

## STEERING SYSTEM

Operation .....	7- 1
Specifications .....	7- 2
Trouble Shooting .....	7- 2
Steering Wheel .....	7- 3
Steering Main Shaft .....	7- 4
Steering Gear Housing .....	7- 7
Steering Linkage .....	7-13

## OPERATION

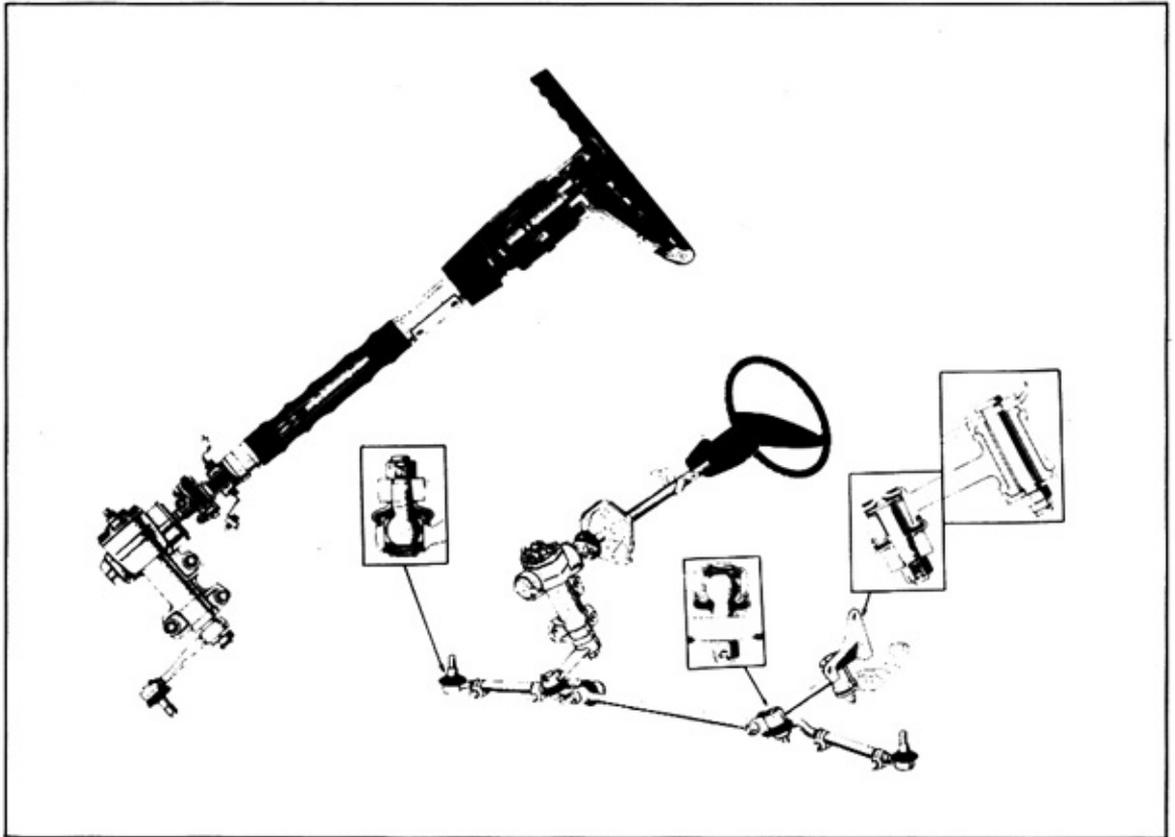


Fig 7-1 Steering System Construction

## RECIRCULATING BALL TYPE STEERING GEAR

Recirculating ball type steering gear is a steering mechanism in which the worm gear torque is transmitted to the sector shaft through the medium of balls and nut, and is a design that offers greater wear and shock resistance. In this steering gear, 60 balls divided up into two groups circulate by rolling in between the worm teeth and grooves cut in the inner face of ball nut. This causes the main shaft torque to change into rolling movement of the balls contacting against the worm gear, which is then transformed to linear movement of the ball nut.

The ball nut is meshed with the sector gear so that the linear movement changes to turning movement of the sector shaft, which becomes the force moving the wheels to either left or right. In handling the recirculating ball type steering gear, the important point is to see that the balls are not being clamped tightly between the worm and ball

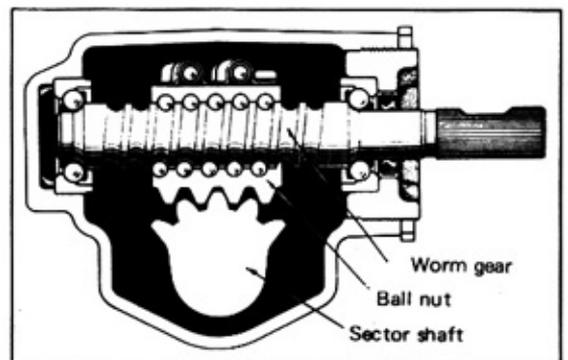


Fig. 7-2 Sectional View of Steering Gear

nut when the ball nut is run from one end of the worm gear to the other.

In reassembling, it is necessary to make the backlash zero between the ball nut and sector gear when at neutral state (the state when the ball nut and sector shaft are meshing together at the center of worm gear)

## SPECIFICATIONS

Table 7-1 Steering System Specifications

		TA10 series TA20, 22 series		RA20L			
Steering Column		Conventional		Collapsible			
Steering Main Shaft		Single joint main shaft					
Steering Linkage		3-Element steering linkage					
Steering Wheel	Diam. Rim Play	390 mm (15-3/8") 0–20 mm (0–3/4")					
Steering Gear	Type Steering Angle Gear Ratio	Recirculating ball 42°–46° 18.18 : 1					
Sector Shaft to Bushing Clearance	From Pit. Arm	No. 1		No. 2		No. 3	
	Reference	0.027–0.069mm (0.0011"–0.0027")		0.007–0.049mm (0.0003"–0.0019")			
Bushings Bore Reference		28.020–28.045mm (1.1031"–1.1041")		28.000–28.025mm (1.1024"–1.1035")			
Sector Shaft	Outside Dia. Axial Play	27.976–27.993mm (1.1014"–1.1021") 0.05mm (0.002") max.					
Sector Shaft Thrust Washer Thickness		A 2.00mm (0.079")	B 2.04mm (0.080")	C 2.08mm (0.082")	D 2.12mm (0.083")	E 2.16mm (0.085")	F 2.20mm (0.087")
Worm Brg. Preload	W/o Sector Shaft W/ Sector Shaft	4.0–5.0 kg (8.8–11.0 lb) (Starting torque) 8.0–11.0 kg (17.6–24.0 lb) (Starting torque)					

## TROUBLE SHOOTING

Symptoms and Probable Causes	Remedies
<b>Heavy steering</b> 1. Tie-rod ends sticking 2. Linkage connections sticking 3. Steering gear housing out of adjustment or damaged	Replace Replace Adjust or replace
<b>Steering wheel unsteady</b> 1. Tie-rod ends loose or worn 2. Linkage connections loose or damaged 3. Steering gear housing out of adjustment or worn 4. Steering gear housing mounting bolts loose	Retighten or replace Retighten or replace Adjust or replace Retighten
<b>Steering Wheel Pulls to One Side</b> 1. Steering gear housing out of adjustment or worn 2. Idler arm bushing deteriorated	Adjust or replace Replace
<b>Shocks Felt on Steering Wheel</b> 1. Sector and ball nut mesh out of adjustment 2. Excessive play in steering wheel	Adjust Adjust

## STEERING WHEEL

## COMPONENT PARTS

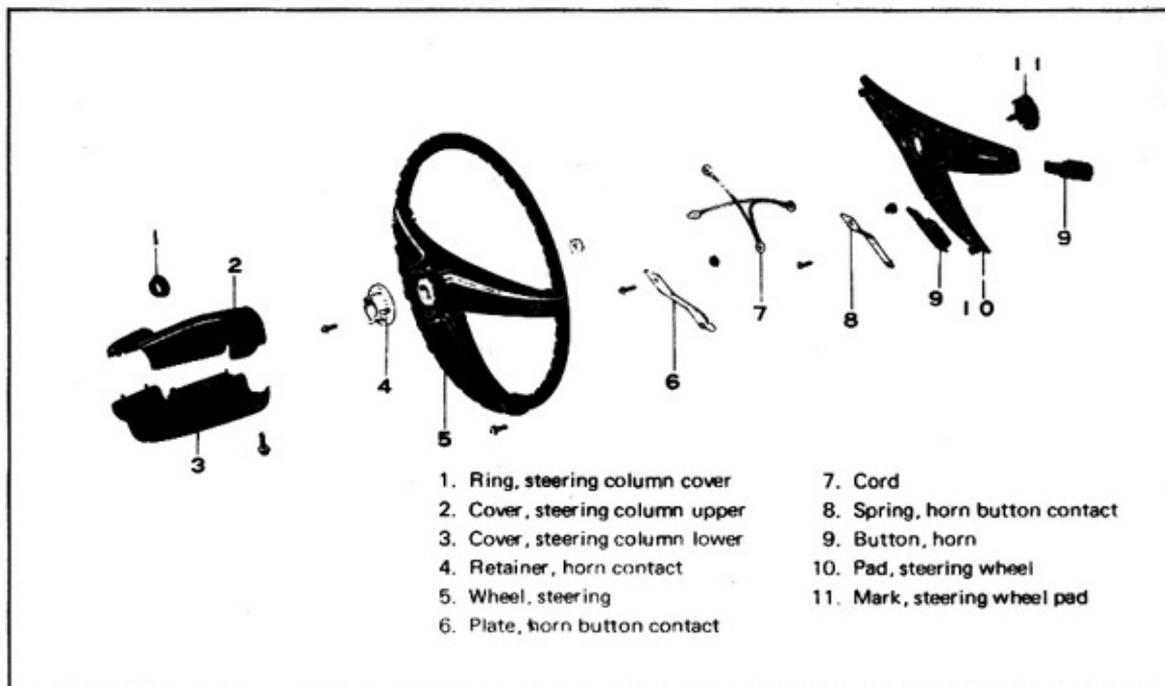


Fig. 7-3 Steering Wheel Component Parts

## REMOVAL

- Loosen the three screws at the back side of the steering wheel, and remove the horn button assembly.
- Remove the nut, and using Steering Wheel Puller [ 09609-20010 ], remove the steering wheel.

## Notes :

- Before removing the steering wheel, scratch alignment marks to remember the relative positions.
- Do not attempt to remove the steering wheel by hammering it out.

## INSPECTION

Inspect the disassembled parts, and repair or replace any part which does not function properly or is damaged.

## INSTALLATION

- Install the steering wheel.  
Tightening torque 200–300 kg-cm (15–22 ft-lb)
- Reconnect the cord and install the horn button assembly.

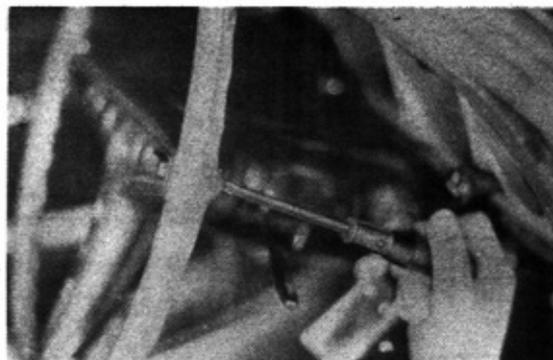


Fig. 7-4 Removing Horn Button

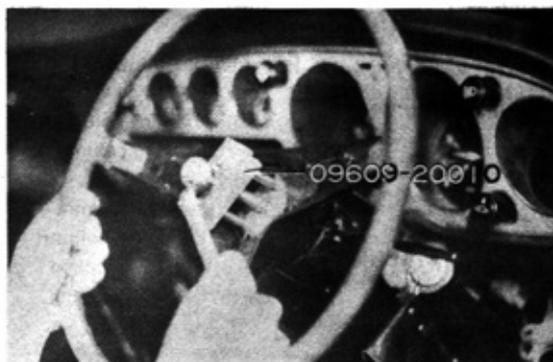
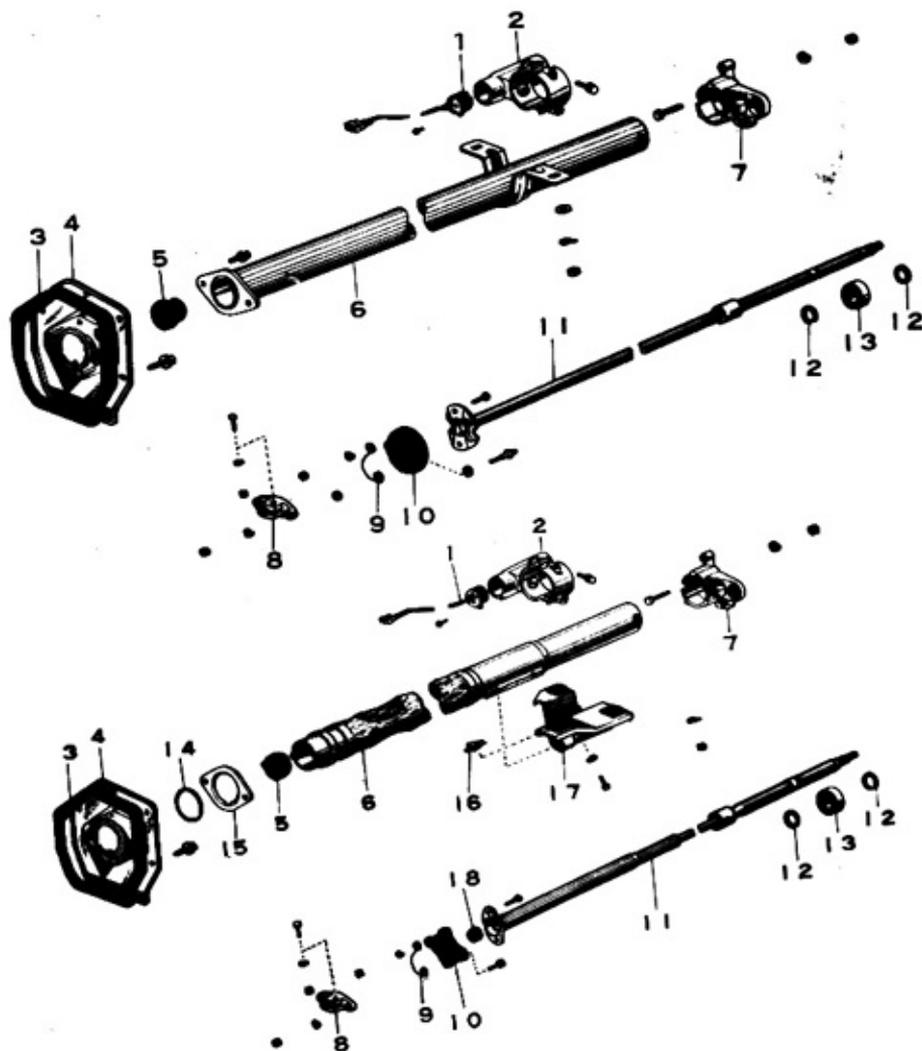


Fig. 7-5 Removing Steering Wheel

## STEERING MAIN SHAFT

## COMPONENT PARTS



- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1. Switch assembly, ignition    | 10. Coupling, flexible          |
| 2. Lock assembly, steering      | 11. Shaft, steering main        |
| 3. Shield, steering column hole | 12. Ring, shaft snap            |
| 4. Cover, steering column hole  | 13. Bearing, radial ball        |
| 5. Seal, dust                   | 14. Ring, "O"                   |
| 6. Tube, steering column        | 15. Plate, steering column hole |
| 7. Bracket, steering column     | 16. Wedge, caster               |
| 8. Yoke, steering coupling      | 17. Bracket, break-away         |
| 9. Earth, flexible coupling     | 18. Plug, plate                 |

Fig. 14-6 Steering Main Shaft Component Parts

**Note :** When working on the collapsible type steering column, care must be taken not to subject the main shaft to unnecessary force or shock.

### REMOVAL

1. Remove the bolt (1) attaching the coupling yoke to the worm shaft.
2. Using Steering Wheel Puller [ 09609-20010 ], remove the steering wheel. (Refer to P7-3 on steering wheel).
3. Remove the column covers and remove the turn signal switch assembly.
4. Remove the column hole cover and column clamp, and pull out the steering column assembly together with the control shaft into the vehicle interior.

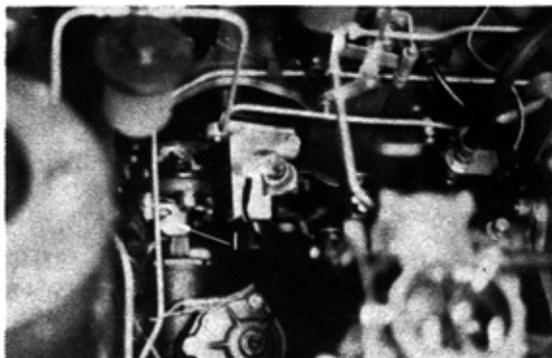


Fig. 7-7 Coupling Yoke Bolt Removal



Fig. 7-8 Column Tube Assembly Removal

### DISASSEMBLY OF STEERING MAIN SHAFT

1. Remove the steering column bracket. Using Snap Ring Expander [ 09905-00010 ], disengage the snap ring and pull out the bearing.
2. Pull out the steering main shaft from the column tube.
3. Remove the column hole plate mounting nuts, and remove the column tube from the column hole cover.
4. Remove the flexible coupling from the main shaft, and remove the yoke by tapping it from the back side.

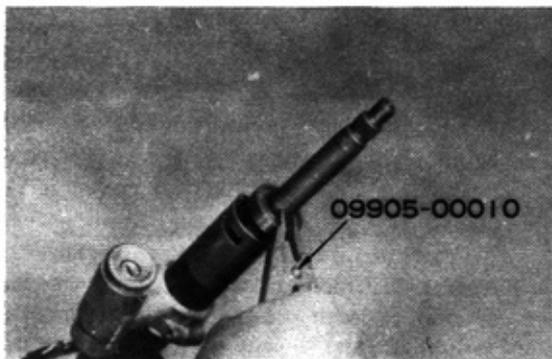


Fig. 7-9 Bearing Removal

### INSPECTION

Inspect the removed parts on the following points and replace any found defective.

1. Main shaft for bending.
2. Plastic pin at main shaft center part coupling for looseness or improper state of installation.
3. Bearing for wear, abnormal noise, or improper rotation.
4. Flexible coupling for deterioration or damage.

**REASSEMBLY**

1. Install the torsion stopper bolts, coupling earth, and coupling yoke on the flexible coupling.
2. Install the flexible coupling on the main shaft, and at the same time, make the earth connection.
3. Install the column hole plate and "O" ring on the column tube, and insert them into the column hole cover.
4. Coat the inside of dust seal with MP grease and install dust seal on the main shaft. Insert the main shaft into column tube.
5. Coat the bearing with MP grease and install it on the main shaft. Using Snap Ring Expander [ 09905-00010 ], install the snap ring.
6. Install the column bracket.

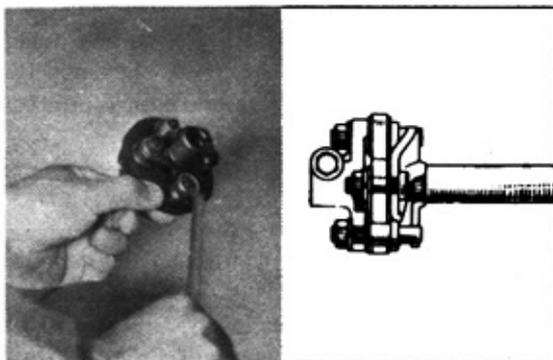


Fig. 7-10 Coupling Reassembly



Fig. 7-11 Main Shaft Reassembly

**INSTALLATION**

1. From the inside of vehicle, insert the steering column assembly into the column hole, and install after aligning the coupling yoke and worm relative positions.
2. Install the column clamp and column hole cover. Then, set the "O" ring tightly against the cover and install the column hole cover.  
**Notes:** In the collapsible type steering column, out of three break-away bracket mounting bolts, install the bolts (1) to the steering wheel side. Then, insert the caster wedge snugly between the instrument panel and flexible bracket, and install the remaining bolt (2), tightening it at the specified torque. Bolt torque 190–310 kg-cm (13.7–22.4 ft-lb)
3. Tighten the bolt (1) attaching the coupling yoke to the worm shaft.  
Bolt torque 200–300 kg-cm (14.5–21.7 ft-lb)
4. Install the turn signal switch assembly, column covers, and steering wheel.

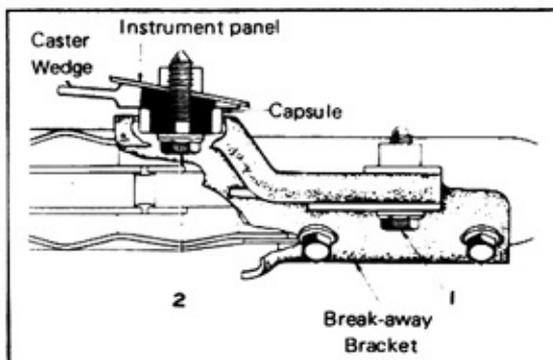


Fig. 7-12 Break-away Bracket Installation



Fig. 7-13 Coupling Yoke Bolt Installation

## STEERING GEAR HOUSING

## COMPONENT PARTS

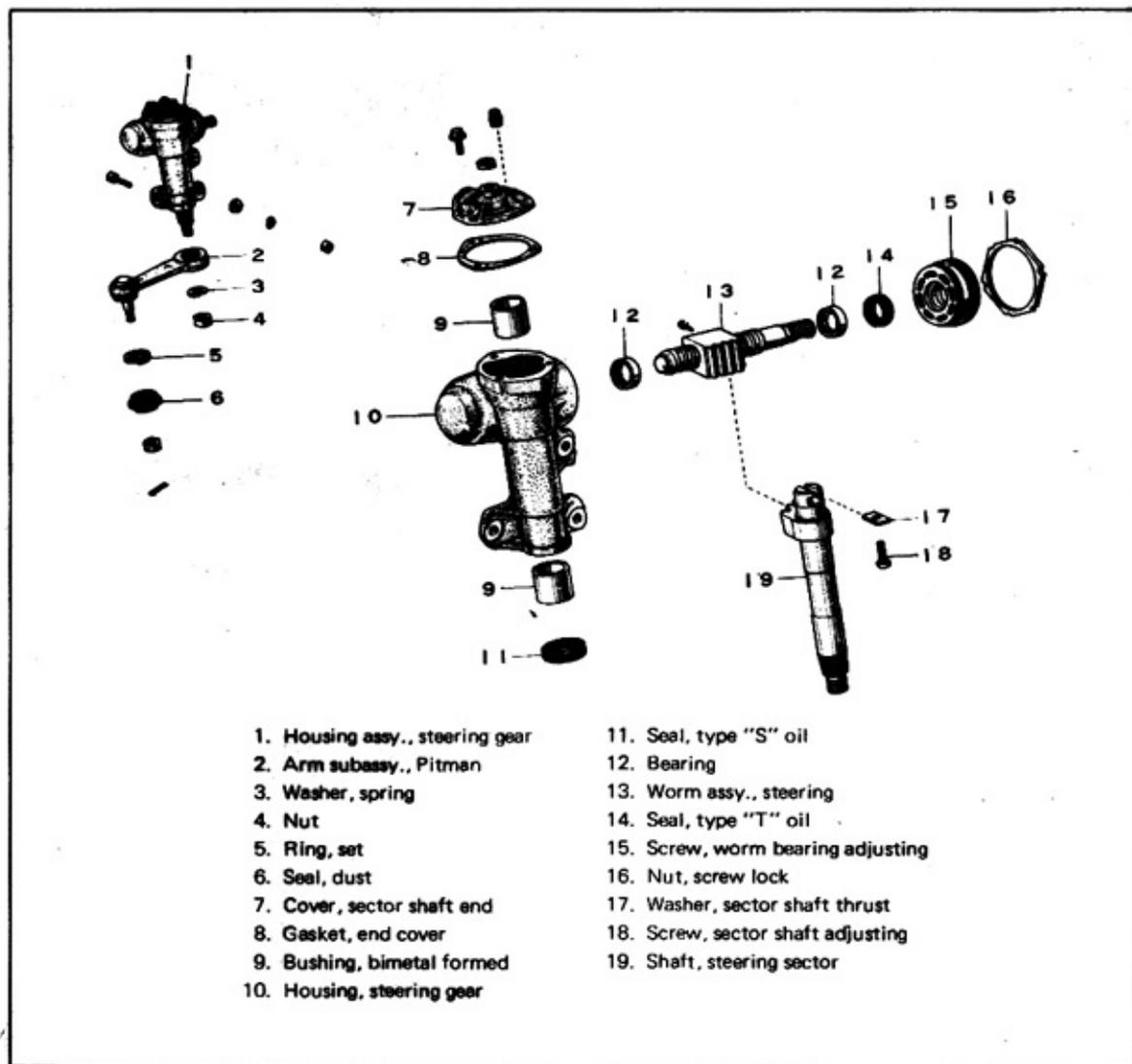


Fig. 7-14 Steering Gear Housing Component Parts

## REMOVAL

1. Using the Pitman Arm Puller [ 09610-20011 ], remove the pitman arm.
2. Loosen the bolt attaching the flexible coupling yoke to the worm shaft.
3. Remove the gear housing mounting nuts and take off the steering gear housing assembly.

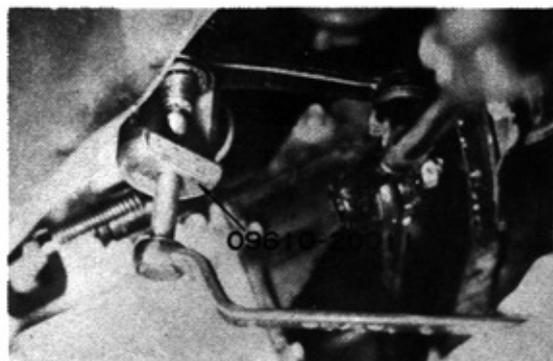


Fig. 7-15 Removing Pitman Arm

**DISASSEMBLY**

1. Loosen the nut that is locking the sector shaft adjusting screw.
2. Loosen the bolts attaching the end cover and remove the end cover and sector shaft.

**Note :** After taking out the sector shaft, drain out the oil in the housing into a container.

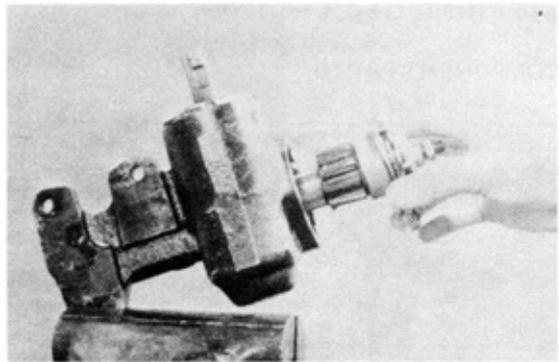


Fig. 7-16 Removing Sector Shaft

3. Loosen the worm bearing adjusting screw lock nut by using Worm Bearing Adjusting Screw Lock Nut Wrench [ 09617-22020 ].

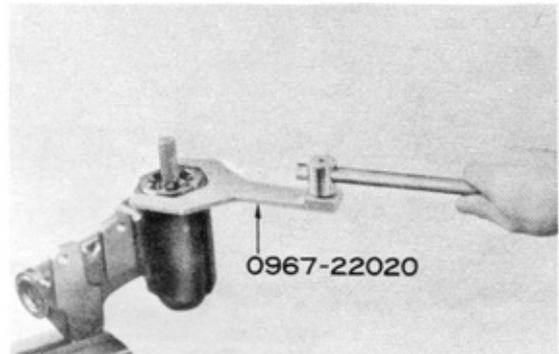


Fig. 7-17 Removing Lock Nut

4. Remove the worm bearing adjusting screw from the gear housing by using Worm Bearing Adjusting Screw Wrench [ 09616-22010 ].

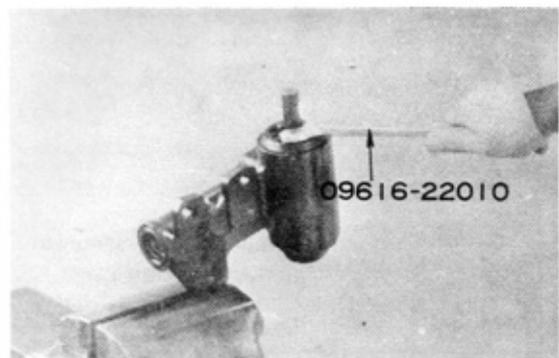


Fig. 7-18 Removing Adjusting Screw

5. Take out the steering worm assembly together with bearing from out of the gear housing.  
**Note :** Do not disassemble the ball nut from the steering worm assembly. If defective, replace the entire assembly.

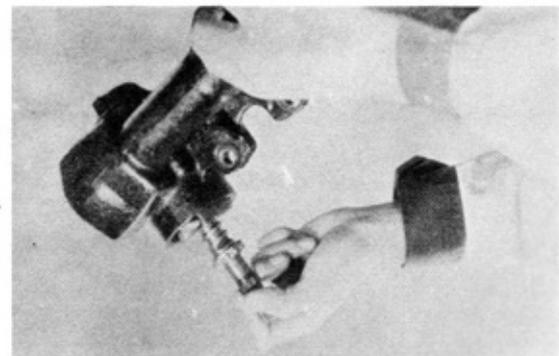


Fig. 7-19 Removing Steering Worm Assembly

**INSPECTION**

Inspect the disassembled parts on the following points, and replace any part found defective.

1. Type "S" and "T" oil seal lips for damage or wear.
2. Steering worm assembly
  - (1) Worm threads and ball nut rack for wear or damage.
  - (2) Ball nut for proper rotation.
3. Worm bearings for wear, damage, or other defect, and for proper rotation.
4. Sector shaft
  - (1) Shaft for wear or damage  
Outside diameter Reference  
27.976–27.993 mm (1.1014"–1.1021")
  - (2) Gear for wear or damage
  - (3) Measure the clearance between the shaft and thrust washer, and if found exceeding the limit, select proper size washer from Table 7-2.  
Clearance limit 0.05 mm (0.002")

Table 7-2 Thrust Washer Sizes

Size	Thickness
A	2.00 mm (0.079")
B	2.04 mm (0.080")
C	2.08 mm (0.082")
D	2.12 mm (0.083")
E	2.16 mm (0.085")
F	2.20 mm (0.087")

5. Bimetal formed bushings for wear or damage.  
**Note** : Inspect for wear by referring to the values specified in Table 7-3.

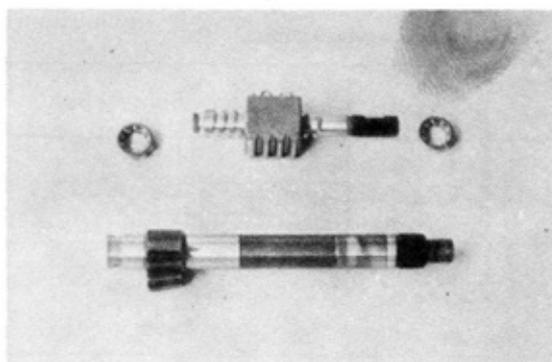


Fig. 7-20 Worm Assembly and Sector Shaft Inspection

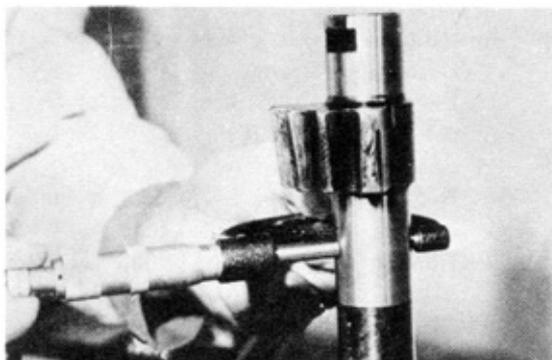


Fig. 7-21 Sector Shaft Inspection

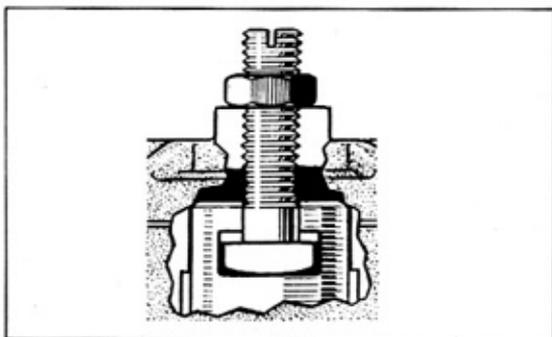


Fig. 7-22 Thrust Washer

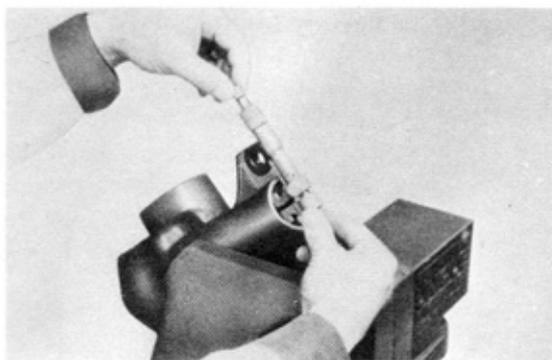


Fig. 7-23 Bushing Inspection

Table 7-3 Bushing Bore and Clearance with Sector Shaft

Bushing No. from Pitman Arm	Bushing Bore	Clearance between Sector Shaft and Bushing
1	28.020–28.045mm (1.1031"–1.1041")	0.027–0.069mm (0.0011"–0.0027")
2	28.000–28.025mm (1.1024"–1.1035")	0.007–0.049mm (0.0003"–0.0019")
3	28.000–28.025mm (1.1024"–1.1035")	0.007–0.049mm (0.0003"–0.0019")

## REPLACEMENT

### 1. Bimetal formed bushing replacement

- (1) Bushing No. 2 removal  
Remove by using Steering Sector Shaft Bushing Puller [ 09615–30010 ].
- (2) Bushing No. 1 removal  
Remove the type "S" oil seal and press out the bushing by using Steering Gear Housing Replacer Set [ 09620–30010 ].
- (3) In case of bushing No. 3  
Replace the sector shaft end cover subassembly.
- (4) Installation of new bushings No. 1 and No. 2  
Using Steering Gear Housing Replacer Set [ 09620–30010 ], press in the new bushings from both sides of the gear housing.

### 2. Worm shaft bearing replacement

- (1) Bearing cup removal (worm front end)  
Pull out by using Steering Worm Bearing Puller [ 09612–30011 ].
- (2) Bearing cup removal (worm rear end)  
Press out together with type "T" oil seal by using Steering Gear Housing Replacer Set [ 09620–30010 ].
- (3) Bearing cup installation  
Using Steering Gear Housing Replacer Set [ 09620–30010 ], press the new cups into the gear housing and worm bearing adjusting screw.
- (4) Finish the No. 1 and No. 2 bushing bores.  
Using pin hole grinder, finish the bushing bores to have the clearance with the sector shaft as specified in Table 7-3.
- (5) Install the oil seal.  
Press the type "S" oil seal into the gear housing.

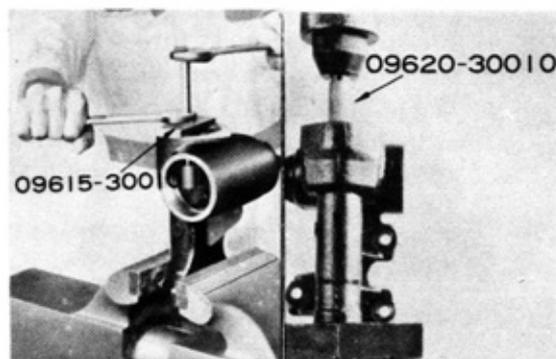


Fig. 7-24 Bushing Replacement

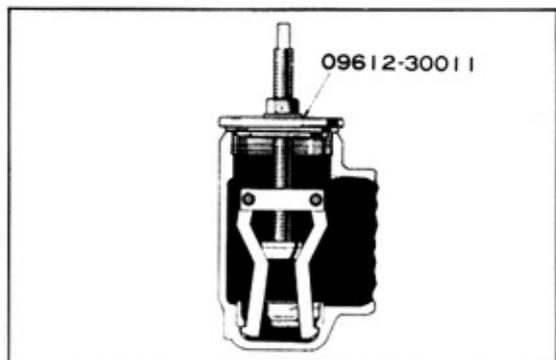


Fig. 7-25 Bearing Cup Removal

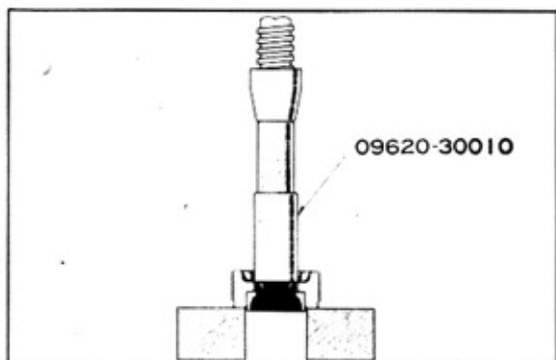


Fig. 7-26 Bearing Cup Removal

## REASSEMBLY AND ADJUSTMENT

## Notes :

1. Coat the oil seal lips and bushing, bores with MP grease.
2. Lightly oil the bearings and sliding surfaces.
3. Make sure that no foreign matter gets in the assembly. Be specially sure that the ball nut threads are clean before reassembling.

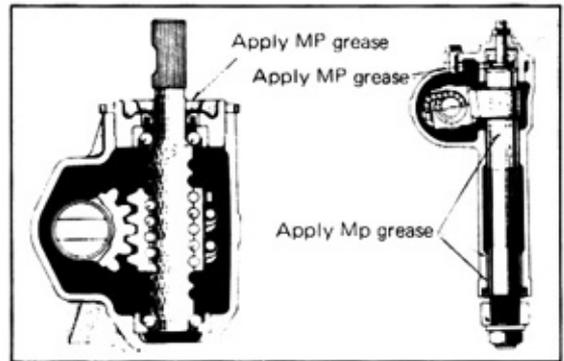


Fig. 7-27 Greasing Points

1. Insert the worm into the gear housing and install the worm bearing adjusting screw and screw lock nut.
  2. Adjust the worm bearing preload.
    - (1) Wind a cord around the worm coupling end, and measure the preload by lightly pulling the cord with spring scale.
    - (2) Set to specified preload by making adjustments with Worm Bearing Adjusting Screw Wrench [ 09616-22010 ].  
Specified preload 4.0-15.0 kg (8.8-33.0 lb) (Starting Torque)
    - (3) Using Worm Bearing Adjusting Screw Lock Nut Wrench [ 09617-22010 ], tighten the lock nut.  
Tightening torque 800-1000 kg-cm (58-72 ft-lb)
- Note :** After tightening the lock nut, recheck the preload.

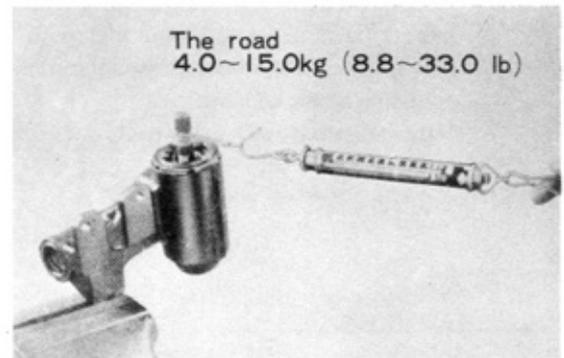


Fig. 7-28 Measuring Bearing Preload

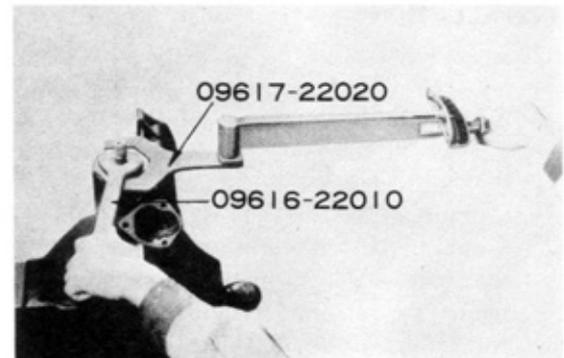


Fig. 7-29 Tightening Lock Nut

3. Install the sector shaft on the end cover, and assemble the sector shaft into the gear housing over end cover gasket.  
Tightening torque 150-220 kg-cm (11-16 ft-lb)

## Notes :

1. Set the ball nut at center and have the sector shaft gear mesh with the center part of nut.
2. Coat the end cover bolts with Seal Packing No. 5 before installing.
3. Turn the adjusting screw with a screwdriver and have it in a fully unscrewed state.

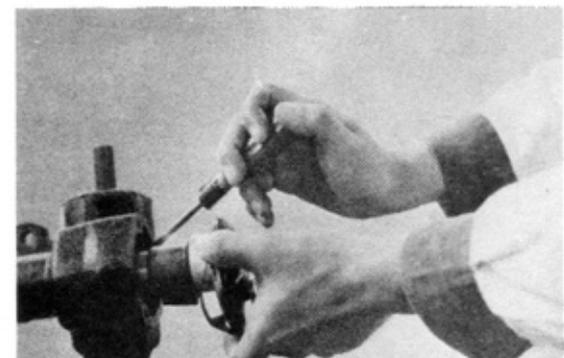


Fig. 7-30 Sector Shaft Reassembly

## 4. Adjust the sector shaft.

- (1) Screw in the sector shaft adjusting screw and adjust to the specified preload. Measure the preload by winding a cord around the worm coupling end and pulling the cord with spring scale.

Preload 8.0–11.0 kg (17.6–24.0 ft-lb)  
(Starting torque)

**Note :** Measure the preload at center meshed position.

- (2) There should be no backlash in the sector shaft rotation within  $5^{\circ}$  from either side of center position.

Inspect by attaching the pitman arm and measuring the pitman arm end with a dial gauge. After measuring, tighten the adjusting screw lock nut.

Nut torque 190–310 kg-cm  
(13.7–22.4 ft-lb)

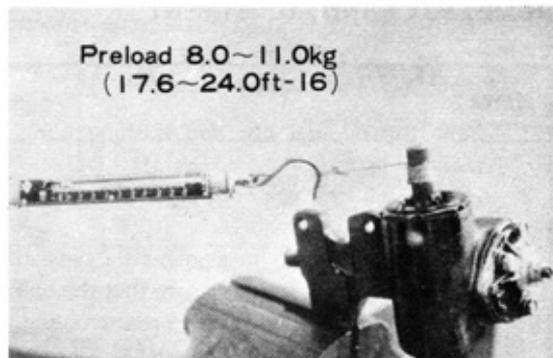


Fig. 7-31 Measuring Preload

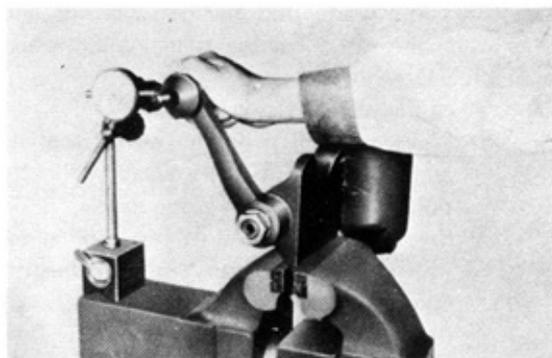


Fig. 7-32 Measuring Backlash

**INSTALLATION**

1. Align the steering worm shaft and flexible coupling yoke to their former relative positions and install the steering gear housing assembly to the frame, tightening the bolts at the specified torque.

Bolt torque 350–500 kg-cm (25–36 ft-lb)

2. Insert the pitman arm on the sector shaft so that their alignment marks are matched, and tighten the nut at the specified torque.

Nut torque 1000–1400 kg-cm (72–101 ft-lb)

3. Remove the breather plug and fill in gear oil to the level shown in Fig. 14-34.

Oil quantity 0.25 liter (1/4 U.S. qt.)

**Note :** Check the plug breather hole to see that it is not clogged.

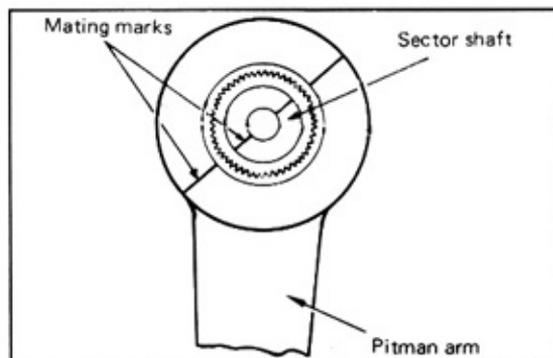


Fig. 7-33 Pitman Arm Alignment Marks

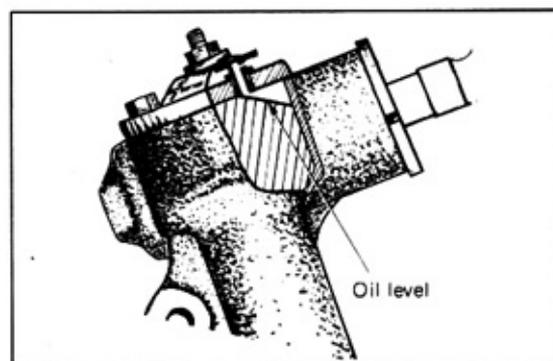


Fig. 7-34 Gear Oil Level

## STEERING LINKAGE

## COMPONENT PARTS

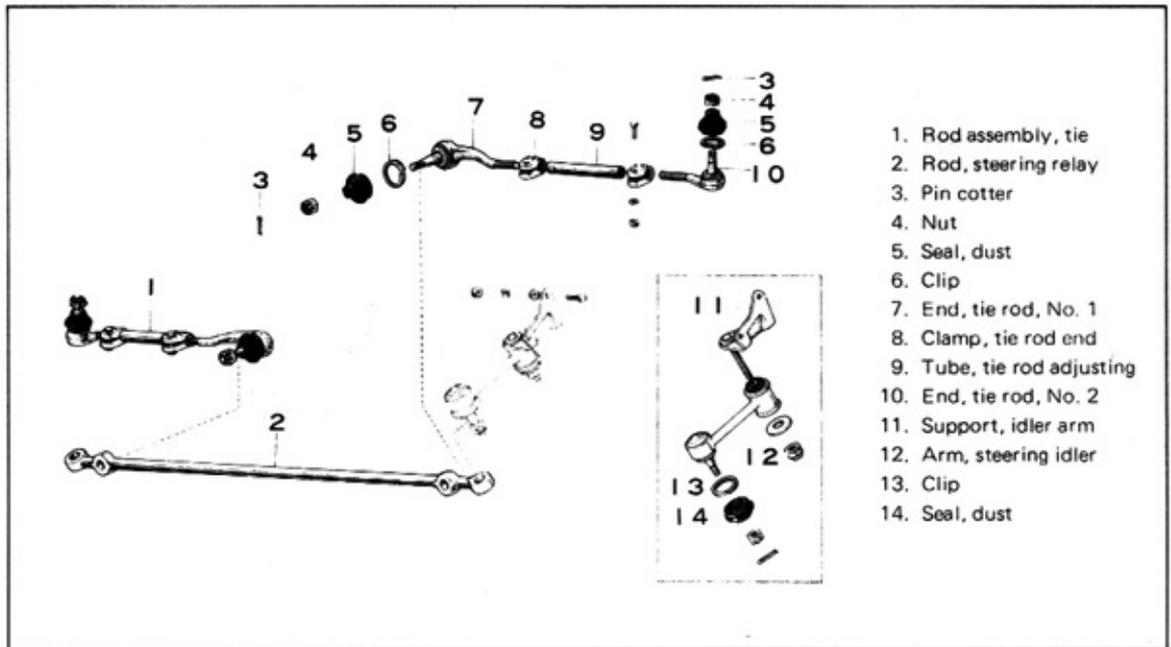


Fig. 7-35 Steering Linkage Component Parts

## REMOVAL

1. Using the Pitman Arm Puller [ 09610-20011 ], pull out the pitman arm.
2. Remove the idler arm support from the frame.
3. Using Tie Rod End Puller [ 09611-20013 ], remove the tie rod ends.



Fig. 7-36 Removing Pitman Arm

## DISASSEMBLY

1. Using Tie Rod End Puller [ 09611-20013 ], remove the pitman arm, idler arm, and tie rod from the relay rod.
2. Loosen the nuts and remove the tie rod end.
3. Remove the idler arm support nut and pull out the arm.



Fig. 7-37 Removing Tie Rod End

**INSPECTION**

Inspect the disassembled parts on the following points and replace any part found defective.

1. Pitman arm and tie rod ends for excessive looseness in studs, faulty operation, or grease leakage from bottom plug.
2. All parts for damage, cracks, or deformation.
3. Dust seals, clips, and rings for damage, deterioration, or deformation.
4. Idler arm
  - (1) Idler arm for damage or wear.
  - (2) Support bushing for deterioration or wear.

**REASSEMBLY**

1. Assemble the idler arm on the idler arm support and tighten the nut (self-locking type).  
Nut torque 700–900 kg-cm (51–65 ft-lb)
2. Connect the idler arm to the relay rod, and after tightening the nut, lock the nut with cotter pin.  
Nut torque 500–700 kg-cm (36–51 ft-lb)
3. Assemble the tie rod ends into the adjusting tube.

**Notes :**

1. Tie rods installed at both ends of adjusting tube should be screwed in by equal amounts.
2. Set the tube clamps so that the clamp bolts will be positioned at the tube seam.
3. Before locking the tie rod ends, leave enough turning reserve in the tie rod ends so that the tie rod inner and outer relative angle can be made to that shown in Fig. 7-38.
4. Install the tie rod ends on the relay rod and after tightening the nuts, lock the nuts with cotter pins.  
Tightening torque 450–650 kg-cm (33–47 ft-lb)
5. Install the pitman arm on the relay rod and after tightening the nut, lock it with cotter pin.  
Tightening torque 500–700 kg-cm (36–51 ft-lb)

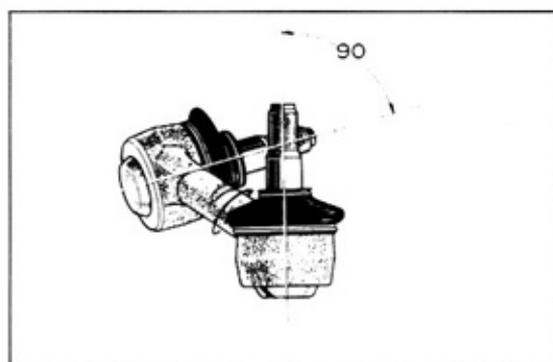


Fig. 7-38 Tie Rod End Intersecting Angle

**INSTALLATION**

1. Install the tie rod ends at both ends of steering linkage to their respective knuckle arms, and after tightening the nuts, lock the nuts with cotter pins.  
Tightening torque 500–700 kg-cm (36–51 ft-lb)
2. Insert the pitman arm on the sector shaft so that their alignment marks are matched, and tighten the nut at the specified torque.  
Tightening torque 1000–1400 kg-cm (72–101 ft-lb)
3. Install the idler arm support on the front side member.  
Tightening torque 350–500 kg-cm (25–36 ft-lb)
4. Adjust the toe-in.  
Refer to P6-19 for adjustment procedures.