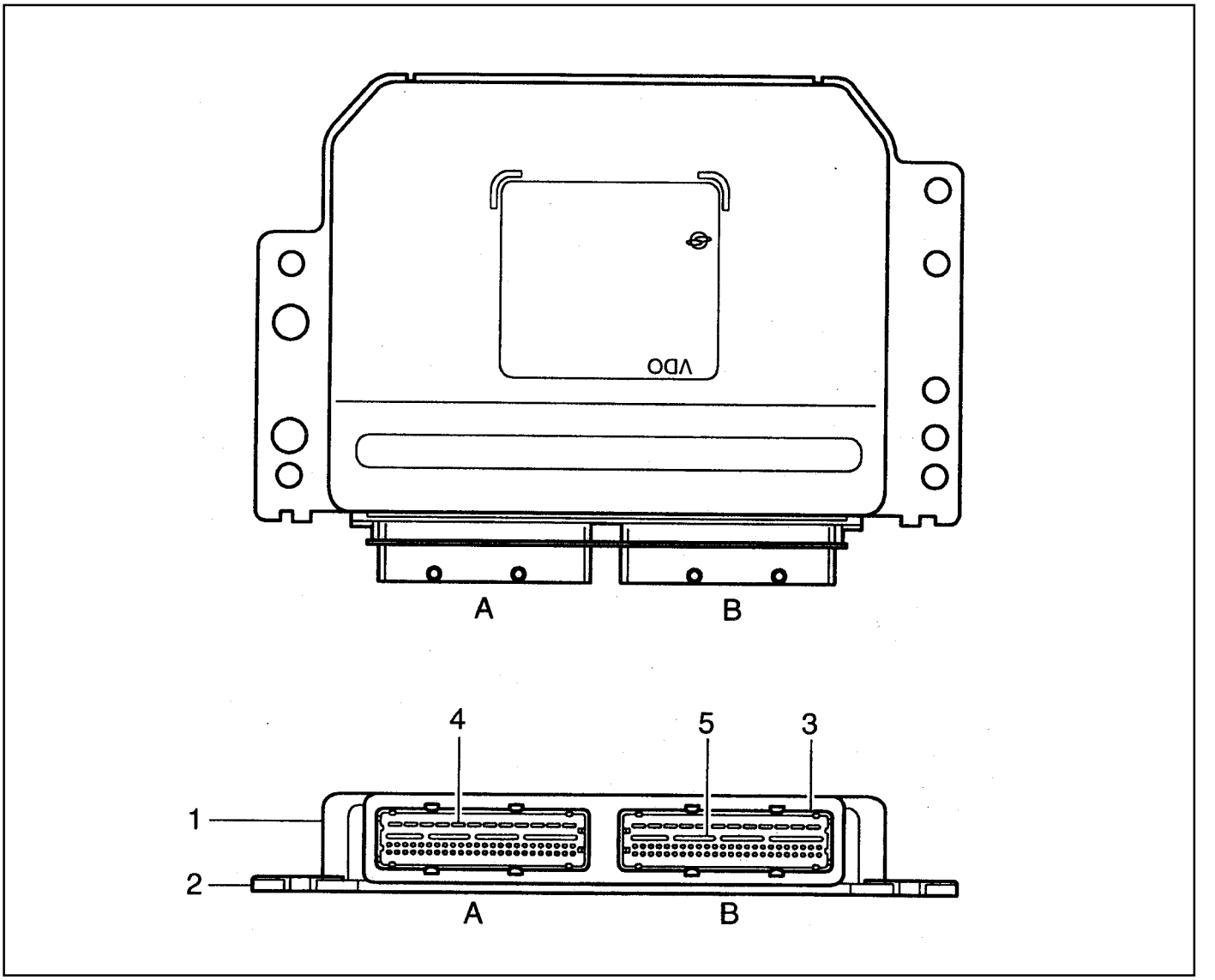
Failure code	Test step	Item	Checking method	Requirement	Specified value	Possible cause
08,		· **ECU:power supply** - terminal 30(TM.30)			11 - 14V	· Þ 1.1 · Þ 1.2
	Þ 1.1	· **Ground cable:** - Battery ground		· Ignition:ON	11 - 14V	· Ground cable · Ground condition (figure 1)
	Þ 1.2	· **Power supply:** - terminal 30(TM.30)		· Ignition:ON	11 - 14V	· Power supply cable · Fuse No.8
08,	Þ 2.0	· **ECU:power supply** - terminal 87(TM.87)		· Ignition:ON	11 -14V	· Þ 2.1 · Þ 2.2
	Þ 2.1	· **Ground cable** - Electronic ground		· Ignition:ON	11 - 14V	· Ground cable
	Þ 2.2	· **Power supply:** - terminal 87(TM.87)		· Ignition:ON · Ignition:OFF	11 - 14V < 1V	· Power supply cable · OVPR
64,	Þ 3.0	· **Ignition coil(T1/1)** - No.2,5 Cylinder		· Ignition:ON · Engine:in cranking	11 - 14 V > 10 V	· Cable · Ignition coil(T1/1) · Fuse No.17

MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

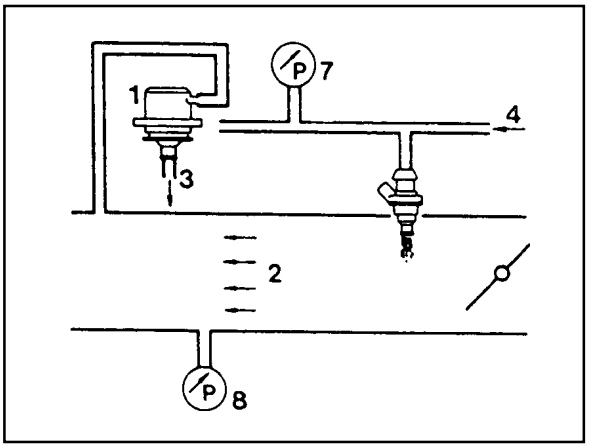
ECU

Appearance



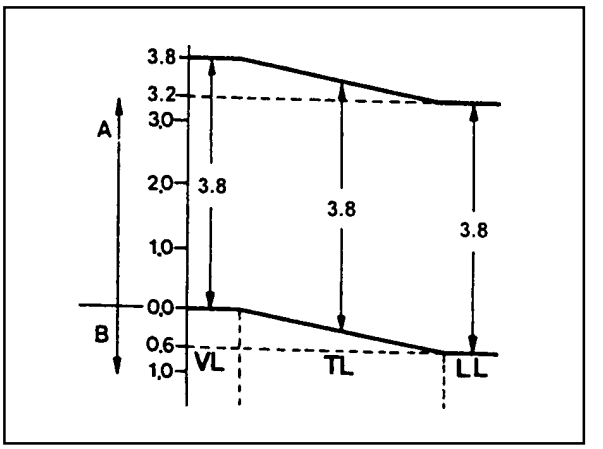
1 Cover
2 Plate
3 Connector
4 Flat Pin
Vehicle Side : Number 1 - 12
Engine Side : Number 61 - 72
5 Pin
Vehicle Side : Number 13 - 60
Engine Side : Number 73 - 120
A Vehicle Connector : Black
B Engine Connector : Gray

The pressure difference between the fuel pressure and the intake manifold is approx. 3.2 bars during idling.



1. Fuel Pressure Regulator
2. Intake Manifold
3. Fuel Return(to fuel tank)
4. Fuel Supply(from fuel pump)
7. Fuel Pressure(approx. 3.2 bars)
8. Intake Manifold Negative Pressure(0.6 bars)

<Fuel Pressure Diagram>



A. Fuel pressure
B. Intake Manifold Negative Pressure
LL. Idling
TL. Partial load
VL. Full load

Test

1. Maintain the normal temperature and idling state by operating the engine.
2. Connect the ECU terminal No.11 and No.34 and check for normal operation through the output waves using the scanner.

   Notice

   Test during purge control switchover valve operation after the minimum of 1 minute after the engine turned on.
3. Connect the ECU terminal No.34 and No.10 and check for current consumption during the ignition switch ON.

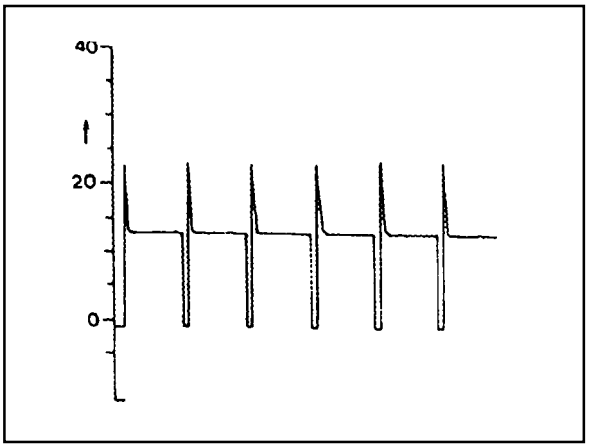
Specified Value	0.3 - 0.5

4. Remove the line to canister and measure the pressure with the vacuum pressure gauge.

Specified Value	> 50mbar (after approx. 1min.) purge switchover valve operates at this time

   Notice

   Test while at normal temperature and at idling state by operating the engine.

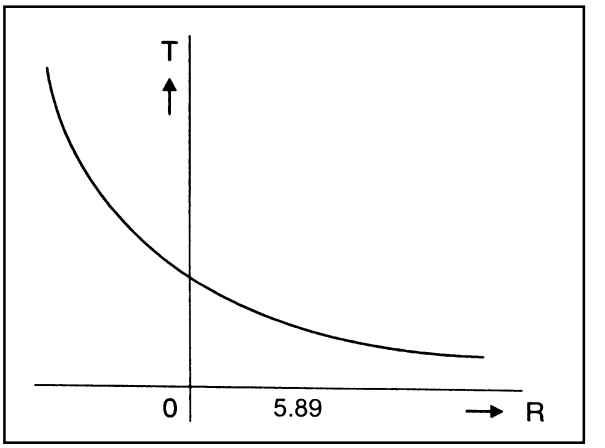


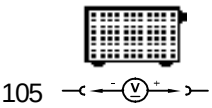
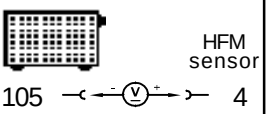
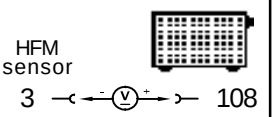
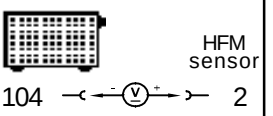
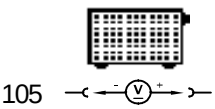
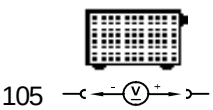
Purge switchover valve output wave

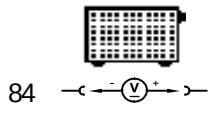
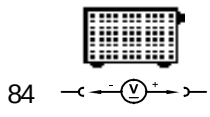
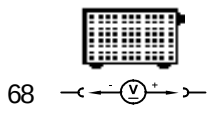
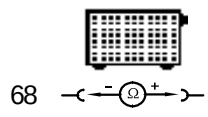
Service Data

Temperature(℃)	Resistance(W)	Voltage(V)	Temperature(℃)	Resistance(W)	Voltage(V)
-40	48,550	4.8991	60	594	1.8632
-30	27,000	4.8214	70	434	1.5132
-20	15,670	4.7001	80	322	1.2179
-10	9,450	4.5215	90	243	0.9775
0	5,890	4.4273	100	185	0.7806
10	3,790	3.9562	110	143	0.6255
20	2,500	3.5714	120	111.6	0.5020
30	1,692	3.1426	130	88.0	0.4044
40	1,170	2.6959	140	71.2	0.3323
50	826	2.2618	-	-	-

Resistance characteristic curve according to the coolant temperature



Failure code	Test step	Item	Checking method	Requirement	Specified value	Possible cause
09, 10, 11,	Þ 4.0	· **HFM sensor signal**		· Ignition:ON	0.9 - 1.1V	· Þ 4.1 - 4.3 · Cable · External air inflow · HFM sensor
				· Engine:in Idle (Coolant temperature : > 70℃)	1.3 - 1.7V : voltage value is increased when engine rpm is increased	
	Þ 4.1	· **HFM sensor:** - 5V power supply		· Ignition:ON · HFM sensor connector removed	4.7 - 5.2V	· Cable · ECU coupling
	Þ 4.2	· **HFM sensor:** - 5V power supply		· Ignition:ON · HFM sensor connector removed	4.7 - 5.2V	· Þ 4.3 · Cable
	Þ 4.3	· **HFM sensor:** - 12V power supply		· Ignition:ON · HFM sensor connector removed	11 - 14V	· Cable · OVPR
03, 04, 05,	Þ 5.0	· **Intake air temperature sensor:** - Voltage		· Ignition:ON	℃ V 10 3.1 20 2.65 30 2.18 40 1.76 50 1.4 60 1.1 ±5%	· Þ 5.1 · ECU
	Þ 5.1	· **Intake air temperature sensor:** - Resistance		· Ignition:OFF · No.2 ECU coupling removed	℃ W 10 3600 20 2420 30 1662 40 1166 50 853 60 600 ±5%	· Cable · HFM sensor

Failure code	Test step	Item	Checking method	Requirement	Specified value	Possible cause
		Throttle valve potentiometer 2		· Position of accelerator pedal: - Closed throttle position - Full throttle with kick down	4.0 - 4.6 V 0.3 - 0.9 V	
	Þ 3.1	· **Throttle valve actuator:** - Power supply Throttle valve potentiometer 1+2		· Ignition:ON	4.75 - 5.25 V	· Cable · ECU
104, 105, 108, 109, 116, 119, 185,	Þ 4.0	· **Throttle valve actuator:** - Signal Throttle valve actuator motor voltage supply Throttle valve actuator motor resistance	 	· Ignition:ON · Engine:in idling - Coolant temperature: > 70 °C · Ignition:OFF	0.8 - 2.3 V The value will be changed in 1.0 - 2.5V. < 10 W	· ECU · Cable · E-GAS actuator

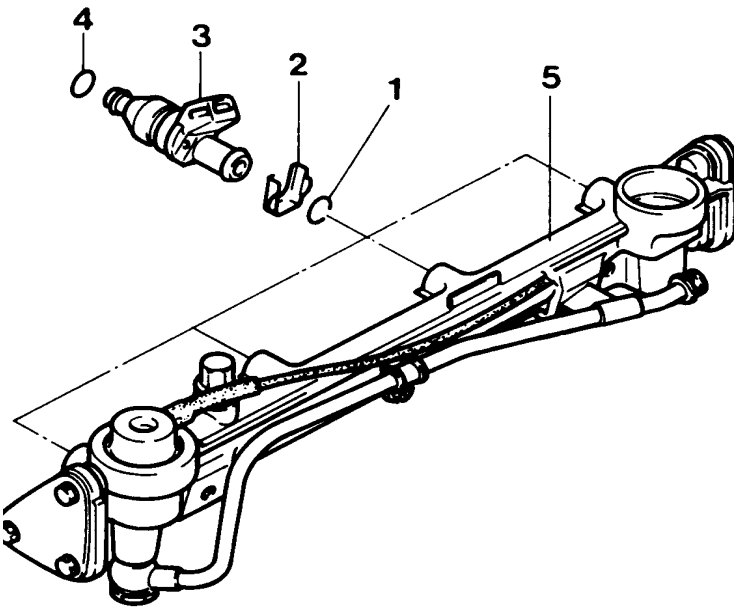
Application

Pin No.	Description	Abbreviation	E23 ENG, 5speed A/T	E23 ENG, 4speed A/T	E20 ENG, 4speed A/T
1	-	-	-	-	-
2	Starter motor TM.50	TM.50	●	●	●
3	-	-	-	-	-
4	-	-	-	-	-
5	Electronic ground	GND	●	●	●
6	-	-	-	-	-
7	Lambda probe 2 heating	LSH2	-	-	-
8	-	-	-	-	-
9	Lambda probe 1 heating	LSH1	●	●	●
10	Power ground TM.31	TM.31	●	●	●
11	V-BATTERY TM.87	TM.87	●	●	●
12	V-BATTERY TM.30	TM.30	●	●	●
13	Immobilizer crypto read	WFS I/O	●	●	●
14	Immobilizer crypto write	WFS O	●	●	●
15	-	-	-	-	-
16	Lambda probe 1 ground	GND	●	●	●
17	Lambda probe 1 signal	LS1	●	●	●
18	-	-	-	-	-
19	-	-	-	-	-
20	-	-	-	-	-
21	Brake switch	BRS	○	○	○
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	-	-
27	Air conditioning clutch relay	KLIKU	●	●	●
28	-	-	-	-	-
29	-	-	-	-	-
30	-	-	-	-	-

●:Standard, ○:Option

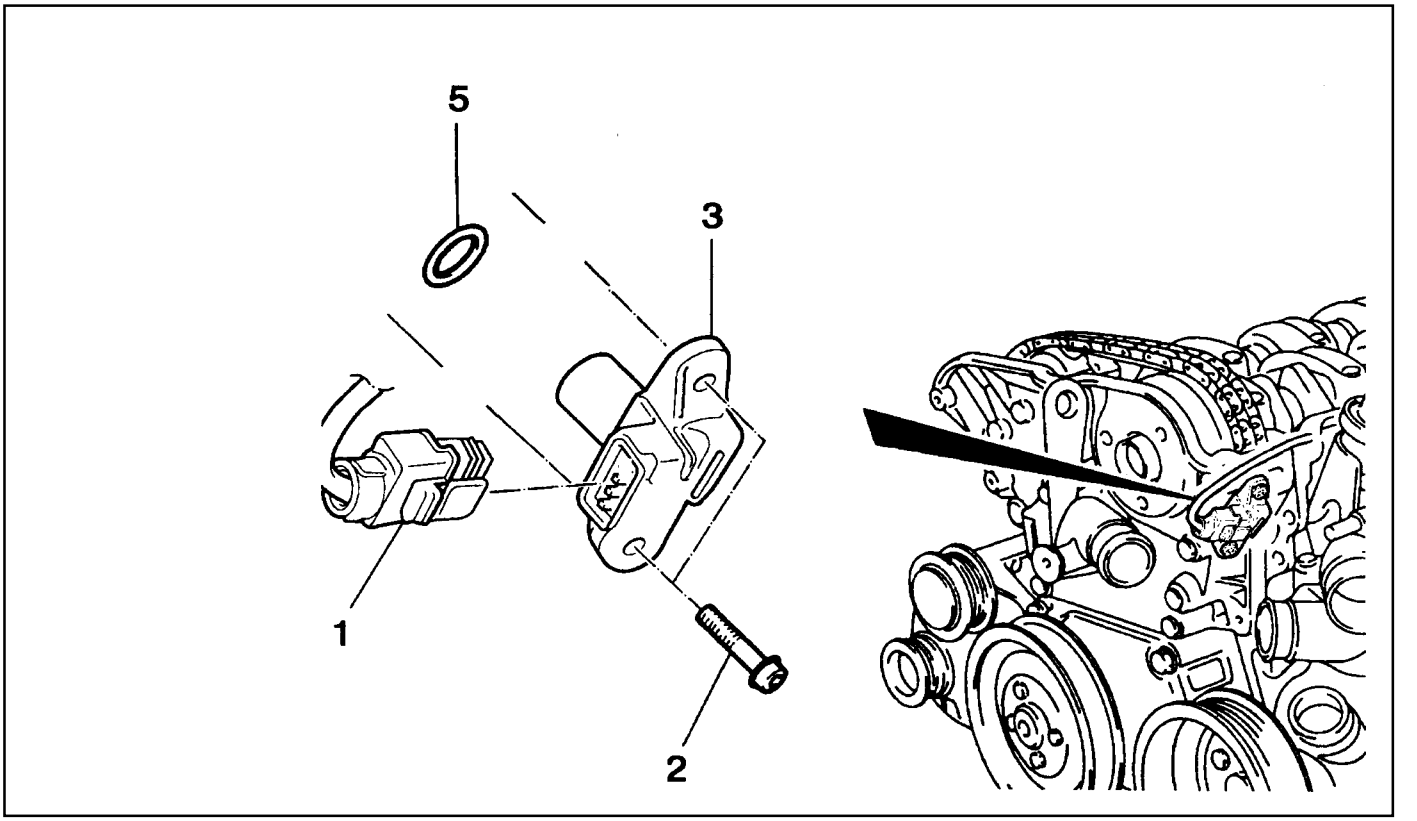
INJECTOR

Preceding Work : Removal of fuel distributor



1 O-ring ..... Replace, if damaged
2 Injector Bracket
3 Injector
4 O-ring ..... Replace, if damaged
5 Fuel Distributor

CAMSHAFT POSITION SENSOR



1 Bolt (M6 X 14) 9-11Nm
2 Camshaft Position Sensor
3 Shim
5 O-ring

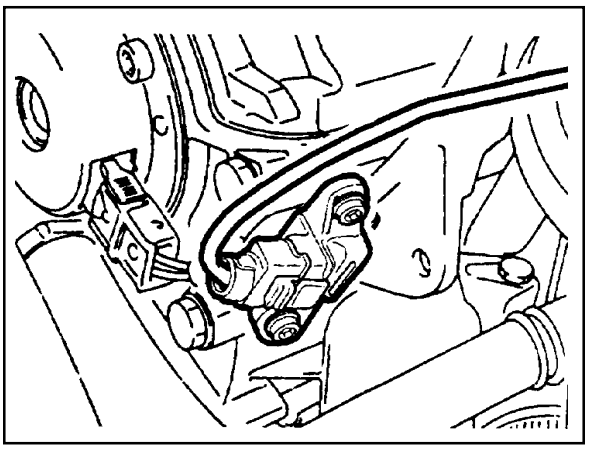
Removal & Installation Procedure

1. Disconnect the wiring connector from the camshaft position sensor.
2. Unscrew the bolt (2) and remove the camshaft position sensor.

Installation Notice

Tightening Torque	9 - 11 Nm

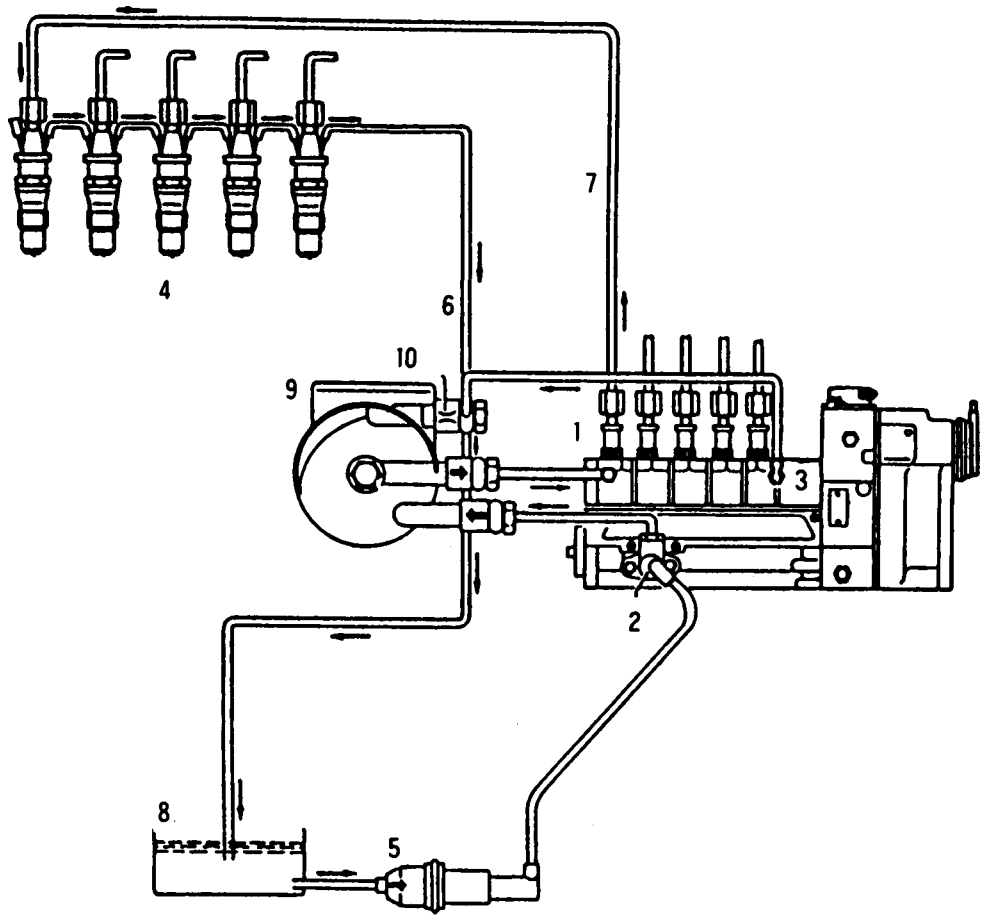
3. Check the clearance and replace the shim if necessary.
4. Check the O-ring for damage and replace it if necessary.
5. Installation should follow the removal procedure in the reverse order.



MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

FUEL SYSTEM



1 Fuel Injection Pump
2 Fuel Feed Pump
3 Overflow Valve
4 Injection Nozzle
5 Pre-filter
6 Fuel Return Hose
7 Injection Line
8 Fuel Tank
9 Fuel Filter
10 Choke Orifice

IDLE SPEED ADJUSTMENT

Service Data

Engine	Idle Speed
OM661LA Engine	750 - 850 rpm
OM662LA Engine	720 - 820 rpm

Tools Required

667 589 00 21 00 TDC Pulse Generato

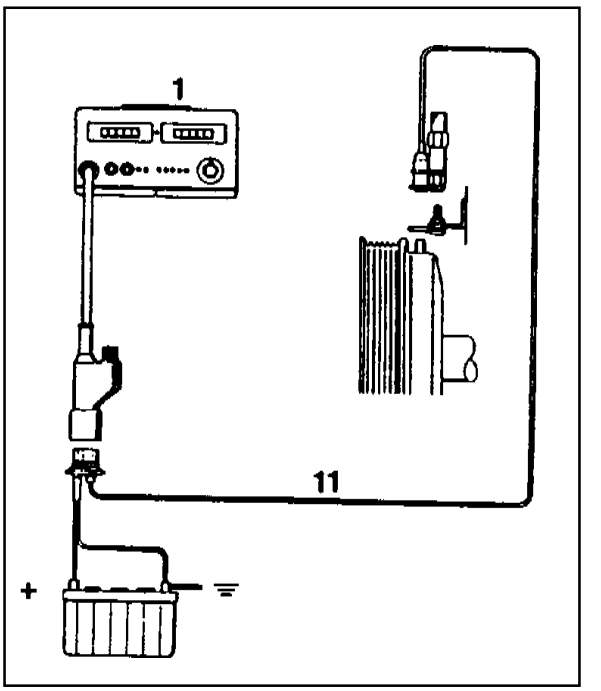
Commercial Tool

Digital tester	e.g. Bosch, MOT 001.03
	Sun, DIT 9000

Adjustment

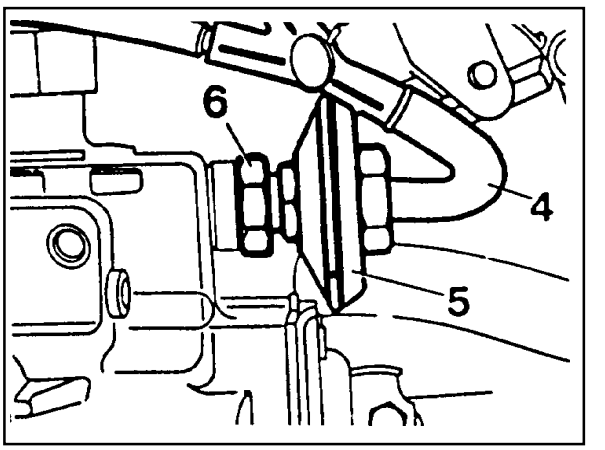
1. Connect the digital tester (1) and TDC pulse sender unit (11).
2. Run the engine and warm up the coolant to 60~80°C.

TDC pulse generator 667 589 02 21 00



3. Disconnect the vacuum hose (4) from the PLA unit to check idle speed with tester.
4. Check idle speed with tester.

OM 661LA Engine	750 - 850rpm
OM 662LA Engine	720 - 820rpm

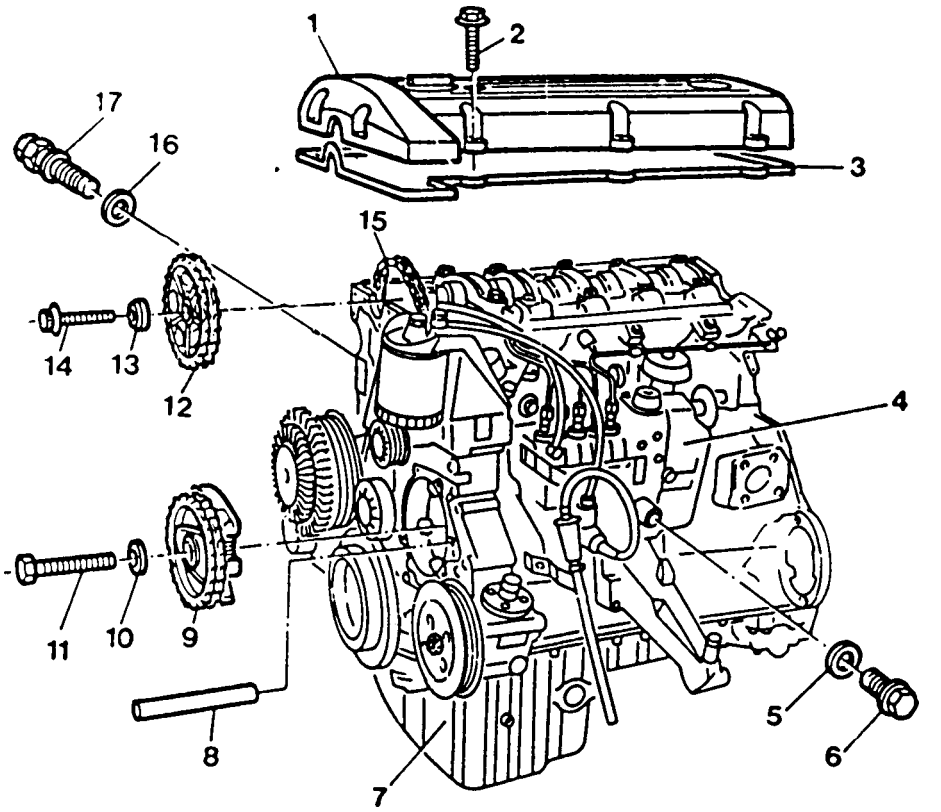


Notice

To adjust idle speed, loosen the locking nut (6) of PLA unit.

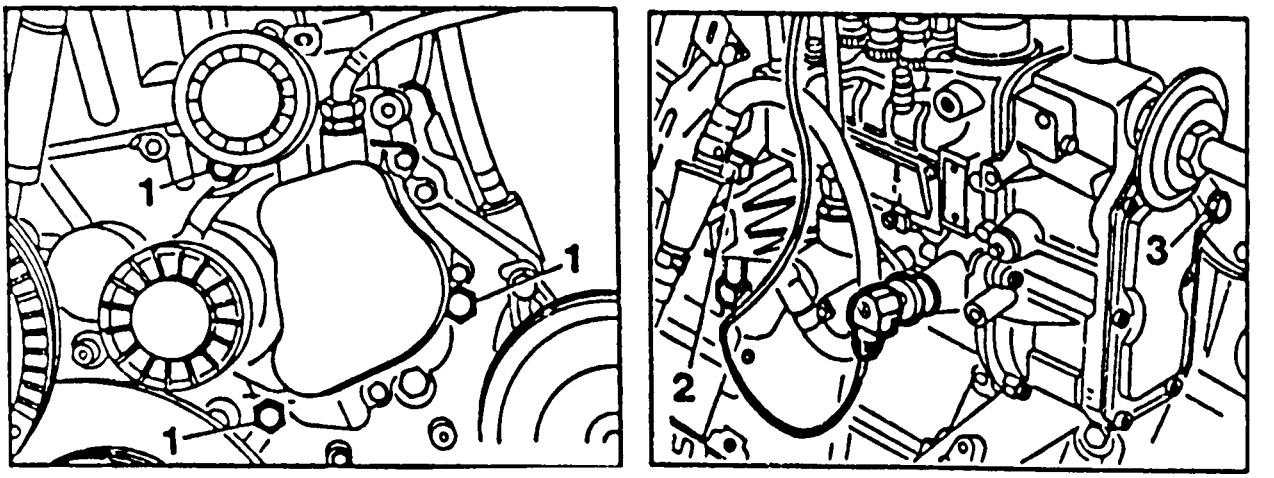
REMOVAL AND INSTALLATION OF INJECTION TIMING DEVICE

Preceding Work : Removal of vacuum pump



1 Cylinder Head Cover
2 Bolt 10Nm
3 Gasket ..... Replace
4 Fuel Injection Pump
5 Seal ..... Replace
6 Screw Plug 30Nm
7 Oil Pan
8 Locking Pin
9 Injection Timing Device
10 Washer
11 Bolt (Left-Hand Thread) 46Nm
12 Camshaft Sprocket
13 Washer
14 12-Sided Stretch Bolt ..... Check, 25Nm + 90°
15 Timing Chain
16 Seal
17 Chain Tensioner 80Nm

Digital tester (RIV Method)



1 Bolt 23Nm
2 Adjusting
Screw ..... To the right : start of delivery retarded
To the left : start of delivery advanced
3 Bolt 23Nm

Service Data

Start of Delivery (RIV)	ATDC 14° - 16°
Ldling Speed	OM661LA : 720 - 820 rpm, OM662LA : 750 - 850 rpm

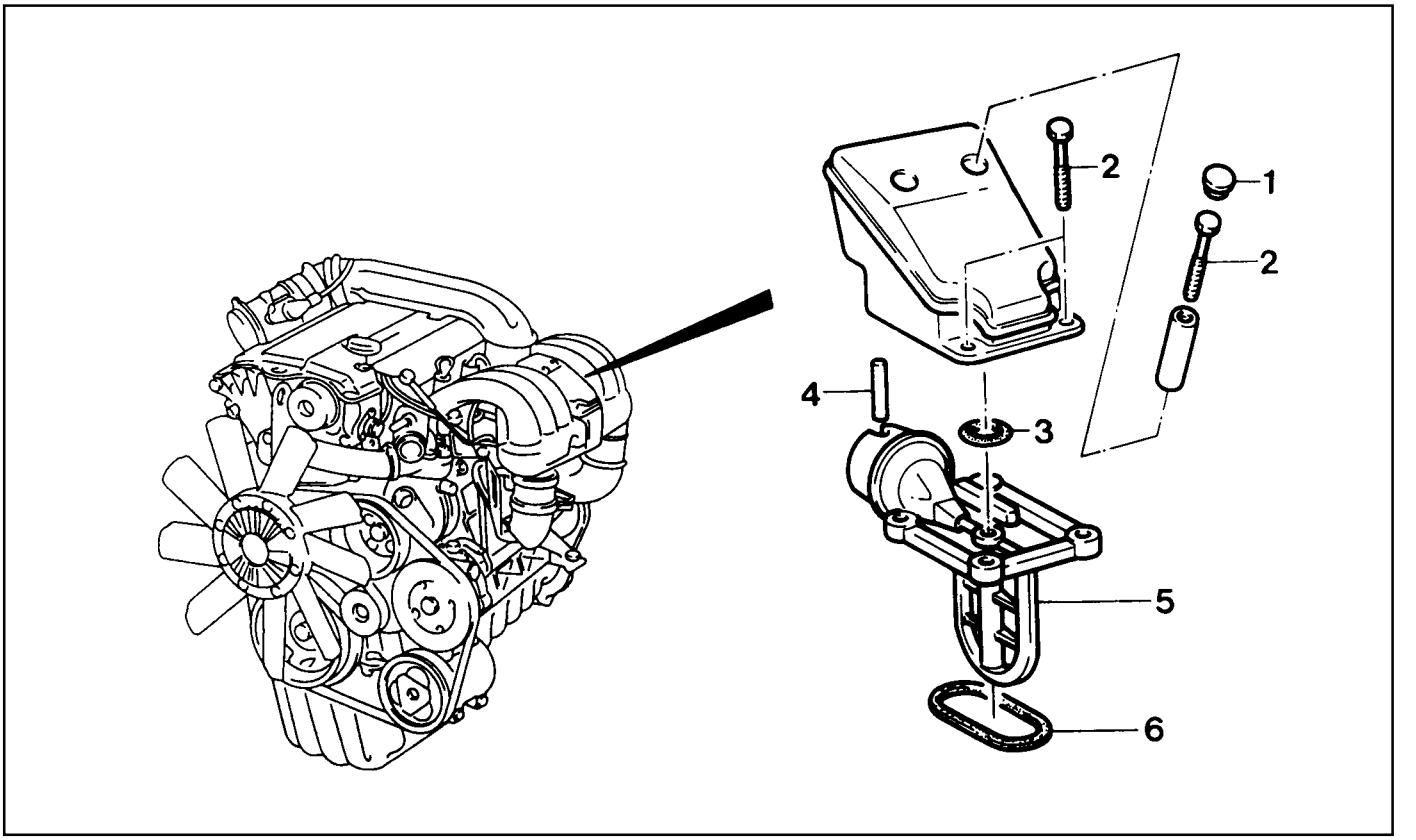
Tools Required

617 589 09 21 00 RI Sensor
617 589 10 21 00 Timing Tester
667 589 00 21 00 TDC Pulse Generator

Commercial Tools

Item		Tools
Digital Tester	With Pulse Generator	Bosch, MOT 001.03
		Hartmann & Braun, EOMT3
	Without Pulse Generator	Bosch, ETD 019.00
		Sun, DIT 9000
		ALV, Diesel - Tester 875

RESONANCE FLAP



1 Soft Cap (2)
2 Bolt (M6 x 25, 4 pieces) ..... 9-11 Nm
3 O-ring
4 Vacuum Hose
5 Resonance Flap
6 Gasket ..... Replace

Removal & Installation Procedure

1. Remove the 2 soft caps (1).
2. Remove the upper resonance flap coupling after removing 4 bolts (2).

   Notice

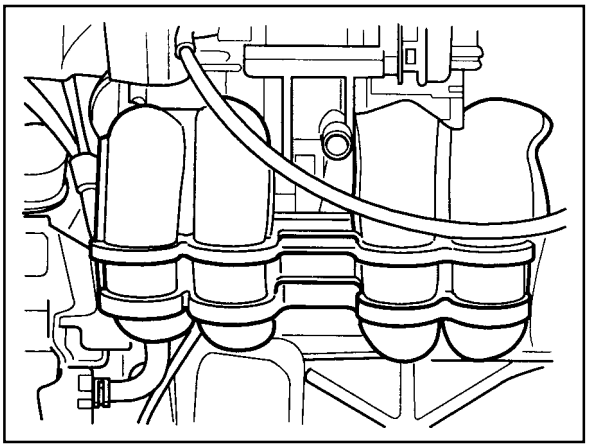
   Connect carefully the vacuum hose (4) for installation.
3. Check the O-ring (3) and replace it if necessary.
4. Remove the lower resonance flap (5).
5. Replace the gasket (6).
6. Installation should follow the removal procedure in the reverse order.

4. Unscrew the eleven nuts (4) and remove the exhaust manifold (5) and gasket (7).

   Installation Notice

Tightening Torque	31.5 - 38.5 Nm

5. Replace the gasket (7) with new one.
6. Installation should follow the removal procedure in the reverse order.



SECTION 2A

SUSPENSION DIAGNOSIS

TABLE OF CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Front	Rear
ECS Control Type		3-stage Variable Damping Force Control Type	
Shock Absorber	Max. Length (mm)	344 - 350	517 - 523
	Compressed Length (mm)	245 ± 3	331 ± 3
	Stroke (mm)	102	188

3. Road test the vehicle. If there is improvement, install the original tires to find the offending tire. If there is no a straight improvement, install good tires in place of all four offending tires.
4. Install original tires one at a time to find the offending tire.

RADIAL TIRE LEAD/PULL

Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel. Lead is usually caused by:

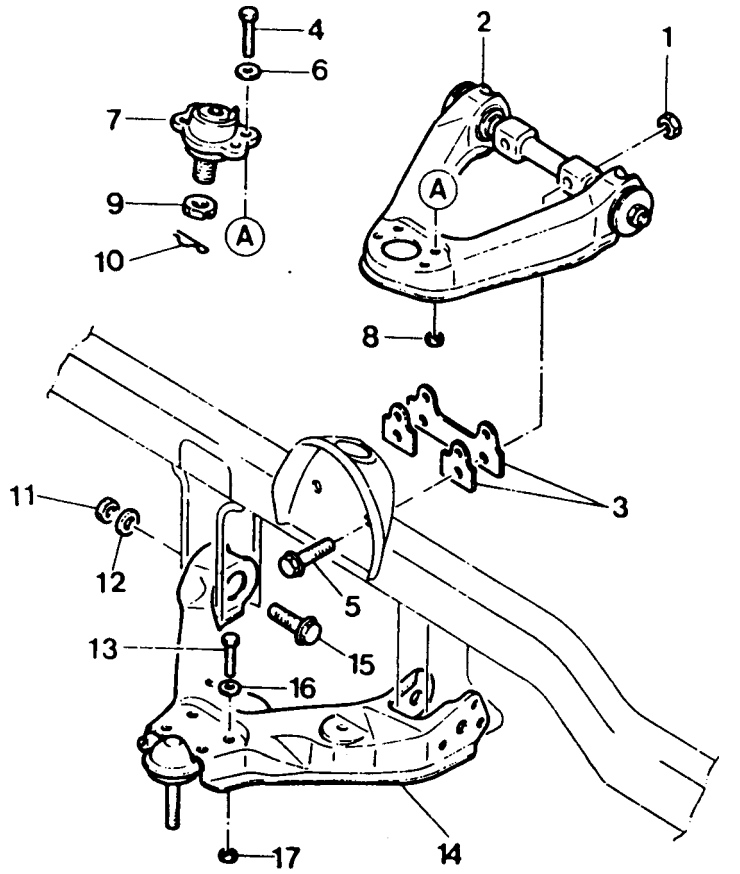
- Incorrect alignment.
- Uneven brake adjustment.
- Tire construction.

The way in which a tire is built can produce lead/pull in the vehicle.011-center belts on radial tires can cause the tire to develop a side force while the vehicle rolls straight down the road. If one side of the tire has even a little larger diameter than the diameter of the other side, the tire will tend to roll to one side. Unequal diameters will cause the tire to develop a side force which can produce vehicle lead/pull.

The radial lead/pull diagnosis chart should be used to determine whether the problem originates from an alignment problem or from the tires. Part of the lead diagnosis procedure calls for tire rotation that is different from the proper tire rotation pattern. If a medium- to high-mileage tire is moved to the other side of the vehicle, be sure to check for ride roughness. Rear tires will not cause lead/pull.

FRONT LOWER AND UPPER ARM

Preceding Work : Removal of the torsion bar spring
Removal of the steering knuckle and drive shaft



1 Nut ..... 120-140 Nm
2 Fulcrum Pin and Upper Arm Assembly
3 Camber/Caster Adjusting Shim
4 Bolt
5 Bolt
6 Washer
7 Upper Arm End
8 Nut ..... 16-22 Nm
9 Castle Nut ..... 80-150 Nm
10 Cotter Pin ..... Replace
11 Nut ..... 150-180 Nm
12 Washer
13 Bolt
14 Lower Arm Assembly and Lower Arm End
15 Bolt
16 Washer
17 Nut ..... 60-80 Nm

2. Remove the lower arm fixing nut from the frame.

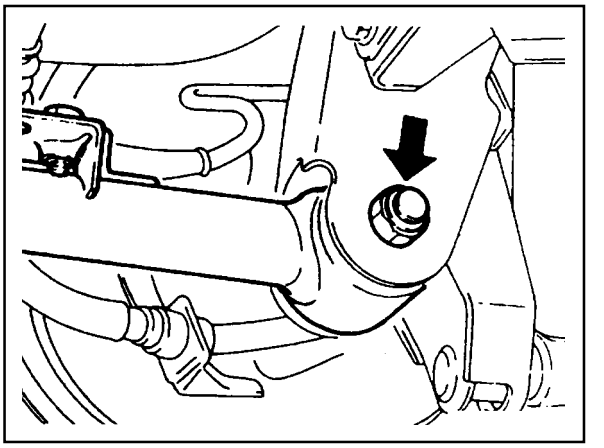
Installation Notice

Tightening Torque	150 - 180 Nm

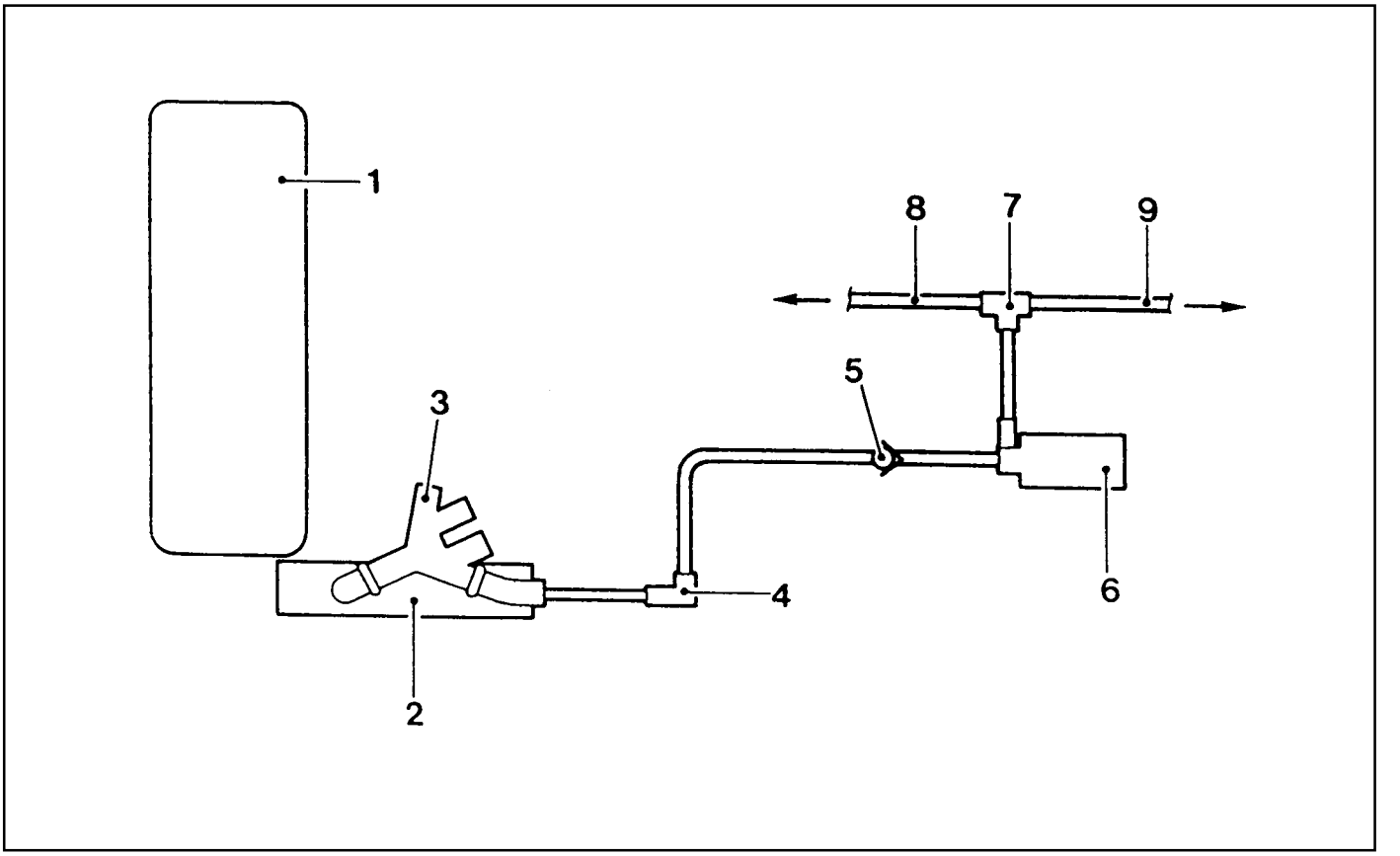
3. Remove the lower arm fixing nut from the rear axle and remove the lower arm.

Installation Notice

Tightening Torque	150 - 180 Nm



VACUUM CIRCUIT

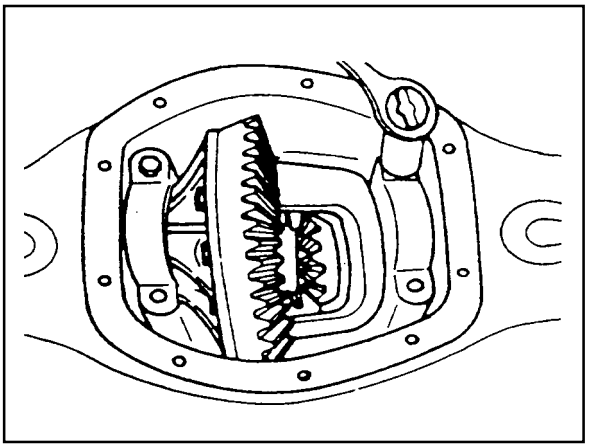


1 Engine
2 Vacuum Pump
3 3-way Connector
4 T-connector
5 Check Valve
6 Auto locking Hub Solenoid Valve
7 T-connector Hose
8 Hub Hose (left)
9 Hub Hose (right)

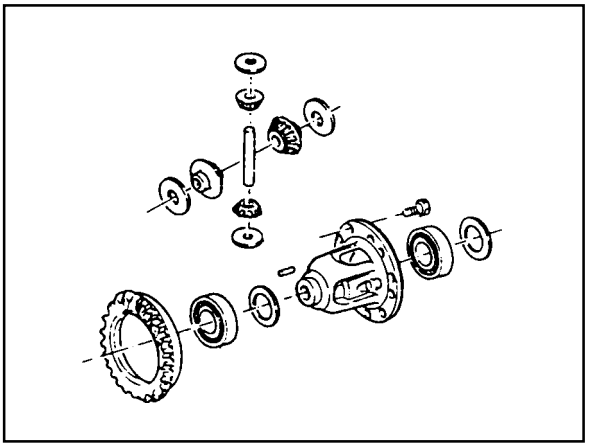
5. Unscrew the bearing cap bolts and remove the bearing caps. Pull out the differential carrier assembly.

   Notice

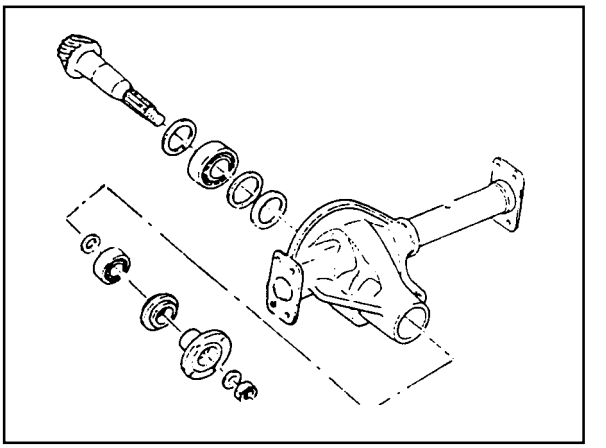
   Place alignment marks on the bearing cap not to change the caps before removal. When pulling out the differential carrier assembly, be careful not to damage the axle housing.



6. Disassemble the parts of the differential carrier assembly.

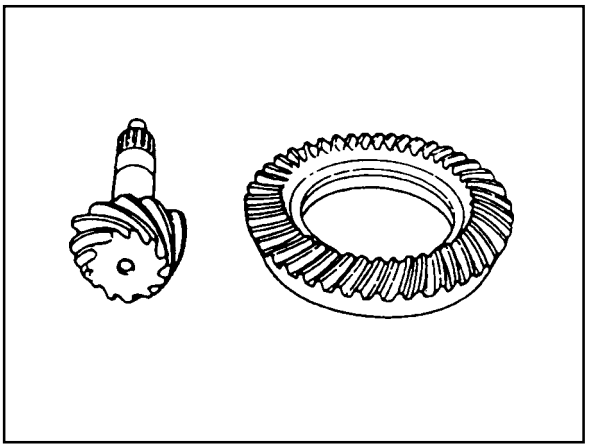


7. Remove the drive pinion lock nut. Disassemble the parts of the drive pinion.



Assembly Procedure

1. Clean the all parts and check the followings :
   - Check the ring gear and drive pinion for wear and damage. If damaged, replace it as a set.
   - Check the bearing for sticks, wear, noise and turning resistance.
   - Check the side gear, pinion, pinion shaft and thrust washer for wear and damage.
   - Check the differential carrier for crack and wear (bearing contact surface). Check the gear case for crack.



VIBRATION

Checks	Action
Faulty Connection of Sliding Joint	Adjust
Bent Propeller Shaft	Replace
Symmetry of Universal Joint Snap Ring	Adjust
Loosened Yoke Bolts	Tighten

NOISE

Checks	Action
Worn or Damaged Universal Joint Bearing	Replace
Fallen Off Universal Joint Snap Ring	Adjust or Replace
Loosened Yoke Connection	Tighten
Worn Sliding Joint Spline	Replace
Insufficient Grease	Apply as Necessary

SECTION 4A

HYDRAULIC BRAKES

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		MANDO Brake	PBR Brake
Brake Pedal	Type	Suspended	
	Pedal Ratio	4.3 : 1	4.3 : 1
	Pedal Stroke	138 mm	132 mm
	Pedal Freeplay	1 - 4 mm	
Master Cylinder	Type	Tandem Type with Lever Sensor	
	Inner Diameter	f25.4 mm	f23.81 mm
Brake Booster	Type	Vacuum Booster Type	
	Ratio	5.6 : 1	5.0 : 1
Front Brake	Type	Ventilated Disc	
	I.D. of Caliper Cylinder	f60 mm	f60.4 mm
	Thickness of Brake Pad	10 mm	
	Thickness of Disc Plate	24 mm	
Rear Brake	Type	Solid Disc	¬
	I.D. of caliper Cylinder	f38.2 mm	f40.5 mm
	Thickness of Brake Pad	10.0 mm	9.5 mm
	Thickness of Disc Plate	10.4 mm	¬
Parking Brake	Type	Rear Wheel Internal Expansion Type	
	Operation	Mechanical	
Brake Fluid	Specification	SAE J1703, DOT3	

SECTION 4B

MASTER CYLINDER

TABLE OF CONTENTS

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N·m
Master Cylinder Nut	14 - 22
Booster Nut	8 - 18

SECTION 4E

REAR DISC BRAKES

TABLE OF CONTENTS

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N·m
Caliper Mounting Bolt	85 - 105
Brake Hose	15 - 18
Caliper Bolt	20

Defect Code	Application	Description
13	Front / left INLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator.
14	Front / left OUTLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
15	Front / right INLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
16	Front / right OUTLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
17	Rear / left INLET Valve (ABD)	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
18	Rear / left OUTLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
19	Rear / right INLET Valve	● Check each valve by using SCANER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short.

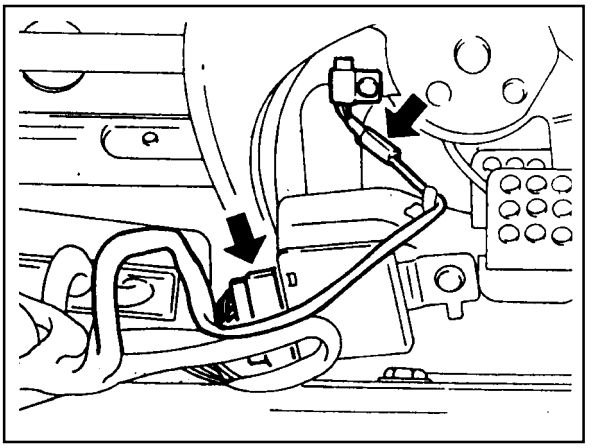
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

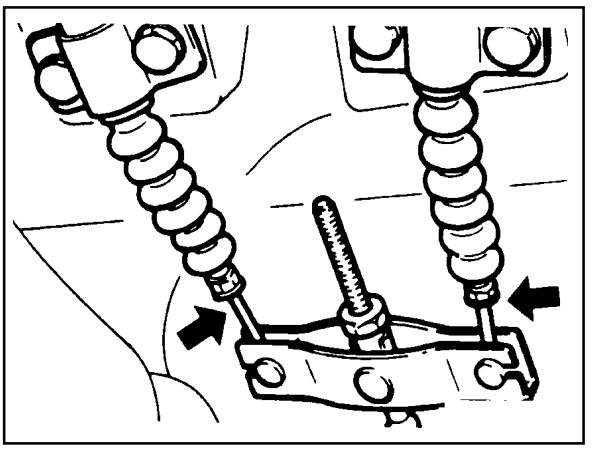
PARKING BRAKE

Removal & Installation Procedure

1. Disconnect the parking brake indicator switch connector.



2. Disconnect the right and left cable from equalizer while parking brake lever is released.



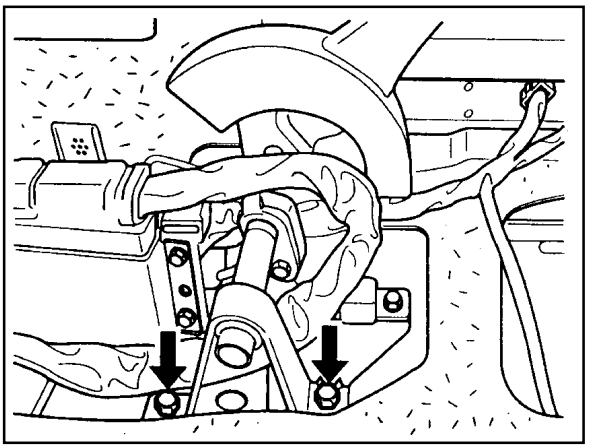
3. Unscrew 8 bolts and remove the parking brake lever assembly.

Installation Notice

Tightening Torque	8 - 18 Nm

Notice

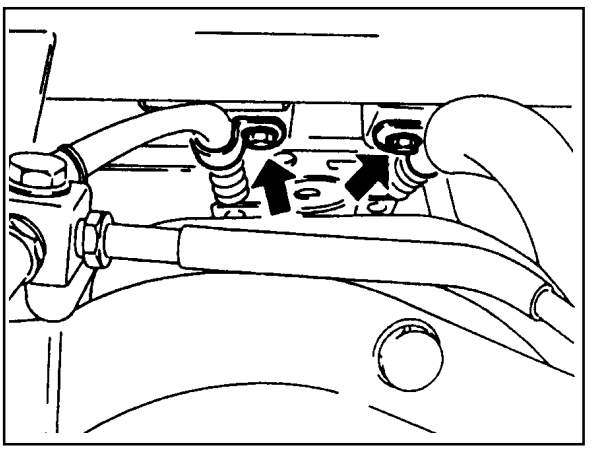
Tighten the bolts with sequence number while the lever is pulled up 4 to 6 notches.



4. Unscrew the frame and lower arm side cable mounting bracket bolts.

Installation Notice

Tightening Torque	8 - 18 Nm



E32 NORMAL MODE

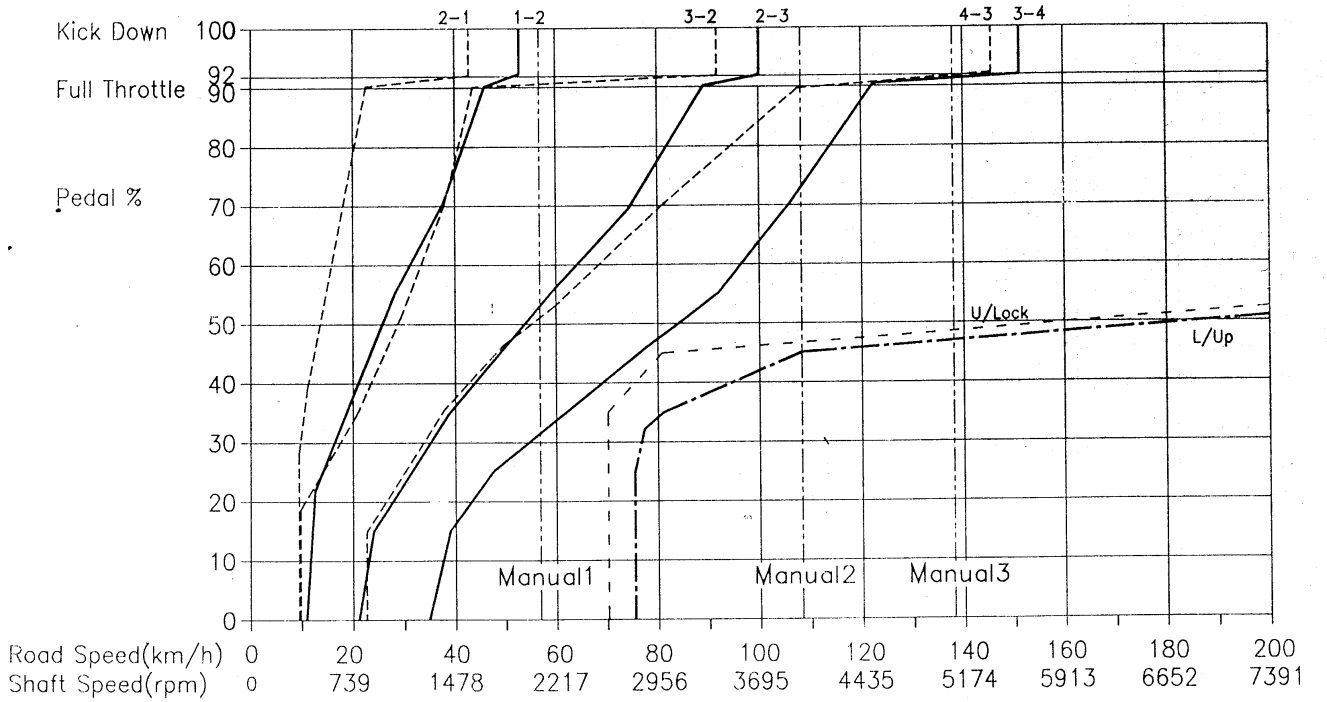


Table 3.3 - Readings for Resistance/Shift Lever Positions

Shift Lever Position	Resistance (OHMS)
Manual 1	1k - 1.4k
Manual 2	1.8k - 2.2k
Manual 3	3k - 3.4k
Drive	4.5k - 4.9k
Netural	6.8k - 7.2k
Reverse	10.8k - 11.2k
Park	18.6k - 19k

Diagnostics Inputs

The diagnostics control input or K-line is used to initiate the outputting of diagnostics data from the TCU to a diagnostic test instrument. This input may also be used to clear the stored fault history data from the TCU's retentive memory. Connection to the diagnostics input of the TCU is via a connector included in the vehicle's wiring harness or computer interface. Refer to the vehicle manufacturer's manual for the location of the self test connectors.

Battery Voltage Monitoring Input

The battery voltage monitoring input connects to the positive side of the battery. The signal is taken from the main supply to the TCU.

If operating conditions are such that the battery voltage at the TCU falls below 11.3V the transmission will adopt a 'low voltage' mode of operating in which shifts into first gear are inhibited. All other shifts are allowed but may not occur because of the reduced voltage. This condition normally occurs only when the battery is in poor condition.

When system voltage recovers, the TCU will resume normal operation after a 3 second delay period.

TCU Outputs

The outputs from the TCU are supplied to the components described below:

Solenoids

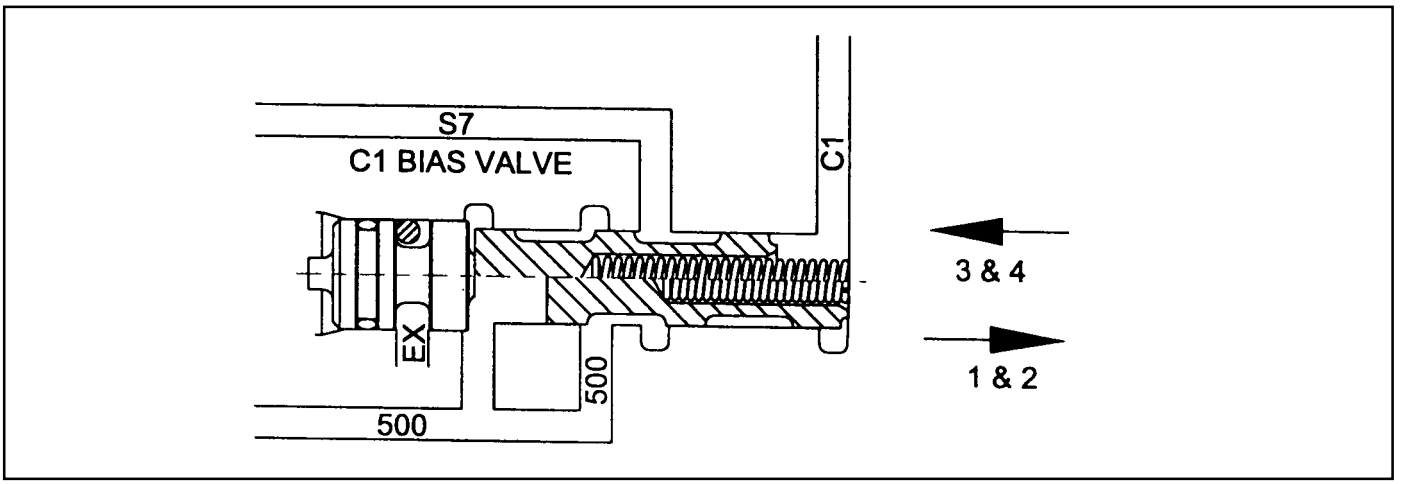
The TCU controls seven solenoids. Solenoids 1 to 6 (S1 to S6) are mounted in the valve body, while Solenoid 7 (S7) is mounted in the pump cover. The normal state (OPEN/CLOSED) and the functions associated with the solenoids are detailed in table 3.4. Table 3.5 details the S1 and S2 logic for static gear states. The logic during gear changes for S1 to S4 and S7 is detailed in table 3.6.

C1 Bias Valve

The C1 bias valve (refer figure 3.22) ensures that the converter lock-up clutch is only applied in third and fourth gears. It uses C1 clutch oil pressure as the switching signal since C1 is only applied in third and fourth gears.

Line to 500 oil is routed through the C1 bias valve to S7. The C1 bias valve therefore acts as a safety feature to ensure drivability in the event of S7 failure.

Figure 3.22- C1 Bias Valve



B1R Exhaust Valve

The B1R exhaust valve (refer figure 3.23) is a two position spring loaded valve located in the transmission case directly adjacent to the front servo. It permits the servo release oil to be rapidly exhausted into the transmission case during application of the front band (B1). This prevents the need to force the oil back from the front servo through the valve body and through the 3-4 shift valve. The spring positions the valve to prevent oil entering the release area of the servo until the B1R circuit oil pressure reaches approximately 100 kPa.

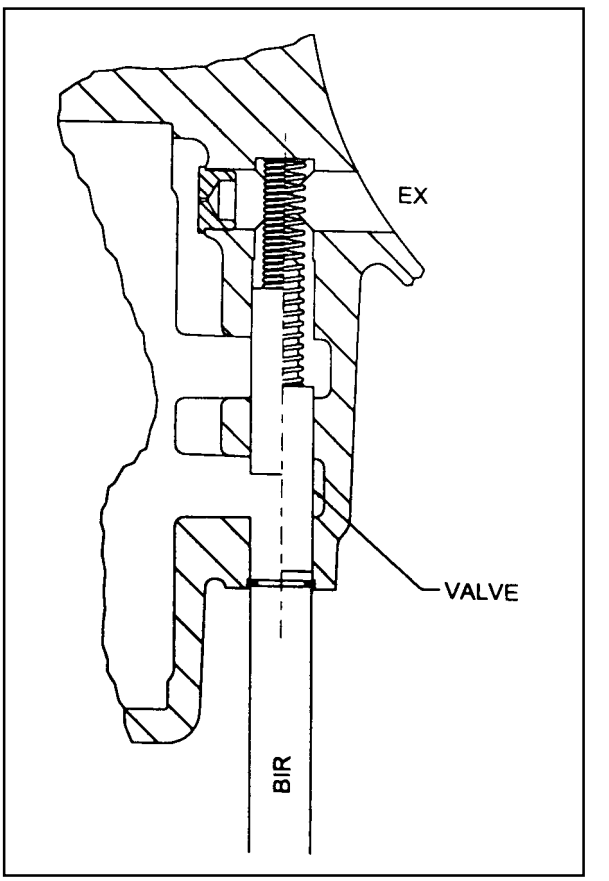
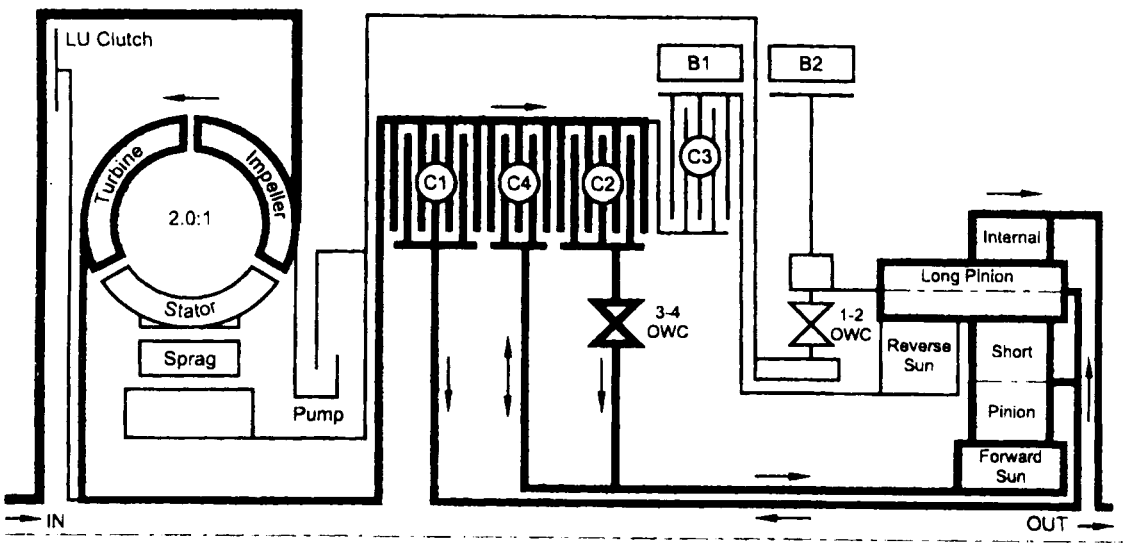


Figure 3.23 - B1R Exhaust Valve


LU Clutch
Turbine
Impeller
2.0:1
Stator
Sprag
Pump
B1
B2
C1
C4
C2
C3
3-4
OWC
1-2
OWC
Internal
Long Pinion
Reverse
Sun
Short
Pinion
Forward
Sun
IN
OUT

MECHANICAL TESTS

In Vehicle Transmission Checks

Carry out the following tests before removing the transmission.

- See Checking Transmission Fluid Level, Section 7.2.1.
- Check that the transmission oil is not burnt (colour and smell are correct).
- Ensure that the transmission is not in limp home mode (LHM).
- Check that the battery terminals and the earth connections are not corroded or loose.
- Check the engine stall speed is within the handbook value.
- Check that the cooler flow is not restricted.
- Check that all electrical plug connections are tight.
- Carry out a road test to confirm the symptoms, if necessary.
- Inspect the oil, ensure that there are no metal or other contaminants in the oil pan.

Diagnosing Oil Leaks

Determine the source of oil leaks by firstly cleaning down the affected area, then driving the vehicle.
Inspect the seals to confirm the source of the leak.

- To determine the source of a rear servo oil leak, raise the vehicle on a hoist, then carry out a reverse stall.
- To determine the source of a front servo leak, raise the vehicle on a hoist, then run the vehicle in second gear.

Troubleshooting Charts

The troubleshooting charts are set out as follows:

- Table 6.2.1 Drive Faults,
- Table 6.2.2 Faulty Shift Patterns.
- Table 6.2.3 Shift Quality Faults.
- Table 6.2.4 After Teardown Faults.

Table 6.2.1 - Drive Faults

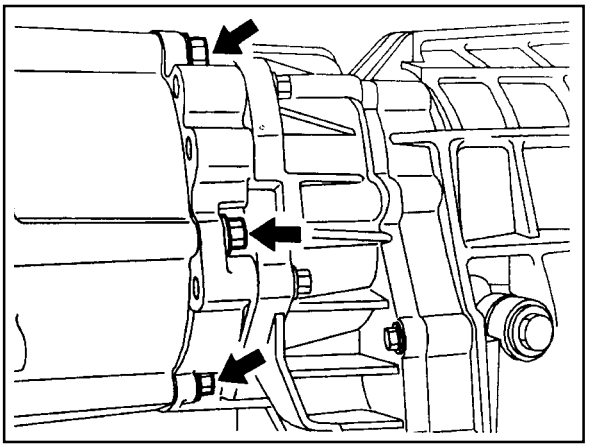
Symptom	Possible Cause	Action
No Drive in D	Insufficient auto transmission fluid.	Check the fluid level. Top up as necessary.
	Blocked feed in C1/C2 cylinder.	Inspect and clean C1/C2 feed.
	'Z' link displaced.	Reinstall/renew the 'z' link.
	Primal regulator valve (PRV) jammed open.	Remove, clean and re-install the PRV.
	Overdrive shaft or input shaft seal rings failed.	Inspect and replace as necessary.
	3-4 or 1-2 one way clutch (OWC) installed backwards or failed.	Inspect and replace as necessary.
	C2 piston broken or cracked.	Inspect and replace as necessary.
No Drive in Reverse		
No engine braking in Manual 1	Rear band or servo faulty.	Check servo adjustment or replace rear band as necessary.
Engine braking in Manual 1 is OK	Failure in C3, C3 hub or C1/C2 cylinder.	Check for failure in C3, C3 hub or C1/C2 cylinder. Repair as necessary.
No drive in Drive and Reverse	Jammed primary regulator valve (PRV).	Inspect and clean PRV.
	Damaged/broken pump gears.	Inspect and replace pump gears as necessary.
	Dislodged output shaft snap ring.	Inspect and repair as necessary.

7. Remove the rear propeller shaft.

   Installation Notice

Tightening Torque	70 - 80 Nm

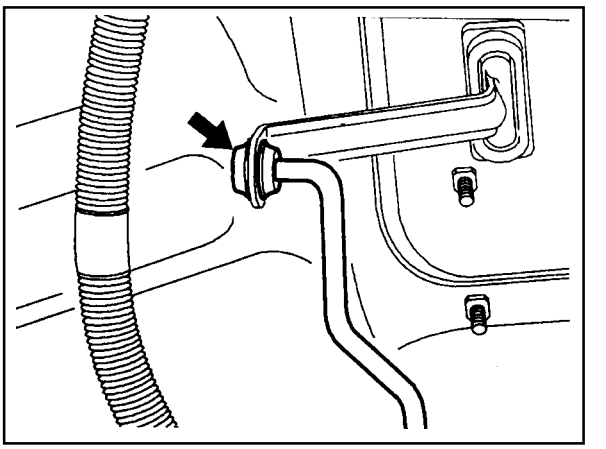
8. Unscrew the five bolts and remove the transfer case.
9. Disconnect the 10-Pins Plug connector from transmission.



10. Separate the locking clip on shift lever and remove the shift rod.

    Notice

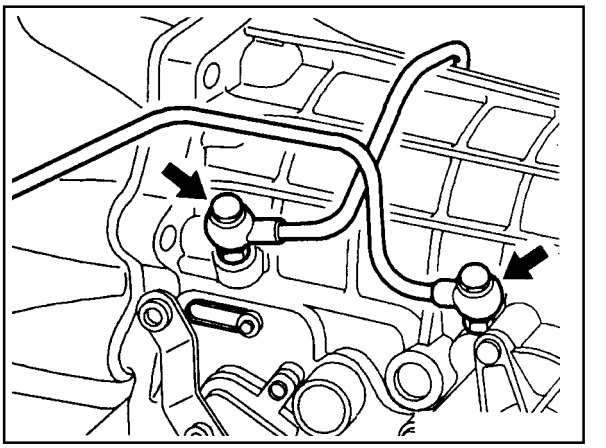
    Removal and installation performed when the shift procedure should be lever is in “D” range.



11. Remove the two pipes for oil cooler.

    Installation Notice

Tightening Torque	24.5 - 34.3 Nm

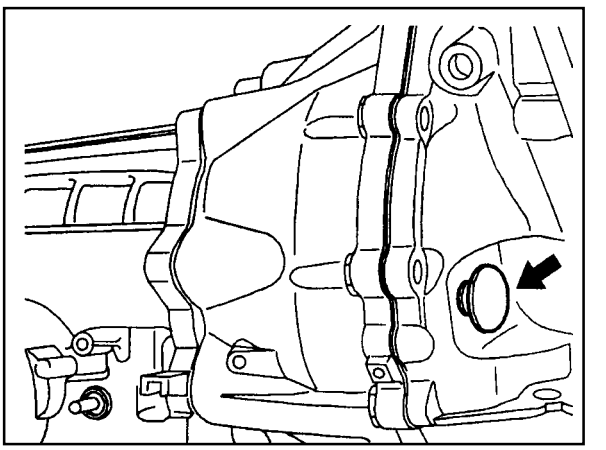


12. Remove the service hall cover on torque converter.
13. Put the alignment mark for installation, and unscrew the six mounting bolts for torque converter from drive plate through the service hole (arrow) by rotating the engine and remove the torque converter.

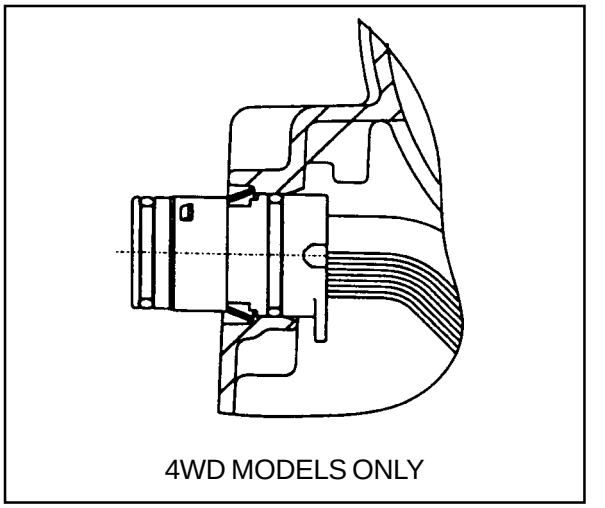
    Installation Notice

Tightening Torque	42 Nm

    Screw the six bolts mounting the torque converter through the service hole by using a mirror and rotating the engine.



20. Install the ten pin connector in the case engaging the tangs on the connector in the notches in case.



4WD MODELS ONLY

21. Route the portion of the wiring loom coming out of the case down between the inhibitor switch and the case. Position the ten pin plug on the wiring loom bracket .

7. Coat the small nylon thrust spacer with petroleum jelly and install it over the overdrive shaft. Refer to figure 8.19.
8. Carefully fit the overdrive shaft into the C1 cylinder so as not to damage the sealing ring.
9. Fit the small bronze C1 hub thrust washer in place with petroleum jelly. Refer to figure 8.19.
10. Check the input shaft for any defect. Fit the input shaft into the cylinder and secure it with the circlip, ensuring that the circlip is completely seated in the groove.
11. Coat the sealing rings with petroleum jelly and fit onto the input shaft.
12. Assemble the C1/C2/C4 clutch assembly to the C3 clutch and sun gear assembly. Refer to figures 8.32 and 8.33.
13. Install this assembly in the transmission case.

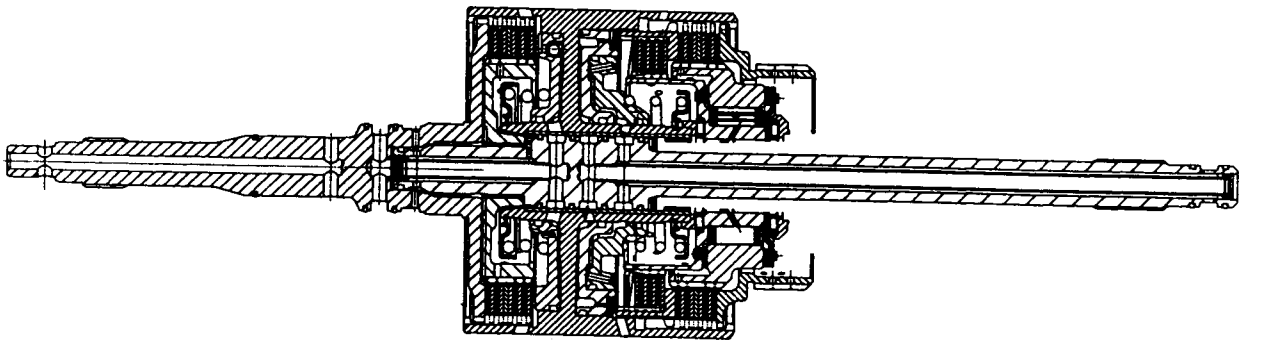


Figure 8.32 - C1, C4 and C2 Clutch

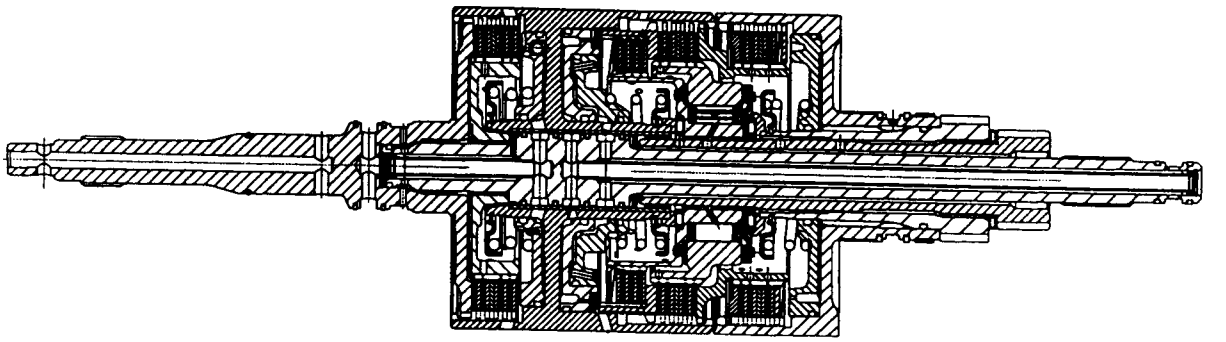
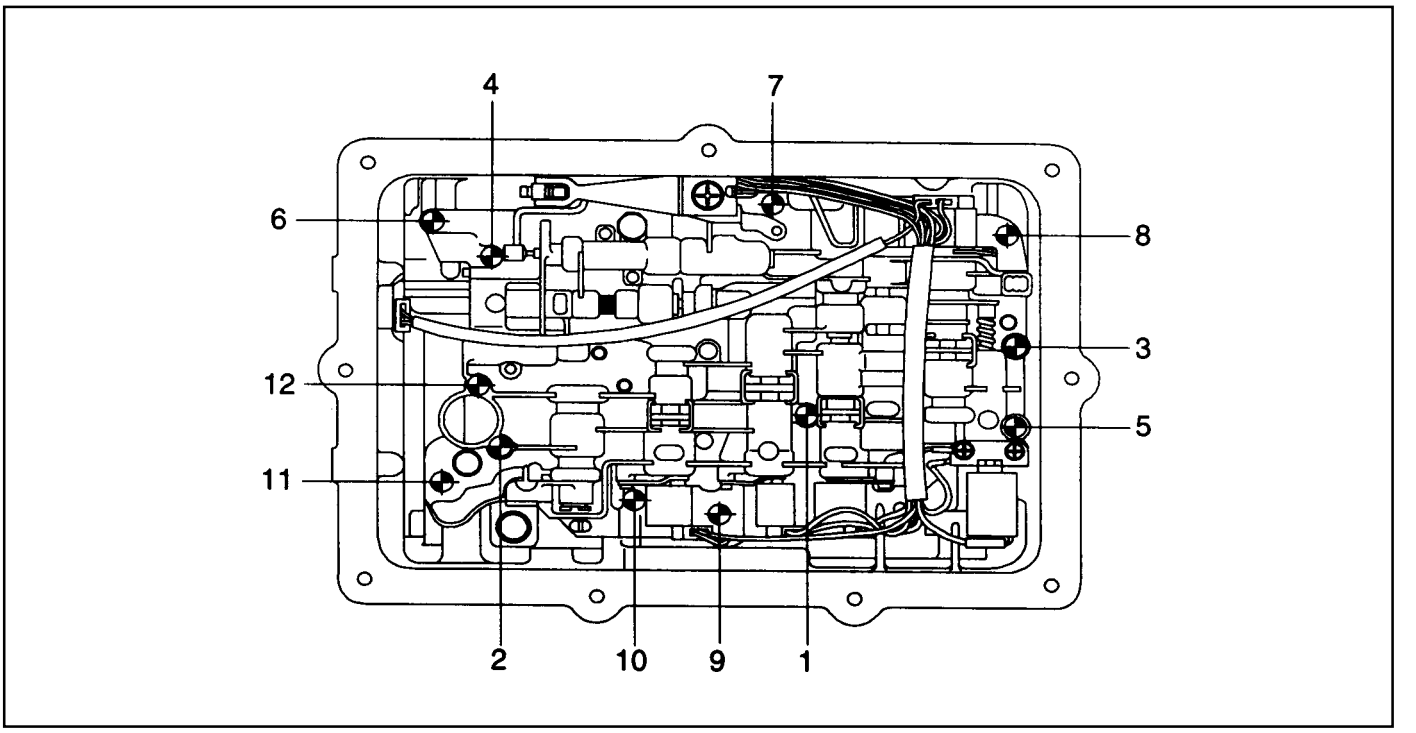


Figure 8.33 - C1, C4, C2 and C3 Clutch

30. Align the valve body assembly on the transmission case and install the manual valve lever to manual valve link. Fit the long end of the link to the manual valve first. Install the securing bolts and tighten to specification in the specified sequence. Refer to figure 8.61.

Figure 8.61 - Tightening Sequence Valve Body to Case

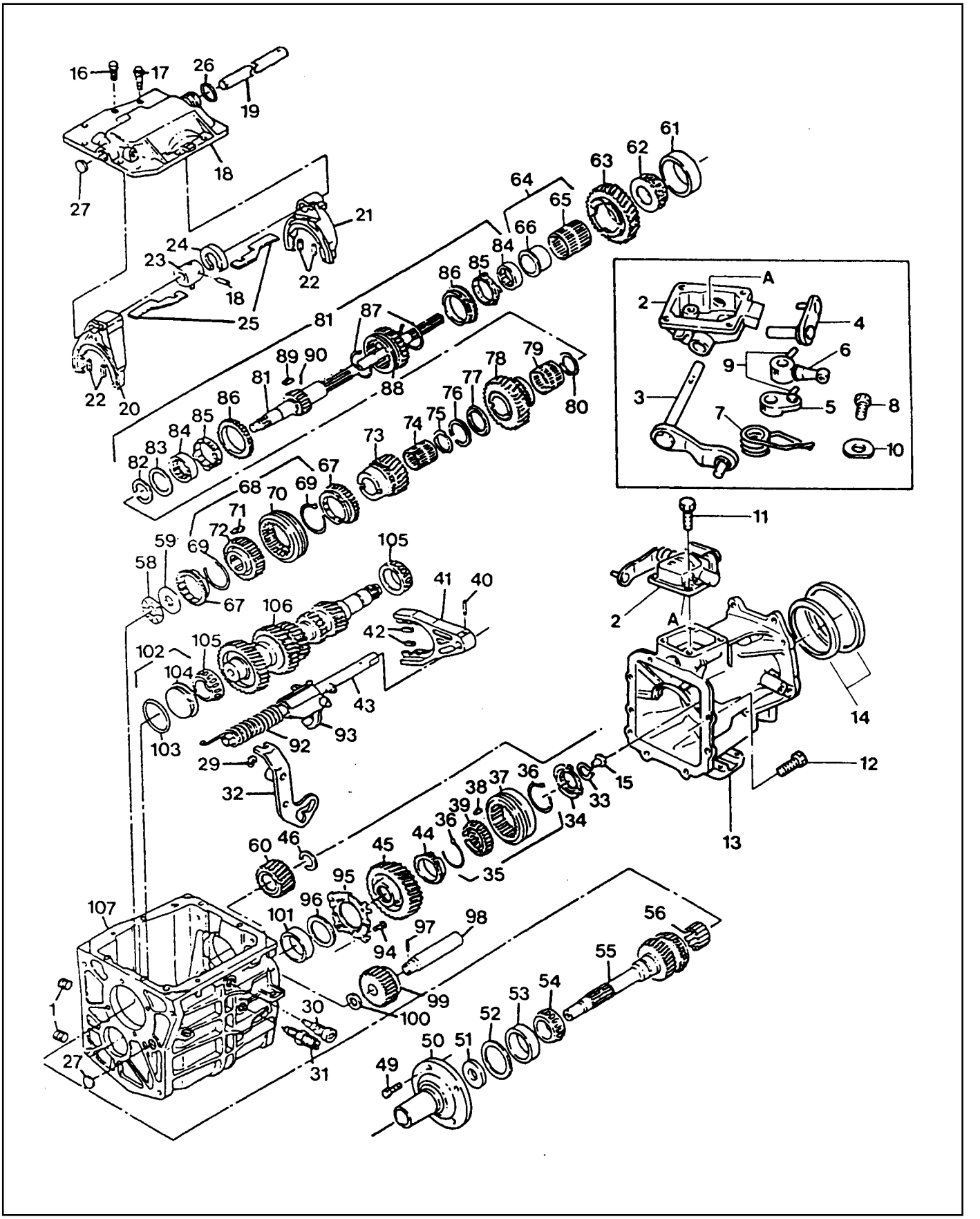


31. Check the alignment of the detent roller and the manual lever quadrant.
32. Connect the solenoid wiring as detailed below:
    - Solenoid 1 - red
    - Solenoid 2 - blue
    - Solenoid 3 - yellow
    - Solenoid 4 - orange
    - Solenoid 5 - green
    - Solenoid 6 - violet (Refer to figure 8.62.)

    Notice

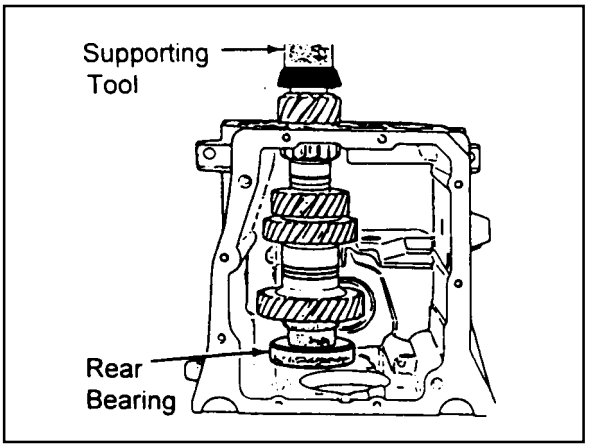
    All hardware must be correctly installed and torqued to specification.

COMPONENT LOCATOR



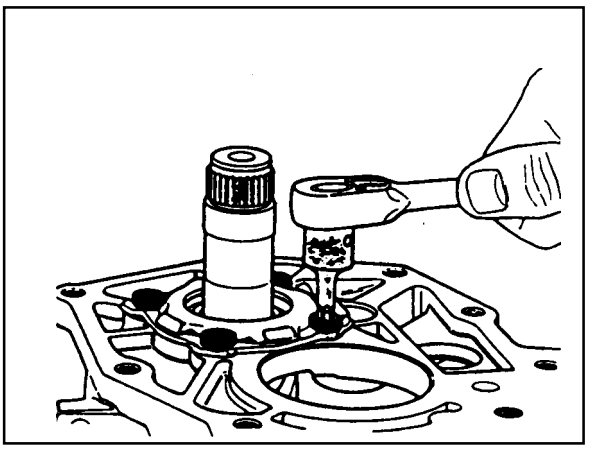
Assembly Procedure

1. Using a hydraulic press and a supporting tool, press the counter shaft rear bearing into the case. Be sure that the supporting tool inside of the case should support the counter shaft.

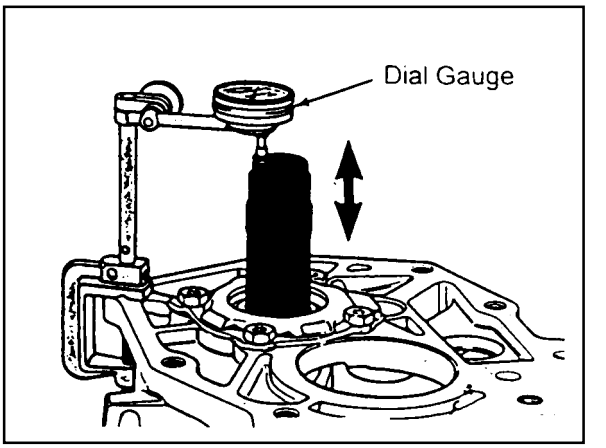


2. Without the shim, install the retainer and counter shaft rear bearing outer race. Tighten the 4 retainer bolts.

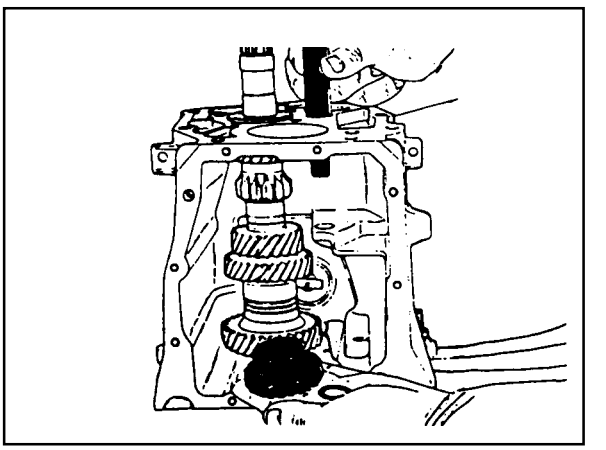
Tightening Torque	20 Nm



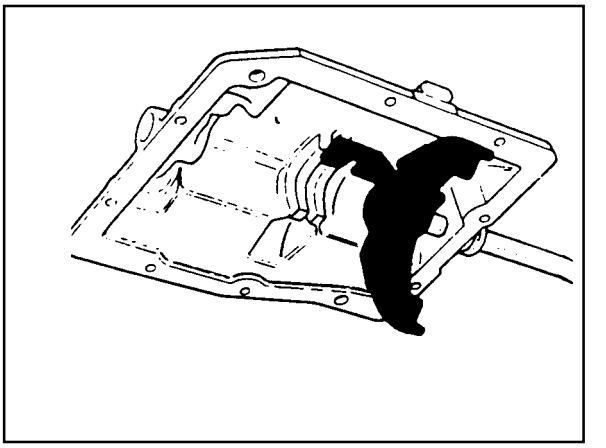
3. Place a dial indicator on the case and measure counter shaft end play by moving up and down.



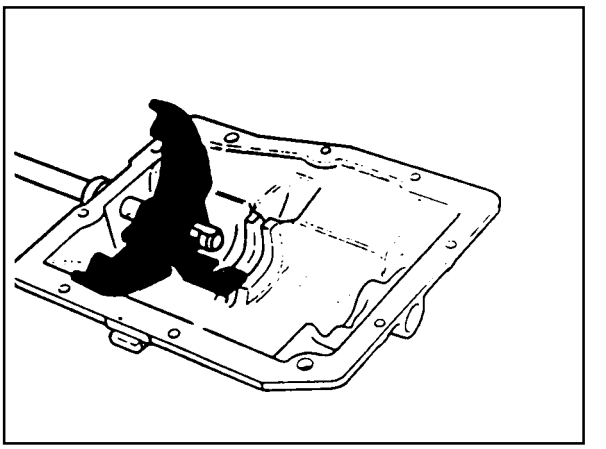
4. Select a shim which is the same thickness as the indicator rearing (up to 0.004 inch) and assemble it.
5. When the end play is correctly adjusted, remove the counter shaft rear bearing retainer and outer race.
6. Using a pin punch and rubber hammer, install the reverse idler shaft, gear and O-ring.



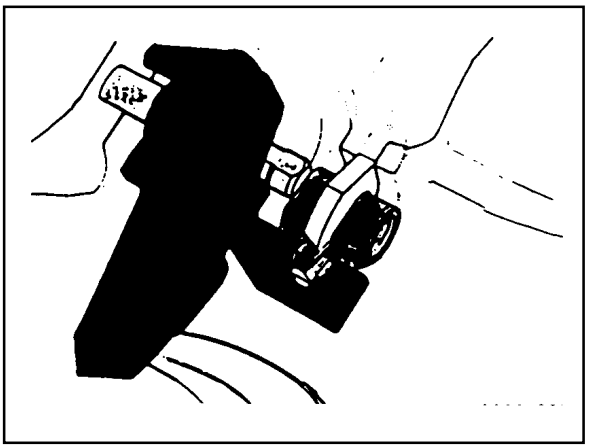
- Install the 1-2 shift fork and its selector plate.



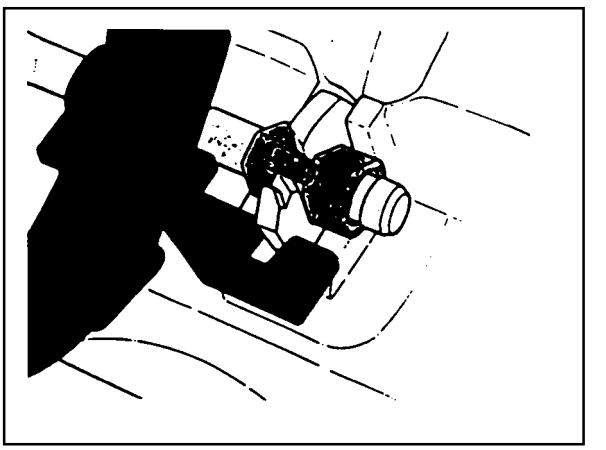
- Push the shift shaft through the 1-2 shift fork.



- Place the selector arm and interlock plate in the cover Note the position of the interlock plate and selector arm.



- Push the shift shaft through the 3-4 shift fork.



DIFFICULT PEDAL OPERATION

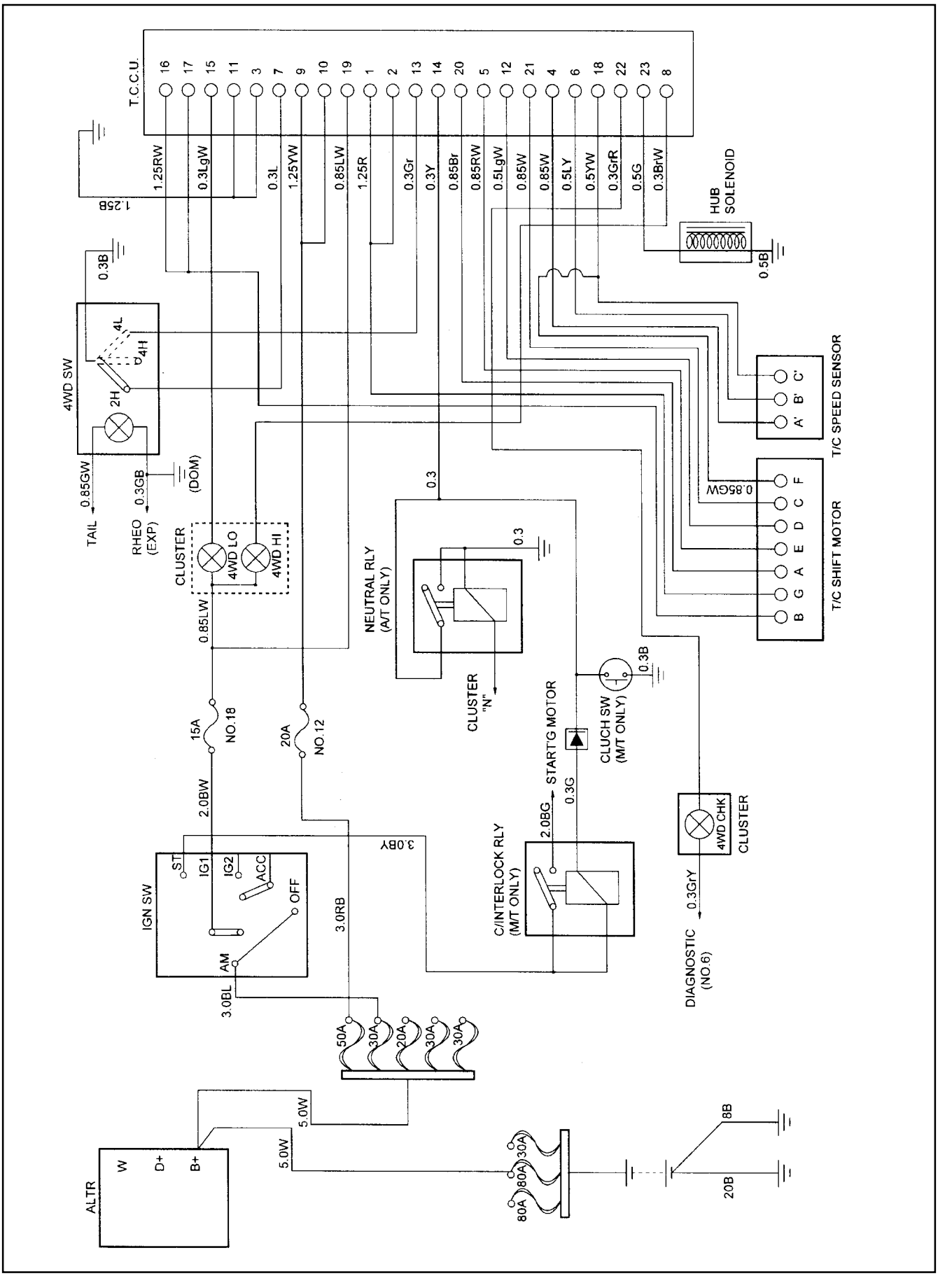
Checks	Action
Poor Lubrication on Clutch Cable	Lubricate or Replace
Poor Lubrication on Pedal Shaft	Lubricate or Replace
Poor Lubrication on Clutch Pedal	Repair

CLUTCH NOISY

Checks		Action
Not Using the Clutch	Insufficient Clutch Pedal Freeplay	Adjust
	Excessive Wear of Facing	Replace
After Disengagement	Worn or Damaged Release Bearing	Replace
When Disengaging	Poor Lubricationon Contact Surface of Bearing	Replace
	Faulty Installation of Clutch Assembly or Bearing	Repair
Clutch pedal is partially depressed and vehicle speed is reduced	Damaged Pilot Bushing	Replace

SCHEMATIC AND ROUTING DIAGRAM

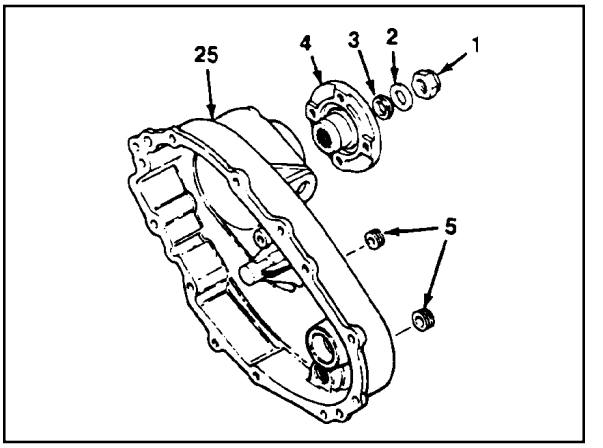
PART TIME TRANSFER CASE - 4408



Disassembly Procedure

<Companion Flange>

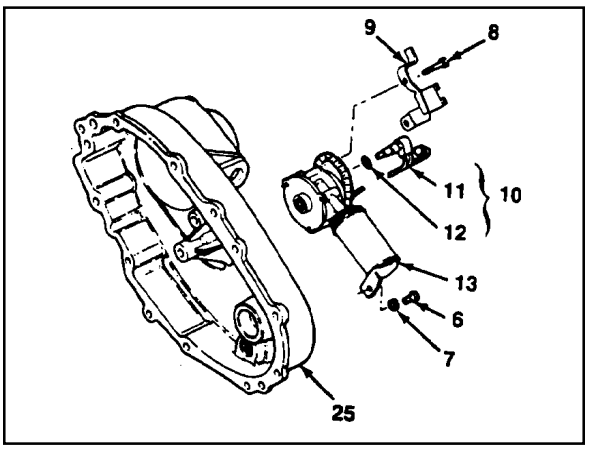
1. Holding the companion flange, remove the nut and washer and then remove the companion flange and oil seal.
2. Remove the 2 plugs from the cover.



1 Nut
2 Washer
3 Oil Seal
4 Companion Flange
5 Plug
25 Cover

<Extension Electric Shift>

1. Remove the bolt, washer,3 bolts and harness bracket.
2. Remove the sensor assembly and remove the O-ring from the speed sensor.
3. Remove the motor assembly.



6 Bolt
7 Washer
8 Bolt
9 Sensor and Harness Bracket
10 Sensor Assembly
11 Speed Sensor
12 O-ring
13 Motor Assembly
25 Cover

Oil Pump

1. Install the pump front cover to be the ‘TOP’ mark down and turn the cover to be the ‘TOP’ mark up when installed in vehicle.
2. Install the 2 pump pins and spring to the output shaft.

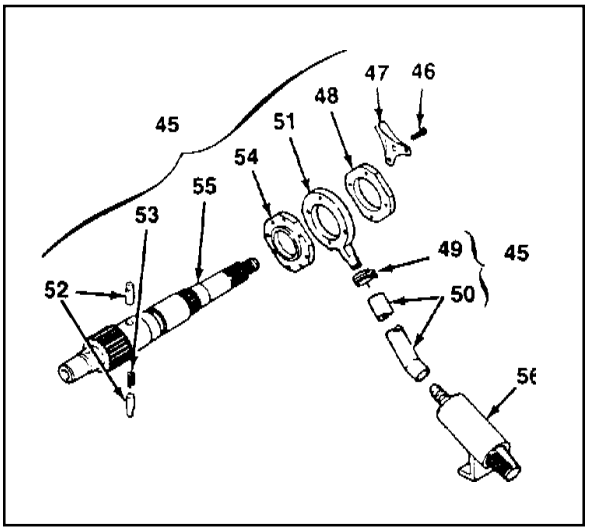
   Notice

   Flat surface of the pins must point out and align the center line of pins and spring.
3. Connect the hose coupling to the strainer coupling and install the strainer foot into the transfer case slot.

   Notice

   The hose coupling must face the pump assembly.
4. Install the pump housing to be the 'REAR' mark up and seat the 2 pump pins inside of the pump housing by moving pump pins inward and compressing the spring.
5. Tighten the hose to pump housing by hose clamp.
6. Position the pump rear cover to be the ‘TOP REAR’ mark up and located at the top of transfer case when installed in vehicle. Position the pump retainer on the cover so that tab on the retainer is in notch in the transfer case. Apply Loctite to the bolts and tighten the bolts with turning the output shaft by hand to make the pump pins move freely.

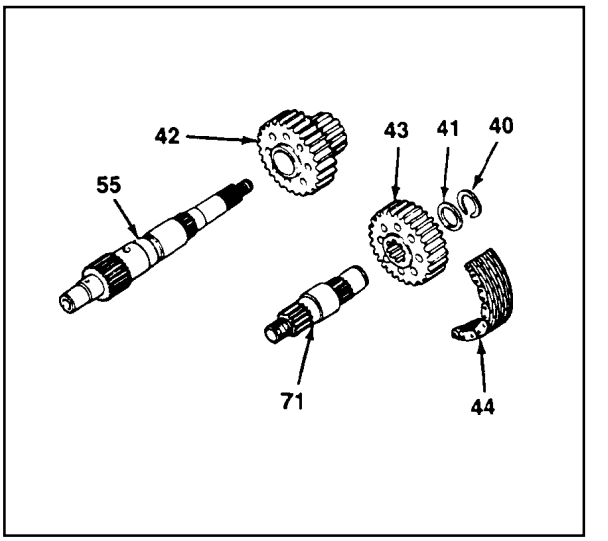
Tightening Torque	4 - 8.5 Nm



45 Shaft and Pump Assembly
46 Bolt
47 Pump Retainer
48 Rear Pump Cover
49 Hose Clamp
50 Hose Coupling
54 Pump Housing
52 Pump Pin
53 Spring
54 Front Pump Cover
55 Output Shaft
56 Strainer

Drive Chain

1. Position the drive sprocket to the rear output shaft end and driven sprocket to the front output shaft end.
2. Install the drive chain onto the sprocket.
3. Holding each sprocket to be the drive chain tight and parallel with transfer case, install the drive chain assembly to the output shafts.
4. Rotate the driven sprocket slightly to engage splines on the front output shaft.
5. Install the spacer to the front output shaft and insert the snap ring into the shaft groove over spacer.



40 Snap Ring
41 Spacer
42 Drive Sprocket
43 Driven Sprocket
44 Drive Chain
55 Output Shaft (Rear)
71 Output Shaft (Front)

Position Sensor Interpretation

1. When the module powers up, it will read the position sensor and the 4H/4L switch input and respond to the possible codes as follows

4H/4L Switch Input	Motor Position	Action
4H	Left Stop	No action required. 4L bulb off.
4H	Left of High	No action required. 4L bulb off.
4H	High	No action required. 4L bulb off.
4H	Right of High	Blink 4L bulb. After the shift conditions are met, attempt a shift to 4H under conditions of below 87 rpm in front and rear propshaft and “Neutral” position. After succesfully shifting into 4H, stop blinking 4L bulb.
4H	Zone 1	Same as above
4H	Neutral	Same as above
4H	Zone 2	Same as above
4H	Low	Same as above
4H	Right Stop	Same as above
4L	Left Stop	Blink 4L bulb. After the shift conditions are met, attempt a shift to 4L. After succesfully shifting into 4L, stop blinking 4L bulb.
4L	Left of High	Same as above
4L	High	Same as above
4L	Right of High	Same as above
4L	Zone 1	Same as above
4L	Neutral	Same as above
4L	Zone 2	Same as above
4L	Low	No action required. 4L bulb on.
4L	Right Stop	No action required. 4L bulb on.

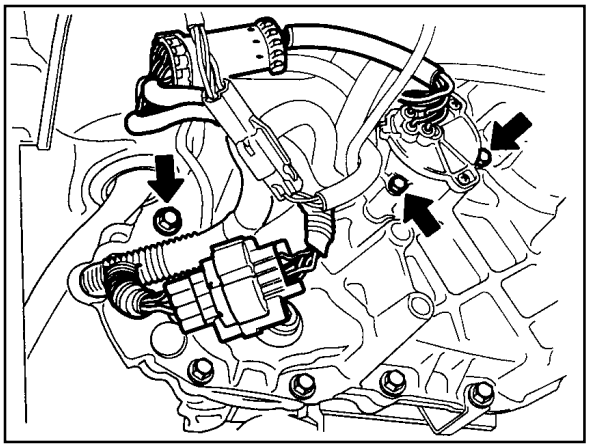
2. A command to shift will only be acted upon if the TCCU is reading a valid code at the time the command to shift is made.
3. After a shift has started, the TCCU will power the shift motor until the code for the requested position is read. If an invalid code is read, the TCCU will go into a default mode.
4. During a shift attempt, the shift motor will be energized for a maximum of 5 seconds.

Error of signal in engine throttle position ; fault code 1715, 1716

- **Phenomenon**
  1. Upon diagnosis by SCAN-100, it display on 1715, 1716 codes.
- **Cause**
  1. Bad communication line between E/G ECU and CAN.
  2. Defect of TOD control unit.
  3. Defect of E/G ECU.

Test Stage / Contents		Result	Countermeasure
Stage	**Test Contents and Procedure**	**Specified Value /Yes/No**	
B1	Check connection status of connector through CAN communication line.		
	1. Check connection of connector. - Does connector connect correctly between TOD control unit and E/G ECU? 2. In case of bad connection, connect correctly then perform the follows ; a. Delete the memorized fault code using SCANNER. b. Ignition “OFF”. c. Ignition “ON”. d. Diagnose by SCANNER. - Does it display fault codes “1715” or “1716”.	Yes No Yes No	Perform B2 stage Perform B1-2 stage Perform B2 stage Normal system
B2	Check connection status of CAN communication line towards E/G ECU.		
	1. Ignition “OFF”. 2. Disconnect 30 pin connector towards TOD control unit. 3. Measure resistance between pin No.22 and 23 in wiring connector using multi-tester. - Specified value - Measured value is within specified range?	115-125W Yes No	Perform B3 STAGE Perform B4 stage, check and replace E/G ECU
B3	Check connection status of CAN communication line towards TOD control unit.		
	1. Ignition “OFF”. 2. Disconnect coupling of E/G ECU (gray, 1-60 pin). 3. Measure resistance between pin No.37 and 38 in coupling using multi-tester. - Specified value - Measured value is within specified range?	115-125W Yes No	Perform B5 STAGE Replace TOD control unit

Replacement of Shift Motor



1. Disconnect (-) cable from battery.
2. Disconnect shift motor/clutch coil connector (black pin7) upper backside.
3. Unscrew 3 units of shift motor mounting bolts (M10).
4. Unscrew 1unit of bracket mounting bolt (M10).

Installation Notice

Tightening torque	9 - 11 Nm

Notice

When disconnecting shift motor and mounting bracket, it is required to unscrew 2 units of adjusting bolts (M10) form motor and bracket.

5. Keep shift motor even then pull rearward.
6. Clean connection surface of transfer case and shift motor.
7. If necessary, make a test by SCAN-100 with shift motor assembly.

Notice

Do not disassemble shift motor. If necessary, replace by shift motor assembly unit.

8. Applying sealant into connecting surface for new shift motor.
9. Installation should follow the removal procedure in the reverse order. Before installation, make sure that motor position match with mode of 4H/4L switch.

Reference

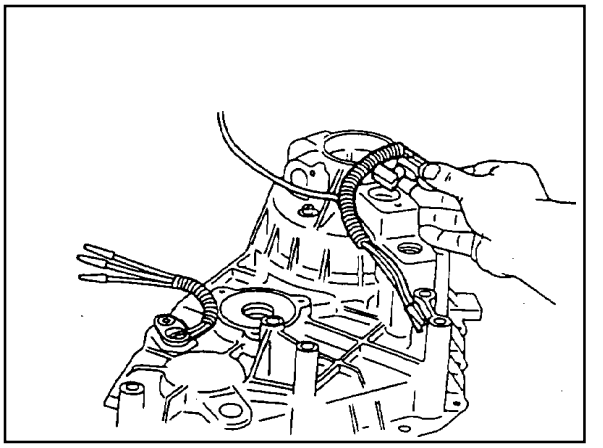
When accord position of motor with 4H/4L switch and transfer case match position of the disconnected motor and new one.

25. Install the pin on the tang end of the helical cam into the hole in the front case. Position the torsion spring tangs so that they are pointing toward the top side of the transfer case and just touching the high-low shift fork.

    CAUTION

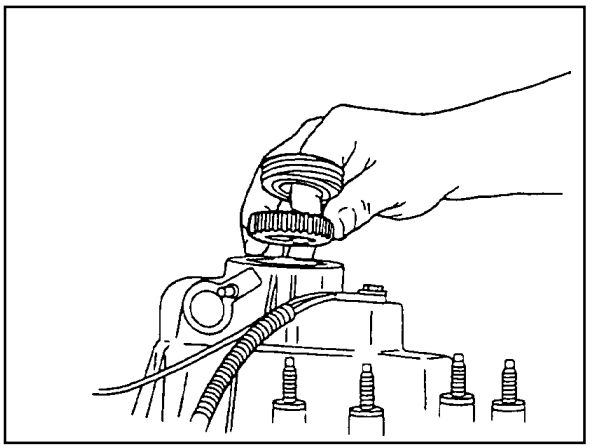
    Do not bend the helical cam during installation to the front case because of possible damage to the pin at the tang end of the motor shaft.

26. Install the shift rail through the high-low shift fork and make sure that the reverse gear shift rail is seated in the front case bore.
27. Install upper and lower speed sensors into the cover. Feed the coil wire through the upper speed sensor wire shield.



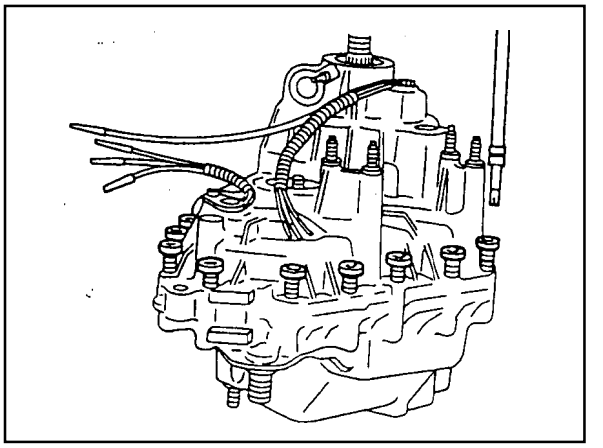
28. Install upper tone wheel, speedometer gear and rear output seal. Use Output Shaft Seal Replacer and Driver or equivalent to install seal.
29. Coat the mating surface of the front case with a bead of Black Non-Acid Cure Silicone Rubber or equivalent.
30. The following procedure must be followed prior to installing the rear case onto the front case half:
    a. Align the output shaft with the rear case output shaft bore.
    b. Align the helical cam with the rear case motor bore.

    If difficulty is encountered with seating the rear case, tap the rear output shaft with a sharp blow using a rubber mallet in a direction away from the triangular shaft while pushing down on the rear case.



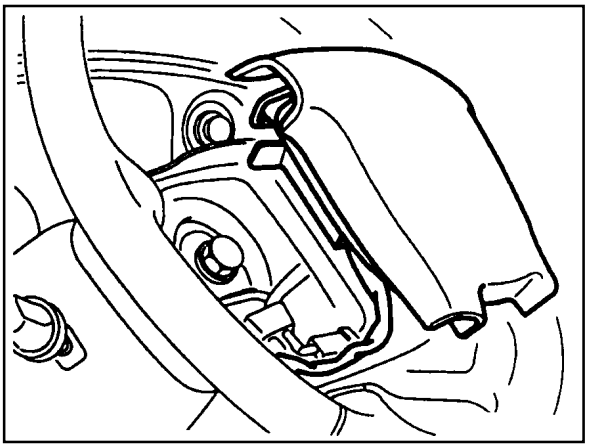
31. Install the bolts retaining the case halves and tighten.

Tightening Torque	25 - 37 Nm



Removal & Installation Procedure

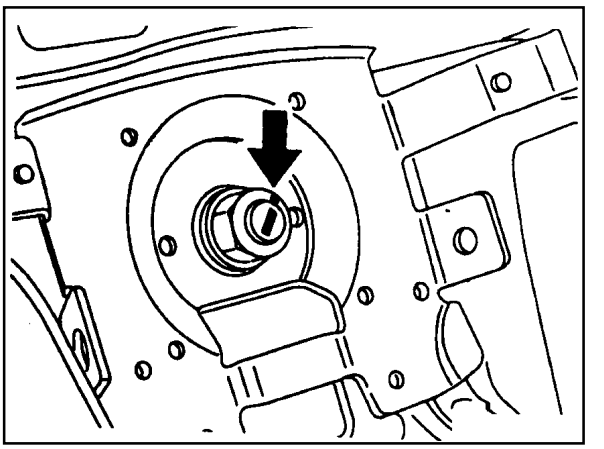
1. Remove the horn pad from the steering wheel and disconnect the connectors .



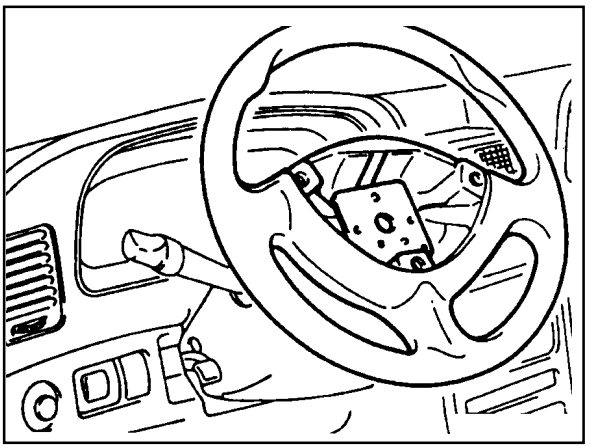
2. Place an alignment marks on the column shaft end and fixing nut and then remove the fixing nut.

   Installation Notice

Tightening Torque	50 - 80 Nm



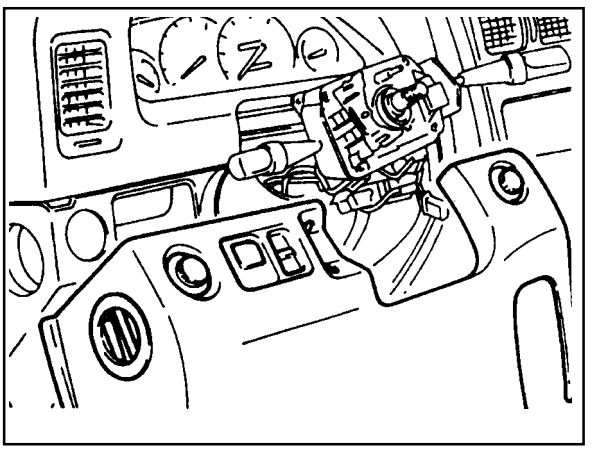
3. Remove the steering wheel and combination switch covers.



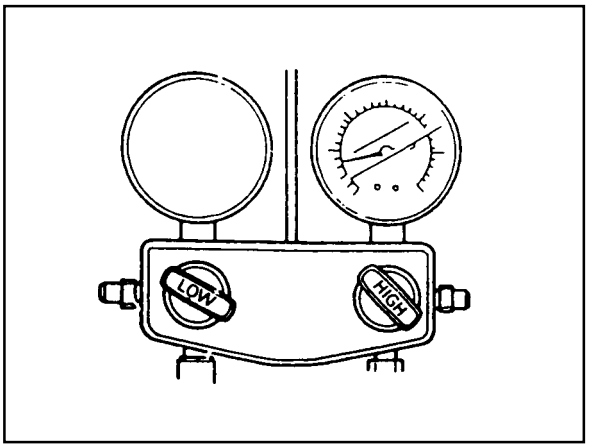
4. Remove the crash pad panel.

   Notice

   Remove the hood release wire and the other switch connectors.

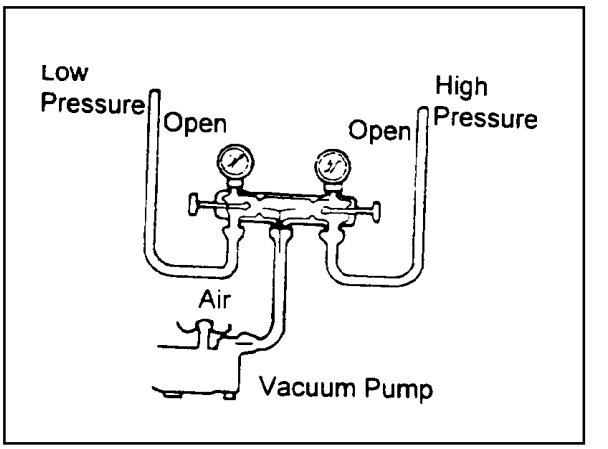


4. After the high pressure gauge reading drops below 3.5kg/ cm2 , slowly open the low pressure valve.
5. When both high and low pressure gauges reading drops to 0 kg/cm, discharging is completed.

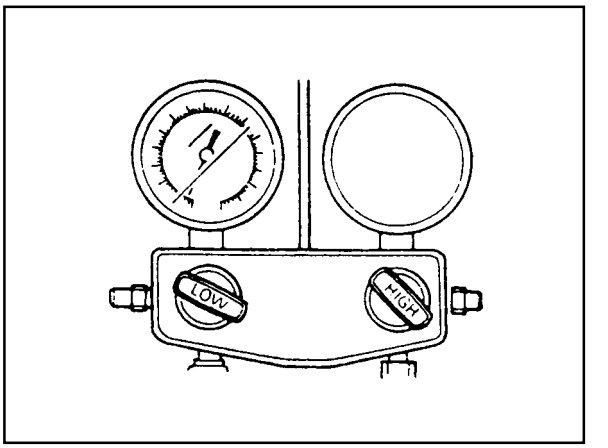


Evacuating Refrigeration System

1. Connect the manifold gauge to the charging valves.
2. Connect the center hose of the gauge to the vacuum pump.
3. Run the vacuum pump and open both high and low pressure hand valves.
4. Run the vacuum pump 15-20 minutes.
5. Check that both high and low pressure gauge reading is more than (-) 750mmHg of vacuum and close both valves.

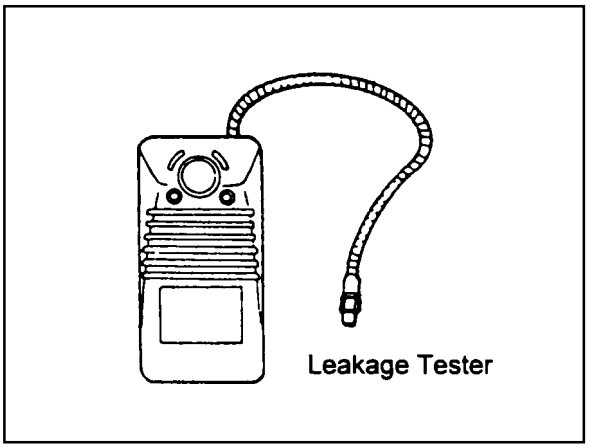


6. Stop the vacuum pump and wait about 5 minutes.
7. After 5 minutes, check that low pressure gauge reading is changed or not.
8. If low pressure gauge reading is changed, check the system for leaks and repair as necessary and repeat steps from '1' to '7'.
9. If there are no changes in low pressure gauge reading, disconnect the vacuum pump.

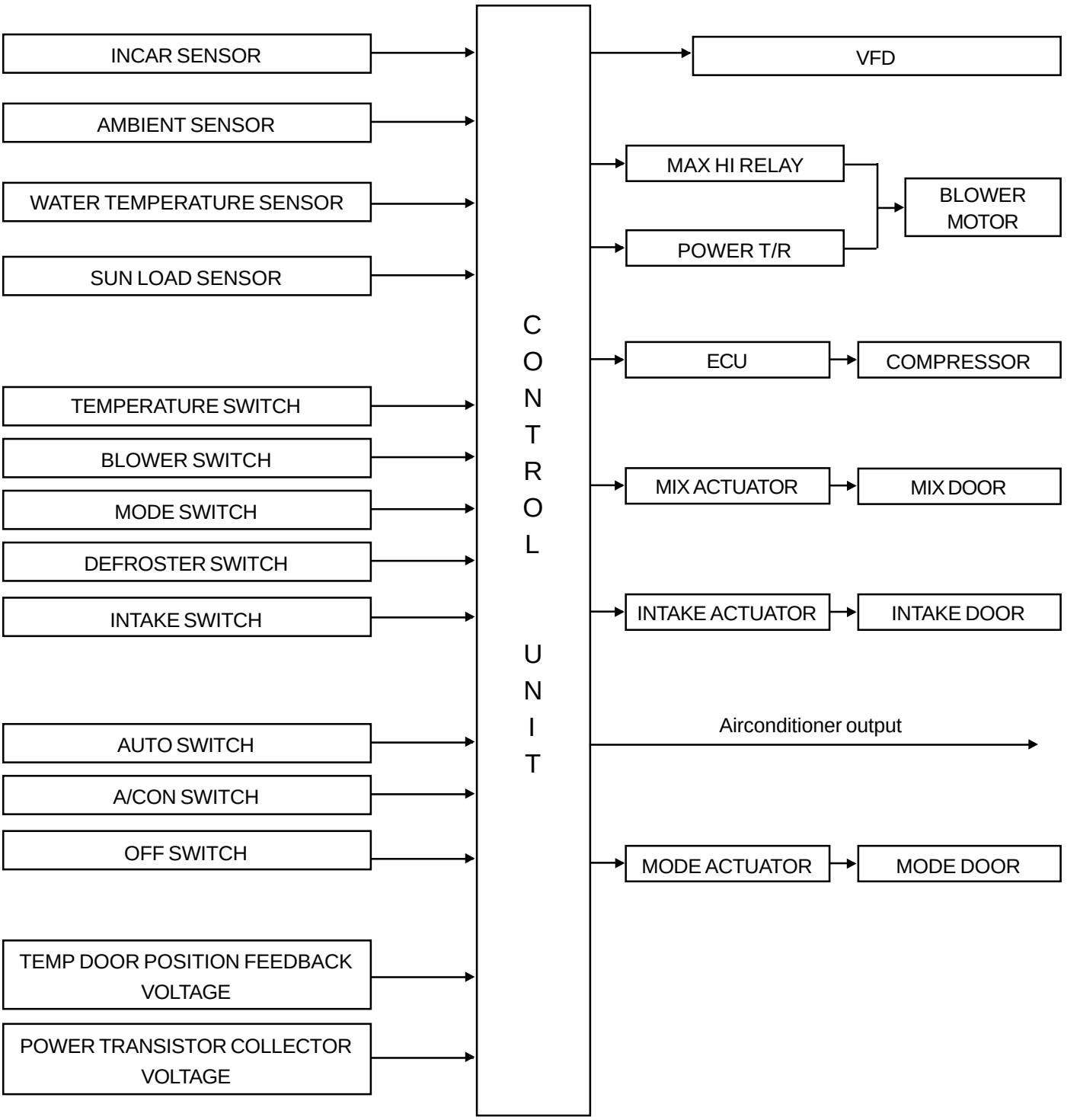


Check for Refrigerant Leaks

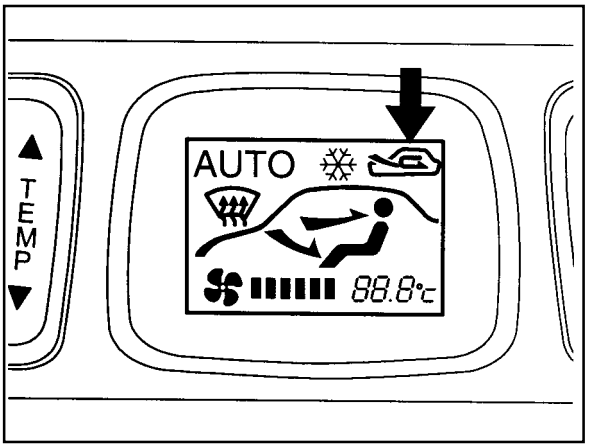
1. Connect the center hose of the gauge to the refrigerant tank.
2. Open the high pressure valve of the gauge to charge with refrigerant gas.
3. Charge until the low pressure gauge reads 1.0kg/cm^{2}and close the valve.
4. Using a gas leak detector, check the system for leaks.
5. If a leak is found, replace a O-ring or repair the faulty connection



FATC BLOCK DIAGRAM



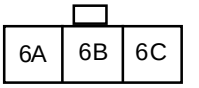
Fault : intake (recirculation/fresh air) door inoperative



Remove the glove box.

Disconnect 3-pin connector of the intake mode actuator and turn the ignition switch to ON position.

Measure voltage between 6c terminal positive pole (+) and body (-).



Wiring side connector

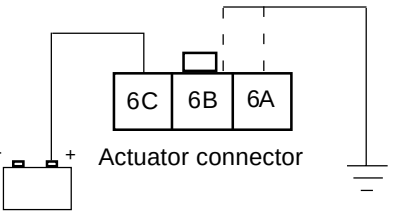
Measured voltage is 12V.

No → Check No. 24 fuse (15A) in the box.

Yes

Turn the ignitin switch OFF and disconnect harness of the intake actuator.

Check that it operates toward each direction after connecting the battery to the 6C terminal of intake actuator and ground 6A & 6B to the body.



Actuator connector

Intake actuator is normal.

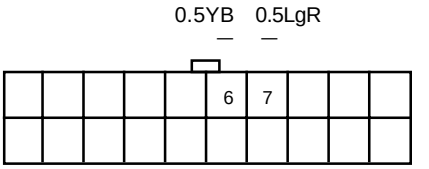
No → Repair and replace the intake actuator.

Yes

Disconnect 20-pin connector from the airconditioner control unit.

Check intake actuator linkage and door for proper operation and repair if necessary.

Check current between the intake actuator (6A, 6B) and the airconditioner control unit (6,7).



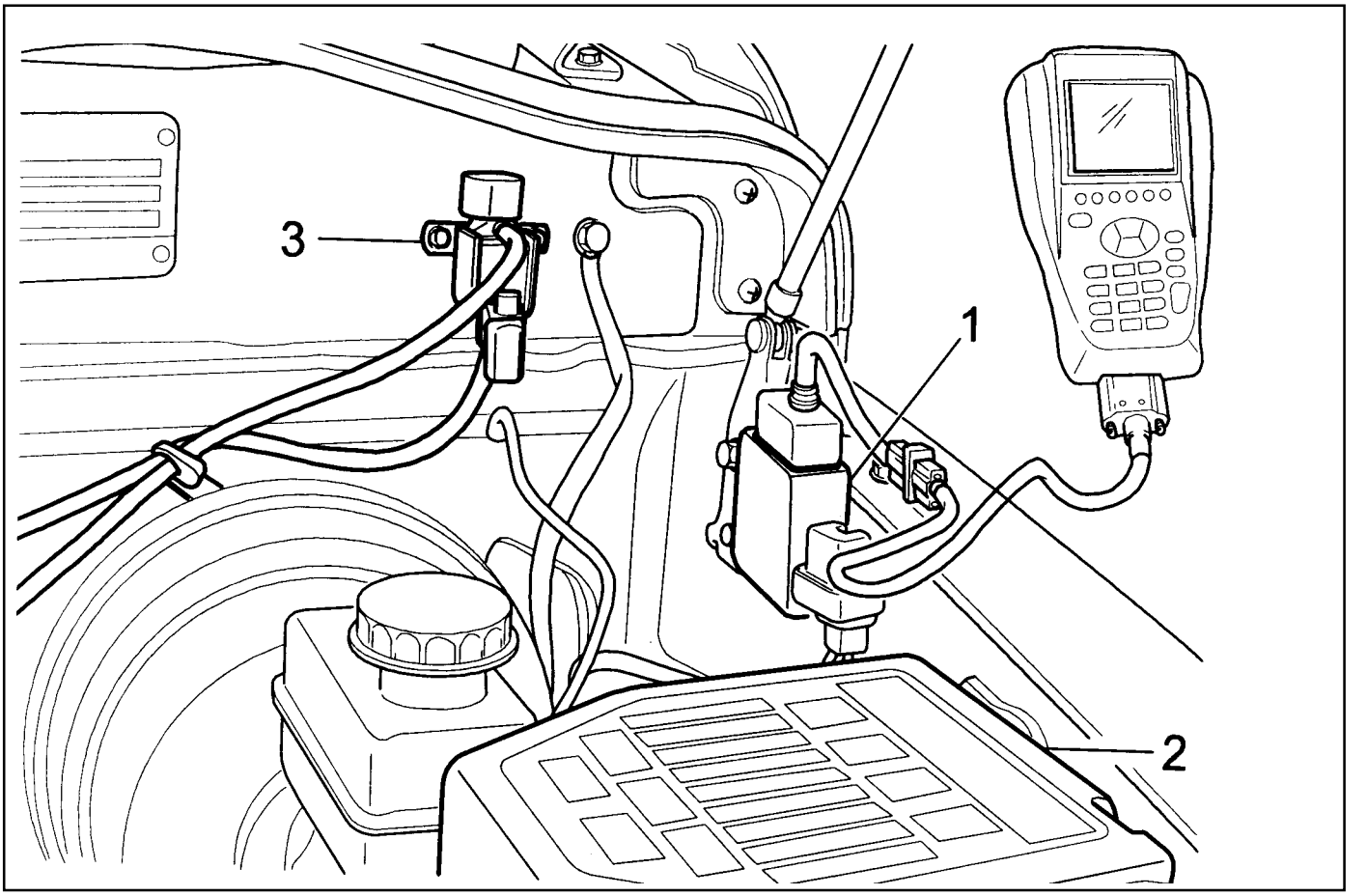
Is there current?

No → Repair open wire between the intake actuator and the control unit.

Yes

Replace the good control unit and re-check. If no fault, replace the control panel.

SELF DIAGNOSIS



1 Diagnosis Connector
2 Fuse Box
3 Solenoid Valve

1. Position the ignition switch to 'OFF'.
2. Connect the harness connector of scanner to the diagnosis socket in engine compartment.
3. Turn the ignition switch to 'ON' position.
4. Select "Electronic control vehicle diagnosis" from function selection display and press 'Enter'.
5. Select "Korando ('98 model year)" from vehicle model selection display and press 'Enter'.
6. Select "Electronic air bag" from control system selection display and press 'Enter'.
7. Select "Self-diagnosis" from diagnosis item selection display.

   Notice

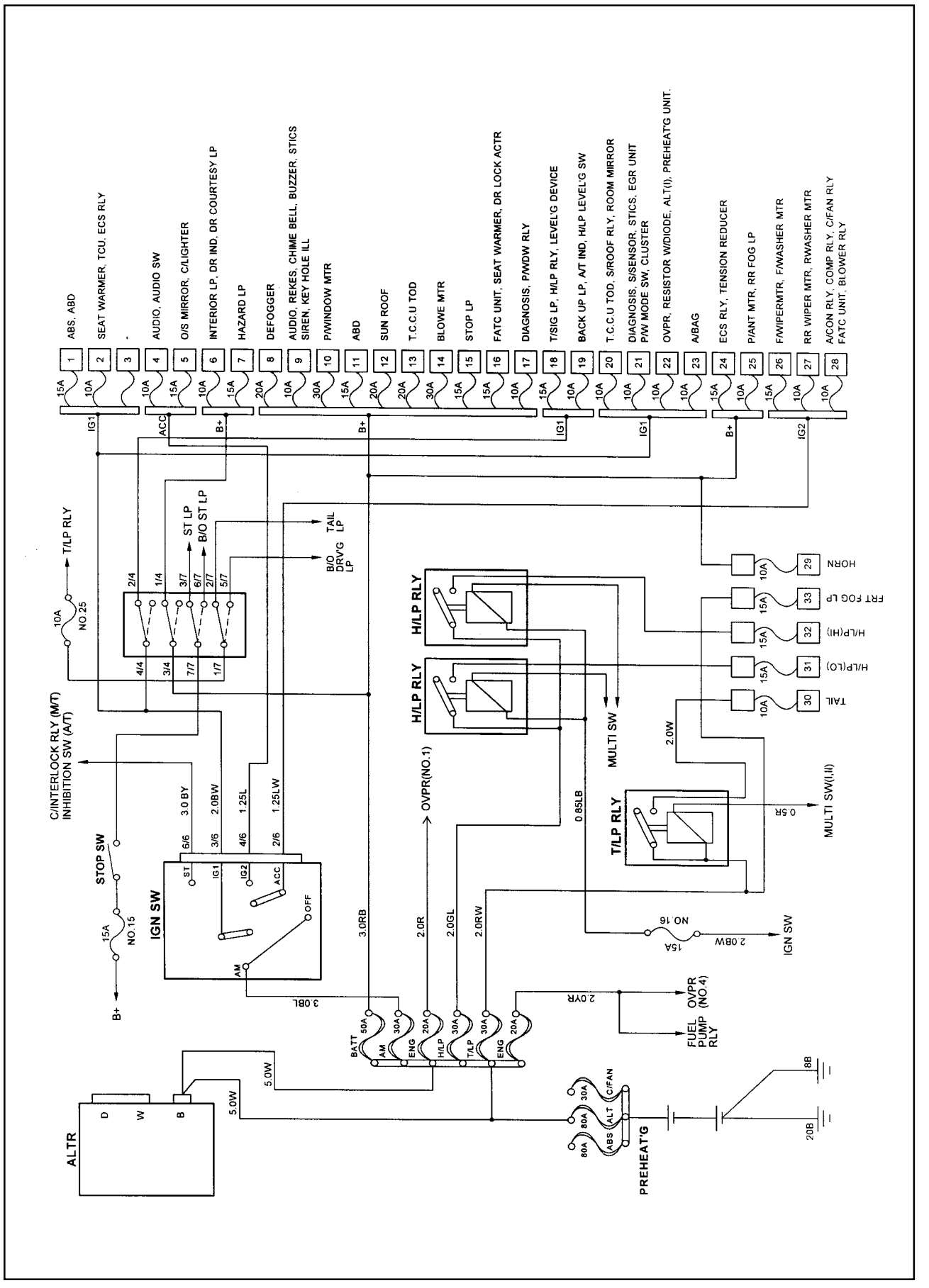
   Check sensor value of output display, if necessary.
8. Determine the fault code and trace defective component.

   Notice

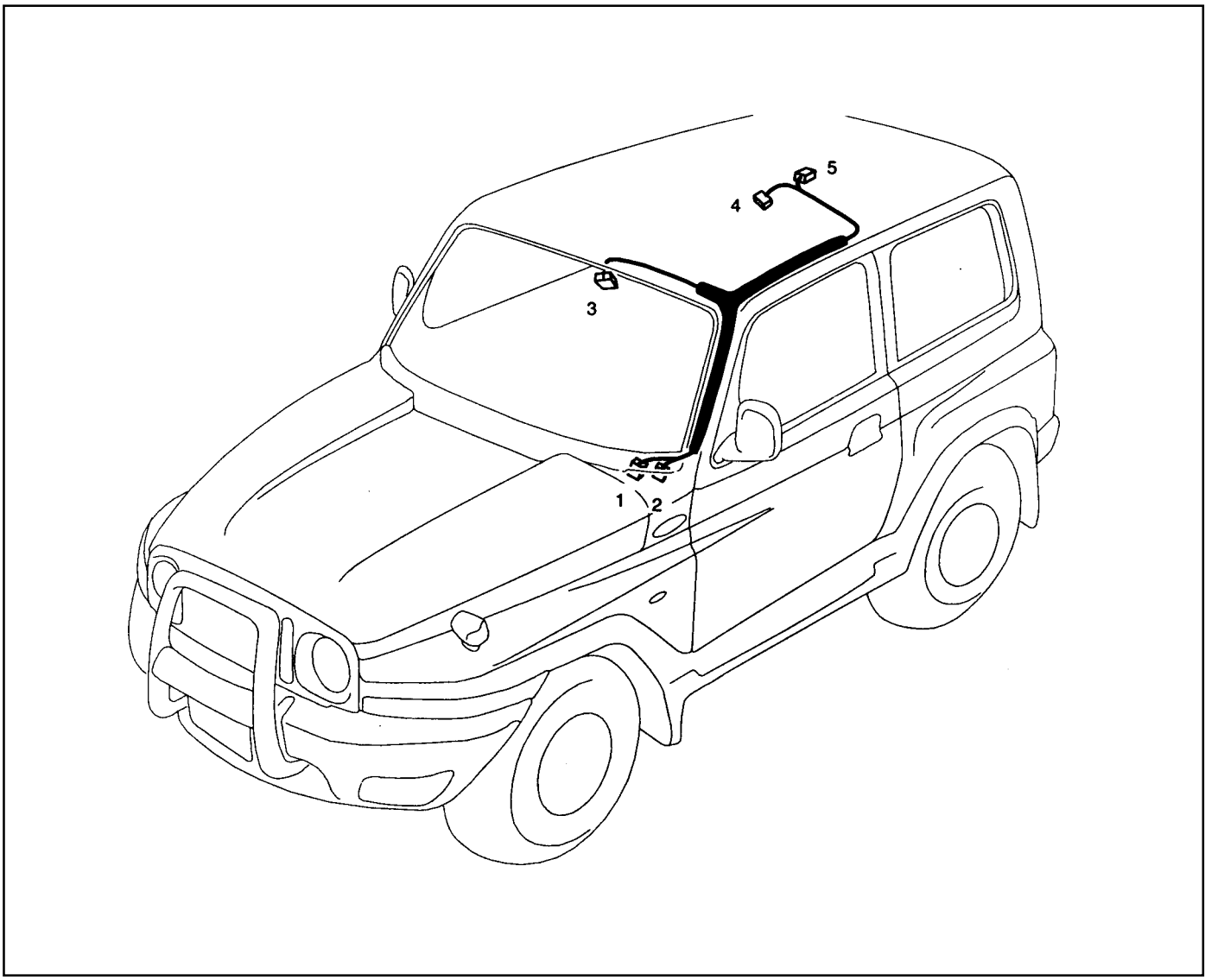
   Refer to self-diagnosis list.

SCHEMATIC AND ROUTING DIAGRAMS

POWER DISTRIBUTION



ROOF



1 Main Wiring Connector
2 Sun Roof Wiring Connector
3 Front Room Lamp
4 Sun Roof
5 Center Room Lamp

SECTION 9C

HORNS

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

Inspection Procedure

1. Speedometer

(DIESEL)

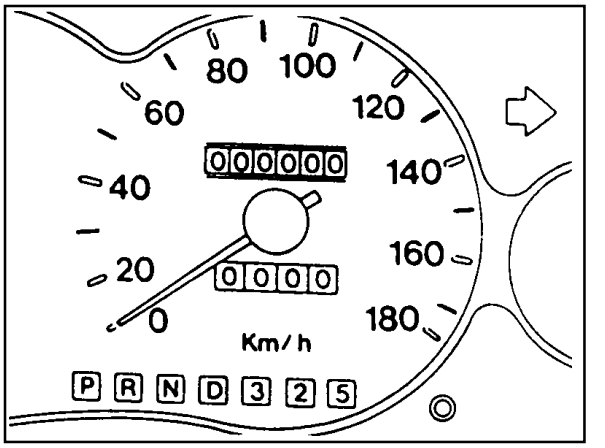
(km/h)

Speed	20	40	60	80	100	120	140	160
Tolerance	+4 +0	+3 +0	+4 +0	+5 +0	+5 +0	+5.5 +0	+5.5 +0.5	+5.5 +0.5

(GASOLINE)

(km/h)

Speed	20	40	60	80	100	120	140	160	180	200
Tolerance	+4 +0	+3 +0	+4 +0	+5 +0	+5 +0	+5.5 +0.5	+5.5 +0.5	+5.5 +0.5	+6 +1	+6 +1



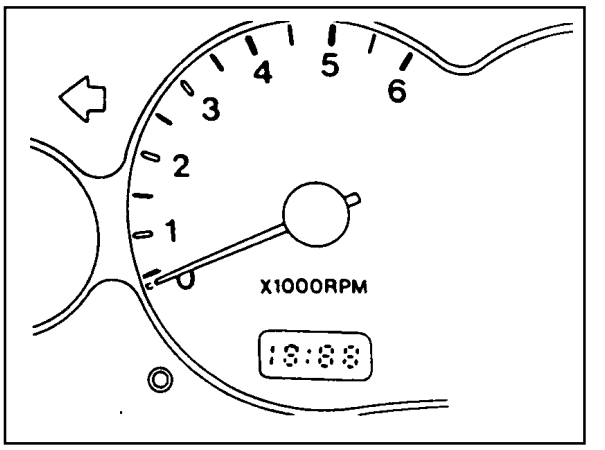
2. Tachometer

(DIESEL)

Revolution	1000	2000	3000	4000	5000
Tolerance	+137 -63	+199 -51	+261 -39	+298 -2	-

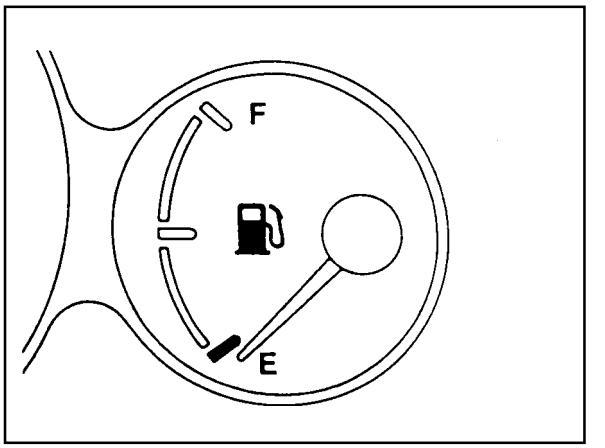
(GASOLINE)

Revolution	1000	2000	3000	4000	5000	6000
Tolerance	±100	±125	±150	±150	±150	±180



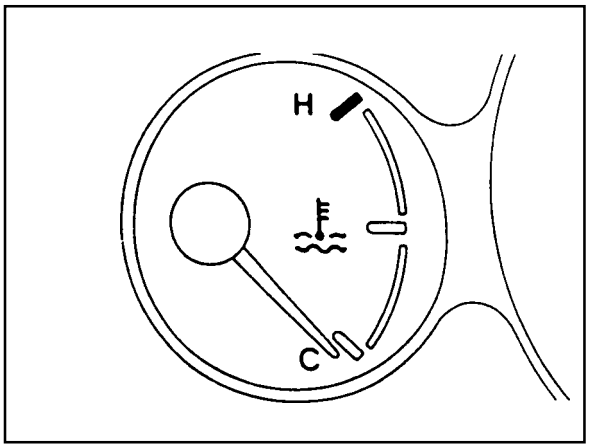
3. Fuel Gauge

Classification	E	1/2	F
Resistance(W)	97	32.5	6
Tolerance(°)	±2.5°	±5°	±2.5°



4. Temperature Gauge (Temperature Sensor)

Temperature (°)	Resistance (W)
50	156.9
86	44.5
105.5	27.3
120	19.4



SECTION 9M

EXTERIOR TRIM

TABLE OF CONTENTS