

INSTRUCTION AND REPAIR MANUAL

Model
651A

HORIZONTAL ONE STAGE SOLIDS HANDLING PUMP

ENGLISH: PAGES 2-12

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.



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.

SERVICE

Your Aurora pump requires no maintenance other than periodic inspection, occasional cleaning and lubrication of bearings. The intent of inspection is to prevent breakdown thus obtaining optimum service life. The liquid end of the pump is lubricated by the fluid being pumped and therefore does not require periodic lubrication. The motor, however, may require lubrication, in which case, the motor manufacturer's recommendations should be followed.

LUBRICATION OF 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.

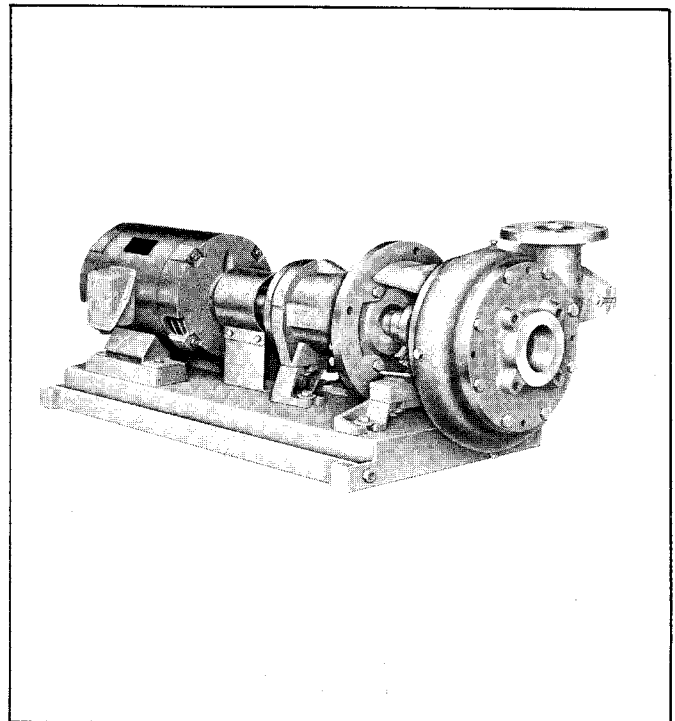
In dry locations, the power frame 4C bearings will need lubrication at least every 2,000 hours of running or every 6 to 12 months, whichever is more frequent. In wet locations the bearings should be lubricated at least every 1,000 hours of running time or every 4 to 6 months, whichever is more frequent.

The 5E and 5F bearing frames have back-to-back angular contact bearings (50). This style bearing requires more frequent lubrication intervals. It is suggested that this bearing be lubricated every 1,000 hours.

The 5F power frame has a spherical roller bearing as the inboard bearing. This bearing should be lubricated every 500 hours.

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 the 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.

The motor that 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 illustration accompanying the disassembly instructions show an exploded view of the pump. The illustration is intended to aid in the correct identification of the parts mentioned in the text.

Inspect parts removed at disassembly to determine their reusability. Cracked castings should never be reused. Gaskets should be replaced 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 the motor and motor controller to the manufacturer for repair.

POWER FRAME 3C PUMP DISASSEMBLY

This pump has been designed with back pull-out features, which allow the power frame and rotating element to be removed without disturbing the suction and discharge piping.

Disassemble only what is needed to make repairs or accomplish inspection.

1. Break electrical connections to prevent drive unit from being energized during disassembly.
2. Close all valves or flow devices that control movement of liquids to or from pump. Remove drain plugs (25) from casing (1).
3. Remove all relief, cooling, flushing or drain lines from pump. Remove handhole cover (19) by removing capscrews (20), nuts (20A), washers (20B) and gasket (18). Break suction and discharge connections unless it is intended to remove only the power frame assembly and leave the casing (1) in the line.
4. Remove the flexible coupling from between the pump and motor. Next unscrew the bolts that hold support(s) (21 & 22) to the base and slide the pump out to be worked on.
5. Remove capscrews (34) and slide casing (1) from bracket (8) and stuffing box (27). Remove gasket (17). Should suction cover (5) need to be removed, unscrew capscrews (15) and remove gasket (16).
6. Unscrew impeller screw (10) and remove o-ring gasket (11) and washer (12), taking care not to damage gasket (13).

NOTE

650A Pumps have a tapered shank impeller to facilitate impeller removal. Use caution in the removal of impeller as it has to be moved only a few thousandths of an inch to become entirely free.

7. Slide impeller (2) and impeller key (14) from the shaft, again taking care not to damage gasket (38) located behind impeller. Remove gasket (38).

8. The various types of stuffing boxes may be disassembled as follows:

PACKING WITH LANTERN RING (STANDARD)

- A. Remove capscrews (45), gland clamps (44E), and split gland halves (44).
- B. Remove and discard old packing (40). Clean all parts to remove any packing that may have adhered.
- C. Unscrew capscrews (33) and remove stuffing box (27) from bracket (8). Remove gasket (32).
- D. Shaft sleeve (36) is a slip fit on the shaft and should be easily removed unless the pump has been in service for a long time. In this case it may be necessary to use a puller. A snap ring may be installed in the sleeve groove to ease disassembly. Take care to prevent damaging the surface of the sleeve. Replace the sleeve if it is grooved from wear. Remove key (54) and retaining ring (37) from shaft.

MECHANICAL SEAL (OPTIONAL)



The mechanical seal is a precision product and must be treated as such. During removal great care must be taken to avoid dropping any part of the seal. Take particular care not to scratch the lapped faces on the washer or the sealing seat. Do not put a seal back into service until the sealing faces of the washer and seat have been lapped or replaced.

- A. Remove seal gland bolts (45) and remove gland (44) carefully exposing seal (47).
- B. Unscrew capscrews (33), and remove stuffing box assembly (27). Remove gasket (32).
- C. Slide sleeve (36) with rotating parts of mechanical seal (47) from the shaft. Remove ceramic seal rings and stainless steel parts from sleeve with great care as ceramic parts are easily damaged.

The sleeve should be carefully cleaned to remove any residue that may be remaining in the seal area. The rubber in the seal may have become partially adhered to the sleeve. The sleeve must also be checked for abrasion or corrosion that can occur when fluid residue penetrates between the seal (47) and sleeve (36). The sleeve under the seal may be polished lightly to a 32 RMS finish before reassembly. Do not reuse a pitted sleeve. Remove retaining ring (37) and key (54).

- D. Remove stationary seats and o-rings from gland (44) and stuffing box (27), using care not to damage these parts.

9. Remove capscrews (15A and 23) and washers (15B and 24) to take off support feet (21 and 22).
10. Unscrew capscrews (35) to remove bracket (8) from power frame (56).
11. Remove key (55) from the shaft.
12. Unscrew capscrews (59) and remove bearing cap (51). Remove o-ring (51A) and retaining ring (50C).

13. Slide out shaft (48) and bearings (49 and 50). Remove shim (60). Since bearings (49 and 50) are press fitted on the shaft, they will have to be pulled or pressed off the shaft. Remove grease seals (52) and (53) from frame (56) and bearing cap (51).

14. Remove screws (72) and nameplate (73) only if replacement is necessary.

POWER FRAME 3C 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. Press grease seals (52) and (53) into frame (56) and bearing cap (51).

2. Press bearings (50 and 49) onto shaft (48) Snap retaining ring (50C) into place.

3. Slide shaft (48) and bearings (50 and 49) into frame (56). Do not install o-ring (51A), shim (60) or bearing cap (51) at this point.

4. Position slinger (43) on the shaft sleeve.

5. Position bracket (8) on the power frame (56) and secure with capscrews (35). Tighten capscrews evenly to assure proper alignment.

6. If nameplate (73) was removed, install and attach with screws (72).

7. Reassemble the various types of stuffing boxes as follows:

PACKING WITH LANTERN RING (STANDARD)

A. Place gasket (32) on stuffing box (27), slide over shaft secure to bracket (8) with capscrews (33).

B. Install retaining ring (37), place key (54) in shaft and slide sleeve (36) over shaft. Packing (40) and lantern ring (41) may be replaced at this time. From impeller end of shaft, place two new rings of packing (40) around shaft sleeve, slide lantern ring (41) back in position and place remaining three rings of packing on shaft sleeve. Be sure to stagger joints of packing rings to avoid excessive leakage through the packing.

C. Thread capscrews (45) into stuffing box (27) approximately $\frac{1}{4}$ in. Insert both halves of gland (44) into stuffing box (27). Insert gland clamps (44E) and tighten packing, adjusting capscrews (45) to obtain proper sealing. Ensure Capscrews (45) are tightened enough to hold parts in place. Final adjustment of packing box will have to be made after pump is returned to operation.

When the pump is returned to service, additional care must be given the packing box to ensure proper packing life. It is necessary to allow 60 to 120 drops leakage per minute through the packing for lubrication purposes. If the flow rate is other than this, capscrews (45) should be either loosened or tightened one quarter turn at a time to acquire the correct leakage (capscrews must be turned equally to prevent cocking

of the gland). It will take approximately ten minutes at any gland setting before the leakage rate will stabilize. When in doubt, choose the greater leakage rate since overly tight packing will ruin not only the packing, but the sleeve as well.

MECHANICAL SEAL (OPTIONAL)

NOTE

The mechanical seal (47) cannot be installed as an assembly. It is necessary to have the seal seats properly in place before the balance of parts can be added.

A. Install retaining ring (37) and key (54) in shaft.

B. Wipe the sealing faces of the seat and seal washer clean. Lubricate the shaft sleeve (36) with a silicone-base lubricant. Slide the entire rotating assembly onto the sleeve.

C. Thoroughly inspect the seal box cavity checking for burrs or nicks that could damage the seat of the seal. Apply a film of liquid dishwashing detergent or rubber lubricant, (do not use oil or grease) to the seal seats. Replace stationary seats and o-rings in gland (44) and stuffing box (27).

NOTE

If it is not possible to insert seat with fingers, place cardboard protecting ring furnished with seal over lapped face of seat and press into place with a piece of tubing having an end cut square. The tubing should be slightly larger than the diameter of the shaft. Remove cardboard after seat is firmly in place. Carefully slip the stuffing box assembly (27) over the shaft sleeve with the stationary seat facing away from the motor. Install gasket (46) into gland (44).

Apply a film of liquid dishwashing detergent or rubber lubricant to the washer and bellows of the seal, and slide the remaining seal parts onto the shaft, making sure the washer is seated against the seal seat.

D. The shaft sleeve (36) with the seal rotating assembly on it may now be placed on the shaft. The shaft sleeve (36) should slide over shaft with keyway for key (54) toward power frame (56).

E. Replace gasket (32) on bracket (8) and carefully slip stuffing box (27) with stationary seal seat toward power frame (56), over the shaft and secure with capscrews (33).

F. Position gland (44) onto stuffing box (27) taking care to seat it evenly and squarely. Secure by tightening capscrews (45) evenly, being careful not to damage gasket (46) between them.

8. Carefully place square o-ring gasket (38) on shaft sleeve (36). Assemble key (14) and impeller (2) to shaft. Secure impeller with gasket (13), washer (12), impeller screw o-ring gasket (11) and impeller screw (10).

9. Fasten the supports (21 and 22) to bracket (8) and frame (56) with capscrews (15A and 23) and washers (15B and 24).

10. Install pipe plugs (25) in the pump casing (1). Position gasket (17) and casing (1) against the bracket (8) and secure with capscrews (34).

11. Place casing gasket (16) on suction cover (5) and bolt to casing (1) with capscrew (15).

LAMINATED SHIM IMPELLER ADJUSTMENT

12. Push the shaft and impeller assembly completely forward until the impeller contacts either the suction cover (5) or inside front surface of casing (1).

With a feeler gauge measure the clearance between the back machined surface of the power frame (56) and the snap ring in the outer race of the outboard bearing (50). This measurement plus the desired clearance between the impeller and casing will give the total required shim thickness. Example: It is recommended to have 0.016 in. clearance between the impeller and casing. With the impeller and shaft assembly moved completely forward and flush with the inside of the casing there is 0.008 in. clearance between the snap ring and the power frame. Therefore, the required shim thickness is: 0.008 in. + 0.016 in. = 0.024 in. or 12 shims.

Remove snap ring on outer race of outboard bearing (50) and install proper shim. Replace snap ring.

13. Install gasket (51A) and fasten bearing cap (51) in position with capscrews (59). Position key (55) and coupling. Replace all pipe plugs and grease fittings.

14. Place handhole cover gasket (18) on handhole cover (19) and bolt to casing (1) with capscrews (20), washers (20B) and nuts (20A). Replace all relief, cooling, flushing or drain lines from the pump.

15. Secure suction and discharge piping to the pump. Make sure to install gaskets on flanged connections.

16. Connect electricity to the motor.

17. Open all valves or flow devices that control flow of liquids to and from pump.

STARTING PUMP AFTER REASSEMBLY

Do not start pump until all air and vapor have been bled, making sure that there is liquid in the pump to provide the necessary lubrication. Without the fluid around it, a seal may be ruined in a few seconds of operation. It is possible that the mechanical seal may drip during the first few minutes to one hour of operation.

Packing should be adjusted as previously discussed in this manual.

POWER FRAME 4C, 5E and 5F DISASSEMBLY

1. Disconnect power so that pump can not be accidentally energized during disassembly.

2. Close all valves or flow devices that control movement of liquids to or from pump. Drain pump by removing drain plug (25) from casing (1). Remove any flushing, drain, or cooling lines from pump. Remove handhole cover (19) from casing by removing capscrews (20) and gasket (18).

3. Loosen capscrews from each hub of spacer type coupling and remove coupling flanges and rubber insert. This leaves a 3-1/2 in. space between end of motor shaft and pump shaft to facilitate back pull-out of pump.

4. Unscrew capscrews that hold support (22) to base. Remove capscrews (34). With the aid of a rope sling and a crane or hoist, carefully slide power frame and rotating element away from casing.

5. Remove gasket (17) from its position between bracket (8) and casing (1). Once the power frame and rotating element have been withdrawn, inspect the sealing surface to ensure that it is clean and free of any gasket material, which may have stuck to parting surfaces. Replace this gasket with a new one when pump is reassembled. Unscrew capscrews (23) and remove support (22) and washers (24).

6. Inspect casing wearing ring (optional) (6) and replace if necessary. Removal can be accomplished by removing capscrews (7).

7. Remove capscrews (10), o-ring gasket (11), washer (12) and gasket (13), which allow impeller (2), key (14), and gasket (38) to be removed.

NOTE

Pumps have a tapered hub impeller to facilitate impeller removal. Use caution in removal of impeller as it has to be moved only a few thousandths of an inch to become entirely free.

The easiest method for removing impeller is to suspend entire power frame and rotating element about 1/32 of an inch above floor or work area. Apply pressure to impeller by means of jackscrews (60 and 61) (located on bearing cap (51)). When impeller is firmly against bracket (8) it should drop free after turning the jackscrews evenly, a flat at a time, three or four flats.

8. Unscrew capscrews (35) to allow removal of bracket (8), stuffing box (27), and shaft sleeve (36) from the power frame (56). Remove truarc snap ring (37) from the inboard end of the shaft sleeve (36). Lift bracket and stuffing box from shaft extension (48).

For further disassembly of sealing box proceed as follows:

A. Packing Box (STANDARD)

I. Remove capscrews (45), gland clamps (44E), and split gland halves (44).

Remove and discard old packing (40). Clean all parts to remove any packing that may have adhered during removal.

B. Double Seal

I. Remove seal gland bolts (45) and remove gland (44) carefully exposing seal (47).

II. Use great care in removing ceramic seal rings and stainless steel metal parts from sealing box, as ceramic parts are easily chipped or cracked.

III. Remove carbon station seats and o-rings only if necessary, using care not to damage these parts.

9. Place power frame on two benches, so that its shaft rests between them or on a bench with a hole cut in it large enough for shaft.

Remove grease zerk (63) and pipe plug (62) from inboard end of power frame. Remove retainer ring (37) by twisting it in a spiral movement toward end of shaft. Also remove grease seal (53).

10. Pull shaft sleeve (36) from pump shaft (48) using gear puller with jaws firmly secure behind sleeve.

11. Remove capscrews (59) and lift out shaft assembly from the power frame (56).

12. The inboard radial bearings are either ball bearings or spherical roller bearings and can be identified by power frame as listed below.

4C, 5E Power Frames have ball bearings.

5F has spherical roller bearings.

13. Remove coupling halve and key (55) from shaft. Remove plug (57) and zerk fitting (58).

14. Retainer ring (50B) is removed with a pair of truarc internal pliers so that grease retainer (50A) can be removed allowing bearing cap (51) to be removed from shaft assembly. Grease seal (52) may be removed if necessary.

15. With a pair of truarc external pliers, remove snap ring (50C) (PF #4 only) or remove locknut (50D) and lockwasher (50C) (P.F. #5).

16. Both inboard bearing (49) and outboard bearing (50) are pressed onto shaft. To remove bearings, use a wheel puller or press them off shaft.

NOTE

When removing the inboard bearing (49) avoid damaging the separate grease shield (49A). This shield can be removed when bearing is removed from shaft.

17. If total disassembly is required, break connections to suction and discharge pipe and remove nuts from foundation bolts that hold support (21) to the pump base.

18. Secure casing and support assembly in sling and move it away from piping. Invert this assembly and set casing (1) on wood blocks, so as not to mar surface that mates with bracket (8).

19. Pipe plug or suction gage (71) can now be removed from suction nozzle (65). Unscrew capscrews (69) and nuts (69A), and remove cover (68) and gasket (67) from suction elbow or nozzle (65).

20. Place rope sling through nozzle and cover opening. Remove capscrews (66) and lift suction nozzle (65) away from cover (5). Remove gasket (64).

21. Unscrew capscrews (15 & 15A) which hold support (21), cover (5) and casing (1) together. Lift support away and then set casing with discharge up. Gently tap cover loose with a rubber mallet. Remove gasket (16) to complete disassembly.

POWER FRAME 4C, 5E & 5F REASSEMBLY

These instructions are for a pump that has been completely disassembled. Use those parts that apply to your reassembly program.

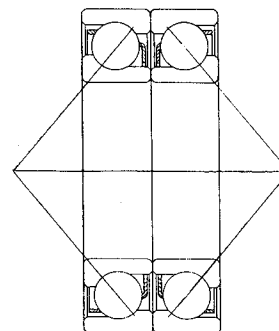
1. Place casing (1) with its outboard side down and position gasket (16) in place. Set cover (5) in place so neither the gasket position is lost nor damaged. Next align support (21) on cover. Use care not to disturb location of other parts. When all the above parts have been aligned, they are fastened together with capscrews (15 & 15A). Tighten capscrews evenly to insure perfect register of mating parts. Replace pipe plugs (25) and (26) in casing.

2. Position gasket (64) on cover and carefully lower suction nozzle (65) into place. Fasten suction elbow in place with capscrews (66).

3. Slip gasket (67) onto shoulder of cover (68) and secure it to suction nozzle (65) with capscrews (69) and nuts (69A). Place drain plug (70) back into suction nozzle (65).

4. Return casing and support assembly to its normal position. Fasten suction and discharge piping to pump. Secure this assembly in place by tightening nuts on foundation bolts. If pump has wearing ring (6) fasten it to cover (5) with screws (7). If handhole cover (19) was removed, place gasket (18) on cover and secure with capscrews (20).

5. Hand pack the outboard bearings (50) with grease and pack the grease retainer (50A) cavity one half full. Slide the grease retainer onto the shaft. Press the outboard bearing onto the shaft until it hits the shoulder of the shaft. Make sure outboard bearing set is properly matched with back-to-back configuration before pressing on shaft. Assemble snap ring (50C) onto the shaft with the beveled side outward to match the bevel in the shaft groove (PF4 only). Install lockwasher (50C) and locknut (50D) to secure outboard bearing (50) to shaft (48) for PF 5. Press or gently tap grease seal (52) into bearing cap (51). Slide the bearing cap (51) over the bearings. Lock in the assembly with snap ring (50B), matching the snap ring bevel to the groove bevel.



Back-to-Back
Bearing Configuration

6. Handpack the inboard bearing (49) and the recessed area of its grease shield (49A). Slide the grease shield onto the shaft with the raised lip toward the bearing. Press the bearing on until all parts are shouldered tight together on the shaft. The grease shield may wear into the outer race during break-in and is considered normal.

7. Place grease seal (53) into place on inboard end of power frame (56).

8. Lower sub-assembly from steps 5 through 7 into outboard end of power frame (56), which has been set on a bench with hole in it to accommodate shaft.

9. Position jack screws so that they extend past bearing caps as given below. This will position impeller hub end of the shaft in a axial position which will allow mounting impeller and closing down liquid end without any adjustment during the intermediate assembly step. Final adjustment will have to be made by evenly tightening capscrews (59) (step 22).

	Gap Clearance	Bolt Extension
Power Frame #4	1/8 in.	1/4 in.
Power Frame #5	1/4 in.	9/16 in.

10. Place plug (57) and grease zerk (58) back in bearing cap.

11. Place plug (62) and grease zerk (63) back on inboard end of power frame (56).

12. Retaining ring (37) can be set in its groove by turning it in a spiral motion up shaft. When in position, the outside diameter of this ring should slope toward impeller end of shaft.

13. Position bracket (8) to power frame (56) and secure in place by evenly tightening capscrews (35).

14. The following procedure is used in assembling sealing box:

A. Packing Box

- I. Place two pieces of packing (40) into stuffing box cavity (27) being careful to get each piece firmly in place. Position lantern ring (41), then add remaining three pieces of packing. When packing is tightened lantern ring should align with holes for plug (29), flushing lines, or cooling lines.

NOTE

Be sure to stagger joints of packing rings to avoid excessive leakage.

- II. Replace bushing (29) and grease zerk (30) in body of stuffing box (27).
- III. Snap retaining ring (39) onto shaft sleeve (36) with a pair of truarc external snap ring pliers. Slide shaft sleeve carefully into inboard end of packing box.
- IV. Thread capscrews (45) into stuffing box (27) approximately 1/4 in. Insert both halves of gland (44) into stuffing box. Insert gland clamps (44E) and tighten packing adjusting capscrews (45) to obtain proper sealing.
- V. Ensure capscrews (45) are tightened enough to hold parts in place. Final adjustment of packing box will have to be made after pump is returned to operation.

When pump is running, gland capscrews (45) should be evenly turned down a flat at a time, allowing packing to work in until a leakage rate of approximately 60 to 120 drops per minute is obtained.

NOTE

Do not over tighten packing as this will cause packing box to over-heat and the shaft sleeve (36) to wear excessively.

VI. Place gasket (38) in radial corner groove that is machined on the inboard end of the shaft sleeve to complete assembly.

B. Double Seal Box

- I. Thoroughly inspect the seal box cavity (27) checking for burrs or nicks which could damage the o-ring of mechanical seal. Apply a film of liquid dishwashing detergent or rubber lubricant (do not use oil or grease) to the o-ring and seal seat. Press one stationary seat with o-ring gently into the seal box cavity and other into gland (44). Replace pipe plug (28) in seal box.
- II. Place gasket (46) in position in the gland register.
- III. Snap retainer ring (39) onto sleeve (36) with a pair of truarc number 8 or 10 external pliers.
- IV. Slide sleeve through bottom of stuffing box and place one seal (47) over sleeve and slide it down to stationary seat. Place metal parts over shaft and then second seal ring.
- V. Position gland (44) over shaft sleeve and fasten to seal box with capscrews (45).

NOTE

Do not put mechanical seal back into service until seal ring and stationary seat faces have been relapped or replaced.

15. Place gasket (32) in groove of bracket (8).

16. Place key (54) in its keyway on shaft. Slide stuffing box assembly onto shaft so that key and keyway in the shaft sleeve mate. Continue to slide assembly forward until shaft sleeve is in contact with retainer ring (37).

17. Align stuffing box (27) with gasket (32) and bracket (8). Fasten with capscrews (33).

18. If pump has impeller wearing ring (3), fasten it to suction end of impeller (2) with capscrews (4).

19. Place impeller key (14) in keyway on the tapered portion of shaft (48), and set impeller (2) in position. Position gasket (13) inside impeller suction eye with washer (12) next, and o-ring gasket (11) last. Secure impeller in place with capscrew (10) to the following chart.

IMPELLER BOLT TORQUE

Power Frame	Impeller Bolt Size	Torque Value
4C	5/8 in.	75 FT-LBS
5E, 5F	3/4 in.	100FT-LBS

20. Place gasket (17) on casing (1) and lower power frame (56) and rotating element assembly into place; fasten this assembly to casing with capscrews (34).

21. Attach support (22) to power frame (56) with capscrews (23) and washers (24). Remove eyebolt that has been used to handle power frame and rotating assembly and place a rope sling on assembly. Carefully lower assembly to a horizontal position.

22. Using jackscrews (60) and nuts (61) located on bearing cap (51), adjust impeller and shaft assembly axially down until impeller bottoms out on its suction cover (5) or wearing rings (3) and (6). Then, loosen capscrews (59) and turn jacking screws (60) inward 3 or 4 flats to raise impeller to running clearance of .015/.025 in. Tighten jam nuts (61) and capscrews (59) to lock in adjustment.

23. Make one last check that all parts of the rotating element turn freely. Return spacer coupling between pump and motor using key (55).

24. Connect any flushing lines or cooling lines that were removed.

25. Open all valves or flow devices that control flow of to and from pump.

26. Connect Power.

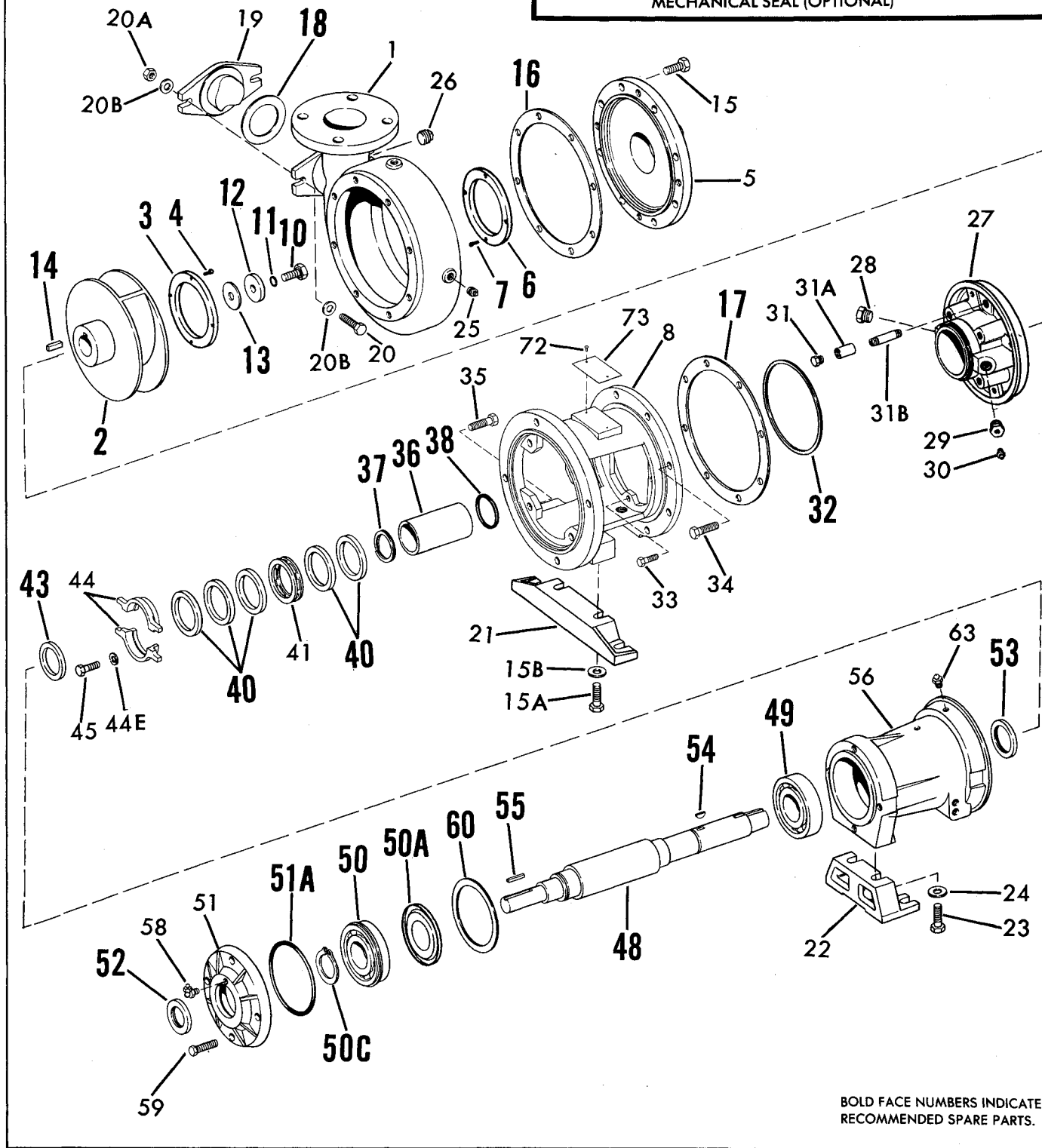
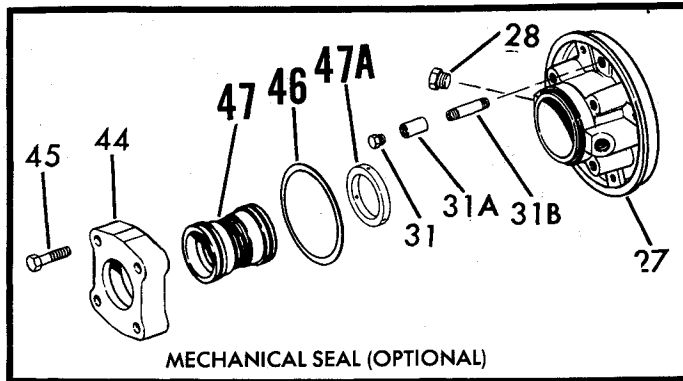
NOTE

Do not start up a pump until all air and vapor have been bled, making sure that there is liquid in the pump to provide the necessary lubrication. It is possible that the mechanical seal may drip during the first few minutes of operation.

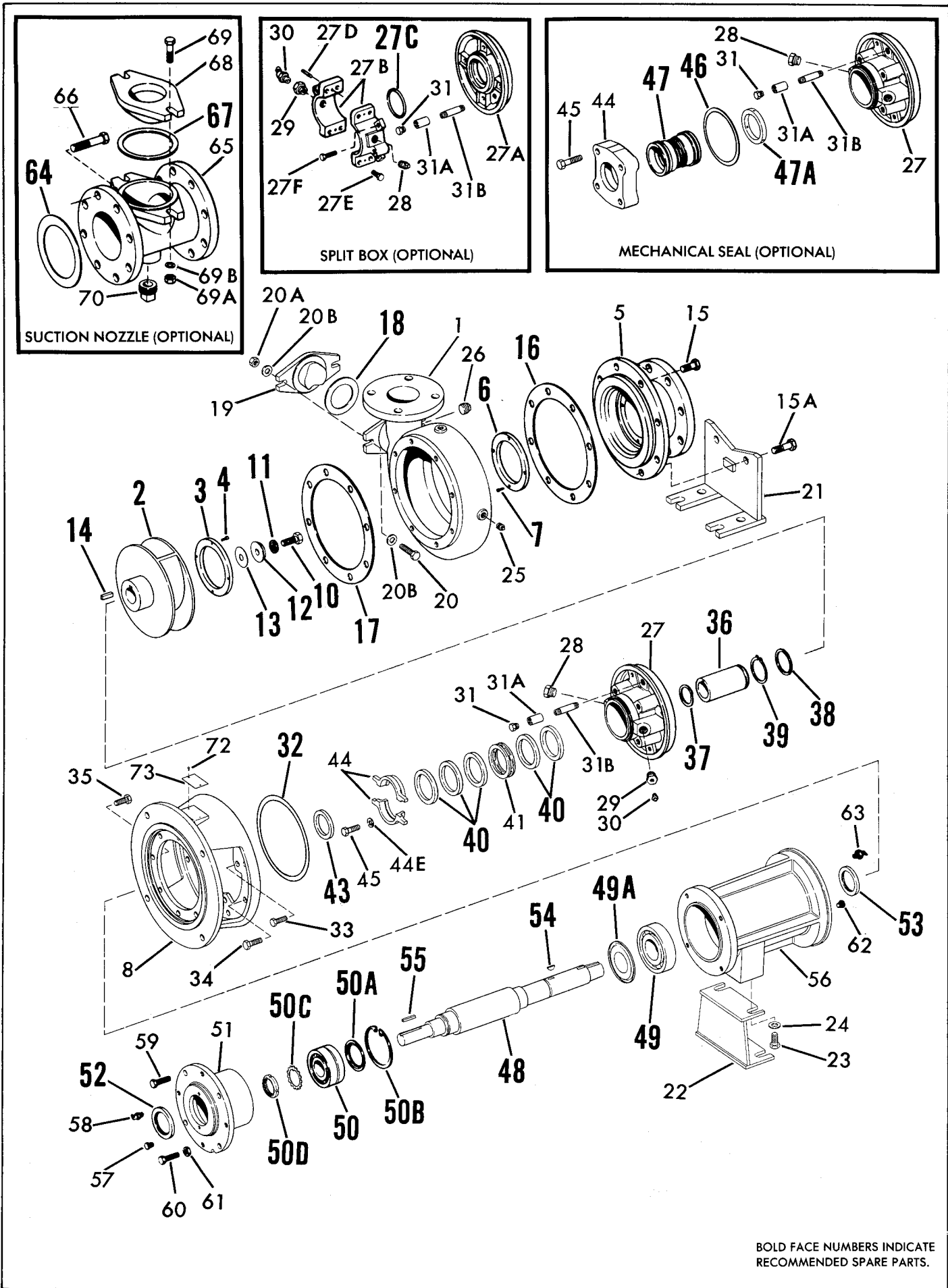
Turn on power momentarily to check for proper rotation. Rotation should be clockwise as viewed from driver (See arrow on casing).

MODEL 651A LIST OF PARTS

1. Casing	24. Washer	43. Slinger	61. Jam Nut
2. Impeller	25. Pipe Plug	44. Gland	62. Pipe Plug
3. Wear Ring	26. Pipe Plug	44E. Gland Clamp	63. Grease Fitting
4. Set Screw	27. Stuffing Box	45. Capscrew	64. Gasket
5. Suction Cover	27A. Adapter Plate	46. Gasket	65. Suction Nozzle
6. Wear Ring	27B. Split Packing Box	47. Mechanical Seal	66. Capscrew
7. Set Screw	27C. Gasket	47A. Bushing	67. Gasket
8. Bracket	27D. Pin	48. Shaft	68. Handhole Cover
10. Imp. Bolt	27E. Capscrew	49. Inboard Bearing	69. Capscrew
11. Imp. Bolt Seal	27F. Capscrew	49A. Grease Shield	69A. Nut
12. Imp. Washer	28. Pipe Plug	50. Outboard Bearing	69B. Washer
13. Imp. Washer Gasket	29. Bushing	50A. Grease Shield	70. Pipe Plug
14. Impeller Key	30. Fitting	50B Retaining Ring	72. Drive Pins
15. Capscrew	31. Pipe Plug	50C. Lockwasher or Retaining Ring	73. Name Plate
15A. Capscrew	31A. Pipe Coupling	50D. Locknut	
15B. Washer	31B. Nipple	51. Bearing Cartridge	
16. Gasket	32. Gasket	51A. O-Ring	
17. Gasket	33. Capscrew	52. Grease Seal	
18. Gasket	34. Capscrew	53. Grease Seal	
19. Handhole Cover	35. Capscrew	54. Sleeve Key	
20. Capscrew	36. Sleeve	55. Shaft Key	
20A. Nut	37. Retaining Ring	56. Power Frame	
20B. Washer	38. Gasket	57. Pipe Plug	
21. Pump Support	39. Retaining Ring	58. Grease Fitting	
22. Pump Support	40. Packing	59. Capscrew	
23. Capscrew	41. Lantern Ring	60. Shim Pack or Capscrew	



BOLD FACE NUMBERS INDICATE RECOMMENDED SPARE PARTS.



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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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