

INSTRUCTION AND REPAIR MANUAL

HORIZONTAL AND VERTICAL TWO-STAGE PUMPS

Models
421, 485, 422
AND 423

ENGLISH: PAGES 2-16

INSTRUCTION AND REPAIR MANUAL

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.



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CALIFORNIA PROPOSITION 65 WARNING:

▲ WARNING This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

NOTE

This repair manual is applicable to pump Models 421 & 485, 422, 423. All photos illustrate Model 422 except where noted.

SERVICE

Your Aurora pump requires no maintenance other than periodic inspection, lubrication and occasional cleaning. The intent of inspection is to prevent breakdown, thus obtaining optimum service life.

LUBRICATION (BALL BEARINGS)

Regreasable bearings will require periodic lubrication and this can be accomplished by using the zerk or lubrication fitting at each bearing. Lubricate the bearings at regular intervals using high quality grease. The initial bearing lubrication at Aurora is Chevron SRI Grease NLGI 2 (polyurea thickener) (Pentair Part Number 384-0002-639). Before lubricating the bearings, thoroughly flushing the old grease with the new grease is required. We recommend Chevron SRI Grease NLGI 2 (polyurea thickener) for follow-up relubrication after the flushing. Most major brands of Grade No. 2 ball bearing grease are satisfactory for pump operation in both wet and dry applications.

CAUTION

Be aware that mixing of different brands or blends of grease should be avoided due to possible incompatibilities that could damage the bearings. A thorough flushing of the old grease with the new grease is required to minimize this potential incompatibility. Avoid using the following: (1) grease of vegetable or animal base that can develop acids or (2) grease containing rosin, graphite, talc or other impurities. Under no circumstances should grease be reused.

CAUTION

Over lubrication should be avoided as it may result in overheating and possible bearing failure. Under normal application, adequate lubrication is assured if the amount of grease is maintained at 1/3 to 1/2 the capacity of the bearing and adjacent space surrounding the bearing.

In dry locations, each bearing will need lubrication at least every 4,000 hours of running time or every 6 to 12 months, whichever is more frequent. In wet locations the bearings will need lubrication at least after every 2,000 hours of running time or every 4 to 6 months, whichever is more frequent. A unit is considered to be installed in a wet location if the pump and motor are exposed to dripping water, to the weather, or to heavy condensation such as found in unheated and poorly ventilated underground locations.

At times it may be necessary to clean the bearings due to accumulated dirt or deteriorated lubricants. This can be accomplished by flushing the bearing with a light oil heated to 180 to 200°F. while rotating it on a spindle. Wipe the bearing housing with a clean rag soaked in a cleaning solvent, and flush all surfaces.

Dry bearing thoroughly before relubricating. Compressed air can be used to speed drying, but care should be taken not to let bearings rotate while being dried.

CAUTION

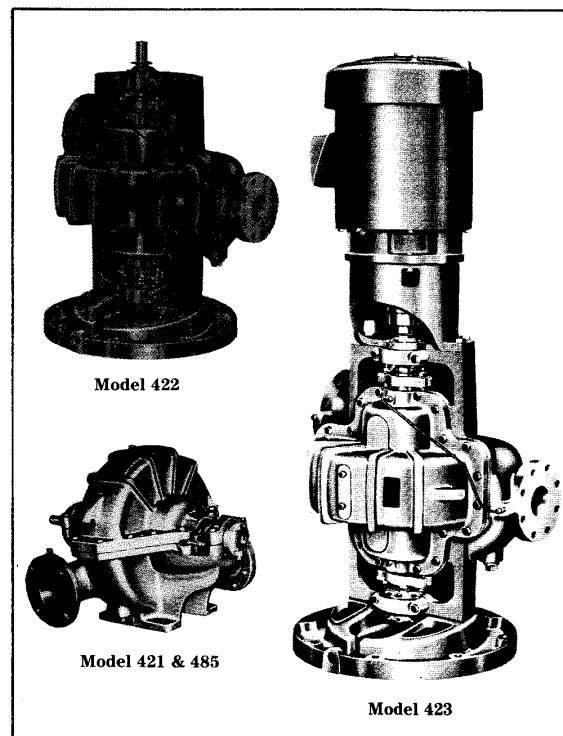
Use normal fire caution procedures when using any petroleum cleaner.

Model 421 pumps are available with two options for lubricating the shaft bearings. They are:

1. Regreasable (standard)
2. Oil Lubrication

Oil lubricated bearings are optional on Model 421 pumps. A fixed oil level is maintained within the bearing cartridge by an oiler which allows visual indications of reserve oil.

At initial installation and before starting a unit that has been shut down for repairs or for any extended length of time, run enough 10W-30 weight motor oil through the oiler to maintain a constant oil level to insure that the bearing will never be without an oil supply. Oil will have to be added at intervals to maintain a constant level in the oiler. This interval can only be determined by experience.



A. Complete pump assemblies.

Under working conditions, oil will breakdown and need to be replaced at regular intervals. The length of these intervals will depend on many factors. Under normal operation, in clean and dry locations, the oil should be changed about once a year. However, when the pump is exposed to dirt contamination, high temperatures (200°F. or above) or a wet location, the oil may have to be changed every 2 or 3 months.

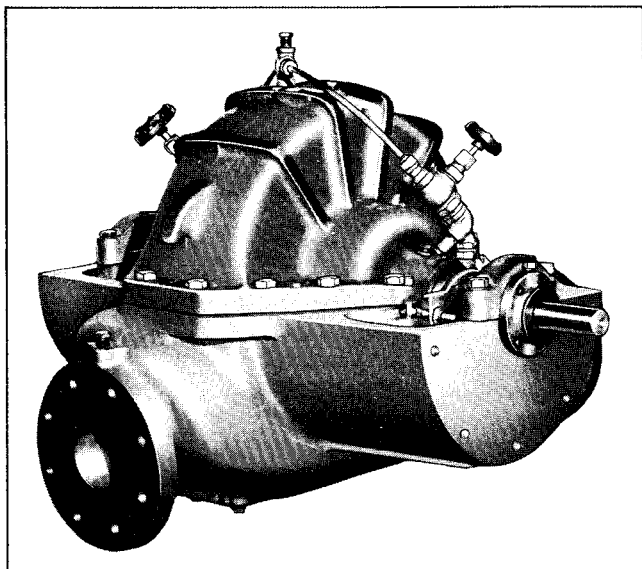
The motor which drives your Aurora pump may or may not require lubrication. Consult the manufacturer's recommendations for proper maintenance instructions.

REPAIRS

The pump may be disassembled using the illustrations and text provided. Although complete disassembly is covered, it will seldom be necessary to completely disassemble your Aurora pump.

The illustrations accompanying the disassembly instructions show the pump at various stages of disassembly. The illustrations are intended to aid in the correct identification of the parts mentioned in the text.

Inspect removed parts at disassembly to determine their reusability. Cracked castings should never be reused. All packing and gaskets should be replaced with new ones at reassembly simply as a matter of economy; they are much less expensive to replace routinely than to replace as the need occurs. In general it is economical to return to the manufacturer for repair only the motor and motor controller.



B. Pump positioned horizontally for disassembly. Pump base removed. Model 422 or 423 Illustrated.

DISASSEMBLY OF THE PUMP.

Disassemble only what is needed to make repairs or accomplish inspection. Proceed to disassemble the pump as follows: (See Figure 4 for Model 421 & 485, Figure 5 for Model 422 and Figure 6 for Model 423.)

1. Break electrical connection to motor or take similar steps to make certain that drive unit will not be unintentionally energized during disassembly.

2. Close such valves or flow-control devices necessary to make certain that flow of liquid will not take place during disassembly.

NOTE

Discharge and suction piping need not be disturbed unless complete pump assembly is to be removed.

3. Drain liquid from pump by removing plugs (1 and 2). Disconnect by-pass lines if applicable.

4. Loosen and remove capscrews (6) securing casing half (8) to remainder of pump assembly.

NOTE

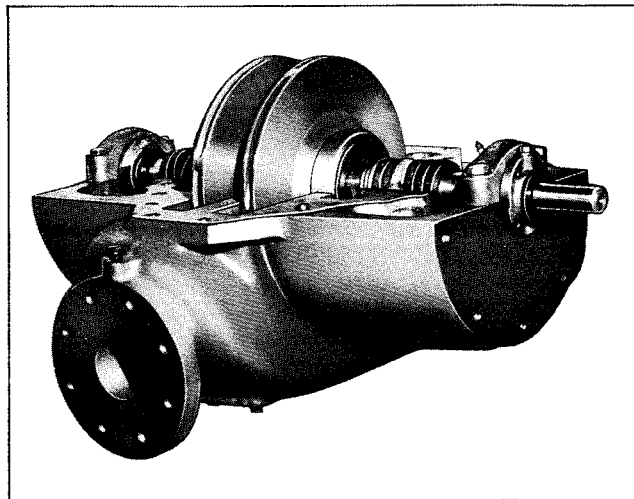
If pump being disassembled is 3 x 4 x 14A or larger, remove capscrews (7) before attempting to separate the casing halves.

5. Make certain that all securing capscrews are removed, then carefully remove casing half (8) using hoist or crane with sling attached to cast hooks.



Use extreme care when casing comes loose that it does not drop out of sling as this would cause extensive damage to other components of pump.

6. Remove gasket (9) and scrape mating surfaces of casing halves to remove pieces of gasket which may have adhered in separation. Take care not to scratch or mar mating surfaces.



C. Upper casing, bearing caps and packing removed. Model 421 or 485 Illustrated.

7. For Model 421 & 485 and 423 pumps, loosen setscrews in flexible coupling and slide halves apart. For Model 422 remove flexible shafting from pump.

8. Remove capscrews (25) securing bearing caps (26). Lift off bearing caps (26) and pins (27). Mark caps to insure correct replacement and orientation on the respective bearing arms.

9. Loosen and remove nuts (18), washers (19), and

clamps (20), securing split halves of packing glands (21). Remove swing bolts (22).

10. Assuming that further work is required on shaft and impeller assembly, use properly secured rope slings and hoist or crane as required to lift it from casing half (74) and place it on suitable bench or work surface.

CAUTION

Take care not to dent or damage impeller and/or other parts. Use of a supporting cradle or work stand is recommended.

NOTE

Disassembly procedure from this point covers pumps having standard packing. If pump has mechanical seals, refer to Specific Instructions.

11. Remove and discard rings of packing (23), since replacement with new packing is recommended whenever pump is disassembled.

12. Slide pump half of flexible coupling off shaft (71) and remove key (24). Pry up on end of key so as not to damage shaft. If preferred, key may be removed by carefully tapping from outer end with a brass drift or similar non-marring tool, using a small hammer.

13. Remove casing wearing rings (28).

14. If pump is grease lubricated remove zerks (10) and pipe plugs (12) from cartridge caps (32 and 42). If pump has oil lubrication option, Model 421 only, remove breather cap from top of cartridge caps and remove close nipples from bottom of cartridge caps. The remaining oil cup, street elbows, and nipples are loose at this point and can be removed as an assembly.

15. For Model 422 and 423 pumps, loosen and remove capscrews (31) from cartridge cap (32). Outboard shaft end protector (29) may be removed from its recess in the outboard cartridge cap at this time if necessary. Remove retainer (35) with truarc pliers. Remove gasket (34).

NOTE

For Model 421 pumps, if unit has tandem shaft, protector (29) is not used. Remove slinger and capscrews (31). Slide cartridge cap (32) and grease seal off shaft. Press grease seal out of cartridge cap if it is necessary to replace this seal. Remove retainer ring (35) with truarc pliers. Remove gasket (34).

16. Outboard bearing (38) is press fitted onto shaft (71). To remove it, place a puller on bearing cartridge (36) and pull cartridge, grease seal (37), and bearing from shaft.

The grease seal can be pressed from the bearing cartridge if it needs replacing. Slide slinger (39), lantern ring (52), and bushing (56) off shaft (71).

17. Removal of the inboard bearing is basically the same as the outboard bearing. Remove capscrews (41) and slide slingers (40), cartridge cap (42), grease seal (43), and gasket (44) off shaft.

18. Pull or press off bearing cartridge (45), grease seal (46), and bearing (47). Remove slinger (48), lantern ring (52), and bushing (56) from shaft.

19. If unit has right hand rotation, unscrew and remove outboard sleeve (57) first. Remove O-ring (58). If unit has left hand rotation, unscrew and remove inboard sleeve (65). Remove O-ring (66).

20. On right hand unit, balance of the parts will be removed as follows: Pull or tap impeller (59) off shaft (71) using care not to damage impeller. Remove gasket (60). Slide casing bushing (61) off separator sleeve (62). Pull separator sleeve, gasket (64), and impeller (67) off shaft. Remove gasket (66) and key (68). Unscrew and remove shaft sleeve (65).

Left hand unit disassembly will begin with impeller (67) and end with sleeve (58).

21. Disassemble wearing ring(s) (70) (optional) from impeller(s) (59) and (67) only if necessary. For pumps on power frame 5, remove setscrews (83). Apply a puller and gradually withdraw wearing rings (70) from impellers (59 and 67). Wearing rings may have to be cut or trimmed off the impeller. If a lathe is used to trim rings off, use care not to clamp impeller too tight and cause distortion. Also use care not to remove any metal from impeller.

22. Remove locking and locating pins (63, 69, 72, and 73) from lower casing half (74) only if replacement is necessary.

23. Nameplate (76) and its securing screws (75) should only be removed if replacement is necessary.

24. On Model 423 pumps unscrew capscrews (79) to remove motor and motor bracket (80) from casing half (74). It is best to leave motor bracket on motor as it helps protect motor shaft from possible damage. Remove nuts (77) from capscrews (78) which allows motor to be separated from motor bracket.

Disassembly of Pumps with Mechanical Seals.

1. Perform disassembly procedures as previously given through step 8.

2. Loosen and remove nuts (18), and washers (19), thus freeing swing bolts (22) to allow shaft and impeller assembly to be lifted from casing half (74) with sling and hoist or crane as described in paragraph 10 above.

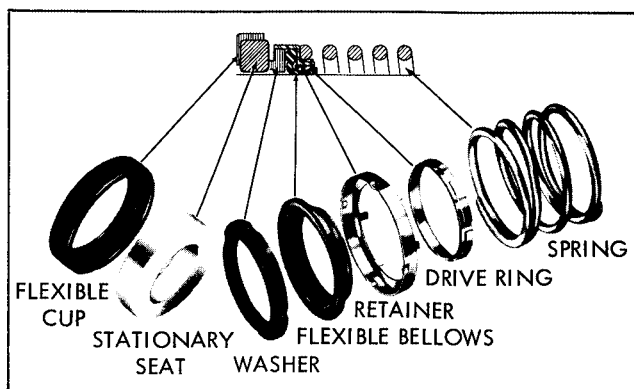


Figure 1. Mechanical Seal

CAUTION

Use extreme care in moving assembly. Ceramic seats can be cracked by just sliding loose on shaft. To prevent this, wrap seal securely in a shop cloth or other protective covering.

3. With shaft and impeller assembly on a suitable bench, cradle, or work stand, loosen and remove pipe plug (12) from inboard cartridge cap (42). Remove grease zerk (10) and capscrews (41) and slide the cartridge cap with grease seal (43) off end of shaft (71). Remove gasket (44).

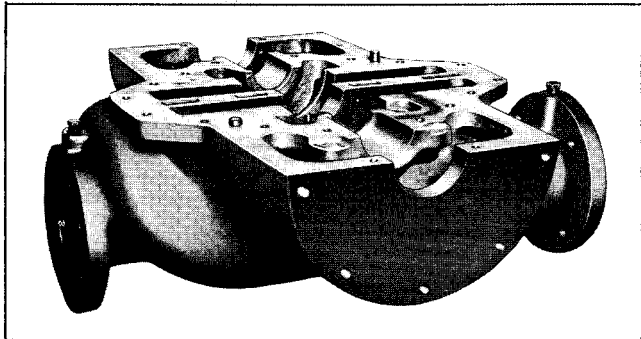
4. Pull or press bearing cartridge (45), grease seal (46), and bearing (47) off shaft. Remove slinger (48).

5. One piece gland (49) used with mechanical seal assembly can now be removed from shaft. "O" ring (50) can be removed from seal gland if desired.

CAUTION

Exercise great care in removing seal assembly (53) to keep from marring or otherwise damaging precision ground mating surfaces.

6. Scribe a mark on shaft sleeves for relocating seal collar on reassembly. Loosen setscrews (55), securing seal collars (54) to shaft sleeves and slide them off.



D. Rotating element removed from lower casing.

7. Proceed with further disassembly of outboard ball bearing and seal assembly using same basic procedure.

8. After removal of mechanical seals proceed with balance of disassembly in same manner of described for packing design.

REASSEMBLY

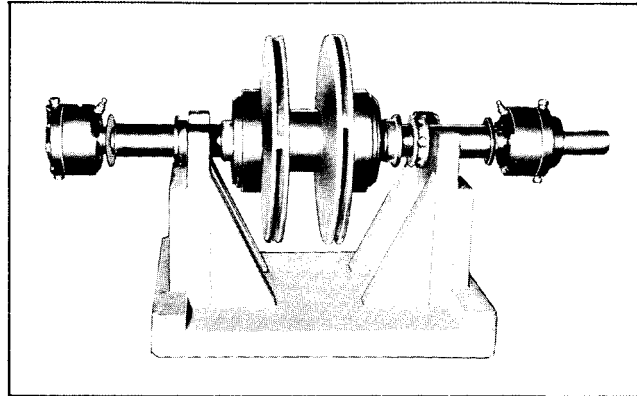
Reassembly will generally be in reverse order of disassembly. If disassembly was not complete, use only those steps related to your particular repair program.

1. Position locating pins (72) in casing half (74), adding swing bolt pins (73) if used on your pump. Install wearing ring pins (69) and casing bushing pins (63). Tap pins gently to seat them in place. Place O-ring (66) in shaft sleeve (65).

If nameplate (76) was removed, install it with screws (75).

2. On right hand unit, thread inboard sleeve (65) onto shaft (71) distance "A" (refer to Figure 2). On left hand unit,

thread outboard sleeve (57) onto shaft distance "A" (refer to Figure 3). When sleeve is in position, its keyway should align



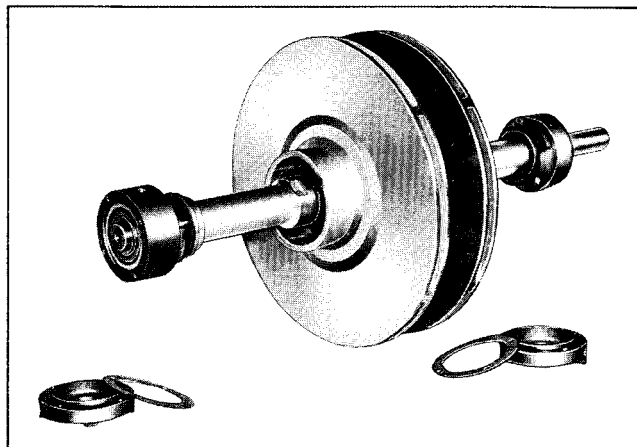
E. Rotating element placed in a protective cradle for further disassembly.

with keyway on shaft. Coat key and keyway with loctite sealant grade 242. Insert key (68) into keyways of shaft and sleeve. Tap key firmly in place.

3. Coat inside diameter of impeller wearing rings (70) (optional) with Loctite sealant Grade 271 and press them over hubs of impeller(s) (59) and (67). Do not attempt to hammer impeller wear rings into position, since they are a press fit. Use of an arbor press is preferred. However, placing a block of wood over the impeller wearing ring and pressing it in will work satisfactorily. For pumps on power frame 5 only, four setscrews (83) will be installed by drilling into wearing rings and impeller. The opposite surface of the impeller should be protected from damage throughout the procedures by resting it against soft wood on the surface of work bench.

CAUTION

Impeller wearing rings must be given special care because they are press fit. Be sure rings are



F. Bearing cartridge cap and gasket removed from shaft.

positioned squarely over hubs of impeller. A soft headed hammer may be used to gently tap impeller wearing rings into correct alignment before they are pressed into place.

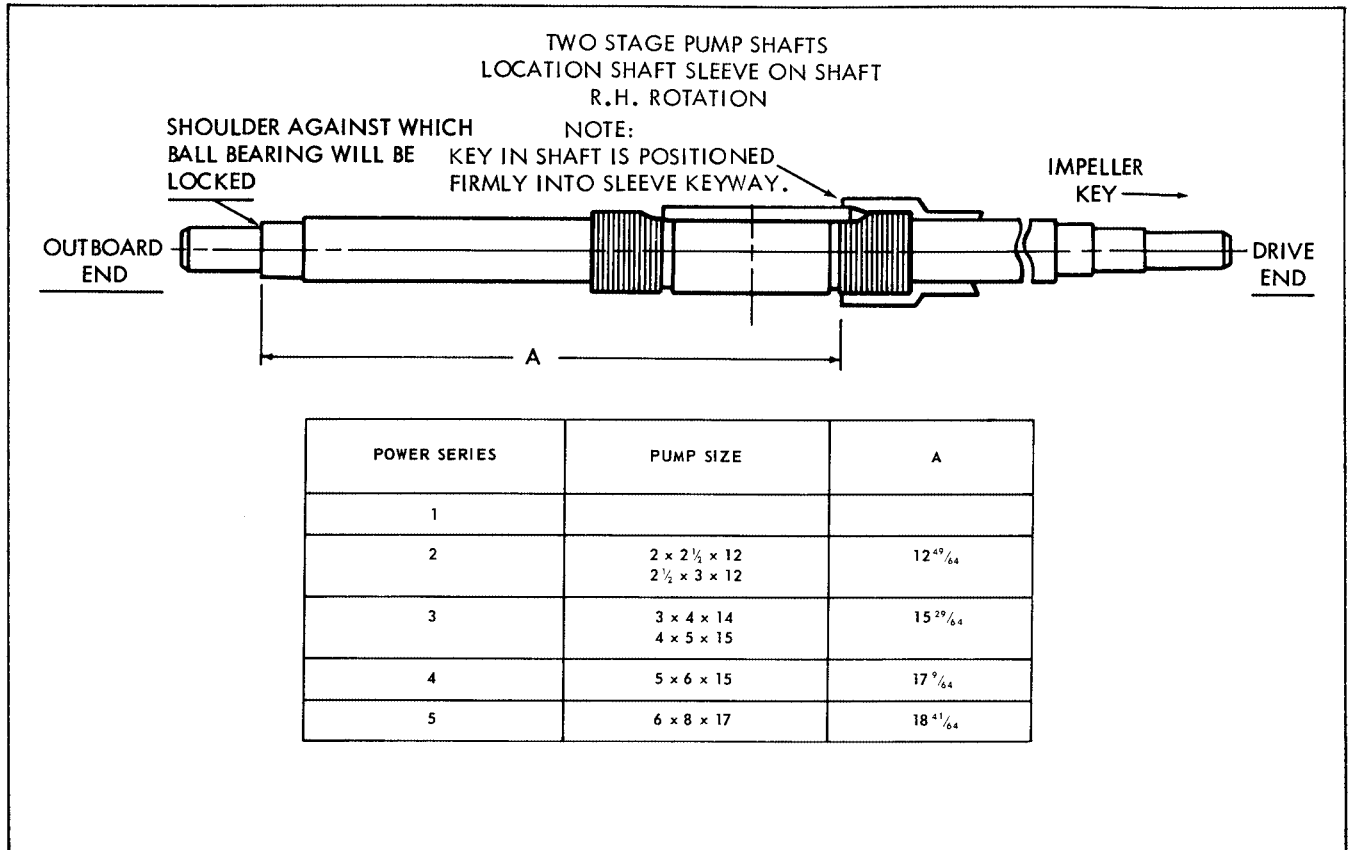


Figure 2

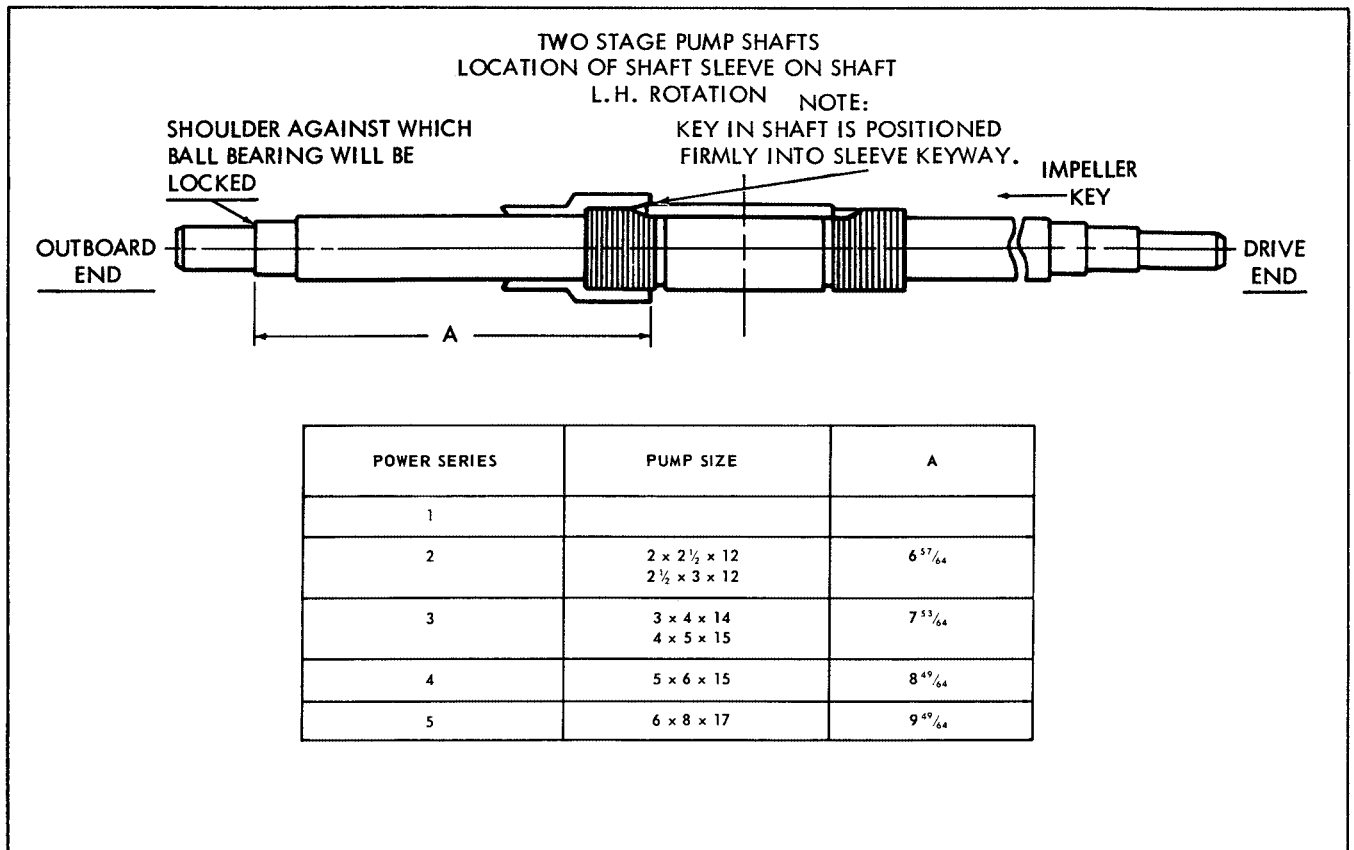


Figure 3

4. On right hand unit proceed to assemble the rotating element as follows:

Coat impeller (59) keyway with loctite sealant grade 242, slide impeller (67) onto shaft (71).

Place gasket (64) on shaft and slide separate sleeve (62) against it. Place casing bushings (61) over separator sleeve. Place gasket (60) on shaft, coat impeller (59) keyway with loctite sealant grade 242 and slide impeller (59) in place. Key (68) should not protrude beyond impeller (59) hub after impeller has been positioned. Place O-ring (58) in shaft sleeve (57), then thread shaft sleeve tight onto shaft (71).

On left hand unit use same procedure only starting with impeller (59).

NOTE

When assembling rotating element of a 420 Series Pump it is important that the curve of impeller blades is in agreement with pump rotation. (See insert in Figures 4, 5, or 6).



Carefully check to see that the proper shaft sleeve has been keyed into place for rotation of pump. If the correct shaft sleeve is not keyed onto shaft, it can spin loose during operation of pump and cause extensive damage.

5. Install packing or mechanical seals and secure according to the following specific instructions:

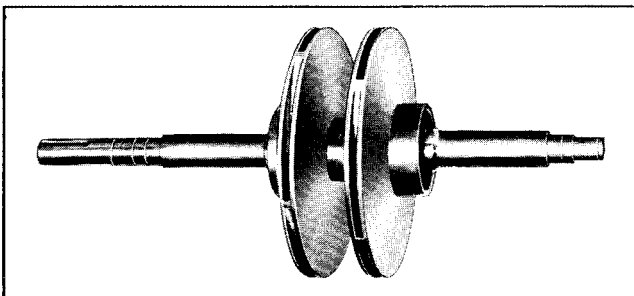
STANDARD PACKING

- a. Slide bushings (56) onto each end of shaft. The raised shoulder on bushings must face away from impeller.
- b. Seven pieces of packing (23) are placed on outboard end of shaft (71) over shaft sleeve. Two pieces of packing, a lantern ring (52), and three more pieces of packing are placed on inboard shaft sleeve.

Stagger breaks in packing rings so that pump will not leak excessively.

MECHANICAL SEAL

- a. Single seal and balanced single seals.



G. Inboard and outboard bearings and bearing cartridges removed.

- I. Slide one seal lock collar (54) with setscrews (55) facing the impeller onto each end of the shaft. Position on scribe mark made during disassembly and lock in place.
- II. Put a light coat of liquid dishwashing detergent on shaft sleeve. Check rotating parts of seal to make sure they are clean. Spread a light coat of liquid detergent on inside diameters of flexible bellows and washer.
- III. Place the seal's spring, drive ring, retainer, flexible bellows, and washer on shaft sleeve in respective order. (Refer to Figure 1.)
- IV. Thoroughly inspect cavity of seal gland (49) for burrs or nicks which could damage the seat of seal. Apply a film of liquid detergent to seal seat and install it in the seal gland cavity, taking care to seat it evenly and squarely.

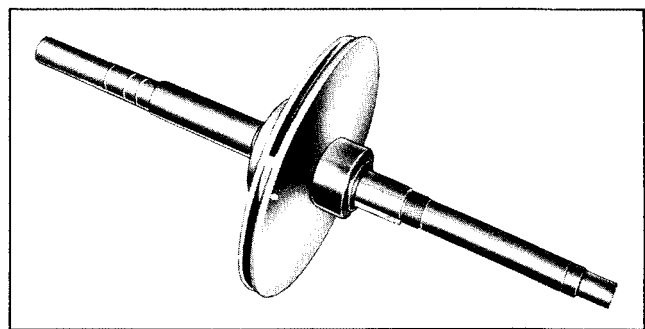
NOTE

If it is not possible to insert seat with fingers, place a cardboard protecting ring furnished with seal over the lapped face of seat and press into place with a piece of tubing having end cut square. Tubing should be slightly larger than the diameter of shaft. Remove cardboard after seat is firmly in place.



Never place a mechanical seal into service after it has been used without replacing or relapping stationary seat and washer faces.

- V. Place "O" rings (50) around seal glands and slide seal glands onto ends of shaft.
- b. Double Seal
 - I. Place one seal seat in collar (54). The other fits into seal gland (49). These parts are set into their cavities in the same manner as they are with a single seal.



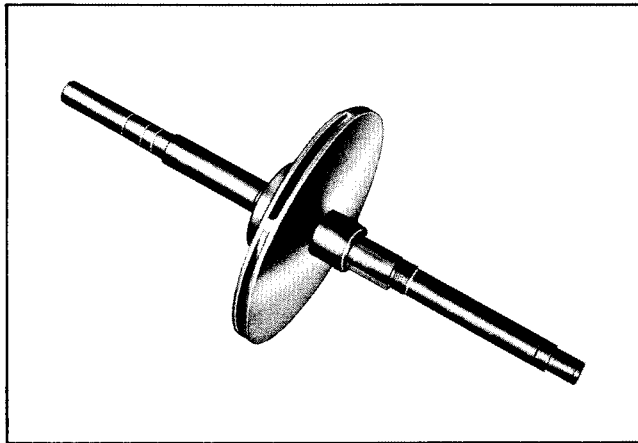
H. Shaft sleeve and outboard impeller removed from shaft.

- II. Place "O" rings (51) around collars (54) and put the collars with stationary seats facing away from impeller on ends of shaft. Slide flexible bellows, washers, and springs on shaft in the order shown in Figure 1, for each half of double seal assembly (53).

III. Place "O" rings (50) around the seal glands (49) and slide seal glands onto ends of the shaft with stationary seats facing impeller.

6. Place slinger (39) onto outboard end of shaft (71).

7. Press grease seal (37) into bearing cartridge (36). Place outboard double row ball bearing (38) in bearing cartridge and press parts onto outboard end shaft. Snap retainer ring (35) in place to secure outboard bearing. Place gasket (34) and cartridge cap (32) in position and secure it with capscrews (31).



I. Casing bushing removed from impeller separator sleeve.

NOTE

Both grease zerk holes in bearing cartridges and pipe plug holes in cartridge caps must be facing in opposite directions when assembled.

8. Protector (29) can be placed in cartridge cap or if unit has tandem shaft press a grease seal into cartridge cap and slide a slinger onto shaft.

9. Place slinger (48) in inboard end of shaft.

10. Press grease seal (46) into bearing cartridge (45). Place inboard ball bearing (47) in bearing cartridge and press this assembly onto inboard end of shaft.

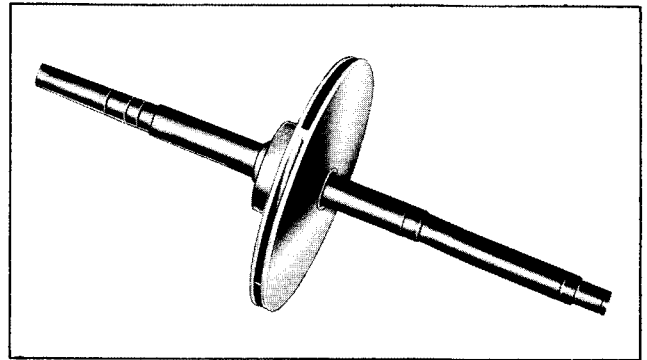
11. Press grease seal (43) into cartridge cap (42). Position gasket (44) and cartridge cap against bearing cartridge and secure it in place with capscrews (41). Be sure to align grease zerk holes and pipe plug hole on opposite sides.

12. Place slinger (40) onto shaft. Place grease zerks (10) in bearing cartridges and pipe plugs (12) in bearing caps. If pump is oil lubricated, Model 421 only, breather tubes are placed in each bearing cartridge. Oilers with nipples and elbows are placed in cartridge caps.

13. Slide casing wearing rings (28) over impeller hub or optional wearing rings (70) and set rotating element into casing half (74). Make certain that drill holes in bottom surface of casing wearing rings are located over pins (69). The drill hole in casing bushing (61) is over pin (63) previously set in casing half (74).

NOTE

Grease zerks or breather tubes should face up.



J. Impeller separator sleeve removed from shaft.

14. Install key (24) in motor end of shaft (71). Check positioning and alignment of packing rings or seal components, install swing bolts (22) and split gland halves (21) if pump has packing. Position clamps (20), washers (19), and nuts (18), securing loosely in place. Swing bolts (22) are set over pins (73) on 3 x 4 x 14A or smaller units. On larger units, swing bolts are held in place by capscrews (7) after casing half (8) is in position.

15. Place pins (27) into bearing cartridges. Place bearing caps (26) in position and secure with capscrews (25).

16. Position new casing gaskets (9) on casing half (74). Set casing half (8) in place. Secure it to casing half (74) with capscrews (6). Pins (72) are used as a means of locating the position of casing halves.

17. On pumps larger than 3 x 4 x 14A thread in capscrews (7) making sure they are placed through eye of swing bolts (22).

18. Place drain plugs (1) and (2) back in casing halves.

19. On Model 423 pumps, set the motor on motor bracket (80) and fasten them together with capscrews (78) and nuts (77). Slide flexible coupling halve onto pump and motor shafts. Attach motor bracket to casing half (74) with capscrews (79). Connect flexible coupling halves.

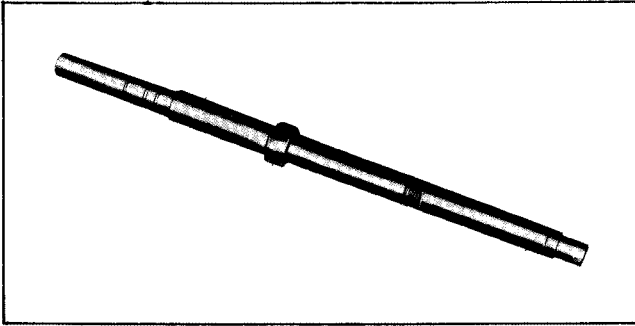
20. If the casing half (74) was removed from base, see section on installation for proper methods of realigning pump to motor and piping. On Model 422 pumps see this section for realigning pump to flexible shafting. Attach flexible shafting to pump. Ideal joint operating angle is 1° to 5°.

21. Replace any flushing or cooling lines that were removed. Connect electricity back to motor.

Starting Pump After Reassembly. Do not start pump until all air and vapor have been bled. Make sure that there is liquid in the pump to provide necessary lubrication.

NOTE

Do not over tighten standard packing assembly before returning unit to operation.



K. Inboard impeller removed. Shaft sleeve in place.

CAUTION

Read operating instructions carefully before starting pump. Jog pump to check for proper rotation. Allow it to run a short time. Gradually tighten nuts (18) until dripping has been reduced to its normal level.

Over tightening the packing will cause stuffing box to over heat. The shaft sleeve will also receive excessive wear.

NOTE

WHEN ORDERING SPARE PARTS ALWAYS INCLUDE THE PUMP TYPE, SIZE, SERIAL NUMBER, AND THE PIECE NUMBER FROM THE EXPLODED VIEW IN THIS MANUAL.

ORDER ALL PARTS FROM YOUR LOCAL AUTHORIZED DISTRIBUTOR, FACTORY BRANCH SALES OFFICE OR THE FACTORY AT NO. AURORA, ILLINOIS.

MODELS 421 & 485-422-423

MODEL 421 & 485 LIST OF PARTS (SEE FIGURE 4)

1. Plug	27. Pin	46. Grease Seal	63. Pin
2. Plug	28. Case Ring	47. Bearing	64. Gasket
6. Capscrew	29. Protector	48. Slinger	65. Sleeve
7. Capscrew	31. Capscrew	49. Gland	66. O-Ring
8. Casing	32. Cartridge Cap	50. "O" Ring	67. Impeller
9. Gasket	34. Gasket	51. "O" Ring	68. Key
10. Grease Fitting	35. Retaining Ring	52. Lantern Ring	69. Pin
12. Plug	36. Cartridge	53. Seal	70. Wearing Ring
18. Nut	37. Grease Seal	54. Collar	71. Shaft
19. Washer	38. Bearing	55. Setscrew	72. Pin
20. Clamp	39. Slinger	56. Bushing	73. Pin
21. Gland Half	40. Slinger	57. Sleeve	74. Casing
22. Swing Bolt	41. Capscrew	58. O-Ring	75. Drive Screw
23. Packing	42. Cartridge Cap	59. Impeller	76. Nameplate
24. Key	43. Grease Seal	60. Gasket	83. Setscrew
25. Capscrew	44. Gasket	61. Bushing	
26. Bearing Cap	45. Cartridge	62. Sleeve	

MODEL 422 LIST OF PARTS (SEE FIGURE 5)

1. Plug	27. Pin	46. Grease Seal	63. Pin
2. Plug	28. Case Ring	47. Bearing	64. Gasket
6. Capscrew	29. Protector	48. Slinger	65. Sleeve
7. Capscrew	31. Capscrew	49. Gland	66. Gasket
8. Casing	32. Cartridge Cap	50. "O" Ring	67. Impeller
9. Gasket	34. Gasket	51. "O" Ring	68. Key
10. Grease Fitting	35. Retaining Ring	52. Lantern Ring	69. Pin
12. Plug	36. Cartridge	53. Seal	70. Wearing Ring
18. Nut	37. Grease Seal	54. Collar	71. Shaft
19. Washer	38. Bearing	55. Setscrew	72. Pin
20. Clamp	39. Slinger	56. Bushing	73. Pin
21. Gland Half	40. Slinger	57. Sleeve	74. Casing
22. Swing Bolt	41. Capscrew	58. Gasket	75. Drive Screw
23. Packing	42. Cartridge Cap	59. Impeller	76. Nameplate
24. Key	43. Grease Seal	60. Gasket	81. Capscrew
25. Capscrew	44. Gasket	61. Bushing	82. Base
26. Bearing Cap	45. Cartridge	62. Sleeve	

MODEL 423 LIST OF PARTS (SEE FIGURE 6)

1. Plug	28. Case Ring	48. Slinger	66. Gasket
2. Plug	29. Protector	49. Gland	67. Impeller
6. Capscrew	31. Capscrew	50. "O" Ring	68. Key
7. Capscrew	32. Cartridge Cap	51. "O" Ring	69. Pin
8. Casing	34. Gasket	52. Lantern Ring	70. Wearing Ring
9. Gasket	35. Retaining Ring	53. Seal	71. Shaft
10. Grease Fitting	36. Cartridge	54. Collar	72. Pin
12. Plug	37. Grease Seal	55. Setscrew	73. Pin
18. Nut	38. Bearing	56. Bushing	74. Casing
19. Washer	39. Slinger	57. Sleeve	75. Drive Screw
20. Clamp	40. Slinger	58. Gasket	76. Nameplate
21. Gland Half	41. Capscrew	59. Impeller	77. Nut
22. Swing Bolt	42. Cartridge Cap	60. Gasket	78. Capscrew
23. Packing	43. Grease Seal	61. Bushing	79. Capscrew
24. Key	44. Gasket	62. Sleeve	80. Bracket
25. Capscrew	45. Cartridge	63. Pin	81. Capscrew
26. Bearing Cap	46. Grease Seal	64. Gasket	82. Base
27. Pin	47. Bearing	65. Sleeve	

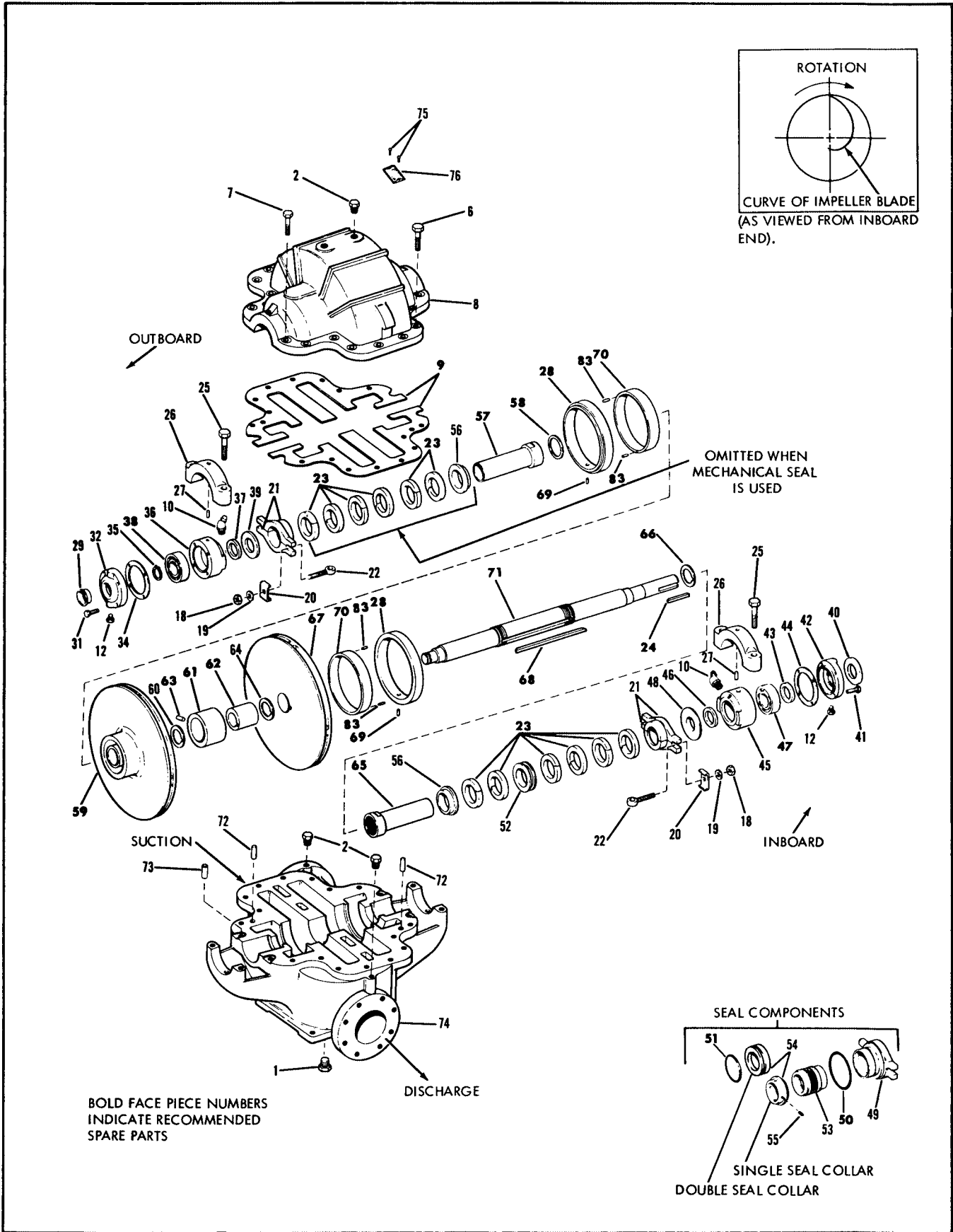


Figure 4. 421 & 485 Pump Exploded View

NOTE: MODEL 485 AVAILABLE WITH PACKING ONLY.

MODEL 422

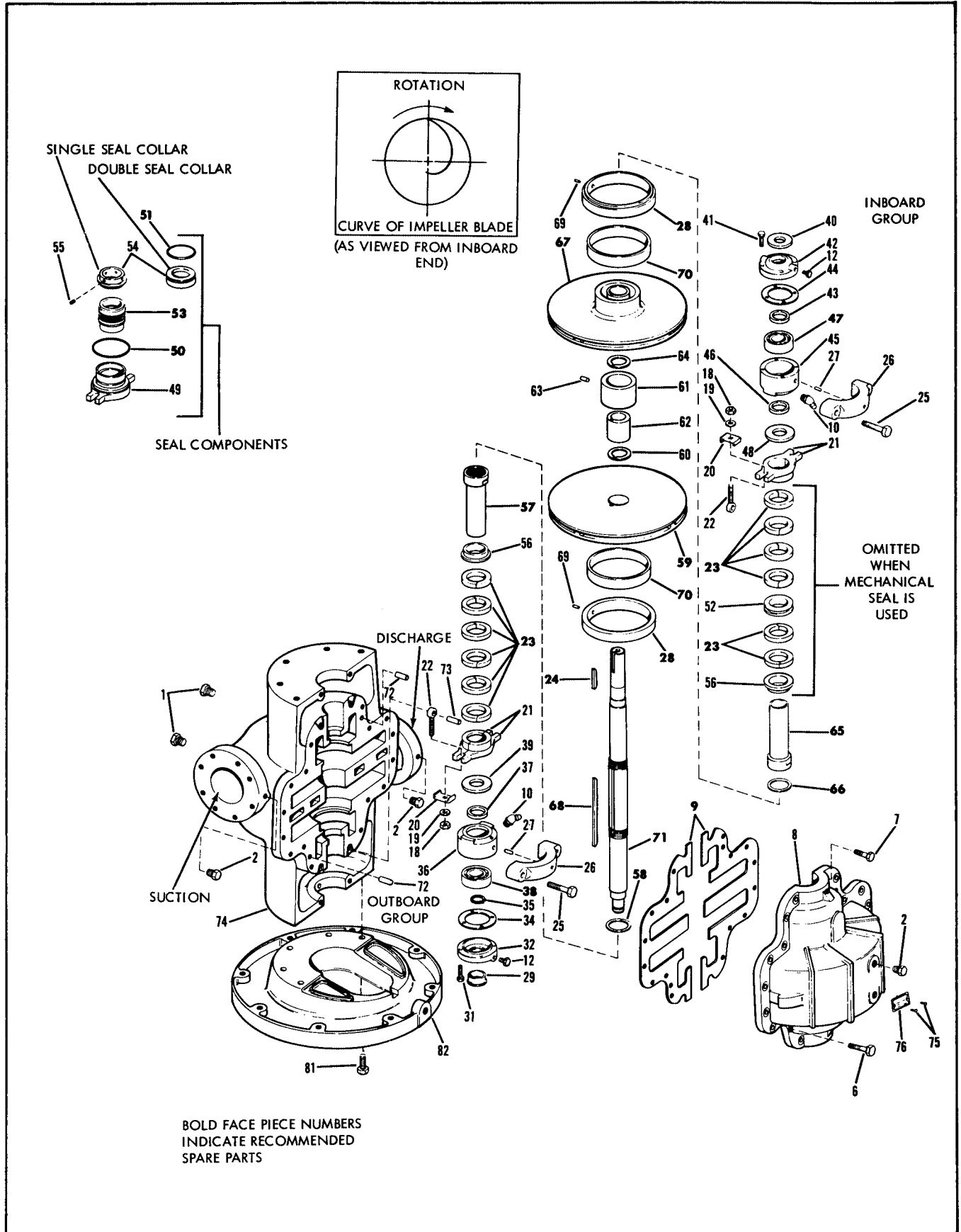


Figure 5. 422 Pump Exploded View

MODEL 423

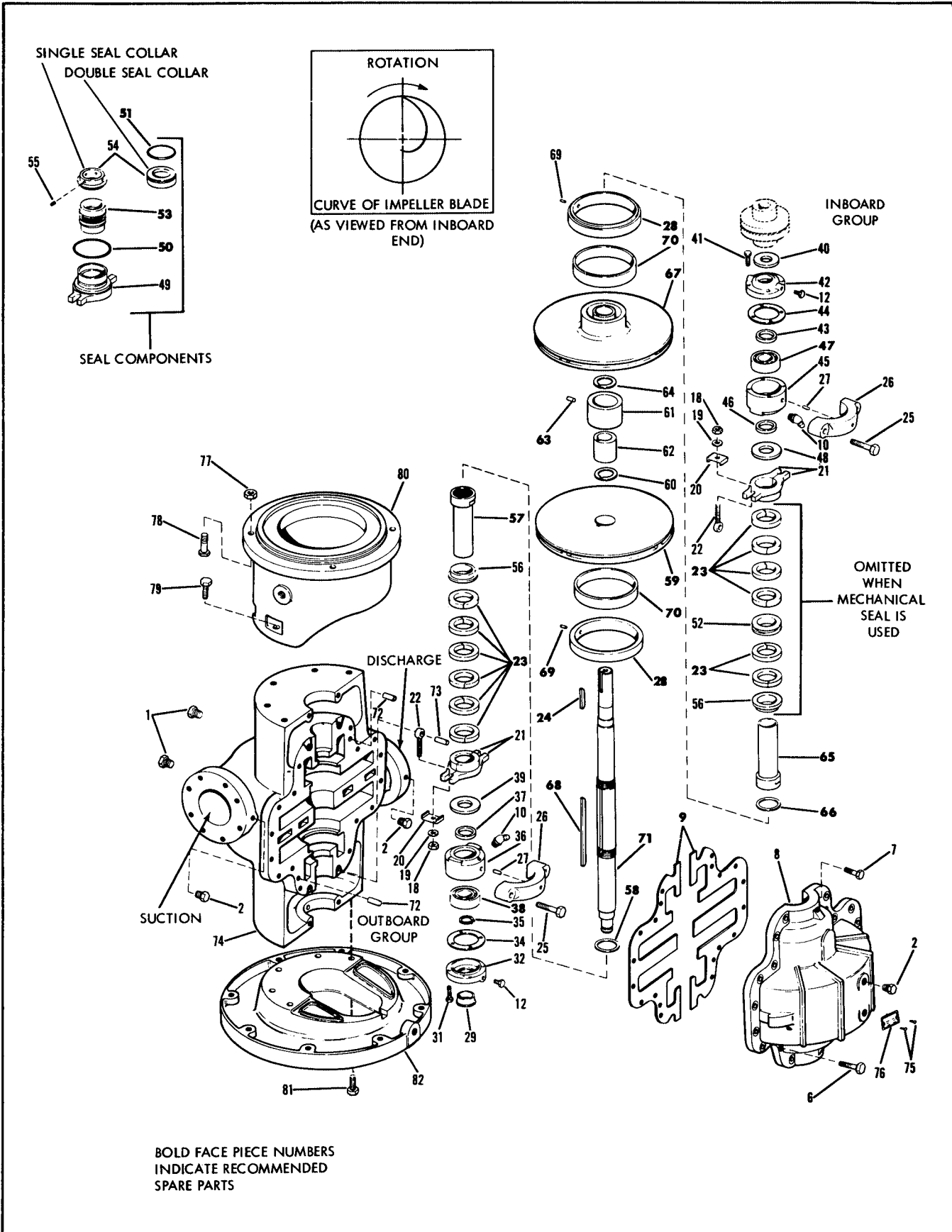


Figure 6. 423 Pump Exploded View

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WARRANTY

Seller warrants equipment (and its component parts) of its own manufacture against defects in materials and workmanship under normal use and service for one (1) year from the date of installation or start-up, or for eighteen (18) months after the date of shipment, whichever occurs first. Seller does not warrant accessories or components that are not manufactured by Seller; however, to the extent possible, Seller agrees to assign to Buyer its rights under the original manufacturer's warranty, without recourse to Seller. Buyer must give Seller notice in writing of any alleged defect covered by this warranty (together with all identifying details, including the serial number, the type of equipment, and the date of purchase) within thirty (30) days of the discovery of such defect during the warranty period. No claim made more than 30 days after the expiration of the warranty period shall be valid. Guarantees of performance and warranties are based on the use of original equipment manufactured (OEM) replacement parts. Seller assumes no responsibility or liability if alterations, non-authorized design modifications and/or non-OEM replacement parts are incorporated. If requested by Seller, any equipment (or its component parts) must be promptly returned to Seller prior to any attempted repair, or sent to an authorized service station designated by Seller, and Buyer shall prepay all shipping expenses. Seller shall not be liable for any loss or damage to goods in transit, nor will any warranty claim be valid unless the returned goods are received intact and undamaged as a result of shipment. Repaired or replaced material returned to customer will be shipped F.O.B., Seller's factory. Seller will not give Buyer credit for parts or equipment returned to Seller, and will not accept delivery of any such parts or equipment, unless Buyer has obtained Seller's approval in writing. The warranty extends to repaired or replaced parts of Seller's manufacture for ninety (90) days or for the remainder of the original warranty period applicable to the equipment or parts being repaired or replaced, whichever is greater. This warranty applies to the repaired or replaced part and is not extended to the product or any other component of the product being repaired. Repair parts of its own manufacture sold after the original warranty period are warranted for a period of one (1) year from shipment against defects in materials and workmanship under normal use and service. This warranty applies to the replacement part only and is not extended to the product or any other component of the product being repaired. Seller may substitute new equipment or improve part(s) of any equipment judged defective without further liability. All repairs or services performed by Seller, which are not covered by this warranty, will be charged in accordance with Seller's standard prices then in effect.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its component parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part. Under the terms of this warranty, Seller shall not be liable for (a) consequential, collateral, special or liquidated losses or damages; (b) equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; (c) the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; (d) damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper voltage, mishandling, or other similar conditions; (e) any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; (f) any labor costs or charges incurred in repairing or replacing defective equipment or parts, including the cost of reinstalling parts that are repaired or replaced by Seller; (g) any expense of shipment of equipment or repaired or replacement parts; or (h) any other loss, damage or expense of any nature.

The above warranty shall not apply to any equipment which may be separately covered by any alternate or special warranties.

PERFORMANCE: In the absence of Certified Pump Performance Tests, equipment performance is not warranted or guaranteed. Performance curves and other information submitted to Buyer are approximate and no warranty or guarantee shall be deemed to arise as a result of such submittal. All testing shall be done in accordance with Seller's standard policy under Hydraulic Institute procedures.

LIABILITY LIMITATIONS: Under no circumstances shall the Seller have any liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses or for loss of production or progress of construction, regardless of the cause of such damages or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price.

ACTS OF GOD: Seller shall in no event be liable for delays in delivery of the equipment or other failures to perform caused by fires, acts of God, strikes, labor difficulties, acts of governmental or military authorities, delays in transportation or procuring materials, or causes of any kind beyond Seller's control.

COMPLIANCE WITH LAW: Seller agrees to comply with all United States laws and regulations applicable to the manufacturing of the subject equipment. Such compliance shall include: The Fair Labor Standards Acts of 1938, as amended; Equal Employment Opportunity clauses of Executive Order 11246, as amended; Occupational Safety and Health Act of 1970 and the standards promulgated thereunder, if applicable. Since compliance with the various Federal, State, and Local laws and regulations concerning occupational health and safety, pollution or local codes are affected by the use, installation and operation of the equipment and other matters over which Seller has no control, Seller assumes no responsibility for compliance with those laws and regulations, whether by way of indemnity, warranty, or otherwise. It is incumbent upon the Buyer to specify equipment which complies with local codes and ordinances.



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