Foreword…

This manual contains instructions for the installation, operation, and maintenance of the MISSION MAGNUM XP PUMP. As pump service conditions and specifications vary considerably in pump installation, this manual cannot possibly cover every situation, but it is intended that the information included will serve as a guide. Should questions arise, or start-up problems occur, it is suggested that you contact the National Oilwell Varco Pump Distributor or Salesman in your area (see back panel).

The Magnum XP Pump is designed to give longer service life through heavier fluid end parts, heavier shaft bearings and reduced hydraulic loads.

There are many principles of proper pump installation and applications as well as special considerations for the Magnum XP design which, if followed, will further enhance its performance.

This document will deal with both general and specific recommendations for improved Magnum XP performance in both oilfield and industrial applications.

GENERAL INSTRUCTIONS

1. Operate the pump only in the performance range for which it was designed.

2. When operating in drilling mud, prevent packing drippage from clogging the drip pan and hardening around the slinger and front seal area.

3. Packed pumps should be adjusted so that a small amount of leakage remains for lubrication and cooling.

4. See Assembly section in this publication for Mechanical Seal installation.

⚠️ CAUTION ⚠️ CAUTION ⚠️ CAUTION ⚠️

EXERCISE SAFETY IN ALL PERFORMANCES: DO NOT IGNORE ANY WARNINGS, USE ONLY APPROVED METHODS, MATERIALS AND TOOLS. DO NOT PERMIT ANY FUNCTION OF QUESTIONABLE SAFETY; ACCIDENTS ARE CAUSED BY UNSAFE ACTS AND UNSAFE CONDITIONS. SAFETY IS YOUR BUSINESS AND YOU ARE INVOLVED.

⚠️ WARNING ⚠️ WARNING ⚠️ WARNING ⚠️

BEFORE PERFORMING ANY SERVICE FUNCTION, BE CERTAIN THAT THE UNIT IS SEPARATED FROM ITS POWER SOURCE OR THAT THE POWER SOURCE IS LOCKED-OUT TO PREVENT ANY FORM OF ENERGY FROM ENTERING THE EQUIPMENT. THIS WOULD INCLUDE ELECTRICAL OR MECHANICAL ENERGY INTO OR FROM THE PRIME MOVER(S), PNEUMATIC ENERGY FROM THE COMPRESSOR/AIR SYSTEM, ETC.
! WARNING ! WARNING ! WARNING !

FAILURE TO OBSERVE THE WARNINGS AND NOTES OF CAUTION IN THIS PUBLICATION CAN RESULT IN PROPERTY DAMAGE, SERIOUS BODILY INJURY, OR DEATH.

! ATTENTION - NOTICE - IMPORTANT !

THESE TERMS ARE USED TO DRAW ATTENTION TO ACTION THAT WILL CAUSE DAMAGE TO THE PUMP, COMPONENTS OR ATTACHMENTS.

! WARNING ! WARNING ! WARNING !

BEFORE SERVICING PUMPS:

1. SHUT DOWN OR DISENGAGE THE PUMP POWER SOURCE.
2. SHUT DOWN ALL PUMP ACCESSORY EQUIPMENT.
3. RELIEVE OR "BLEED OFF" ALL PRESSURE FROM THE LINES PRIOR TO REMOVING PIPING.

FAILURE TO SHUT DOWN POWER AND RELIEVE PRESSURE FROM THE PUMP BEFORE SERVICING CAN RESULT IN SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.
### INSTALLATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. GENERAL</td>
<td></td>
</tr>
<tr>
<td>A. Location</td>
<td>7</td>
</tr>
<tr>
<td>B. Foundation</td>
<td>7</td>
</tr>
<tr>
<td>C. Coupling Alignment</td>
<td>8</td>
</tr>
<tr>
<td>D. Piping</td>
<td></td>
</tr>
<tr>
<td>1. General</td>
<td>9</td>
</tr>
<tr>
<td>2. Suction</td>
<td>9</td>
</tr>
<tr>
<td>3. Discharge</td>
<td>9</td>
</tr>
</tbody>
</table>

### PREPARATION FOR OPERATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. GENERAL</td>
<td></td>
</tr>
<tr>
<td>A. Mechanical Seals</td>
<td>10</td>
</tr>
<tr>
<td>B. Start-Up Checklist</td>
<td>10</td>
</tr>
</tbody>
</table>

### OPERATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. GENERAL</td>
<td></td>
</tr>
<tr>
<td>A. Priming The Pump</td>
<td>11</td>
</tr>
<tr>
<td>B. Maximum Operating Conditions</td>
<td>11</td>
</tr>
<tr>
<td>C. Pump Records</td>
<td>11</td>
</tr>
<tr>
<td>D. Pump Speed Limitations</td>
<td>11</td>
</tr>
<tr>
<td>E. Lubrication</td>
<td></td>
</tr>
<tr>
<td>1. Bearings (Grease)</td>
<td>12</td>
</tr>
<tr>
<td>2. Stuffing Box</td>
<td>12</td>
</tr>
<tr>
<td>3. Outboard Lip Seals</td>
<td>12</td>
</tr>
</tbody>
</table>
Table of Contents…

MAINTENANCE

I. GENERAL ........................................................................................................................................ 13

II. DISASSEMBLY
   A. General ........................................................................................................................................ 13

III. INSPECTION
   A. Impeller ........................................................................................................................................ 14
   B. Shaft .............................................................................................................................................. 14
   C. Shaft Sleeve ................................................................................................................................... 14
   D. Mechanical Seal .............................................................................................................................. 14
   E. Ball Bearings ................................................................................................................................. 14
   F. Seals ............................................................................................................................................... 14
   G. General .......................................................................................................................................... 14

IV. ASSEMBLY
   A. Installing Bearings On Shaft ......................................................................................................... 15
   B. Installing Rear Bearing Cover ....................................................................................................... 15
   C. Installing Shaft Assembly Into Frame ........................................................................................... 16
   D. Installing Water Slinger and Sleeve O-ring ................................................................................... 16
   E. Preparation Of Stuffing Box For Mechanical Seal ......................................................................... 16
   F. Installing Stuffing Box on Frame .................................................................................................... 17
   G. Installing Garlock Mudsaver Seal On Sleeve ................................................................................. 17
   H. Installing Type 1 Mechanical Seal On Sleeve ............................................................................... 18
   I. Installing Sleeve and Seal On Shaft ............................................................................................... 18
   J. Installing Impeller, Jam Nut And Nose ......................................................................................... 19
   K. Temporary Setting Of Impeller Clearance To Avoid Interference On Installation Of Cover ............... 20
   L. Installing Secondary Packing For Mechanical Seals ...................................................................... 20
   M. Installing Front Cover On Casing .................................................................................................. 20
   N. Installing Split Stuffing Box And Packing (Old Style) ................................................................... 21
   O. New Design Packing Installation .................................................................................................. 22
   P. Installing Power Frame Into Casing ............................................................................................... 22
   Q. Miscellaneous .............................................................................................................................. 22
Table of Contents…

TROUBLE SHOOTING PROCEDURES

I. GENERAL
   A. Excessive Packing Leakage and Rapid Packing Wearout; Shaft Sleeve Coating Worn .......................................................................................................................... 23
   B. Packing Burned ….............................................................................................................. 23
   C. Excessive Stuffing Box Pressure ................................................................................... 23
   D. Trouble Shooting Guide …................................................................................................. 24

ENGINEERING DATA

I. SUCTION PIPING …........................................................................................................... 25-28

CROSS SECTION DRAWING …......................................................................................... 29

PARTS LIST …...................................................................................................................... 30
Installation...

I. GENERAL

A. LOCATION

The pump should be located near the liquid source so that the suction line may be short and direct. The pump should be located below the level of the liquid to eliminate the necessity of priming.

B. FOUNDATION

The foundation should be sufficiently rigid and substantial to absorb any vibration and to permanently support the base plate at all points. A concrete foundation, poured on a solid footing of adequate thickness to support the pumping unit, provides the most satisfactory foundation. The base plate should be installed in a level position. Figure 1 shows a typical arrangement for bolting channel bases.

The rugged design of the frame and fluid end makes the Magnum XP more tolerant of improper foundations than many other pumps. When fabricated bases or fabricated skid bases are utilized, the foundation should be sufficiently rigid and leveled properly to absorb any vibration and to permanently support the base at all points.

Note: A detailed description of proper Procedures for grouting base plates may be found in the Hydraulic Institute Standards, 13th Edition, Pages 116, 117.
C. COUPLING ALIGNMENT

Good service life of the pump and driver depends upon good alignment through the flexible coupling. If the electric motor was mounted at the factory, the pump and motor were in alignment when shipped. The alignment between the pump and driver should be inspected after installation to ensure that transportation or other handling has not caused misalignment of the unit. Poor alignment may cause vibration and failure of the coupling, pump, motor, or bearings.

Alignment must not be attempted until the base is in position and the mounting and flange bolts have been tightened.

The recommended procedure for coupling alignment is with the use of a dial indicator, as illustrated in Figures 2 and 3. The dial indicator is attached to one coupling half with the indicator button resting on the O.D. of the other coupling half to measure offset misalignment. To measure angular misalignment, the indicator is positioned so that the buttons rest on the face, near the O.D., of the other coupling half (see Figure 3). Rotate the shaft and dial indicator one full revolution while the other shaft remains stationary and note the Total Indicator Reading (T.I.R). Unless otherwise specified by the coupling manufacturer, offset misalignment should be limited to 0.010 inches T.I.R. and angular misalignment should be limited to 0.005 inches T.I.R. Adjust the alignment by loosening driver or pump mounting bolts and retightening or shimming as required.

In areas where a dial indicator arrangement is not available, an adequate job of alignment can be done with a straightedge. This method is especially useful if the coupling used contains a rubber drive element.

To check offset misalignment, lay the straightedge in line with the shafts on the O.D.’s of the coupling halves. There should be no gaps under the straightedge. Check two locations 90° apart. Angular misalignment can be checked by measuring the gap between coupling half faces. There should be no more than a 1/64 inch gap under the straightedge or a 1/64 inch variation in the gap between the coupling halves. See Figures 2A and 3A.

NOTE: Further reference on coupling alignment can be found in Hydraulic Institute Standards, 13th Edition, Pages 117 and 120.
Installation…

I. GENERAL (Continued)…

D. PIPING

1. General

   Piping must not be connected to the pump until the grout has hardened and the foundation and pump hold down bolts have been tightened.

   Piping should be anchored independently of the pump and as near to it as possible. Pipe companion flanges should line up naturally with pump flanges. Do not draw the pipe to the pump with flange bolts.

   To reduce induced stresses on the pump frame and fluid end Mission recommends the use of expansion joints on both the suction and discharge piping. Expansion joints will isolate the pump from external forces such as thermal expansion/contraction of the piping and vibration.

2. Suction

   Properly selected and installed suction piping is extremely important to eliminate vibration and cavitation in the pump. Vibration can cause packing problems, mechanical seal damage, or undue bearing loads.

   The suction line should be equal to or larger than the pump suction. The capacity of a centrifugal pump should never be adjusted by throttling the suction line. A positive shut-off valve of a type to cause minimal turbulence should be installed in the suction line to permit the closing of the line for removal of the pump for inspection and maintenance.

   The suction line should be designed to eliminate any air pockets. The piping should gradually slope downward to the supply source to eliminate air pockets.

   The suction line should have a straight section into the pump of a length equivalent to at least two times its nominal diameter; i.e. a four inch suction; eight inch straight run.

   For temporary hook-up where flexible hose is used, a non-collapsing hose is essential since the suction line pressure is often below atmospheric pressure. A collapsed suction line will result in below average or complete loss of flow. See Engineering Data section in this manual.

3. Discharge

   A positive shut-off valve should be located in the discharge piping to permit inspection and maintenance of the pump.

   All piping should be independently supported and accurately aligned. The pump must not support the weight of the pipe or compensate for misalignment.

   If operating conditions are not known with sufficient accuracy, it will be necessary to provide a throttle valve in the discharge line to ensure that the pump operates at the design point.

   If the pump is connected to a pressurized system or the discharge piping has sufficient vertical height, it is important to install a check valve between the pump discharge and the throttling valve. The check valve will prevent back flow through the pump. A loose impeller will likely result in mechanical seal damage and fluid leakage beneath the shaft sleeve.
Preparation for Operation…

I. GENERAL

A. MECHANICAL SEALS

When mechanical seals are furnished, the description and identification is indicated on the order write-ups, which are a part of the order acknowledgement, dimension print, and the packing list. The seals are installed and adjusted at the factory. To properly prepare the seal for operation, various cooling and flushing flows may have to be connected. Liquid from an outside source may be required. Connect necessary cooling and flushing flows to seal and be sure it is turned on before starting the pump.

⚠️ WARNING ! WARNING ! WARNING ! WARNING ! ⚠️

NEVER OPERATE A PUMP “DRY” WITH MECHANICAL SEALS. MECHANICAL SEAL FAILURE WILL OCCUR!

B. START-UP CHECKLIST

⚠️ WARNING ! WARNING ! WARNING ! WARNING ! ⚠️

IT IS ABSOLUTELY ESSENTIAL THAT THE ROTATION OF THE MOTOR BE CHECKED BEFORE CONNECTING THE SHAFT COUPLING. INCORRECT ROTATION OF THE PUMP FOR EVEN A SHORT TIME WILL DISLODGE THE IMPELLER AND DAMAGE THE IMPELLER, SHAFT OR BEARING HOUSING. THE PUMP SHAFT MUST TURN CLOCKWISE WHEN VIEWED FROM THE MOTOR END.

Check the following items before starting the pump:

1. Pump rotates freely by hand.
2. Coupling aligned.
4. Pump and suction line full of fluid.
5. Water to stuffing box or gland flush, if required.
6. Discharge valve is slightly open, not fully open. Fully open the discharge valve after the pump is running.
Operation...

I. GENERAL

A. PRIMING THE PUMP

Vent air from the suction line and fill it with liquid. Start the pump with the discharge valve cracked open. After discharge pressure stabilizes, gradually open the discharge valve to the required position. If flow is lost, close the discharge valve and wait a few seconds for the discharge pressure to build. Continued flow difficulty indicates improper selection or installation.

Running the pump with improper prime may severely damage or destroy the mechanical seal elements due to heat generated at the interface between stationary and rotating seal components. **Do not run the pump with the suction or discharge valves closed AT ANY TIME!** Thermal shock may crack the seal elements if the temperature is raised from room temperature to 250° F. in less than 30 seconds.

B. MAXIMUM OPERATING CONDITIONS

Note: These maximum operating conditions apply to pumps that are exposed to room temperatures without external insulation.

1. XP Pumps are available in H-30 and Magnachrome Alloy, contact National Oilwell Varco distributor.
2. Cooling water through the lantern ring may be required when fluid being pumped is between 150° and 250° F. In addition, it may be necessary to run water over the exposed shaft to prevent excessive heat build up at the bearings.
3. Maximum hydraulic performance is in accordance with published performance curves.

C. PUMP RECORDS

Maintain data cards or pump records whenever possible. **This will provide ready access to information for ordering spare parts and for evaluating pump and mechanical seal performance.**

Information to be included in these records should be:

1. Pump size and serial number.
2. Pump model number, impeller diameter, material of construction.
3. Mechanical seal type and part number.
4. Motor horsepower and speed of operation.
5. Service conditions.
6. Frequency of operation.
7. Record of maintenance, including parts usage and general pump conditions.
8. Nomenclature and part number of replacement items.

D. PUMP SPEED LIMITATIONS

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>Bearing Lubricant</th>
<th>Max. RPM Allowable</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 x 12, 12 x 10</td>
<td>(Grease)</td>
<td>1400</td>
</tr>
<tr>
<td>8 x 6</td>
<td>(Grease)</td>
<td>1800</td>
</tr>
</tbody>
</table>

With the large shaft and bearings used in this pump, the above limitations must be observed in order to control bearing operating temperature.
Operation...

I. GENERAL (Continued)...

E. LUBRICATION

1. Bearings (Grease)

   Bearings are prelubricated from the factory and in low speed, low temperature application may need no
   lubrication throughout the life of the pump.

   In heavy loads and hot applications, the bearings should be relubricated at regular intervals for maximum
   bearing life. The bearings are lubricated with Mystic JT-6 grease at the factory. When relubricating, the Mystic
   grease would be the best choice since mixing greases sometimes causes incompatibility problems. Chevron
   SRI-2, Texaco Premium RB, Shell Dolum-R, Amoco Rycon Premium Grease and Mobilux EP multi-service are
   also acceptable. These have not been available in tubes. Greases that are available in tubes and are
   acceptable, in order of preference are: EXXON Unirex N2, Chevron Polyurea EP 2, Texaco Marfak Multi-
   Purpose 2, Shell MP (Alvania) 2, and Amoco Rycon Premium 2 EP.

   When using the five premium bearing greases listed above or their equivalent, five shots of grease,
   with a standard size hand operated grease gun, in each bearing once a week, will be sufficient in a twenty-four per
   day operation. Reduce for lesser operation. For example: Five shots every three weeks for eight hour a day
   operation. If a longer cycle is desired, twenty shots of grease while rotating the shaft may be applied once a
   month, assuming twenty-four hours per day operation.

2. Stuffing Box

   The stuffing box may be relubricated as often as necessary to prevent the packing from over-heating. It
   should be lubricated at least once a day.

   Grease should be pumped into the box while turning the shaft until it comes out around the packing gland
   (approximately twenty shots).

   If the packing leakage is excessive, a thick water pump grease should be used rather than the general
   purpose grease. In most cases, general purpose grease will be acceptable.

3. Outboard Lip Seals

   The outboard bearing cover is supplied with a Zert fitting. This is designed to create a grease barrier
   between the outboard lip seals and should be greased prior to washdown and at least once a week with five
   shots of general purpose or water pump grease. See Figure 4.

   ![Figure 4](Front View Of Outboard Bearing Cover)
Maintenance…

I. GENERAL

Refer to Cross Section Drawing Fig. 9, Pg. 29, and Parts List on page 30 for materials and location.

II. DISASSEMBLY

A. GENERAL

1. Loosen packing gland bolts (40). Remove packing gland halves (41) [on old style split designs].
2. Remove the casing retaining nuts (2).
3. Remove the casing (1).
4. Restrained the shaft at the coupling end to prevent rotation while removing the impeller. **Note: Mission Impeller Removal Tool, Part No. 24041 is very useful.** The jam nut (11) has a locking screw (10) that must be backed off before it is rotated.
5. Remove the stuffing box cover bolts (15).
6. Remove the stuffing box cover (14) from the frame by tapping on the back side in the area where the box fits into the frame (22), with a low impact hammer. **Note: If the disassembly being performed does not require the replacement of the mechanical seal, the stationary seat must not be removed from the stuffing box.**
7. Pull the packing (42) from the stuffing box bore.
8. Remove the shaft sleeve (16). A wedge may be driven between the end of the sleeve and the shoulder on the shaft to free the sleeve. If the pump has a mechanical seal that does not need to be replaced, care must be taken to avoid damaging or dropping the extremely fragile rotary mechanical seal ring when removing the sleeve. **NOTE: If the disassembly is being performed to replace or install a mechanical seal and/or shaft sleeve only, no further disassembly is required. See Mechanical Seal installation instructions in Step 7.**
9. Remove slinger (18).
10. Remove the four bolts (38) on the outboard bearing housing (23). **Two of these are bolts threaded into the frame (22).**
11. The complete shaft and bearing sub-assembly can now be pulled from the frame.
12. Remove the outboard bearing cover (34).
13. Bend the tab on the lockwasher (27) back and remove the locknut (28) and lockwasher.
14. Remove the bearing housing (23) and bearings (25) from the shaft.
15. The inboard bearing (21) may now be pressed off the shaft.
Maintenance (Continued)...

III. INSPECTION

A. IMPELLER

Replace if impeller shows excessive erosion (especially on the pump-out vanes on the back of the impeller), corrosion, extreme wear, or vane breakage.

B. SHAFT

Check for runout to see that the shaft has not been bent. If runout exceeds 0.003 inch, replace the shaft. Bearing seat area and oil seal area must be smooth and free of scratches or grooves. Shaft threads must be in good condition. Replace shaft, if necessary. Proper inspection requires precision shaft rollers and proper indicating equipment.

C. SHAFT SLEEVE

Sleeve surface in the stuffing box must be smooth and free of grooves. If grooved, replace.

D. MECHANICAL SEAL

Seal faces, gaskets, and shaft sealing members must be in perfect condition or excessive leakage may result. Replace worn or damaged parts.

E. BALL BEARINGS

Replace if worn, loose, or rough and noisy when rotated. New bearings should not be unwrapped until ready for use. Replacement bearings must be of the proper size and type as supplied with the original equipment.

F. SEALS

It is recommended that all O-ring and gasket seals removed during disassembly be replaced. In those cases where new seals are not available, the old ones can be reused if they are not torn or otherwise damaged.

G. GENERAL

All parts should be clean before assembly. This is especially important for retaining rings and O-ring grooves, threads, gasket surfaces and bearings and bearing lubricated areas. Any burrs should be removed with crocus cloth.
Maintenance (Continued)...

IV. ASSEMBLY

A. INSTALLING BEARINGS ON SHAFT

1. Clean shaft thoroughly.

2. Heat bearings uniformly to 200° F. for 30 minutes. Heating temperature should not exceed 250° F.

3. Install the duplex bearings first. Install bearing “B” with the letters out so that the bearings will assemble back-to-back. Slip bearing “A” with the lettering towards “B”. 14 x 12 Pump bearings come as a set. Alignment “V” on O.D. Signify relationship. Point V toward impeller. 12 x 10 and 8 x 6 bearings have individual bearings are installed by lettering inward as discussed above.

4. While bearings are still hot, install locknut on threads in order to seal the bearings tight.

5. Install bearing housing from impeller end onto the duplex bearings until it shoulders.

6. Slip double row bearings on shaft.

7. Allow bearings to cool. Then retighten the locknut to take up any clearance resulting from the cool-down.

8. Remove the locknut and install the lockwasher. Reinstall the locknut and tighten securely to 750 ft. lbs. torque. Seat the locking tab.

9. Install O-ring on bearing housing.

B. INSTALLING REAR BEARING COVER

1. Fill each grease seal cavity and lips with grease, before pressing them into the cover.

2. Install both seals with lips facing the bearings.

3. Slip O-ring over the guide diameter of the cover.

4. Install the 1/8” pipe plug.

5. Slip entire cap over the shaft, being careful not to damage the seals over the sharp edge of the keyway. Orient the pipe plug toward the letters of the bearing housing.

6. Install 3/8” washers and bolts and tighten cover securely against bearings. Apply 25 ft. lbs. torque.
Maintenance…

IV. ASSEMBLY (Continued)...

C. INSTALLING SHAFT ASSEMBLY INTO FRAME

1. Attach two 1/2" eye bolts to the bearing housing.
2. Fill grease seal inner lips with grease completely.
3. Install the two front oil seals into frame with lips facing the bearings. Use a pipe or tool to exert uniform pressure on the seal cages to prevent damage.
4. Lay frame vertically with rear end up. Apply never seize to the outboard bearing housing bore.
5. With hoist, lower shaft assembly, through frame, being careful not to damage the lips of the front oil seals.
6. Install 1/2" bolts and jam nuts on bearing nuts on bearing housing. By using jack bolts, set a gap of 1/8” between the bearing housing flange and frame. Do not tighten the 1/2" bolts until being ready to set the final impeller clearance.

D. INSTALLING WATER SLINGER AND SLEEVE O-RING

1. Install O-ring on I.D. of slinger. Do not lubricate the O-ring.
2. Orient the cup flange of the slinger towards the bearing frame and push the slinger onto the shaft all the way back until it shoulders on the shaft.
3. Install O-ring for the shaft sleeve over the shaft and push against the shaft radius.
4. Apply anti-seize compound to the shaft O.D.’s and shoulders, and threads.

E. PREPARATION OF STUFFING BOX FOR MECHANICAL SEAL

1. Wipe some oil on O-ring of the stationary seat before pressing it into the stuffing box.
2. Install the 1/8” pin. Pin should stand up 1/8”. This pin is supplied with the mechanical seal.
3. Align the notch of the stationary seat with the pin press the seat into the place. Ensure the pin stops rotation.
4. Install pipe plugs.
Maintenance…

IV. ASSEMBLY (Continued)…

F. INSTALLING STUFFING BOX ON FRAME

1. Brush anti-seize compound on the guide diameter of the stuffing box and on the sleeve area of the shaft in the power end.

2. Install stuffing box and secure with two 1/2" bolts. Tighten to 60 ft. lbs. torque.

3. Mount casing gasket on O.D. of stuffing box. Use grease to stick it in place.

G. INSTALLING GARLOCK MUDSAVER SEAL ON SLEEVE

1. Wipe oil on O.D. of sleeve.

2. Install seal as shown. Align pin with notch on sleeve.

3. Oil sealing surface as shown. See Figure 5.

Figure 5
H. INSTALLING TYPE 1 MECHANICAL SEAL ON SLEEVE

1. Oil sleeve O.D. as shown (See Figure 6). Do not use never seize here.

2. Install back ring and spring.

3. Install rubber bellows on sleeve. NOTE: Clean I.D. of bellows with suitable solvent. The bellows is Viton material. The factory uses toluene to remove residual seal face cement.

4. Oil sealing surface of rotating ring.

5. Current sleeve design for mechanical seals is 416 SS. This allows the bellows to slip during installation. Ceramic coated sleeves should only be used on packed pumps.

I. INSTALLING SLEEVE AND SEAL ON SHAFT

1. Ensure shaft sleeve O-ring is on shaft and install sleeve onto shaft with never seize lubricant.

2. Install O-ring on sleeve face. It may be necessary to apply grease on the sleeve groove to hold the O-ring in place until impeller is installed.

3. Install key on shaft (vertically upward).
Maintenance...

IV. ASSEMBLY (Continued)...

J. INSTALLING IMPELLER, JAM NUT AND NOSE

1. Slip impeller on shaft. Use tool 24041, if necessary to facilitate installation of impeller. Use never seize here. Use of overhead lifting device like a crane would not require tool 24041.

2. Attach 7/8” key to coupling end of shaft. Attach tool 24042 to coupling end.


4. Install set screw in jam nut and tighten securely.

5. Install impeller nose using Loctite (243 or 222). Secure with 350 ft. lbs. torque using standard 2½ inch flats across impact hex socket. The nose cone has been redesigned with a hex pattern.

Figure 7
Maintenance…

IV. ASSEMBLY (Continued)…

K. TEMPORARY SETTING OF IMPELLER CLEARANCE TO AVOID INTERFERENCE ON INSTALLATION OF COVER

1. Using the 1/2” jack bolts on the bearing housing, set the clearance (see note) between the impeller and the stuffing box. NOTE: 14 x 12, 12 x 10, and 8 x 6 are set at 0.025 inch.

⚠️ WARNING ! WARNING ! WARNING ! ⚠️

SINCE PUMP DESIGN REQUIRES THE IMPELLER CAP TO BE FINAL SET OFF THE FRONT COVER, THE PROCEDURE TO SET THE IMPELLER WITHOUT DAMAGING THE PUMP BY INTERFERENCE ON CLOSURE REQUIRES THE TEMPORARY SETTING AND FINAL SETTING IN STEP P FOLLOWING TO BE PERFORMED WITHIN 30 MINUTES.

L. INSTALLING SECONDARY PACKING FOR MECHANICAL SEALS

1. Put two packing rings onto shaft.
2. Assemble two-piece gland over packing and bolt together.
3. Attach to stuffing box.

M. INSTALLING FRONT COVER ON CASING

1. Install double ended studs on casing.
2. Before assembling the front cover on the casing, determine the rotation of the pump (as ordered) to determine which side the cover must be mounted.
3. Install the casing gasket on the O.D. of the front cover. Use grease to hold it on, if necessary.
4. Lower front cover into casing and install nuts, torque to 200 ft. lbs. using a criss-cross tightening method.
IV. ASSEMBLY (Continued)...

N. INSTALLING SPLIT STUFFING BOX AND PACKING (OLD STYLE)

NOTE: If pump is ordered with mechanical seal, skip this portion and go to Step O.

1. If pump is ordered with split stuffing box and packing assemble pump by following Steps A through G.
2. Install sleeve per Step I.
3. Proceed with Steps J, K and L.
4. Install packing rings and lantern ring around sleeve O.D. If necessary, attach one split box half and one 1/2" bolt to hold parts together. Then attach other half and 1/2" bolt. Secure the halves together with set screws.
5. Tighten 1/2" bolts to 60 ft. lbs. Tighten the washer nuts to 10 ft. lbs.
6. Grease the packing rings through the grease fitting. If necessary rotate the shaft to relieve trapped air that might prevent the grease from flowing around the lantern ring.

Figure 8
Maintenance...

IV. ASSEMBLY (Continued)...

O. NEW DESIGN PACKING INSTALLATION

The Magnum XP Pumps have new packing and box designs to allow a conventional packing arrangement.

The stuffing box is bolted to a modified stuffing box/wear plate that has the internal packing area machined away. The new stuffing box is attached by two studs and nuts to this flat wear plate.

1. The packing is split design and is pushed over the shaft and into the box. Each ring should be tamped individually to the bottom of the box.

2. Slide the gland into place over the two studs.

3. Attach nuts and run them hand tight.

4. Allow packing to leak while starting the pump.

5. After 15 minutes tighten gland to slow leaking.

6. Allow minute leakage to cool packing.

P. INSTALLING POWER FRAME INTO CASING

1. Because the casing and front cover weigh approximately 900 pounds, it will be easier to drop the frame assembly into the casing cover assembly.

2. Lower the frame assembly into the casing assembly. Secure with hex nuts. Apply 200 ft. lbs. torque to nuts tightening in criss-cross pattern.

3. *IMPORTANT:* Using jack bolts on the bearing housing, set the impeller clearance 0.025" from the front pad.

4. Secure the clearance with the bolts and jam nuts on the bearing housing using 60 ft. lbs. torque.

   **WARNING:** The outer bearing housing has two bolts to pull and two to push. When moving bearing housing, release opposing bolts.

Q. MISCELLANEOUS

1. Install all pipe plugs as necessary.

2. Install breather on frame.

3. Turn pump shaft to ensure that the impeller is not rubbing, and that there is not any excessive torque required to turn the shaft.
Trouble Shooting Procedures...

I. GENERAL

NOTE: See also Trouble Shooting Guide.

A. EXCESSIVE PACKING LEAKAGE AND RAPID PACKING WEAROUT; SHAFT SLEEVE COATING WORN

Remove the packing. Slide a wire, with a short section of the tip bent 90°, into the stuffing box. Run the “stylus” tip of the wire along the shaft sleeve. If deep grooves are noted the sleeve must be replaced. Excessive tightening of the packing will cause rapid sleeve failure.

B. PACKING BURNED

Replace the packing. Initial overtightening and attempting to run packing without leakage will cause the packing to burn. Once the packing is burned it becomes hard and will not squeeze down on the shaft causing uncontrollable leakage.

C. EXCESSIVE STUFFING BOX PRESSURE

Caused by excessive clearance between the impeller back vanes and the stuffing box cover and/or worn impeller back vanes. The solution is to readjust the impeller clearance. See previous section entitled “Setting Impeller Clearance” in this manual.

NOTE: Trouble shooting of mechanical seals is left to the seal manufacturer. Consult the factory if the problems persist.
Trouble Shooting Procedures…

I. GENERAL (continued)…

D. TROUBLE SHOOTING GUIDE

<table>
<thead>
<tr>
<th>Causes</th>
<th>Noise/ Vibration</th>
<th>No Flow</th>
<th>Insufficient Flow</th>
<th>Insufficient Pressure</th>
<th>Excessive Power Required</th>
<th>Intermittent Flow</th>
<th>Short Bearing Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump not primed</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Speed too low</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excessive discharge head</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient NPSH available</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Impeller clogged</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong direction of rotation</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plugged suction or discharge line</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot valve or suction line not immersed deeply enough</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Impeller damaged</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft packing or seal defective</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impeller diameter too small</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impeller diameter too large</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excessive amount of air or gas in liquid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Speed too high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Total head lower than design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Specific gravity or viscosity too high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bent shaft</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Improper electric motor wiring or voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotating elements bind</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Leaky suction line or shaft seal</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Misalignment</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bearings worn</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Impeller out of balance</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Suction or discharge piping not anchored</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improper foundation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient discharge head (excessive flow)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Improper lubricant or level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Impeller clearance too large</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Engineering Data...

I. SUCTION PIPING

Vortex can be prevented by proper baffle arrangements.
I. SUCTION PIPING (Continued)...

This can be used as a guide for minimum submergence and piping design.

Velocity, feet per second = \[
\frac{\text{GPM} \times 0.4}{D^2 \text{ (inches)}}
\]
Engineering Data…

I. SUCTION PIPING (Continued)…

**Conversion Data**

GPM = \(0.3\) X Barrels per day

Specific gravity = weight fluid in pounds/gal.

\(8.34\)

SP. GR. = \(\frac{\text{Pounds/cu. ft}}{62.4}\)

Feet Head = \(\frac{\text{PSI} \times 2.31}{\text{SP. GR.}}\)

**Metric Conversions**

GPM = 264 X liters/min.

\(15.9\) X liters/sec.

GPM = 4.4 X meters\(^3\)/hr.

GPM = 264 X meters\(^2\)/min.

feet = 3.28 X meters

PSI = 14.2 X Kg/cm\(^2\)

SP. GR. = 1 X grams/cu. cm.

Pounds per gallon = .133 X pounds/cu. ft.

Brake Horsepower = Curve Horsepower X SP. GR. Required

![Diagram of suction piping correct and incorrect methods]

Wrong

Recommended

Pump Suction
## Engineering Data...

### I. SUCTION PIPING (Continued)...

#### Theoretical Discharge of Nozzles in U.S. Gallons Per Minute

<table>
<thead>
<tr>
<th>Head*</th>
<th>Diameter of nozzle in inches</th>
<th>Velocity of discharge ft/sec.</th>
<th>⅛</th>
<th>⅜</th>
<th>⅝</th>
<th>⅞</th>
<th>1</th>
<th>1 ⅛</th>
<th>1 ⅝</th>
<th>2</th>
<th>2 ⅛</th>
<th>2 ⅝</th>
<th>2 ⅞</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>23.13</td>
<td>36.6</td>
<td>13.3</td>
<td>23.6</td>
<td>36.9</td>
<td>53.1</td>
<td>72.4</td>
<td>94.5</td>
<td>120</td>
<td>148</td>
<td>179</td>
<td>213</td>
<td>289</td>
<td>378</td>
</tr>
<tr>
<td>15</td>
<td>4.6</td>
<td>47.25</td>
<td>16.3</td>
<td>28.9</td>
<td>45.2</td>
<td>65.0</td>
<td>88.5</td>
<td>116.0</td>
<td>147</td>
<td>181</td>
<td>219</td>
<td>260</td>
<td>354</td>
<td>463</td>
</tr>
<tr>
<td>20</td>
<td>46.2</td>
<td>54.55</td>
<td>18.8</td>
<td>33.4</td>
<td>52.2</td>
<td>75.1</td>
<td>102.0</td>
<td>134.0</td>
<td>169</td>
<td>209</td>
<td>253</td>
<td>301</td>
<td>409</td>
<td>535</td>
</tr>
<tr>
<td>25</td>
<td>57.7</td>
<td>61.0</td>
<td>21.0</td>
<td>37.3</td>
<td>58.3</td>
<td>84.0</td>
<td>114.0</td>
<td>149.0</td>
<td>189</td>
<td>234</td>
<td>283</td>
<td>336</td>
<td>458</td>
<td>598</td>
</tr>
<tr>
<td>30</td>
<td>69.3</td>
<td>66.05</td>
<td>23.0</td>
<td>40.9</td>
<td>63.0</td>
<td>92.0</td>
<td>125.0</td>
<td>164.0</td>
<td>207</td>
<td>256</td>
<td>309</td>
<td>368</td>
<td>501</td>
<td>655</td>
</tr>
<tr>
<td>35</td>
<td>80.8</td>
<td>72.2</td>
<td>24.8</td>
<td>44.2</td>
<td>69.0</td>
<td>99.5</td>
<td>135.0</td>
<td>177.0</td>
<td>224</td>
<td>277</td>
<td>334</td>
<td>398</td>
<td>541</td>
<td>708</td>
</tr>
<tr>
<td>40</td>
<td>92.4</td>
<td>77.2</td>
<td>26.6</td>
<td>47.3</td>
<td>73.8</td>
<td>106.0</td>
<td>145.0</td>
<td>188.0</td>
<td>239</td>
<td>296</td>
<td>357</td>
<td>425</td>
<td>578</td>
<td>756</td>
</tr>
<tr>
<td>45</td>
<td>103.9</td>
<td>81.8</td>
<td>28.2</td>
<td>50.1</td>
<td>78.2</td>
<td>113.0</td>
<td>153.0</td>
<td>200.0</td>
<td>253</td>
<td>313</td>
<td>379</td>
<td>451</td>
<td>613</td>
<td>801</td>
</tr>
<tr>
<td>50</td>
<td>115.5</td>
<td>86.25</td>
<td>29.7</td>
<td>52.8</td>
<td>82.5</td>
<td>119.0</td>
<td>162.0</td>
<td>211.0</td>
<td>267</td>
<td>330</td>
<td>399</td>
<td>475</td>
<td>647</td>
<td>845</td>
</tr>
<tr>
<td>55</td>
<td>127.0</td>
<td>90.5</td>
<td>31.1</td>
<td>55.3</td>
<td>86.4</td>
<td>125.0</td>
<td>169.0</td>
<td>221.0</td>
<td>280</td>
<td>346</td>
<td>418</td>
<td>498</td>
<td>678</td>
<td>886</td>
</tr>
<tr>
<td>60</td>
<td>138.6</td>
<td>94.6</td>
<td>32.5</td>
<td>57.8</td>
<td>90.4</td>
<td>130.0</td>
<td>177.0</td>
<td>231.0</td>
<td>293</td>
<td>362</td>
<td>438</td>
<td>521</td>
<td>708</td>
<td>926</td>
</tr>
<tr>
<td>65</td>
<td>150.1</td>
<td>98.3</td>
<td>33.8</td>
<td>60.2</td>
<td>94.0</td>
<td>136.0</td>
<td>184.0</td>
<td>241.0</td>
<td>305</td>
<td>376</td>
<td>455</td>
<td>542</td>
<td>737</td>
<td>964</td>
</tr>
<tr>
<td>70</td>
<td>161.7</td>
<td>102.1</td>
<td>35.2</td>
<td>62.5</td>
<td>97.7</td>
<td>141.0</td>
<td>191.0</td>
<td>250.0</td>
<td>317</td>
<td>391</td>
<td>473</td>
<td>563</td>
<td>765</td>
<td>1001</td>
</tr>
<tr>
<td>75</td>
<td>173.2</td>
<td>105.7</td>
<td>36.4</td>
<td>64.7</td>
<td>101.0</td>
<td>146.0</td>
<td>198.0</td>
<td>259.0</td>
<td>327</td>
<td>404</td>
<td>489</td>
<td>582</td>
<td>792</td>
<td>1037</td>
</tr>
<tr>
<td>80</td>
<td>184.8</td>
<td>109.1</td>
<td>37.6</td>
<td>66.8</td>
<td>104.0</td>
<td>150.0</td>
<td>205.0</td>
<td>267.0</td>
<td>338</td>
<td>418</td>
<td>505</td>
<td>602</td>
<td>818</td>
<td>1070</td>
</tr>
<tr>
<td>85</td>
<td>196.3</td>
<td>112.5</td>
<td>38.8</td>
<td>68.9</td>
<td>108.0</td>
<td>155.0</td>
<td>211.0</td>
<td>275.0</td>
<td>349</td>
<td>431</td>
<td>521</td>
<td>620</td>
<td>844</td>
<td>1103</td>
</tr>
<tr>
<td>90</td>
<td>207.9</td>
<td>115.8</td>
<td>39.9</td>
<td>70.8</td>
<td>111.0</td>
<td>160.0</td>
<td>217.0</td>
<td>284.0</td>
<td>359</td>
<td>443</td>
<td>536</td>
<td>638</td>
<td>866</td>
<td>1136</td>
</tr>
<tr>
<td>95</td>
<td>219.4</td>
<td>119.0</td>
<td>41.0</td>
<td>72.8</td>
<td>114.0</td>
<td>164.0</td>
<td>223.0</td>
<td>292.0</td>
<td>369</td>
<td>456</td>
<td>551</td>
<td>656</td>
<td>892</td>
<td>1168</td>
</tr>
<tr>
<td>100</td>
<td>230.9</td>
<td>122.0</td>
<td>42.1</td>
<td>74.7</td>
<td>117.0</td>
<td>168.0</td>
<td>229.0</td>
<td>299.0</td>
<td>378</td>
<td>467</td>
<td>565</td>
<td>672</td>
<td>915</td>
<td>1196</td>
</tr>
</tbody>
</table>

*Head loss across nozzle. The actual quantity discharged by a nozzle will be less than above table.
A well tapered smooth nozzle may be assumed to give 97 to 99% of the values in the tables.
Cross Section Drawing...

Figure 9

CAUTION
Assembled weight: 1850 lbs.
Do not attempt to lift with straps.
Use chains, hook, or fork lift.
<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Qty.</th>
<th>Base Part Number</th>
<th>Processing Number</th>
<th>Item #</th>
<th>Description</th>
<th>Qty.</th>
<th>Base Part Number</th>
<th>Processing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Casing, 14X12X22</td>
<td>1</td>
<td>24022-01-30A</td>
<td>651122026</td>
<td>25</td>
<td>Bearing, Outboard (14 X 12)</td>
<td>1</td>
<td>20616-2</td>
<td>658413307</td>
</tr>
<tr>
<td></td>
<td>Casing, 12x10x23</td>
<td>2</td>
<td>25008-01-30A</td>
<td>662001010</td>
<td>25</td>
<td>Bearing, Outboard (12 X 10 &amp; 8 X 6)</td>
<td>2</td>
<td>20616-2</td>
<td>661009001</td>
</tr>
<tr>
<td></td>
<td>Casing, 8x6x18</td>
<td>2</td>
<td>25289-02-30A</td>
<td>662002089</td>
<td>26</td>
<td>Seal, Bearing Cover</td>
<td>1</td>
<td>7496-267</td>
<td>658408802</td>
</tr>
<tr>
<td>2</td>
<td>Nut, Casing</td>
<td>32</td>
<td>3932-61</td>
<td>648402014</td>
<td>27</td>
<td>Lock Washer</td>
<td>1</td>
<td>6124-6</td>
<td>658407002</td>
</tr>
<tr>
<td>3</td>
<td>Stud, Casing (14 X 12 &amp; 12 X 10)</td>
<td>32</td>
<td>3892-86</td>
<td>658403308</td>
<td>28</td>
<td>Lock Nut, Bearing</td>
<td>1</td>
<td>6123-6</td>
<td>658406509</td>
</tr>
<tr>
<td></td>
<td>Stud, Casing (8 X 6)</td>
<td>16</td>
<td>3892-90</td>
<td>60128285</td>
<td>29</td>
<td>Oil Seal, Bearing Cover</td>
<td>2</td>
<td>20619-04</td>
<td>658413638</td>
</tr>
<tr>
<td></td>
<td>Stud, Casing (8 X 6)</td>
<td>16</td>
<td>3892-92</td>
<td>648401118</td>
<td>30</td>
<td>Drive Screws</td>
<td>6</td>
<td>12530</td>
<td>601482417</td>
</tr>
<tr>
<td>4</td>
<td>Gasket, Casing (14x12x22)</td>
<td>2</td>
<td>10339-55-01</td>
<td>658410301</td>
<td>31</td>
<td>Nameplate</td>
<td>1</td>
<td>23017</td>
<td>651015005</td>
</tr>
<tr>
<td></td>
<td>Gasket, Casing (12x10x23)</td>
<td>2</td>
<td>25012-01-01</td>
<td>661016001</td>
<td>32</td>
<td>Shaft</td>
<td>1</td>
<td>24029-33</td>
<td>658420007</td>
</tr>
<tr>
<td>5</td>
<td>Cover, Front (14x12x22)</td>
<td>1</td>
<td>24021-01-30</td>
<td>654131030</td>
<td>34</td>
<td>Cover, Bearing</td>
<td>1</td>
<td>24033-01-01</td>
<td>654314004</td>
</tr>
<tr>
<td></td>
<td>Cover, Front (12x10x23)</td>
<td>1</td>
<td>25009-01-30</td>
<td>662014003</td>
<td>35</td>
<td>Bolts, Bearing Cover</td>
<td>2</td>
<td>3861-139</td>
<td>648401081</td>
</tr>
<tr>
<td></td>
<td>Cover, Front (8x6x18)</td>
<td>1</td>
<td>25281-02-30</td>
<td>662014129</td>
<td>36</td>
<td>Washer, Bearing Cover</td>
<td>2</td>
<td>3936-19-6L</td>
<td>658402030</td>
</tr>
<tr>
<td>6</td>
<td>Impeller, 14x12 Clockwise Rot. 22&quot;</td>
<td>1</td>
<td>24024-X0-HS</td>
<td>662005003</td>
<td>37</td>
<td>Nuts, Bearing Housing</td>
<td>2</td>
<td>3932-62</td>
<td>658404702</td>
</tr>
<tr>
<td></td>
<td>Impeller, 12x10 Clockwise Rot. 23&quot;</td>
<td>1</td>
<td>25010-Y0-30</td>
<td>662005002</td>
<td>38</td>
<td>Bolt, Bearing Housing</td>
<td>4</td>
<td>3861-138</td>
<td>648401057</td>
</tr>
<tr>
<td></td>
<td>Impeller, 8x6 Clockwise Rot, 18&quot;</td>
<td>1</td>
<td>25282-T0-30</td>
<td>662005018</td>
<td>39</td>
<td>Washer, Flat</td>
<td>2</td>
<td>3936-19-8L</td>
<td>658402030</td>
</tr>
<tr>
<td>7</td>
<td>Seal, Impeller Nose</td>
<td>1</td>
<td>7496-156</td>
<td>658408109</td>
<td>40</td>
<td>Bolt, Packing Gland</td>
<td>2</td>
<td>3861-165</td>
<td>601408289</td>
</tr>
<tr>
<td>8</td>
<td>Seal, Impeller</td>
<td>1</td>
<td>4372-29-21</td>
<td>658405006</td>
<td>41</td>
<td>Gland, Packing Half</td>
<td>2</td>
<td>24034-01-13</td>
<td>654315100</td>
</tr>
<tr>
<td>9</td>
<td>Nose, Impeller (Hex Design)</td>
<td>1</td>
<td>24025-04-25L</td>
<td>652390901</td>
<td>42</td>
<td>Packing Set</td>
<td>1</td>
<td>8264-344-K</td>
<td>658409503</td>
</tr>
<tr>
<td>10</td>
<td>Nose, Impeller (Two Flat Design)</td>
<td>1</td>
<td>24025-01-25L</td>
<td>652390900</td>
<td>43</td>
<td>Screw, Cap</td>
<td>2</td>
<td>3909-04-87</td>
<td>658404027</td>
</tr>
<tr>
<td>11</td>
<td>Screw, Set</td>
<td>1</td>
<td>14410-19</td>
<td>658414003</td>
<td>44</td>
<td>Plug, Grease</td>
<td>1</td>
<td>8505-1</td>
<td>601474695</td>
</tr>
<tr>
<td>12</td>
<td>Jam Nut</td>
<td>1</td>
<td>24026-25L</td>
<td>658414255</td>
<td>45</td>
<td>Seabriher</td>
<td>1</td>
<td>8527-1</td>
<td>601473008</td>
</tr>
<tr>
<td>13</td>
<td>Screw, Impeller</td>
<td>1</td>
<td>7496-153</td>
<td>658406059</td>
<td>46</td>
<td>Plug, Fitting</td>
<td>1</td>
<td>13368</td>
<td>661010020</td>
</tr>
<tr>
<td>14</td>
<td>Mechanical Seal (Crane Type)</td>
<td>1</td>
<td>24036</td>
<td>658416102</td>
<td>47</td>
<td>Plug, Pipe</td>
<td>2</td>
<td>8505-2-01</td>
<td>658409859</td>
</tr>
<tr>
<td>15</td>
<td>Sliding Box, Mech. Seal (14 X 12)</td>
<td>1</td>
<td>24027-01-30</td>
<td>653322305</td>
<td>48</td>
<td>Wearplate, Sliding Box</td>
<td>1</td>
<td>24023-01-XX</td>
<td>654310507</td>
</tr>
<tr>
<td>16</td>
<td>Sliding Box, Mech. Seal (12 X 10)</td>
<td>1</td>
<td>24027-02-30</td>
<td>662014002</td>
<td>49</td>
<td>Nut and Washer Assembly</td>
<td>2</td>
<td>22216-02</td>
<td>658413935</td>
</tr>
<tr>
<td>17</td>
<td>Sleeve, Shaft</td>
<td>1</td>
<td>24029-21BZ</td>
<td>656422201</td>
<td>50</td>
<td>Bolt, Packing Box</td>
<td>2</td>
<td>3861-168</td>
<td>1/2-13x4 lg Gr 5</td>
</tr>
<tr>
<td>18</td>
<td>Sleeve, Seal</td>
<td>1</td>
<td>7496-234</td>
<td>658408505</td>
<td>51</td>
<td>Stuffing Box, Spill</td>
<td>2</td>
<td>24037-01-87</td>
<td>654317007</td>
</tr>
<tr>
<td>19</td>
<td>Seal, Slinger</td>
<td>1</td>
<td>7496-238P</td>
<td>658408554</td>
<td>52</td>
<td>Lantern Ring Half</td>
<td>2</td>
<td>24039-13</td>
<td>658418207</td>
</tr>
<tr>
<td>20</td>
<td>Oil Seal, Inboard Bearing</td>
<td>2</td>
<td>20619-03</td>
<td>658413604</td>
<td>53</td>
<td>Filling, Grease</td>
<td>1</td>
<td>13368-01</td>
<td>601499403</td>
</tr>
<tr>
<td>21</td>
<td>Bearing, Inboard</td>
<td>1</td>
<td>20515-2</td>
<td>658413000</td>
<td>54</td>
<td>Screw, Cap</td>
<td>2</td>
<td>3909-13-87</td>
<td>658404065</td>
</tr>
<tr>
<td>22</td>
<td>Frame, 14 X 12</td>
<td>1</td>
<td>24031-01-01</td>
<td>654312008</td>
<td>55</td>
<td>Tool, Impeller Nose &amp; Nut</td>
<td>1</td>
<td>24040</td>
<td>658420203</td>
</tr>
<tr>
<td></td>
<td>Frame, 12 X 10</td>
<td>1</td>
<td>24031-02-01</td>
<td>662014001</td>
<td>56</td>
<td>Tool, Impeller Removal</td>
<td>1</td>
<td>24041</td>
<td>658420252</td>
</tr>
<tr>
<td></td>
<td>Frame, 8 X 6</td>
<td>1</td>
<td>25283-02-01</td>
<td>662014130</td>
<td>57</td>
<td>Tool, Shaft Holder</td>
<td>1</td>
<td>24042</td>
<td>658420302</td>
</tr>
</tbody>
</table>
With over 120 locations worldwide, National Oilwell Varco is located near you. To find the nearest Distribution Service Center, machinery center or repair facility, please give us a call at our main office listed below.

Or you can access our website at the URL listed below, where you may search by location or country.

http://www.nov.com/contactus/

Sales/Technical Information:
USA Tollfree:  1 (800) 800-4110
Internet:  http://www.nov.com

National Oilwell Varco is a leading manufacturer of reciprocating plunger pumps, centrifugal pumps, and fluid end replacement parts. We also offer a complete set of solutions to fluid transfer challenges. For more Information, contact National Oilwell Varco directly at the Headquarters in Houston, Texas. All National Oilwell Varco products are available throughout the U.S. and around the world from service centers, authorized distributors, and representatives.

© Copyright 1999 by National Oilwell, L.P. All Rights Reserved. NATIONAL OILWELL, NATIONAL, and OILWELL are registered trademarks of NATIONAL OILWELL, L.P. Houston, Texas, USA. All other trademarks used are registered to their respective companies. The information and data in this brochure, including but not limited to pictures, photographs, charts, diagrams, drawings, lists, written comments, and specifications, are accurate to the best of our knowledge and belief, but are intended for general information only. Applications suggested for the materials and other information are described only to help readers make their own evaluations and decisions, and are neither guarantees nor are they to be construed as express or implied warranties of suitability for these or other applications. National Oilwell makes no warranty, either express or implied, beyond that stipulated in National Oilwell’s Standard Terms and Conditions of Sale which are available upon request.