OH1 Pumps

Installation, Operation, and Maintenance Manual

Model OH1/SL, EN 22858 / ISO 2858 / ISO 5199

ARYA SEPEHR KAYHAN

Table of Contents

1 General

Caution

This manual contains important information for reliable, proper and efficient operation.
Compliance with the operating instructions is of vital importance to ensure reliability and long service life of the pump, 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 specified in the technical documentation for the medium handled, capacity, speed, density, pressure, temperature and motor rating. Make sure that operation is in accordance with the instructions given in this manual or in the contract documentation.

The nameplate indicates the type series / size, main operating data and serial 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 your ASK representative.

2 Safety

These operating instructions contain fundamental information that must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the operating location of the machine / unit for easy access.

Not only must the general safety instructions given in this chapter of “Safety” be complied with, but also the safety instructions outlined under specific headings.

2.1 Marking of Instructions in the Manual

The safety instructions contained in this manual whose nonobservance might cause hazards to persons are specially marked with the general hazard sign, namely

Safety sign in accordance with DIN 4844-W9.

The electrical danger warning sign is

Safety sign in accordance with DIN 4844-W8.

The word

Caution

Is to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.
Instructions attached directly to the machine, such as:

- Arrow indicating the direction of rotation

- Marking for fluid connections must always be complied with and be kept in legible condition at all times.

2.2 Personnel Qualification and Training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved.

Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question are not already in possession of the requisite knowhow, appropriate training and instruction must be provided.
If required, the operator may commission the manufacturer / supplier to provide such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

2.3 Non-compliance with Safety Instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself.
Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.

In particular, non-compliance can, for example, result in:
- Failure of important machine / unit functions
- Failure of prescribed maintenance and servicing practices
- Hazard to persons by electrical, mechanical and chemical effects
- Hazard to the environment due to leakage of hazardous substances.

2.4 Safety Awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national and local health and safety regulations and the operator's own internal work, operation and safety regulations.

2.5 Safety Instructions for the Operator / User

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards that are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed while the machine is operating.
- Leakages (e.g. at the shaft seal) of hazardous media handled (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons and the environment.
  Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (Refer to the relevant safety regulations applicable to different countries and / or the local energy supply companies.)

2.6 Safety Instructions for Maintenance, Inspection and Installation

The operator is responsible for ensuring that all maintenance, inspection and installation work is performed by authorized and qualified personnel who are thoroughly familiar with the manual.

Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.

Pumps or pump units handling media injurious to health must be decontaminated.

Immediately following completion of the work, all safety / protective devices must be re-installed and / or re-activated.

Please observe all instructions set out In the chapter on “Commissioning” before returning the machine to service.

2.7 Unauthorized Modification and Manufacture of Spare Parts

Modifications or alterations of the machine are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for damage or warranty.

2.8 Unauthorized Modes of Operation

Any warranty of the operating reliability and safety of the pump / unit supplied is only valid if the machine is operated in accordance with its designated use as described in the following sections. The limits stated in the data sheet must not be exceeded under any circumstances.

3 Transport and Interim Storage

3.1 Transport

Proper lifting and safety practices must be observed at all times. Lifting the pump assembly requires extreme care, since the center of gravity is not located in the physical center of the unit, but is usually closer to the stuffing box / shaft seal area.

Never lift by a single point and do not use the pump or motor shaft as a lift point. Eyebolt locations on the bearing assembly and motor are intended for lifting those items only and must not be used to lift the pump assembly.

At least four (4) connections are recommended to stabilize the load, and they should be as far apart as practical. Avoid excessive side loads on cast lifting eyes. Note that certain lift points on the pedestal are intended for use in handling the pedestal alone and are not necessarily optimum balance points for the pump assembly.

Always make sure that the unit remains in the horizontal position during transport and cannot slip out of the transport suspension arrangement.

If the pump / unit slips out of the suspension arrangement, it may cause personal injury and damage to property.

Figures below give suggested lifting methods. Actual safe lifting method will vary with pump configuration and type of lifting equipment. Ensure secure attachments and test lifting method for stability before moving pump.

In corrosive environments be sure to remove all lifting devices from the pump and store in a non-corrosive environment until needed.

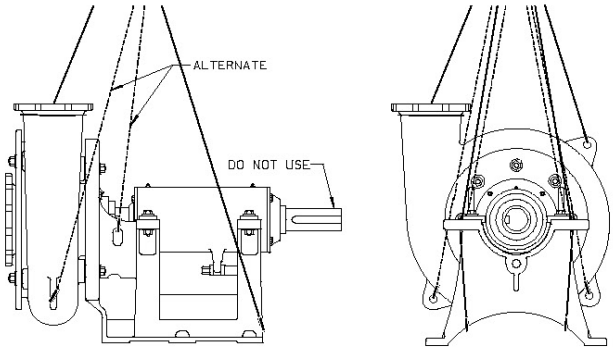
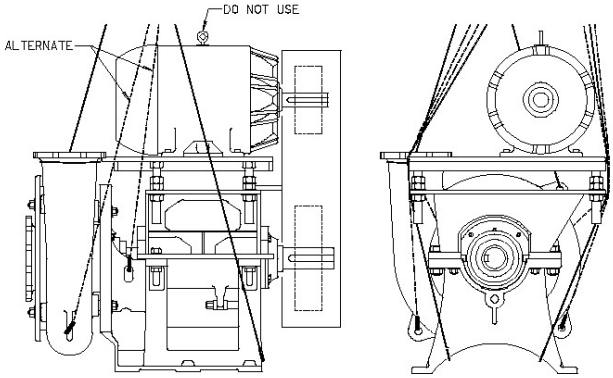


Fig. 3.1-1 Transport of the pump



WARNING: Very top heavy

Fig. 1 Transport of the complete unit

3.2 Short Term Storage

The pump / unit should be stored in a dry room where the atmospheric humidity is as constant as possible.

If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.

All openings of the assembled pump / unit components are closed and must only be opened when required during installation.

Caution

Protect all stored goods against humidity, dirt, vermin and unauthorized access!

Short term storage requirements are defined for up to 3 months. For storage exceeding 3 months see Section 6.3 on long term storage requirements.

4 Description of the Product and Accessories

4.1 Technical Specification

Centrifugal pump for handling coarse or fine particles from solids-laden waste water to aggressive slurries of an abrasive or corrosive nature.

Applications include process pumping and tailings disposal for mining, dredging and other industrial operations.

4.2 Design Details

Horizontal, end suction, modified volute casing pump with non clogging impeller for large solids passage. Available in interchangeable elastomer, metal and extra-heavy designs.

4.2.1 Pump Casing

Two standard configurations are available:

1 Hard Metal. Single-wall casing, impeller and suction liner of high-chrome white iron. Suitable for high-discharge head, all particle sizes up to maximum sphere passage and mildly corrosive slurries. Custom materials available for highly corrosive slurries.

2 Elastomer Lined. Radially split construction with ductile iron outer casing and molded-elastomer inner liners. Impeller of high chrome white iron or polyurethane. For moderate discharge head, fine to medium particles and highly corrosive slurries.

4.2.2 Shaft Seal

All standard pumps use replaceable gland packing in a stuffing box with connections for flush water or sealing liquid.

Options include throat bushing, slurry duty mechanical seals or expeller with grease lubricated gland packing.

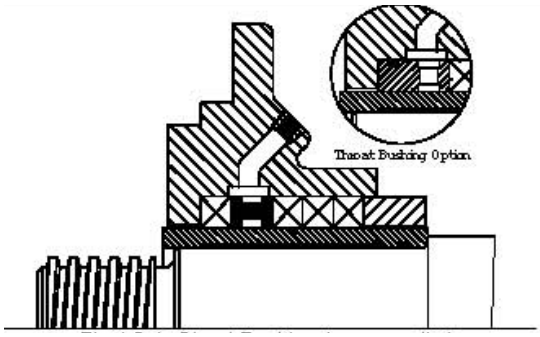


Fig. 2 Gland Packing (non-expeller)

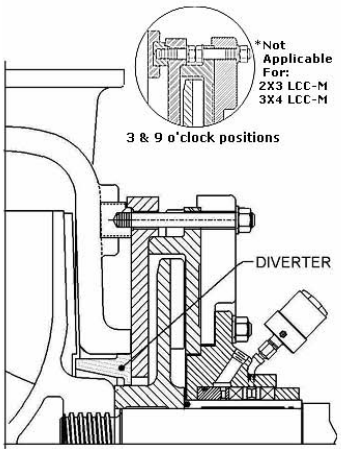


Fig.3 Typical Expeller Arrangement

Expeller seals are used in pump applications where limited or no gland flush water is readily available or where it is not compatible with the process fluid. A second rotating impeller contained in a separate casing creates a lower pressure at the stuffing box seal area. This allows the shaft sleeve to be grease lubricated and run with only enough packing compression to seal the pump.

Unlike mechanical seals, expellers must be carefully selected for each application and specific operating conditions. Expellers require additional driver horsepower, which must be accounted for during motor selection.
Changes to head, flow, pump speed, process solids or sump level after the pump has been installed can affect the functionality of an expeller sealing system.

Correct installation, adjustment and operating procedures are extremely critical to the proper function and life of these seals. Extensive testing has shown that the following guidelines can help keep the expeller system operating properly while prolonging the life of wear components.
Further engineering review is recommended for expeller operation outside these guidelines.

Particle size – The D50 should be kept between 200 and 1500 microns.
Slurry SG – The Specific Gravity of the slurry should remain below 1.35.

Solids – Slurries that could deposit scale on pump surfaces should be avoided.

Flow rate – Stay between 0.5 and 1.3 times the Best Efficiency Point (QBEP).
Flushing – Solids in the process flow can precipitate out when the pump stops and build up in the expeller chamber.
Over time, this reduces efficiency and accelerates wear. The system should always be purged with clear water for at least
15 minutes prior to stopping the pump. Starting the system on clear water will help the expeller displace solids. For applications where precipitate buildup in the expeller chamber is unavoidable, intermittent gland water flush may be necessary.

When the stuffing box does not have flush water, the packing must be lubricated with grease or oil. Graphite packing such as Tuf-Pak 400 is recommended. Manual or automatic grease dispensers are available depending on the application. Twisting the cap in on the manual units will add a small amount of grease to the packing. These are refilled by removing the cap and packing the cup with lubricant.
Automatic greasers use a spring driven piston to maintain a steady supply of grease. These are refilled by connecting a grease gun to the fitting on the side of the unit. Note that extremes in temperature can alter the amount of lubricant supplied to the packing and must be accounted for. Springs are available for the automatic greaser with three different tension levels to control the flow of grease.

New expeller pumps are equipped with a diverter ring pressed into the hub area of the pump casing. This acts as a baffle to help reduce the amount of solids entering the seal chamber. The diverter can be ordered as a service part and retrofit into earlier units.

It is important to operate the expeller pump within the speed limitations and operating conditions specified in the original design parameters. Wide variations in flow rate and solids can allow particles to accumulate in the expeller chamber, which may result in a plugging or premature component failure. Any change in the operating conditions should be discussed with your ASK representative to establish if the new conditions are suitable for the equipment.

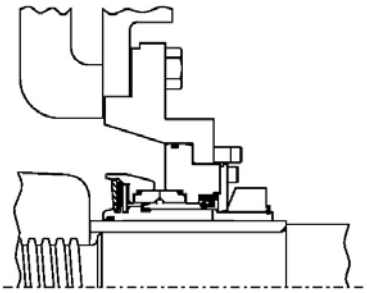


Fig. 4 Typical Slurry Mechanical Seal

For information on mechanical seals, consult the manufacturer's manual.

4.2.3 Bearings

The bearing assembly is a cartridge design mounted on a concentric pedestal with an adjustment mechanism for setting the impeller axial clearance.
Standard lubrication is grease. Oil lube is also available.

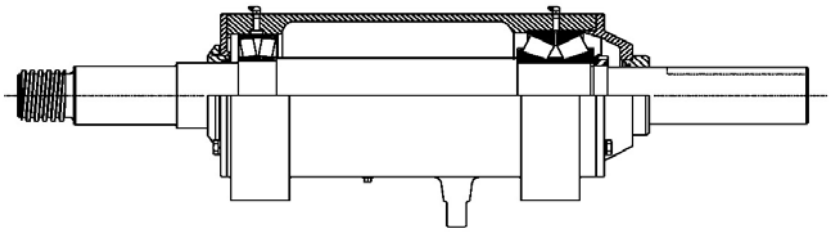
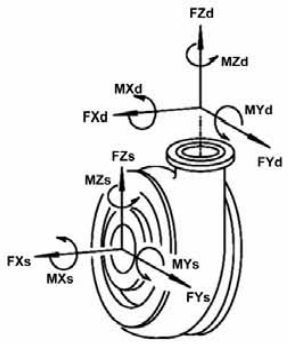


Fig. 5 Cartridge Bearing Assembly

4.2.4 Permissible Forces and Moments at the Pump Nozzles



Allowable combined branch loads applicable for all ASK slurry pumps. Methods based on ANSI/HI 12.1-12.6-2005 Slurry Pump Standard. Coordinate system per HI/ANSI 9.6.2 and API 610 (see figure). Loads generally exceed
HI/ANSI 9.6.2-2008 table 9.6.2.1.4a and API 610-2004, Table 4. Higher allowable loads may be possible depending on individual pump configuration and operating conditions. Contact your ASK Application Engineer for more information.

	Flange Size	Allowable Forces lbs (N)						Allowable Moments ft-lbs (N-m)					
		F_X		F_Y		F_Z		M_X		M_Y		M_Z	
Discharge Pipe	2 inch (50 mm)	2490	(11070)	1980	(8800)	3000	(13340)	2640	(3570)	2640	(3570)	4000	(5420)
	3 inch (75 mm)	2730	(12170)	2170	(9680)	3290	(14670)	2900	(3930)	2900	(3930)	4390	(5960)
	4 inch (100 mm)	2980	(13270)	2370	(10550)	3590	(15990)	3160	(4290)	3160	(4290)	4790	(6500)
	6 inch (150 mm)	3470	(15440)	2760	(12280)	4180	(18610)	3680	(4990)	3680	(4990)	5580	(7570)
	8 inch (200 mm)	3950	(17580)	3140	(13980)	4760	(21190)	4200	(5690)	4200	(5690)	6360	(8620)
	10 inch (250 mm)	4420	(19690)	3520	(15660)	5330	(23730)	4700	(6380)	4700	(6380)	7130	(9670)
	12 inch (300 mm)	4890	(21780)	3890	(17320)	5900	(26240)	5210	(7070)	5210	(7070)	7900	(10710)
	14 inch (350 mm)	5350	(23830)	4260	(18950)	6450	(28710)	5710	(7740)	5710	(7740)	8650	(11730)
Suction Pipe	3 inch (75 mm)	3290	(14670)	2730	(12170)	2170	(9680)	4390	(5960)	2900	(3930)	2900	(3930)
	4 inch (100 mm)	3590	(15990)	2980	(13270)	2370	(10550)	4790	(6500)	3160	(4290)	3160	(4290)
	6 inch (150 mm)	4180	(18610)	3470	(15440)	2760	(12280)	5580	(7570)	3680	(4990)	3680	(4990)
	8 inch (200 mm)	4760	(21190)	3950	(17580)	3140	(13980)	6360	(8620)	4200	(5690)	4200	(5690)
	10 inch (250 mm)	5330	(23730)	4420	(19690)	3520	(15660)	7130	(9670)	4700	(6380)	4700	(6380)
	12 inch (300 mm)	5900	(26240)	4890	(21780)	3890	(17320)	7900	(10710)	5210	(7070)	5210	(7070)
	14 inch (350 mm)	6450	(28710)	5350	(23830)	4260	(18950)	8650	(11730)	5710	(7740)	5710	(7740)

4.2.5 Noise Characteristics

If running within the normal limits of operation and on clear liquid, the sound pressure level for the pump alone does not exceed 85 dB at one meter.

The addition of coarse solids, froth or cavitating conditions can significantly increase the noise levels in both the pump and piping. If accurate noise levels are required for these conditions, field-testing will be required.

Sound pressure levels from motor and gear reducer must be added to the above in accordance with standard acoustic formulas, taking into account the distance between units. For belt driven units, add an additional 2 dB.

4.3 Accessories

Couplings, pulleys, belts, motor mounts and/or base plates may be provided. Refer to the bill-of-materials, data sheets and/or drawings for further information.

4.4 Dimensions and Weights

Dimensions and weights are listed on the pump installation plan.

5 Installation at Site

5.1 Safety Regulations

Electrical equipment operated in hazardous locations must comply with the applicable explosion protection regulations. This is indicated on the motor rating plate. If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access (e.g. foreman's office).

5.2 Foundation

All structural work required must have been prepared in accordance with the dimensions stated in the dimension table / installation plan.

The concrete foundation shall have sufficient strength for the pump and be completely cured before installation. The mounting surface must be flat and level. Anchor bolts must be located according to the installation plan. This can be done when the concrete is poured, or by drilling holes in existing foundations and grouting the bolts in place.

5.3 Installing the Pump / Unit

After placing the base plate on the foundation, it must be leveled by shimming. Shims should be fitted between the base plate and the foundation itself; they should always be inserted to the left and right of the foundation bolts and in close proximity to these bolts. For a bolt-to-bolt clearance of more than 800mm (30 in.), additional shims should be inserted halfway between the adjoining holes. All shims must lie perfectly flush.

Insert the foundation bolts and set them into the foundation using concrete. When the mortar has set, tighten the foundation bolts evenly and firmly and grout the base plate using low shrinkage grout.

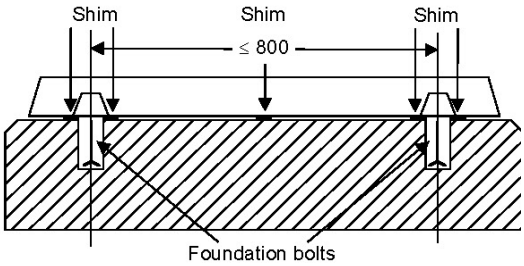


Fig. 6 Fitting required shims (mm)

5.3.1 Aligning the Pump / Drive Train

Caution

All components must be level during operation unless special provisions for bearing lubrication and oil sealing have been made. After attaching the unit to the foundation and connecting the piping, the pump and drive train must be thoroughly checked and, if necessary, realigned

Proper alignment must be taken into consideration when using the overhead motor mount accessory. Motor feet must be firmly supported at each mounting bolt location before the bolts are tightened. Shims should be used to fill any gaps and ensure solid mounting and vibration prevention.

Use of the mounting bolts to close gaps between motor feet and the mounting plate (in place of shimming) is not recommended and may result in twisting of the motor frame, “soft foot” mounting and excessive vibration.

Coupling check and realignment must be done even if pump and motor are supplied completely assembled and aligned on a common base plate. The correct distance between the coupling halves as specified in the installation plan must be observed.

The pump set is correctly aligned if a straight-edge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a feeler gauge, a wedge gauge or a dial micrometer to verify.

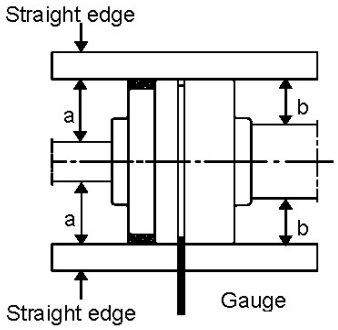


Fig. 7 Aligning the coupling with the help of a gauge and a straight-edge

The radial and axial deviation (tolerance) between the two coupling halves should not exceed 0.1 mm (0.004 inch).

Improper alignment of the unit can cause damage to both the coupling and the unit itself!

For V-belt installations, the pulleys are correctly aligned if a straight-edge placed vertically shows a deviation of no more than 1.0 mm (0.04 in.). Both pulleys must be parallel.

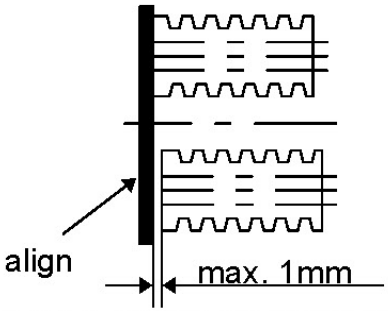


Fig. 8 Aligning of V- belt pulleys

5.3.2 Place of Installation

The volute casing and the mechanical seal (if equipped) take on approximately the same temperature as the pump fluid. The mechanical seal (if equipped), bearing assembly and bearing housing must not be insulated.

Take the necessary precautions to avoid burns to personnel and adjacent equipment.

5.4 Connecting the Piping

Caution

Never use the pump itself as anchorage point for the piping. The permissible pipeline forces must not be exceeded.

Suction lift lines should be laid with a rising slope towards the pump and suction headlines with a downward slope towards the pump. The pipelines should be anchored in close proximity to the pump and should be connected without transmitting any stresses or strains. The nominal diameters of the pipelines should be at least equal to the nominal diameters of the pump nozzles. It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. It must be ensured, however, that the pump can still be drained and dismantled without problems.
Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump exceeding the permissible pipeline forces and moments.

An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.

Danger of life when toxic or hot media are handled.

The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

5.4.1 Auxiliary Connections

The dimensions and locations of the auxiliary connections (cooling, heating, sealing liquid, flushing liquid, etc.) are indicated on the installation plan or piping layout.

Caution

These connections are required for proper functioning of the pump and are therefore of vital importance!

5.4.2 Safety Guards

In compliance with the accident prevention regulations the pump must not be operated without coupling and drive guards. If the customer specifically requests not to include guards in our delivery, then the operator must supply them.

5.5 Final Check

Re-check the alignment as described above.
It must be easy to rotate the shaft by hand at the coupling.

5.6 Connection to Power Supply

A ***trained electrician*** must make the connection to the power supply. Check available mains voltage against the data on the motor rating plate and select the appropriate start-up method.

We strongly recommend the use of a motor protection device.

6 Commissioning, Start-up /Shutdown

Caution
Compliance with the following requirements is of paramount importance.
Damage resulting from non-compliance shall not be covered by the scope of warranty.

This manual applies to single stage pumps.

6.1 Commissioning

Before starting up the pump make sure that the following requirements are checked and fulfilled.
The operating data, the oil level, if required, the nose clearance, and the direction of rotation must be checked. The pump set must be primed.

- Make sure the unit is properly connected to the electric power supply and is equipped with all protection devices.
- Make sure all auxiliary connections are connected and functioning.
- If the pump has been out of service for a long period of time, proceed in accordance with Section **Returning to Service after Storage**.

6.1.1 Lubricants

Grease Lubricated Bearings

Grease lubricated bearings are packed with grease at the factory. They should be re-lubricated after the initial 50 hours of operation, and at regular intervals thereafter.

If shaft speeds exceed those in the table below, the bearing housing temperature should be monitored during commissioning and additional grease added if it exceeds100 °C (210 °F), or if bearings are noisy. In some cases where external cooling of the housing is poor, it may be necessary to stop and allow the bearings to cool several times during this break-in period.

Some lubricant may be expelled from the labyrinth oil seals upon startup. This is normal and will stop once the excess grease has been purged.

6.1.2 Priming the Pump and Other Checks

Before start-up, the pump, suction line and (if applicable) the tank must be vented and primed with the liquid to be pumped. Any valve in the suction line must be fully open.

Open all auxiliary connections (flushing, sealing, cooling liquid, etc.) and check the through flow.

6.1.3 Checking the Direction of Rotation

Caution

The impeller must rotate in the direction indicated by the arrow on the pump casing. This must be verified by briefly running the motor with the coupling or belt drive disconnected. If the motor runs in the wrong direction of rotation, have it corrected and verify direction of rotation before reconnecting coupling or belts. If a Variable Frequency Drive (VFD) or other controller is used, it is recommended to permanently disable REVERSE and BRAKE function during controller set up.

If motive power is applied to the pump, and it is run in the wrong direction of rotation, even momentarily, the impeller may unscrew causing extensive damage to the entire unit.
This is especially important during initial start up as the impeller may not be fully torque onto the pump shaft.

6.1.4 Cleaning the Plant Piping

The cleaning operation mode and duration for flushing and pickling service must be matched to the casing and seal materials used.

6.1.5 Suction Strainer

If a suction strainer has been fitted to protect the pumps against dirt and/or to retain contamination from the plant; the strainer's contamination level must be monitored by measuring the differential pressure to ensure adequate inlet pressure for the pump.

6.1.6 Start-up

Caution

Before starting the pump ensures that the shut-off element in the suction line is fully open. The pump may be started up against a closed discharge-side swing check valve or shut-off element.
Only after the pump has reached full rotational speed should the shut-off be opened slowly and adjusted to comply with the duty point. When starting up against an open discharge-side shut-off element, take the resulting increase in input power into account.

Prolonged operation against a closed shut-off element is not permitted.

Danger of steam generation and explosion!

Caution

Once the operating temperature has been reached and / or in the event of leakages, switch off the unit and retighten all bolts. Check the coupling alignment as described in this manual and re-align, if necessary.

6.1.7 Shutdown

Under no circumstances should the pipe system be equipped with a check valve or other device that can rapidly decelerate the flow rate.

Switch off the drive, making sure that the unit runs smoothly down to a complete stop. Variable Frequency Drive (VFD) and other controllers must not use any braking function to slow the pump. Diesel power trains should disengage the clutch and allow the pump to coast to a stop.

Close any auxiliary connections. Pressurized bearing lubrication systems must remain running until all rotation has stopped. If the any part of the system uses a cooling liquid supply, turn that off only after the pump has cooled down. Where liquid filled shaft seals are used, consult seal maintenance manual for specific shutdown procedures.

Caution

In the event of shutdown where a significant static discharge head exists in the system, the impeller can begin to run backwards as the flow reverses in the pipeline. This creates a positive torque on the shaft so the impeller connection will not unscrew. Until the flow stops, do not close any main line valves. A change in fluid velocity can create a negative torque on the impeller and unscrew it from the shaft. This can damage wet end pump parts as well as bearings, seals and other components where temperatures may drop below freezing, the pump and system must be drained or otherwise protected against freezing.

6.2 Operating Limits

The pump's / unit's application limits regarding pressure, temperature and speed are stated on the data sheet and must be strictly adhered to. If a data sheet is not available, contact your ASK representative.

6.2.1 Temperature of the Medium Handled, Ambient Temperature, Bearing Temperature

Do not operate the pump at temperatures exceeding those specified on the data sheet or the nameplate unless the written permission of the manufacturer has been obtained.

Damage resulting from disregarding this warning will not be covered by the manufacturer's warranty.

Bearing temperatures must be observed. Excessive bearing temperature could indicate misalignment or other technical problem.

6.2.2 Switching Frequency

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, the switching frequency should not exceed the following number of start-ups per hour (h):

Motor rating	max. switchings / hr
up to 12kW (16hp)	25
up to 100kW (135hp)	20
more than 100kW (135hp)	10

6.2.3 Density of the Medium Handled

The power input of the pump will increase in proportion to the density of the medium handled. To avoid overloading of the motor, pump and coupling, the density of the medium must comply with the data specified on the purchase order.

6.3 Shutdown / Storage / Preservation

Each ASK pump leaves the factory carefully assembled. If commissioning is to take place sometime after delivery, we recommend that the following measures be taken for pump storage exceeding 3 months.

6.3.1 Storage of New Pumps

• Maximum protection for up to 12 months, if the pump is properly stored indoors.
• Store the pump in a dry location
• Rotate the pump rotor by hand once a month.
• Follow manufacturer's instructions for mechanical seals.
• See requirements for rubber liner storage below.

6.3.2 Measures to be taken for Prolonged Shutdown

1 The pump remains installed; operation check run

In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3 months for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.

2 The pump is dismantled and stored

Before putting the pump into storage carry out all checks specified in this manual. It is advisable to close the nozzles (for ex. with plastic caps or similar).

6.3.3 Storage of Elastomer Linings

Pumps with elastomer linings should be stored in a cool dark location free from electrical equipment such as motors, or any other ozone generating devices. Exposure to direct sunlight or temperatures in excess of 50°C (120°F) must be avoided.

Properly stored elastomer parts will retain their properties for about two years for gum rubber, or five years for neoprene or urethane. The parts should be periodically inspected for the presence of a soft chalky layer, easily rubbed off, which would indicate deterioration. Darkening or discoloration of elastomer parts over time is a natural occurrence and does not by itself indicate any loss of properties.

6.4 Returning to Service after Storage

Before returning the pump to service carries out all checks and maintenance work specified in this manual.

The instructions given in the sections on "Commissioning" and "Operating Limits" must be observed.

Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set.

7. Maintenance /Repair

7.1 General Instructions

The operator is responsible for ensuring that all maintenance inspection and installation work is carried out by authorized, duly qualified staff that is thoroughly familiar with these operating instructions.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure.

Work on the unit must only be carried out with the electrical connections disconnected and locked out. Make sure that the pump set cannot be switched on accidentally.

Pumps handling liquids posing health hazards must be decontaminated. When draining the medium ensure there is no risk to persons or the environment. All relevant laws must be adhered to.

7.2 Maintenance / Inspection

7.2.1 Supervision of Operation

Caution

The pump should run quietly and free from vibrations at all times. Unusual noise or vibration should be investigated and corrected immediately.

Operational procedures that may cause system water hammer must be avoided. ***Sudden and catastrophic failure of pump casing and plates may result.***

When running the pump against a closed discharge-side shut-off element for a short period, the permissible pressure and temperature values must not be exceeded.

Prolonged operation against a closed shut-off element is not permitted. **Danger of steam generation and explosion!**

The gland packing (if the pump is fitted with one) should drip slightly during operation. The gland should only be gently tightened.

Any stand-by pumps installed should be switched on and off again once a week to keep them operational. Attention should be paid to the correct functioning of the auxiliary connections.

Caution

If the flexible coupling elements begin to show signs of wear, they should be replaced.

7.3 Drainage / Disposal

Caution

If the pump was used for handling liquids posing health hazards, see to it that there is no risk to persons or the environment when draining the medium. All relevant laws, local codes, and safety procedures must be heeded. If required, wear safety clothing and a protective mask.

If the media handled by the pumps leaves residues which might lead to corrosion when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the unit must be flushed thoroughly and neutralized.

The flushing liquid used and any liquid residues in the pump must be properly collected and disposed of without posing any risk to persons or the environment.

7.4 Dismantling

Before dismantling, secure the pump so as to make sure it cannot be switched on accidentally.

The shut-off elements in the suction and discharge nozzles must be closed. The pump must have cooled down to ambient temperature, it must be drained and its pressure must be released.
Repair and maintenance work to the pump must only be carried out by specially trained personnel, using original equipment spare parts

7.4.1 Sectional Drawings and Bills of Material

Dismantling and reassembly must always be carried out in accordance with the relevant sectional drawing. Any work on the motor, gear reducer, mechanical seal or other non-pump equipment shall be governed by the specifications and regulations of the respective supplier.

7.4.2 Dismantling Procedures Impeller

During normal operation, the impeller becomes tightly screwed onto the shaft by the running torque. A steady torque or mild, yet sudden, torsional jolt is usually required to disengage the impeller. Several methods of achieving this end are possible. One of the easiest methods is outlined below. To order the jigs described here, contact your ASK representative. Please provide your pump assembly number with the order to insure a good fit.

Do not apply heat to the impeller hub or nose due to the sealed cavity at the impeller nose.
DANGER OF EXPLOSION!

For Plates Using Swivel Hoist Rings

Always ensure that lifting equipment does not bind to the hoist ring. Binding can cause ring failure.

When lifting a plate that contains two swivel hoist rings, do not allow the angle between the lines of tension from the rings exceed 120°. This could cause the hoist rings to fail.

Impeller Break-Loose Jig

Rotate the impeller until the tip of one blade is facing the pump discharge. Insert the jig through the eye of the impeller and attach to trailing edge of blade facing discharge. Rotate the shaft in the direction opposite to normal, using the pump pulley or a spanner wrench.

NOTE: For ease of impeller removal, the shaft threads should be heavily coated with anti-seize compound during re-assembly. Also, **two** aramid paper gaskets should be used between the shaft sleeve and the impeller.

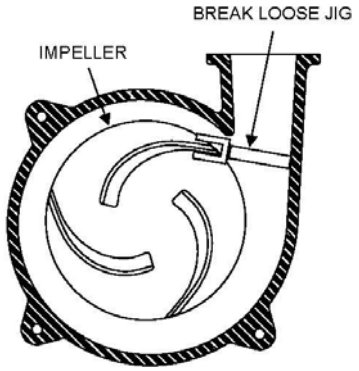


Fig. 9 Impeller Break-Loose Jig

Impeller Lifting Jig

For impeller removal or installation, grasp the impeller at the suction eye as shown in Figure 7.4-2. The impeller can be leveled by turning the adjusting bolt which bears against the impeller nose. This is especially useful during re-installation. For impeller removal ensure that the lifting line is tight prior to thread disengagement.

7.5 Reassembly

7.5.1 General Instructions

The pump should be reassembled in accordance with the rules of sound engineering practice. Use the sectional drawing and bill of material for guidance.

See section 7.4.2 for safety precautions regarding lifting plates with swivel hoist rings.

Caution

Before assembly, thoroughly clean all shaft, housing bore, and end cover surfaces with a suitable solvent to remove old grease and any water, dust or grit. Clean all dismantled components and check them for signs of wear. Damaged or worn components are to be replaced by ***original equipment spare parts.*** *Make sure that the seal faces are clean and the O-rings and gaskets are properly fitted.*

It is recommended that new seal elements (O-rings/ gaskets) be used whenever the pump is reassembled.
Make sure that new gaskets have the same thickness as the old ones. Avoid the use of mounting aids as much as possible. Should a mounting aid be required, use a commercially available contact adhesive. The adhesive should only be applied at selected points (three to four spots) and in thin layers. Do not use cyano acryiate adhesives (quick-setting adhesives). If in certain cases mounting aids or anti-adhesives other than those described are required, please contact the sealing material manufacturer.

7.5.2 Impeller

Coat the shaft threads heavily with anti-seize compound.
Do **not** coat the shaft sleeve faces which contact the impeller and the step in the shaft.

Two 0.5mm (0.020 inch) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal.
The gaskets should be installed dry, without grease.
Screw on the impeller tightly by hand. With larger sizes, it may be convenient to hold the impeller stationary while turning the shaft. Impeller lifting jigs are available to assist in this operation (see Figure 7.4-2).
When assembly of the pump is complete, check the impeller to suction wear plate clearance and adjust if necessary, (see section on Axial Adjustment of Bearing Housing).

7.5.3 Axial Adjustment of the Bearing Housing

In order to maximize the performance and reduce wear, the clearance between the suction face of the impeller and the suction liner must be adjusted to a minimum clearance of 0.25 mm (0.010 in.). This is done by moving the bearing housing assembly with the adjusting screw.

Before adjustment may proceed, the pump wet end must be completely assembled. The stuffing box may be packed before or after the adjustment procedure; however, the axial set of any mechanical seal must be left until **after** adjustment is complete.

After insuring that the four bearing housing clamps are slightly loosened, run the bearing assembly towards the impeller end by means of the adjusting screw until the impeller first begins to rub the suction liner. It is helpful to slowly rotate the impeller during this procedure.

Next, reverse the adjusting screw until the clearance between the impeller and the suction liner is brought to the recommended value shown in the table below.

Once the clearance is correct, lightly tighten the bolts of the four bearing housing clamps by hand, making sure that proper contact is maintained at all four locations.
Finally, firmly lock the adjusting screw and nut together against the bearing housing tab.

Caution
Proper tightening of the bearing housing clamps and adjusting nut is essential to prevent movement of the rotating assembly during operation. Failure to do so can result in severe vibration and damage to all pump components.

7.5.4 Expeller Running Clearance

Proper adjustment of the impeller nose clearance as covered in the section Axial Adjustment of the Bearing Housing should result in proper expeller clearances in the new condition and no further adjustments should be necessary.
In some cases, however, adjusting the impeller after excessive suction liner wear may result in the expeller rubbing against the expeller plate. In other cases, it is desired to optimize expeller performance rather than optimize the impeller clearance.

The following procedure is recommended for optimizing expeller performance or for setting the clearances in pumps containing any worn parts:

1 With the suction plate/liner removed, adjust the bearing assembly toward the pump end until the back surface of the expeller just begins to rub the expeller plate.

2 Mount a dial gauge to indicate cartridge bearing assembly axial movement and zero the dial gauge at this location.

3 Now adjust the bearing assembly toward the drive (or motor) end until the expeller vanes just begin to rub on the expeller casing, or the impeller begins to rub on the hub side of the pump shell, whichever comes first.

4 Adjust the bearing assembly toward the pump end again approximately 1.0 mm (0.04 in.) to provide a minimal expeller running clearance. If optimization of expeller performance is desired, lock the adjustment at this location

Caution
Optimizing the expeller clearances is recommended only in cases where expeller performance is marginal and a small increment in performance is required to seal against the pump pressure. Setting of clearances for optimal expeller performance may result in excessive impeller clearance and accelerated wear. If necessary, this may be remedied by providing a custom fitted machined spacer with gaskets between the impeller and expeller.

5 Reassemble the suction plate and check the impeller to liner clearance. If not optimizing expeller clearances set the impeller clearance as detailed in the section “Axial Adjustment of the Bearing Housing”. Do not allow

the dial gauge to come closer than 1.0 mm (0.04 in.) to the original zero setting or expeller rubbing may occur. If necessary, consider the use of a spacer as mentioned in step 4.

7.5.5 Water Purge for Gland Packing

The stuffing box is equipped with tapped holes for sealing water. In order to keep the stuffing box free from abrasive particles, the sealing water pressure and gland (452) tightness should be adjusted to maintain a small flow of cool or lukewarm leakage out of the stuffing box. If the leakage becomes hot, the gland should be loosened to allow a greater flow. If cloudiness is seen in the leakage, greater water pressure is needed.

Purge water must be non-aggressive, not liable to form deposits and not containing suspended solids.
(Hardness: on average 5; pH > 8, or conditioned and neutral with regard to mechanical corrosion).
Inlet temperature t_E = 10 to 30° C (50 to 85 ° F)
Outlet temperature t_A max. 45°C (115 ° F)

The sealing water pressure required to maintain satisfactory stuffing box operation will vary with pump operating pressure, slurry properties, condition of the packing, and the type of stuffing box. A supply pressure of 10 psi (0.7 bar) over the discharge pressure of the pump should be available. In most cases, adjustments to supply pressures can be made with a manual valve and gauge near the stuffing box.

7.6 Spare Parts Stock

Due to the erosive action of the slurry, many of the wet end components of the pump may require replacement during normal maintenance. Inspection or overhaul of the mechanical components may also warrant replacement of certain parts.

The following are recommended lists of parts to have on hand for normal maintenance and inspection. The quantities of parts kept in store will depend upon the severity of the slurry duty and the number of units operating. Maintenance practices may also favor keeping fully built sub-assemblies or complete pumps on hand in some cases. Previous experience in similar duties often provides the best experience. If in doubt, contact your ASK representative for specific recommendations.

Wet End
- Casing (or casing liners)
- Impeller
- Side Liner
- Gasket Kit

Stuffing Box
- Shaft Sleeve
- Seal Water Ring
- Packing
- Gasket Kit

Bearing Assembly
- Bearings
- Gasket Kit

Expeller
- Casing
- Plate
- Expeller
- Gasket Kit

7.6.1 Maintenance Procedures for Maximum Parts Life

The wear of slurry pump parts is influenced by many factors and the following procedures are designed to help you get the most out of your wet end wear parts. If problems occur, contact your ASK representative for a review of your application.

Also see section 7.7: “Operational Problems and Solutions”.

Impeller

The impeller to suction liner clearance should be adjusted forward several times during its life cycle for maximum impeller and suction liner life.

In general, an impeller does not require replacement until it fails to produce sufficient head for the application. Impellers are sometimes changed too soon based on appearance. Vibration caused by an impeller wearing out of balance is rare but possible. If this occurs, the impeller may be statically balanced by hand grinding on back shroud. The impeller should never be repaired by welding.

Shell

If wear is localized with a deep gouge, repair or replace as recommended by ASK. Excessive wear problems are usually indications that the pump is not operating at the flow and head conditions originally specified for the design.

7.7 Operational Problems and Solutions

Many pump wear problems are caused by unstable system operation, or off duty pump operation. Although the dynamics of slurry piping systems cannot be fully addressed in this manual, the following items should be considered. Also refer to section 8: “Trouble Shooting”

Sump Design

A minimum sump capacity of one minute at the expected flow conditions should be provided. Sump design should prevent any uneven flow of the solids to the suction. Often, a flat bottom sump is best since it will allow the solids to assume a natural slope of repose. The sump should be observed during operation to insure that solids are not building up and sloughing off.

Sump design should prevent the formation of a vortex, or other means of introducing air into the pump. Where a submerged suction is available, the depth of water level above the pump suction is more important than the cross-sectional area of the sump. Frothing of the sump should be eliminated by the installation of baffles, a submerged inlet pipe or other methods to prevent air becoming entrained in the slurry. If unavoidable, frothing must be accounted for in the system design and operation.

If the sump runs dry, the system will surge causing accelerated pump wear. Pump speed or impeller diameter should be decreased or make up water increased. If the flow variations are too great, a variable speed motor may be required.

Cavitation / NPSH Performance

The NPSH available must always be greater than the NPSH required by the pump or cavitation will occur resulting in head loss (drop in discharge pressure), increased wear rate of the pump parts, and shock loading of the pump bearing assembly. If any conditions occur, consult your ASK representative for the NPSH requirements of your pump.

To maximize the NPSH available to the pump, insure that the suction line is as short and straight as possible and the sump level is as high as possible, (or the suction lift as small as possible in the case of a pump located above the water level). Minimizing the number of valves or short radius fittings and attaching a suction inlet bell will also reduce entrance losses. A larger diameter suction pipe may help, but one must be careful not to reduce the flow velocity below safe carrying levels or bedding of the slurry will occur and result in increased suction liner and impeller wear.

In dredging applications where a free suction pipe or suction cutter head is lowered into the solids to be pumped, it is useful to have pressure gauges attached to the pump suction and discharge. An operator, by observing the gauges, will be able to maintain a maximum suction vacuum without cavitating the pump.

Piping System Design

With coarse settling slurries, the pipelines should be vertical or horizontal. Inclined pipelines may surge due to a backward drift or build up of solids. Also, an increase in slurry friction loss may be experienced in these sloped lines, further reducing performance.

Piping diameters must be properly sized to maintain sufficient carrying velocity. Oversized pipelines may result in the formation of a sliding bed of slurry, which can greatly accelerate the wear of pumps and pipelines.

Operating Conditions of Flow and Head

It should be noted that the pump always operates at the intersection of the pump curve and the pipeline "system" curve.

During the initial stages of operation, motor load on the pump should be checked. If there is an excess amount of power being drawn by the pump, it may be caused by the system head (TDH) being lower than predicted thus resulting in higher flow rates and power consumption. This sometimes happens when a safety factor is applied to the head during the design of the system. Cavitation may also occur under these high flow conditions. The pump speed should be slowed down to reduce flow, or the total discharge head against the pump should be increased (resulting in reduced flow and power consumption).

If actual supply flow rates are lower than predicted, the sump may run dry causing the system to surge and accelerating pump wear. Pump speed or impeller diameter should be decreased or make up water increased to keep the sump at the highest stable level possible. If the flow variations are too great, a variable speed motor may be required. This problem is especially common in applications with a high proportion of static head, such as mill discharge and cyclone feed. It can be further aggravated by operation well below the best efficiency flow rate of the pump where the pump head curve is relatively flat. Under these conditions, minor fluctuations in the system resistance caused by normal variations in solids concentration or size can result in surging flow rates.

Whenever possible, avoid prolonged operation at flows well below the optimum flow rate. This causes recirculation of slurry within the pump and encourages localized wear.

In the event problems are encountered, contact your ASK representative. The pump serial number, in addition to the following, should be furnished to assist in evaluation of the problem:

A. Pump serial number (from the nameplate on the pedestal), customer location, and the approximate startup date.

B. Pumped fluid SG (specific gravity), slurry information including SG and particle size, and liquid temperature.
C. The approximate flow rate desired and the actual minimum and maximum flow rate of the system if known.

D. The system static head (the difference in elevation between the water level on the suction side of the pump and the point of discharge)

E. The length and size of suction and discharge lines, including a description of the general arrangement including fittings, bends and valves

F. If the discharge point is not to atmosphere, what is the pressure, (e.g. cyclone backpressure)?

G. If suction is taken from a sump; provide the general arrangement including size dimensions and minimum and maximum sump levels referenced to the suction centerline of the pump.

H. The available driver horsepower, speed of motor and pump or description of the ratio device between the pump and motor.

I. The impeller diameter if different from that supplied with the pump.

The above items of data are especially important when a pump has been transferred from the duty for which it was selected to some other application.

In many instances, it will be found that unusual wear in the pump, or low efficiencies, are caused by a mismatch between the pump and the system application and can be corrected once the operating conditions are known.

Contact your ASK representative for further specific recommendations regarding system design.

8 Trouble Shooting

8.1 Low Flow Rate

a) Verify that the pump is correct for the system parameters in terms of flow and head. The pump curve can be used to determine the output, power and speed.

b) Depending on the age and service of the pump, parts could be worn sufficiently to reduce performance.

c) Verify that the motor has the correct power and voltage required for the system, and is operating properly.

d) Verify that the pump is running at the correct speed.

e) Verify that the suction side has adequate NPSH (Net Positive Suction Head) as outlined in the pump specifications.

f) Check the suction pipe for air pockets, leaks, partially closed valves or other restrictions.

g) Be certain that the suction inlet and impeller are not clogged.

h) Verify that the discharge valve is fully open.

8.2 Bearing Temperature

a) During the initial break in period, the bearings will normally run hotter as explained in the Initial Start Up section.

b) Excess temperature may be due hot process fluid

c) Verify correct oil level. Overfilling causes viscous drag, which builds heat.

d) Verify oil viscosity. High viscosity and mineral oils cause drag and build heat, especially at higher speeds.

e) Misalignment of the motor or coupling can create excess bearing load and increased heat.

f) Insufficient coupling clearance between the pump shaft and motor shaft can add axial loads to the thrust bearings.

g) External pipe forces can distort the pump and bind the bearings.

h) Worn or damaged bearings may generate excess heat before failure.

i) Drag from external parts such as coupling guards.

8.3 Bearing Contamination

a) Excess leakage at stuffing box

b) Damaged Inpro bearing isolator

c) Improper maintenance

d) Wrong lubricant

e) End covers seal damaged or missing

8.4 Stuffing Box

See the Packing section for procedures.

a) High temperature due to packing adjusted too tight.

b) High temperature due hot process fluid.

c) Leaking caused by excess flush pressure.

d) Leaking caused by wrong adjustment.

e) Leaking caused by worn parts.

f) Excess wear of packing or sleeve:

1. Adjusting the packing too tight.
2. Insufficient flush flow or pressure.
3. Contaminated flush water.
4. Poor quality packing
5. Failure to lubricate new packing

8.5 Overheating of Pump Casing

See Piping Connection section for details.

a) Hot process fluid being pumped

b) Prolonged running against shut head or blocked discharge.

NOTE: This is could create a Dangerous condition!!

c) Blocked suction

d) NPSH too low for pump.

e) Air pockets in suction pipe or pump.

8.6 Pump Leaking

a) Defective gasket at pump flange.

b) Defective seal between pump casing, liner or housing.

c) Casing or liner worn through.

d) Normal or excess stuffing box flow

8.7 Motor Overload

a) Verify that the motor has the correct power and voltage supply, and is operating properly.

b) Verify that the motor is correct for the pump. The pump specifications and curve can be used to determine the power and speed required

c) Verify that the pumped fluid matches the system design viscosity and specific gravity.

d) Coupling misaligned.

e) Gland adjusted too tight.

f) External pipe forces can distort the pump and bind the motor and pump bearings.

g) Drag from external parts such as guards.

8.8 Vibrations or Abnormal Noises

a) Cavitation due to low NPSH or blocked suction.

b) Impeller rubbing due to incorrect nose adjustment.

c) Out of balance impeller.

d) Debris jammed in impeller vanes.

e) Pump or motor mounting bolts loose.

f) Improper shimming of overhead motor mount.

g) Air in system.

h) Large solids in pumped fluid.

i) Coupling misaligned.

j) Belts misaligned or incorrectly tightened.

k) Insufficient clearance between the pump shaft and motor shaft at coupling.

l) Worn bearings in pump or motor.

m) Gland adjusted too tight.

n) Vibrations from system transmitted through piping.

o) Damaged or bent shaft in pump or motor.

9 Torque Values for Metric Fasteners not otherwise specified

Tightening Torque Values

Class 8.8 Metric Hex Head Capscrews

Metric Coarse & Fine Thread

Thread Size	Dry (reference only)				Oil or Thread Lock				Anti-Seize			
	in-lbs	ft-lbs	Ncm	Nm	in-lbs	ft-lbs	Ncm	Nm	in-lbs	ft-lbs	Ncm	Nm
M4 X 0.7	28		316		21		236		17		190	
M5 X 0.8	57		644		42		480		34		386	
M6 X 1	95		1074		71		800		57		644	
M8 X 1.25	228		2576		170		1919		137		1546	
M8 X 1	239		2701		178		2012		143		1620	
M10 X 1.5	468	38	5288	52	349	28	3940	38	281	23	3173	31
M10 X 1.25		38		52		28		38		23		31
M12 X 1.75		67		91		50		68		40		55
M12 X 1.25		70		95		52		71		42		57
M14 X 2		105		142		78		106		63		85
M14 X 1.5		111		150		83		112		67		90
M16 X 2		158		214		118		160		95		129
M16 X 1.5		166		225		124		168		100		135
M20 X 2.5		317		430		236		320		190		258
M20 X 1.5		339		460		253		342		203		276
M24 X 3		548		743		408		554		329		446
M24 X 2		575		780		428		581		345		468
M30 X 3.5		1098		1489		818		1109		659		893

How did we measure up?

It is our sincere intention to exceed our customer's expectations on every order. Tell us if we achieved our goal on your order.

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ARYA SEPEHR KAYHAN

Pump & Electro Power System

www.aryask.com

info@aryask.com