

## 7 Maintenance

	<p><b>⚠ DANGER</b></p> <p><b>LOCKOUT-TAGOUT (LOTO)</b></p> <ul style="list-style-type: none"><li>• Prior to allowing any checking, maintenance, or other work on the equipment, all hazardous energy sources (for example, electrical, mechanical, hydraulic, pneumatic, etc.) must be isolated using an appropriate lockout-tagout procedure.</li><li>• Ensure that the intake and discharge openings are totally isolated from all potentially pressurized connections and that they are, and can only be exposed to atmospheric pressure.</li><li>• Drain the pump and isolate pipework before dismantling the pump. The appropriate safety precautions must be taken when the pumped liquids are hazardous.</li><li>• Failure to follow appropriate LOTO procedures may result in serious personal injury or death.</li></ul>
	<p><b>⚠ WARNING</b></p> <p><b>PERSONNEL INJURY</b></p> <ul style="list-style-type: none"><li>• The pump must be installed, operated and maintained only by the personnel who are trained and have sufficient knowledge about the hazards that may occur during the pump operation and maintenance.</li><li>• A comprehensive risk assessment shall be conducted prior to performing any maintenance or repair work on the equipment.</li><li>• Refer to the requirements in the driver, seal, and other auxiliary equipment IOMs prior to beginning work.</li></ul>
	<p><b>⚠ WARNING</b></p> <p><b>PERSONNEL INJURY DUE TO HAZARDOUS MATERIALS</b></p> <p>During disassembly, personnel may come in contact with hazardous materials. These materials must be identified before disassembly, and the correct SDS must be made available and appropriate safety management precautions put in place. Hazardous pumpage must be purged and flushed from the pump prior to disassembly. Always wear appropriate PPE.</p>
	<p><b>⚠ WARNING</b></p> <p><b>HOT FLUIDS AND SURFACES</b></p> <p>Fluids and surfaces may become hot during operation (for example, hot pumpage, pump surfaces, thrust bearing surfaces, thrust bearing oil, driver oil, driver surfaces, packing leakage, etc.). Appropriate safety measures and PPE must be utilized to prevent personnel injury.</p>

## 7.1 Periodic Inspection, Condition Monitoring, and Preventative Maintenance

- Periodic inspections (ideally once a month) and preventative maintenance are recommended as the best means of preventing breakdown and keeping maintenance costs at a minimum.
- Maintenance personnel should look over the entire installation with a critical eye, each time the pump is inspected.
- A change in noise level, amplitude of vibration, or performance is an indication of a possible impending trouble and must be investigated for probable causes.
- During inspection the pump and driver should be checked for performance and change in noise or vibration level, loose bolts or piping, dirt and corrosion. It helps to develop a vibration trend analysis based upon periodic vibration reading recordings. This helps determine changes in equipment condition and optimum repair frequency.
- Variances from initial performance are an indication of changing system conditions, wear or impending breakdown of the unit.
- Clean and repaint all areas that are rusted or corroded.

## 7.2 Packing Box Maintenance

Maintenance of the packing box will consist of greasing the box when required, tightening the packing gland occasionally as the leakage becomes excessive, and installing new packing rings or sets as required.

### 7.2.1 Packing Box Greasing

- Under normal operation, once a month greasing of the packing box is typically adequate.
- Use good grade multipurpose grease such as Chevron Industrial Grease - Medium or Marfak MULTIPURPOSE #2.

### 7.2.2 Replacing the Packing

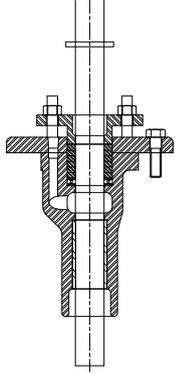
- Remove the gland and old packing. If the box contains a lantern ring remove this and the packing below it.
- Inspect the shaft or sleeve for score marks or rough spots. Ensure that the bypass holes (if required) are not plugged.
- Repair or replace badly worn shaft or sleeve. If the wear is minor dress down until smooth and concentric. Clean the box bore.
- Oil the inside and outside of the replacement rings lightly and install in the box, staggering joints 90°. Be sure to replace lantern ring in proper position when used.



#### **i** NOTICE

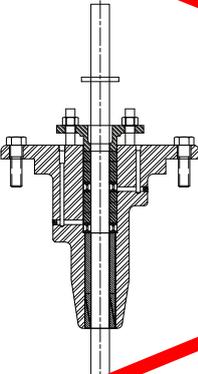
Formed replacement packing rings are recommended and are available from the factory.

- Replace the gland, tighten the nuts and make sure the gland enters the box squarely. Keep the packing under moderate pressure for one minute to allow it to cold flow and adjust itself. Back off on the gland until loose and the gland nuts are hand tight before starting the pump.



	Shaft Size	# Packing Rings	Packing Ring Size	Depth of Box	O.D. of Packing
	3/4	5	5/16	1 23/32	1 3/8
	1	5	5/16	1 23/32	1 5/8
	1 3/16, 1 1/4	5	3/8	2 1/16	2
	1 1/2	5	3/8	2 1/16	2 1/4
	1 11/16	5	7/16	2 13/16	2 5/8
	1 15/16	6	3/8	2 13/32	2 3/4
	2 1/4	6	3/8	2 3/4	3 1/16
	2 7/16	6	3/8	4 3/4	3 1/4

Table 7-1: Standard Type Box



	Shaft Size	# Packing Rings	Packing Ring Size	Depth of Box	O.D. of Packing
	3/4	6	5/16	3 5/8	1 3/8
	1	6	5/16	3 5/8	1 5/8
	1 3/16, 1 1/4	7	3/8	4 5/8	2
	1 1/2	7	3/8	4 5/8	2 1/4
	1 11/16	7	7/16	4 7/8	2 5/8
	1 15/16	8	3/8	4 7/8	2 11/16
	2 1/4	6	1/2	4 3/4	3 1/4
	2 7/16	6	1/2	4 3/4	2 1/2
	2 11/16	7	1/2	4 1/2	3 3/4

Table 7-2: Hi-pressure Type Box

### 7.3 Start-up with New Packing

- Check that the bypass line (if used) is connected and packing gland is loose.
- Start the pump and allow it to run for 20 to 30 minutes; do not tighten the gland during this “run-in” period even if leakage is excessive. If the leakage continues to be more than normal, adjust as outlined in [“Packing Box Adjustment” on page 36.](#)
- If the new packing causes excess heating during run-in, flush the shaft and packing box area with cold water or shut the pump down. Allow to cool if necessary.

### 7.4 Auxiliary Packing Box Maintenance

- Pumps equipped with mechanical seals may also be provided with an auxiliary packing box to restrict leakage, should the mechanical seal fail.
- This packing gland must be left loose since under regular operation the packing is not cooled or lubricated by the pumpage.
- This packing box arrangement is designed to help contain leakage past the mechanical seal in the event of a seal failure. It is not designed as a primary seal and must not be used as such.

## 7.5 Mechanical Seal Maintenance

	<b>⚠ CAUTION</b>
	<b>DAMAGE DUE TO MECHANICAL SEAL TABS</b> <ul style="list-style-type: none"><li>• For pumps fitted with mechanical seals always follow the seal manufacturer's instruction manuals.</li><li>• Always remove the mechanical seal setting tabs prior to starting the pump.</li><li>• Failure to remove the tabs will result in damage to both the pump and the seal.</li><li>• Ensure that the set screws are tight before removing the setting tabs.</li></ul>

Mechanical seals should not be readjusted unless there is a reason. Best results are obtained when the seal is properly set at start-up and left that way. If the seal starts to leak after an extended operating period, some readjusting can be done at that time. However, it is usually best to replace the seal during the next scheduled maintenance cycle.

After impeller readjustment, seal leakage may occur due to improper seal adjustment or improper seating of the seal parts.

	If readjustment of the seal does not correct the problem, refer to the manufacturer's instruction manual for further information.
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## 7.6 Impeller Readjustment

Typically, impellers do not require readjustment if properly set at initial installation. Almost no change in performance can be obtained by minor adjustment of enclosed impellers; however, the positioning of semi-open impellers has a definite effect on the performance of the pump. This characteristic is sometimes used to adjust the output of the pump without valving. Figure 7-1 on page 43 illustrates the general effect of raising semi-open impellers.

~~After extended operation, the sealing faces between the semi-open impellers and the bowl will wear causing a reduction in performance. The pump performance can be brought back up to almost "as new" by proper readjustment of the impellers. Refer to "Impeller Adjustment - General" on page 29 for proper adjustment procedure.~~

	<b>i NOTICE</b>
	Adjusting the impellers will change the mechanical seal setting unless the seal is loosened from the shaft. It is recommended to first loosen the seal from the shaft, perform the impeller adjustment, then reset the mechanical seal.

# Vertical Turbine Pumps

2001299 - VTP- IOM

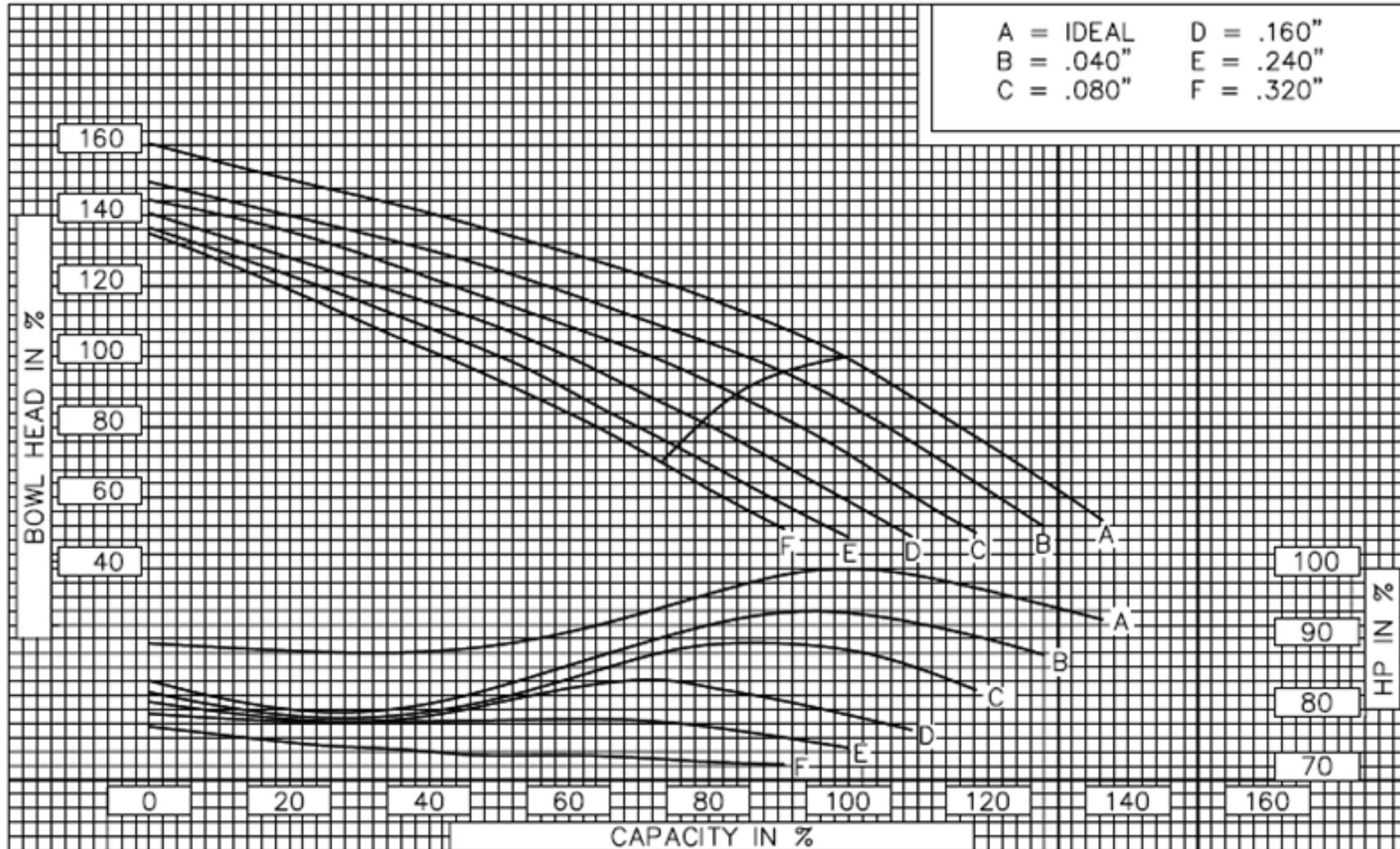


Figure 7-1: Effect of Adjusting Semi-open Impellers

~~Figure 7.1 on page 43 indicates the approximate effect of raising semi-open impellers from their ideal (a) operating position. Raising the impellers increases the clearance between the impeller and the bowl seat and reduces the performance accordingly. The chart is generic and not exact for any particular pump model since each model reacts differently. 100% head and capacity are to be taken as the head and capacity of the pump at the best efficiency point (BEP).~~

~~For example, if a particular pump delivers 250 gpm and 50' head at BEP, when impellers are properly adjusted, raising the impellers 0.080" will reduce the capacity to approximately 181 gpm (72.5% of 250 gpm) while maintaining 50' head or conversely, the pump will deliver 250 gpm at 37.5' head (75% of 50'). The horsepower will be about 91.50% of the previous horsepower.~~

## 7.7 Pump Lubrication

Other than the packing box lubrication outlined in "Packing Box Greasing" on page 40 and lineshaft lubrication outlined in "Lineshaft Lubrication" on page 37 the pump does not require further periodic lubrication. The suction bearing should be repacked with grease when repairs are done on the bowl assembly (it is not necessary to repack the suction bearing before bowl assembly repairs are required). Special pump construction may allow for more lubrication options, reference the pump's Certified Outline Drawing for such features and details.

## 7.8 Driver and Auxiliary Equipment Maintenance

Drivers and auxiliary equipment require periodic maintenance.



Refer to the manufacturer's instruction manual for proper installation, operation, and maintenance.