OPERATION AND
SERVICE GUIDE
O-2505
FEB. 2001

SERIES 'HK' HORIZONTAL PUMPS

MODELS
HK 1½ x 1½ CK
HK 1½ x 1½ K

Refer to Bulletin P-203 and Parts List P-990.

The Series HK horizontal pump is constructed of CPVC or 100% PVDF with an external single seal or double water-flushed mechanical seal with choice of EPDM or Viton elastomers and "O"-rings. Mechanical seal components that contact the solution are the carbon face, ceramic face, and the elastomers. All fasteners are stainless steel for total chemical resistance with non-metallic construction of all wetted components. Impellers are designed to offer maximum pump output and the motors are sized for non-overloading at maximum flow conditions. Pump flow curves are based upon water. Increased motor horsepower will be necessary for pumping solutions with a specific gravity greater than 1.0 or reduced horsepower may be permissible when pumping at higher discharge head.

Care should be taken to protect the pump components against unnecessary wear and physical abuse. Review parts list and maintain an emergency inventory of replacement items to assure that pump is returned to service with the least delay. Record model, serial and product code numbers for future reference and specify numbers when ordering parts.

⚠ 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. Shut off power to motor at disconnect switch.

IMPORTANT

1. Do not use a double mechanical seal pump with solutions, such as concentrated sulfuric acid, that have an endothermic reaction when mixed with water.
2. The Series HK pump is not a self-priming pump. It is recommended that the pump have a constant flooded suction. Damage to pump seals can result within 30 seconds of the onset of dry run operation. A vortex or other means of air introduced into the pump will cause premature pump/seal failure.
3. Double seal pumps require a fresh water supply line connected to the seal chamber. When pump is in operation, a constant flow of 4 GPH @ 15 PSI above pump operating pressure provided to the seal chamber is recommended.
4. Rotation of motor must be correct. Incorrect rotation will cause an extreme reduction in flow rate, discharge head, and could also cause the impeller to unscrew. A rotation arrow affixed to the motor indicates proper rotation. View the motor from the fan end and bump start the pump motor to verify correct rotation. Check pump rotation with liquid in the pump. Dry rotation of the mechanical seal can cause immediate failure of the seal components.

INSTALLATION

Secure the motor to a flat, level surface. Locate the pump as close to the process tank as possible. The pump is not self-priming. A flooded suction is required to maintain proper prime for the pump to function properly. If the pump is installed without flooded suction (not recommended), proper priming of pump will be required. It is absolutely necessary that the suction line and pump be completely filled with liquid before energizing motor. A foot valve might be required on the suction line to maintain proper prime. However, the use of a foot valve could result in the possibility of damage to the pump or pump performance. Avoid the use of elbows on the suction supply line of the pump. The total flow rate will be decreased by 2.5 gallons per hour for every 90° elbow on the suction side. Do not place an elbow within 10 pipe diameters of the suction supply line of the pump. If it is unavoidable to use elbows or to keep the suction intake piping run as short as possible, the pipe size for the suction intake will have to be increased to compensate for restriction and friction loss especially if solution is above ambient temperature.

Do not decrease the pipe size of the suction or the discharge.

Double seal pumps require a water flush. Install an adequate supply line to the inlet side of the seal chamber. For optimum seal performance and longevity, an incoming flow of 4 gallons per hour @ 15 PSI above discharge pressure is required. Install a line from the outlet side of the seal chamber to a drain. Installing a valve and a pressure gauge on the outlet side is recommended to control the pressure inside the seal chamber.

SERFILCO offers a flow activated Dri-Stop Pump Protector for double seal pumps and a pressure activated Dri-Stop Pump Protector for single seal pumps to prevent pump damage due to dry operation. Installation of a strainer will keep foreign material from entering the pump, causing impeller and/or pump damage. Do not over-tighten suction and discharge connections to the pump body. It is suggested that TFE tape be used to seal threads rather than a pipe compound.

All units are factory tested to verify published or specified flow rates and to confirm that the pump functioned properly at time of shipment.

Please feel free to contact SERFILCO's technical support department to review your plumbing layout or other areas of concern prior to installation .

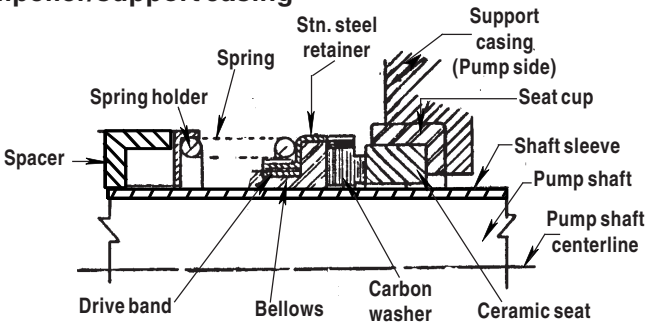
ELECTRICAL

It is recommended that a motor starter and external fused disconnect switch near the unit is installed for overload protection. Single phase units up to 1 HP are supplied with a line cord wired for 120 volts. Plug unit into a properly fused receptacle.

Rotation of motor must be correct. Incorrect rotation will cause an extreme reduction in flow rate, discharge head, and could also cause the impeller to unscrew. A rotation arrow affixed to the motor indicates proper rotation. View the motor from the fan end and bump start the pump motor to verify correct rotation. Check pump rotation with liquid in the pump. Dry rotation of the mechanical seal can cause immediate failure of the seal components.

PUMP SERVICE

Replacing single mechanical seal and/or impeller/support casing



SINGLE SEAL

1. **Removal of suction casing and/or "O"-ring**
   a. Remove the 8 screws that hold suction casing to motor connecting bracket.
   b. "O"-ring is located inside the groove of suction casing.
2. **Removal of impeller/support casing assembly**
   a. Remove the fan cover and fan.
   b. Grasp back of motor shaft with vise grips or monkey wrench.
   c. Unscrew impeller/support casing assembly using a strap wrench on the impeller. Threads of impeller are right-handed. Turn assembly counterclockwise to remove.
3. **Removal of mechanical seal**
   a. Remove the seal spacer from the back of impeller sleeve. Remove and discard washer and spring.
   b. If seal spin or slight dry run has occurred, it will be difficult to slide seal bellow over impeller sleeve. Block up support casing in an arbor press (2 x 4 or similar) and push impeller through support casing. It will help with removal to break bellow retaining ring with a chisel. If servicing only to replace seal, lubricate impeller sleeve and bellow generously with liquid soap. Place end of impeller sleeve on table. Grasp the support casing by the outer edge and push the impeller sleeve through the seal bellow.
   c. Remove ceramic seat from support casing using a punch to knock out of counterbore.
   d. Wash all reusable parts.
4. **Installing impeller and/or seal**
   a. Lubricate elastomer cup and counterbore of support casing with a lubricant (polypropylene glycol, glycerin, PAC-ease rubber lubricant, distilled water). Keep oil from contacting elastomeric parts. Place elastomer cup into bottom support casing (lapped side facing up). Press into place using a plastic pipe or a block of wood. Elastomer cup must seat flat in counterbore.
   b. Wipe off excess lubricant from ceramic face.
   c. Lubricate impeller sleeve. Insert impeller sleeve through support casing. Place a temporary 1/8" spacer on each side of the impeller. Slide bellow assembly over sleeve until carbon face meets ceramic seat. Make sure no debris is on seal faces.
   d. Wrap impeller sleeve threads with Teflon tape. Install spring and washer over impeller sleeve. Push washer and spring down with the seal spacer and screw on to impeller sleeve until threads are even with end of seal spacer.
   e. Remove 1/8" spacer from between impeller and support casing.
5. **Replacing/installing pump shaft and/or motor**
   a. Remove the 4 screws that attach connecting bracket to the motor.
   b. Grasp the back of the motor shaft with vise grips or pipe wrench.
   c. Using a pipe wrench, turn pump shaft counterclockwise to remove.
   d. Insert new shaft into motor using a thread-lock sealant on threads of shaft and tighten. Check run-out of shaft (eccentricity) using a dial indicator.
      1. Put dial indicator on end of shaft.
      2. Turn shaft to find high spot.
      3. Using a pipe, press downward on the high spot of the shaft until run-out is within .002 TIR. maximum.
      4. Install connecting bracket onto motor with the opening on bracket facing downward. Fasten to the motor with 4 bolts and flat washers.

6. Installing impeller/support casing assembly

a. Place the flat washer (11-0607) onto the motor shaft. Use a small amount of thread-lock sealant on end of motor shaft threads. Impeller has right-handed threads. Screw assembly onto motor shaft turning clockwise. Tighten using strap wrench on impeller.

b. Insert a 1/4" rod through the hole in the motor connecting bracket into the hole in the seal spacer. Turn the impeller counterclockwise until the seal spacer butts up against the flat washer.

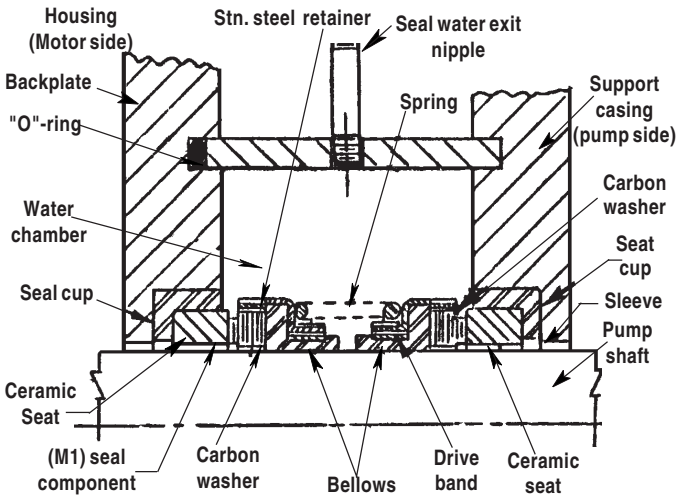
7. Installing suction casing

a. Lightly lubricate "O"-ring and insert into groove of suction casing.

b. Fasten suction casing to motor connecting bracket. Tighten the 4 screws in an alternating pattern. Do not over-tighten.

c. Replace fan and fan cover.

Replacing double mechanical seal and/or impeller/support casing



DOUBLE SEAL

1. Removal of suction casing and/or impeller/ support casing

Reference Section 1 of Pump Service.

2. Removal of impeller support casing assembly.

a. Remove the inlet and outlet flush line nipples.

b. Reference Section 2 of Pump Service.

3. Removal of mechanical seals

a. Remove the 4 bolts that hold mechanical seal back plate to support casing.

b. Reference Sections 3B through 3D of Pump Service.

4. Installing impeller and/or seal

a. Note that the seals are marked for identification. Green is for Viton. EPDM is not marked. Reference Sections 4A through 4C of Pump Service. Place elastomer cup in back plate in same manner. Wipe off excess lubricant from impeller sleeve. Place spring over impeller sleeve. Place second bellow assembly on spring. Make sure the carbon face is facing you. Push the bellow down until spring is fully compressed. If seal does not stay down, wipe off sleeve with a dry rag. No lubricant residue should be present.

b. Lightly lubricate back plate "O"-ring and insert into groove of back plate.

c. Assemble seal back plate to support casing. Place assembly in an arbor press with impeller against a flat surface. Let the arbor come down on a piece of pipe placed on the back plate over the impeller sleeve. DO NOT APPLY FORCE. This will keep the impeller from moving forward when tightening the 4 bolts. Tighten the bolts in an alternating pattern until snug. Do not over-tighten.

d. Remove 1/8" spacers.

5. Replacing/installing pump shaft and/or motor

Reference Section 5.

6. Installing impeller/support casing

a. Place adapter ring onto motor connecting bracket. Counterbore of adapter will engage into motor connecting bracket. Place the holes of the adapter ring at the 11 o'clock and the 4 o'clock positions.

b. Wrap threads of flush nipples with Teflon tape.

c. Insert flush nipples through adapter ring and tighten nipples into water jacket of support casing.

d. Reference Sections 6 and 7.

TROUBLESHOOTING

1. Motor stops after a few minutes of operation.

a. Check for correct voltage, wiring, and that the overload of the starter is set correctly to the amp-draw value for the proper voltage.

b. Verify specific gravity. Required horsepower of the pump was determined using water. Applications with a higher specific gravity will require more horsepower.

c. Verify motor is not overloading by taking an ammeter reading at operating conditions.

2. Pump does not deliver correct flow

a. Check that pump rotation is correct. Rotation must follow the same direction as the pump discharge.

b. Check that pump inlet is not blocked by debris.

c. Verify specific gravity of solution being pumped. Pump curve is based on water only.

3. Cavitation and/or vibration

The following can cause frequent seal failure:

a. Undersized suction piping, too many elbows, tees, etc.

b. Air being introduced into the pump suction by improper priming or loose pipe/hose fittings.

c. Worn motor bearings or bent pump shaft.

d. Abrasive in solutions, crystallization, and chemical attack of seal components.

CAVITATION OR 'STARVATION' OF SINGLE MECHANICAL SEAL 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** are 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 pump flow curves 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. 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 conduction of some of the heat which is rapidly generated at the seal face, through the elastomer retaining cup, to the support plate itself.

DAMAGE TO IMPELLER SLEEVE

Some of the rapidly generated heat at the seal face is conducted from the face to the rotating seal assembly through the metal ring and bellows to the impeller sleeve, resulting in charring of 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 installation instructions.

Cavitation, starvation or dry run are readily identified by inspecting failed parts. Pumps failing due to these operating conditions are not subject to warranty claims.

SERFILCO, LTD.®
2900 MacArthur Blvd. 847-509-2900
Northbrook, IL 60062-2005 U.S.A. 800-323-5431
Email: sales@serfilco.com FAX: 847-559-1995
www.serfilco.com

WESTERN
13721 Alma Avenue 310-532-0801
Gardena, CA 90249-2513 FAX: 310-532-0866