

## SUBARU

## SVX

## 1992

### Precaution for Supplemental Restraint System "Airbag"

The Supplemental Restraint System "Airbag" helps to reduce the risk or severity of injury to the driver in a frontal collision.

The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control unit, warning light, wiring harness and spiral cable.

Information necessary to service the safety is included in the "5-5. SUPPLEMENTAL RESTRAINT SYSTEM" of this Service Manual.

#### WARNING:

- To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SUBARU dealer.
- Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.
- All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System "Airbag".



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# M MECHANISM AND FUNCTION

## 1. Steering Column

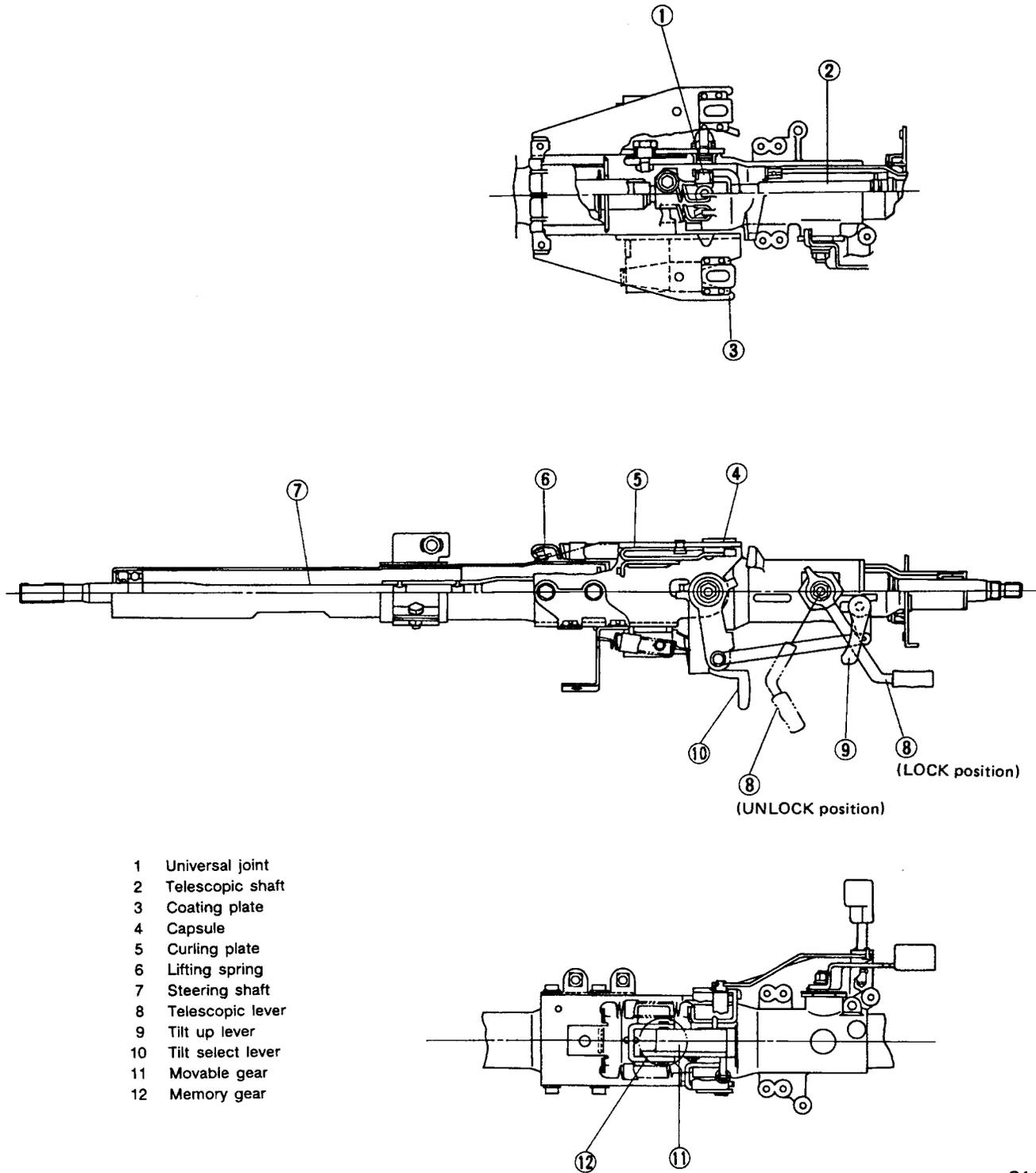


Fig. 1

C4-001

**A: FEATURE****1. TILT & TELESCOPIC STEERING COLUMN WITH MEMORY FUNCTION**

1) The tilt position is determined by engagement of the movable gear and stationary gear.

The tilt position can be adjusted up and down in 3 steps each way from the neutral position. Each step changes the column tilt angle 1.925 degrees [or 34/3 mm (1.34/3 in)]. Also, when swung up, the steering column can be tilted up an additional 21 mm (0.83 in) from the top position.

2) The previous column position is memorized via the memory gear when the steering column is tilted upwards.

3) The gears are engaged directly below the steering column to increase rigidity.

4) The tilt-up lever tilts the steering column all the way up, and the tilt-select lever tilts it to an optimum driving position.

**2. TELESCOPIC FUNCTION**

1) The telescopic lever adjusts the driving position forward and backward in a 37 mm (1.46 in) range for the optimum driving posture.

2) The high-precision splines are used to provide smooth telescopic steering wheel operation.

**3. ENERGY ABSORBING MECHANISM OF CURLING PLATE**

1) Effective impact-absorbing performance is assured.

2) The plate comes in a detachable capsule set.

**4. RUBBER COUPLING**

A rubber coupling is used between the two universal joints in the engine compartment to reduce flutter, kickbacks and the noise from the steering gearbox.

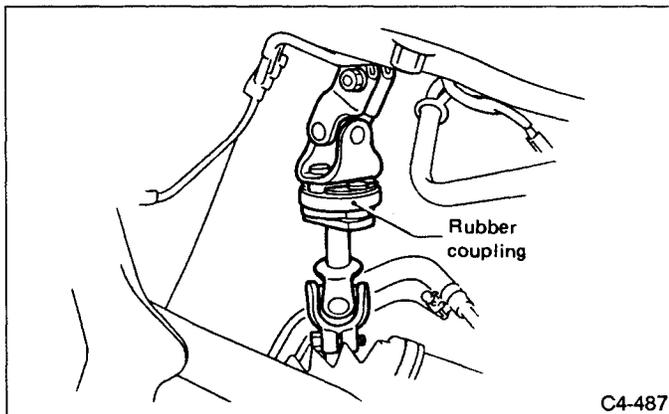


Fig. 2

C4-487

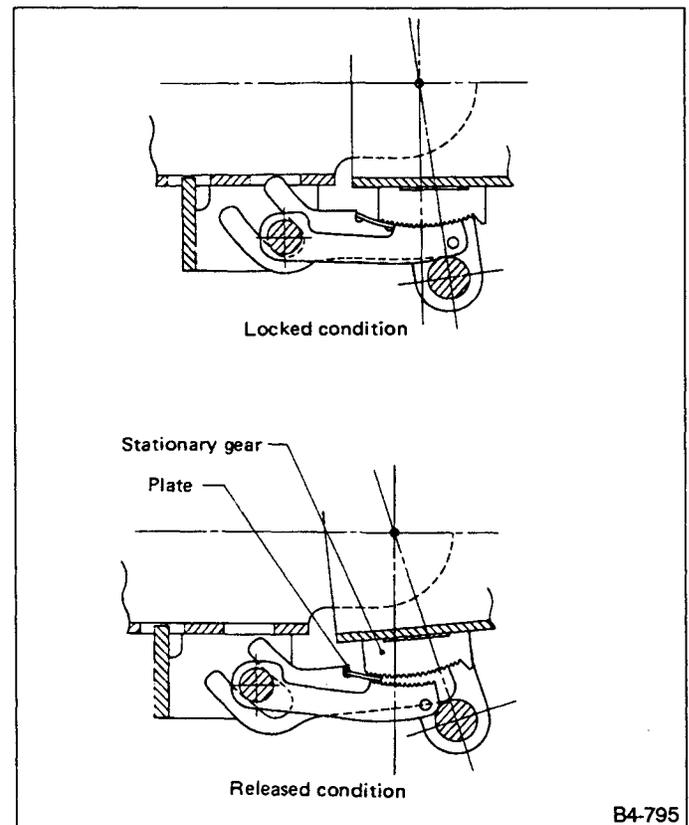
**B: OPERATION****1. TILT STEERING COLUMN WITH MEMORY FUNCTION**

1) When the tilt-up lever is pulled back, the movable gear is disengaged from the stationary gear. This causes the coil spring to tilt the steering column up.

At this point, the memory gear is held engaged with the movable gear and operates according to the movement of the movable gear.

A plate united with the memory gear is then interposed between the movable and stationary gears. This holds the two gears disengaged (when the tilt-up lever is released).

2) When the stationary gear and the memory gear, which is engaged with it, return to the original position while pushing the steering wheel down, the movable gear is disengaged from the plate. This causes the tilt-up lever to be locked.



B4-795

Fig. 3

3) When the tilt-select lever is pulled toward the driver, both the movable and memory gears are simultaneously disengaged from the stationary gear. This unlocks the tilt-select lever. (The tilt-up lever is also moved by the movement of the tilt-select lever.)

When the steering wheel is released at the desired position, it will remain locked there.

**2. TELESCOPIC FUNCTION**

The telescopic lever is locked when pulled toward the driver. Pushing it releases the steering wheel for adjustment. After adjusting the wheel position, the lever must be locked.

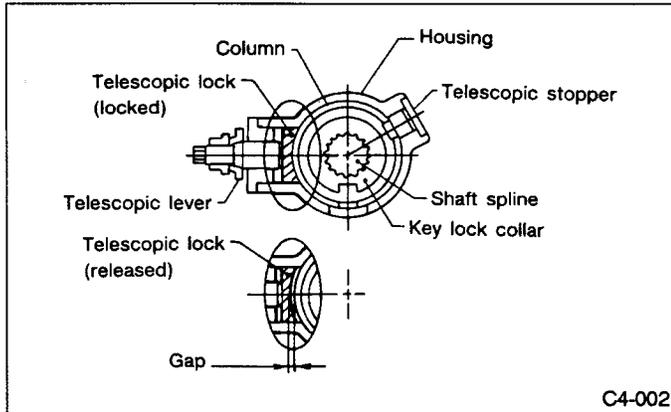


Fig. 4

**3. ENERGY ABSORBING MECHANISM OF CURLING PLATE**

The curling plate is installed between the column mounting bracket and the support bracket. In a collision, the curling plate deforms to effectively absorb the energy of the impact.

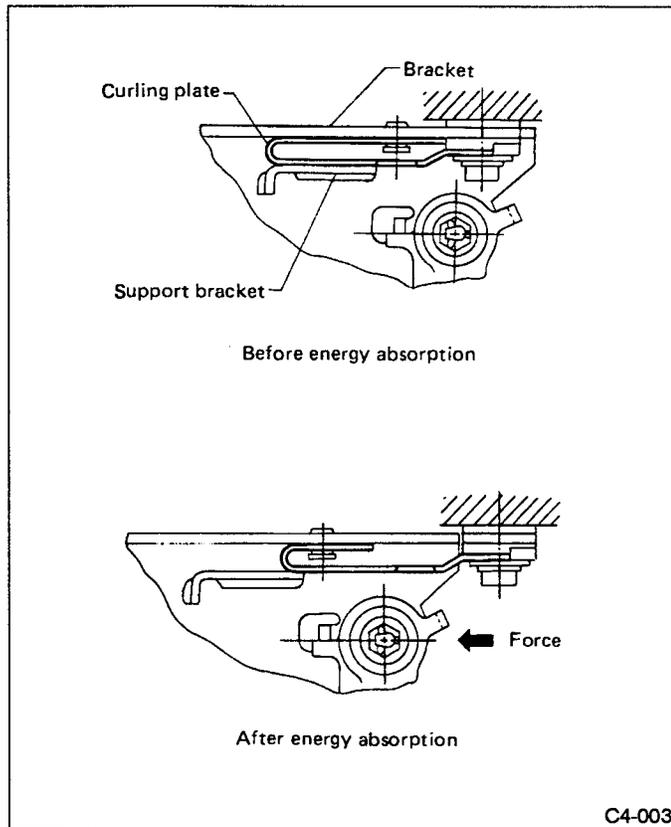


Fig. 5

- The steering column is held by a support beam located close to the steering wheel to reduce the overhang. The upper bearing is also located close to the steering wheel to increase supporting rigidity, as well as to reduce the problem of a shaking or shimmying wheel.

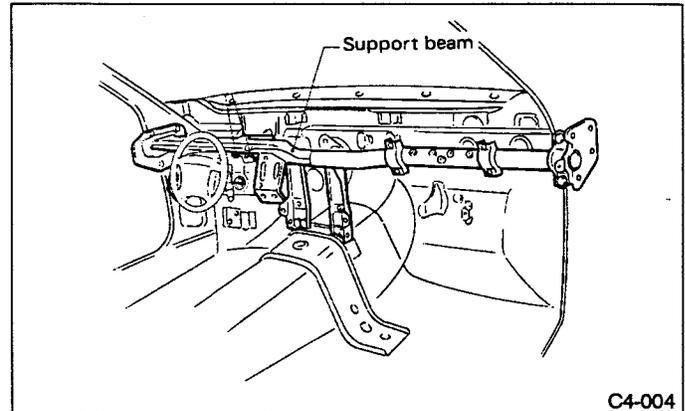


Fig. 6

- The steering column is supported solely by the support beam. So, in the case of a frontal collision, even if the toe-board is deformed, the throwback of the column can be minimized.

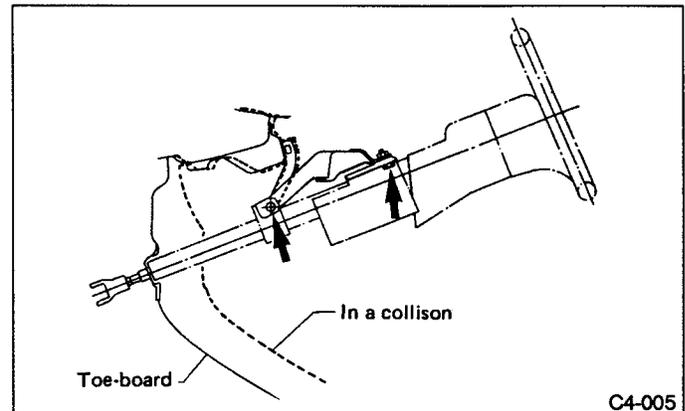
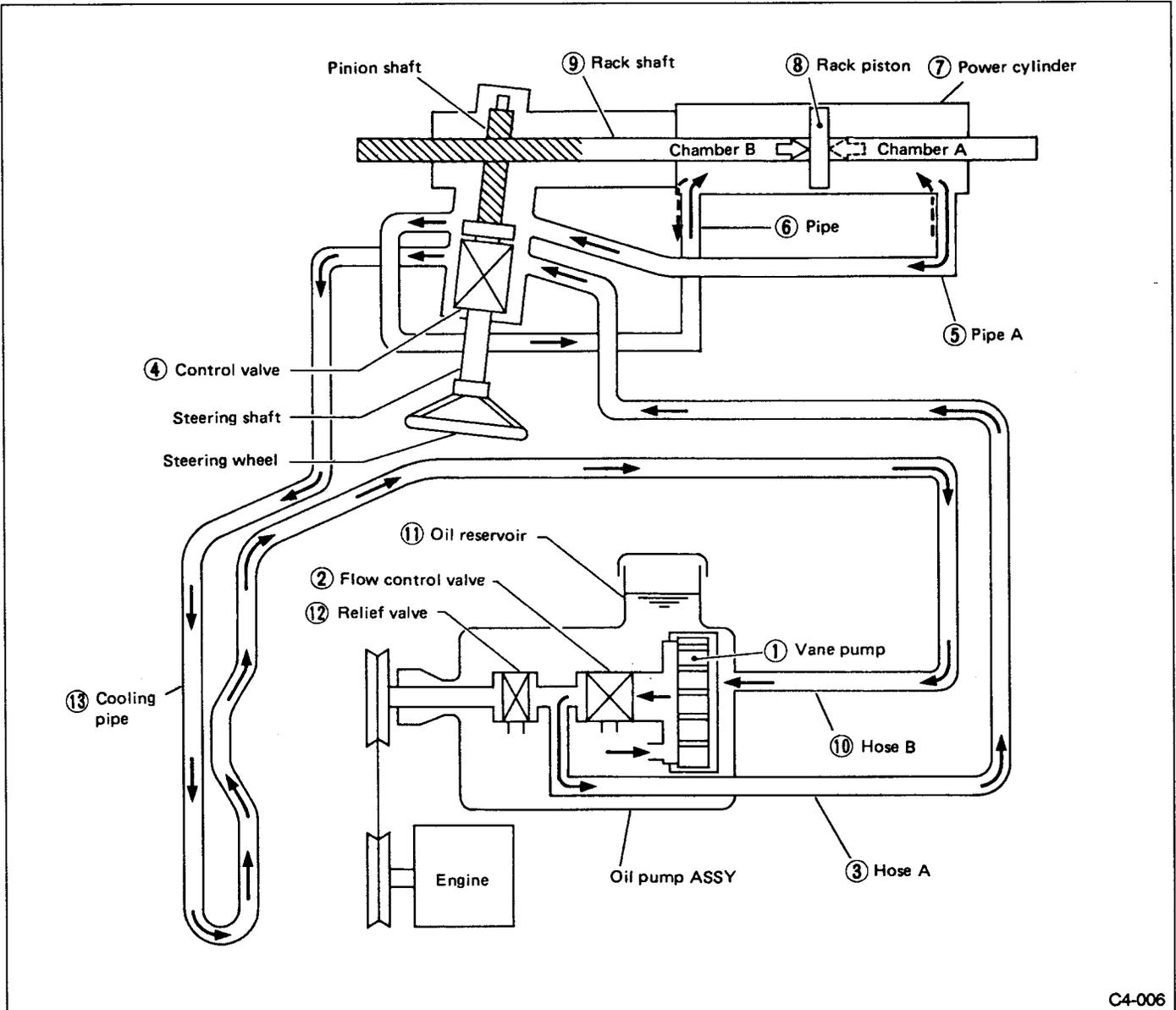


Fig. 7

## 2. Power Steering System (Engine Speed Sensing Type)

### 1. HYDRAULIC SYSTEM



C4-006

Fig. 8

- 1) Vane pump ① is belt-driven from the engine to discharge oil under pressure.
- 2) Oil under pressure is controlled by the flow control valve ② located inside the oil pump ASSY in response to engine speed and is delivered to control valve ④ via hose A ③.
- 3) When the steering wheel is turned, control valve ④ connected to the pinion shaft activates to form an oil flow circuit corresponding to the rotation direction of the steering wheel. Oil will then be delivered to chamber A or B via pipe A ⑤ or B ⑥.
- 4) Oil in chamber A or B acts on rack piston ⑧ to produce the force required to move rack shaft ⑨ to the left or the right. This helps reduce the effort required to operate the steering wheel.
- 5) Movement of rack piston ⑧ in turn causes oil in the

other chamber to return to oil reservoir ⑪ via pipe A ⑤ or B ⑥, control valve ④, cooling pipe and hose B ⑩.

- If the hydraulic system becomes inoperative, the steering shaft will then be connected to the pinion shaft mechanically via control valve ④. Thus, the steering shaft can act as one similar to a manual steering system to move the rack and pinion.
- To control the maximum oil pressure setting, relief valve ⑫ is built into flow control valve ② of the oil pump ASSY to release excess oil pressure.

#### 6) Cooling pipe

A cooling pipe is incorporated to prevent the deterioration of the power steering oil due to an increase in oil temperature. By cooling the oil the stability of the oil temperature is improved.

2. GEARBOX ASSY

1) Power cylinder

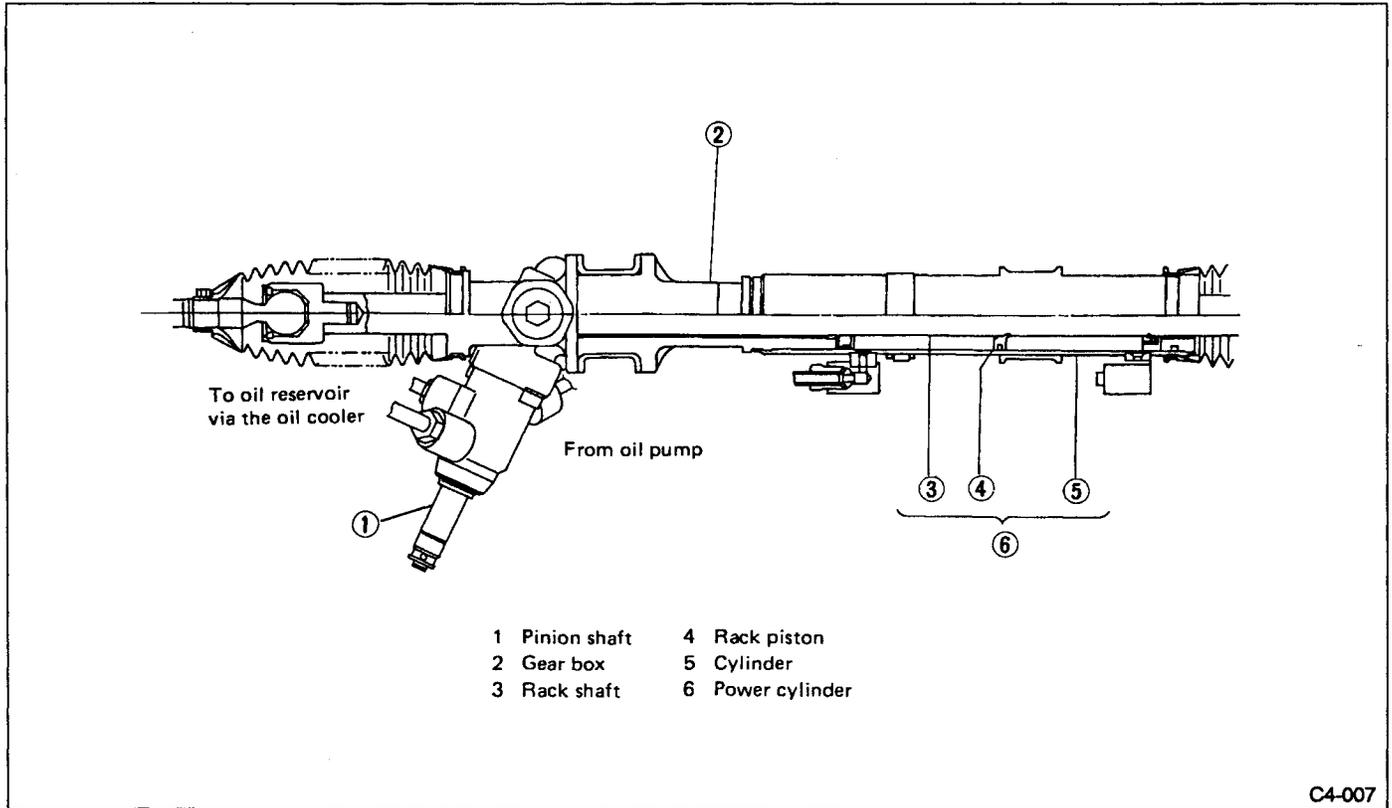
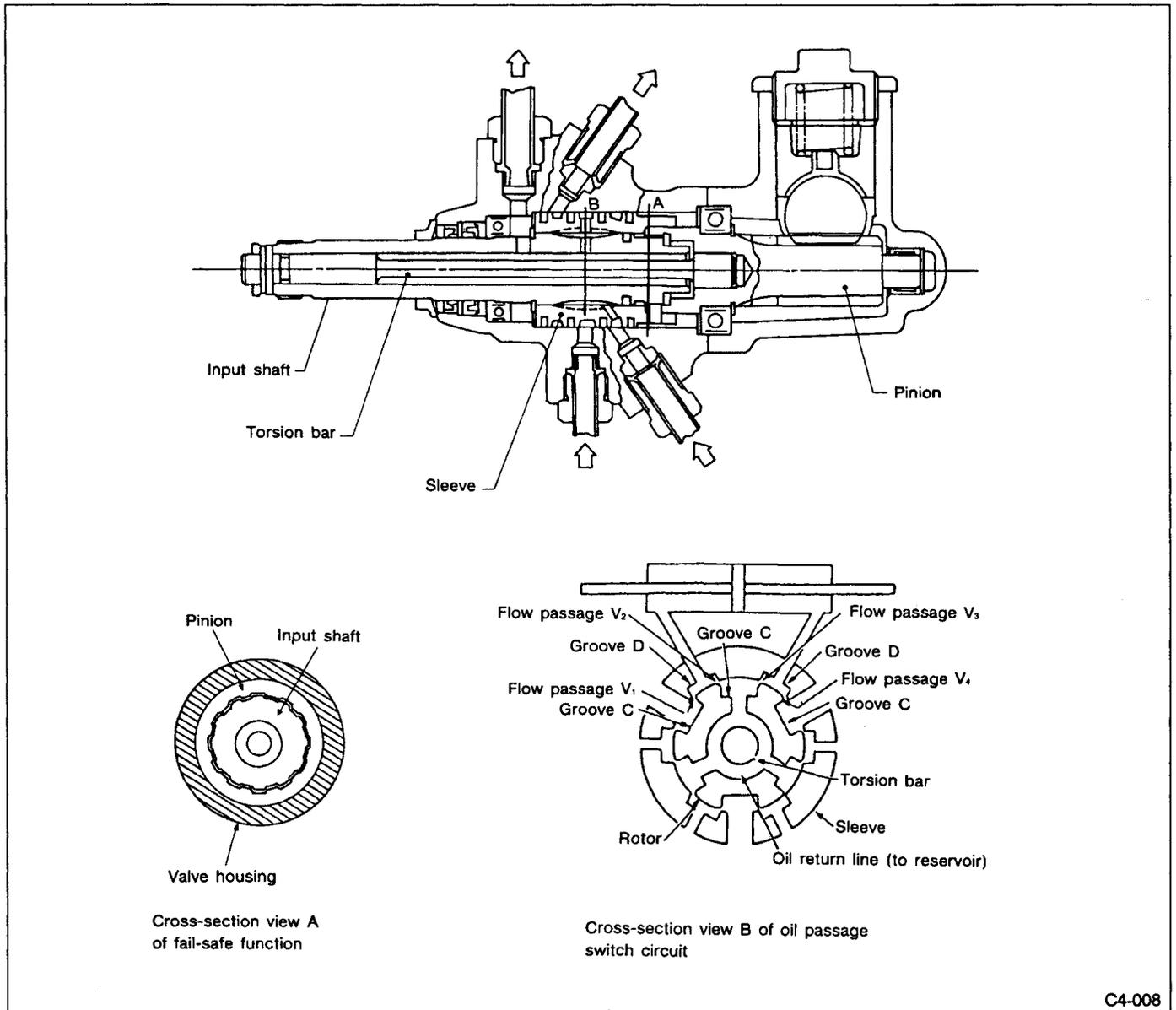


Fig. 9

The gearbox is integrated with a built-in control valve and power cylinder. The rack shaft is used as a power cylinder piston and a rotary control valve is located in such a manner as to enclose the pinion shaft.

The control valve and power cylinder are connected to each other by two pipes through which hydraulic oil flows.

2) Control valve



C4-008

Fig. 10

The control valve consists of a rotor (which rotates together with the steering shaft), a pinion (which is connected to the rotor and torsion bar), and a sleeve (which rotates together with the pinion). Oil grooves C and D are located in the rotor and sleeve to form oil flow passages V<sub>1</sub> through V<sub>4</sub>. The pinion and rotor are meshed with adequate clearance. They utilize a fail-safe design.

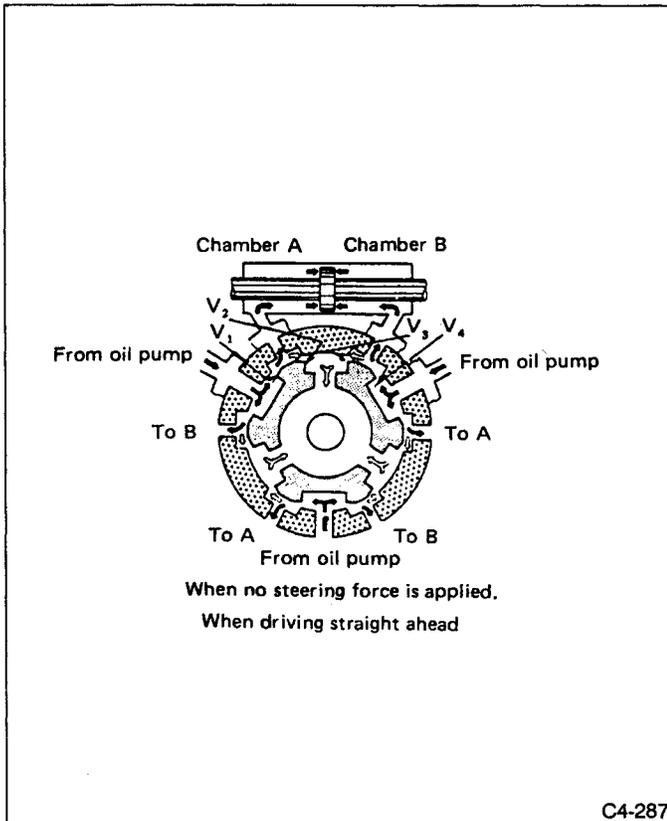


Fig. 11

### 3) Operating principle

When the torsion bar twists in relation to the steering force, a relative rotational displacement occurs between the rotor and sleeve. This displacement changes the cross-sectional area of oil passages  $V_1$ ,  $V_2$ ,  $V_3$  and  $V_4$ , which in turn switches oil passages and controls oil pressure.

#### (1) When no steering force is applied:

The rotor and sleeve are held at the neutral position. Oil passages  $V_1$ ,  $V_2$  and  $V_3$ , which are formed by valve grooves C and D are open equally. Under this condition, oil delivered from the oil pump returns to the oil reservoir so that neither oil pressure builds up nor does the power cylinder activate.

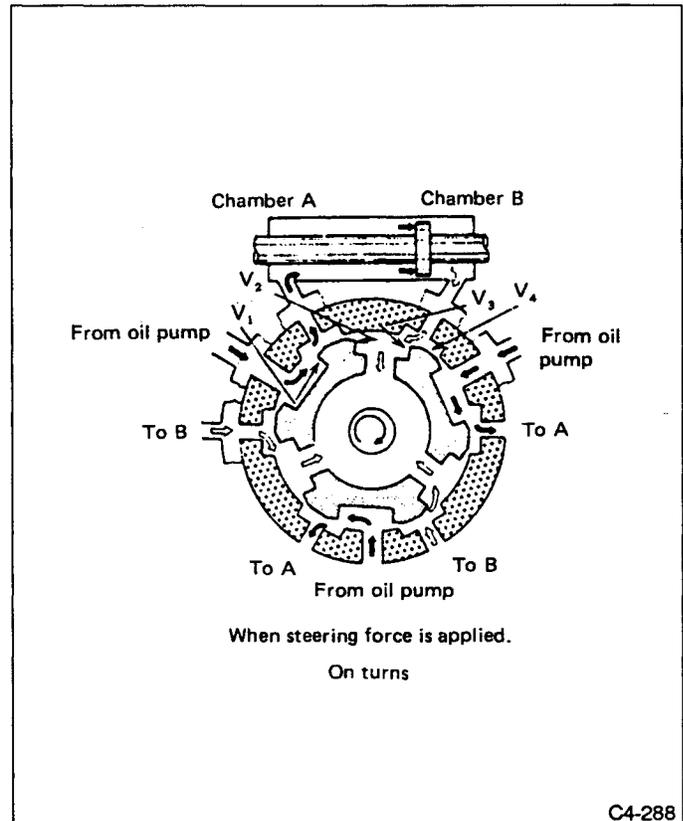


Fig. 12

#### (2) When steering force is applied:

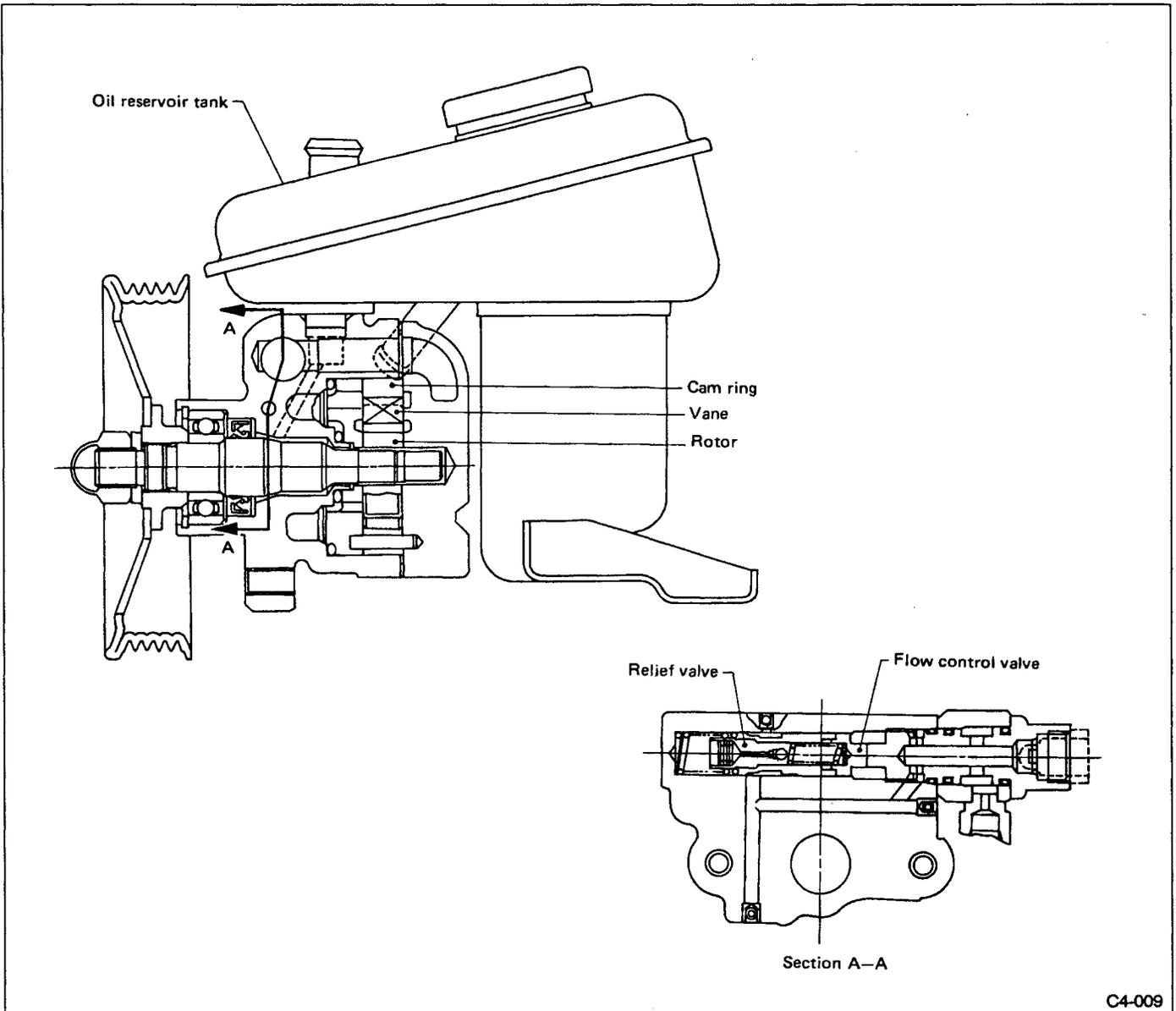
When the steering wheel is turned to the right, for example, oil passages  $V_1$  and  $V_3$  open while oil passages  $V_2$  and  $V_4$  nearly close.

At this point, oil under pressure in chamber A increases in response to the throttle position of oil passages  $V_2$  and  $V_4$  so that the rack piston moves to the right. Oil in chamber B, on the other hand, is discharged through oil passage  $V_3$ , returning to the oil reservoir.

#### 4) Fail-safe function

If oil pressure fails to build up due to a broken oil pump drive belt, torque is transmitted from the valve rotor to the pinion by way of the fail-safe function.

3. OIL PUMP & RESERVOIR TANK



C4-009

Fig. 13

The oil pump is belt-driven from the engine. The oil flow is controlled in response to engine speed so that an adequately "heavy" steering effort is maintained during high-speed operation.

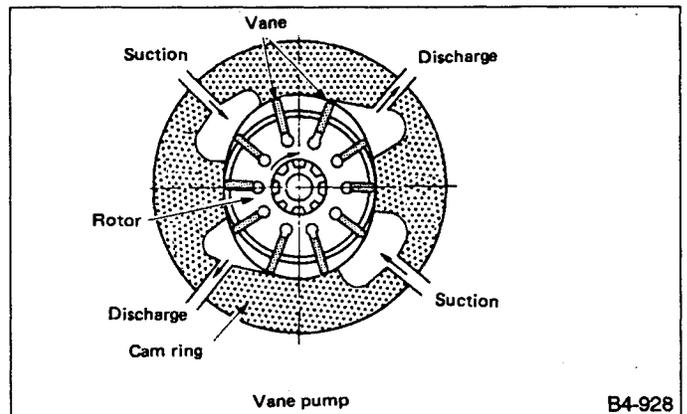
The oil pump is a vane type. It is integrated with an oil reservoir and houses the flow control and relief-valves.

1) Vane pump

The vane pump consists of a rotor, cam rings, and ten vanes.

When the rotor rotates, the vane located in each groove of the rotor is radially swung out by centrifugal force and pressed against the cam ring. The tip of the vane slides along the inner oval wall of the cam ring so that oil is delivered to the chamber formed by the rotor, cam ring and vane by way of a pea-shaped groove. Oil from

the chamber is discharged into the oil circuit via the discharge port.



B4-928

Fig. 14

2) Flow control valve

The flow control valve adequately regulates the discharge flow of oil which increases in proportion to pump speed and delivers it to the gearbox. It consists of orifices 1 and 2, valve spool, return port and flow control spring. When a pressure differential occurs

between the front and rear of orifice 2 in response to increases in discharge flow, the valve spool moves against the tension of the flow control spring so that the oil flow is controlled by the open and close operation of the return port and orifice 3.

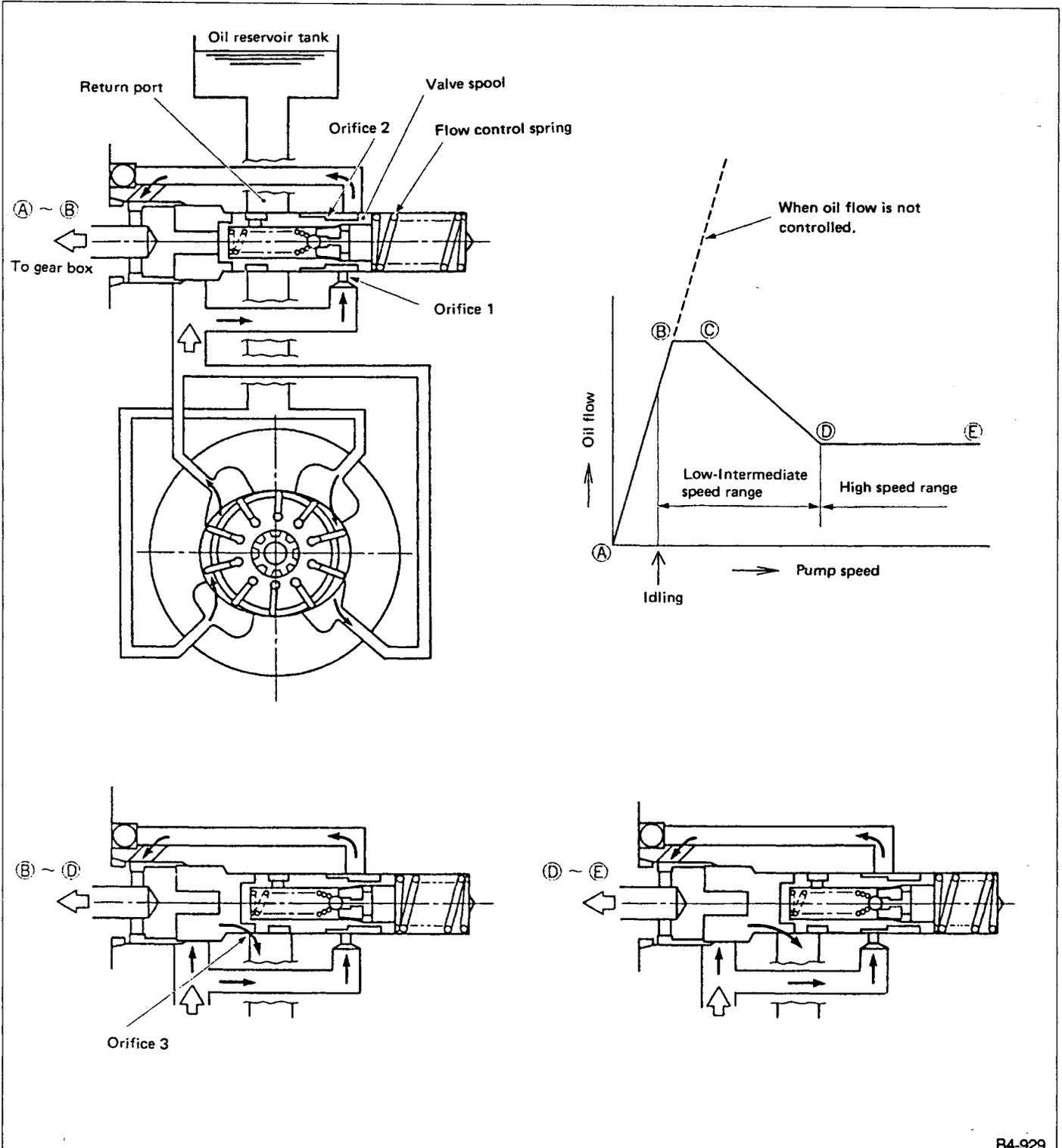


Fig. 15

B4-929

### 3. Power Steering System (Vehicle Speed Sensing, Electronically Controlled, Hydraulic Reaction Type)

A hydraulic reaction mechanism is installed between the pinion shaft and input shaft to vary the oil pressure according to the vehicle speed. This permits the driver to use less steering effort during low-speed driving and to have a firm, rigid response during high-speed driving.

#### A: FEATURE

- 1) Less steering effort is required even when the steering wheel is fully turned or when driving at reduced speeds. The same light steering feeling as with a conventional power steering system can be enjoyed.
- 2) The steering power is controlled according to the vehicle speed responding to the road conditions.

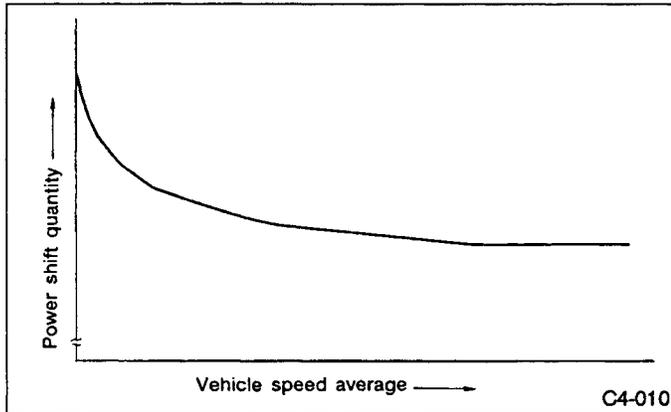


Fig. 16

3) A built-in failsafe function enables the system to maintain the same steering characteristic as a conventional steering system even when a problem occurs in such electrical units as ECU, vehicle speed signal, engine speed signal, solenoid valve, etc.

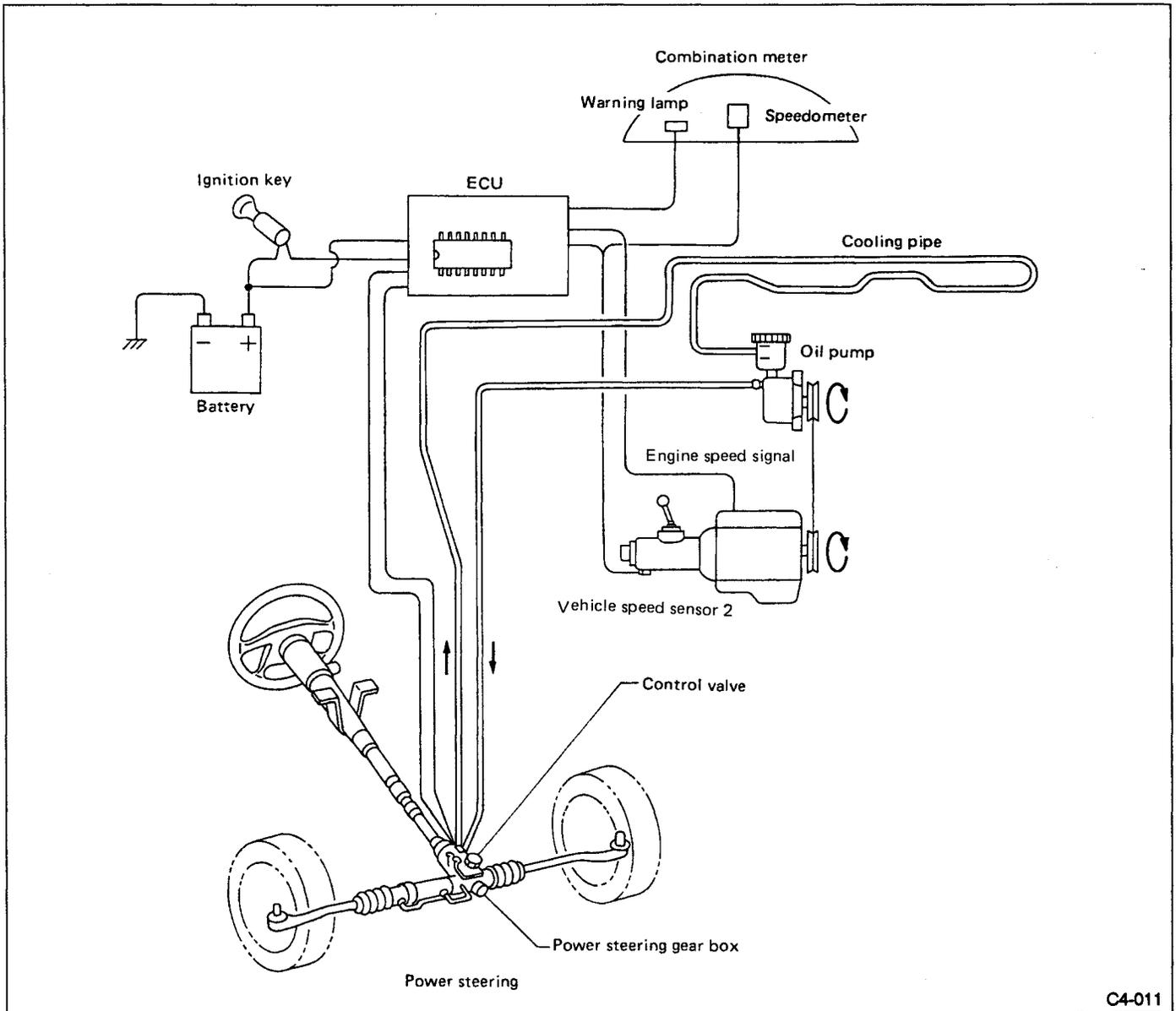


Fig. 17

C4-011

**B: OPERATION**

**1. HYDRAULIC SYSTEM**

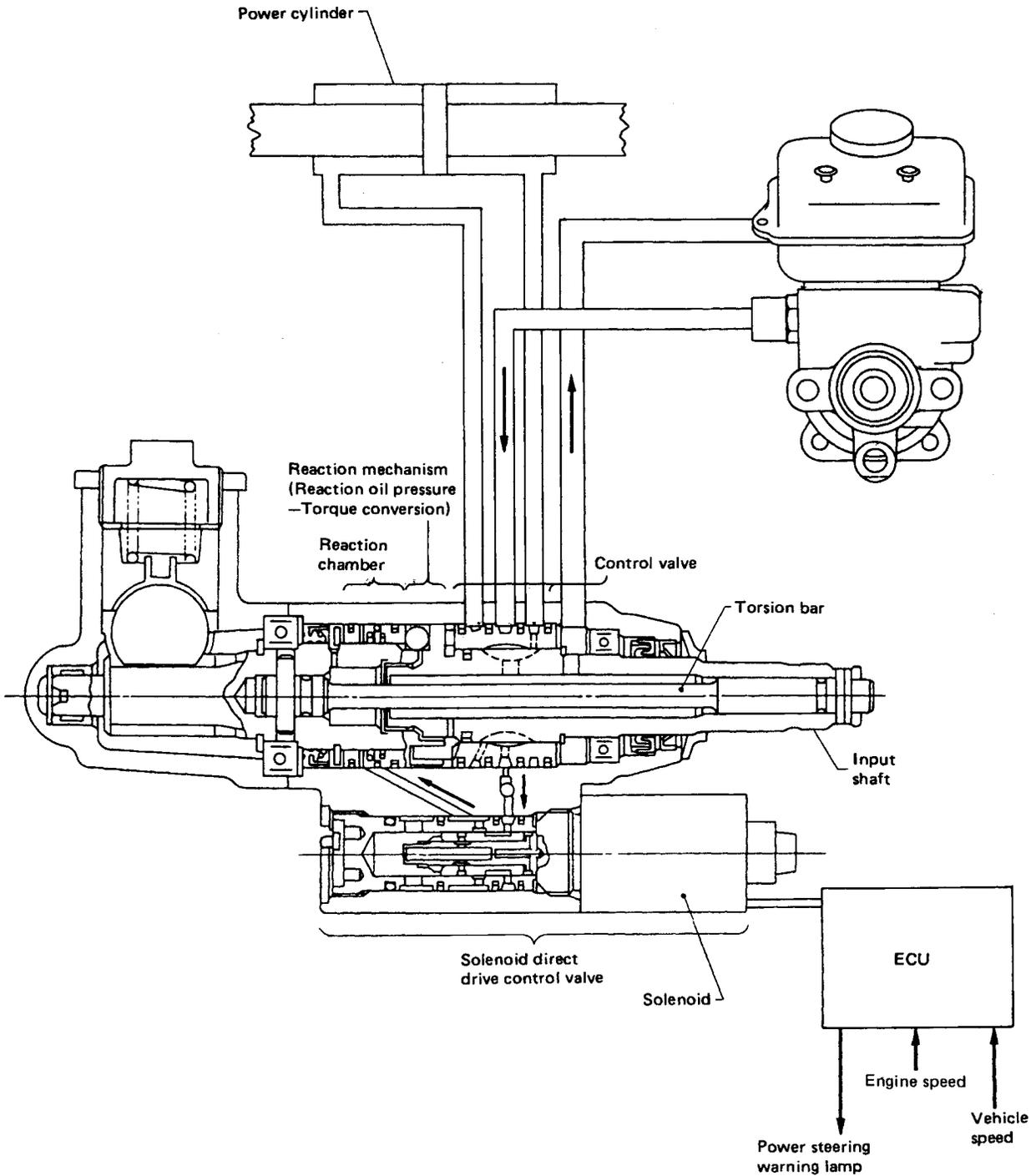


Fig. 18

C4-012

## 2. GEARBOX ASSEMBLY

The gearbox components are:

Rotary type control valve composed of sleeve and pinion shaft; torsion bar and reaction chamber; reaction piston and solenoid direct drive control valve.

The control valve is made up of a direct drive solenoid valve, solenoid plunger, reaction valve and a sleeve (that forms a passage). It drives the solenoid by current from the ECU to control reaction pressure. The power cylinder is the same as that used in the engine speed sensing type power steering.

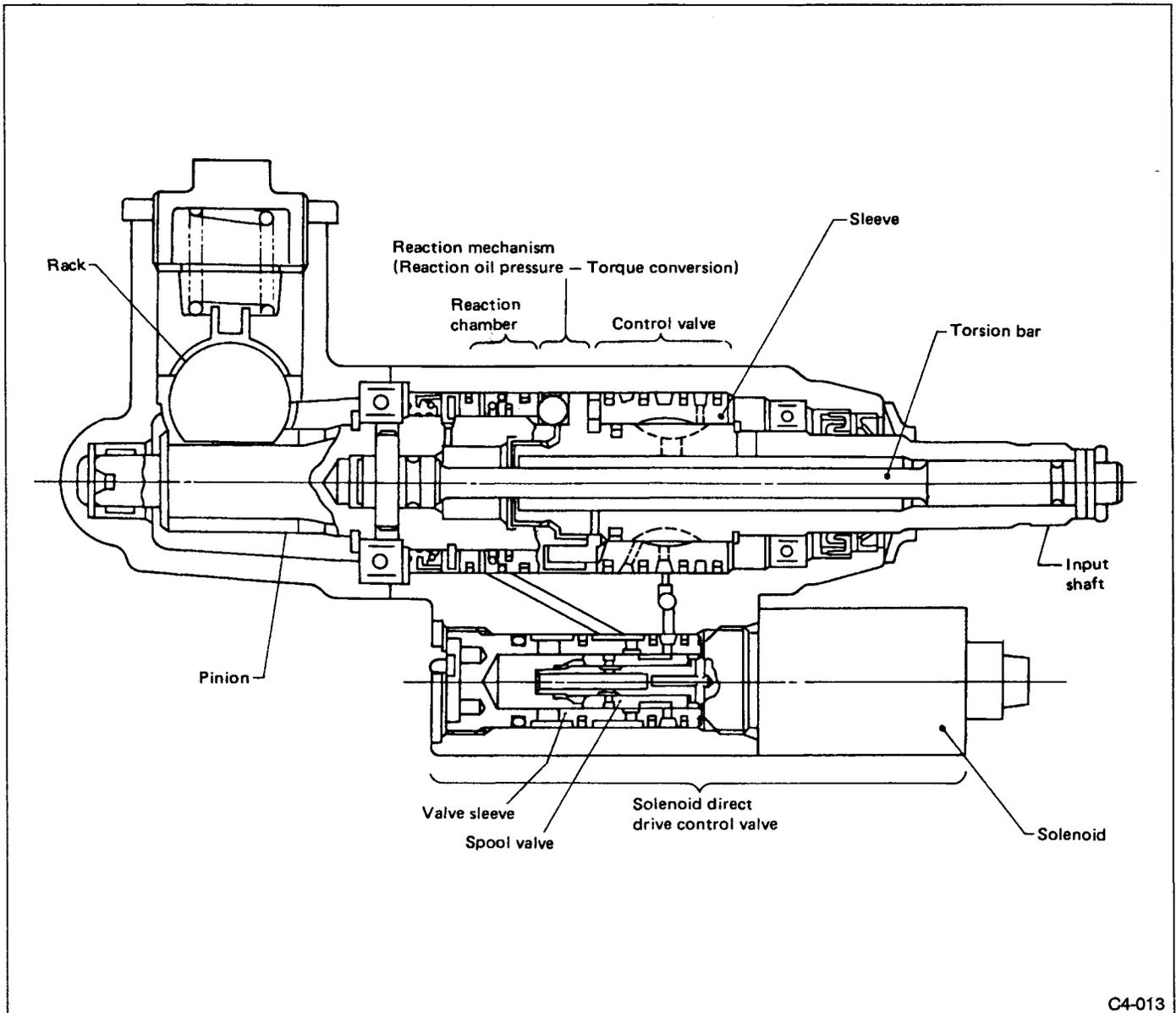


Fig. 19

**3. REACTION MECHANISM**

1) Construction

The input shaft has 3 reaction arms, each with a "V" groove cut lengthwise to convert thrust from the reaction piston into turning torque.

The reaction piston moves back and forth in the axial direction to provide thrust to the V groove via a ball. The pinion shaft has holes on its flange to hold steel balls. The ball corresponding with the V groove moves freely in the axial direction.

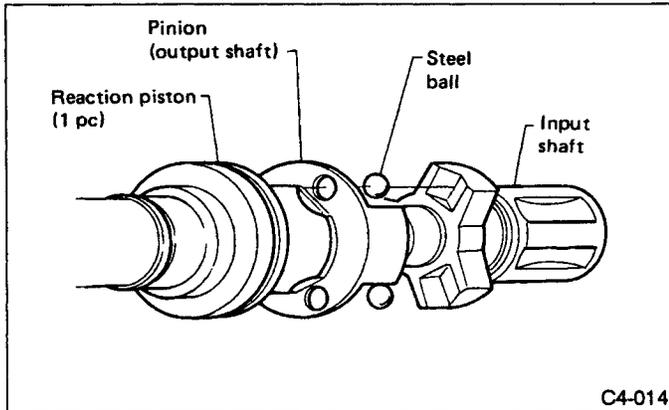


Fig. 20

2) Operation

(1) When driving straight ahead:

The ball is pressed onto the innermost position of the V groove by means of reaction spring and preset hydraulic pressure.

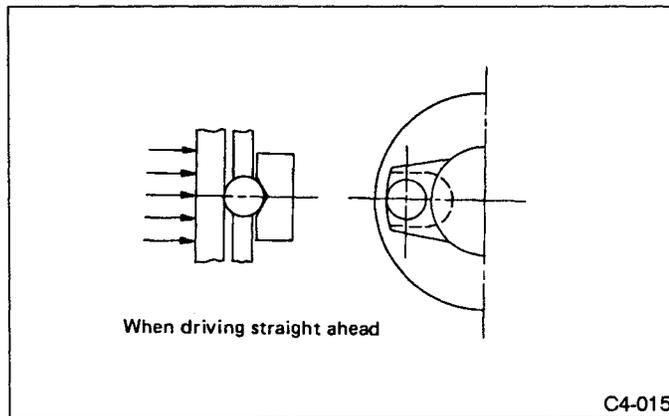


Fig. 21

(2) On turns:

When steering wheel is turned, a relative displacement occurs between input shaft and pinion shaft in the corresponding direction because of the tire load on the pinion shaft. This causes the ball to push the reaction piston via the reclining angle of the V groove. Since the reaction piston is under reaction hydraulic pressure, the ball receives thrust  $F$  from the reaction piston. Thrust  $F$  creates a vector ( $F_t = F \tan \theta$ ), which is converted into a reaction torque ( $T = F_t \times \ell$ ) by the reaction arm.

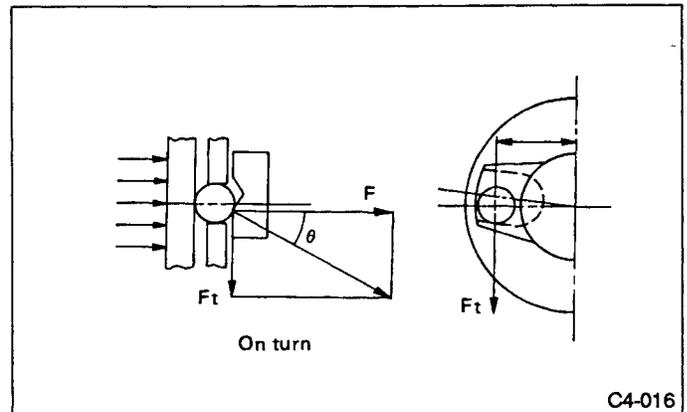


Fig. 22

### 4. OIL PUMP & RESERVOIR TANK

The construction is basically the same as the engine speed sensing type, but flow control valve design is

different because of difference in the flow control characteristic.

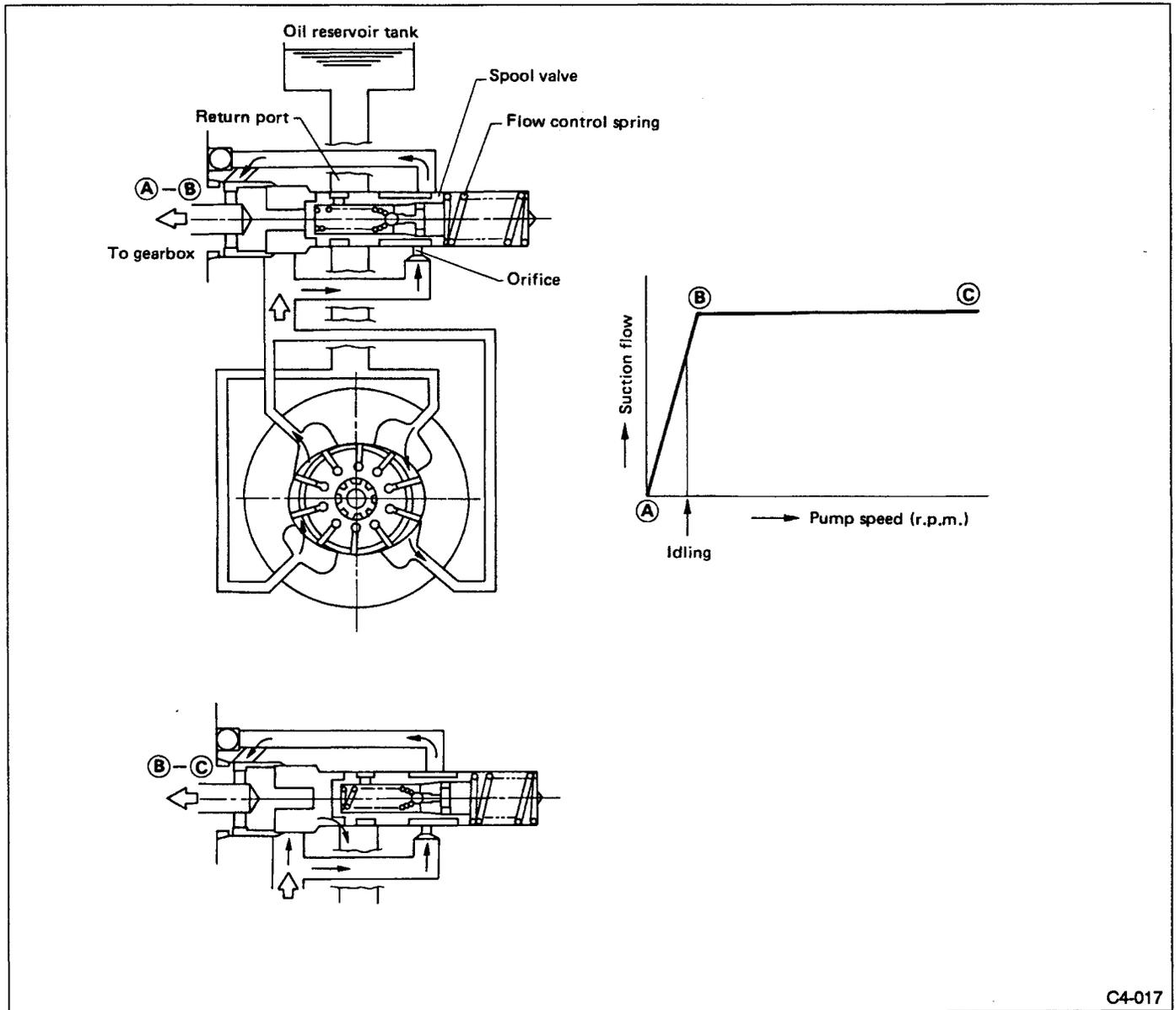


Fig. 23

C4-017

**5. SYSTEM OPERATION**

The ECU, receiving signals input from vehicle speed and engine speed sensors, sends current (correspond-

ing with vehicle speed) to the control valve to control reaction pressure via reaction control valve.

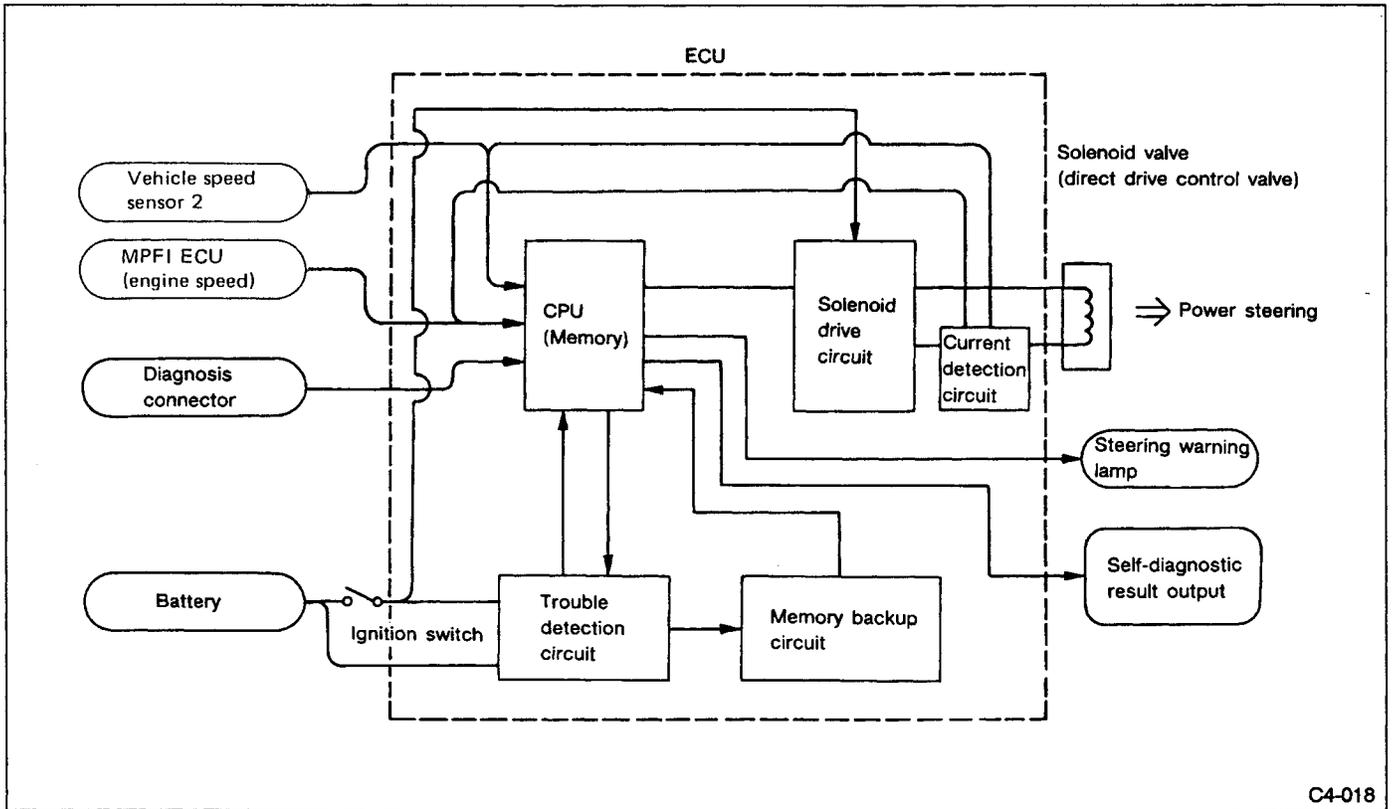


Fig. 24

1) When steering wheel is fully turned or during low-speed driving:  
 As a large current flow is supplied to the solenoid, the solenoid plunger moves right while the spool valve, unitized with the plunger, is pushed right. The power steering reaction chamber and oil reservoir tank are

connected by a path, making the reaction pressure 0 kPa (0 kg/cm<sup>2</sup>, 0 psi). In this condition, the reaction pressure does not work on the reaction piston, nor does the reaction piston operate. So, light, effortless steering as with conventional power steering, can be enjoyed.

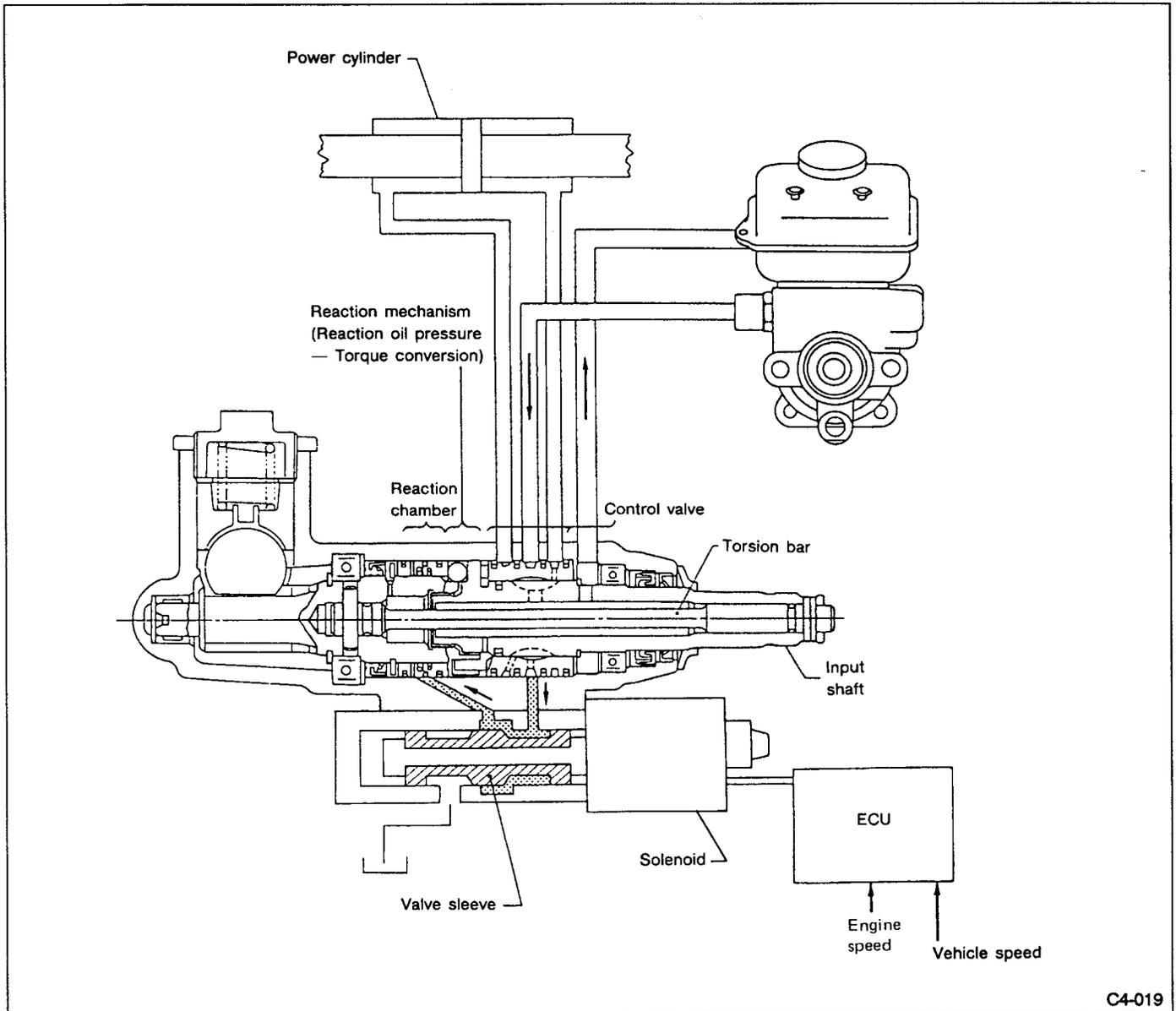
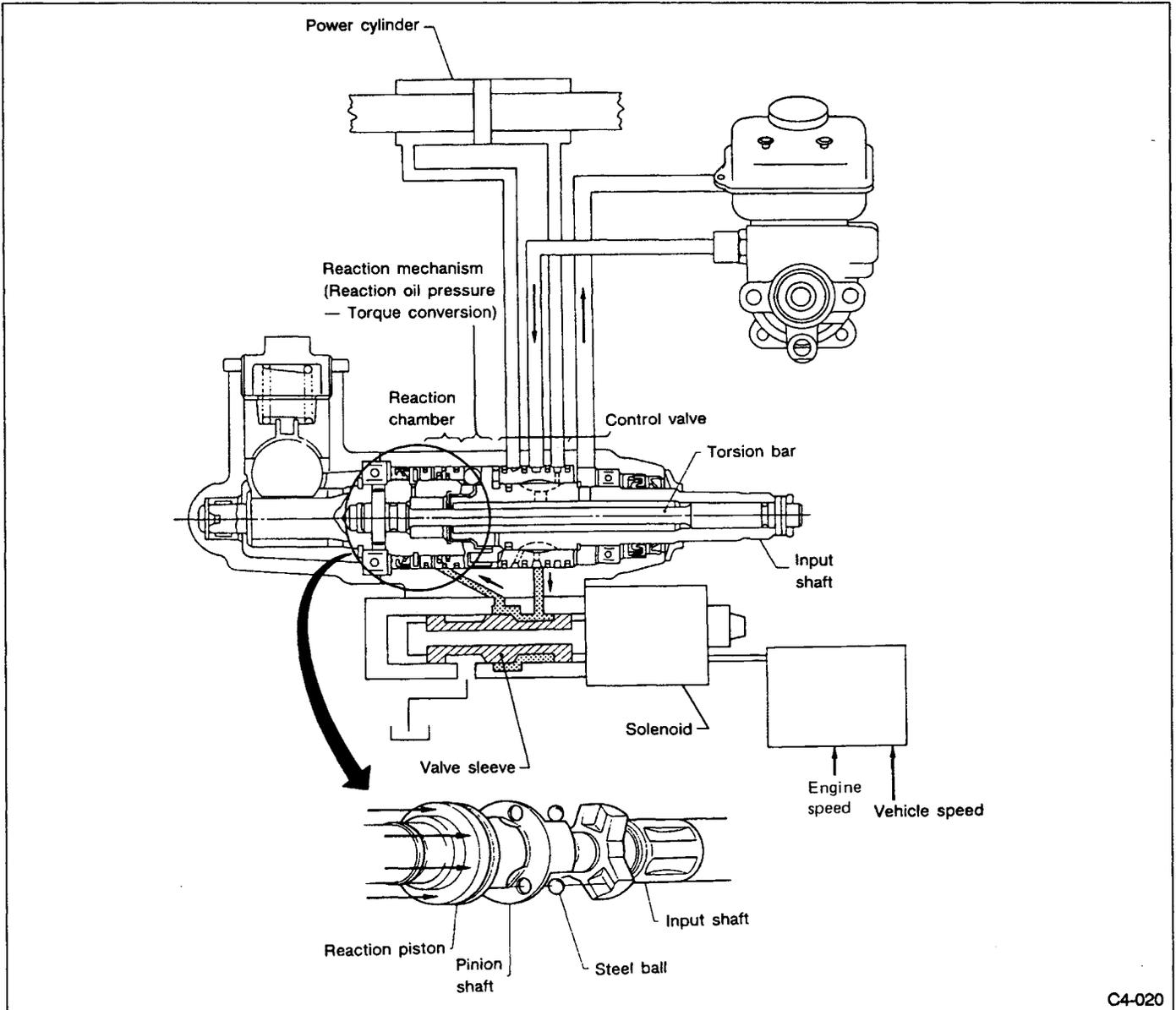


Fig. 25

C4-019

- 2) When driving at a medium speed:  
 From low to high or from straight ahead to turns, the reaction pressure of the power steering changes continuously.
- 3) When driving at a high speed:  
 As the current being supplied to the plunger becomes the minimum value, and the solenoid plunger moves

left to move the spool valve in the same direction, the pump pressure divided at the valve spot is led into the power steering reaction chamber to act on the reaction piston. As a result, a rigid steering response is felt by the driver during high-speed, straight ahead driving.



C4-020

Fig. 26

## 4. Self-Diagnosis System

### A: Function

#### 1. SELF-DIAGNOSTIC FUNCTION

##### 1) U-check mode:

Allows warning lamp to illuminate and trouble to be stored in memory if problem occurs.

#### 2. TROUBLE CODE

##### 2) Read memory mode:

Allows trouble memorized in U-check mode to read out.

##### 3) D-check mode:

Used when troubleshooting systems.

##### 4) Clear memory mode:

Clears or erases trouble stored in memory.

Troubleshooting and self-diagnostic results are identified by number of flashes on steering warning lamp located in instrument panel.

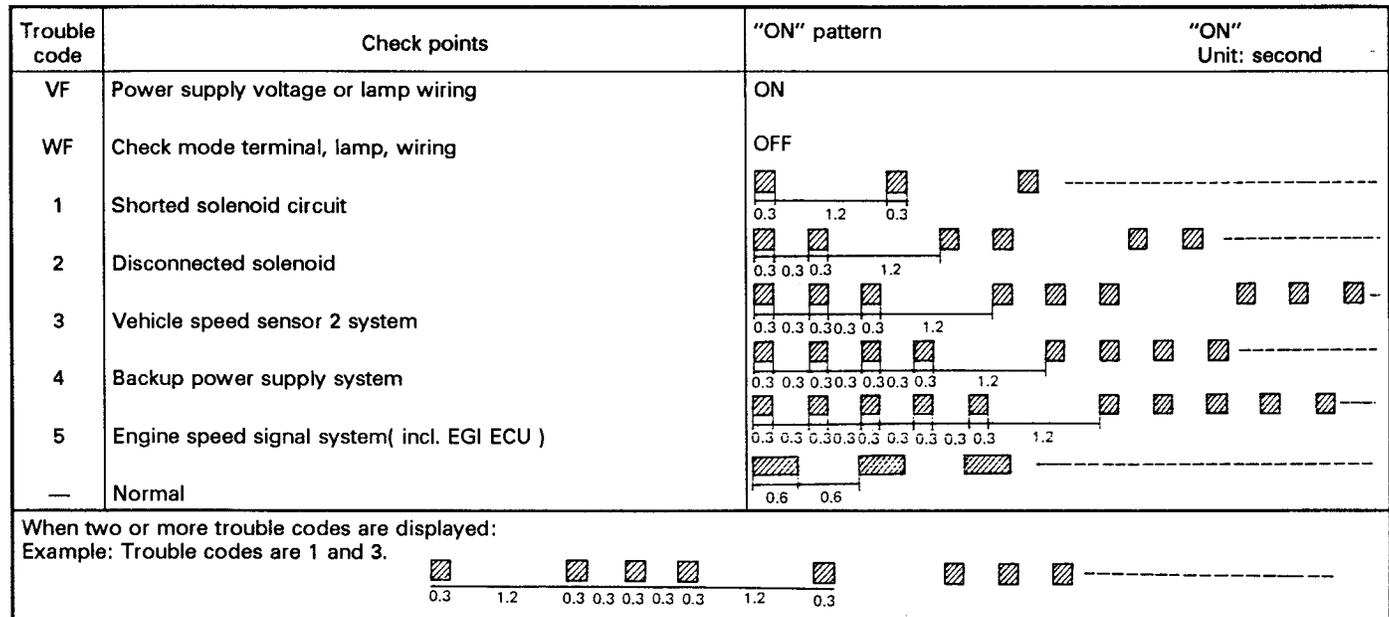


Fig. 27

C4-286

### B: FAIL-SAFE FUNCTION

Faulty system	Description	Control function
Vehicle speed sensor 2	When vehicle speed sensor 2 is disconnected during driving	To maintain "assist" characteristic at the time the trouble occurred.
	When vehicle speed sensor 2 is disconnected before driving	To control by engine speed sensing instead of vehicle speed.
Engine speed signal system	Engine r.p.m. is not input while vehicle speed sensor 2 is input.	To control by vehicle speed sensor 2 alone.
Solenoid	Solenoid valve coil harness is disconnected or shorted.	To turn "OFF" solenoid (Heavy steering)
ECU	ECU is faulty.	To turn "OFF" solenoid (Heavy steering)

# S SPECIFICATIONS AND SERVICE DATA

## A: SPECIFICATIONS

		Engine speed sensing type	Electronically controlled type	
Whole system	Minimum turning radius	m (ft)		
	Steering angle (Inside-Outside)	5.4 (17.7)		
	Steering wheel	Diameter	mm (in)	
		Maximum revolution (rev.)	36.2° — 31.6°	
		385 (15.16)		
		3.1		
Gearbox	Type	Rack and pinion, Integral		
	Backlash	0 (Automatically adjustable)		
	Valve (Power steering system)	Rotary valve		
	Overall gear ratio	16.2		
Oil pump (Power steering system)	Type	Vane pump		
	Oil reservoir tank	Installed on pump		
	Output	cm <sup>3</sup> (cu in)/rev.		
	Relief pressure	kPa (kg/cm <sup>2</sup> , psi)		
	Hydraulic fluid control		Dropping in response to increased engine revolution	Constant flow type
	Hydraulic fluid ℓ (US qt, Imp qt)/min	1,000 rpm	8.5 (9.0, 7.5)	9.0 (9.5, 7.9) (Constant)
		3,500 rpm	4.5 (4.8, 4.0)	
	Revolution speed range		(rpm)	
Direction of revolution		Clockwise		
Working fluid (Power steering system)	Name		ATF DEXRON II	
	Capacity ℓ (US qt, Imp qt)	Oil tank	0.3 (0.3, 0.3)	
		Total	1.0	

**B: SERVICE DATA**

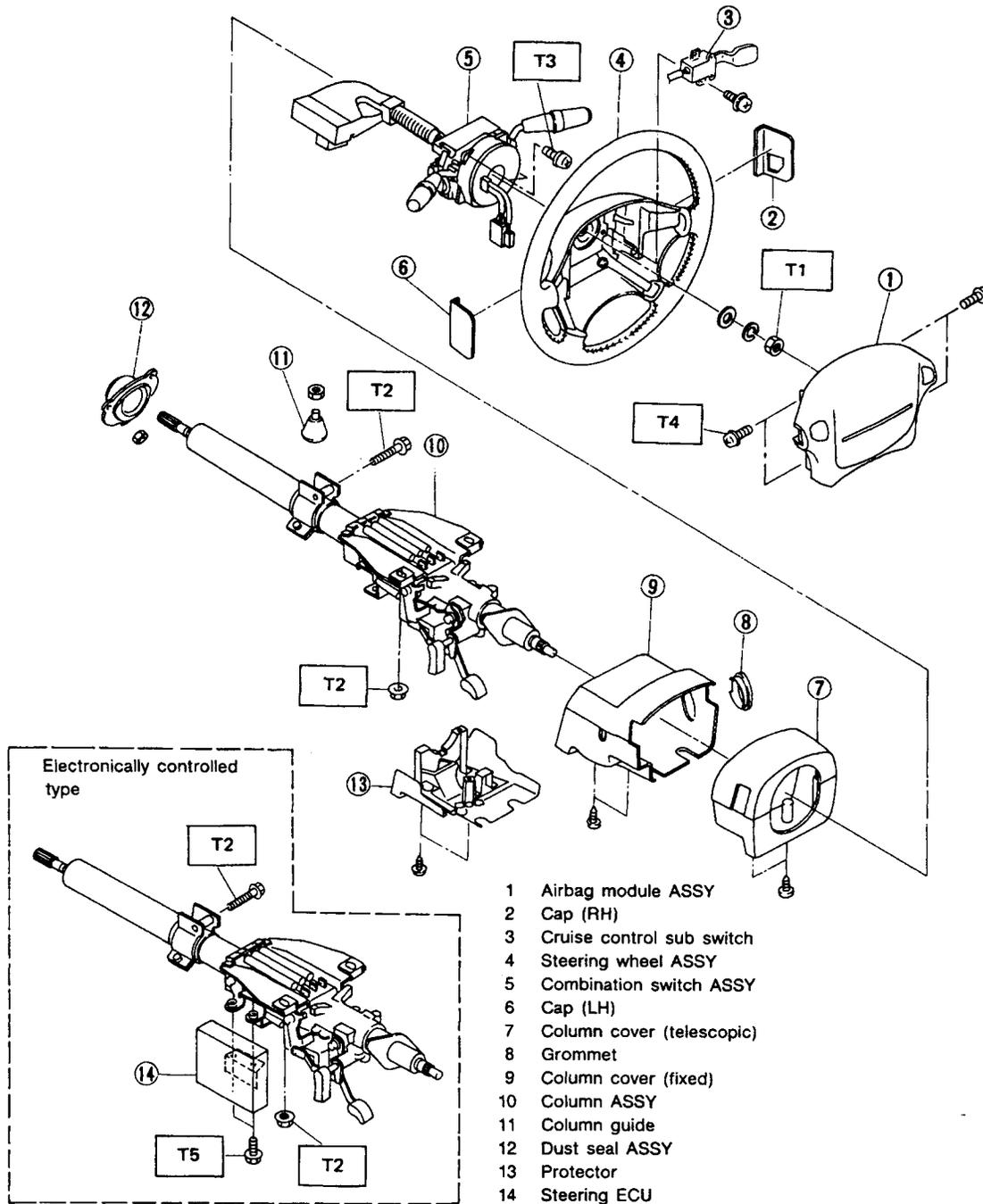
	ITEM	STANDARD	SERVICE LIMIT
Steering wheel	Free play mm (in)	17 (0.67)	
Turning angle	Inner tire & wheel	36.2°	
	Outer tire & wheel	31.6°	
Steering shaft	Clearance between steering wheel and column cover mm (in)	3.0 (0.118)	
Steering gearbox	Sliding resistance N (kg, lb)	265 (27, 60) less	
	Rack shaft play in radial direction Right-turn steering Left-turn steering mm (in)	0.15 (0.0059) or less Horizontal movement: 0.3 (0.012) or less Vertical movement: 0.15 (0.0059) or less	
	Input shaft play In radial direction In axial direction mm (in)	0.18 (0.0071) or less 0.1 (0.004) or less	
	Turning resistance N (kg, lb)	Within 30 mm (1.18 in) from rack center in straight ahead position: Less than 11.18 (1.14, 2.51) Maximum allowable value: 12.7 (1.3, 2.9)	
Oil pump (Power steering system)	Pulley shaft Radial play Axial play mm (in)	0.4 (0.016) or less 0.9 (0.035) or less	
	Pulley Ditch deflection Resistance to rotation mm (in) N (kg, lb)	1.0 (0.039) or less 9.22 (0.94, 2.07) or less	
	Regular pressure kPa (kg/cm <sup>2</sup> , psi)	981 (10, 142) or less	
	Relief pressure kPa (kg/cm <sup>2</sup> , psi)	7,649 — 8,336 (78 — 85, 1,109 — 1,209)	
Steering wheel effort (Power steering system)	At standstill with engine idling on a concrete road N (kg, lb)	Engine speed sensing type	30.4 (3.1, 6.8)
		Electronically controlled type	24.5 (2.5, 5.5)
	At standstill with engine stalled on a concrete road N (kg, lb)	147 (15, 33) or less	

**C: RECOMMENDED POWER STEERING FLUID**

Recommended power steering fluid	Manufacturer
ATF DEXRON II	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

# C COMPONENT PARTS

## 1. Steering Wheel & Column



**Tightening torque: N·m (kg-m, ft-lb)**

T1:	29 — 39 (3.0 — 4.0, 22 — 29)
T2:	20 — 29 (2.0 — 3.0, 14 — 22)
T3:	3 — 5 (0.3 — 0.5, 2.2 — 3.6)
T4:	8 — 12 (0.8 — 1.2, 5.8 — 8.7)
T5:	6 — 9 (0.6 — 0.9, 4.3 — 6.5)

Fig. 28

C4-021

## 2. Power Steering System

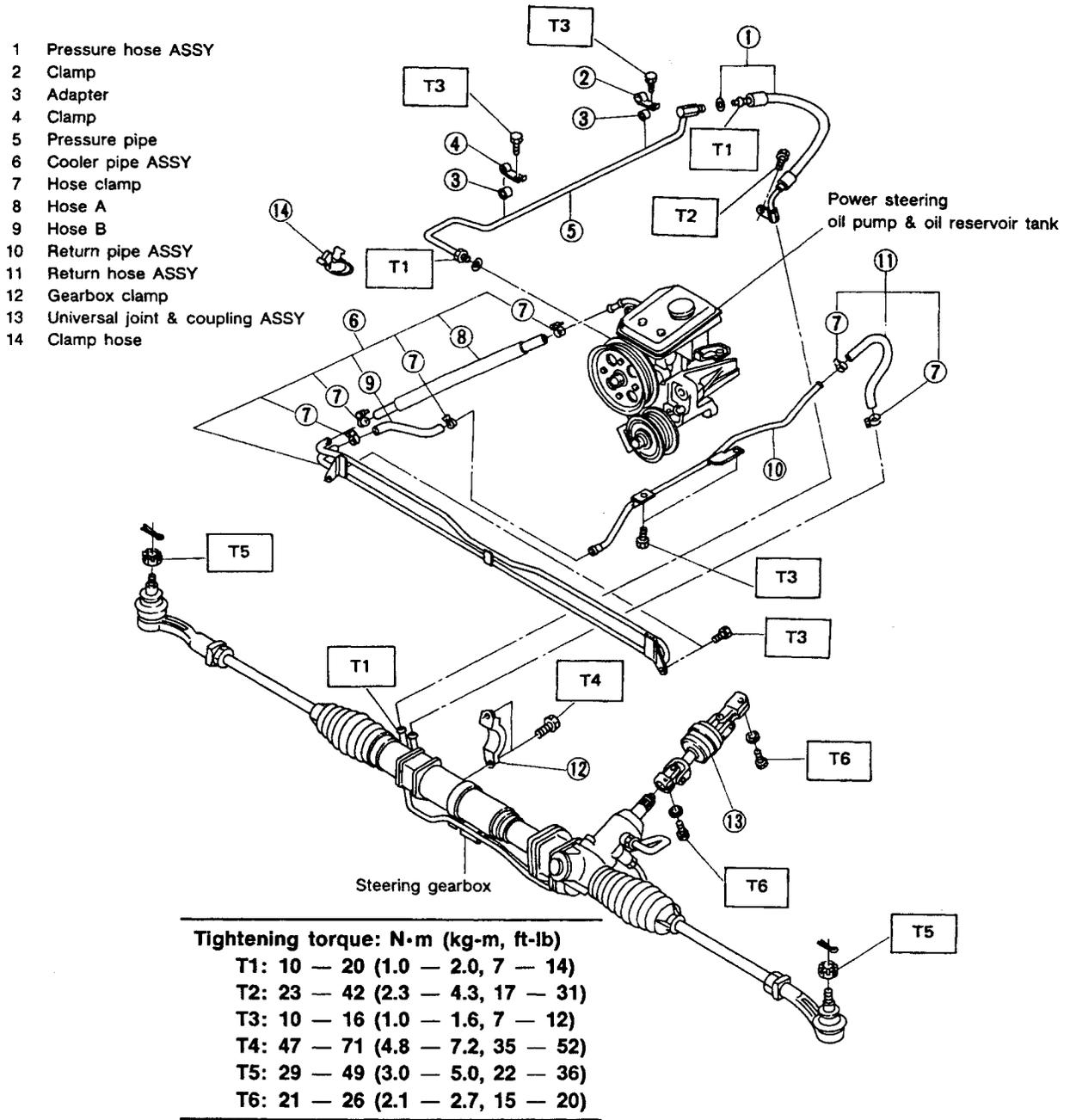


Fig. 29

C4-022

### 3. Steering Gearbox

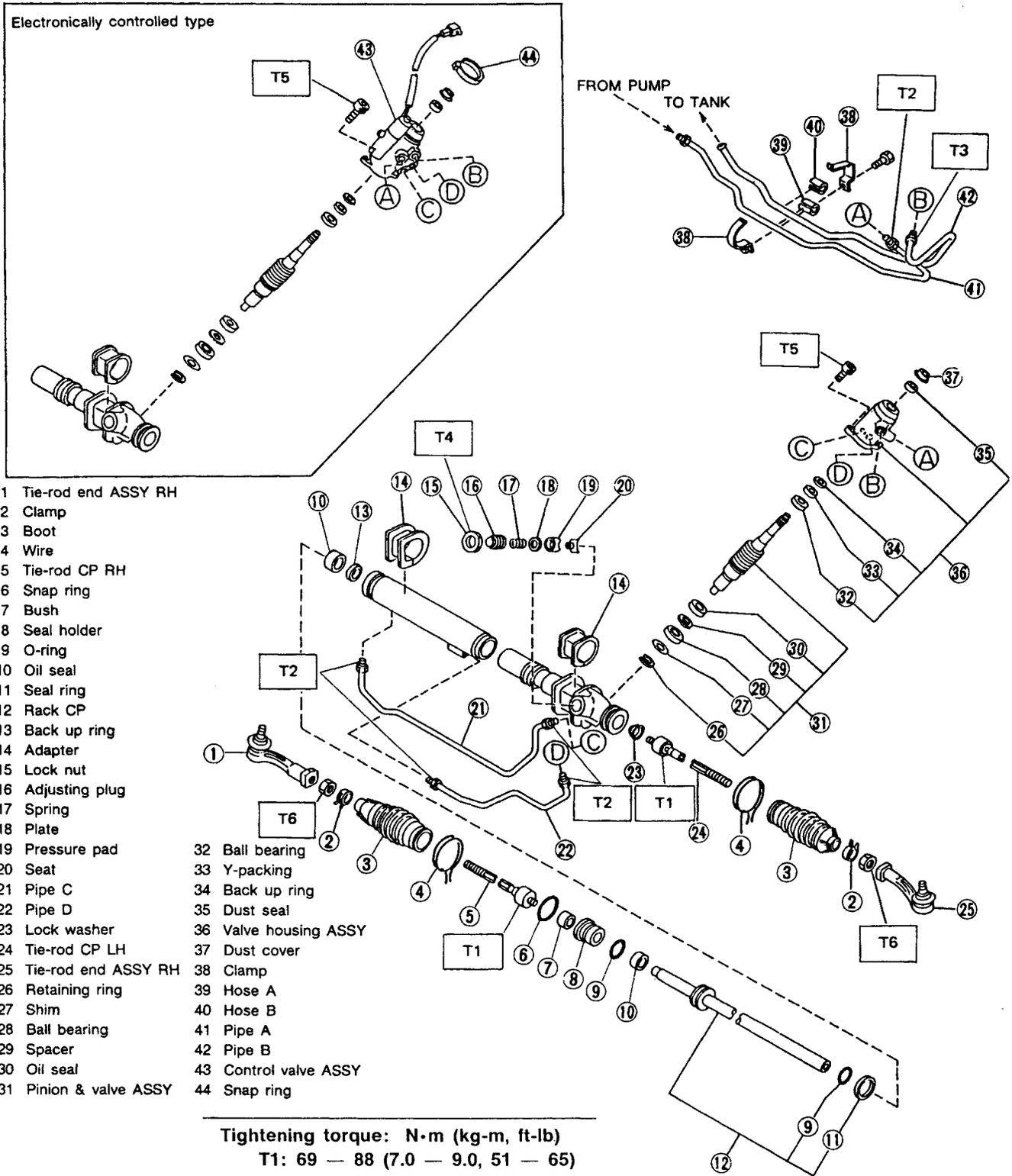


Fig. 30

C4-026

### 4. Power Steering Oil Pump & Tank

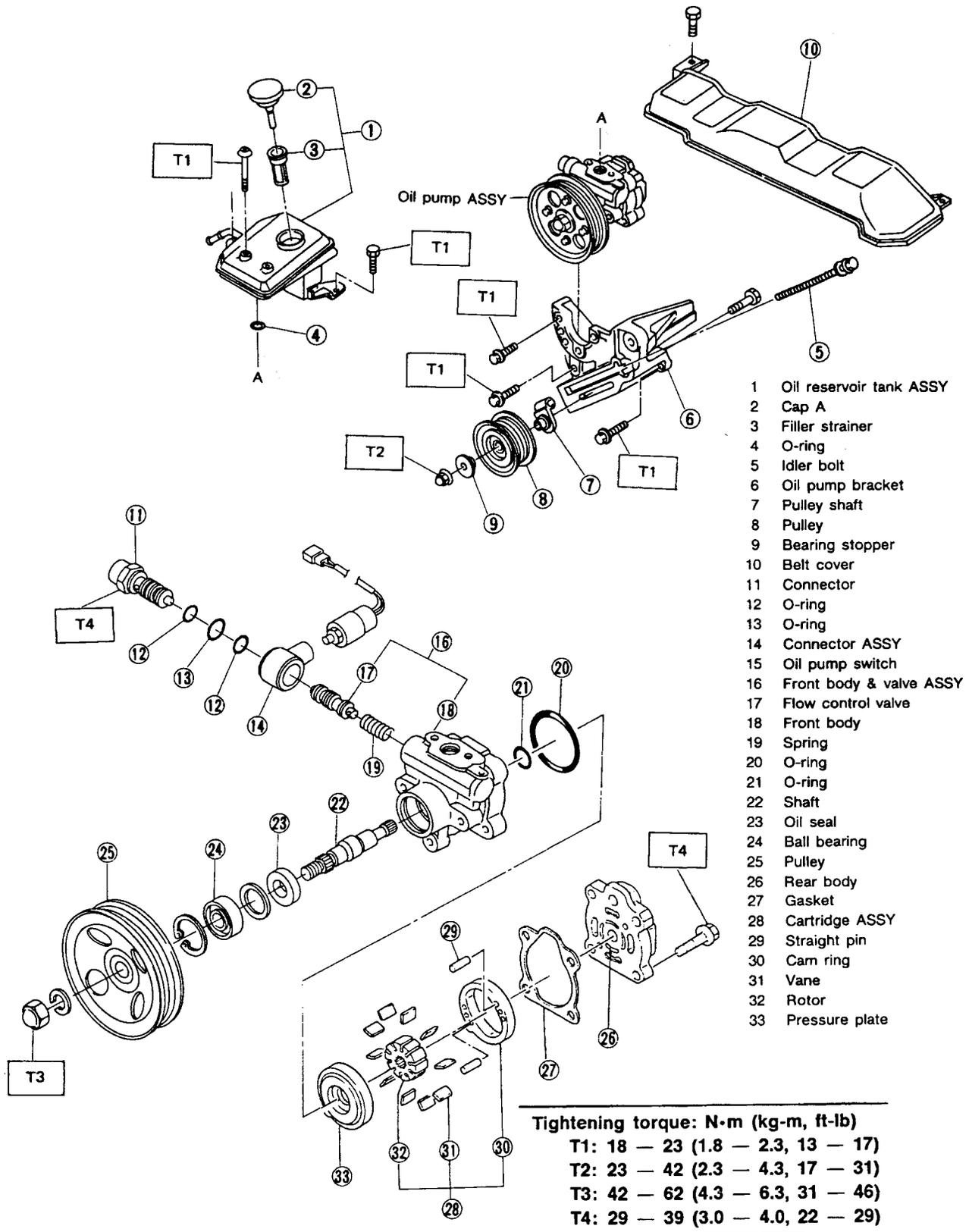


Fig. 31

# W SERVICE PROCEDURE **AIRBAG**

## 1. Supplemental Restraint System "Airbag"

Airbag system wiring harness is routed near the steering system.

a. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

b. Be careful not to damage system wiring harness when servicing steering system.

## 2. Tilt & Telescopic Steering Column with Memory Function

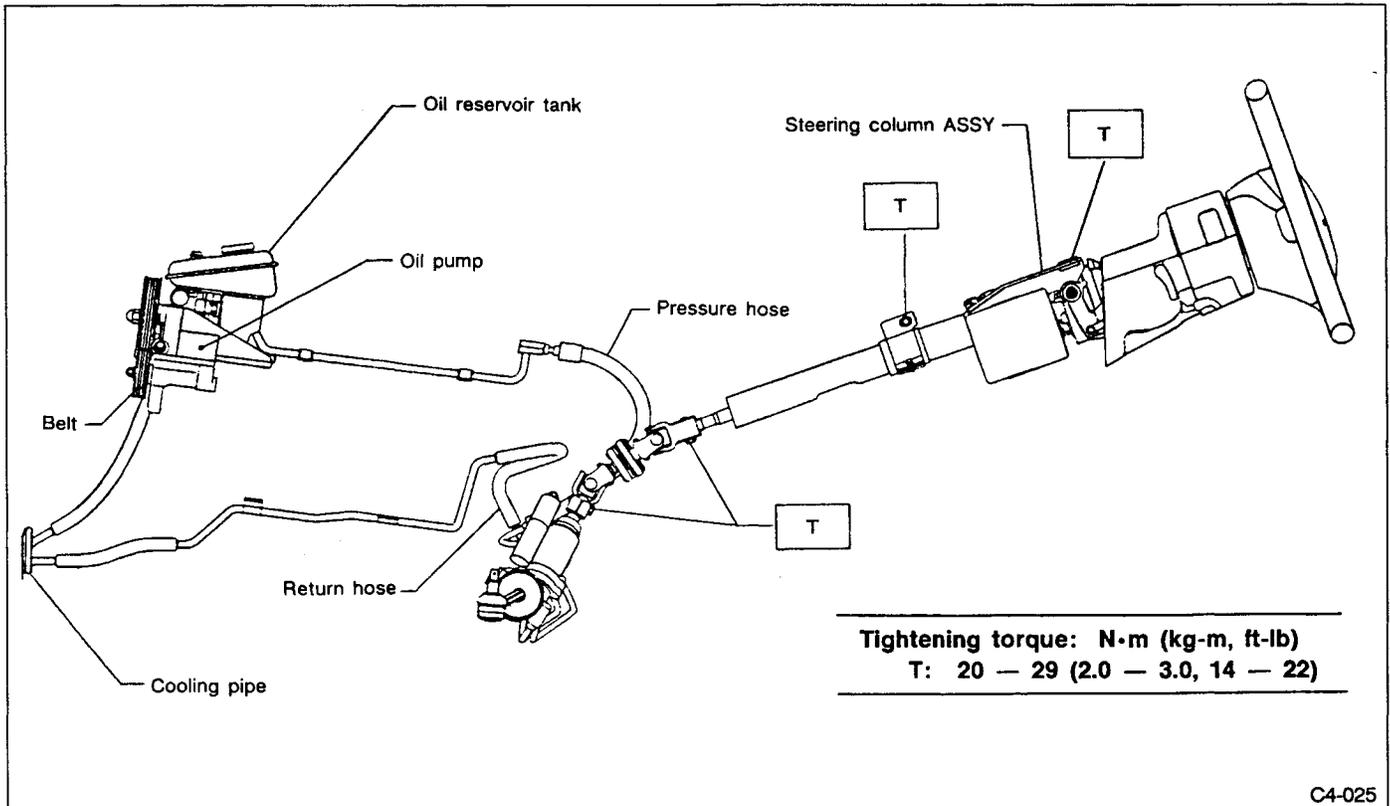


Fig. 32

### A: REMOVAL

- 1) Disconnect battery earth (-) terminal.
- 2) Remove airbag module ASSY. (Ref. to [5-5] No. W1B2.)
  - a. Turn ignition switch "OFF" and wait 10 minutes before starting work.
  - b. After removal, store airbag module with pad side facing upward. Do not put any object on pad.
    - (1) Remove cap (LH).
    - (2) Remove cap (RH).
    - (3) Disconnect airbag system connector at harness spool.
    - (4) Set front tires in straight ahead direction.
    - (5) Remove both steering wheel covers and remove bolts securing airbag module ASSY using TORX® bit T30.

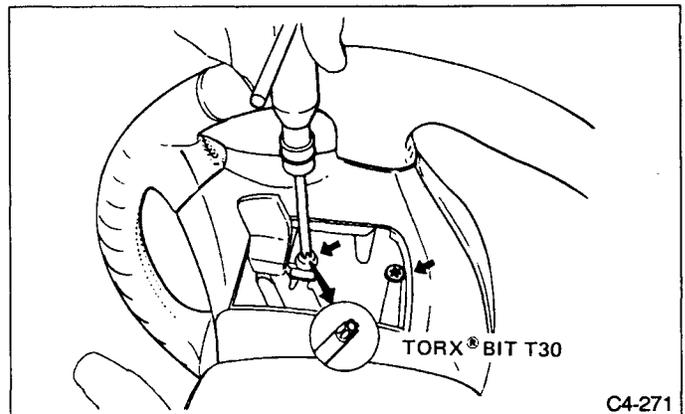


Fig. 33

- (6) Turn over airbag module ASSY and disconnect airbag system connector. (Ref. to [5-5] No. W1B2.)
- (7) Disconnect horn and cruise control connectors.

3) Lift vehicle and remove lower and upper bolts from universal joint ASSY, and then remove universal joint in the upward direction.

**Scribe alignment marks on universal joint ASSY so that it can be reassembled at the original serration.**

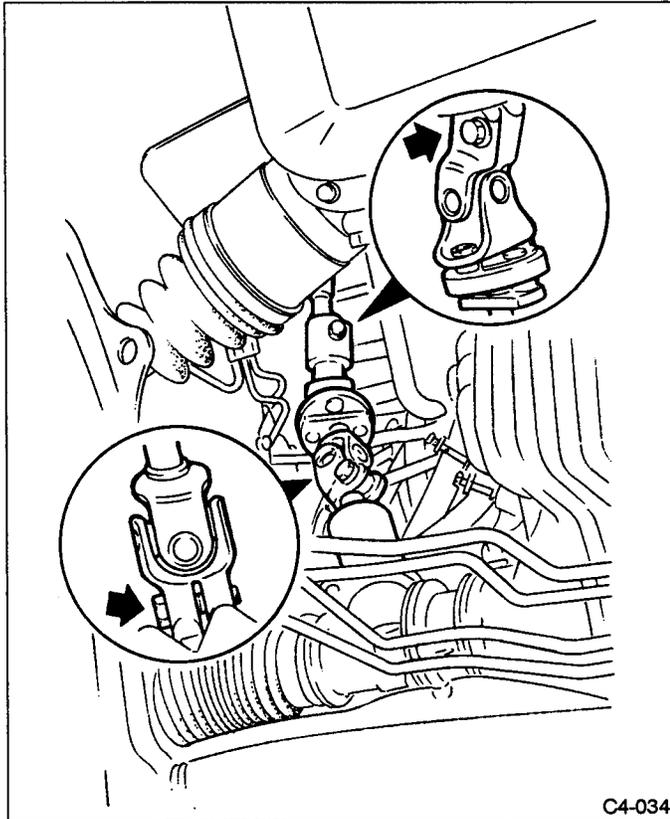
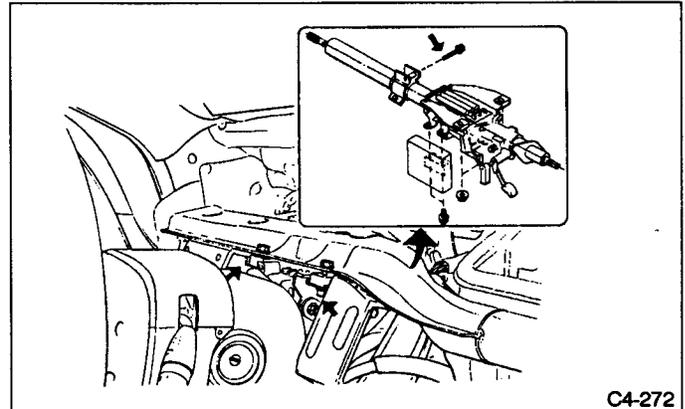


Fig. 34

C4-034

4) Disconnect connectors for ignition switch, steering ECU, and combination switch wiring harness under instrument panel.

5) Remove two nuts and a bolt under instrument panel securing steering shaft.



C4-272

Fig. 35

6) Pull out steering shaft ASSY from hole on toe board. **Be sure to remove universal joint before removing steering shaft ASSY installing bolts when removing steering shaft ASSY or when lowering it for servicing of other parts.**

**B: DISASSEMBLY**

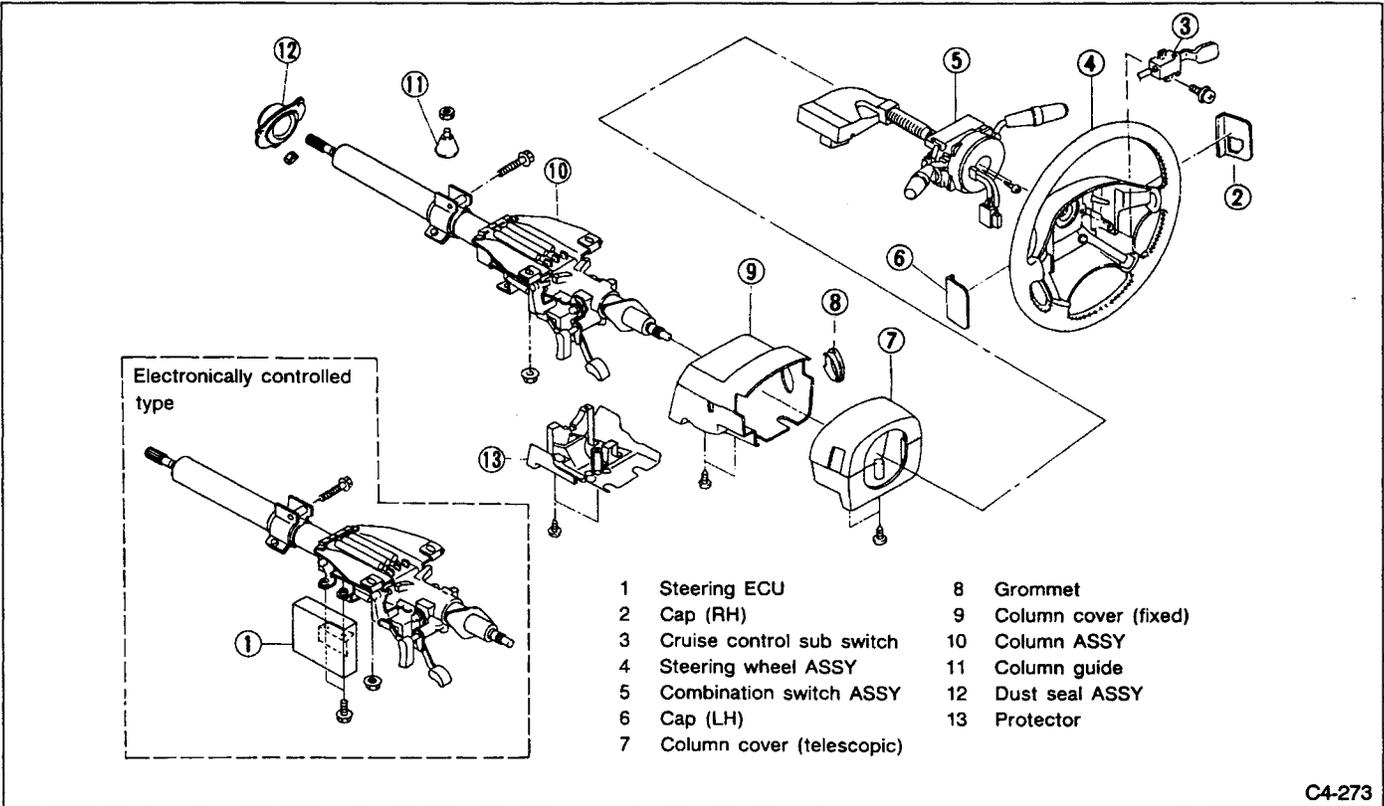


Fig. 36

1) Remove steering wheel nut, then draw out wheel from shaft using steering puller.

2) Remove steering column covers, combination switch ASSY, protector and steering ECU (only for electronically controlled type).

**Steering column ASSY is not disassembled.**

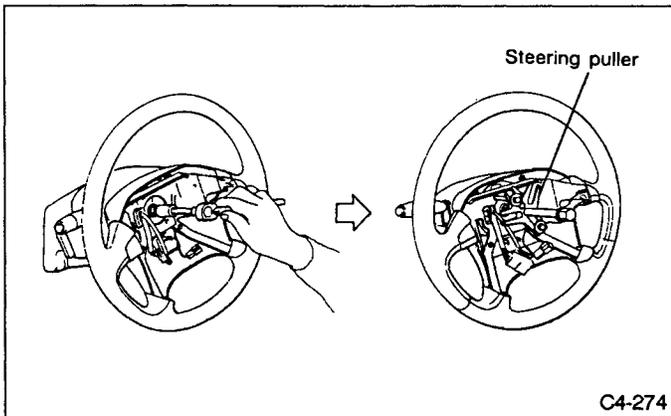
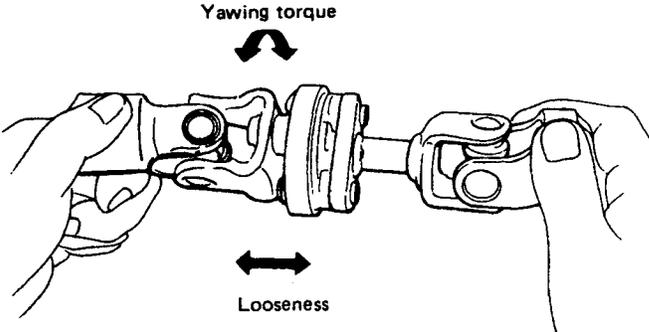
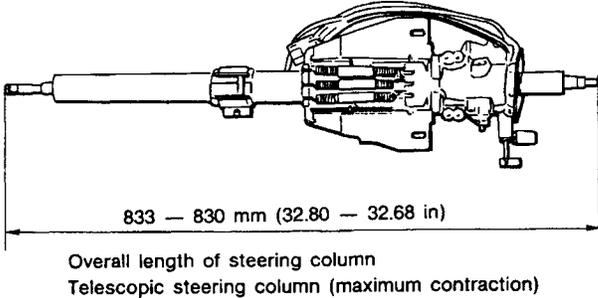


Fig. 37

**Be careful not to catch connector when removing steering wheel.**

**C: INSPECTION**

Clean the disassembled parts with a cloth, and check for wear, damage or any other faults. If necessary, repair or replace faulty parts.

Part name	Inspection	Corrective action
Universal joint ASSY	<ul style="list-style-type: none"> <li>● Free play</li> <li>● Swinging torque</li> <li>Yawing torque</li> <li>Looseness</li> </ul>  <p style="text-align: right;">C4-269</p> <p><i>Fig. 38</i>  <b>Standard value of universal joint free play : 0 mm (0 in)</b>  <b>Max. value of universal joint swinging torque : 0.3 N·m (0.03 kg·m, 0.2 ft·lb)</b></p>	Replace if faulty.
Steering column	<ul style="list-style-type: none"> <li>● Overall length of steering column</li> </ul> <p>Measure overall length of steering column.          Standard overall length of steering column.</p>  <p style="text-align: right;">C4-270</p> <p><i>Fig. 39</i></p>	Replace steering column ASSY.

Concerning "Airbag module", refer to chapter 5-5.

**D: ASSEMBLY**

Install steering ECU, protector, combination switch ASSY and steering column covers.

- a. **Don't overtorque screw.**
- b. **Before installing combination switch ASSY, ensure that front wheels are set in straight-forward direction.**
- c. **Before installing column cover (telescopic), turn airbag system roll connector to neutral (CENTER).**  
(Ref. to [5-5] No. W1E1.)

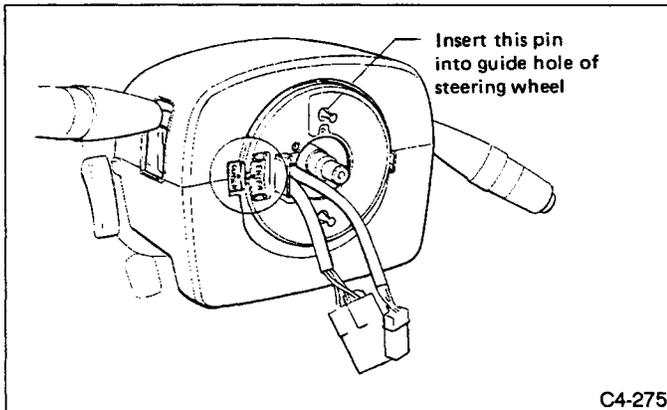


Fig. 40

**E: INSTALLATION**

- 1) Insert end of steering column ASSY into toe-board dust seal.
- 2) Tighten column ASSY mounting bolt and nuts under instrument panel.
- 3) Connect ignition and combination switch connectors under instrument panel.
- 4) Connect airbag system connector at harness spool.  
**Make sure to apply double lock.**
- 5) Set steering wheel to neutral and install it onto steering shaft. Insert roll connector guide pin into guide hole on lower end of surface of steering wheel to prevent damage.  
Draw out airbag system connector, horn connector and cruise control connectors from guide hole of steering wheel lower end.
- 6) Tighten steering wheel securing nut.
- 7) Install universal joint.

- (1) While aligning marks scribed during disassembly, push long yoke of joint ASSY all the way into serrated portion of column ASSY, setting bolt hole in cutout.
- (2) Then pull the short yoke all the way out of the serrated portion of the gear box ASSY setting the bolt hole in the cutout.
- (3) Insert the bolt through the short yoke, pull the joint ASSY and confirm that the bolt is in cutout of the gearbox ASSY.
- (4) Fasten the short yoke side with a spring washer and bolt, then fasten the long yoke side.

**Tightening torque:**

**21 — 26 N·m (2.1 — 2.7 kg-m, 15 — 20 ft-lb)**

- a. **Make sure that universal joint bolts are tightened through notch in shaft serration.**
- b. **Excessively large tightening torque of universal joint bolts may lead to heavy steering wheel operation.**

**Standard clearance between universal joint ASSY and FTJ (Free ring Tripod Joint):**

**Over 15 mm (0.59 in)**

- 5) Installation of airbag module.
  - a. **Do not install deployed module.**
  - b. **Do not allow harness and connector to interfere with other parts or get caught between them.**
    - (1) **Make sure that ignition switch is turned "OFF".**  
**After ignition switch is turned off, wait 10 minutes before starting work.**
    - (2) Make sure that front tires are set in straight ahead direction.
    - (3) Make sure that roll connector is in neutral position.
    - (4) Connect airbag connector.

**Make sure to apply double lock.**

- (5) Connect horn and cruise control connectors.
- (6) Fasten bolts securing module using TORX® bit T30. (Refer to 5-5 [C000].)
- (7) Install both steering wheel lower covers.

**Airbag warning lamp check:**

**Make sure that when ignition switch is turned to "ON", airbag warning lamp goes off after being "lit" for 8 seconds.**

### 3. Steering Gearbox (Power Steering System)

For disassembly and assembly of gearbox unit, refer to section Control Valve (Power Steering Gearbox).

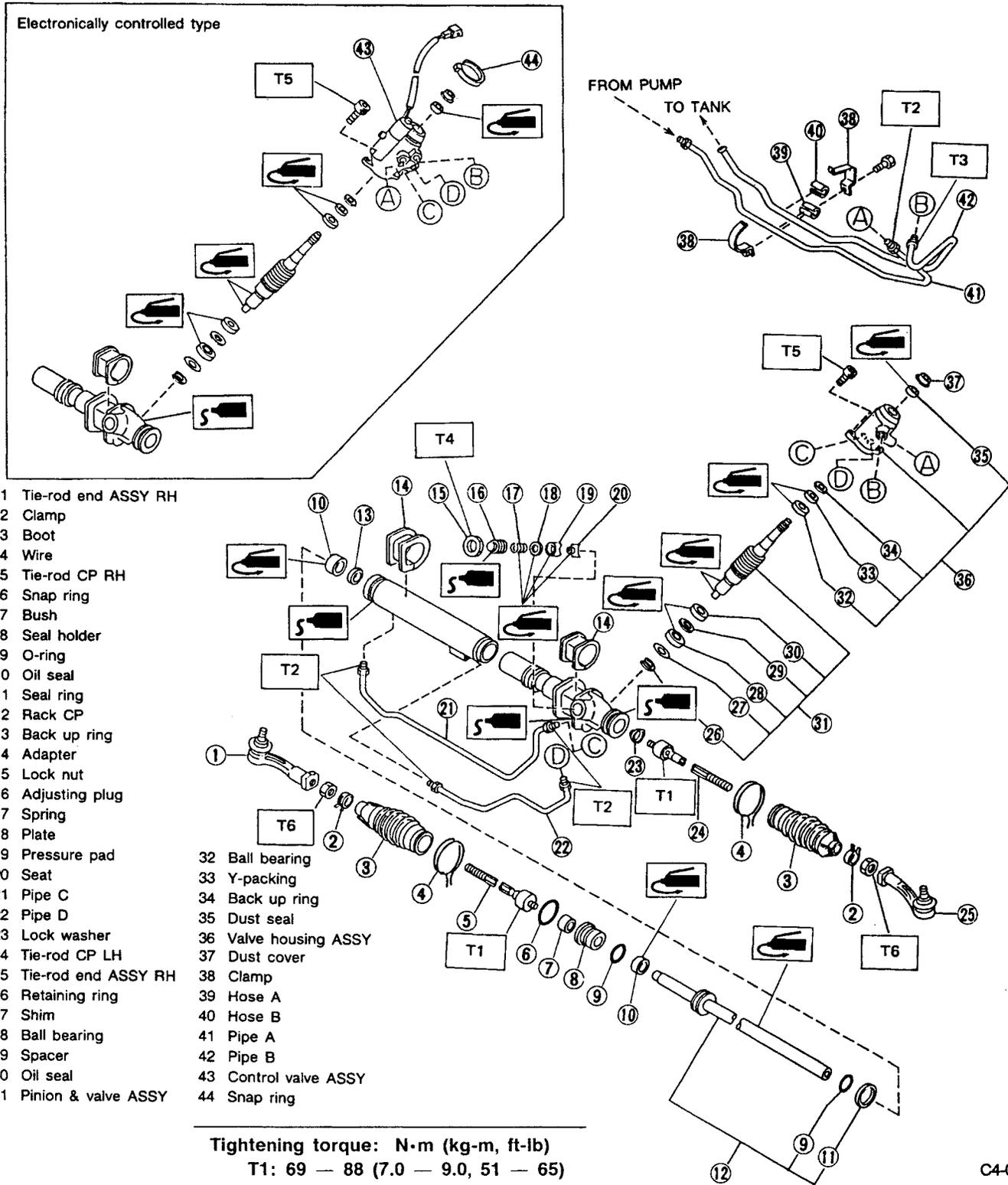
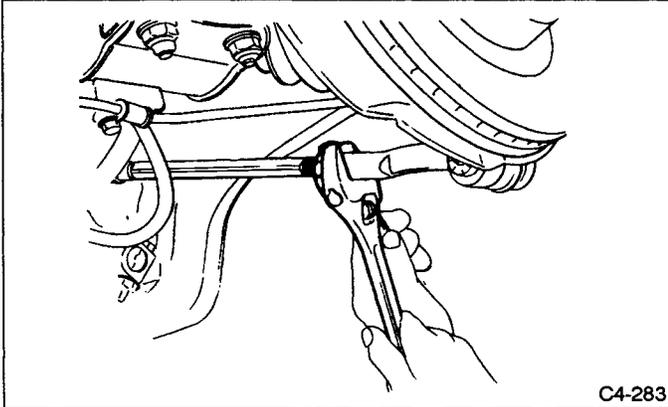


Fig. 41

C4-023

**A: ON CAR SERVICE****— Replacement of gearbox boot (When replacing boot without removing gearbox)**

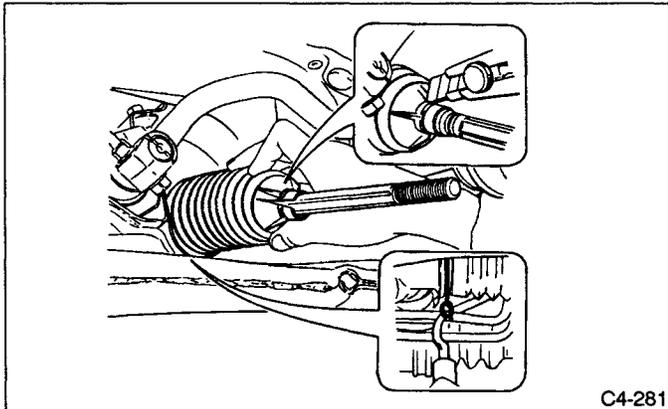
- 1) Remove front wheel.
- 2) Remove tie-rod end from knuckle arm. (Ref. to [4-2] No. W1A0.)
- 3) Remove tie-rod end ASSY.



C4-283

Fig. 42

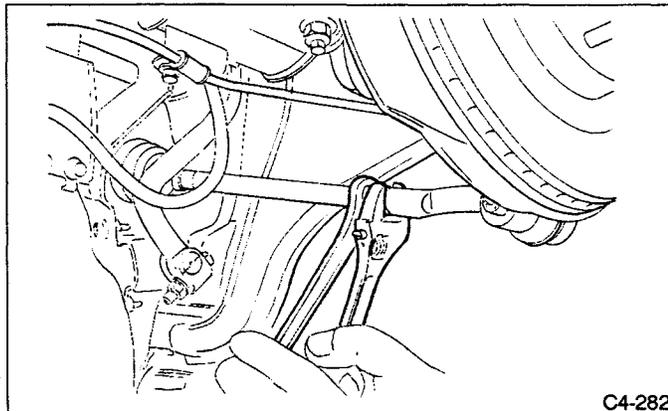
- 4) Remove boot clip and wire.
- 5) Cut outer end of boot and remove boot.



C4-281

Fig. 43

- 6) Installation is in the reverse order of removal. Apply sealant to large end of boot and silicon grease to small end.



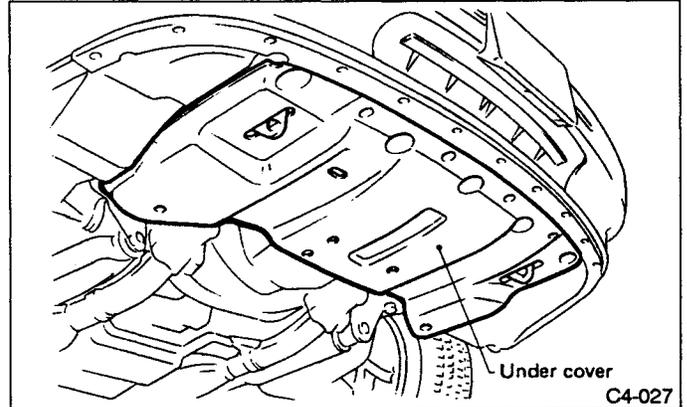
C4-282

Fig. 44

- a. When installing new boot, secure small side (wheel side) end of boot, then secure the other (large) end.
- b. After replacing boot, make sure toe-in/out is adjusted.

**B: REMOVAL**

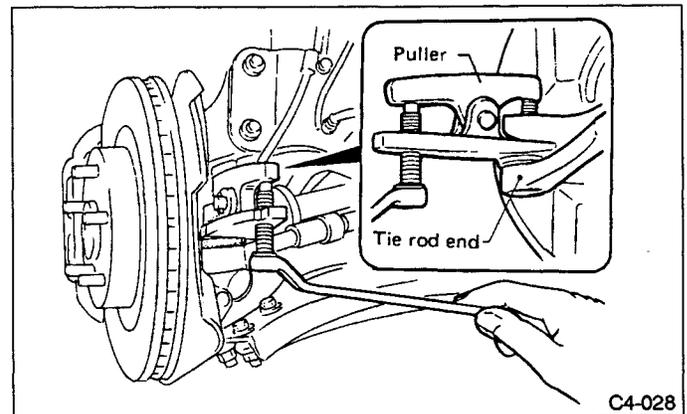
- 1) Disconnect battery earth (-) terminal.
- 2) Disconnect both O<sub>2</sub> sensor and steering harness connector. (only for electronically controlled type)
- 3) Raise vehicle with a jack and remove front wheels.
- 4) Remove front under cover.



C4-027

Fig. 45

- 5) Disconnect O<sub>2</sub> sensor harness from clip.
- 6) Remove collector cover and rear catalytic converter protector.
- 7) Disconnect front exhaust pipe. (Ref. to [2-9] No. W3A0.)
- 8) Using a puller, remove tie-rod end from knuckle arm after pulling off cotter pin and removing castle nut.



C4-028

Fig. 46

- 9) Remove spring pin which secures transmission spindle to FTJ (Free ring Tripod Joint). Discard old spring pin. Replace with a new one.

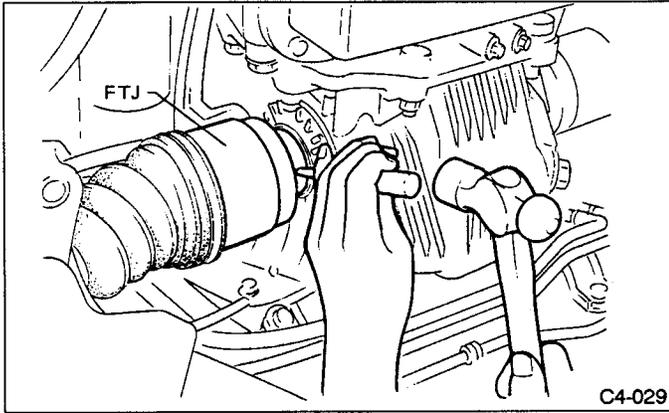


Fig. 47

10) Remove FTJ from transmission spindle and free from transmission.

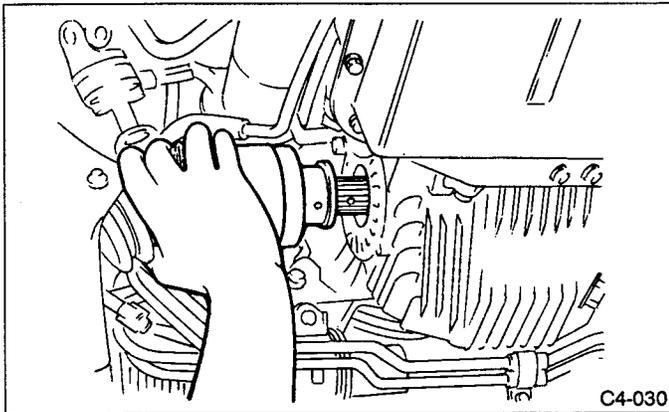


Fig. 48

11) Disconnect the pipe joint from upper hose and drain fluid rotating steering wheel to the right and left. Similarly, loosen flare nut securing other pipe and disconnect the pipe and drain fluid from the pipe.

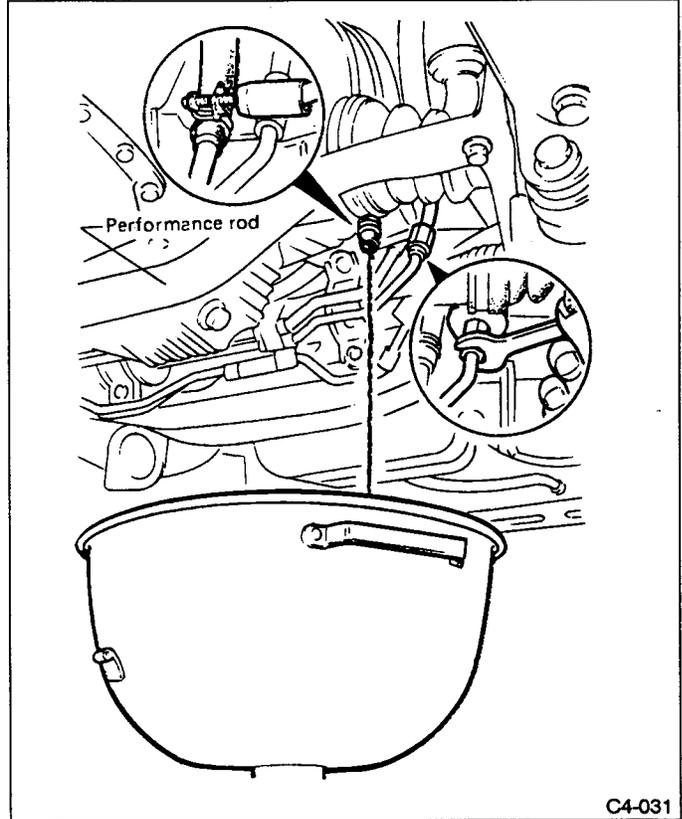


Fig. 49

12) Disconnect performance rod.

13) Disconnect transverse link ball joint from housing.

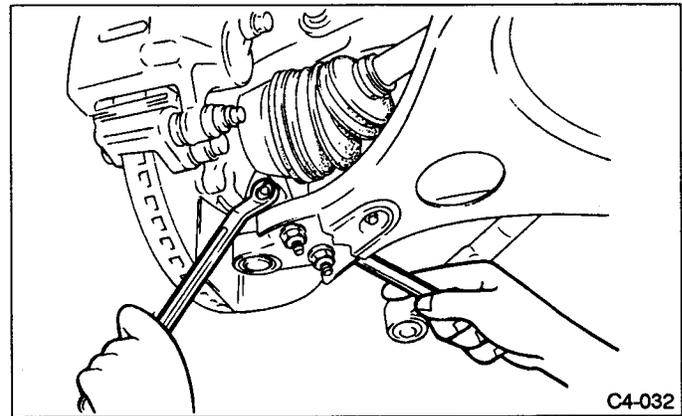


Fig. 50

a. After removal, cover with a waste cloth at the transverse link ball joint to prevent being scratched.

b. This step applies to facilitate operation for left side only.

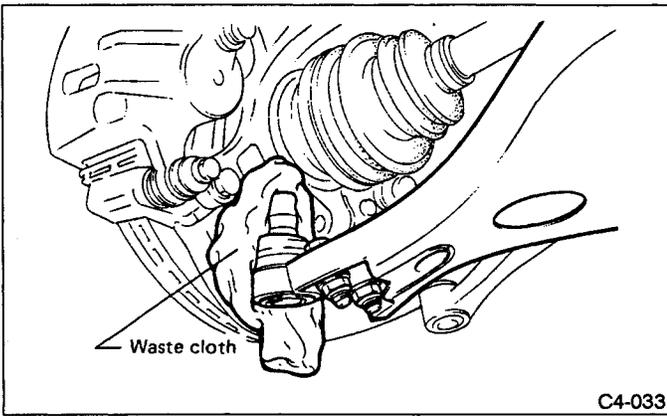


Fig. 51

14) Remove lower and upper bolts from universal joint ASSY, and remove universal joint in the upward direction.

- a. Scribe alignment marks on universal joint ASSY so that it can be reassembled at the original serration.
- b. Do not turn steering wheel as this will cause the airbag system roll connector become misaligned.

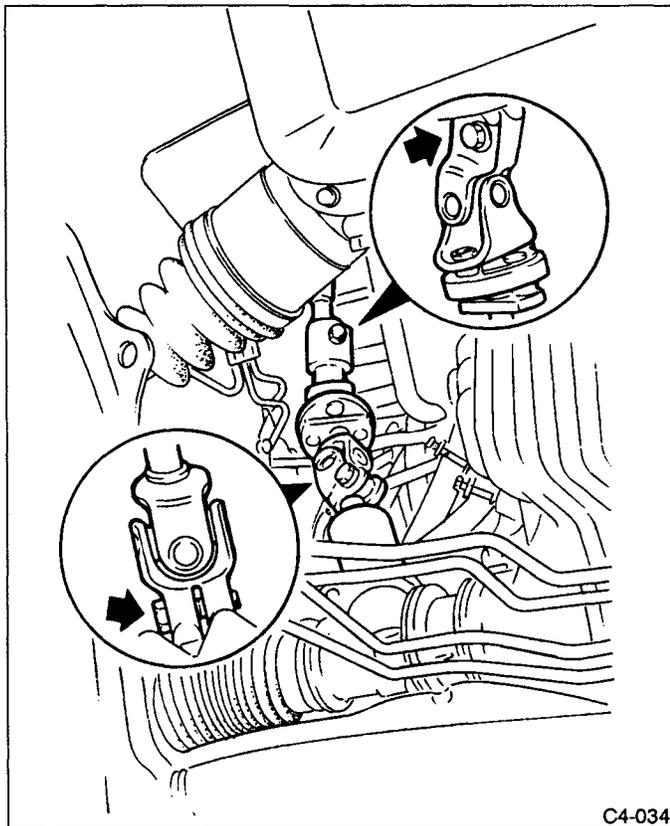


Fig. 52

15) Remove bolts securing gearbox to sub-frame, and detach gearbox.

● To avoid scratching pipes, wrap with cloth during removal.

(1) Remove securing bolts.

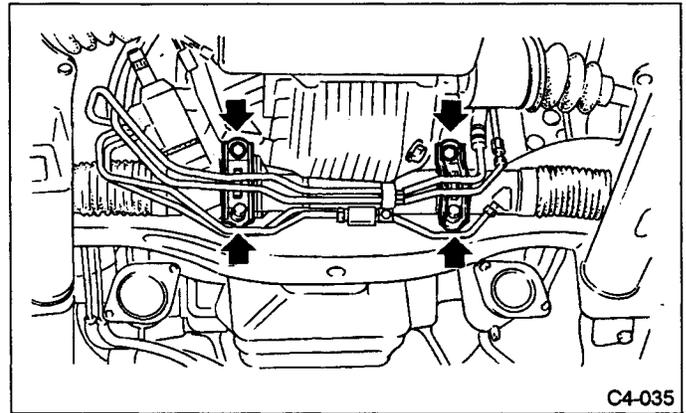


Fig. 53

(2) To ease removal of gearbox, turn gearbox ASSY around so that control valve faces rear.

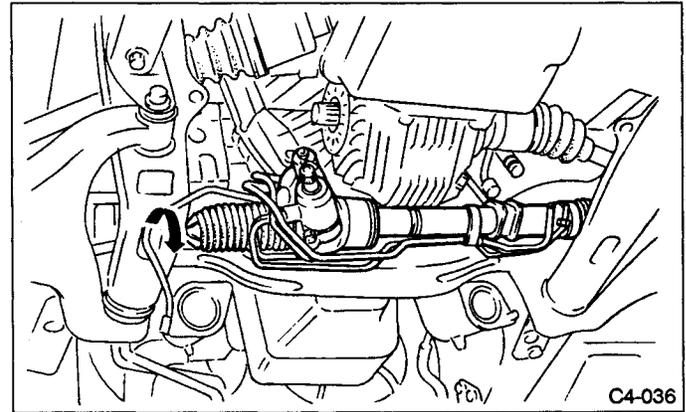


Fig. 54

(3) Move gearbox ASSY fully to the right so that left tie-rod end can be removed from subframe.

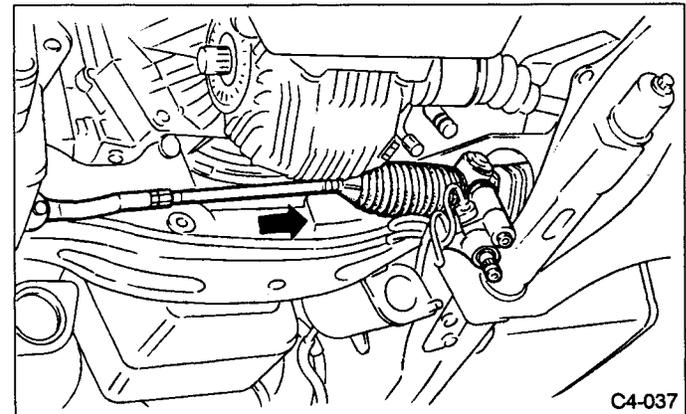


Fig. 55

(4) Remove gearbox ASSY from vehicle.

**C: DISASSEMBLY**

1) Secure gearbox removed from vehicle in vice using STAND.

**Secure the gearbox ASSY in a vice using the special tool as shown. Do not attempt to secure it without this special tool.**

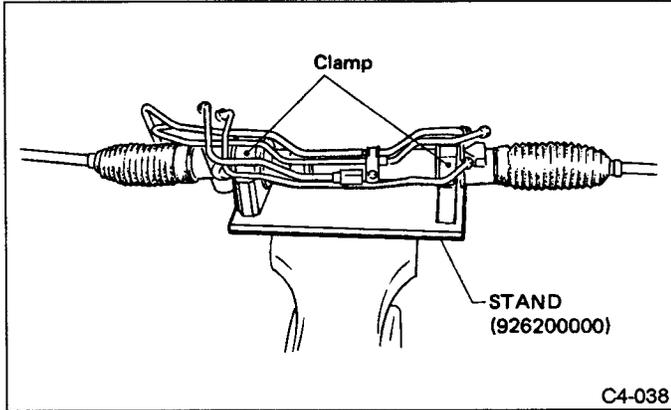


Fig. 56

- 2) Disconnect the two pipes in/out from gear box after removal of pipe clamp.
  - 3) Disconnect pipes A and B from steering body and control valve housing.
- Replace pipes and/or flare nuts if damaged.**

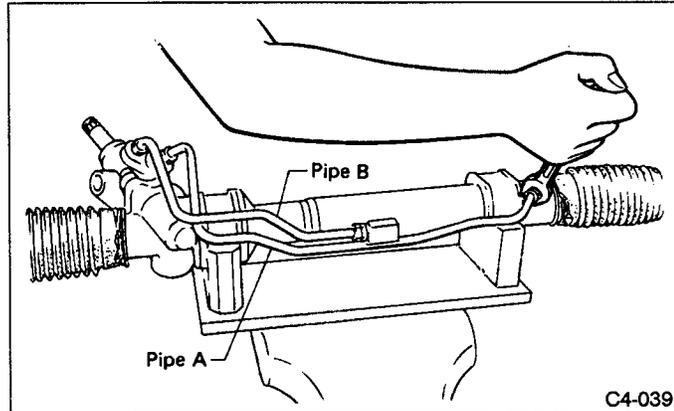


Fig. 57

- 4) Remove tie-rod end and lock nut.
- 5) Pry off clip from small end of boot, and slide it toward tie-rod end.

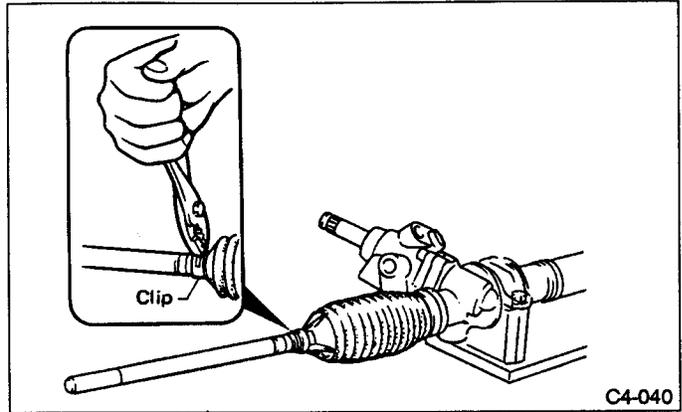


Fig. 58

- 6) Using special tool, remove lock wire from large end of boot.

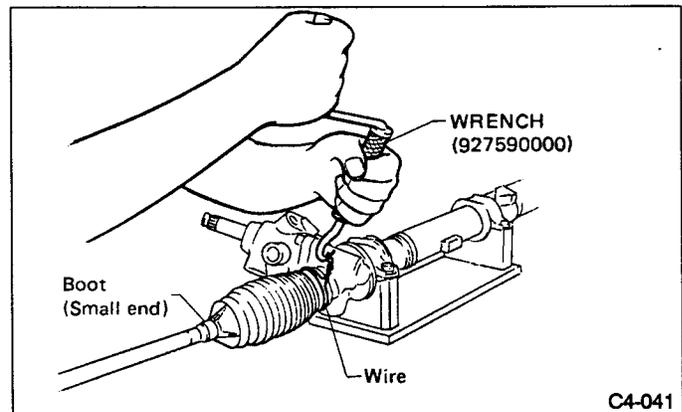


Fig. 59

- 7) Cut and remove the boot.
- Boot must be replaced with a new one whenever it is removed.**

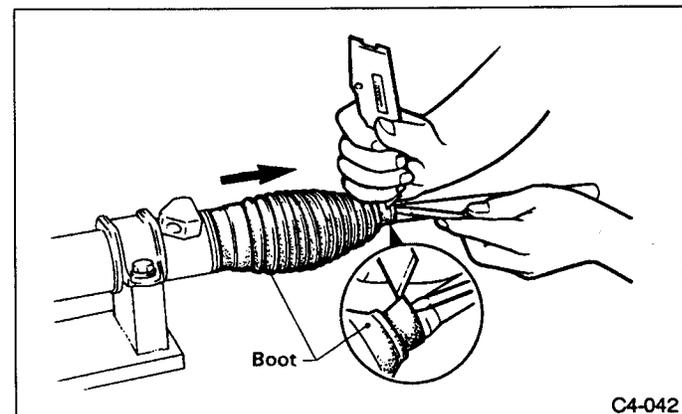


Fig. 60

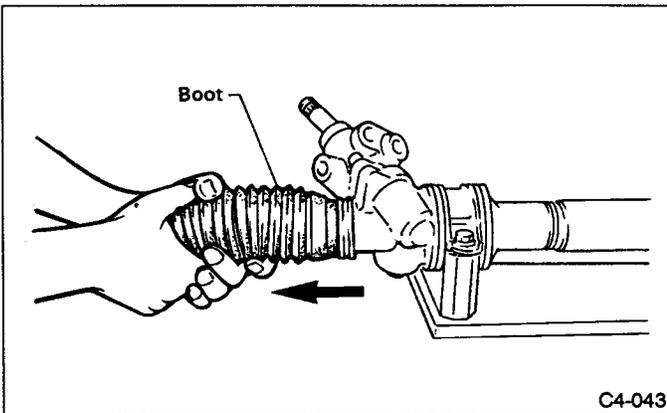


Fig. 61

8) Set rack so that it protrudes about 40 mm (1.57 in) outside. Pry clinched portion of tie-rod lock washer with standard screwdriver. (both left and right side)

- a. Be careful not to scratch rack, since it can cause oil to leak.
- b. Tie-rod lock washer must be replaced with a new one whenever it is removed.

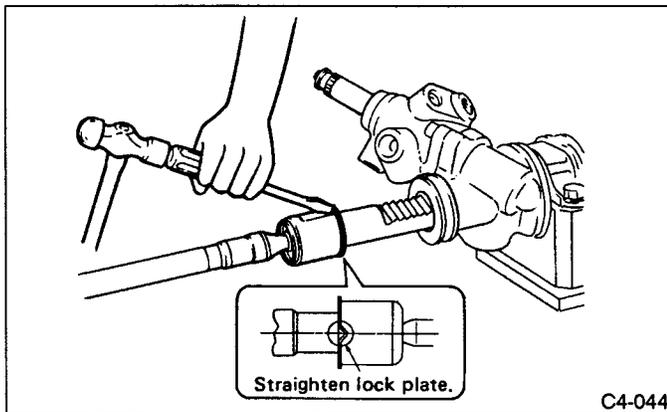


Fig. 62

9) Using special tool, loosen lock nut. Tighten adjusting screw until it no longer tightens.

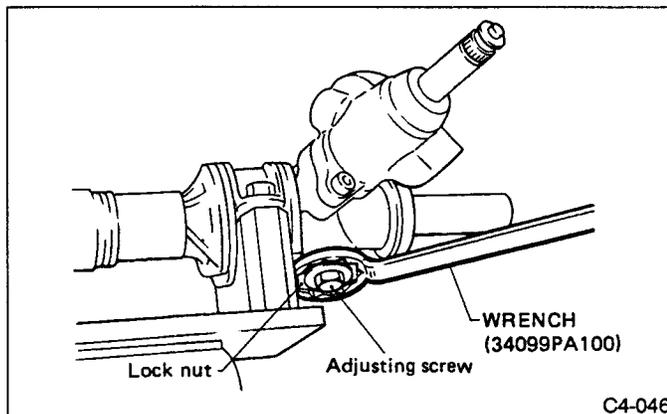


Fig. 63

10) Using WRENCH [32 mm (1.26 in) width across flats], (P/N 34099PA100) or adjustable wrench, remove tie-rod CP.

- a. Check ball joint for free play, and tie-rod for bends; replace if necessary.
- b. Check dust seals used with tie-rod end ball joint for damage or deterioration. Replace if necessary.

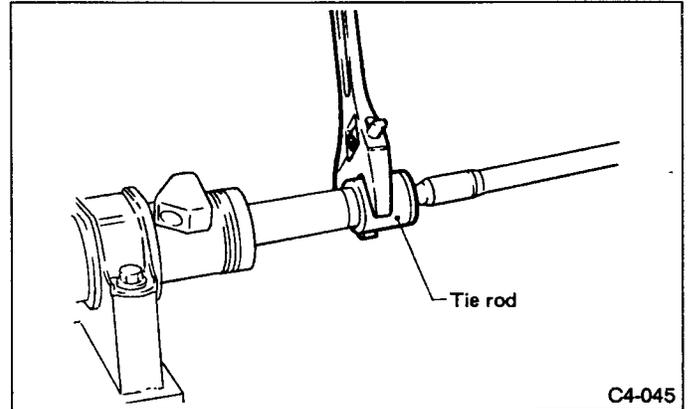


Fig. 64

11) Loosen adjusting screw and remove spring and sleeve. Replace spring and/or sleeve if damaged.

12) Removal of valve ASSY

- (1) Remove the two bolts securing valve housing ASSY.

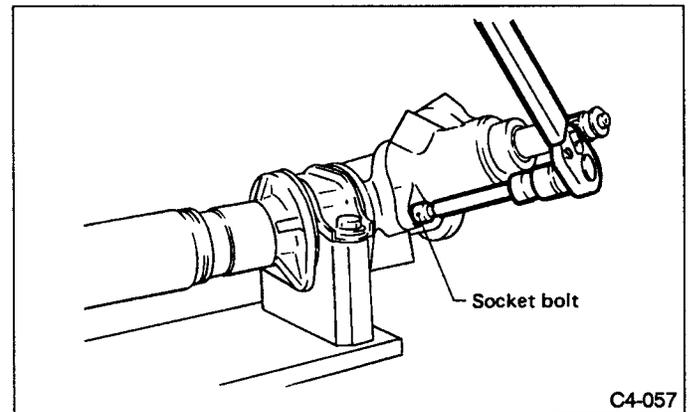


Fig. 65

(2) Remove valve housing ASSY, pinion and valve ASSY as a unit.

Extract input shaft when removing valve ASSY.

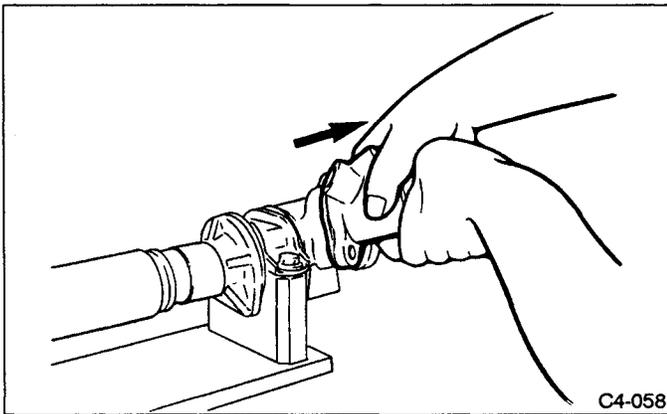


Fig. 66

13) Removal of snap ring from seal holder ASSY

While attaching small screwdriver blade to snap ring via groove on boot (on cylinder side of steering body ASSY), push the snap ring using another screwdriver.

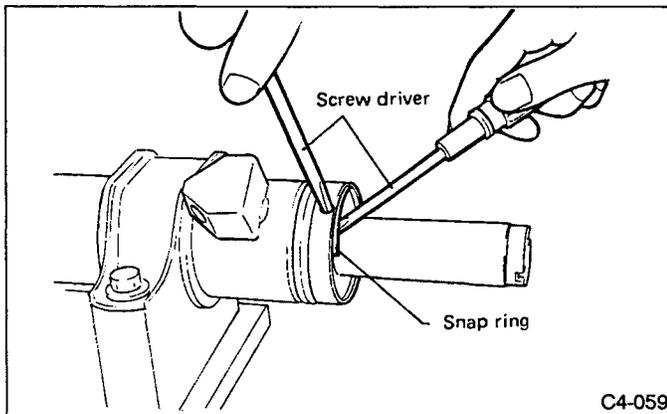


Fig. 67

14) Removal of rack ASSY

Push rack out of steering body ASSY while pushing it on valve side.

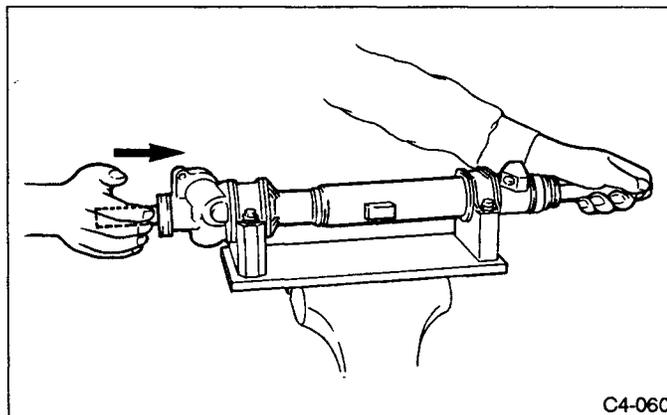


Fig. 68

a. Block pipe connection of steering body ASSY to prevent fluid from flowing out.

b. Do not allow rack to come in contact with inner wall of cylinder. Otherwise, cylinder wall may be scratched, resulting in oil leaks.

c. Remove holder ASSY and rack ASSY as a unit.

d. Check rack and steering body ASSY for bends or cracks; replace as required.

15) Removal of high-pressure seal

Insert REMOVER from valve side, and lightly tap it using a hammer to drive out back-up ring and oil seal.

Discard back-up ring and oil seal after removal; replace with new ones.

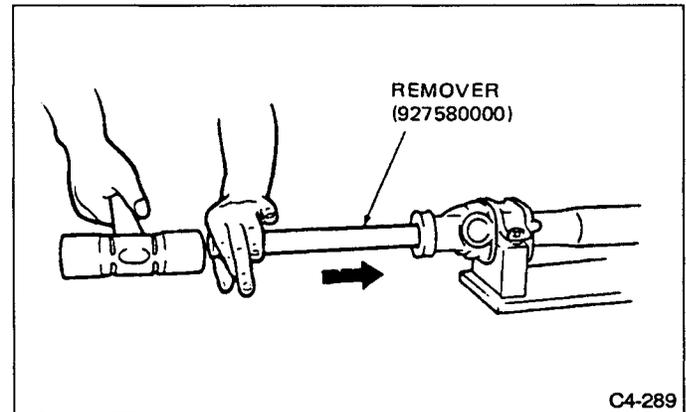


Fig. 69

16) Removal of oil seal and O-ring

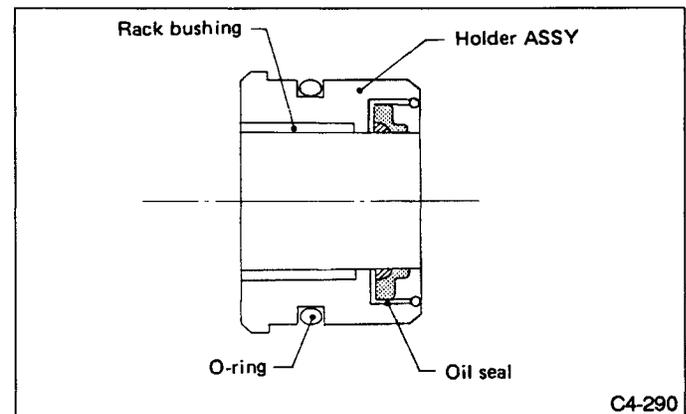


Fig. 70

- (1) Using a small rod, pry out oil seal.
- a. **Be careful not to scratch oil seal groove on holder ASSY. A scratch may cause oil leaks.**
- b. **Be careful not to scratch mating surfaces of holder ASSY and rack. A scratch may cause oil leaks.**
- c. Check rack bushing for wear or damage; replace as required.
- d. **Discard oil seal and O-ring after removal; replace with new ones.**

(2) Remove O-ring.

(3) Apply a coat of grease to oil seal groove in holder ASSY.

(4) Install a new oil seal and O-ring.

#### 17) Removal of rack piston seal ring and O-ring

- (1) Using a sharp-edged, long rod, remove seal ring and O-ring from rack piston.

**Be careful not to scratch outer surface of rack piston and seal ring groove. A scratch may reduce the sealing effect, resulting in faulty piston operation.**

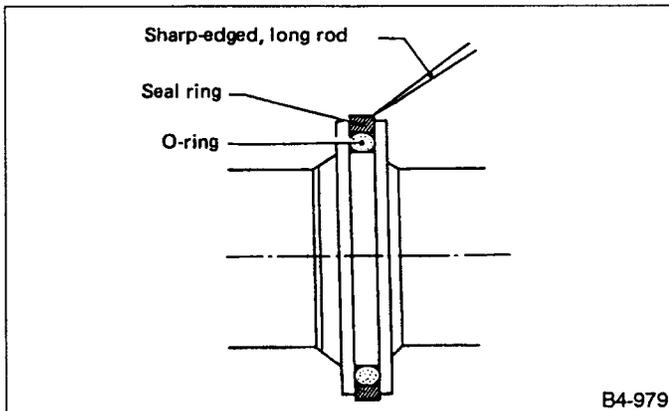


Fig. 71

(2) Wash clean rack piston.

(3) Install O-ring and seal ring in groove on rack piston.

a. **Do not expand O-ring and seal ring more than necessary.**

b. **To facilitate installation of seal ring, first position one half of entire seal ring in groove. Then slowly position the second half using a spatula, as shown.**

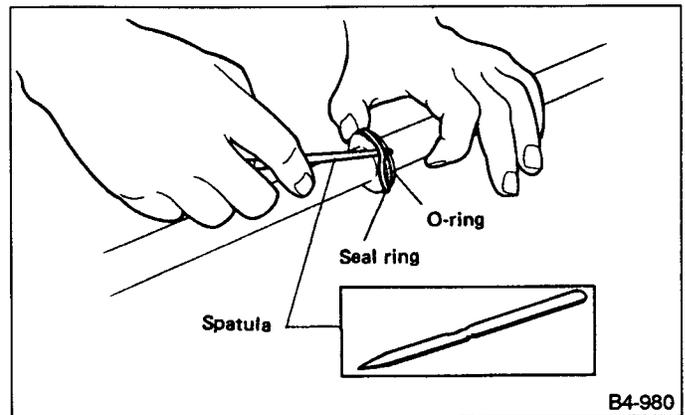


Fig. 72

(4) Apply a coat of grease to inner surface of FORMER (special tool) and insert rack piston into it. Leave FORMER at least 10 minutes until seal ring settles down in place.

**Be careful not to scratch rack, piston and seal ring during installation.**

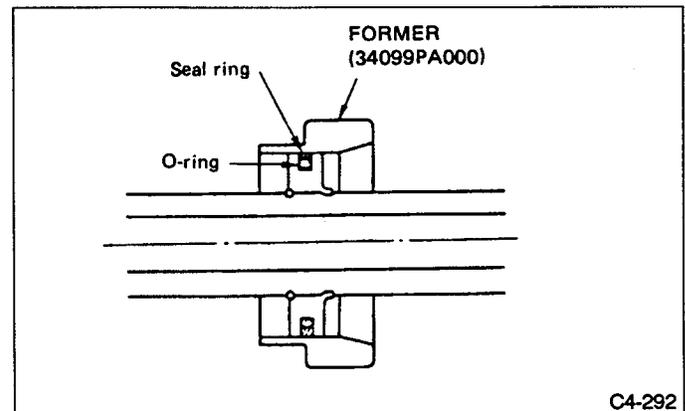


Fig. 73

**D: INSPECTION**

1) Clean all disassembled parts, and check for wear, damage, or any other faults, then repair or replace as necessary.

2) When disassembling, check inside of gearbox for water. If any water is found, carefully check boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bend of input shaft (2) Damage on serration	If bend or damage is excessive, replace entire gearbox ASSY.
2	Dust seal	(1) Crack or damage (2) Wear	If outer wall slips, lip is worn out or damage is found, replace it with new one.
3	Rack and pinion	Poor mating of rack with pinion	(1) Adjust backlash properly. By measuring turning torque of gearbox and sliding resistance of rack, check if rack and pinion engage uniformly and smoothly with each other. (Refer to "Service limit".) (2) Keeping rack pulled out all the way so that all teeth emerge, check teeth for damage. Even if abnormality is found in either (1) or (2), replace entire gearbox ASSY.
4	Gearbox unit	(1) Bend of rack shaft (2) Bend of cylinder portion (3) Crack or damage on cast iron portion	Replace gearbox ASSY with new one.
		(4) Wear or damage on rack bush	If free play of rack shaft in radial direction is out of the specified range, replace gearbox ASSY with new one. (Refer to "Service limit".)
		(5) Wear on input shaft bearing	If free plays of input shaft in radial and axial directions are out of the specified ranges, replace gearbox ASSY with new one. (Refer to "Service limit".)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod CP	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration on dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipes	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.
12	Control valve ASSY (only electronically controlled type)	Damage to solenoid harness	Replace.

**1. SERVICE LIMIT**

Make a measurement as follows. If it exceeds the specified service limit, adjust or replace.

**When making a measurement, vise gearbox by using special tool (STAND; 926200000). Never vise gearbox by inserting aluminum plates, etc. between vise and gearbox.**

**Sliding resistance of rack shaft**

**Service limit:**

**304 N (31 kg, 68 lb) or less**

**Difference between left and right sliding resistance:**

**Less than 20%**

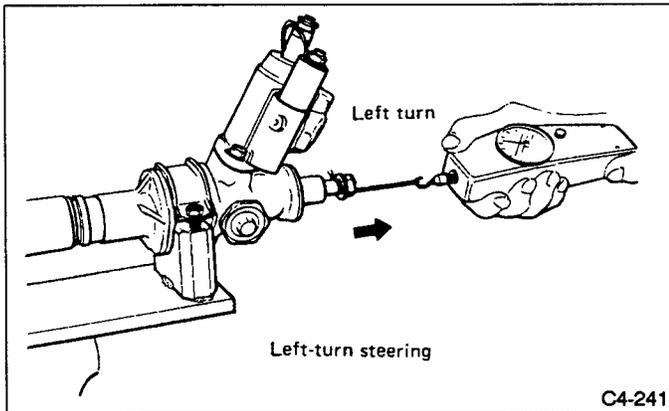


Fig. 74

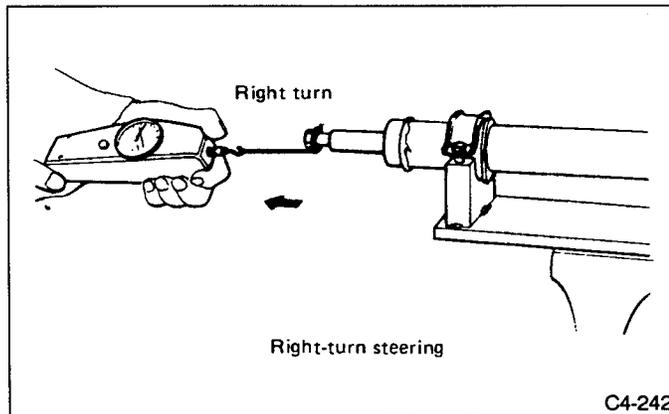


Fig. 75

**2. RACK SHAFT PLAY IN RADIAL DIRECTION**

**• Left-turn steering**

**Service limit:**

**Less than 0.4 mm (0.016 in) (direction  $\leftarrow \Rightarrow$ )**

**Less than 0.6 mm (0.024 in) (direction  $\leftarrow \Rightarrow$ )**

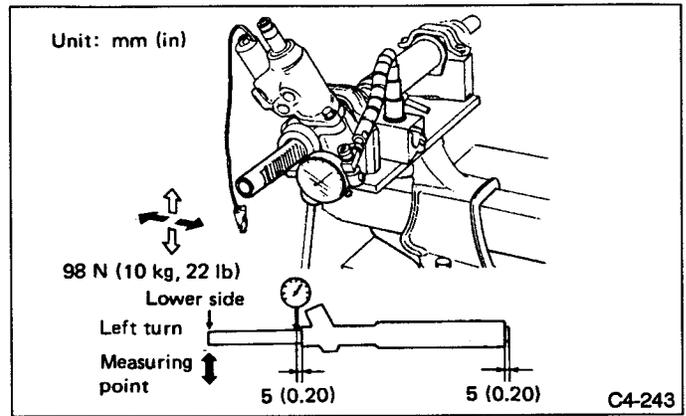


Fig. 76

**• Right-turn steering**

**Service limit:**

**Less than 0.4 mm (0.016 in) (direction  $\leftarrow \Rightarrow$  and  $\leftarrow \Rightarrow$ )**

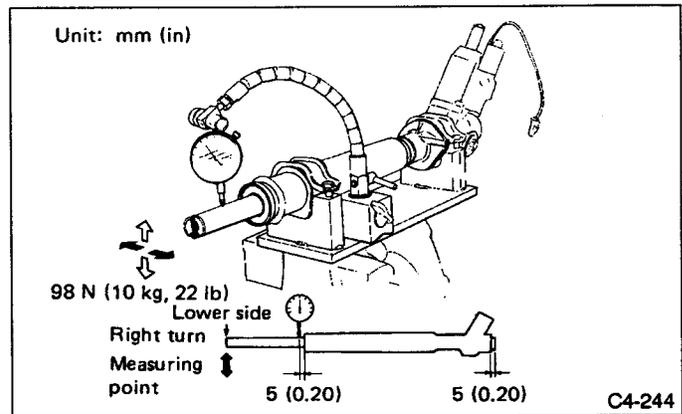


Fig. 77

**3. INPUT SHAFT PLAY**

**• In radial direction**

**Service limit:**

**0.18 mm (0.0071 in) or less**

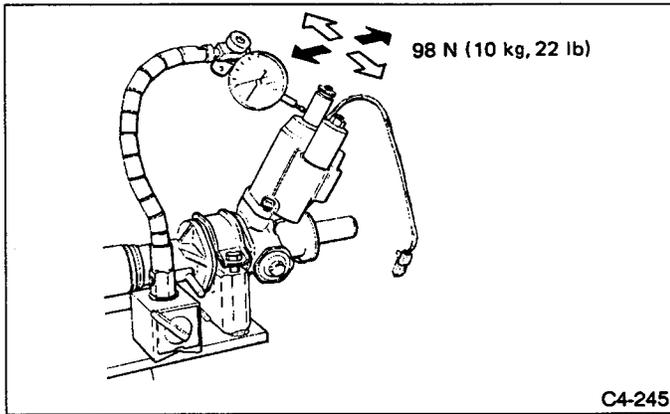


Fig. 78

- In axial direction

**Service limit:**

**0.27 mm (0.0106 in) or less**

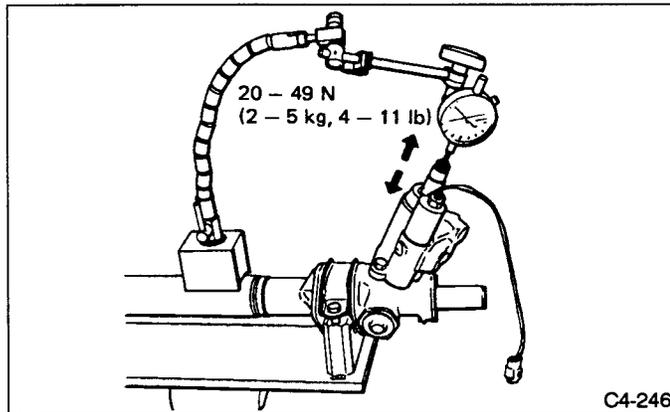


Fig. 79

#### 4. TURNING RESISTANCE OF GEARBOX

**Service limit:**

**Straight-ahead position within 30 mm (1.18 in) from rack center**

**Less than 11.18 N (1.14 kg, 2.51 lb)**

**Maximum allowable resistance**

**15.79 N (1.61 kg, 3.55 lb) or less**

**Difference between left and right sliding resistance:**

**Less than 20%**

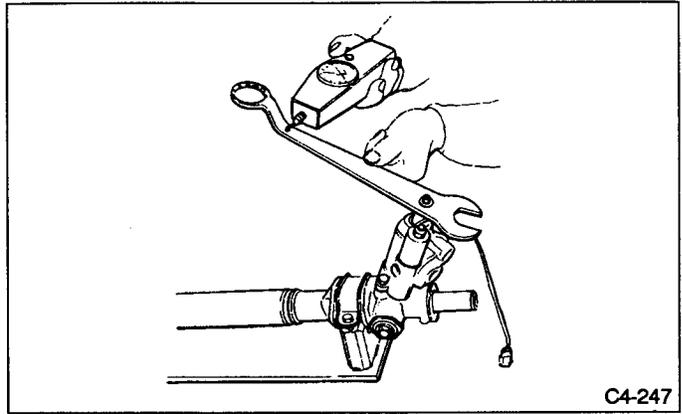


Fig. 80

#### E: ASSEMBLY

**Use only SUBARU genuine grease for gearbox.**

Specified grease for gearbox

VALIANT GREASE M2

[Parts No. 003608001, net 0.5 kg (1.1 lb)]

#### 1) Reassembly of rack ASSY

(1) Attach steering body ASSY to STAND as shown. Apply a coat of grease to needle bearing.

- Use a special tool to support steering body ASSY.
- If steering body ASSY is removed from vehicle, be sure to remove rust and clean.
- Ensure that needle bearing is free from defects. If it is faulty, replace steering body ASSY with a new one.

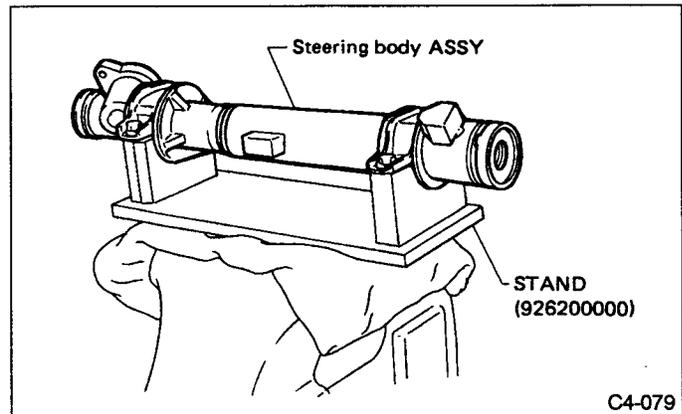


Fig. 81

(2) Using INSTALLERs B and C, attach oil seal to INSTALLER A. Insert INSTALLER A into rack ASSY from gear side. Remove oil seal from INSTALLER A when it approaches piston and remove INSTALLERs from rack ASSY.

Face oil seal in the direction shown in Figure 82.

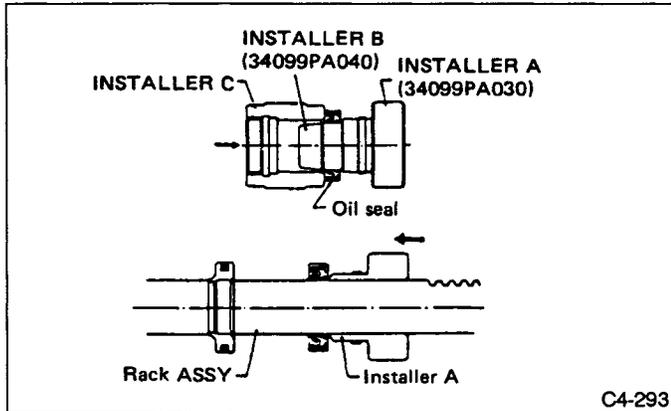


Fig. 82

(3) Install back-up ring from gear side of rack ASSY. **INSTALLER C (927490000)** is furnished with **INSTALLERS B and C** as a tool set for use on all Legacy models.

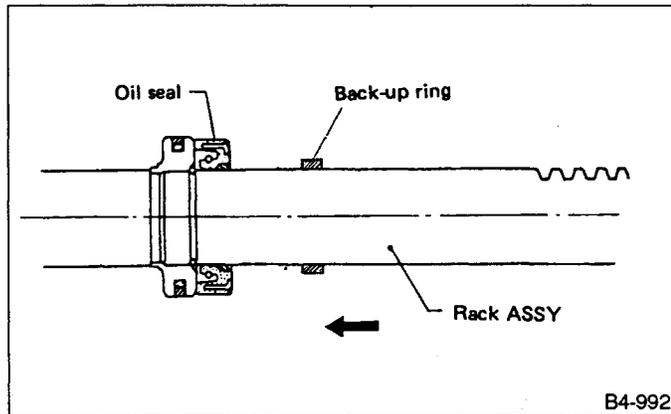


Fig. 83

(4) Apply a coat of grease to grooves in rack, sliding surface of sleeve and sealing surface of piston. Then insert rack ASSY into steering body ASSY from cylinder side.

- a. Be sure to apply grease so that it covers the entire surface of rack gear teeth.
- b. Do not allow grease to block air vent hole on rack.

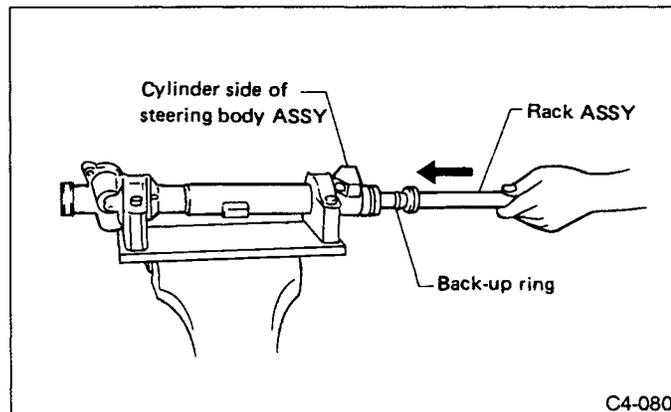


Fig. 84

(5) Installation of holder ASSY

Attach **GUIDE** to rack ASSY to prevent scratching cylinder, and apply a thin coat of grease to rack ASSY and **GUIDE**.

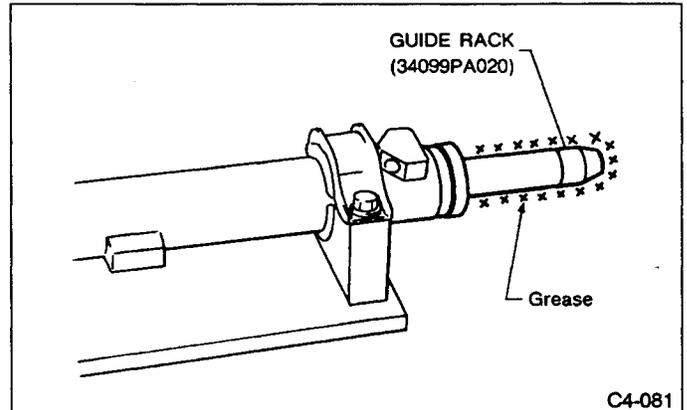


Fig. 85

(6) Apply a coat of grease to inner wall of holder ASSY and O-ring, and install holder ASSY on steering body ASSY.

- a. Ensure that guide is free from scratches. Scratches may damage oil seal.
- b. Be careful not to damage oil seal lips when installing holder ASSY.

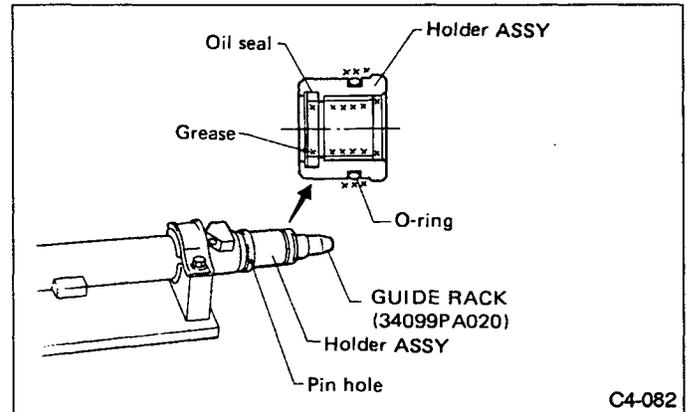


Fig. 86

(7) Apply a coat of grease to snap ring, and insert into groove in steering body ASSY. Secure holder ASSY.

**Ensure that both ends of snap ring are close to pin hole when installed.**

(8) Attach **INSTALLER** to rack ASSY's cylinder. Using a press, install back-up ring and oil seal.

**Press INSTALLER until its groove is aligned with end of holder ASSY.**

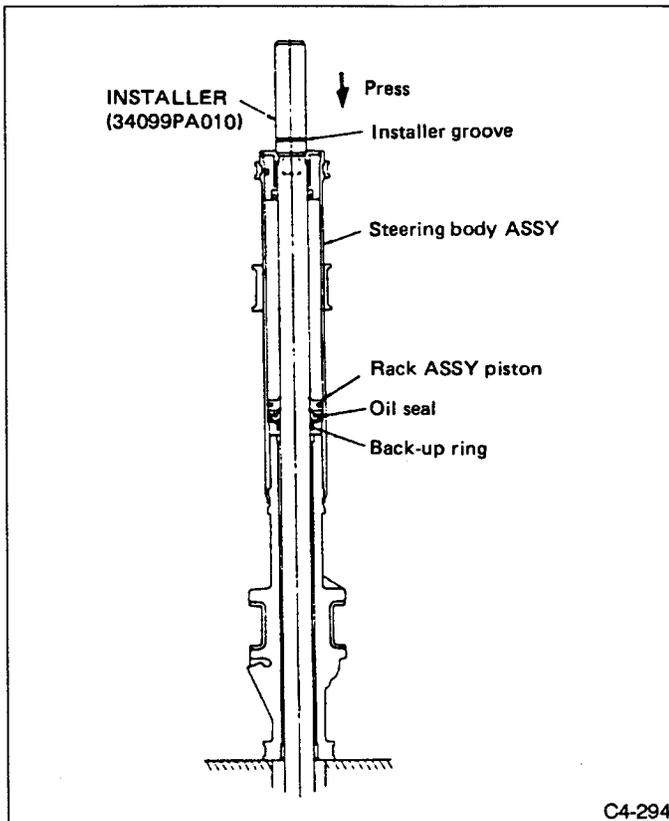


Fig. 87

## 2) Installation of valve ASSY

(1) Remove traces of sealer, oil, rust, etc., from mating surfaces of valve housing and steering body ASSY.

(2) Position a shim in graded portion of steering body ASSY's pinion housing, and apply an even coat of sealer (Fuji Bond: 004403004) to end of pinion housing.

a. Use the same number of shims as that used when steering body ASSY was removed.

b. If steering body ASSY, valve housing or pinion & valve ASSY is replaced with a new one, add two or three shims, install valve ASSY on pinion housing and tighten with two bolts to 20 — 29 N·m (2.0 — 3.0 kg·m, 14 — 22 ft·lb). Then, measure clearance between steering body ASSY and valve housing using a thickness gauge. Remove shims so that the clearance is zero.

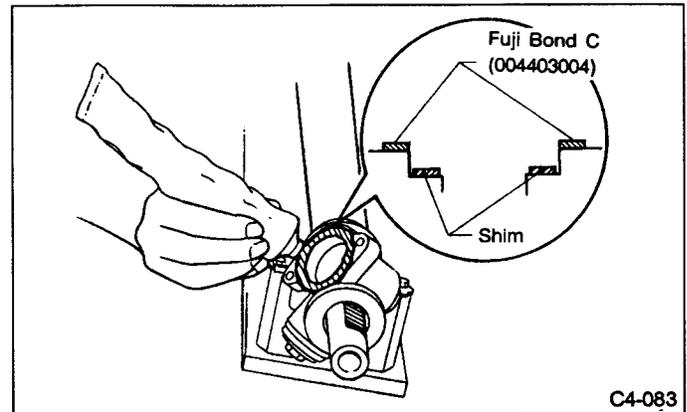


Fig. 88

(3) Extend rack ASSY 75.9 mm (2.988 in) beyond pinion side of steering body ASSY.

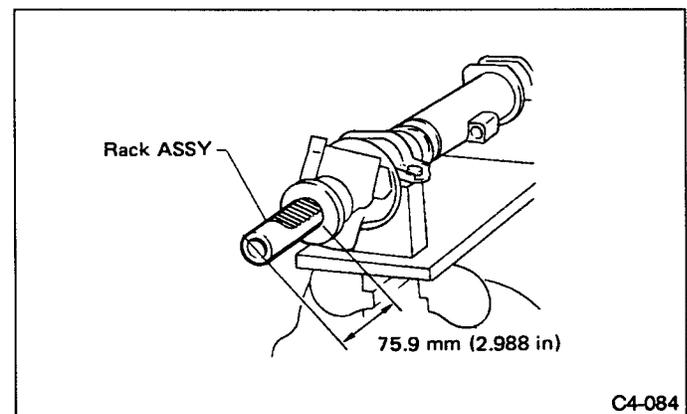


Fig. 89

(4) Apply grease to pinion gear teeth and ball bearing. Insert valve ASSY into place.

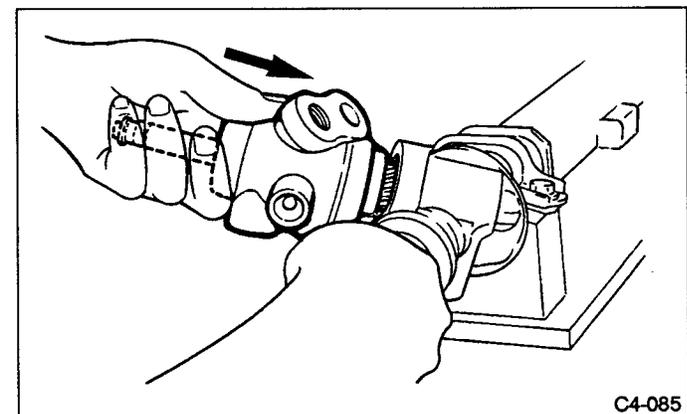


Fig. 90

(5) Alternately and slowly tighten socket bolts. Replace faulty parts before installing valve ASSY. Otherwise, valve ASSY may not be installed properly.

**Tightening torque:**

20 — 29 N·m (2.0 — 3.0 kg·m, 14 — 22 ft·lb)

- Clean all parts and tools before reassembling.
  - 1) Move rack shaft fully to the left and right two or three times to lubricate shaft ends with grease. Remove excess grease, being careful not to block air vent hole.
    - a. When rack is fully moved to its stroke ends with tie-rod removed, be careful not to bump rack ends.
    - b. Ensure that screw located at end of rack shaft is free from grease.
  - 2) Apply grease to bore wall which accommodates sleeve.
- Ensure that hands are clean when applying grease.**
- 3) Apply a coat of grease to sliding surface of pressure pad and seating surface of spring, and insert pressure pad into steering body ASSY. Charge adjusting screw with grease, insert spring into adjusting plug and install on steering body ASSY.

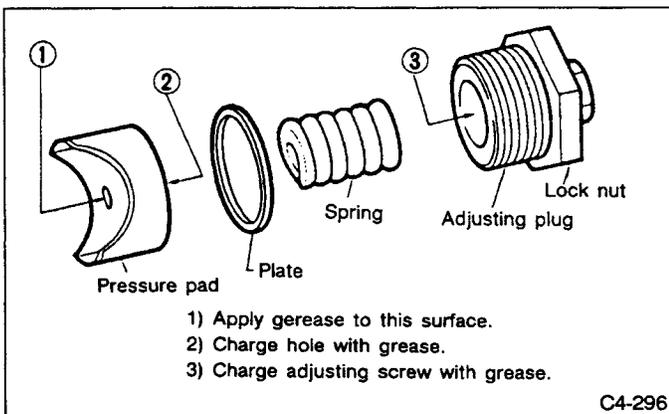


Fig. 91

The left and right tie-rod CP differ as indicated in the table below.

Left tie-rod (pinion side)	No air vent hole provided	Grooved (for identification)
Right tie-rod (cylinder side)	Air vent hole provided	Not grooved (for identification)

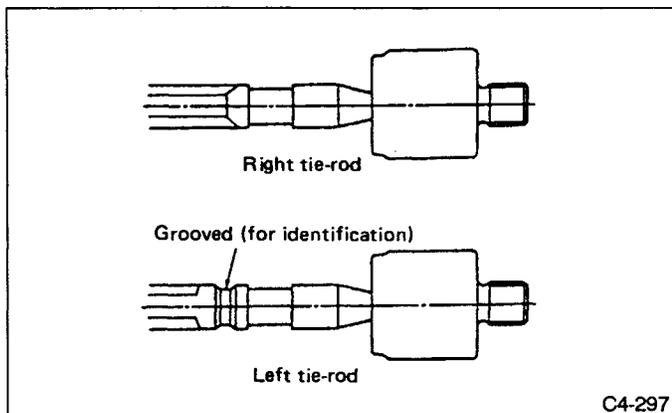


Fig. 92

4) Installation of tie-rod CP

- (1) Rotate input shaft until rack extends approximately 40 mm (1.57 in).

- (2) Tighten adjusting plug until it will no longer tighten.
- (3) Install lock washers and tighten left and right tie-rod CPs into rack ends.

Tightening torque:

69 — 88 N·m (7.0 — 9.0 kg-m, 51 — 65 ft-lb)

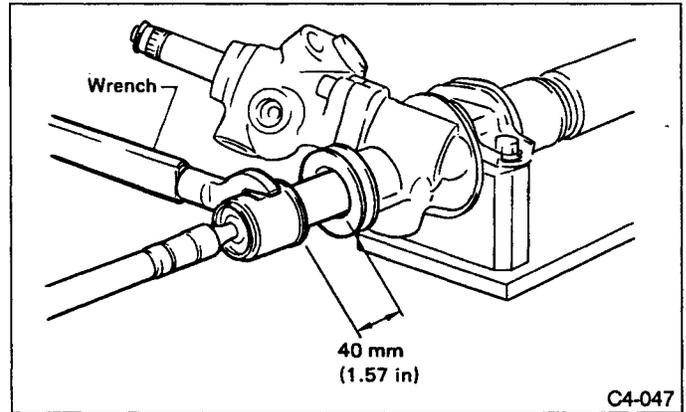


Fig. 93

- (4) Using a chisel and hammer, bend lock washers (at two places).

**Be careful not to scratch rack.**

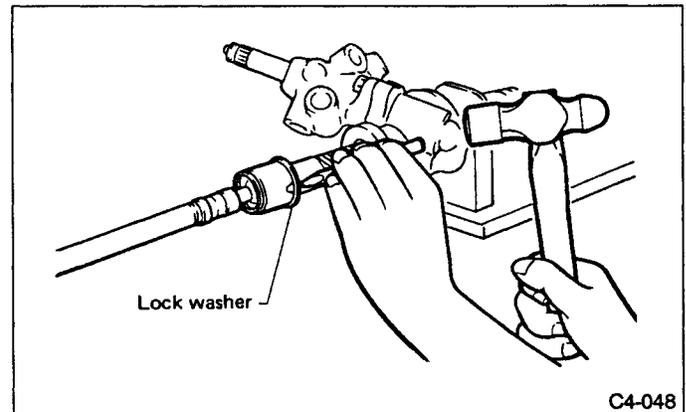


Fig. 94

5) Rack & pinion backlash adjustment

- (1) Loosen adjusting plug.
- (2) Rotate input shaft so that rack is in the straight ahead direction. [Ensure that distance between rack end and stopper is 75.9 mm (2.988 in).
- (3) Tighten adjusting plug by two threads.

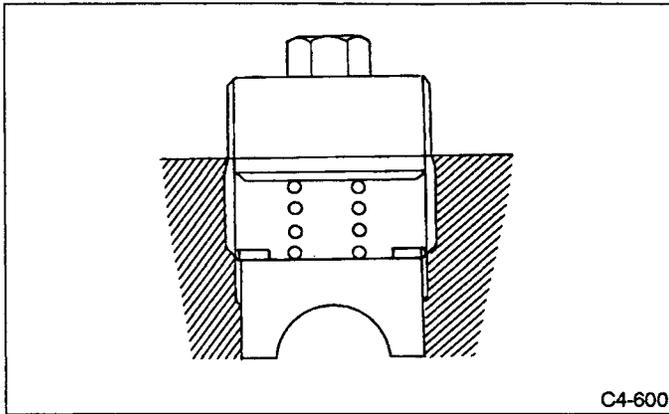


Fig. 95

- (4) Turn adjusting screw so that the entire thread area is coated with liquid packing.

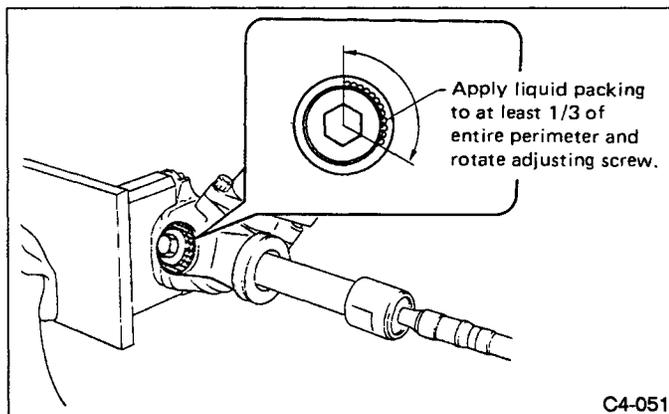


Fig. 96

- a. Apply liquid packing of approximately 1.5 grams (0.053 oz) to adjusting screw thread area.  
b. Also turn plug to ensure that its entire contact area is coated with liquid packing.

#### Liquid packing:

Three-bond 1102 or equivalent

- (6) Tighten adjusting plug to 20 N•m (2.0 kg-m, 14 ft-lb) and loosen, then tighten to 5 N•m (0.5 kg-m, 3.6 ft-lb) and loosen, and finally tighten to 5 N•m (0.5 kg-m, 3.6 ft-lb) and loosen 25°.  
(7) While holding adjusting plug using a closed wrench, tighten lock nut using LOCK NUT WRENCH.

#### Tightening torque:

59 — 74 N•m (6.0 — 7.5 kg-m, 43 — 54 ft-lb)

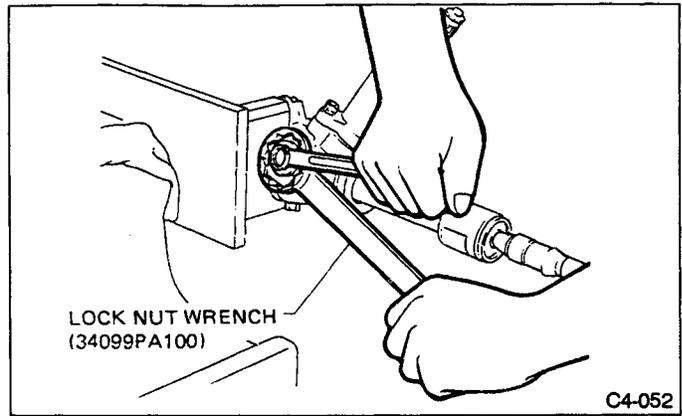


Fig. 97

- a. Do not allow liquid packing to come in contact with pressure pad.  
b. While rotating input shaft to fully move rack shaft to the left and right, ensure that rack moves smoothly without binding, and that rotating torque is constant.  
6) Installation of boot

- (1) Apply sealant to gearbox housing groove.  
Use accessory sealant for boot kit (P/N: 34099PA110).

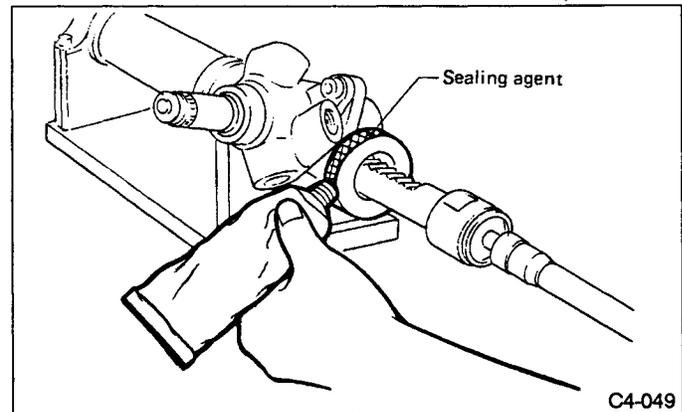


Fig. 98

- (2) Position boot large end in groove of gearbox, and small end in groove of tie-rod CP.  
a. Ensure that both ends of boot are properly situated in grooves.  
b. When installing another side boot, secure small end of boot first and then secure large end to prevent an increase in gearbox internal pressure.

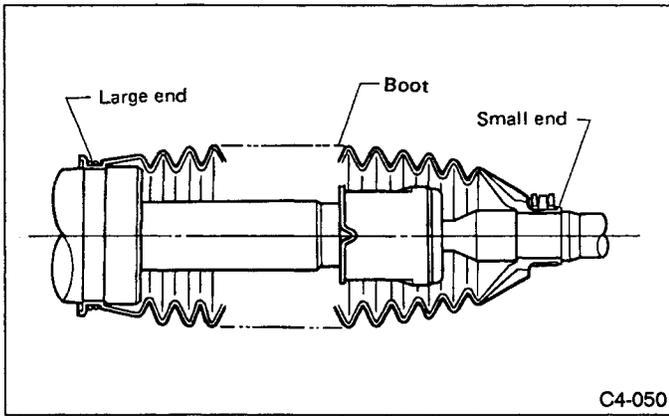


Fig. 99

c. Ensure that boot is free from abnormal swelling or dents.

(3) Wind two complete turns of lock wire on large end of boot, and twist it while pulling it upward (with a force of approximately 29 N– 49 N (3 N– 5 kg, 7 N– 11 lb)). Then bend wire end along boot as shown.

- a. Wind up wire until it contacts boot.
- b. Ensure that lock wire is not loose.

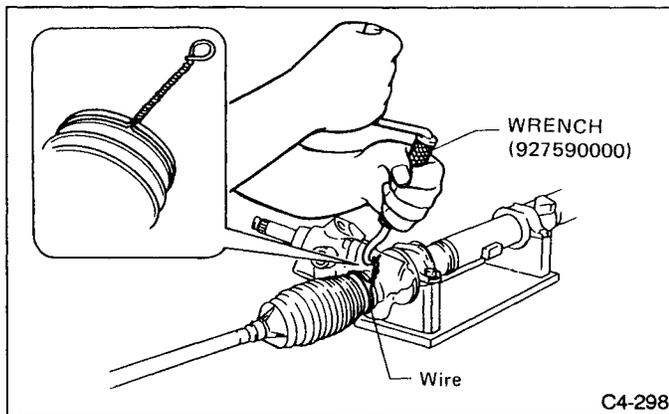


Fig. 100

(4) Install clip using pliers.

After installing clip, ensure that boot's small end is properly positioned in groove on tie-rod CP.

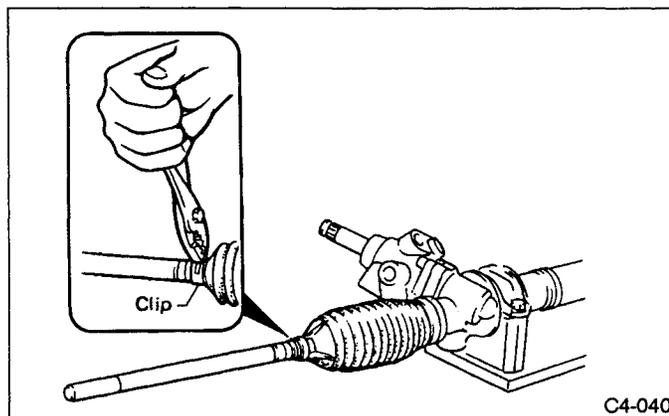


Fig. 101

(5) If tie-rod end was removed, screw in lock nut and tie-rod end to screwed portion of tie-rod, and tighten lock nut temporarily in a position as shown in the illustration.

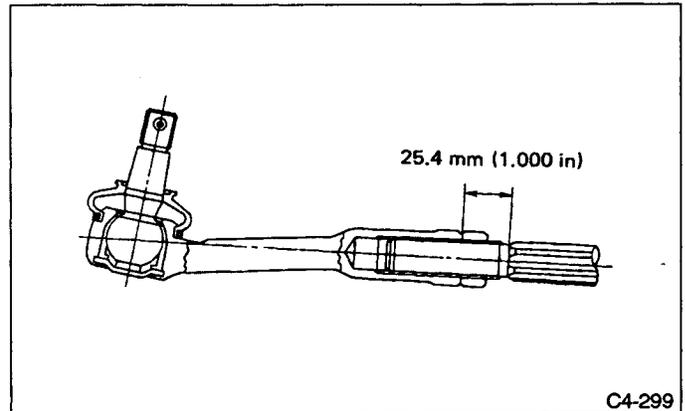


Fig. 102

Pay attention to difference between right and left tie-rod ends.

Identification mark	Left one	LH
	Right one	RH

7) Inspect gear box ASSY as follows:

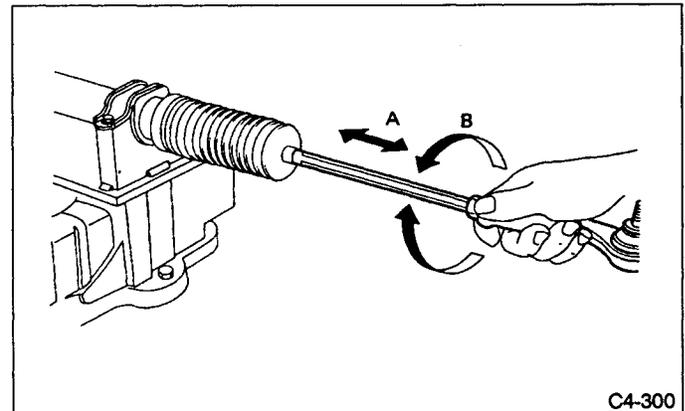


Fig. 103

(1) Holding tie-rod end, repeat lock to lock two (2) or three (3) times as quickly as possible.

(2) Holding tie-rod end, turn ASSY slowly at a radius one (1) or two (2) times as large as possible.

After all, make sure that boot is installed in the specified position without deflation.

8) Install four pipes on gearbox.

**Tightening torque:**

**29 — 39 N·m (3.0 — 4.0 kg-m, 22 — 29 ft-lb)**

**F: INSTALLATION**

Installation is in the reverse order of removal.  
Observe the following:

- a. If center airbag system roll connector becomes misaligned by accidental rotation of steering wheel, realign connector. (Refer to C 5-5 [W1E1].)
- b. When adjusting toe-in, hold boot as shown to prevent it from being rotated or twisted. If twisted, straighten it.

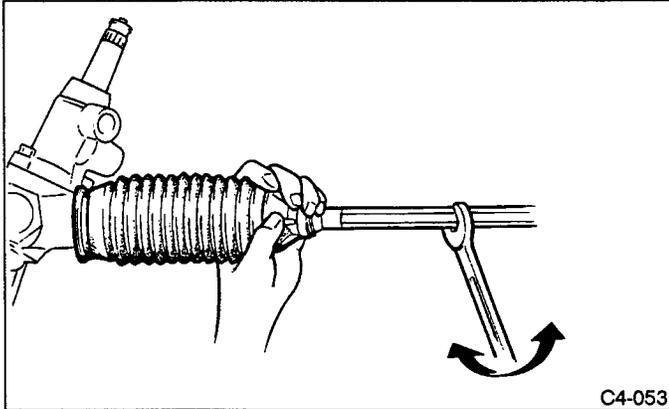


Fig. 104

**G: ADJUSTMENT**

- 1) Adjust front toe.

Standard of front toe:

IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)

- 2) Adjust steering angle of wheels.

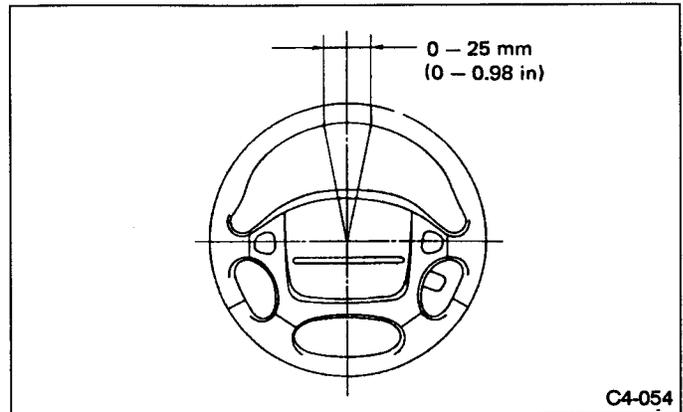
Inner wheel:

34°42' — 37°42'

Outer wheel:

30°06' — 33°06'

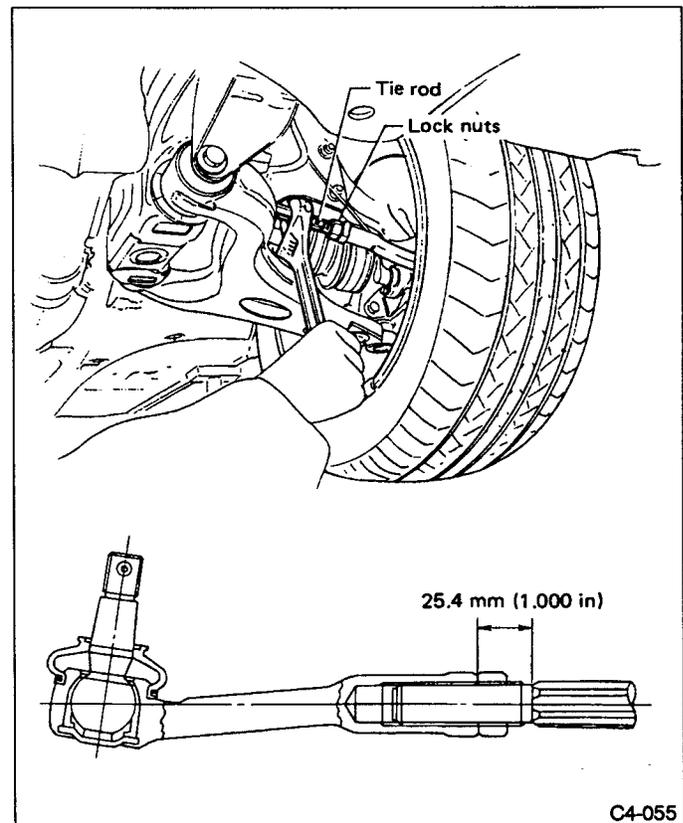
- 3) If steering wheel spokes are not horizontal when wheels are set in the straight ahead position, and error is more than 5° on the periphery of steering wheel, correctly re-install the steering wheel.



C4-054

Fig. 105

If steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the same direction by the same amount.



C4-055

Fig. 106

Ensure that the lengths of the left and right tie-rod ends are the same.

## 4. Control Valve (Power Steering Gearbox)

This section focuses on the disassembly and reassembly of control valve. For the inspection and adjustment and the service procedures for associated parts, refer to "Steering Gearbox (Power Steering System)".

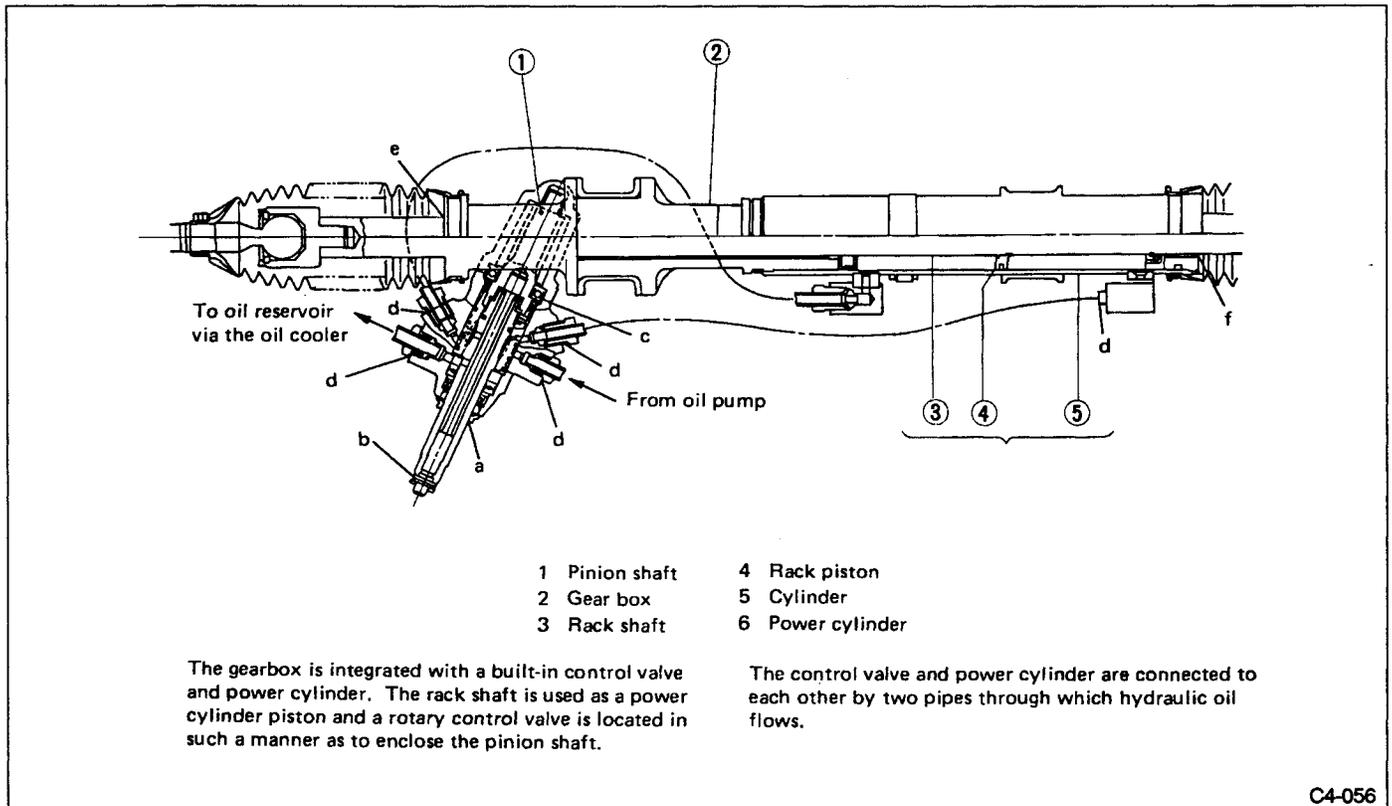


Fig. 107

### A: CHECKING OIL LEAKING POINTS

#### 1. OIL LEAKING POINTS

- a. If leak point is other than a, b, c, or d, perform check (5) in 2) before dismounting gearbox ASSY from vehicle. If gearbox ASSY is dismounted without confirming where the leak is, it must be mounted again to locate the leak point.
- b. Even if the location of the leak can be easily found by observing the leaking condition, it is necessary to thoroughly remove the oil from the suspected portion and turn the steering wheel from lock to lock about 30 to 40 times with engine running, then make comparison of the suspected portion between immediately after and several hours after this operation.
- c. Before starting oil leak repair work, be sure to clean the gearbox ASSY, hoses, pipes, and surrounding parts. After completing repair work, clean these areas again.

#### 2. OIL LEAK CHECK PROCEDURE AND REPLACEMENT PARTS

Parts requiring replacement are described in the smallest unit of spare parts including damaged parts and spare parts damaged. In actual disassembly work, accidental damage as well as inevitable damage to some related parts must be taken into account, and spare parts for them must also be prepared. However, it is essential to pinpoint the cause of trouble, and limit the number of replacement parts as much as possible.

##### 1) Leakage from "a"

The oil seal is damaged. Replace valve ASSY with a new one.

##### 2) Leakage from "b"

The torsion bar O-ring is damaged. Replace valve ASSY with a new one.

##### 3) Leakage from "c"

The oil seal is damaged. Replace valve ASSY with a new one.

##### 4) Leakage from "d"

The pipe ASSY is damaged. Replace the faulty pipe ASSY.

5) If leak is other than a, b, c, or d, and if oil is leaking from the gearbox ASSY, move the right and left boots toward tie-rod end side, respectively, with the gearbox

ASSY mounted to the vehicle, and remove oil from the surrounding portions. Then, turn the steering wheel from lock to lock 30 to 40 times with the engine running, then make comparison of the leaked portion immediately after and several hours after this operation.

(1) Leakage from "e"

The cylinder seal is damaged. Replace rack bush ASSY with a new one.

(2) Leakage from "f"

There are two possible causes. Take following step first. Remove the pipe ASSY B from the valve housing, and close the circuit with PLUG (926420000). Turn the steering wheel from lock to lock 30 to 40 times with the engine running, then make comparison of the leaked portion between immediately after and several hours after this operation.

a. If leakage from "f" is noted again:

The oil seal of pinion & valve ASSY is damaged. Replace pinion & valve ASSY with a new one. Or replace the oil seal and the parts that are damaged during disassembly with new ones.

b. If oil stops leaking from "f":

The oil seal of rack housing is damaged. Replace the oil seal and the parts that are damaged during disassembly with new ones.

## B: DISASSEMBLY

### 1. ENGINE SPEED SENSING TYPE

1) Remove dust cover.

a. Be careful not to scratch housing or input shaft during dust cover removal. Also do not allow foreign matter to enter housing interior.

b. Replace dust cover with a new one if its inside bore or lips are worn or damaged.

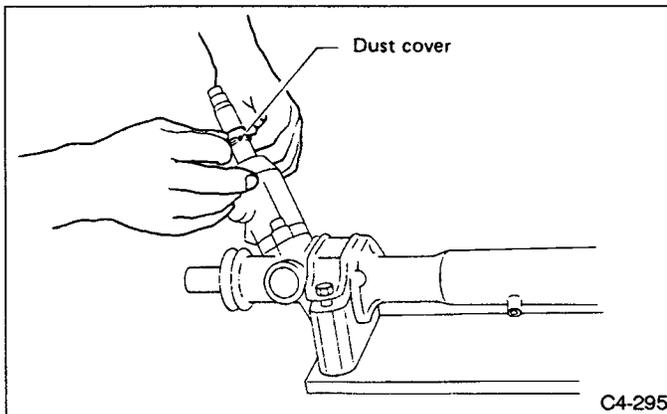


Fig. 108

2) Removal of valve ASSY

Refer to Step 11) to 15) on [W3C0].

1) Disassembly and reassembly of valve ASSY

(1) Press pinion & valve ASSY out from valve housing.

a. Discard Y-packing after removal; replace with a new one.

b. Check rotor for bends and serrations for damage; replace as required.

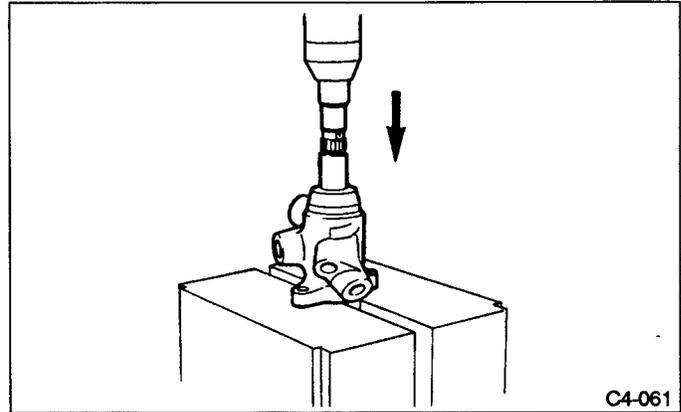


Fig. 109

(2) Using REMOVER and press, remove dust seal, back-up washer, Y-packing and ball bearing from valve housing.

a. Use the "A" end of remover.

b. Do not apply a force to end surface of valve housing.

c. Do not reuse Y-packing after removal.

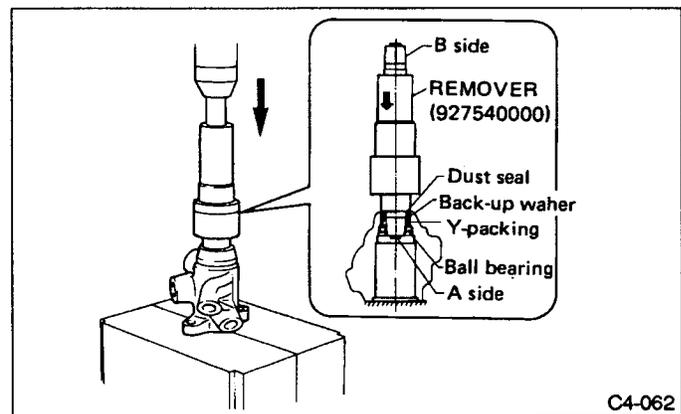


Fig. 110

(3) Remove snap ring securing valve sleeve to pinion & valve ASSY, and remove valve sleeve.

Before removal, paint alignment mark on the original position between valve sleeve groove and pinion pin.

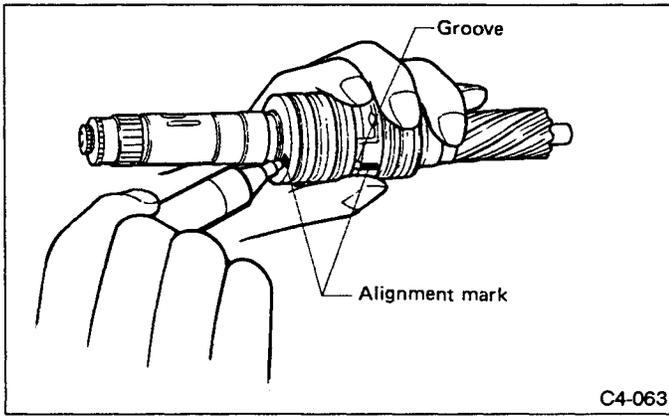


Fig. 111

Be careful not to scratch pinion & valve ASSY when removing retaining ring.

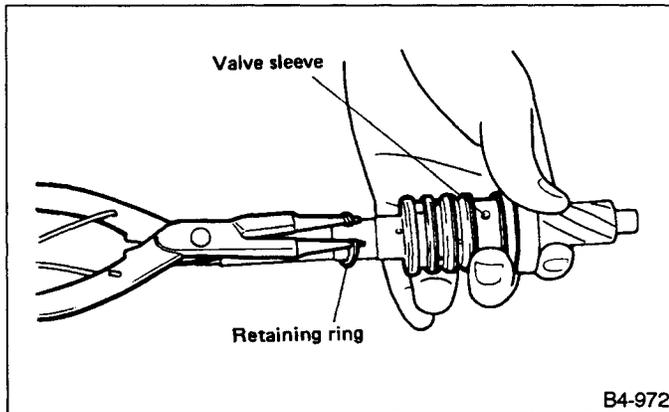


Fig. 112

(4) Remove oil seal and spacer.

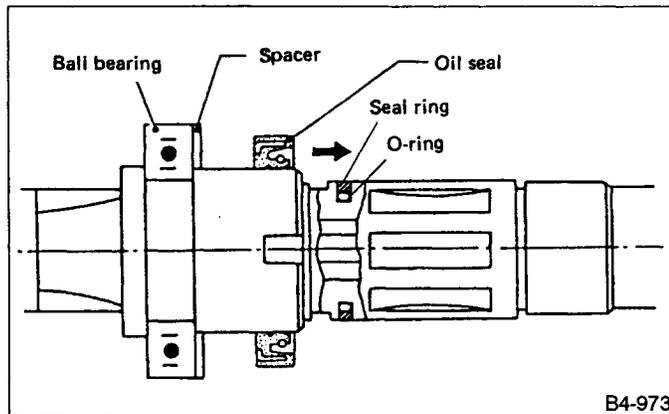


Fig. 113

(5) Using a long rod, remove seal ring and O-ring from pinion ASSY.

Be careful not to scratch outer surface and seal ring groove of input shaft. If scratched, sealing effect will be lost, resulting in a malfunctioning valve.

## 2. ELECTRONICALLY CONTROLLED TYPE

### Disassembly of valve housing

Leave the clips and wire wound up on the housing as is.

#### 1) Removal of valve ASSY

(1) Remove two retaining bolts from valve housing ASSY.

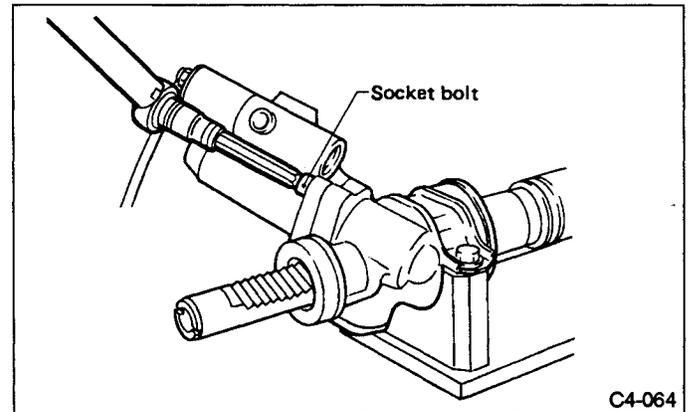


Fig. 114

(2) Remove valve housing ASSY together with pinion & valve ASSY as a unit.

When extracting valve ASSY, remove input shaft and valve ASSY as a unit.

#### 2) Disassembly of control valve ASSY

(1) After removing dust cover, push pinion & valve ASSY out of valve housing.

- a. If pinion & valve ASSY is difficult to remove, use pressing tool. DO NOT HAMMER INPUT SHAFT.
- b. Discard old Y-packing and install new one.

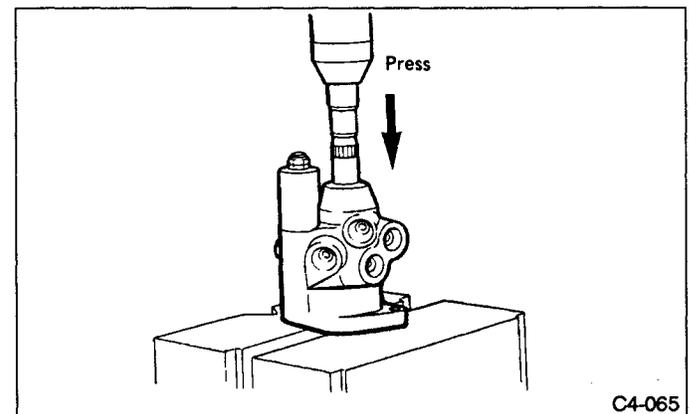


Fig. 115

(2) Using REMOVER and press, remove back-up ring, Y-packing and ball bearing from valve housing. (Same as the engine r.p.m. sensing type )

- a. Use "A" side of REMOVER.
  - b. Do not apply undue force to valve housing end.
- 3) Removal of pinion ball bearing

(1) Remove retaining ring.

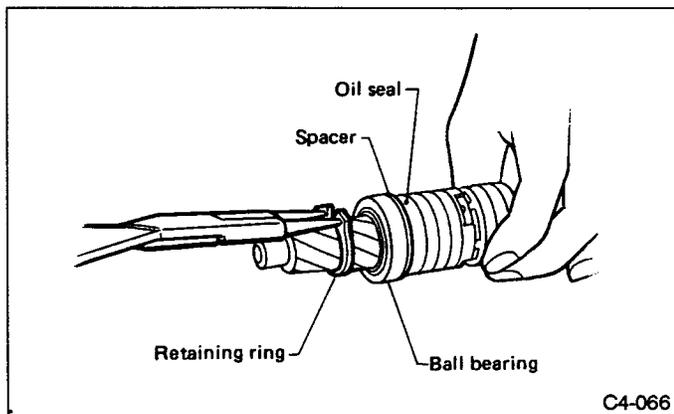


Fig. 116

(2) Using REMOVER, press pinion end carefully and remove ball bearing and spacer as a unit. **Be careful not to drop valve ASSY.**

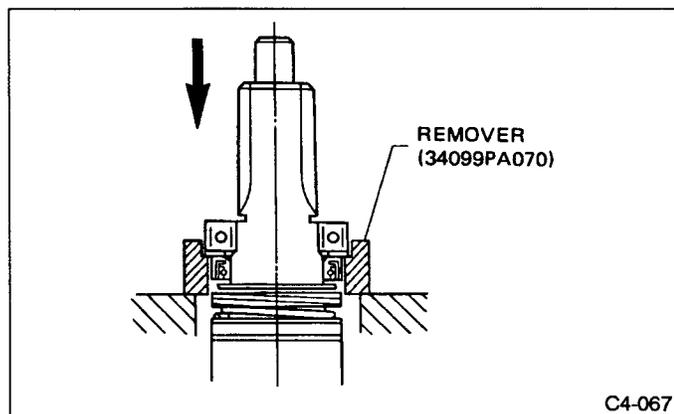


Fig. 117

(3) Remove oil seal with hands.

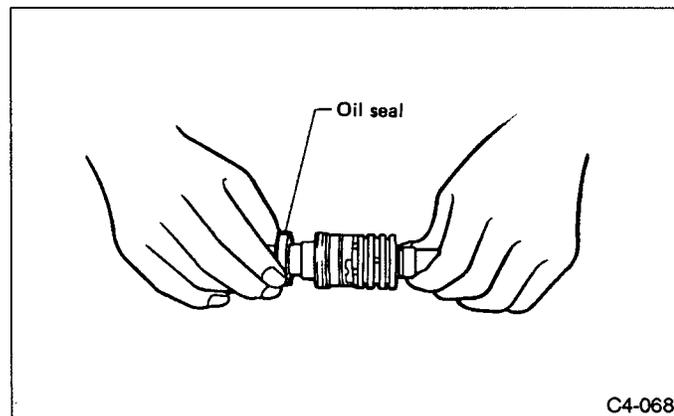


Fig. 118

4) Removal of valve sleeve

(1) Remove retaining ring.

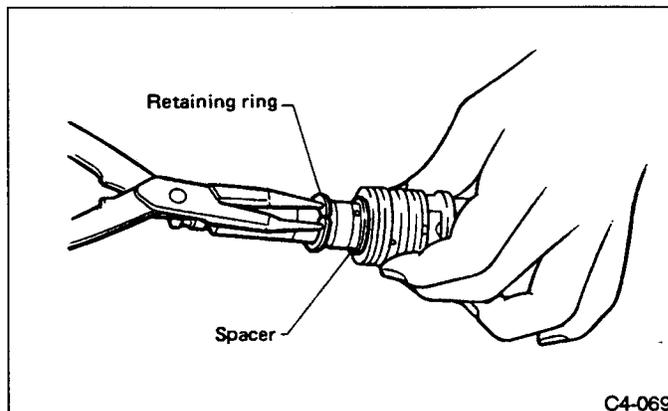


Fig. 119

(2) Remove spacer and take off the sleeve smoothly.  
 a. Scratching input shaft can cause oil to leak.  
 b. Do not deform spacer as it is reusable.  
 c. To facilitate reassembly, mark the point in valve sleeve groove meshed with pinion pin.

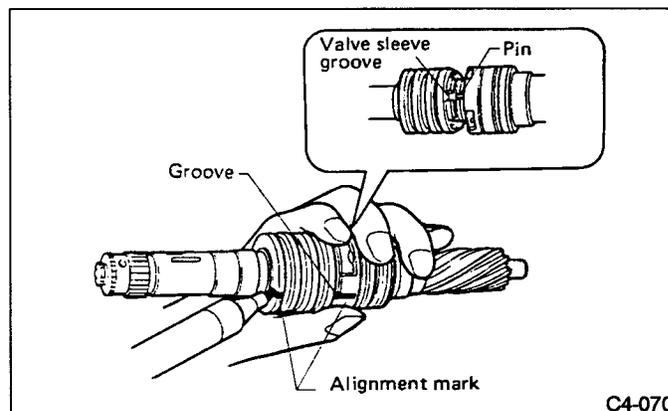


Fig. 120

**C: ASSEMBLY**

**1. ENGINE SPEED SENSING TYPE**

- 1) Wash and clean pinion & valve ASSY and valve housing.
- 2) Attach COVER to pinion ASSY, and apply grease to outer perimeter of the cover and mating surface of oil seal.

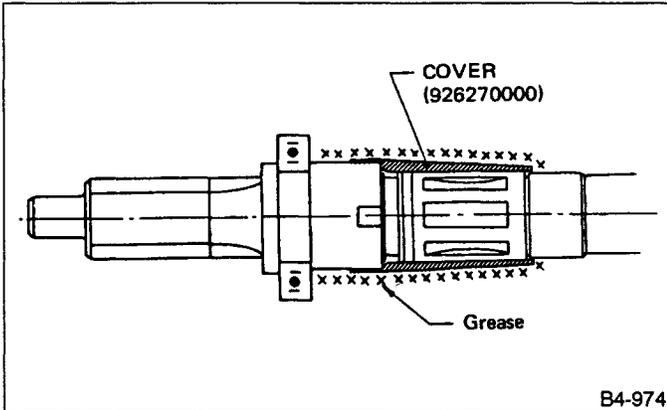


Fig. 121

- 3) Apply a coat of grease to spacer and sealing lips of oil seal, and install spacer and oil seal.
  - a. Face chamfered side of spacer toward oil seal.
  - b. Face oil seal in correct direction.

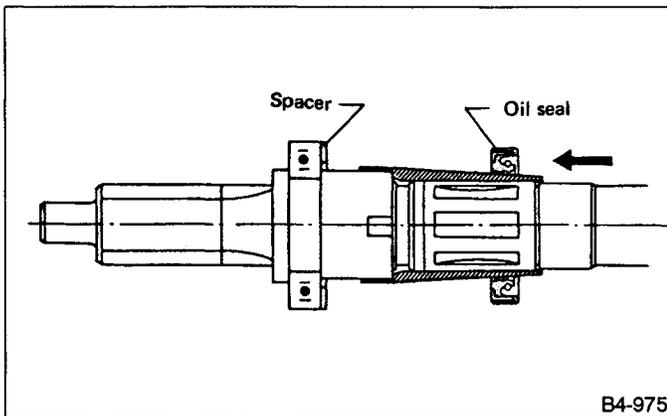


Fig. 122

- 4) Install COVER to input shaft, and apply a coat of grease to the cover surface. Install O-ring and seal ring. Do not expand O-ring and seal ring more than necessary.

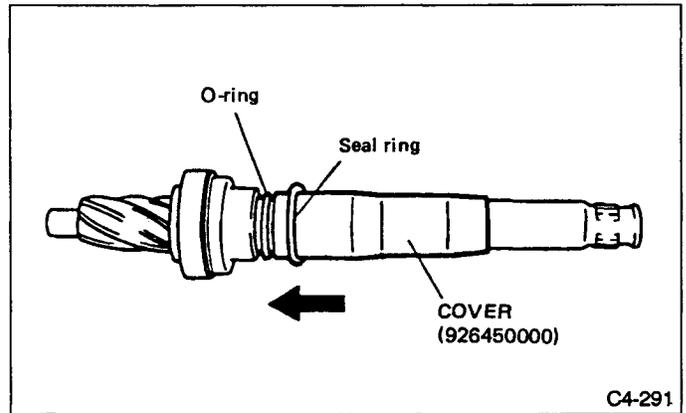


Fig. 123

- 5) Apply a coat of grease to inner wall of FORMER, and secure seal ring assembled in step (9) as shown. Leave seal ring unattended for approximately 10 minutes until it settles down.

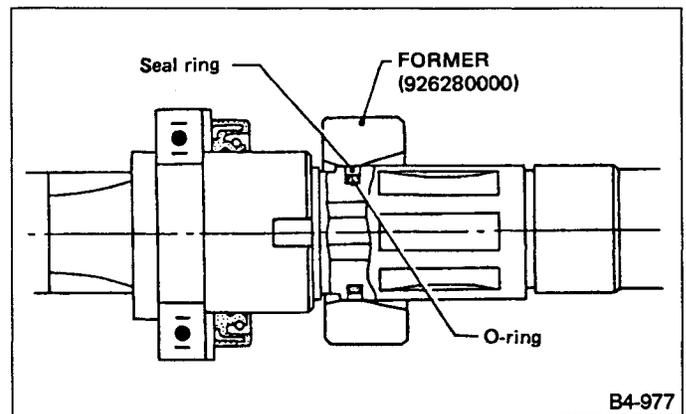


Fig. 124

- 6) While aligning valve sleeve pin with groove on pinion ASSY, secure with snap ring.
  - a. Be careful not to damage inner wall of valve sleeve and contact surface of pinion.
  - b. Align pinion groove with pin using alignment mark.
  - c. Before assembling valve sleeve and pinion ASSY, clean in kerosene and dry with compressed air.

7) Reassembly of valve ASSY

(1) Apply a coat of grease to inner wall of valve housing, Y-packing and outer perimeter of dust seal.

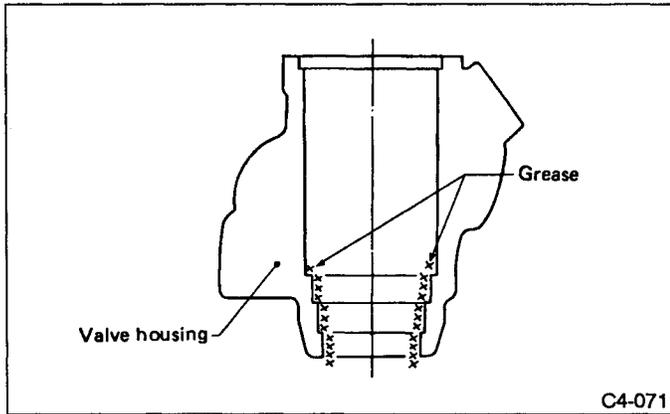


Fig. 125

(2) Using INSTALLER and press, install dust seal.

- a. Face dust seal in the direction shown in Figure 126.
- b. Apply a coat of grease to contact surface of installer and dust seal when installing dust seal. Be careful not to scratch dust seal during installation.

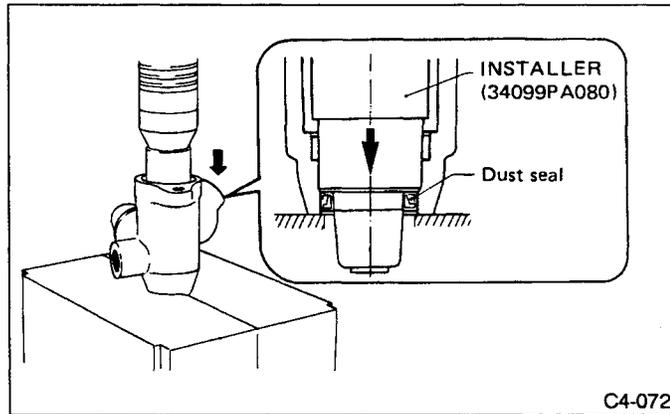


Fig. 126

(3) Using INSTALLER and press, install Y-packing and back-up washer in valve housing.

- a. Face Y-packing in the direction shown in Figure 127 when installing.
- b. To avoid scratching Y-packing, apply a coat of grease to contact surface of installer and Y-packing.
- c. To facilitate installation, attach Y-packing and back-up washer to installer and position in valve housing before pressing into place.

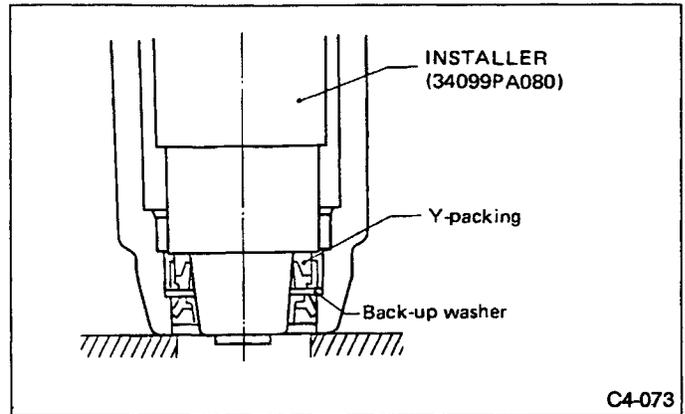


Fig. 127

(4) Attach SPACER to REMOVER, and press ball bearing into place using a press.

- a. To facilitate installation, attach ball bearing to remover and position in valve housing before pressing it into place.
- b. Use the "B" end of remover.

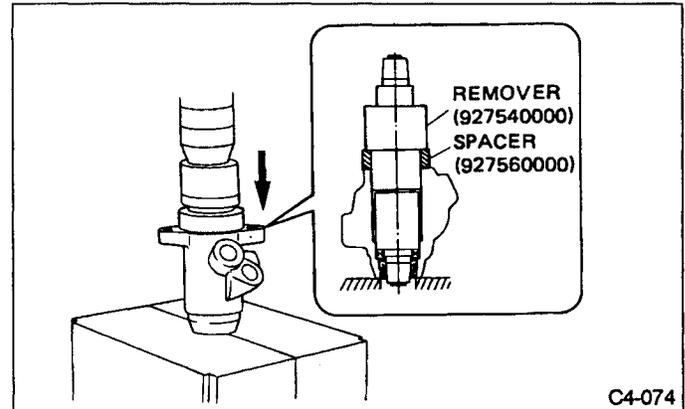


Fig. 128

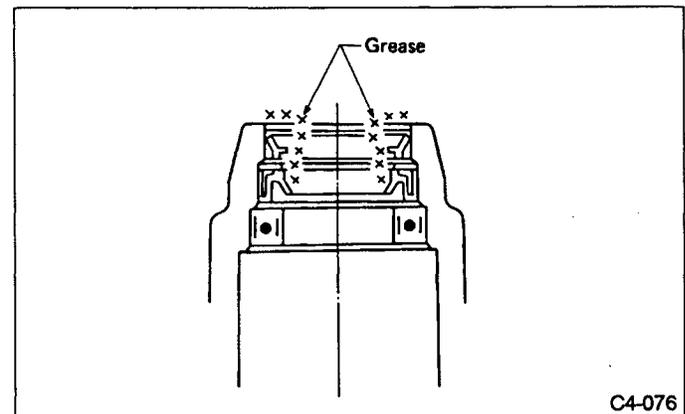


Fig. 129

(5) Apply a coat of grease to GUIDE surface, and install GUIDE onto end of input shaft. Insert pinion & valve ASSY until "A" of oil seal contacts "B" of valve housing. The GUIDE is used to prevent scratching Y-packing.

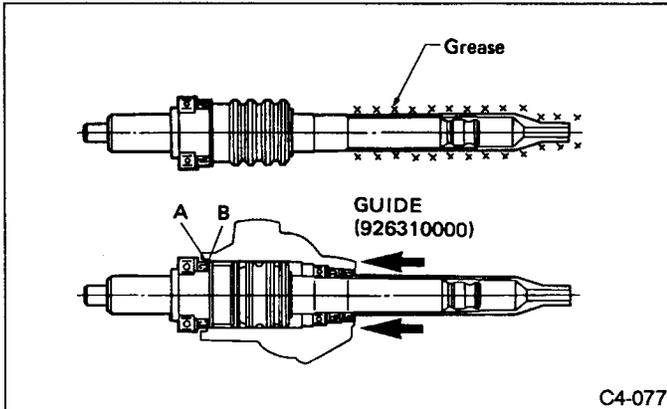


Fig. 130

(6) Secure input shaft with press and insert valve ASSY into valve housing. Do not allow spacer to extend beyond brazed end. Otherwise, pinion cannot be inserted properly.

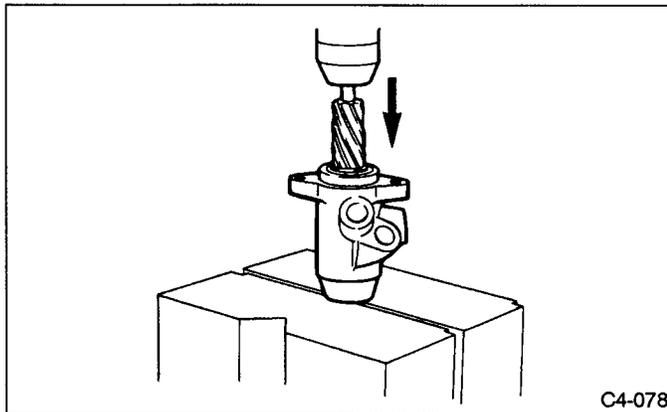


Fig. 131

(7) Apply a coat of grease to sealing lips of dust cover and insert dust cover until it contacts staged portion of input shaft.

**2. ELECTRONICALLY CONTROLLED TYPE**

Before assembly, clean parts and tools in kerosene and dry with compressed air. (Do not use organic solvent.)

1) Apply grease to oil seal lip. Drive COVER and SPACER into place as shown in figure below.

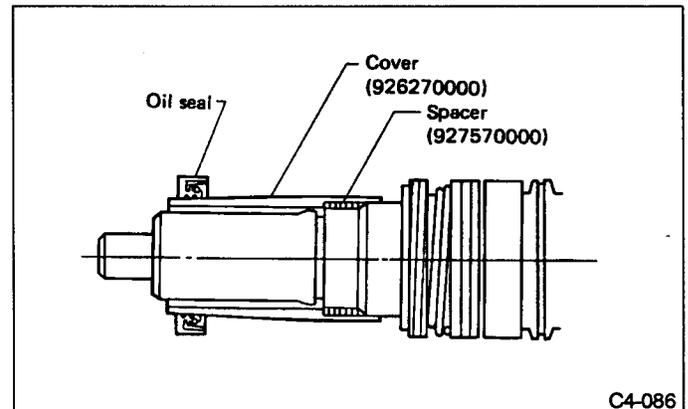


Fig. 132

2) Place INSTALLER D (927520000) on hand press. Set ball bearing packed with grease into INSTALLER and put spacer on it.

3) Place INSTALLER E onto pinion & valve ASSY with valve sleeve removed. Carefully press INSTALLER into place.

Set pinion pin into slot on INSTALLER E end surface.

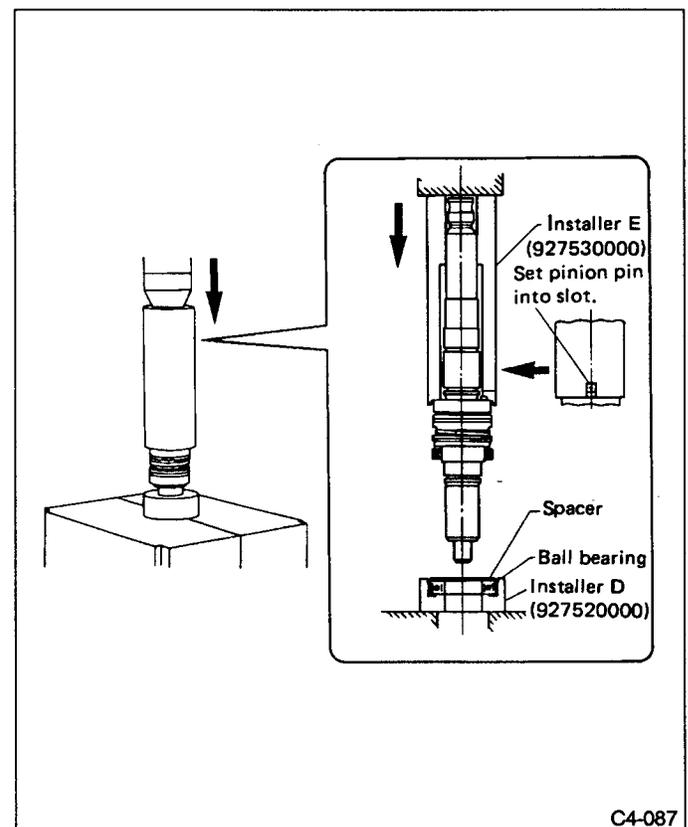


Fig. 133

## 4) Install retaining ring.

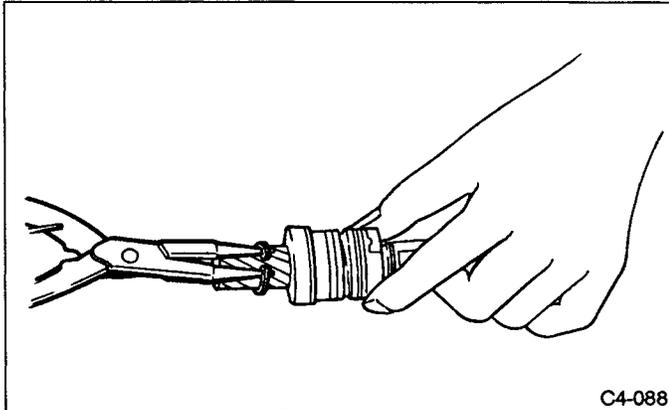


Fig. 134

5) Install valve in such a way that when valve sleeve is removed, pin groove is engaged properly with pinion shaft pin. (Align marking.)

- a. Wrong alignment will affect symmetric characteristic of valve.
- b. Make sure that the machined groove which is not marked with "x" is properly meshed with pinion shaft. (See figure below.)

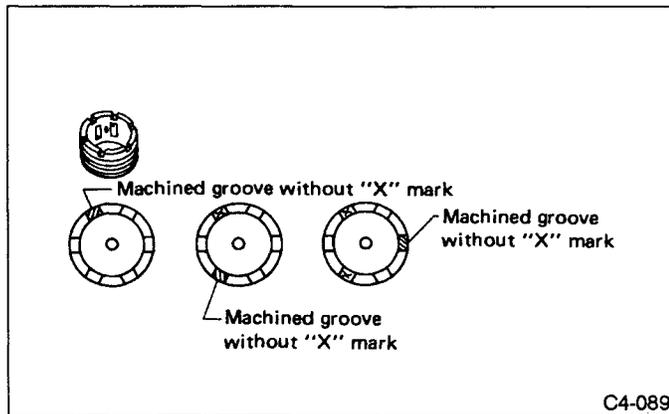


Fig. 135

- 6) Install spacer and retaining ring.
  - a. Fit retaining ring properly in groove.
  - b. Be careful not to scratch input shaft as it can cause oil to leak.
  - c. Do not expand retaining ring excessively.

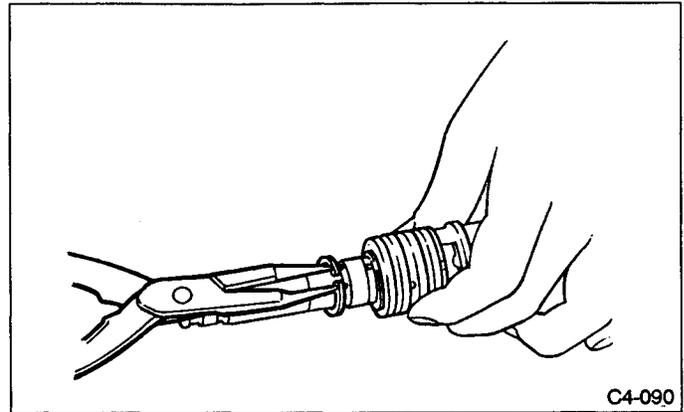


Fig. 136

7) Install Y-packing, back-up washer, dust seal and ball bearing in valve housing.

(Installation procedure is the same as that for the engine speed sensing type)

8) Secure input shaft with press and install valve ASSY in valve housing.

**Do not allow spacer to extend beyond brazed end. Otherwise, pinion cannot be inserted properly.**

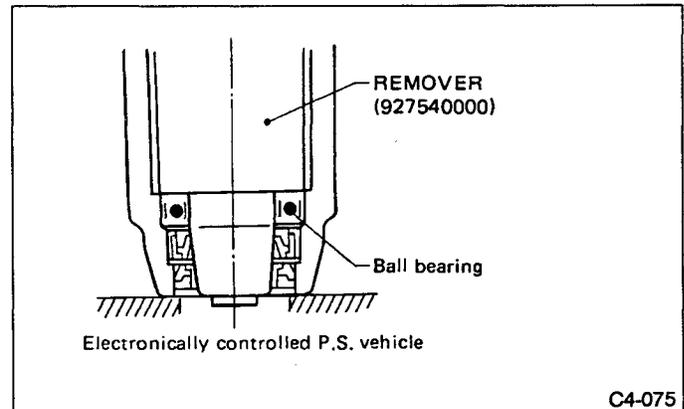


Fig. 137

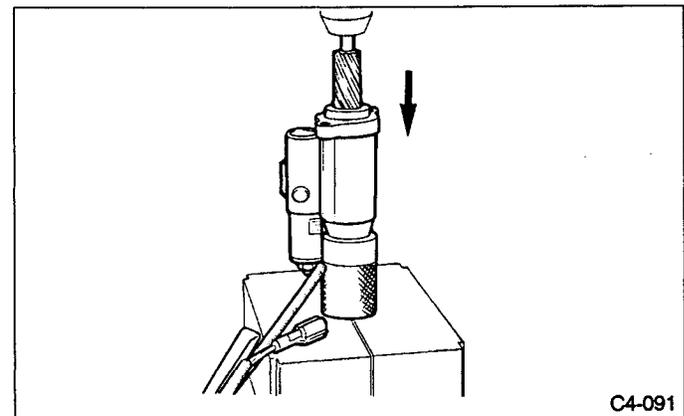


Fig. 138

9) Installation of valve ASSY. Refer to 4-3 [W3E0] STEP 2).

## 5. Oil Cooler and Hose & Pipe ASSY (Power Steering System)

### A: REMOVAL

- 1) Disconnect battery earth terminal.
- 2) Drain approximately 0.3 liters (0.3 US qt, 0.3 Imp qt) of fluid from oil tank. (Ref. to [4-3] No. W5A0.)
- 3) Remove belt cover.
- 4) Remove radiator bracket.
- 5) Disconnect radiator fan connector.
- 6) Remove main and sub radiator fans.
- 7) Separate canister from bracket and leave as it is.
- 8) Raise vehicle.
- 9) Remove under cover.
- 10) Remove bolts securing oil cooler with condenser from both sides.

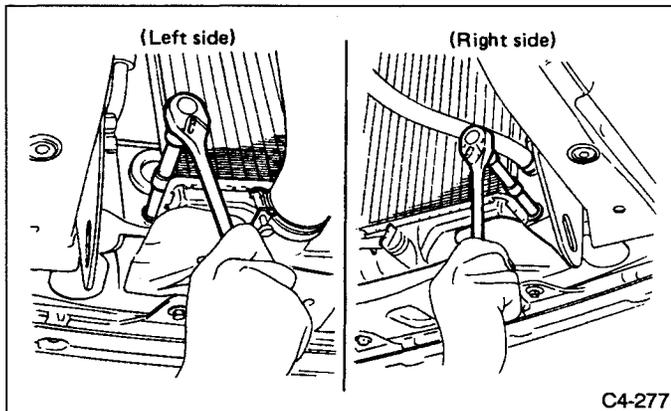


Fig. 139

- 11) Slightly lift and move radiator ASSY and draw out oil cooler.

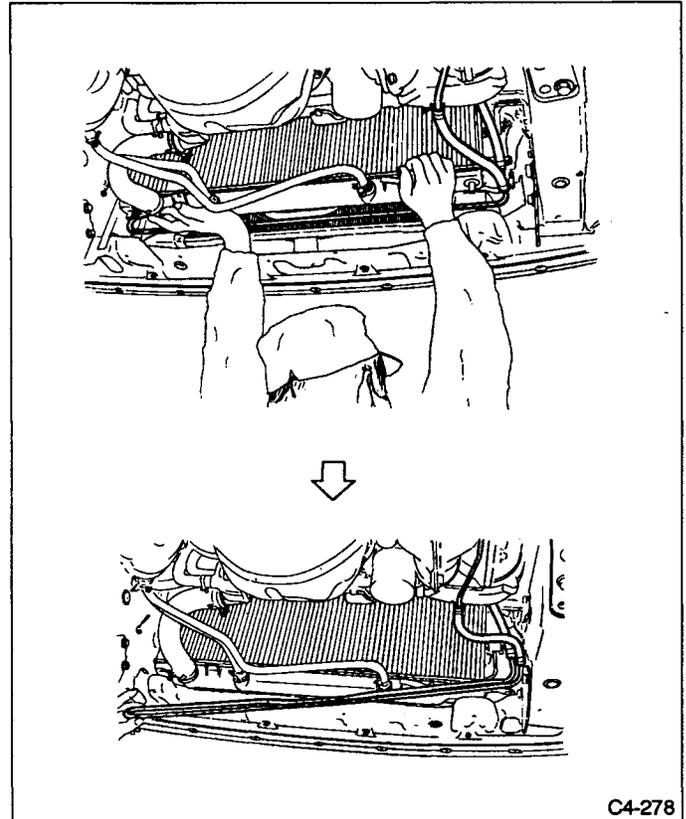


Fig. 140

- 12) Disconnect hoses A and B at points indicated in the figure below and remove oil cooler.

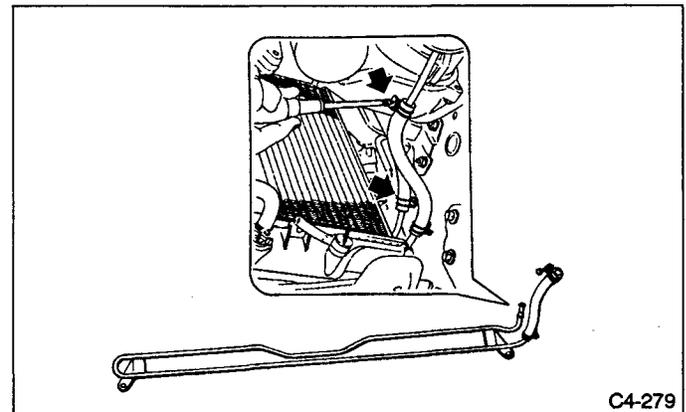


Fig. 141

- a. Do not allow fluid from the hose end to come into contact with pulley belt.
- b. To prevent foreign matter from entering the hose and pipe, cover the open ends with a clean cloth. (For removal of hose and pipe, refer to the component parts figure.)

**B: CHECK**

Check all disassembled parts for wear, damage or other abnormalities. Repair or replace faulty parts as required.

Part name	Inspection	Remedy
Pipe	<ul style="list-style-type: none"> <li>● O-ring fitting surface for damage</li> <li>● Nut for damage</li> <li>● Pipe for damage</li> </ul>	Replace with new one.
Clamp	<ul style="list-style-type: none"> <li>● Clamps for weak clamping force</li> </ul>	Replace with new one.
Hose	<ul style="list-style-type: none"> <li>● Flared surface for damage</li> <li>● Flare nut for damage</li> <li>● Outer surface for cracks</li> <li>● Outer surface for wear</li> <li>● Clip for damage</li> <li>● End coupling or adapter for degradation</li> </ul>	Replace with new one.

**C: ASSEMBLY**

Assembly is in the reverse order of removal.

**6. Oil Pump & Reservoir Tank**

**A: REMOVAL**

- 1) Disconnect battery earth (-) terminal
- 2) Remove belt cover.
- 3) Loosen nuts which secure idler pulley.
- 4) Loosen slider bolt, and remove V-belt.

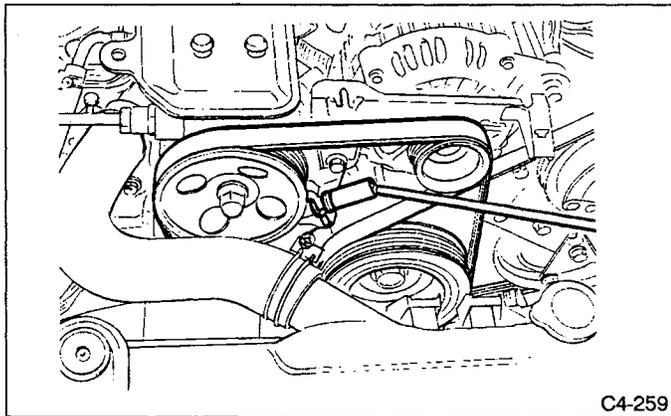


Fig. 142

- 5) Remove nut from front end of oil pump pulley, and detach oil pump pulley.

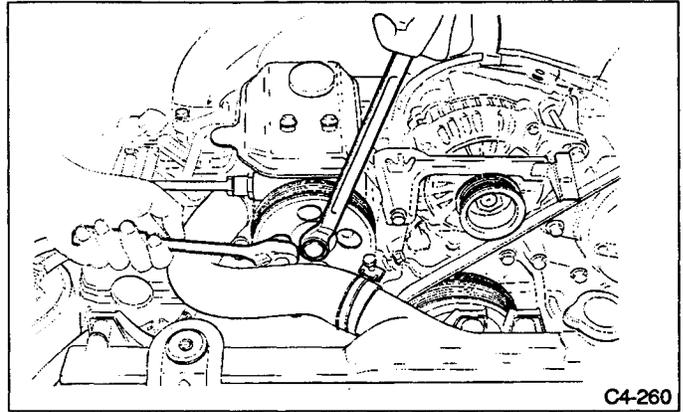


Fig. 143

- 6) Disconnect oil pump switch harness connector.
- 7) Drain approximately 0.3 liters (0.3 US qt, 0.3 Imp qt) of fluid from oil reservoir tank.

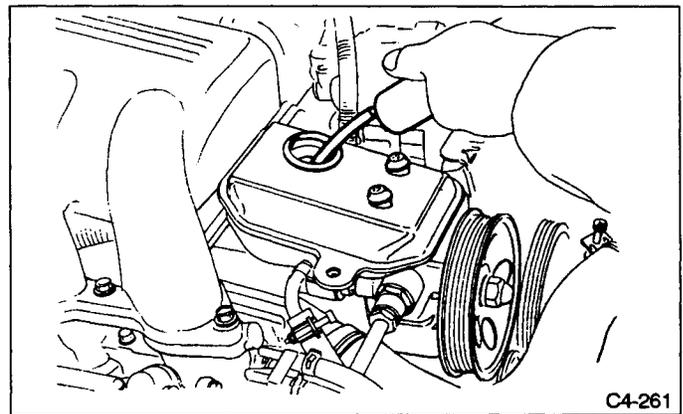


Fig. 144

- 8) Disconnect hose from oil reservoir tank.
  - a. Be careful not to spill fluid from hose end to V-belt.
  - b. Cover open ends of hose and pipe with a clean cloth to prevent entry of foreign matter.
- 9) Disconnect pressure pipe from pump.

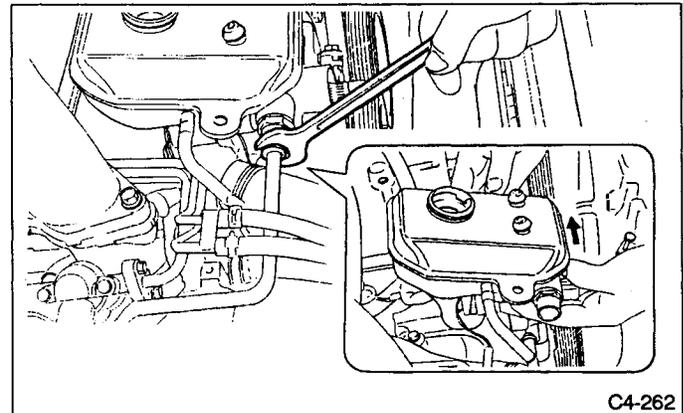


Fig. 145

- 10) Remove bolts securing oil pump & tank to bracket, and then remove pump and tank.

11) Place pump in a vise, and remove bolts from upper surface of tank.

**a. Use soft jaws and lightly tighten vise jaws.**

**b. After bolts are loose enough to be rotated with your hand, press pump against tank while removing bolts. Failure to do so causes fluid to spill out. Remove tank as quickly as possible, and wipe clean fluid spilled on parts. Except when only tank is to be checked, remove tank and pump as a unit and separate from each other on a work bench. This prevents fluid from spilling on the engine.**

**B: CHECK**

- In accordance with the following table, check all removed parts for wear and damage, and make repair or replacement if necessary.

No.	Parts	Inspection	Corrective action
1	Oil pump (Outside)	(1) Crack, damage or oil leakage	Replace oil pump ASSY with a new one.
		(2) Play of pulley shaft	Measure radial play and axial play. If any of these exceeds the service limit, replace oil pump ASSY with a new one. (Refer to "Service limit".)
2	Pulley	(1) Damage	Replace it with a new one.
		(2) Bend	Measure V ditch deflection. If it exceeds the service limit, replace pulley with a new one. (Refer to "Service limit".)
3	Tank cap	Crack or damage	Replace it with a new one.
4	Filler strainer	(1) Clogging with dirt	Wash it.
		(2) Breakage	Replace it with a new one.
5	Oil pump (Interior)	(1) Defect or burning of vane pump	Check resistance to rotation of pulley. If it is past the service limit, replace oil pump ASSY with a new one. (Refer to "Service limit".)
		(2) Bend in the shaft or damage to bearing	Oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump when turning with a string put around its pulley, replace oil pump ASSY with a new one.
6	O-ring	Crack or deterioration	Replace it with a new one.
7	Oil tank	Crack, damage or oil leakage	Replace it with a new one.
8	Bracket	Crack	Replace it with a new one.

**1. SERVICE LIMIT**

Make a measurement as follows. If it exceeds the specified service limit, replace the parts with a new one.

a. Fix oil pump ASSY on a vise to make a measurement. At this time, hold oil pump ASSY with the least possible force between two wood pieces.

b. Do not set outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.

Play of pulley shaft

Service limit:

Radial play (Direction  $\leftrightarrow$ )

0.4 mm (0.016 in) or less

Axial play (Direction  $\rightleftarrows$ )

0.9 mm (0.035 in) or less

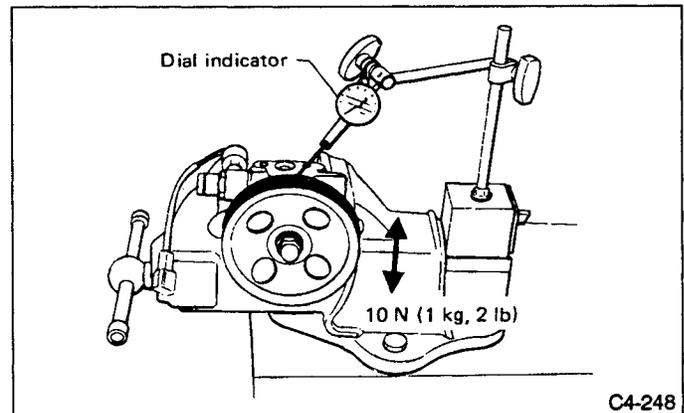


Fig. 146 Radial play

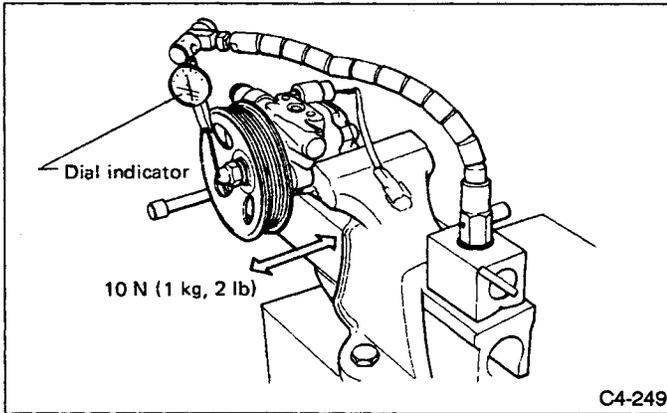


Fig. 147 Axial play

**Ditch deflection of pulley**

**Service limit:**  
**1.0 mm (0.039 in) or less**

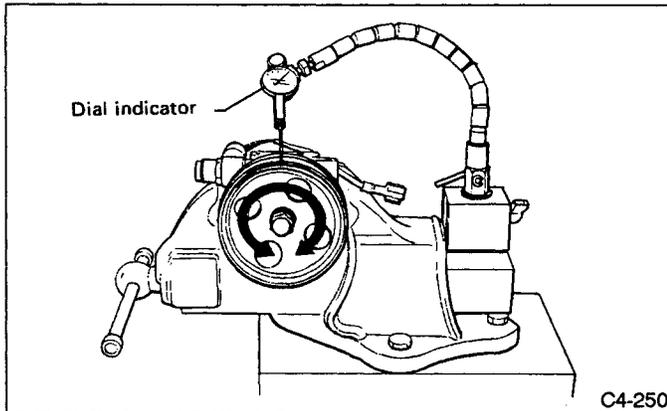


Fig. 148

Read the value for one surface of V ditch, and then the value for another off the dial.  
**Resistance to rotation of pulley**

**Service limit:**  
**Maximum load; 9.22 N (0.94 kg, 2.07 lb) or less**

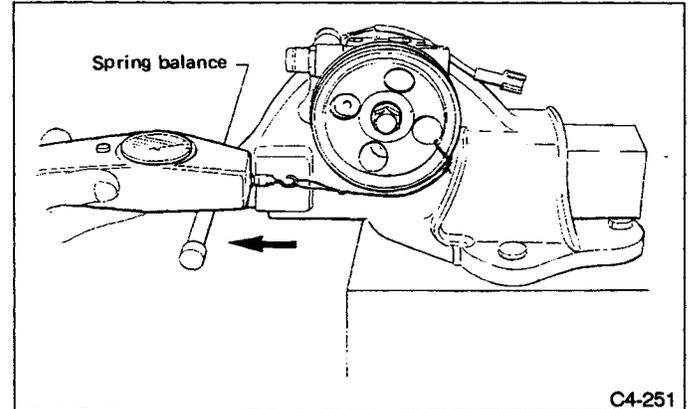
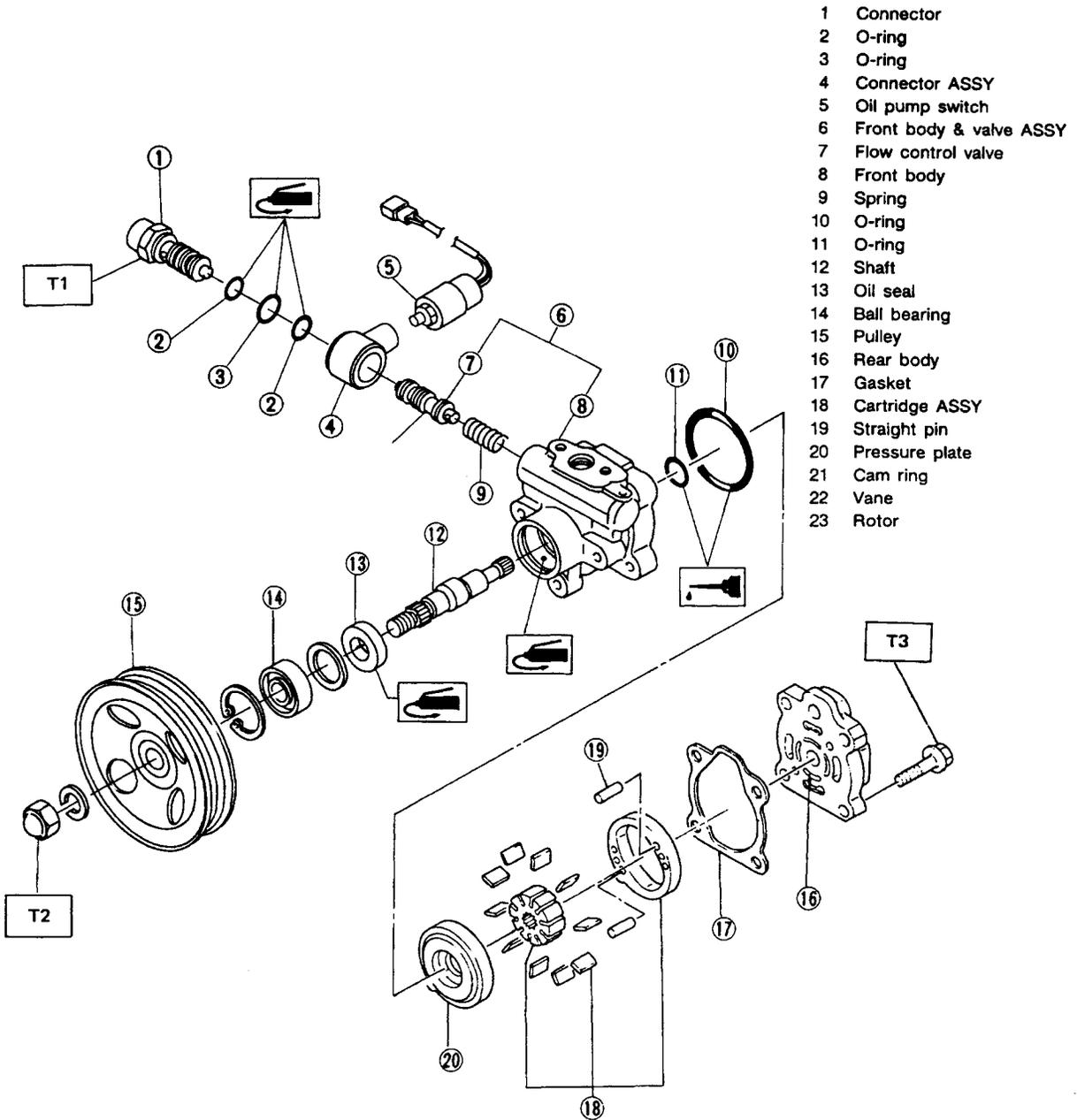


Fig. 149

**A rather higher value may be indicated when pulley starts turning.**  
**Measure the load during rotation and make a judgement.**

**C: DISASSEMBLY**



Tightening torque: N·m (kg·m, ft·lb)	
T1:	69 — 78 (7.0 — 8.0, 51 — 58)
T2:	42 — 62 (4.3 — 6.3, 31 — 46)
T3:	14 — 18 (1.4 — 1.8, 10 — 13)

Fig. 150

1) Place pump bracket (with pump installed) in a vise using soft jaws.

**Do not place pump itself in a vise.**

2) Valve removal

Remove oil pump switch, and disconnect connectors and remove valve ASSY and spring.

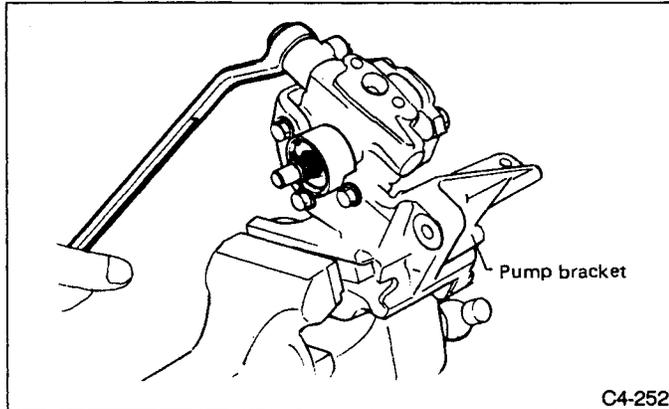


Fig. 151

3) Rear body removal

(1) Loosen bolts securing rear body so that they can be rotated by hand.

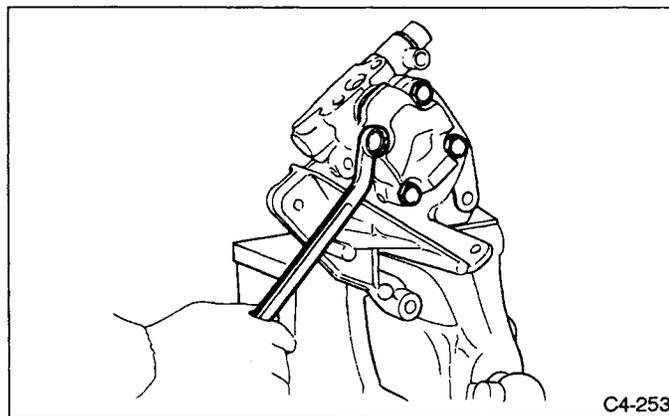


Fig. 152

(2) Remove pump from pump bracket.

(3) Remove pump bracket from vise.

(4) Place pump in a vise.

**Use soft jaws.**

(5) Remove bolts which have already been loosened in step (1) above.

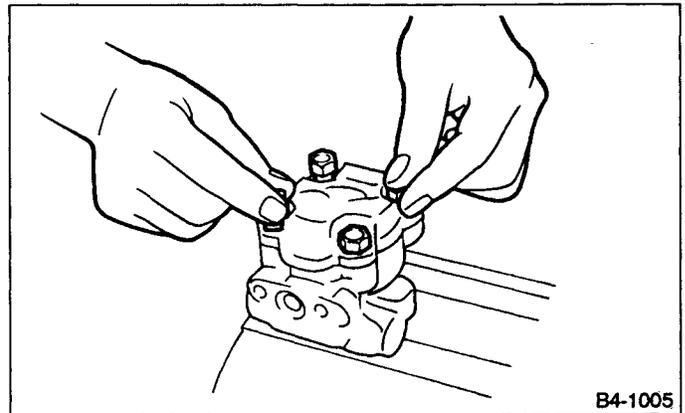


Fig. 153

(6) Remove gasket.  
 4) Removal of cartridge ASSY, pressure plate and pin  
 Remove cartridge ASSY, pressure plate and pin from front body as a unit. (Cartridge ASSY consists of a rotor, ten vanes and a cam.)

**Be careful not to scratch cartridge ASSY.**

5) Remove two types of O-rings by hand.

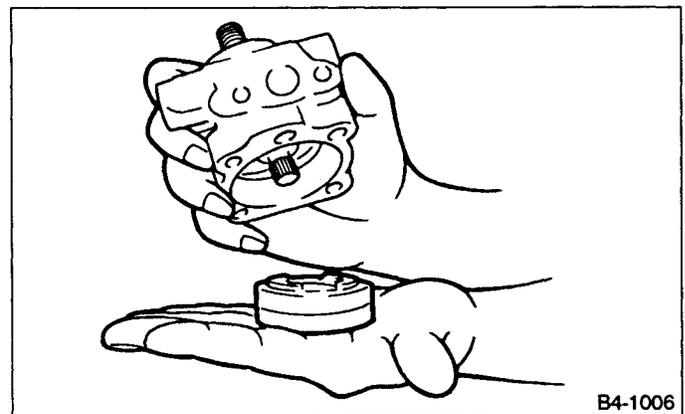


Fig. 154

6) Disassembly of front body

(1) Pry off retaining ring from inner perimeter groove of front body at pulley location.

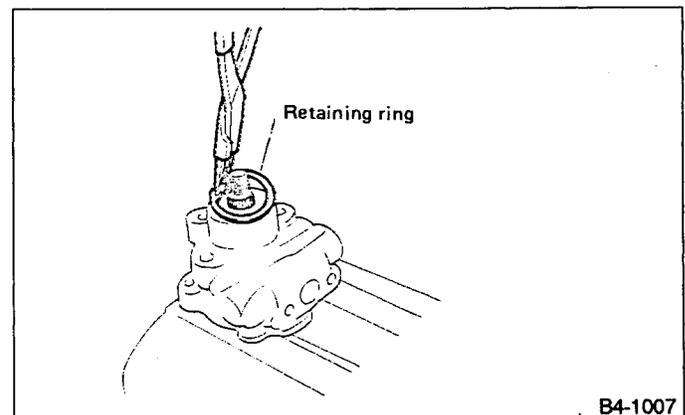


Fig. 155

(2) Using a hand press, press out drive shaft (on the cartridge side).

(3) Press ball bearing out of drive shaft using a hand press.

(4) Remove oil seal by attaching it to a hooked-end plate placed in a vise.

- a. Use a plate without sharp edges.
- b. Replace oil seal with new ones.

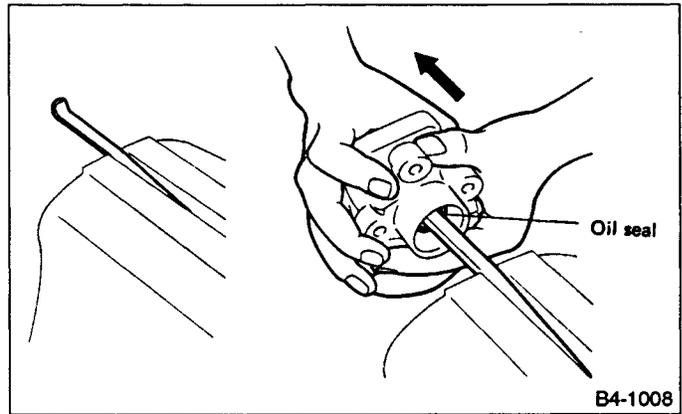


Fig. 156

## D: INSPECTION

Perform following inspection procedures and repair or replace defective parts.

Part name	Description	Remedy
1. Front body	<ol style="list-style-type: none"> <li>1) Damage on body surfaces</li> <li>2) Excessive wear on hole, into which spool valve is inserted.</li> <li>3) Wear and damage on cartridge ASSY mounting surface</li> <li>4) Wear and damage on surfaces in contact with shaft and oil seal</li> </ol>	Replace with a new one together with spool valve as selective fit is made.
2. Rear body	<ol style="list-style-type: none"> <li>1) Damage on body surfaces</li> <li>2) Wear and damage on sliding surfaces</li> </ol>	Replace with a new one.
3. Shaft	<ol style="list-style-type: none"> <li>1) Shaft bend</li> <li>2) Wear and damage on surfaces in contact with bushing and oil seal</li> <li>3) Wear and damage on rotor mounting surfaces</li> <li>4) Bearing damage</li> </ol>	Replace with a new one.
4. Side plate	Wear and damage on sliding surfaces	Replace with a new one.
5. Cam ring	Ridge wear on sliding surfaces	If damage is serious, replace with a new cartridge ASSY.
6. Vane	Excessive wear on nose radius and side surfaces	
7. Rotor	<ol style="list-style-type: none"> <li>1) Wear and damage on sliding surfaces</li> <li>2) Ridge wear on vane sliding grooves (If light leaks with vane in slit against light source)</li> </ol>	Correct with oil stone. If damage is serious, replace with a new cartridge ASSY.
	<ol style="list-style-type: none"> <li>3) Damage resulting from snap ring removal</li> </ol>	
8. Spool valve	Damage or burrs on sliding surface periphery	Replace with a new one together with front casing as selective fit is made.
9. Connector	Damage on threads	Replace with a new one.
10. Spring	Damage	Replace with a new one.
11. Bolts and nuts	Damage on threads	Replace with a new one.
12. Oil pump switch	Damage on harness	Replace with a new one.

## E: ASSEMBLY

### 1) Installation of oil seal

Apply a coat of lithium grease to outer perimeter of oil seal and charge sealing lips with grease. Using INSTALLER and a hand press, press oil seal into front body.

Place the seating surface of front body on a soft cloth to prevent it from sustaining scratches while pressing oil seal into place.

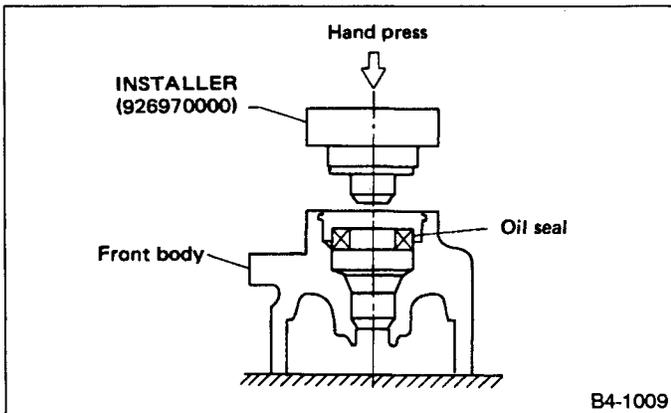


Fig. 157

2) Installation of drive shaft

- (1) Using GUIDE and a hand press, drive bearing onto shaft.

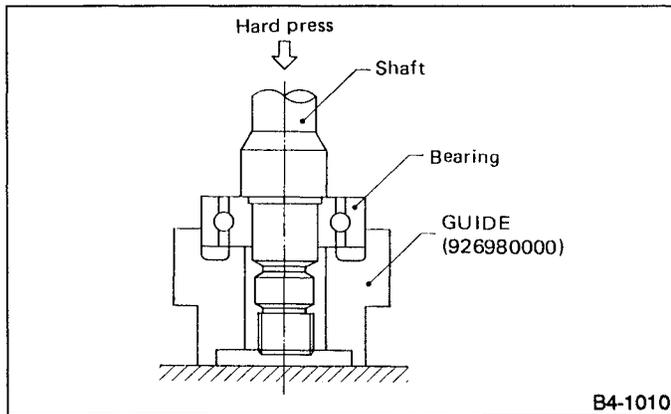


Fig. 158

- (2) Install retaining ring on oil seal. Using GUIDE, press shaft & bearing ASSY into front body.

- a. Be careful not to strike shaft splines on oil seal's sealing lips during installation.
- b. Do not hit end of shaft during installation.

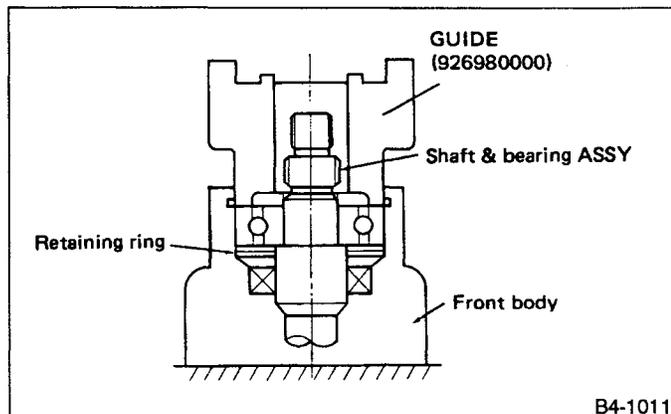


Fig. 159

- (3) Lock drive shaft using a retaining ring.
- 3) Installation of pressure plate

Place front body in a vise with pulley side facing down. Position two O-rings and pressure plate in front body in that order.

**Do not forget to install O-rings.**

4) Installation of cartridge

- (1) Install cam, rotor and vane in that order.
- (2) Insert pin into holes in cam and pressure plate.

a. Ensure that vane is installed with "R" side facing the cam.

b. Check that vane moves smoothly.

c. Apply a coat of automatic transmission fluid (DEXRON II) to vane.

5) Installation of rear body

- (1) While aligning pin hole of rear body with pin on the pump, install rear body using a gasket and tighten bolts by hand.
- (2) Remove pump from vise.

- (3) Place pump bracket in a vise, install pump on pump bracket.

(4) Tighten rear body mounting bolts in a criss-cross fashion to one-half of specified torque, then tighten to specified torque.

After tightening rear body mounting bolts, ensure that shaft rotates properly.

**After tightening rear body mounting bolts, ensure that shaft rotates properly.**

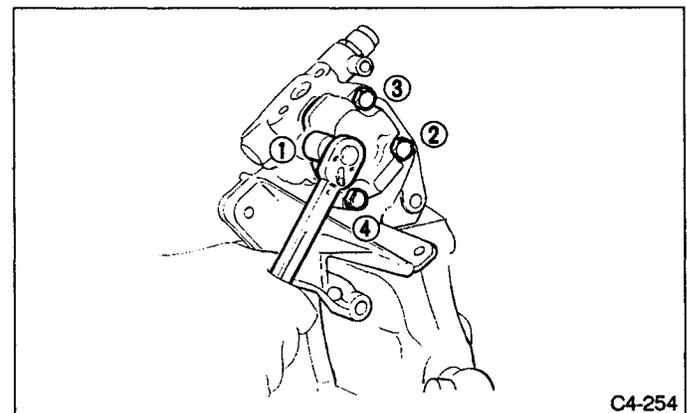


Fig. 160

6) Installation of valve

- (1) Position spring and valve ASSY in front body in that order.
- (2) Connect connector to front body with an O-ring in place.

**Tightening torque:**

29 — 39 N·m (3.0 — 4.0 kg-m, 22 — 29 ft-lb)

**F: INSTALLATION**

To install, reverse the order of removal procedures. Replenish specified fluid and purge air.

**Do not operate engine before replenishing fluid as this will seize oil pump.**

### G: FILLING POWER STEERING FLUID AND AIR BLEEDING

Recommended power steering fluid	Manufacturer
ATF DEXRON II	B.P.
	CALTEX
	CASTROL
	MOBIL
	SHELL
	TEXACO

(1) Feed the specified fluid with its level being about 4 cm (1.6 in) lower than the mouth of tank.

(2) Continue to turn steering wheel slowly from lock to lock until bubbles stop appearing in the tank while keeping the fluid at that level.

**In case air is absorbed to deliver bubbles into piping because the fluid level is lower, leave it about half an hour and then do the step (2) all over again.**

(3) Start, and idle the engine.

(4) Continue to turn steering wheel slowly from lock to lock again until bubbles stop appearing in the tank while keeping the fluid at that level.

It is normal that bubbles stop appearing after three times turning of steering wheel.

**In case bubbles do not stop appearing in the tank, leave it about half an hour and then do the step (4) all over again.**

(5) Stop the engine, and take out safety stands after jacking up vehicle again.

Then lower the vehicle, and idle the engine.

(6) Continue to turn steering wheel from lock to lock until bubbles stop appearing and change of the fluid level is within 3 mm (0.12 in).

**In case the following happens, leave it about half an hour and then do step (6) again.**

a. The fluid level changes over 3 mm (0.12 in).

b. Bubbles remain on the upper surface of the fluid.

c. Grinding noise is generated from oil pump.

1) Check the fluid leakage at flare nuts after turning steering wheel from lock to lock with engine running.

a. Before checking, wipe off any fluid on flare nuts and piping.

b. In case the fluid leaks from flare nut, it is caused by dust (or the like) and/or damage between flare and tapered seat in piping.

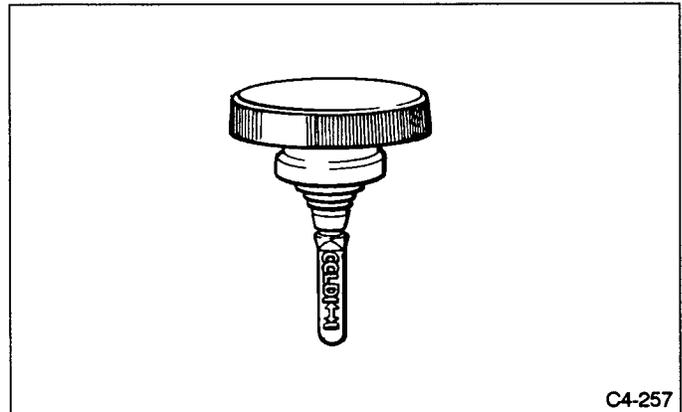
So remove the flare nut, tighten again it to the specified torque after cleaning flare and tapered seat. If flare or tapered seat is damaged, replace it with a new one.  
2) Inspect fluid level on flat and level surface with engine "OFF" by indicator of filler cap.

If the level is at lower point or below, add fluid to keep the level in the specified range of the indicator. If at upper point or above, drain fluid by using a syringe or the like.

**Fluid capacity:**

**1.0 ℓ (1.1 US qt, 0.9 Imp qt)**

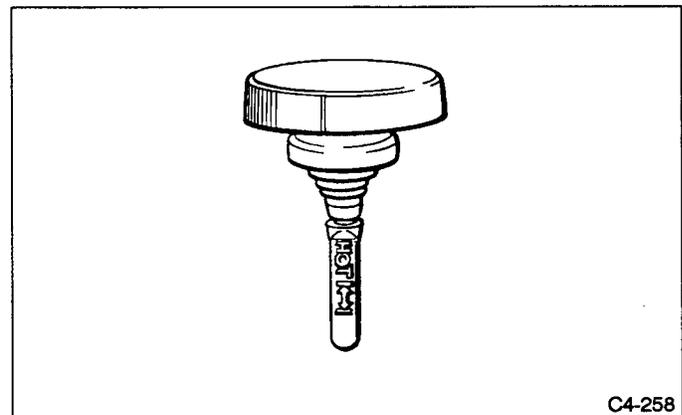
(1) Check at temperature 21°C (70°F) on reservoir surface of oil pump.



C4-257

Fig. 161

(2) Check at temperature 60°C (140°F) on reservoir surface of oil pump.



C4-258

Fig. 162

# T TROUBLESHOOTING **AIRBAG**

## 1. Supplemental Restraint System "Airbag"

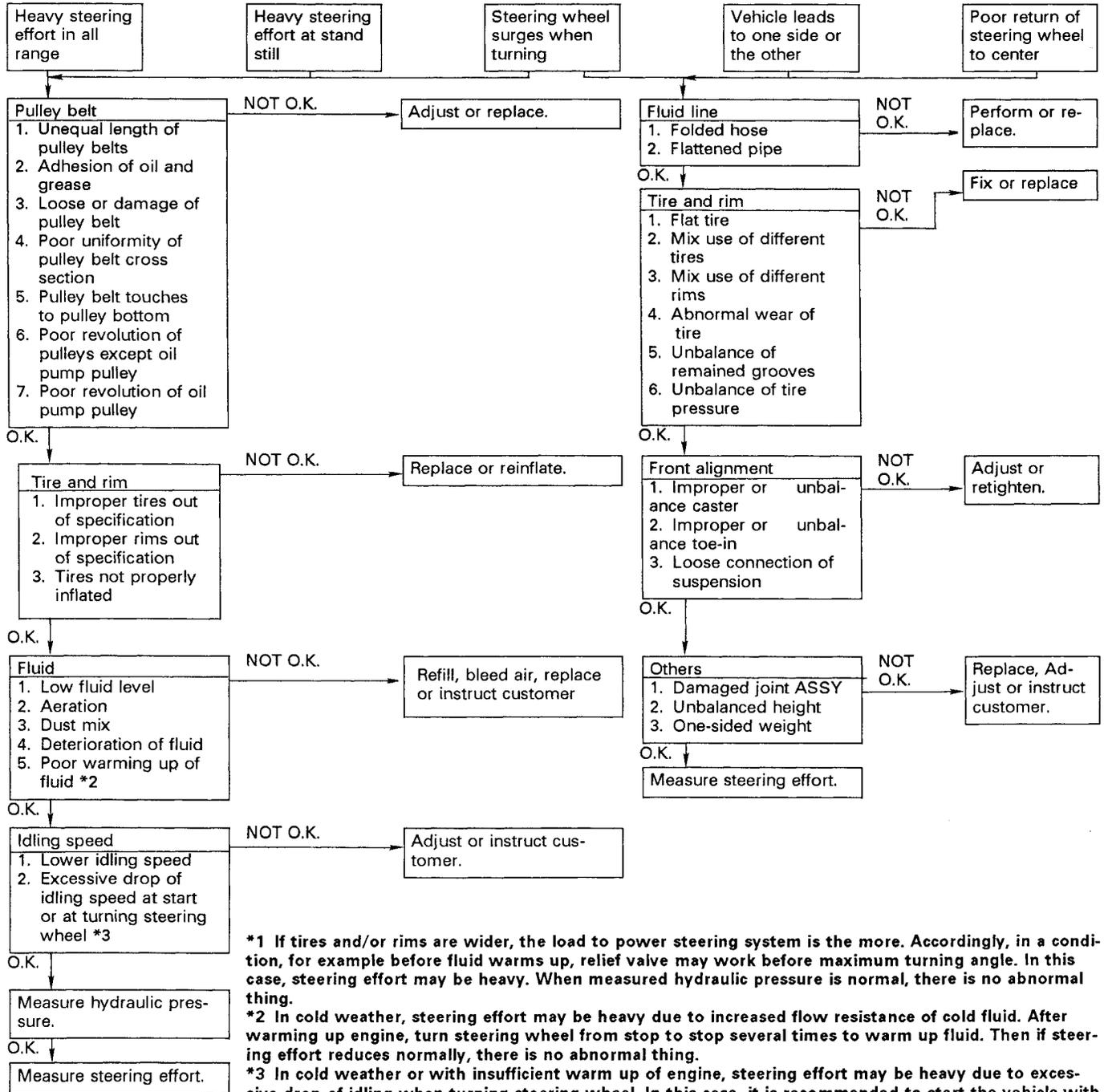
Airbag system wiring harness is routed near the steering system.

a. All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.

b. Be careful not to damage Airbag system wiring harness when servicing the steering system.

## 2. Power Steering

### 1. STEERING CONDITION



**2. MEASUREMENT OF HYDRAULIC PRESSURE**

- a. Be sure to complete all items aforementioned in article 1), prior to measuring hydraulic pressure. Otherwise, pressure can not be measured correctly.
- b. Do not leave the valve of pressure gauge closed or hold the steering wheel at stop end for 5 seconds or more in any case, as the oil pump may be damaged due to long keep of these conditions.
- c. Put cotton cloth waste at a place where fluid drops before pressure gauge is installed. Wipe off split fluid thoroughly after the measurement.
- d. Keep engine idling during the measurement.

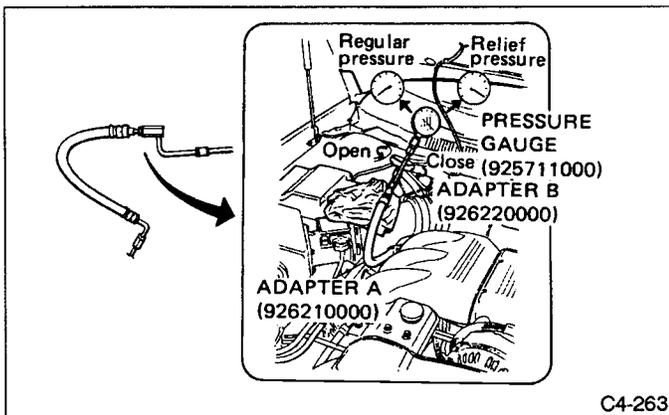
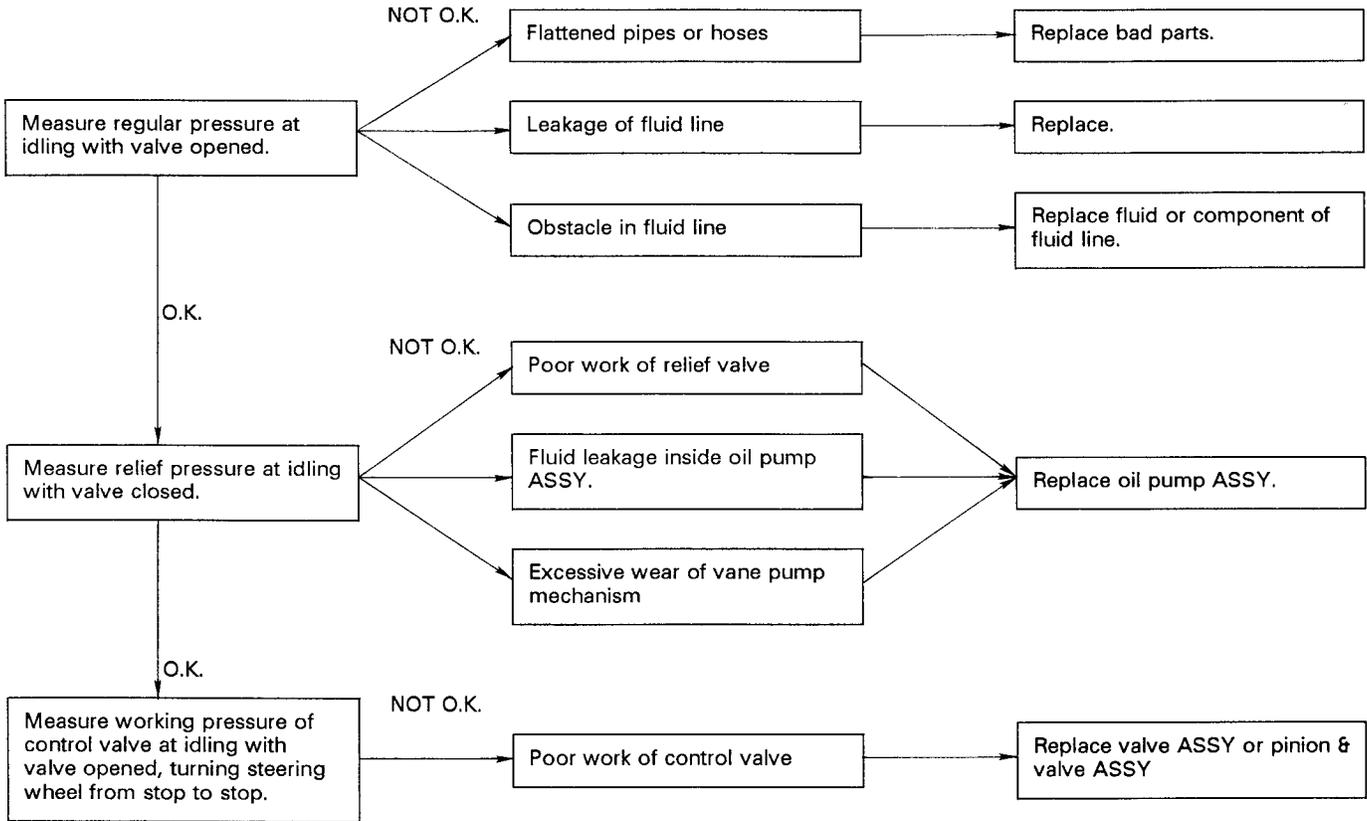
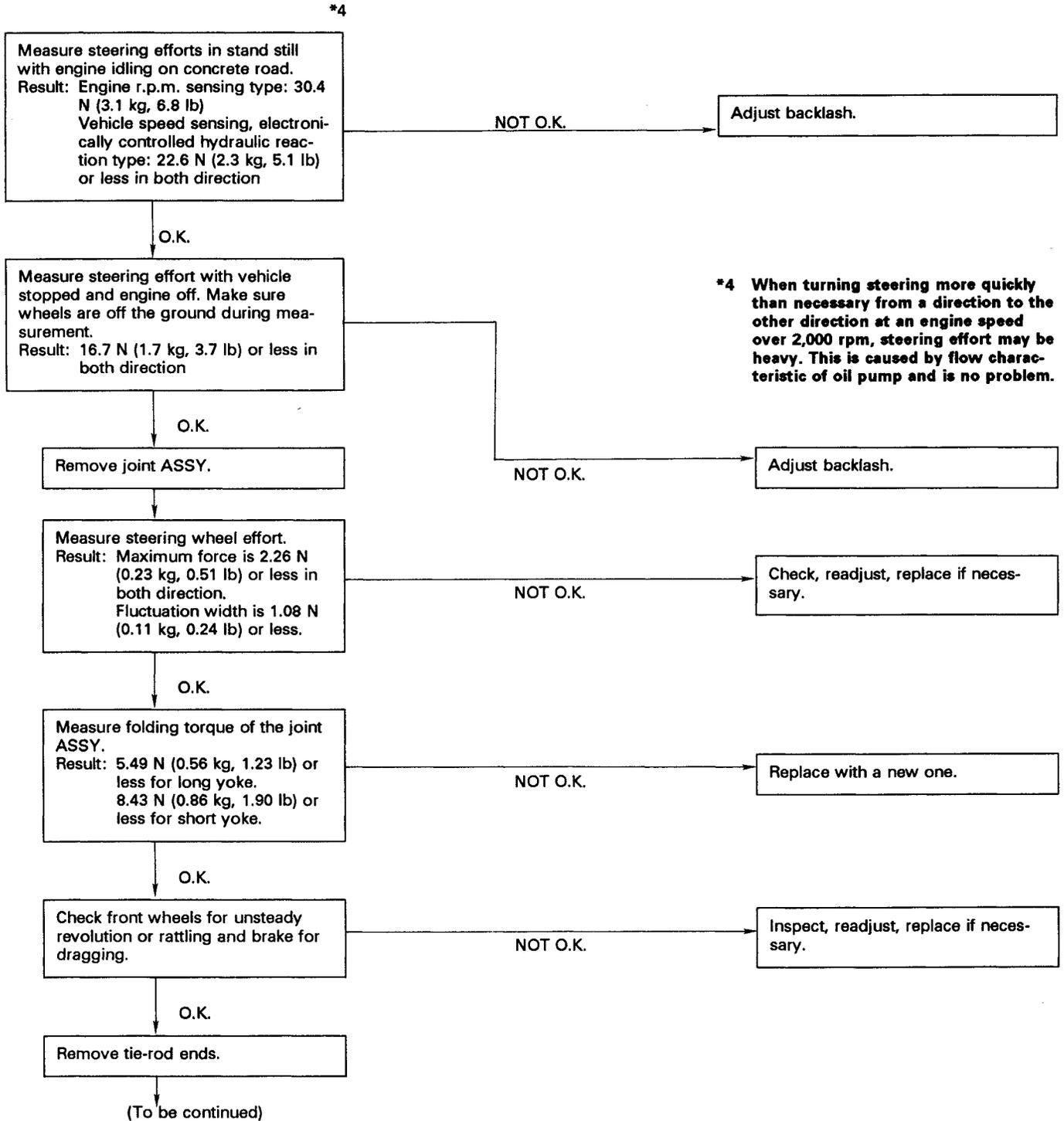


Fig. 163

<b>Regular pressure:</b> 981 kPa (10 kg/cm <sup>2</sup> , 142 psi) or less
<b>Relief pressure:</b> 7,649 — 8,336 kPa (78 — 85 kg/cm <sup>2</sup> , 1,109 — 1,209 psi)

3. MEASUREMENT OF STEERING EFFORT

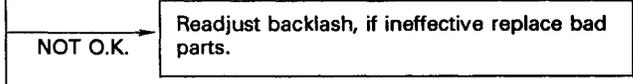




Measure rotating and sliding resistance of gearbox ASSY.  
Result:

Unit: N (kg, lb)

		Engine speed sensing type	Vehicle speed sensing, hydraulic reaction type
Rotating resistance	Straight ahead	10.49 (1.07, 2.36) or less	
	All positions	11.8 (1.2, 2.6) or less	
	Difference between left and right turns	20% or less	
Sliding resistance		265 (27, 60) or less	
	Difference between left and right turns	20% or less	



**Measurement of steering effort**

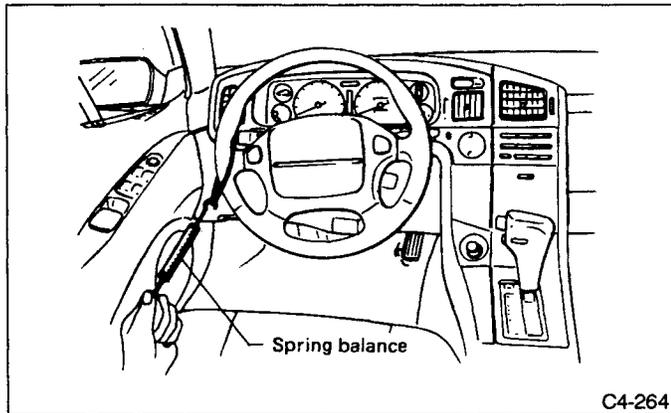


Fig. 164

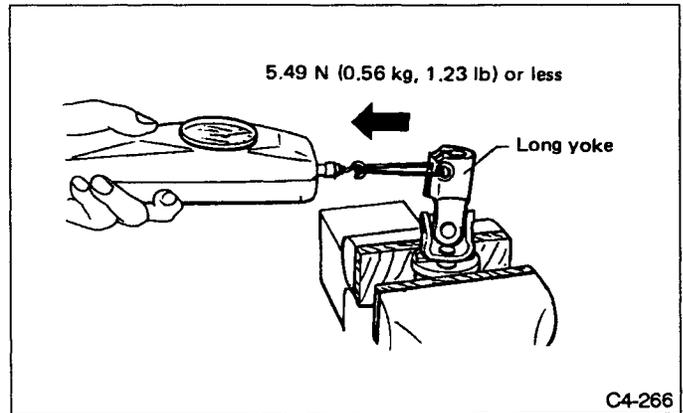


Fig. 166

**Measurement of folding torque of joint assembly**

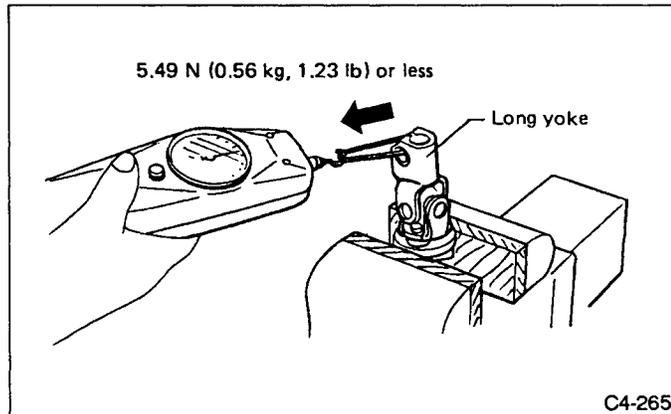


Fig. 165

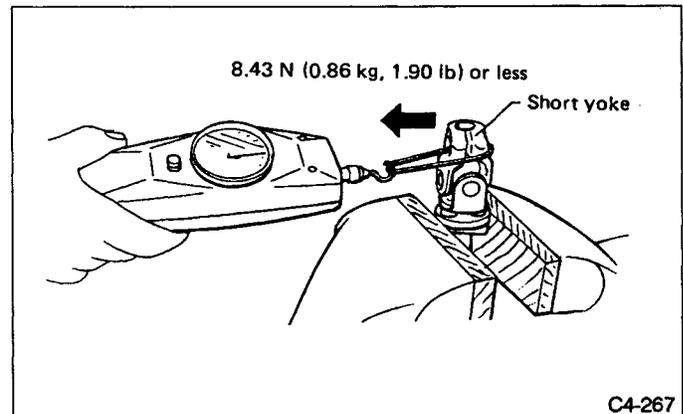


Fig. 167

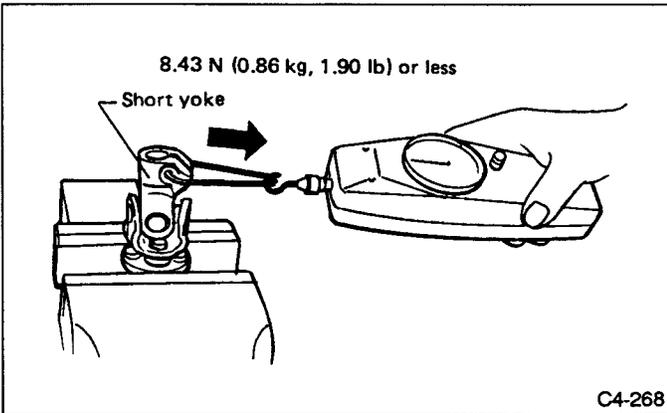


Fig. 168

**Measurement of resistances of gearbox assembly**

**Rotating resistance:**

Straight-ahead position within 30 mm (1.18 in) from rack center

Less than 10.49 N (1.07 kg, 2.36 lb)

Maximum allowable torque

11.8 N (1.2 kg, 2.6 lb)

**Sliding resistance:**

**Left-turn steering**

314 N (32 kg, 71 lb) or less

**Right-turn steering**

265 N (27 kg, 60 lb) or less

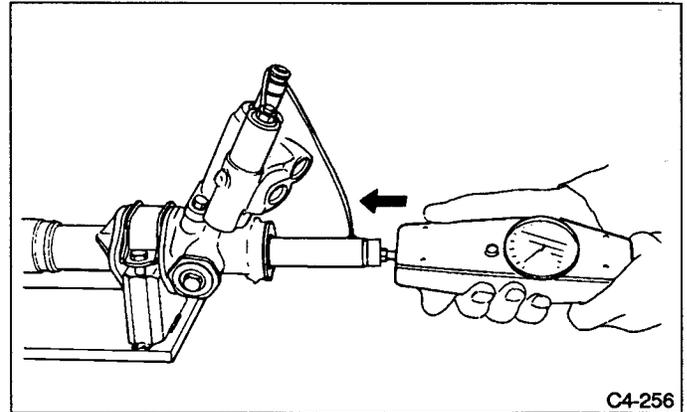


Fig. 170

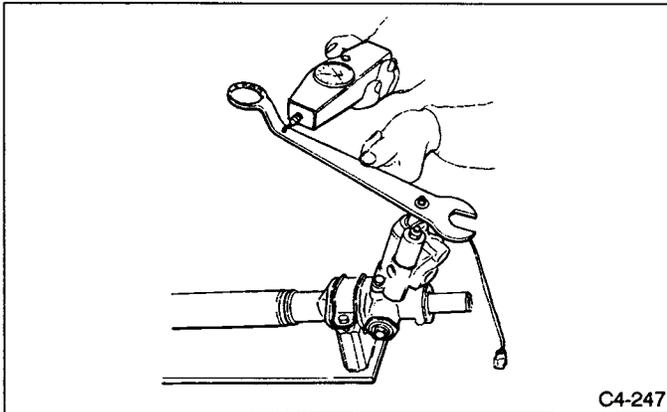


Fig. 169

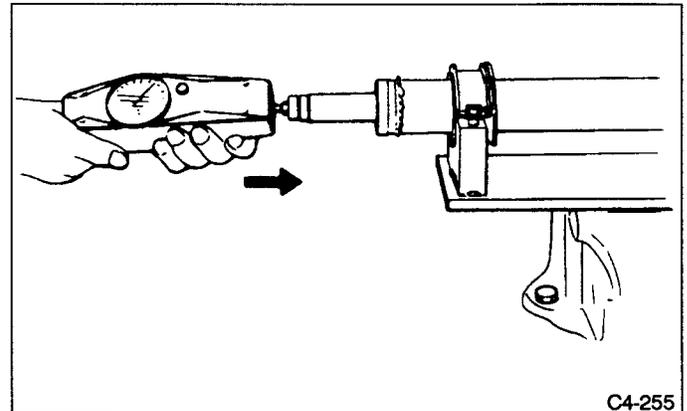
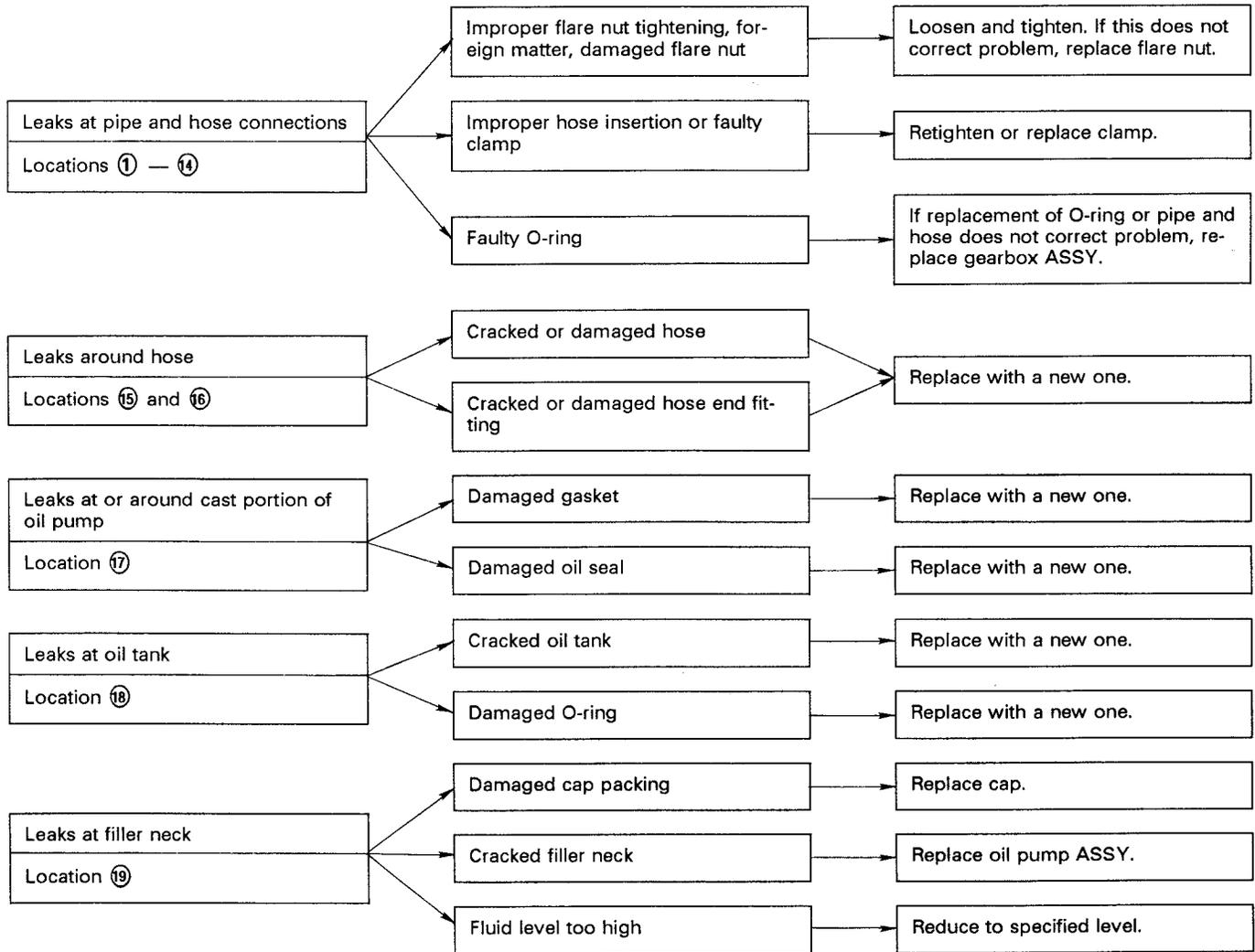


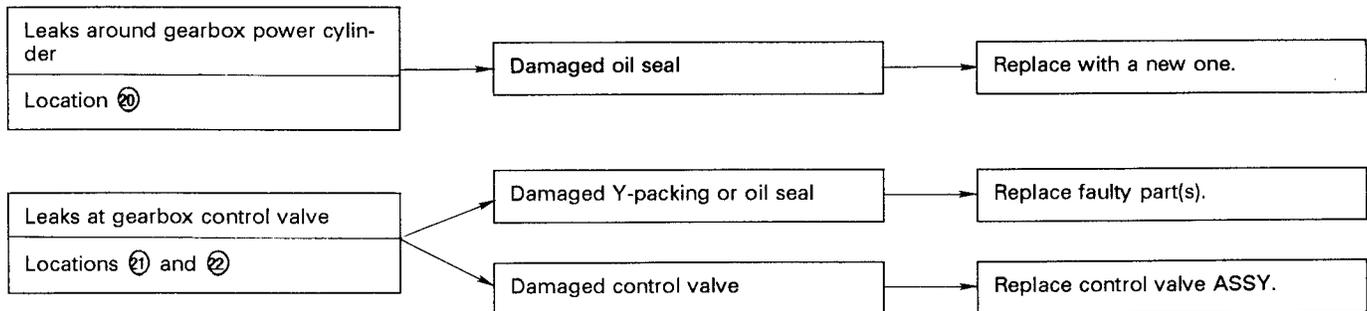
Fig. 171

**4. FLUID LEAKAGE**

**It is likely that although one judges fluid leakage, there is actually no leakage. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.**



**Severe operation of vehicle may cause fluid to ooze out at air vent in cap. However, this is not a problem.**



**Wipe clean spilled fluid after servicing.**

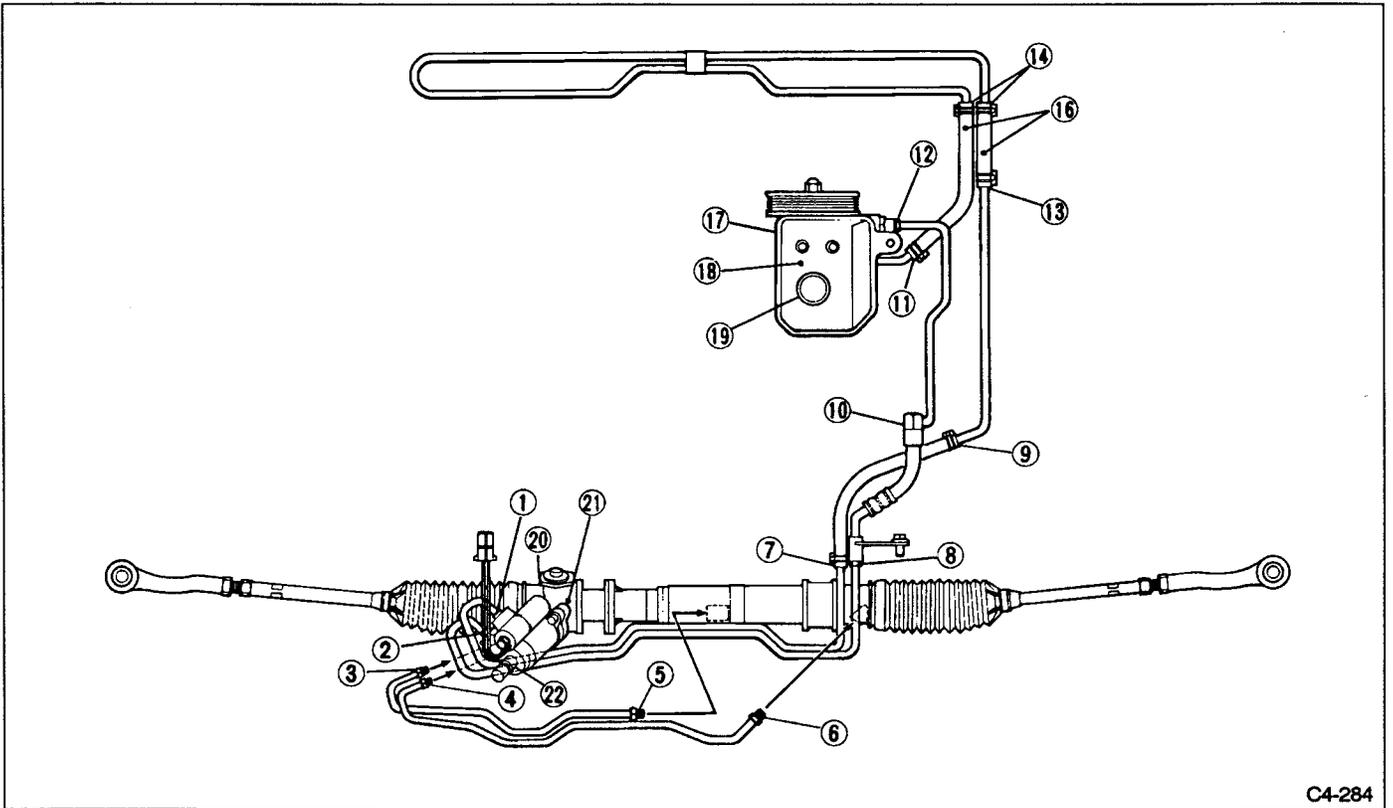
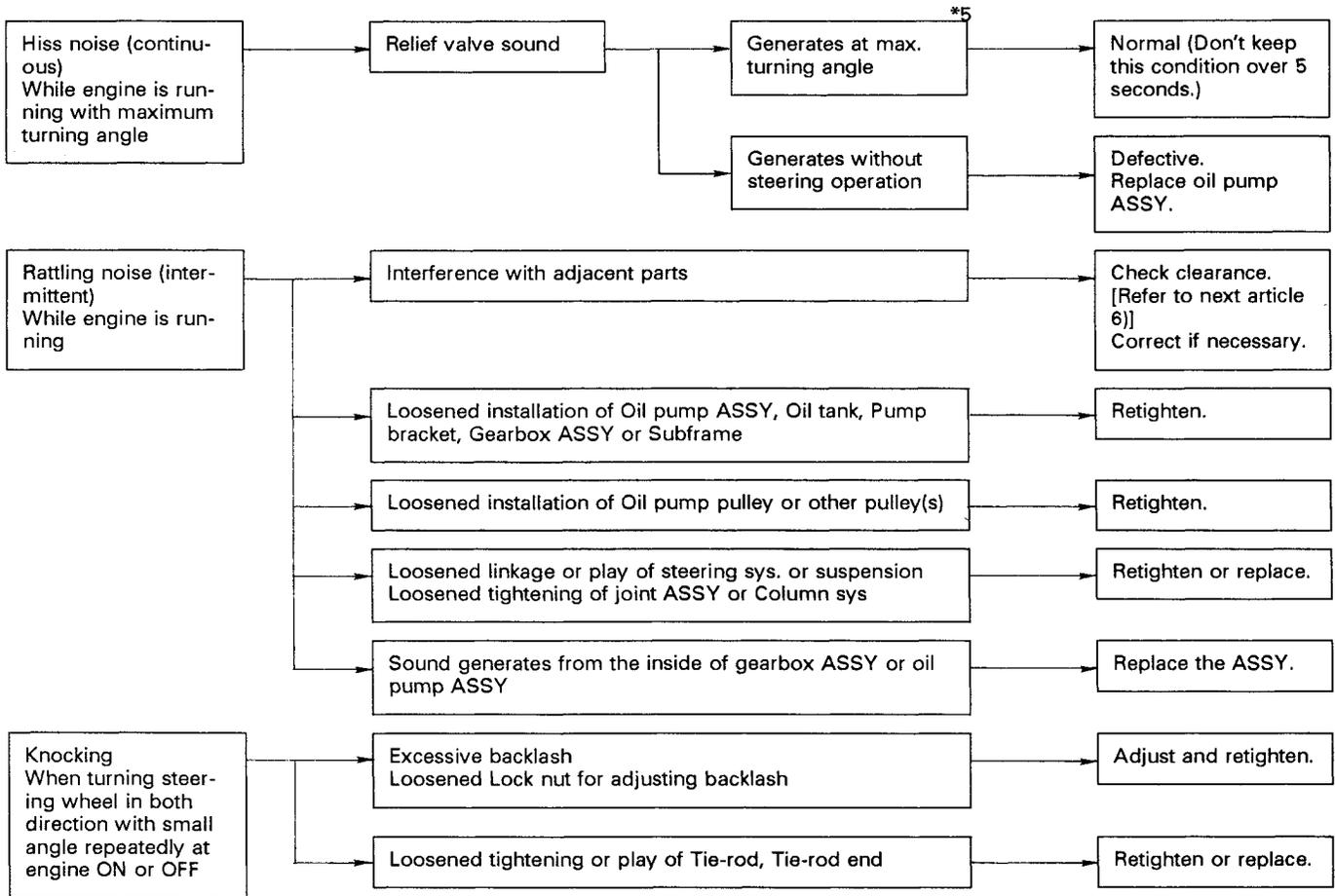
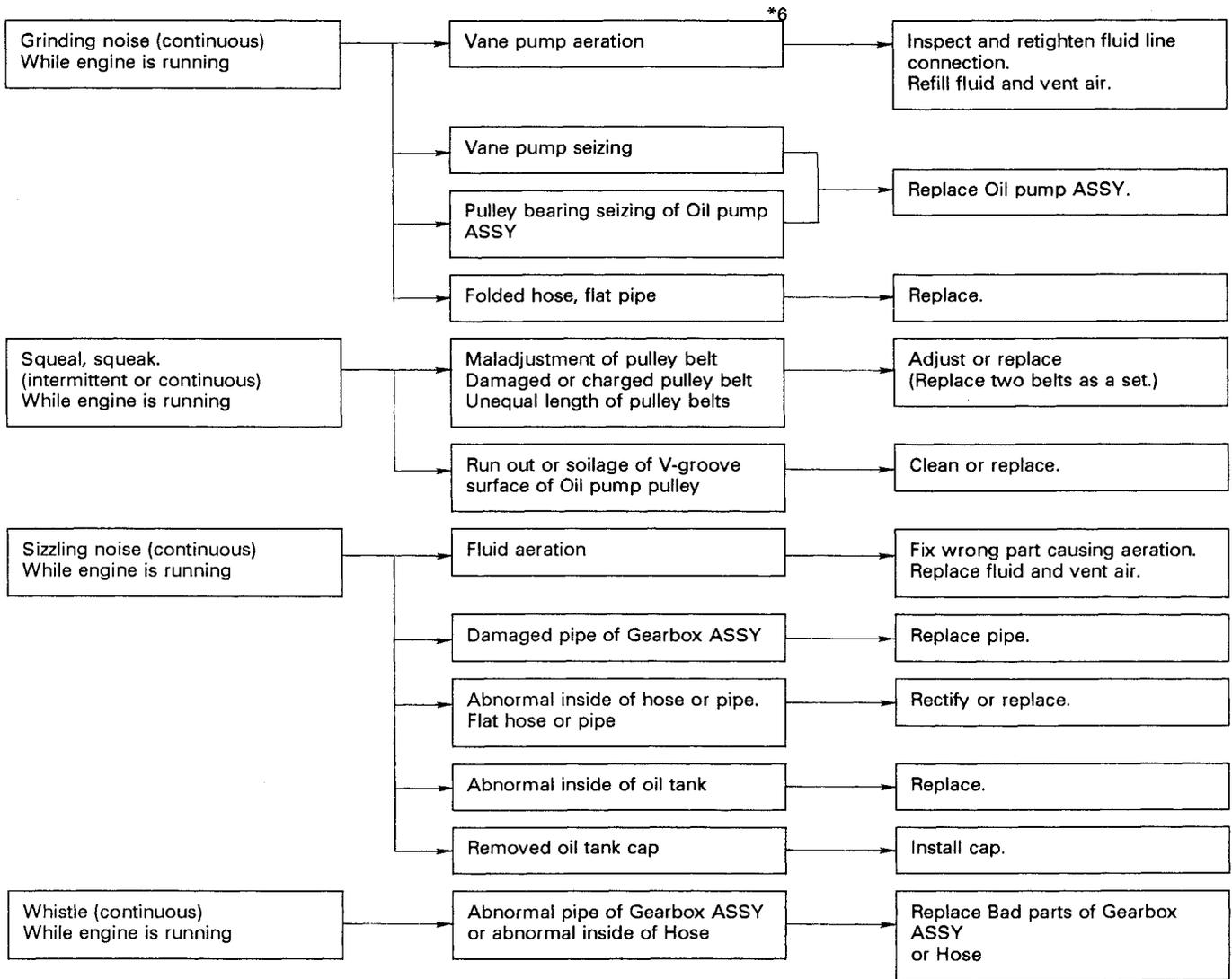


Fig. 172

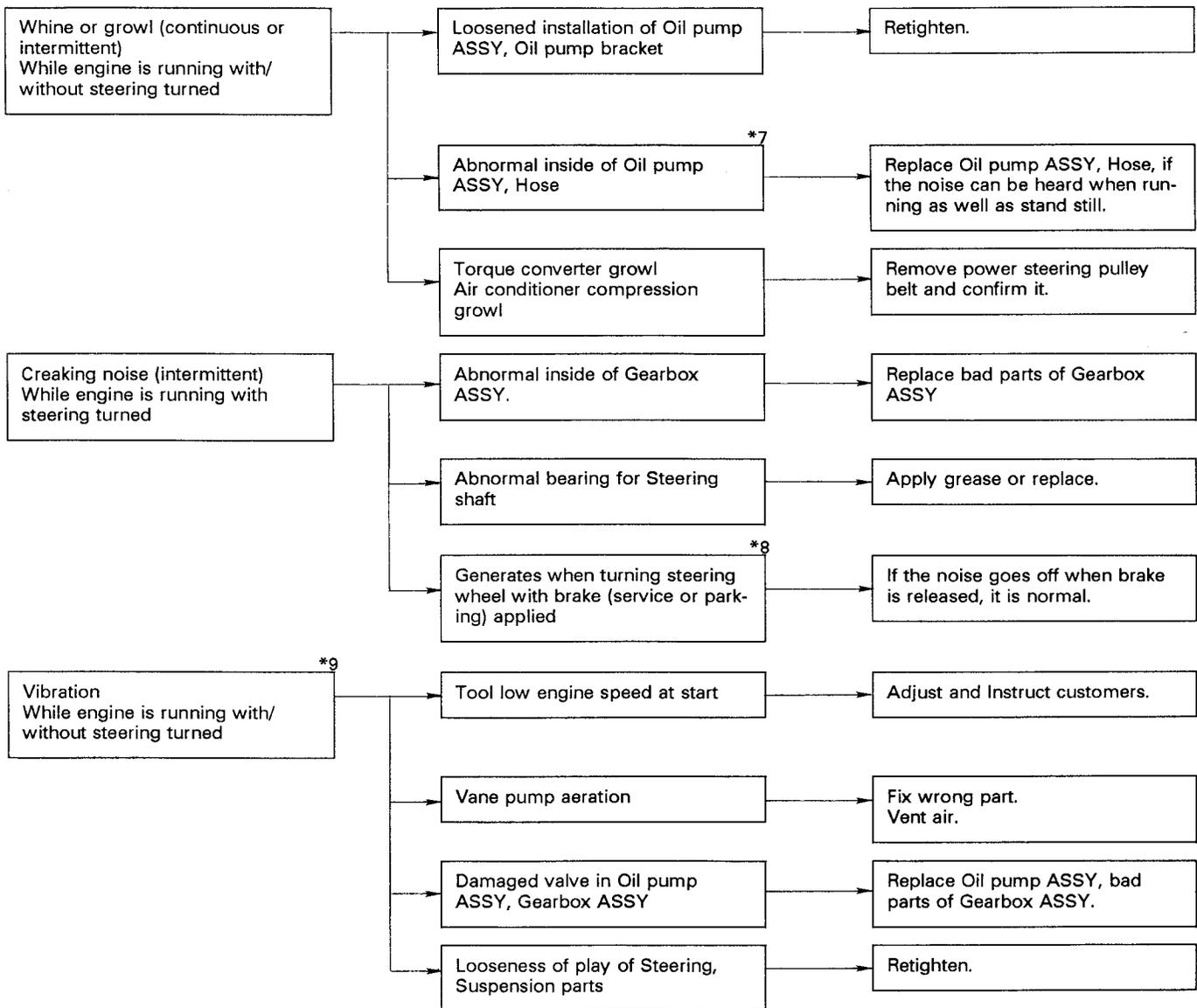
5. NOISE AND VIBRATION



**\*5 Don't keep the relief valve operated over 5 sec. at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.**



**\*6 Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.**



- \*7** Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at standstill there is no abnormal function in the system provided that the noise eliminates when the car is running.
- \*8** When stopping with service brake and/or parking brake applied, power steering can be operated easily due to its light steering effort. If doing so, the disk rotates slightly and makes creaking noise. The noise is generated by creaking between the disk and pads. If the noise goes off when the brake is released, there is no abnormal function in the system.
- \*9** There may be a little vibration around the steering devices when turning steering wheel at standstill, even though the component parts are properly adjusted and have no defects. Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e.,  
Road surface and tire surface, Engine speed and turning speed of steering wheel, Fluid temperature and braking condition.  
This phenomena does not indicate there is some abnormal function in the system.  
The vibration can be known when steering wheel is turned repeatedly at various speeds from slow to rapid step by step with parking brake applied on concrete road in "D" range.

**6. CLEARANCE TABLE**

This table lists various clearances that must be correctly adjusted to ensure normal vehicle driving without interfering noise, or any other faults.

No.	Location	Minimum clearance mm (in)	No.	Location	Minimum clearance mm (in)
①	Pipe to sub frame	5 (0.20)	⑦	Cylinder pipe to ATF pipe	15 (0.59)
②	FTJ (Free ring Tripod Joint) to Shaft and Universal joint ASSY	13 (0.51)	⑧	Hydraulic reaction harness to FTJ	20 (0.79)
③	FTJ to Valve housing	10 (0.39)	⑨	Hydraulic pressure reaction control solenoid to ATF cooling pipe	25 (0.98)
④	Pipe to Pipe	2 (0.08)	⑩	Radiator and condenser to Cooling pipe	5 (0.20)
⑤	Exhaust pipe to Gearbox boot	25 (0.98)	⑪	Return hose to cylinder block	20 (0.79)
⑥	FTJ to Pressure hose	20 (0.79)			

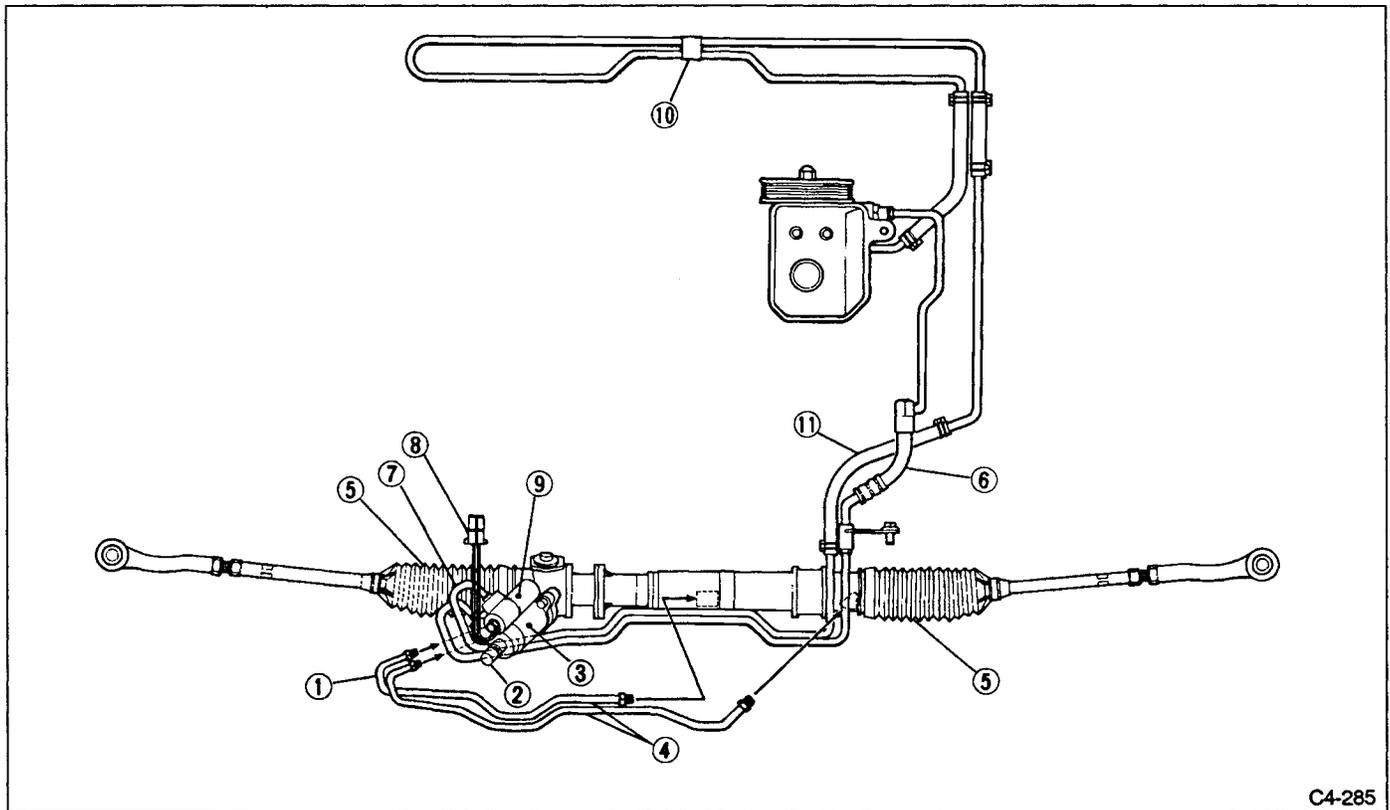
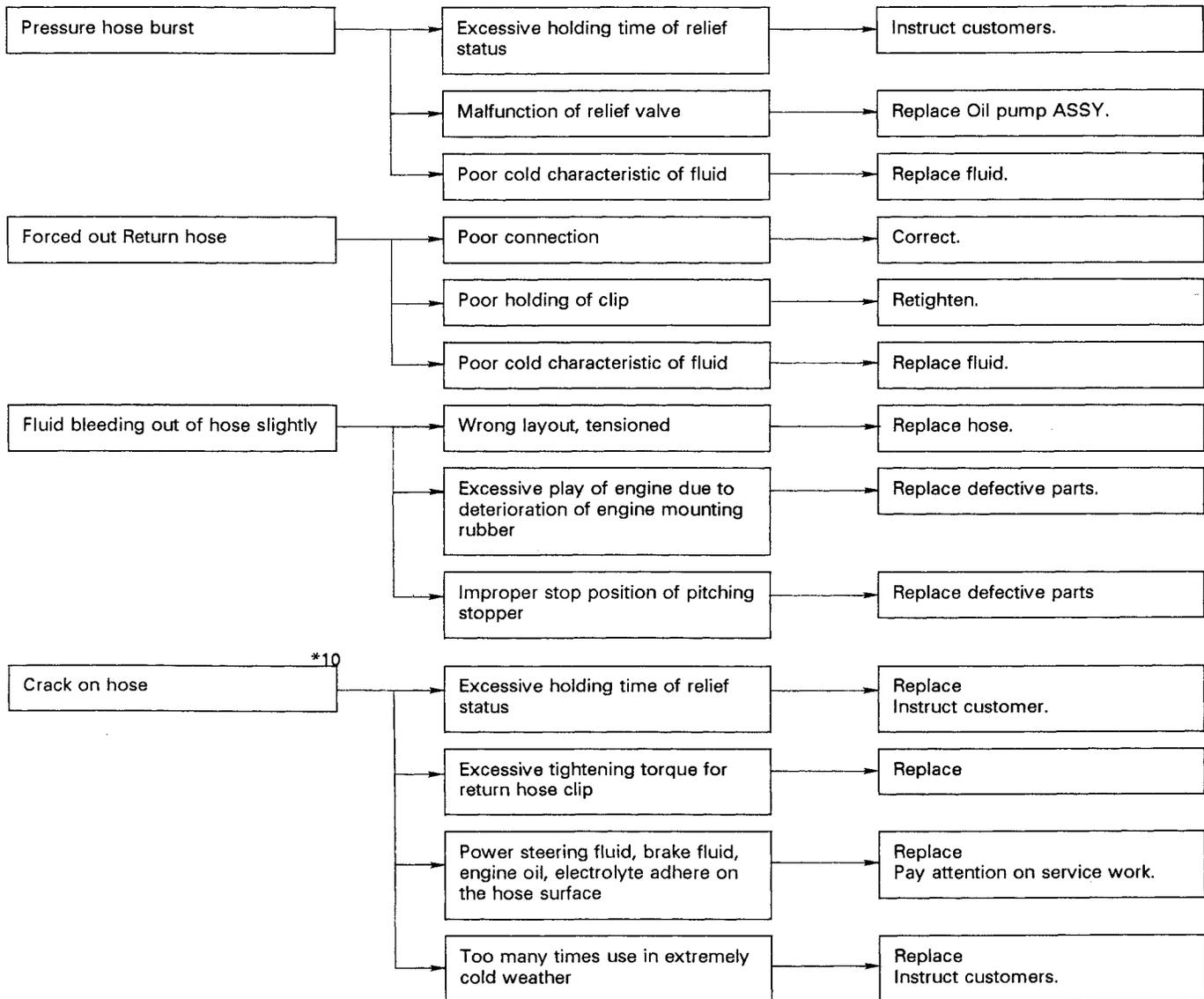


Fig. 173

## 7. BREAKAGE OF HOSES



**\*10** Although surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. It is very important to keep the hoses free from before-mentioned fluids and to wipe out immediately when the hoses are adhered with the fluids.

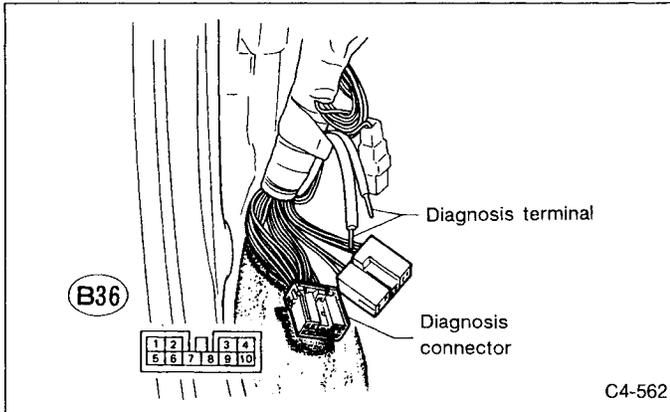
Since resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform careful inspection frequently when the car is used in hot weather areas, cold weather area and/or a driving condition in which many steering operations are required in short time. Particularly continuous work of relief valve over 5 seconds causes to reduce service lives of the hoses, the oil pump ASSY, the fluid, etc. due to over heat.

So, avoid to keep this kind of condition when servicing as well as driving.

T TROUBLESHOOTING **AIRBAG**

3. Troubleshooting for Self-diagnosis System — Only for Electronically Controlled Power Steering

**A: HOW TO USE DIAGNOSIS CONNECTOR**

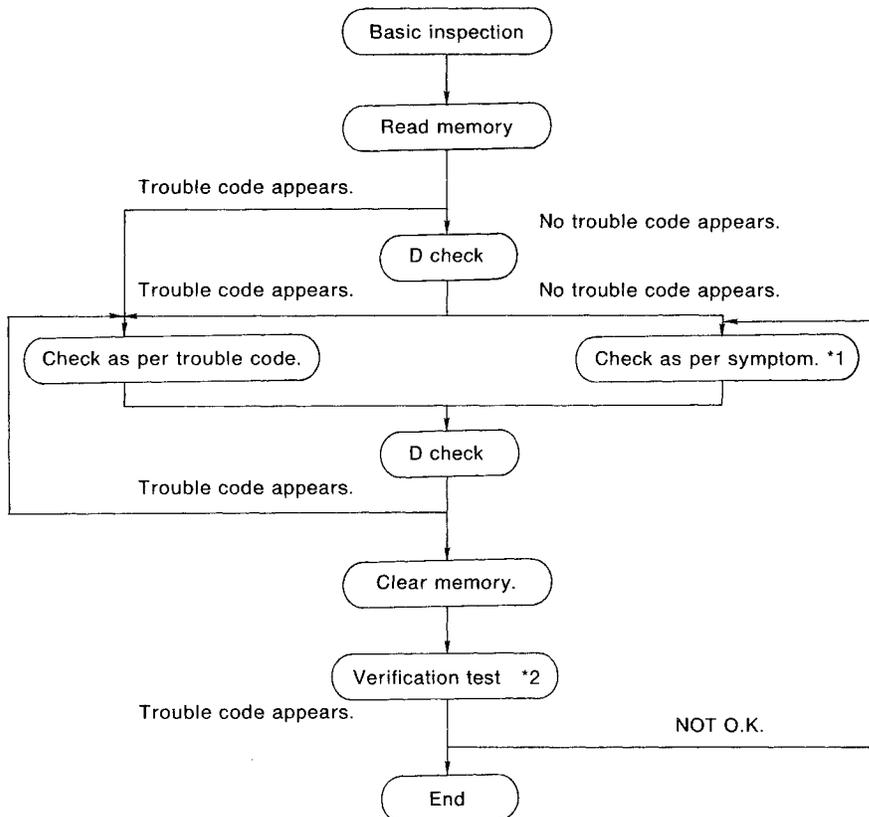


- 1) Turn ignition switch "OFF."
- 2) Connect one of two DIAG. terminals to diagnosis connector mode\* terminal No. 5, 6 or 7.
- 3) Turn ignition switch "ON." Read trouble code.
- 4) Disconnect male terminal from diagnosis connector terminal.

\* Power steering mode terminals:  
 No. 5 - TEST  
 No. 6 - READ MEMORY  
 No. 7 - DIAGNOSIS

Fig. 1

**B: TROUBLESHOOTING PROCEDURE**



\*1: Conduct normal power steering troubleshooting procedure. If no problems exist, replace PCM (Power steering Control Module).

\*2: In verification test, conduct D (Dealer's) check and basic inspection first, then actual drive test, to ensure that no problems exist.

- a. Before disconnecting PCM connector, turn ignition switch "OFF".
- b. Before removing PCM, disconnect battery cables.

**1. BASIC INSPECTION**

- 1) Check battery voltage.
- 2) Check fuses No. 8, 15 (in F/B) and 25 (in M/B).

**2. READ MEMORY**

- 1) Turn ignition switch "OFF."
- 2) Connect male terminal to diagnosis connector mode terminal No. 6.
- 3) Start engine.
- 4) Disconnect male terminal from diagnosis connector mode terminal No. 6.

**3. D CHECK**

- 1) Turn ignition switch "OFF."
- 2) Connect male terminal to diagnosis connector mode terminal No. 5.
- 3) Start engine.
- 4) Drive vehicle at least 10 meters (33 ft).
- 5) Disconnect male terminal from diagnosis connector mode terminal No. 5.

**4. CLEAR MEMORY**

- 1) Turn ignition switch "OFF."
- 2) Connect male terminals to diagnosis connector mode terminals No. 5 and 6.
- 3) Start engine.
- 4) Disconnect male terminals from diagnosis connector mode terminals No. 5 and 6.
- 5) Ensure that memory is cleared in read memory mode.

**C: TROUBLE CODES LIST**

**1. TROUBLE CODES**

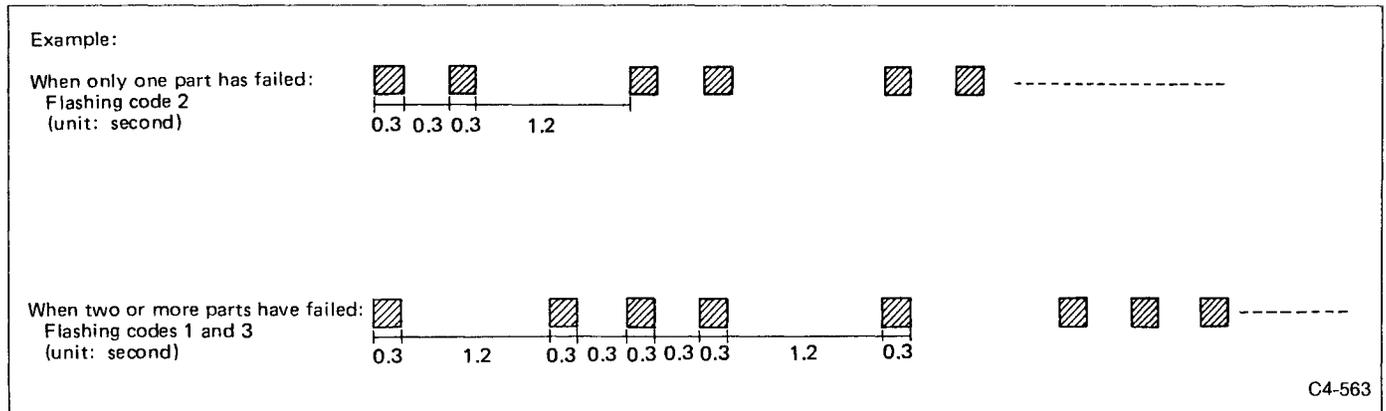
Trouble code	Description	Flashing pattern	ON Unit: Seconds
VF	Faulty source voltage	Remains on	
WF	Faulty check mode terminal, warning, light wiring, etc.	Remains off	
1	Shorted solenoid system circuit		
2	Open in solenoid system circuit		
3	Faulty vehicle sensor 2 system		
4	Faulty back-up power supply		
5	Engine speed signal system (including engine control module)		
—	Normal		

C4-1106

Fig. 2

**2. HOW TO READ TROUBLE CODE (FLASHING)**

The steering warning light flashes the code corresponding to the faulty part. The long segment (1.2 sec on) indicates a "ten", and the short segment (0.2 sec on) signifies "one".



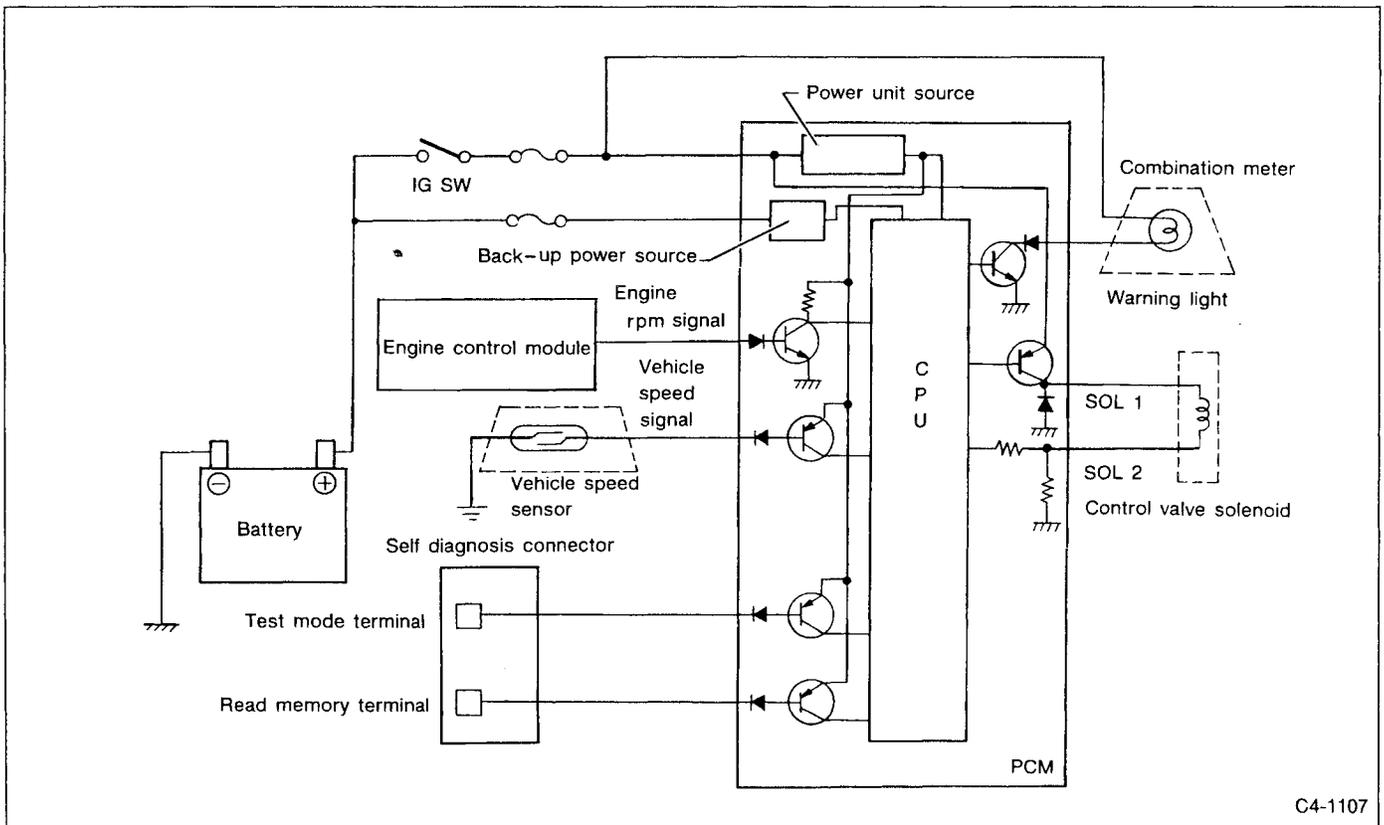
C4-563

Fig. 3

D: SYSTEM COMPOSITION TABLE

System	Component parts	Description	Characteristics control	"Assist" amount control	Warning	Self-diagnostic function	
Input signal (sensor)	Vehicle speed sensor 2	Detects vehicle speed.	○	○			
	Engine control module	Detects engine revolution.	○	○			
	Diagnosis connector	Read memory mode terminal	Connects read memory mode circuit.				○
		Test mode terminal	Connects test mode circuit.				○
Diagnosis mode terminal		Connects diagnosis mode circuit.				○	
Control unit	PCM (Power steering control module)	Computes and sends control output signal in relation to input signal received.	○	○	○	○	
Output signal (Actuator)	Solenoid	Regulates reaction chamber oil pressure (Maximum reaction force (heavy steering operation) occurs when solenoid is "OFF").	○	○			
	Warning light	Indicates trouble code.			○	○	

E: INPUT-OUTPUT DIAGRAM



C4-1107

Fig. 4

**F: I/O (INPUT/OUTPUT) VOLTAGE DATA**

System to check		< Refer to NOTE. > Measuring terminal		Measuring condition and measurement value			Remarks
				IG SW		Engine idling	
		No.	Lead color	OFF	ON (engine off)		
Vehicle speed sensor 2		4	RW	0 V	0 or 5 V	0 or 5 V	Vehicle speed: 0 km/h (0 MPH)
Engine control module (engine speed)		3	BL	0 V	10 V min.	10 V min.	Input rectangular
Solenoids	Solenoid-1 (+ side)	11	YG	0 V	10 V min.	10 V min.	Output rectangular pulse [at vehicle speed of 0 km/h (0 MPH)]
	Solenoid-2 (Return side)	9	BrW	0 V	0 to 1 V	0 to 1 V	
Warning light		1	WL	0 V	10 V min.	10 V min.	
Self-diagnosis	Read memory mode	6	Br	0 V	5 V	5 V	
	Test mode	5	YB	0 V	5 V	5 V	
	Diagnosis mode	7	BrY				
Power supply	PCM power supply	16	BrR	0 V	10 V min.	10 V min.	
	Back-up power supply (for memory)	15	LR	10 V min.	10 V min.	10 V min.	
GND		13	B	0 V	0 V	0 V	

**NOTE:**

- 1: Measure voltage across applicable terminal and GND (body metal).
- 2: Measuring terminals No.

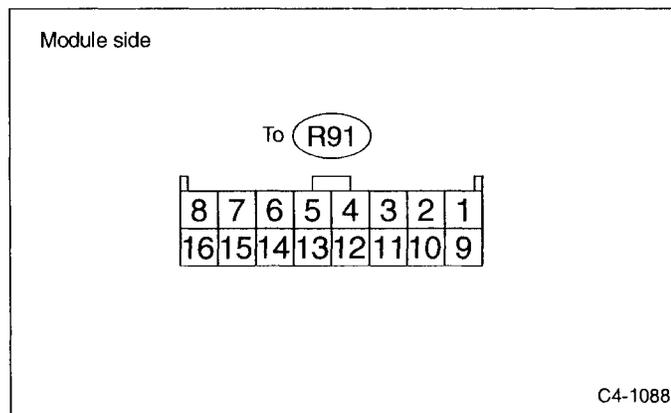


Fig. 5

### 4. Troubleshooting Chart with Trouble Code — Only for Electronically Controlled Power Steering

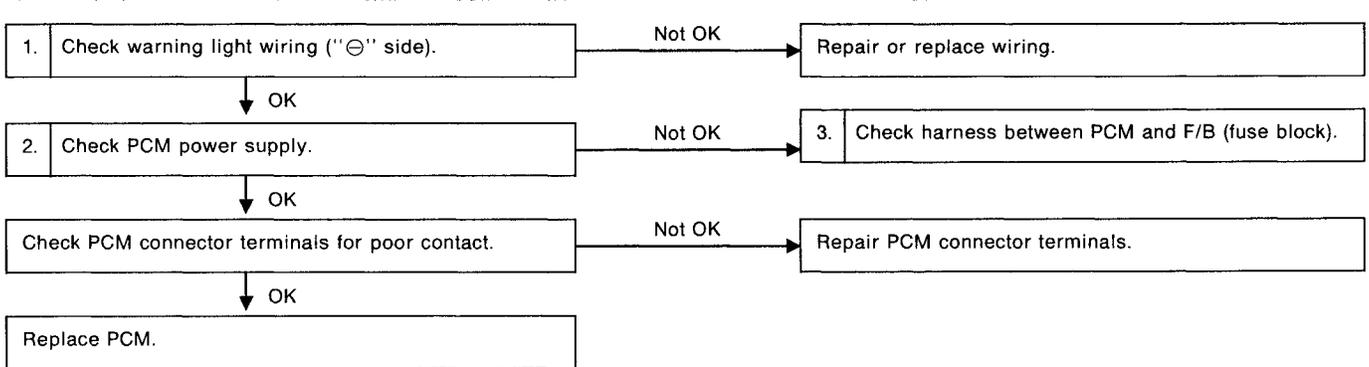
**A: TROUBLE CODE "VF" — POWER SUPPLY SYSTEM OR LIGHT WIRING IS FAULTY**

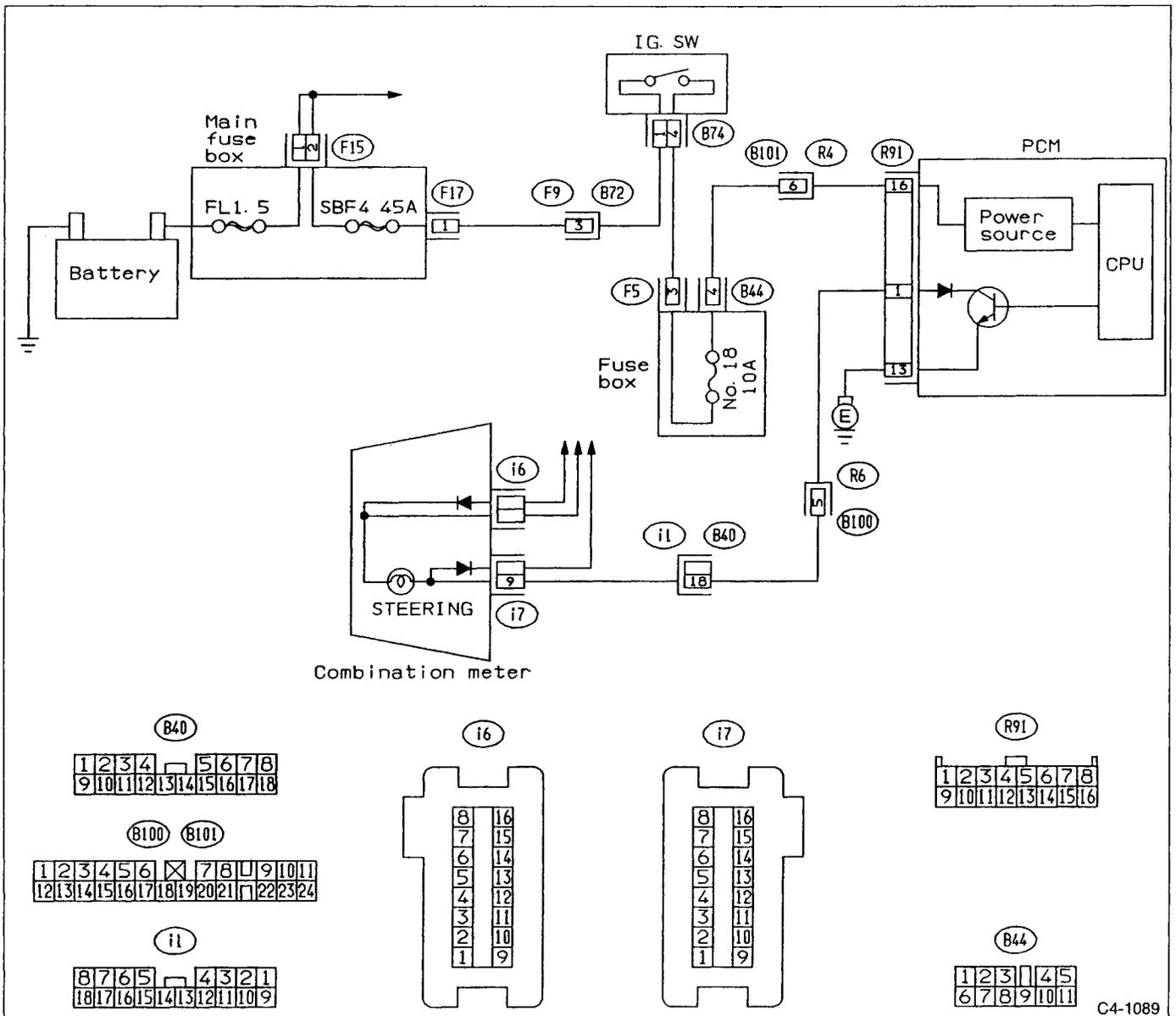
**Diagnosis**

- Faulty light wiring
- Faulty power supply system
- Faulty PCM (power steering control module)

**Symptom**

Warning light does not go out.





C4-1089

Fig. 6

**1. CHECK WARNING LIGHT WIRING (“⊖” SIDE).**

- 1) Turn ignition switch “OFF.”
- 2) Disconnect PCM from connector.
- 3) Disconnect connector (i1).
- 4) Check continuity between PCM connector terminal and GND.

**Connector & Terminal/Specified resistance:**  
**(R91) No. 1 — Body/1 MΩ, or more**

- 5) Extract combination meter assembly.
- 6) Disconnect connector (i7).
- 7) Check continuity between connector (i7) terminal and GND.

**Connector & Terminal/Specified resistance:**  
**(i7) No. 9 — Body/1 MΩ, or more**

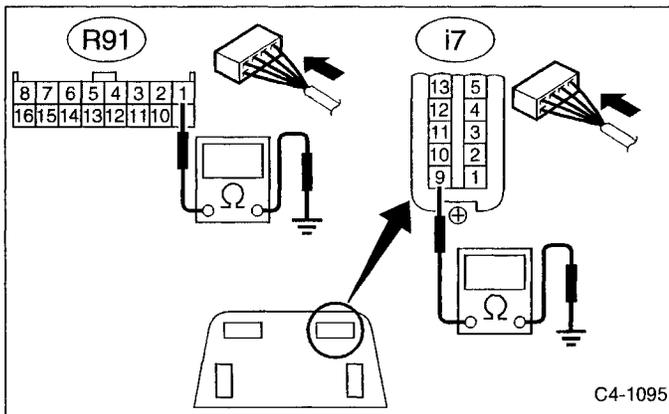


Fig. 7

**2. CHECK PCM POWER SUPPLY.**

- 1) Turn ignition switch “OFF.”
- 2) Disconnect PCM from connector.
- 3) Turn ignition switch “ON.”
- 4) Measure voltage between PCM connector terminal and GND.

**Connector & Terminal/Specified voltage:**  
**(R91) No. 16 — Body/10 V, or more**

- 5) Check continuity between PCM connector terminal and GND.

**Connector & Terminal/Specified resistance:**  
**(R91) No. 13 — Body/1 Ω, or less**

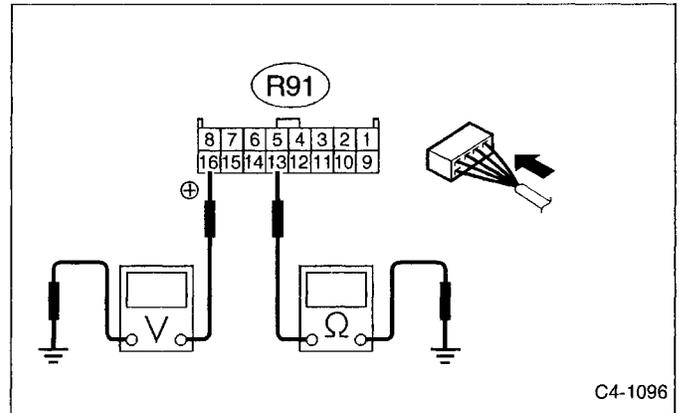


Fig. 8

**3. CHECK HARNESS BETWEEN PCM AND F/B (FUSE BLOCK).**

- 1) Disconnect PCM from connector.
- 2) Turn ignition switch “ON.”
- 3) Measure voltage across connector (B44) terminal and GND.

**Connector & Terminal/Specified voltage:**  
**(B44) No. 4 — Body/10 V, or more**

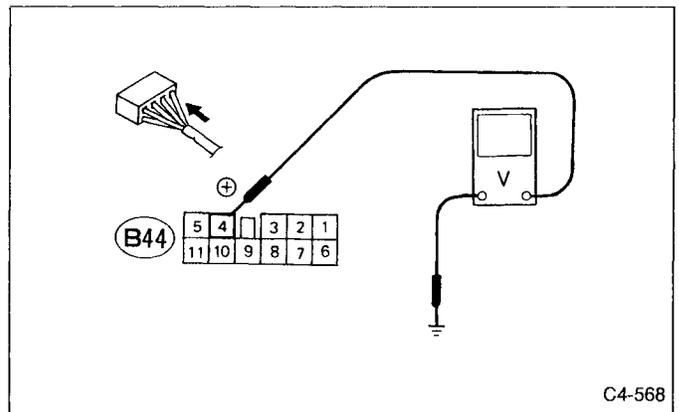


Fig. 9

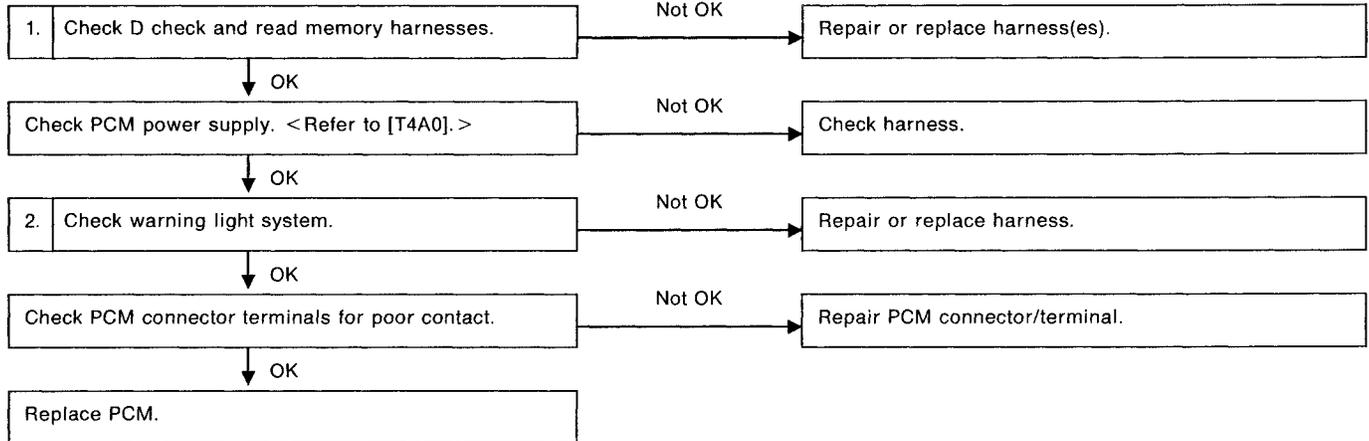
**B: TROUBLE CODE "WF" — FAULTY WARNING LIGHT OR HARNESS**

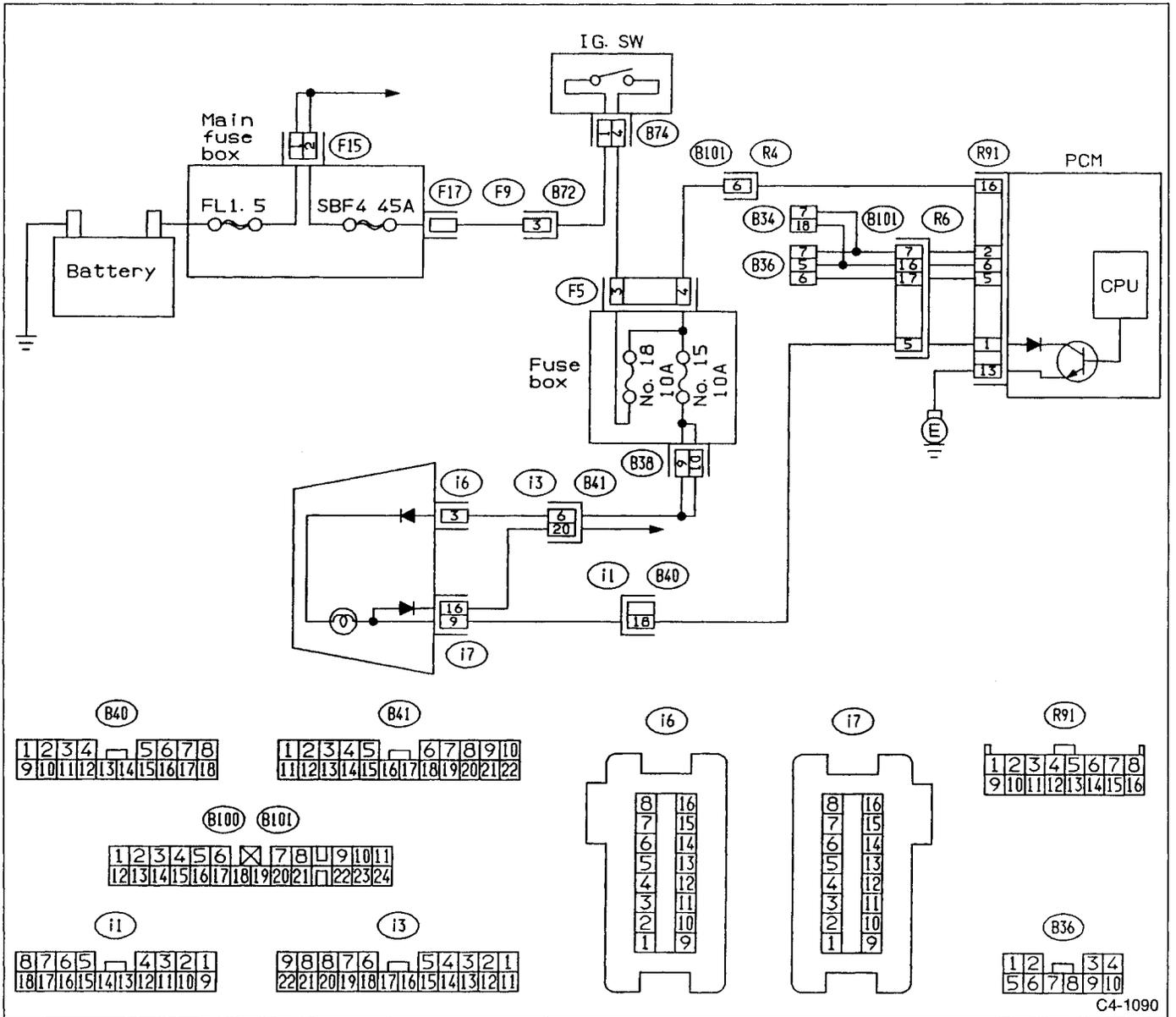
**Diagnosis**

- Faulty D check and read memory harnesses
- Faulty power supply or GND circuit.
- Faulty warning light or harness
- Faulty PCM (power steering control module)

**Symptom**

Warning light remains off during diagnosis.





C4-1090

Fig. 10

**1. CHECK D CHECK AND READ MEMORY HARNESSES.**

- 1) Turn ignition switch "OFF."
- 2) Disconnect PCM from connector.
- 3) Check continuity between PCM connector and connector (B36).

**Specified resistance:**

- (R91) No. 5 — (B36) No. 6/1  $\Omega$ , or less
- (R91) No. 6 — (B36) No. 5/1  $\Omega$ , or less

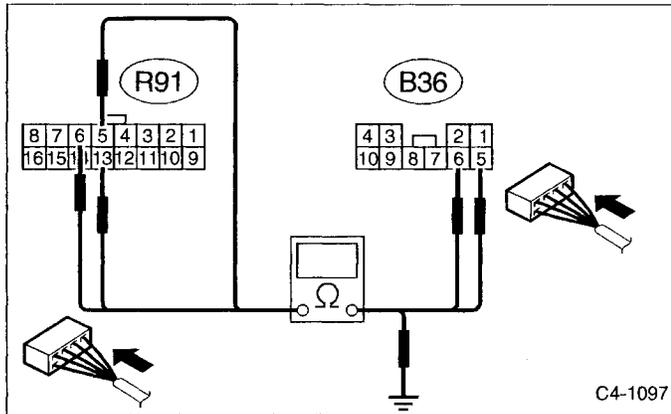


Fig. 11

- 4) Check connector (R91) terminal and GND.

**Connector & Terminal/Specified resistance:**

- (R91) No. 13 — Body/1  $\Omega$ , or less

**2. CHECK WARNING LIGHT SYSTEM.**

- 1) Disconnect connector (i1). Turn ignition switch "ON."
- 2) Measure voltage across connector (B40) terminal and GND.

**Connector & Terminal/Specified voltage:**

- (B40) No. 18 — Body/10 V, or more

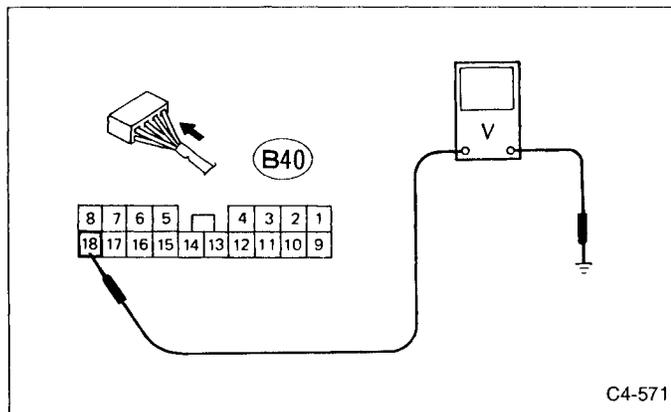


Fig. 12

- O.K. → Go to 3).
- NOT O.K. → Open circuit between connector (B40) and PCM terminals

- 3) Turn ignition switch "OFF."
- 4) Remove steering warning light (including combination meter).
- 5) Apply a voltage of 12 volts across warning light terminals to make sure it illuminates.

- O.K. → Go to 6).
- NOT O.K. → Faulty warning light

- 6) Disconnect connectors (i6) and (i7).
- 7) Check continuity between connector (i1) and connector (i7) terminals.

**Connector & Terminal/Specified resistance:**

- (i1) No. 18 — (i7) No. 9/1  $\Omega$ , or less

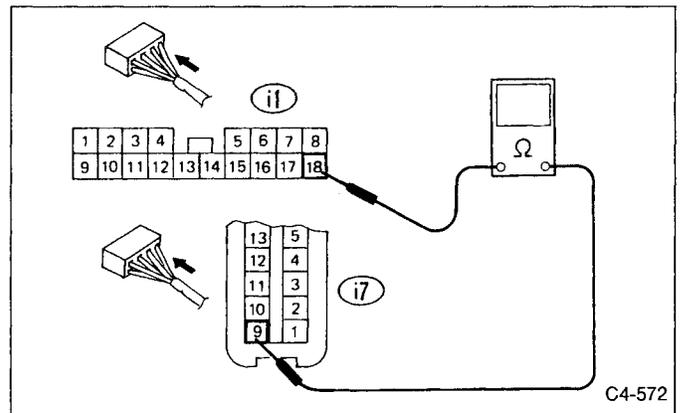


Fig. 13

- 8) Turn ignition switch "ON."
- 9) Measure voltage across connector (i6) terminal and GND.

**Connector & Terminal/Specified voltage:**

- (i6) No. 3 — Body/10 V, or more

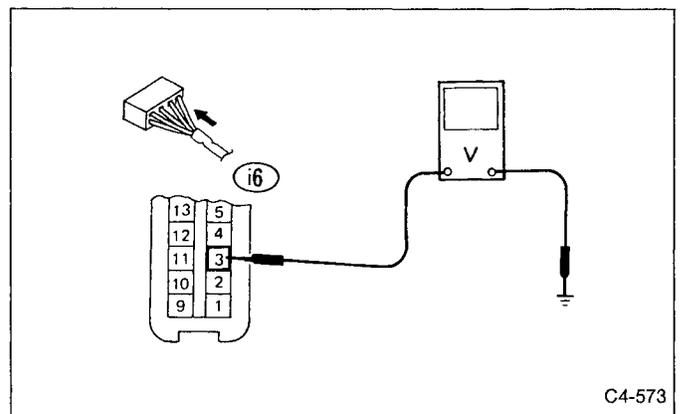


Fig. 14

- O.K. → Faulty PCM
- NOT O.K. → Open circuit between F/B (fuse block) and combination meter

**C: TROUBLE CODE "1" — SHORTED SOLENOID**

**Diagnosis**

- Faulty solenoid and wiring
- Faulty PCM (power steering control module)

**Symptom**

- Steering wheel is too easy to turn (or does not become firm as vehicle speed increases).
- Warning light illuminates.

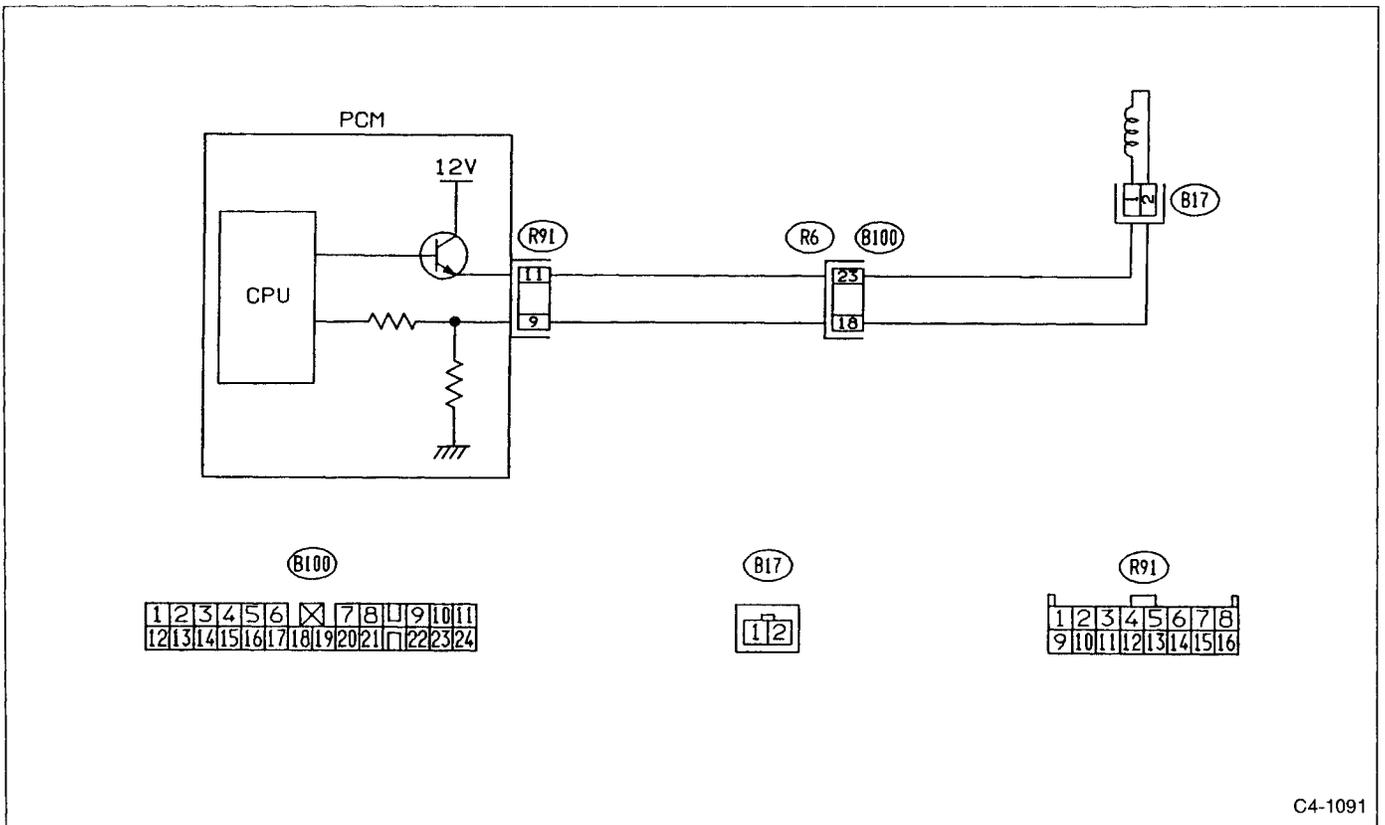
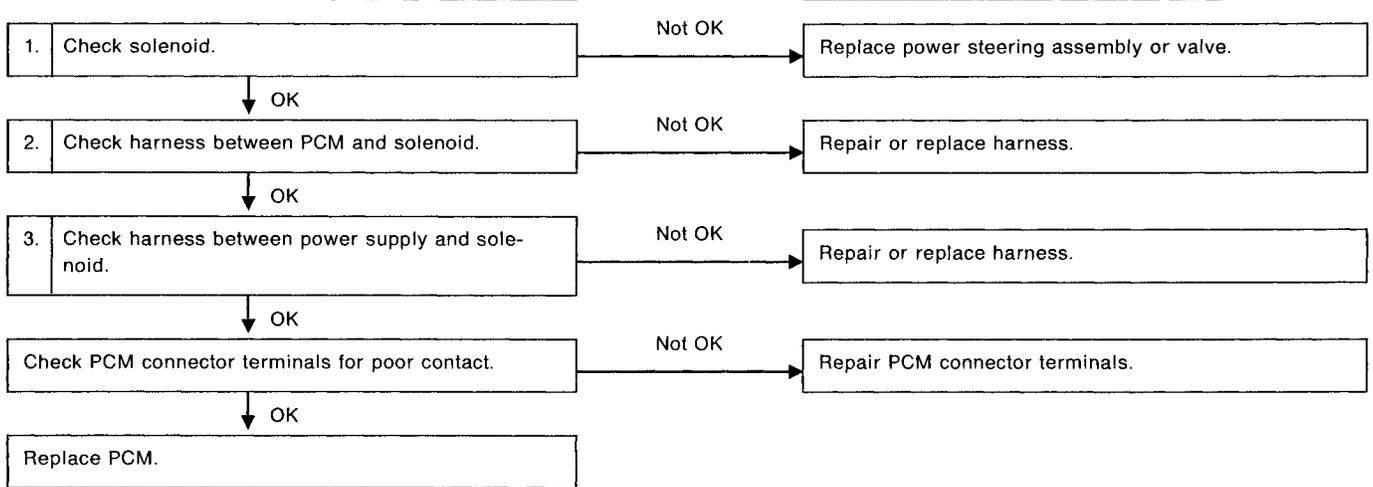


Fig. 15

### 1. CHECK SOLENOID.

- 1) Turn ignition switch "OFF."
- 2) Disconnect connector (B17).
- 3) Measure resistance solenoid connector terminals (indicated below) using digital ohmmeter.

**Connector & Terminal/Specified resistance:**  
**To (B17) No. 1 — No. 2/5 — 9 Ω**

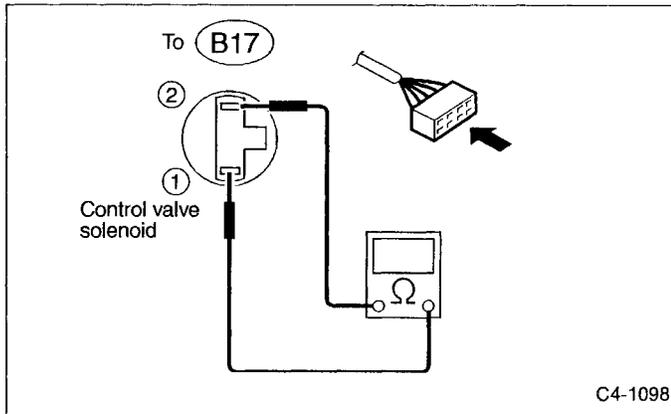


Fig. 16

### 2. CHECK HARNESS BETWEEN PCM AND SOLENOID.

- 1) Disconnect PCM from connector.
- 2) Connect connector (B17).
- 3) Check resistance and continuity between connector-(R91) terminals indicated below.

**Connector & Terminal/Specified resistance:**  
**(R91) No. 9 — No. 11/5 — 9 Ω**  
**(R91) No. 9 — Body/1 MΩ, or more**

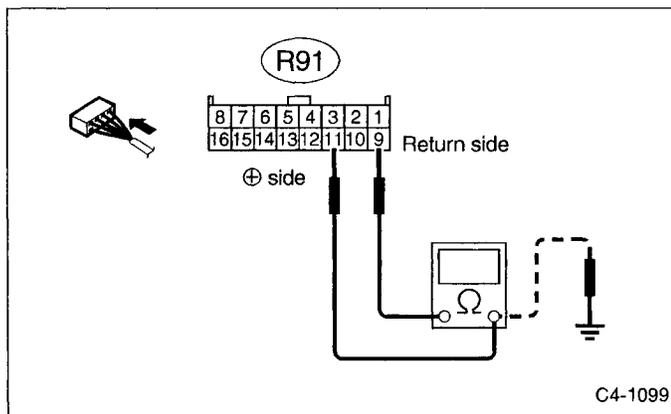


Fig. 17

### 3. CHECK HARNESS BETWEEN POWER SUPPLY AND SOLENOID.

- 1) Turn ignition switch "OFF."
- 2) Disconnect connector (B17).
- 3) Measure voltage across connector (B17) and GND.

**Connector & Terminal/Specified voltage:**  
**(B17) No. 2 — Body/0 V**

Note:

When battery voltage is produced, line between power supply harness and solenoid ⊕ terminal is shorted to set solenoid in "full assist" state.

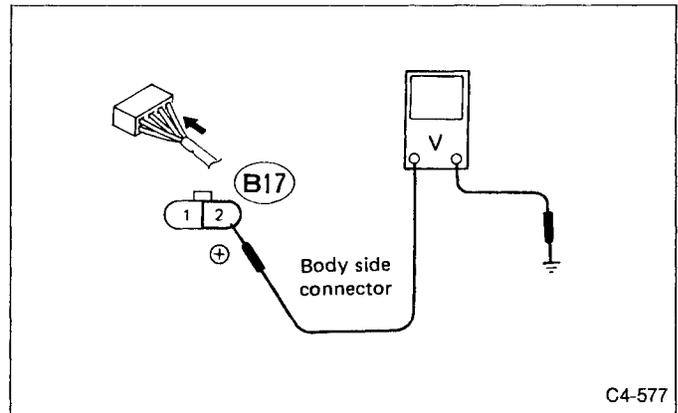


Fig. 18

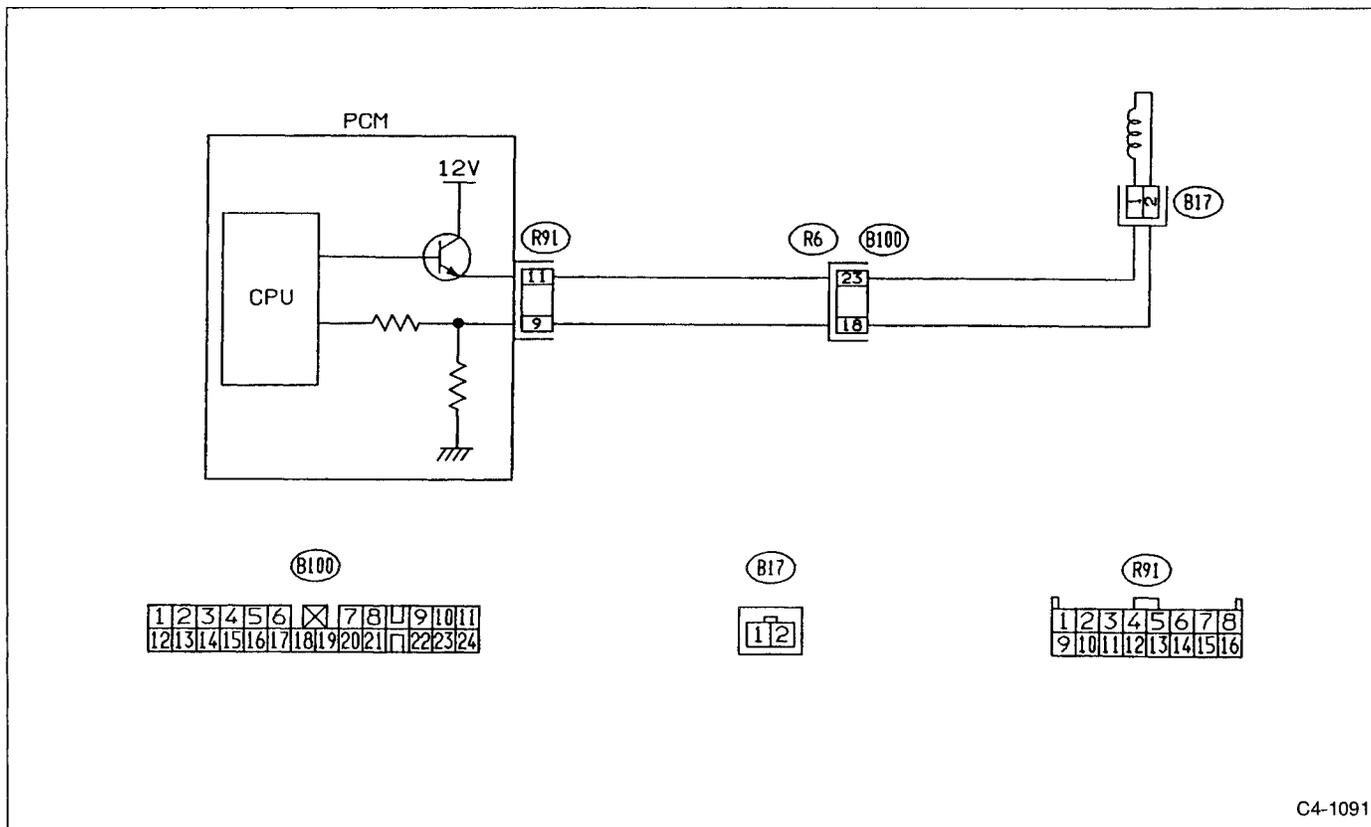
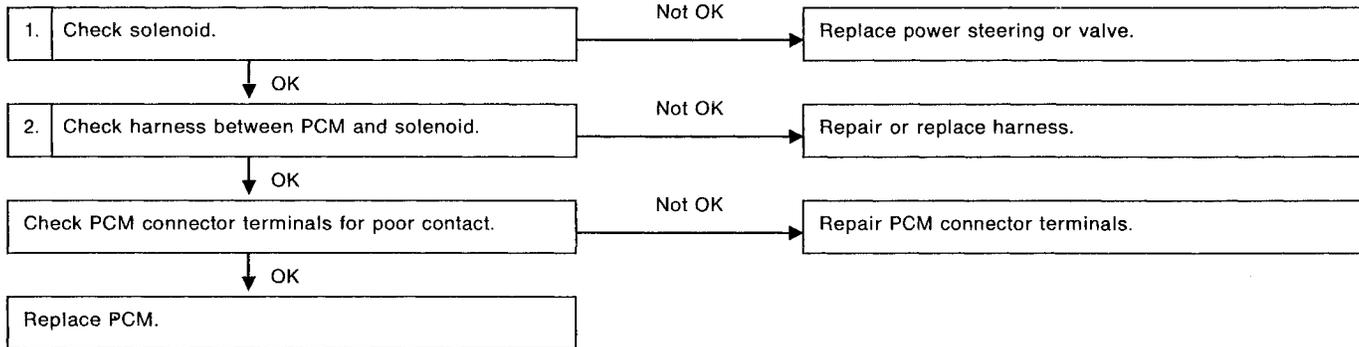
**D: TROUBLE CODE "2" — OPEN IN SOLENOID CIRCUIT**

**Diagnosis**

- Faulty solenoid and wiring
- Faulty PCM (power steering control module)

**Symptom**

- Effort is required to operate steering wheel.
- Warning light illuminates.



C4-1091

Fig. 19

## 1. CHECK SOLENOID.

- 1) Turn ignition switch "OFF."
- 2) Disconnect connector (B17).
- 3) Measure resistance between solenoid terminals indicated below.

**Connector & Terminal/Specified resistance:**

To (B17) No. 1 — No. 2/5 — 9 Ω

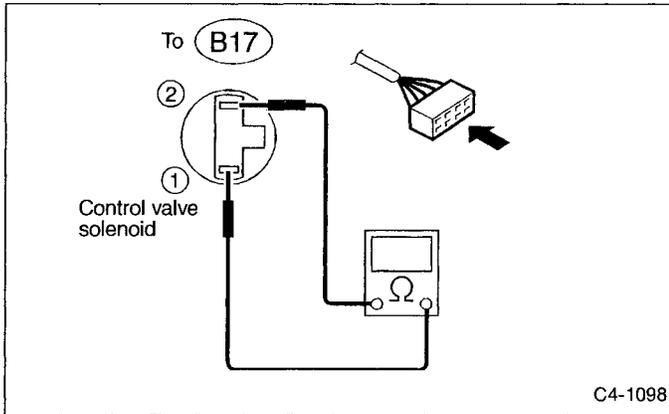


Fig. 20

## 2. CHECK HARNESS BETWEEN PCM AND SOLENOID.

- 1) Disconnect PCM from connector.
- 2) Connect connector (B17).
- 3) Measure resistance between connector (R91) terminals, and check continuity between connector (R91) terminal and GND, indicated below.

**Connector & Terminal/Specified resistance:**

(R91) No. 9 — No. 11/5 — 9 Ω

(R91) No. 9 — Body/1 MΩ, or more

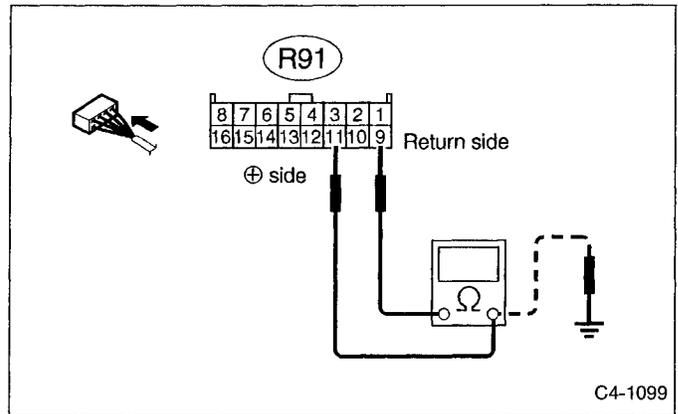


Fig. 21

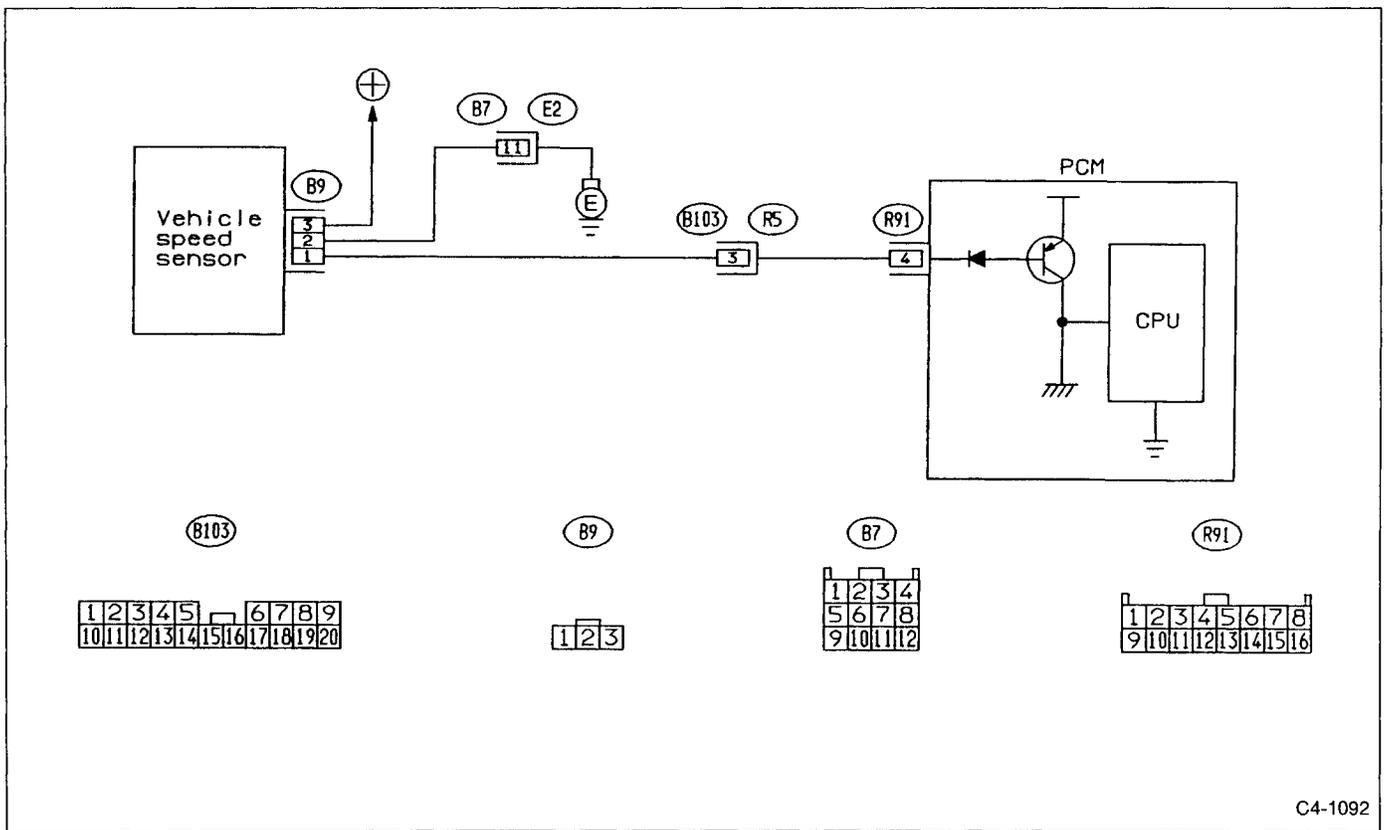
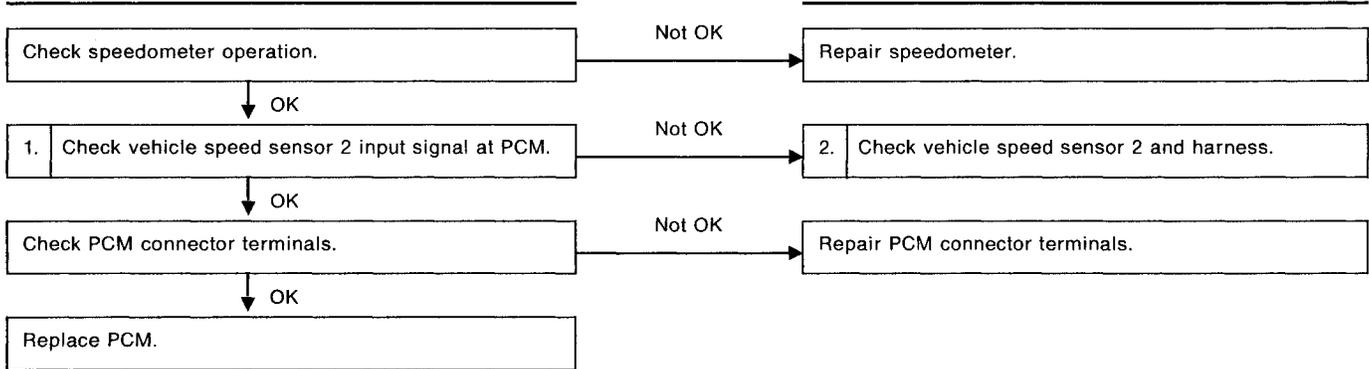
**E: TROUBLE CODE "3" — FAULTY VEHICLE SPEED SENSOR 2**

**Diagnosis**

- Faulty speedometer or speedometer cable
- Faulty vehicle speed sensor 2 and wiring
- Faulty PCM (power steering control module)

**Symptom**

Steering wheel is too easy to turn during high-speed operation.



C4-1092

Fig. 22

## 1. CHECK VEHICLE SPEED SENSOR 2 INPUT SIGNAL AT PCM.

- 1) Connect oscilloscope between PCM and GND. (DC COUP, 0.5 V/Div, 1s/Div, x 10 probe)
- 2) Raise vehicle using jack and slowly rotate wheels.
- 3) Measure voltage across connector (R91) terminal and GND indicated below.

**Connector & Terminal/Specified voltage:**  
**(R91) No. 4 — Body/0 ↔ 5 V**

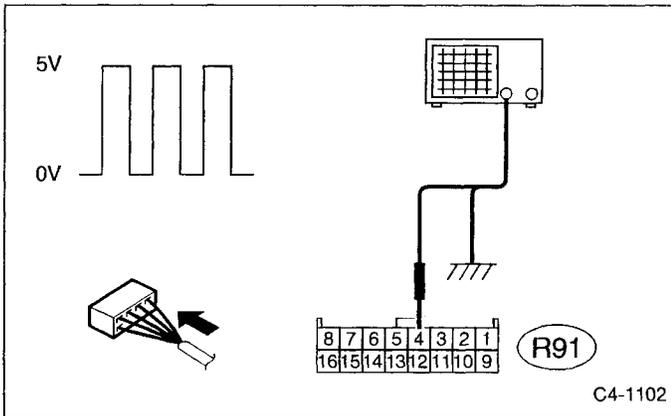


Fig. 23

## 2. CHECK VEHICLE SPEED SENSOR 2 AND HARNESS.

- 1) Check harness routing outside instrument panel. Measure resistance between connector (B9) and PCM connector (R91) terminals, and PCM connector (R91) terminal and GND, indicated below.

**Connector & Terminal/Specified resistance:**  
**(B9) No. 1 — (R91) No. 4/1 Ω, or less**  
**(R91) No. 4 — Body/1 MΩ, or more**

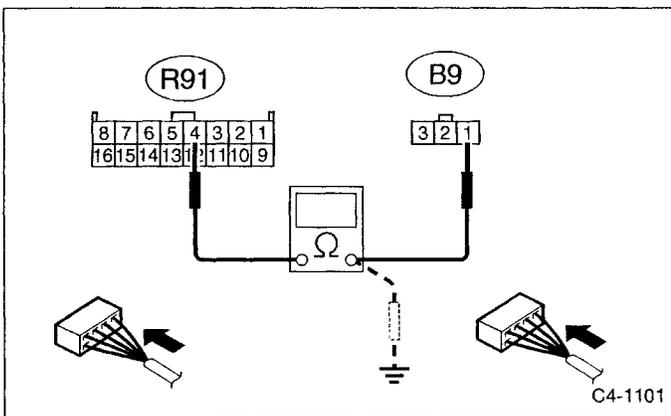


Fig. 24

- 2) Disconnect connector (B9).
- 3) Measure resistance between connector (B9) and connector (B7) terminals, and connector (B7) terminal and GND, indicated below.

**Connector & Terminal/Specified resistance:**  
**(B9) No. 2 — (B7) No. 11/1 Ω, or less**  
**(B7) No. 11 — Body/1 MΩ, or more**

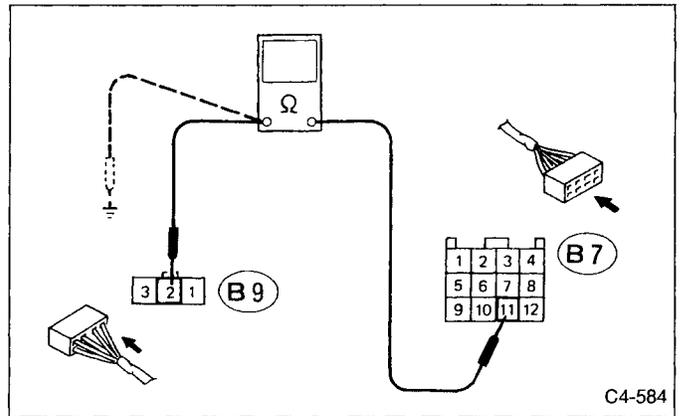


Fig. 25

- 4) Check continuity between connector (B9) and GND.

**Connector & Terminal/Specified resistance:**  
**(B9) No. 2 — Body/1 Ω, or less**

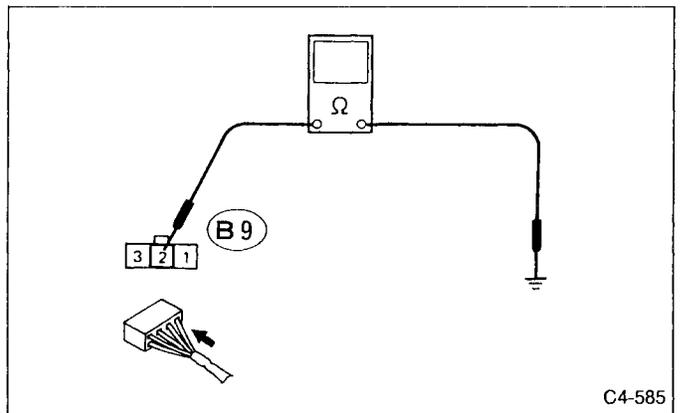


Fig. 26

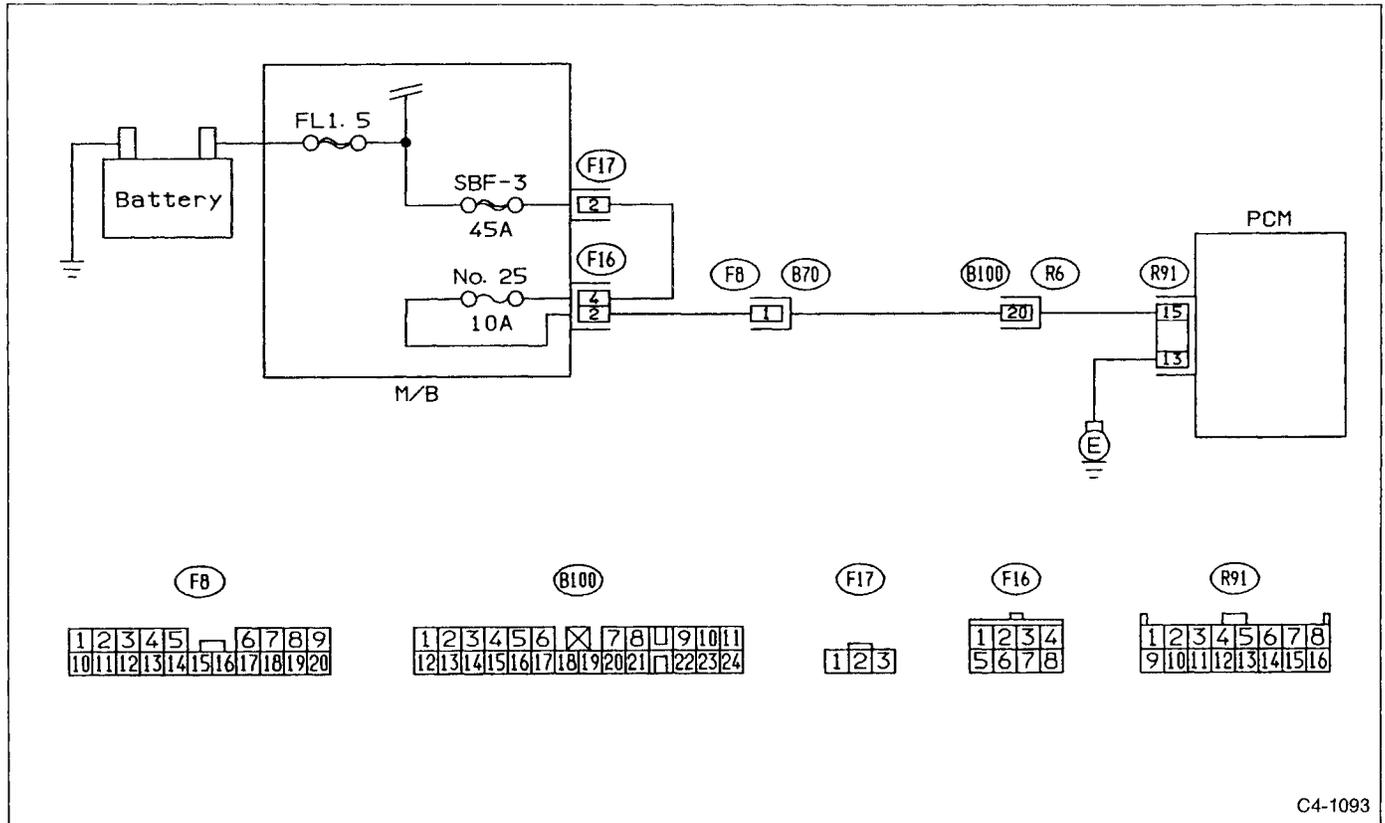
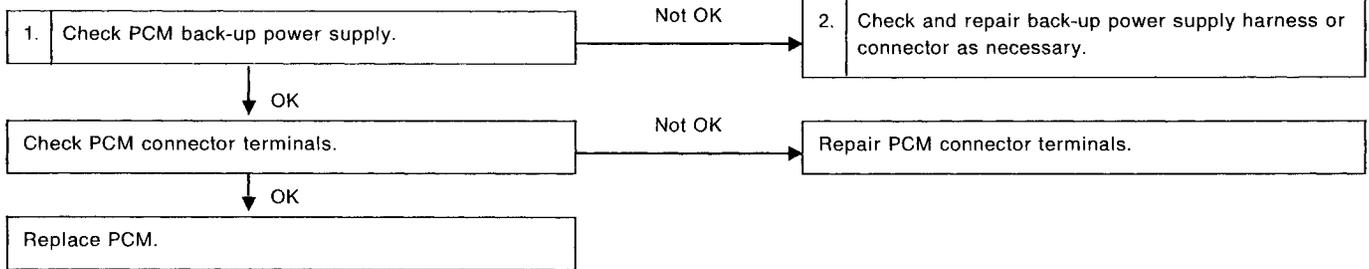
**F: TROUBLE CODE "4" — FAULTY BACK-UP POWER SUPPLY**

**Diagnosis**

- Faulty back-up power supply harness
- Faulty PCM (power steering control module)

**Symptom**

Trouble contents are not retained in memory.



C4-1093

Fig. 27

## 1. CHECK PCM BACK-UP POWER SUPPLY.

- 1) Disconnect connectors from PCM.
- 2) Measure voltage across PCM connector and GND.

**Connector & Terminal/Specified voltage:**  
**(R91) No. 15 — Body/10 V, or more**

If fuse No. 25 is blown, it can be identified by shorted circuit between F/B (fuse block) and PCM.

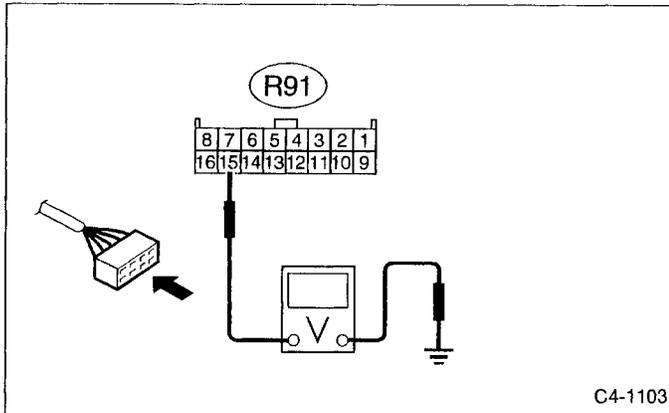


Fig. 28

## 2. CHECK AND REPAIR BACK-UP POWER SUPPLY HARNESS OR CONNECTOR AS NECESSARY.

Measure voltage across connector (F16) terminal and GND.

**Connector & Terminal/Specified voltage:**  
**(F16) No. 2 — Body/10 V, or more**

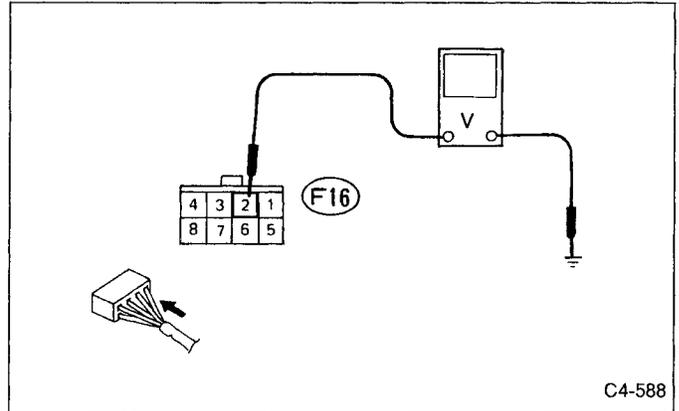


Fig. 29

O.K. → Open circuit between M/B and PCM (including SMJ)

NOT O.K. → Open circuit between connectors (F17) and (F16)

**G: TROUBLE CODE "5" — FAULTY ENGINE SPEED SIGNAL**

**Diagnosis**

- Faulty engine control module or harness
- Faulty PCM (power steering control module)

**Symptom**

Engine operation is controlled only by vehicle speed sensor 2.

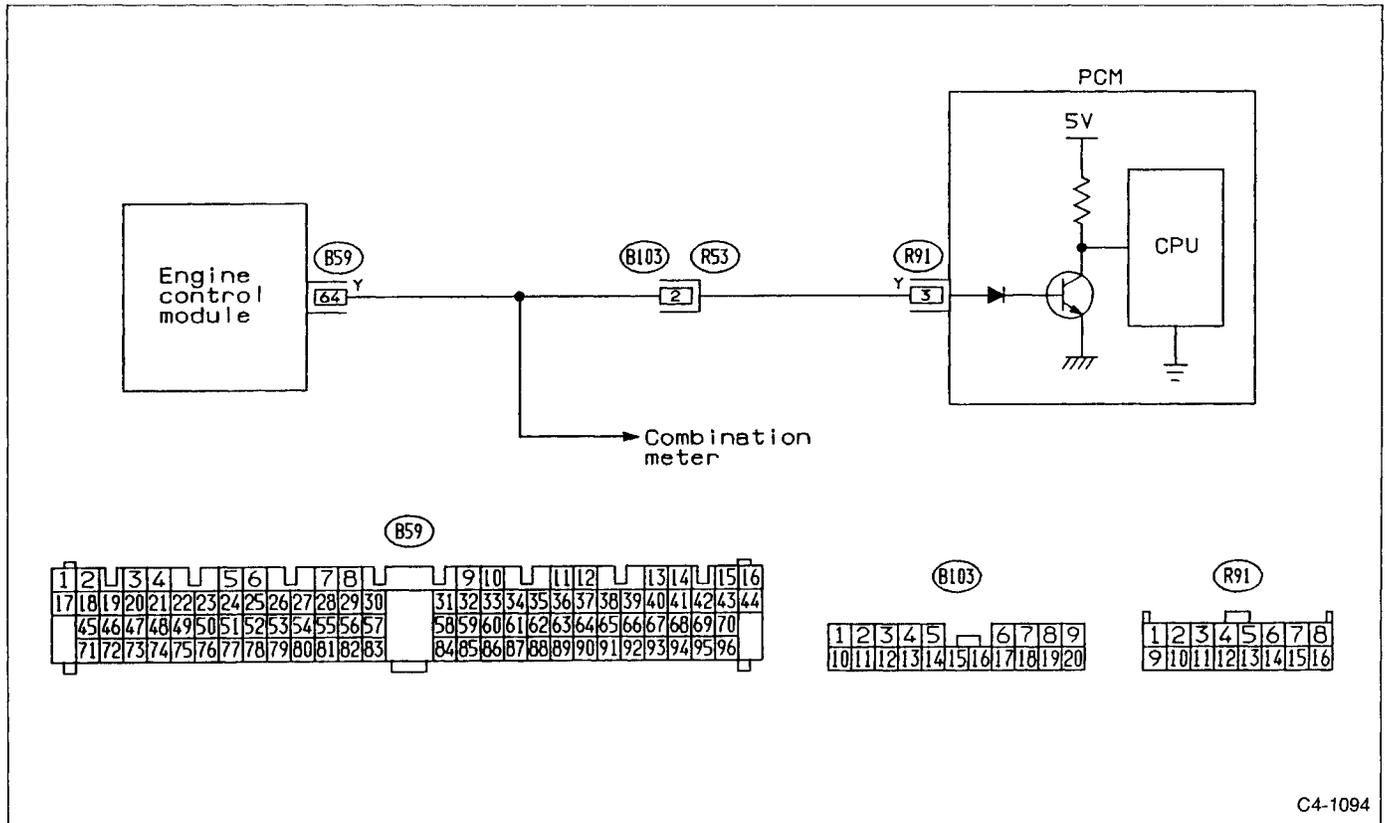
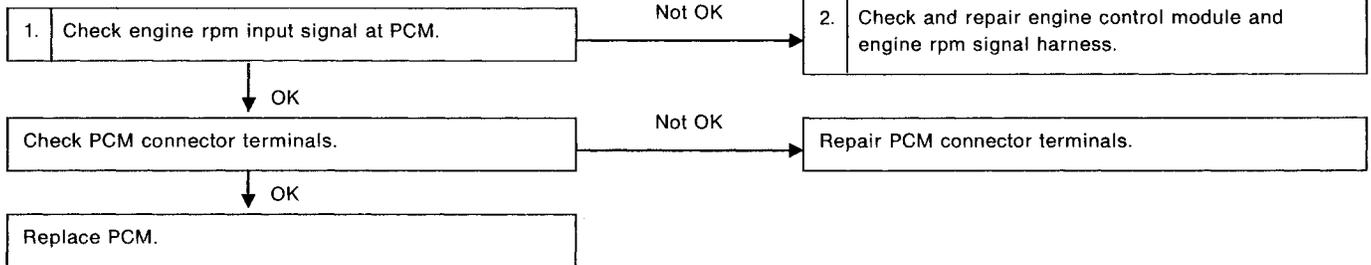


Fig. 30

C4-1094

## 1. CHECK ENGINE RPM INPUT SIGNAL AT PCM.

- 1) Connect oscilloscope between PCM and GND. (DC COUP, 0.5 V/Piv, 5 ms/Div, x 10 probes)
- 2) Turn ignition switch "ON."
- 3) Start engine.
- 4) Observe waveform pattern shown on oscilloscope screen.

### Connector & Terminal/Specified voltage:

(R91) No. 3 — Body/0 ↔ 10 V

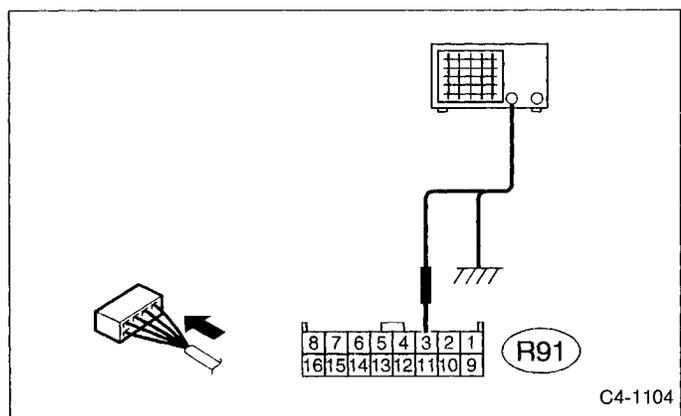


Fig. 31

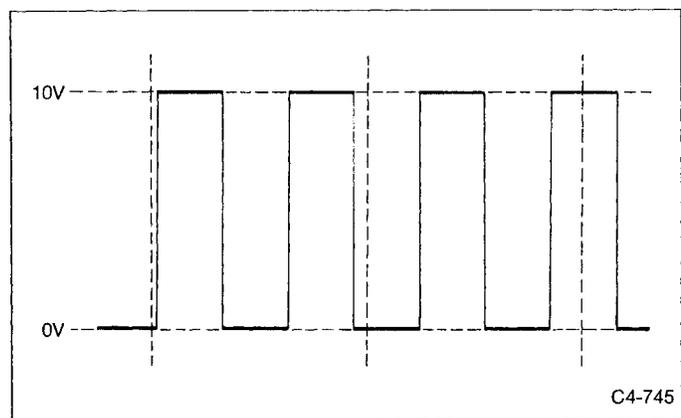


Fig. 32

## 2. CHECK AND REPAIR ENGINE CONTROL MODULE AND ENGINE RPM SIGNAL HARNESS.

- 1) Turn ignition switch "OFF."
- 2) Disconnect PCM from connectors.
- 3) Disconnect engine control module from connectors.
- 4) Measure resistance between PCM connector and engine control module connector terminals indicated below.

### Connector & Terminal/Specified resistance:

(R91) No. 3 — (B59) No. 64/1 Ω, or less

(R91) No. 3 — Body/1 MΩ, or more

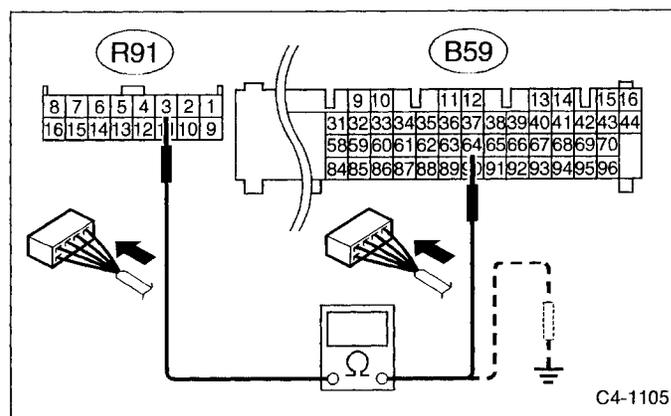


Fig. 33