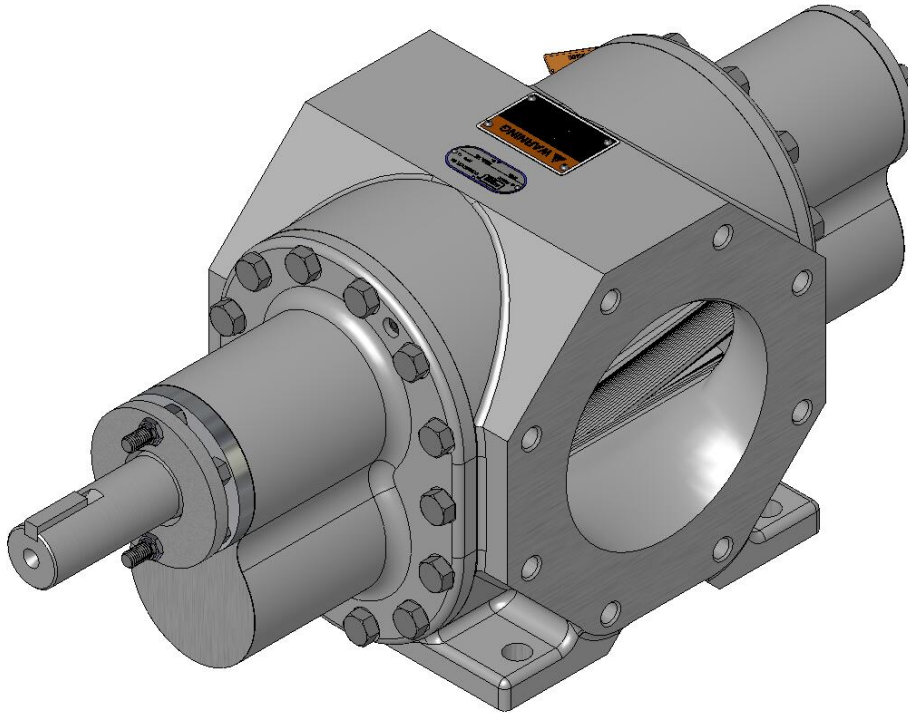




BULK LIQUID HANDLING 4659, 4668, 4699, 4759, 4768, 4799 OWNERS MANUAL

G12-294

03/06/08



SAFETY INSTRUCTIONS

This is an industrial component. Only a qualified systems integrator should be allowed to design it into a system. The integrator must determine proper plumbing, mounting, driveline and guard components.

Improper installation or use could lead to a serious, even fatal, accident. The system integrator must communicate all safe operation procedures to the end user(s).

Before operation, fully understand and follow the instructions shown in this manual and any instructions communicated by the system integrator. No one should be allowed to operate or maintain this pump who has not been fully trained to work safely according to the configuration of the pump system and in accordance with all applicable government and industry regulations.

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Good Practice

NOTE: These are general guidelines and do not cover all possible situations.

It is the responsibility of the system integrator to apply this product properly.

Plumbing

1. The inlet pipe should be as short and straight as possible to minimize suction pressure losses. Excessive restrictions at the inlet can cause cavitation resulting in poor performance, noise, vibration, or pump damage.
2. Slope the inlet plumbing appropriately to avoid air pockets.
3. Plumbing weight, misalignment with the ports or thermal expansion can exert excessive force on the pump. Plumbing must be properly supported and aligned with expansion joints, if required, to minimize these forces.
4. To prevent over pressure situations, install a relief valve as close to the pump outlet as possible. Install the relief valve before any shut-off valves.

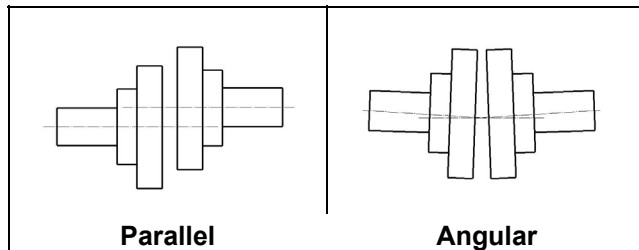
Separate Pump and Drive Assemblies

Driveline Guards

1. Assure adequate guards have been installed to prevent personnel contacting moving components.
2. Follow all OSHA, Federal, state and local codes.

Check Alignment of Pump to Driveline

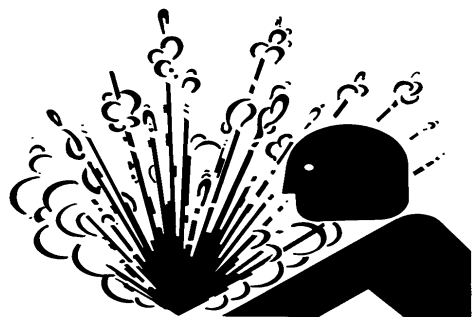
Excessive misalignment can overload the pump input shaft and cause premature failure. The figures below show parallel and angular misalignments.



Mounting Base

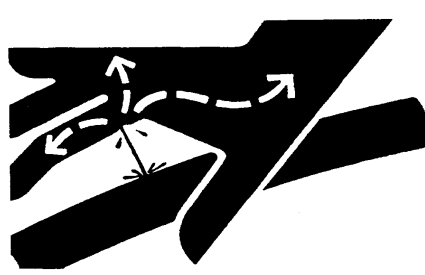
1. Mount the unit on a rigid, heavy base to provide support and absorb shock. Bases should be designed for high rigidity, not just strength.
2. The pump feet were not designed for mounting to concrete and do not have enough contact area to prevent concrete from failing. When mounting to cement or concrete, use a steel base plate (supplied by others) to distribute the mounting stress over an area large enough to prevent the cement from failing. The base plate should be at least as thick as the pump feet. Grout it in place.

! WARNING



Over-pressure may burst pump or system components. Always include a relief valve in installation. Do not over pressurize pump or block discharge line while running.

! WARNING



Injection Hazard: Do not try to stop a leak with your hand! Avoid any close contact with hydraulic fluid jets. Escaping fluid can penetrate skin, causing serious injury. In case of accident, see a doctor immediately for removal of fluid.

Guarding PTO Drive Shafts

PTO drive systems can be dangerous and when used, additional safety precautions, including guarding, may be required and must be provided by the drive system installer. Roper Pump Company has no responsibility for recommending or providing proper guarding or other safety measures in any particular application.

The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who know the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application and installation is the user's.*



1. NAMEPLATE DATA

Roper Pump Company identifies each pump manufactured by a metal nameplate attached to the pump. This nameplate describes the pump as built at the factory. Copy the nameplate data from your pump in the area provided below. Use this for ready reference when ordering repair parts or when consulting with a Roper distributor or Roper Pump Company about this pump.

MODEL NUMBER: _____
SPEC NUMBER: _____
TYPE: _____
SERIAL NUMBER: _____

PUMP NOMENCLATURE

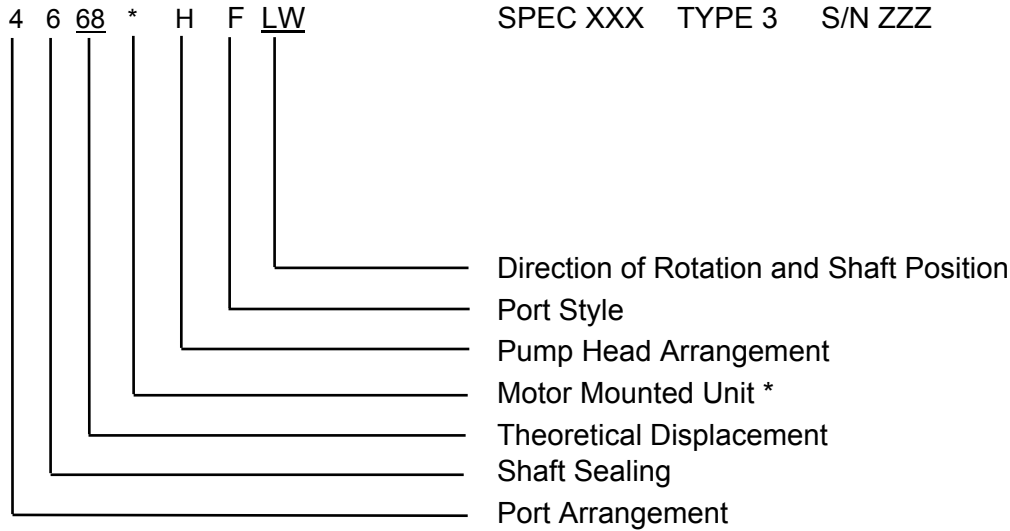
MODEL 4668 HFLW

SPEC XXX **TYPE** 3

SERIAL NO. ZZZ

1. The Model Number consists of a seven or eight digit number.
 - The first digit (4) indicates the port arrangement.
4 – Straight through ports
 - The second digit (6) indicates shaft sealing.
6 – Packing
7 – Mechanical Seal
 - The third and fourth digits (68) indicate the approximate theoretical displacement in U.S. gallons per 100 revolutions.
Gallons/100 Rev. [Liters/100 Rev.]
59 [223.3]
68 [257.4]
99 [374.7]
 - The letter (H) indicates the pump head arrangement.
H – Pump without outboard bearing
 - The letter (F) indicates port style
F – Pump with flange ports to accept ANSI flanges
 - The letter or group of letters (LW) indicates direction of rotation and shaft position. The letter (L) indicates low drive unit. If the letter (L) is not used, the shaft will be in a high drive position.
W – Clockwise rotation, inlet on left, high drive
Z – Counter-clockwise rotation, inlet on right, high drive
LW – Clockwise rotation, discharge on left, low drive
LZ – Counter-clockwise rotation, discharge on right, low drive

Example:



* The letter (M) may be used in this space indicating the pump is mounted with motor.
The letter (E) may be used in this space indicating the pump is mounted on a base with or without engine.

- Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are clarified by a SPECification number. Identification of any items different than a standard pump can be made by consulting Roper Pump Company or an authorized distributor.
- The TYPE number is a number used by Roper Pump Company for in-house identification of construction and hydraulics. Always include the type number in any references to the pump.
- The SERIAL number is a unique number assigned to each pump built by Roper Pump Company.

In any communication concerning this pump, always be sure to include the Figure, Spec, Type, and Serial numbers so proper identification of the pump can be assured.

2. MAXIMUM PUMP RATINGS

The maximum pressure, speed, and temperature limits for this pump SERIES are shown below.

The maximum rating of a pump with a SPEC number may be different depending on the materials of construction.

Maximum limits for this SERIES:

Pressure

- 125 psi [862 kPa] Maximum Inlet
- 125 psi [862 kPa] Maximum Discharge

Speed

- 1200 rpm Maximum for 4659-4759 and 4668-4768 Pumps
- 1000 rpm Maximum for 4699-4799 Pumps

Temperature

- Mechanical Seal Pumps: 250°F [121°C]
- Packed Box Pumps: 250°F [121°C]

3. PREOPERATION CHECKS

Read and understand the instructions and recommendations contained in this manual.

Disconnect the coupling between the driver and pump.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Rotation is shown on the pump faceplate if the pump has an integral relief valve. When an integral relief valve is used, make sure it is positioned and adjusted as discussed in Section 5, **DIRECTION OF ROTATION**. After the unit is mounted and the piping is connected, the pump should be checked to be sure it operates freely without binding. After operation is proved satisfactory, both pump and driver should be tightly secured and the alignment rechecked before operation.

Before starting, make sure all guards are in place and the inlet and discharge valves are opened.

After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and correct the problem. After the pump is delivering liquid, check the unit for excessive vibration, localized heating, and excessive shaft seal leakage. Check the pressure or vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure or vacuum conforms to specifications.

4. RECOMMENDED TOOL LIST

NOTE: Tools not furnished with pump.

Tools for all Pumps:

- (1) Safety Glasses
- (1) 3/4" Combination Wrench
- (1) 15/16" Combination Wrench
- (1) 1-1/8" Combination Wrench
- (1) CG-46 Snap-On® Tool Bearing Puller
- (1) 6" to 10" Three Square File
- (1) Pliers

Additional Tools for Pumps with Shaft Packing:

Packing Hook for .38" square packing rings

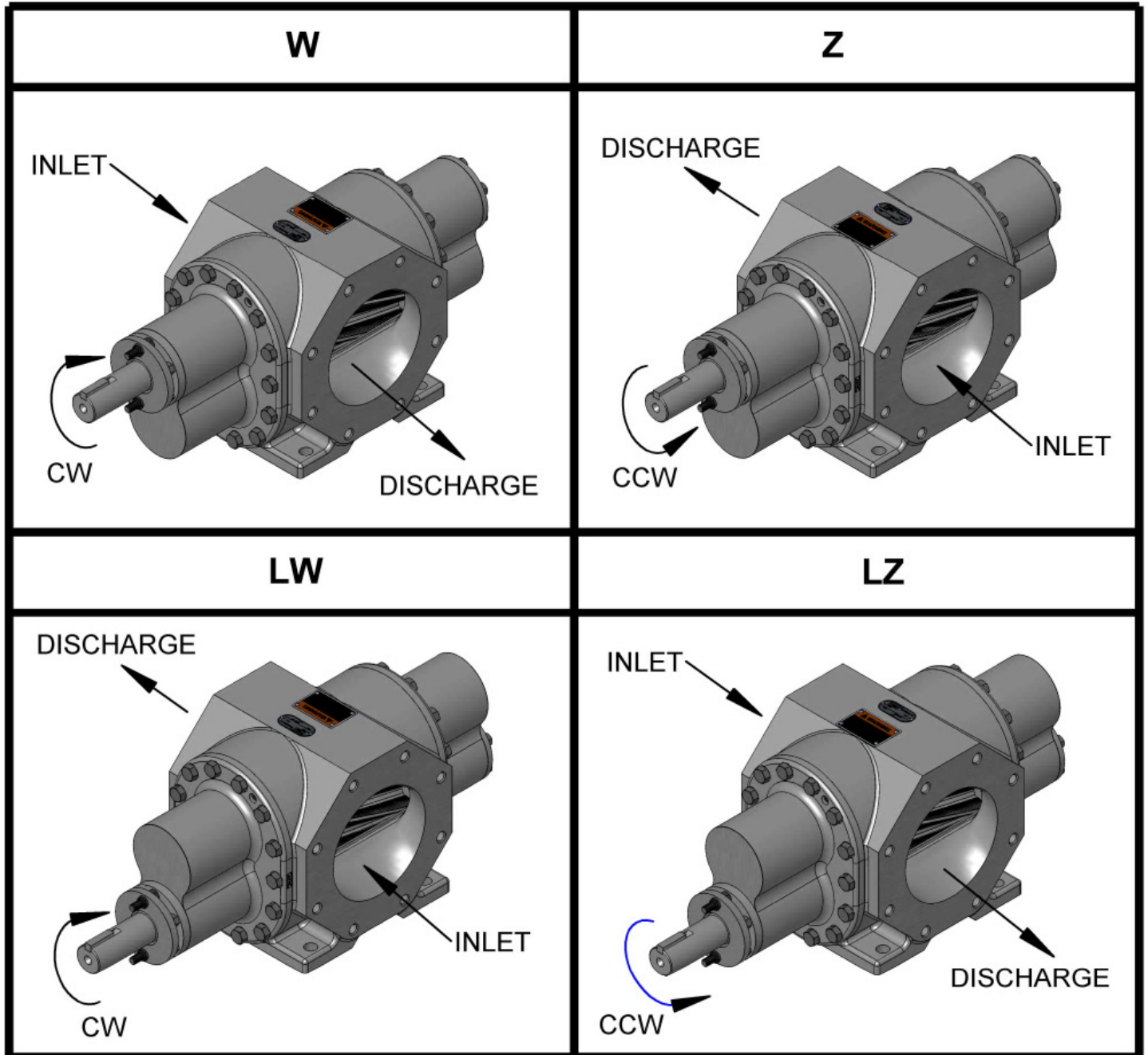
Additional Tools for Pumps with Mechanical Seals:

- (1) 0600 External Retaining Ring Pliers
- (1) 3/8" Hex Key

5. DIRECTION OF ROTATION

Prior to operating the pump, make sure that the shaft rotation, pipe connections, and endplate position are in accordance with the instructions and illustrations shown below. The pump may be assembled or reassembled with its drive shaft in either “high” or “low” drive positions. The pump “inlet” plate will be located on the faceplate end of the pump next to the inlet port.

For inlet pressure over 15 psig [103.4 kPa], consult a Roper distributor or Roper Pump Company.



DIRECTION OF ROTATION
Figure 5.1

6. HIGH DRIVE TO LOW DRIVE

Prior to operating pump, make sure that the shaft rotation and pipe connections are in accordance with the appropriate illustrations shown in Section 5. In order to change the rotation and/or piping orientation, it may be necessary to remove the piping from the pump or the pump from the mounting.

Whenever changing rotation, inspect all parts before reassembly. Replace all worn parts and install new gaskets in appropriate numbers as removed.

1. Remove coupling or universal joint and drive key (D) from drive gear & shaft (4). Remove all burrs and sharp edges from drive shaft and keyway.
2. Follow the procedure in Section 7, **INSTRUCTIONS FOR DRAINING PUMP**.
3. A.) To reverse pump rotation and keep piping arrangement the same, drive shaft (4) position must be changed. Follow steps 4 – 7A & 8 – 21 for packed box pumps and 4 – 7B & 22 – 33 for mechanical seal pumps.
B.) To reverse pump rotation and leave drive gear & shaft (4) in same position; liquid flow through pump will be reversed. Follow steps 34 – 37A & 38 – 50 for packed box pumps and 34 – 37B & 51 – 61 for mechanical seal pumps.
C.) To change port to opposite side of pump and maintain same pump rotation, follow steps 62 – 65A & 66 – 76 for packed box pumps and 62 – 65B & 77 – 86 for mechanical seal pumps.

REVERSE ROTATION, SAME PIPING ARRANGEMENT

4. To reverse pump rotation and keep piping arrangement the same, it is necessary to change from high drive to low drive or low drive to high drive (W to LZ, Z to LW) or vice versa.
5. Remove six hex head cap screws (C) securing coverplate (8) to endplate (3). Remove coverplate gasket (7).
6. Remove fourteen hex head cap screws (B) securing endplate assembly (3) to case assembly (1) opposite coupling end of pump. Remove endplate.
7. A.) To continue assembly and reassembly for 4659-4699 HF pumps, follow steps 8 – 21.
B.) To continue assembly and reassembly for 4759-4799 HF pumps, follow steps 22 – 33.

4659-4699 HF Pumps

8. Remove two jam nuts (F) from studs (G) securing packing gland (11) in place. Remove packing gland.
9. Remove hex nuts (H) from studs (G). Remove studs from endplate assembly (2).
10. Remove packing rings (10). Packing hooks are commercially available to assist in removal of packing rings.
11. Remove four hex head cap screws (E) securing packing housing (9) to endplate assembly (2). Remove packing housing and packing housing gasket (7).
12. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
13. Remove drive gear & shaft (4) and idler gear & shaft (5). Place drive gear & shaft and idler gear & shaft in opposite bores in case assembly (1).
14. Position appropriate number of new case gaskets (6) on each side of case (1). (Oil or grease may be used to hold gaskets in place.)

15. Rotate endplate assembly 180°, then position endplate assembly (2) on dowel pins (A) on case assembly (1) opposite coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
16. Install new coverplate gasket (7) and coverplate (8) to endplate assembly (2) using six hex head cap screws (C).
17. Rotate endplate assembly 180°, then position endplate assembly (3) on dowel pins (A) on case assembly (1) on coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
18. Install two studs (G) into endplate assembly (3).
19. Install new packing housing gasket (7) and packing housing (9) to endplate assembly (3) using four hex head cap screws (E) and two hex nuts (H) on studs (G).
20. Install packing rings (10) over drive shaft (4) and into packing housing (9). Stagger joints on each packing ring 180° apart. Seat each ring before adding the next ring. Rings must not be tamped or seated too tightly. Check drive shaft for free movement after each ring is installed. When packing housing is sufficiently full to allow entry of packing gland (11) about 3/8 of an inch [10 mm], slide packing gland over drive shaft and studs into packing housing. Secure packing gland in place using two jam nuts (F). Draw jam nuts up evenly on packing gland to assure proper seating of packing. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
21. Install drive key (D).

4759-4799 HF Pumps

22. Remove six socket head cap screws (K) securing seal retainer (13) to endplate assembly (2). Remove seal retainer gasket (7).
23. When removing mechanical seal (12), clean and lubricate drive gear & shaft (4) prior to removing mechanical seal making sure drive shaft is smooth and free from all burrs. Remove mechanical seal. Inspect sealing surfaces of stationary seal face and rotating element. Remove retaining ring (J) from drive shaft.
24. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
25. Remove drive gear & shaft (4) and idler gear & shaft (5) placing drive gear & shaft and idler gear & shaft in opposite bores in case assembly (1).
26. Position appropriate number of new case gaskets (6) on each side of case (1). (Oil or grease may be used to hold gaskets in plate.)
27. Rotate endplate assembly 180°, then position endplate assembly (2) on dowel pins (A) on case assembly (1) opposite coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
28. Install new coverplate gasket (7) and coverplate (8) to endplate assembly (2) using six hex head cap screws (C).
29. Rotate endplate assembly 180°, then position endplate assembly (3) on dowel pins (A) on case assembly (1) on coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
30. Install retaining ring (J) on drive shaft (4).
31. Lubricate drive shaft and mechanical seal bore with compatible lubricant. Install mechanical seal (12) on drive shaft and position seal back against retaining ring (J). Care must be taken not to nick o-ring. Be sure lapped (polished) faces of stationary seal face and rotating element are together.
32. Install new seal retainer gasket (7) and seal retainer (13). Secure seal retainer and gasket in place using six socket head cap screws (K).
33. Install drive key (D).

REVERSE ROTATION, SAME DRIVE SHAFT ARRANGEMENT

34. To reverse flow of liquid through pump ports, reverse rotation and maintain original position of drive gear & shaft (W to Z, LW to LZ) or vice versa.
35. Remove six hex head cap screws (C) securing coverplate (8) to endplate assembly (3). Remove coverplate gasket (7).
36. Remove fourteen hex head cap screws (B) securing endplate assembly (3) to case assembly (1) opposite coupling end of pump. Remove endplate.
37. A.) To continue disassembly and reassembly for 4659-4699 HF pumps, follow steps 38 – 50.
B.) To continue disassembly and reassembly for 4759-4799 HF pumps, follow steps 51 – 61.

4659-4799 HF Pumps

38. Remove two jam nuts (F) from studs (G) securing packing gland (11) in place. Remove packing gland.
39. Remove hex nuts (H) from studs (G). Remove studs from endplate assembly (2).
40. Remove packing rings (10). Packing hooks are commercially available to assist in removal of packing rings.
41. Remove four hex head cap screws (E) securing packing housing (9) to endplate assembly (2). Remove packing housing and packing housing gasket (7).
42. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
43. Position appropriate number of new case gaskets (6) on each side of case (1). (Oil or grease may be used to hold gaskets in place.)
44. Position endplate assembly (2) on dowel pins (A) on case assembly (1) opposite coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
45. Install new coverplate gasket (7) and coverplate (8) to endplate assembly (2) using six hex head cap screws (C).
46. Position endplate assembly (3) on dowel pins (A) on case assembly (1) on coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
47. Install two studs (G) into endplate assembly (3).
48. Install new packing housing gasket (7) and packing housing (9) to endplate assembly (3) using four hex head cap screws (E) and two hex nuts (H) on studs (G).
49. Install packing rings (10) over drive shaft (4) and into packing housing (9). Stagger joints on each packing ring 180° apart. Seat each ring before adding the next ring. Rings must not be tamped or seated too tightly. Check drive shaft for free movement after each ring is installed. When packing housing is sufficiently full to allow entry of packing gland (11) about 3/8 of an inch [10 mm], slide packing gland over drive shaft and studs into packing housing. Secure packing gland in place using two jam nuts (F). Draw jam nuts up evenly on packing gland to assure proper seating of packing. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
50. Install drive key (D).

4759-4799 HF Pumps

51. Remove six socket head cap screws (K) securing seal retainer (13) to endplate assembly (2). Remove seal retainer gasket (7).
52. When removing mechanical seal (12), clean and lubricate drive gear & shaft (4) prior to removing mechanical seal making sure drive shaft is smooth and free from all burrs. Remove mechanical seal. Inspect sealing surfaces of stationary seal face and rotating element. Remove retaining ring (J) from drive shaft.
53. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
54. Position appropriate number of new case gaskets (6) on each side of case (1). (Oil or grease may be used to hold gaskets in place.)
55. Position endplate assembly (2) on dowel pins (A) on case assembly (1) opposite coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
56. Install new coverplate gasket (7) and coverplate (8) to endplate assembly (2) using six hex head cap screws (C).
57. Position endplate assembly (3) on dowel pins (A) on case assembly (1) on coupling end of pump making sure inlet plate is positioned on inlet side of pump. Secure endplate to case using fourteen hex head cap screws (B).
58. Install retaining ring (J) on drive shaft (4).
59. Lubricate drive shaft and mechanical seal bore with compatible lubricant. Install mechanical seal (12) on drive shaft and position seal back against retaining ring (J). Care must be taken not to nick o-ring. Be sure lapped (polished) faces of stationary seal face and rotating element are together.
60. Install new seal retainer gasket (7) and seal retainer (13). Secure seal retainer and gasket in place using six socket head cap screws (K).
61. Install drive key (D).

CHANGE PORT AND DRIVE SHAFT LOCATION, SAME ROTATION

62. To change port to opposite side and maintain same pump rotation, change drive gear & shaft (4) from high drive to low drive (W to LW, Z to LZ) or vice versa.
63. Remove fourteen hex head cap screws (B) securing endplate assembly (3) to case assembly (2) opposite coupling end of pump. Remove endplate.
64. Rotate endplate assembly 180°, then remount endplate assembly (3) on case assembly (1). Secure endplate assembly to case assembly using fourteen hex head cap screws (B).
65. A.) To continue disassembly and reassembly for 4659-4699 HF pumps, follow steps 66 – 76.
B.) To continue disassembly and reassembly for 4759-4799 HF pumps, follow steps 77 – 86.

4659-4699 HF Pumps

66. Remove two jam nuts (F) from studs (G) securing packing gland (11) in place.
67. Remove hex nuts (H) from studs (G).
68. Remove packing rings (10). Packing hooks are commercially available to assist in removal of packing rings.
69. Remove four hex head cap screws (E) securing packing housing (9) to endplate assembly (2). Remove packing housing and packing housing gasket (7).

70. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
71. Remove drive gear & shaft (4) and idler gear & shaft (5) placing drive gear & shaft and idler gear & shaft in opposite bores in case assembly (1).
72. Position appropriate number of new case gaskets (6) on each side of case (1). (Oil or grease may be used to hold gaskets in place.)
73. Rotate endplate assembly 180°, then remount endplate assembly (2) on case assembly (1). Secure endplate assembly to case assembly using fourteen hex head cap screws (B).
74. Install new packing housing gasket (7) and packing housing (9) to endplate assembly (2) using four hex head cap screws (E) and two hex nuts (H) on studs (G).
75. Install packing rings (10) over drive shaft (4) and into packing housing (9). Stagger joints on each packing ring 180° apart. Seat each ring before adding the next ring. Rings must not be tamped or seated too tightly. Check drive shaft for free movement after each ring is installed. When packing housing is sufficiently full to allow entry of packing gland (11) about 3/8 of an inch [10 mm], slide packing gland over drive shaft and studs into packing housing. Secure packing gland in place using two jam nuts (F). Draw jam nuts up evenly on packing gland to assure proper seating of packing. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
76. Install drive key (D).

4759-4799 HF Pumps

77. Remove six socket head cap screws (K) securing seal retainer (13) to endplate assembly (2). Remove seal retainer gasket (7).
78. When removing mechanical seal (12), clean and lubricate drive gear & shaft (4) prior to removing mechanical seal making sure drive shaft is smooth and free from all burrs. Remove mechanical seal. Inspect sealing surfaces of stationary seal face and rotating element. Remove retaining ring (J) from drive shaft.
79. Remove fourteen hex head cap screws (B) securing endplate assembly (2) to case assembly (1) on coupling end of pump. Remove endplate.
80. Remove drive gear & shaft (4) and idler gear & shaft (5) placing drive gear & shaft and idler gear & shaft in opposite bores in case assembly (1).
81. Position appropriate number of new case gaskets (6) on case assembly (1). (Oil or grease may be used to hold gaskets in place.)
82. Rotate endplate assembly 180°, then remount endplate assembly (2) on case assembly (1). Secure endplate assembly to case assembly using fourteen hex head cap screws (B).
83. Install retaining ring (J) on drive shaft (4).
84. Lubricate drive shaft and mechanical seal bore with compatible lubricant. Install mechanical seal (12) on drive shaft and position seal back against retaining ring (J). Care must be taken not to nick o-ring. Be sure lapped (polished) faces of stationary seal face and rotating element are together.
85. Install new seal retainer gasket (7) and seal retainer (13). Secure seal retainer and seal retainer gasket in place using six socket head cap screws (K).
86. Install drive key (D).

7. INSTRUCTIONS FOR DRAINING PUMP

Refer to Section 12, **PARTS LIST**.

The extent to which a pump can be drained is dependent upon the product being pumped. Low viscosity products such as solvents will drain quickly and easily. High viscosity products such as molasses and tar will drain very slowly. Also, the draining of high viscosity products will be less complete.

Regardless of the product pumped, the areas at the blind end of the bearing bores and the mechanical seal chamber will not drain.

1. Read and understand all safety instructions and warnings before starting draining procedure.
2. Loosen, approximately one to two turns, fourteen hex head cap screws (B) securing endplate assembly (3) opposite coupling end of pump. Move endplate away from case (1).
3. Allow to drain.
4. Retighten fourteen hex head cap screws (B).

8. INSTRUCTIONS FOR PUMP DISASSEMBLY

Refer to Section 12, **PARTS LIST**.

1. Read and understand all safety instructions and warnings before starting to disassemble pump. While disassembling pump, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required.
2. If you do not know which pump arrangement you have, collect nameplate data and refer to Section 1, **NAMEPLATE DATA**, to determine what you have. Consult a Roper distributor or Roper Pump Company if you have any questions.
3. When cleaning or lubricating, use only cleaning solutions and lubricants that are compatible with products being pumped and with sealing elastomers. **DO NOT** use petroleum base products with seals with EPR elastomers. Use a nonpetroleum base lubricant with EPR elastomers.
4. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of pump if there is the slightest possibility that driver may be started.
5. If used, turn off and disconnect flush from mechanical seal.
6. Close inlet and discharge valves.
7. Remove guard and disconnect coupling between driver and pump.
8. Drain inlet and discharge lines. Disconnect lines from pump inlet and discharge.
9. Follow the procedure in Section 7, **INSTRUCTIONS FOR DRAINING PUMP**.
10. A.) To continue disassembly for 4659-4699 HF pumps, follow steps 11 – 25.
B.) To continue disassembly for 4759-4799 HF pumps, follow steps 26 – 38.

4659-4699 HF Pumps

11. Remove six hex head cap screws (C) securing coverplate (8) to endplate (3). Remove coverplate gasket (7).
12. Remove fourteen hex head cap screws (B) securing endplate assembly (3) opposite coupling end of pump. Remove endplate.
13. Remove two dowel pins (A) from case.
14. Remove case gasket (6).

15. Remove drive key (D).
16. Remove two jam nuts (H) from studs (G) securing packing gland (11) in place. Remove packing gland.
17. Remove hex nuts (H) from studs (G). Remove studs from endplate assembly (2).
18. Remove packing rings (10). Packing hooks are commercially available to assist with removal of packing rings.
19. Remove four hex head cap screws (E) securing packing housing (9) to endplate assembly (2). Remove packing housing.
20. Remove packing housing gasket (7).
21. Remove fourteen hex head cap screws (B) securing endplate assembly (2) on coupling end of pump. Remove endplate.
22. Remove two dowel pins (A) from case assembly (1).
23. Remove case gasket (6).
24. Remove drive gear & shaft (4) and idler gear & shaft (5) from case assembly (1). Clean drive and idler gears and shafts. Examine both shafts. Replace drive and idler gears and shafts if excessively worn or scored.
25. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets (6, 7) be installed each time pump is disassembled and reassembled.

4759-4799 HF Pumps

26. Remove six hex head cap screws (C) securing coverplate (8) to endplate (3). Remove coverplate gasket (7).
27. Remove fourteen hex head cap screws (B) securing endplate assembly (3) opposite coupling end of pump. Remove endplate.
28. Remove two dowel pins (A) from case.
29. Remove case gasket (6).
30. Remove drive key (D).
31. Remove six socket head cap screws (K) securing seal retainer (13) to endplate assembly (2). Remove seal retainer.
32. Remove seal retainer gasket (7).
33. When removing mechanical seal (12), clean and lubricate drive gear & shaft (4) prior to removing mechanical seal making sure that drive shaft is smooth and free from all burrs. Remove mechanical seal. Inspect sealing surfaces of stationary seal face and rotating element. Replace as required. Remove retaining ring (J) from drive shaft.
34. Remove fourteen hex head cap screws (B) securing endplate assembly (2) on coupling end of pump. Remove endplate.
35. Remove two dowel pins (A) from case assembly (1).
36. Remove case gasket (6).
37. Remove drive gear & shaft (4) and idler gear & shaft (5) from case assembly (1). Clean drive and idler gears and shafts. Examine both shafts. Replace drive and idler gears and shafts if excessively worn or scored.
38. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets (6, 7) be installed each time pump is disassembled and reassembled.

9. BEARING REMOVAL AND INSTALLATION

BEARING REMOVAL

Pump bearings are available in babbitt-filled carbon, copper-carbon, iron, and hi-lead bronze. Any of these bearings may be removed using a puller. If a puller is not available, the bearings may be removed by using a hacksaw blade to cut through the bearing in two places 180° apart. This procedure will usually loosen the bearing enough to be pulled out. If this procedure is used, take care to prevent damage to the bore into which the bearing is pressed.

Carbon bearings may also be removed by carefully chipping the bearing out with a chisel. Take care not to scar the endplate bores during the bearing removal process.

After removing the bearings, always check the endplate bores for nicks and burrs caused by the removal process. The bores must be clean, smooth, and free of burrs before attempting to install new bearings.

BEARING INSTALLATION

1. Remove all burrs and raised edges from bores for bearings.
2. Place endplate or backplate on a press base with milled face upward. Support endplate so that milled face is perpendicular (square) with press ram.
3. Position endplate so that one bearing bore is located directly under press ram.
4. A.) If babbitt-filled carbon or copper-carbon bearings are to be installed, lubricate bearings by submerging them in cold water prior to installation.
B.) If iron or hi-lead bronze bearings are to be installed, lubricate endplate bores with light oil that is compatible with product to be pumped.
5. Place end of new bearing at entrance of bore in endplate, taking care to align grooves in bearing with grooves in face of endplate.
6. Press bearing into endplate bore. *When carbon bearings are being installed, it is important to press them in with one slow uninterrupted stroke to prevent cracking.* It is best to use a stepped arbor with a few thousandths of an inch clearance between arbor and bore of bearing. Be sure to press bearings in until they are .002/.004 of an inch [.051/.102 mm] above milled face of endplate.
7. Repeat procedure for second bearing.
8. Using a three square file, file shallow grooves in ends of bearings to connect grooves inside bearings with groove on milled face of endplate. If your bearings or endplates do not have grooves, omit this step.

10. DIMENSIONAL DATA FOR INTERNAL PARTS

Nominal dimensions are given below. With the exception of gasket thickness and lateral clearance, your actual measurements should vary from these numbers by no more than .002". Use properly calibrated measuring equipment when measuring parts.

ITEM	PUMP SIZE		
	59	68	99
Bore for Bearings	2.876	2.876	2.876
Shaft O.D.	2.1247	2.1247	2.1247
Case Bores	5.172	5.172	5.669
Gear O.D.	5.156	5.156	5.653
Gear O.D. to Case Bore Diametral Clearance	0.013	0.013	0.013
Bronze Bearing O.D.	2.88	2.88	2.88
Bronze Bearing Press Fit	.004 min.	.004 min.	.004 min.
Bronze Bearing I.D. (Free)	2.136	2.136	2.136
Bronze Bearing I.D. (Installed)	2.132	2.132	2.132
Shaft to Bronze Bearing Diametral Clearance	0.007	0.007	0.007
Carbon Bearing O.D. (Std.)	2.879	2.879	2.879
Carbon Bearing Press Fit	.003 min.	.003 min.	.003 min.
Carbon Bearing I.D. (Free)	2.133	2.133	2.133
Carbon Bearing I.D. (Installed)	2.132	2.132	2.132
Shaft to Carbon Bearing Diametral Clearance	0.007	0.007	0.007
Case Width	11.278	12.998	12.998
Gasket Thickness (One)	0.012	0.012	0.012
Compressed Gasket Thickness (Two)	0.016	0.016	0.016
Gear Face Width	11.279	12.999	12.999
Lateral Clearance (Two Compressed Gaskets)	0.014	0.014	0.014

(Dimensions are in inches)

11. INSTRUCTIONS FOR PUMP ASSEMBLY

Refer to Section 12, **PARTS LIST**.

Refer to Section 5, **DIRECTION OF ROTATION**, to assure proper configuration for pump rotation and port location prior to assembling pump.

1. Read and understand all safety instructions and warnings before assembling pump. Visually inspect all parts during assembly. Replace all worn or damaged parts. Although they may appear reusable, it is recommended that new gaskets (6, 7) be installed when pump is being reassembled.
 - **WARNING!** Only use genuine Roper gaskets. Gasket thickness determines proper clearances. Always check quantity of gaskets removed and replace with exact quantity. Proper material must be used based on application.
2. When cleaning or lubricating, only use products that are compatible with product being pumped and elastomers within pump. **DO NOT** use petroleum base products with seals with EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers.
3. Mechanical seals are precision pieces of equipment. Use extreme care not to damage seal faces or elastomers during assembly.
4. Install two dowel pins (A) on each side of case (1). Place appropriate number of new case gaskets (6) on each side of case. Align endplate assembly (3) onto dowel pins on end opposite coupling end of pump. Secure endplate assembly to case using fourteen hex head cap screws (B).
5. Install new coverplate gasket (7) and coverplate (8) to endplate assembly (3) using six hex head cap screws (C).
6. Slide idler gear & shaft (5) into appropriate bore of case (1).
7. Slide drive gear & shaft (4) into appropriate bore of case (1).
8. Align endplate assembly (2) onto dowel pins (A) on coupling end of pump. Secure endplate assembly to case using fourteen hex head cap screws (B).
9. A.) For 4659-4699 HF pumps, follow steps 10 – 16.
B.) For 4759-4799 HF pumps, follow steps 17 – 21.

4659-4699 HF Pumps

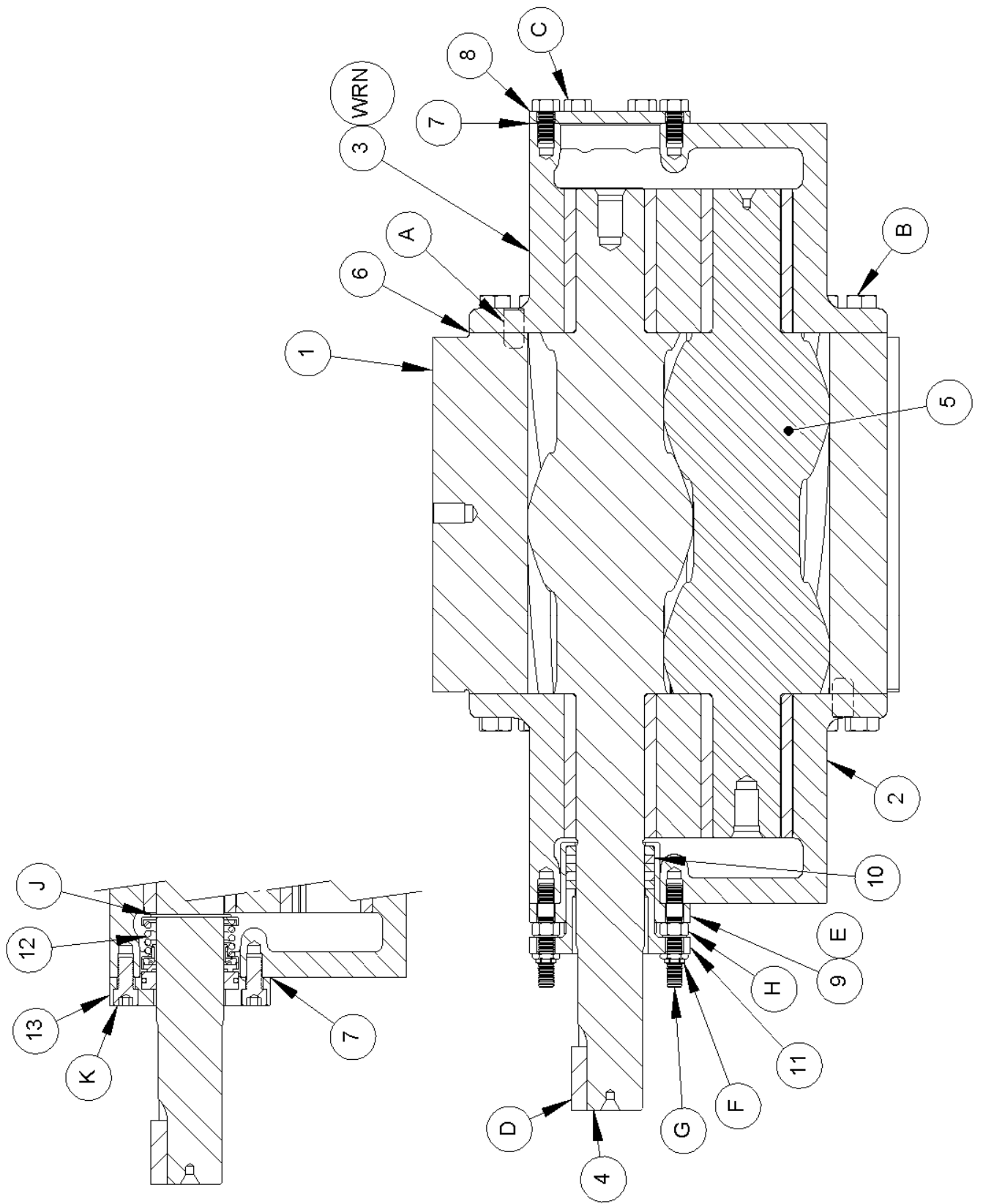
10. Install two studs (G) into endplate assembly (2).
11. Install new packing housing gasket (7) and packing housing (9) to endplate assembly (2) using four hex head cap screws (E) and two hex nuts (H) on studs (G).
12. Install packing rings (10) over drive shaft and into packing housing (9). Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
13. Check drive shaft (4) for free movement after each ring is installed.
14. When packing housing is sufficiently full to allow entry of packing gland (9) about 3/8 of an inch [10 mm], slide packing gland over drive shaft and studs into packing housing. Secure packing gland in place using two jam nuts (F). Draw jam nuts up evenly on packing gland to assure proper seating of packing (10). **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
15. Install drive key (D).
16. Read and understand all safety instructions and warnings before installing and operating pump.

4759-4799 HF Pumps

17. Install retaining ring (J) on drive shaft (4).
18. Lubricate drive shaft and mechanical seal bore with a compatible lubricant. Install mechanical seal (12) on drive shaft and position seal back against retaining ring (J). Care must be taken not to nick o-ring. Be sure lapped (polished) faces of stationary seal face and rotating element are together.
19. Install new seal retainer gasket (7) and seal retainer (13). Secure seal retainer and gasket in place using six socket head cap screws (K).
20. Install drive key (D).
21. Read and understand all safety instructions and warnings before installing and operating pump.

12. PARTS LIST

- | | | | |
|-----|--------------------|------|--|
| 1. | Case Assembly | A. | Dowel Pin |
| 2. | Endplate Assembly | B. | Hex Head Cap Screw, Endplate to Case |
| 3. | Endplate Assembly | C. | Hex Head Cap Screw, Coverplate to Endplate |
| 4. | Drive Gear & Shaft | D. | Drive Key |
| 5. | Idler Gear & Shaft | E. | Hex Head Cap Screw, Packing Housing to Endplate |
| 6. | Case Gasket | F. | Jam Nut |
| 7. | Coverplate Gasket | G. | Stud |
| 8. | Coverplate | H. | Hex Nut |
| 9. | Packing Housing | J. | Retaining Ring |
| 10. | Packing Rings | K. | Socket Head Cap Screw, Seal Retainer to Endplate |
| 11. | Packing Gland | L. | Roll Pin (pinned Mechanical Seals only) |
| 12. | Mechanical Seal | | |
| 13. | Seal Retainer | WRN. | Warning Tag |



4659-4799HF
Figure 12.1

13. SHAFT SEALING

STANDARD COMPRESSION PACKING

One type of shaft sealing used in these pumps is formed ring packing. When using a packed box pump, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Packing rings are available in a wide selection of materials for various applications and temperatures. Previous experience with the pumped fluid is the best guide in selecting the proper packing ring material for your particular application.

CARE OF PACKING

Packing hooks are commercially available to help in removing packing rings from the stuffing box. It is generally not recommended to reuse old packing rings. When installing packing, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft. **DO NOT** over-tighten the packing. The gland nuts should then be backed off until finger-tight. Connect the flush or lubricate the packing if either method is used. After the pump is started, note the amount of leakage from the stuffing box. If the packing leakage exceeds ten drops per minute, stop the pump and adjust the gland nuts. The gland nuts should be adjusted evenly in 1/6 to 1/3 turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers, and generate excessive heat.

The pump should be stopped and the packing gland adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

MECHANICAL SEALS

Various types of mechanical seals are available to fit most pumps. (See **VARIOUS SEALING ARRANGEMENTS** shown in Figure 13.3.)

SEAL INSTALLATION

Due to the various seal types and material combinations available, it is not practical to include specific seal installation and setting instructions in this manual. The seal manufacturer's instructions for installation and setting should be followed when available. The information furnished in this section is general in nature and is offered as a reminder of items to check during seal installation. If any conflict exists between guidelines in this section and the seal manufacturer's instructions for your particular seal, follow the seal manufacturer's instructions.

Many seal failures can be traced to installation errors. Careful installation is a major factor in the life of a seal. The seal manufacturer's instructions and drawings for seal installation and setting should be followed. Thoroughly read and fully understand the seal installation drawings and instructions. This is a major key to proper seal installation.

Make sure that all parts are clean and not damaged, especially the mating seal faces. Inspect the primary (sealing faces) and secondary (o-rings) sealing areas. **DO NOT** scratch, nick, or get those areas dirty. Keep in mind that o-rings can easily become cut or torn without paying proper attention to their well being. Remove all burrs and sharp edges from the shaft, including sharp edges of the keyway. Replace worn shafts.

Use sound judgment during the installation. **DO NOT** over-tighten bolts, align or install seal or seal retainer with a hammer, or apply anything except professional workmanship to the job.

NOTE: When cleaning or lubricating, use only cleaning solutions and lubricants that are compatible with products being pumped and with sealing elastomers. **DO NOT** use petroleum base products with seals with EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers.

Know the materials you are working with. Critical seal parts are often made from brittle materials that will chip, crack, or break if carelessly handled. It is permissible to touch the seal faces. It is **NOT** permissible to abuse seal faces. Abusing the faces is handling them in such a way that they may be chipped or scratched. Denatured alcohol and lens tissue may be used to clean the faces. Cleaning solutions may remove the “shine” from carbon seal faces. Reflectiveness or “shine” is not important. Flatness is important. **DO NOT** use penetrating fluids for cleaning.

In many applications, the seal faces should be prelubricated. The prelubricant should be applied after the seal assembly is mounted and the faces are cleaned, just prior to mating the faces together, not sooner. The prelubricant should be applied from a clean non-refillable dispenser. One or two drops of lubricant are sufficient. Generally, a light weight oil, ISO/ASTM viscosity grade 32 (SAE 10), may be used as a prelubricant. Heavy oils (such as STP[®]) have a tendency to solidify with time when exposed to air. **NEVER** use grease or grease-like substances to prelubricate mechanical seal faces. Some lubricants may attack the materials of the seal parts or may prevent the seals from performing properly. In some cases, water may be the only acceptable lubricant for the seal. The seal manufacturer’s instructions should provide information for seal installation lubrication. If you are not sure of a lubricant’s compatibility with the pumped fluid or seal parts, consult with the seal manufacturer or assemble the faces dry.

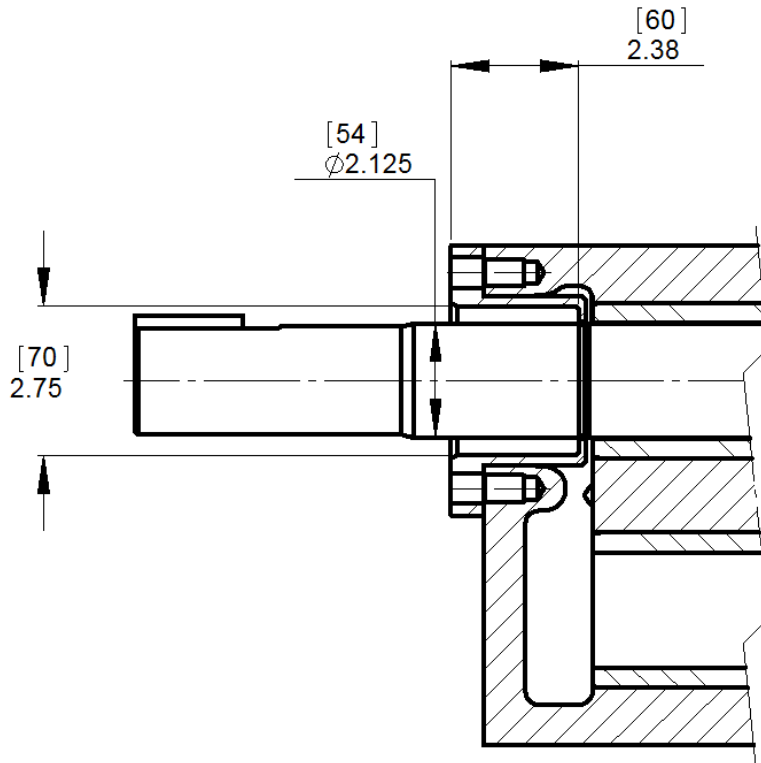
Installing the mechanical seal stationary seat into the seal retainer or the rotating element onto the shaft often requires a different lubricant than what is used for face prelubrication. Lubrication for installation is basically a sliding aid due to the tight fit of the mechanical seal secondary seal. Lubrication will reduce the chances of abrading, pinching, or cutting the secondary seals during installation. The lubricant, and any additives selected, must meet the following requirements:

- It must be compatible with the pumped liquid.
- It must not cause swelling of the secondary seals.
- It must not solidify.
- It must not break down and leave deposits.
- It must not impede the design or action of the secondary seals.

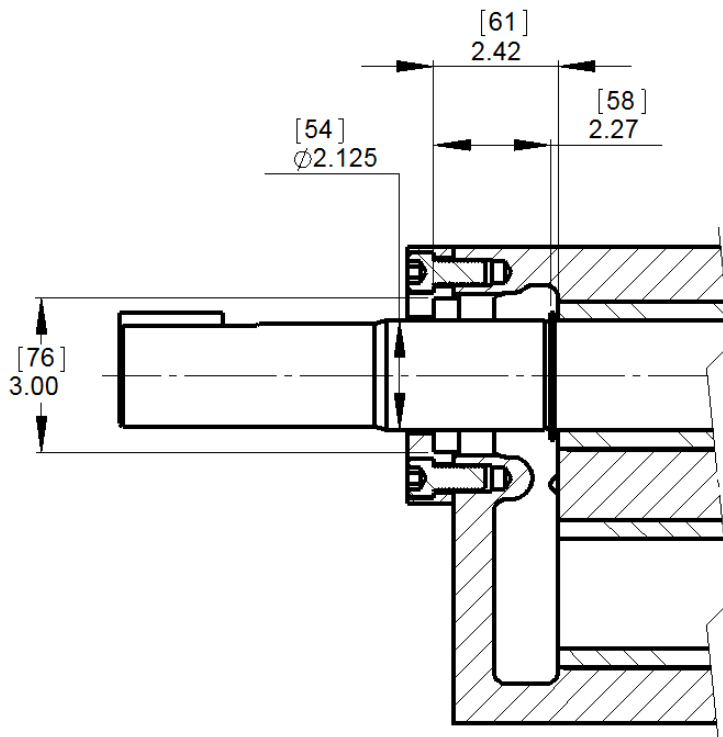
Keep installation lubrication to a minimum. Apply only a thin coating to the shaft and inside diameter of the seal. Apply a thin film to the bore of the seal retainer and outside diameter of the stationary seat. **DO NOT** immerse seal parts in oil.

It is normal for a new seal to leak somewhat after initial startup. Allow the seal faces to “wear-in” to each other. Fluids with good lubricating properties will naturally delay this wear-in period. However, if leakage occurs immediately and does not decrease, the secondary seals may be damaged or the seal faces may be warped out of flat.

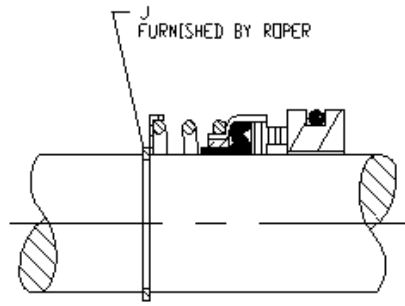
As these type seals are designed to operate in a liquid, the seal faces must be immersed in a liquid from the very beginning. Dry operation will damage the seal faces. Refer to Section 3, **PREOPERATION CHECKS**, before starting a pump with a new seal.



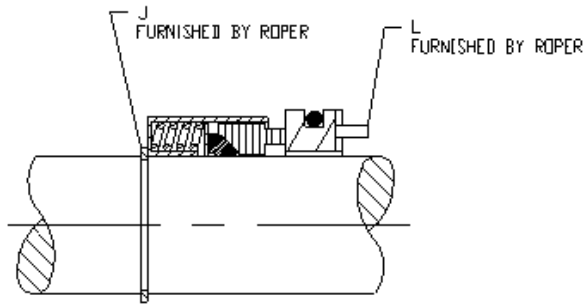
PACKED BOX SEAL CHAMBER DIMENSIONAL
Figure 13.1



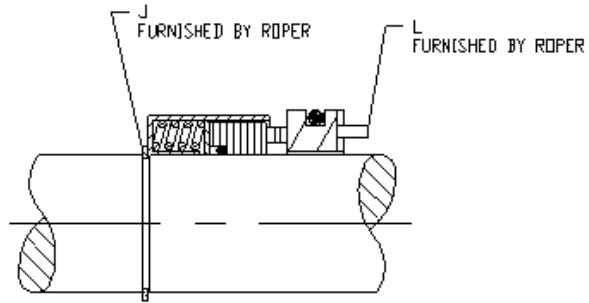
MECHANICAL SEAL CHAMBER DIMENSIONAL
Figure 13.2



JOHN CRANE® TYPE 21



JOHN CRANE® TYPE 9



JOHN CRANE® TYPE 8-1

VARIOUS SEALING ARRANGEMENTS
Figure 13.3

14. STORAGE

When removing a pump from service for storage, the pump should be completely cleaned and flushed of any pumped fluid. The unit should be carefully inspected and have any necessary repairs made before placing the pump into storage.

Make yourself a reminder to read and understand this manual completely before installing the pump.

SHORT TERM STORAGE (up to six months)

For storage of up to six months, special preparations are not usually necessary; however, the following should be observed:

- Protect the pump from the elements. Store the pump indoors whenever possible. If indoor storage is not possible, cover the pump with a protective covering. **DO NOT** allow moisture to collect in or around the pump.
- Read and understand this manual thoroughly before installing the pump.

LONG TERM STORAGE (over six months)

For storage periods over six months, observe the following:

- Protect the pump from the elements. Store the pump indoors. **DO NOT** allow moisture to collect in or around the pump.
- Make sure the pump is dry. Cap or plug any flanged openings with suitable metallic closures.
- Wrap exposed shafts and machined surfaces with suitable corrosion-inhibiting cloth or paper. Seal the seams with an oil-proof, low-chloride content tape.
- On packed box pumps, relieve the compression on the packing by loosening the packing gland. If you intend to grease lubricate the packing after installing the pump, inject a liberal amount of grease into the stuffing box.
- Apply a suitable preservative to the pump.
- If applicable, remove the drive belts from belt-driven units or disconnect the coupling on direct-connected units.
- Read and understand this manual thoroughly before installing the pump.

If other equipment included with this pump (i.e. couplings, drivers, mechanical seals, etc.) is to be stored also, refer to its manufacturer's instructions for storage.

15. INDEX

Assembly Instructions, 17-18

Bearing

Removal, and Installation, **15**

Conversions

High Drive to Low Drive, **8-12**

Dimensional Data, 16

Disassembly Instructions, 13-14

Draining Pump, 13

Guarding Power Take-Off Shafts, 3

Mechanical Seals

Care and Installation, **20-21**

Various Mechanical Seal Arrangements, **22-23**

Mounting Base, 2

Nameplate Data, 4-5

Packing Standard Compression, 20

Parts List and Drawing, 18-19

Plumbing, 2

Ratings

Pressure, **5**

Speed, **5**

Temperature, **5**

Rotation

Direction of Rotation, **7**

Reversing, **8-12**

Seal Chamber Dimensions, 22

Special Precautions for PTO Drive, 3

Special Warnings, 2-3

Storage, 24

Tools, 6