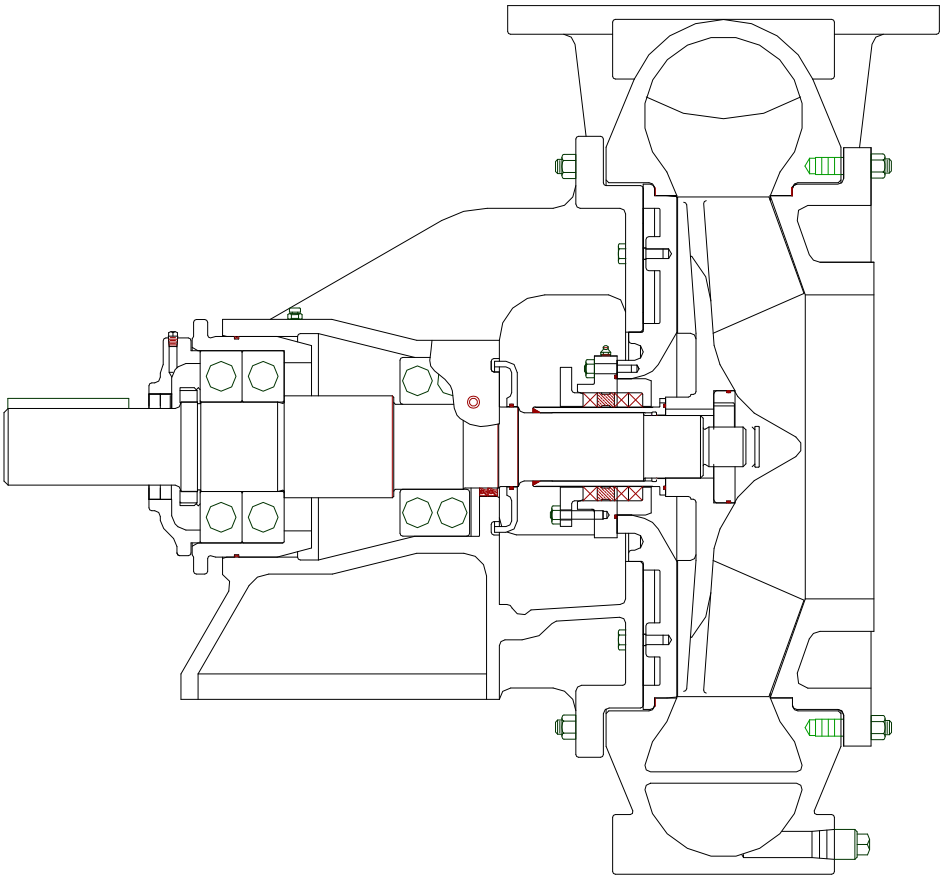
NATIONAL OILWELL VARCO

Mission Magnum XP Pump

Installation, Operation and Maintenance Instructions with Parts List



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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.

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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.

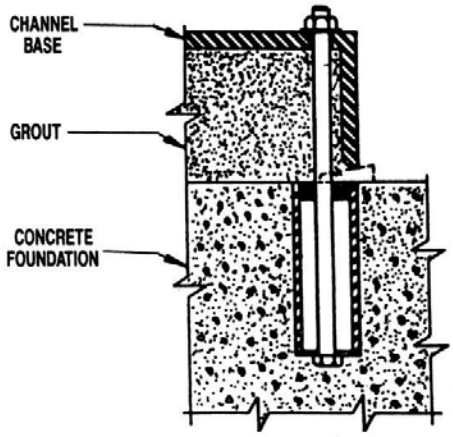


Figure 1

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

Installation…

I. GENERAL (Continued)…

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.

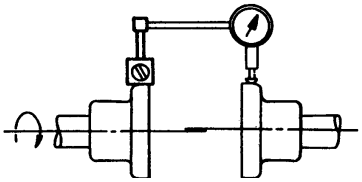


Figure 2
Measuring Offset Misalignment

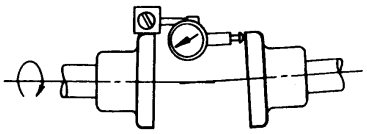


Figure 3
Measuring Angular Misalignment

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.

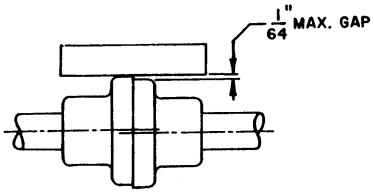


Figure 2A
Measuring Offset Misalignment

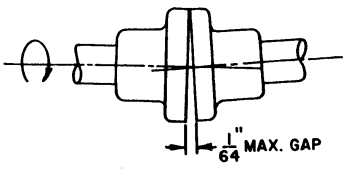


Figure 3A
Measuring Angular Misalignment

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 !

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

B. START-UP CHECKLIST

! 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.
3. Suction valve fully open.
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

Pump Size	Bearing Lubricant	Max. RPM Allowable
14 x 12, 12 x 10	(Grease)	1400
8 x 6	(Grease)	1800

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 Dolium-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.

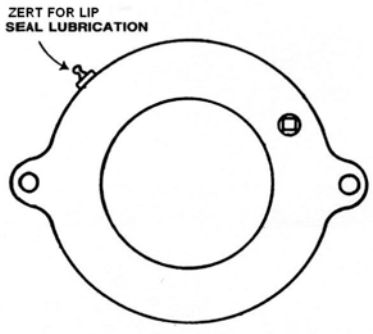


Figure 4 Front View Of Outboard Bearing Cover

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. Restrain 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.

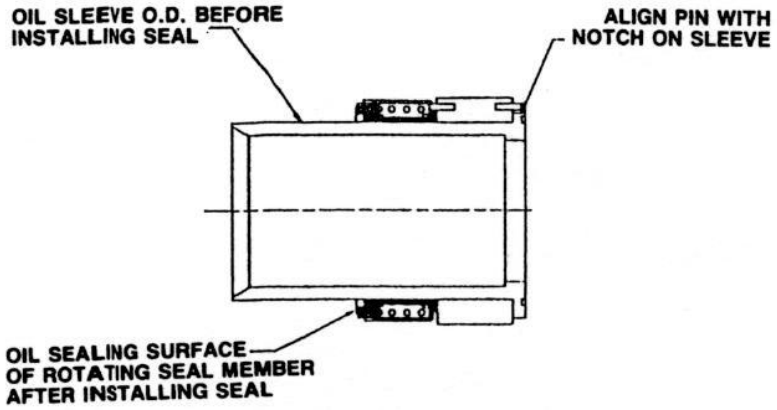


Figure 5

Maintenance…

IV. ASSEMBLY (Continued)…

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 tolulene 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.

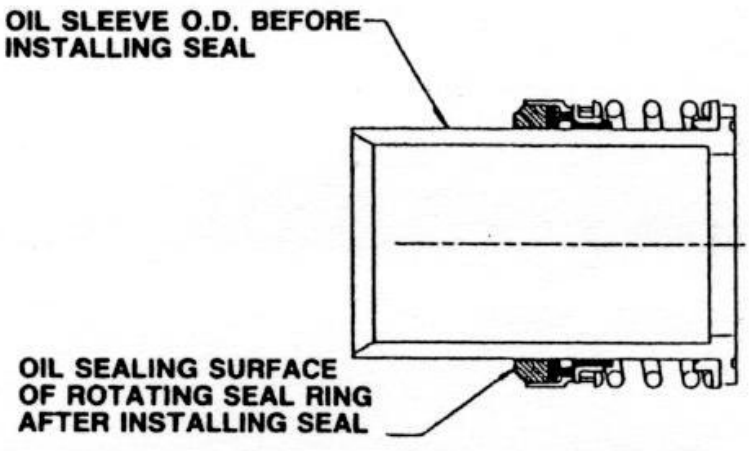


Figure 6

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.

3. Install jam nut using Loctite (243 or 222). Secure with 350 ft. lbs. torque, using tool 24042.

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.

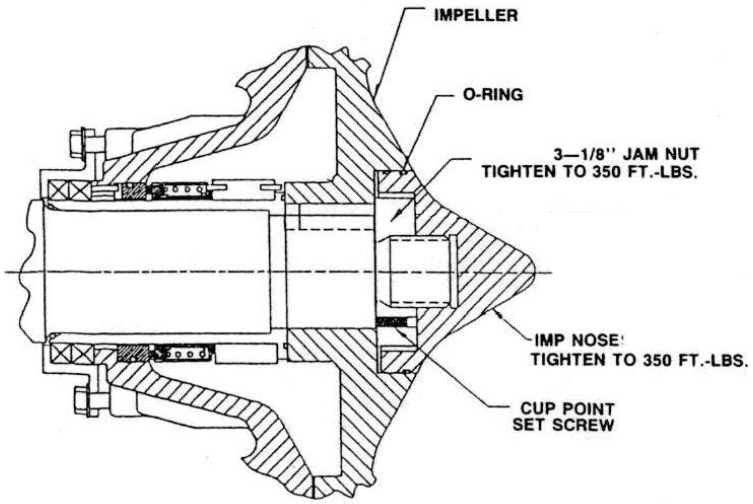


Figure 7

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.

Maintenance…

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.

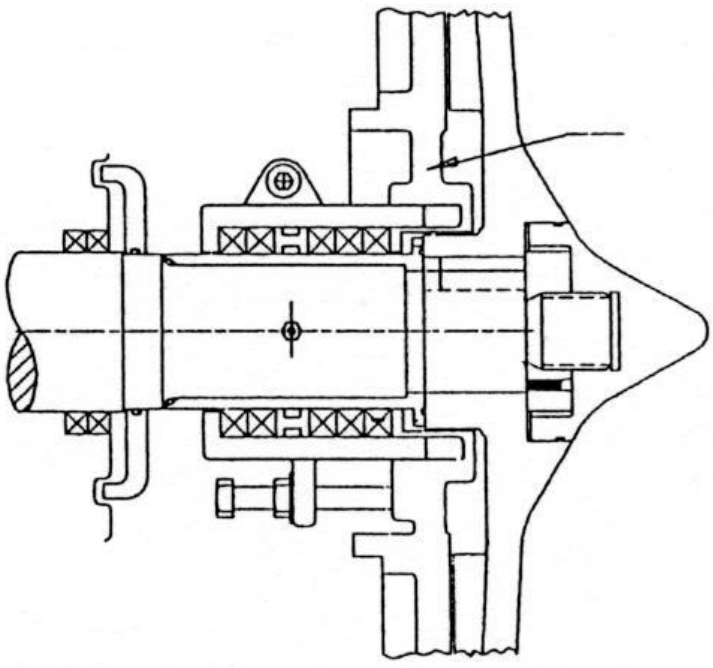


Figure 8

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…

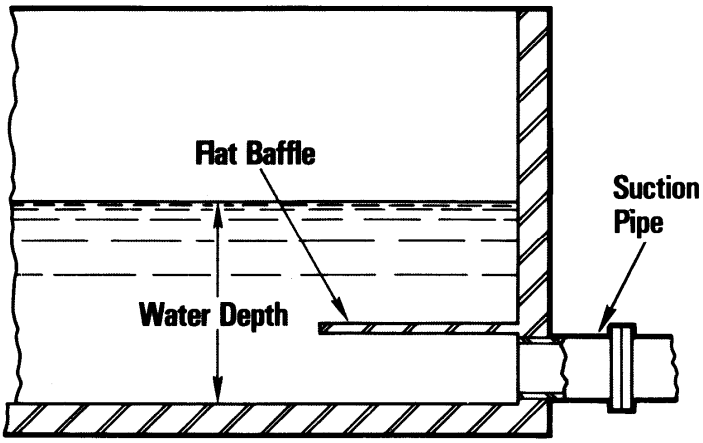
I. GENERAL (continued)…

D. TROUBLE SHOOTING GUIDE

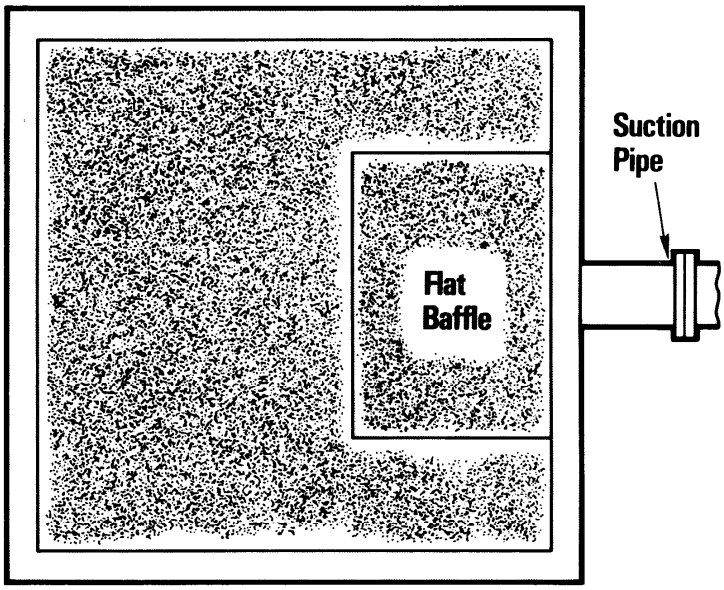
Causes	Noise/ Vibration	No Flow	Insufficient Flow	Insufficient Pressure	Excessive Power Required	Intermittent Flow	Short Bearing Life
Pump not primed		X	X				
Speed too low			X	X			
Excessive discharge head		X	X				
Insufficient NPSH available	X	X	X			X	
Impeller clogged		X	X			X	
Wrong direction of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

Engineering Data...

I. SUCTION PIPING

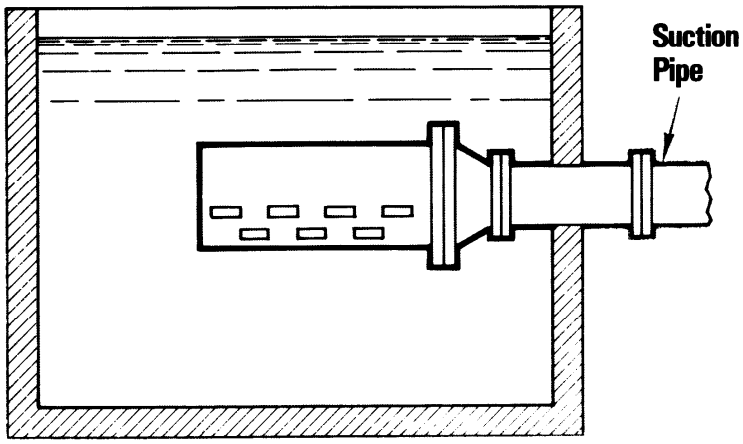


Side View



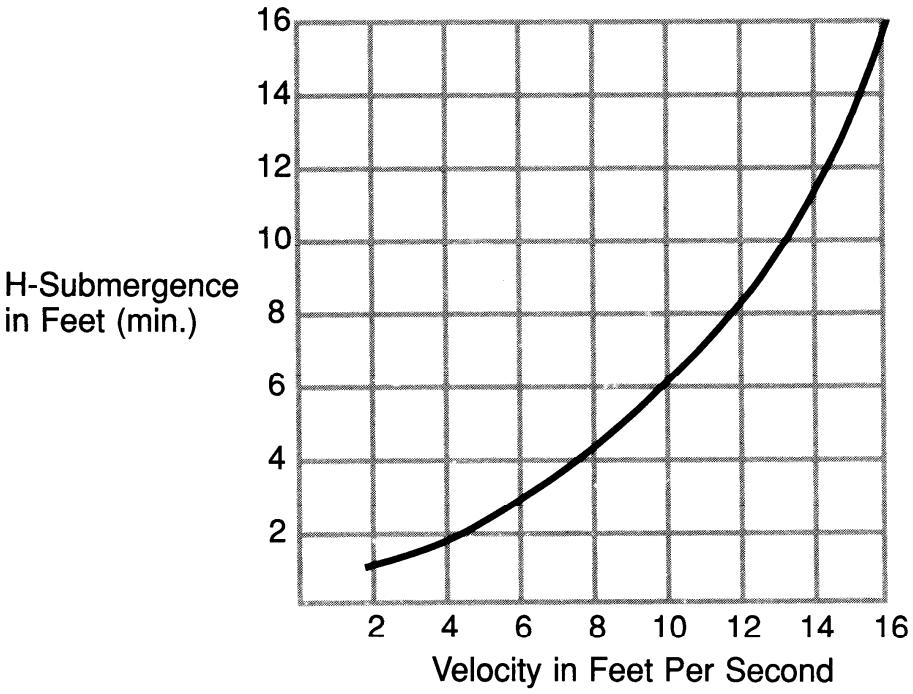
Top View

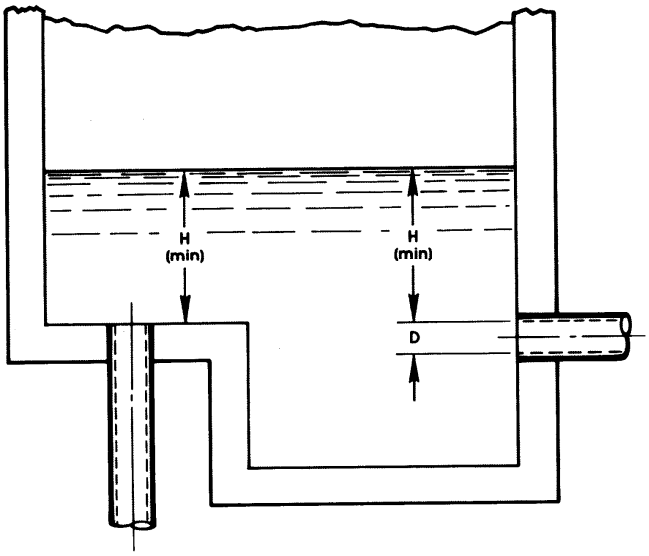
Vortex can be prevented by proper baffle arrangements.

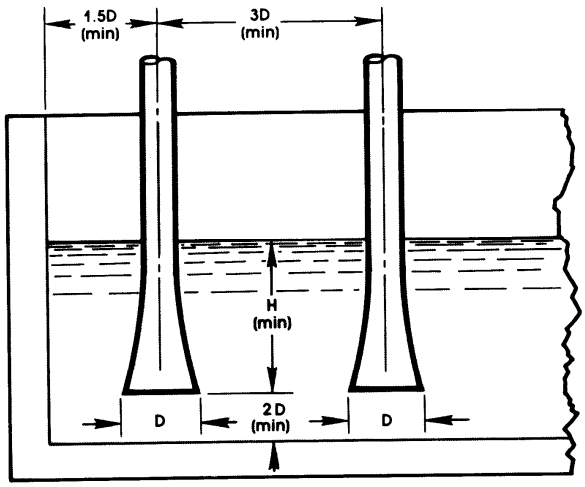


Engineering Data...

I. SUCTION PIPING (Continued)...





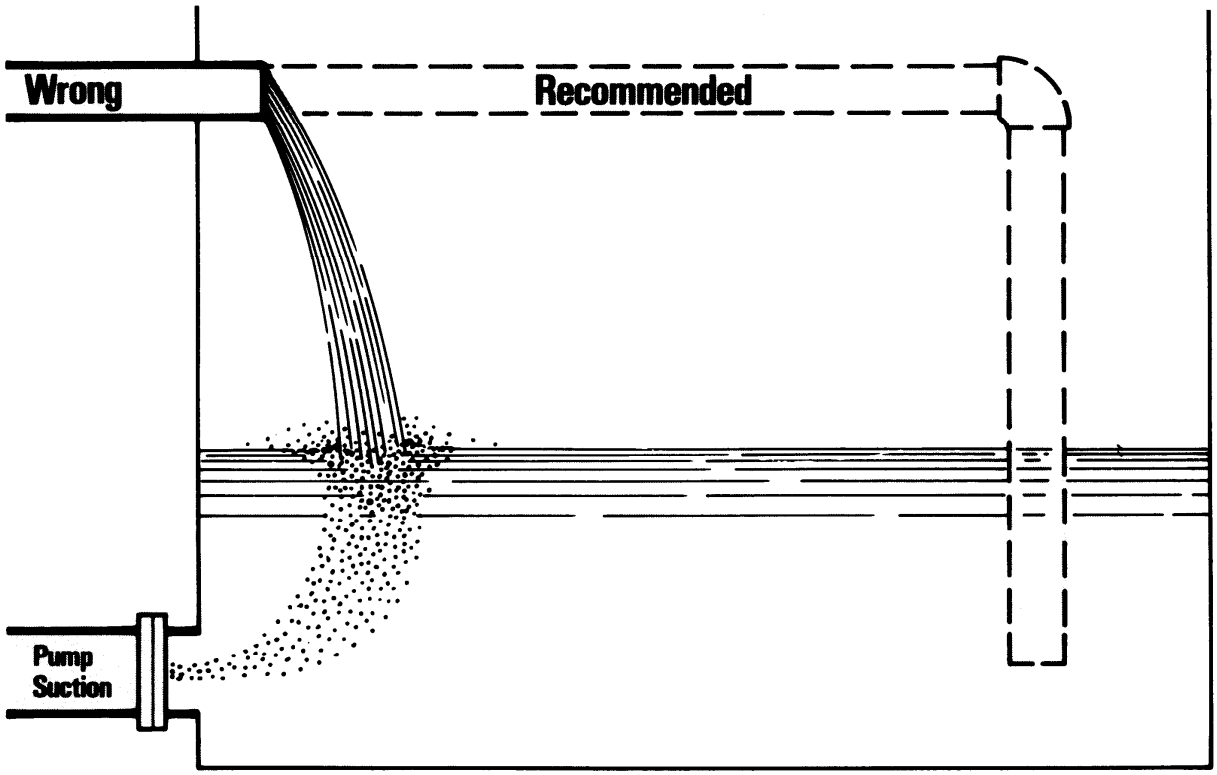


This can be used as a guide for minimum submergence and piping design.

$$\text{Velocity, feet per second} = \frac{\text{GPM x .4}}{D^2 \text{ (inches)}}$$

Engineering Data...

I. SUCTION PIPING (Continued)...



Conversion Data

GPM = .03 X Barrels per day

Specific gravity = $\frac{\text{weight fluid in pounds/gal.}}{8.34}$

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

Feet Head = $\frac{\text{PSI X 2.31}}{\text{SP. GR.}}$

PSI = $\frac{\text{Feet Head X SP. GR.}}{2.31}$

Brake Horsepower Required = Curve Horsepower X SP. GR.

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

Metric Conversions

GPM = .264 X liters/min.
GPM = 15.9 X liters/sec.
GPM = 4.4 X meters³/hr.
GPM = 264 X meters³/min.
feet = 3.28 X meters
PSI = 14.2 X Kg/cm²
SP. GR. = 1 X grams/cu. cm.

Engineering Data...

I. SUCTION PIPING (Continued)...

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

Head*		Velocity of disch	Diameter of nozzle in inches																
lb.	Feet	ft/sec.	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3
10	23.13	38.6	13.3	23.6	36.9	53.1	72.4	94.5	120	148	179	213	289	378	479	591	714	851
15	4.6	47.25	16.3	28.9	45.2	65.0	88.5	116.0	147	181	219	260	354	463	585	723	874	1041
20	46.2	54.55	18.8	33.4	52.2	75.1	102.0	134.0	169	209	253	301	409	535	676	835	1009	1203
25	57.7	61.0	21.0	37.3	58.3	84.0	114.0	149.0	189	234	283	336	458	598	756	934	1128	1345
30	69.3	66.85	23.0	40.9	63.9	92.0	125.0	164.0	207	256	309	368	501	655	828	1023	1236	1473
35	80.8	72.2	24.8	44.2	69.0	99.5	135.0	177.0	224	277	334	398	541	708	895	1106	1335	1591
40	92.4	77.2	26.6	47.3	73.8	106.0	145.0	188.0	239	296	357	425	578	756	957	1182	1428	1701
45	103.9	81.8	28.2	50.1	78.2	113.0	153.0	200.0	253	313	379	451	613	801	1015	1252	1512	1802
50	115.5	86.25	29.7	52.8	82.5	119.0	162.0	211.0	267	330	399	475	647	845	1070	1320	1595	1900
55	127.0	90.5	31.1	55.3	86.4	125.0	169.0	221.0	280	346	418	498	678	886	1121	1385	1671	1991
60	138.6	94.6	32.5	57.8	90.4	130.0	177.0	231.0	293	362	438	521	708	926	1172	1447	1748	2085
65	150.1	98.3	33.8	60.2	94.0	136.0	184.0	241.0	305	376	455	542	737	964	1220	1506	1819	2165
70	161.7	102.1	35.2	62.5	97.7	141.0	191.0	250.0	317	391	473	563	765	1001	1267	1565	1888	2250
75	173.2	105.7	36.4	64.7	101.0	146.0	198.0	259.0	327	404	489	582	792	1037	1340	1619	1955	2330
80	184.8	109.1	37.6	66.8	104.0	150.0	205.0	267.0	338	418	505	602	818	1070	1354	1672	2020	2405
85	196.3	112.5	38.8	68.9	108.0	155.0	211.0	276.0	349	431	521	620	844	1103	1395	1723	2080	2480
90	207.9	115.8	39.9	70.8	111.0	160.0	217.0	284.0	359	443	536	638	868	1136	1436	1773	2140	2550
95	219.4	119.0	41.0	72.8	114.0	164.0	223.0	292.0	369	456	551	656	892	1168	1476	1824	2200	2625
100	230.9	122.0	42.1	74.7	117.0	168.0	229.0	299.0	378	467	565	672	915	1196	1512	1870	2255	2690

*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…

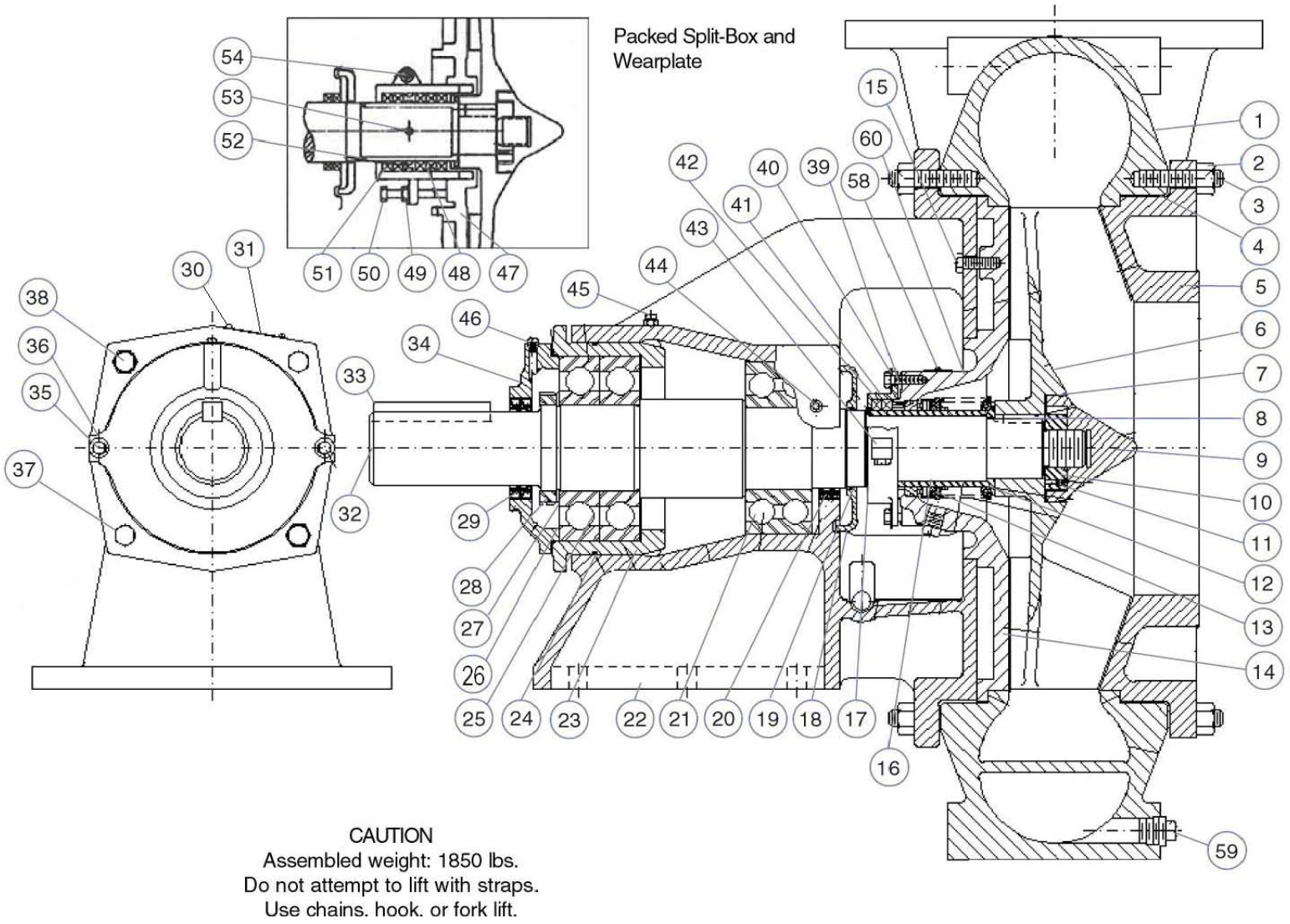


Figure 9

Parts List…

Item #	Description	Qty.	Base Part Number	Processing Number	Item #	Description	Qty.	Base Part Number	Processing Number
1	Casing, 14X12X22	1	24022-01-30A	651120206	25	Bearing, Outboard (14 X 12)	1	20616-2	658413307
	Casing, 12x10x23		25008-01-30A	662001001		Bearing, Outboard (12 X 10 & 8 X 6)	2	20616-2	661009001
	Casing, 8x6x18		25289-02-30A	662002089	26	Seal, Bearing Cover	1	7496-267	658408802
2	Nut, Casing	32	3932-61	648402014	27	Lock Washer	1	6124-6	658407002
3	Stud, Casing (14 X 12 & 12 X 10)	32	3862-86	658403308	28	Lock Nut, Bearing	1	6123-6	658406509
	Stud, Casing (8 X 6)	16	3862-90	601208285	29	Oil Seal, Bearing Cover	2	20619-04	658413638
	Stud, Casing (8 X 6)	16	3862-92	648401118	30	Drive Screws	6	12530	601482417
4	Gasket, Casing (14x12x22)	2	10399-55-01	658410501	31	Nameplate	1	23017	601501505
	Gasket, Casing (12x10x23)		25012-01-01	661010001	32	Shaft	1	24028-33	656420007
	Gasket, Casing (8x6x18)		25012-02-05	662010032	33	Key, Coupling	1	4372-30-21	658405055
5	Cover, Front (14x12x22)	1	24021-01-30	654310309	34	Cover, Bearing	1	24033-01-01	654314004
	Cover, Front (12x10x23)		25009-01-30	662014003	35	Bolts, Bearing Cover	2	3861-139	648401081
	Cover, Front (8x6x18)		25291-02-30	662014129	36	Washer, Bearing Cover	2	3936-19-L8	648402030
6	Impeller, 14x12 Clockwise Rot. 22"	1	24024-X0-HS	662005003	37	Nuts, Bearing Housing	2	3932-62	658404702
	Impeller, 12x10 Clockwise Rot. 23"		25010-Y0-30	662005002	38	Bolt, Bearing Housing	4	3861-138	648401057
	Impeller, 8x6 Clockwise Rot. 18"		25292-T0-30	662005018	39	Washer, Flat	2	3936-19-L8	648402030
7	Seal, Impeller Nose	1	7496-158	658408109	40	Bolt, Packing Gland	2	3861-165	601408289
8	Key, Impeller	1	4372-29-21	658405006	41	Gland, Packing Half	2	24034-01-13	654315100
9	Nose, Impeller (Hex Design)	1	24025-04-25L	652309601	42	Packing Set	1	8264-344-K	658409503
	Nose, Impeller (Two Flat Design)		24025-01-25L	652309600	43	Screw, Cap	2	3909-04-87	658404207
	Nose, Impeller (2 Flat Ion Nitride)		24025-03-25L	662014054	44	Plug, Grease	1	8505-1	601474695
10	Screw, Set	1	14430-19	658411400	45	Breather	1	8267-1	601473689
11	Jam Nut	1	24026-25L	658414255	46	Plug, Fitting	1	19368	661010020
12	Seal, Impeller	1	7496-153	658408059	58	Plug, Pipe	2	8505-2-01	658409859
13	Mechanical Seal (Crane Type)	1	24036	658416102	59	Plug, Pipe	1	8505-6-01	658410006
14	Stuffing Box, Mech. Seal (14 X 12)	1	24027-01-30	653322305	60	Tag, Mechanical Seal	1	22566	603445727
	Stuffing Box, Mech. Seal (12 X 10)		24027-02-30	662014002	**Packed Split-Box and Wearplate**				
	Stuffing Box, Mech. Seal (8 X 6)		25290-02-30	662014128	47	Wearplate, Split Box	1	24023-01-XX	654310507
15	Bolt, Stuffing Box	2	3861-117	648401016	48	Packing Set	1	8264-345-K	658409552
16	Sleeve, Shaft	1	24029-21BZ	656422201	49	Nut and Washer Assembly	2	22216-02	658413935
17	Seal, Sleeve	1	7496-234	658408505	50	Bolt, Split-Box	2	3861-168	1/2-13x4 lg Gr 5
18	Slinger	1	24030-01-13	654311604	51	Stuffing Box, Split	2	24037-01-87	654317007
19	Seal, Slinger	1	7496-238P	658408554	52	Lantern Ring Half	2	24039-13	658418207
20	Oil Seal, Inboard Bearing	2	20619-03	658413604	53	Fitting, Grease	1	19368-01	601499403
21	Bearing, Inboard	1	20615-2	658413000	54	Screw, Cap	2	3909-13-87	658404405
22	Frame 14 X 12	1	24031-01-01	654312008	**Auxiliary Tools**				
	Frame 12 X 10		24031-02-01	662014001	55	Tool, Impeller Nose & Nut	1	24040	658420203
	Frame 8 X 6		25293-02-01	662014130		Tool, Impeller Nose (HEX)		Standard Hex Socket	
23	Housing, Bearing	1	24032-01-01	654313006	56	Tool, Impeller Removal	1	24041	658420252
24	Seal, Bearing Housing	1	7496-272	658408901	57	Tool, Shaft Holder	1	24042	658420302

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