



# SERIES 'HA' PLASTIC HORIZONTAL PUMP

OPERATION AND  
SERVICE GUIDE  
O-0121A  
SEPTEMBER 2006

MODEL

HA6 x 4F x 10

Refer to Bulletin P-207 and Parts List P-0979

## **! SAFETY PRECAUTIONS BEFORE STARTING PUMP**

1. Read Operating Instructions and Instructions supplied with chemicals to be used.
2. **Refer to a chemical resistance data chart for compatibility of materials in pump with solution to be used.**
3. Note temperature and pressure limitations.
4. **Personnel operating pump should always wear suitable protective clothing: face mask or goggles, apron and gloves.**
5. All piping must be supported and aligned independently of the pump.
6. Always close valves slowly to avoid hydraulic shock.
7. Ensure that all fittings and connections are properly tightened.

## **! BEFORE CHANGING APPLICATION OR PERFORMING MAINTENANCE**

1. **Wear protective clothing as described in Item 4 above.**
2. Flush pump thoroughly with a neutralizing solution to prevent possible harm to personnel.
3. **Verify compatibility of materials as stated in Item 2 above.**
4. Shut off power to motor at disconnect switch.

## **! IMPORTANT**

1. **Pump is constructed of plastic, all fasteners are stainless steel. The shaft is Titanium or Hastelloy C. The plastic may be chemically compatible with the solution being pumped, but care should be taken to protect the pump components against unnecessary wear and abuse. Confirm seal material compatibility.**
2. Record all model and serial numbers for future reference. Always specify model number and serial number when ordering parts.
3. Pump flow curves are based on pumping water. Increased motor horsepower may be necessary for pumping other liquids or reduced motor horsepower may be permissible when pumping at higher discharge head. Refer to pump curve.
4. Impellers are designed to offer maximum pump output and the motors are sized for non-overloading at maximum flow conditions. Impellers may be trimmed to reduce flow and discharge head, if desired. See Parts List for impellers of various diameters.
5. **NOTE: Pump inlet piping should be one to two sizes larger than pump suction size for long suction lines operating near vaporization temperature and low atmospheric pressure (high elevation). Refer to Bul-**

letin for pipe, fittings, etc. Be aware of the high rate of thermal expansion of plastic pipe when piping to a pump. Refer to **PRE START-UP instruction No. 9.**

6. **Review Parts List and maintain an emergency inventory of replacement items to assure that pump is returned to service with the least delay.**
7. **! Maximum pressure produced by pumps when pumping water -**
  - A. 37 PSI on 60 HZ – 1725 RPM motors
  - B. 177 KPa on 50 HZ – 1450 RPM motors.**Do not subject pump to pressures over 22 PSI or 151 KPa, when motor is not running. Mechanical seal faces can separate and leak.**
8. When recirculating, use syphon breaker to prevent solution loss due to malfunction.

## **PRE START-UP**

**Read items 1-12 below and cavitation supplement page, before starting pump.**

1. Verify that operating temperature is not in excess of pump design temperature.
2. Before attaching suction line to pump, turn the impeller slightly to verify free rotation of seal faces.
3. Connect electrical supply to motor starter. If starter is furnished, verify that starter and motor are wired for the correct operating voltage and correct overload heaters. It is recommended that a motor starter be installed for overload protection, if one was not provided with the pump assembly. Wire in accordance with local codes.
4. Wire for counter clockwise rotation when facing the pump suction. **DO NOT** start a motor to check rotation before liquid is in the pump body. Dry rotation of the mechanical seal can cause immediate failure of the seal components. Check pump rotation only with liquid in the pump by **jogging** motor. If pump rotation is incorrect, the motor should be stopped and properly wired. Incorrect rotation causes a reduction in flow rate and can cause pump failure.
5. All units are factory tested to meet published or specified flow rates and to confirm that the seal assembly functioned properly at time of shipment.
6. Install a strainer on the pump suction line to prevent foreign material from entering the pump and possibly causing impeller damage. The pump is constructed of plastic for chemical resistance and does not have the shock resistance of cast steel.
7. Do not over-tighten suction and discharge flanges.
8. Do not use double water flushed seal with solutions that have high 'heat of solutions' such as concentrated sulfuric acid which will have an exothermic reaction when mixed with water.

9. **IMPORTANT:** Suction Pipe should never be less than diameter of suction port size. Using pipe smaller than the suction port size increases the velocity of the fluid and the friction loss in the suction line, thereby negatively affecting the pump performance or service life. Suction pipe velocities should be as low as possible. An increase in suction pipe size will accomplish this. For long suction lines in excess of 10 ft. of straight pipe, the next larger pipe should be used. This is especially important when pumping at elevated temperatures, high elevations or when the suction line includes several elbows. The preceding conditions contribute to pump cavitation which results in under-performance and premature failure of pump components. The suction pipe should be as short and straight as possible with a minimum of pipe fittings. Refrain from using elbows or tees in the suction line. Do not install any elbows within 10 pipe diameters of the suction line.
10. Do not install a valve on suction line for throttling/controlling pump flow. A valve in the suction line should only be used as a shut-off valve when pump is removed for servicing. A ball valve is recommended for this application.
11. A flow control valve should only be installed on the pump discharge.
- IMPORTANT:** Considerable damage will result from the rapid temperature rise which will occur if the pump is run against a closed discharge valve.
12. A Dri-Stop pump protector is recommended for prevention of pump damage during abnormal operation. See Bulletin A-105 and Operation and Service Guides O-1680 & O-1685.

**START-UP**

1. If pump is installed with a liquid head at the suction line, it will not be necessary to prime the pump. It is only necessary to make sure that liquid is in the suction line and pump body before energizing the motor.

2. If the pump is installed without a positive suction head, proper priming procedure should be followed. It is absolutely necessary that the suction line and pump be completely filled with liquid. If piped in place, liquid for priming may be introduced through the discharge line.
3. Operate pump for 2 - 4 minutes, then de-energize motor. With bare fingers and after rotation stops, feel metal spring and retainer of seal assembly (only applicable on single seal pumps). If hot to the touch, pump is cavitating and corrective action should be taken before energizing motor. If seal area is not hot, motor may be energized. Refer to supplement.

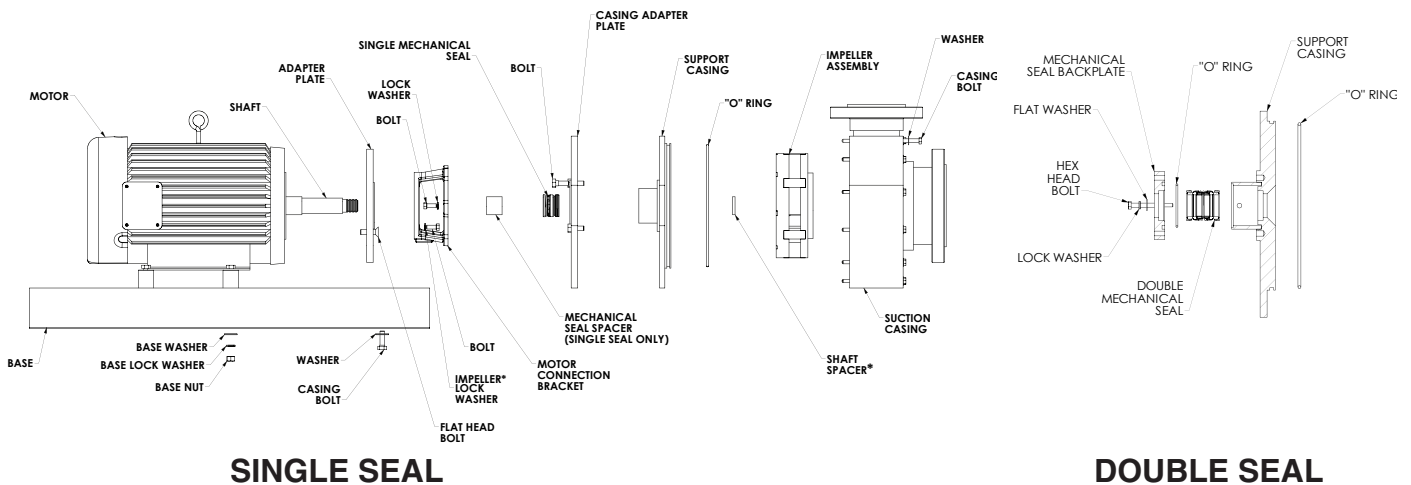
**PUMP SERVICE**

**1. TO REMOVE SUCTION CASING**

Remove the eight 3/8"-16 hex head bolts that hold the suction casing to the support casing. Pull suction casing forward to release it from the "O"-ring seal. Replace suction casing by assembling it to the support casing and fastening with the eight bolts. Tighten in an alternating pattern.

**2. TO REPLACE SINGLE MECHANICAL SEAL AND/OR IMPELLER**

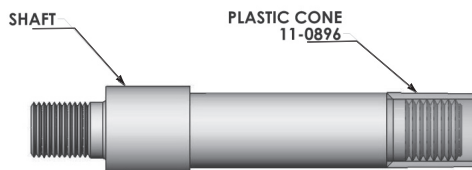
- A. Remove suction casing as described in Section 1. Mechanical seal is located inside the sleeve support casing.
- B. Remove motor fan and cover.
- C. Grip end of motor shaft with vice grips
- D. Remove impeller by turning counter clockwise using a strap wrench. Also remove shaft spacer.\*
- E. Remove the six 3/8"-16 hex head bolts located on inside wall of motor connecting bracket. The steel casing adapter plate and support casing will come off the motor together.
- F. Slide carbon washer, bellows and spring off of shaft.
- G. The mechanical seal ceramic seat can be removed from the counterbore in the support casing by using



\* Shaft spacer (1 3/4" OD x 1/4" thick) to be used only with impellers that **DO NOT** have a metal impeller insert permanently attached to the impeller

a piece of plastic pipe that will fit into the end of the support casing. Push the ceramic ring to force it out of its seat.

- H. Lubricate ceramic seat cup before installing:  
Viton: vegetable oil or water. Use of non-petroleum products (silicone etc.) may cause problems with chemical solution. EPDM: glycerine or water. Use of petroleum product will react with EPDM and prevent proper sealing. Place support casing into hot water for approximately 5 minutes so that seat recess will expand. Insert ceramic seat and elastomer cup into bottom of support casing sleeve. Use a piece of plastic pipe to push the ceramic seat to bottom of recess. Do not use metal or objects that will scratch the lapped face of the ceramic seat. Check for squareness.
- I. Lubricate the shaft as indicated in Section H. Install plastic cone (p/n 11-0896) on shaft threads to prevent damaging bellows. Slide spring on shaft. Slide carbon washer and bellows assembly on shaft with carbon face out.



- J. Install adapter plate and support casing assembly to motor connecting bracket with the six 3/8"-16 hex head bolt and washer.
- K. Impeller shaft spacer (1 3/4 OD x 1/4 THICK) is to be used only with impellers that that **DO NOT** have a metal insert permanently attached to the impeller.
- L. Install impeller by turning clockwise. Tighten with strap wrench while motor shaft is locked with vise grips.
- M. Replace motor fan and fan cover.
- N. Replace suction casing as described in Section 1.

### 3. TO REPLACE DOUBLE MECHANICAL SEAL

- A. Take off water lines to inlet and outlet of sealhousing by removing top hex nut at fitting.
- B. Remove suction casing and impeller as described in section 2.
- C. Remove the six 3/8"-16 hex head bolts located on inside wall of motor connecting bracket. The steel casing adapter plate, support casing and double mechanical seal chamber with mechanical seals will come off the motor together.
- D. Remove mechanical seal back-plate by taking out the four 5/16"-18 hex head bolts.
- E. The mechanical seal ceramic seat can be removed

from the counterbore in the support casing by using a piece of plastic pipe that will fit into the end of the support casing. Push the ceramic ring to force it out of its seat. The ceramic seat in the back-plate can be removed the same way.

- F. Install solution-side ceramic washer and elastomer cup into counterbore of support casing as described in Section 2-H. Note elastomer material identification color code. Install water-end ceramic washer and elastomer cup into mechanical seal back-plate.
- G. Install solution-side carbon washer and bellows assembly into sleeve of support casing with the carbon face toward the ceramic seat. Place spring on top of bellows. Place water-side carbon washer and bellows assembly on top of spring with carbon face up.
- H. Put 'O'-ring in groove at end of support casing sleeve.
- I. Assemble mechanical seal back-plate to support casing with four 5/16"-18 hex bolts and flat washer.
- J. Lubricate the shaft as indicated in Section 2-H. Install plastic cone (p/n 11-0896) on shaft threads to prevent damaging bellows. Align mechanical seals in seal chamber with a piece of plastic pipe. Slide complete assembly onto shaft.
- K. Install adapter plate and support casing assembly to motor connecting bracket with the six 3/8"-16 hex head bolt and washer.
- L. Impeller shaft spacer (1 3/4 OD x 1/4 THICK) is to be used only with impellers that that **DO NOT** have a metal insert permanently attached to the impeller.
- M. Install impeller by turning clockwise. Tighten with strap wrench while motor shaft is locked with vise grips.
- N. Replace motor fan and fan cover.
- O. Replace suction casing as described in Section 1.

### 4. TO REPLACE SUPPORT CASING

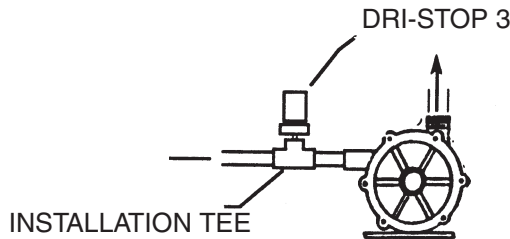
See Section 2 or 3.

### 5. TO REPLACE MOTOR

- A. Remove suction casing as described in Section 1.
- B. Remove impeller and support casing as outlined in Section 2 or 3. Remove the 3/8"-16 x 1" long hex head machine screws holding the motor connecting bracket to the motor end bell.
- C. While motor shaft is locked with vice grips, unscrew (turn ccw) pump shaft from motor shaft with a pipe wrench. Make sure pipe wrench is placed on larger diameter section of the shaft near the motor. **DO NOT** place pipe wrench on smaller diameter section of the shaft where the mechanical seal will be positioned.
- D. Assemble pump to motor by:
  - 1. Apply "Loctite Thread Lock" to pump shaft threads and install shaft in motor. Tighten pump shaft with a pipe wrench placed on the larger diameter section of the shaft near the motor.

2. Fasten motor connecting bracket to motor.
3. Check run-out (eccentricity) of shaft by turning shaft and measuring at extreme end. It must be less than .005 TIR. Straighten shaft by pressing down on that area of the shaft where maximum run-out occurs.
4. Assemble impeller and support casing as outlined in Section 2 for single seal, and in Section 3 for double seal.

## 6. INSTALLATION OF DRI-STOP PUMP PROTECTOR



### - SINGLE MECHANICAL SEAL PUMP (See Bulletin A-105 and Operation and Service Guide O-1680)

- A. Dri-Stop 3 Pressure Switch Pump Protector assembly should be assembled to a tee fitting installed in the pump discharge pipework.
- B. The unit is designed to operate from a 24V-115V-230V-1/50-60 supply.
- C. Switch contacts are pressure sensitive and close at approximately 4 PSI. These contacts should be wired in series with the coil of a suitable push button motor starter equipped with a set of contacts which are momentarily made when start button is pressed. These contacts are connected such that they short out the Dri-Stop Switch contacts to enable the motor to be energized.
- D. Head/pressure of liquid generated at the pump discharge keeps the Dri-Stop contacts closed and the motor energized until such time that the absence of liquid allows the switch contacts to open and de-energize the motor.
- E. The Dri-Stop pressure switch provides effective protection in circumstances where the supply of liquid to the pump is instantaneously interrupted, eg. tank is empty; suction pipe leaks.

## 7. INSTALLATION OF DRI-STOP PUMP PROTECTOR-DOUBLE WATER FLUSHED MECHANICAL SEAL PUMP (See Bulletin A-105 and Operation and Service Guide O-1685.)

**⚠ Double mechanical seal pumps require a constant flow of fresh water when pump is in operation.**

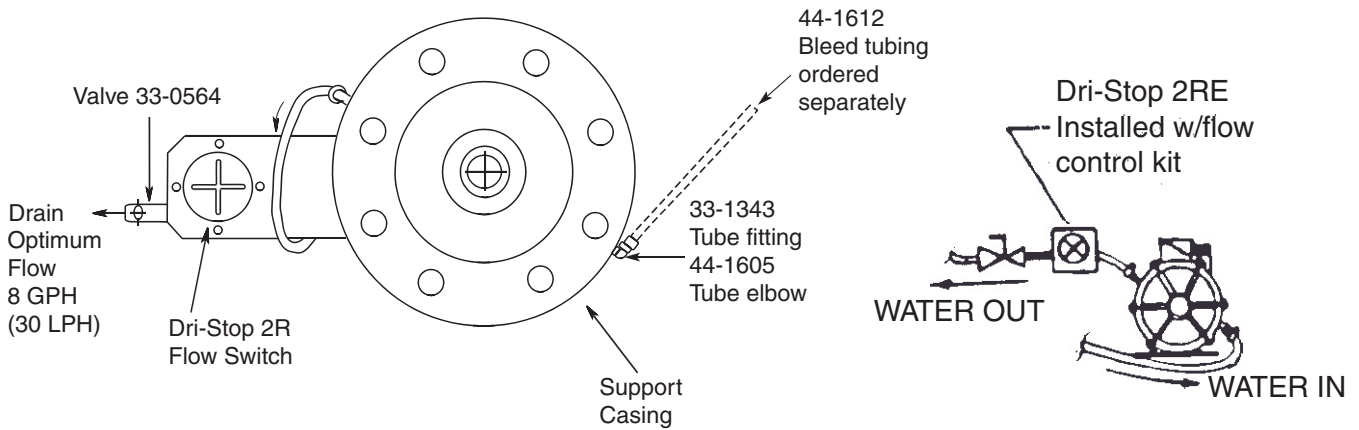
- A. Dri-Stop 2 Flow Switch should be installed in the water outlet line from the seal housing.
- B. It is recommended that a valve be fitted to the outlet of the switch unit to enable adjustment of flow rate.

- C. The unit is designed to operate from a 24V or 115V or 230V/1/50-60 supply. It has a relay with open contacts when the rotor is stationary. Flow of water through the unit causes the rotor to rotate and close the contacts which are connected in series with the coil of the motor starter.
- D. The motor can only be energized when water is flowing through the seal housing causing closure of the switch contacts. Interruption of the water supply will cause the starter to trip, de-energizing the motor.
- E. For optimum seal performance and longevity, an incoming flow of 8 GPH @ 15 PSI above pump operating pressure must be provided to the seal chamber. The seal will operate with lower incoming water pressure under certain conditions. Provide the following operating conditions to SERFILCO'S Application Engineering Department to confirm suitability of the application with lower water pressure to the seal chamber:

- |                  |                        |
|------------------|------------------------|
| - NPSH available | - Pump operating PSI   |
| - Motor HP       | - Solution S.G.        |
| - Motor RPM      | - Solution temperature |
| - Operating flow | - Solution content     |

## TROUBLESHOOTING

1. **MOTOR STOPS:** Check for correct voltage, wiring and proper overload heaters in motor starter. Take an ammeter reading at operating conditions and compare to value shown on motor nameplate. Measured value should be equal to or less than rated value. Check for friction free rotation of pump by manually turning fan blade.
2. **PUMP DOES NOT DELIVER CORRECT FLOW:** Check suction strainer and pump inlet to be sure neither is plugged with debris. Compare required flow conditions to original specifications and pump curve which is based on water. Check motor running direction. It should be clockwise from motor fan end.
3. **FREQUENT SEAL FAILURE** can be caused by the following: Abrasives in solution, crystallization on seal components, chemical attack on seal components (see available alternates), improper priming and pump operation while dry, pump sucking air or under-sized suction piping causing cavitation and vibration. Worn motor bearings or bent pump shaft may also be causes of failure. Always flush pump with clean liquid after pumping solutions that could crystallize during pump shut-down.
4. Review parts list and maintain an inventory of recommended spare parts for replacement. This will assure that the pump is returned to operation with minimum delay.



## **CAVITATION OR 'STARVATION' OF SINGLE MECHANICAL SEAL SERIES 'H' PUMPS**

Dry operation and cavitation can cause seal failure in an identical manner, "burning" of plastic seal plate. It is the duration of these operating conditions which determines the degree of burning. **A charred impeller sleeve** is the result of short duration of dry operation or cavitation. **A charred impeller sleeve and charred seal support plate** is the result of longer dry operation or cavitation.

It is imperative that all users are alerted to the conditions which cause cavitation and make sure they are avoided. A pump can operate with some degree of cavitation and apparently not fail.

### **CAVITATION - STARVATION**

A review of the 'H' pump flow curve shows that for all combinations of flow and TDH, there is a required NPSH. If the "available" is less than the "required NPSH", the pump will cavitate. This does not necessarily imply that the pump will immediately fail, or that it will not function to **apparent** stated performance. Cavitation means that the pump is operating inefficiently and at less than minimum design conditions. Premature wear or failure can occur and the duration of inefficient operation is not necessarily accompanied by excessive noise and/or vibration.

Cavitation is usually the result of a restricted inlet, such as undersized or long suction pipe or an excess of fittings and flow restrictions on the pump suction line. Conversely, if no inlet restriction, then the pump will perform exactly to the flow curve. Unfortunately it is usually difficult to determine or know if or when a pump is performing "under spec" caused by cavitation because of the difficulty in accurately determining flow and TDH under field conditions. The sound of cavitation is much like pumping gravel.

It has been verified by test that cavitation can cause seal failure within 30 seconds and failure is **identical** to

that of dry operation . . . while pumping 50-60 GPM! The restricted inlet is causing limited flow into the pump and a partial vacuum or a "void of solution" now exists at the seal face. Heat is rapidly generated and radiated from the ceramic-carbon face. Temperatures between the faces and the adjacent plastic reach 450°F. The plastic gets hot and continued operation causes seal failure and charring of the plastic. Note that lowering the pump flow with a valve on the discharge will not affect the pump as being described above.

### **DAMAGE TO SEAL SUPPORT PLATE**

This is caused by the convection of some of the heat which is rapidly generated at the seal face, through the the air space to the support plate itself.

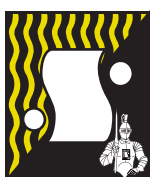
### **DAMAGE TO IMPELLER SLEEVE**

Some of the rapidly generated heat at the seal face is transmitted by convection from the face to the impeller sleeve.

### **DRY OPERATION**

When the pump has been operated dry or has lost its prime and continues to run, seal failure will occur due to excessively high temperatures generated on the mating carbon and ceramic seal faces. Cause of failure can easily be verified by black charring of the plastic sleeve of the impeller assembly and the plastic around the stationary seal area and distortion at rear of seal support plate. Failure can occur within 30 seconds and the degree of failure is strictly dependent upon duration of pump operation. Trying to stop burning (excessive heat) by liquid cooling will thermal shock the ceramic. This can be seen by a ceramic cracked in 2 - 6 places.

The above problem conditions can be avoided. Refer to Page 2, Pre Start-Up Instructions No. 10 and 11.



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