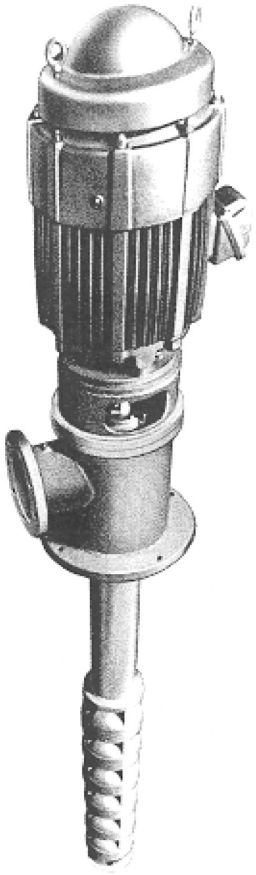


INSTRUCTION MANUAL
IOMAC8499R00-EN

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

A-C Fire Pump
Vertical Turbine Fire Pump
A-C Model FP

AC FIRE PUMP
a xylem brand

Pump Safety Tips

Safety Apparel:

- Insulated work gloves when handling hot bearings or using bearing heater.
- Heavy work gloves when handling parts with sharp edges, especially impellers.
- Safety glasses (with side shields) for eye protection, especially in machine shop areas.
- Steel-toed shoes for foot protection when handling parts, heavy tools, etc.
- Other personal protective equipment to protect against hazardous/toxic fluid.

Coupling Guards:

- Never operate a pump without a coupling guard properly installed.

Flanged Connections:

- Never force piping to make a connection with a pump.
- Use only fasteners of the proper size and proper material.
- Ensure there are no missing fasteners.
- Beware of corroded or loose fasteners.
- Do not operate below minimum rated flow, or with suction/discharge valves closed.
- Do not open vent or drain valves, or remove plugs while system is pressurized.

Maintenance Safety:

- Always lock out power.
- Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, or disconnecting piping.
- Use proper lifting and supporting equipment to prevent serious injury.
- Observe all decontamination procedures.
- Know and follow company safety regulations.

Note: Observe all cautions and warnings highlighted in the pump Installation, Operation and Maintenance Instructions.

FOREWORD

This manual provides instructions for the Installation, Operation, and Maintenance of the A-C Fire Pumps. This manual covers a standard product. For special options, supplemental instructions are available. **This manual must be read and understood before installation and start-up.**

This instruction manual covers several different pump models. Most assembly, disassembly, and inspection procedures are the same for all the pumps. However, where there are differences, these differences will be noted within the manual. The design, materials, and workmanship incorporated in the construction of the A-C Fire Pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

The information contained in this book is intended to assist operating personnel by providing information on the characteristics of the purchased equipment. It does not relieve the user of their responsibility of using accepted engineering practices in the installation, operation, and maintenance of this equipment.

A-C Fire Pumps shall not be liable for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this manual.

Warranty is valid only when genuine A-C Fire Pumps parts are used.

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from A-C Fire Pumps.

For information or questions not covered in this manual, contact A-C Fire Pump Systems at (847) 966-3700.

THIS MANUAL EXPLAINS

- **Proper Installation**
- **Start-up Procedures**
- **Operation Procedures**
- **Routine Maintenance**
- **Pump Overhaul**
- **Trouble Shooting**
- **Ordering Spare or Repair Parts**

Warranty

WARRANTY – Company warrants title to the product(s) and, except as noted with respect to items not of Company's manufacturer, also warrants the product(s) on date of shipment to Purchaser, to be of the kind and quality described herein, and free of defects in workmanship and material. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY OF COMPANY WITH RESPECT TO THE PRODUCT(S).

If within one year from date of initial operation, but not more than 18 months from date of shipment by Company of any item of product(s), Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such nonconformance by, at Company's option, adjustment or repair or replacement of the item and any affected part of the product(s). Purchaser shall assume all responsibility and expense for removal, reinstallation, and freight in connection with the foregoing remedies. The same obligations and conditions shall extend to replacement parts furnished by Company hereunder. Company shall have the right of disposal of parts replaced by it. Purchaser agrees to notify Company, in writing, of any apparent defects in design, material or workmanship, prior to performing any corrective action back-chargeable to the Company. Purchaser shall provide a detailed estimate for approval by the Company.

ANY SEPARATE LISTED ITEM OF THE PRODUCT(S) WHICH IS NOT MANUFACTURED BY THE COMPANY IS NOT WARRANTED BY COMPANY and shall be covered only by the express warranty, if any, of the manufacturer thereof.

THIS STATES THE PURCHASER'S EXCLUSIVE REMEDY AGAINST THE COMPANY AND ITS SUPPLIERS RELATING TO THE PRODUCT(S), WHETHER IN CONTRACT OR IN TORT OR UNDER ANY OTHER LEGAL THEORY, AND WHETHER ARISING OUT OF WARRANTIES, REPRESENTATIONS, INSTRUCTIONS, INSTALLATIONS OR DEFECTS FROM ANY CAUSE.

Company and its suppliers shall have no obligation as to any products which has been improperly stored or handled, or which has not been operated or maintained according to instructions in Company or supplier furnished manuals.

Job Specific Table of Contents

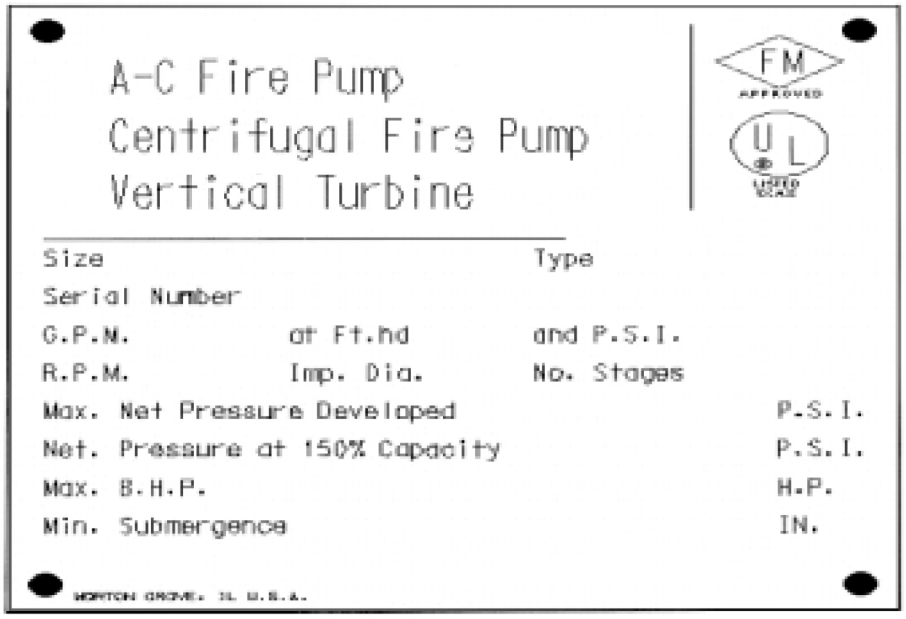


Figure 1

Checked boxes denote items that apply to your specific pump.

CERTIFIED BY

DATE

Index

Section 1 - Safety

Definitions

These pumps have been designed for safe and reliable operation when property used and maintained in accordance with instructions contained in this manual. A pump is a pressure containing device with rotating parts that can be hazardous. Operators and maintenance personnel must realize this and follow safety measures. A-C Fire Pumps shall not be liable for physical injury, death, damage or delays caused by a failure to observe the instructions in this manual.

Throughout this manual the words **WARNING**, **CAUTION**, and **NOTE** are used to indicate procedures or situations which require special operator attention:

WARNING: Operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION: Operating procedure, practice, etc. which, if not followed, could result in damage or destruction of equipment.

NOTE: Operating procedure, condition, etc. which is essential to observe.

EXAMPLES:

WARNING: Pump shall never be operated without coupling guard installed correctly.

CAUTION: Throttling flow from the suction side may cause cavitation and pump damage. **NOTE:** Proper alignment is essential for long pump life.

General Precautions

WARNING: Personal injuries will result if procedures outlined in this manual are not followed.

- **NEVER** apply heat to remove impeller. It may explode dueto trapped liquid.
- **NEVER** use heat to disassemble pump due to risk of explosion from trapped liquid.
- **NEVER** operate pump without coupling guard correcly installed.
- **NEVER** operate pump beyond the rated conditions to which the pump was sold.
- **NEVER** start pump without proper prime (sufficient liquid in pump casing).
- **NEVER** run pump below recommended minimum flow or when dry.
- **ALWAYS** lock out power to the driver before performing pump maintenance.
- **NEVER** operate pump without safety devices installed.
- **NEVER** operate pump with discharge valve closed.
- **NEVER** operate pump with suction valve closed.
- **DO NOT** change conditions of service without approval of an authorized A-C Fire Pumps representative.

Section 2 - General Information

Introduction

CAUTION: The information in this manual is intended to be used as a guide only. If you are in doubt, consult your A-C Fire Pumps representative for specific information about your pump.

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

WARNING: Rotating components of the pump assembly must be covered with a suitable rigid guard to prevent injury to personnel.

Study thoroughly Sections 1 through 6 and carefully follow the instructions for installing and operating. Sections 5 contains answers to trouble shooting and maintenance questions. Keep this instruction manual handy for reference.

WARNING: A-C Fire Pumps will not be liable for any damages or delay caused by failure to comply with the provisions of this instruction manual.

Receiving & Checking

The pump should be carefully supported prior to unloading from the carrier. Handle all components carefully. Inspection for damage of the shipping crate should be made prior to unpacking the pump. After unpacking, visually inspect the pump and check the following:

1. Contents of the pump assembly against the packing list.
2. All components against damage.
3. All shafting for straightness and damage, should the crate be broken or show careless handling.

Any shortages or damages should be immediately called to the attention of the local freight agent of the carrier by which the shipment arrived and proper notation made on the bill. This will prevent any controversy when claim is made and facilitate prompt and satisfactory adjustment

Materials & Equipment Required

The material and equipment necessary for installation of the pump will vary with the size of the pump and the type of installation.

The following list of standard tools and supplies is offered only as a guide.

BULK MATERIAL

- Anti-Galling lubricant (such as Dow Corning "MOLYKOTE")
- Thread Compound
- Lubrication Oil
- Turbine Oil

  Grease

RIGGING EQUIPMENT

- Mobile power hoist, traveling crane, or derrick
- Drag line and blocks
- Elevator clamps, if unit is unassembled
- Clevises – for use with eyebolts
- Timbers – size, length, and quantity to support long pump parts on the floor
- I-Beams or timbers to support pump over installation

HAND TOOLS

- Pipe wrenches
- Feeler gauges
- Set of mechanics tools including: files, wire brush, pliers, wire cutters and pocket knife
- Clean rags

OPTIONAL TOOLS TO FACILITATE PUMP ASSEMBLY AND DISASSEMBLY

- Dial indicator to assist in motor and pump alignment
- Collet driver to assist in bowl assembly and disassembly for pumps with taper lock impellers only

Storage

A-C Fire Pumps carefully preserves and protects its products for shipment. However, the effective life of the preservatives applied at the factory can vary from 3 to 18 months depending on the severity of the environment in which the equipment is stored. This section provides procedures for preparation prior to storage and maintenance during storage of A-C Fire Pumps. These procedures are necessary to protect the precision parts of the pumps. Specific procedures for storing motors, gearheads, and engines, should be obtained from the equipment manufacturer. This section is intended to be of general assistance to users of A-C Fire Pumps. It shall not modify, amend and/or otherwise alter the scope of A-C Fire Pumps warranty responsibilities to the purchaser in any way whatsoever.

STORAGE PREPARATION

A-C Fire Pumps require proper preparation for storage and regular maintenance during storage. The pump shall be considered in storage when it has been delivered to the job site and is awaiting installation.

Preferably, the storage area shall be paved, well drained and free from flooding, and be indoors whenever possible.

Weatherproof coverings used for outdoor storage shall be flame resistant type sheeting or tarpaulins. They shall be placed so as to provide good drainage and air circulation and shall be tied down to protect from wind damage.

Storage area shall be maintained in a clean condition at all times.

Pumps and/or component parts shall be placed on skids, pallets, or shoring to permit good air circulation.

Pumps and/or component parts shall be sorted so as to permit ready access for inspection and/or maintenance without excessive handling.

Pumps and/or component parts stacked during storage shall be arranged so that the racks, containers, or crates bear full weight without distortion of pumps or parts. Identification markings must be readily visible. Any cover removed for internal access shall be replaced immediately.

Pump and bowl assembly shafting shall be rotated counter clockwise, as a minimum, once a month. Shaft shall not be left in the same previous position, nor in the extreme raised or lowered lateral position. Shaft should rotate freely.

NOTE: For further information on these procedures contact your A-C Fire Pumps representative.

RECOMMENDED STORAGE PROCEDURES

Controlled storage facilities should be maintained at an even temperature 10ºF (6°C) or more above the dew point with relative humidity less than 50% and little or no dust. (If these requirements can not be met the pump is to be considered in uncontrolled storage.)

For uncontrolled storage periods of 6 months or less, the pump is to be inspected periodically to insure that all preservatives are intact.

All pipe threads and flanged pipe covers are to be sealed with tape.

The pump must not be stored closer than six inches (15 cm) from the ground.

UNCONTROLLED LONG TERM STORAGE PREPARATIONS

When applicable to the pump, storage periods over six months require the preceding storage procedure and storage preparation plus the following:

Inspect the lube oil and seal flush piping and either fill the piping with rust preventative oil, or re-coat the piping periodically to prevent corrosion.

Place 10 pounds (4.5 kg) of moisture absorbing desiccant or 5 pounds (2.3 kg) of vapor phase inhibitor crystals near the center of the pump. If the pump is assembled, place an additional one pound (0.5 kg) in the discharge nozzle securely fastened to the discharge elbow.

Install a moisture indicator near the perimeter of the pump. Cover the pump with 6 mil (0.15 mm) minimum thickness black polyethylene or equal and seal it with tape. Provide a small ventilation hole approximately 1/2 inch (12 mm) diameter.

Provide a roof or shed shelter to protect from direct exposure to the elements.

General Description

The model FP pump is a vertical turbine fire pump, which is designed to meet many wide ranges of service.

DRIVERS

When packed stuffing boxes are used with open lineshaft pumps, hollow shaft motors or right angle gear drives, are often used with a separate driveshaft through the driver and connected to the pump by a rigid coupling.

DISCHARGE HEAD

The discharge head is either a cast iron head or a fabricated 'F' type head. Ports are provided for connecting the discharge gauge and stuffing box bypass return. The driver support portion of the discharge head is designed with large hand holes for easy mechanical seal or stuffing box adjustment.

COLUMN

Threaded or flanged column construction provides positive shaft and bearing alignment. Bearings are spaced to provide vibration free operation. This will insure long bearing life and reduced shaft wear. The lineshaft is supported within the column by use of bearing retainers in the column assembly.

BOWL ASSEMBLY

The bowls are generally of flanged construction for accurate alignment and ease of assembly and disassembly. Impellers are enclosed. For temperatures over 180ºF (82ºC) and in the larger size bowls, impellers are keyed to the shaft.

THRUST POT

A thrust pot is utilized when the driver is not designed to carry the pump thrust.

Section 3 - Installation

Foundation /Piping

BASE (SOLE PLATE) INSPECTION

Sub Base and Sole Plate are terms in common use to describe a general class of solid steel plates mounted in grout (or bolted to steel structures) at the pump-foundation interface.

1. Remove the Sub Base from the Pump Discharge Head, when shipped assembled.

2. Completely clean the underside of the Sub Base. It is sometimes necessary to coat the underside of the Sub Base with an epoxy primer. (This is available as an option.)

3. Remove the rust preventative solution from the machined topside with an appropriate solution.

SITE WITH CONCRETE FOUNDATION

1. A pump should have adequate space for operation, main tenance, and inspection.

2. Sub Base mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit.

3. The foundation must be of adequate strength to support the complete weight of the pump, plus the weight of the liquid passing through it. A typical installation will have bolts with a pipe sleeve $2^1/_2$ times the bolt diameter embed ded in the concrete, sized and located in accordance with the dimensions given on the Pump Certified Outline Drawing, if provided. The pipe sleeve allows movement for final positioning of the foundation bolts to conform to the holes in the Sub Base flange. See Figure 2.

4. Remove water and/or debris from anchor bolt holes/ sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

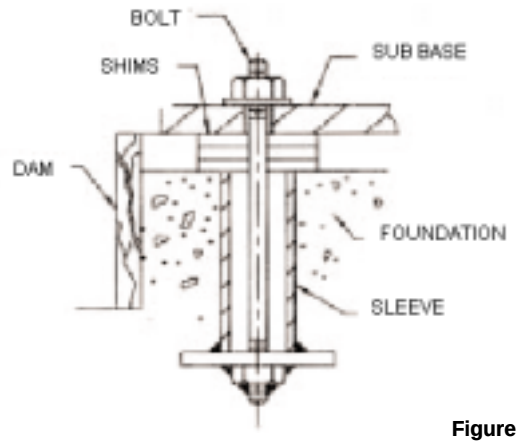


Figure 2

5. Carefully lower the Sub Base onto the foundation bolts. Hand tighten the bolt nuts.

6. Leveling the Sub Base may be done by several methods. Two common methods are:

   A. Leveling the wedges. This is shown in Figure 3.
   B. Leveling nuts on the anchor bolts.

   Regardless of the method, a machinist level must be used for leveling.

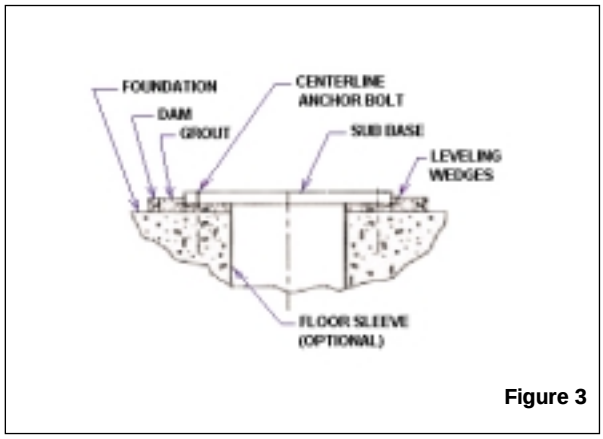


Figure 3

NOTE: When using a machinist level, it is important that the surface being leveled is free of all contaminants, such as dust, to ensure an accurate reading.

7. Level the Sub Base in two directions at 90 degrees on the machined surface. The levelness tolerance is 0.005 inches per foot for commercial, and 0.001 inches per foot for API.

SUB BASE GROUTING

1. Inspect foundation for dust, dirt, oil, chips, water, etc.,and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it. Refer to grout manufacturer's instructions.

2. Build dam around foundation. Thoroughly wet foundation.

3. Pour grout between Sub Base and concrete foundation, up to level of dam. Remove air bubbles from grout as it is poured by puddling, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.

4. Allow grout to set at least 48 hours.

5. Tighten foundation bolts.

SITE WITH STRUCTURAL STEEL FOUNDATION

1. When the pump is mounted directly on a structural steel frame, pumps shall be located directly over, or as near as possible to the main building members, beams, or walls. be bolted to the support to avoid distortion, prevent vibration, and retain proper alignment.

2. If a Sub Base is being bolted to a structural steel foundation, or the Sub Base is not grouted to the concrete foundation, use shims for leveling the plate.

PIPING

Guidelines for piping are given in the "Hydraulic Institute Standards", available from: Hydraulic Institute, 9 Sylvan Way, Parisppany, NJ 07054-3802 and must be reviewed prior to pump installation.

WARNING: Never draw piping into place by forcing at the flange connections of the pump. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.

1. All piping must be supported independently of, and line up naturally with, the pump flange.

2. DO NOT connect piping to pump until grout has hardened and pump hold down bolts have been tightened.

3. It is suggested that expansion loops or joints, if used, be properly installed in discharge line when handling liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment.

4. Carefully clean all pipe parts, valves and fittings, and pump branches prior to assembly.

5. Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump, this will permit inspection of the check valve. The isolation valve is required for regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.

6. Increasers, if used, should be placed between pump and check valves.

7. Cushioning devices should be used to protect the pump from surges and water hammer if quick-closing valves are installed in the system.

FINAL PUMP CHECK

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.

2. Check alignment, per the alignment procedure outlined on page 16, to determine absence of pipe strain. If pipe strain exists, correct piping.

Pump Installation

Pumps 20 feet (6m) or less in length are usually shipped assembled, with the exception of the driver and packing. When provided, refer to the Certified Pump Outline for the applicable base plate plan for location of anchor bolt holes.

INSTALLING A PARTIALLY ASSEMBLED PUMP

1. If a baseplate was supplied, install as described in Foundation/Piping Section page 10.

2. Clean the plate mounting flange and clean bottom surface of discharge head mounting flange.

3. Sling through discharge hand holes or thread two eyebolts through bolt holes in mounting flange and hoist unit into position over foundation.

NOTE: Eyebolts or sling should be rated to handle in excess of the pump weight (see Order Outline Drawing, if provided).

4. Lower the unit and carefully guide it so that unit does not strike the sides of the base plate. Continue to lower unit until the discharge head base flange engages and rests firmly on the plate, then secure with capscrews provided.

5. When a lineshaft is shipped separately check shaft for straightness; average total runout should not exceed 0.005" T.I.R. (0.127mm) for every 10 feet (3m). Shaft straightness must be within tolerance prior to installation.

6. Remove stuffing box (if installed), and carefully slide shaft through top column bearing retainer and thread into coupling after replacing stuffing box or seal housing. Useextreme care not to damage bearing retainer.

7. Refer to the remainder of this manual for complete assembly, startup, maintenance, disassembly, and recommended lubricants for the pump.

Installing Bowl Assembly

The following bowl installation instructions apply to pumps shipped disassembled.

WARNING: Do not work under a heavy suspended object unless there is positive support and safe guards which will protect personnel should a hoist or sling fail.

CAUTION: Do not attempt to lift bowl assembly by the pump shaft. This can result in damaging the pump shaft.

1. Prior to installing the bowl assembly, check that all capscrews are tight and any integral piping is installed. Remove all accumulated dust, oil, or other foreign material from the external surfaces.

2. Place two I-beam supports across the base plate opening, strong enough to safely support the weight of the entire pump assembly. These I-beams should be connected by threaded rods and nuts, so as to clamp them firmly together for the portion to be supported. (See Figure 4).

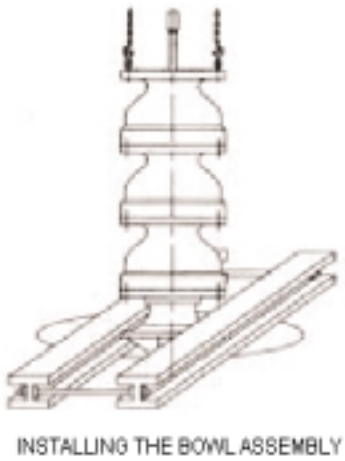
3. Put in place a suitable hoist or derrick over base plate opening. Place the elevator clamps just below the dicharge bowl flange or install two threaded eye bolts through bolt holes in flange 180° apart.

4. Attach sling to elevator clamps or eye bolts and hoist into position over foundation opening (See Figure 4).

5. Carefully lower bowl assembly, guiding the unit so it does not strike the sides of the opening. Continue to lower bowl assembly until the elevator clamps or discharge bowl flange rests firmly on the I-beam supports.

6. Place a cover over the discharge bowl opening to prevent entrance of dirt or other foreign matter.

CAUTION: Do not drop any foreign object into the bowl assembly. Such an object can cause serious damage to the pump and any downstream components Any foreign object dropped into the bowl assembly must be retrieved prior to continuing assembly.



INSTALLING THE BOWL ASSEMBLY

Figure 4

Installing the Column

OPEN LINESHAFT

Pump lineshafts are connected with threaded couplings. When provided, see the Certified Pump Outline Drawing for the number of column and shaft sections required:

1. Check the headshaft (608) and lineshaft (646) for straightness. Average total runout should be less than 0.0005" TIR (0.013 mm) per foot (0.305 m), not to exceed 0.005" T.I.R. (0.127 mm) for every 10 feet (3 m) of shafting.

2. Apply a thin film of oil to lineshaft (646) and coupling (649) threads (in non-galling material, or Molykote if galling material). Start threads manually until resistance is felt. A fine wire inserted in the drill hole at the center of the coupling can be used as a gauge to determine when the coupling is correctly positioned on the shaft. Run the upper lineshaft into the coupling until it is hand tight. Remove the wire after installing the coupling. Complete the joint using a pair of pipe wrenches, one on the top of pump shaft (660) and the other on the coupling (649).

CAUTION: Use "MOLYKOTE" Dow-Corning or equal for all galling material such as 316 stainless steel.

3. Use chain wrenches (clamp type) attached to the shaft to tighten the two shafts, using care not to damage any bearing journal areas. **NOTE:** Shaft threads are left-handed.

4. Hoist column section over bowl assembly. Lower column over lineshaft until column flange engages the discharge bowl. Manually thread the column into the discharge bowl.

   Complete joint by tightening column with chain tongs until the end of the column butts firmly against discharge bowl.

5. For flanged column, install two eyebolts diametrically opposite the upper flange of the bottom volume. Attach a sling to the eyebolts and to the hoist hook.

   Lower column section until the flange engages the flanged top bowl register. Insert as many bolts through both flanges as possible. Lift column assembly high enough to allow rotation of the supports. Install and tighten remaining capscrews gradually in diametrically opposite pairs until all are uniformly tight.

6. Lift the assembly and remove the elevator clamp or supports and slowly lower the bowl and column assembly. Place supports on the base plate and continue to lower the assembly until the column elevator clamps or colum flange comes to rest on the supports. Place an elevator clamp under the column pipe and allow it to butt firmly against the column pipe coupling

7. Place the bearing retainer over the shaft and locate it in the column coupling recess.

   Flanged columns will normally have separate bearings retailers, which will fit into the female registers in the flanges on both ends of the column. Large flange column will have the bearing retainer integral with the column. The top flange of the column will have a male register and the bottom flange of the column will have a female register.

   For metal bearings, pour a small amount of oil between the bearing and shaft. Install threaded coupling on protruding end of lineshaft.

8. Repeat the preceding procedures until all column sections required have been installed. For deeper set pump units, a stub shaft will be the top shaft.

Installing the Discharge Head

OPEN LINESHAFT

1. A-C Fire Pumps are provided with either a cast iron or fab steel type head. Install the discharge head as follows:

2. If the stuffing box is assembled to the head, remove it and all attached piping. See Figure 5 for the stuffing box provided for the A-C Fire Pump being assembled.

3. Remove coupling guard if provided. Attach a sling through windows (hand holes) or thread two eyebolts in the head driver support mounting holes diametrically opposite and hoist discharge head over the protruding headshaft.

CAUTION: Do not bend or scrape the shaft protruding above the column. This could result in bending or damaging the shaft.

4. Orient the discharge head in the required position and lower the head, centering the vertical hole with the headshaft or stub shaft protruding above the column. For threaded column, continue to lower the discharge head until the large threaded hole in the bottom of the discharge head rests squarely on top of the column. Rotate the discharge head, screwing it onto the column, butting the top of the column tightly against the discharge head.

5. For flanged column, continue to lower the discharge head until the discharge head engages the column. Install capscrews and secure discharge head to the column flange. Tighten capscrews gradually in diametrically opposite pairs.

6. Lift pump assembly high enough to allow rotation of the supports. Realign and lower assembly. Install and tighten remaining capscrews. Repeat rotation and tightening procedure, until all capscrews are uniformly tight.

7. Using a device with the capacity to support the weight of the entire pump assembly, hoist bowl, column, and head assembly and remove supports.

   NOTE: Eyebolts or sling should be rated to handle in excess of the pump weight.

8. Lower bowl, column and head assembly, until discharge head mounting flange engages base plate. Secure discharge head to mounting plate. Check the levelness of the discharge head in all directions, utilizing a spirit level across the driver mounting surface of the discharge head.

Stuffing Box Installation

Assemble stuffing box in accordance with Figure 5, below.

STANDARD CONSTRUCTION

1. Position gasket on discharge head. Slide stuffing box (616) down over shaft and into position on the gasket. Secure stuffing box with capscrews.

2. Insert lantern ring (621) into stuffing box. Be sure it is properly positioned so that it aligns with the lubrication passage in the stuffing box.

3. Grease the packing rings (620) for easier installation.

4. Twist the packing ring sideways to get it around the shaft easily. Start the first ring into the stuffing box. When the entire ring is worked in using the fingers, tamp it down using a split wood bushing (or equal) and push the packing ring down firmly. It must seal on the shaft and bore of the stuffing box. Install all five (5) rings in this manner. Stagger ring joints 90° apart. The split gland may be used as a tamper for the top ring.

5. Install the split gland and threaded nuts on the split gland studs. Tighten nuts then relieve the nuts and tighten finger tight. Attach bypass line to tube fitting in the stuffing box.

6. Final adjustment of the stuffing box must be made at pump start up. This final adjustment applies to all stuffing box styles.

7. A properly packed stuffing box should be loose enough to allow the shaft to be turned manually.

CAUTION: Check that the split gland is square in the stuffing box. Cocking can cause uneven compression of packing and damage to the shaft or sleeve.

CAUTION: Do not overtighten packing or excessive wear can occur on the shaft or sleeve.

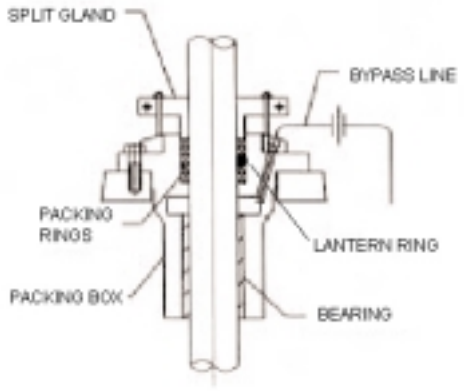


Figure 5

Installing the Driver

INSTALLATION OF A HOLLOW SHAFT DRIVER

This refers to either VHS type electric motors or hollow shaft type gear drives.A small paragraph will be devoted to combination electric motor and right angle gear drives.

NOTE: When pump is supplied with a thrust pot, do not secure driver to discharge head until after the thrust pot and flexible coupling are installed.

WARNING: Do not work under a heavy suspended object unless there is a positive support and safeguards which will protect personnel should a hoist or sling fail.

1. The driveshaft projecting through the quill or hollow-shaft of the driver is separate from the pump shaft and connected to same by a rigid flanged coupling or threaded coupling.

2. Driver support. When a driver support is furnished and not installed, proceed as follows:

   A. Hoist driver support, inspect the mounting surfaces, register, and clean these surfaces thoroughly.

   B. Install driver support on discharge head and secure with capscrews provided.

3. Attach a sling to the lifting lugs of driver, hoist motor, inspect the mounting surface, register, and shaft extension, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

4. Orient the motor conduit box in the required position. Align the motor mounting holes with the mating tapped holes on the discharge head. Lower the motor until the registers engage and the motor rests on the discharge head. Secure motor with capscrews provided.

5. On drivers having a non-reverse ratchet or pins, manually turn the driver shaft clockwise viewed from the top until the non-reverse ratchet or pins fully engage.

6. Lubricate motor bearings in accordance with instructions given on lubrication plate attached to the motor case.

7. The driving mechanism of all hollow shaft drives is shown on Figure 6. The driveshaft (606) extends up through the quill or hollow shaft of the motor (or gear drive) and is held in place by an adjusting nut (604), which not only carries all the static and hydraulic thrust of the impellers and shaft but also provides the adjustment for the impeller clearances.

8. After lowering and orienting the motor and/or gear drive as explained above, remove the drive coupling and the hold down bolts as shown in Figure 6.

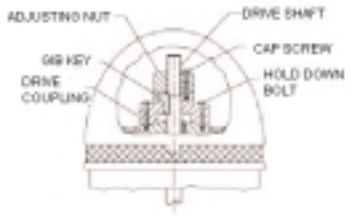


Figure 6

9. Screw the adjusting nut (604) loosely onto the end of driveshaft (606). Clean thoroughly and attach a light line below the nut. Lower the driveshaft through the motor quill shaft. Examine closely for dirt or burrs between shaft ends.

10. Apply a suitable thread compound to the driveshaft threaded coupling. Thread the driveshaft into the threaded coupling and tighten.

COMPLETION OF INSTALLATION OF A HOLLOW SHAFT DRIVER

1. Remove lifting sling and see if driveshaft centers inside the motor quill shaft within 0.06" (1.5mm). If it does not, misalignment is indicated.

2. Any driveshaft misalignment with driver quill shaft could be caused by a bent driveshaft, burrs, or foreign matter between shaft ends or any of the mounting flanges: motor to mount, mount to discharge head, discharge head mounting to plate or the plate itself could be out of level. If the latter, shimming between it and discharge head base, will correct it. Also, check concentricity of motor to motor stand to discharge head.

3. With the motor in place and the driveshaft projecting through the motor quill shaft, connect up the electricity and check motor rotation. This should be counter-clockwise when viewed from the top. See arrow on pump name plate. If motor does not rotate counter-clockwise, you can change the rotation by interchanging any two leads (for three phase only, for single phase motors see motor manufacturer's instructions.)

CAUTION: Never check motor rotation with the drive coupling in place. The bore clearance between the drive coupling and the pump shaft O.D. is so close that should the motor spin with this shaft stationary, galling and locking together is very likely to take place.

4. Install motor drive coupling, inserting the ratchet pins if a non-reverse ratchet is used. Match the coupling lugs with corresponding holes in motor. Tighten down hold down bolts evenly, making sure drive coupling is properly seated in the register fit.

5. Fit gib key (760) into keyway, by filing if necessary, to where there is a snug but sliding fit. This key must be able to be removed by gentle leverage with a screwdriver under it.

6. Be careful that the gib key (760) is not too high so as to hold up the adjusting nut (604) from seating on the drive coupling. If it is, cut off some of it.

7. Install adjusting nut (604) to hand tight.

GEAR DRIVES WITH ENGINES

1. The procedure for installing a hollow shaft gear is exactly the same as for the motor.

2. Checking pump rotation is very simple matter. Check the arrows of rotation on the engine. Throw out the clutch, take a bar and jack over the flexible driveshaft in direction of engine rotation, and note if it turns the pump shaft in the proper direction. **Note:** engines almost invariably turn clockwise when looking toward the gear drive.

COMBINATION ENGINE AND MOTOR DRIVES

1. On combination drivers, the motor is invariably on top with a projecting head shaft extension.

2. Follow all procedures outlined on page 19, except that the motor must be lowered over this extended driveshaft and great care must be taken to center it exactly so as not to bump or miss-align the shaft while the motor is being lowered into place.

3. There are several methods of running engines without electric motors and vise versa, requiring simple adjustment to the combination drive, but they are too numerous to mention here and can be obtained from the gear manufacturers instructions included with the shipment.

IMPELLER ADJUSTMENT FOR ALL HOLLOW SHAFT DRIVES

NOTE: Shaft adjustment up or down is accomplished by turning the adjusting nut (604) Figure 7.

NOTE: There are five holes in the adjusting nut and only four in the motor coupling. See Figure 7 and Figure 8.

CLOSED IMPELLERS

1. The same procedure is followed as described under, "Gear Drives with Engines", above. The adjustment is not critical. A clearance of 1/8" to 3/16" (4.8mm) is considered adequate. See Outline Drawing (if available) for this setting.

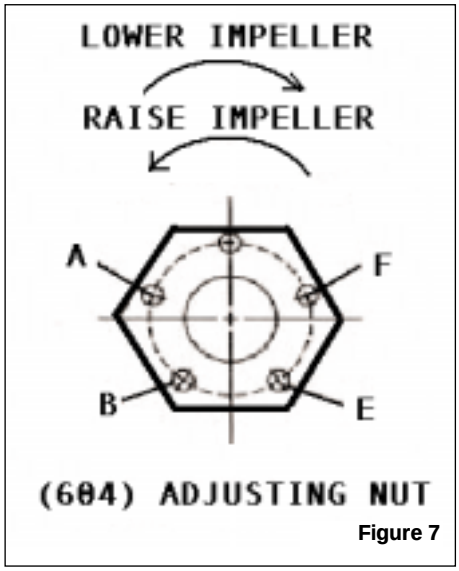


Figure 7

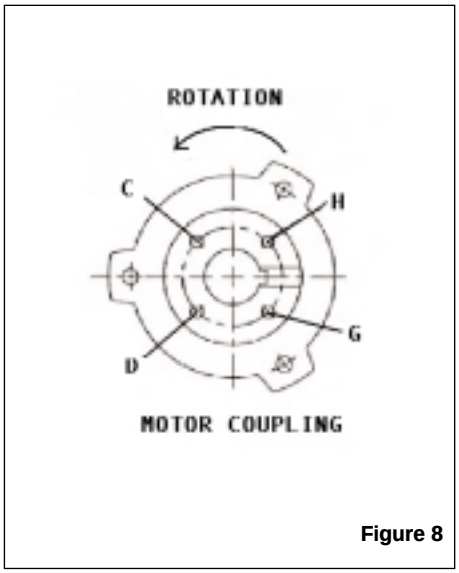


Figure 8

Section 4 - Operation

Pump Startup & Operation

PRE-START PROCEDURE

Consult the applicable manufacturer's instructions for detailed information for the prime mover (electric motor, engine or steam turbine), coupling, driveshaft, gear head or mechanical seal. When applicable to the pump and prior to startup, check the following.

1. Confirm that the following procedures described in the "Installing the Drivers" sections have been performed:

   A. Wiring of Driver.

   B. Driver must rotate counterclockwise (CCW) when viewed from above.

> **WARNING:** Do not check motor rotation unless motor is bolted to pump and drive coupling is removed.

   C. Check alignment between pump and driver.

   D. Impeller adjustment has been made.

   E. Mechanical seal lock collar is attached to shaft.

2. Make sure mechanical seal is properly lubricated and all piping to seal is connected. Also, check that all cooling, heating and flushing lines are operating and regulated.

3. All connections to driver and starting device match wiring diagram.

4. Voltage, phase, and frequency on motor nameplate agree with line current.

5. Rotate shaft manually to ensure impellers are not binding.

6. Verify that driver bearings are properly lubricated and check oil level in housing.

7. Check that auxiliary seal components are properly vented.

8. Inspect discharge piping connection and pressure gauges for proper operation.

PRECISION ALIGNMENT

A Precision Alignment Procedure, Section MA027, has been written that describes our factory precision alignment.

PUMP STARTUP

1. Partially close valve in discharge line.

2. Crack open suction side valves on pressurized systems slowly. Open suction valves fully.

3. Vent system when the pump surface temperature has reached an equilibrium.

4. Start pump.

5. When pump is operating at full speed, slowly open discharge valve. If driver overheats or there is excessive vibration, stop the pump.

   NOTE: If the impellers have not been finally adjusted, due to extreme liquid temperature, they should be adjusted prior to startup and after pump surface temperatures have reached equilibrium.

STUFFING BOX

With the pump in operation, there should be some leakage at the stuffing box packing. The correct leakage is a rate which keeps the shaft and stuffing box cool (approximately one drop per second). Check the temperature of the leakage as well as the discharge head. If the pump runs hot and the leakage begins to choke off, stop the pump and allow it to cool down. A few light taps with a hammer on the gland will

upset the packing sufficiently to resume leakage. After pump has cooled, restart pump and follow preceding procedure. Run pump 15 minutes, check leakage, if it exceeds two drops per second, adjust packing as described in "Packing Adjustment and Replacement" (page 17).

THRUST POT INSTALLATION

Thrust pots are not standard on most pumps. A separate supplement will be inserted for pumps with thrust pots.

Section 5 - Preventive Maintenance

Preventive maintenance includes periodic inspection of oil level in thrust pots, re-lubrication of electric motors, gear drives and prime mover. Systematic inspection of the pump and its components shall be made at regular intervals. The frequency required depends upon the operating conditions of the pump and its environment. See Page 17 for Preventive Maintenance Procedures. Consult the applicable manufacturer's instructions for detailed information on maintenance for the prime mover, driveshaft, electric motors and gear drives. Any deviation in performance or operations from what is expected can be traced to some specific cause. Variances from initial performance will indicate changing system conditions, wear, or impending breakdown of the unit.

WARNING: Before initiating maintenance procedures, disconnect all power sources to the equipment and accessories and compleyely discharge all parts and accessories which retain electric charge. Failure to comply may result in severe personnel injury or death.

Packing Adjustment & Replacement

Pumps equipped with packing, shall be adjusted whenever the leakage rate exceeds two drops per second. If there is no leakage or the stuffing box overheats, stop the pump and allow packing to cool. Back off gland nuts. This will allow the entire set of rings to move away from the bottom of the box, without relieving pressure of the packing on the shaft. Restart the pump. It may be necessary to repeat this procedure several times before proper amount of liquid comes through to efficiently prevent overheating. If leakage is excessive, adjust the stuffing box as follows:

1. With the pump in operation, tighten the gland nuts one-quarter turn for each adjustment. Allow packing to equalize against the increased pressure and leakage to gradually decrease to a steady rate, before making another adjustment.

CAUTION: Do not overtighten the stuffing box. Excessive pressure can wear out packing prematurely and seriously damage the shaft.

2. With the pump shut down and when packing has been compressed to the point that the gland is about to contact the upper face of stuffing box, remove the split gland, add one extra packing ring and readjust. If this fails to reduce leakage to two drops per second, remove all packing rings and replace with new rings.

3. Remove the packing with the aid of a packing hook. If a lantern ring is provided, remove it by inserting a wire hook in the slots of the ring and pull it from the packing box. Thoroughly clean the stuffing box of all foreign matter.

4. If the replacement packing is in the form of a continuous coil or rope, it must be cut into rings before installing. Tightly wrap one end of the packing material around the top shaft like one coil spring, and cut through the coil with a sharp knife. For re-packing sequence, refer to "Stuffing Box Installation" (page 13).

Thrust Pot Lubrication & Maintenance

It is a good practice to flush the oil reservoir before first time operation, and at the time of oil changes, to remove all grit particles in the oil reservoir container. Use the same type of oil to flush reservoir as specified for lubrication. Because of the special nature of the TURBINE OIL recommended, it is wise to keep a supply on hand. Remove drain plug before flushing. Flushing oil may be poured through oil fill opening in cover after removing oil fill plug. The proper oil level when the unit is not running shall not be more than 1/8" to 1/4" from the top of the oil sight gauge. Overfilling may result in overheating of the unit. During operation the oil level in the sight gauge may be higher than the recommended range mentioned above. Under no circumstances is it allowed to rotate the unit when the oil in the sight gauge is not at the required level. To avoid oxidation of the anti-friction bearings during shut-down periods lasting longer than one week, it is recommended to fill up the oil reservoir until the oil runs over the oil retainer tube and down the shaft so that the bearings remain completely immersed in the oil. Before startup, do not forget to drain the excess oil to its required level. Oil change depends on the severity of the environment. Generally speaking, when the oil in the sight gauge changes to a darkish brown color, it is time for an oil change. However, for a longer bearing life, it is recommended that the oil be changed every six months. Be sure to flush the oil reservoir, as noted above, with each oil change.

Preventive Maintenance Procedures Thrust Pot

PROCEDURE	TIME INTERVAL (in operating hours)
Clean dirt, oil and grease from driver and discharge head.	As required.
Clean driver ventilation passage to prevent overheating.	As required.
Change lubrication in gear drive.	2,000 or once a year
Change lubrication in thrust pot.	See Section 13
Tighten all loose bolts, and check for excessive vibration.	As required.
If packing is grease lubricated, add as required.	100
Check that there is some leakage through stuffing box while pump is in operation. Do not tighten gland nuts unless necessary. Refer to Page 17 for tightening requirements.	As required.
Maintain a liquid film of lubrication between the seal rubbing faces.	As required.
Regrease motor bearings: 1800 RPM and above Below 1800 RPM	 1,000 2,000

Corrective Maintenance

Corrective maintenance procedures include troubleshooting for isolating and remedying malfunctions of the pump and its components during operation.

TROUBLE	PROBABLE CAUSE	REMEDY
1. Pump does not start	A. Electrical circuit open or not completed	Check circuit and correct.
	B. Steam turbine not receiving steam pressure	Make sure that turbine receives full steam pressure.
	C. Impellers binding against bowl	Reset impeller adjustment
	D. Low voltage supplied to electric driver	Check whether driver wiring is correct and receives full voltage.
	E. Defective motor	Consult factory.
2. No liquid delivered	A. Insufficient submergence of bowl assembly	Check for adequate submergence.
	B. Obstruction in liquid passage	Pull pump, inspect impeller and bowl.
3. Not enough liquid delivered	A. Speed is too low	Check if driver is directly across the line and receiving full voltage.
	B. Wrong rotation	Check for CCW rotation when viewed from above. Check engagement of motor coupling.
	C. Total pump head is too high	Check pipe friction losses. Larger piping may correct condition.
	D. Partial obstruction in liquid passages	See step 2-B.
	E. Cavitation	Insufficient NPSH available.
	F. Impellers adjusted too high	See pages 3-B.
4. Not enough pressure	A. Speed is too low	See step 1-B.
	B. Obstruction in liquid passages	Pull pump and inspect impeller and bowl passages.
	C. Wrong rotation	See step 3-B.

TROUBLE	PROBABLE CAUSE	REMEDY
5. Pump works for a while and quits	A. Excessive horsepower required	Use larger driver. Consult factory.
	B. Pumping higher viscosity or specific gravity liquid than designed for	Test liquid for viscosity and specific gravity.
	C. Mechanical failure of critical parts in these parts will cause a drag on the shaft.	Check bearings and impellers for damage. Any irregularities
	D. Speed may be too high	Check frequency on motor.
	E. Misalignment	Re-align pump and driver.
6. Pump takes too much power	A. Damaged impeller	Inspect, replace if damaged.
	B. Foreign object lodged between impeller and bowl	Remove object as required.
	C. Specific gravity higher than pump designed for	Test liquid for viscosity and specific gravity.
	D. Viscosity too high, partial freezing of pumpage	Check for both. They can cause drag on impeller.
	E. Defective bearing shaft sleeve for scoring.	Replace bearing, check shaft or
	F. Packing is too tight	Release gland pressure. Retighten. Refer to Packing Adjustment and Replacement (page 24). Keep leakage flowing. If no leakage, check packing, sleeve or shaft.
7. Pump is too noisy	A. Cavitation (insufficient NPSH available)	Increase liquid level in sump.
	B. Bent shaft	Straighten as required.
	C. Rotating parts binding, loose or broken	Replace as required.
	D. Bearings are worn out	Replace bearings.
8. Excessive vibrations	A. Coupling misalignment, bent impeller unbalance, worn bearings, cavitation, piping strain and/or resonance factory service assistance.	Determine cause utilizing shaft vibration frequency analyzer and/or pump disassemble. Complex problem may require
	B. Motor or gear driveshaft end play maladjustment	See Installation of Hollow Shaft Driver (VHS).
9. Pump leaks excessively	A. Defective packing at stuffing box	Replace worn packing. Replace packing damaged by lack of lubrication.
	B. Wrong type of packing installed or run-in. Replace improper packing with correct grade or liquid being pumped.	Replace packing not properly
10. Stuffing box is overheating	A. Packing is too tight	Release gland pressure. See step 6 F
	B. Packing is not lubricated packing if burnt or damaged. Re-grease packing as required.	Release gland pressure and replace all
	C. Wrong grade of packing	Consult factory.
	D. Stuffing box improperly packed	Repack stuffing box.
11. Packing wears too fast	A. Shaft or shaft sleeve worn or	Pull pump and remachine, or replace shaft and/or sleeve.
	B. Insufficient or no lubrication	Repack and make sure packing is loose enough to allow some leakage.
	C. Improperly packed old packing is removed and stuffing box is clean.	Repack properly, make sure all
	D. Wrong grade of packing	Consult factory.

Section 6 - Disassembly & Reassembly

Disassembly

WARNING: Before starting, lock out driver power to prevent accidental startup and physical injury.

NOTE: Pump components should be match-marked prior to disassembly to ensure they are reassembled in the correct location.

HEAD AND COLUMN

1. On pumps which are driven through a gear drive, remove the driveshaft between the gear and the prime mover.

2. On pumps, which are electric motor driven, remove the electrical connections at the conduit box and tag the electrical leads, so they can be reassembled the same way they were disassembled.

WARNING: Never try to lift entire pump assembly by the lifting lugs or eyebolts furnished for the driver only.

3. Uncouple driver (or gear box) from pump shaft and mounting flanges and lift off by the lifting lugs or eyebolts as furnished.

4. Disconnect discharge head from the discharge piping. Remove all hold down bolts and integral piping. Remove coupling, packing box and proceed with disassembly down to the bowls by reversing the procedures described in detail for assembling the unit.

BOWL ASSEMBLY

The bowl assembly is composed of a suction bell, intermediate bowl(s), discharge bowl, impellers and securing hardware, bearings, and pump shaft.

Turbine bowl impellers are secured to the shaft by either a taper collet or a key and split thrust ring. Follow only those procedures that apply to the particular construction supplied.

NOTE: Match mark bowl assembly in sequence of disassembly to aid in the reassembly procedure.

TAPER LOCK CONSTRUCTION BOWL DISASSMBLY

1. Remove capscrews that secure discharge bowl (669) to intermediate bowl (670).

2. Slide discharge bowl off the pump shaft (660).

3. Pull shaft out as far as possible and strike impeller hub utilizing a collet driver or equivalent sliding along the pump shaft to drive the impeller off the taper collet (See Figure 9).

4. After the impeller is freed, insert a screwdriver into the slot in the taper collet and spread it to remove the collet. Slide the collet off the pump shaft.

5. Repeat the above procedures until the bowl assembly is completely disassembled.

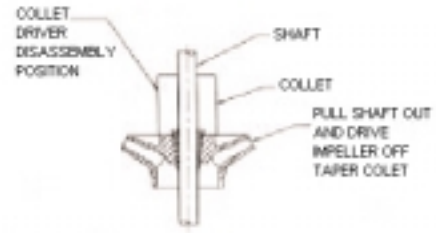


Figure 9

KEYED CONSTRUCTION BOWL DISASSEMBLY (**Fire Pump Option**)

1. Remove capscrews that secure discharge bowl (669) to intermediate bowl (670).

2. Slide discharge bowl off the pump shaft (660).

3. Remove capscrews (759) and split thrust ring (725) from pump shaft.

4. Slide impeller off the pump shaft and remove the key (730). If impeller is seized to the shaft, strike impeller with a fiber mallet and drive impeller off the pump shaft.

5. Repeat the above procedures until the bowl assembly is completely disassembled.

TURBINE BOWL – WEAR RING REMOVAL

1. Remove set screws or grind off tack weld, when rings are furnished with those locking methods.

2. Utilizing a diamond point chisel, cut two "V" shaped grooves on the bowl wear ring approximately 180° apart. Use extreme care not to damage the wear ring seat.

3. With a chisel or drift, knock the end of one half of the ring in, and pry the ring out.

4. On special materials such as chrome steel, set up the bowl in a lathe and machine the wear ring off using extreme care not to machine or damage the ring seat.

BOWL, SUCTION BELL AND LINESHAFT BEARING REMOVAL

1. Utilizing an arbor press and a piece of pipe or sleeve with an outside diameter slightly smaller than the diameter of the bowl or lineshaft bearing housing bore, press the bearing out.

2. Remove suction bell bearing by setting the suction bell in a lathe and machine the bearing off. The suction bell bearing can also be removed by using bearing pullers to pull the bearing out.

   NOTE: Bowl bearings are press fit. Do not remove unless replacement is necessary.

Inspection & Replacement

1. Clean all pump parts thoroughly with a suitable cleaner.

2. Check bearing retainers for deformation and wear.

3. Check shafts for straightness and excessive wear on bearing surfaces. Check deflection of shafts, average total runout shall not exceed 0.005" (0.13mm) T.I.R. for every 10 feet (3m) of shaft length.

4. Visually check impellers and bowls for cracks and pitting. Check all bowl bearings for excessive wear and corrosion.

5. Replace all badly worn or damaged parts with new parts. In addition, replace all gaskets and packing as required.

TURBINE BOWL WEAR RING INSTALLATION

1. Place chamfered face of the bowl or impeller wear ring towards the ring seat and press the ring into the seat. Use an arbor press or equal, making sure the ring is flush with the edge or the wear ring seat.

BOWL, SUCTION BELL AND LINESHAFT BEARING INSTALLATION

1. Press bearing (653) into retainer (652) using an arbor press or equal.

2. Press bearing (690) into suction bell (689) using an arbor press or equal.

3. Press bearings (672) into intermediate bowl (670) and beaing (664) into discharge bowl (669). Place the bowl with the flange downward and press bearing through chamfered side of bowl hub until the bearing is flush with the hub using an arbor press or equal.

TAPER COLLET CONSTRUCTION BOWL ASSEMBLY

1. For ease in reassembly apply a thin film of turbine oil to all mating and threaded parts.

2. If the sand collar is not assembled to the shaft, install the sand collar. The sand collar is attached to the shaft with a shrink fit. The larger diameter of the counterbore of the sand collar goes toward the suction bell bearing. Heat the sand collar until it slips over the shaft and quickly position it so that the bottom of the sand collar is set according to the "X" dimension, before it cools. See Figure 10. See Table 1 for the "X" dimensions. Slide the pump shaft into the suction bell bearing until the sand collar rests against the suction bell.

WARNING: Wear protective gloves and use appropriate eye protection to prevent injury when handling hot parts.

3. Hold the shaft in this position by inserting a capscrew with an assembly jig into the hole in the end of the suction bell and then into the threaded hole in the end of the shaft.

4. Slide the first impeller over the shaft until it seats on the suction bell.

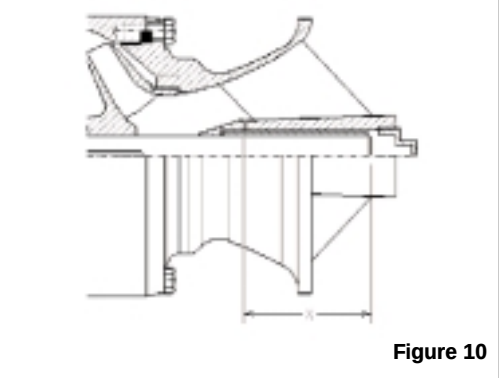


Figure 10

Pump Shaft Set Up Dimensions

Pump Model	"X" Dim.
10WALC	5.19"
11CLC	4.88"
11CHC	4.88"
12CHC	5.31"
14RJHC	5.06"
14RHHC	7.13"
16DMC	5.88"
18DMC	7.56"
18DHC	7.56"
20EHC	7.00"

Table 1

5. Insert a screwdriver into the slot in the taper collet (677) spread the slot and slide the collet over the pump shaft. Hold the impeller against bowl and slide the collet into the impeller hub.

6. Hold shaft with capscrew and washer against the suction bell and drive the taper collet into place with a collet driver, (See Figure 11). After collet is in place, recheck "X" dimension (Table 1).

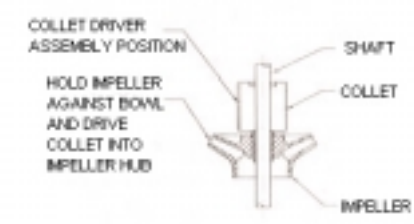


Figure 11

7. Slide intermediate bowl (670) onto shaft and secure with capscrews provided.

8. Repeat preceding procedure for number of stages required.

9. Remove capscrew and washer and check that the shaft rotates freely without dragging or binding. Also check for adequate lateral end play.

KEYED CONSTRUCTION BOWL ASSEMBLY

1. Install key (730E) into pump shaft keyway, slide impeller (673) over shaft and locate it on the key.

2. Install split thrust ring (725) on pump shaft groove and secure to impeller with capscrews (759E).

3. Slide intermediate bowl (670) over pump shaft and secure to suction bell (689) with capscrews (759E).

4. Repeat preceding procedures for the number of stages required.

FINAL ASSEMBLY

After assembly of bowl assembly, reassemble pump as described in Section 3, Installation. Refer to Section 4, Operation for startup and adjusting procedures.

Section 7 - Repair Parts

ORDERING PARTS

When ordering spare or replacement parts. The pump serial number and size and type of pump must be given. This can be found on the nameplate furnished with the unit. Give the complete name and reference number of each part as indicated on the applicable sectional drawings, Figure 12 or Figure 13, and the quantity required.

STOCKING SPARE PARTS

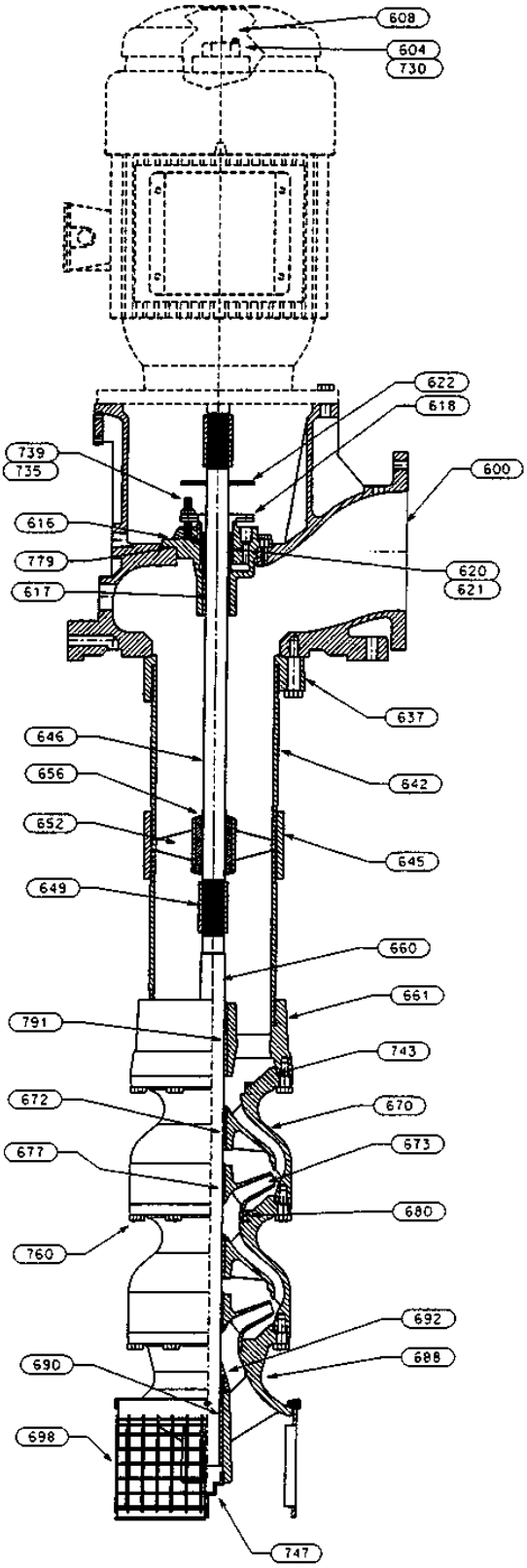
Spare parts to be kept in inventory will vary according to service, field maintenance, allowable down time and number of units. A minimum inventory of one complete set of bearings and one spare of each moving part is suggested.

RETURNING PARTS

A completed Return Material Authorization (RMA) form must accompany all materials returned to the factory. The RMA forms can be obtained direct form the factory or through your A-C Fire Pump Systems representative. The RMA form must be filled in completely and forwarded as directed thereon. Parts being returned under warranty claim must have a complete written report submitted with the RMA form.

CAUTION: Returned material must be carefully packaged to prevent transit damage – the factory cannot assume any responsibility for parts damaged in transit.

SECTIONAL VIEW
FIRE PUMP TURBINE
CAST IRON HEAD/THREADED COLUMN



Discharge Head Assembly

Item	Description
600	Discharge Head
616	Stuffing Box
617	Stuffing Box Bearing
779	Stuffing Box Gasket
622	Slinger
620	Packing
618	Stuffing Box Split Gland
757	Gland Hex Screw
604	Adjusting Nut
730	GIB Key
608	Headshaft
739/735	Stuffing Box Stud & Nut
637	Hanger Flange
621	Lantern Ring

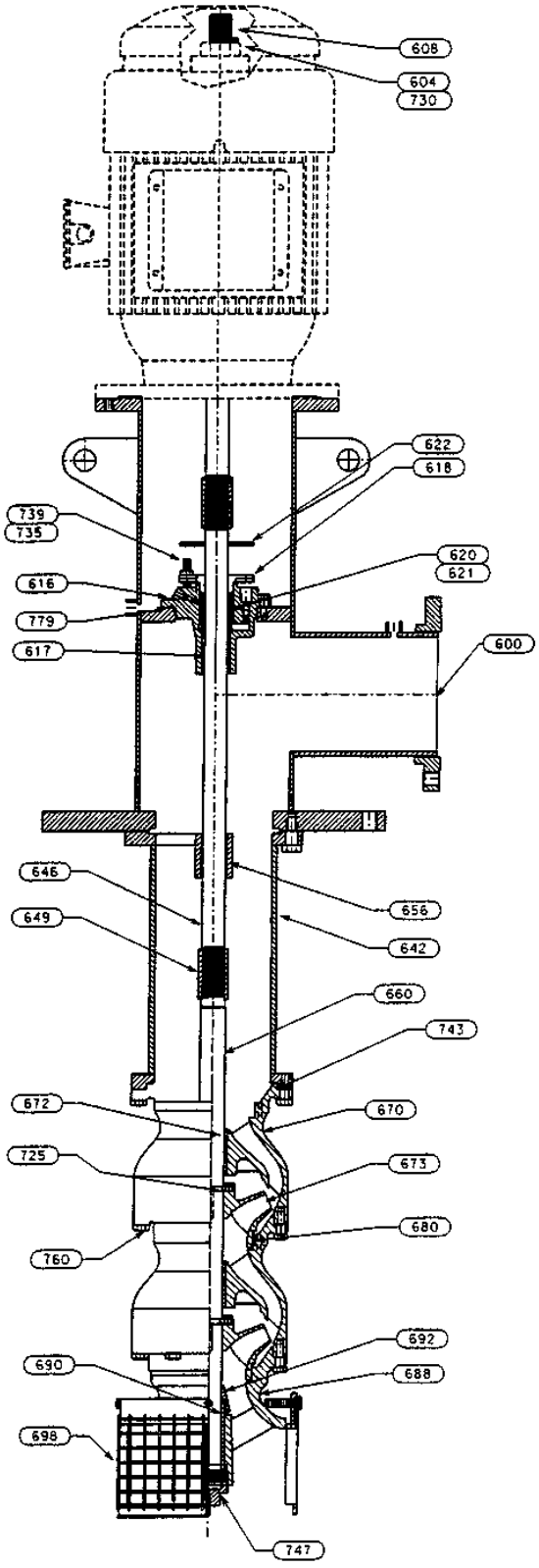
Column & Lineshaft Assembly

Item	Description
642	Column Pipe
645	Column Coupling
646	Lineshaft
649	Lineshaft Coupling
652	Bearing Retainer
656	Lineshaft Bearing

Bowl Assembly

Item	Description
688	Suction Bell
747	Plug
690	Suction Bearing
692	Sand Collar
760	Hex Bolt
673	Impeller
677	Impeller Taper Lock
670	Intermediate Bowl
680	Wear Rings
672	Inter Bowl Bearing
661	Discharge Bowl
791	Discharge Bearing
660	Bowl Shaft
698	Suction Strainer
743	O-Ring

SECTIONAL VIEW
FIRE PUMP TURBINE
FAB STEEL HEAD/FLANGED COLUMN



Discharge Head Assembly

Item	Description
600	Discharge Head
616	Stuffing Box
617	Stuffing Box Bearing
779	Stuffing Box Gasket
622	Slinger
620	Packing
618	Stuffing Box Split Gland
757	Gland Hex Screw
604	Adjusting Nut
730	GIB Key
608	Headshaft
739/735	Stuffing Box Stud & Nut
621	Lantern Ring

Column & Lineshaft Assembly

Item	Description
642	Column Pipe
646	Lineshaft
649	Lineshaft Coupling
656	Lineshaft Bearing

Bowl Assembly

Item	Description
688	Suction Bell
747	Plug
690	Suction Bearing
692	Sand Collar
760	Hex Bolt
673	Impeller
725	Thrust Ring
670	Intermediate Bowl
680	Wear Rings
672	Inter Bowl Bearing
660	Bowl Shaft
698	Suction Strainer
743	O-Ring

Appendix I

APPENDIX I

FIELD SERVICE

INSTALLATION AND STARTUP CHECKLIST

Customer: _____ **A-C Fire Pump Serial No.:** _____

Pump Model: _____ **Pump Size:** _____ **Stages:** _____

USE THIS CHECKLIST IN CONJUNCTION WITH THE STANDARD INSTRUCTION MANUAL FURNISHED WITH THE EQUIPMENT. INITIAL EACH ITEM COMPLETED OR WRITE N/A IF NOT APPLICABLE.

Part 1: **System and Installation Inspections and Checklist**

_____ 1) Verify that the pump foundation (head, barrel, sub-base, etc.) is level to within .005 inch per foot of diameter. Note that on API units the level requirement is .001 inch per foot of diameter.

_____ 2) Inspect the foundation to determine whether it appears adequately designed to handle the weight and oading of the pump. Note that A-C Fire Pump Systems does not design foundations and is not responsible for foundation inadequacies.

_____ 3) Insure that the head, or barrel, or sub-base, etc., is properly grouted using high quality non-shrink grout. This can be verified by "sounding" the foundation.

_____ 4) Insure that all the anchor bolts are tight.

_____ 5) Insure that the discharge piping is properly supported and that there is no excess nozzle loading on the discharge flange. Verify this by loosening and then checking freedom on the flange bolting.

_____ 6) On units with flexible or expansion joints attached to pump discharge, insure that tie rods are in place and properly installed.

_____ 7) Insure that all valves operate freely and are properly installed for the direction of flow. Also insure that they have the proper pressure rating.

_____ 8) In conjunction with your contact or customer's rep, verify where the pumpage is going and that the system is properly "lined up" for the test.

_____ 9) Verify that the pumpage supply will be continuously available for the duration of the test. It is very important that the initial run is at least ten minutes in duration in order to completely 'flush' the pump.

_____10) If possible, verify the cleanliness of the pumpage and piping. If on hand during the installation, insure that the sump, barrel, and piping is clean.

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FIELD SERVICE

INSTALLATION AND STARTUP CHECKLIST

Part 2: **Pump Assembly Pre-Start Inspections and Checks**

_____ 1) Verify that the drivers (motors, gears, engines, etc.) are properly lubricated before startup. On drives with grease lubricated motor bearings, insist that they be greased on site as motor vendors generally only add grease to the bearing itself during assembly. Inspection will usually reveal the in and out ports as well as the reservoir to be "dry". Lubrication information can usually be found on special tags on most motors or in the motor manuals and this gives type and quantity of lubrication to be used.

_____ 2) Determine the allowable number of cold/hot starts with the motor vendor. This is very important especially during initial startup when numerous "bugs" have to be worked out of the system and controls. The general rule of thumb is two cold or one hot start per hour. Exceeding the recommended starts breaks down the motor's insulation and can cause failure. Merger the motor if possible.

_____ 3) Prior to coupling up the driver to the pump, verify proper rotation of the driver by "bumping" it. Note that the proper rotation for our vertical pumps is CCW when viewed from above. In addition to verifying rotation, run uncoupled to insure that the driver runs smooth and sounds normal. Note that on units with VHS motors, you must remove the driveshaft if a coupling is provided and the steady bushing and driver coupling in the event one is not provided. On drivers with NRR's remove ratchet pins, if possible. Otherwise, rotate the drive coupling clockwise until pin stops tight against ratchet plate. If customer refuses to allow a check of rotation, make a notation in Section 4B and have customer sign and date before proceeding.

_____ 4) Only after verifying the proper rotation of the driver, proceed with the coupling of the pump to the driver. On VHS units you will set the impeller lift using the adjusting nut atop the motor. The specific impeller lift required for an individual pump will be listed on the pump nameplate and can also be found on the outline drawing.

_____ 5) Special alignment of the pump to the motor is not usually required as all components are equipped with register fits. An exception to this is a pump equipped with jacking bolts. A unit so equipped requires the motor be physically aligned to the pump.

_____ 6) Upon completion of coupling of the pump to the driver, and the setting of the impeller lift, verify, using a dial indicator, that the shaft run-out above the sealing element is not excessive.

LIMITS: PACKING = MAX. .008"

_____ 7) On units with packing, do not over-tighten the gland. Excessive leakage should be eliminated over time and not all at once. Normal leakage is 60 drops/minutes = 13 liters/day.

_____ 8) On water lubricated, enclosed lineshaft units, check the water PSI and flow rate. Check the solenoid valve and its connection for proper operation.

APPENDIX I

FIELD SERVICE

INSTALLATION AND STARTUP CHECKLIST

Part 3: **Starting Unit**

_____ 1) After all checks in Parts 1 and 2 are completed, conduct a startup meeting with customer to discuss the actual procedures they might require during startup and commissioning. Also, verify with the customer that their 'system' is ready for pumpage.

_____ 2) When the system is ready, push the start button and adjust the discharge valve to meet the design point (if required).

_____ 3) Watch for signs of trouble (look and listen). Again, the unit must run at least ten minutes to flush out the pump and system.

_____ 4) Verify that the unit runs smoothly with no unusual noise, vibration, or over heating.

_____ 5) Run the unit for one hour mechanical test (if possible).

Part 4: **Readings and Notes**

A) Readings

Impeller Lift: _____ Shaft Runout: _____

Megger: _____

Vibration: _____

B) Notes:

_____

_____

_____

_____

_____

_____

_____

_____ _____

A-C Fire Pump Representative **Date**

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xyleminc.com

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