VERTICAL TURBINE

PUMPS Manual

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

vansan
WATER TECHNOLOGIES

Pump Safety Tips

Safety Apparel:

- Use insulated work gloves when handling hot bearings or using bearing heater.
- Heavy work gloves when handling parts with sharp edges, especially impellers.
- Safety glasses (with side shields) for eye protection, especially in machine shop areas.
- Steel-toed shoes for foot protection when handling parts, heavy tools, etc.
- Other personal protective equipment to protect against hazardous/toxic fluids.

Coupling Guards:

- Never operate a pump without a coupling guard properly installed.

Flanged Connections:

- Never force piping to make a connection with a pump.
- Use only fasteners of the proper size and material.
- Ensure there are no missing fasteners. Beware of corroded or loose fasteners.

Maintenance Safety:

- Always lock out power.
- Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, or disconnecting piping.
- Use proper lifting and supporting equipment to prevent serious injury.
- Observe proper decontamination procedures.
- Know and follow company safety regulations.

Observe all cautions and warnings highlighted in pump Installation, Operation and Maintenance Instructions.

IMPORTANT SAFETY REMINDER

To: Our Valued Customers
Vansan pumps will provide safe, trouble-free service when properly installed, maintained, and operated. We have an extensive network of experienced sales and service professionals to assist in maximizing your satisfaction with our products. Safe installation, operation, and maintenance of Vansan's equipment are an essential end-user responsibilities. This Instruction, Operation, and Maintenance (IOM) manual identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment. Specific to pumping equipment, two significant risks bear reinforcement above and beyond normal safety precautions.

WARNING - 1

Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

WARNING - 2

Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for assembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this manual.

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COLUMN

Flanged column construction provides positive shaft and bearing alignment, and also eases of assembly and disassembly. Bearings are spaced to provide vibration free operation below the shaft first critical speed in order to insure long bearing and shaft wear. The line shaft is supported within the column by use of bearing retainers within the column assembly. These retainers are usually integrally fabricated for all diameters.

BOWL ASSEMBLY

The bowls are generally of flanged construction for accurate alignment and ease of assembly and disassembly. Impellers may be either open or enclosed, depending on the design requirements. For sizes over 20" and in the larger size bowls, impellers are keyed to the shaft. A special first stage low NPSH impeller may be provided in certain applications.

THRUST POT

A thrust pot is utilized when the driver is not designed to carry the pump thrust.

INSTALLATION

When pumping unit is installed in a potentially explosive atmosphere, the instructions after the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact a Vansan representative before proceeding.

FOUNDATION/PIPING

SUBBASE (SOLE PLATE) INSPECTION

Sub Base and Sole Plate are terms in common use to describe a general class of solid steel plates mounted in grout (or bolted to steel structures) at the pump-foundation interface.

1. Remove the Sub Base from the Pump Discharge Head, when shipped assembled.

2. Completely clean the underside of the Sub Base. It is sometimes necessary to coat the underside of the Sub Base with an epoxy primer. This may have been purchased as an option.

3. Remove the rust preventative solution from the machined topside with an appropriate solution.

SITE WITH CONCRETE FOUNDATION

1. A pump should have adequate space for operation, maintenance, and inspection.

2. Sub Base mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit.

3. The foundation must be of adequate strength to support the complete weight of the pump, plus the weight of the liquid passing through it. A typical installation will have bolts with a pipe sleeve 2 1/2 times the bolt diameter embedded in the concrete, sized and located in accordance with the dimensions given on the Pump Certified Outline Drawing. The pipe sleeve allows movement for final positioning of the foundation bolts to conform to the holes in the Sub Base flange. Fig.1 shows a typical installation.

4. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

5. Carefully lower the Sub Base onto the foundation bolts. Hand tighten the bolt nuts.

6. Leveling the Sub Base may be done by several methods. Two common methods are:

A. Leveling wedges. This is shown in Fig.2

B. Leveling nuts on the anchor bolts. Regardless of the method, a machinist level must be used for leveling.

7. Level the Sub Base in two directions at 90 degrees on the machined surface. The levelness tolerance is 0.5 mm per meter for commercial, and 0.1 mm per meter for API.

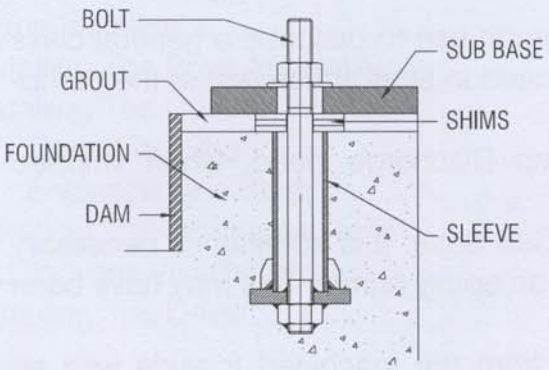

Fig. 1

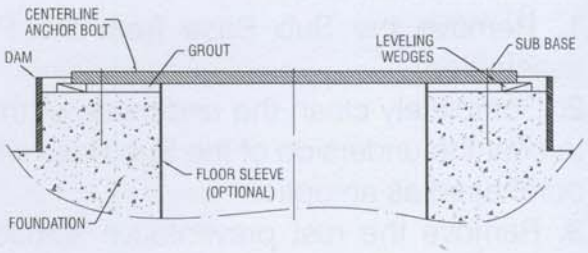

Fig. 2

NOTE: When using a machinist level, it is important that the surface being leveled is free of all contaminants, such as dust, to ensure an accurate reading. All equipment being installed must be properly grounded to prevent unexpected static electrical discharge. If not, a static electric discharge may occur when the pump is drained and disassembled for maintenance purposes.

SUBBASE GROUTING

1. Inspect foundation for dust, dirt, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it. Refer to grout manufacturer's instructions.
2. Build dam around foundation.Thoroughly wet foundation.
3. Pour grout between sub b ase and concrete foundation, up to level of dam. Remove air bubbles from grout as it is poured by puddling, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.
4. Allow grout to set at least 48 hours.
5. Tighten foundation bolts.

FINAL PUMP CHECK

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment, per the alignment procedure outlined in the Operation section to determine absence of pipe strain.

If pipe strain exists, correct piping.

PUMP INSTALLATION

When pumping unit is installed in a potentially explosive atmosphere, the instructions after the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact a Vansan representative before proceeding.

Pumps 6 m or less in length are usually shipped assembled, with the exception of the driver, packing, mechanical seal with tubing and coupling assembly, spacer or non spacer type. When provided, refer to the Certified Pump Outline for the applicable base plate plan for location of anchor bolt holes.

INSTALLING A PARTIALLY ASSEMBLED PUMP

1. If a base plate was supplied, install as described in the Foundation/Piping section.
2. Clean the plate mounting flange and clean bottom surface of discharge head mounting flange.
3. Sling through discharge hand holes or thread two eyebolts through bolt holes in mounting flange and hoist unit into position over foundation.

NOTE: Eyebolts or sling should be rated to handle in excess of the pump weight (see Outline Drawing).

INSTALLING THE BOWL ASSEMBLY

The following bowl installation instructions apply to pumps shipped disassembled.

! WARNING
Do not work under a heavy suspended object unless there is positive support and safe guards which will protect personnel should a hoist or sling fail.

! CAUTION
Do not drop any foreign object into the bowl assembly. Such an object can cause serious damage to the pump and any downstream components. Any foreign object dropped into the bowl assembly must be retrieved prior to continuing assembly.

! CAUTION

Do not attempt to lift bowl assembly by the pump shaft. This can result in damaging the pump shaft.

1. Prior to installing the bowl assembly, check that all cap screws are tight and any integral piping is installed. Remove all accumulated dust, oil, or other foreign material from the external surfaces.

2. Place two I-beam supports across the base plate opening strong enough to safely support the weight of the entire pump assembly. These Ibeams should be connected by threaded rods and nuts so as to clamp them firmly together for the portion to be supported (See Fig.3)

3. Put in place a suitable hoist or derrick over base plate opening. Place the elevator clamps just below the discharge bowl flange or install two threaded eye bolts through bolt holes in flange 180° apart.

4. Attach sling to elevator clamps or eye bolts and hoist into position over foundation opening (See Fig. 3).

5. Carefully lower bowl assembly, guiding the unit so it does not strike the sides of the opening. Continue to lower bowl assembly until the elevator clamps or discharge bowl flange rests firmly on the I-beam supports.

6. Place a cover over the discharge bowl opening to prevent entrance of dirt or other foreign matter.

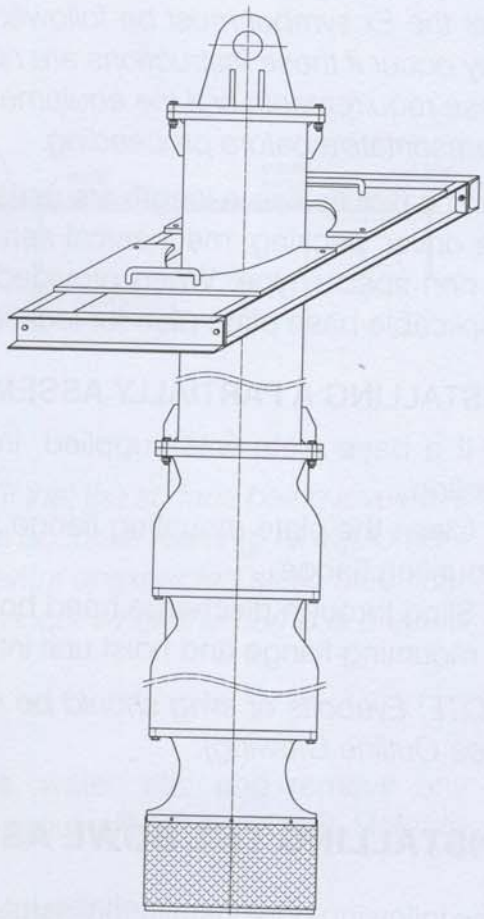

Fig. 3

! CAUTION

Do not drop any foreign object into the bowl assembly. Such an object can cause serious damage to the pump and any downstream components. Any foreign object dropped into the bowl assembly must be retrieved prior to continuing assembly.

THREADED COUPLING INSTALLATION

! CAUTION

Use "MOLYKOTE" Dow-Corning or equal for all galling material such as 316 stainless steel.

NOTE: Shaft threads are left hand.

When the threaded coupling is not installed on the pump shaft, install as follows:

1. Coat the threads with a light coat of oil for a non-galling material, or Molykote for galling material.

2. Install threaded coupling onto pump shaft by threading it on for one-half its length. A fine wire inserted in the drill hole at the center of the coupling can be used as a gauge to determine when the coupling is correctly positioned on the pump shaft. Remove the wire after installing the coupling.

KEYED COUPLING INSTALLATION

For a pump with keyed shaft coupling, proceed to *Installing the Column* section.

INSTALLING THE COLUMN

OPEN LINE SHAFT

Pump line shafts are connected with either threaded or keyed couplings. Follow only those procedures appropriate for the type of line shaft coupling supplied.

THREADED LINE SHAFT COUPLINGS

When provided, see the Certified Pump Outline Drawing for the number of column and shaft sections required.

1. Check the head shaft and line shaft for straightness. Average total run out should be less than 0.05 mm not to exceed 0.1 mm for every 3 m of shafting.

2. (See Fig. 7) Apply a thin film of oil to line shaft and coupling threads (if non-galling material, or Molykote if galling material). Start thread manually until resistance is felt. A fine wire inserted in the drill hole at the center of the coupling can be used as a gauge to determine when the coupling is correctly positioned on the shaft. Remove the wire after installing the coupling. Complete the joint using a pair of pipe wrenches, one on the top of pump shaft and the other on coupling. Run the upper line shaft into the coupling until it is hand tight. Use care not to apply wrenches on bearing journal surfaces.

CAUTION

Use "MOLYKOTE" Dow-Corning or equal for all galling material such as 316 stainless steel.

NOTE: Shaft threads are left hand.

3. Install two eyebolts diametrically opposite in the upper flange of bottom column. Attach a sling to the eyebolts and to the hoist hook. Hoist column section over bowl assembly. Lower column over line shaft until column flange engages the discharge bowl flange register. Insert as many cap screws through both flanges as possible. Tighten cap screws gradually in diametrically opposite pairs.
4. Lift bowl and column assembly high enough to allow rotation of the I-beam supports. Install and tighten remaining cap screws.
5. Lift assembly and remove supports. Slowly lower the bowl and column assembly. Place supports on the base plate and continue to lower the assembly until the column flange comes to rest on the supports.

NOTE: Normally, the bearing retainer will be integral with the column. The top flange of the column will have a male register and the bottom flange of the column will have a female register. If you have separate bearing retainers, there will be a female register in the flanges at both ends of the column. Follow step 6 below.

6. Place bearing retainer with bearing over line shaft and locate it in the bottom column flange register. (See Fig. 7)
7. Assemble next column section, or top column as required, and make certain bottom column register [or bearing retainer engages the top column register, and secure with cap screws and hex nuts provided until all column and line shaft sections required for the proper pump setting have been assembled. Tighten cap screws into hex nuts gradually and uniformly.
8. Install threaded coupling on protruding end of line shaft, if required.

NOTE: Where separate bearing retainers are used, do not over tighten flange bolts in order to make flange faces meet. Flange faces are designed to be separated by bearing retainer.

KEYED LINE SHAFT COUPLINGS

When provided, see the Certified Pump Outline Drawing for the number of column and shaft sections required. Check the head shaft and line shaft for straightness. Average total run out should not exceed 0.1 for every 3 m.

1. Apply a thin film of oil to line shaft.
2. See Fig 4.
3. Insert key onto pump shaft.
4. Lower sleeve over pump shaft to approximately one inch below top of shaft.
5. Lower line shaft until it touches pump shaft. Insert split ring into grooves in pump shaft and line shaft. Raise sleeve until it covers split ring.
6. Insert key onto line shaft. Raise sleeve to top of key.
7. Secure sleeve to split ring with lock screw and lock wire.
8. Install two eyebolts diametrically opposite in the upper flange of column. Attach a sling to the eyebolts and to thehoist hook. Hoist column section over bowl assembly. Lower column over line shaft until column flange engages the discharge bowl flange register. Insert as many cap screws through both flanges as possible. Tighten cap screws gradually in diametrically opposite pairs.
9. Lift bowl and column assembly high enough to allow rotation of the I-beam supports. Install and tighten remaining cap screws.
10. Lift assembly and remove supports. Slowly lower the bowl and column assembly. Place supports on the base plate and continue to lower the assembly until the column flange comes to rest on the supports.

NOTE: Normally, the bearing retainer will be integral with the column. The top flange of the column will have a male register and the bottom flange of the column will have a female register. If you have separate bearing retainers, there will be a female register in the flanges at both ends of the column. Follow step 11 below.

11. Place bearing retainer with bearing over line shaft and locate it in the bottom column flange register. (See Fig. 7)
12. Install next line shaft coupling assembly on protruding end of line shaft, if required, per steps 3-7 above.
13. Assemble next column section, or top column as required, and make certain bottom column register or bearing retainer engages the top column register, and secure with cap screws provided until all column and line shaft sections required for the proper pump setting have been assembled. Tighten cap screws gradually and uniformly.

NOTE: Where separate bearing retainers are used, do not over tighten flange bolts in order to make flange faces meet. Flange faces are designed to be separated by bearing retainer.

! CAUTION
Use a light turbine oil of S.A.E. 10 or equivalent. Do not use automotive oils.

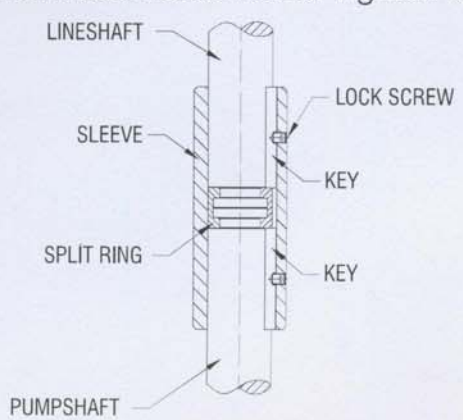

Fig. 4

ENCLOSED LINE SHAFT

Pump line shafts are connected with either threaded or keyed couplings. Follow only those procedures appropriate for the type of line shaft coupling supplied.

THREADED LINE SHAFT COUPLINGS

When provided, see the Certified Pump Outline Drawing for the number of column and shaft sections required.

1. Check the head shaft and line shaft for straightness. Average total run out should be less than 0.05 mm, not exceed 0.1 mm for every 3 m.

2. See Fig.7. Apply a thin film of oil to line shaft and coupling threads (if non-galling material, Molykote or equivalent if galling material). Start thread manually until resistance is felt. A fine wire inserted in the drill hole at the center of the coupling can be used as a gauge to determine when the coupling is correctly positioned on the shaft. Remove the wire after installing the coupling. Complete the joint utilizing a pair of pipe wrenches butting the bottom of line shaft against the top of pump shaft . Use care not to apply wrenches on bearing journal surfaces.

3. Shafting and enclosing tube will usually be made up in 3m lengths, with one odd length, generally shorter, to come out with the proper T.P.L. required by the installation. The same will apply to the column pipe. These odd lengths must go together, and are usually the top lengths, unless otherwise designated. The enclosing tube, although probably made up in 3m lengths as described, is actually composed of shorter sections screwed together over externally-threaded bronze tube bearings. The very top-most piece of line shaft tubing, the tube nipple, which extends up into the discharge head, may be distinguished by its having a long, externally threaded portion.

4. Attach a small, adjustable, pipe vise type of lifting device to a 3 m enclosing tube assembly and raise up and lower the assembly over the first length of shaft attached to the bowl. If such a device is not available, use a piece of light manila line, fastened to the tubing by a clove hitch or a double half hitch.

5. Apply "Never Seize" or some other non-hardening compound to the matching threads of the pump top screw bearing and take up tightly.
6. Install the first length of column pipe over the tube as follows: Install two eyebolts diametrically opposite in the upper flange of column. Attach a sling to the eyebolts and to the hoist hook. Hoist column section over enclosing tube / bowl assembly. Lower column over enclosing tube until column flange engages the discharge bowl flange register. Insert as many cap screws through both flanges as possible. Tighten cap screws gradually in diametrically opposite pairs.
7. Lift entire assembly by the column pipe eyebolts and remove the supports. Slowly lower the bowl and column assembly. Place the supports on the base plate and continue to lower the assembly until the upper column flange comes to rest on the supports.
8. Pour about one quart of light turbine oil into the top tubing section and screw the tube bearing into the top length until it bottoms, ready to receive the next length of tubing assembly.

! CAUTION
Use a light turbine oil of S.A.E. 10 or equivalent.
Do not use automotive oils.

9. Install line shaft coupling onto projecting end of line shaft for half the length of the coupling and continue on with each succeeding joint in same manner until all are installed.

CROSS SECTIONAL–VDP (ENCLOSED LINE SHAFT)

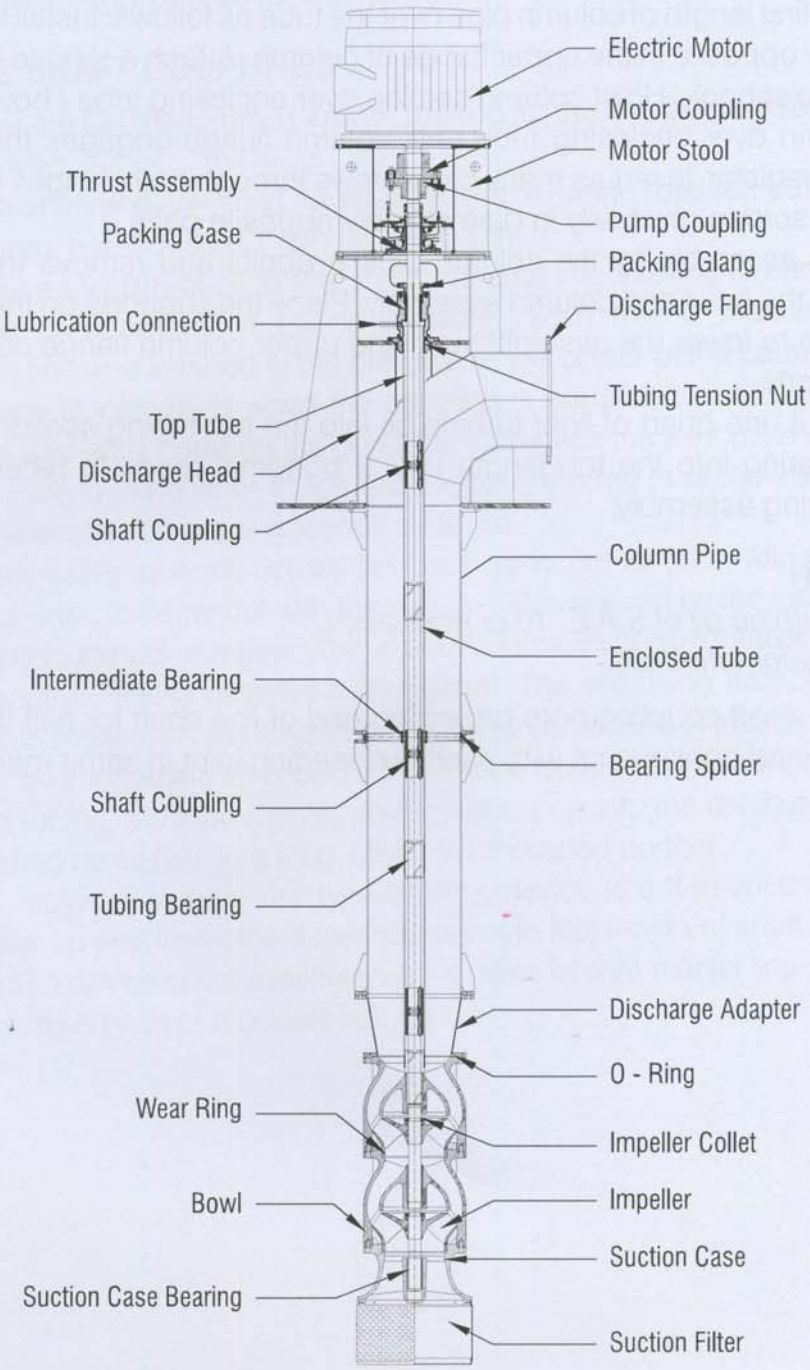

Fig. 5

INSTALLING THE DISCHARGE HEAD

OPEN LINE SHAFT

1. Vansan VDP pumps are provided with an "L" type head. Install the discharge head as follows.
2. If the stuffing box is assembled to the head, remove it and all attached piping. See Fig.9 for the applicable stuffing box provided for the pump being assembled. Remove coupling guard if provided.
Packed stuffing boxes are not allowed in an ATEX classified environment.
3. When a mechanical seal is provided, it is usually shipped separately. In case the seal is assembled to the discharge head, remove the seal prior to installing the head. See Dissassembly / Reassembly section for removal of the seal.
The mechanical seal used in an ATEX classified environment must be properly certified.
4. Remove coupling guard if provided. Attach a sling through windows (hand holes) or thread two eyebolts in the head driver support mounting holes diametrically opposite and hoist discharge head over the protruding head shaft.

! CAUTION
Do not bump or scrape the shaft protruding above the column. This could result in bending or damaging the shaft.

5. Orient the discharge head in the required position and lower the head centering the vertical hole with the head shaft protruding above the column until the discharge head engages the column. Install cap screws and secure discharge head to column. Tighten cap screws gradually in diametrically opposite pairs.
6. Lift pump assembly high enough to allow rotation of the supports. Realign and lower assembly. Install and tighten remaining cap screws. Repeat rotation and tightening procedure until all cap screws are uniformly tight.
7. Using a device with the capacity to support the weight of the entire pump assembly, hoist bowl, column, and head assembly and remove supports.
8. Lower bowl, column and head assembly until discharge head mounting flange engages baseplate. Secure discharge head to mounting plate.

NOTE: Eyebolts or sling should be rated to handle inexcess of the pump weight (see Outline Drawing).

ENCLOSED LINE SHAFT

Proceed exactly as outlined in the Open Line shaft Section , steps 4 and 5.

DRIVE SHAFT ALIGNMENT

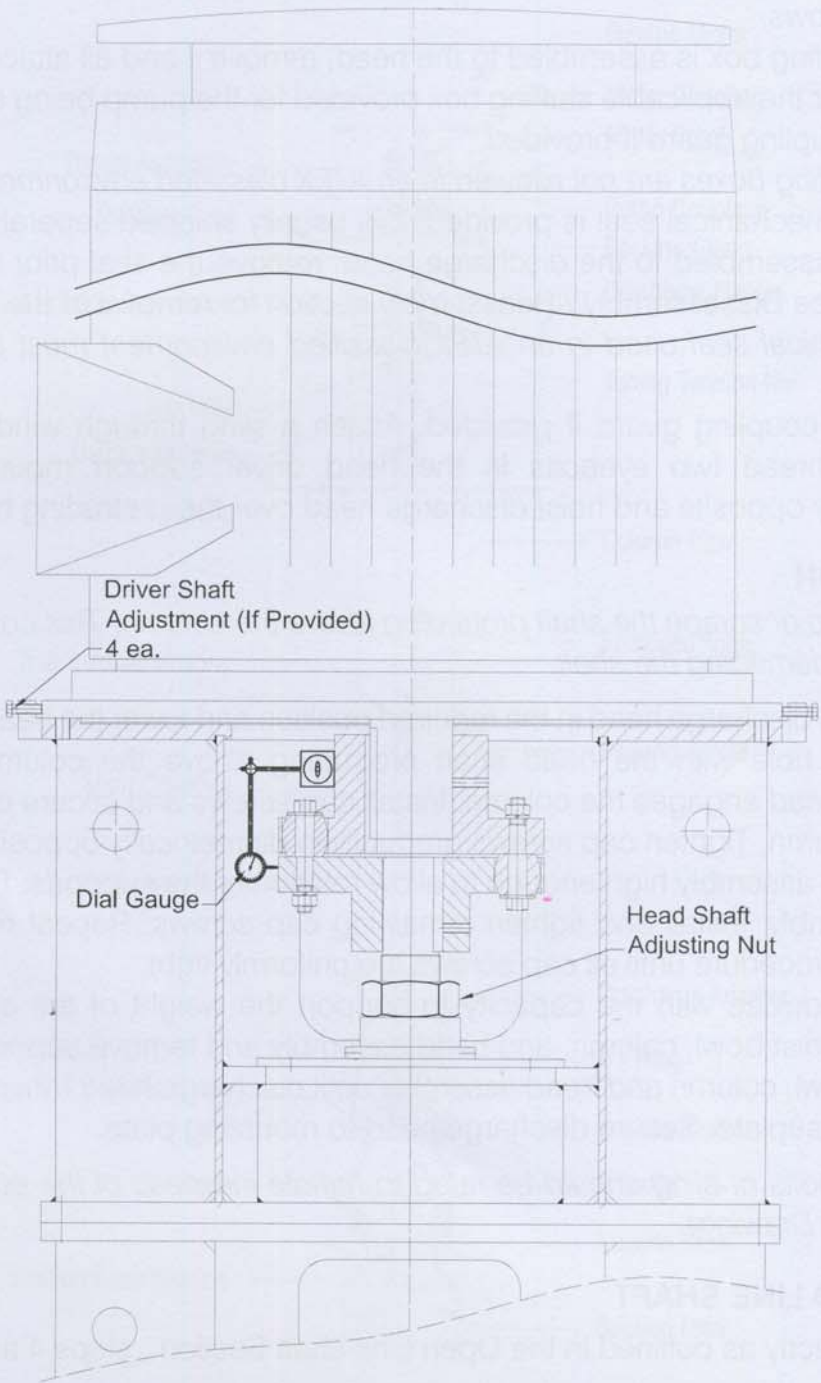

Fig. 6

STUFFING BOX INSTALLATION

Packed stuffing boxes are not allowed in an ATEX classified environment.

STYLE A STANDARD CONSTRUCTION

1. Position gasket on discharge head. Slide stuffing box down over shaft and into position on the gasket. Secure stuffing box with cap screws.

2. Insert packing washer into stuffing box if provided. Packing washer not required on shaft sizes 2.19" (55mm) and larger. Grease the packing rings for easier installation.

3. Twist the packing ring sideways to get it around the shaft easily. Start the first ring into the stuffing box. When the entire ring is worked in using the fingers, tamp it down using a split wooden bushing (or equal) and push the packing ring down firmly. It must seal on the shaft and bore of the stuffing box. Install all 6 rings in this manner (the 6th ring may be set aside until the packing is adjusted for leakage after the first startup). Stagger ring joints 90 degrees apart. The split gland may be used as a tamper for the top ring.

4. Install the split gland and thread nuts on split gland studs. Tighten nuts then relieve the nuts and tighten finger tight. Attach bypass line to tube fitting in the stuffing box.

5. Final adjustment of the stuffing box must be made at pump start up. This final adjustment applies to all stuffing box styles.

! CAUTION

Check that the split gland is square in the stuffing box. Cocking can cause uneven compression of packing and damage to the shaft or sleeve.

6. A properly packed stuffing box should be loose enough to allow the shaft to be turned manually.

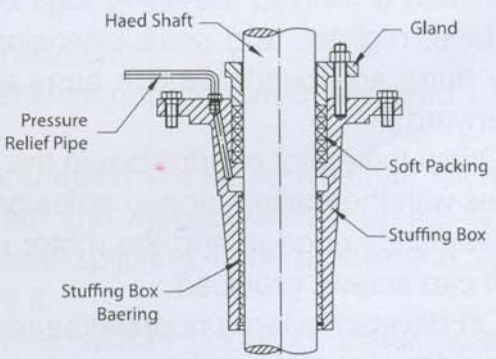

Fig. 8

! CAUTION

Do not over tighten packing or excessive wear can occur on the shaft or sleeve.

INSTALLING THE DRIVER

When installed in a potentially explosive environment, please ensure the motor is properly certified.

INSTALLATION OF A SOLID SHAFT DRIVER

NOTE: When pump is supplied with a thrust pot, do not secure driver to discharge head until after the thrust pot and flexible coupling are installed. (A separate supplement for thrust pots will be furnished as required).

! WARNING

Do not work under a heavy suspended object unless there is a positive support and safe guards which will protect personnel should a hoist or sling fail. Serious damage may result if pump is run in the wrong direction.

The coupling between the driveshaft and discharge head shaft may be a nonspacer type or a spacer type. The latter is used on pumps furnished with a mechanical seal to permit servicing of the seal without removal of the driver.

1. Driver support. When a driver support is furnished and not installed, proceed as follows:

A. Hoist driver support, inspect the mounting surfaces, register, and clean these surfaces thoroughly.

B. Install driver support on discharge head and secure with cap screws provided.

2. Attach a sling to the lifting lugs of driver, hoist motor, inspect the mounting surface, register, and shaft extension, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

3. Orient the motor conduit box in the required position. Align the motor mounting holes with the mating tapped holes on the discharge head. Lower the motor until the registers engage and the motor rests on the discharge head. Secure motor with cap screws provided.

4. On drivers having a nonreverse ratchet or pins, manually turn the driver shaft clockwise viewed from the top until the nonreverse ratchet or pins fully engage.

5. Lubricate motor bearings in accordance with instructions given on lubrication plate attached to the motor case.

NOTE: Please read and follow the motor manufacturer's instructions before lubricating the motor bearings. Too much lubricant can cause the bearings to overheat and fail prematurely.

! WARNING

The motor must not be tested for direction of rotation when coupled to the pump. If pump should rotate in the wrong direction, serious damage to the pump and motor would result. Also serious injury to personnel could result.

6. Make temporary electrical connections according to tagged leads or diagram attached to the motor. Motor must rotate counter-clockwise when viewed from the top. See arrow on pump nameplate. If motor does not rotate counter-clockwise, you can change the rotation by interchanging any two leads (for three phase only, for single phase motors see motor manufacturer's instructions.)
7. Motor shaft end play adjustment: if required, motor shaft end play shall be checked with a dial indicator prior to connecting the pump coupling to the solid shaft motor. Consult the applicable motor manufacturer's instruction manual for detailed information on motor shaft end play.

COUPLING INSTALLATION: (Fig. 9)

1. Apply a thin film of oil on the pump key and insert key into head shaft keyway seat.
2. Gently lower pump hub of coupling onto head shaft.
3. Thread on the adjusting nut onto the head shaft until bottom of the head shaft touches the thrust pot.
4. Apply a thin film of oil to the driver key and insert key into drive shaft keyway seat. Place the driver hub onto the drive shaft and with key slide it up the drive shaft until the annular groove is exposed. Install split ring in the groove and slide driver hub down over the split ring to capture it.
5. If the pump is supplied with an adjustable spacer coupling, install spacer between head shaft and driveshaft hubs. Secure with cap screws and hex nuts.

IMPELLER ADJUSTMENT

Impeller adjustment is identical for all motors and right angle gear drives. Adjustment is accomplished by turning the adjusting plate. The correct adjustment is listed on the Outline Drawing for the specific unit.

NOTE: Mechanical seal, when provided, must not be secured to the shaft prior to impeller adjustment(open or enclosed type impeller's). Shaft must move up or down within the seal assembly.

NOTE: For pumps handling liquids between - 45 ° C to 93 ° C, impeller adjustments can be made under ambient conditions. For liquids in excess of this range, it is recommended that impeller adjustment be made after the pump surface temperature has reached an equilibrium when charged with the pumpage.
In those cases, where this is not feasible due to safety considerations or impossible due to external ice build up in cryogenic applications, refer to factory for specific instructions. Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.

OPEN IMPELLERS

1. With the impellers touching the bottom of the bowls, turn the adjusting plate towards the driver hub or spacer. Obtain 0.015 inch clearance between the adjusting plate and driver hub or spacer for the first 3 m of column. Add 0.010" for each additional 3 m of column.

NOTE: The determination of driver shaft end play can be critical and should be added to this setting. For larger pumps over 8", this amount may be too little; please refer to Outline Drawing. Example: total pump length is 15 m - set impellers at 0.055 inch.

2. After impeller adjustment, align adjusting plate with the pump hub, and tightly draw coupling flanges together with cap screws and nuts.
3. Set seal after impeller adjustment. Securely tighten all set screws in the collar. Remove the spacer between
the gland plate and collar. Retain spacer for future resetting of seal.

NOTE: When impellers are reset, the seal must also be reset.

ENCLOSED IMPELLERS

For enclosed impellers obtain the clearance between the adjusting plate and driver hub or spacer as specified on the outline drawing.

OPERATION

PUMP STARTUP AND OPERATION

When pumping unit is installed in a potentially explosive atmosphere, the instructions after the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact a VANSAN representative before proceeding.

Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.

PRE-START PROCEDURE

Consult the applicable manufacturer's instructions for detailed information for the prime mover (electric motor, engine or steam turbine), coupling, drive shaft, gear-head or mechanical seal. When applicable to the pump and prior to startup, check the following:

1. Confirm that the following procedures described in the "Installing the Drivers" sections have been performed:

A. Wiring of Driver.

B. Driver must rotate counterclockwise (CCW) when viewed from above.

! WARNING

For VSS motor, do not check motor rotation unless motor is bolted to pump and driver hub is disconnected from pump hub. For VHS motor, do not check motor rotation unless motor is bolted to pump and drive coupling is removed. Serious damage may result if pump is run in the wrong direction.

C. Check alignment between pump and driver.

D. Impeller adjustment has been made.

E. Mechanical seal lock collar is attached to shaft.

TABLE 4 - REGULAR SETTING

Drops per Minute per 30 M of Setting	Line Shaft Size
8	¾ to 1" (19 mm to 25 mm)
16	13 16 to 115 16" (30 mm to 49 mm)
20	23 16" and larger (55 mm and larger)

2. Make sure mechanical seal is properly lubricated and all piping to seal is connected. Also, check that all cooling, heating and flushing lines are operating and regulated.
3. All connections to driver and starting device match wiring diagram.
4. Voltage, phase, and frequency on motor nameplate agree with line current.
5. Rotate shaft manually to ensure impellers are not binding.
6. Verify that driver bearings are properly lubricated and check oil level in housing.
7. Check that auxiliary seal components are properly vented.
8. Inspect discharge piping connection and pressure gauges for proper operation.
9. For enclosed line shaft construction, turn on oil drip or water flush. For oil lubricated, set the sight feed dripper for the number of drops per minute as directed in Table 4.

START-UP PRECAUTIONS

1. All equipment and personal safety related devices and controls must be installed and operating properly.
2. To prevent premature pump failure at initial start-up due to dirt or debris in the pipe system, ensure the system has been adequately cleaned and flushed.
3. Variable speed drivers should be brought to rated speed as quickly as possible.
4. Variable speed drivers should not be adjusted or checked for speed governor or overspeed trip settings while coupled to the pump at initial start-up. If settings have not been verified, uncouple the unit and refer to driver manufacturer's instructions for assistance.
5. Running a new or rebuilt pump at slow speeds may not provide enough flow to adequately flush and cool the stuffing box bushing's close running surfaces.
6. Pumpage temperatures in excess of 93° C will require warm-up of pump prior to operation. Circulate a small amount of pumpage through the pump until the casing temperature is within 100° C of the pumpage temperature and evenly heated.

NOTE: Warm-up rate should not exceed 1.5° C per minute.

PRECISION ALIGNMENT

A Precision Alignment Procedure has been written that describes our factory precision alignment. Precision Alignment will be supplied will be supplied as an addition to our Standard Instruction Manual, when precision alignment is a Purchase Order requirement.

PRIMING

The first stage must always be completely submerged. Pump must not run dry as the rotating parts within the pump may gall and seize to the stationary parts. The parts must be lubricated by the liquid being pumped.
NPSHa must always exceed NPSHr as shown on VANSAN's performance curves.

STARTING PUMP

PUMP START-UP

1. Make sure suction valve and any recirculation or cooling lines are open.
2. Fully close or partially open discharge valve as dictated by system conditions.
3. Start Driver.

! CAUTION
Immediately observe pressure gauges. If discharge pressure is not quickly attained, stop driver, reprime, and attempt to restart.

4. Slowly open discharge valve until the desired flow is obtained.

! CAUTION
Observe pump for vibration levels, bearing temperature and excessive noise. If normal levels are exceeded, shut down and resolve.

OPERATION

GENERAL CONSIDERATIONS

! CAUTION

Always vary capacity with regulating valve in the discharge line. NEVER throttle flow from the suction side.

! CAUTION

Driver may overload if the pumpage specific gravity (density) is greater than originally assumed, or the rated flow rate is exceeded.

! CAUTION

Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.

OPERATING AT REDUCED CAPACITY

! WARNING

DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.

! CAUTION

Damage occurs from:

1. Increased vibration levels - Affects bearings, stuffing box or seal chamber, and mechanical seal.

2. Increased radial loads - Stresses on shaft and bearings.

3. Heat build up - Vaporization causing rotating parts to score or seize.

4. Cavitation - Damage to internal surfaces of pump.

OPERATING UNDER FREEZING

CONDITIONS

Exposure to freezing conditions, while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside pump should be drained. Liquid inside cooling coils, if supplied, should also be drained.

STUFFING BOX

Packed stuffing boxes are not allowed in an ATEX classified environment. With the pump in operation, there should be some leakage at the stuffing box packing. The correct leakage is a rate which keeps the shaft and stuffing box cool (approximately one drop per second). Check the temperature of the leakage as well as the discharge head. If the pump runs hot and the leakage begins to choke off, stop the pump and allow it to cool down. A few light taps with a hammer on the gland will upset the packing sufficiently to resume leakage. After pump has cooled, restart pump and follow preceding procedure. Run pump 15 minutes, check leakage, if it exceeds two drops per second, adjust packing as described in *Packing Adjustment and Replacement.*

MECHANICAL SEAL

The mechanical seal used in an ATEX classified environment must be properly certified. If seal leaks slightly at startup, allow a reasonable amount of time for seal to adjust itself. Liquids with good lubricating qualities normally take longer to wear in the seal than liquid with lesser qualities. When a seal starts out with a slight leak and gets progressively less while running, it is indicative of leakage across the seal faces. Continued running will eliminate this. Where leakage occurs immediately and remains constant, unaffected by running, it usually indicates secondary seal (shaft packing) damage, or seal faces are warped out of flat. Refer to Preventive Maintenance section for probable cause.

THRUST POT INSTALLATION

Thrust pots are not standard on most pumps. A separate supplement will be inserted for pumps with thrust pots.

RUBBER BEARINGS

PRELUBRICATION

Rubber bearings must be wet prior to start-up if non-submerged (dry column) length is greater than 15 m. Lubricant shall be clean water / seawater only.

SHUTDOWN

1. Slowly close discharge valve.
2. Shut down and lock driver to prevent accidental rotation.

❗ WARNING

When handling hazardous and/or toxic fluids, proper personal protective equipment should be worn. If pump is being drained, precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

PREVENTIVE MAINTENANCE

PUMP STARTUP AND OPERATION

Preventive maintenance includes periodic inspection of oil level in thrust pots, relubrication of electric motors, gear drives and prime mover. Systematic inspection of the pump and its components shall be made at regular intervals. The frequency required depends upon the operating conditions of the pump and its environment. Consult the applicable manufacturer's instructions for detailed information on maintenance for the prime mover, driveshaft, electric motors and gear drives. Any deviation in performance or operations from what is expected can be traced to some specific cause. Variances from initial performance will indicate changing system conditions, wear, or impending breakdown of the unit.

The Preventive Maintenance section must be adhered to in order to keep the applicable ATEX classification of the equipment. Failure to follow these procedures will void the ATEX classification for the equipment.

! WARNING

Before initiating maintenance procedures, disconnect all power sources to the equipment and accessories and completely discharge all parts and accessories which retain electric charge. Failure to comply may result in severe personnel injury or death.

PACKING ADJUSTMENT AND REPLACEMENT

Packed stuffing boxes are not allowed in an ATEX classified environment.

Pumps equipped with packing, shall be adjusted whenever the leakage rate exceeds two drops per second. If there is no leakage or the stuffing box overheats, do not back off gland nuts while pump is running, as this will allow the entire set of rings to move away from the bottom of the box, without relieving pressure of the packing on the shaft. Stop the pump and allow packing to cool, then restart the pump. It may be necessary to repeat this procedure several times before proper amount of liquid comes through to efficiently prevent overheating. If leakage is excessive, adjust the stuffing box as follows:

1. With the pump in operation, tighten the gland nuts one-quarter turn for each adjustment. Allow packing to equalize against the increased pressure and leakage to gradually decrease to a steady rate before making another adjustment.

! CAUTION

Do not over tighten the stuffing box. Excessive pressure can wear out packing prematurely and seriously damage the shaft.

2. With the pump shut down and when packing has been compressed to the point that the gland is about to contact the upper face of stuffing box, remove the split gland, add one extra packing ring, and readjust. If this fails to reduce to two drops per second, remove all packing rings and replace with new rings.
3. Remove the packing with the aid of a packing hook. If a lantern ring is provided, remove it by inserting a wire hook in the slots of the ring and pull it from the packing box. Thoroughly clean the stuffing box of all foreign matter.
4. If the replacement packing is in the form of a continuous coil or rope, it must be cut into rings before installing. Tightly wrap one end of the packing material around the top shaft like one coil spring, and cut through the coil with a sharp knife. For repacking sequence, refer to Stuffing Box Installation.

THRUST POT LUBRICATION AND MAINTENANCE

! WARNING

Pumps are shipped without oil. Oil lubricated anti-bearings must be lubricated at the jobsite.

It is a good practice to flush the oil reservoir before first time operation and at the time of oil changes to remove all grit particles in the oil reservoir sump. Use the same type of oil to flush reservoir as specified for lubrication. Because of the special nature of the TURBINE OIL recommended, it is wise to keep a supply on hand. Remove drainplug before flushing. Flushing oil may be poured through oil fill opening in cover after removing oil fill plug. The proper oil level when the unit is not running shall be not more than 1/8" to 1/4" from the top of the oil sight gauge. Overfilling may result in overheating of the unit.

During operation the oil level in the sight gauge may be higher than the recommended range mentioned above. Under no circumstance is it allowed to rotate the unit when the oil in the sight gauge is not at the required level. To avoid oxidation of the anti-friction bearings during shut-down periods lasting longer than one week, it is recommended to fill up the oil reservoir until the oil runs over the oil retainer tube and down the shaft so that the bearings remain completely immersed in the oil. Before startup, do not forget to drain theexcess oil to its required level. Oil change depends on the severity of the environment. Generally speaking, when the oil in the sight gauge changes to a darkish brown color it is time for an oil change. However, for a longer bearing life, it is recommended that the oil be changed every six months. Be sure to flush the oil reservoir (see above) with each oil change. See the special thrust pot supplement.

PREVENTIVE MAINTENANCE PROCEDURES

PROCEDURE	TIME INTERVAL (in operating hours)
Clean dirt, oil and grease from driver and discharge head.	As required
Clean driver ventilation passage to prevent overheating.	As required
Change lubrication in gear drive.	2,000 or once a year
Change lubrication in thrust pot.	See Supplement
Tighten all loose bolts, and check for excessive vibration.	As required
If packing is grease lubricated, add as required.	100
Check that there is some leakage through stuffing box while pump is in operation.	As required
Do not tighten gland nuts unless necessary, refer to Installation section for tightening requirements.	As required
Regrease motor bearings:	
1800 RPM and above	1000
Below 1800 RPM	2000

INSPECTION INTERVALS

Inspection intervals should be shortened appropriately if the pumpage is abrasive and/or corrosive, *or if the environment is classified as potentially explosive.*

CORRECTIVE MAINTENANCE

Corrective maintenance procedures include troubleshooting for isolating and remedying malfunctions of the pump and its components during operation.

TROUBLE	PROBABLE CAUSE	REMEDY
1. Pump does not start	A. Electrical circuit open or not completed	Check circuit and correct.
	B. Steam turbine not receiving steam pressure	Make sure that turbine receives full steam pressure.
	C. Impellers binding against bowl	Reset impeller adjustment. See Installation section.
	D. Low voltage supplied to electric driver	Check whether driver wiring is correct & receives full voltage.
	E. Defective motor	Consult factory.
2. No liquid delivered	A. Insufficient submergence of bowl assembly	Check for adequate submergence.
	B. Obstruction in liquid passage	Pull pump, inspect impeller and bowl.
3. Not enough liquid delivered	A. Speed is too low	Check if driver is directly across the line and receiving full voltage.
	B. Wrong rotation	Check for CCW rotation when viewed from above. Check engagement of motor coupling.
	C. Total pump head is too high	Check pipe friction losses. Larger piping may correct condition.
	D. Partial obstruction in liquid passages	Pull pump and inspect impeller and bowl passages. Consult factory.
	E. Cavitation	Insufficient NPSH available.
	F. Impellers adjusted too high if semi-open construction	See Installation section.
4. Not enough pressure	A. Speed is too low	Control and measure voltage and frequency
	B. Obstruction in liquid passages.	Pull pump and inspect impeller and bowl
	C. Wrong rotation.	Control phasing direction
	D. Impellers adjusted too high if semi-open construction	See Installation section.
5. Pump works for a while and quits	A. Excessive horsepower required	Use larger driver. Consult factory.
	B. Pumping higher viscosity or specific gravity liquid than designed for	Test liquid for viscosity and specific gravity.
	C. Mechanical failure of critical parts	Check bearings and impellers for damage. Any irregularities in these parts will cause a drag on the shaft.
	D. Speed may be too high.	Check frequency on motor.
	E. Misalignment	Realign pump and driver.
6. Pump takes too much power	A. Damaged impeller	Inspect, replace if damaged.
	B. Foreign object lodged between impeller and bowl	Remove object as required.
	C. Specific gravity higher than pump designed for	Test liquid for viscosity and specific gravity.
	D. Viscosity too high, partial freezing of pumpage	Check for both. They can cause drag on impeller.
	E. Defective bearing	Replace bearing, check shaft or shaft sleeve for scoring.
	F. Packing is too tight	Release gland pressure. Retighten. Refer to Packing Adjustment and Replacement. Keep leakage flowing. If no leakage, check packing, sleeve or shaft.

CORRECTIVE MAINTENANCE

7. Pump is noisy	A. Cavitation (Insufficient NPSH available)	Increase liquid level in sump.
	B. Bent shaft	Straighten as required.
	C. Rotating parts binding, loose or broken	Replace as required.
	A. Coupling misalignment, bent shaft, impeller unbalance, worn bearings, cavitation, piping strain, and/or resonance	Replace bearings.
	B. Motor or gear drive shaft end play maladjustment	Determine cause utilizing vibration frequency analyzer and/or pump disassembly. Complex problem may require factory service assistance.
8. Excessive vibrations	A. Insufficient submergence of bowl assembly	Check for adequate submergence.
	B. Obstruction in liquid passage	See Installation of A Solid Shaft Driver (VSS), or Installation of A Hollow Shaft Driver (VHS)
9. Pump leaks excessively at stuffing box	A. Defective packing	Replace worn packing. Replace packing damaged by lack of lubrication.
	B. Wrong type of packing	Replace packing not properly installed or runin. Replace improper packing with correct grade or liquid being pumped.
10. Stuffing box is over-heating.	A. Packing is too tight	Release gland pressure.
	B. Packing is not lubricated	Release gland pressure and replace all packing if burnt or damaged. Regrease packing as required.
	C. Wrong grade of packing	Consult factory.
	D. Stuffing box improperly packed	Repack stuffing box.
11. Packing wears too fast.	A. Speed is too low	Pull pump and remachine, or replace shaft and/or sleeve.
	B. Obstruction in liquid passages.	Repack and make sure packing is loose enough to allow some leakage.
	C. Wrong rotation.	Repack properly, make sure all old packing is removed and stuffing box is clean.
	D. Impellers adjusted too high if semi-open construction	Consult factory.
12. Mechanical seal leaks steadily	A. Faces are not flat	Gland bolts possibly too tight, causing warpage of gland and insert, remove, check and reinstall.
	B. Insufficient or no lubrication	Replace packing.
	C. Improperly packed	Remove, inspect and replace as required.
	D. Wrong grade of packing	Install strainer, filter or cyclone separator as required to filter out foreign particles.
13. Seal squeals during operation	A. Inadequate amount of liquid at the seal faces	Bypass flush line may be necessary. If one is in use it may need to be enlarged to produce more flow.
14. Carbon dust accumulating on outside of gland ring	A. Inadequate amount of liquid at the seal faces	Consult factory.
	B. Liquid film flashing and evaporating between seal faces and leaving residue which is grinding away the carbon	Consult factory.
15. Seal leaks, nothing appears to be wrong	C. Specific gravity higher than pump designed for	Seal faces should be replaced or relapped.
16. Short seal life	A. Product is abrasive, causing excessive seal face wear	Determine source of abrasives and install bypass flushing if required to prevent abrasives from settling out or accumulating in the seal area. Install cyclone separator as required.
	B. Abrasives forming due to the process liquid cooling and crystallizing or partially solidifying in the seal area	Install bypass flush line to hold liquid temperature around the seal above crystallization point.
	C. Seal is running too hot	Check for possible rubbing of seal components.
	D. Improper choice of seal	Consult factory.