"Pump parts...may easily cause personal injury if dropped or unsafely handled."

Before opening the conduit box of an electric motor, be certain that the current to the motor is shut off. An electrical shock from contact with live motor leads can be fatal.

The driver cover must be in place when the pump is in operation. Rotating parts below this cover could cause grave personal injury if exposed.

Petroleum-base cleaning solvents are flammable. Smoking by personnel in the vicinity of these solvents is extremely hazardous and must not be permitted.

Pump parts, and the tools and rigging equipment used in installing pumps, are heavy and may easily cause personal injury if dropped or carelessly handled. The normal precautions and safety rules associated with the erection of heavy machinery, in regard to manual lifting, use of power equipment, and handling of tools, must be observed in the installation of this pump.

Do not work under a heavy suspended object unless there is a positive support under it to stop its fall in event of sling or hoist failure. Disregard of this warning could result in grave personal injury or death.

"Disregarding this warning may result in grave personal injury."
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"Refer to instruction manual step by step ...."
SECTION 1
INTRODUCTION

This manual gives detailed instructions for installing, adjusting, operating, servicing, disassembling, and repairing Peerless Hydro-Line (vertical can-type) pumps.

Hydro-Line pumps are produced in several standard models and many variations. It would be impractical to give complete information for every possible variation; therefore, the instructions given here cover only the more common configurations of each model. These are illustrated in Fig. 1-1 through 1-4. For other variations it will be necessary to interpret the instructions to suit the requirements of the pump being installed.

Proper installation and maintenance of this pump will contribute to maximum efficiency and long, trouble-free life. Before starting the installation, review the entire procedure given in the manual, omitting those portions which do not apply to the particular pump to be installed. Refer to the manual step by step as the work progresses. Retain the manual for future use in servicing the pump.

WARNING

THE PUMPS DESCRIBED BY THIS MANUAL MUST NOT BE INSTALLED IN ANY MANNER EXCEPT AS SPECIFIED HEREIN, AND MUST NOT BE OPERATED AT S pixel speeds, pressures, capacities, or temperatures other than those specified for the order. A table of temperature limitations for various bearing materials is reproduced below.

THESE PUMPS MUST NOT BE USED TO PUMP ANY FLUID OTHER THAN THOSE SPECIFIED FOR THE ORDER.

VIOLATION OF THIS WARNING MAY RESULT IN SERIOUS PROPERTY DAMAGE OR GRAVE PERSONAL INJURY.

BEARING TEMPERATURE LIMITATIONS AND RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Material</th>
<th>Temp. Range °F</th>
<th>Specific Gravity Minimum</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoprene</td>
<td>32 to 115</td>
<td>1.0</td>
<td>Good for abrasive service. Do not use where (H_2S) is present.</td>
</tr>
<tr>
<td>Bronze: SAE 660 (In Bronze or class 30 cast iron housing)</td>
<td>-60 to 170</td>
<td>0.5</td>
<td>General purpose bearing successfully applied on non-abrasive fresh or salt water and hydro-carbons.</td>
</tr>
<tr>
<td>Carbon</td>
<td>-300 to 450(^\circ)</td>
<td>0.3</td>
<td>Good for extreme temperatures and non-abrasive fluids. Also excellent where fluid has poor lubricating qualities.</td>
</tr>
<tr>
<td>Teflon</td>
<td>0 to 170(^\circ)</td>
<td>0.3</td>
<td>Non-abrasive fluids. Not to be used on pump more than 2900 rpm.</td>
</tr>
<tr>
<td>Cast Iron: with ground and electrofilmed I.D. (In class 30 cast iron housing).</td>
<td>32 to 180</td>
<td>0.8</td>
<td>Factory may substitute bronze at its option where fluids are hydro-carbons.</td>
</tr>
</tbody>
</table>

\(^\circ\) Refer to factory for Hydro-Line operating temperatures below -20 and above 300\(^\circ\).  
\(^\circ\) Used for temperature specified on order only.
Fig. 1-1 Typical Hydro-line Pumps

Mechanical seal and spacer-type coupling shown. Pumps equipped with packing use a coupling with no spacer.
Fig. 1-2 Typical Hydro-Line Pumps

Mechanical seal and spacer-type coupling shown. Pumps equipped with packing use a coupling with no spacer.
MODEL HE

Other variations of Model HE are similar to Model HL except that vertical hollow-shaft motor and threaded coupling are used.

Fig. 1-3 Typical Hydro-Line Pumps
Fig. 1-4. Typical Hydro-Line Pumps with column between discharge head and bowl unit. Mechanical seal and spacer-type coupling shown. Pumps equipped with packing use a coupling with no spacer.
SECTION 2
MATERIALS AND EQUIPMENT REQUIRED

The materials and equipment necessary for installation will vary with the size of the pump and the type of installation. The following list is offered only as a guide.

A. Bulk Material

- Lubricating oil (such as automotive engine oil)
- Grease (See Table 10-1).
- Solvent, petroleum-base (such as kerosene, distillate or unleaded gasoline)
- Grouting material, non-shrinking

B. Rigging Equipment

- Mobile power hoist or a traveling crane
- Elevator clamp (2) — for threaded-type bowl unit
- Box Clamp (2) — for flange-type bowl unit
- Sling

- Eyebolts
- Clevises — for use with eyebolts
- Pry bars (2)
- Timbers — size, length and quantity as required to support long pump parts on the floor
- Tail rope — size and length as required (for pumps having a column section)
- Spirit level

C. Hand Tools

- Pipe wrench (2)
- Chain tongs (2)
- Clean rags
- Feeler gages
- Torque wrench

Set of mechanic's hand tools, including: files, brush, pliers, wire cutters, pocket knife, wrenches.

SECTION 3
PREPARING THE SITE AND THE PUMP PARTS

A. The pump must be installed on a foundation rigid enough to support the entire weight of the pump plus the weight of the fluid contained in it. If the pump has a below-base suction inlet, a suitable opening must be provided in the foundation to accommodate it. Foundation bolts must be provided to firmly anchor the pump to its foundation. Be sure that the foundation bolts are properly oriented with respect to the suction and discharge piping. Sleeve-type foundation bolts are recommended because they allow some flexibility in the final positioning of the discharge head. (See Fig. 3-1). If the foundation is concrete, grout will be forced between the pump barrel flange and the foundation after the pump is installed and properly leveled. Instructions for doing this are given in Section 4.

B. Clear an area adjacent to the pump site as a working space for laying out the pump parts to prepare them for installation. Arrange parallel timbers on the floor in the cleared area to support the bowl unit and column (if applicable) horizontally. Parts which are shipped crated should be unloaded from the transporting vehicle in the crate and not be uncrated until ready for installation.
CAUTION

THE COLUMN AND SHAFTING USED IN EXTRA-LONG PUMPS MUST BE HANDLED WITH EXTREME CARE. THESE PARTS ARE MACHINED TO ACHIEVE PRECISION ALIGNMENT. IF DROPPED OR OTHERWISE MIS-TREATED, MISALIGNMENT, POOR PERFORMANCE AND ULTIMATE FAILURE WILL RESULT. A BENT OR DAMAGED COLUMN OR SHAFT MUST NOT BE USED.

C. All of the pump parts were carefully inspected before leaving the factory but may have become damaged in shipping and handling. Therefore, all parts must be inspected by the installer to ascertain that they are clean and undamaged before installing.

D. The shaft used inside the column of extra-long pumps must be inspected for straightness before installing. This may be done by slowly rotating the shaft on precision rollers or vee-blocks and checking for run-out with a dial indicator. The maximum permissible run-out is .001 inch (full indicator reading) per foot of length. Do not use a shaft which exceeds this error limit. A rejected shaft may be straightened and re-tested.

E. Move a mobile power hoist or a traveling crane to the pump site.
SECTION 4

INSTALLING THE BARREL

A. Place four blocks of wood on the foundation, arranged around the opening as a temporary support for the flange of the barrel. Install eyebolts in two diametrically opposite holes in the barrel flange. Attach a sling to the eyebolts, using suitable hooks or clevises, and pass the looped end of the sling over the hoist hook. (See Fig. 4-1.) While a workman guides the lower end to prevent bumping or dragging, hoist the barrel into position over the foundation. Lower the barrel into the opening, and rotate it as necessary to orient the mounting holes in the flange with the foundation bolts. Continue to lower the barrel until the flange rests on the wooden blocks. Remove the eyebolts and sling. Place the wedges under the flange, one adjacent to each of the four foundation bolts. Raise the barrel slightly by means of pry bars applied under the flange, and remove the wooden blocks, allowing the flange to drop slowly in place over the foundation bolts. Adjust the wedges so that the weight is distributed evenly.

B. Place a spirit level on the machined mounting surface for the discharge head, orienting it parallel with one of the edges. Adjust the wedges under the barrel flange to obtain a level indication with the machined mounting surface at the correct height for later attachment of the suction and discharge pipes. Reposition the level on the same surface, oriented 90° from the first position. Again adjust the wedges to obtain a level indication, taking care not to upset the levelness in the original direction. After each adjustment, check for levelness in both directions. Drive in any loose wedges to distribute the weight evenly. The barrel flange must be made perfectly level with all four wedges bearing tightly against the lower edge.

C. **NOTE**

IT IS RECOMMENDED THAT ONLY NON-SHRINKING GROUTING MATERIAL BE USED FOR GROUTING THE BARREL FLANGE TO THE FOUNDATION.

Build a frame or dam on the foundation, enclosing an area which includes all of the leveling wedges. The top of the dam should be approximately 1/2 inch above the bottom of the discharge head base. (See Fig. 3-1.) Pour the grouting material into the dammed-in area and force it between the discharge head and the foundation all around. Level off the grout flush with the top of the dam. Allow the grout to cure at least 48 hours before installing the pump.

Fig. 4-1. Pump barrel being lifted, using eyebolts and sling.
SECTION 5

INSTALLING THE PUMP

The procedure for installing the pump in the barrel varies, depending upon the configuration of the pump and its size. If the pump being installed is exceptionally long, it will have a cylindrical column between the bowl unit and the discharge head. (See Fig. 1-4.) The column may be in one section or more. The impeller shaft may extend through the column and discharge head to the driver, or there may be another shaft, called the top shaft, coupled to the impeller shaft. In some cases a third shaft (the column shaft) is coupled between the impeller shaft and top shaft. Install this type of pump per the instructions of Part A, below. If the pump does not have a column, but the bowl unit and discharge head are separate, see Part B. Pumps in which the bowl unit and discharge head are pre-assembled at the factory will be installed per Part C. A few smaller sizes are shipped complete with driver. Instructions for installing these are also included in Part C.

A. Bowl Unit, Column, and Discharge Head Separate.

1. If the bowl unit is of the flanged type, place two eyebolts diametrically opposite in the uppermost flange. For a threaded bowl unit, secure fasten an elevator clamp just below the uppermost threaded coupling. Attach a sling to the eyebolts or elevator clamp and pass the looped end of the sling over the hoist hook. (See Fig. 5-1.) While a workman guides the lower end to prevent bumping or dragging, hoist the bowl unit into position over the barrel.

On flange-type bowl units, fasten an elevator clamp or box-type clamp to the bowl unit, below the flange of one of the upper bowls. Small diameter units require an elevator clamp; a box-type clamp is preferred for large units. Lower the bowl unit into the barrel until the elevator clamp or box clamp rests on the barrel flange. When installing a very large unit, a suitable box clamp will be too heavy to lift manually. In this case the box clamp can be positioned on the barrel flange by the hoist before lifting the bowl unit. And the bowl unit can be lowered through the box clamp and into the barrel until the upper flange rests on the clamp. The clamp can then be tightened around the bowl unit. Remove the eyebolts and sling.

Place over the top of the bowl unit a specially made wood or metal apron which covers the opening and fits closely around the shaft hub. Wrap a clean rag tightly around the impeller shaft, over the apron. (See Fig. 5-2.) This will prevent entry of foreign matter into the bowl unit.

Fig. 5-1. Bowl unit with eyebolts, sling, and elevator clamp attached.
2. Place two eyebolts diametrically opposite in the flange at the upper end of the bottom column section. If there is to be a bearing at the upper end of this section, the two ends will be identical (both flanges female). If there is no provision for a bearing, the upper end will have a male flange. Attach the sling to the eyebolts and to the hoist hook as was done previously with the bowl unit.

If a top shaft or column shaft is to be coupled to the impeller shaft, insert the shaft into the column section. The top shaft must be installed with the keyed end upward. The ends of the column shaft are identical; either end may be upward. Tie one end of a suitable tail rope to the hoist hook, using a clove or timber hitch. Pass the remainder of the rope through the inside of the column and take a double half-hitch at the lower end of the shaft, in the threaded area. Allow enough slack between the hoist hook and the shaft so that when hoisted, the shaft will extend about one foot below the column section. (See Fig. 5-3). There should be enough excess rope below the shaft to enable a workman to maintain a grip on the rope while the column section is being hoisted.

3. While guiding the lower end to prevent bumping and dragging, hoist the column section and shaft over the pump.

**CAUTION**

**TENSION MUST BE MAINTAINED ON THE TAIL ROPE WHILE HOISTING, TO PREVENT THE SHAFT FROM SLIPPING OUT.**

"Tension must be maintained on the tail rope while hoisting..."
4. The next step is to couple the top shaft or column shaft to the impeller shaft. The procedure varies depending upon the type of coupling used. Instructions for plain couplings are given in Par. a, below. For locked-type coupling, see Par. b.

NOTE

THE SHAFT THREADS ARE LEFT HAND.

CAUTION

WHEN MAKING UP THREADED JOINTS, START THE JOINT BY HAND TO VERIFY THAT THE THREADS ARE PROPERLY ENGAGED BEFORE APPLYING A WRENCH. IF CROSS-THREADING IS SUSPECTED, BREAK THE JOINT IMMEDIATELY AND REPAIR THE DAMAGED EXTERNAL THREADS WITH A FILE. CLEAN THE THREADS THOROUGHLY BEFORE RE-MAKING THE JOINT. IF THE THREADS ARE TOO DEFORMED TO REPAIR WITH A FILE, REPLACE THE DAMAGED PART. WHEN COUPLING THREADS ARE DAMAGED, REPLACE THE COUPLING.

CAUTION

DO NOT STRIKE THE COUPLING WITH A HAMMER TO ASSIST IN MAKING THE JOINT TIGHT. THIS CREATES LOCAL STRESSES WHICH MAY CAUSE CRACKING OF THE COUPLING WHEN TORQUE IS APPLIED DURING PUMP OPERATION.

a. For plain coupling:

Carefully lower the column until the lower end of the shaft rests squarely on the impeller shaft coupling. Untie the tail rope from the lower end of the shaft. Clean the shaft threads and lubricate them with engine oil. Start the shaft into the coupling thread by hand then use a pair of pipe wrenches to screw the joint tight, butting the bottom of the shaft firmly against the end of the impeller shaft. File smoothly any burrs which may have been raised on the shaft, and wipe off all metal chips with a clean rag. Remove the apron and rag which were protecting the top of the bowl unit.

b. For locked-type couplings: (See Fig. 5-4.)

Carefully lower the column until the shaft rests in the impeller shaft coupling body. Untie the tail rope from the lower end of the shaft. Clean the shaft threads and lubricate them with engine oil. Lift the shaft and slide the upper coupling cap onto it, then lower the shaft to again rest it in the coupling body.

Fig. 5-4. Sectional view of a locked type shaft coupling.
Slide the cap about a foot up the shaft and hold it in this position with tape or rope. Start the shaft into the coupling body thread by hand, then use a pair of pipe wrenches to screw the joint tight, butting the bottom of the column shaft tightly against the impeller shaft. Install the split ring in the groove at the lower end of the shaft. Lower the coupling cap over the split ring and screw it on the upper external thread of the coupling body. Tighten the joint with a pair of pipe wrenches. File smoothly any burrs which may have been raised on the shaft, and wipe off all metal chips with a clean rag. Remove the apron and rag which were protecting the top of the bowl unit.

5. Wipe the bowl unit upper flange and the column lower flange with a clean rag. Place a gasket or O-ring (when furnished) on top of the bowl unit flange. Carefully lower the column to engage the two flanges, and install bolts in all the holes not obstructed by the box clamp. (See Fig. 5-5.) Tighten the bolts gradually in diametrically opposite pairs until all are uniformly snug. Raise the entire unit a few inches and remove the box clamp. Install the remaining bolts in the mated flanges, tightening gradually and uniformly as before.

![Fig. 5-5. Bolting the column to the bowl unit.](image)

CAUTION

TAKE CARE NOT TO DROP TOOLS, SCREWS, NUTS OR ANY OTHER FOREIGN OBJECT INTO THE PUMP COLUMN OR BARREL. SUCH AN OBJECT COULD IMPAIR PUMP PERFORMANCE OR RUIN THE IMPELLERS. IF PASSED BY THE PUMP INTO THE DISCHARGE PIPING, A SOLID OBJECT COULD CAUSE SERIOUS DAMAGE TO DOWNSTREAM COMPONENTS. ANY FOREIGN OBJECT DROPPED INTO THE PUMP COLUMN OR BARREL MUST BE RETRIEVED BEFORE PROCEEDING WITH THE PUMP INSTALLATION.

7. Clean the protruding upper end of the shaft. Place a gasket in the recess in the column section flange. Slide a bearing retainer over the shaft, as shown in Fig. 5-6, resting the rim of the retainer on the gasket. Place another gasket on top of the rim.

![Fig. 5-6 Bearing retainer installed between column sections.](image)

8. If there are two or more column sections, install them in the same manner as for the bottom section, except that the top column section may not have a bearing retainer. When installing bolts in column flanges containing a bearing retainer, the bolts must be tightened gradually to obtain a uniform gap between the flanges. The gap must not vary by more than .002 inch all around. (See Fig. 5-6). Check this with a feeler gage as the bolts are tightened.
9. High pressure pumps such as Model HP require a special shaft sleeve assembly in the packing or seal area. The lower portion of this assembly must be installed on the shaft before the discharge head is in place. The correct position is found by making measurements as shown in Fig. 5-7. A detailed view of the shaft sleeve assembly is given in Fig. 6-3. Before installing the sleeve, place the protective apron over the bowl unit and around the shaft. Wrap a clean rag tightly around the shaft, above the apron. (See Fig. 5-2.) This will prevent entry of foreign matter into the bowl unit. Slide the collar (107.358), the taper-lock bushing

![Diagram]

Fig. 5-7 Measurements necessary for positioning lower sleeve on shaft.
(092.358) and the washer (423.000) over the shaft as shown in Fig. 6-3. The bushing may be spread for easy installation by inserting a screwdriver into the split.

Apply a compatible lubricant to the O-ring (336.358), and slide it on the shaft a short distance from the top, followed by the back-up ring (436.000). Next, install the lower sleeve (358.000) on the shaft. Insert the back-up ring and O-ring into the groove at the lower end of the lower sleeve. Lift the collar up to the sleeve, moving the taper-lock bushing and washer with it, and manually screw the collar onto the sleeve. Position the collar and sleeve to the “D” dimension in Fig. 5-7. Tighten the collar on the sleeve, using pipe wrenches. This will lock the sleeve firmly in place on the shaft. File smoothly any burrs which may have been raised on the collar or sleeve, and wipe off all metal chips with a clean rag. Remove the apron and rag which were protecting the top of the bowl unit.

10. If the discharge head has become soiled in shipping and handling, clean it thoroughly, inside and outside. Place two eyebolts diametrically opposite in the upper flange of the discharge head, and attach the sling as before. Hoist the discharge head over the pump. Place a gasket or O-ring on the flange of the column.

11. CAUTION

WHEN LOWERING THE DISCHARGE HEAD TO THE PUMP COLUMN, TAKE CARE NOT TO BUMP OR SCRAPE THE SHAFT PROTRUDING ABOVE THE COLUMN.

Lower the discharge head slowly, aligning the vertical hole in the center with the shaft protruding above the column so that there will be no bumping or scraping as the shaft enters and passes through the hole. Continue to lower the discharge head until the recess in the lower flange nests over the rim of the bearing retainer or over the register of the top column flange. Install bolts in all the holes not obstructed by the box clamp but do not fully tighten them at this time.

Raise the entire unit a few inches, and remove the box clamp. Install the remaining bolts in the flanges. Tighten all of the bolts gradually to obtain a uniform gap between the flanges. The gap must not vary by more than .002 inch all around. (See Fig. 5-6). Check this with a feeler gage as the bolts are tightened. Raise the entire unit a few inches, and remove the box clamp.

12. Before attaching the discharge head to the barrel, carefully clean the discharge head mounting surface of the barrel flange. If there are any burrs on this surface, remove them with a smooth mill file. Wipe off all chips with a clean rag. Place two blocks between the discharge head and the barrel flange to protect the hands in event of hoist or sling failure. Clean the surface thoroughly and install the gasket or O-ring. Rotate the discharge head as necessary to align the suction flange and discharge flange with the external piping; then lower the discharge head slowly until it rests on the barrel flange. Lubricate the studs with engine oil. Install the nuts and tighten them gradually and uniformly to the torque values specified in Table 5-1.

**WARNING**

FAILURE TO TIGHTEN THIS JOINT PROPERLY WILL CAUSE LEAKAGE, IN PUMPS HANDLING HAZARDOUS FLUIDS THIS COULD RESULT IN SERIOUS PROPERTY DAMAGE AND GRAVE PERSONAL INJURY OR DEATH.

<table>
<thead>
<tr>
<th>STUD SIZE</th>
<th>TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 - 10 UNC</td>
<td>27</td>
</tr>
<tr>
<td>7/8 - 9 UNC</td>
<td>45</td>
</tr>
<tr>
<td>1 - 8 UNC</td>
<td>65</td>
</tr>
<tr>
<td>1-1/8 - 7 UNC</td>
<td>105</td>
</tr>
<tr>
<td>1-1/4 - 7 UNC</td>
<td>145</td>
</tr>
</tbody>
</table>

**TABLE 5-1. Minimum Tightening Torque for Nuts Attaching Discharge Head to Barrel.**

The studs and the surface contacting the nuts must be well lubricated.

B. **Bowl Unit and Discharge Head Separate (no Column)**

1. Place two eyebolts diametrically opposite in the upper flange of the bowl unit. Attach a sling to the eyebolts, using suitable hooks or clevises, and pass the looped end of the sling over the hoist hook. (See Fig. 5-1.) While a workman guides the lower end to prevent bumping or dragging, hoist the bowl unit into position.
over the barrel. Fasten an elevator clamp or a box-type clamp to the bowl unit, under the flange of one of the upper bowls. Small-diameter units and all threaded units require an elevator clamp. A box-type clamp may be used for large-diameter bowls. Lower the bowl unit into the barrel until the elevator clamp or box clamp rests on the barrel flange. When installing a very large unit, a suitable box clamp will be too heavy to lift manually. In this case the box clamp can be positioned on the barrel flange by the hoist before lifting the bowl unit, and the bowl unit can be lowered through the box clamp and into the barrel until the upper flange rests on the clamp. The clamp can then be tightened around the bowl unit. Remove the eyebolts and sling.

2. High pressure pumps such as Model HP require a special shaft sleeve assembly in the packing or seal area. The lower portion of this assembly must be installed on the shaft before the discharge head is in place. The correct position is found by making measurements as shown in Fig. 5-7. A detailed view of the shaft sleeve assembly is given in Fig. 6-3.

Before installing the sleeve, place over the top of the bowl unit a specially made wood or metal apron which covers the opening and fits closely around the shaft. Wrap a clean rag tightly around the shaft, above the apron. (See Fig. 5-2). This will prevent entry of foreign matter into the bowl unit.

Slide the collar (107.358), the taper-lock bushing (092.358), and the washer (423.000) over the shaft as shown in Fig. 6-3. The bushing may be spread for easy installation by inserting a screwdriver into the split. Apply a compatible lubricant to the O-ring (336.358) and slide it on the shaft a short distance from the top, followed by the back-up ring (436.000). Next, install the lower sleeve (358.000) on the shaft. Insert the back-up ring and O-ring into the groove at the lower end of the lower sleeve, lift the collar up to the sleeve, moving the taper-lock bushing and washer with it, and manually screw the collar onto the sleeve. Position the collar and sleeve to the “D” dimension in Fig. 5-7. Tighten the collar on the sleeve, using pipe wrenches. This will lock the sleeve firmly in place on the shaft. File smoothly any burrs which may have been raised on the collar or sleeve, and wipe off all metal chips with clean rag. Remove the apron and rag which were protecting the top of the bowl unit.

3. If the discharge head has become soiled in shipping and handling, clean it thoroughly, inside and outside. Place two eyebolts diametrically opposite in the upper flange of the discharge head, and attach the sling as before. Hoist the discharge head over the pump. Place a gasket or O-ring on the upper flange of the bowl.

4. CAUTION

WHEN LOWERING THE DISCHARGE HEAD TO THE BOWL UNIT, TAKE CARE NOT TO BUMP OR SCRAPE THE SHAFT PROTRUDING ABOVE THE BOWL UNIT.

Lower the discharge head slowly, aligning the vertical hole in the center with the shaft protruding above the bowl unit so that there will be no bumping or scraping as the shaft enters and passes through the hole. Continue to lower the discharge head until it rests firmly on the flange of the bowl unit with the registers engaged. Install bolts in all the holes not obstructed by the box clamp. Tighten the bolts gradually in diametrically opposite pairs until all are uniformly snug. Raise the entire unit a few inches and remove the box clamp. Install the remaining bolts in the flanges, tightening them gradually and uniformly as before.

5. Before attaching the discharge head to the barrel, carefully clean the discharge head mounting surface of the barrel flange. If there are any burrs on this surface, remove them with a smooth mill file. Wipe off all chips with a clean rag. Place two blocks between the discharge head and the barrel flange to protect the hands in event of hoist or sling failure. Clean the surface thoroughly and install the gasket or O-ring. Rotate the discharge head as necessary to align the suction flange and discharge flange with the external piping; then lower the discharge head slowly until it rests on the barrel flange. Lubricate the studs with engine oil. Install the nuts and tighten them gradually and uniformly to the torque values specified in Table 5-1.

C. Bowl Unit and Discharge Head Assembled

1. Carefully clean the top of the barrel flange, using a clean rag and a petroleum-base solvent. With a smooth mill file, remove any burrs which might have been incurred during shipping and handling. Reclean to remove all metal chips.

2. If the driver motor was installed on the discharge head at the factory, hoist the pump by looping slings through the hand holes in the discharge head. Take care that the slings do not interfere with the shaft. If the driver is not installed on the discharge head, hoist the pump by means of eyebolts placed in diametrically opposite holes in the upper flange of the discharge head. When hoisting the pump, guide the lower end of the bowl unit manually to prevent bumping or dragging. Position the pump directly over the barrel and start to lower it in. Rotate the pump as necessary to orient the discharge outlet in the desired direction and to align the mounting holes. Lower the pump slowly until it
rests on the barrel flange. Install the cap screws and and tighten them gradually and uniformly.

3. The following instructions and precautions apply at this time only to pumps equipped with a factory-installed motor.

   a. The motor must be tested for direction of rotation before starting the pump for the first time.

   **CAUTION**

   **THE MOTOR MUST BE UNCOUPLED FROM THE PUMP SHAFT BEFORE TESTING FOR DIRECTION OF ROTATION. IF THE PUMP SHOULD BE ROTATED IN THE WRONG DIRECTION, SERIOUS DAMAGE TO THE PUMP AND GRAVE INJURY TO NEARBY PERSONNEL COULD RESULT.**

   The method of disconnecting the motor depends upon whether it is a solid-shaft type or hollow-shaft. For a solid-shaft motor, see Fig. 7-2. Remove cap screws (326.137) and (326.253), then rotate the adjusting nut (253.000) downward until the pump half-coupling (140.000) is well clear of the motor half-coupling (137.000) or the spacer (363.000, if applicable). For a hollow-shaft motor, refer to Fig. 7-3. Remove the motor cover. Remove the locking screws, and unscrew the top shaft nut. Remove the gib key and the top drive coupling.

   b. To test for direction of motor rotation, see Section 7, Part A, Par. 6, for solid-shaft motors, or Section 7, Part B, Par. 5 for hollow-shaft motors.

   c. **CAUTION**

   **BEFORE STARTING THE PUMP FOR THE FIRST TIME, THE IMPELLERS MUST BE ADJUSTED TO THEIR PROPER POSITION. THIS WILL PREVENT UNDE WARE OR POSSIBLE DAMAGE TO THE PUMP.**

   For the method of adjusting the impellers, see Section 7, Part A, Par. 10 (pumps with solid-shaft motors) or Section 7, Part B, Par. 10 (pumps with hollow-shaft motors). After the impeller adjustment is made, continue the installation procedure with Section 8. Sections 6 and 7 do not apply to pumps equipped with a factory-installed driver motor.
SECTION 6

INSTALLING THE SHAFT PACKING OR SEAL

All pumps are equipped with packing or a mechanical seal to limit or prevent leakage around the lineshaft. Separate instructions are given below for pumps with packings (Part A) and for pumps using mechanical seals (Part B). Part C gives instructions for installing pressure by-pass piping.

A. Installing the Packing Assembly

Packing configurations vary with the model of the pump and the pressure characteristics. Fig. 6-1, 6-2, and 6-3 show the principal varieties. Before installing an O-ring in its groove, coat the O-ring with a film of liquid soap or rubber lubricant.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.000</td>
<td>CLAMP, GLAND</td>
</tr>
<tr>
<td>126.000</td>
<td>CONTAINER, PACKING</td>
</tr>
<tr>
<td>167.126</td>
<td>FITTING, GREASE</td>
</tr>
<tr>
<td>185.000</td>
<td>GLAND, SPLIT-TYPE PACKING</td>
</tr>
<tr>
<td>197.000</td>
<td>GASKET, PACKING CONTAINER</td>
</tr>
<tr>
<td>265.000</td>
<td>PACKING</td>
</tr>
<tr>
<td>318.000</td>
<td>RING, TOP SHAFT SEAL</td>
</tr>
</tbody>
</table>

Fig. 6-1 Packing arrangement, Model HE and HF.

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<tr>
<th>ITEM NO.</th>
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<tbody>
<tr>
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<td>Cap, Shaft Sleeve</td>
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<tr>
<td>100.000</td>
<td>Clamp, Packing Gland</td>
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<tr>
<td>126.000</td>
<td>Container, Packing</td>
</tr>
<tr>
<td>170.000</td>
<td>Flange, Packing Container</td>
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<tr>
<td>185.000</td>
<td>Gland, Split-type Packing</td>
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<tr>
<td>196.000</td>
<td>Gasket, Pkg., Container Flange</td>
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<tr>
<td>233.000</td>
<td>Ring, Lantern</td>
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<tr>
<td>265.000</td>
<td>Packing</td>
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<tr>
<td>318.000</td>
<td>Ring, Top Shaft Seal</td>
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<tr>
<td>336.126</td>
<td>O-ring, Packing Container</td>
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<td>336.170</td>
<td>O-ring, Packing Flange</td>
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<td>336.362</td>
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<tr>
<td>360.000</td>
<td>Sleeve, Removable Packing</td>
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</table>

Fig. 6-2 Packing arrangement, Models HL, HM and HH.