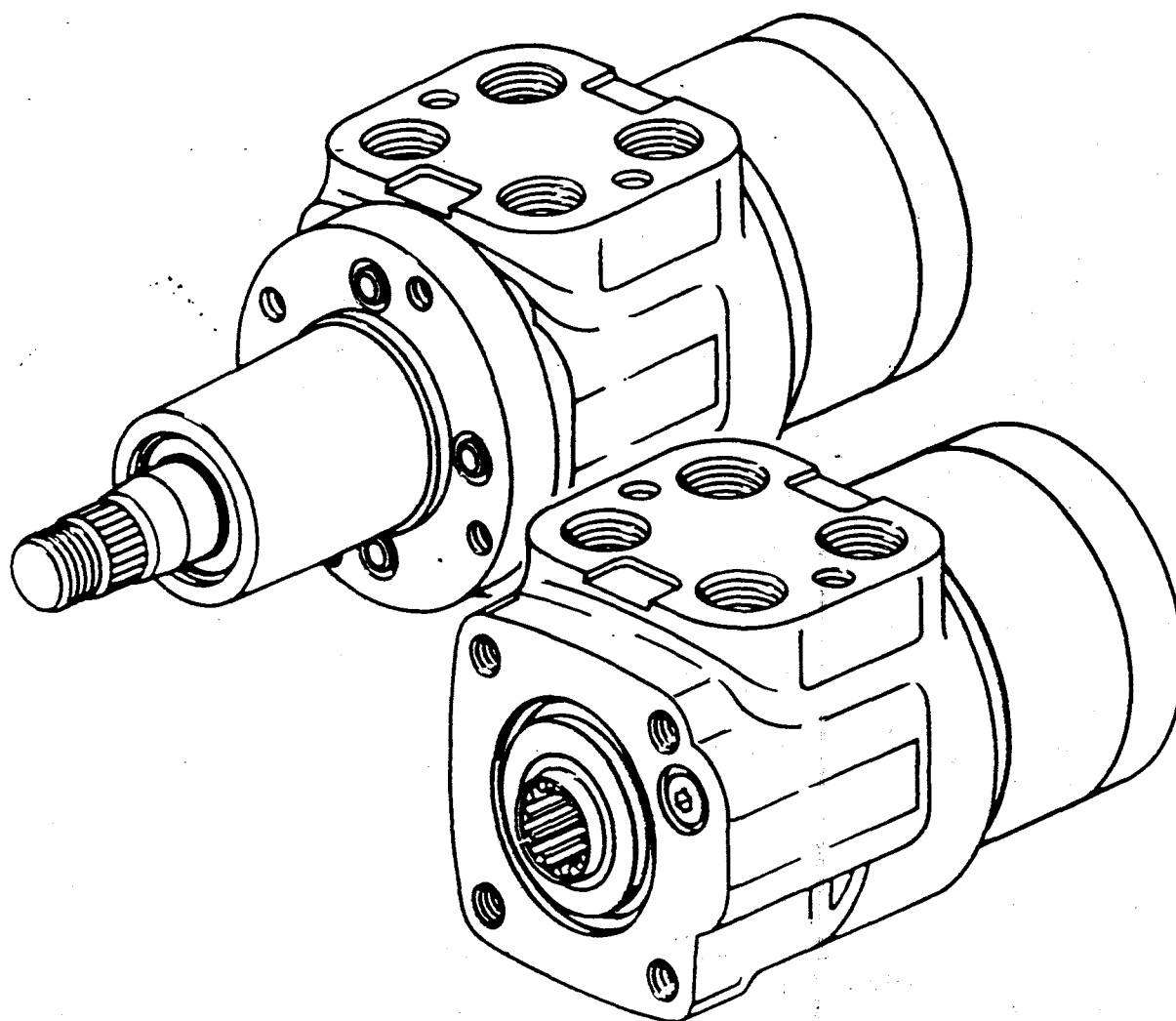


 **Eaton  
Hydraulics  
Division**

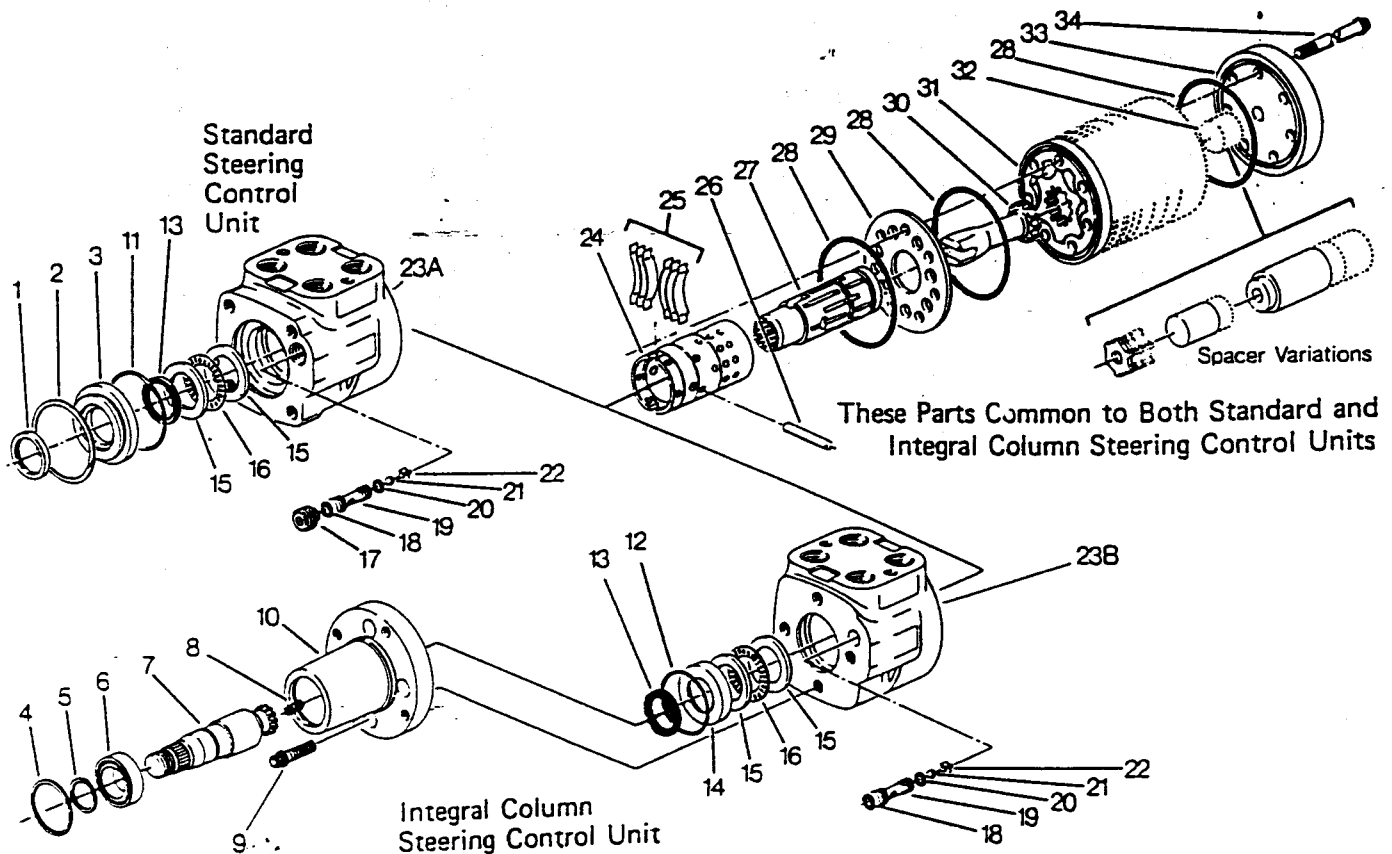
# Repair Information

**Steering Control Units, Char-Lynn®**

**001**



**EAT•N**



1. Dust Seal
2. Retaining Ring
3. Seal Gland Bushing
4. Retaining Ring
5. Retaining Ring
6. Control Column Bearing Ass'y
7. Control Shaft
8. Spring
9. Cap Screw
10. Steering Control Column
11. Seal, 2-1/8" OD
12. Seal, 1-15/16" OD

13. Quad Ring Seal
14. Bearing Locator
15. Bearing Race
16. Needle Thrust Bearing
17. Set Screw
18. Seal, 5/8" OD
19. Check Ball Seat
20. Seal, 7/16" OD
21. Check Ball
22. Check Ball Retainer
- 23A. Standard Housing
- 23B. Housing w/integral control column

24. Control Sleeve
25. Centering Springs
26. Pin
27. Control Spool
28. Seal, 3" OD
29. Spacer Plate
30. Drive
31. Meter (Gerotor)
32. Spacer(s)
33. End Cap
34. Cap Screw

See pages 10 thru 12 for disassembly and reassembly instructions covering the power steering integral control column.

#### Tools required for disassembly and reassembly.

- Screwdriver (4"-6" long, 1/8" flat blade)
- 5/16" - 12 pt. socket 5422
- Breaker bar wrench
- Torque wrench (275 inch pound capacity)
- Plastic hammer or rubber hammer
- 1/4" Allen wrench
- 1/8"-24 machine screw, 1-1/2" long.
- Needle nose pliers

The following tool isn't necessary for disassembly and reassembly, but is extremely helpful.

\*Spring installation tool 600057

\* Tools available--by special order--through our service department.

# Disassembly

Cleanliness is extremely important when repairing a steering control unit. Work in a clean area. Before disconnecting lines, clean port area of unit thoroughly. Use a wire brush to remove foreign material and debris from around exterior joints of the unit.

Note: Trouble shooting information on pages 13, 14, and 15 defines terms and problems, possible causes for problems, and recommends procedures for correcting problems.

Although not all drawings show the unit in a vise, we recommend that you keep the unit in the vise during disassembly. Follow the clamping procedures explained throughout the manual.

## Meter (Gerotor) End

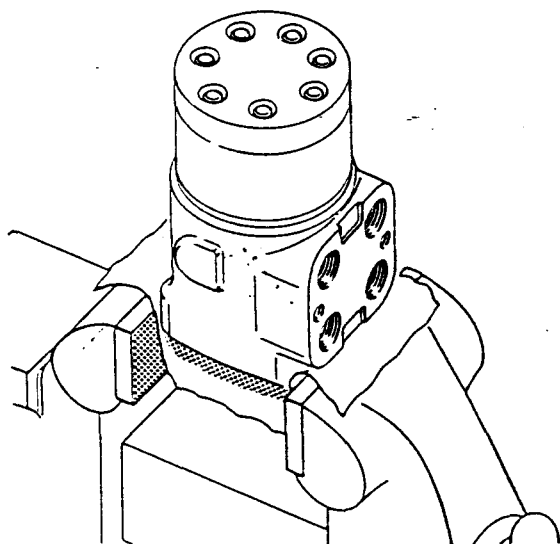


Figure 1

1 Clamp unit in vise, meter end up. Clamp lightly on edges of mounting area, see Fig. 1. Use protective material on vise jaws. Housing distortion could result if jaws are overtightened.

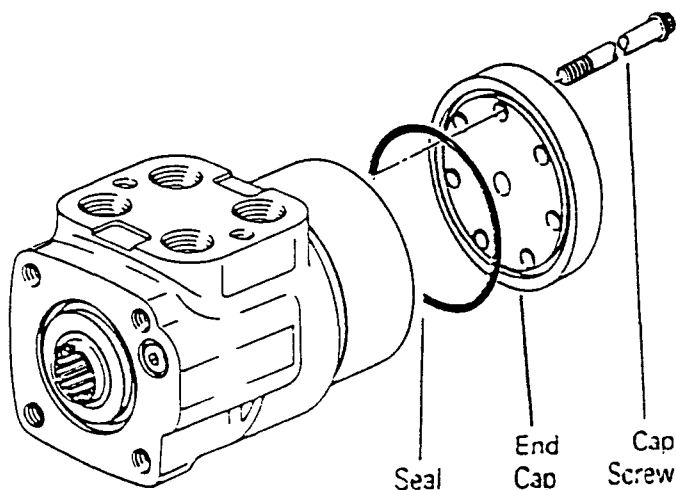


Figure 2

4

- 2 Remove 5/16" cap screws.
- 3 Remove end cap.
- 4 Remove seal from end cap.

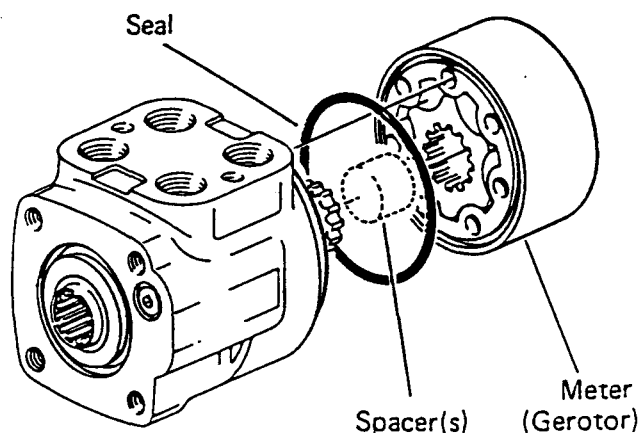


Figure 3

- 5 Remove meter. Be careful not to drop star.
- 6 Remove seal from meter.
- 7 Remove drive spacer(s) (not used on 4.5 cu. in displacement units).

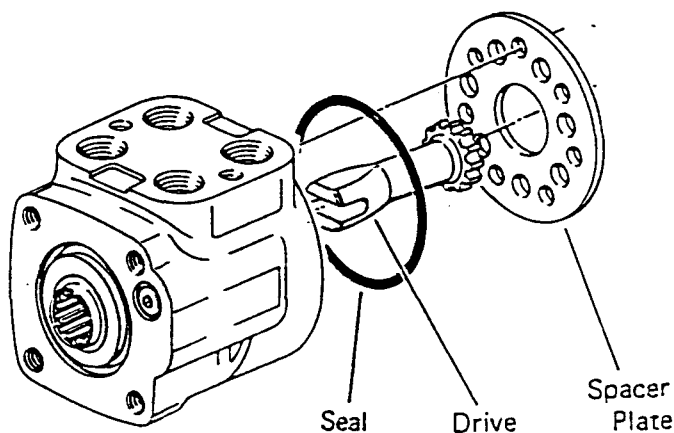


Figure 4

- 8 Remove drive.
- 9 Remove spacer plate.
- 10 Remove seal from housing.

## Control End

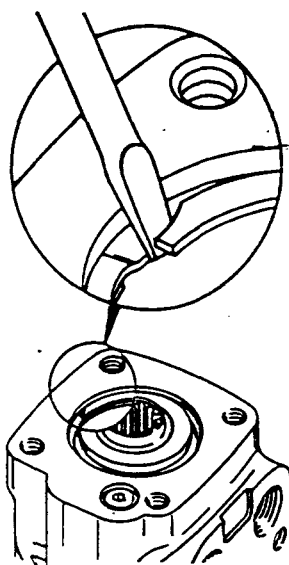


Figure 5

11 Remove housing from vise. Place housing on a clean soft cloth to protect surface finish. Use a thin bladed screwdriver to pry retaining ring from housing, as shown in Fig. 5.

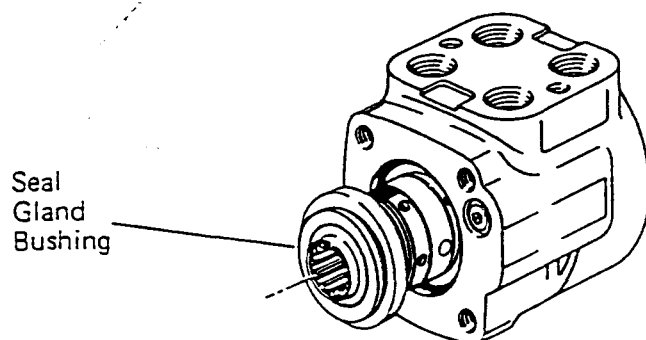


Figure 6

12 Rotate spool and sleeve until pin is horizontal. Push spool and sleeve assembly forward with your thumbs just far enough to free gland bushing from housing, see Fig. 6. Remove bushing

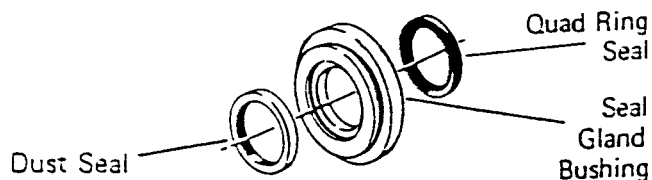


Figure 7

13 Remove quad ring seal from seal gland bushing.

14 Use a thin bladed screwdriver to pry dust seal from seal gland bushing. Do not damage bushing.

Note: If the unit you are repairing is a low input torque steering control unit, see page 12 for disassembly and reassembly procedures.

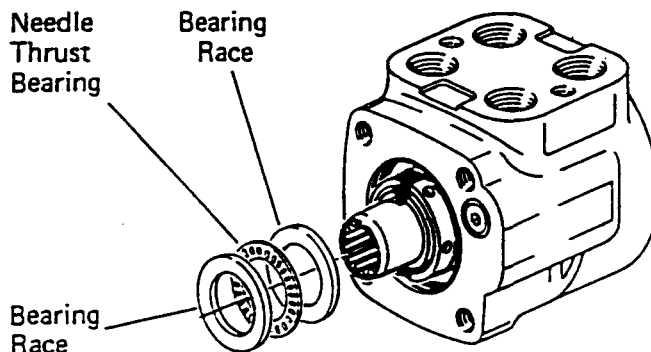


Figure 8

15 Remove 2 bearing races and the needle thrust bearing from spool and sleeve assembly.

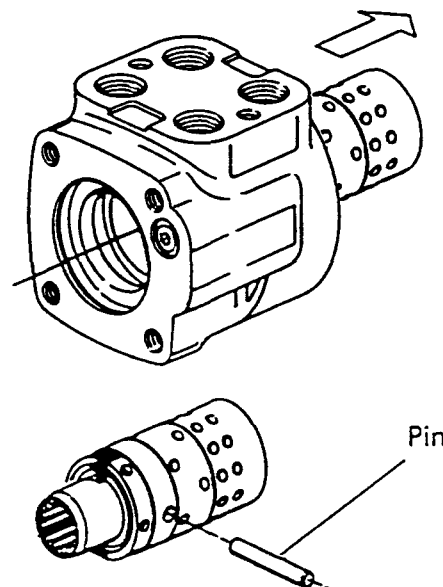


Figure 9

16 Remove spool and sleeve assembly from 14 hole end of housing, see Fig. 9.

**Attention:** Do not bind spool and sleeve in housing. Rotate spool and sleeve assembly slowly when removing from housing.

17 Push pin from spool and sleeve assembly.

# Disassembly

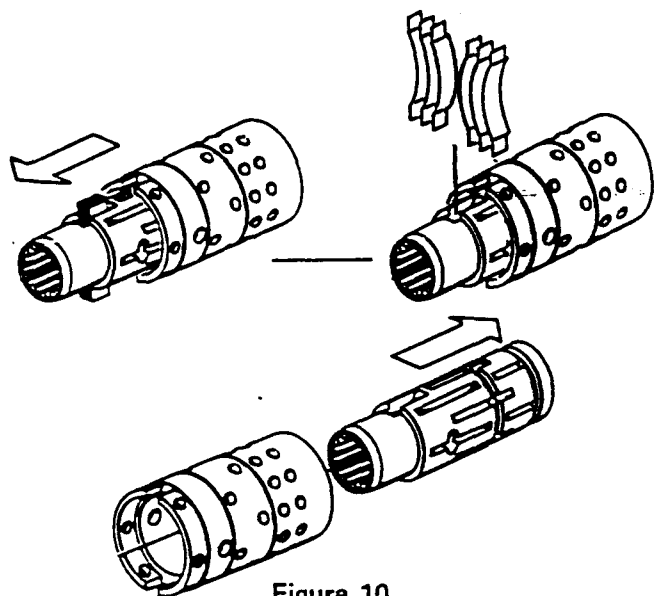


Figure 10

18 Push spool partially from control-end of sleeve, then remove 6 centering springs from spool carefully by hand, see Fig. 10.

19 Push spool back through and out of sleeve, see Fig. 10. Rotate spool slowly when removing from sleeve.

20 Remove seal from housing, see Fig. 11.

6

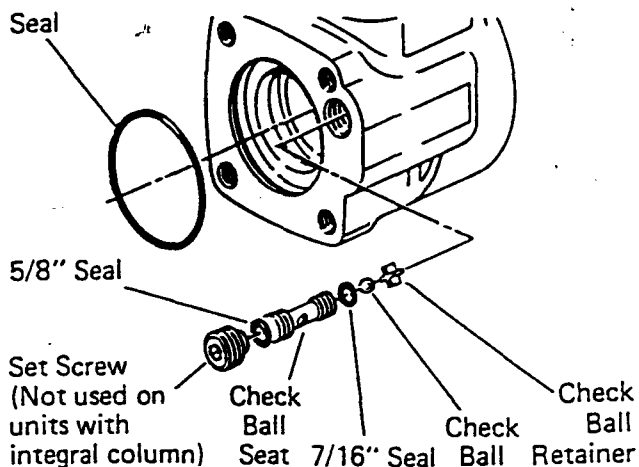


Figure 11

21 Remove set screw (not used on units with integral column) from housing, see Fig. 11.

22 Screw a 1/8"-24 machine screw into end of check ball seat. Then by pulling on screw, with a pliers, lift seat out of housing.

23 Remove 2 seals from check valve seat.

24 Tip housing to remove check ball and check ball retainer.

# Reassembly

Check all mating surfaces. Replace any parts that have scratches or burrs that could cause leakage. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage. Do not use a coarse grit or try to file or grind these parts.

**Note:** Lubricate all seals with clean petroleum jelly such as Vaseline.

Do not use excessive lubricant on seals for meter section.

Refer to parts listings covering your steering control unit when ordering replacement parts. A good service policy is to replace all old seals with new seals.

## Control End

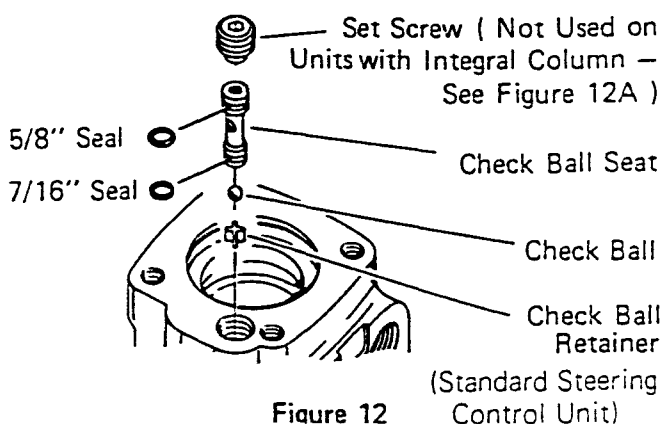


Figure 12

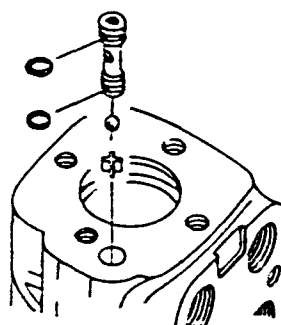


Figure 12A (Integral Column Steering Control Unit)

1 Use a needle nose pliers to lower check ball retainer into check valve hole of housing. Make sure retainer is straight (not tilted on edge) in housing, see Fig. 12.

2 Install check ball in housing.

3 Lubricate 5/8" diameter seal and 7/16" diameter seal. Install seals on check ball seat as shown in Fig. 12.

4 Lubricate check ball seat and seals thoroughly before installing seat in housing. When installing seat do not twist or damage seals. Install check ball seat in housing, insert open end of seat first, see Fig. 12. Push check ball seat to shoulder of hole.

5 Install set screw (not used on units with integral column, see Fig. 12A). Use a 1/4" allen wrench to torque set screw to 100 inch pounds. To prevent interference, make sure top of set screw is slightly below housing mounting surface.

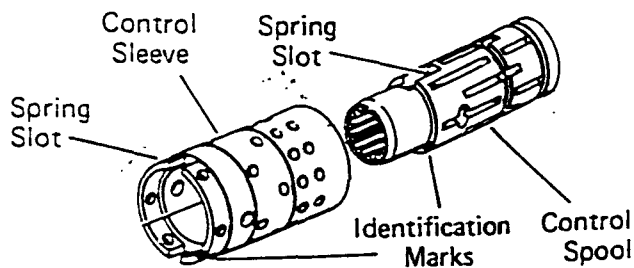


Figure 13

6 Assemble spool and sleeve carefully so that the spring slots line up at the same end. Rotate spool while sliding parts together. Some spool and sleeve sets have identification marks, align these marks as shown in Fig. 13. Test for free rotation. Spool should rotate smoothly in sleeve with finger tip force applied at splined end.

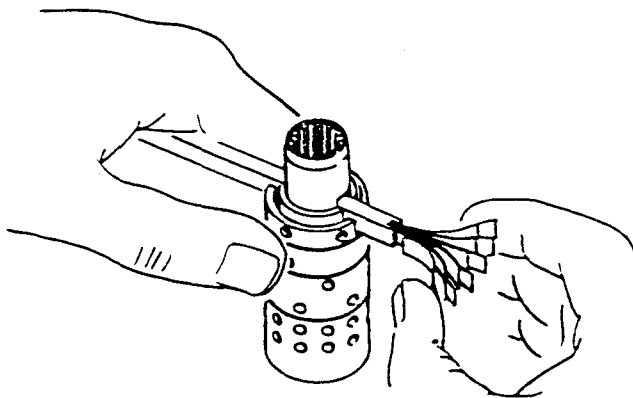


Figure 14

7 Bring spring slots of both parts in line and stand parts on end of bench. Insert spring installa-

tion tool through spring slots of both parts. Tool is available as part no. 600057. Position 3 pairs of centering springs (or 2 sets of 3 each) on bench so that extended edge is down and arched center section is together. In this position, insert one end of entire spring set into spring installation tool, as shown in Fig. 14, with spring notches facing sleeve.

8 Compress extended end of centering spring set and push into spool sleeve assembly withdrawing installation tool at the same time.

9 Center the spring set in the parts so that they push down evenly and flush with the upper surface of the spool and sleeve.

10 Install pin through spool and sleeve assembly until pin becomes flush at both sides of sleeve.

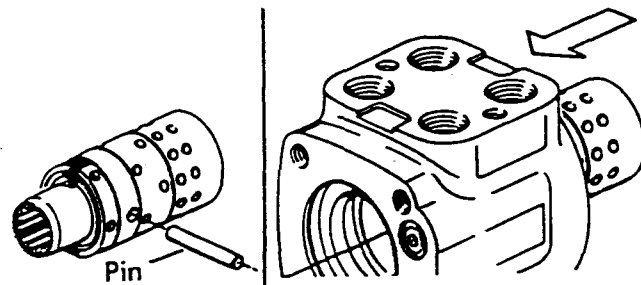


Figure 15

Figure 16

11 Position the spool and sleeve assembly so that the splined end of the spool enters the 14 hole end of housing first, see Fig. 16.

**Attention:** Be extremely careful that the parts do not tilt out of position while inserting. Push parts gently into place with slight rotating action, keep pin nearly horizontal. Bring the spool assembly entirely within the housing bore until the parts are flush at the meter end or 14 hole end of housing. Do not pull the spool assembly beyond this point to prevent the cross pin from dropping into the discharge groove of the housing. With the spool assembly in this flush position, check for free rotation within the housing by turning with light finger tip force at the splined end.

# Reassembly

8

12 Place housing on clean, lint free cloth. Install 2-1/8" diameter seal in housing, see Fig. 17.

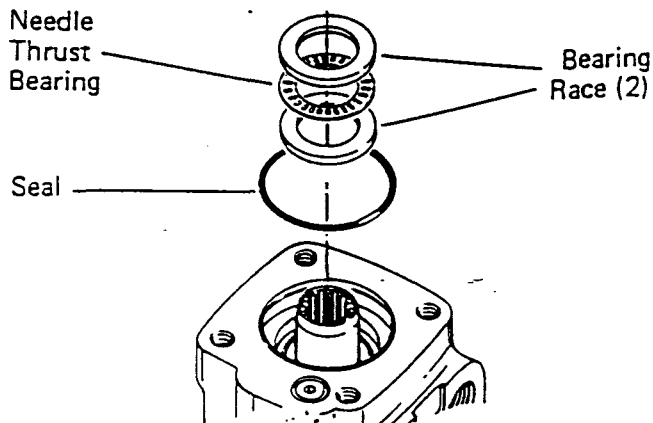


Figure 17

13 Install 2 bearing races and the needle thrust bearing in the order shown in Fig. 17.

14 Install 1-1/4" diameter dust seal in seal gland bushing, flat or smooth side of dust seal must face down towards bushing, see Fig. 19.

15 Install the quad ring seal in seal gland bushing. Smooth seal in place with your finger. Do not use any seal that falls freely into pocket of bushing, see Fig. 19.

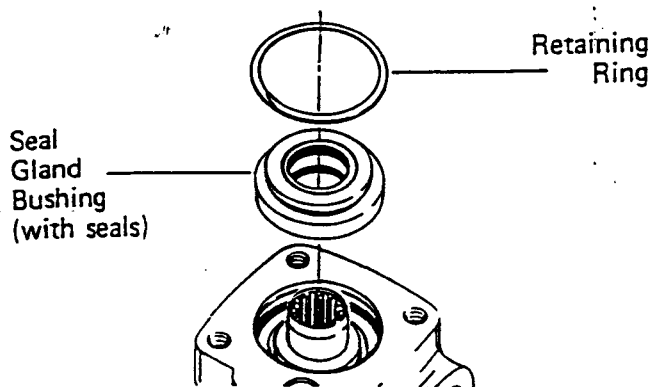


Figure 18

16 Install seal gland bushing over the spool end with a twisting motion. Tap the bushing in place with a rubber hammer. Make sure the bushing is flush against the bearing race.

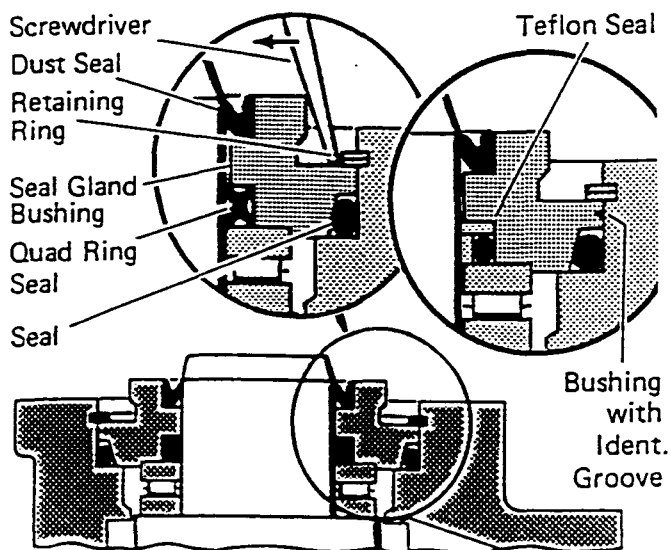


Figure 19

17 Install retaining ring (see Fig. 18-19) in housing. After installing ring, tap on ring end or pry with screwdriver around entire circumference of ring to properly seat ring in groove.

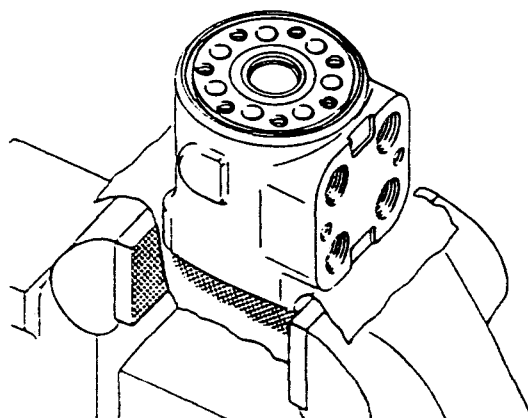


Figure 20

18 Clamp housing in vise, as shown in Fig. 20. Clamp lightly on edges of mounting area. Do not over tighten jaws.

**Note:** Check to insure that the spool and sleeve are flush or slightly below the 14 hole surface of the housing.

**Attention:** Clean the upper surface of the housing by wiping with the palm of clean hand. Clean each of the flat surfaces of the meter section parts in a similar way when ready for reassembly. Do not use cloth or paper to clean surfaces.

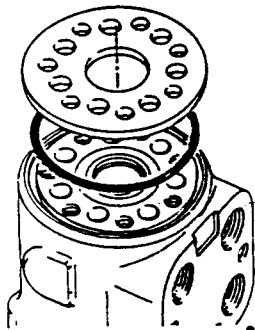


Figure 21

19 Install 3" diameter seal in housing, see Fig. 21.

20 Install spacer plate. Align bolt holes in spacer plate with tapped holes in housing.

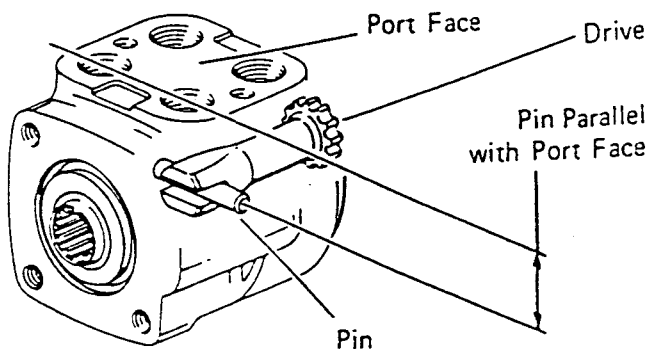


Figure 22

21 Rotate spool and sleeve assembly until pin is parallel with port face, see Fig. 22. Install drive, make sure you engage drive with pin. To assure proper alignment, mark drive as shown in Fig. 24 (ref. B). Note relationship between slotted end of drive to splined end of drive when marking.

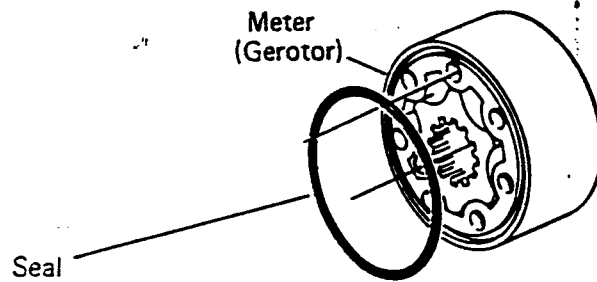


Figure 23

22 Install 3" diameter seal in meter.

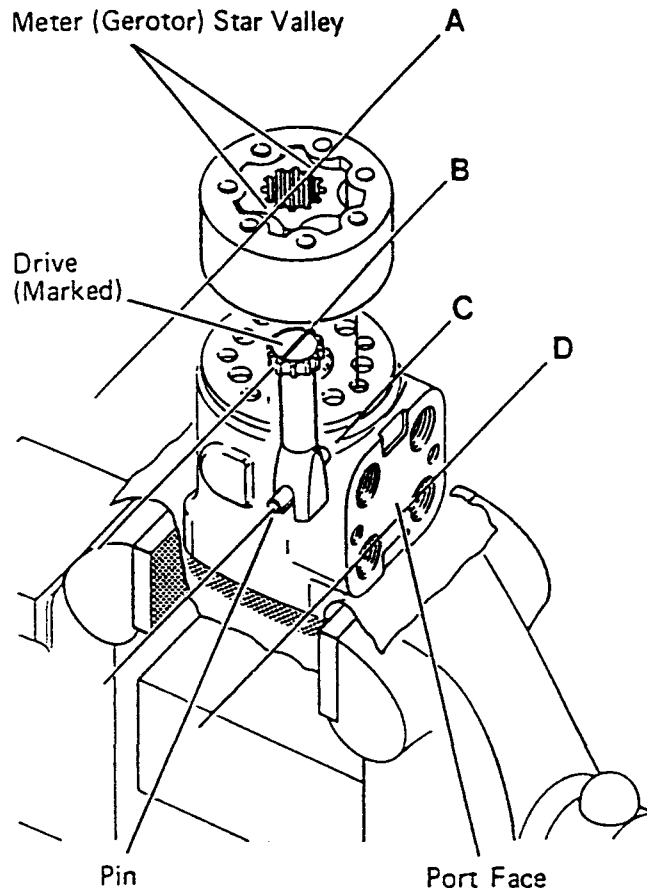


Figure 24

23 With seal side of meter toward spacer plate, align star valleys (ref. A) on drive (ref. B). Note the parallel relationship of reference lines A, B, C, and D— Fig. 24. Align bolt holes without disengaging meter from drive.



# Reassembly

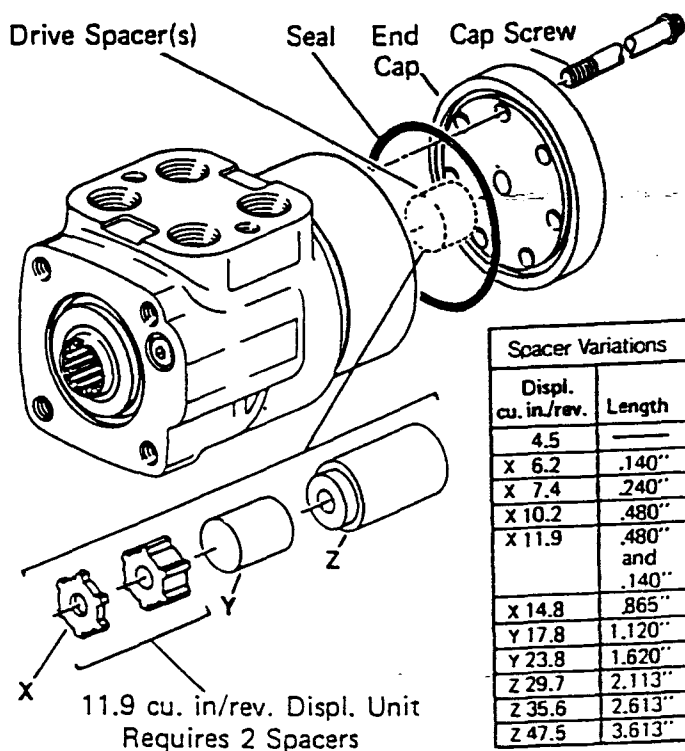


Figure 25

10

24 Install drive spacer(s) when used, in meter, see Fig. 25.

25 Install 3" diameter seal in end cap.

26 Install end cap on gerotor, align holes.

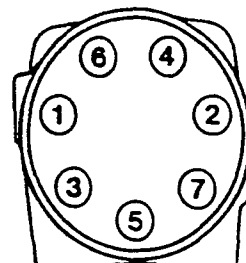


Figure 26

27 Install 7 dry cap screws in end cap. Pretighten screws to 150 inch pounds, then torque screws to 275 inch pounds in the sequence shown in Fig. 26.

## Disassembly

### Disassembly of Integral Column Sub Assembly

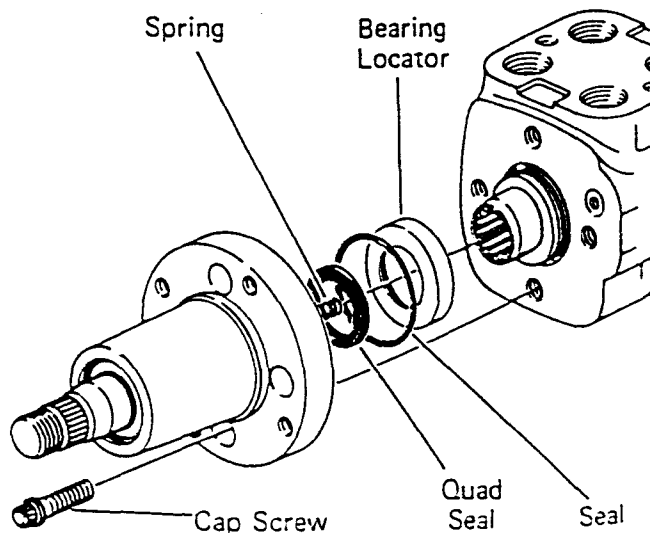


Figure 27

- 1 Remove 4 cap screws from column.
- 2 Remove column and spring, see Fig. 27.
- 3 Remove bearing locator.
- 4 Remove quad ring seal, and 1-15/16" diameter seal from column.

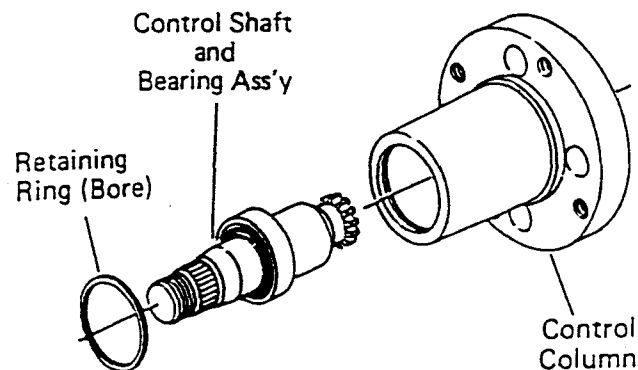


Figure 28

5 Use a thin bladed screwdriver to pry retaining ring from bore of control column.

6 Remove control shaft and bearing assembly from column, see Fig. 28. If tight, tap lightly with a plastic hammer or rubber hammer) on splined end of control shaft until the shaft breaks loose from the column.

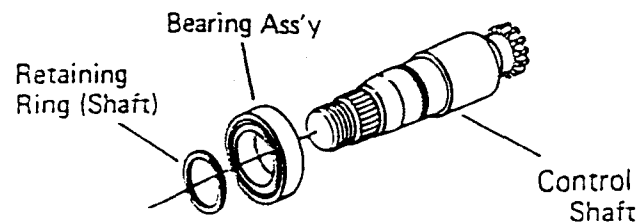


Figure 29

7 Use a thin bladed screwdriver to pry retaining ring from shaft. The retaining ring fits very tight, be careful not to distort it. Remove this ring only if it's necessary to remove bearing assembly from shaft, see Fig. 29.

8 Press bearing assembly from control shaft. Remove bearing assembly from threaded end of shaft, see Fig. 29. Remove this bearing assembly only if necessary.

## Reassembly

### Reassembly of Integral Column Sub Assembly

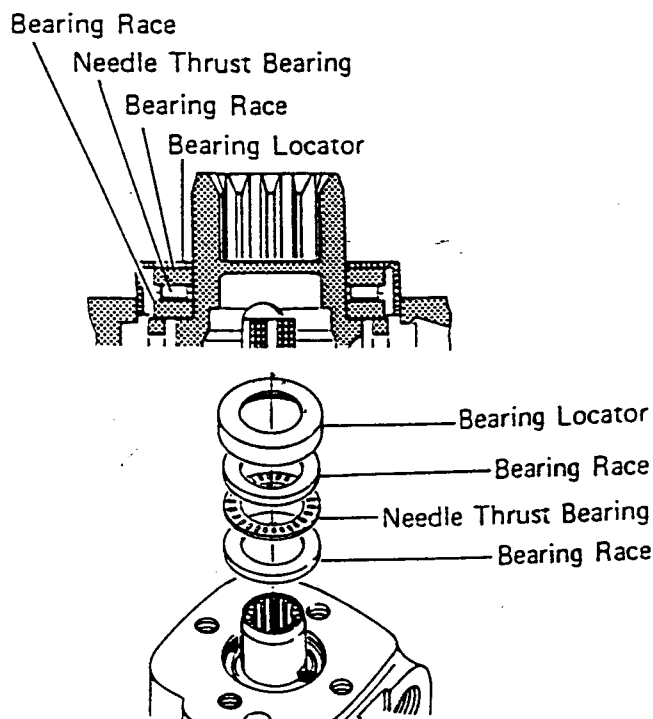


Figure 30

1 Install bearing locator over 2 bearing races and the needle thrust bearing, see Fig. 30. Use a soft plastic hammer or rubber hammer to lightly tap bearing locator in housing.

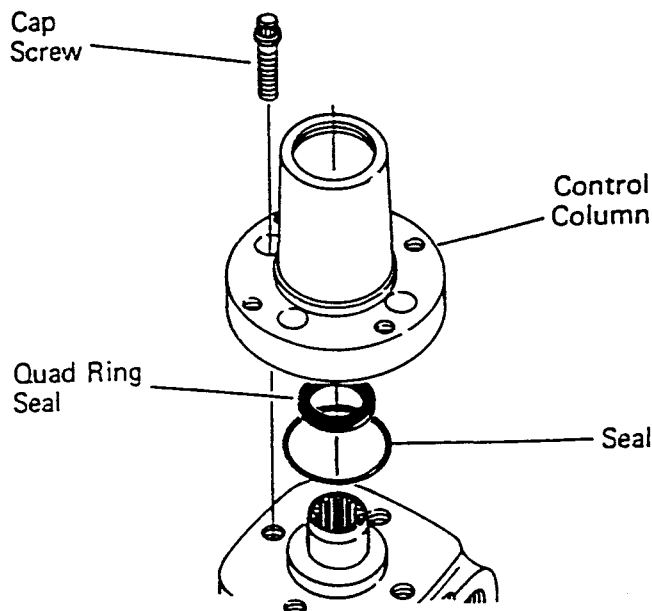


Figure 31

2 Install dry quad ring seal, and lubricated 1-15/16" diameter seal in column, see Fig. 31.

3 Install column on housing. Align bolt holes.

4 Install 4 dry cap screws. Torque screws in a criss-cross pattern to 200 inch pounds.

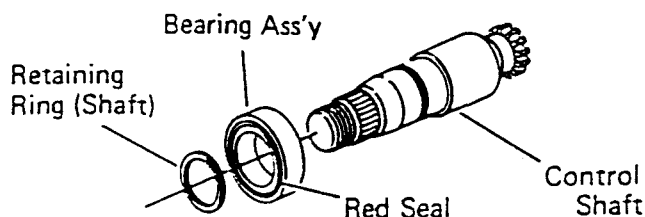


Figure 32

5 Press bearing assembly on control shaft with seal (red) side of bearing assembly facing toward threaded end of shaft. Make sure the bearing assembly seats against shoulder of shaft.

6 Install retaining ring on control shaft, see Fig. 32. Make sure ring seats properly in ring slot above bearing assembly.

# Reassembly

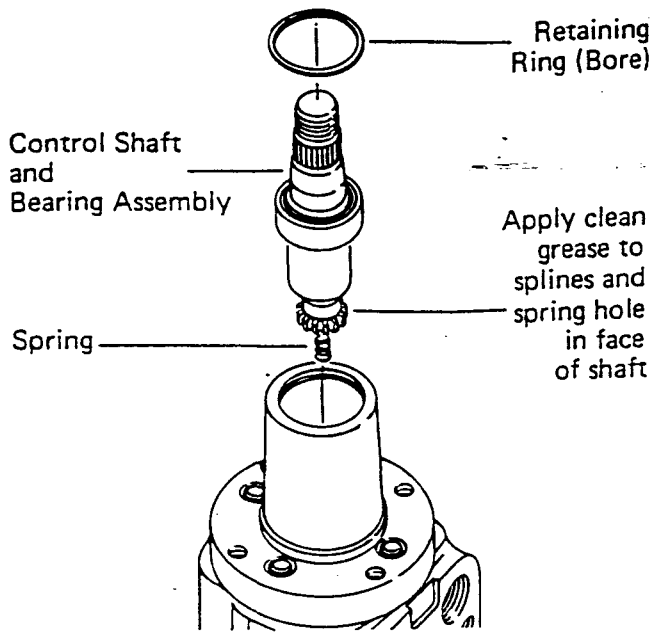


Figure 33

7 Apply clean grease to splines and spring hole located in face of control shaft, see Fig. 33. Install spring in hole. The grease should hold the spring in place until you install control shaft in column.

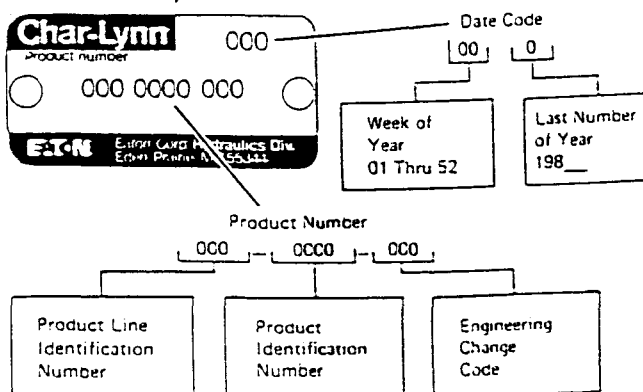
8 Install control shaft and bearing assembly in column (insert splined end of control shaft in column first), see Fig 33. Turn shaft to engage with spool. Push bearing assembly in far enough so you can install retaining ring in bore of column.

9 Install retaining ring in bore of column. Make sure you fully seat this retaining ring in ring groove.

## How to order replacement parts.

Each order must include the following information:

1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts



# 12

## Low Input Torque Steering Control Unit

1 After disassembling steering control unit, discard quad-ring seal, seal gland bushing and two centering springs. Seal gland bushings for Teflon seal and quad-ring seal are not interchangeable.

2 Low torque steering control unit has one pair of spring spacers and two pairs of centering springs. Install spring spacers between two sets of centering springs. The installation procedure is the same as that used on the standard units.

3 Install Teflon seal, o-ring and back-up ring on the spool, see Figure X.

**Note:** Apply a light coat of hydraulic oil to all seals before installation.

4 Install dust seal in seal gland bushing, flat or smooth side down. This bushing has identification groove in outer diameter. Non-grooved bushing cannot be used with Teflon seal.

5 Install seal gland bushing over spool end with a twisting motion. Tap bushing in place with a rubber hammer. Make sure bushing is flush against bearing race.

6 Install retaining ring ( see Figure X ) in housing. After installing ring , tap on ring end or pry with screwdriver around entire circumference of ring to properly seat ring in groove.

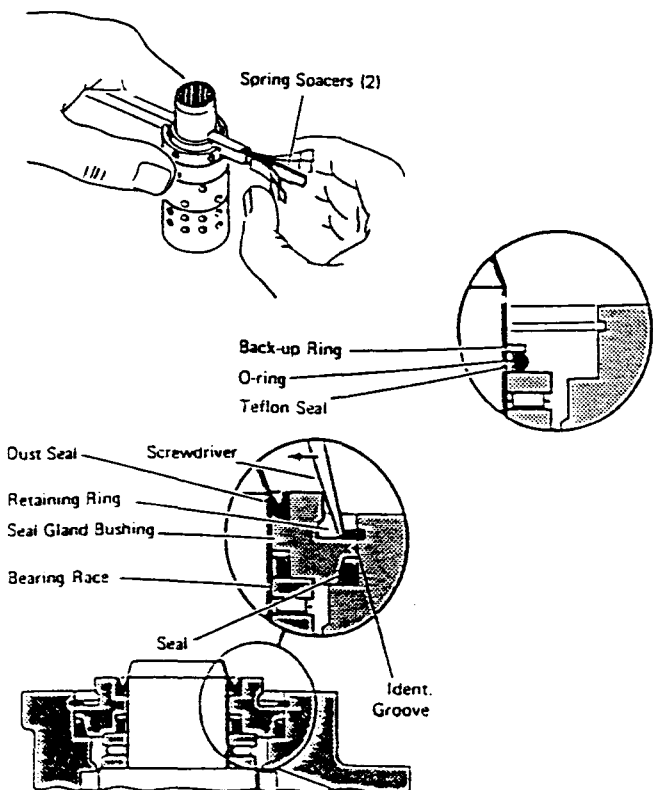


Figure X

Most steering problems can be corrected if the problem is properly defined. The entire steering system should be evaluated before removing any components. The steering control unit is generally not the cause of most steering problems. The following is a list of steering problems along with possible causes and suggested corrections.

<u>Problem</u>	<u>Possible Cause</u>	<u>Correction</u>
1. Slow steering, hard steering, or loss of power assist.	Worn or malfunctioning pump.	Replace pump.
	Stuck flow divider piston.	Replace flow divider.
	Worn pump compensator allowing the system pressure to be less than specified.	Replace pump and compensator.
	Malfunctioning relief valve allowing the system pressure to be less than specified.	Replace the relief valve.
	Overloaded steer axle.	Reduce load.
2. Wander—Tendency of vehicle path to deviate from course defined by operator input.	If load sensing system	Correct
	1. Leaking or kinked load sensing signal line.	Check spring and sticking spool. Check damping orifices in both ends of main bore for debris. Check system pressure at SCU inlet for proper system pressure. If not correct replace priority valve relief cartridge.
	2. Malfunctioning priority valve.	
	Air in the system due to low level of oil, cavitating pump, leaky fitting, pinched hose, etc.	Correct condition and add fluid.
	Worn mechanical linkage.	Repair or replace.
	Bending of linkage or cylinder rod.	Repair or replace.
	Loose cylinder piston.	Repair or replace.
	Leaky crossover relief or anti-cavitation valve in cylinder lines.	Repair or replace the accessory valve.
	Severe wear in steering control unit.	Replace the steering control unit.
	Single rod end cylinder slowly extends without turning the steering wheel.	A small rate of extension may be normal on a closed center system.
3. Drift—Diviation of vehicle path, without operator input, from normally expected continuing course.	Worn or damaged steering linkage.	Replace linkage and align front end.
4. Slip—A slow movement of steering wheel fails to cause any movement of steered wheels.	Leakage of cylinder piston seals or accessory valve between cylinder lines or ports.	Replace seals or accessory valve.
	Worn steering control unit meter.	Replace steering control unit.
5. Temporary hard steering or hang-up—A momentary increase in steering wheel torque during steering reversal or initial input.	Thermal Shock*	Check unit for proper operation and cause of thermal shock.

\*Thermal shock definition bottom of page 14.

<u>Problem</u>	<u>Possible Cause</u>	<u>Correction</u>
6. Erratic steering.	Air in system due to low level of oil, cavitating pump, leaky fitting, pinched hose, etc.	Correct condition and add fluid.
	Loose cylinder piston.	Replace cylinder.
	*Thermal shock damage.	Replace steering control unit.
	Sticking flow control spool.	Replace flow control valve.
7. "Spongy" or soft steering.	Air in hydraulic system. Most likely air trapped in cylinders or lines.	Bleed air out of system. Placing ports on top of the cylinder will help prevent air trapping.
	Low fluid level.	Add fluid and check for leaks.
8. Free Wheeling—Steering wheel turns freely with no feeling of pressure and no action on steered wheels.	Steering column upper shaft is loose or damaged.	Tighten steering wheel nut.
	Lower splines of column may be disengaged or broken.	Repair or replace column.
	Steering control unit meter has a lack of oil. This can happen on start-up, after repair, or long periods of non use.	Usually starting engine will cure problem.
	No flow to steering unit can be caused by: 1. Low fluid level. 2. Ruptured hose. 3. Internal steering control unit damage due to thermal shock*.	Add fluid and check for leaks. Replace hose. Replace the unit.
9. Free Wheeling—Steering wheel turns with slight resistance but results in little or no steered wheel action.	Leaking crossover relief or anti-cavitation valve in cylinder lines.	Repair or replace the accessory valve.
	Piston seal blown out.	Determine cause. Correct and replace seal.
10. Excessive free play at steering wheel.	Loose steering wheel nut. Steering column shaft worn or damaged. There should be very little free play in the unit itself.	Repair or replace steering wheel connection or column.
11. Excessive free play at steered wheels.	Broken or worn linkage between cylinder and steered wheels.	Check for loose fitting bearings and anchor points in steering linkage between cylinder and steered wheels.
	Leaky cylinder seals.	Replace cylinder seals.

\*Thermal shock—A condition caused when the hydraulic system is operated for some time without turning the steering wheel so that fluid in the reservoir and system is hot and the steering control unit is relatively cool (more than 50° F temperature differential). When the steering wheel is turned quickly the result is temporary seizure and possible damage to internal parts of the steering control unit. The temporary seizure may be followed by total free wheeling. This applies to closed center and load sensing units only.

<u>Problem</u>	<u>Possible Cause</u>	<u>Correction</u>
12. Binding or poor centering of steering wheel.	<p>Binding or misalignment in steering column or splined input connection.</p> <p>High back pressure in tank line can cause slow return to center. Should not exceed 300 psi.</p> <p>Large particles can cause binding between the spool and sleeve.</p>	<p>Align column pilot and spline to steering control unit.</p> <p>Revise circuit return line.</p> <p>Clean the unit and filter the oil. If another component has failed generating contaminants, flush the system while bypassing the steering control unit.</p>
13. Steering unit locks up.	<p>Large particles in meter section.</p> <p>Insufficient hydraulic power (units over 15 cu. in./rev.)</p> <p>Severe wear and/or broken pin.</p> <p>*Thermal shock.</p>	<p>Clean the unit.</p> <p>Check hydraulic power supply.</p> <p>Replace the unit.</p> <p>Replace the unit.</p>
14. Steering wheel oscillates or turns by itself, either side of neutral, after operator has removed input.	<p>Parts assembled wrong. Steering unit improperly timed.</p> <p>Lines connected to wrong ports.</p>	<p>Correct timing.</p> <p>Reconnect lines correctly.</p>
15. Steered wheels turn in wrong direction when operator activates steering wheel	<p>Lines connected to wrong cylinder ports.</p>	<p>Reconnect lines correctly.</p>
16. Kick—Momentary kick back of steering wheel at start of steering.	<p>No inlet check valve on steering control unit.</p>	<p>Install a check valve.</p>
17. Instability—Fluid-born oscillation.	<p>Air in lines</p> <p>Harmonic system</p> <p>Plumbing</p> <p>Relief Setting</p> <p>Priority Valve</p> <p>Load Sensing Pump</p>	<p>Check pump inlet. Bleed sensing lines.</p> <p>Add hose or an accumulator.</p> <p>Bleed all lines. Pilot lines should be tubing. lines to cylinder should be tubing. If 2 pilot lines are used go to 1.</p> <p>Pump relief should be 300 PSI above priority relief.</p> <p>Bleed by holding against stop for 30 seconds on models w/built in relief only.</p> <p>Decrease damping orifice by adding small wire.</p> <p>Increase spring rate ( this will raise the standby pressure ).</p> <p>Compensator sticky. Increase standby pressure.</p>

\*Thermal shock definition bottom of page 14.

# Selection Data

## 3 Series

System	Load Circuit	Rated Flow GPM ★ [LPM]	Port Size	External Configuration	Product Number						
					Displacement-cu. in. rev. [cu. cm. rev.]						
					4.5 [75]	6.2 [100]	7.4 [120]	10.2 [165]	11.9 [195]	14.8 [240]	17.8 [290]
Open Center	Non-Load Reaction	2-4 [7.5-15]	9/16-18	Standard	211-1001	211-1002	211-1003	-	-	-	-
				Integral Column	211-1004	211-1005	211-1006	-	-	-	-
Closed Center	Non-Load Reaction	2-4 [7.5-15]	9/16-18	Standard	212-1009	212-1010	212-1011	212-1012	-	-	-
	Load Reaction	2-4 [7.5-15]	9/16-18	Standard	212-1021	212-1022	212-1023	212-1024	-	-	-
				Integral Column	212-1025	212-1026	212-1027	212-1028	-	-	-

## 6 Series

System	Load Circuit	Rated Flow GPM ★ [LPM]	Port Size	External Configuration	Displacement-cu. in. rev. [cu. cm. rev.]						
					Displacement-cu. in. rev. [cu. cm. rev.]						
					4.5 [75]	6.2 [100]	7.4 [120]	10.2 [165]	11.9 [195]	14.8 [240]	17.8 [290]
Open Center	Non-Load Reaction	4-8 [15-30]	3/4-16	Standard	211-1007	211-1008	211-1009	211-1010	211-1011	211-1012	211-1013
	Load Reaction	4-8 [15-30]	3/4-16	Integral Column	211-1014	211-1015	211-1016	211-1017	211-1018	211-1019	211-1020
				Standard	211-1047	211-1048	211-1049	211-1050	211-1051	211-1052	211-1053
Closed Center	Non-Load Reaction	12 [45]	3/4-16	Standard	212-1001	212-1002	212-1003	212-1004	212-1005	212-1006	212-1007
	Load Reaction	8 [30]	3/4-16	Standard	-	-	-	212-1018	212-1019	212-1020	-
Load Sensing	Non-Load Reaction	6 [23]	3/4-16	Standard	213-1001	213-1002	213-1003	213-1004	213-1005	213-1006	213-1007

## 12 Series

System	Load Circuit	Rated Flow GPM ★ [LPM]	Port Size	External Configuration	Displacement-cu. in. rev. [cu. cm. rev.]						
					Displacement-cu. in. rev. [cu. cm. rev.]						
					17.8 [290]	23.8 [390]	29.7 [490]	35.6 [585]	47.5 [780]	-	-
Open Center	Non-Load Reaction	8-16 [30-60]	3/4-16	Standard	211-1037	211-1038	211-1039	211-1040	211-1041	-	-
				Integral Column	211-1042	211-1043	211-1044	211-1045	211-1046	-	-
Closed Center	Non-Load Reaction	16 [60]	3/4-16	Standard	-	212-1014	212-1015	212-1016	212-1017	-	-
Load Sensing	Non-Load Reaction	12 [45]	3/4-16	Standard	213-1012	213-1013	213-1014	213-1015	213-1016	-	-

Other combinations of the above standard features available on special order—consult factory

★For closed center unit, rated flow is measured at 1000 PSI pressure drop at full valve deflection.  
For load sensing unit, rated flow is designed for 65 PSI pressure drop between inlet (P) and load sensing (LS) port at full valve deflection.

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