INSTRUCTION, INSTALLATION, MAINTENANCE AND REPAIR MANUAL
MODEL 384
END SUCTION FIRE PUMPS

IMPORTANT NOTE TO INSTALLER:

This manual contains important information about the installation, operation and safe use of this product. This information should be given to the owner/operator of this equipment.

ATTENTION: SAFETY WARNINGS:

Read and understand all warnings before installation or servicing pump.

OPERATIONAL LIMITS: *

Maximum Operating Pressure: See UL Listings for max pressure by model.
Maximum Operating Temperature: 150°F (66°C)

Pumps are not to be operated outside the operating envelope as stated on the nameplate and the maximum case working pressure as published in the product catalog for the relevant model. Shaft couplings are selected for the maximum power output of the driver, however, the pump is not to be operated outside its normal limits.

All pumps are designed to allow 1/16" for corrosion. Should this value be exceeded, the pump should be taken out of service.

The 384 Pumps are not designed for use in potentially explosive atmospheres.

*See ASTM A126/ANSI B16.1 for pressure/temperature ratings of flanges.

ELECTRICAL SAFETY:

Warning: Electrical Shock Hazard

All electrical connections are to be made by a qualified electrician in accordance with all codes and ordinances. Failure to follow these instructions could result in serious personal injury, death or property damage.

Warning: Electrical Overload Hazard

Ensure all motors have properly sized overload protection. Failure to follow these instructions could result in serious personal injury, death or property damage.

Warning: Sudden Start-Up Hazard

Disconnect and lock out power source before servicing. Failure to follow these instructions could result in serious personal injury, death or property damage.

HIGH TEMPERATURE SAFETY:

Warning: Hot Surface Hazard

If pumping hot water, ensure guards or proper insulation is installed to protect against skin contact with hot piping or pump components. Failure to follow these instructions could result in serious personal injury, death or property damage.

HIGH PRESSURE SAFETY: INSTALLATION

Warning: Hot Surface Hazard

Some pump surfaces may be subject to elevated temperatures; there is no required operator contact necessary while the pump is operating.

Warning: Spraying Water Hazard

When servicing pump replace all gaskets and seals. Do not reuse old gaskets or seals. Failure to follow these instructions could result in serious personal injury, death or property damage.

Warning: High Pressure Hazard

Do not exceed the maximum pressure. Install properly sized pressure relief valves in system. Failure to follow these instructions could result in serious personal injury, death or property damage.

AURORA
Pentair Water
Read and understand all safety warnings at the beginning of the manual before beginning installation or any repair work.

PUMP LOCATION. You probably have spent considerable time planning where your pump will be located. However, you may have overlooked some factor that may affect pump operation or efficiency.

The pump should be located as close to the liquid source as possible so that the suction line can be short and direct. It should be located in a clean, open area, where it is easily accessible for inspection, disassembly and repair. Pumps installed in dark, dirty areas or in cramped locations are often neglected, which can result in premature failure of both the pump and the driver.

The Aurora pump must be installed horizontally. Install isolating valves on each side of pump so pump maintenance can be performed without draining the system. Special mounting requirements may be required if the pump is to be mounted near a noise or vibration sensitive area.

These pumps are intended for use in applications where the water supply to the suction connection is permanently flooded. Operation of these pumps under static suction lift condition is prohibited.

The installation must be evaluated to ensure that the net positive suction head available (NPSHA) meets or exceeds the net positive suction head required (NPSHR), as stated by the pump performance curve.

FOUNDATION. The foundation for your pump must be sufficiently rigid to absorb any vibration and stress encountered during pump operation. A raised foundation of concrete is preferable for most floor mounted pumps. The raised foundation assures a satisfactory base, protects against flooding, simplifies moisture drainage, and facilitates keeping the area clean.

Your pump should be firmly bolted to the foundation, whether it is a raised concrete base, steelwork wall, or structural member. The mounting bolts or lag screws should be accurately located per the applicable Aurora dimension sheet. Refer to Fig. 1.

LEVELING THE PUMP. Leveling the pump will require enough shims to support the base plate near the foundation bolts and at any points of the base plate carrying a substantial weight load. The shims should be large enough to allow a gap of 3/4" to 1-1/2" between the base plate and foundation for grouting.
IMPORTANT: The pump base must be set level to avoid any mechanical difficulties with the pump or motor. The 384 pump was properly aligned, if supplied with a motor, at the factory. However, since the pump base is flexible, it may spring and twist during shipment. Do not pipe the pump until it is realigned. Realign the base after piping is completed and after the pump is grouted in and bolted down. NOTE: It may be necessary to readjust the alignment from time to time while the unit and foundation are new. Realignment will prevent premature bearing failure, excessive vibration or shaft failure.

Ensure that proper hydronic accessories such as pressure relief valves, thermal expansion tanks and flow/pressure control devices are installed in the system. Consult the responsible party for your system to ensure these devices are installed and of the proper size.

GROUTING THE INSTALLATION. Grouting the base plate prevents lateral movement of the base plate and improves the vibration absorbing characteristics of the foundation by increasing its mass. A wooden dam should be constructed around the base plate to contain the grout while it is being poured. The dam can be built tight against the base plate or slightly removed from it as desired. Refer to Fig. 2. The entire base plate should be completely filled with nonshrinkable type grout. The grout should be puddled frequently to remove any air bubbles from the grout.

ROTATION. Pump rotation is clockwise when viewed from the back of the motor. An arrow is also located on the pump to show the direction of rotation.

INITIAL ALIGNMENT OF THE FLEXIBLE COUPLING. The pump and driver were accurately aligned at the factory. However, it is impossible to maintain this alignment during shipping and handling. Therefore it will be necessary for you to realign the pump and driver. Flexible couplings are not universal joints. They should not be used to compensate for misalignment of the pump and motor shafts. Their function is to transmit power from the driver to the pump while compensating for thermal expansion and shaft end movement. The coupling faces should be far enough apart so that they do not make contact when the motor shaft is forced to the limit of the bearing clearance toward the pump shaft.

In order to properly align the coupling, you will need a taper gauge or set of feeler gauges and a straight edge.

There are two types of misalignment encountered with flexible couplings: angular misalignment, in which the shafts are not parallel, and parallel misalignment where the shafts are parallel but not on the same axis.

To check angular alignment, insert a feeler gauge or taper gauge at any four places 90-degrees apart around the coupling halves. Insert shims under the driver feet until the same reading is obtained at all four check points. The pump and driver will then be in angular alignment.

To check parallel alignment, a straight edge should be held against the edges of the coupling halves at any four places 90° apart around the coupling. The straight edge should be parallel to the pump and driver shafts at all times. Insert shims until the straight edge lies flat against both coupling halves at all four checkpoints. The pump and driver will then be in proper parallel alignment. Refer to Fig. 3.

For fine alignment, 3500 RPM operation, for all other coupler types.

A dial indicator should be used when greater alignment accuracy is required. Use the following alignment tolerances unless specified otherwise by the coupling manufacturer. On sleeve type couplings make sure there is at least 1/8" end clearance between the sleeve and the two coupling halves.

To check angular misalignments, mount the dial indicator base to the coupling half, and position the dial indicator button on the front or rear face of the opposite coupling half. Set the dial to zero, rotate both coupling halves together, making sure the indicator button always indicates off the same spot. Misalignment values within 0.004 inches TIR per inch of coupler radius is permissible.
To check parallel misalignment, mount the dial indicator base to one coupling half, or shaft, and position the dial indicator button on the outside diameter of the opposite coupling half. Set the dial to zero. Rotate both coupling halves together, making sure the indicator button always indicates off the same spot. Misalignment within 0.004 inches TIR is permissible.

**Warning:** Coupling Failure

Do not operate pump with coupling out of alignment. Ensure final coupling alignment according to coupling manufacturer’s instructions. Coupling, pump or driver failure may occur. Failure to follow these instructions could result in serious personal injury or death and property damage.

Pumps are supplied by the manufacturer with adequate guards for the coupling. The installer is to ensure that any additional guarding required shall be compliant with EN 953.

**PIPING:**

**SUCTION PIPING.** The suction piping should be short, but no less than ten pipe diameters in length, and direct with as few elbows and fittings as possible to keep head loss, from friction, at a minimum. However, the suction pipe should provide a minimum uninterrupted length, equal to ten pipe diameters, to the pump suction flange. A horizontal suction line should have a gradual rise to the pump, and pass under any interfering piping.

The suction pipe diameter should be at least the same diameter as the suction nozzle on the pump, and preferably larger. Use of a smaller diameter pipe will result in loss of head due to friction. All joints must be tight to maintain prime on the pump.

**REDUCERS.** Eccentric reducers should be installed directly at the suction nozzle, with the taper at the bottom to prevent air pockets from forming. Straight taper reducers should never be used in a horizontal suction pipe because of the air pocket that is formed at the leg of the reducer and the pipe. Refer to Fig. 4.

**DISCHARGE PIPING.** Discharge piping should also be short and direct as possible, with few elbows and fittings, to reduce head loss from friction.

**PIPE.** The discharge pipe diameter should be the same as, or larger than, the discharge nozzle diameter.

**DISCHARGE VALVES.** The discharge piping should include a check valve and a gate valve. The check valve should be located between the gate valve and the pump. If an increaser is used in the discharge piping, the increaser should be installed between the pump nozzle and the check valve. The check valve protects against a reverse flow of the liquid if the driver fails. Refer to Fig. 5.

**PRESSURE RELIEF VALVE.** All End Suction Fire Pump Models are provided with a pressure relief valve by the pump manufacturer to prevent an over pressure condition. For rotodynamic pumps, these valves are to set in the field at a point between the duty pressure and shut-off pressure to prevent a no-flow condition. For rotary positive displacement pumps, the pressure relief valve is factory set to 10% above the duty pressure and sealed with a safety wire, and are not to be field adjusted.

**SPECIAL CONSIDERATIONS FOR DIESEL ENGINES:**

**ENGINE FLUIDS.** Many diesel engines are shipped dry and must have lubricating oil and coolant added prior to start-up. It is the installer’s responsibility to assure that all fluid levels are correct to avoid damage to the engine.

**DIESEL ENGINE WIRING.** The End Suction Fire Pump controller must be wired to the diesel engine’s junction box. This is usually a simple matter of connecting like-numbered terminals of each with the correct wire gauge size. Refer to panel manufacturer’s wiring diagram.

The electric solenoid valve in the diesel engine cooling loop piping must be wired to the engine junction box. Either red wire goes to terminal 1; the other red wire goes to terminal 11; the green wire is grounded to the engine block.

Engines may have 12-volt or 24-volt systems, but all batteries furnished are 12-volt. Since dual battery sets are required by N.F.P.A. 20, two batteries are furnished for 12-volt systems and four batteries are furnished for 24-volt systems.

Aurora’s standard battery racks are designed to keep the batteries elevated off the floor for housekeeping purposes. They must be placed on a suitable level surface as close to the diesel engine as possible. Each rack holds two batteries; one rack is required for 12-volt systems and two racks for 24-volt systems. If two racks are used, they are to be placed side-by-side and not stacked.
Electrolyte is not furnished by Aurora Pump; it must be procured locally (approximately 16 quarts per battery).

Electrolyte must be added and the batteries charged at a low rate for at least 24 hours prior to start-up. It is recommended for safety reasons that the batteries be filled with electrolyte only after being placed in their permanent positions in the pump room.

The positive battery terminal of each battery (or pair of batteries for 24-volt systems) is connected to one of the engine's starter contactors. The negative terminals are to be connected to the engine block or other suitable ground. Aurora Pump's standard battery cable wire gauge sizes are selected for a maximum 10-foot circuit length (5-foot cables). Longer cables will require heavier gauge wire to be used.

Power wiring to the engine's jacket water heater must be completed only after it has been assured that there is sufficient coolant in the engine. Most heaters are continuously energized when wiring is connected and will burn out the heating element if no water is present. This failure is not covered by warranty. Refer to engine manufacturer's data sheet for correct voltage of the heater.

DIESEL ENGINE COOLING LOOP PIPING. The cooling loop system diverts a small amount of water from the pump discharge through the engine's heat exchanger to help control the operating temperature of the engine. Prior to start-up, it is recommended that this piping be checked for damage or displacement that might have occurred during shipment.

During normal operation, the top two valves of the cooling loop (in the by-pass line) are to be closed, and the lower two valves (in the pressure regulated line) are to be open. Failure to observe this may result in overpressurization of the heat exchanger when the pump is started, causing damage to the engine.

Piping from the engine's heat exchanger to a drain is to be provided by the installer. It is important to use the recommended size piping to reduce back pressure and avoid overpressurizing the heat exchanger.
A length of PVC tubing is provided by Aurora to be connected to the petcock in the cooling loop piping in order to vent the system and visually verify the flow of water through the heat exchanger.

DIESEL ENGINE FUEL SYSTEM. The fuel tank should be installed so that the supply outlet is at the same elevation as the engine’s fuel pump. Since the unit base is usually elevated as described earlier, this may require that the fuel tank is likewise elevated. The means of elevating the tank is the responsibility of the installer. Substituting the legs furnished with the tank with pipes of greater length is not a recommended method of elevating the tank.

All fuel fittings shown in Figure 9 are shipped loose for field installation. They are to be assembled as shown in Figure 9 to be consistent with Figure A-8-4.6 of N.F.P.A. Pamphlet 20. Installation may vary at the discretion of the installer with the approval of the local authority having jurisdiction. Note that some sections of common piping needed to complete this installation are not furnished by Aurora and must be procured locally.

Tube fittings are provided to allow the use of 5/8" O.D. tubing for the fuel supply and return lines (the tubing itself is NOT furnished by Aurora). If hard piping is used, these tube fittings are simply to be discarded.

Diesel fuel is not furnished by Aurora and must be procured locally prior to start-up.

DIESEL MUFFLER AND EXHAUST SYSTEM. A commercial grade muffler and flexible connector are furnished as standard on diesel End Suction Fire Pumps. If necessary, additional fittings needed for connecting these to the engine are also provided.

Commercial grade mufflers have NPT connections on 3" and 3-1/2" sizes, slip-on (automotive type) connectors for 4", 5" and 6" sizes, and 125# ANSI flanged connections for larger sizes.

Optional residential grade mufflers have NPT connections on 3" and 3-1/2" sizes; ANSI 125# flanges on 4" and larger sizes.

Piping, elbows and other components required to route the exhaust to the outside are not provided by Aurora. It is suggested that the building contractor or on-site engineers design and install the remainder of the exhaust system.

Mufflers are sized by Aurora to allow the engine to operate at its rated speed with nominal back pressure. However, if more than 25 feet of additional piping and/or more than four 90-degree elbows are required to complete the system, it is important to contact the factory for re-evaluation of the system with respect to back pressure. A larger muffler and piping may be required to allow the engine to operate properly.

The flexible connectors furnished by Aurora are intended for use as a vibration control device and cannot be substituted for elbows in the piping system. It is recommended that the flexible connector be placed as close to the engine’s exhaust outlet as possible. The muffler and piping must be supported to prevent strain on any diesel engine component.

START-UP AND FIELD ACCEPTANCE TEST:

GENERAL. The following is a general outline for starting and field testing End Suction Fire Pump systems. It is recognized that requirements and methods may vary depending on local customs and practices. Those involved in End Suction Fire Pump sales MUST fully understand all local requirements and N.F.P.A. Pamphlet 20. A general method to follow is outlined below.

Be specific and complete when ordering End Suction Fire Pumps and accessories so that all necessary and correct items are on hand for the start-up. Trouble cannot be tolerated on the day of the field acceptance test.

Visit the jobsite after delivery of the equipment to verify that all components ordered have been received and are correct for the installation.

Visit the jobsite again after installation to assure that the components have been correctly assembled and installed.

After the installation is complete and the End Suction Fire Pump system is pressurized and checked by the contractor, the following items must be verified:

1. Coupling has been properly aligned.
2. Motor has been “bumped” to check for proper rotation.
3. Diesel engine (where applicable) has been properly serviced, necessary fluids added, batteries filled and charged, jacket water heater operating.

INITIAL TEST. The following steps are basic for an initial test of the End Suction Fire Pump system:

1. Close the valves on all discharge outlets.
2. Open the suction valve.
3. Having read the controller manual and gained an understanding of its operation, set the End Suction Fire Pump controller to “manual”. The Jockey pump panel should be set to the “off” position.
4. With the controller door closed, start the End Suction Fire Pump.
5. Adjust the packing to allow approximately 60 drops per minute to flow from each packing box. Further adjustment may be required later, so a recheck upon completion of the test is advised.
6. Close the relief valve completely for a brief period to verify that the shut-off pressure agrees with that on the certified factory test curve.

7. Adjust the casing relief valve (electric-driven units only) to allow enough flow to keep the pump cool.

8. Stop the End Suction Fire Pump.

9. Set the End Suction Fire Pump controller to the “automatic” position.

10. Slowly lower the system pressure with the control valve. The End Suction Fire Pump should start. Observe this starting pressure and adjust if necessary. (Adjustment procedure varies with controller manufacture.) Stop the End Suction Fire Pump.

FIELD ACCEPTANCE TEST. Personnel on hand for the End Suction Fire Pump field acceptance test should include the controller representative, diesel engine service technician (if applicable), representatives of the insuring agency and local fire authority, as well as those responsible for building maintenance and supervision.

Equipment needed for the field acceptance test includes:

1. Calibrated ammeter.

2. Volt meter.

3. Tachometer.

4. Pitot tube & gauge.

5. Calibrated suction and discharge gauges with 1/4% accuracy. (Gauges furnished with the pump are 2%-3% accurate and could be troublesome for the field acceptance test.)

6. 50 feet of 2-1/2” hose for each connection on the hose manifold.

7. Play pipe with suitable nozzle for each hose.

While field acceptance tests vary by location, the following steps are usually taken. Additional operations may be required depending on the special needs in some territories.

1. A hose and play pipe are connected to each valve on the hose manifold.

2. The discharge valve leading to the building’s fire system is closed.

3. The discharge valve leading to the hose manifold (or “test header”) is opened.

4. The suction valve is opened.

5. All relief valves are closed.

6. One hose valve on the hose manifold is opened.

7. With the End Suction Fire Pump operating, the hose valve is adjusted for a flow of 500 GPM at the play pipe as indicated by the pitot tube. Refer to Table 1 to determine the pressure vs. flow for the size play pipe used for this test.
8. By opening additional valves and measuring the flow equal to 500 GPM, readings of 1000 GPM, 1500 GPM, 2000 GPM, etc. can be determined.

9. Open the necessary hose valves to obtain the total rated flow. When this flow is assured, check and record the following data:
   a. Suction gauge pressure
   b. Discharge gauge pressure
   c. RPM with tachometer
   d. Voltage
   e. Amps (on all legs)

10. Verify that the flow remained constant during the above data readings.

11. Adjust hose valves to achieve 150% of rated flow. Proceed as before and record the necessary data.

12. Repeat these steps as required by supervising authorities to obtain the desired number of points on the test curve.

Table 1. GPM At Various Nozzle Sizes.

<table>
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<th>Nozzle Pressure</th>
<th>1-1/8</th>
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<th>1-3/8</th>
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13. Finally, close all valves and record the above readings in Step 9 at shut-off (zero GPM) condition.

If a number of automatic and/or manual starts are to be demonstrated, this series of tests can now be conducted.

The Jockey Pump controller must be set to start the Jockey Pump at a pressure greater than that of the main End Suction Fire Pump. The following procedure may be used to accomplish this.

1. The main End Suction Fire Pump controller is set to the “off” position.

2. The Jockey Pump controller is set to the “automatic” position.

3. The system pressure is slowly reduced by opening the test valve until the Jockey Pump starts. Observe the pressure at which the Jockey Pump starts.

4. Allow the Jockey Pump to continue running until the system pressure rises enough to stop the pump automatically. Typically, there is a minimum of 10 psi between the “pump start” and “pump stop” pressure readings.

5. Adjust the set points in the Jockey Pump controller as necessary to achieve the desired results. As with the main End Suction Fire Pump controller, adjustment methods vary with controller manufacturer.

IMPORTANT:

Upon successful completion of the field acceptance test, the following points must be verified:

1. The discharge valve leading to the outside hose manifold should be closed.

2. The discharge valve leading to the building fire protection system should be opened.

3. The casing relief valve should be set to a pressure just below the shut-off pressure of the pump.

4. The main relief valve (if applicable) should be set to a pressure just above the maximum system pressure.

5. Both the End Suction Fire Pump and Jockey Pump controllers should be set to the “automatic” position.

6. Any alarm systems disabled during the tests should be reactivated.

7. The individual or authority responsible for maintaining the building’s fire protection system must be made aware of all settings and the operational condition of the system before leaving the site.

MAINTENANCE:

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.
LUBRICATION OF IMPELLER SHAFT BEARINGS:

Regreaseable bearings will require periodic lubrication and can be accomplished by using the zerk or lubrication fittings in the cartridge cap and power frame. Lubricate the bearings at regular intervals using a grease of high quality. Mixing of different brands of grease should be avoided due to possible chemical reactions between the brands which could damage the bearings. Accordingly, avoid grease of vegetable or animal base which can develop acids, as well as grease containing rosin, graphite, talc and other impurities. Under no circumstances should used grease be reused.

Overlubrication 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 space surrounding it.

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 (exposed to dripping water, to the weather, or to heavy condensation such as is found in unheated and poorly ventilated underground locations) the bearings should be lubricated at least after every 2,000 hours of running time or every 4 to 6 months, whichever is more frequent.

Use Chevron SRI, NLGI2. Lubricate motor per motor manufacturer’s instructions.

GENERAL INSTRUCTIONS:

1. Keep this pump and motor properly lubricated.
2. Inspect the pump regularly for leaky seals of gaskets and loose or damaged components. Replace or repair as required.

ELECTRICAL WIRING. Normally, your pump will be supplied with an attached drive motor. The motor should be wired in accordance with the wiring diagram found on the motor nameplate. Be sure the voltage, frequency, and phase of your power supply corresponds with the nameplate data. It is advisable to provide a separate switch and overload protection for your pump motor to protect against power failure in some other area. Conversely, if the pump motor develops electrical problems, it will be isolated from other equipment.

PRESTARTING INSTRUCTION. The coupling halves should be connected. Prior to connection, however, the drive motor should be started to make sure the direction of rotation is the same as the direction indicated by the arrow on the pump casing.

When the pump is used in conjunction with electric motors and controls, these components must be in accordance with EN 60529 IP 22. Electrical equipment applied to conform to the requirements of EN 50081 parts 1 or 2, and to EN 50082 parts 1 or 2, and the relevant parts of EN 61000 with regard to electromagnetic compatibility. Protection of the electrical assembly against electrostatic phenomena shall be per paragraph 5.2.2.2 of EN 809. General compliance of the electrical assembly shall be per EN 60204-1. The installer shall ensure that any displays and control actuators are designed and installed in accordance with EN 894. The nature of the pumped liquid precludes the need for an emergency stop device; the pump can be shut down by normal means. Any electrical equipment shall be properly earthed.

Overall assembly shall be shown to comply with 98/37/EC Annex 1 paragraph 1.7.4 (f) by the final assembler with respect to noise and vibration.

Installation must comply with the Machinery Directive 98/37/EC as well as any other applicable national regulations in the member state of the installation. The final installation must not be put into service until it has been declared in conformity with the provisions of the Machinery Directive.

PUMP DISASSEMBLY: For frame mounted pumps, model 384.

Any disassembly/assembly procedures performed will require testing per NFPA 20 Table 14.5.2.3 after re-assembly has been completed prior to the pump being returned to service.

<table>
<thead>
<tr>
<th>CAPSCREW TORQUE FOR COMMON BOLT DIAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN-POUNDS</td>
</tr>
<tr>
<td>1/4&quot;</td>
</tr>
<tr>
<td>85</td>
</tr>
</tbody>
</table>

Table 2. Torque Chart.
PACKING REMOVAL/REPLACEMENT ONLY:

a. Remove capscrews (65), gland lamps (22) and gland halves (23).

b. Use a flexible Packing Tool* with a hook attachment for removal of the packing, and a wood screw attachment for removal of the lantern ring. The lantern ring contains several holes for the packing tool.

* The Packing Tool can be purchased from industrial supply, or hardware stores. It is not considered a special tool.

c. Thoroughly clean the shaft sleeve (25) and packing cover (26) seal cavity. Thoroughly inspect the bore of the Pump Packing Cover (26) and the Shaft Sleeve (25) for wear or signs that replacement is needed.

d. Place one ring of packing (28) into the packing cover (26). On successive rings of packing stagger the packing joints to prevent excessive leakage through the packing box. If a lantern ring (29) is used, place a second ring of packing (28) into the cover before installing lantern ring. Refer to Fig. 10.

5. Remove the two foot support capscrews from the powerframe. Loosen, but do not remove the volute capscrews (5). Use capscrew in the jack screw holes to loosen the impeller subassembly from the volute.

6. Now remove the volute capscrews (5) and remove the impeller subassembly from the volute.

7. Remove the impeller capscrew (9), washer (9A), gasket (9B), and capscrew seal (9C). Remove impeller (11).

8. Remove impeller key (12).

9. Remove the O-ring (10).

10. Remove capscrews (65), gland lamps (22) and gland halves (23).

11. Unscrew capscrews (5) and remove cover assembly (26). The bore of the pump packing cover (26) should be checked for excessive wear.

12. Shaft sleeve (25) 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. Take care to prevent damaging the surface of the sleeve. Replace the sleeve if it is grooved from wear.

13. All packing (28) and lantern ring (29) (if used) must now be removed from the packing box, and the cavity thoroughly cleaned to allow new packing to fit properly.

14. Thoroughly clean the shaft sleeve (25) and packing cover (26) seal cavity.

15. Wear ring(s) (7 & 16) are pressed into their housings with an interference fit and must be removed with a puller if new rings are required.

PUMP REASSEMBLY:

1. Replace the shaft sleeve (25) or packing cover (26) if there is evidence of surface damage like pitting, corrosion, nicks or scratches.

2. Replace wear ring(s) (7 & 16) in casing (6) and cover (26). Rings should not be hammered into place. Use a press or clamp the parts in a bench vice using wooden blocks to protect the rings. It may be necessary to pin or dowel the
rings after assembly if the cover or casings has had rings replaced before, since each reassembly can stretch or tear metal and thereby loosen fits. If the facilities are available, it is good practice to take a very light finish cut or to ream the inside diameter of the casing rings after pressing to restore roundness. When rings are pressed, they may get squeezed out of shape.

3. Place one ring of packing (28) into the packing cover (26). On successive rings of packing stagger the packing joints to prevent excessive leakage through the packing box. If a lantern ring (29) is used, place a second ring of packing (28) into the cover before installing lantern ring. Refer to Fig. 10.

There must be two (2) rings of packing in front of lantern ring (29) to assure proper alignment between the lantern ring and the sealing tube connection (3) in the cover (26). Install remaining packing rings (28). Each ring should be tapped firmly into place with a wood or metal bushing.

4. Slide the shaft sleeve (25) through the packing. Proceed to next step if only replacing packing.

5. Replace gland halves (23) and place capscrews (65) through gland clamps (22). Tighten capscrews (65) finger tight into either cover assembly (26).

6. Slide Packing Cover Assembly onto shaft.

NOTE: The slots in gland halves (23) should be diagonal to pump horizontal center line.

7. Install O-ring (10).

8. Install a new impeller key (12).

9. Install impeller, impeller washer (9A), new impeller washer gasket (9B), capscrew seal and capscrew (9). Tighten capscrew per torque chart (see Table 2).

10. Install new casing gasket (8). Then install the pump assembly into the volute.

11. Tighten volute capscrews (5) per torque chart (see Table 2).

12. Install foot support capscrews (62) and tighten per torque chart (see Table 2).

13. Install coupling and align.


15. Replace all relief, cooling, flush lines (1, 3, 2, 75), or drain lines from the pump including compression connections (1 and 2) and tubing (3).

16. Reinstall the coupling guard.

17. Open isolation valves and inspect pump for leaks.

18. Return pump to service.

**Starting Pump After Reassembly:**

Do not start pump until all air and vapor has been bled and until making sure that there is liquid in the pump to provide the necessary lubrication for the packing.

When the pump is returned to service, additional care must be given to packing box to ensure a proper packing life. It is necessary to allow 60–120 drops leakage per minute through the packing for lubrication purposes. If the flow rate is other than this, the capscrews should be either loosened or tightened one quarter turn at a time to acquire the correct leakage (both capscrews must be turned equally to prevent cocking of the gland). It will take approximately ten minutes at any one 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.
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POWER FRAME OR PUMP SHAFT DISASSEMBLY/REPLACEMENT:

Read and understand all safety warnings at the beginning of the manual before beginning installation or any repair work.

Follow steps 1 – 14 from main pump disassembly procedure.

15. Remove the power frame capscrews and bearing/shaft assembly from the packing cover. If replacing the shaft, continue to Step 16.

16. Remove the grease fittings (43) from the power frame.

17. Unscrew capscrews (48) and remove bearing cap (49). Remove O-ring (oil lubed only) and retainer ring (52).

18. Slide out shaft (55) and bearings (53 and 54). Since bearings (53 and 54) are press fitted on the shaft, they will have to be pulled or pressed off the shaft. Remove grease seals (51) from frame (57) and bearing cap (49).

19. Thoroughly clean the shaft (55), removing any oil or dirt.

POWER FRAME 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 (51/51A) into frame (57), and bearing cap (49).

2. Press bearings (53 and 54) onto shaft (55). Snap retainer ring (52) into place.

3. Slide shaft (55) and bearings (53 and 54) into frame (57).

4. Fasten bearing cap (49) in position with capscrews (48). Position slingers (47) on the shaft.

5. Position bracket (35) on the frame (57) and secure with capscrews (5A). Tighten screws evenly to assure proper alignment.

Follow steps 1 through 18 from Pump Reassembly procedure to complete pump assembly.

Do not start pump until all air and vapor have been bled and until making sure that there is liquid in the pump to provide the necessary lubrication for the packing.

When the pump is returned to service, additional care must be given to packing box to ensure a proper packing life. It is necessary to allow 60–120 drops leakage per minute through the packing for lubrication purposes. If the flow rate is other than this, the capscrews should be either loosened or tightened one quarter turn at a time to acquire the correct leakage (both capscrews must be turned equally to prevent cocking of the gland). It will take approximately ten minutes at any one 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.
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Figure 11. Model 384.

MODEL 384 LIST OF PARTS

1. Compression Fitting
2. Compression Fitting
3. Tubing
4A/4B/4C. Pipe Plug
5/5A/B/C. Capscrew
6. Casing
7. Wear Ring
8. Gasket
9. Impeller Screw
9A. Washer
9B. Gasket
9C. Capscrew Seal
10. O-Ring
11. Impeller
12. Impeller Key
16. Back Wear Ring
22. Gland Clamp
23. Packing Gland
25. Shaft Sleeve
26. Pump Packing Cover
28. Packing
29. Lantern Ring
33. Nameplate Screw
34. Nameplate
35. Motor Bracket
36. Key
42. Key
43. Grease Fitting
47. Water Slinger
48. Capscrew
49. Bearing Cap
51/51A. Lip Seal
52. Retaining Ring
53. Bearing
54. Bearing
55. Shaft
57. Frame
62. Capscrew
63. Washer
64. Foot Support
65. Capscrew
75. Ball Valve

AURORA PUMP RESERVES THE RIGHT TO SUBSTITUTE MATERIALS WITHOUT NOTICE.

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 OR THE FACTORY AT NORTH AURORA, ILLINOIS.