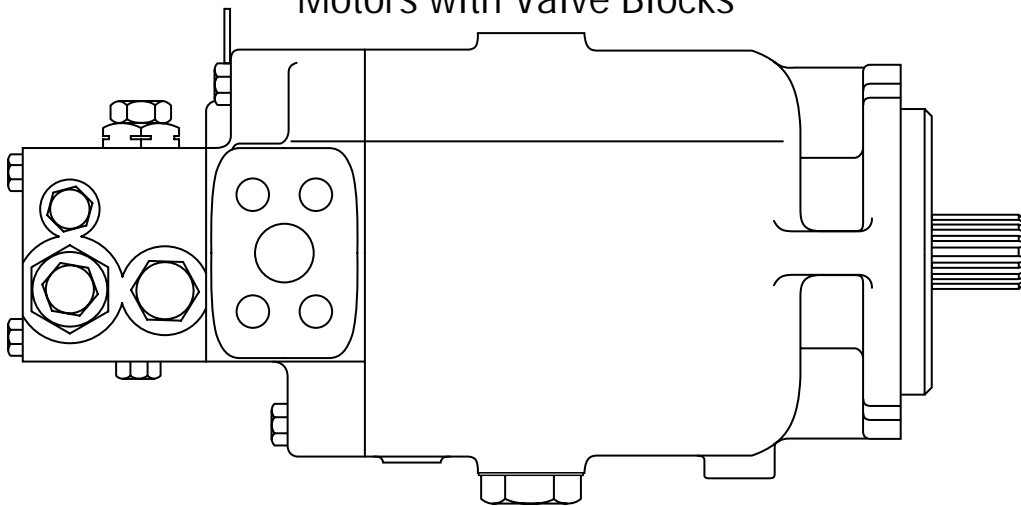


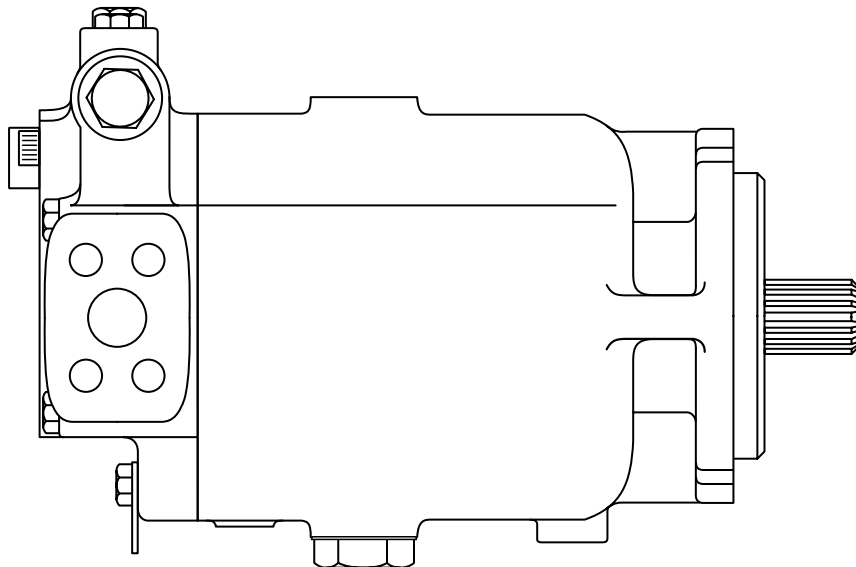


## Repair Information

Motors with Valve Blocks



Motors with Integral Shuttle and Low Pressure Relief Valves



Series 1 Models 33-64  
Hydrostatic Fixed Motors

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### Introduction

The purpose of this manual is to provide you with service information and procedures for disassembly and reassembly of Eaton Hydrostatic Fixed Displacement Motors (Series 1; Models 33, 39, 46, 54, and 64). Motors with valve blocks and motors with integral shuttle and low pressure relief valves are covered. We feel the procedures outlined in this manual will allow you to better service your motors and obtain the best results possible. To ensure accuracy of repair, and prevent part loss or damage, certain components or subassemblies are disassembled, inspected, and reassembled upon removal from the motor.

Note: All requests or inquiries must be accompanied by the complete model and serial number.

Refer to specific part listings covering your Eaton motor when ordering replacement parts. Listings are available from the Hydraulics Division in Eden Prairie, MN. See example tag below for motor identification.

When ordering replacement parts, you must include the following information:

## ID Tag

### A - Displacement (cu.in./rev.)

0033 = 3.3  
 0039 = 3.9  
 0046 = 4.6  
 0054 = 5.4  
 0064 = 6.4

### B - Identifies Type of Product

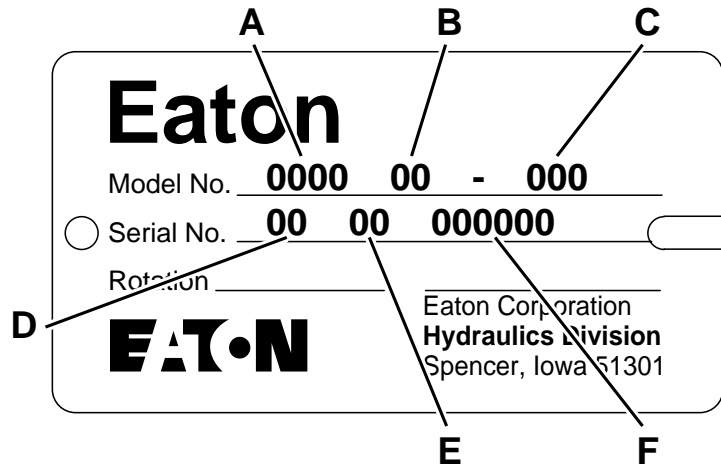
21 =Variable Displacement Pump  
 31 =Fixed Displacement Motor  
 41 =Variable Displacement Motor  
 61 =Tandem Variable Displacement Pumps

### C - Identifies Specific Unit Configuration

### D - Month of Manufacture

### E - Year of Manufacture

### F - Specific Serial Number of Unit



## Tools Required

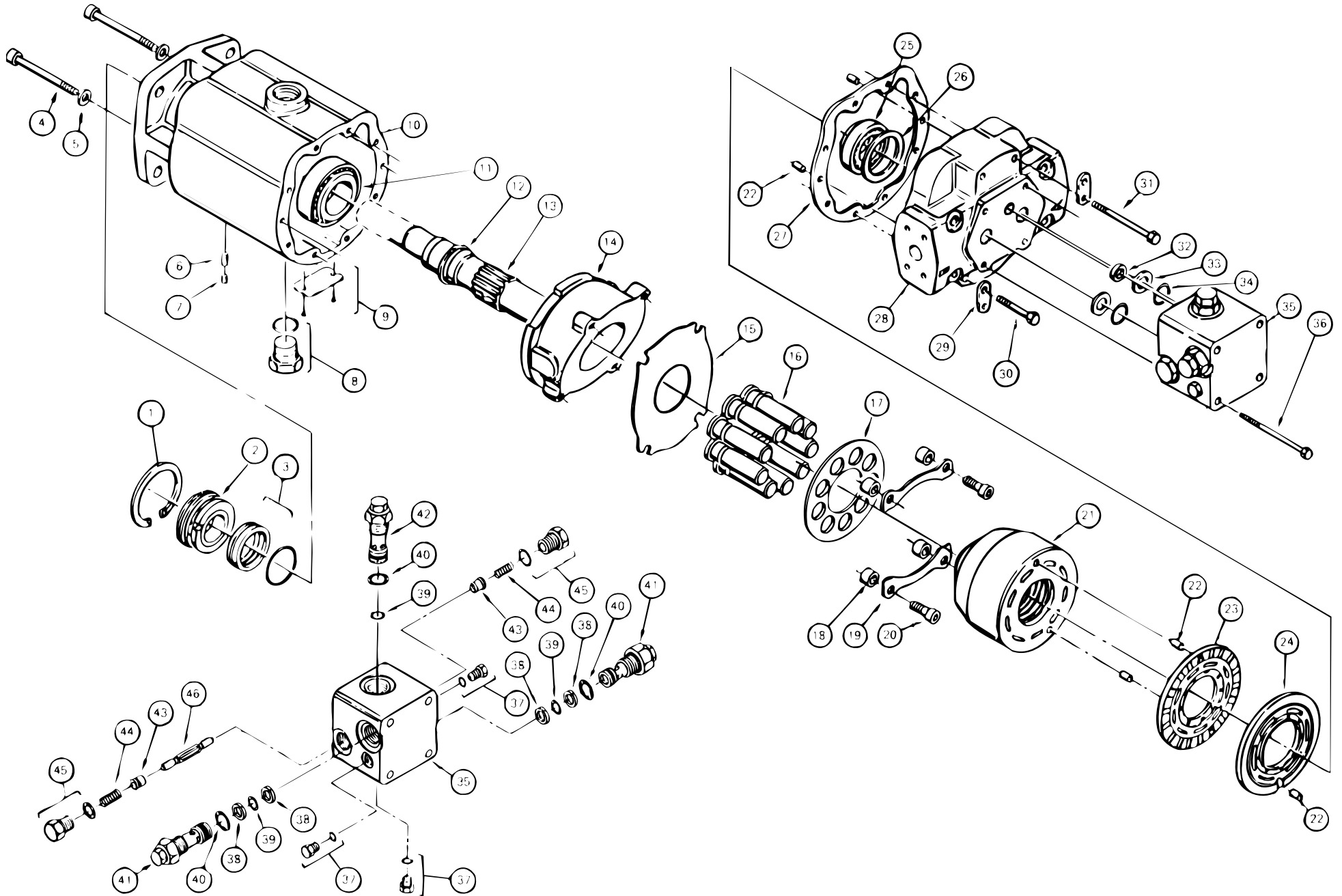
- Stationary Seal Puller (1/4 in. x 20 UNC Cap Screw, 3 to 4 in. Long)
- Rotating Seal Puller (Special)
- Retaining Ring Pliers, No. 5 or 7
- Breaker Bar or Ratchet Wrench
- 1-3/8 in. Hex Wrench
- 1 in. Hex Wrench
- 9/16 in. Socket
- Torque Wrench (200 lb-ft Capacity)
- 1/4 in. Hex Bit Socket
- 1/4 in. Hex Key
- Loctite No. 271
- Pliers
- Punch
- Magnetic Base Indicator
- Hammer
- Bearing Press or Driver
- Light Petroleum Jelly (like Vaseline)
- Cleaning Solvent
- Two Headless 5/16 in. Cap Screws, 5 to 6 in. Long (Special)
- Micrometer or Vernier Calipers
- Small Screwdriver (1/8 in. Blade)
- Low Clearance Bearing Puller (Special)
- Clean Lint Free Rags

Seal all open ports. Thoroughly clean exterior of motor before disassembly.

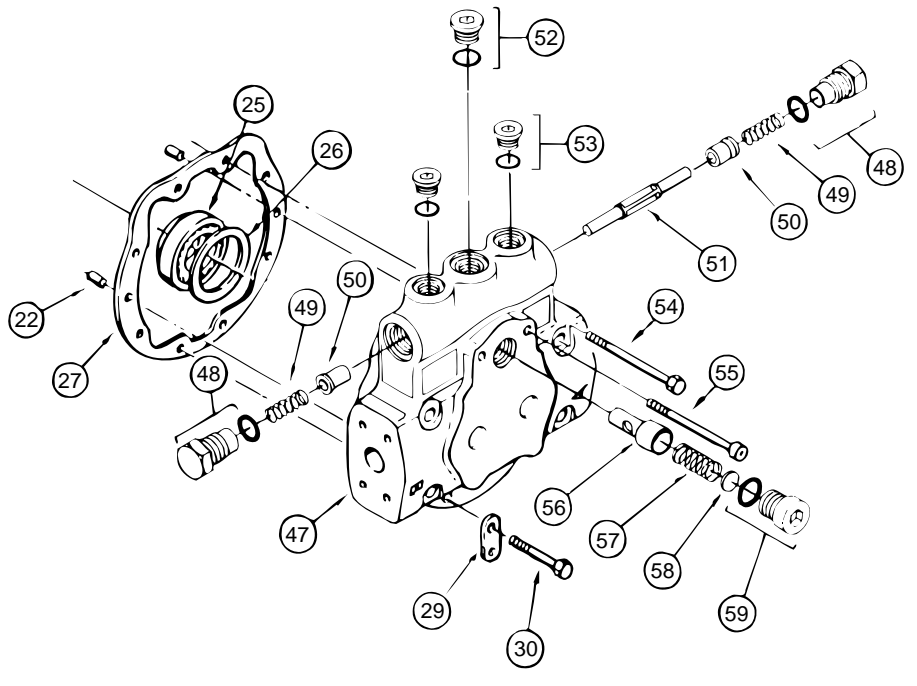
Whenever a unit is disassembled, it is a good service policy to replace all seals. Lubricate the seals with petroleum jelly (Vaseline®). Use only clean, recommended oil when assembling the unit. See Hydrostatic Fluid Recommendations on page 20 or Form No. 3-401 for recommended fluids.

Cleanliness is extremely important when repairing a hydrostatic pump or motor. Work in a clean area. Clean all metal parts in clean solvent and blow dry the parts with filtered, moisture free air.

Special Tools are shown on pages 17-19.



## End Cover with Integral Shuttle and Low Pressure Relief Valve



Item No.	Description	Qty.
1	Retaining Ring	1
2	Stationary Seal	1
3	Rotating Seal and O-ring	1
4	Cap Screw	2
5	Washer	2
6	Dowel Pin	1
7	Socket Pipe Plug (1/8-27)	1
8	Case Drain Plug/O-ring	1
9	I.D. Tag and Screws	1
10	Fixed Motor Housing	1
11	Output Shaft Bearing Cup and Cone	1
12	Retaining Ring	1
13	Motor Drive Shaft	1
14	Swashplate	1
15	Thrust plate	1
16	Piston and Slipper Assembly	9
17	Slipper Retainer Plate	1

Item No.	Description	Qty.
18	Spacer	4
19	Retaining Strap	2
20	Cap Screw	4
21	Cylinder Barrel Assembly	1
22	Dowel Pin (5/16 x 5/8 long)	5
23	Bearing Plate	1
24	Valve Plate	1
25	End Cover Bearing Cup and Cone	1
26	End Cover Bearing Shims	A/R
27	End Cover Gasket	1
28	Standard Motor End Cover	1
29	Lifting Strap	2
30	Hex Head Bolt	2
31	Hex Head Bolt	6
32	Square Cut Seal	1
33	Back-up Washer	2
34	O-ring	2
35	Valve Block Assembly	1
36	Hex Head Bolt	4
37	Gauge Port Plug/O-ring	3
38	Back-up Ring	4
39	O-ring	3
40	O-ring	3
41	High Pressure Relief Cartridge	2
42	Low Pressure Relief Cartridge	1
43	Shuttle Valve	2
44	Shuttle Spring	2
45	Shuttle Valve Plug/O-ring	2
46	Shuttle Spool	1
47	Motor End Cover with Integral Shuttle and Low Pressure Relief Valve	1
48	Shuttle Valve Plug/O-ring	2
49	Shuttle Spring	2
50	Shuttle Valve	2
51	Shuttle Spool	1
52	Gauge Port Plug/O-ring	1
53	Gauge Port Plug/O-ring	2
54	Hex Head Bolt	4
55	Cap Screw, Socket Head	2
56	Plunger	1
57	Spring	1
58	Low Pressure Relief Valve Shims	A/R
59	Low Pressure Relief Valve Plug/O-ring	1

A/R – As Required

Important: Cleanliness is extremely important when repairing a hydrostatic pump or motor. Before disconnecting the lines, clean foreign material from exterior of unit. Work in a clean area. Clean all metal parts in clean solvent. Blow parts dry with air. Don't wipe parts with cloth or paper towel, because lint or other matter could cause damage. Check all mating surfaces. Replace any parts that have scratches or burrs that could cause leakage. Don't use coarse grit paper, files or grinders on parts.

Note: All torque specifications are for lubricated threads. Bolts for gasketed surfaces should be retorqued a second time.

A good service policy is to replace all old seals with new seals whenever unit is disassembled. Lubricate seals (except metal sealing surfaces of shaft seal assembly) with petroleum jelly. Use only clean, recommended oil when assembling unit. See Fluid Recommendation Form 3-401.

See page 16 for shaft seal reassembly instructions.

#### Disassembly Shaft Seal

Important: Clean surface area around stationary seal assembly.

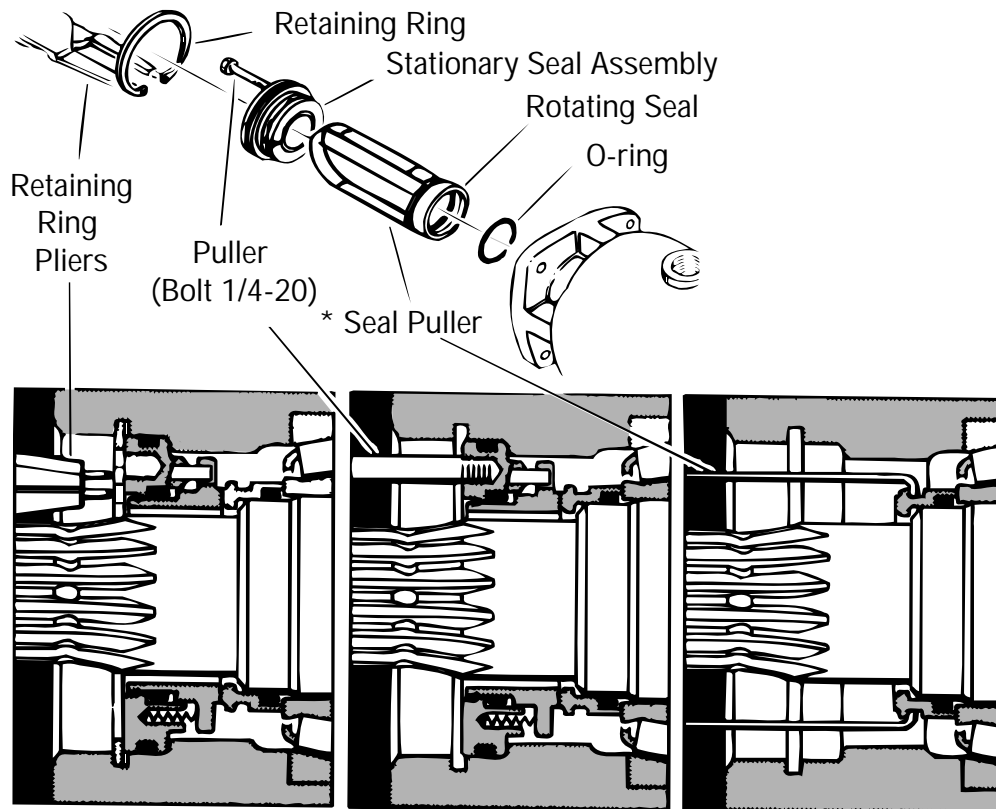


Figure 1

1. Use a pair of retaining ring pliers to remove retaining ring.
2. Insert stationary seal puller into threaded hold of station seal assembly to pull seal assembly from mounting flange.
3. Use rotating seal puller\* (Figure 1) to grip outside diameter of bronze rotating seal. Remove seal from output shaft.
4. O-ring may remain in rotating seal recess. If not found in recess, remove O-ring from main motor shaft.

\* Owatonna Tool Company No CAS 1844

# Disassembly

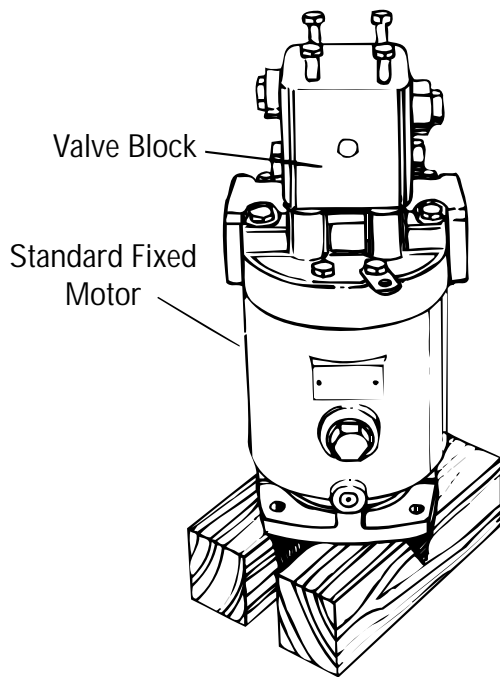
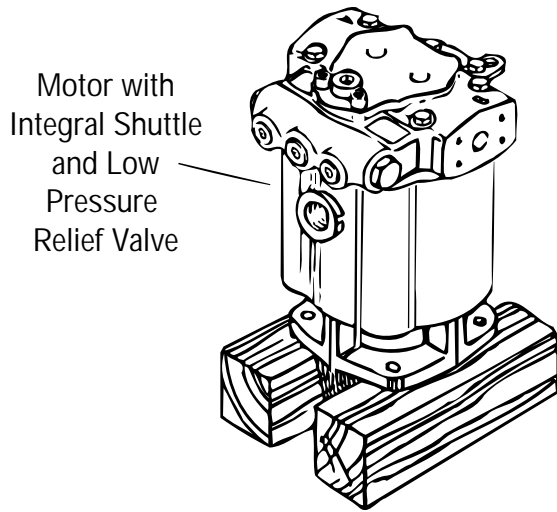


Figure 2

- Position the motor on its mounting flange as shown in Figure 2. If your motor has an integral shuttle and low pressure relief, go to the box on page 9. Otherwise loosen all of the relief valves and plugs in the valve block. Remove the four bolts that hold the valve block to the motor. Then remove the valve block.

- Remove O-rings and back-up rings from mounting face of valve block.

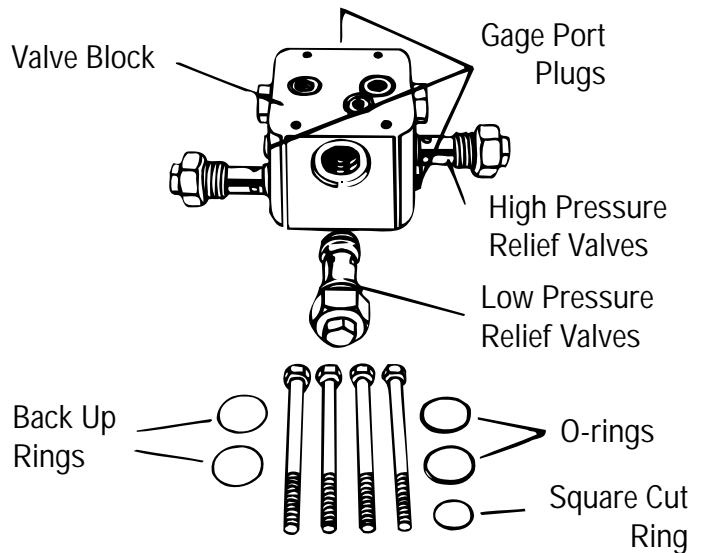


Figure 3

- Use a 1-3/8 in hex wrench to remove valve block low pressure relief valve cartridge.

Note: The low pressure relief valve doesn't have back-up rings. It has only one O-ring in lower groove. Also, low and high pressure relief settings are preset at the factory. Stamping on cartridge identifies setting.

Example:

	0 Thousands	0 Hundreds	0 Tens
Low pressure example:	016=	160 PSI [ 11 Bar]	
	022=	220 PSI [ 15 Bar]	
High pressure example:	500=	5000 PSI [344 Bar]	
	400=	4000 PSI [275 Bar]	

- Using a 1-3/8 in hex wrench to remove two high pressure relief valve from valve block.

Note: High pressure relief valves have two white back-up rings and one O-ring in the lower groove. See Note above (Step 7) for pressure settings.

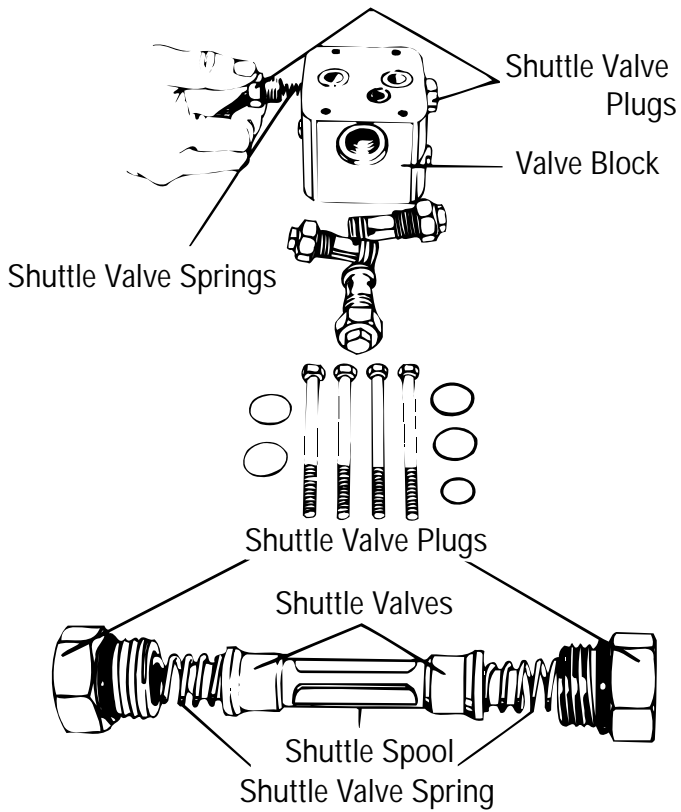


Figure 4

8. Use a 1 in. hex wrench to remove two shuttle valve plugs. Then remove shuttle valve springs.
10. Remove shuttle valves and shuttle spool.
11. Remove three gage port plugs assemblies.

Reassembly Valve Block

12. Install three gage port plug assemblies. Torque plugs 16 lb-ft [22Nm].

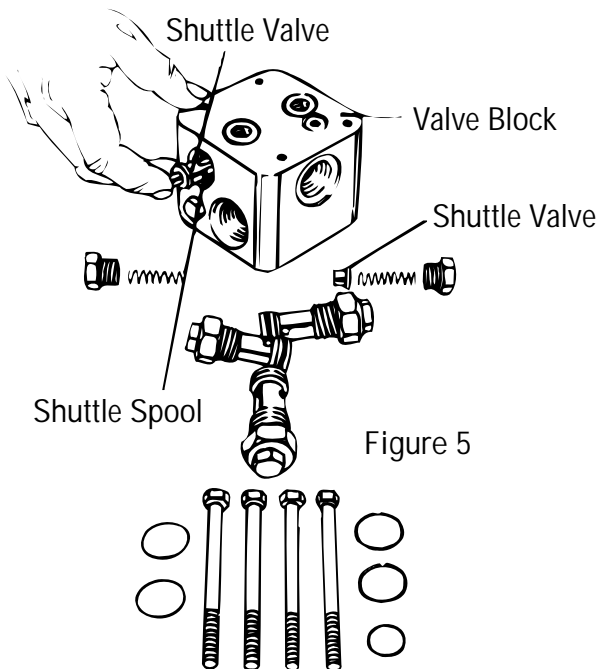


Figure 5

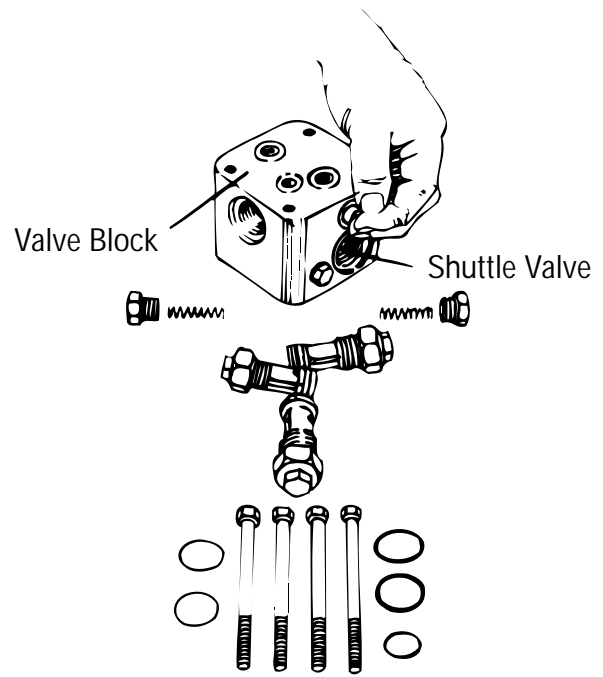


Figure 6

13. Install shuttle spool and shuttle valves in valve block.

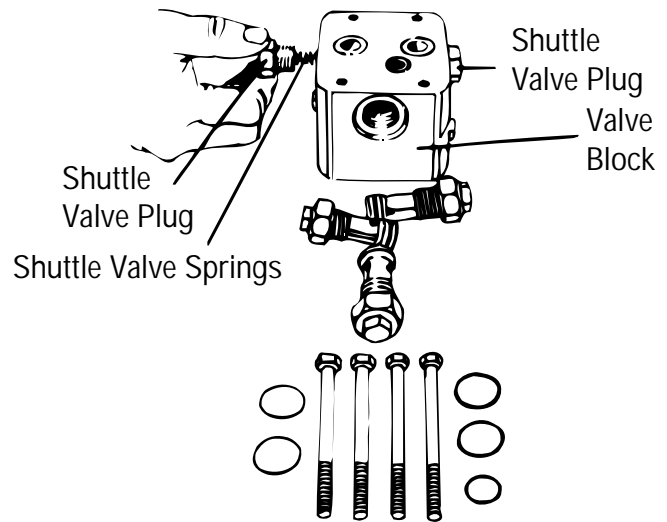


Figure 7

14. Install shuttle valve plugs and shuttle valve springs. Torque valve plugs to 68 lb-ft [92Nm].



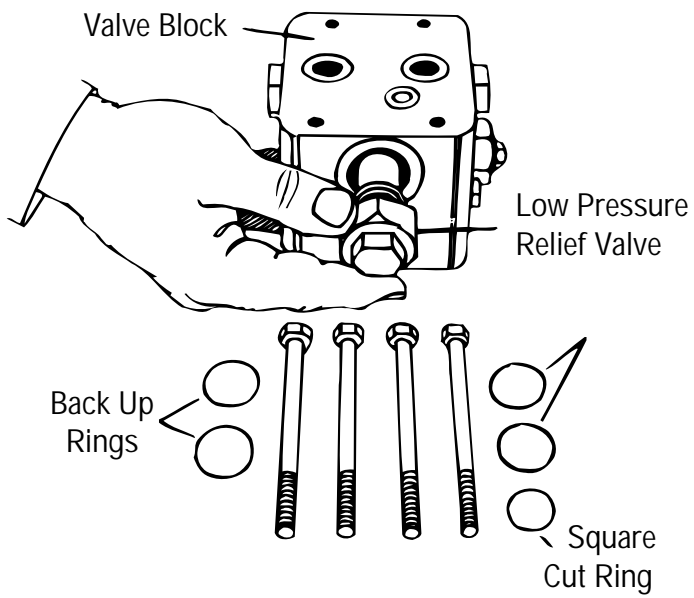


Figure 7

15. Install two high pressure relief valves – as shown in Fig 5. Torque valve to 25 lb-ft [Nm].

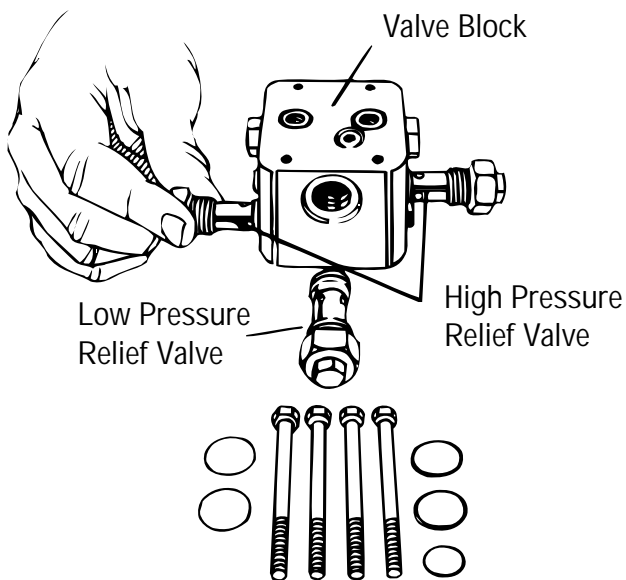
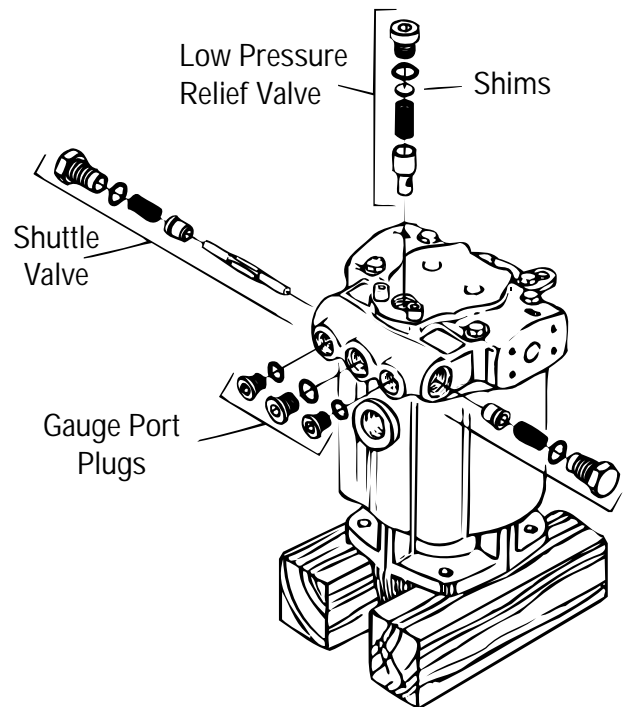


Figure 9

16. Install low pressure relief valve. Torque valve to 75 lb-ft [100 Nm].

### Disassembly End Cover with Integral Shuttle and Low Pressure Relief Valve



Remove the low pressure relief valve. Keep track of the shims, they are used to adjust the relief setting.

Remove the shuttle valve and gauge port plugs.

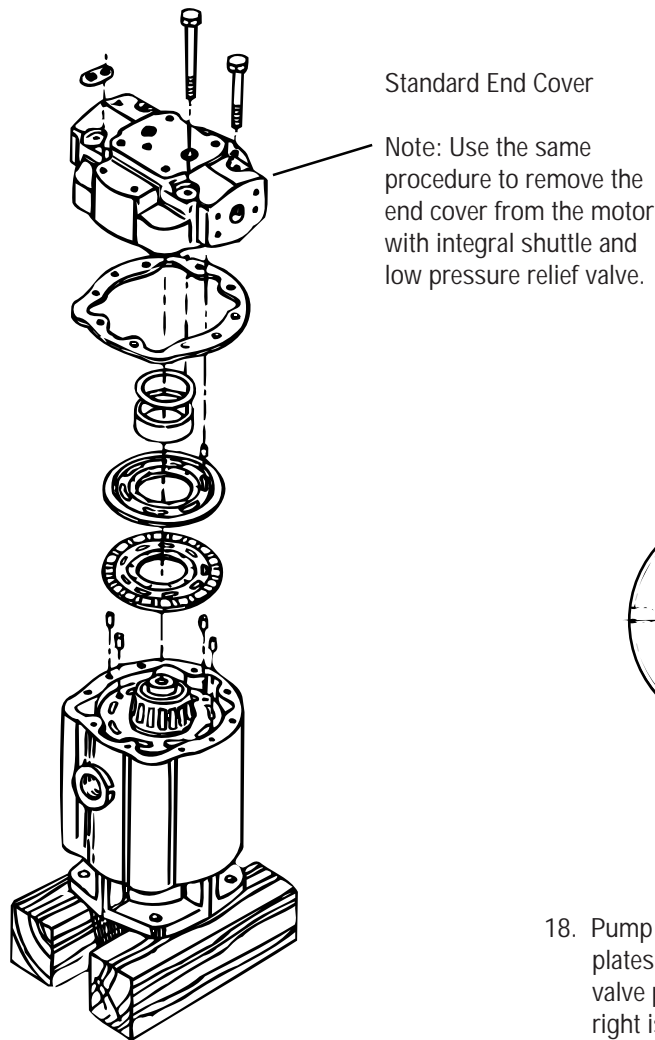


Figure 10

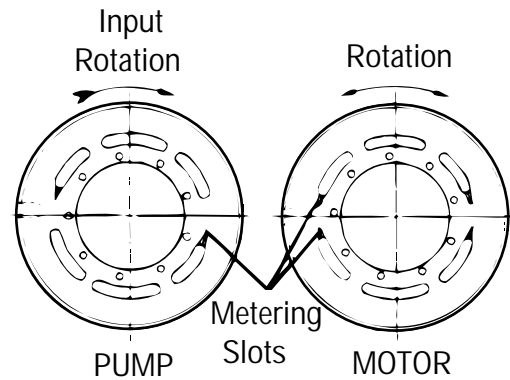


Figure 11

## Disassembly of End Cover

17. Remove eight hex bolts from end cover. See caution below.

Caution: Internal parts are spring loaded. To avoid internal part damage, remove six bolts leaving two bolts opposite each other tight. Then, gradually and evenly remove two remaining bolts.

18. Carefully remove end cover, gasket and two end cover dowel pins. Don't drop any parts (valve plate, bearing cup, or shims) which may (may not) stick to end cover.

## Disassembly of Rotating Group

Note: Use extreme care when handling all close tolerance internal parts of motor.

Keep Parts Clean

18. Pump valve plates are all unidirectional and motor valve plates are bidirectional. Shown on left is clockwise pump valve plate, which is identified by two metering slots. On right is the bidirectional motor valve plate, which is identified by four metering slots. Pump and motor valve plates are not interchangeable.
20. Remove rear bearing race from end cover. Use slight twisting motion to remove bearing race. It is slip-fit into end cover.
21. Remove rear bearing shims from end cover. Make sure you do not misplace shims as they are used to adjust shaft bearing end play of motor output shaft.
22. Remove end cover gasket and dowel pins from motor housing. Gasket may have remained on end cover during removal.
23. Remove bearing plate and pins from cylinder barrel. If small screwdriver is used to pry bearing plate from cylinder barrel, make sure bearing plate and barrel surfaces are not scratched or damaged.

Important: Handle the bearing and valve plates with extreme care. Both plates are lapped to extremely close tolerances for flatness.

Bearing Puller and  
Special Tool – Low  
Clearance Bearing Puller  
(see page 19)

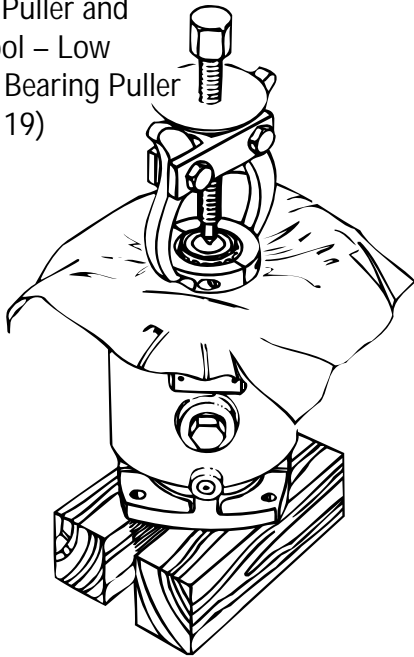


Figure 12

24. Use of low clearance bearing puller is recommended from removal of end cover bearing cone (see Figure 12).

This bearing puller pulls against bearing rollers, not against inner race. It is designed to prevent bearing cone and cylinder barrel face from being damaged when bearing is removed. Close clearance between end cover bearing and cylinder barrel makes it difficult to use any other type of bearing puller.

25. Install bearing puller and remove bearing from output shaft.

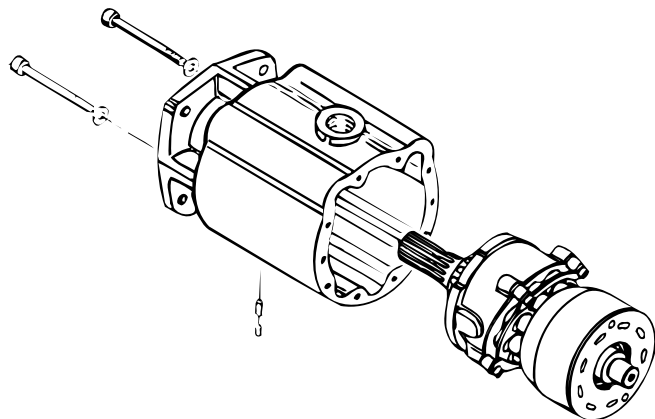


Figure 13

26. Carefully reposition motor on its side. Using 1/4 inch hex bit socket, remove two cap screws that retain swashplate in housing.
27. Remove washers from cap screws and discard. Replace with new washers.
28. Push output shaft assembly inward to dislodge swashplate from its pocket in housing.
29. Carefully remove cylinder barrel assembly and output shaft from housing.

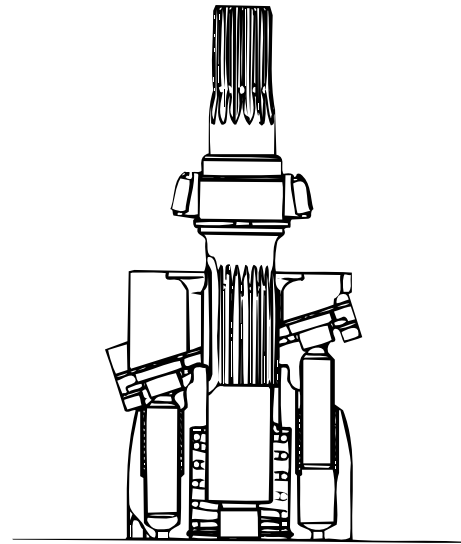


Figure 14

30. Reposition cylinder barrel and output shaft assembly in the up position. Remove output shaft assembly.
31. When output shaft bearing cone must be replaced, use a press to remove cone from shaft assembly.

You must use special stop limit tool (page 18) when installing new cone on shaft.

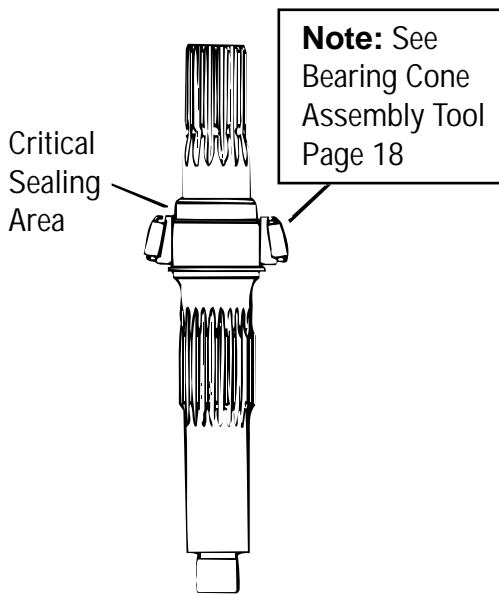


Figure 15

Important: When removing or installing bearing cone, do not damage output shaft sealing area (stepped area between bearing journal and output shaft splines). This area is critical for sealing output shaft seal.

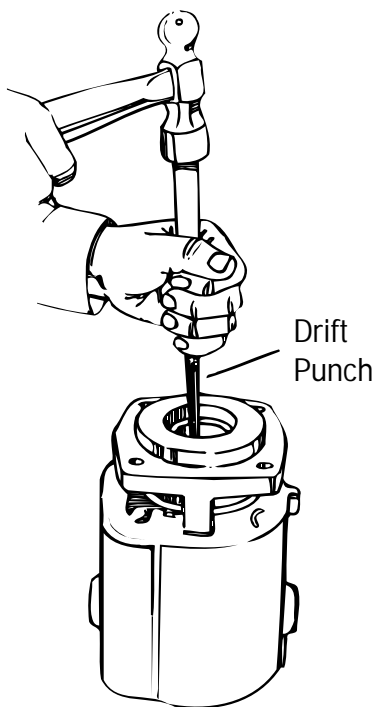


Figure 16

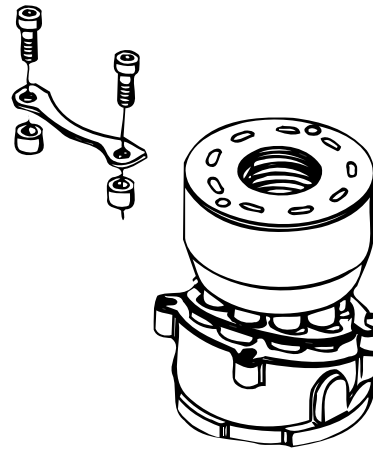


Figure 17

33. Reposition cylinder barrel and swashplate so that the swashplate is in the down position. Using a 1/4 inch hex key to remove the cap screws from the retaining strap on one side of the swashplate. Loosen the cap screws on the other retaining strap as this makes it easier to remove cylinder barrel from swashplate.

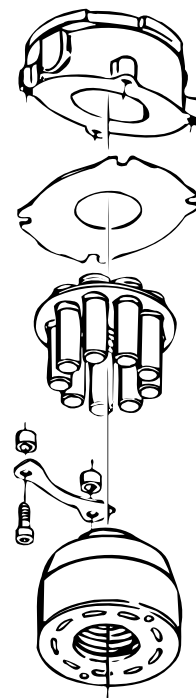


Figure 18

34. Carefully reposition cylinder barrel and swashplate with swashplate in the up position. Remove swashplate by lifting slightly and sliding it over to disengage from retaining strap.
35. Remove cap screws, retaining strap, spacers and thrust plate from swashplate.
36. Disassemble cylinder barrel assembly. Place it on a clean protective surface for inspection and cleaning.

## Reassembly

37. Before reassembly of fixed displacement (fixed clearance) motor, clean all parts and assemblies in clean solvent and blow them dry with compressed air. Inspect and replace all scratched or damaged parts. When reworking parts. Do not use coarse grit paper, files or grinders on any finished surfaces. Replace all gaskets and O-rings.

Lubricate O-rings with petroleum jelly for retention during reassembly. Freely lubricate all bearings and finished part surfaces with clean hydraulic fluid. This will provide required start-up lubrication for moving parts.

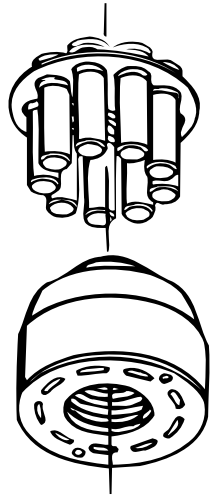


Figure 19

38. Lubricate and install slipper retainer plate and piston slippers in cylinder barrel assembly. After installation, freely lubricate brass slipper faces with clean hydraulic fluid.

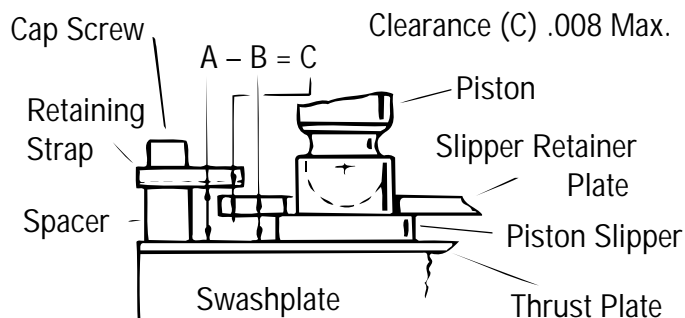


Figure 20

39. Before assembling motor any further, you must check fixed clearance of unit. Do this by first measuring height of retaining strap spacer with a micrometer or vernier calipers. There are two spacer heights – one for the 33, 39, 46 units and one for the 54, 64 units. Spacers are critical to the unit design and may not be adjusted.

Next, measure thickness of both piston slipper flange and slipper retainer plate. Subtracting this measurement from spacer measurement gives fixed clearance of unit. Fixed clearance must not exceed .008 [.20 mm]. If fixed clearance exceeds .009 in [.02 mm], replace worn parts, (i.e., piston slipper assemblies thrust plate, retaining strap and slipper retainer plate).

$$\text{Fixed Clearance} = \text{Spacer Height} - [\text{Slipper Flange} + \text{Retainer Plate}]$$

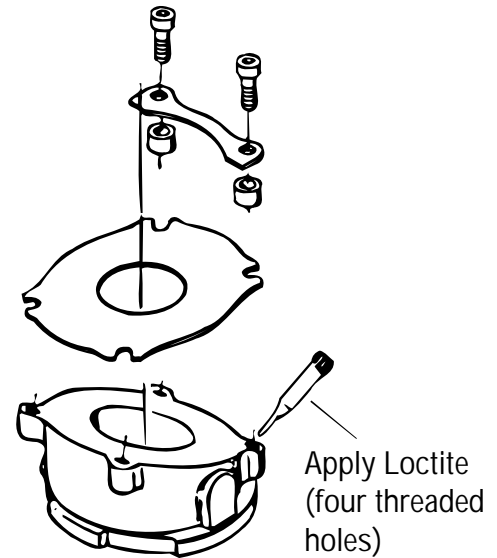


Figure 21

40. After checking fixed clearance, continue with assembly of cylinder barrel and swashplate. Apply one or two drops of Loctite No. 271 in first or second thread down in each of four hole in swashplate.

Caution: Loctite parts must contact only those surfaces intended for assembly. Wipe excess Loctite from swashplate with non-petroleum base solvent applied to cloth. Do not apply Loctite to threads more than 15 minutes before installing cap screws. If Loctite stands for more than 15 minutes, repeat application. If repeating application is not necessary to remove previously applied Loctite.

41. Lightly lubricate and then install thrust plate, aligning cap screw holes. Install spacers, retaining strap and cap screws on one side of the swashplate. Do not tighten cap screws at this time.
42. Place cylinder barrel assembly on clean, flat surface with piston slippers pointing upward. Carefully install swashplate on cylinder barrel by slightly lifting side without retaining strap. Slide swashplate over to engage installed retaining strap around piston retainer.

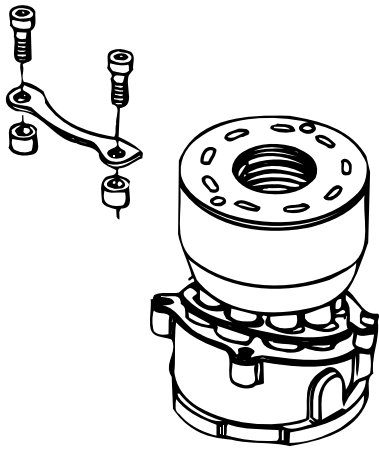


Figure 22

43. Carefully reposition cylinder barrel and swashplate with the swashplate in the down position. Install the remaining spacers, strap and cap screws in the swashplate. Tighten all four cap screws 16-19 lb-ft [22 to 26 Nm].
44. An alternate method of checking fixed clearance is with the use of a feeler gauge. If using this method, make sure gauge is inserted between retaining strap and slipper retainer plate only. Piston slipper faces could be damaged if gauge is inserted between piston slipper and thrust plate.
45. Carefully reposition cylinder barrel assembly and swashplate so that cylinder barrel face is on a clean, flat surface. Lubricate and install output shaft subassembly in cylinder barrel subassembly.

Guide –  
Headless  
Cap Screws (2)

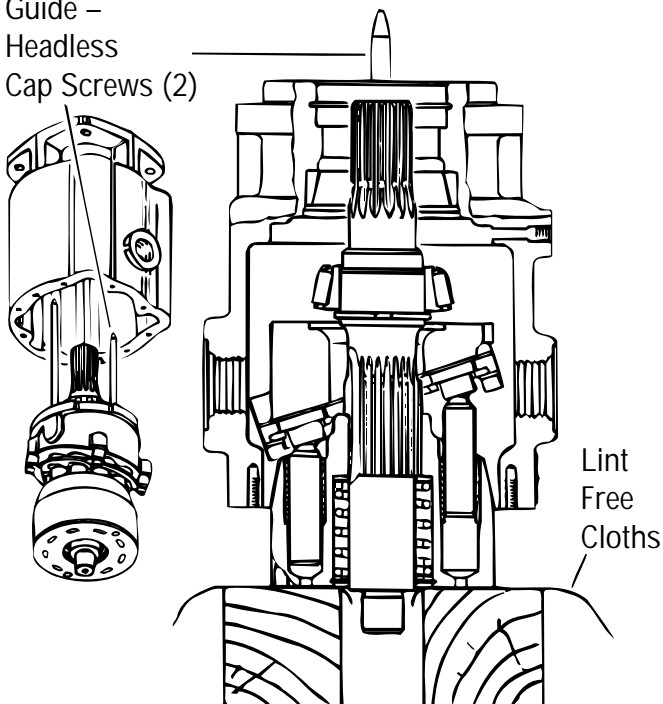


Figure 23

46. Install two headless 5/16 inch cap screws (five to six inches long) in swashplate. These cap screws will guide swashplate into pocket in housing.
47. When installing cylinder barrel and swashplate into housing, align pin in housing with notch in swashplate.
48. Carefully slide housing over output shaft subassembly, swashplate and cylinder barrel assembly.

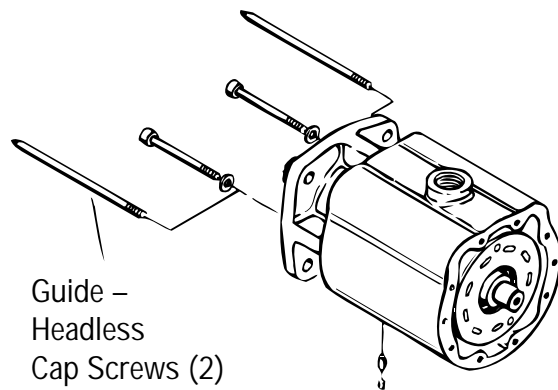


Figure 24

49. Holding cylinder barrel assembly carefully in position in housing, reposition motor on its side and remove headless cap screws.
50. Install new special washers on swashplate cap screws.
51. Install two cap screws in swashplate. Tighten them 20 to 24 lb-ft [27 to 33 Nm].

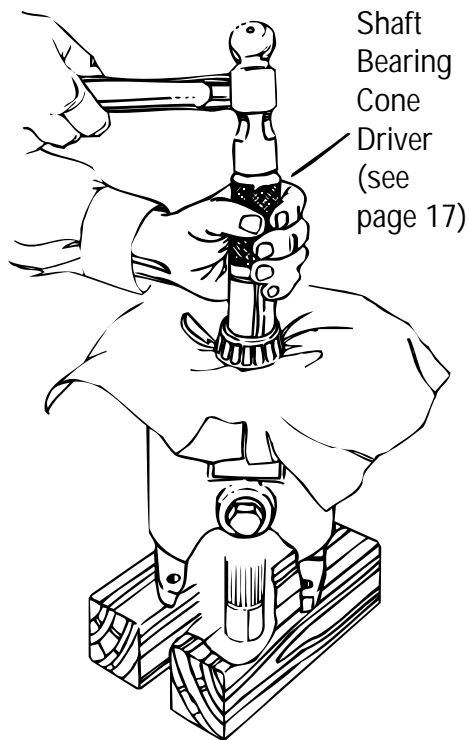


Figure 25

52. Carefully reposition and support motor on mounting flange. Support output shaft in a slightly raised position.

Use a press or bearing driver to install end cover bearing cone on output shaft. Bearing cone must seat against shoulder of output shaft.

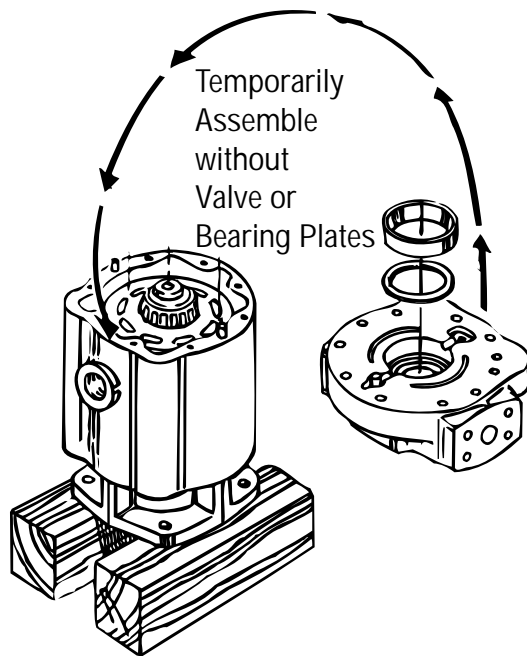


Figure 26

53. Install two dowel pins and gasket on end cover.
54. Lubricate and install bearing shims and bearing cup into end cover.
55. Check output shaft subassembly end play by installing end cover without installing either valve or bearing plates. This remove cylinder barrel's spring tension against output shaft.
56. Install cap screws in end cover and slowly and evenly tighten them. Torque cap screws as follows:  
Models 33, 39, 46 – 39 lb-ft [53 Nm]  
Models 54, 54 – 63 lb-ft [85 Nm]
57. Place and support motor assembly on end cover. Gently tap output shaft inward with hammer.

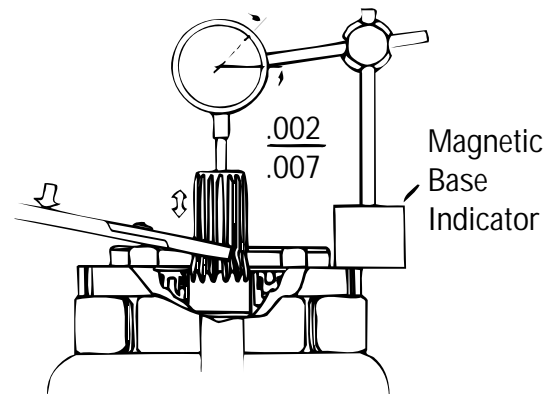


Figure 27

58. Install magnetic base indicator on mounting flange with gauge on output shaft end. Use pliers to grip output shaft as low as possible. Pry upward to determine shaft end play. Indicator must read .002 to .007 in [.05 to .17 mm] shaft end play. If end play is incorrect, adjust by adding or removing shims under bearing cup located in end cover.
59. After adjusting end play, reposition motor on mounting flange and remove end cover.
60. Install two dowel pins in face of cylinder barrel subassembly. Freely lubricate bearing plate with dowel pins and install it on cylinder barrel assembly.
61. Install valve plate dowel pin in face of end cover. Using petroleum jelly, lightly coat side of valve plate facing end cover. This will retain valve plate during assembly. Install valve plate over bearing cup, aligning it with dowel pin. Valve parts must rest flat and be flush with end cover.

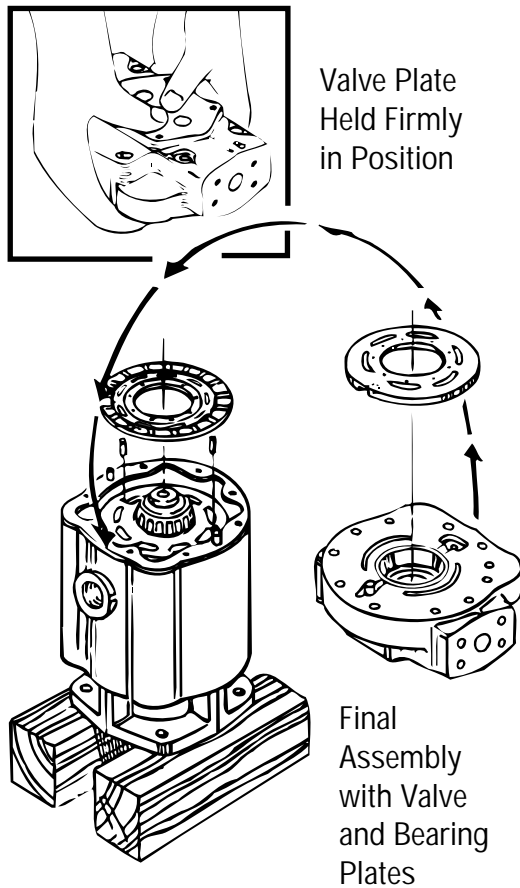


Figure 28

62. Hold valve plate firmly in position. Install end cover on housing.
63. Install cap screws in end cover. Slowly and evenly tighten them. Torque cap screws as follows:  
 Models 33, 39, 46 – 39 lb-ft [53 Nm]  
 Models 54, 64 – 63 lb-ft [85 Nm]

Torque screws in star pattern. Then torque each screw a second time to compensate for gasket compression set.

**Reassembly of End Cover with Integral Shuttle and Low Pressure Relief Valve**

Install the gauge port plug assemblies. The two outer ports have smaller plugs; torque them to 25 - 31 lb-ft [18 - 23 Nm]. Torque the larger plug to 40 - 48 lb-ft [30 - 35 Nm].

Lubricate and install the shuttle spool and shuttle valves in end cover. Make sure the shuttle valve are installed correctly, with the smaller ends facing the center of the spool.

Install the shuttle valve springs and plugs. Torque the plugs to 68 - 82 lb-ft [50 - 60 Nm].

Install the low pressure relief valve plunger and spring. Lubricate and insert the shims in the relief valve plug. Install the plug over the spring, making sure the shims are not dislodged. Screw the plug in and torque it to 68 - 82 lb-ft [50 - 60 Nm].

**Reassembly of Shaft Seal**

Important: For best sealing results, clean the metal-to-metal seal surfaces with an aerosol cleaner such as Freon or trichlorethylene. This cleaner must evaporate and not leave any residue. It must also be compatible with Viton. Do not touch these surfaces with hands. Coat with clean, filtered oil before reassembly.

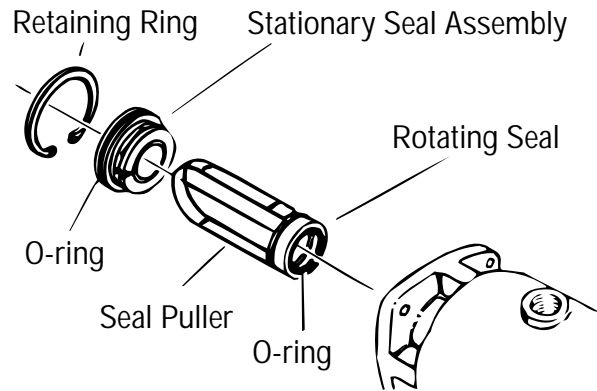
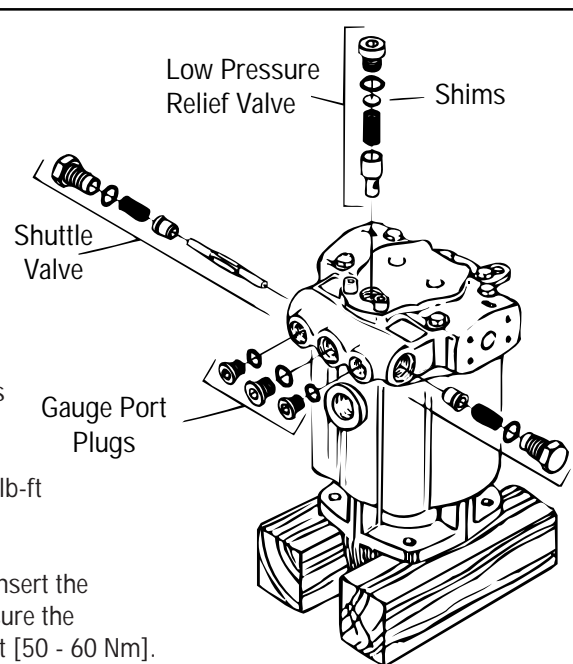


Figure 29

64. Lubricate O-ring seal of rotating seal. Then install rotating seal with seal puller (Owatonna Tool Company No., CAS-1844). Ensure that rotating seal O-ring is placed inside the rotating seal before assembly onto the drive shaft.
65. Lubricate O-ring seal of stationary seal assembly. Then install stationary seal assembly (see Fig. 29).
66. Use a No. 5 or No. 7 retaining ring pliers to install retaining ring (beveled side of ring out).





## Reassembly Install Valve Block

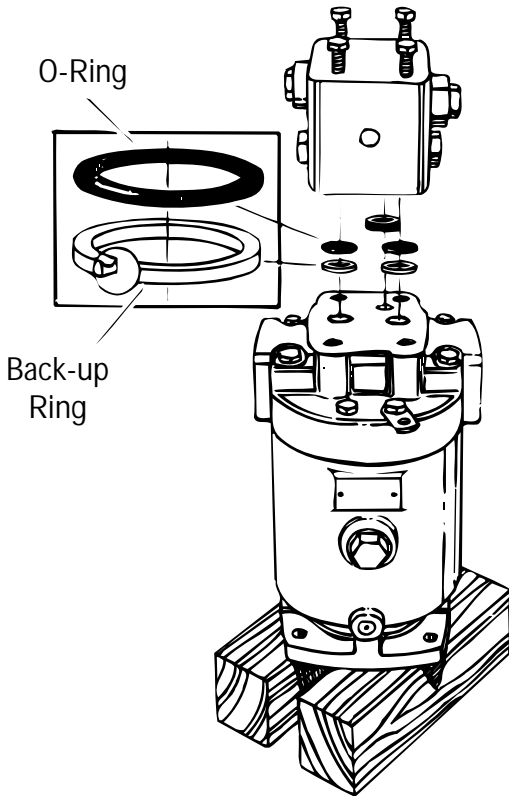


Figure 30

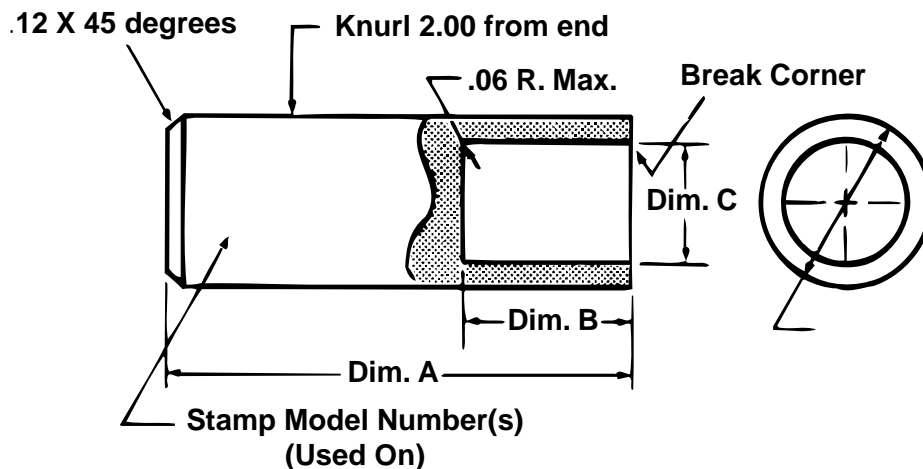
67. Install O-rings and back-up rings on valve block. The high pressure ports require an O-ring and back-up ring. The O-ring goes on first, then the back-up ring – with the rounded side of ring toward the O-ring – as shown in Fig 30. Install square-cut ring in low pressure drain port of valve block.

Note: Be careful not to damage O-rings and back-up rings. Use clean petroleum jelly to hold O-rings and back-up rings in place during block installation.

68. Install valve block on end cover. Then install four hex bolts. Torque bolts 28 lb-ft [38 Nm].

Torque Specifications for Lubricated Threads – lb-ft [Nm]		
Where Used	Model 33-39-46	Model 54-64
End Cover Bolts – Grade 8	39 [53]	63 [85]
Relief Valve (Low Press.)	75 [100]	75 [100]
Relief Valve (High Press.)	25 [34]	25 [34]
Relief Valve (Feathering)	25 [34]	25 [34]
Shuttle Cap	68 [92]	68 [92]
Socket Pipe Plug	16 [22]	16 [22]
Valve Block Mounting Bolts	28 [38]	28 [38]

## Shaft Bearing Cone Driver (End Cover end)

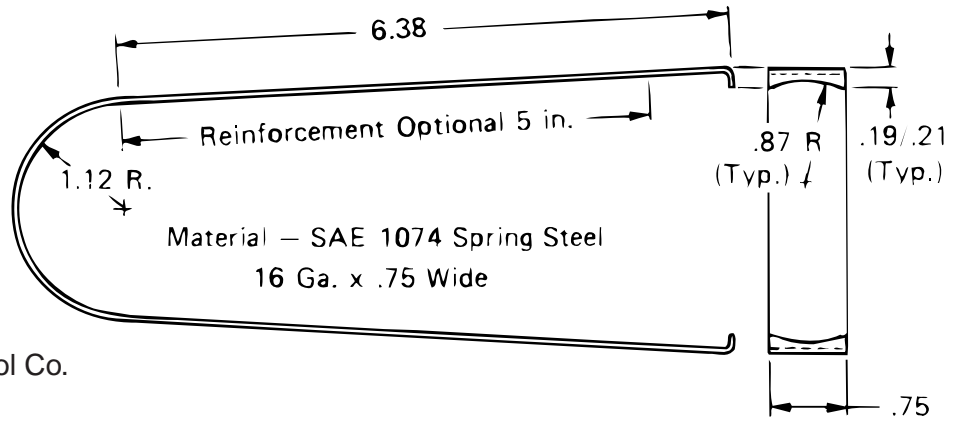


Material: C.R.S., Hardened to Rc 50-55

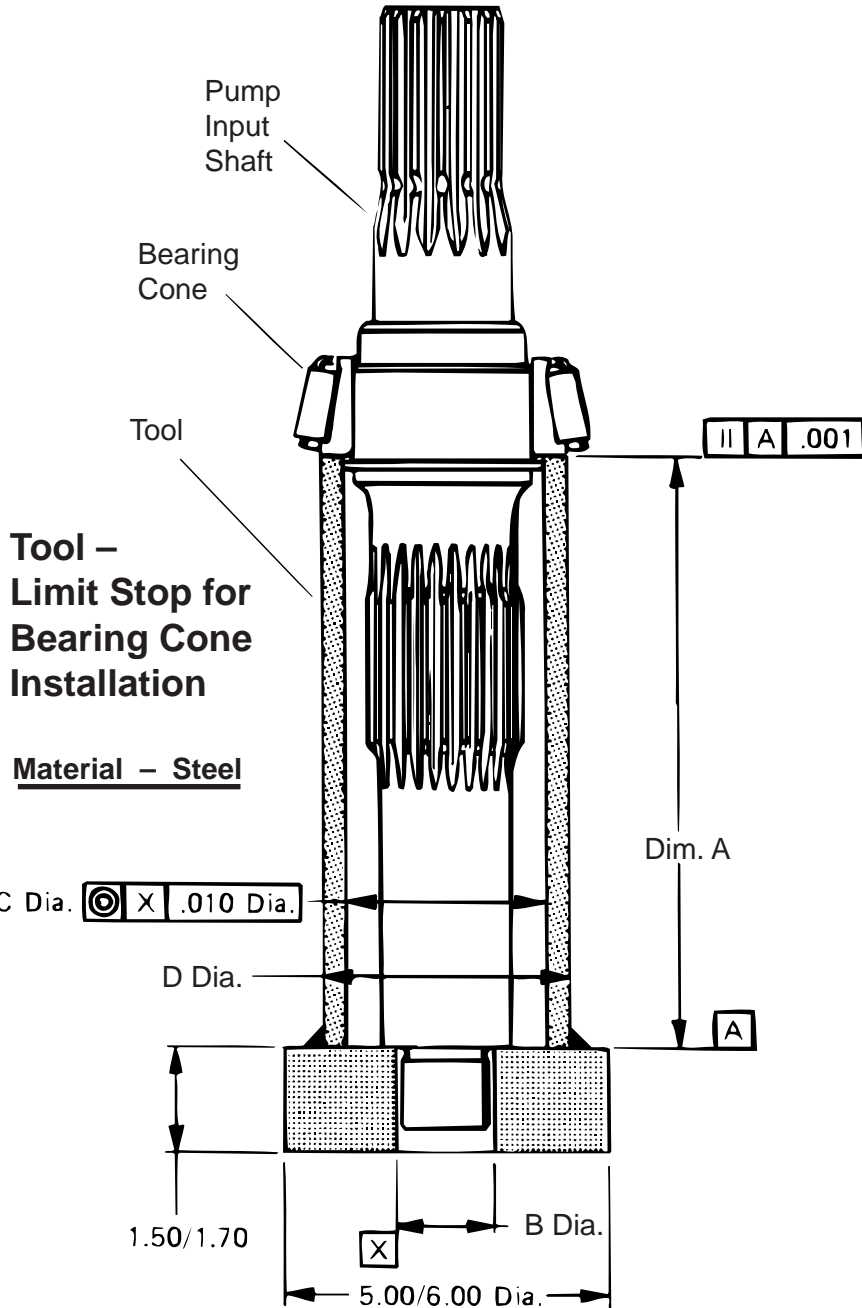
Model	Dim. A	Dim. B	Dim. C	Dim. D
33, 39, 46	4.0	1.5*	1.01	1.25
54, 64	4.0	1.5*	1.30	1.48

\* 1.5 in from shaft with splined drive for B pad Charge Pump

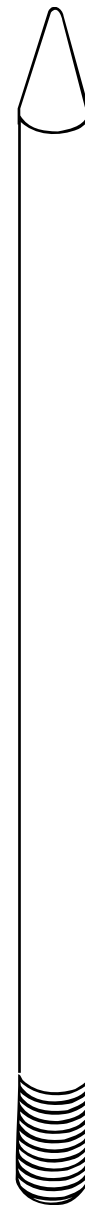
**Tool –  
Shaft  
Rotating  
Seal Puller**



Available from Owatonna Tool Co.  
No. CAS - 1844



**Headless  
Cap Screw  
Guide**

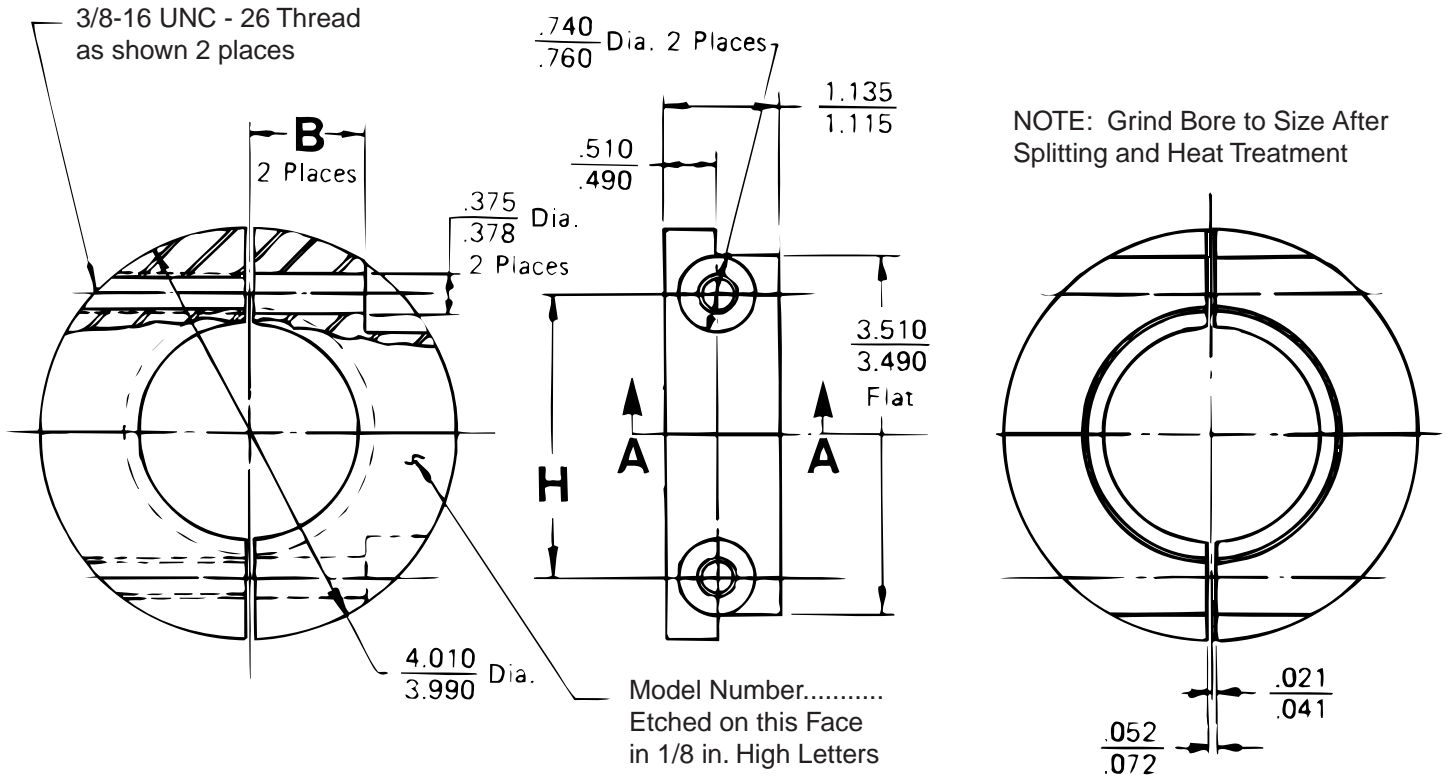


Remove head  
and grind end  
into cone

5/16 - 18 UNC  
Cap Screw  
2 Required

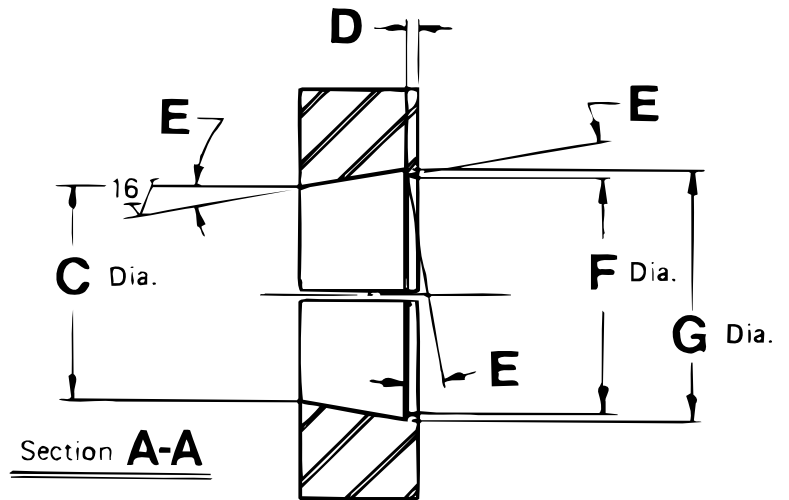
Tool	Model	Dim. A $\pm .001$	Dim. B	Dim. C	Dim. D
1	33,39,46	5.803	1.00/1.20	2.20/2.30	3.00 Min.
2	54,64	6.682	1.30/1.32	2.20/2.30	3.00 Min.

# Low Clearance Bearing Puller



Material/ Heat Treat	Stentor / 45 - 55 R <sub>C</sub>
Title	Cone Bearing Puller

	Displacement cu. in./rev.				
	3.3	3.9	4.6	5.4	6.4
<b>B</b>	$\frac{1.050}{1.070}$			$\frac{1.115}{1.135}$	
<b>C</b>	$\frac{1.565}{\text{Ref.}}$			$\frac{2.071}{\text{Ref.}}$	
<b>D</b>	$\frac{1.35}{1.29}$			$\frac{.131}{.125}$	
<b>E</b>	$\frac{12^\circ - 45'}{13^\circ - 15'}$			$\frac{10^\circ - 5'}{10^\circ - 35'}$	
<b>F</b>	$\frac{1.907}{1.913}$			$\frac{2.310}{2.316}$	
<b>G</b>	$\frac{2.020}{2.026}$			$\frac{2.432}{2.438}$	



## Hydrostatic Fluid Recommendations

A reputable supplier can help you make the best selection of hydraulic fluid for use in Eaton hydrostatic products.

For satisfactory operation, the following recommendations apply:

- The filter system used in the hydraulic circuit must be capable of maintaining the fluid at ISO Cleanliness Code 18/13 per SAE J1165. This code allows a maximum of 2500 particles per milliliter greater than 5 $\mu$ m and a maximum of 80 particles per milliliter greater than 15 $\mu$ m.
- At normal operating temperatures, optimum viscosity ranges are from 80–180 SUS [16–39 cSt]. Viscosity should never fall below 60 SUS [10cSt] and, at the lowest expected startup temperature, should not exceed 10,000 SUS [2158 cSt].
- The fluid should contain anti-wear agents, rust inhibitors, and anti-foaming agents.

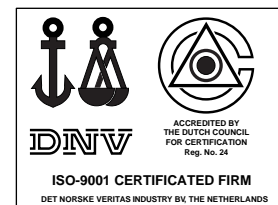
Note: If the fluid becomes black or milky, an overheating or water contamination problem exists.

Take fluid level readings when the fluid is cold.

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