

## 31-3. STEERING GEAR REPAIR

This task covers:

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| <ul style="list-style-type: none"> <li>a. Disassembly</li> <li>b. Cleaning</li> <li>c. Housing Group Inspection and Repair</li> <li>d. Pitman Shaft Inspection and Repair</li> </ul> | <ul style="list-style-type: none"> <li>e. Rack Piston Group Inspection and Repair</li> <li>f. Valve and Adjuster Group Inspection and Repair</li> <li>g. Assembly</li> <li>h. Adjustment</li> </ul> |
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### INITIAL SETUP:

#### Tools

General mechanic's tool kit:  
automotive (Appendix B, Item 1)

#### Special Tools

Adjuster plug bearing remover/installer  
(Appendix B, Item 116)  
Pitman shaft bearing remover/installer  
(Appendix B, Item 117)  
Spanner wrench (Appendix B, Item 118)  
Rack piston arbor (Appendix B, Item 119)

#### Materials/Parts

Adjuster plug seal service kit  
(Appendix G, Item 3)  
Valve ring seal service kit  
(Appendix G, Item 467)  
Rack piston seal service kit  
(Appendix G, Item 314)

#### Materials/Parts (Cont'd)

Pitman shaft seal service kit (Appendix G, Item 308)  
Side cover seal service kit (Appendix G, Item 440)  
Seal service kit (Appendix G, Item 403)  
Crocus cloth (Appendix C, Item 22)  
Grease (Appendix C, Item 35)  
Hydraulic fluid (Appendix C, Item 37)

#### Manual References

TM 9-2320-387-24P  
TM 9-214

#### Equipment Condition

Steering gear removed (para. 8-20).

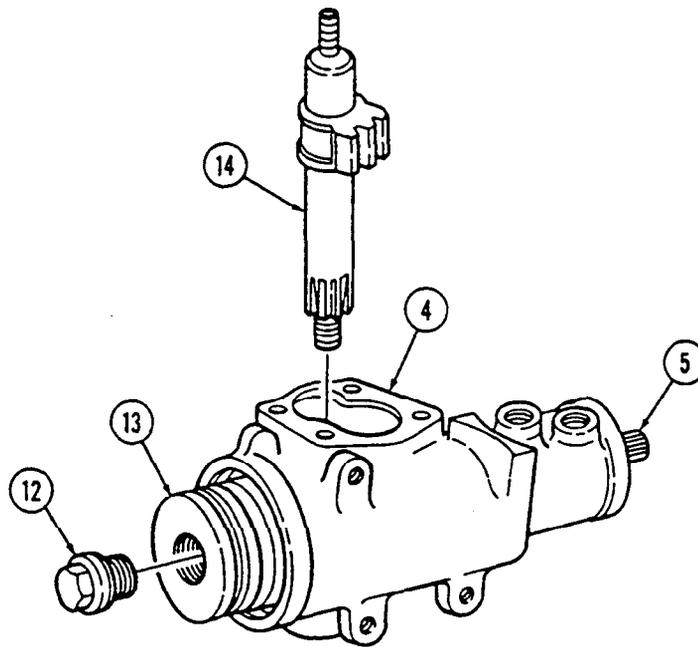
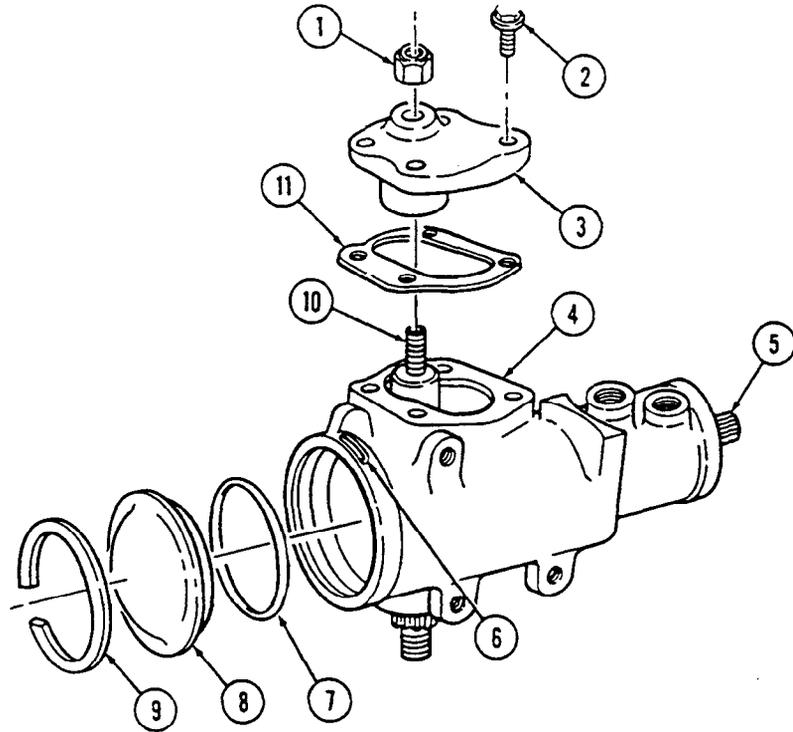
#### Maintenance Level

General support

### a. Disassembly

1. Hold adjuster screw (10) and remove lash adjuster nut (1).
2. Remove four capscrews (2) from side cover (3) and housing (4).
3. Remove side cover (3) from adjuster screw (10).
4. Remove gasket (11) from side cover (3). Discard gasket (11).
5. Insert punch through access hole (6) and force out retaining ring (9). Discard retaining ring (9).
6. Rotate stub shaft (5) counterclockwise to force end plug (8) from housing (4).
7. Rotate stub shaft (5) clockwise and remove O-ring (7). Discard O-ring (7).
8. Remove plug (12) from rack piston (13).
9. Rotate stub shaft (5) to center and remove pitman shaft (14) from housing (4).

31-3. STEERING GEAR REPAIR (Cont'd)



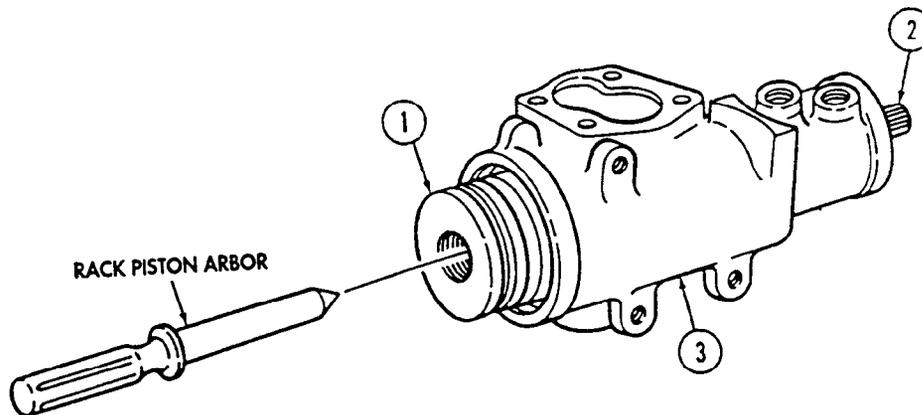
### 31-3. STEERING GEAR REPAIR (Cont'd)

10. Insert rack piston arbor in rack piston (1) and hold tightly while turning stub shaft (2) counter-clockwise.
11. Remove rack piston (1) and rack piston arbor from gear housing (3) together.
12. Remove nut (4) from adjuster plug (5).

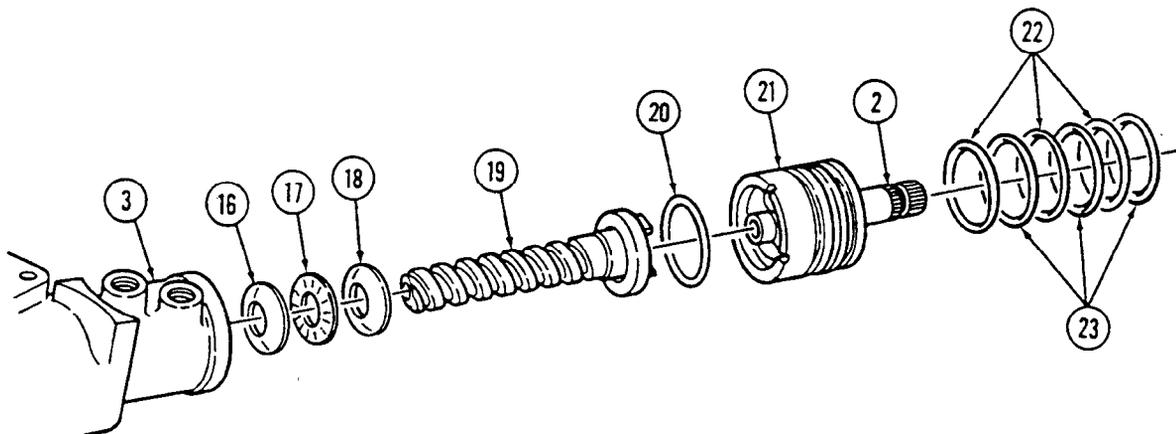
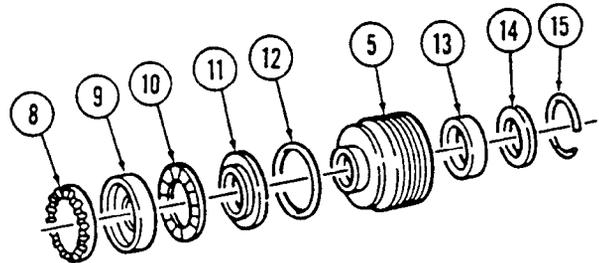
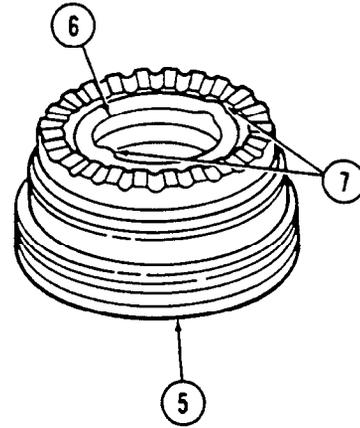
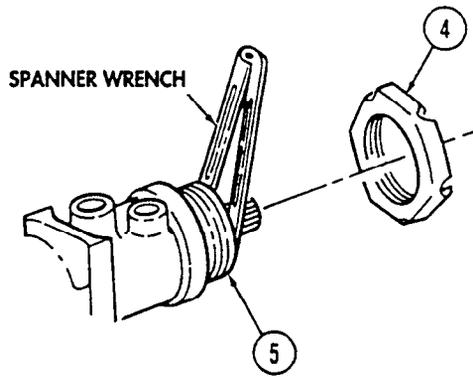
**NOTE**

Worm and valve may come out with adjuster plug. If so, separate adjuster from worm and valve.

13. Using spanner wrench, remove adjuster plug (5) from housing (3).
14. Pry off bearing retainer (6) at raised area (7).
15. Remove thrust bearing spacer (8), small bearing race (9), upper thrust bearing (10), and large bearing race (11) from plug (5).
16. Remove O-ring seal (12) from plug (5). Discard O-ring seal (12).
17. Remove retaining ring (15) from opposite side of adjuster plug (5). Discard retaining ring (15).
18. Remove stub shaft dust seal (14) and stub shaft oil seal (13) from plug (5). Discard seals (14) and (13).
19. Hold stub shaft (2) and remove valve (21) and worm shaft (19) together from housing (3).
20. Remove bearing race (16), lower thrust bearing (17), and bearing race (18) from worm shaft (19).
21. Clamp worm shaft (19) in soft-jawed vise and pull valve (21) from worm shaft (19).
22. Remove and discard three valve body Teflon rings (23) and O-ring seals (22) from valve body (21).
23. Remove stub shaft O-ring seal (20) from valve body (21). Discard O-ring seal (20).



31-3. STEERING GEAR REPAIR (Cont'd)



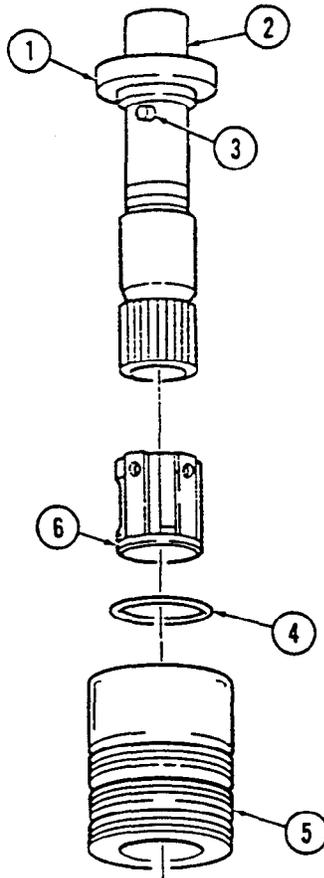
**31-3. STEERING GEAR REPAIR (Cont'd)**

- 24. Tap splined end of stub shaft (2) lightly on wood block until shaft cap (1) is free of valve body (5).
- 25. Pull shaft (2) outward 0.25 in. (6 mm).
- 26. Press spool valve locating pin (3) inward and remove stub shaft (2) from valve body (5).

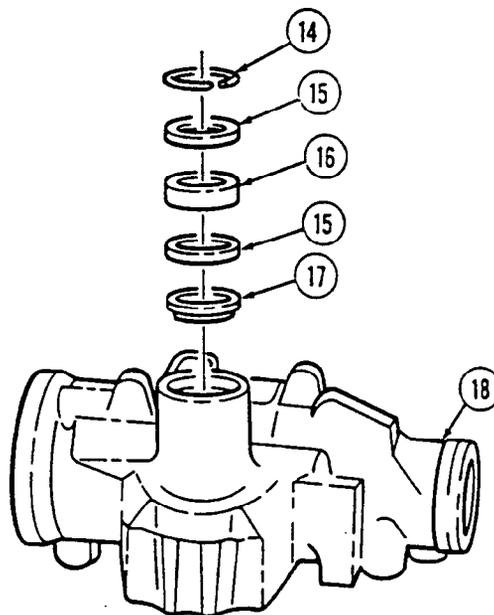
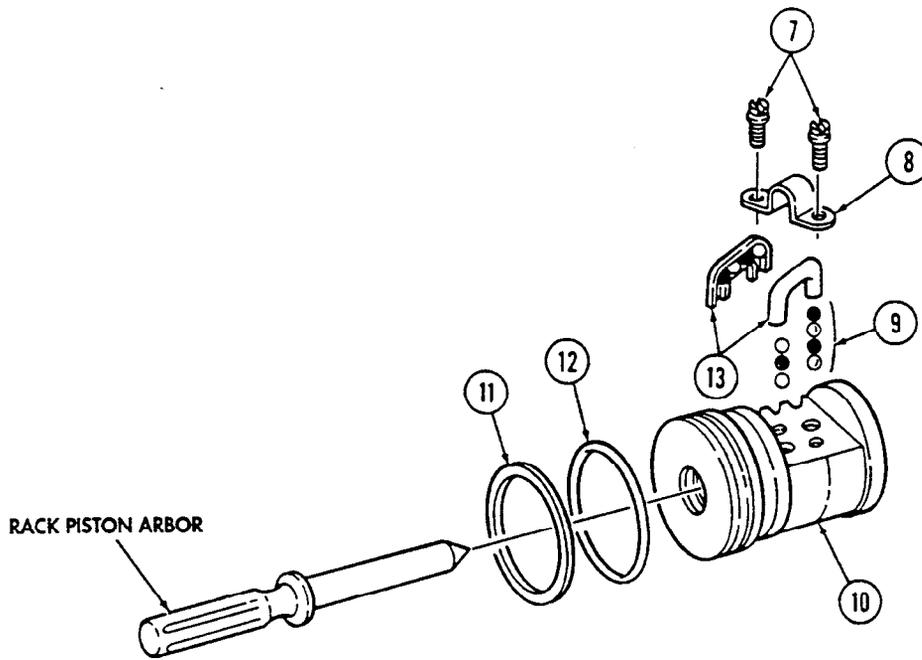
**NOTE**

Rotate spool to remove from valve.

- 27. Remove valve (6) from valve body (5).
- 28. Remove O-ring (4) from valve (6). Discard O-ring (4).
- 29. Remove two screw-assembled washers (7) and clamp (8) from rack piston (10).
- 30. Remove and separate two halves of guide (13).
- 31. Remove black and chrome bearing balls (9) from two halves of guide (13).
- 32. Tip rack piston (10) so remaining bearing balls (9) fall out. The total number of bearing balls (9) should be twenty-four (twelve black and twelve chrome-colored).
- 33. Remove rack piston arbor from rack piston (10).
- 34. Remove Teflon ring (11) and O-ring seal (12) from rack piston (10). Discard Teflon ring (11) and O-ring seal (12).
- 35. Remove pitman shaft retaining ring (14) from housing (18). Discard retaining ring (14).
- 36. Remove washer (15), double-lip seal (16), washer (15), and single-lip seal (17) from housing (18). Discard seals (16) and (17) and washers (15).



31-3. STEERING GEAR REPAIR (Cont'd)



### 31-3. STEERING GEAR REPAIR (Cont'd)

#### b. Cleaning

Clean all parts (para. 2-14).

#### c. Housing Group Inspection and Repair

1. Inspect housing (4) for breaks, cracks, chipped or broken retaining ring grooves (5) and (22), and damaged sealing surfaces. Replace steering gear if housing (4) is damaged.
2. Inspect housing (4) for crossed or stripped threads. Refer to paragraph 2-16 for thread repair. Replace steering gear if housing (4) threads cannot be repaired.

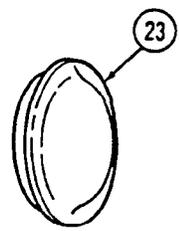
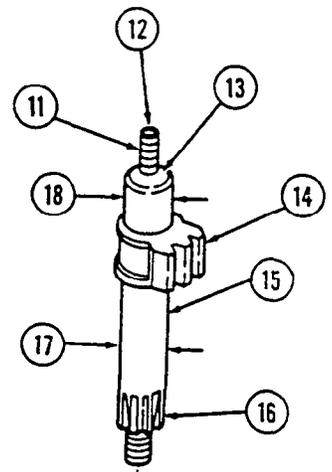
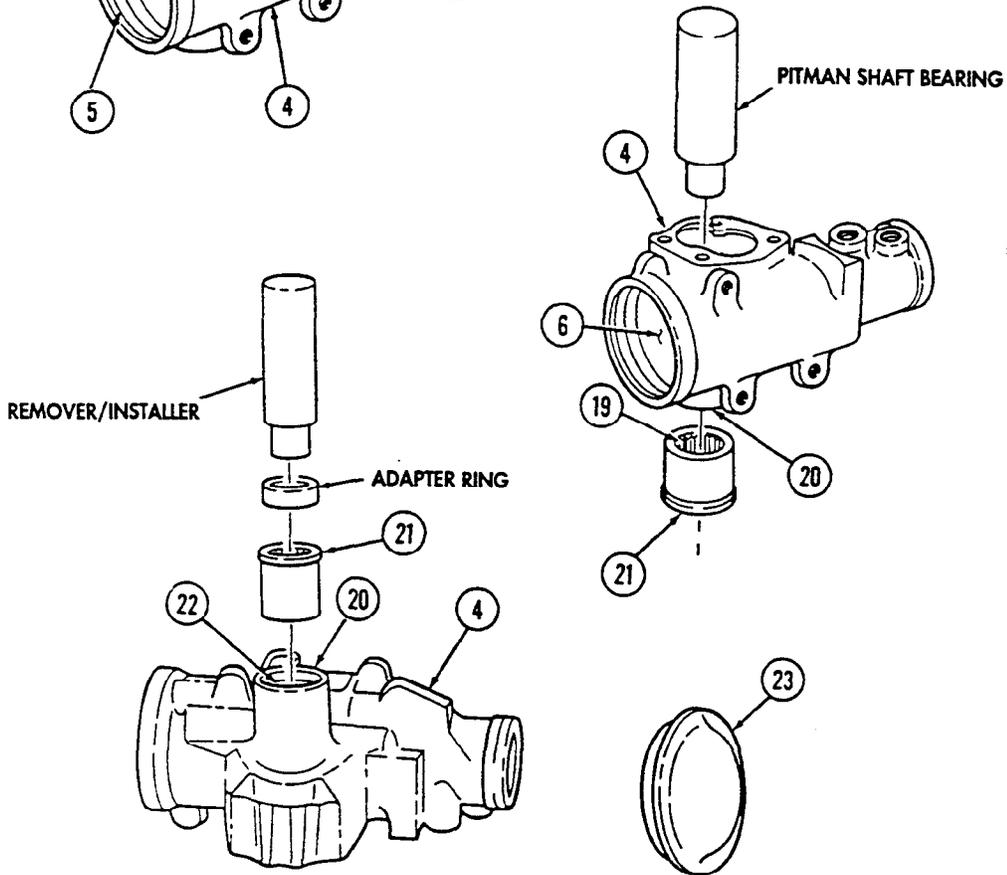
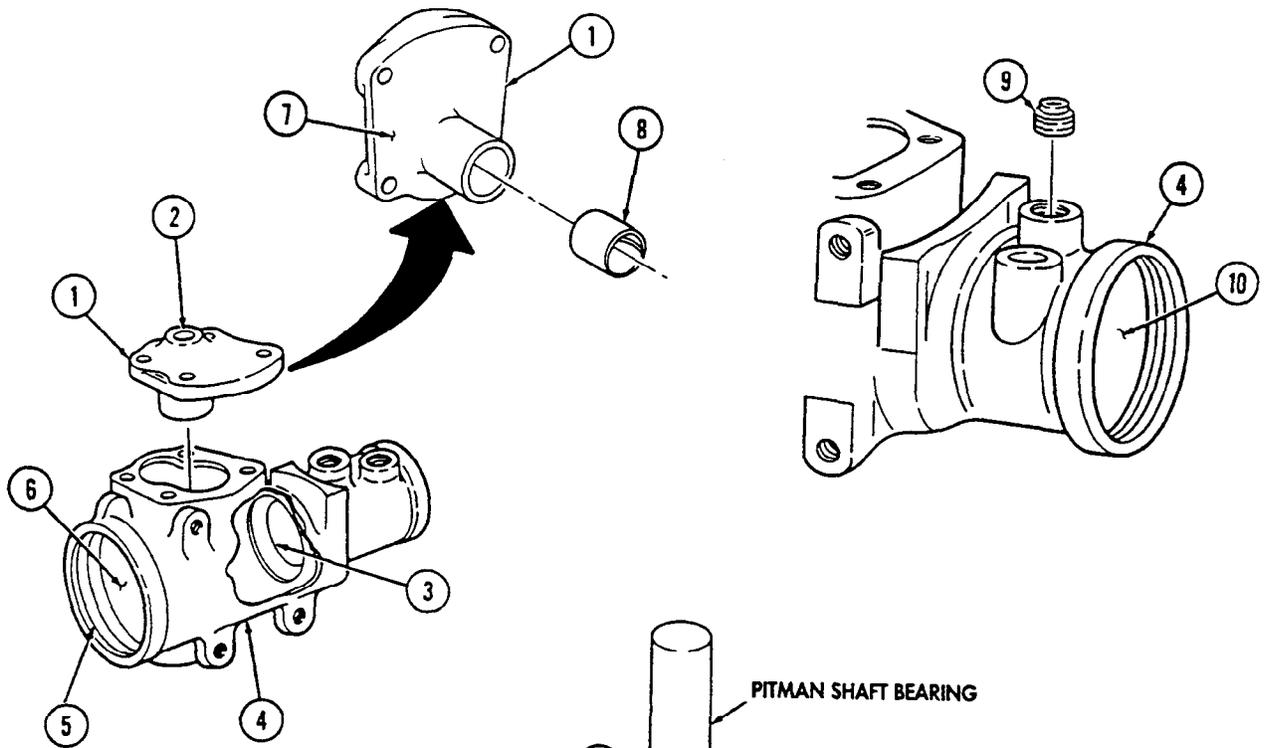
**NOTE**

- Rack piston bore has laser-hardened tracks on side of piston bore opposite pitman shaft cavity. These are not wear or scoring indicators.
  - Inspect pitman shaft bearing bore only if pitman shaft bearing is replaced (refer to steps 3 and 4).
3. Inspect pitman shaft needle bearing (21) for damage or wear (TM 9-214). Replace needle bearing (21) if damaged or inside diameter (I.D.) (19) is worn below 1.2510 in. (31.75 mm). If damaged or worn, replace needle bearing (21) as follows:
    - a. Using pitman shaft bearing remover/installer, remove bearing (21) from housing (4).
    - b. Lubricate bearing bore (20) and bearing (21) with hydraulic fluid.
    - c. Using pitman shaft bearing remover/installer and adapter ring, install bearing (21) until seated in housing (4).
  4. Inspect valve bore (10), rack piston bore (6), worm support bore (3), and pitman shaft bearing bore (20) for rust, pitting, scoring, galling, and wear. Wear limits for bore I.D. are: valve bore (10) 2.034 in. (51.66 mm), rack piston bore (6) 3.128 in. (79.45 mm), worm support bore (3) 1.040 in. (26.42 mm), and pitman shaft bearing bore (20) 1.766 in. (44.86 mm). Remove minor rust, pitting, and scoring with crocus cloth. If bore(s) do not meet specifications, or if there is other unreparable damage, replace steering gear.
  5. Inspect check valve (9) for freedom of movement. If damaged, replace check valve (9) as follows:
    - a. Pry check valve (9) out of housing (4) with a small screwdriver.
    - b. Lubricate housing (4) and check valve (9) with hydraulic fluid.
    - c. Install check valve (9) using 3/8 in. (9.53 mm) outside diameter (O.D.) tubing, 4 in. (10.16 cm) long.
  6. Inspect side cover (1) for breaks, cracks, stripped or crossed threads (2), warped or damaged sealing surface (7), and scored or worn bushing (8). Repair minor scoring and thread (2) damage. Replace side cover (1) if bushing (8) is worn through or loose in bore. Replace bushing (8) if I.D. is worn over 1.248 in. (31.70 mm).
  7. Inspect housing end plug (23) for breaks, cracks, and chipped edges. Replace housing end plug (23) if damaged.

#### d. Pitman Shaft Inspection and Repair

1. Inspect pitman shaft (15) for bends, breaks, chipped, cracked, or broken gear teeth (14), wear on bushing journal (18) or bearing journal (17), crossed or stripped threads, and bent or twisted splines (16). Bushing journal (18) minimum O.D. is 1.2468 in. (31.699 mm) and bearing journal (17) minimum O.D. is 1.2500 in. (31.750 mm). Repair minor thread damage. Replace pitman shaft (15) if worn or unreparable.
2. Inspect lash adjuster screw (11) for free rotation in shaft (15), tight retainer plug (13), crossed or stripped threads, and rounded hex-socket hole (12). Repair minor thread damage. Replace pitman shaft (15) if damaged.

**31-3. STEERING GEAR REPAIR (Cont'd)**



### 31-3. STEERING GEAR REPAIR (Cont'd)

#### e. Rack Piston Group Inspection and Repair

**NOTE**

If rack piston internal worm thread, worm thread, or ball bearings are broken, chipped, or moderately or badly scored, replace all three parts.

1. Inspect rack piston (7) for breaks, burrs, chipped seal grooves (8), crossed or stripped threads, cracked or broken gear teeth (3), and broken, chipped or scored internal worm thread. Repair minor burrs and scoring with fine mill file or crocus cloth. Repair minor thread damage. Replace rack piston (7) if gear teeth (3) are cracked or broken or other damage is unrepairable.
2. Inspect twenty-four ball bearings (6) for breaks, chipped surface, flats, and scoring. Minor scoring on ball bearings (6) is acceptable. Replace ball bearings (6) as a set if any one or more fails inspection (refer to note above).
3. Inspect ball bearing guides (2) for bends, dents, and breaks and clamp (5) for bends and breaks. Replace damaged parts.
4. Inspect screw-assembled washers (4) for crossed or stripped threads. Replace screw-assembled washers (4) if damaged.
5. Inspect rack piston plug (1) for burred or rounded hex-flats and stripped or crossed threads. Replace rack piston plug (1) if damaged.

#### f. Valve and Adjuster Group Inspection and Repair

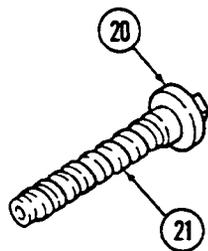
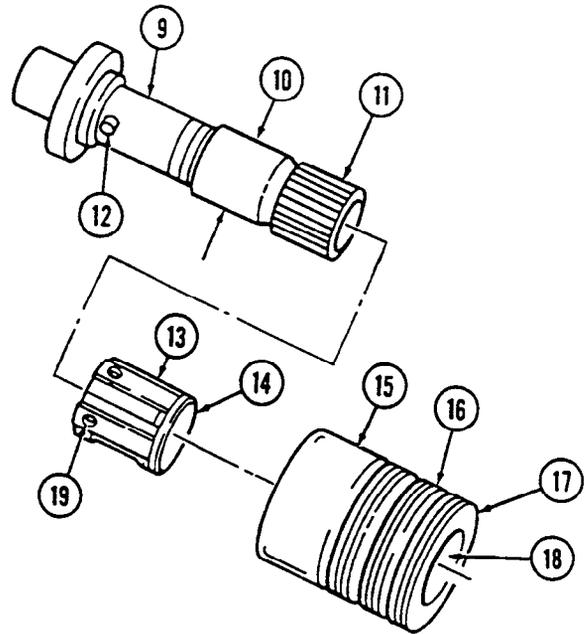
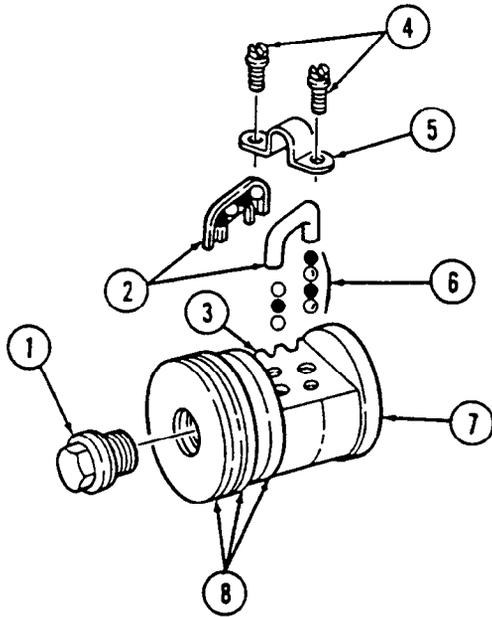
1. Inspect valve body (17) for burrs, chipped or broken seal ring grooves (16), scoring on inner bore (18), and wear. Repair minor burrs and scoring with crocus cloth. Valve body bore (18) maximum I.D. is 1.1557 in. (29.355 mm) and valve body (17) minimum O.D. (15) is 2.0150 in. (51.181 mm). Replace valve body (17) if worn or unrepairable.
2. Inspect valve (14) for burrs, cracks, blocked oil passages (19), chipped or cracked seal ring groove, scoring, and wear. Spool valve (14) minimum O.D. (13) is 1.152 in. (29.26 mm). Remove minor burrs and scoring with crocus cloth and clear blocked oil passages (19). Replace valve (14) if worn or unrepairable.
3. Inspect stub shaft (9) for bends, cracks, breaks, damaged pin (12), bent or twisted splines (11), and worn bearing journal (10). Bearing journal (10) minimum O.D. is 1.2495 in. (31.737 mm). Replace stub shaft (9) if worn or damaged.
4. Inspect worm shaft (20) for bends, breaks, burrs, chipped threads (21), and scoring. Remove minor burrs and scoring with fine mill file or crocus cloth. Replace worm shaft (20) if damage is unrepairable (refer to note before step e.1).
5. Inspect adjuster plug (22) for cracks, breaks, crossed or stripped threads, chipped retainer grooves, and seal ring surface. Replace plug (22) if damaged.
6. Inspect adjuster plug needle bearing (23) for damage (TM 9-214) and wear. Replace needle bearing (23) if damaged or I.D. is worn over 1.2505 in. (31.763 mm). If damaged or worn, replace needle bearing (23) as follows.
  - a. Using adjuster plug bearing remover/installer, remove bearing (23) from adjuster plug (22).
  - b. Lubricate adjuster plug (22) and bearing (23) with hydraulic fluid.
  - c. Using adjuster plug bearing remover/installer, install bearing (23) 0.625 in. (15.88 mm) deep in adjuster plug (22).

**NOTE**

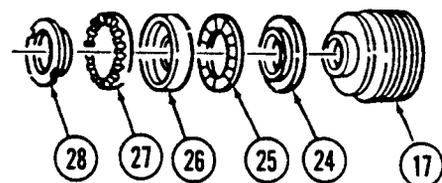
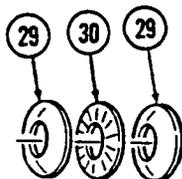
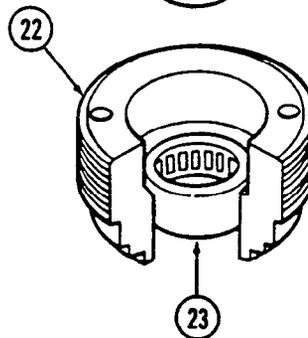
Outer edge of bearing is marked with identification number.

7. Inspect bearing retainer (24), thrust bearing spacer (25), small race (26), upper thrust bearing (27), and large race (28) for damage (TM 9-214). Replace all items if one item is damaged.
8. Inspect lower thrust bearing (30) and two races (29) for damage (TM 9-214). Replace all items if any one is damaged.

31-3. STEERING GEAR REPAIR (Cont'd)



ADJUSTER PLUG BEARING  
REMOVER/INSTALLER



**31-3. STEERING GEAR REPAIR (Cont'd)**

**g. Assembly**

**NOTE**

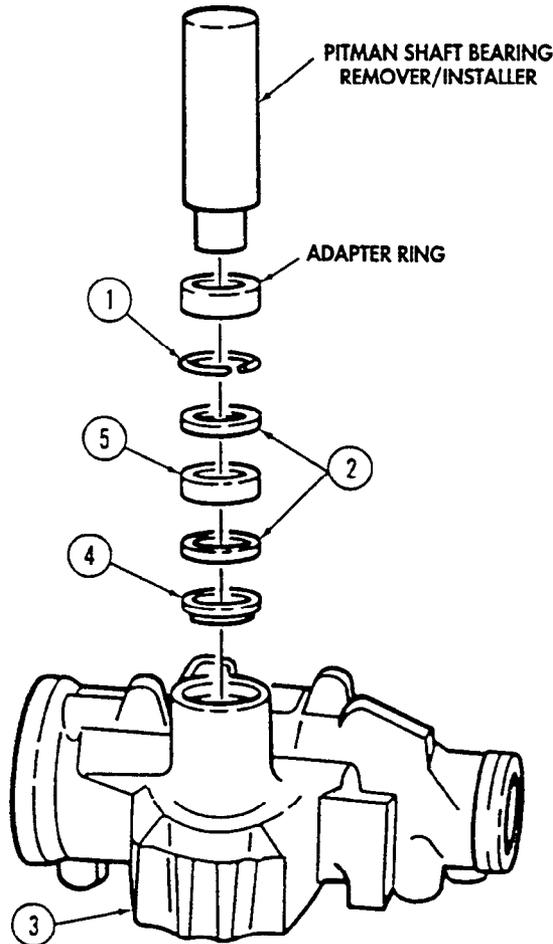
For general assembly instructions, refer to para. 2-17.

1. Using pitman shaft bearing remover/installer and adapter ring, install single-lip seal (4) and washer (2) in housing (3) only far enough to provide clearance for next seal (5) and washer (2).
2. Using pitman shaft bearing remover/installer and adapter ring, install double-lip seal (5) and washer (2) in housing (3) only far enough to provide clearance for retaining ring (1).
3. Install retaining ring (1) in housing (3).

**NOTE**

Soak Teflon ring in warm water to ease assembly.

4. Install O-ring seal (7) and Teflon ring (6) on rack piston (8).
5. Install worm shaft (9) in rack piston (8).
6. Align lower ball return guide hole (10) with worm shaft groove.
7. Alternately install eight black and eight chrome bearing balls (11) into lower guide hole (10) while rotating worm shaft (9) counterclockwise.

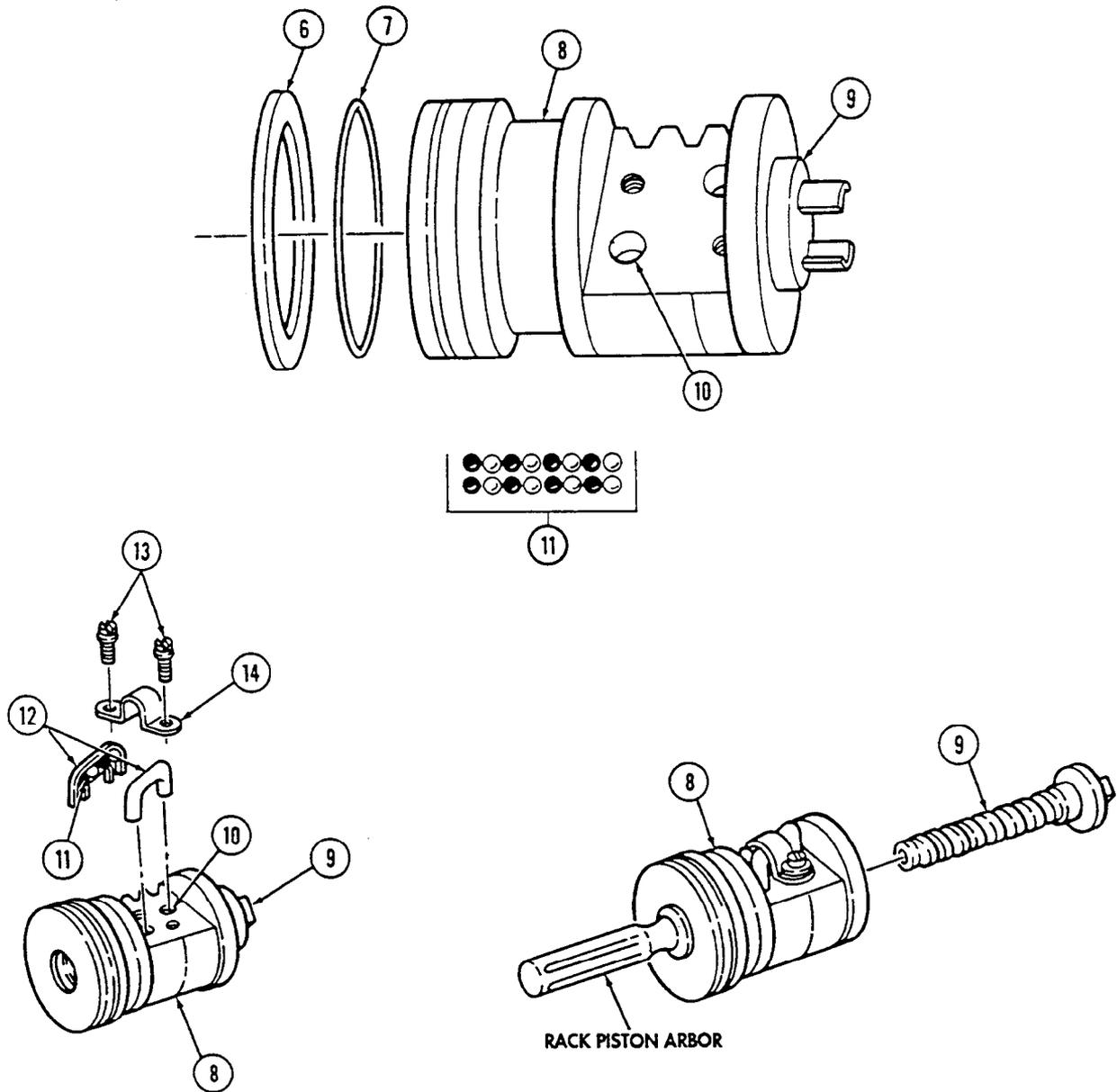


**31-3. STEERING GEAR REPAIR (Cont'd)**

**NOTE**

Keep bearing balls in alternating sequence when installing guide in rack piston. Ensure a total of 24 bearing balls are used.

8. Install eight remaining bearing balls (11) in guide (12) half and retain with grease.
9. Assemble both guide (12) halves together and install guide (12) in guide holes (10).
10. Install clamp (14) over guide (12) with two screw-assembled washers (13). Tighten screw-assembled washers (13) to 4 lb-ft (5 N·m).
11. Rotate worm shaft (9) clockwise until flush with rack piston (8).
12. Install rack piston arbor into rack piston (8) and hold firmly against worm shaft (9). Remove worm shaft (9).



**31-3. STEERING GEAR REPAIR (Cont'd)**

**NOTE**

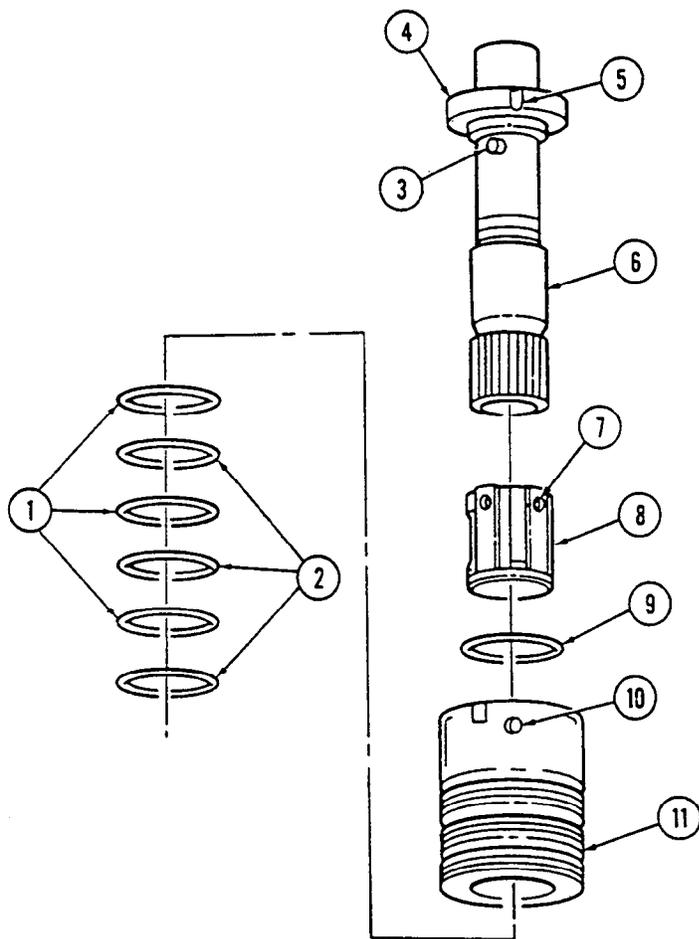
Soak Teflon rings in warm water to ease assembly.

- 13. Starting on inner seal ring groove, install O-ring seal (2) and a backup Teflon ring (1) on valve body (11).
- 14. Repeat step 13 in order from innermost seal ring groove and install two remaining O-rings (2) and Teflon rings (1) on valve body (11).

**NOTE**

Rotate valve spool to install in valve.

- 15. Install O-ring (9) on valve (8) and install valve (8) into valve body (11) until flush with notched end of valve body (11).
- 16. Install stub shaft (6) in valve (8) so pin (3) on stub shaft (6) engages hole (7) in valve (8).
- 17. Align notch (5) in stub shaft cap (4) with pin (10) in valve body (11) and press stub shaft (6) and valve (8) into valve body (11).



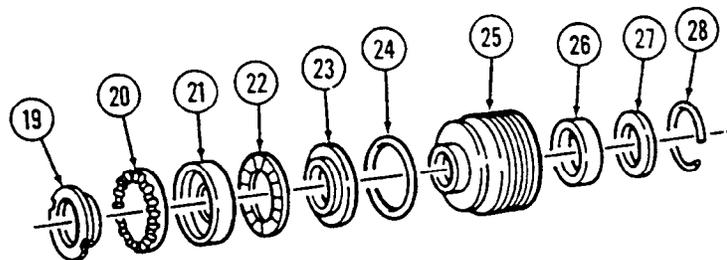
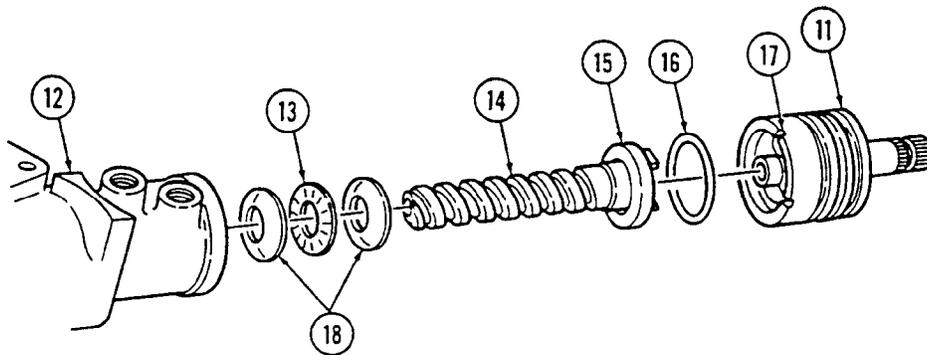
### 31-3. STEERING GEAR REPAIR (Cont'd)

18. Install O-ring (16) in valve body (11).
19. Insert worm shaft (14) into valve body (11).
20. Engage locating pin (15) on worm shaft (14) with slot (17) in valve body (11).

#### NOTE

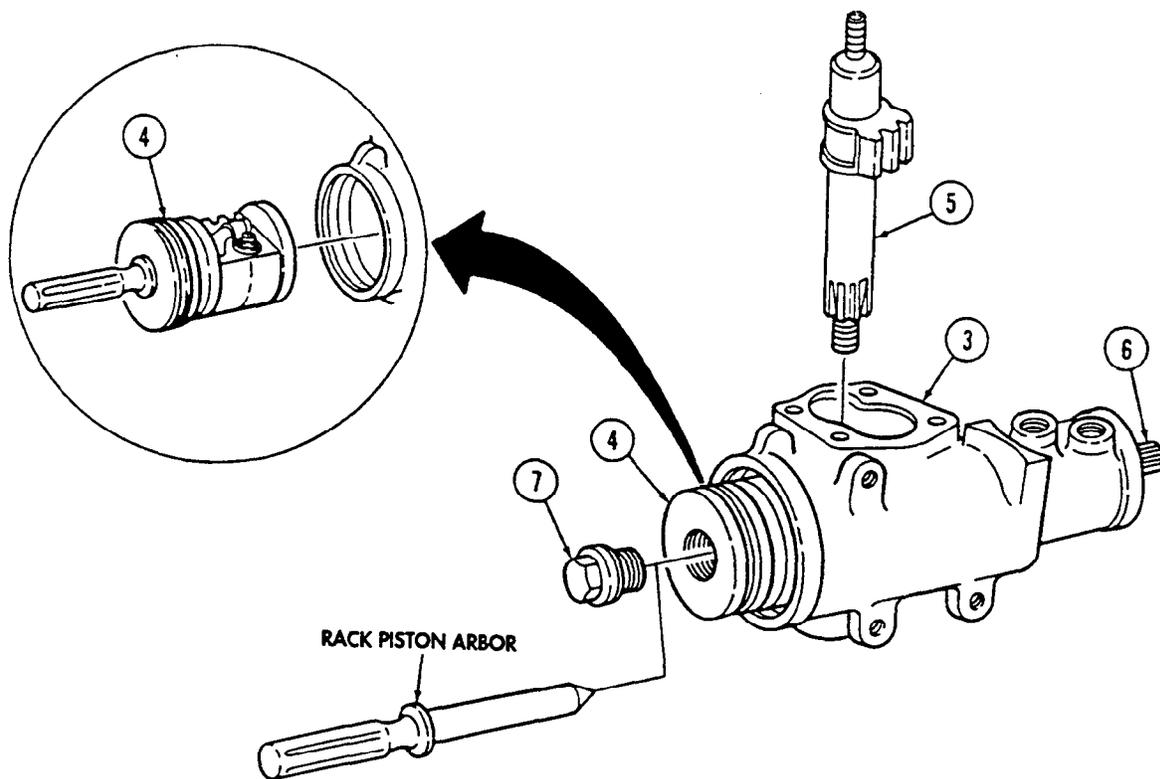
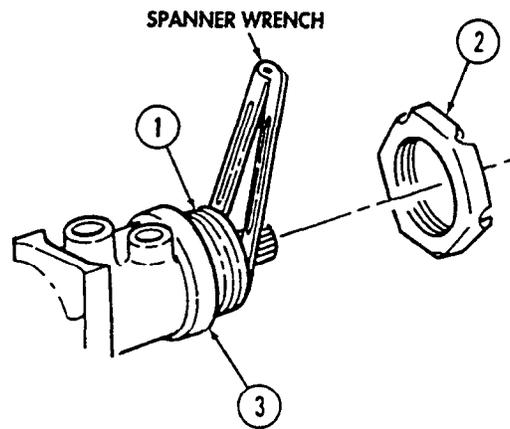
Coned surface of races face toward housing.

21. Install lower thrust bearing race (18), lower thrust bearing (13), and lower thrust bearing race (18) on worm shaft (14).
22. Install assembled valve body (11) and worm shaft (14) into housing (12).
23. Install O-ring seal (24), large upper bearing race (23), upper thrust bearing (22), small upper bearing race (21), thrust bearing spacer (20), and bearing retainer (19) on adjuster plug (25). Press retainer (19) onto adjuster plug (25) with a brass drift.
24. Install stub shaft oil seal (26) in adjuster plug (25). Install far enough to provide clearance for dust seal (27) and retaining ring (28).
25. Install stub shaft dust seal (27) and retaining ring (28) in adjuster plug (25).



### 31-3. STEERING GEAR REPAIR (Cont'd)

26. Using spanner wrench, install adjuster plug (1) in housing (3). Do not tighten.
27. Install locknut (2) over adjuster plug (1). Do not tighten.
28. Install rack piston (4) and rack piston arbor into gear housing (3). Ensure gear teeth on rack piston (4) align with gear teeth on pitman shaft (5).
29. Hold rack piston arbor tightly against rack piston (4) while turning stub shaft (6) clockwise. Remove rack piston arbor.
30. Install rack piston plug (7) into rack piston (4). Do not tighten.
31. Center rack piston (4) and install pitman shaft (5) in housing (3).
32. Tighten rack piston plug (7) to 75 lb-ft (102 N·m).



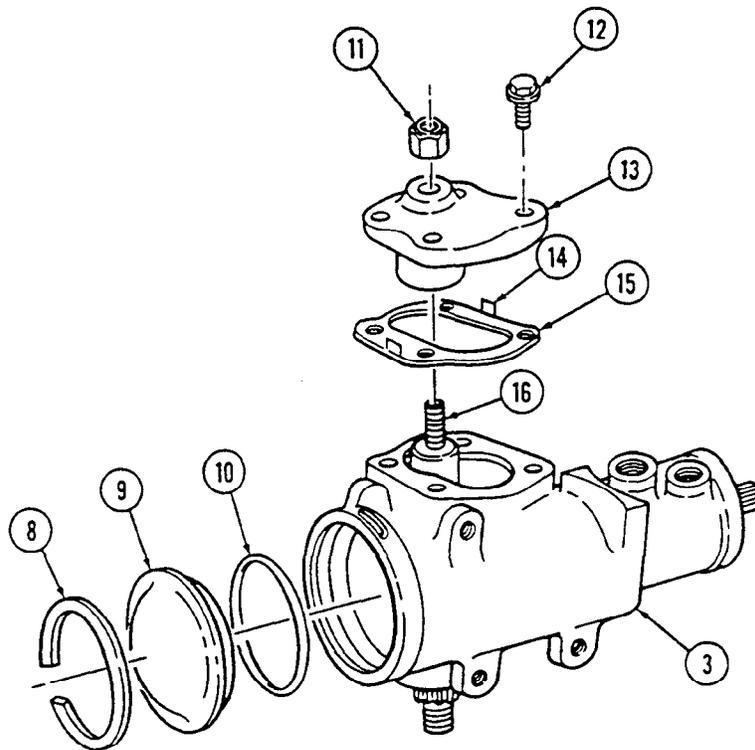
**31-3. STEERING GEAR REPAIR (Cont'd)**

33. Install housing end plug O-ring seal (10) and housing end plug (9) in housing (3).

**NOTE**

Opening in retaining ring should be located approximately 1 in. (25 mm) from access hole.

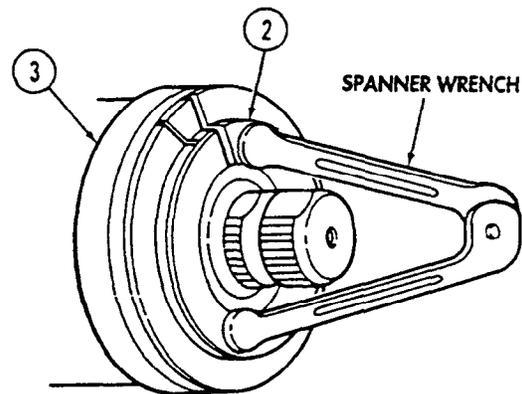
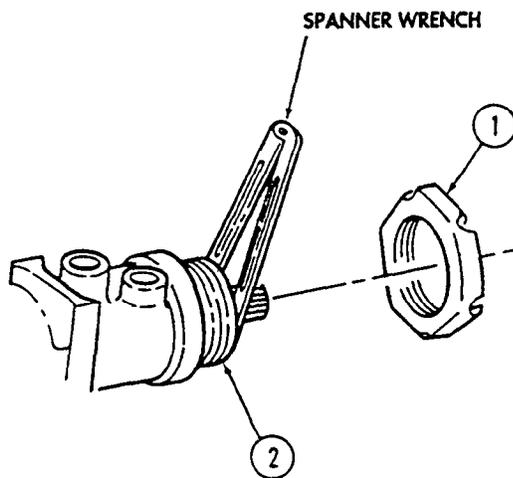
34. Install retaining ring (8) in housing (3).  
35. Install side cover gasket (15) on side cover (13) by bending tabs (14) around side cover (13) edge.  
36. Install side cover (13) onto adjuster screw (16).  
37. Install four capscrews (12) on side cover (13). Tighten capscrews (12) to 40 lb-ft (54 N·m).  
38. Install lash adjuster nut (11) on pitman shaft adjuster screw (16).



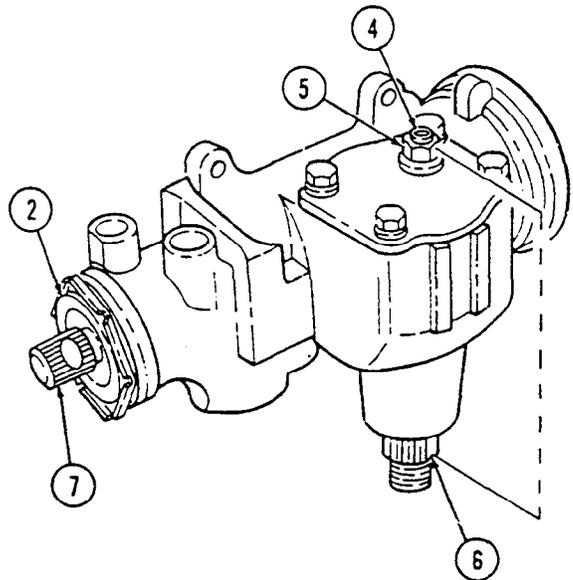
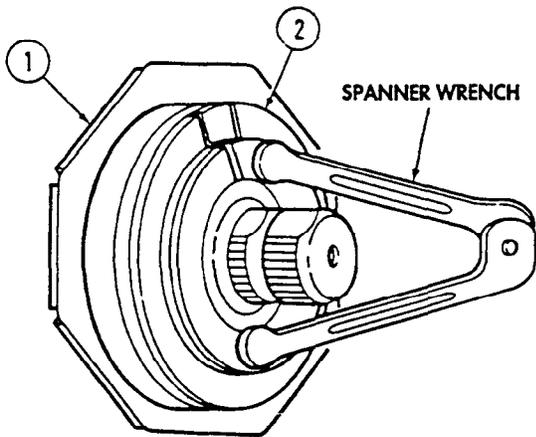
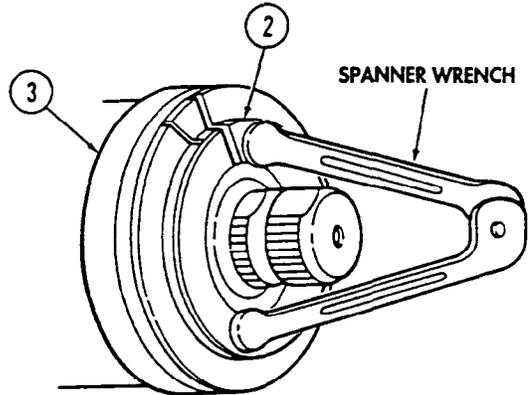
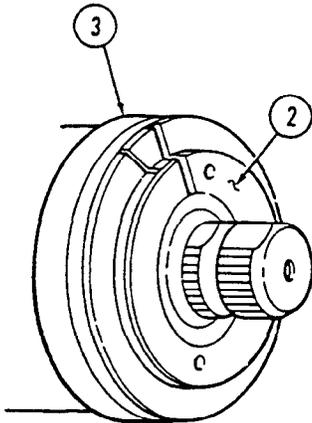
### 31-3. STEERING GEAR REPAIR (Cont'd)

#### h. Adjustment

1. For worm shaft bearing preload adjustment, remove locknut (1).
2. Using spanner wrench, tighten adjuster plug (2) clockwise until thrust bearing is firmly bottomed.
3. Match mark housing (3) and adjuster plug (2) face.
4. Measure back counterclockwise 0.5 in. (13 mm) and place second mark on housing (3).
5. Turn adjuster plug (2) counterclockwise until mark on face of adjuster plug (2) aligns with second mark on housing (3).
6. Install locknut (1) on adjuster plug (2).
7. Hold adjuster plug (2) using spanner wrench and tighten locknut (1).
8. Turn stub shaft (7) clockwise to stop, then back one-quarter turn.
9. Check torque required to turn stub shaft (7). Reading should be 4-10 lb-in. (0.5-1 N·m).
10. If reading is not correct, turn adjuster plug (2) in or out and repeat steps 7 through 9 until torque required to turn stub shaft (7) is 4-10 lb-in. (0.5-1 N·m).
11. For pitman shaft-over-center adjustment, loosen adjuster screw locknut (5).
12. Turn adjuster screw (4) counterclockwise until fully extended, then turn clockwise one full turn.
13. Rotate stub shaft (7) from stop to stop and count number of turns.
14. Back off stub shaft (7) one-half number of turns counted.
15. With gear centered, flat on stub shaft (7) will face upward and block tooth (6) should be in line with adjuster screw (4).
16. With gear at center of travel, check torque to turn stub shaft (7).
17. Turn adjuster screw (4) clockwise until torque to turn stub shaft (7) is 6-10 lb-in. (0.7-1 N·m) more than the reading obtained in step 16.
18. Hold adjuster screw (4) and tighten locknut (5) to 20 lb-ft (27 N·m).



31-3. STEERING GEAR REPAIR (Cont'd)



- FOLLOW-ON TASKS:
- Perform leak test (para. 23-4).
  - Install steering gear (para. 8-20).

