



Installation, Operation and Maintenance Instructions



EAGLE MODEL V200 ANSI PUMPS

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Introduction

This instruction manual is intended to assist those involved with the installation, operation, and maintenance of Eagle Model V200 pumps. It is recommended that this manual be thoroughly reviewed prior to installing or performing any work on the pump or motor.

SECTION I—GENERAL

A. Importance of Instructions

The design, material and workmanship incorporated in the construction of Eagle pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and correct methods of installing, operating and maintaining these pumps.

Study thoroughly Sections I, II, III and carefully follow the instructions for installation and operation. Sections IV, V, VII, and VIII are answers to trouble and maintenance questions. Keep this instruction manual handy for reference. Further information can be obtained by contacting the Eagle Pump & Compressor representative nearest you.

B. Special Warnings

Eagle Pump & Compressor will not be liable for any damages or delay caused by failure to comply with the provisions of this instruction manual. This pump is not to be operated at speeds, working pressures, discharge pressures or temperatures higher than, nor used with liquids other than stated in the original order/quotation without written permission of Eagle Pump & Compressor.

C. Receiving Inspection—Shortages

Care should be taken when unloading pumps. If shipment is not delivered in good order and in accordance with the Bill-of-Lading, note the damage(s) or shortage(s) on both receipt and freight bill. MAKE ANY CLAIMS TO THE TRANSPORTATION COMPANY PROMPTLY.

Instruction sheets on various components as well as the Instruction Book for the pump are included in the shipment. DO NOT DISCARD!

D. Preservation and Storage

Eagle's normal domestic storage preparation is suitable for protecting the pump during shipment in covered trucks. It also provides protection during covered storage at the jobsite, and for a short period between installation and start-up.

If the pump is to be idle and exposed to the elements for an extended period, either before or after installation, special precautions are required. One approach is to provide special preservatives and wrapping before shipment. However, after installation, the protective wrappings will have been removed. Therefore, application of preservatives after installation is considered a good practice. Information about various long term preservation and storage options available can be obtained from your local Eagle representative.

The driver, coupling, and mechanical seal manufacturers should be contacted for their recommendations on preservations and protection procedures.

E. Handling Techniques

Care should be used in moving pumps. Where required by size of units, slings should be put under both pump and motor.

SECTION II—INSTALLATION

A. Location

Pumping unit should be placed as close as practical to the source of supply. Floor space and head room allotted to the unit must be sufficient for inspection and maintenance. Be sure to allow for crane or hoist service.

B. Foundation and Baseplate

Model V200 In-Line Pumps are designed to be mounted directly in, and supported by the piping. Pipe supports should be located close to the pump, and be designed to support the weight of the complete unit (pump and motor).

C. Piping

1. The piping, both suction and discharge, should be as short and direct as possible. Avoid all unnecessary elbows, bends, and fittings as they increase the friction losses in the piping. The size of the pipe and fittings should be carefully selected and of sufficient size to keep the friction losses as low as practical. Piping flanges must line up and be square to the suction and discharge nozzles to eliminate casing distortion due to pipe strain.
2. The suction pipe should never be of smaller diameter than the pump suction. Use of suction pipe one or two sizes larger than the pump suction, with a reducer at the pump suction flange, is desirable. Reducers, if used, should be eccentric and preferably at the pump suction flange, sloping side down.

A gate valve should be installed in the suction line to permit closing of the line for pump inspection and maintenance.

Keep suction pipe free from air pockets.

3. Gate and check valves should be installed in the discharge line. The check valve should be located between the gate valve and pump to permit inspection of the check valve. The gate valve is required for priming, regulation of flow and for inspection and maintenance of the pump. The check valve is required to prevent reverse flow through the pump when the driver is turned off.

Additional information on piping can be found in "Hydraulic Institute Standards".

D. Alignment

Alignment between pump and motor is built in by use of a machined lock fit between the C-face motor and motor support. No further alignment is normally required.

If there are difficulties aligning the motor shaft with the pump shaft, it might be necessary to loosen the motor support cap screws at the casing, reposition the motor support, then retighten motor support cap screws.

PRIOR TO COUPLING DRIVER TO PUMP, ROTATION OF DRIVER SHOULD BE CHECKED! Serious damage can result if pump is rotated in wrong direction. Once motor rotation is checked, connect coupling, following the manufacturer's instructions. If a coupling guard is furnished with the unit, ensure that it is securely fastened in place.

E. Stuffing Box

1. Packing

Packing must not run dry. If the pumped liquid is clean, gland leakage of 40-60 drops per minute is satisfactory. If the liquid is dirty, connect a clean liquid flush to the lantern ring connection to keep solids out of the packing. Occasionally, the stuffing box is below atmospheric pressure (suction under vacuum, etc.) Under these condition, supply sealing liquid through a line from the discharge of the pump to the lantern ring connection. Leakage from the box can be piped away through the 1/2 inch drain connection in the casing.

2. Mechanical Seals

When mechanical seals are supplied, they are installed in the pump. Mechanical seals must not run dry, or in abrasives. Connect recirculation, flush and/or cooling flows as required, following instructions on the seal print supplied for the order.

SECTION III—OPERATION

A. Startup

1. Checklist

a. Lubrication

Pump bearings are normally grease lubricated, and are lubricated at the factory. Two types of bearings are used. Some pumps are equipped with sealed bearings which never require lubrication. Some pumps are equipped with grease fittings on the bearing housing. On the latter type grease at approximately 3-6 month intervals, until grease comes out the grease relief caps which serve as grease relief fittings. Use a sodium or lithium base grease NLGI #2 consistency. Follow motor and coupling manufacturer's lubrication instructions to lubricate the driver and/or coupling.

b. Alignment

As described in Section II-D, alignment is normally built-in and need not be rechecked.

c. Stuffing Box

On pumps with packed boxes, check to be sure gland nuts are finger tight only.

d. Stuffing Box Lubrication/Cooling

Check to be sure that any required auxiliary piping is installed and functioning. If cooling and/or flushing from an outside source is being used, establish these flows.

e. Priming

Pump and suction pipe must be full of liquid before pump is started. Usually, pump will be primed when shutoff valves to pump are opened. If suction supply is below pump, priming by other means such as foot valve or ejector will be required.

2. Startup Procedures

a. Valves

Be sure suction valve is fully open. Normally, discharge valve should be at least partially closed so that flow will be controlled.

b. Rotation Check

If not already done, uncouple the unit and jog the motor to check for proper rotation.

c. Start

Pump is now ready to start.

B. Operational Checks

Inspect pump carefully and frequently during the first few hours of operation. If packing runs hot, shut pump down, allow box to cool, loosen gland if necessary. (Do not loosen gland until packing has cooled.) Mechanical seal may weep slightly but should "run-in" in a few hours. Be sure all auxiliary lines (cooling, flushing, sealing, etc.) are functioning properly.

Check pump bearings for excessive heating. Check motor for excessive heating. Check complete unit for excessive vibration or unusual noises. Do not run pump at greatly reduced flow, because all the motor horsepower will go into heating the liquid in the pump, and damage will result.

C. Shutdown Procedure

Pump can be shut off without closing any valves, unless the pump is installed without a check valve. When no check valve is used, the discharge valve must be closed before the pump is stopped to prevent backflow through the pump.

If the pump is to be serviced, be sure suction valves are closed, auxiliary cooling and flushing flows are shut off and motor is locked out before working on pump.

SECTION IV—PREVENTIVE AND CORRECTIVE MAINTENANCE

A. Lubrication

Pump bearings are normally grease lubricated, and are lubricated at the factory. Two types of bearings are used. Some pumps are equipped with sealed bearings which never require lubrication. Some pumps are equipped with grease fittings on the bearing housing. On the latter type regrease at approximately 3-6 month intervals, until grease comes out the grease caps which serve as grease relief fittings. Use a sodium or lithium base grease, NLGI #2 consistency. Follow motor and coupling manufacturer's lubrication instructions to lubricate the driver.

B. Stuffing Box

1. Packed Stuffing Box

Periodically inspect stuffing box to see that there is sufficient leakage to lubricate the packing and maintain a cool box. Never draw up packing so that the stuffing box heats, as this will cause damage to both packing and sleeve. Draw up gland nuts slowly and evenly and only when pump is running.

After pump has been in operation for some time and the packing has been completely "run-in", at least 40 to 60 drops per minute of the liquid should be allowed to trickle from the stuffing box at all times for cooling and lubricating the packing and shaft sleeve.

2. Stuffing Boxes with Mechanical Seal

This type of box requires no attention other than to make sure that the circulating lines do not become clogged.

C. Vibration

It is good practice to periodically monitor vibration of the pump. Normally, vibration level will be well below accepted standards. Of equal importance is that the vibration level not increase. If a problem with vibration is encountered, refer to Trouble Shooting, Section VII.

D. Performance

If performance deteriorates, refer to Trouble Shooting, Section VII.

SECTION V—DISASSEMBLY AND REASSEMBLY

A. Disassembly

The Model V-200 is designed to permit the complete pullout assembly to be removed without disturbing the casing or motor. The sectional drawing, parts list and construction details should be used in conjunction with the disassembly instructions.

1. Lock out motor.
2. Valve off and drain pump.
3. Remove auxiliary piping.
4. Unbolt and remove spacer member of coupling.
5. Remove the bolts (370) that hold the frame (228) to the casing (100). Lift the pullout assembly from casing. Jacking bolts (418) are provided to assist disassembly. Tighten the bolts evenly, a flat at a time, to jack assembly from casing.
6. Remove casing gasket (351).
7. Unscrew impeller (101) from shaft (122). The threads are right-hand. Prevent the shaft turning by using a wrench on coupling "flats". Do not lose or damage the O-ring (412A) which seals between the impeller (101) and shaft (122) or shaft sleeve (126).
8. On units with mechanical seal (383).
 - a. Inside single or double seat—remove gland stud nuts (355) and carefully slide gland (250) toward bearing frame (228). Do not damage seal faces.
 - b. Outside seal—loosen set screws which position rotary portion of seal and slide seal toward bearing frame (228). Remove gland stud nuts (355) and carefully slide gland (250) off studs. Do not damage seal faces.
9. Remove stud nuts (370H) which hold stuffing box cover (184) to frame (228). Pull stuffing box cover (184) from frame. Do not allow stuffing box to contact shaft (122), sleeve (126), shaft threads or any mechanical seal parts. (Slide sleeve (126), if any, off shaft (122).)
10. On units with mechanical seal, loosen set screws which position rotary portion of seal to shaft (122) and carefully slide seal and gland (250) assembly off shaft. On units which have a shaft sleeve, (126), it is not necessary to remove rotary portion of seal from the sleeve unless replacement of seal is required.
11. Slide deflector (123) off shaft (122).
12. Scribe shaft (122) at coupling hub for proper positioning of hub during reassembly and remove hub.
13. Remove bearing housing bolts (370C). Impeller adjustment bolts (370D) with jam nuts can be used to assist in the removal of the shaft (122) and bearing assembly from the bearing frame (228).
14. Slide complete shaft assembly from bearing frame. This will include the shaft (122), both bearings (112 and 168), and bearing housing (134). Do not lose or damage O-ring (496). Do not damage inboard grease seal (333).
15. Pull inboard bearing (168).

16. Remove bearing retaining ring (361) and slide bearing housing off ball bearing. Do not damage bearing housing grease seal (332).
17. Straighten “tang” in lockwasher (382) and remove bearing locknut (136) and lock-washer. Pull ball bearing (112).
18. On units with stuffing box packing, remove packing (106) and lantern ring (105) from stuffing box cover (184).

B. Inspection and Parts Replacement Guidelines

1. Impeller(101) — Replace if impellers shows excessive erosion (especially on ejector vanes on back side of impeller), corrosion, extreme wear or vane breakage. O-ring groove and impeller hub must be in good condition. Check impeller balance.
2. Shaft (122) — Check for runout to see that shaft has not been bent. On pumps without shaft sleeves, shaft surface in stuffing box area must be smooth and free of grooves. Bearing seats and oil seal areas must be smooth and free of scratches or grooves. Shaft threads must be in good condition. Replace shaft if necessary.
3. Shaft Sleeve (126) — Surface in stuffing box must be smooth and free of grooves. If grooved, replace.
4. Mechanical Seal (383) — Seal faces, gaskets, and shaft sealing members must be in perfect condition or excessive leakage may result. Replace worn or damaged parts.
5. Ball bearings (112 and 168) — Replace if worn, loose or rough and noisy when rotated. New bearings should not be unwrapped until ready for use. Replacement bearings must be of proper size and type as specified in the Construction Details (Section VI). Where possible, avoid re-using bearings that have been pulled.
6. Grease Seals (332 and 333) — Replace if torn or otherwise damaged. Seals are held by press fit. Lips on seals should face outward, (away from bearings).
7. General — All parts should be clean before assembly. This is especially important at retaining ring and O-ring grooves, threads, lock fits, gasket surfaces and bearing and bearing lubricated areas. Any burrs should be removed with crocus cloth.

C. Reassembly

This procedure covers reassembly of pump after complete disassembly. Make sure all directions in “Inspection and Overhaul” (Section V-B) have been followed.

1. Oil bearing seat on coupling end of shaft (122.) Slide coupling end bearing (112) (double row) on shaft as far as possible by hand. Place pipe or driving sleeve over shaft, making sure it rests against inner race only. Make sure bearing is “square” on shaft. Tap or press evenly until bearing is seated firmly against the shaft shoulder. Do not mar the shaft, especially where it contacts the grease seal.
2. Place lockwasher (382) and bearing locknut (136) on shaft and tighten firmly. Bend “tang” of lockwasher into slot in locknut.
3. Slide bearing housing (134) with O-ring (496) in place, on shaft and over bearing as far as possible. Do not damage grease seal (332).

4. Insert retaining ring (361) into groove in bearing housing (134). Flat side of retaining ring must be against bearing. Oil inboard bearing seat on shaft (122). Slide inboard ball bearing (168) on shaft as far as possible by hand. Place pipe or driving sleeve over shaft, making sure it rests against inner race only. Make sure bearing is “square” on shaft. Tap or press evenly until bearing is seated firmly against the shaft shoulder. Do not mar the shaft, especially where it contacts the grease seal.
6. Place a small amount of O-ring lubricant on inside of bearing frame (228) at bearing housing (134) and inboard bearing seats, on O-ring, and on inboard grease seal (333). Carefully slide shaft assembly into the bearing frame as far as possible. Do not damage inboard grease seal. Be sure O-ring (496) is in place in groove on housing. Screw bearing housing bolts (370C) about ¼” (12 mm) into bearing frame.
7. Slide deflector (123) on shaft (122).
8. If unit has stuffing box packing:
Place stuffing box cover (184) against frame making sure that the studs (370H) align with proper holes in frame. Replace nuts and firmly tighten. Slide sleeve (126) if any, on shaft (122). Make sure groove in end of sleeve engages drive pin (469) on shaft.
9. If unit has mechanical seal (383):

The following instructions refer to pumps equipped with mechanical seals, either with or without sleeves. On units with sleeves, the rotary portion of the seal may be mounted on the sleeve, and the seal-sleeve assembly mounted on the shaft as a unit. Before mounting any seals, wipe the seal faces carefully with a clean soft cloth and lubricate with clean oil.

A preliminary impeller adjustment must be performed to assure proper positioning of the mechanical seal.

- a. Position sleeve (126) if any, on shaft (122) and engage groove in sleeve with drive pin (469) on shaft. Place stuffing box cover (194) against frame (118). Make sure studs (370H) align with proper holes in frame. Firmly tighten nuts or bolts.
- b. Screw impeller (101) with new O-ring (412) (if available) in place on shaft. Make sure that shaft assembly extends through stuffing box cover (184) so that the impeller will NOT contact face of stuffing box cover.
- c. Using impeller adjusting bolts (370C & 370D), adjust the impeller clearance until a .020” (0.51 mm) feeler gauge can be inserted between the back of the impeller and the face of the stuffing box cover.

The following instructions are for three basic seal types: Inside, Outside, and Double Seals. Refer to seal manufacturer’s drawing to determine seal type and positioning dimension. Follow the pertinent procedures.

Single Inside Seal

- i. Assemble the gland (250), gaskets and stationary seat. If unit has sleeve (126), position sleeve on shaft (122) and engage groove in sleeve with drive pin (469) on shaft. Slide gland assembly on shaft or sleeve.
- ii. Refer to Section V-D for instructions on proper positioning of mechanical seals.
- iii. Place stuffing box cover (184) against frame (228) making sure that studs (370H) align with proper holes in frame. Replace nuts and firm-ly tighten. Do not allow stuffing box cover to contact shaft, sleeves, if any, or mechanical seal.

- iv. Refer to Step 10 for further instructions.

Outside Seal

- i. If unit has shaft sleeve (126), slide on shaft (122) and engage groove in sleeve with drive pin (469) on shaft.
- ii. Lubricate rotary portion of seal and slide on shaft or sleeve. Do not tighten set screws.
- iii. Assemble gland (250), gaskets, and stationary seat and slide assembly on shaft or sleeve.
- iv. Place stuffing box cover (184) against frame making sure that the studs (370H) align with the proper holes in frame. Firmly tighten nuts.
- v. Place gland assembly against face of stuffing box and firmly tighten stud nuts.
- vi. Slide rotary portion toward gland until it contacts stationary seat. Compress the rotary. Tighten screws.
- vii. Refer to Step 10 for further information.

Double Seal

- i. Assemble the gland (250), gaskets and stationary seat. If unit has shaft sleeve (126), position sleeve on shaft (122) and engage groove in sleeve with drive pin (469) on shaft. Slide gland assembly on shaft or sleeve.
 - ii. Refer to Section V-D for instructions on proper positioning of mechanical seals.
 - iii. Place inboard stationary seat and gaskets into bottom of stuffing box.
 - iv. Place stuffing box cover (184) against frame making sure that studs (370H), align with proper holes in frame. Firmly tighten nuts.
 - v. Refer to Step 10 for further instructions.
10. Screw impeller (101) with O-ring (41 2) in place, on the shaft (122).
 11. Install and position coupling hub at scribe mark on shaft.
 12. Place casing gasket (351) against shoulder in casing.
 13. Slide the pullout assembly into the casing (100). Drain slot in stuffing box cover (184) should line up with drain connection in casing. Install and tighten the frame-to-casing. Make sure the pump turns FREELY. If not, adjust the impeller adjusting bolts (370C) & (370D). Install and tighten the frame to casing bolts (370) evenly while turning the pump by hand. Do not jam the impeller into the casing.
 14. Reset impeller clearances.
 - a. Loosen bolts 370 - C & D
 - b. Tighten bolts 370C while turning shaft until impeller starts to rub against casing.

- c. Loosen Bolts 370C until a 0.015" (0.375 mm) feeler can be placed between the bolt head and the bearing housing.
- d. Tighten bolts 370D evenly. Bearing housing, shaft and impeller will be jacked to proper clearance from casing. Tighten bolts 370C and jam nuts on bolts 370D.
- e. If desired, a dial indicator can be used instead of a feeler gauge to check that the bearing housing has been moved the correct 0.015" (0.375 mm) distance.

D. Additional Details

Instructions for Positioning of Inside Mechanical Seals.

1. Place stuffing box cover (184) against frame (228), making sure that the studs (370H) align with the proper holes in frame. Firmly tighten nuts.
2. Correct location of the rotary portion or a mechanical seal can be determined by two methods.
 - a. *Scribe Method*
 - i. Scribe the shaft (122) or sleeve (126) lightly at the face of the stuffing box.
 - ii. Remove the nuts or bolts and slide stuffing box cover (184) away from the frame.
 - iii. Lubricate rotary portion of seal and slide on shaft or sleeve.
 - iv. Compress rotary portion of seal to correct dimension as shown on seal manufacturer's drawing and tighten set screws.
 - b. *Modified Visegrip Method.*
 - i. Slide the gland assembly (250) against the stuffing box. Do not damage seal face. Do not bolt gland to stuffing box.
 - ii. Clamp modified visegrip on the shaft (122) or sleeve (126) directly against the gland.
 - iii. Leaving visegrip in position, remove nuts or bolts and slide stuffing box cover away from frame adapter.
 - iv. Lubricate rotary portion of seal and slide on shaft (122) or sleeve (126).
 - v. Compress rotary portion of seal to correct dimension as shown on seal manufacturer's drawing and tighten set screws.
 - vi. Remove visegrip and refer to Step 9 on Page 6 for further instructions.

SECTION VI—ENGINEERING DATA CONSTRUCTION DETAILS

POWER END		MODEL V200-S	MODEL V200-M	MODEL V200-L										
Shaft Diameters	At Impeller	3/4" (19.0)	1" (25.4)	1 1/4" (31.8)										
	In Stuffing Box (Less Sleeve)	1 3/8" (34.9)	1 3/4" (44.5)	2 1/8" (54.0)										
	In Stuffing Box (With Sleeve)	1 1/8" (28.6)	1 1/2" (38.1)	1 7/8" (47.6)										
	Sleeve Outside Diameter	1 3/8" (34.9)	1 3/4" (44.5)	2 1/8" (54.0)										
	Between Bearings	1 1/2" (38.1)	2 1/8" (54.0)	2 1/2" (63.5)										
	At Coupling	7/8" (22.2)	1 1/8" (28.6)	1 7/8" (47.6)										
Bearings	Radial	6207 Z	6309 Z	6311 Z										
	Coupling End (Double Row)	3306 Z	3309 Z	3311 Z										
	Bearing Span	4 1/4" (108.6)	6 15/16" (176)	6 3/4" (170.6)										
	Shaft Overhang	5 7/8" (150)	8 3/8" (212)	8 1/4" (210)										
Stuffing Box	Bore	2" (50.8)	2 1/2" (63.5)	2 7/8" (73.0)										
	Depth	2 1/8" (54.0)	2 5/8" (66.7)	2 5/8" (66.7)										
	Packing Size	5/16" x 5/16" (7.9 x 7.9)	3/8" x 3/8" (9.5 x 9.5)	3/8" x 3/8" (9.5 x 9.5)										
	No. of Rings	5	5	5										
	Width of Lantern Ring	7/16" (11.1)	5/8" (15.9)	5/8" (15.9)										
	Distance - End of Box to Nearest Obstruction	2" (50.8)	2 7/8" (73)	2 7/8" (73)										
PUMP END	V200-S				V200-M				V200-L					
		1 1/2x1-6	3x1 1/2-6	3x2-6	1 1/2x1-8	3x1 1/2-8	2x1 1/2-10	3x1 1/2-10	3x2-10	4x3-10	3x1 1/2-13	3x2-13	4x3-13	6x4-13
	Maximum Diameter Solids	5/16" (8)	3/8" (9.5)	7/16" (11.1)	7/32" (5.5)	5/16" (8)	3/16" (4.7)	7/32" (5.6)	9/32" (7.1)	5/8" (15.9)	7/32" (5.6)	9/16" (14.3)	5/8" (15.9)	1" (25.4)
	Minimum Casing Thickness	3/8" (9.5)					1/2" (12.7)				9/16" (14.3)			
	Casing Corrosion Allowance	1/8" (3.2)												
	Working Pressure	See Pressure-Temperature Chart												
	Test Pressure	150% of Working Pressure at 100°F (38°C)												
	Max. Liquid Temp (w/out cooling)	250°F (120°C)												
	Max. Liquid Temp (with cooling)	300°F (150°C)												
	Unit Weight lbs. (Kg)	See Dimensions												

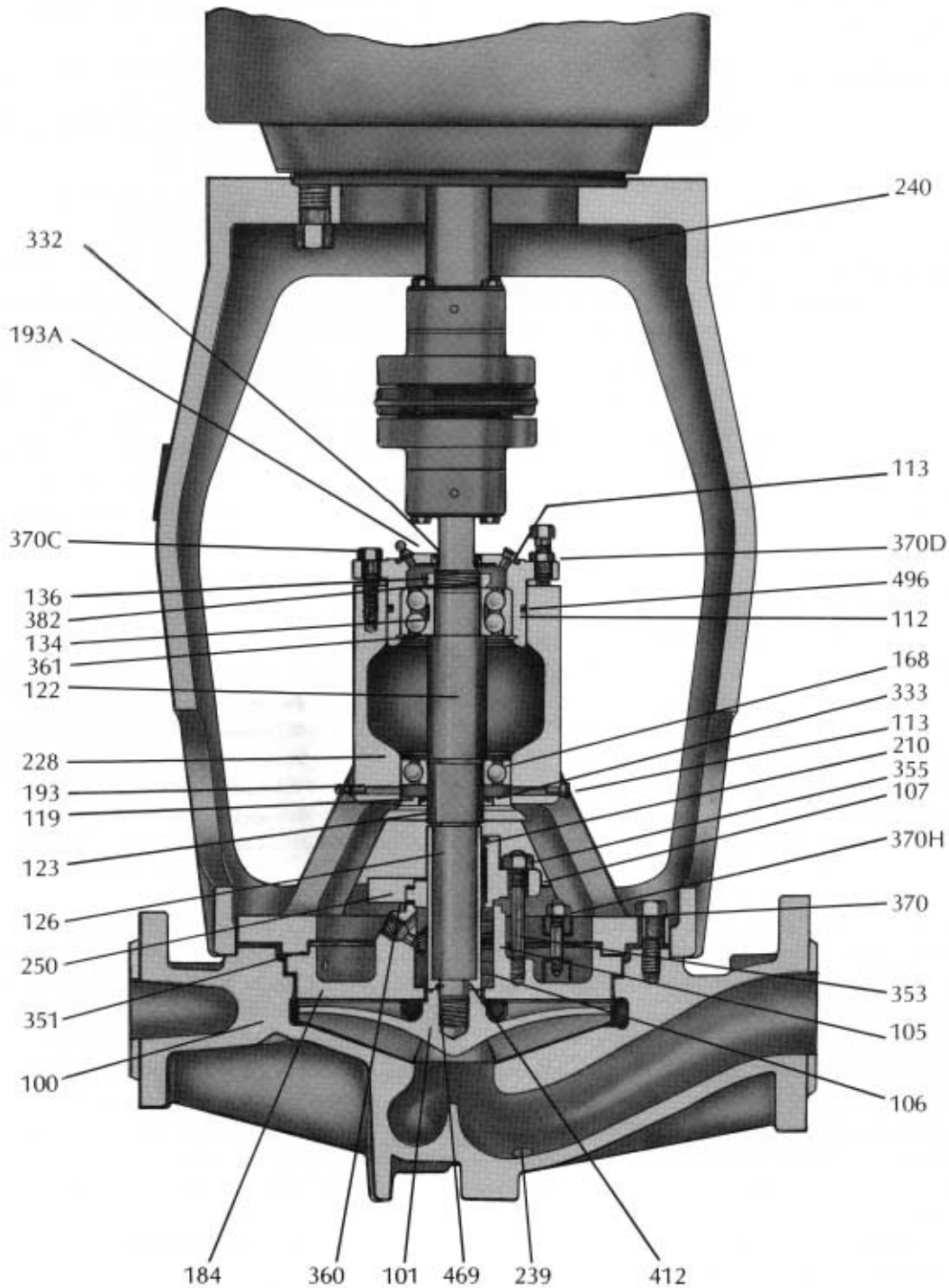
SECTION VII—TROUBLE SHOOTING

Problem	Possible Causes & Corrections
A. No liquid delivered, not enough liquid delivered, or not enough pressure	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 20.
B. Pump works a while and then quits	4, 5, 7, 8, 9, 11, 12, 20.
C. Pump takes too much power	6, 13, 14, 15, 16, 21, 22, 23, 24, 31.
D. Pump is noisy or	15, 16, 17, 28, 31.
E. Pump leaks excessively at stuffing box	8, 24, 25, 26, 27.
F. High bearing temperature	15, 16, 17, 29, 30, 31.
G. Stuffing box overheating	8, 24, 25, 26, 27.

Causes & Corrective Measures

1. Pump not primed or properly vented — check that casing and suction pipe are completely filled with liquid.
2. Speed too low — check whether motor wiring is correct and receives full voltage or turbine receives full steam pressure.
3. System discharge head too high — check system (particularly friction losses).
4. Suction lift too high — check NPSH available (suction piping too small or too long may cause excessive friction losses). Check with vacuum or compound gauge.
5. Impeller or piping obstructed — check for obstructions.
6. Wrong direction of rotation — check rotation.
7. Air pocket or leak in suction line — check suction piping for air pockets and/or air leaks.
8. Stuffing box packing or seal worn allowing leakage of air into pump casing — check packing or seal and replace as required. Check for proper lubrication.
9. Not enough suction head for hot or volatile liquids — increase suction head, consult factory.
10. Foot valve too small — install correct size foot valve.
11. Foot valve or suction pipe not immersed deep enough — consult factory for proper depth. Use baffle to eliminate vortices.
12. Entrained air or gases in liquid — consult factory.
13. Impeller clearance too great — check for proper clearance.
14. Impeller damaged — inspect and replace as required.
15. Rotating parts bind — check internal wearing parts for proper clearance.
16. Shaft bent — straighten or replace as required.
17. Coupling or pump and driver misaligned — check alignment and realign if required.
18. Impeller diameter too small — consult factory for proper impeller diameter.
19. Improper pressure gauge location — check correct position and discharge nozzle or pipe.
20. Casing gasket damaged — check gaskets and replace as required.
21. Speed too high — check motor winding voltage or steam pressure received by turbine.
22. Head lower than rating; pumps too much liquid — consult factory. Install throttle valve, cut impeller.
23. Liquid heavier than anticipated — check specific gravity and viscosity.
24. Stuffing box not properly packed (insufficient packing, not properly inserted or run in, packing too tight) — check packing and repack stuffing box.
25. Incorrect packing or mechanical seal — consult factory.
26. Damaged mechanical seal — inspect and replace as required. Consult factory.
27. Shaft sleeve scored — remachine or replace as required.
28. Cavitation — increase NPSH available. Consult factory.
29. Pump capacity too low — consult factory for minimum continuous flow.
30. Excessive vibration — See Section V-D.
31. Improper bearing lubrication or bearings worn out — inspect and replace as required.

SECTION VIII—SECTIONAL VIEW AND PARTS LIST



Recommended Spare Parts

101	1	Impeller
106	1 set	Stuffing Box Packing (2)
112	1	Ball Bearing - Outboard
126	1	Shaft Sleeve
168	1	Ball Bearing - Inboard
210	1	Gland Packing (2)
332	1	Grease Seal - Outboard

333	1	Grease Seal - Inboard
351	1	Gasket - Casing
412	1	"O" Ring - Impeller
469	1	Drive Pin - Shaft Sleeve
496	1	"O" Ring Bearing Housing
383	1	Mechanical Seal (3)

NOTES: (2) - Required on packed pumps only.
(3) - Required on pumps equipped with mechanical seal only.

Parts List and Materials of Construction

Item No.	No. Req'd. Per Pump	Part Name	MATERIAL							
			Carbon Steel	316SS	CD4MCu	C-20	Monel	Nickel	Hast.	
100	1	Casing	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
101	1	Impeller	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
105	1	Lantern Ring	Stainless Steel							
106	1 Set	Stuffing Box Packing	Teflon							
107	1	Gland (Packed Box)	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
112	1	Ball Bearing - Outboard	Steel							
113	2	Grease Relief Fitting	Steel							
119	1	Bearing End Cover	Steel							
122	1	Pump Shaft (Less Sleeve)	4340	316		C-20	Monel	Nickel	Hast.	
122A	1	Pump Shaft (With Sleeve)	4340			316				
123	1	Deflector	Stainless Steel							
126	1	Shaft Sleeve	316		CD4M	C-20	Monel	Nickel	Hast.	
134	1	Bearing Housing	Cast Iron							
136	1	Bearing Locknut	Steel							
168	1	Ball Bearing - Inboard	Steel							
184	1	Stuffing Box Cover - Standard	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
184A	1	Stuffing Box Cover - Jacketed	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
193	1	Grease Fitting	Steel							
193A	1	Grease Fitting	Steel							
210	1	Gland Packing	Teflon							
228	1	Bearing Frame	Cast Iron							
239	1	Drain Plug	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
240	1	Motor Support	Ductile Iron							
250	1	Mechanical Seal Gland	C S	316	CD4M	C-20	Monel	Nickel	Hast.	
332	1	Grease Seal - Outboard	Buna Rubber							
333	1	Grease Seal - Inboard	Buna Rubber							
351	1	Gasket - Casing	Asbestos							
353	2 or 4	Gland Stud	304				Monel			
355	2 or 4	Gland Stud Nut	304				Monel			
360	1	Mechanical Seal Gland Gasket	Asbestos							
361	1	Retaining Ring - Bearing Housing	Steel							
370	4 - 24	Capscrew Brg Hsg to Casing	Steel							
370C	3 - 4	Capscrew - Bearing Housing	Steel							
370D	3 - 4	Capscrew - w/Jam Nut Impeller Adjust.	Steel							
370H	2	Stud & Nut-Cover to Brg Hsg	304							
372	4	Capscrew Motor Support	Steel							
382	1	Bearing Lockwasher	Steel							
383	1	Mechanical Seal	Steel							
412	1	"O" Ring - Impeller	Teflon							
418	2 - 3	Capscrew - Jacking	304							
469	1	Drive Pin - Shaft Sleeve	420							
496	1	"O" Ring - Bearing Housing	Buna Rubber							

*Available in Hast-B or Hast-C Material.

SECTION IX—ORDERING SPARE PARTS

Spare Parts

To insure against possible long and costly downtime periods, especially on critical services, it is advisable to have spare parts on hand.

1. For critical services: It is recommended that a "back pull-out assembly" be kept on hand. This is a group of assembled parts which includes all parts except the casing and the coupling.
 - a. If this unit is equipped with stuffing box packing the following parts should be on hand:
 - i. Stuffing box packing (item 106) one set.
 - ii. Stuffing box gland packing item (item 210) one set.

2. An alternative, though not as desirable as that stated above, can be used on non-critical services. This involves having on hand parts that are most likely to wear and can be used as needed. See Section VIII for these recommended spares.

Instructions for Ordering Spare Parts

Repair orders will be handled with the minimum of delay if the following directions are followed:

1. Give the model number, size of pump, and serial number. These can be obtained from the nameplate on the pump.
2. Write plainly the name, part number, and material of each part required. These names and numbers should agree with those on the sectional drawing in Section VIII.
3. Give the number (quantity) of parts required.
4. Give complete shipping instructions.



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