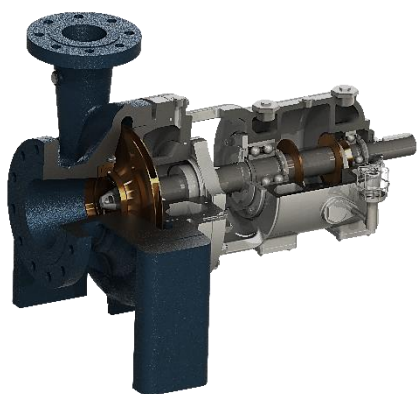


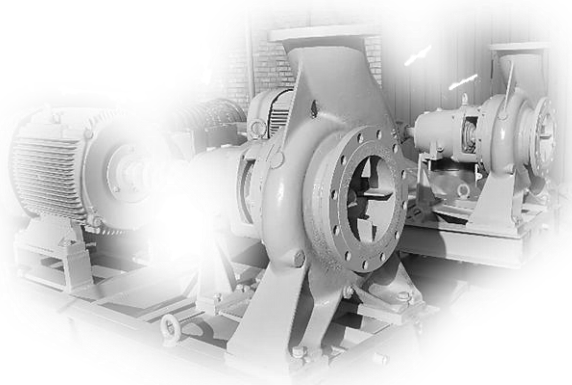


Installation, operation and maintenance manual

Horizontal Centrifugal Pump



OH2



OH1

- ❖ **Introduction and Safety**
- ❖ **Product Description**
- ❖ **Transportation and Storage**
- ❖ **Installation**
- ❖ **Commissioning ,Startup, Operation and Shutdown**
- ❖ **Maintenance**
- ❖ **Troubleshooting**

❖ Introduction and Safety

General

This Berkeh product has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control. These operating instructions are intended to facilitate familiarization with the unit and its designated use. The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the unit and to avoid any risks. These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.

This pump / unit must not be operated beyond the limit values for the fluid handled, capacity, speed, density, pressure, temperature and motor rating specified in the technical datasheet. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation. Contact the manufacturer, if required.

The name plate indicates the type series / size, main operating data and order number; please quote this information in all queries, repeat orders and particularly when ordering spare parts.

If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact Berkeh's manufacturing Co.

User Health and safety

Safety equipment

Use safety equipment according to the company regulations. The following safety equipment should be used within the work area:

- Helmet
- Safety goggles (with side shields)
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection

The work area

Observe these regulations and warnings in the work area:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.

Precautions before work

Observe the following safety precautions before working with the product or in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that the equipment is properly insulated when operating at extreme temperatures.
- Allow all system and pump components to cool before you handle them.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line as required.
- Make sure that the product has been thoroughly cleaned.
- Make sure that there are no poisonous gases within the work area.
- Make sure that a first-aid kit is close at hand.
- Disconnect and lock out power before servicing.
- Check the explosion risk before welding or using electric hand tools.

Precautions during work

Observe the following safety precautions when working with the product or in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after disassembling the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Ensure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

- Never operate a pump without a coupling guard that has been correctly installed.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety regulations for Ex-approved products in potentially explosive atmospheres

Personnel requirements

Berkeh disclaims all responsibility for work done by untrained and unauthorized personnel.

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and Berkeh authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas and/or vapor present in hazardous areas.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved Products in potentially explosive atmospheres:

- The product may be used only in accordance with the approved motor data Stated on the nameplates.
- The Ex-approved product must never run dry during normal operation. Dry Running during service and inspection is only permitted outside the classified area.
- Never start a pump without the proper priming.
- Before you start working with the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an authorized Berkeh Representative.
- Only use parts that have been provided by an authorized Berkeh representative.

Equipment for monitoring

For additional safety, use condition-monitoring devices. Condition monitoring devices include but are not limited to these devices:

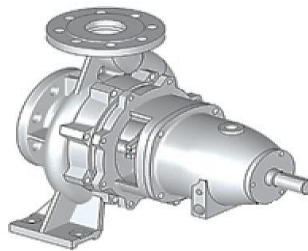
- Pressure gauges
- Flow meters
- Motor load readings
- Temperature detectors
- Pump Smart control system

❖ Product Description

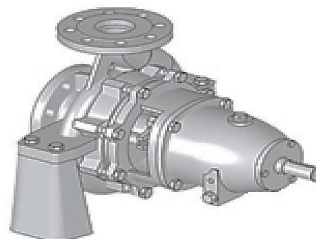
Product overview

General description

Pump type OH1¹ or BSSH²: Foot mounted single-stage overhung Pumps shall be designated pump type OH1.



Pump type OH2: A range of OH2 single stage, centerline mounted centrifugal end suction pumps with centerline or tangential discharge manufactured in a variety of alloys.



They have a single bearing housing to absorb all forces imposed upon the pump shaft and maintain rotor position during operation. The pumps are mounted on a base plate and are flexibly coupled to their drivers.

¹ Over hung Pumps

² Berkeh Single Stage Horizontal

Construction

Back pullout design with metal to metal fits.

Design methodology

Advanced computer techniques including: CAD, CFD & etc.

Design standards

API 610 10th: 2004 / ISO 13709: 2003

Pumping temperature

For high or low temperature applications (i.e. above 175 °C or below -10°C)³, the pump manufacturer/supplier shall give due consideration to mechanical design.

Configurations

Long coupled pump

Bare shaft pump

Rotating assembly

Design life Bearing

25000 hours for standard API610 (~3 year's uninterrupted operation)

20000 hours for standard ISO5199 (~2.5 year's uninterrupted operation)

Key features

- OH single stage centerline mounted or Foot mounted centrifugal pumps.
- 16 bar pumps to API 610 (10th edition) Compliant.
- Shrouded or Close (Type C) Impellers.
- A range of alloys available on request including NACE compliant materials.
- Tested to API610 / ISO13709 procedures – Head, Flow, NPSH, Noise & Vibration.
- A range of API 682 Seals & systems.

❖ Transportation and Storage

Receive the unit

³ Recourse To ISO5199:2002(E), Part 5.1

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.

Unpack the unit

1. Remove packing materials from the unit. Dispose of all packing materials in accordance with local regulations.
2. Inspect the unit to determine if any parts have been damaged or are missing.
3. Contact your Berkeh representative if anything is out of order.

Pump handling

WARNING:

Make sure that the pump cannot roll or fall over and injure people or damage property.

Pump storage requirements

Storage requirements are dependent on the amount of time the pump is stored. The normal packaging is designed only to protect the pump during shipping.

Length of time in storage	Storage requirements
Upon receipt/short-term (less than six months)	<ul style="list-style-type: none"> • Store in a covered and dry location. • Store the unit free from dirt and vibrations.
Long-term (more than six months)	<ul style="list-style-type: none"> • Store in a covered and dry location. • Store the unit free from heat, dirt, and Vibrations. • Rotate the shaft by hand several times at Least every three months.

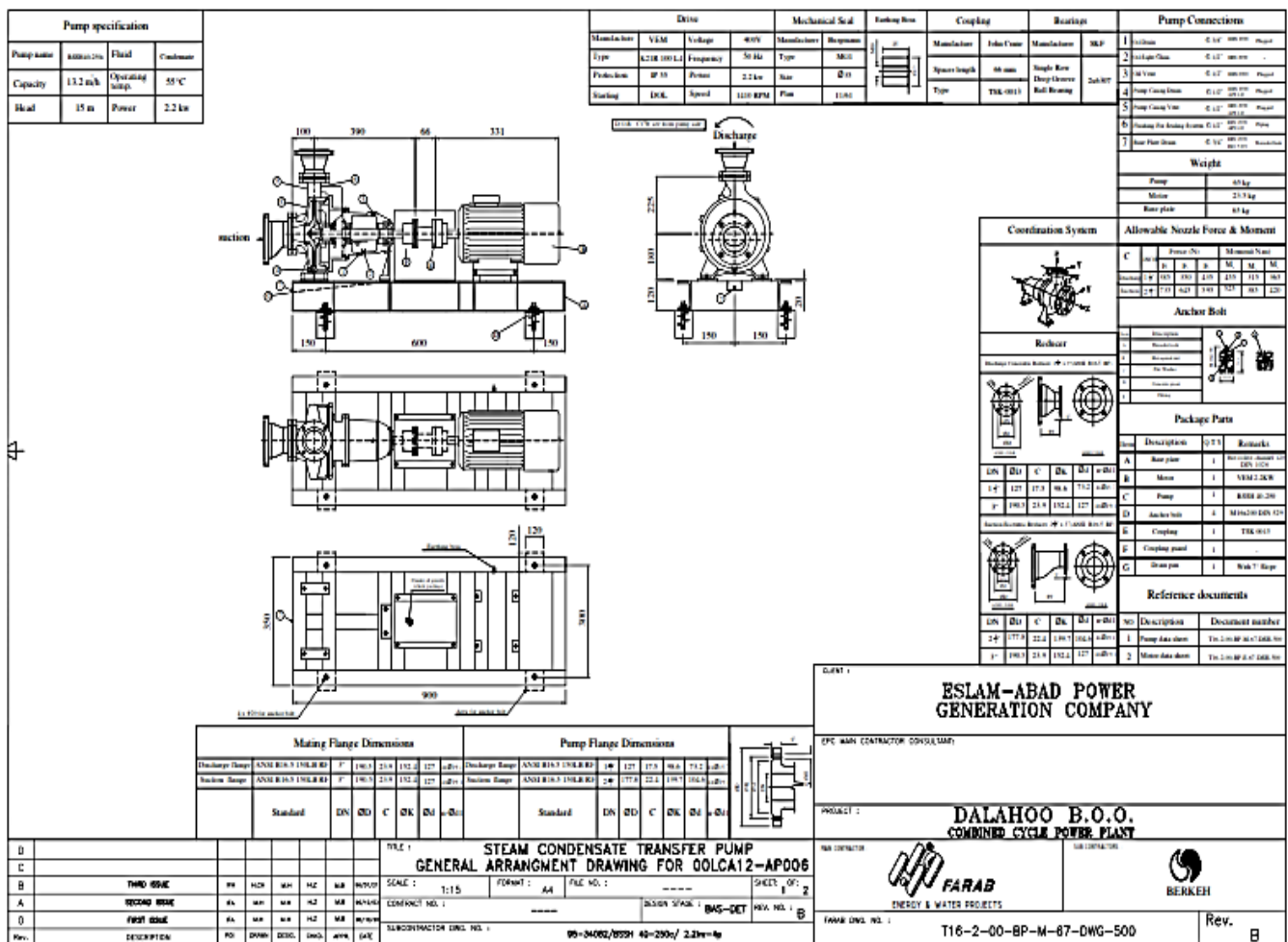
Treat bearing and machined surfaces so that they are well preserved. Refer to drive unit and coupling manufacturers for their long-term storage procedures. You can purchase long-term storage treatment with the initial pump order or you can purchase it and apply it after the pumps are already in the field. Contact your Local Berkeh sales representative.

❖ Installation

Supervision by an authorized Berkeh representative is recommended to ensure proper installation. Failure to do so may result in equipment damage or decreased performance.

All electrical equipment must be earthed (grounded). This applies to the pump equipment, the driver, and any monitoring equipment. Make sure that the earth (ground) lead is correctly connected by testing it.

General Arrangement (Sample)

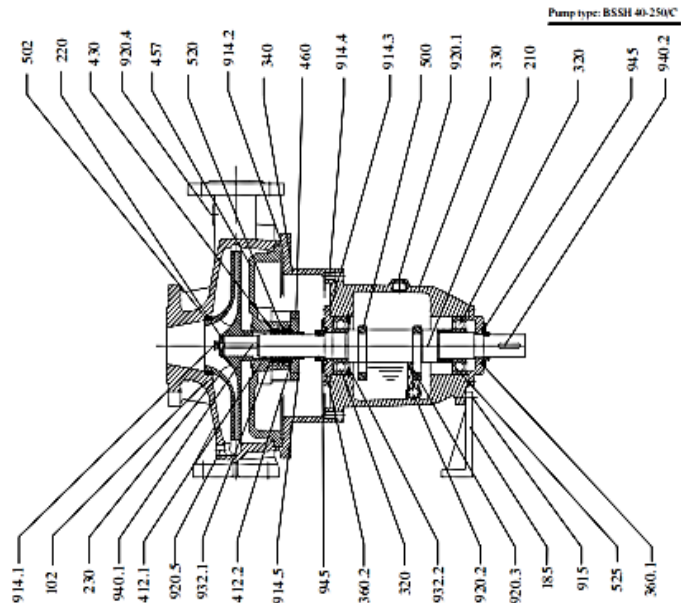


Cross Sectional Drawing (Sample)

Part number	Description	Standard	Size	Material	QTY.
102	Volute Casing	Note 1	40-250/C	ASTM A351 CF8M	1
105	Support	Note 1	45x15x25	ASTM A48 Gr 25	1
200	shaft	Note 1	Ø45	ASTM A276 Gr 306	1
209	Impeller Ring	Note 1	Ø30	ASTM A351 CF8M	1
230	Impeller	Note 1	Ø200	ASTM A351 CF8M	1
300	Deep Groove Ball Bearing	DM25-1	Ø307 (SKF)	"	2
330	Bearing Housing	Note 1	Ø150	ASTM A48 Gr 25	1
340	Adaptor	Note 1	Ø150	ASTM A48 Gr 25	1
3603	Bearing Cover	Note 1	13xØ110	ASTM A48 Gr 25	1
3602	Bearing Cover	Note 1	28.5xØ110	ASTM A48 Gr 25	1
402.1	O-ring	DM 3770	Ø25x2.5	NBR	1
402.2	O-ring	DM 3770	Ø45x2.5	NBR	1
430	Mechanical Seal	DM EM 22756	Ø45 (Kurtz)	SiC	1
457	Pump Cover	Note 1	Ø250	ASTM A351 CF8M	1
460	Seal Cover	Note 1	Ø35	ASTM A276 Gr 420	1
500	Ø1 Ring	Note 1	Ø65xØ95x10	ASTM A276 Gr 306	2
502	Casing Wear ring	Note 1	Ø35x70	ASTM A351 CF8M	1
520	Shaft Sleeve	Note 1	Ø35x21	ASTM A276 Gr 420	1
525	Bearing Spacer	Note 1	Ø45x38	ASTM A276 Gr 420	1
914.1	Hexagonal Socket Head Screw	DM 922	M16x25	ASTM A325 H	1
914.2	Hexagonal Socket Head Screw	DM 922	M16x35	ASTM A325 H	6
914.3	Hexagonal Socket Head Screw	DM 922	M16x20	ASTM A325 H	8
914.4	Hexagonal Socket Head Screw	DM 922	M16x25	ASTM A325 H	6
914.5	Hexagonal Socket Head Screw	DM 922	M16x25	ASTM A325 H	4
915	Hexagonal Head Screw	DM 929	M16x25	ASTM A325 H	1
920.1	Ø1 Vent Plug	DM 2999	5/8"	"	1
920.2	Ø1 Drain Plug	DM 2999	5/8"	"	1
920.3	Ø1 Sight Glass	DM 2999	5/8"	"	1
920.4	Pump Casing Vent	DM 2999	5/8"	"	1
920.5	Pump Casing Drain	DM 2999	5/8"	"	1
932.1	External Snap Ring	DM 472	35x15	"	1
932.2	Internal Snap Ring	DM 472	Ø6x25	"	1
940.1	Shear Key	DM 6885	Ø6x25	"	1
940.2	Shear Key	DM 6885	Ø6x25	"	1
945	Splash Ring	Note 1	17xØ50	"	2
971.1	Thinner	Note 2	"	"	"
971.2	Epoxy Primer Coating	Note 2	"	"	"
971.3	Epoxy Finish Coating	Note 2	"	"	"
971.4	Epoxy Filler	Note 2	"	"	"

Note 1: These standards are based on Berkoh requirements.
Note 2: Pars Parnchal EP-Series paint.

Reference documents					
No.	Description	Document number			
1	Pump data sheet	T16-2-00-BP-M-67-DWG-501			
2	External Assemblies	T16-2-00-BP-M-67-DWG-501			
			PROJECT :		
			DALAHOO B.O.O.		
			COMBINED CYCLE POWER PLANT		
			FARAB		
			BERKEH		
			ENERGY & WATER PROJECTS		
			PUMP DWG. NO. :		
			T16-2-00-BP-M-67-DWG-501		
			Rev. :		
			B		



Pump-to-driver alignment

- Follow shaft alignment procedures to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow the coupling manufacturer's coupling installation and operation procedures.
 - ALWAYS lock out power to the driver before performing any installation or maintenance tasks.
- Failure to lock out driver power will result in serious physical injury.

Proper alignment is the responsibility of the installer and the user of the unit. You must check the alignment of frame-mounted units before the unit is operated. Failure to do so may result in equipment damage or decreased performance.

Alignment methods

Four common alignment methods are used:

- Dial indicator
- Reverse dial indicator
- Laser
- Shim

Follow the equipment manufacturer's instructions when using the reverse dial indicator or laser methods. Detailed instructions for using the dial indicator method are contained in this section.

Alignment checks

When to perform alignment checks

Alignment checks must be performed when the following occurs:

- The process temperature changes.
- The piping changes.
- The pump has been serviced

Initial alignment (cold alignment)

When it is used? Prior to operation when the pump and the driver are at Ambient temperature.

1.

When: Before grouting the baseplate

Why: This ensures that alignment can be accomplished.

2.

When: After grouting the baseplate

Why: This ensures that no changes have occurred during the grouting process.

3.

When: After connecting the piping

Why: This ensures that pipe strains have not altered the alignment.

If changes have occurred, you must alter the piping to remove pipe strains on the pump flanges.

Final alignment (hot alignment)

When it is used? After operation when the pump and the driver are at operating temperature.

When: After the first run

Why: This ensures correct alignment when both the pump and the driver are at operating temperature.

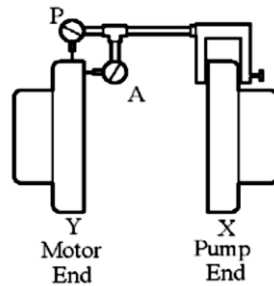
Attach the dial indicators for alignment

You must have two dial indicators to complete this procedure.

1. Attach two dial indicators on the pump's coupling half:

a) Attach one indicator so that the indicator rod comes into contact with the perimeter of the driver's coupling half. This indicator is used to measure parallel misalignment.

- b) Attach the other indicator so that the indicator rod comes into contact with the inner end of the driver's coupling half. This indicator is used to measure angular misalignment.
2. Rotate the pump's coupling half to check that the indicators are in contact with the driver's coupling half but do not bottom out.
3. Adjust the indicators if necessary.



Pump location guidelines

Assembled pumping units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified Lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

Suction-piping checklist

1- Liquid source below the pump

Check	Explanation/comment
Make sure that the suction piping is free from air pockets.	This helps to prevent occurrence of air and cavitation in the pump inlet.
Check that the suction piping slopes upwards from the liquid source to the pump inlet.	-
If the pump is not self-priming, check that a device for priming the pump is installed.	Use a foot valve with a diameter at least equivalent to the diameter of the suction piping.

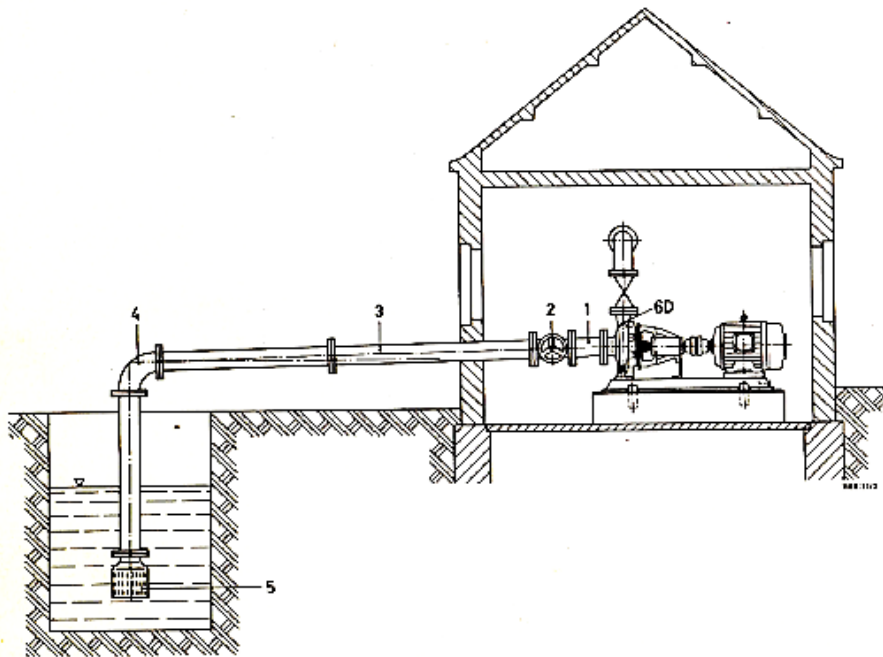
2- Liquid source above the pump

Check	Explanation/comment
Check that an isolation valve is installed in the suction piping at a distance of at least two times the pipe diameter from the suction inlet.	This permits closing the line during pump inspection and maintenance. Do not use the isolation valve to throttle the pump. Throttling may cause the following problems: <ul style="list-style-type: none"> • Loss of priming

	<ul style="list-style-type: none"> • Excessive temperatures • Damage to the pump • Voiding the warranty
Check that the piping is level or slopes downward from the liquid source.	-
Make sure that no part of the suction piping extends below the suction flange of the pump.	-
Make sure that the suction piping is adequately submerged below the surface of the liquid source.	This prevents air from entering the pump through a suction vortex.

Suction Lift Line

Trouble-free operation of the pump depends on the correct laying of the suction line. It must be absolutely leak tight, and should not present any features tending to promote the formation of air pockets. It should be laid with a steadily rising incline towards the pump.



Correct laying of suction lift line

1= A concentric reducer will promote the formation of air pockets , therefore use an eccentric reducer , fitted belly down.

2= An isolating valve with its stem pointing vertically upwards also promotes the formation of air pockets, therefore fit the valve with its stem horizontal or pointing vertically down (remember that the valve in the suction lift line must always be kept fully open when the pump is running).

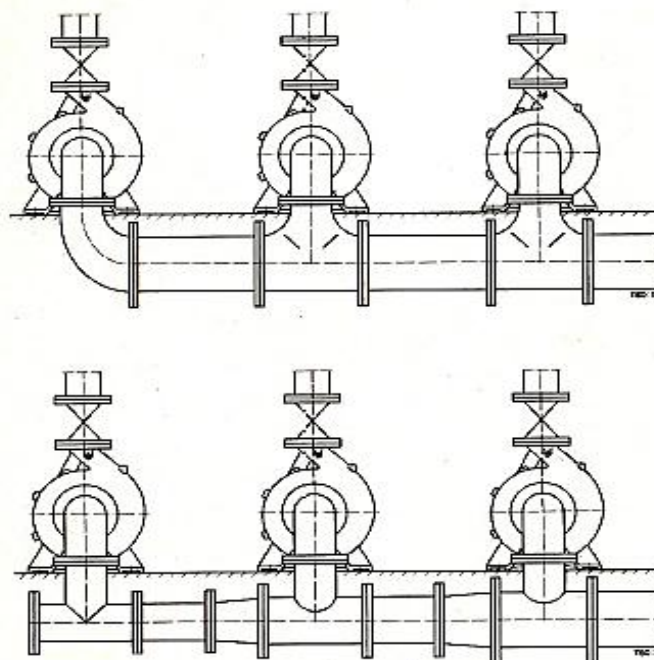
3= the suction lift line should rise towards the pump with a gradual and constant slope.

4= only use standard pipe bends or elbows, and avoid excessively sharp bends.

5= The foot valve and strainer basket should be installed 0.5 m (2ft) beneath the minimum water level likely to occur and 0.5 m above the floor of the pit, to prevent air or sand and sludge from being entrained into the pump.

6D= priming and venting connection.

The nominal size of the pump suction flange is no guide to the correct size of the suction lift line. The flow velocity in the suction lift line should preferably not exceed 2 meters per second (6.5. feet / second). It is generally preferable to provide an individual suction lift line for each pump. If this is not possible for practical reasons, the common suction line should be sized for as low a flow velocity as practicable, and its nominal size should preferably remain constant right up to the last pump on the line.



Connection of several pumps to a common suction lift line
Picture up) Correct Picture down) Wrong

All sharp bends and sudden and abrupt changes of cross-section and direction must be avoided at all costs. Make sure than the flange gaskets do not protrude inside the pipe.

Instead of a foot valve cum strainer basket, a vent pump can be arranged on the suction lift line. A strainer basket should however also be provided in this case, in order to prevent any foreign matter from penetrating inside the pump.

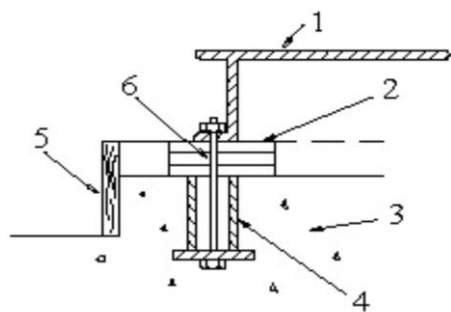
Foundation requirements

- The foundation must be able to absorb any type of vibration and form a

Permanent, rigid support for the pump unit. The location and size of the foundation bolt holes are shown on the general arrangement drawing provided with the pump data package.

- The foundation must weigh between two and three times the weight of the pump.
- A flat substantial foundation of concrete must be provided to prevent strain and distortion when tightening the foundation bolts.
- Sleeve-type and J-type foundation bolts are most commonly used. Both designs allow movement for the final bolt adjustment.

Diagram: sleeve-type bolts



1. Base plate
2. Shims or wedges
3. Foundation
4. Sleeve
5. Dam
6. Bolt (sleeve type)

Install the pump, driver, and coupling

1. Mount and fasten the pump on the baseplate. Use applicable bolts.
 2. Mount the driver on the baseplate. Use applicable bolts and hand tighten.
 3. Install the coupling.
- See the coupling manufacturer's installation instruction

Grout the baseplate

You need the following:

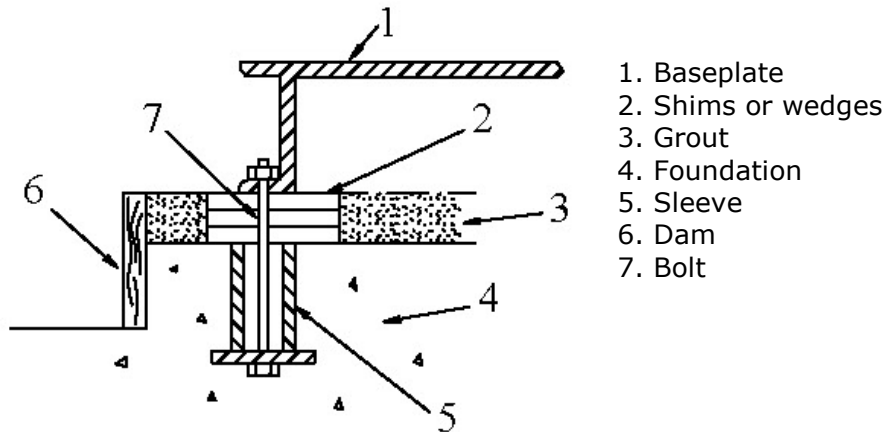
Cleaners: Do not use oil-based cleaners because the grout will not bond to it. See the grout manufacturer's instructions.

It is assumed that the installer who grouts the baseplate has knowledge of acceptable methods. More detailed procedures are described in various publications, including API Standard 610, 10th Edition, Appendix L; API RP 686, Chapter 5; and other industry standards.

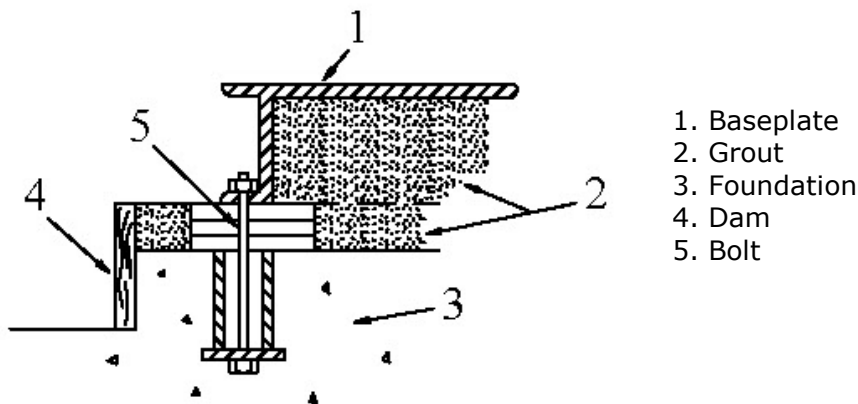
1. Clean all the areas of the baseplate that will come into contact with the grout.
2. Build a dam around the foundation.
3. Thoroughly wet the foundation that will come into contact with the grout.

4. Pour grout through the grout hole into the baseplate up to the level of the dam. When you pour the grout, remove air bubbles from it one using one of the following methods:

- Puddle with a vibrator.
- Pump the grout into place, and allow the grout to set.



5. Fill the remainder of the baseplate with grout, and allow the grout to set for at least 48 hours.



6. Remove the leveling screws after the grout hardens to remove any stress points.

7. Tighten the foundation bolts.

❖ **Commissioning ,Startup, Operation and Shutdown**

Preparation for startup

Hazard statements

- Failure to follow these precautions before you start the pump will lead to serious personal injury and equipment failure.
- DO NOT operate the pump below the minimum rated flows or with suction and discharge valve closed. These conditions can create an explosive hazard due to vaporization of pumped fluid and can quickly lead to pump failure and physical injury.
- NEVER operate the pump without the coupling guard correctly installed.
- ALWAYS lock out power to the driver before performing any installation or maintenance tasks. Failure to lock out driver power will result in serious physical injury.
- Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.

Precautions

You must follow these precautions before you start the pump:

- Flush and clean the system thoroughly to remove dirt or debris in the pipe system in order to prevent premature failure at initial startup.
- Bring variable-speed drivers to the rated speed as quickly as possible.
- Run a new or rebuilt pump at a speed that provides enough flow to flush and cool the close running surfaces of the stuffing-box bushing or .
- If temperatures of the pumped fluid will exceed 200°F (93°C), then warm up the pump prior to operation. Circulate a small amount of fluid through the pump until the casing temperature is within 100°F (38°C) of the fluid temperature. At initial startup, do not adjust the variable-speed drivers or check for speed governor or over-speed trip settings while the variable-speed driver is coupled to the pump. If the settings have not been verified, then uncouple the unit and refer to instructions supplied by the driver manufacturer.

Check the rotation

- Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.
- ALWAYS lock out power to the driver before performing any installation or maintenance tasks. Failure to lock out driver power will result in serious physical injury.

1. Lock out power to the driver.
2. Make sure that the coupling hubs are fastened securely to the shafts.

3. Make sure that the coupling spacer is removed. The pump ships with the coupling spacer removed.
4. Unlock power to the driver.
5. Make sure that everyone is clear, and then jog the driver long enough to determine that the direction of rotation is the same as depicted in general arrangement drawing.
6. Lock out power to the driver.

Bearing lubrication

You must lubricate oil-lubricated bearings at the job site.

Ring oil-lubricated bearings are standard on Model OH pumps.

For the majority of operational conditions, bearing temperatures run between 120°F (49°C) and 180°F (82°C) and you can use an oil of ISO Viscosity grade 68 at 100°F (40°C). If temperatures exceed 180°F (82°C), refer to the table for temperature requirements.

Temperature	Oil requirement
Bearing temperatures exceed 180°F (82°C)	Use ISO viscosity grade 100. Bearing temperatures are generally about 20°F (11°C) higher than bearing-housing outer surface temperatures.
Pumped-fluid temperatures are extreme	Refer to the factory or a lubrication expert.

Lubricate the bearings with oil

Ring oil-lubricated pumps are supplied with an oiler that maintains a constant oil level in the bearing housing.

1. Set the oiler adjusting stem so that the oil is at the level of the mark on the side of the frame, which corresponds to the center of the bulls eye sight glass. Adjust the setting dimension to 0 by removing the oiler-adjusting stem.

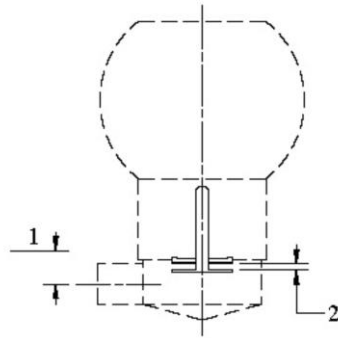
2. Fill the oil reservoir in the bearing frame:

- a) Fill the oiler bottle with oil.

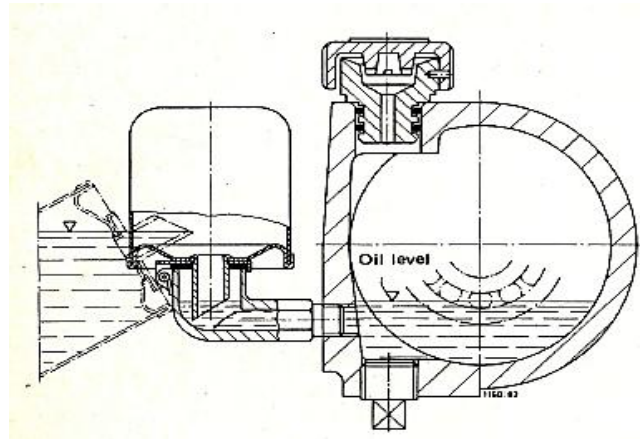
- b) Place the oiler bottle into the oiler housing.

You will need to fill the oiler bottle several times.

3. Verify that the oil level is correct by comparing the oil level as viewed in the bulls eye sight glass with the oil level line on the side of the bearing frame.



1. Oil level 3/16 in. (4.8 mm)
2. Setting dimension of "0"



Constant Level Oiler

NOTICE:

Lubricate the bearings after a shutdown period.

1. Flush out the bearings and bearing frame with a light oil to remove contaminants. During flushing, make sure to rotate the shaft slowly by hand.
2. Flush the bearing housing with the proper lubricating oil to ensure oil quality after cleaning.

Shaft sealing with a mechanical seal

The mechanical seal used in an Ex-classified environment must be properly Certified. Prior to startup, make sure that all areas that could leak pumped fluid to the work environment are closed.

- The mechanical seal must have an appropriate seal-flush system. Otherwise, excess heat generation and seal failure can occur.
- Cooling systems such as those for bearing lubrication and mechanical-seal systems must be operating properly to prevent excess heat generation, sparks, and premature failure.
- Sealing systems that are not self-purging or self-venting, such as plan 23, Require manual venting prior to operation. Failure to do so will result in excess heat generation and seal failure.

Pumps may be shipped with or without a mechanical seal installed.

Seal faces must have liquid film between them for proper lubrication. Locate the taps using the illustrations shipped with the seal.

Cartridge-type mechanical seals

Cartridge-type mechanical seals are commonly used. Cartridge seals are preset by the seal manufacturer and require no field settings. Cartridge seals installed by the user require disengagement of the holding clips prior to operation, allowing the seal to slide into place. If the seal has been installed in the pump by Berkeh, these clips have already been disengaged.

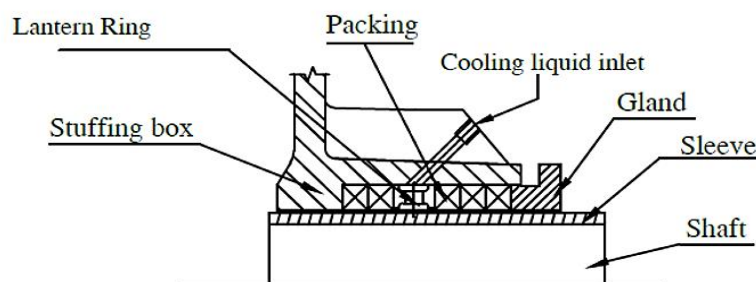
Other mechanical seal types

For other types of mechanical seals, refer to the instructions provided by the seal manufacturer for installation and setting.

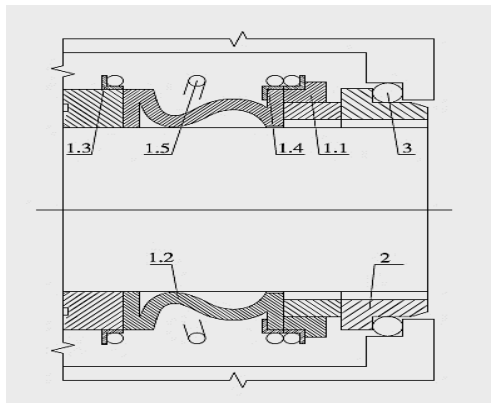
Seal flushing methods

Refer to the mechanical seal reference drawing and piping diagrams.(Piping Plans Description in API 610) OR You can use other methods that employ multiple gland or seal chamber connections.(Product & External flush)

Cross section of stuffing box (Packing)

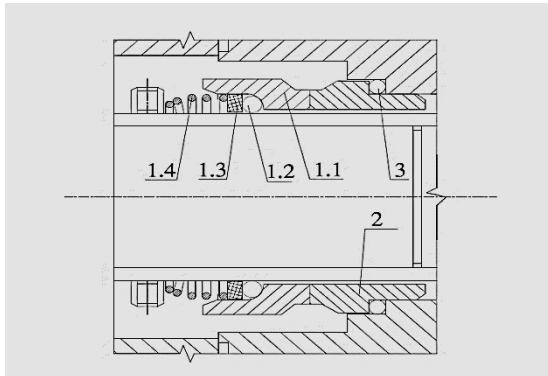


Cross section of Typical Unbalanced Single Seal



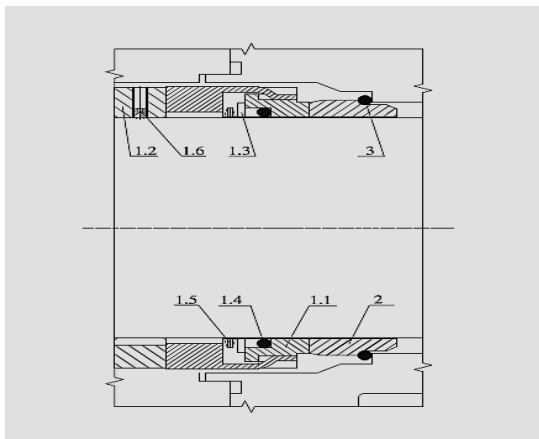
Item	Part name	p.no DIN24250
1.1	Seal face	472
1.2	Bellows	481
1.3	"L" -ring	484.2
1.4	"L" -ring	484.1
1.5	Spring	477
2	Seat	475
3	O-ring or cup rubber	412

Cross section of Mechanical seal M3N



Item	Part name	p.no DIN24250
1.1	Seal face	472
1.2	O-ring	412.1
1.3	Thrust ring	474
1.4	Spring	478
2	Type G9 stationary	475
3	O-ring	412.2

Cross section of Typical Balanced Single Seal (H7N)

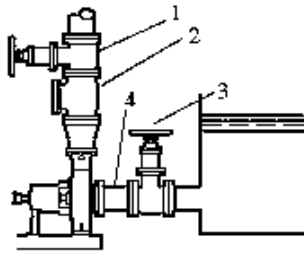


Item	Part name	p.no DIN24250
1.1	Seal face	472
1.2	Drive Collar	485
1.3	Thrust ring	474
1.4	O-ring	412.1
1.5	Multiple Spring	477
1.6	Set Screw	904
2	Type G9 stationary	475
3	O-ring	412.2

Pump priming

Prime the pump with the suction supply above the pump

1. Slowly open the suction isolation valve.
2. Open the air vents on the suction and discharge piping until the pumped fluid flows out.
3. Close the air vents.

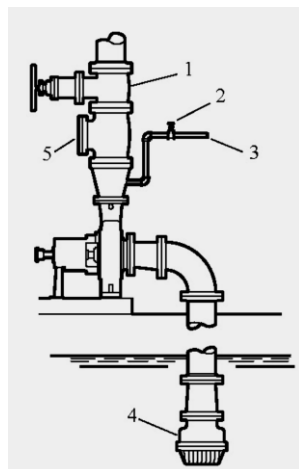


1. Discharge isolation valve
2. Check valve
3. Suction isolation valve
4. Air Vent

Prime the pump with the suction supply below the pump

Use a foot valve and an outside source of liquid to prime the pump. The liquid can come from one of the following sources:

- A priming pump
 - A pressurized discharge line
 - Another outside supply
1. Close the discharge isolation valve.
 2. Open the air vent valves in the casing.
 3. Open the valve in the outside supply line until only liquid escapes from the vent valves.
 4. Close the vent valves.
 5. Close the outside supply line.



1. Discharge isolation valve
2. Shutoff valve
3. From outside supply
4. Foot valve
5. Check valve

This illustration is an example of priming the pump with a foot valve using a bypass around the check valve.

Other methods of priming the pump

Besides the methods described in the procedures in this section, you can also prime the pump using the following methods:

- Priming by ejector
- Priming by automatic priming pump

Start the pump

- Immediately observe the pressure gauges. If discharge pressure is not quickly attained, stop the driver, re-prime, and attempt to restart the pump.
- Observe the pump for vibration levels, bearing temperature, and excessive noise. If normal levels are exceeded, shut down the pump and resolve the issue.

Before you start the pump, you must do the following:

- Open the suction valve.
- Open any recirculation or cooling lines.
- 1. Fully close or partially open the discharge valve, depending on system conditions.
- 2. Start the driver.
- 3. Slowly open the discharge valve until the pump reaches the desired flow.
- 4. Immediately check the pressure gauge to ensure that the pump quickly reaches the correct discharge pressure.
- 5. If the pump fails to reach the correct pressure, do the following:
 - a) Stop the driver. b) Prime the pump again. c) Restart the driver.
- 6. Monitor the pump while it is operating:
 - a) Check the pump for bearing temperature, excessive vibration, and noise.
 - b) If the pump exceeds normal levels, then shut down the pump immediately and correct the problem. A pump can exceed normal levels for several reasons. Refer to the Troubleshooting chapter for information about possible solutions to this problem.
- 7. Repeat steps 5 and 6 until the pump runs properly.

Pump operation precautions

General considerations

- Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side. Doing so may result in decreased performance, unexpected heat generation, and equipment damage.
- Do not overload the driver. Doing so may result in unexpected heat generation and equipment damage. The driver can overload in the following circumstances:

- The specific gravity of the pumped fluid is greater than expected.
- The pumped fluid exceeds the rated flow rate.
- Make sure to operate the pump at or near the rated conditions.

Failure to do so may result in pump damage from cavitation or recirculation. On ring oil-lubricated pumps, remove oil ring viewing port plugs to verify The following:

- The oil rings are properly positioned in the grooves on the shaft.
- The oil rings are turning.
- The oil rings are throwing oil.

Replace the plugs.

Operation at reduced capacity

Never operate any pumping system with a blocked suction and discharge. Operation, even for a brief period under these conditions, can cause enclosed pumped fluid to overheat, which results in a violent explosion. You must take all necessary measures to make sure that this condition is avoided.

- Avoid excessive vibration levels. Excessive vibration levels can damage the bearings, stuffing box or seal chamber, and the mechanical seal, which may result in decreased performance.
- Avoid increased radial load. Failure to do so may cause stress on the shaft and bearings.
- Avoid heat build-up. Failure to do so may cause rotating parts to score or seize.
- Avoid cavitation. Failure to do so may cause damage to the internal surfaces of the pump.

Operation under freezing conditions

Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump and the cooling coils. Failure to do so can cause liquid to freeze and damage the pump.

Shut down the pump

The pump can handle hazardous and toxic fluids if the appropriate mechanical seal is employed. Identify the contents of the pump and observe proper decontamination procedures to eliminate the possible exposure to any hazardous or toxic fluids. Proper personal protective equipment should be worn. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks. Pumped fluid must be handled and disposed of in compliance with applicable environmental regulations.

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

Make the final alignment of the pump and driver

- ALWAYS lock out power to the driver before performing any installation or maintenance tasks. Failure to lock out driver power will result in serious physical injury.
- Follow shaft alignment procedures to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow the coupling manufacturer's coupling installation and operation procedures.



You must check the final alignment after the pump and driver are at operating temperature. For initial alignment instructions, refer to the installation chapter.

1. Run the unit under actual operating conditions for enough time to bring the pump, driver, and associated system to operating temperature.
2. Shut down the pump and the driver.
3. Remove the coupling guard.
4. Check the alignment while the unit is still hot.
5. Reinstall the coupling guard.
6. Restart the pump and driver.

❖ Maintenance

Maintenance schedule

Maintenance inspections

A maintenance schedule includes these types of inspections:

- Routine maintenance
- Routine inspections
- Three-month inspections
- Annual inspections

Shorten the inspection intervals appropriately if the pumped fluid is abrasive or corrosive or if the environment is classified as potentially explosive.

Routine maintenance

Perform the following tasks whenever you perform routine maintenance:

- Lubricate the bearings.
- Inspect the seal.

Routine inspections

Perform the following tasks whenever you check the pump during routine inspections:

- Check the level and condition of the oil through the sight glass on the bearing frame.
- Check for unusual noise, vibration, and bearing temperatures.
- Check the pump and piping for leaks.
- Analyze the vibration.
- Inspect the discharge pressure.
- Inspect the temperature.
- Check the seal chamber and stuffing box for leaks.
- Ensure that there are no leaks from the mechanical seal.
- Adjust or replace the packing in the stuffing box if you notice excessive leaking.

Three-month inspections

Perform the following tasks every three months:

- Check that the foundation and the hold-down bolts are tight.
- Check the mechanical seal if the pump has been left idle, and replace as required.

- Change the oil every three months (2000 operating hours) at minimum.
- Change the oil more often if there are adverse atmospheric or other conditions that might contaminate or break down the oil.
- Check the shaft alignment, and realign as required.

Annual inspections

Perform the following inspections one time each year:

- Check the pump capacity.
- Check the pump pressure.
- Check the pump power.

If the pump performance does not satisfy your process requirements, and the process requirements have not changed, then do the following:

1. Disassemble the pump
2. Inspect it.
3. Replace worn parts.

Bearing maintenance

Bearing lubrication schedule

Type of bearing	First lubrication	Lubrication intervals
Oil-lubricated bearings	Add oil before you install and start the pump. Change the oil after 200 hours for new bearings.	After the first 200 hours, change the oil every 2000 operating hours or every three months.

Mechanical-seal maintenance

The mechanical seal used in an Ex-classified environment must be properly Certified. Prior to startup, make sure that all areas that could leak pumped fluid to the work environment are closed.

Never operate the pump without liquid supplied to mechanical seal. If you run a mechanical seal dry, even for a few seconds, this can cause seal damage. Physical injury can occur if a mechanical seal fails.

- Sealing systems that are not self-purging or self-venting, such as plan 23, require manual venting prior to operation. Failure to do so will result in excess heat generation and seal failure.
- Cooling systems such as those for bearing lubrication and mechanical-seal systems, must be operating properly to prevent excess heat generation, sparks, and premature failure.
- The mechanical seal must have an appropriate seal flush system for excess heat generation and seal failure can occur.

Before you start the pump

Check the seal and all flush piping.

Mechanical seal life

The life of a mechanical seal depends on the cleanliness of the pumped fluid. Due to the diversity of operating conditions, it is not possible to give definite indications as to the life of a mechanical seal.

Disassembly

Disassembly precautions

- Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, open vent or drain valves, or disconnect the piping.
- ALWAYS lock out power to the driver before performing any installation or maintenance tasks. Failure to lock out driver power will result in serious physical injury.
- The pump and the components can be heavy. Make sure to use proper lifting methods. Failure to do so can result in physical injury or equipment damage.

Make sure that all replacement parts are available before you disassemble the pump for overhaul.

Drain the pump

1. Close the isolation valves on the suction and discharge sides of the pump. You must drain the system if no valves are installed.
2. Open the drain valve.
Do not proceed until liquid stops coming out of the drain valve. If liquid continues to flow from the drain valve, the isolation valves are not sealing properly and you must repair them before you proceed.
3. Leave the drain valve (if installed) open and remove the drain plug located on the bottom of the pump casing. Do not reinstall the plug or close the drain valve until the reassembly is complete.
4. Drain the liquid from the piping and flush the pump if it is necessary.
5. Disconnect all auxiliary piping and tubing.
6. Remove the oiler bottle and store it in a safe place.
7. Remove the coupling guard.
8. Remove the coupling spacer. (Follow the coupling manufacturer's instructions for assistance).
9. Disconnect the coupling.

Replacement guidelines

Oil ring replacement

Oil rings must be as round as possible to function properly. Replace oil rings if they are worn, distorted, or damaged beyond reasonable repair.

Cartridge mechanical seal replacement

Cartridge-type mechanical seals should be serviced by the seal manufacturer. Refer to the mechanical seal manufacturer's instructions for assistance.

Coupling guard replacement

Repair or replace the coupling guard if you notice corrosion or other defects.

Gaskets, O-rings, shims, and seats replacement

- If required; replace all gaskets, O-rings, and shims at each overhaul and disassembly.
- Inspect the seats. They must be smooth and free of physical defects. To repair worn seats, skin cut them in a lathe while maintaining dimensional relationships with other surfaces.
- Replace parts if seats are defective beyond reasonable repair.

Shaft replacement guidelines

1-Shaft measurement check

Check the bearing fits of the shaft. If any are outside the tolerances shown in the Bearing fits and tolerances table (Refer to related tolerance table), then replace the shaft.

2-Shaft straightness check

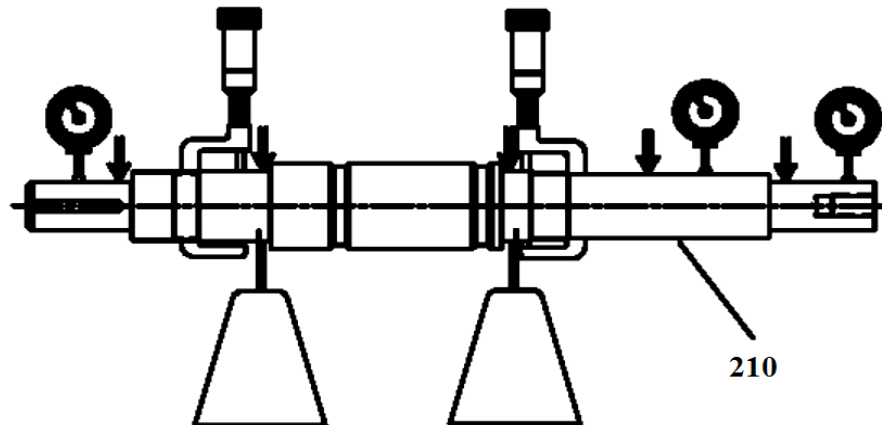
Check the shaft straightness. Use "V" blocks or balance rollers to support the shaft on the bearing fit areas. Replace the shaft if runout exceeds 0.001 in. (0.03 mm).

NOTICE:

Do not use shaft centers for the runout check as they may have been damaged during the removal of the bearings or impeller.

3-Shaft surface check

Check the shaft surface for damage, especially in areas indicated by the arrows in the following figure. Replace the shaft if it is damaged beyond reasonable repair.
(210=Shaft)



Post-assembly checks

Perform these checks after you assemble the pump, then continue with pump startup:

- Make sure you can rotate the shaft easily by hand to ensure that it rotates smoothly and that there is no rubbing.
- Open the isolation valves and check the pump for leaks.

❖ Troubleshooting

Operation troubleshooting

Symptom	Cause	Remedy
The pump is not delivering liquid.	The pump is not primed.	Re-prime the pump and check that the pump and suction line are full of liquid.
	The suction line is clogged.	Remove the obstructions.
	The impeller is clogged.	Back-flush the pump to clean the impeller.
	The shaft is rotating in the wrong direction.	Change the rotation. The rotation must match the direction which has been depicted in general arrangement drawing.
	The foot valve or suction pipe opening is not submerged enough.	Consult a Berkeh representative for the proper submersion depth. Use a baffle to eliminate vortices.
	The suction lift is too high.	Shorten the suction pipe.
The pump is not producing the rated flow or head.	The gasket or O-ring has an air leak.	Replace the gasket or O-ring.
	The stuffing box has an air leak.	Replace or readjust the mechanical seal.
	The impeller is partly clogged.	Back-flush the pump to clean the impeller.
	The clearance between the impeller and the pump casing is excessive.	Adjust the impeller clearance.
	The suction head is insufficient.	Ensure that the suction-line shutoff valve is fully open and that the line is unobstructed.
	The impeller is worn or broken.	Inspect and replace the impeller if necessary.
The pump starts and then stops pumping.	The pump is not primed.	Re-prime the pump and check that the pump and suction line are full of liquid.
	The suction line has air or vapor pockets.	Rearrange the piping to eliminate air pockets.
	The suction line has an air leak.	Repair the leak.
The bearings are running hot.	The pump and driver are not aligned properly.	Realign the pump and driver.
	There is insufficient lubrication.	Check the lubricant for suitability and level.
	The lubrication was not cooled properly.	Check the cooling system.

The pump is noisy or vibrates.	The pump and driver are not aligned properly.	Realign the pump and driver.
	The impeller is partly clogged.	Back-flush the pump to clean the impeller.
	The impeller or shaft is broken or bent.	Replace the impeller or shaft as necessary.
	The foundation is not rigid.	Tighten the hold-down bolts of the pump and motor. Make sure the base plate is properly grouted without voids or air pockets.
	The bearings are worn.	Replace the bearings.
	The suction or discharge piping is not anchored or properly supported.	Anchor the suction or discharge piping as necessary according to recommendations in the Hydraulic Institute Standards Manual.
	The pump is in cavitation.	Locate and correct the system problem.
There is excessive leakage from the stuffing box.	The packing gland is not adjusted properly	Tighten the gland nuts.
	The stuffing box is not packed properly.	Check the packing and repack the box.
	The mechanical-seal parts are worn.	Replace the worn parts.
	The mechanical seal is overheating.	Check the lubrication and cooling lines.
	The shaft sleeve is scored	Machine or replace the shaft sleeve as necessary.
The motor requires excessive power.	The discharge head has dropped below the rated point and is pumping too much liquid.	Install a throttle valve. If this Does not help, trim the impeller diameter. If this does not help, contact your Berkeh representative.
	The liquid is heavier than expected.	Check the specific gravity and viscosity.
	The stuffing-box packing is too tight.	Readjust the packing. If the Packing is worn, then replace the packing.
	Rotating parts are rubbing against each other.	Check the parts that are wearing for proper clearances.
	The impeller clearance is too tight.	Adjust the impeller clearance.

Assembly trouble shooting

Symptom	Cause	Remedy
There is excessive shaft end play.	The internal clearance of the bearings is excessive.	Replace the bearings with a bearing of the correct type.
	The thrust-bearing end cover is loose.	Tighten the screws.
	There are too many shims under the thrust bearing end cover.	Remove the individual shims to obtain the proper thickness.
The runout for the shaft is excessive.	The shaft is bent.	Replace the shaft.
The runout for the bearing coevr is excessive.	The shaft is bent.	Replace the shaft.
	The bearing cover is distorted.	Replace the bearing cover.
The runout for the seal-chamber cover is excessive.	The seal-chamber cover is improperly seated on the frame.	Replace or re-machine the seal chamber cover.
	There is corrosion or wear on the seal chamber cover.	Replace the seal-chamber cover.
The runout for the impeller wear ring is excessive.	The shaft is bent.	Replace the shaft.
	The wear ring was machined improperly.	Replace or re-machine the impeller.