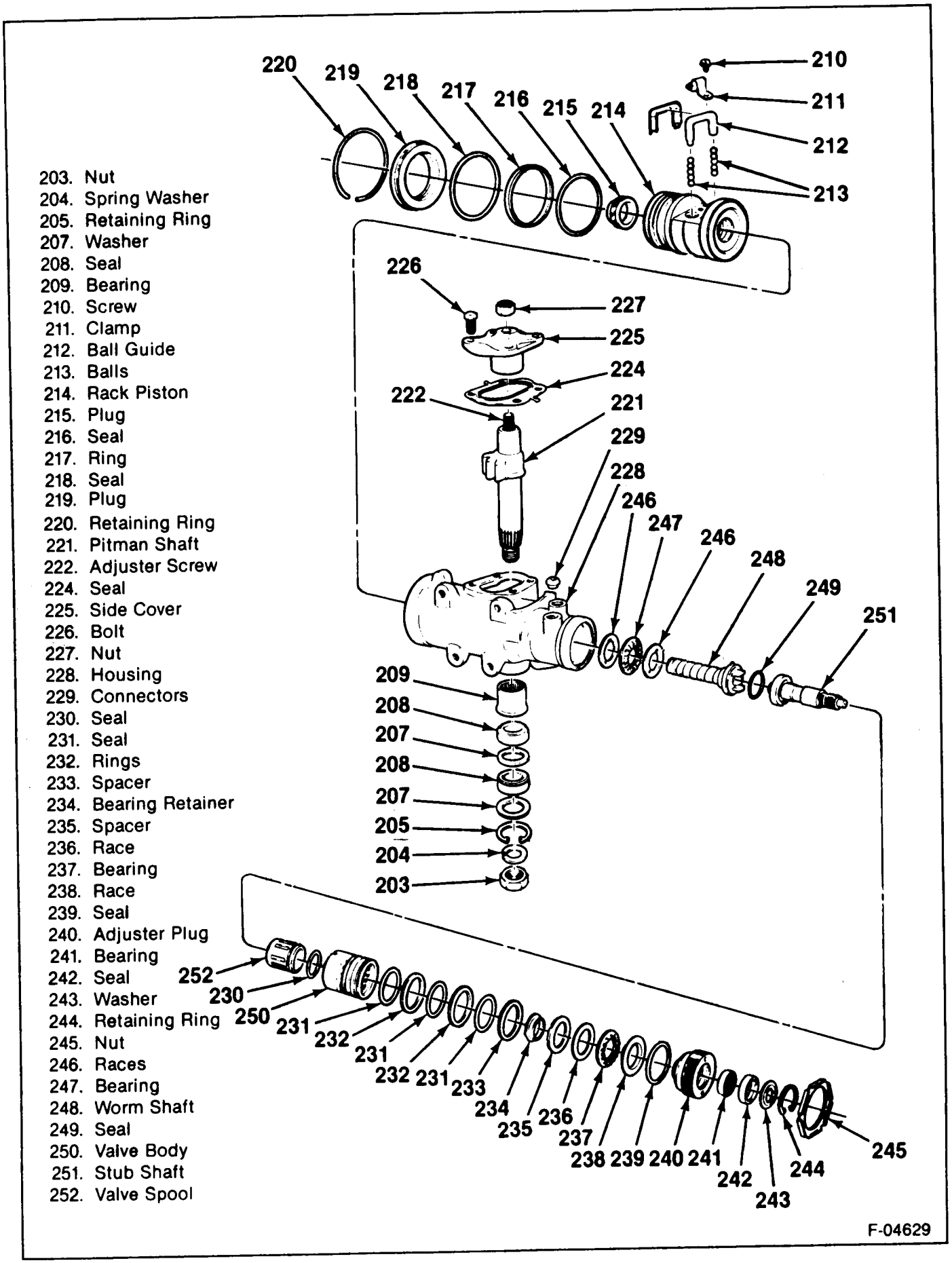


Figure 1—Integral Steering Gear Components — RV, G, P, ST and M Vehicles

union, flow control valve, and spring. The flow control orifice is part of the pressure line union. The pressure relief valve inside the flow control valve limits the pump pressure.

SAGINAW INTEGRAL POWER STEERING GEAR—RV, G, P, ST, M

NOTICE: Repair the steering gear in a clean, dust-free location, using clean tools and equipment. Dirt or grit will damage the machined surfaces and result in leakage or damage to the steering gear assembly.

If broken components or foreign materials are found during disassembly of the gear the hydraulic system should be disassembled, inspected, cleaned and flushed before servicing is complete.

The ball nut and control rings (seals) generally need not be replaced unless cut or damaged. If cut or damaged, inspect all mating parts for burrs, cracks, scratches, or damage. Replace or repair as needed.

In some instances, "power steering fluid" will be specified to lubricate parts upon assembly. In these cases, GM Power Steering Fluid, part no. 1050017 or equivalent should be used. DO NOT use brake fluid, automatic transmission fluid, or other non-approved fluids.

DISASSEMBLY

Remove or Disconnect (Figures 2 through 12)

Tools Required:
- J-4245 Internal Snap Ring Pliers
- J-21552 Ball Retainer Tool
- J-8524-1 Bearing Remover
- J-7624 Spanner Wrench
- J-7079-2 Driver
- J-6278 Pitman Shfaft Bearing Puller
- J-21552 Rack Piston Arbor

1. Retaining Ring (220) (figure 2).
   - Pry retaining ring out of the housing groove with a screwdriver (figure 3).
2. Plug (219). Turn stud shaft (251) to the left only until the plug is forced out of the cylinder.
3. Seal (218).
4. Plug (215) from the rack piston (214) (figure 4).
5. Nut (227), bolt (226), side cover (225) and gasket (224). Turn adjuster screw (222) to the right until the side cover separates from the pitman shaft (221).

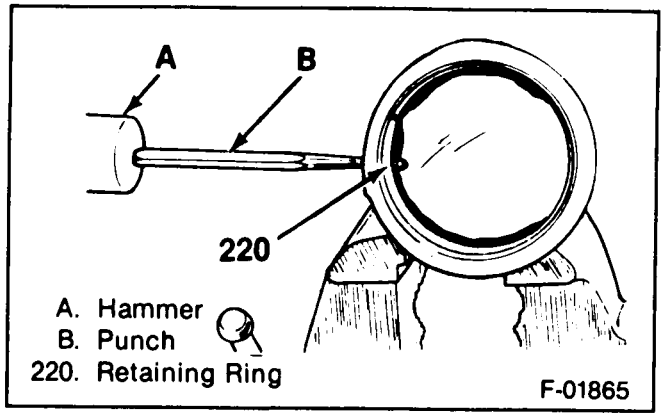


Figure 2—Unseating the Retaining Ring

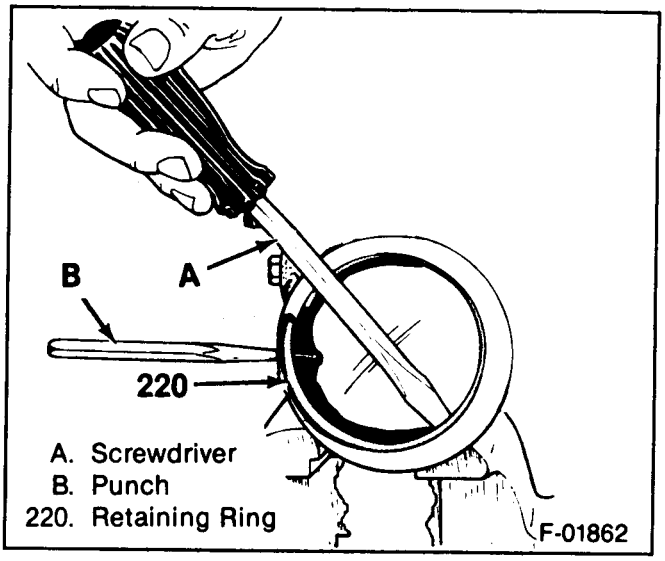


Figure 3—Removing the Retaining Ring

6. Pitman shaft (221). Turn the stub shaft (251) to the left until the pitman shaft teeth (221) and rack piston (214) disengage.
7. Retaining ring (205) with J-4245.
8. Washers (207) and seals (208) using a screwdriver.

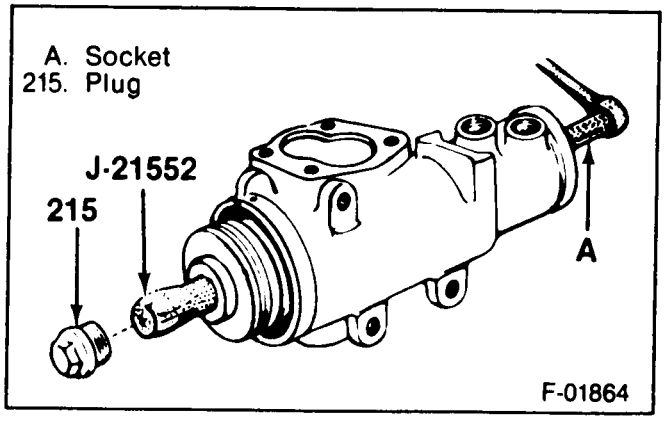


Figure 4—Removing the Plug and Piston Rack

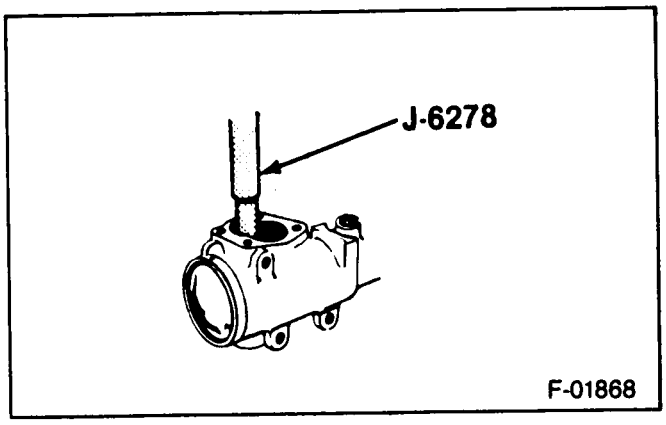


Figure 5—Removing the Pitman Shaft Bearing

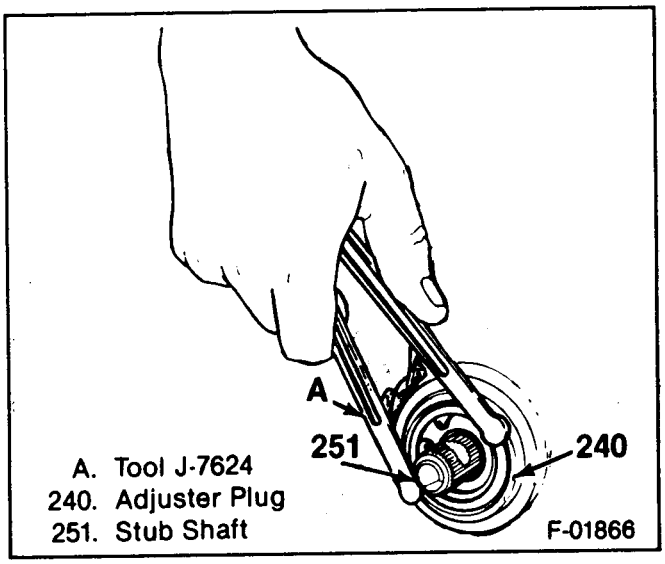


Figure 6—Removing the Adjuster Plug

9. Bearing (209). If necessary, use tool J-6278 (figure 5).
10. Rack piston (214) and balls (213).
    - Insert tool J-21552 into the rack piston bore with the pilot of the tool seated into the end of the worm (248).

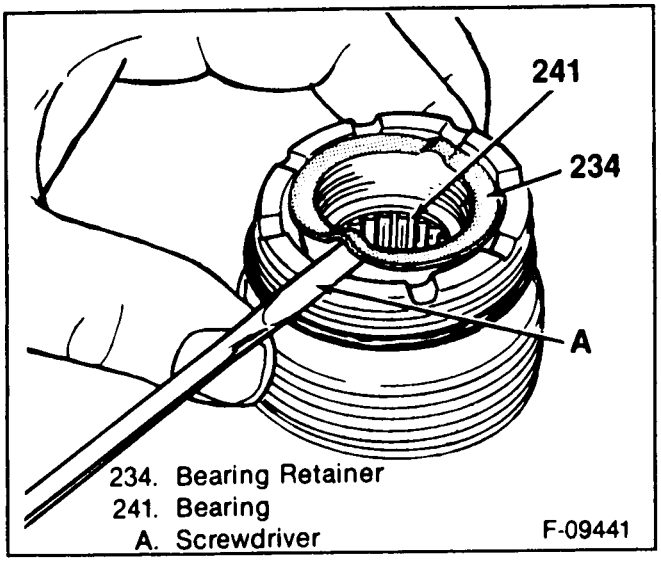


Figure 7—Removing the Bearing Retainer

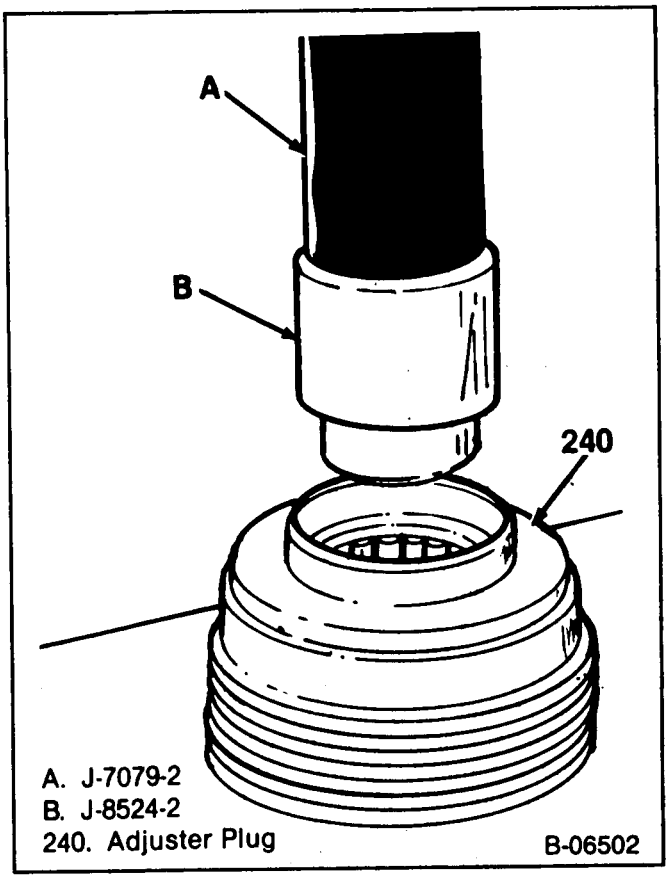


Figure 8—Removing the Needle Bearing

- Hold the tool against the worm and turn the stub shaft to the left. The rack piston (214) will be forced onto the tool.
- Hold the tool and pull the rack piston toward the handle until it is against the flange on the tool. This will prevent the end circuit balls from falling out.

11. Adjuster nut (245).
12. Adjuster plug (240) using J-7624 (figure 6).
    - Retaining ring (244) using J-4245.
    - Washer (243), seal (242) and bearing (241).
    - Bearing retainer (234). Pry the retainer with a screwdriver at the raised area (figure 7).
    - Seal (239) and needle bearing (241). Use J-8524-1 and J-7079-2 (figure 8).

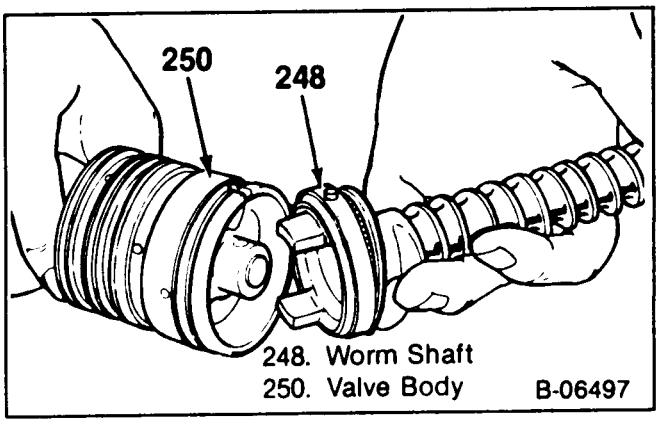


Figure 9—Separating the Wormshaft from the Valve Assembly

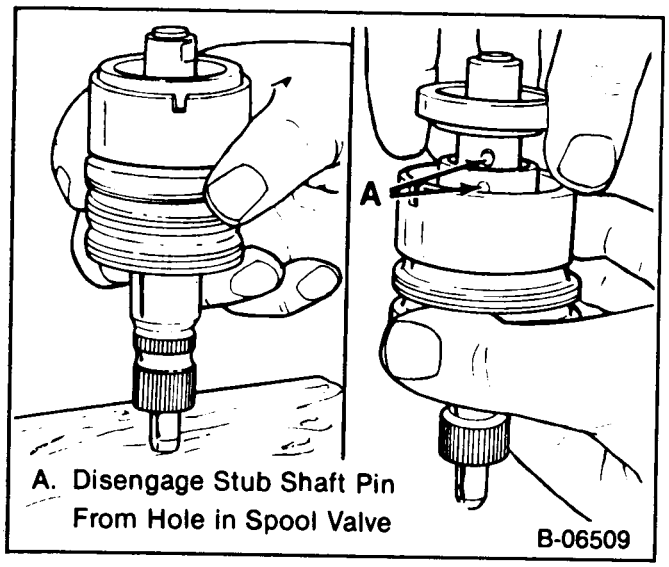


Figure 10—Removing or Installing the Stub Shaft Assembly

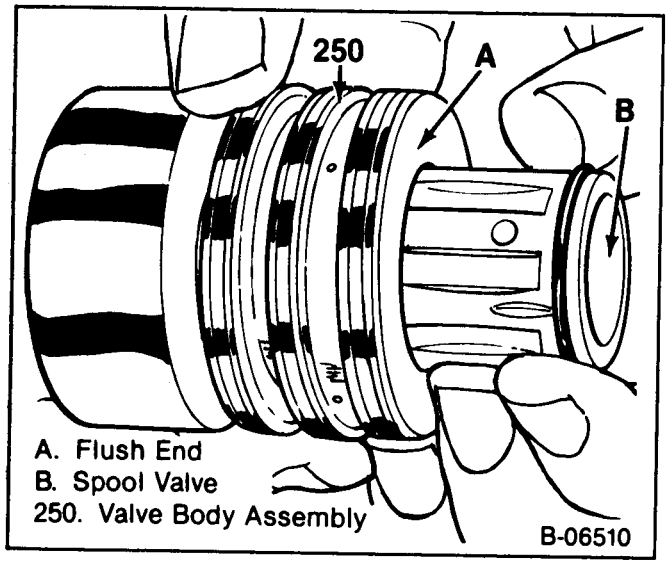


Figure 11—Remove or Install Valve Spool

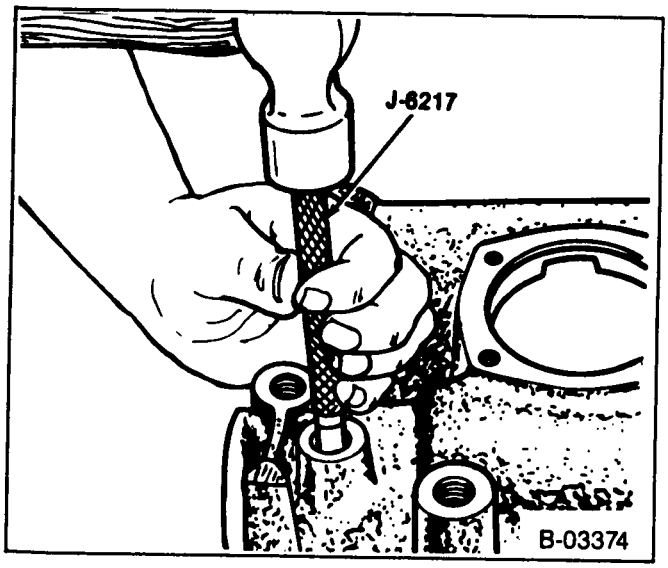


Figure 12—Remove or Install the Connector Seat

13. Valve (250) and wormshaft (248) as an assembly, with both races (246) and bearing (247).
    - Wormshaft (248) from valve assembly (figure 9).
    - Races (246) and bearing (247) from the wormshaft (248).
    - Seal (249).
14. Stub shaft (251) from valve body (250) (figure 10).
    - Hold the assembly and lightly tap the stub shaft against the bench until the shaft cap is free from the valve body.
    - Pull the shaft assembly until the shaft cap clears the valve body by about 6 mm (1/4-inch).
    - Valve spool (252) and seals (230) and (231) (figure 11).
15. Screws (210), clamp (211) and ball guide (212).
    - Balls (213).

Important

- The following procedure should not be performed with the valve assembly in the gear housing.

16. Connectors (229) (figure 12).

CLEANING AND INSPECTION

Clean

- All parts with solvent and blow dry.

Inspect (Figure 1)

1. Pitman shaft and side cover.
   - — Bearing. Needles should rotate freely using finger pressure. Replace the bearing and side cover (225) if necessary.
   - — Bearing surfaces in the side cover (225) for scoring. Replace the side cover assembly if necessary.
   - — Sealing and bearing surfaces of the pitman shaft (221) for roughness, nicks, or other damage. Replace the pitman shaft assembly if necessary.
   - — Pitman shaft (221) for excessive wear or scoring. Check the sector gear teeth for wear. Replace the pitman shaft assembly if necessary.
   - — Adjuster screw (222) threads for wear. The adjuster screw must be free to turn with no end play.
2. Rack piston.
   - — Worm (248) and rack piston (214) grooves and all balls (213) for scoring. BOTH MUST BE REPLACED as a matched assembly.
   - — Seal (216) and ring (217) for wear.
   - — Ball return guide halves (212) for cracks and damaged.
   - — Bearing (247) and races (246) for scoring and excessive wear.
   - — Rack piston (214) teeth and external ground surfaces for scoring or excessive wear. If either condition exists, replace the rack piston (214) and worm (248).
3. Adjuster plug.

— Spacer (235) for wear or cracks.
— Races (236, 238) for wear or scoring.
— Adjuster plug (240) threads for wear.
— Bearing (237) for wear or scoring.
— Needle bearing (241) for wear, pitting or scoring. Replace if necessary.

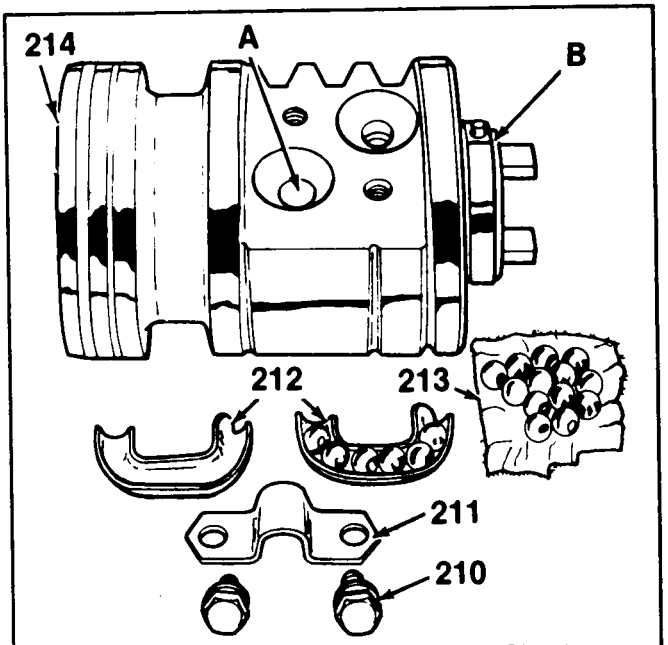
4. Valve and stub shaft.
   — Seals (231) and rings (232).
   — Shaft pin for wear or cracks. If excessively worn or broken, replace the complete valve and shaft assembly.
   — Ground surface of the stub shaft (251). If a crocus cloth cannot clean the nicks or burrs, replace the entire valve assembly.
   — Outside diameter of the valve spool and inside diameter of the valve body (250). If a crocus cloth cannot clean the nicks or burrs, replace the entire shaft and valve assembly.
   — The small notch in the skirt of the valve for wear. If worn replace the complete valve assembly.
   — Valve spool inside the valve body (250). The valve spool, when lubricated with steering fluid, must rotate freely without binding. If binding occurs, replace the complete valve and shaft assembly.
5. Steering gear hose connectors.
   — Brass inverted flare connectors (229) for looseness.

ASSEMBLY

Install or Connect (Figures 1, 4, and 10 through 15)

Tools Required:
J-4245 Snap Ring Pliers
J-6217 Valve Connector
J-21552 Ball Retainer
J-22407 Bearing Installer
J-8092 Bearing Driver
J-7079 Bearing Remover and Installer
J-8524-1 Driver
J-7624 Bearing Preload Spanner Wrench

1. Connectors (229), using J-6217 (figure 12).
2. Balls (213), alternately by color, in the rack piston (214) (figure 13). Use J-21552 in the rack piston.
   • Lubricate the 24 balls with power steering fluid.
3. Balls (213), alternating by color, in the ball guide (212 (figure 14).
   • Retain the balls in the guide with petroleum jelly.
4. Ball guide (212), clamp (211) and screws (210) to the rack piston (214).
5. Stub shaft (251) into the valve body (250) (figure 10).
   • Lubricate the stub shaft (251) with power steering fluid.
6. Valve spool (252) and seals (230, 231) into the valve body (250).
   • Lubricate the valve spool (252) and seals (230, 231) with power steering fluid before assembling.



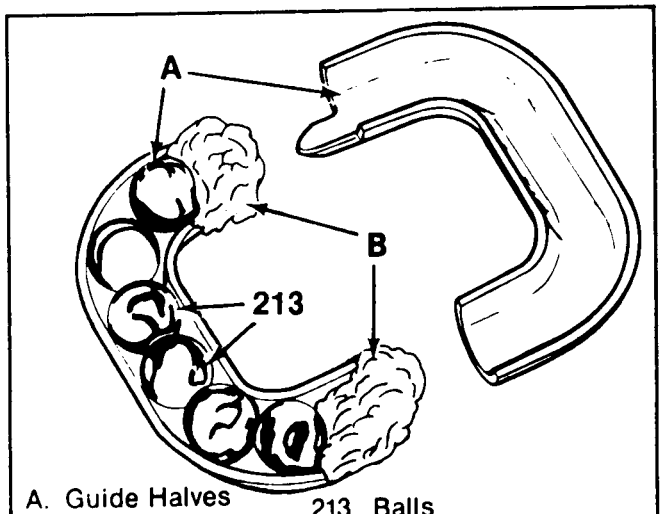
A. Install Balls In This Hole While Slowly Rotating Worm Counterclockwise
B. Worm Flange
210. Screw
211. Clamp
212. Ball Guides
213. Balls
214. Rack Piston
B-06517

Figure 13—Installing the Balls into the Rack Piston

7. Valve body (250), seal (249), wormshaft (248), bearing races (246) and roller bearing (247).
8. Seal (239) on the adjuster plug (240).
9. Needle bearing (241) in the adjuster plug. Use J-8524-1 and J-7079-2 (figure 15).
10. Seal (242), washer (243), and retaining ring (244) in the adjuster plug (240).

Important

• The retainer projections must not extend beyond the



A. Guide Halves
B. Petroleum Jelly
213. Balls
B-06518

Figure 14—Retaining the Balls in the Ball Guide

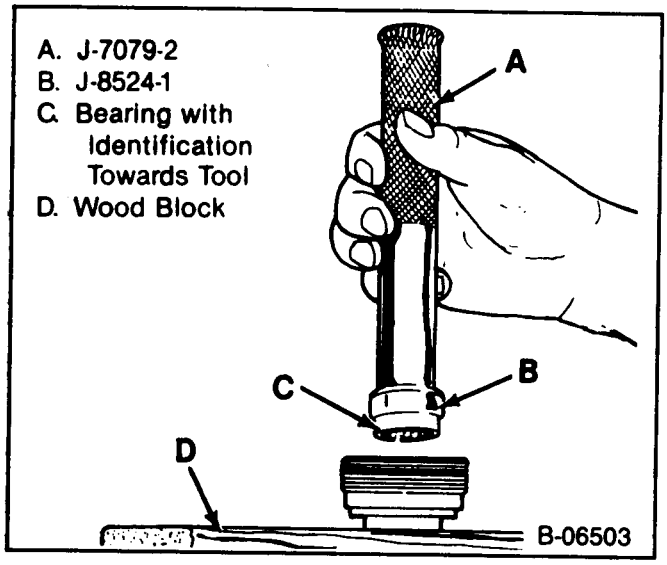


Figure 15—Installing the Needle Bearing

washer (243) when the retainer ring (244) is seated. The washer must be free to rotate.

11. Wormshaft, valve assembly into the steering gear housing.
12. Adjuster plug (240) into the steering gear housing. Use spanner wrench J-7624.

Adjust (Figures 16 through 23)

Tools Required:
J-7624 Spanner Wrench
J-7754-01 Torque Wrench

1. Bearing preload:
   - Use tool J-7624. Turn the adjuster plug (240) to the left until the plug and bearing (237) are firmly bottomed – about 27 N·m (20 ft. lbs.) (figure 16).
   - Mark the housing in line with one of the holes in the adjuster plug (figure 17).
   - Measure back (to the left) 13 mm (½-inch) and re-mark the housing (figure 18).

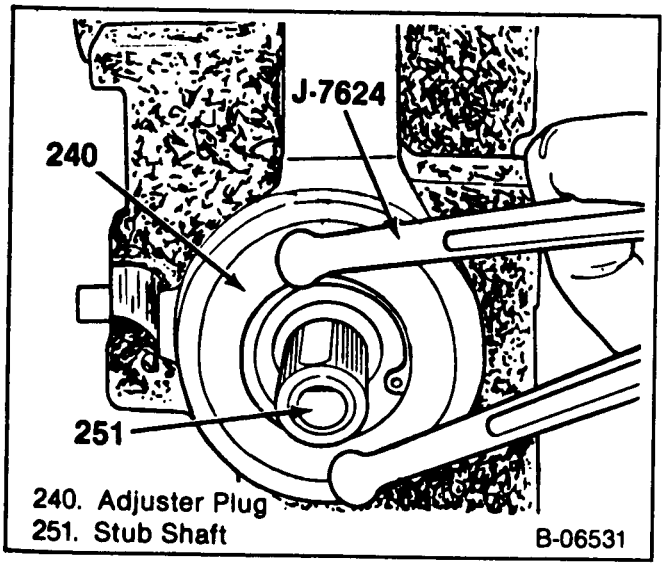


Figure 16—Bottoming the Adjuster Plug

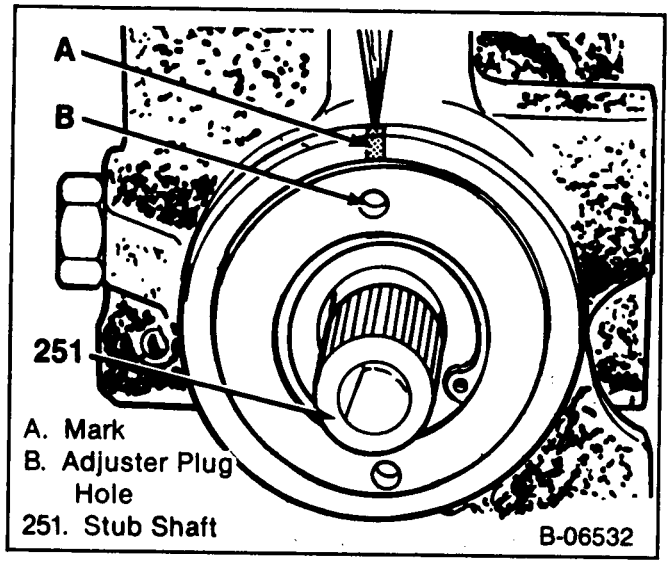


Figure 17—Marking the Housing

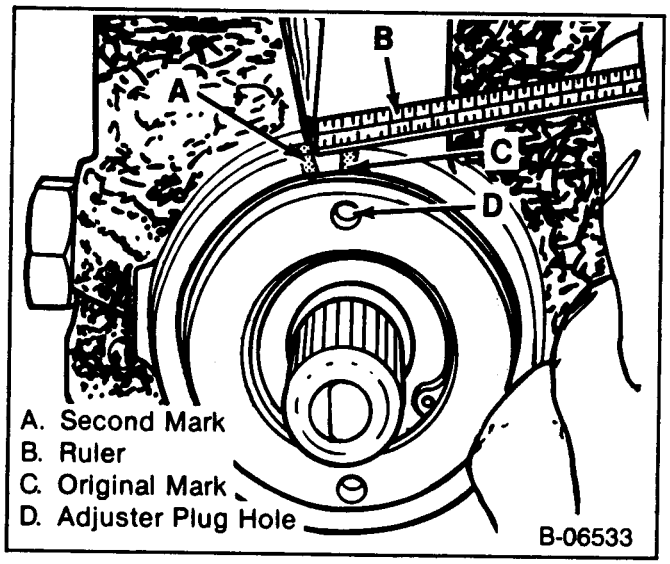


Figure 18—Remarking the Housing

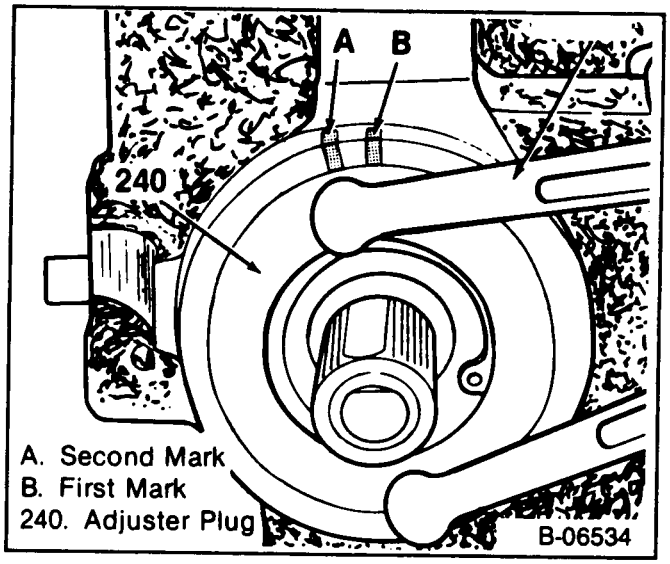


Figure 19—Aligning the Adjuster Hole with the Secount Mark

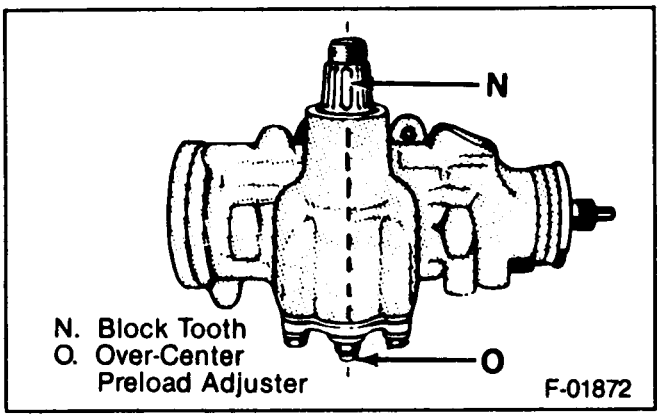


Figure 20—Pitman Shaft "Over-Center" Sector Adjustment

- Rotate the adjuster to the left until the hole in the adjuster is in line with the second mark (figure 19).

NOTICE: See "Notice" on page 3B-1 of this manual.

- Install the adjuster nut (245) and torque the nut to 108 N·m (80 ft. lbs.). Hold the adjuster plug to maintain alignment of the hole with the mark.
- Check the turning torque of the stub shaft, using J-7754-01 and a 12-point socket. The reading should be taken with the beam of the wrench near vertical while turning the wrench to the left at an even rate (figure 20). If the reading is less than 0.45 N·m (4 in. lbs.) or more than 1.15 N·m (10 in. lbs.), repeat the adjustment procedure.
- Lubricate the stub shaft (251) area outside the dust seal (206) with chassis lubricant or an all purpose grease.

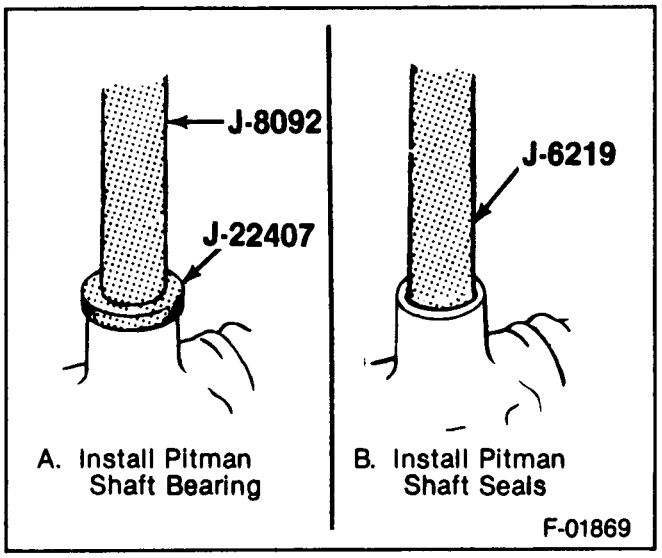


Figure 21—Installing the Pitman Shaft Bearing and Seals

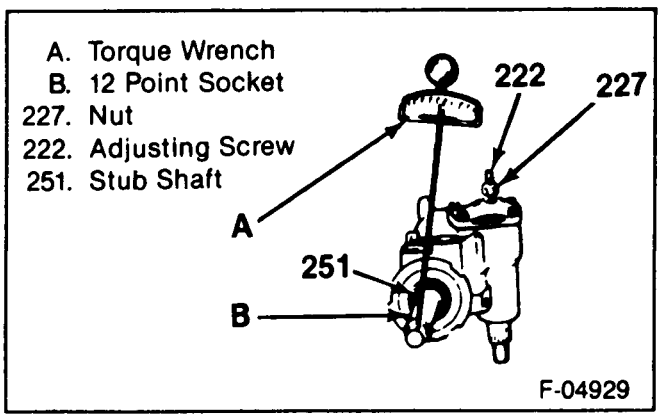


Figure 22—Aligning the Over-Center Preload

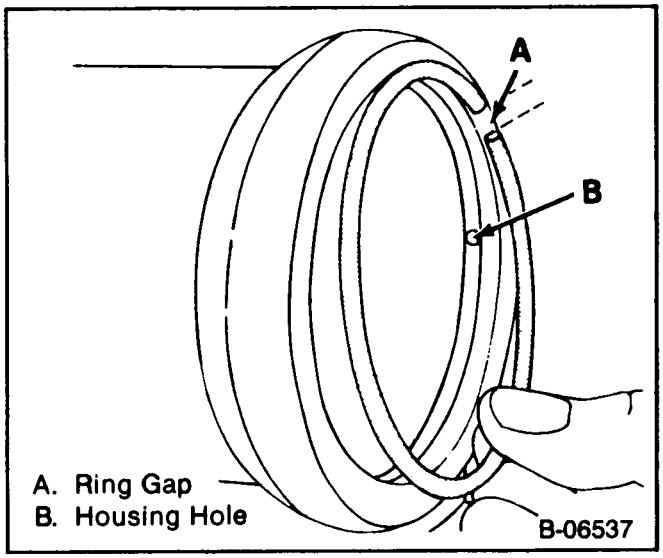


Figure 23—Installing the Retaining Ring

2. Rack piston (214) using J-21552 (figure 4).
3. Bearing (209) using J-22407 and J-8092.
4. Washers (207) and seals (208) using J-6219 (figure 21).
5. Retaining ring (205).
6. Pitman shaft (221), gasket (224) and side cover (225).
7. Bolt (226) and nut (227).

Adjust (Figure 22)

Tool Required:
J-7754-01 Torque Wrench

- Pitman shaft preload (figure 22).

1. Attach tool J-7754-01 and a 12-point socket on the stub shaft splines.
2. Center the steering gear by turning the stub shaft (251) from right to left and counting the number of turns. Turn the shaft back halfway to the center position.
3. Check the combined ball and bearing preload by turning the torque wrench through the center of travel. Note the highest reading.
4. Tighten the adjusting screw (222) until the torque wrench reads 0.6 – 1.2 N·m (6–10 in. lbs.) higher than the reading noted in step "3."
   - The total reading should not exceed 2.25 N·m (20 in. lbs.) torque.