

SERVICE REPAIR

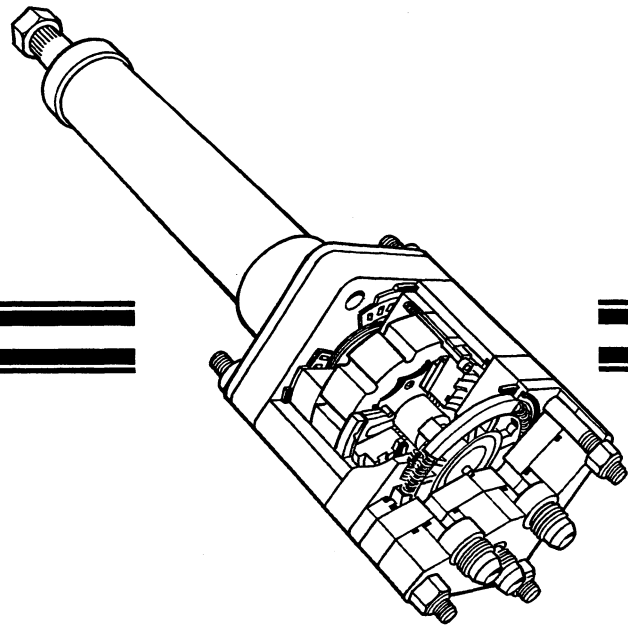
MANUAL

Hyster C098 (E70XL, E80XL, E100XL, E120XL, E100XLS) Electric Forklift

HYSTER

STEERING CONTROL UNIT

(ROSS HGF)



HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure that all slings, chains or cables are correctly fastened and that the load being lifted is balanced. Make sure that the crane, cables and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand. Use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See "How To Put The Lift Truck On Blocks" in the **OPERATING MANUAL** or the **PERIODIC MAINTENANCE** section.
- Keep the unit and working area clean and in order.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure that all nuts, bolts, snap rings and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE sign to the controls of the unit when making repairs or if the unit needs repairs.
- Make sure you follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), and Diesel are flammable fuels. Make sure that you follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area has ventilation.

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This section is for the following models:

S2.00-3.00XL (S40-60XL)(C187)
E1.25-1.75XL (E25-35XL)(C114)
E2.00-3.00XL (E40-60XL)(C108)
E3.50-5.50XL (E70-120XL, E70-120XL₃)(C098)
H1.50XM, H1.75XM, H2.00XMS
(S/H25XM, S/H30XM, S/H35XM, H/S40XMS)(C010)(D001)

**Thanks very much for your reading,
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manual**

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**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

STEERING CONTROL UNIT

GENERAL

This section has the description and operation for the HGF Hydraguide™ steering control unit made by Ross Gear. The disassembly and assembly procedure is for making repairs. A Troubleshooting chart is at the end of the section.

DESCRIPTION

The steering control unit has two sections: a fluid control valve and a fluid metering section. The two sections are connected hydraulically and mechanically inside of the housing.

Control Valve Section

The open center control valve is a rotating valve plate. The control valve controls the pressure and flow of the hydraulic oil to the steering cylinder. The valve plate is held in its center position by two sets of three coil springs. When the valve plate is in the center position, hydraulic oil flows from the hydraulic pump, through the steering control unit, and returns to the hydraulic tank. When the valve plate is moved from its center position by the steering wheel, a port is opened in the isolator manifold and hydraulic pressure is sent to the metering section.

Metering Section

WARNING

The use of the steering control unit as a pump for manual steering can damage the unit if the torque on the steering wheel is greater than 170 Nm (125 lbf ft). This damage will cause the complete loss of control of the steering system.

The metering section has the following three functions:

- measures the hydraulic oil to the steering cylinder
- keeps a constant ratio of steering wheel turns to the direction of the steered wheels
- operates as a pump for manual steering of the lift truck if hydraulic pressure is not available from the hydraulic pump

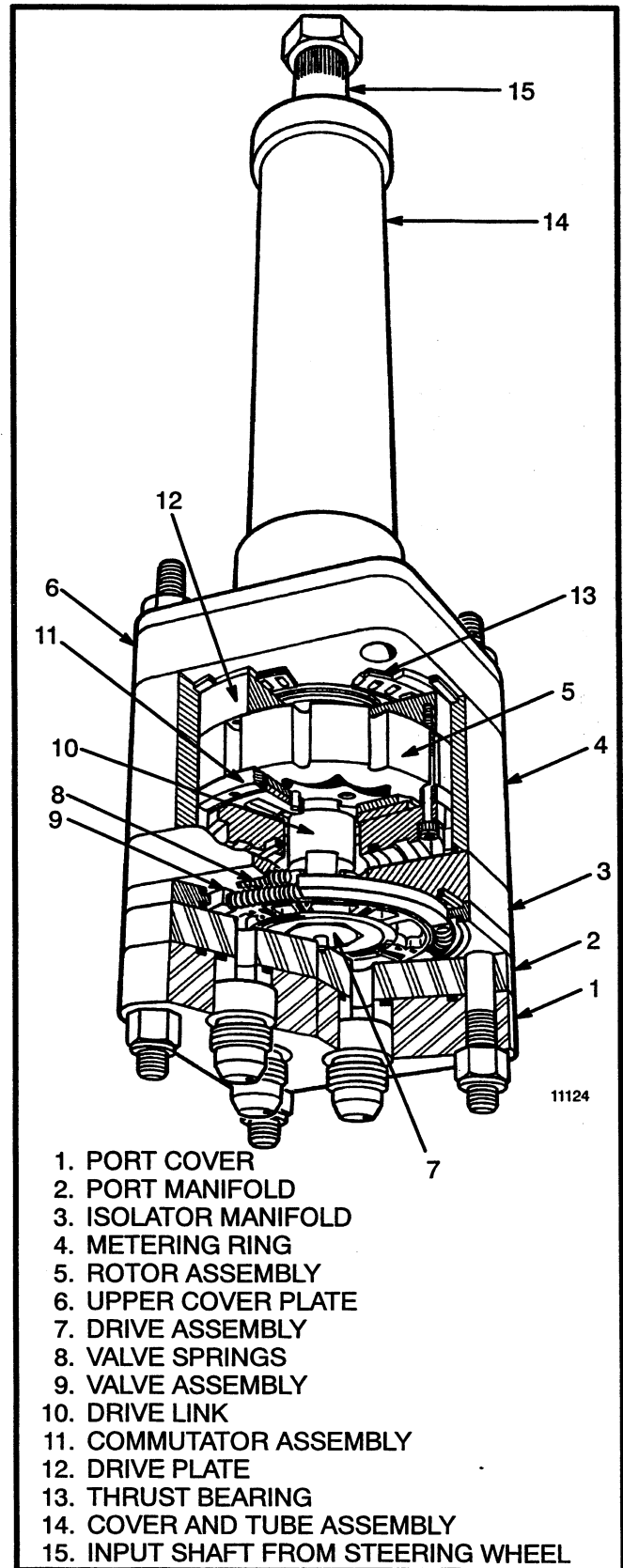
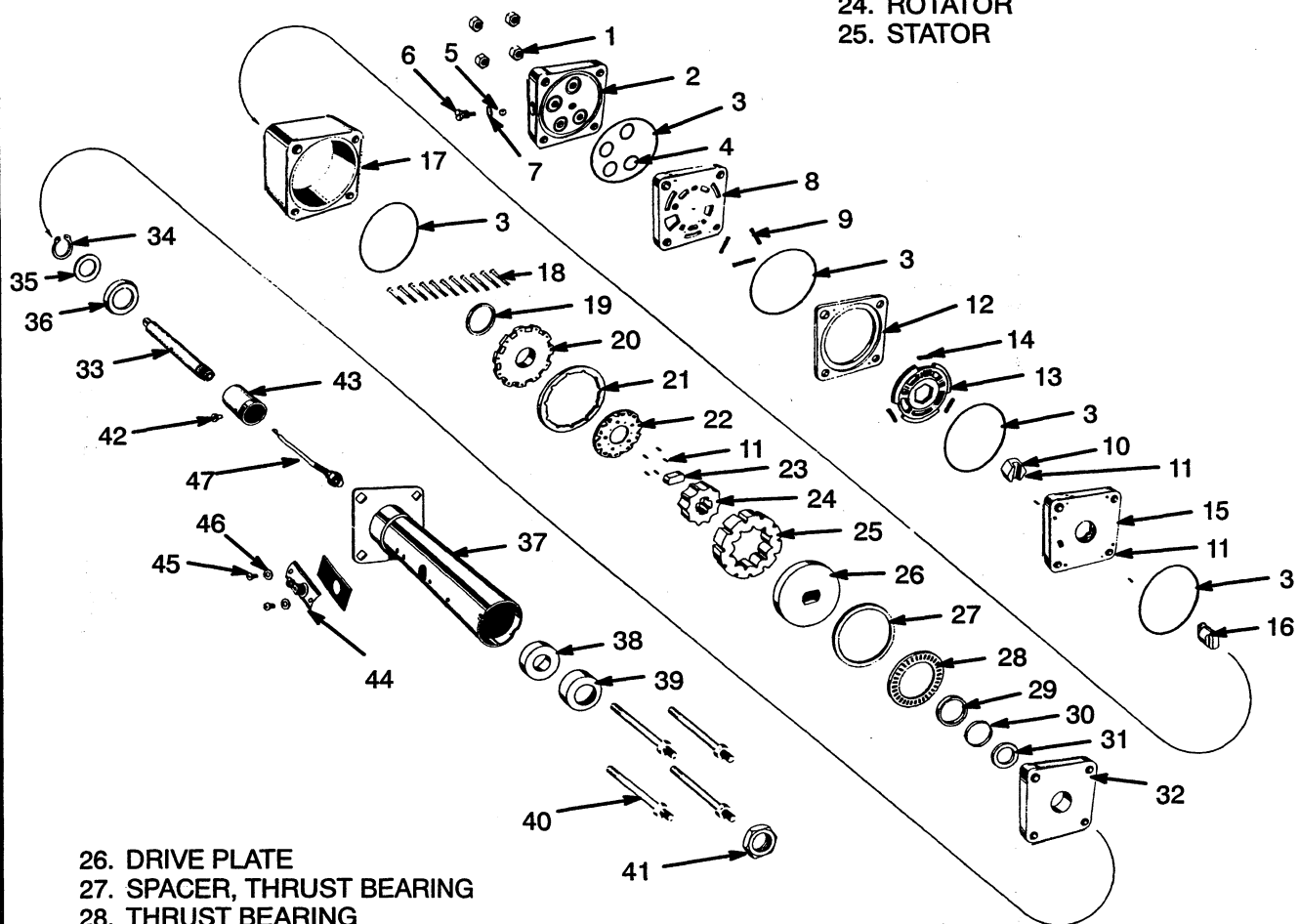


FIGURE 1. ROSS HGF STEERING CONTROL UNIT

1. NUT $\frac{5}{16} \times 24$ UNF (4)
2. PORT COVER
3. SEAL RING
4. O-RING (4)
5. BALL 6 mm ($\frac{7}{32}$ in)
6. PLUG
7. O-RING
8. PORT MANIFOLD
9. SPRING 19 mm (0.75 in)
10. DRIVE ASSEMBLY

11. ALIGNMENT PIN (9)
12. VALVE RING
13. VALVE PLATE
14. SPRING 13 mm (0.50 in)
15. ISOLATOR MANIFOLD
16. DRIVE LINK
17. METERING RING
18. CAPSCREW, SOCKET HEAD (11)
19. SEAL, COMMUTATOR
20. COMMUTATOR COVER
21. COMMUTATOR RING
22. COMMUTATOR
23. SPACER, LINK DRIVE
24. ROTATOR
25. STATOR

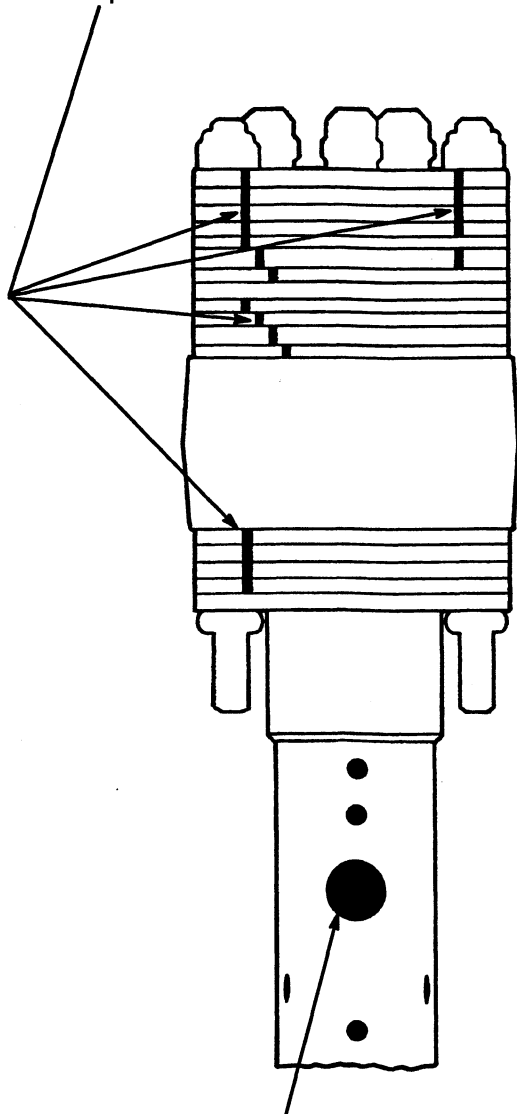


26. DRIVE PLATE
27. SPACER, THRUST BEARING
28. THRUST BEARING
29. FACE SEAL
30. BACK-UP RING
31. SEAL SPACER
32. UPPER COVER PLATE
33. INPUT SHAFT
34. RETAINER RING
35. WASHER, RETAINER PLATE
36. RETAINER PLATE
37. UPPER COVER AND JACKET TUBE
38. BUSHING
39. SEAL
40. SPECIAL BOLT $\frac{5}{16} \times 24$ UNF-2A (4)

41. NUT
42. SCREW
43. CONTACT RING ASSEMBLY
44. CONTACT BRUSH ASSEMBLY
45. SCREW AND LOCKWASHER
46. SPACER
47. HORN WIRE ASSEMBLY

FIGURE 2. PARTS FOR THE STEERING CONTROL UNIT

Components with alignment grooves must be assembled as shown in the illustration. The alignment grooves make sure that the parts are in the correct position.



Make a note of the contact brush assembly. The position of the hole from the alignment grooves must be the same when the steering control unit is assembled.

FIGURE 3. ILLUSTRATION FOR COMPONENT GROOVE ALIGNMENT

The procedures and illustrations in this section are supplied by the Ross Gear Division of TRW.

DISASSEMBLY AND INSPECTION

⚠ WARNING

Use a work area with good ventilation when solvents are used. Keep fire and sparks away from the area. Commercial cleaning solvents may be flammable and toxic, and can cause severe skin irritation. When using commercial cleaning solvents, always comply with the solvent manufacturer's recommended safety precautions.

Wear eye protection when making repairs described in this section.

Compressed air can move particles so that they cause injury to the user or to other personnel. Make sure that the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

⚠ CAUTION

Use a puller to remove the steering wheel from the input shaft. Do not use a hammer to remove the steering wheel or the steering control unit can be damaged.

Do not put the steering control unit directly into a vise. The clamp pressure will cause distortion and damage. Make a service assembly fixture as shown in FIGURE 4.

Make sure you understand the procedures described in this section before you begin disassembly and repair. Keep a clean area for the parts and assemblies. The parts are machined to small tolerances. Use minimum force and carefully disassemble and assemble the parts. Do not permit damage to occur from small scratches, damage, and dirt. Use a petroleum solvent to clean the parts. Dry the parts with compressed air.

Some parts are bonded together and must be replaced as a single part. Disassemble the parts only as described in this section. Some parts have a special small tolerance and can be only replaced as an assembly.

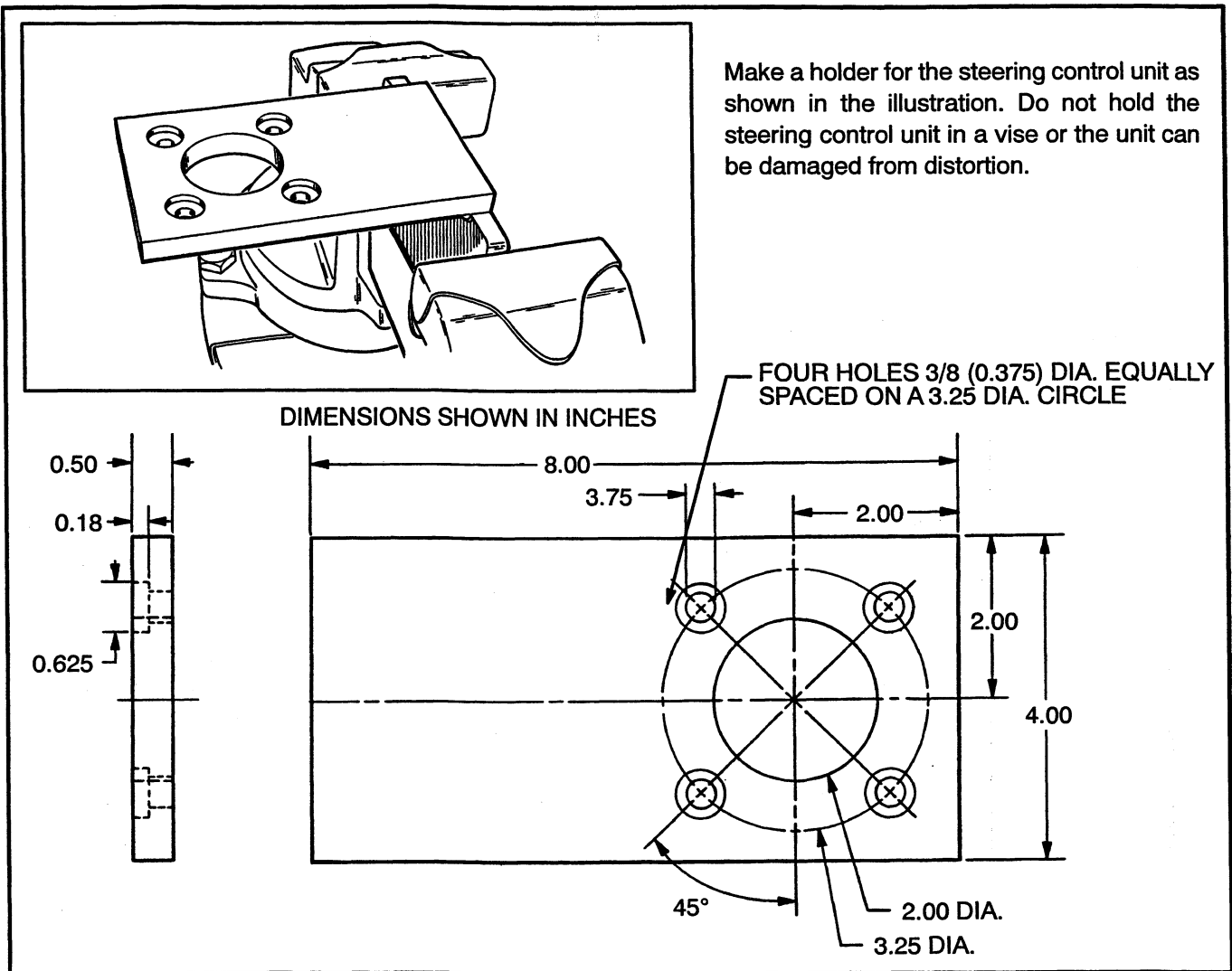
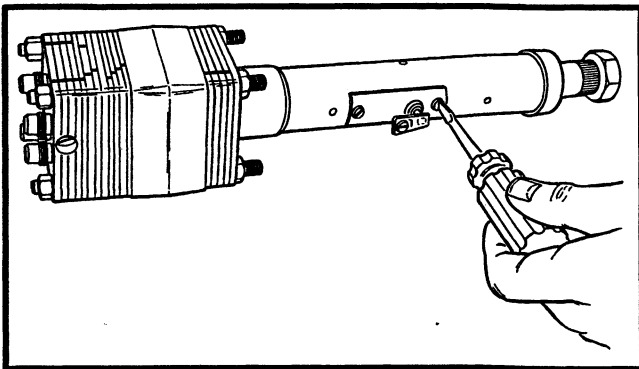
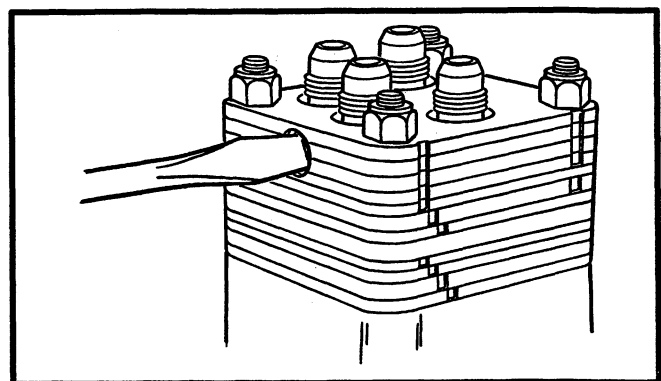


FIGURE 4. SERVICE FIXTURE ASSEMBLY

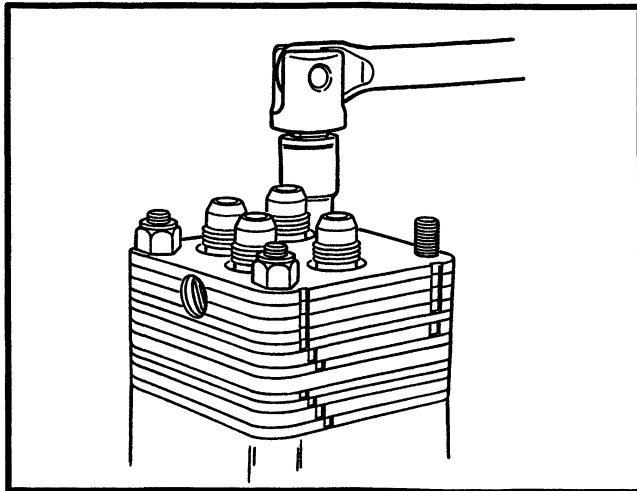
NOTE: The numbers in parenthesis () in the following steps are a reference to the parts list in FIGURE 2.



1. Remove the contact brush assembly. Remove the screws (45) and washers (46), contact brush assembly (44), and spacer (37) from the upper tube and jacket assembly.



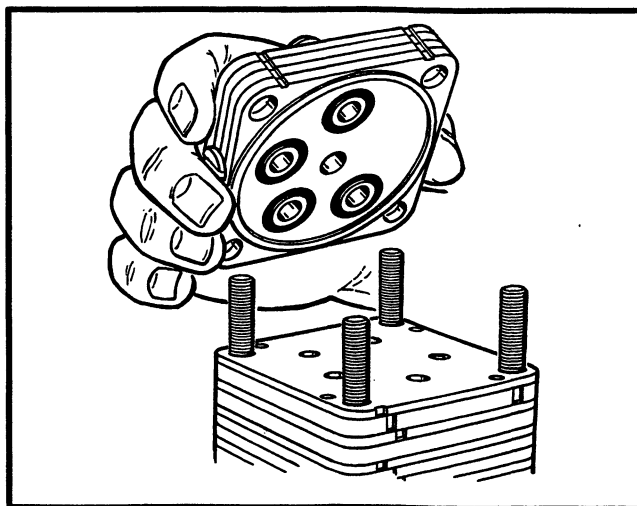
2. Loosen the plug (6) assembly in the port cover (2) for disassembly after the port cover is removed.



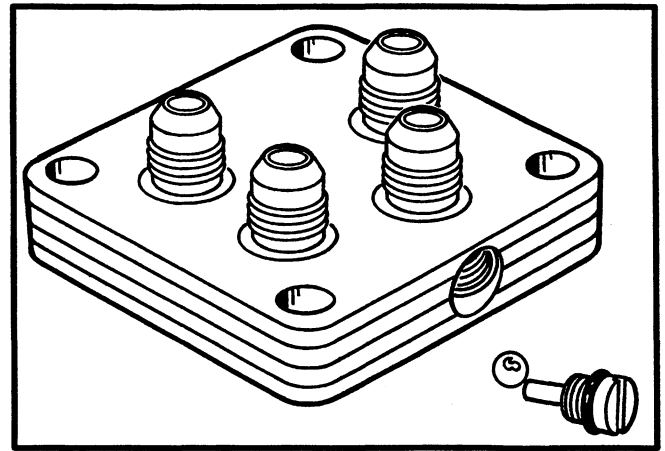
3. Remove the four nuts (1) that hold the port cover (2) to the unit. Do not damage the ports.

⚠ CAUTION

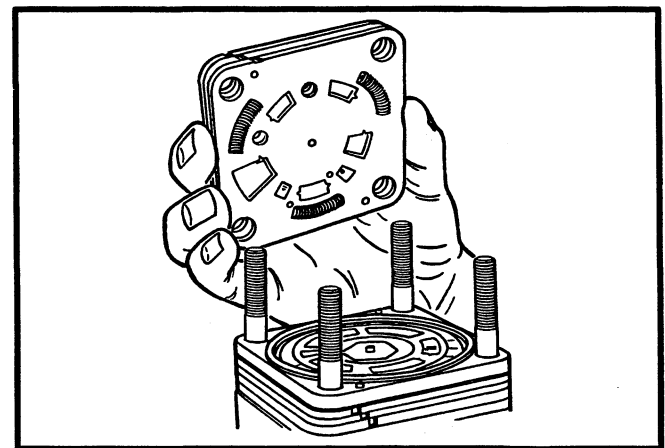
The nuts (1) are a special lock nut. Use only approved parts as replacement nuts.



4. Remove the port cover (2). Discard the four O-rings and the seal ring.



5. Remove the loosened plug (6) and O-ring from the port cover. Do not lose the steel check ball (5) as it falls from its cavity. Inspect the port cover for wear and damage. Replace damaged parts.



6. Carefully lift the port manifold (8) from the unit

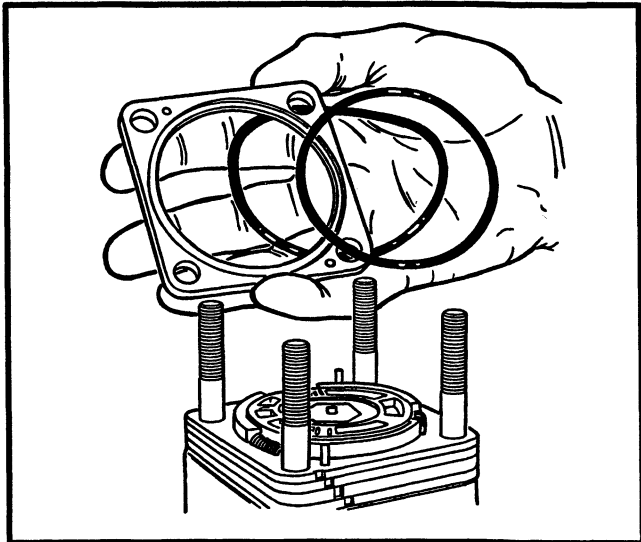
NOTE: The three springs can become disengaged when the port manifold is removed. Do not permit the loss of the three springs (9).

Remove the three springs from the port manifold. Inspect the springs for damage or distortion.

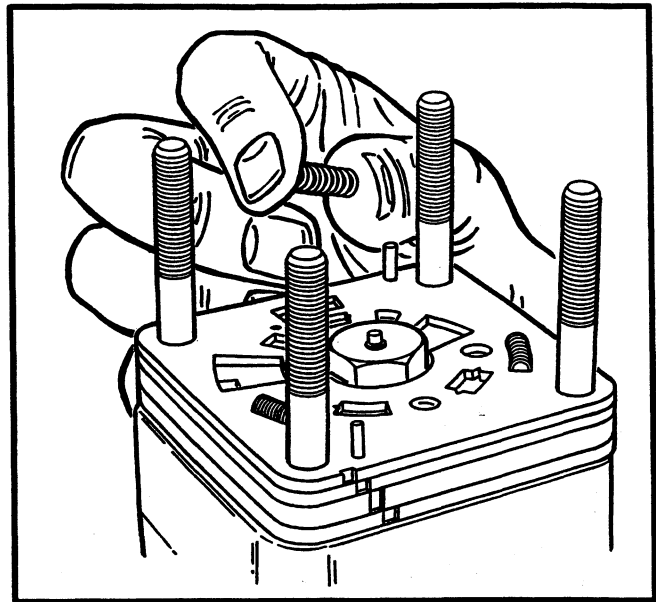
NOTE: Keep the three springs from the port manifold separate from the three springs you will remove from the isolator manifold. The three springs in the port manifold are 19 mm (0.75 in) in length. The three springs in the isolator manifold are 13 mm (0.50 in) in length. If any of the springs are damaged, the springs in both the

port manifold and the isolator manifold must be replaced.

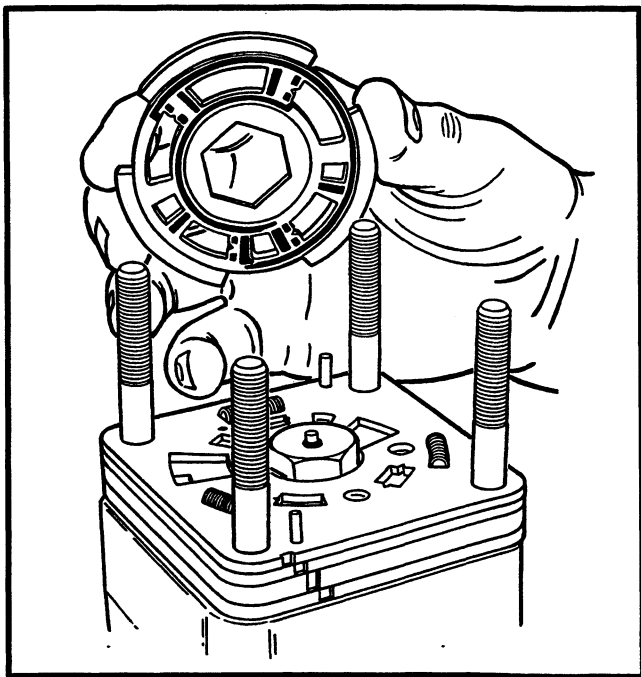
Inspect the port manifold. The rotation of the valve plate will normally polish a pattern in the port manifold. An acceptable part can have this pattern if there are not scratches, grooves, or other damage.



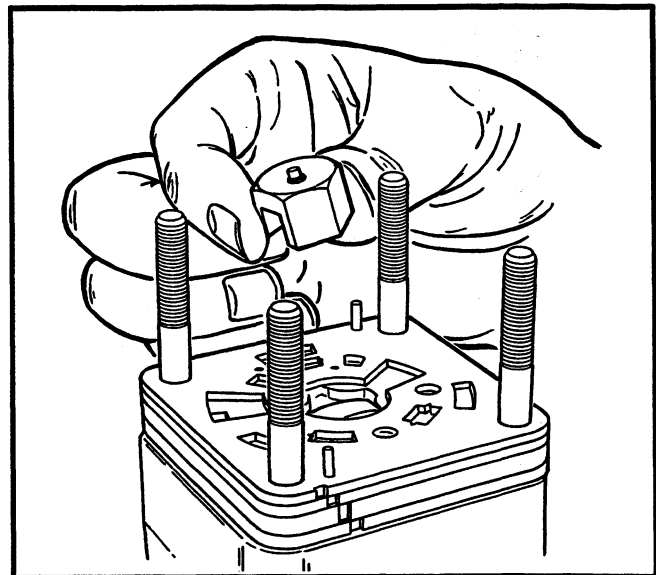
7. Remove the valve ring (12). Discard the two seal rings (3).



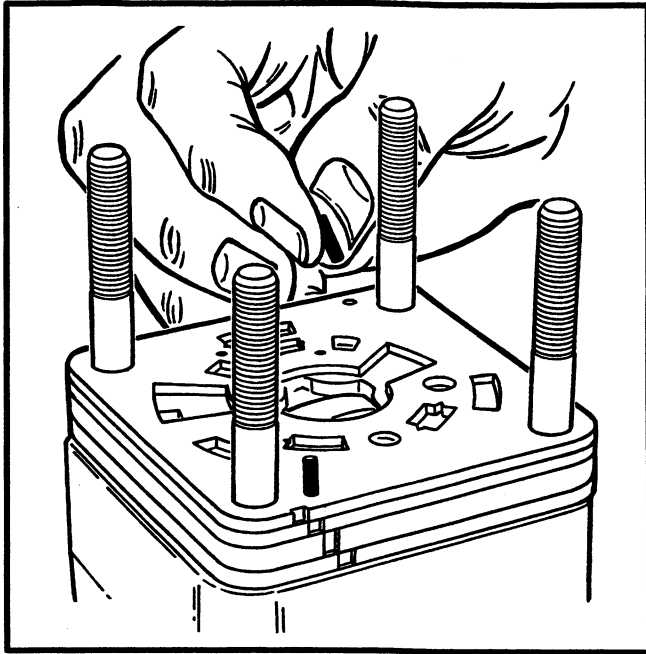
9. Remove the three springs from the isolator manifold. See the NOTE about the springs in step 6.



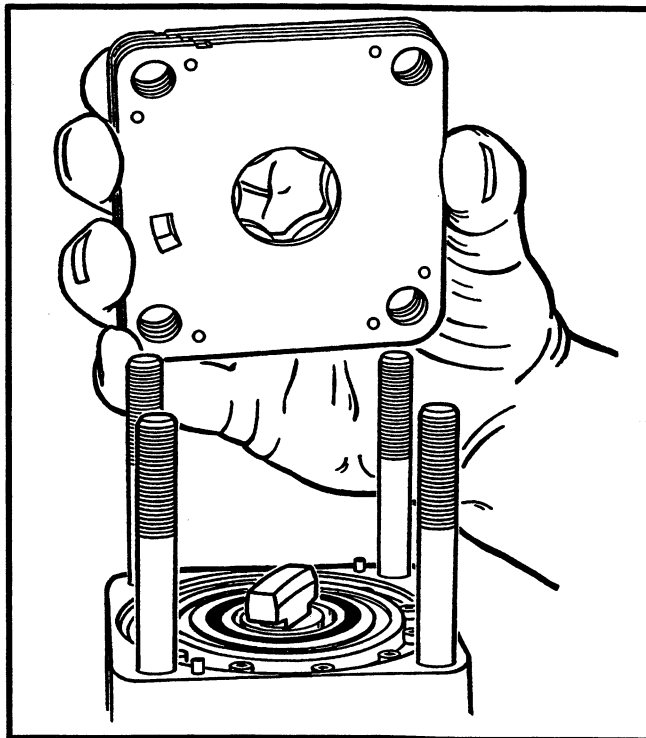
8. Remove the valve plate (13). Inspect the edges and surfaces for wear and damage. The slots must have sharp edges. The valve ring and valve plate must be replaced as a set.



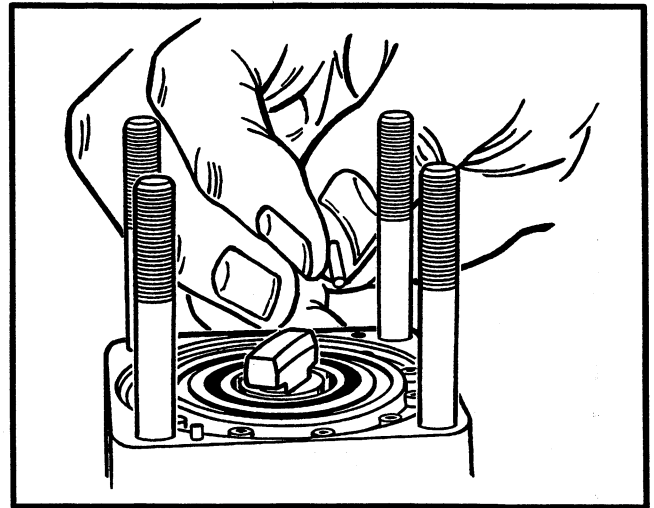
10. Remove the drive assembly (10) from the drive link. The alignment pin (11) in the drive assembly must not be worn and must fit the hole tightly. The sides and slot of the drive assembly must be replaced if there is wear.



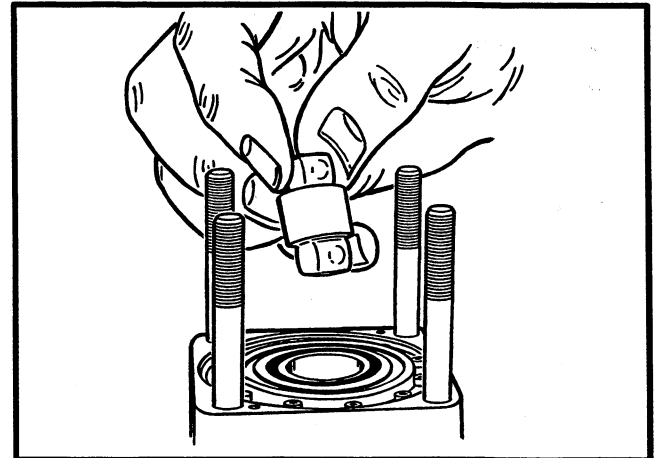
11. Remove the two alignment pins (11) that align the port manifold, valve ring, and isolator manifold.



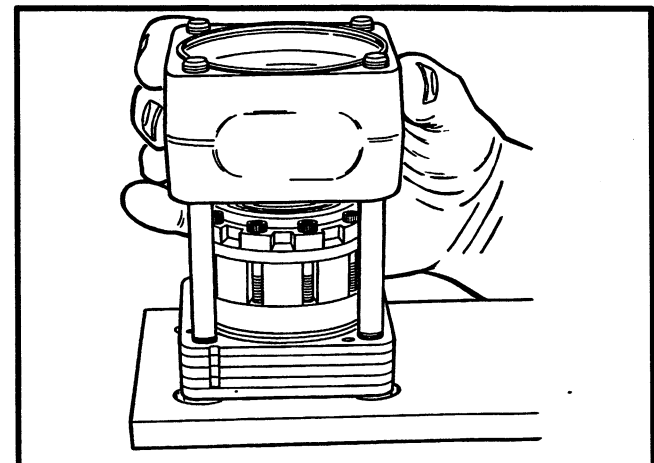
12. Remove the isolator manifold (15). Inspect the surfaces of the isolation manifold. The rotation of the valve plate will normally polish a pattern in the isolator manifold. A similar pattern will be on the opposite side of the isolator manifold caused by the commutator cover. An acceptable part can have this pattern if there are not scratches, grooves, or other damage.



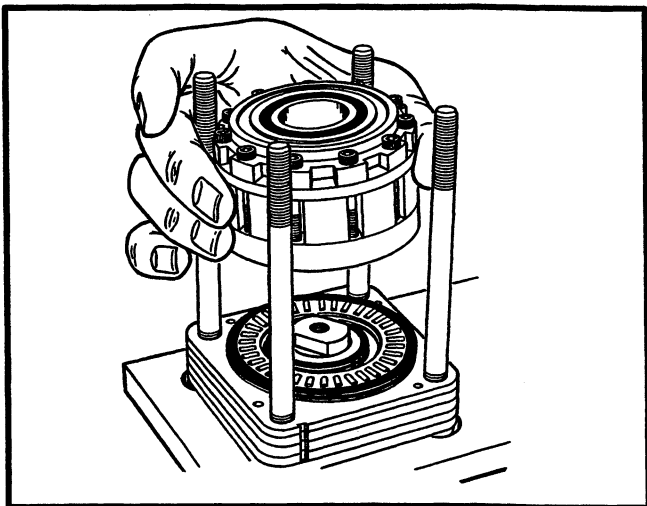
13. Remove the two alignment pins from the metering ring.



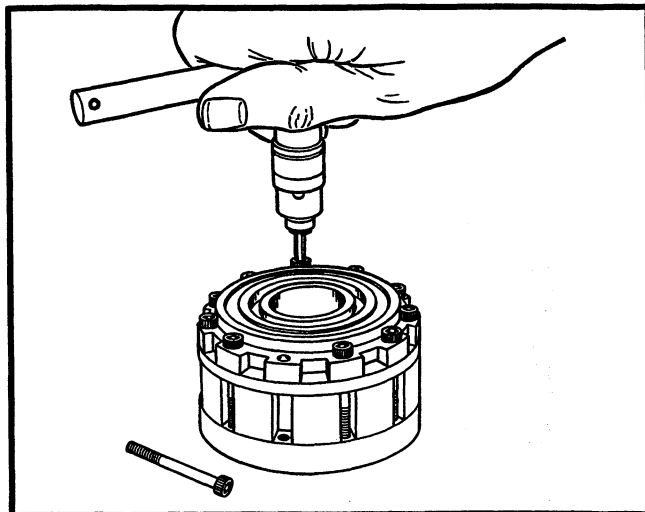
14. Remove the drive link (16). Inspect the ends of the drive link for wear. The four contact surfaces can not have wear or have grooves. Replace a worn drive link.



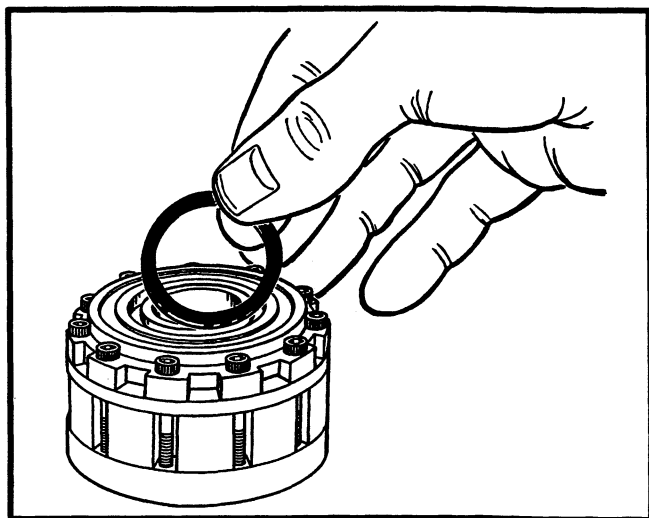
15. Remove the metering ring (17). Discard the two seal rings (3). Inspect the bore of the metering ring for grooves. Replace a worn metering ring.



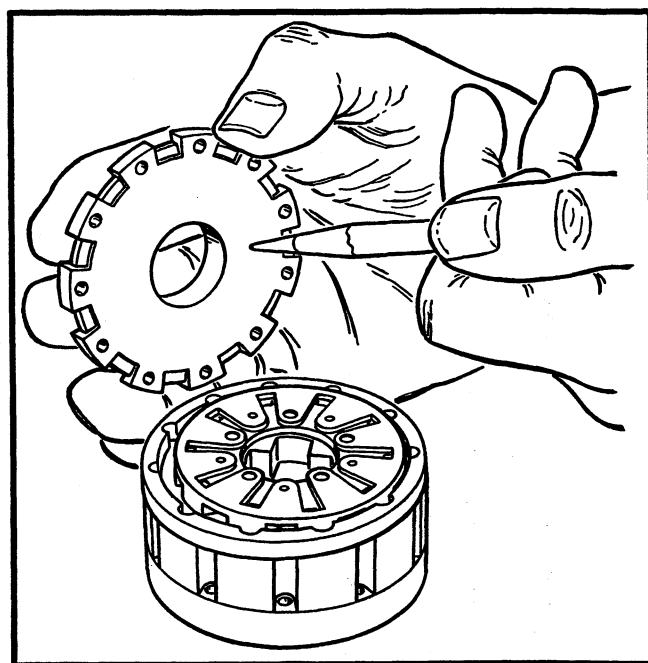
16. Remove the metering assembly and put it on a clean surface. DO NOT put the assembly in a vise.



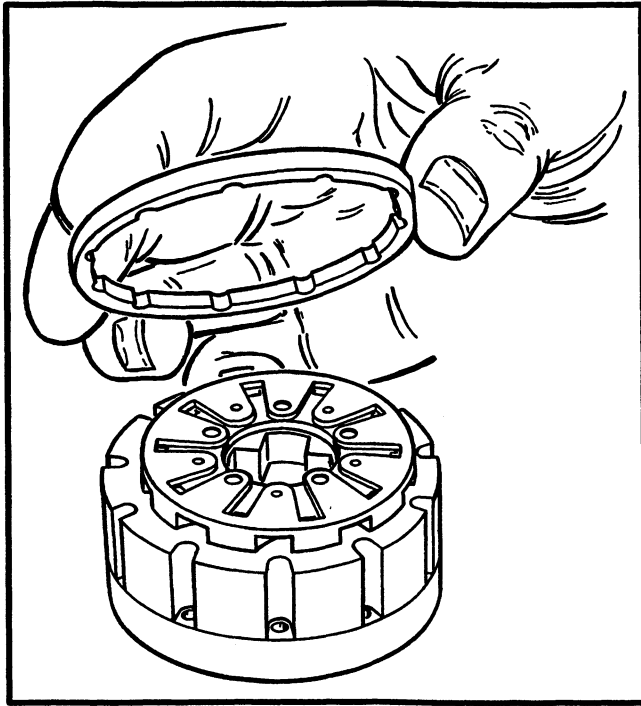
18. Remove the 11 socket head capscrews that hold the metering assembly together. Use a $\frac{3}{32}$ inch allen wrench.



17. Remove and discard the commutator seal (19).



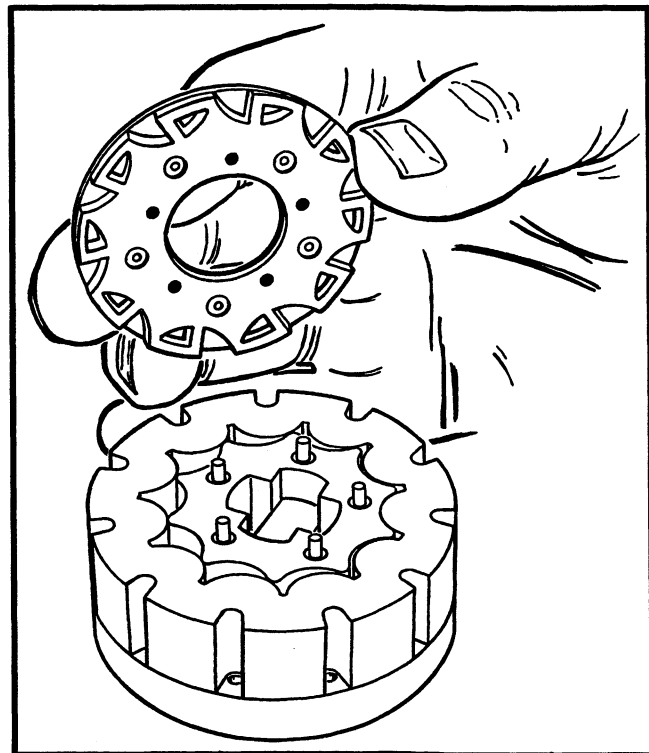
19. Remove the commutator cover (20). Inspect the commutator cover. The rotation of the commutator will normally polish a pattern in the commutator cover. An acceptable part can have this pattern if there are not scratches, grooves, or other damage.



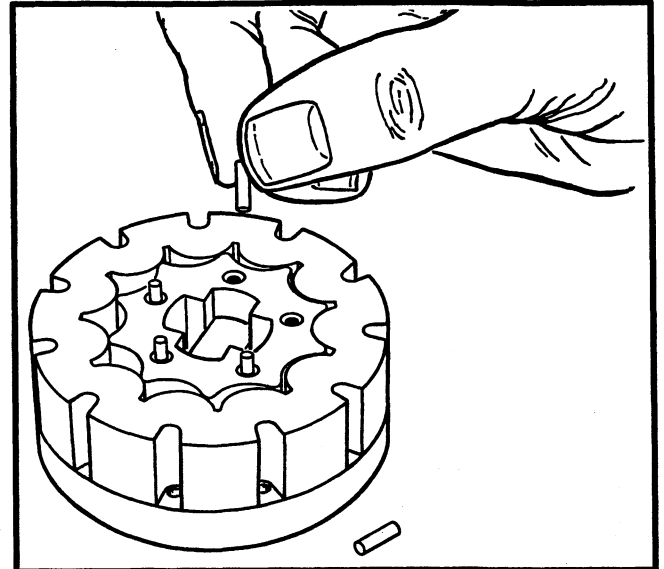
⚠ CAUTION

The commutator ring breaks easily.

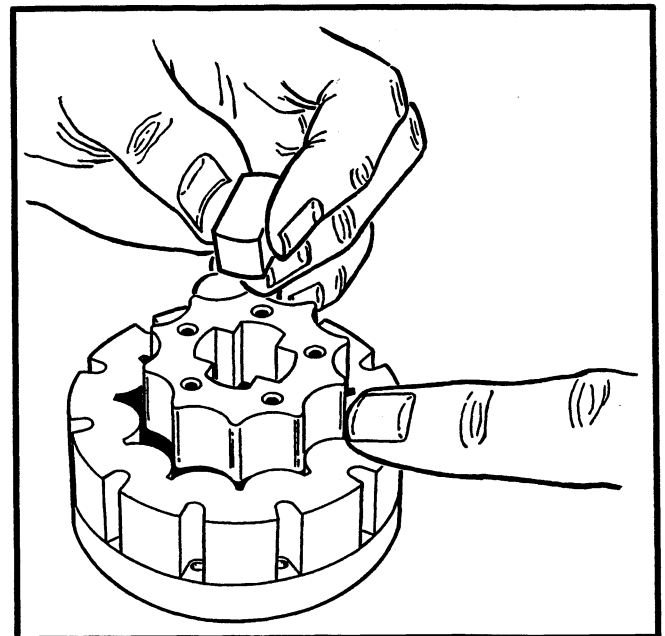
20. Remove the commutator ring (21). Inspect for cracks and wear.



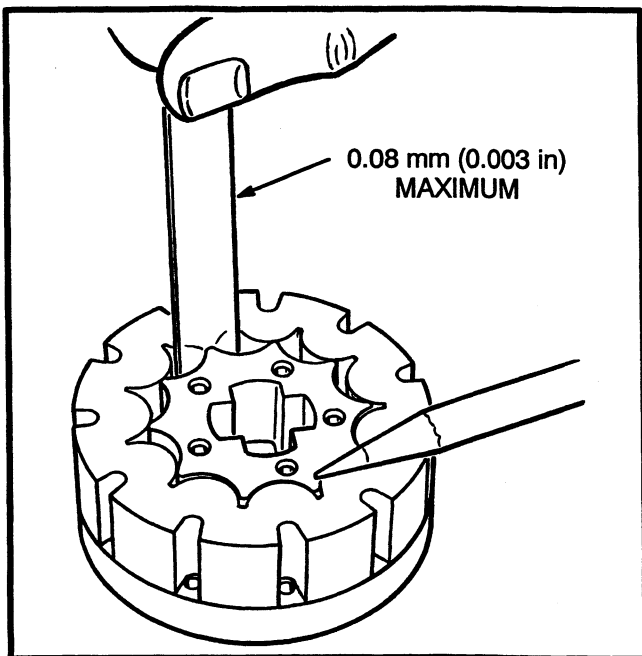
21. Remove the commutator from the rotor. Five alignment pins hold the commutator to the rotor. Carefully separate the two parts



22. Remove the five alignment pins.

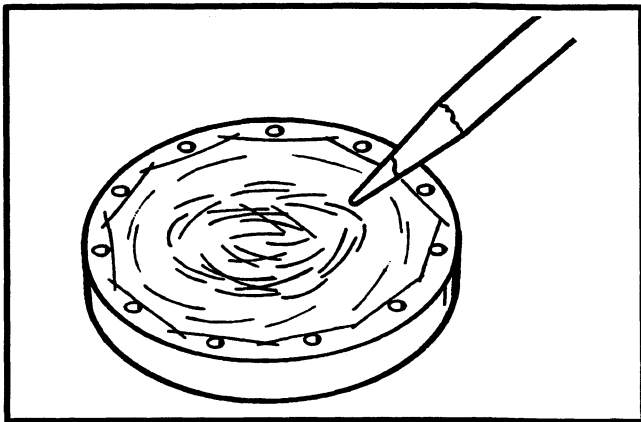


23. Remove and inspect the drive link spacer (23). Replace a worn part.

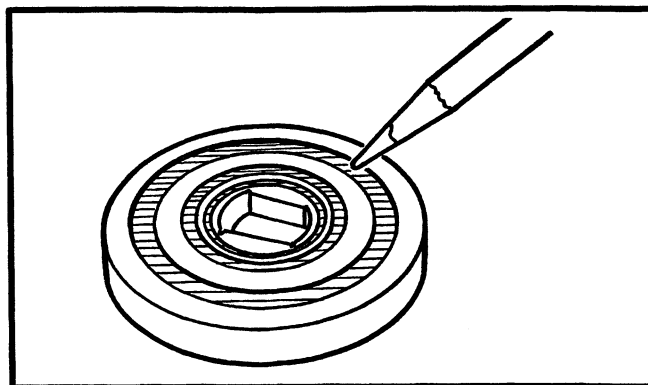


24. Inspect the rotor (24) and stator (25) as they are found on the drive plate (26). The rotor must rotate and move freely within the stator. Acceptable parts can not have grooves or damage. The rotor and stator must be replaced as a unit if they are worn or damaged.

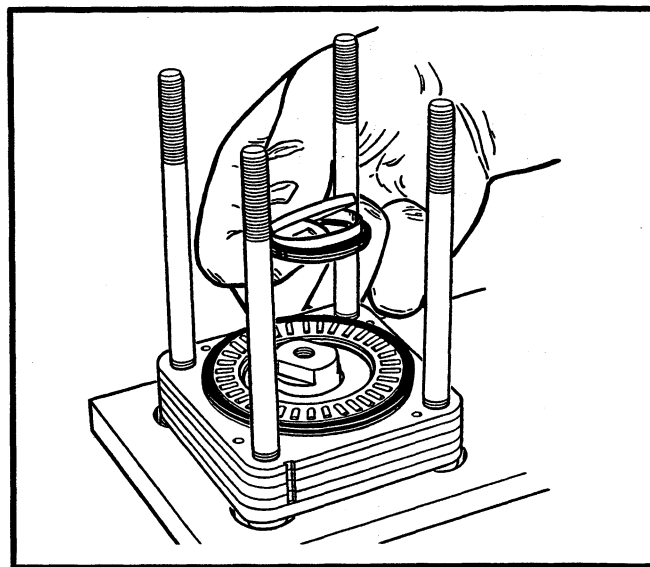
Check the clearance between the rotor and the stator with a spacer gauge. The pointer in the illustration shows the position of the rotor when the clearance is measured. The maximum clearance is 0.08 mm (0.003 in). Replace a worn rotor and stator.



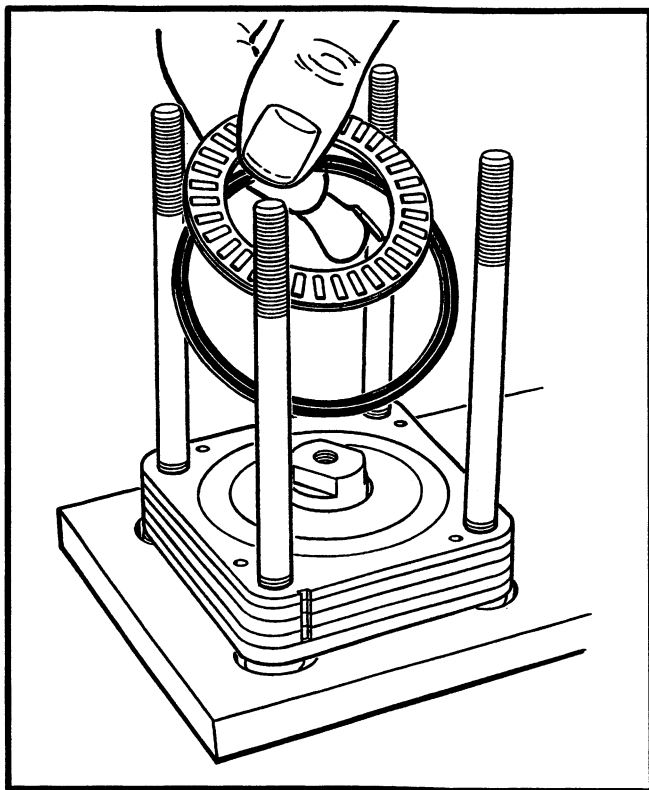
25. Remove the rotor and stator from the drive plate. Make sure the drive plate does not have wear or damage.



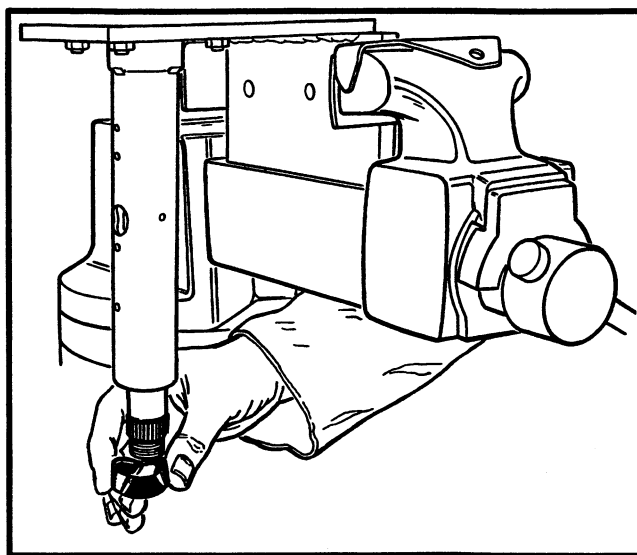
26. Inspect the other side of the drive plate. The movement of the rotor will polish a pattern in the drive plate. Acceptable parts can not have grooves or wear. Make sure the hole that engages the input shaft is not worn.



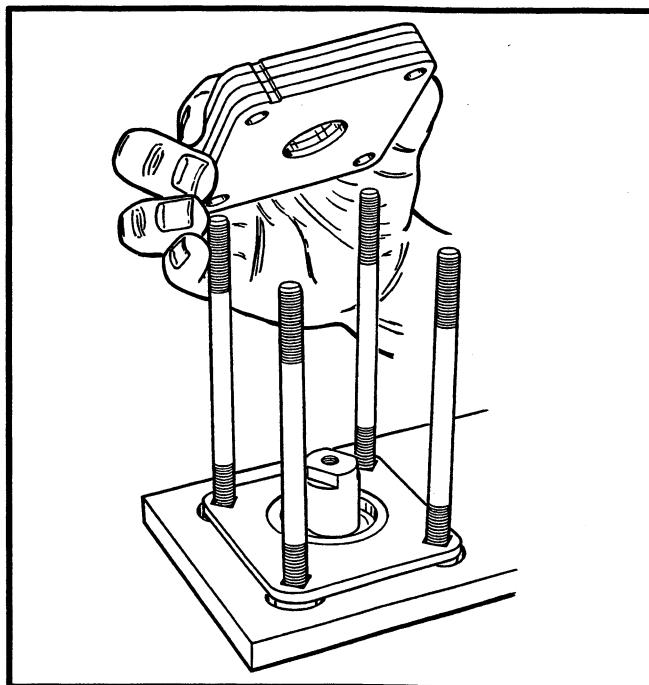
27. Remove the seal (29), back-up ring (30), and the spacer (31). Discard the seal and back-up ring. Keep the spacer.



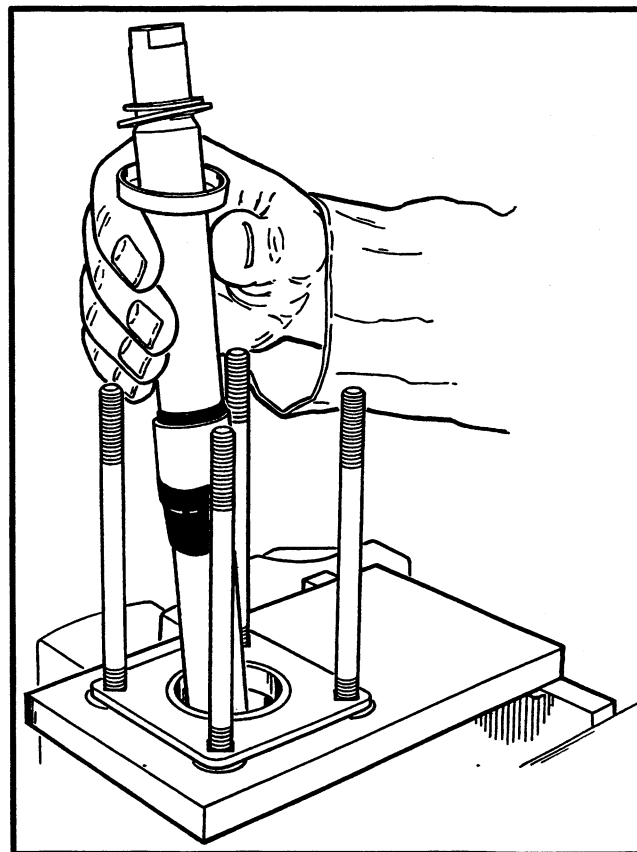
28. Remove the thrust bearing (28) and the bearing spacer (27). Inspect the parts for wear and damage.



30. Slide the seal (39) from the tube. Replace a worn or damaged seal.

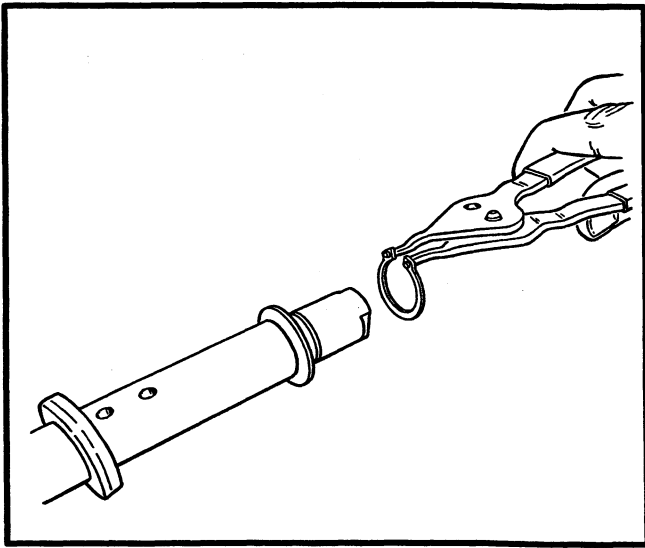


29. Make a note of the position of the upper cover plate (32) to the upper cover and jacket assembly (37) so that the parts will be assembled again in the same position. Remove the upper cover plate and inspect for wear and damage.

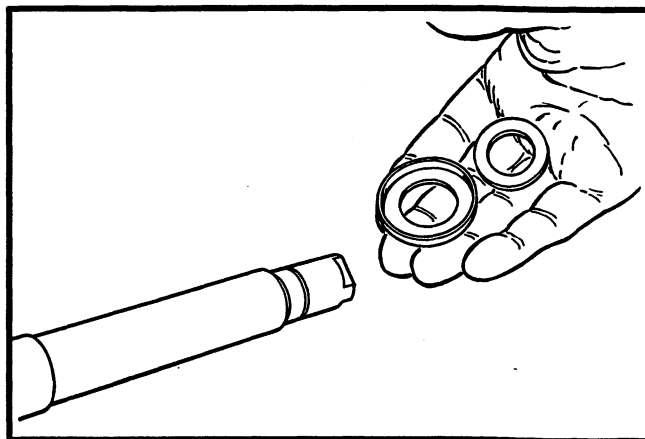


31. Remove the input shaft assembly (33).

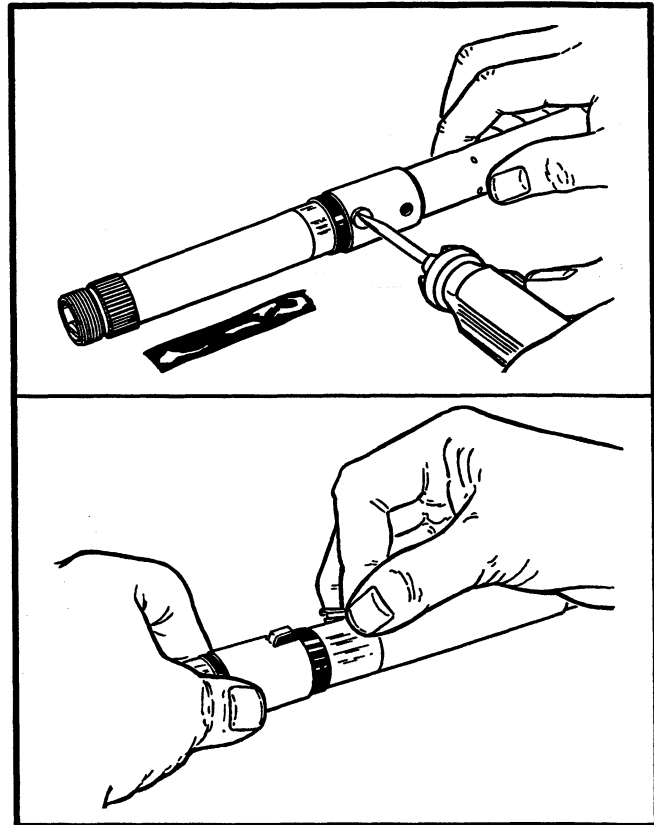
32. Inspect the input shaft for wear and damage. Check the horn circuit for an open circuit or a short-circuit. Use an ohmmeter. There must be an electrical connection between the upper terminal of the horn cable assembly (47) and the contact ring (43). There must be an open circuit between the upper terminal of the horn cable assembly and any other parts of the input shaft assembly. If the input shaft and horn circuit, are correct go to step 37.



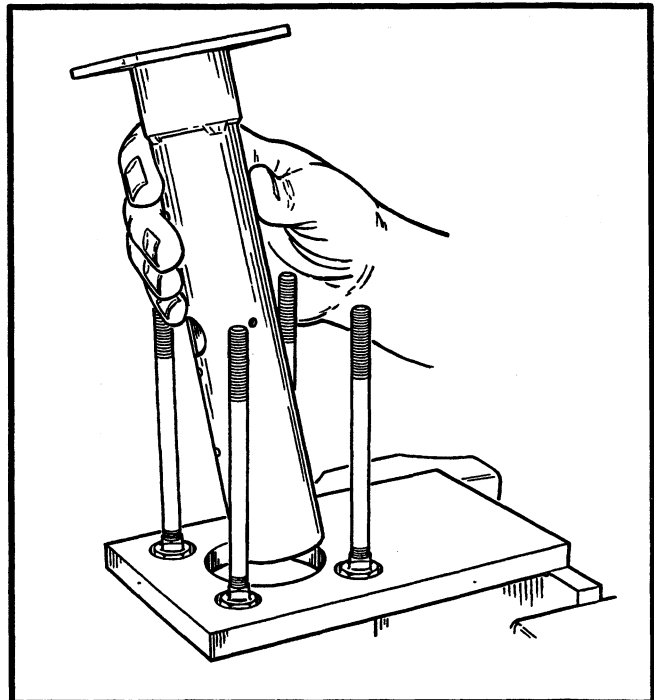
33. Remove the snap ring.



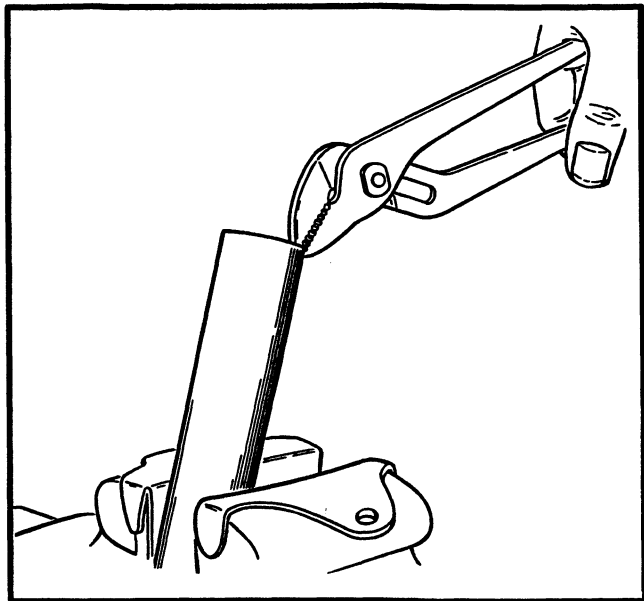
34. Remove the washer (35) and the retainer plate (36). Discard the parts if they are worn or damaged.



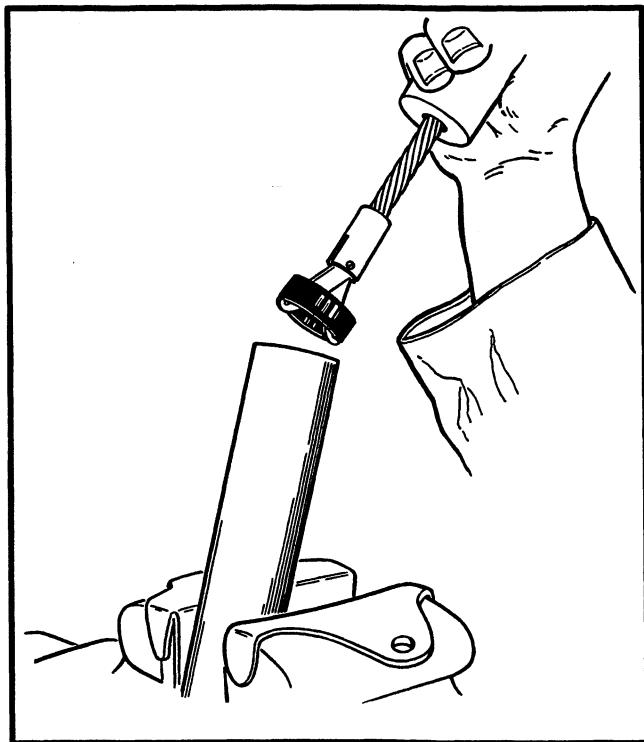
35. Remove the tape, horn cable assembly (47), and contact ring assembly (43) from the input shaft. Replace worn or damaged parts. Make a note of the position of the contact rings so that they can be assembled in the same position again.



36. Remove the upper cover and jacket tube assembly (37).

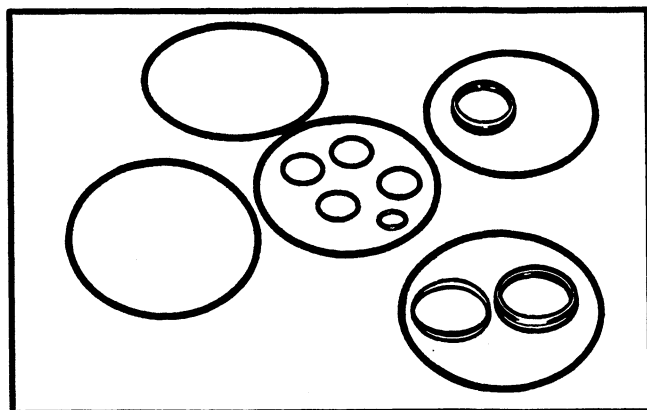


37. If the bushing must be replaced, use pliers to open the two areas that hold the bushing in the tube.

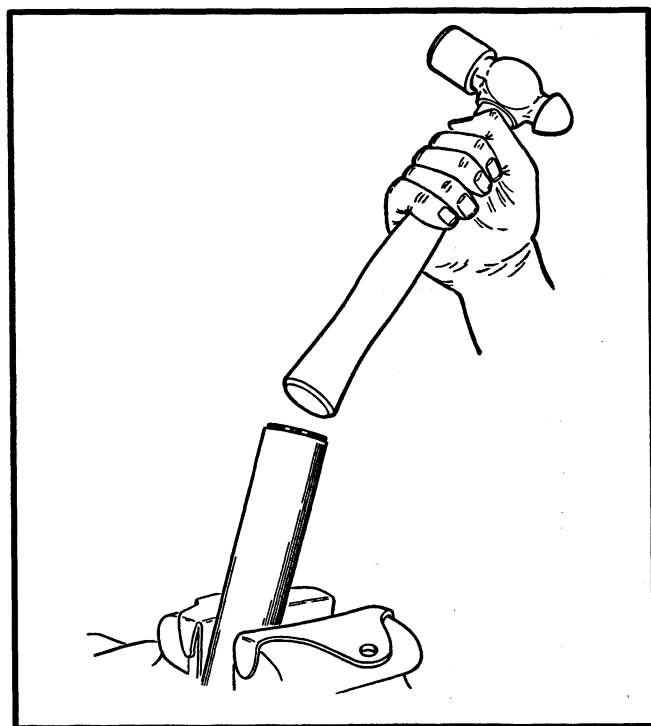


38. Use a puller to remove the bushing from the tube. Discard the bushing.

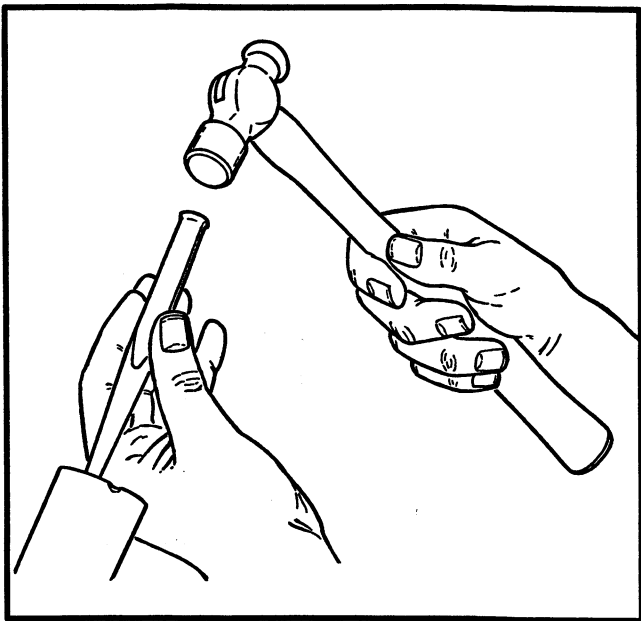
ASSEMBLY



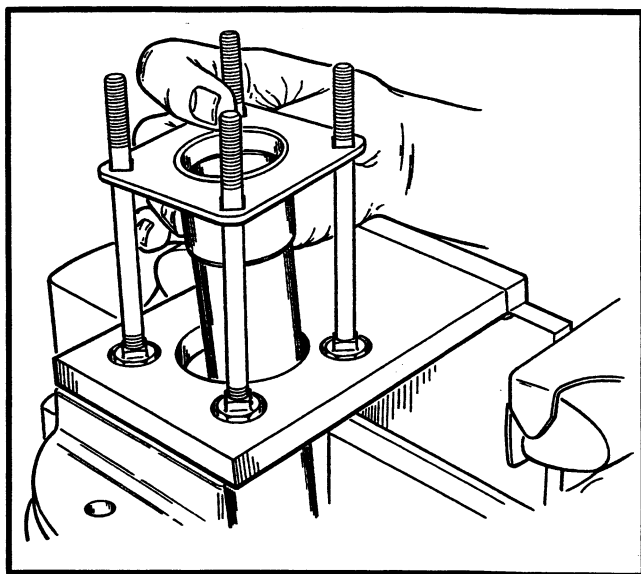
Make sure the parts are clean before they are assembled. Install new O-rings and seals when the steering control unit is assembled.



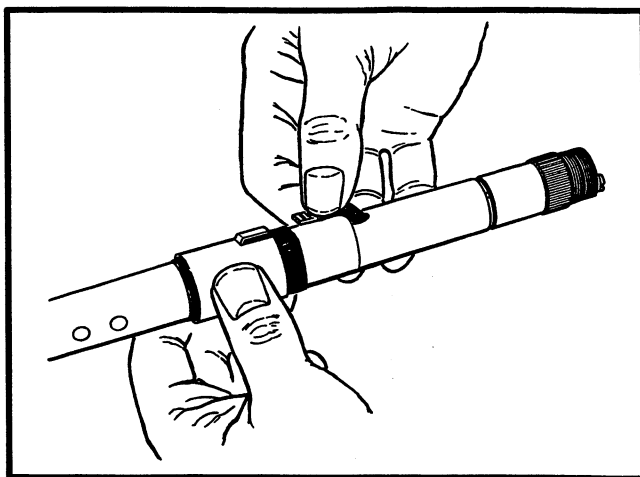
1. If the bushing (38) was removed from the upper cover and jacket tube (37), Install a new bushing. The end of the bushing with the smaller size goes into the tube first. The bushing must be below the end of the tube.



2. Use pliers or a punch to bend two small areas of the tube to lock the bushing in position. Do not use the original areas that were used as the locks.



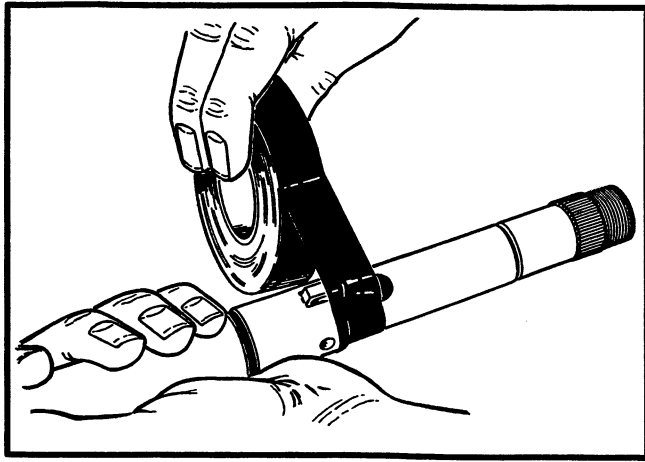
3. Apply clean grease to the bushing (38) and install the jacket tube assembly (37) on the service assembly fixture. Make sure that the square shoulder of the bolts engage the square holes in the upper cover.



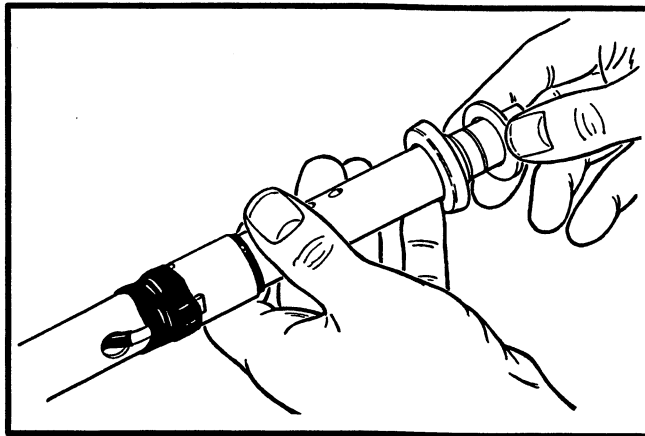
4. If the horn contact assembly was removed for repairs, install the horn contact assembly (43) on the input shaft. Make sure the position is like unit before it was disassembled.

⚠ CAUTION

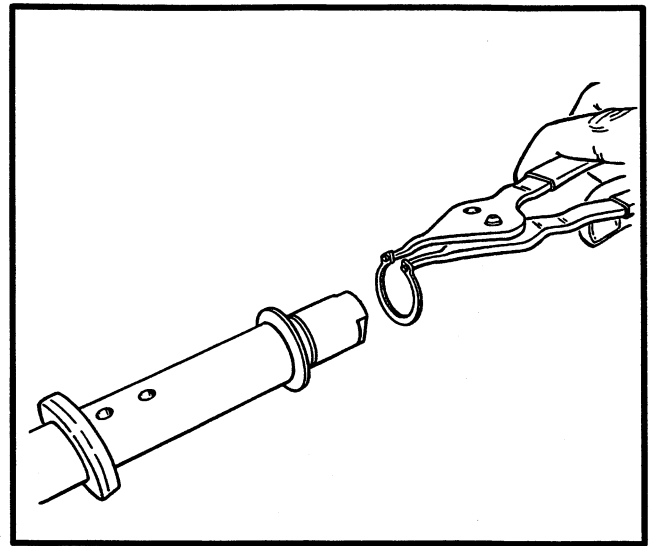
Make electrical checks with an ohmmeter. Make sure there is an electric connection between the upper terminal of the horn wire and the contact ring on the contact ring assembly. There must not be an electric connection to any other part. The repair of the horn wire and connections requires the complete disassembly of the steering control unit.



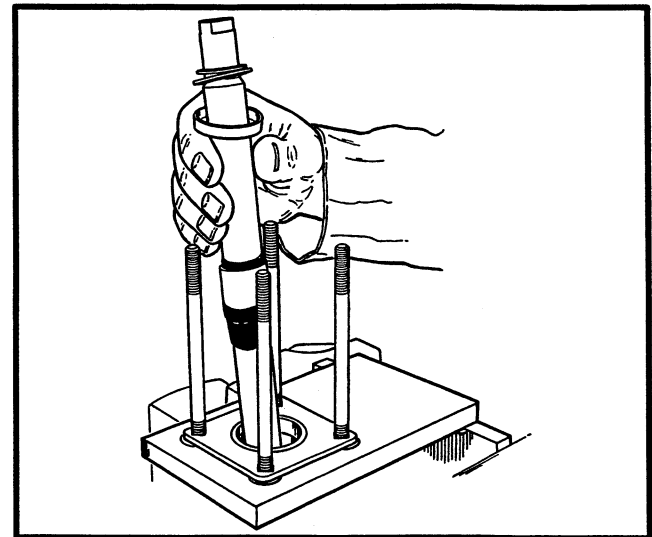
5. Install the horn cable assembly (47) in the input shaft. The spade connector must come through the outlet hole in the input shaft. Connect the spade connector to the horn contact assembly (43). Put the protective sleeve on the wire in position so that it protects the wire from sharp corners in the outlet hole. Fasten the horn contact assembly in position with the setscrew. Put approximately $1\frac{1}{2}$ rotations of electrical insulation tape around the contact ring to hold the horn wire in position.



6. Apply a small amount of grease to the face of the retainer plate (36) and washer (35). Install the retainer plate and then the washer. The flange of the retainer plate must be towards the washer.



7. Install the snap ring.



8. Slide the input shaft assembly into the upper cover and tube assembly.