Installation, Operation, and Maintenance Manual

Model: PW-PC

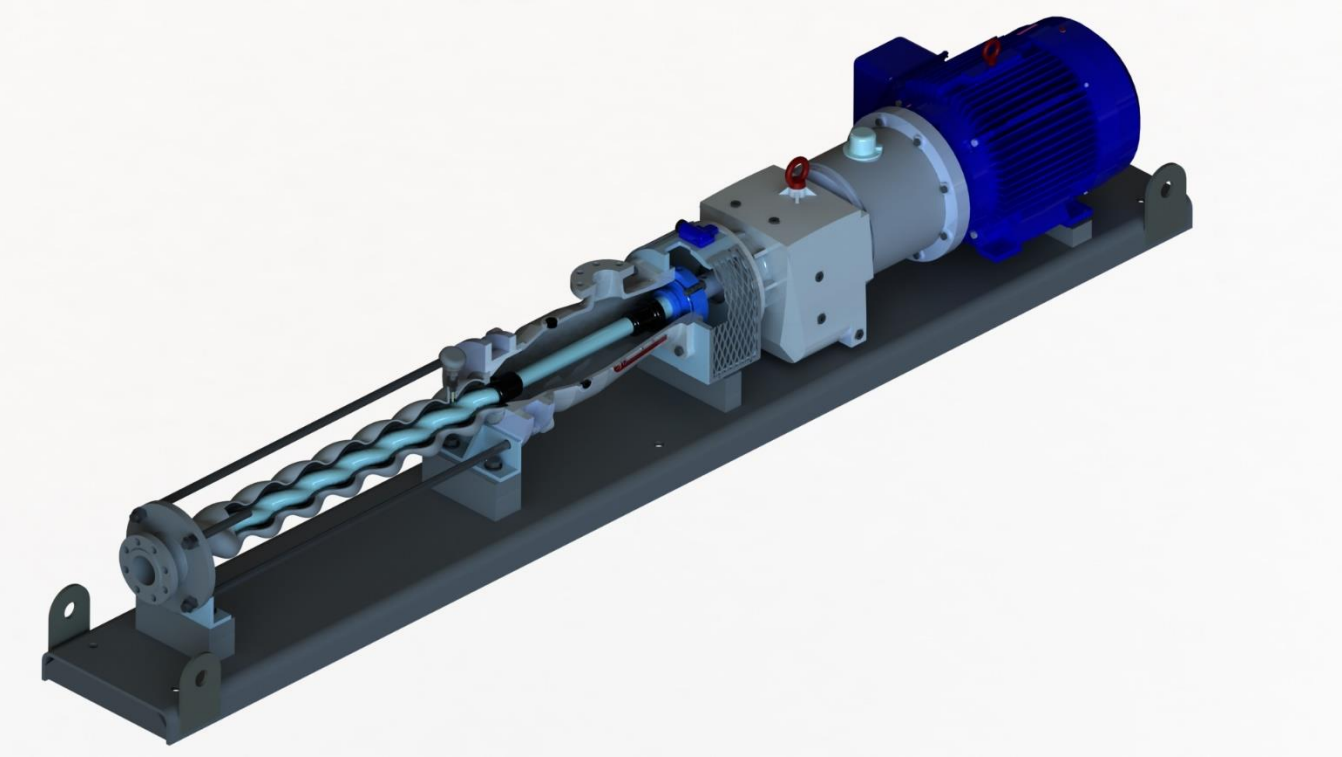


TABLE OF CONTENTS

TABLE OF CONTENTS

Introduction and Safety

Introduction

The purpose of this manual is to provide necessary information for installation, operation and maintenance of the PumpWorks Model PW-PC

⚠CAUTION

CAUTION:
Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages in this manual before handling the product. They are published to help prevent these specific hazards:

- Personal accidents and health
- Product damage
- Product malfunction

Hazard criteria

⚠DANGER

DANGER:
A situation where a hazard, if not avoided, will result in serious bodily injury and/or death.

⚠WARNING

WARNING:
A situation where a hazard, if not avoided, could result in serious bodily injury and/or death.

⚠CAUTION

CAUTION:
A situation where a hazard, if not avoided, could result in less severe bodily injury.

NOTICE

NOTICE:
A potential situation, which if not avoided, could lead to product malfunctions.

Safety

⚠WARNING

WARNING:

- *The operator must be aware of safety precautions to prevent physical injury.*
- *Any pressure-containing device can explode, rupture, or discharge its contents if it is over pressurized. Take all necessary measures to avoid over-pressurization.*
- *Operating, installing, or maintaining the unit in any way that is not intended could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by PW-IND. If there is a question regarding the intended use of the equipment, please contact a PumpWorks representative before proceeding.*
- *This manual clearly identifies accepted methods for disassembling units. These methods must be followed. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to rotors or their retaining devices to aid in their removal unless explicitly stated in this manual.*
- *If the pump/motor is damaged or leaking, do not operate as it may cause an electric shock, fire, explosion, release of toxic fumes, physical harm, or environmental damage. Correct/repair the problem prior to putting the pump back in service.*
- *Do not change the service application without the approval of an authorized PumpWorks representative.*

User safety

General safety rules

These safety rules apply:

- 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.

Safety equipment

Use safety equipment according to local regulations. Use this safety equipment within the work area:

- Helmet
- Safety glasses
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- Safety devices

NOTICE

NOTICE:
Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local codes.

Precautions before work

- 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 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, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

Precautions during work

⚠CAUTION

CAUTION:
Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

- Always wear Personal Protective Equipment (PPE).
- Always lift the product as illustrated in the Transportation and Storage Section.
- Beware of the risk of a sudden start if the product is used with an automatic control.
- Clean all components thoroughly after pump disassembly.
- 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.

- Make sure 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 properly installed coupling guard.

Product Warranty

Basic Coverage

PumpWorks will remedy faults in products under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to a PumpWorks representative within the warranty period.
- The product is used only under the conditions described in this manual.
- All service and repair work is done by PumpWorks authorized personnel.
- Genuine PumpWorks parts are used.

Limitations to Warranty:

Except where noted above, the warranty **does not** cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation made without consulting PumpWorks
- Incorrectly executed repair work
- Normal wear and tear

PumpWorks assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses
- Environmental damage

Product Description

General Description PW-PC

The PW-PC is a positive displacement pump that utilizes a rotor and stator to move fluid through various stages. The pressure built in each stage is twice that of its previous stage.

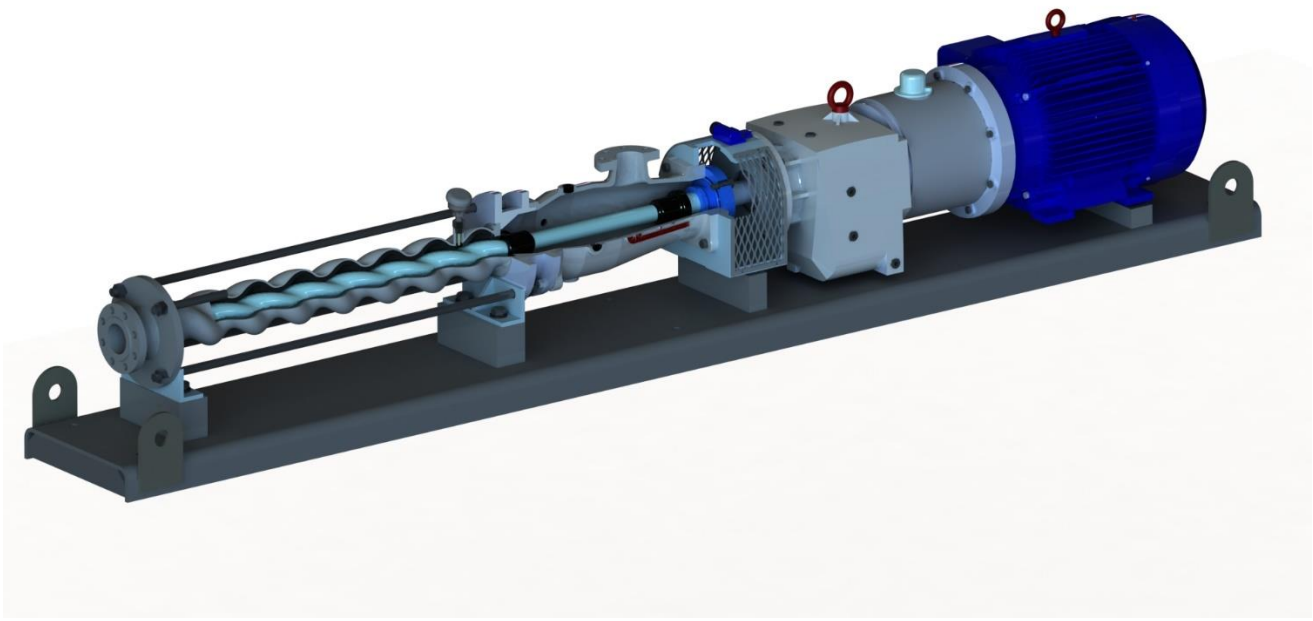


Figure 1: PW-PC pump package

Table 1 : Hydraulic sizes per piping size

Piping size group	Number of hydraulic sizes
3X3	2
4X4	2

Pumping Parts Description PW-PC

Seal

Single Cartridge Seal (RBX1) in 3.250", 4.000", or 5.625" shaft sizes.
Dual Tandem Cartridge Seal (79X) in 3.250", 4.000", or 5.625" shaft sizes.
Is located on the non-oscillating plugin shaft portion of the Rotating Assembly.
Pilots with the bore of the Case.

Case

ANSI class 300# raised-faced serrated suction flange.
Suction flange is axially rotatable in 90 degree increments.
Material is either ASTM A216 WCB (Carbon Steel) or ASTM A351 GR CF3M (Stainless Steel)
¾" FNPT Vent and drain port accommodations.
Sealed at the back end with a mechanical seal and at the front end with a double o-ring.
Fully suspended between the stator module and the motor adapter.

Stator Adapter

Seals to the case with double OD o-rings.

Counter bore on front end mates and seals with back end of stator.

Material is carbon steel.

Stator Housing

Material is carbon steel.

Contains Stator elastomer at all times.

Dedicated location for installation of temperature sensing mechanism.

Stator

Even Wall geometry to allow for higher pressures.

Material is either HNBR elastomer (FF) or Fluoroelastomer Terpolymer (H5)

Takes shape and extends out both ends of the stator housing which creates a sealing face to the Stator Adapter and the Discharge Casing.

Rotating Assembly

Includes two universal joints with a plug in shaft on one end and a rotor on the other.

Rotor is inserted into and makes contact with inner surfaces of the stator.

Plugin shaft is locked into the gearbox shaft by a high tolerance coupling pin and rubber sleeve.

Rotor material is either AISI 4140 with Duktil coating or 316L Stainless Steel.

Plugin shaft and coupling pin is either AISI 420 or 316L Stainless Steel.

Discharge Casing

ANSI class 600# raised-faced serrated discharge flange.

Counter bore on back end mates and seals with front end of stator.

Material is carbon steel.

Important Information for Ordering PW-PC

Every pump package has nameplates that provide information about the pump and powertrain. The nameplate for the pump is located on the Pump Motor Adapter.

When you order spare parts or replacement packages, identify this pump information:

- Model
- Size
- Serial number
- Item or Tag numbers of the required parts
- Purchase Order Number

Refer to the nameplate on the Pump Motor Adapter for most of the information. See Parts List for item numbers.

Nameplate types

Table 2: Nameplate Description

Nameplate	Description
Pump Motor Adapter	Provides information about the hydraulic characteristics of the pump. Discharge x Suction, Number of stages. (Example: 3X3 4S)
ATEX	If applicable, your pump unit might have an ATEX nameplate affixed to the pump, the baseplate, or the discharge casing. The nameplate provides information about the ATEX specifications of this pump.

Figure 2: Nameplate on the Pump Motor Adapter using English units

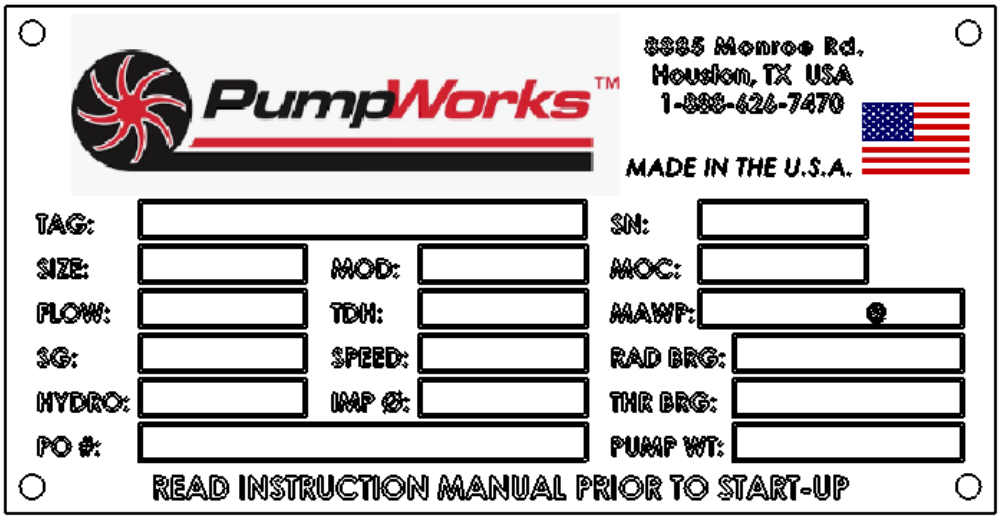


Table 3: Definition of nameplate on the Pump Motor Adapter English units

Nameplate field	Definition
TAG	Pump package part number
SIZE	3X3 4S
FLOW	Rated pump flow, in Barrels Per Day
SG	Specific gravity of rated product fluid
HYDRO	Hydrostatic test pressure
PO#	Package purchase order number
MOD	Pump package model
SPEED	Rotational speed of the pump in RPM
SN	Serial number of the pump package
MOC	Material of which the pump is constructed
MAWP	Maximum pressure at 100ºF according to the pump design
PUMP WT	Total pump package weight

Powertrain Description PW-PC

Gearbox

Manufacturer: Nord Gear Corporation.

Uses a disposable auto greaser and grease catch mechanism.

Fastens directly to the Motor Adapter.

Inserts directly into the Rotating Assemblies plugin shaft and is installed by coupling pin and sleeve.

Suspended between the feet mounted Motor and Motor adapter.

Table 4: Gearbox per PW-PC Model

PW-PC Model	Gearbox Model	Gear Ratio
4X4 4-Stage	Nord SK92F_VL-N400TC	3.51
4X4 2-Stage	Nord SK72F-N360TC	4.12
3X3 4-Stage	Nord SK72F-N320TC	4.12
3X3 2-Stage	Nord SK52F-N280TC	4.38

Motor

Manufacturer: ABB Baldor.

Feet mounted.

Various horsepower in 280TC, 320TC, 360TC, and 400TC frame C-Faced configurations.

Transportation and Storage

Inspect the delivery

Inspect the package

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 immediately if anything is out of order.

NOTE: Contact your local PumpWorks sales office if any items are missing or for replacement components.

Inspect the pump unit

1. Inspect the product to determine if any parts have been damaged or are missing.
2. Note and report any evidence of damaged paint to your PumpWorks representative. This might be evidence of impact damage during shipment that could result in reduced product performance.

Transportation guidelines

Pump handling

⚠WARNING

WARNING:

- *Make sure that the unit cannot roll or fall over and injure people or damage property.*
- *PumpWorks pumps contain sensitive parts that can be damaged if dropped or subjected to impact. Handle the equipment with care and do not attempt to install or operate a pump unit that is damaged*.

⚠WARNING

Lifting methods

WARNING:

- *All lifting must be done in compliance with all applicable regulations/standards.*
- *Assembled 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.*
- *Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.*
- *Do not lift any pump or motor by attaching lifting equipment to shaft ends.*

Table 1: Lifting Methods

Pump type	Lifting method
A bare pump without lifting handles	Use a suitable sling attached properly to solid points like the casing, the flanges, or the stator housing.
A baseplate-mounted pump	Use shackles and chains (or straps) in the provided lifting pad eyes on the baseplate. Never lift the pump package by the motor or gearbox lifting eyes.

Examples

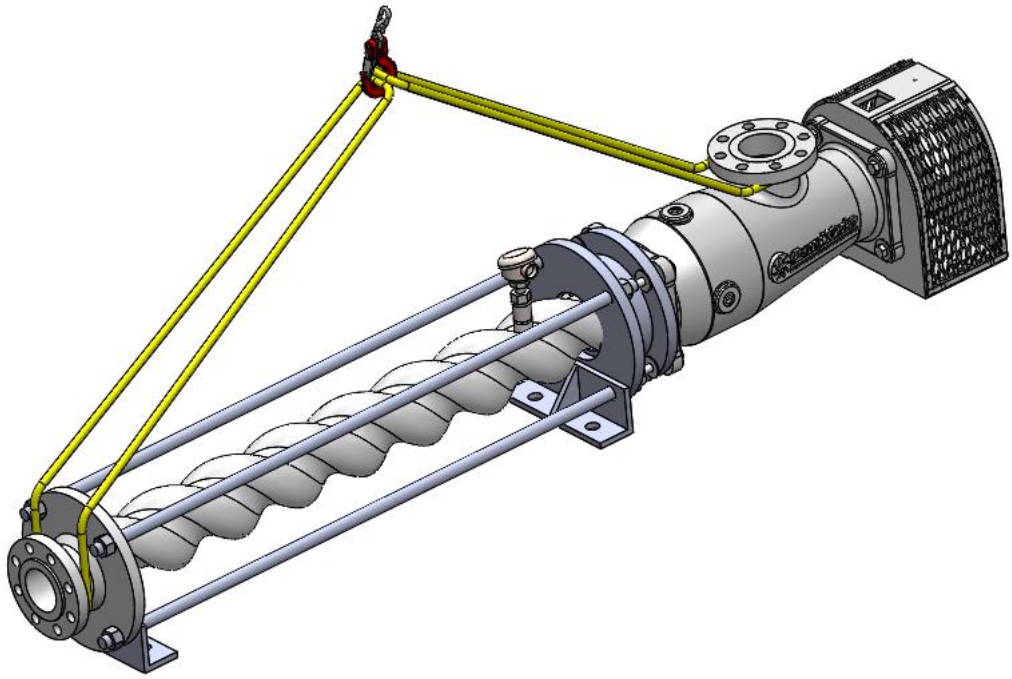


Figure 1: Example of Proper Lifting – Bare Pump

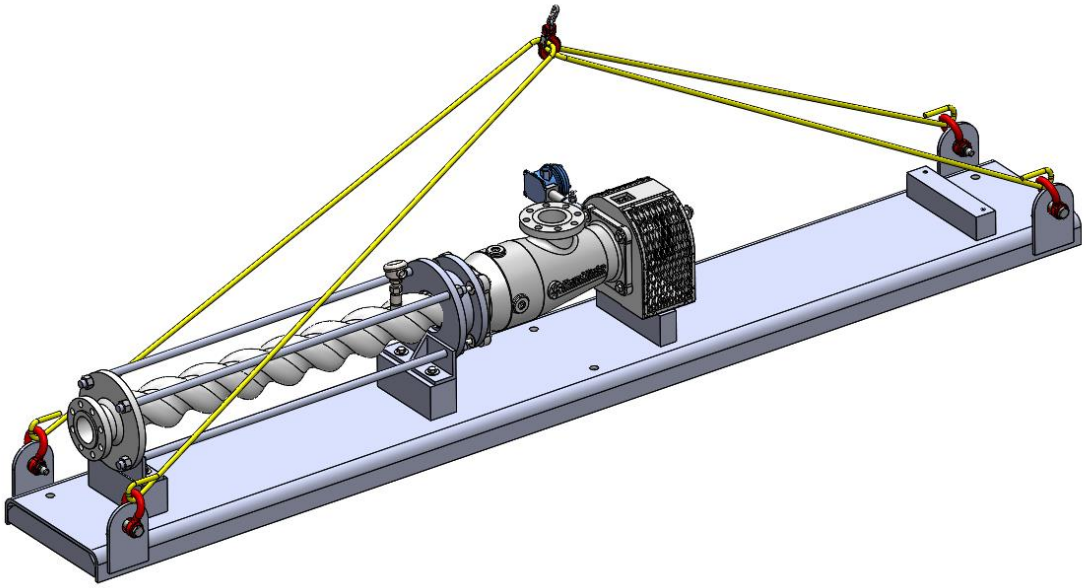


Figure 2: Example of Proper Lifting – Base Mounted Pump

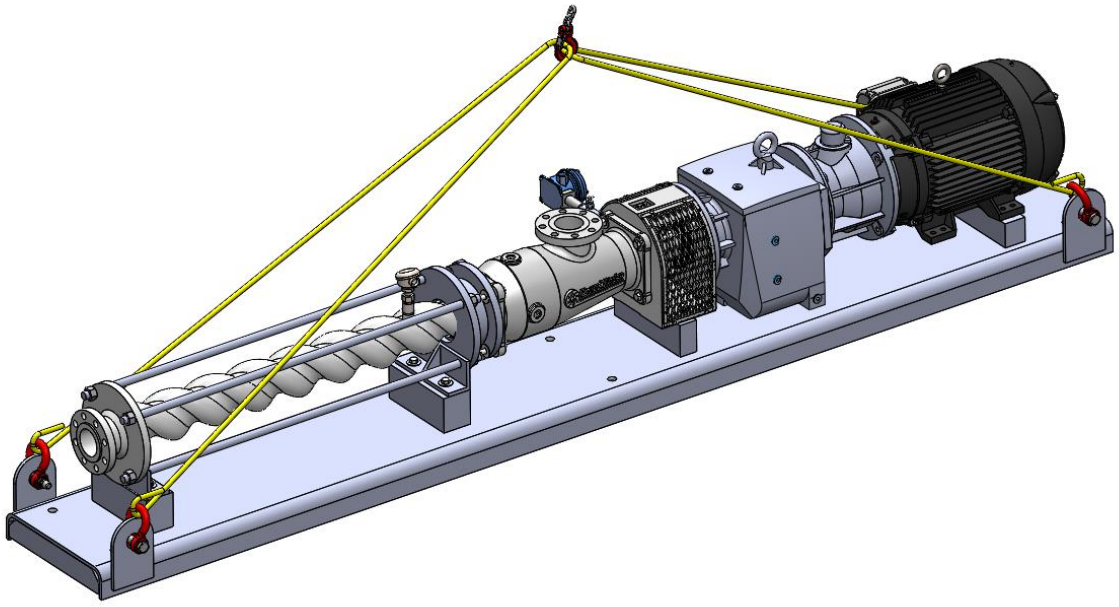


Figure 3: Example of Proper Lifting –Base Mounted Pump with Gearbox and Driver

Storage guidelines

Pump storage requirements

Storage requirements depend on the amount of time the pump unit will be stored prior to installation and start up. The normal packaging is designed only to protect the unit during shipping.

Table 2: Storage

Length of time in storage	Storage requirements
Upon receipt/short-term (less than six months)	• Store in a covered and dry location. • Store the unit free from dirt and vibration.
Long-term (more than six months)	• Store in a covered and dry location. • Store the unit free from heat, dirt, and vibration. • Rotate the shaft by hand several times at least every month ensuring that the shaft is not in the same position each time.

NOTICE

NOTICE:
Risk of damage to the mechanical seal on units supplied with cartridge mechanical seals. Follow seal manufacture's recommendations for long term storage.

Treat bearing and machined surfaces so that they are well preserved. Refer to motor and gearbox manufacturers for their long-term storage procedures.

Long term storage preparation is available as part of initial product purchase or after your pump has been delivered. Contact your local PumpWorks sales representative.

Frost proofing

Table 3: Situations when the pump is or is not frost proof

Situation	Condition
Operating	The pump is frost proof.
Not Operating	The pump internals might be subject to frost damage. Protect non-operational units with climate control or an anti-freeze solution in the casing.

Installation

Precautions

⚠WARNING

WARNING:

- *When installing in a potentially explosive environment, make sure that the motor and other electrical equipment are properly rated for the area of classification.*
- *You must ground all electrical equipment. This applies to the pump equipment, the driver, the gearbox, and any monitoring equipment. Test the ground lead to verify that it is connected correctly.*
- *Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.*

NOTICE

NOTICE:

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

Pump location guidelines

Table 1: Guidelines for locations

Guideline	Explanation/comment
Keep the pump as close to the liquid source as possible.	This minimizes friction loss and keeps the suction piping as short as possible.
Make sure that the space around the pump is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as a hoist or tackle, make sure that there is enough space above the pump.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor.

Foundation requirements

Requirements

- The foundation must form a permanent, rigid support for the unit.
- The location and size of the foundation fasteners should be in accordance with those shown on the construction drawing provided with the pump data package.
- The foundation must weigh between three and five times the weight of the entire pump package.
- Ensure foundation is level and free of discontinuity to prevent distortion when foundation bolts are tightened.

1. Baseplate
2. Shims or wedges
3. Foundation
4. Sleeve
5. Form
6. Bolt

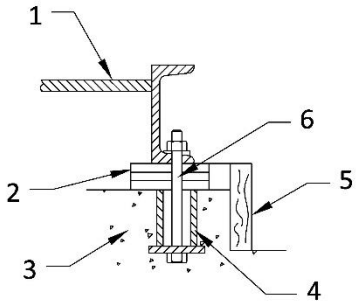


Figure 1: Sleeve-type bolts

1. Baseplate
2. Shims or wedges
3. Foundation
4. Form
5. Bolt

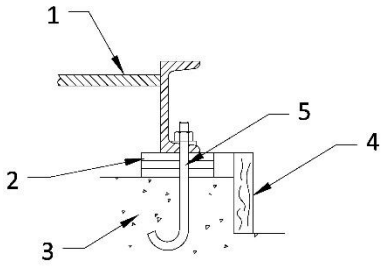


Figure 2: J-type bolts

Baseplate mounting procedures

Prepare the baseplate for mounting

1. Remove the pump, gearbox, and driver from the baseplate.
2. Clean the underside of the baseplate completely.
3. If applicable, coat the underside of the baseplate with a re-coatable epoxy primer. Use an epoxy primer only if you will be using an epoxy-based grout.
4. Remove the rust-proof coating from the machined mounting pads using an appropriate solvent.
5. Remove water and debris from the foundation-bolt holes.

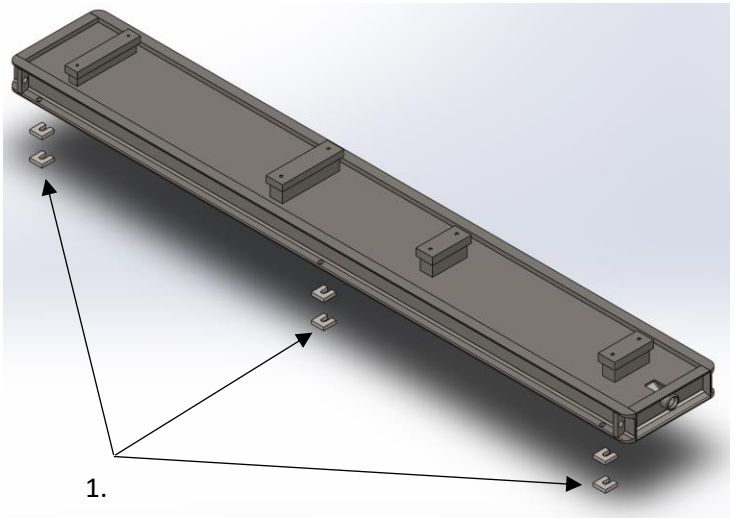
Install the baseplate using shims

Required tools:

- Two sets of shims for each foundation bolt
- Two machinist's levels

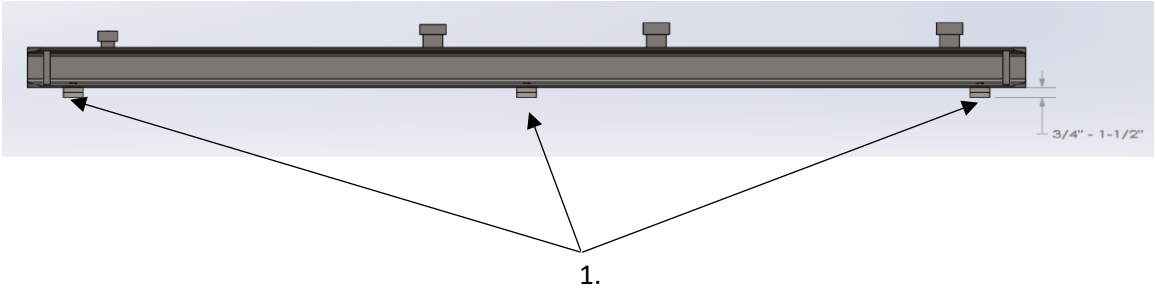
This procedure is applicable to rolled steel baseplates.

1. If you use sleeve-type bolts, fill the bolt sleeves with packing material or rags to prevent grout from entering the bolt sleeves.
2. Set shims on each side of each foundation bolt.
   The shims should have a height of between 0.75 in. (19 mm) and 1.50 in (38mm).



1. Shims

Figure 3: Top view



1. Shims

Figure 4: Side view

3. Lower the baseplate carefully onto the shims.
4. Set the machinist's levels across the mounting pads of the driver and the mounting pads of the pump.

NOTICE

NOTICE:
Remove all dirt from the mounting pads in order to make sure that you achieve the correct level indication.

5. Level the baseplate both lengthwise and across by adding or removing shims. **The correct level measurement is a maximum of 0.005 in./ft (400 micrometers/m).**
6. Hand-tighten the foundation bolts.

Install the pump, gearbox, and driver

1. Mount and fasten the pump on the baseplate. Use appropriate bolts.
2. Mount the C-faced driver to the gearbox and fasten to the baseplate with mechanical seal and coupling sleeve placed on plugin shaft. Use appropriate bolts and hand tighten. (See driver and gearbox manufacturer for proper installation.)
3. With the gearbox inserted into the pump plugin shaft, slide coupling pin through plugin shaft and gearbox shaft holes. Then slide coupling sleeve over coupling pin to hold in place. (Reference Figure 5: Coupling Details below.)

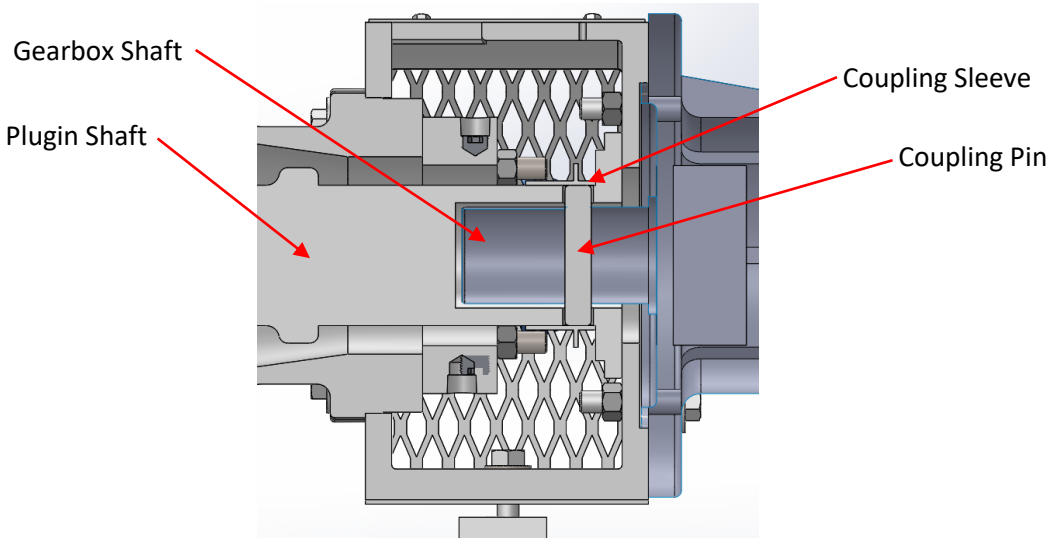


Figure 5: Coupling Details

Piping checklists

General piping checklist

Precautions

⚠CAUTION

CAUTION:

- *Never draw piping into place by using force at the flanged connections of the pump. This can impose dangerous strains on the unit and cause misalignment between the pump and driver. Pipe strain adversely affects the operation of the pump, which results in physical injury and damage to the equipment.*
- *Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side. This action can result in decreased performance, unexpected heat generation, and equipment damage.*

Piping guidelines

Guidelines for piping are given in the Hydraulic Institute Standards

Checklist

Table 2: Piping guidelines

Check	Explanation/comment	Checked
Check that all piping is supported independently of, and lined up naturally with, the pump flange.	This helps to prevent: • Strain on the pump • Misalignment between the pump and the drive unit • Wear on the mechanical seal, and shafting	
Keep the piping as short as possible.	This helps to minimize friction losses.	
Check that only necessary fittings are used.	This helps to minimize friction losses.	
Do not connect the piping to the pump until: • The hold-down bolts for the pump and the driver are tightened.	--	
Make sure that all the piping joints and fittings are airtight.	This prevents air from entering the piping system or leaks that occur during operation.	
If the pump handles corrosive fluids, make sure that the piping allows you to flush out the liquid before you remove the pump.	--	
If the pump handles liquids at elevated temperatures, make sure that the expansion loops and joints are properly installed.	This helps to prevent misalignment due to linear expansion of the piping.	
Pump flange and piping flange face alignment and separation.	• The pump and piping flange faces shall be parallel to a min. of .001 in./in. (10 micrometers/cm) of outer flange diameter. • Flange face separation, including single gasket spacing, shall be 1/16” (1.5 mm).	

Fastening

⚠WARNING

WARNING:

- *Only use fasteners of the proper size and material.*
- *Replace all corroded fasteners.*
- *Make sure that all fasteners are properly tightened and that there are no missing fasteners.*

Suction piping checklist

Suction-piping checks

Table 3: Suction piping guidelines

Check	Explanation/comment	Checked
Check that the distance between the inlet flange of the pump and the closest bend is at least five pipe diameters.	This minimizes the risk of cavitation in the suction inlet of the pump due to turbulence. See the Example sections for illustrations.	
Check that component or pipe diameter changes in general do not have sharp bends.	See the Example sections for illustrations.	
Check that the suction piping is one or two sizes larger than the suction inlet of the pump. Install an eccentric reducer between the pump inlet and the suction piping.	The suction piping must never have a smaller diameter than the suction inlet of the pump. See the Example sections for illustrations.	
Check that the eccentric reducer at the suction flange of the pump has the following properties: • Sloping side down • Horizontal side at the top	See the example illustrations.	
When suction strainers or suction bells are used, check that they are at least three times the area of the suction piping.	Suction strainers help to prevent clogging. Mesh holes with a minimum diameter of 1/16 in. (1.6 mm) are recommended.	
If more than one pump operates from the same liquid source, check that separate suction-piping lines are used for each pump.	This recommendation helps you to achieve a higher pump performance.	
If necessary, make sure that the suction piping includes a drain valve and that it is correctly installed.	—	

Liquid source below the pump

Table 4: Suction piping guidelines – Liquid source below pump

Check	Explanation/comment	Checked
Make sure that the suction piping is free from air pockets.	This helps to prevent the occurrence of air and cavitation in the pump inlet.	
Check that the suction piping slopes upwards from the liquid source to the pump inlet.	This prevents air from accumulating in the suction piping.	

This pump is not self-priming. Make sure a venting valve is installed in the top boss of the suction casing.	Open the venting valve slow until all of the air in the suction casing is removed. Once product fluid starts coming out of this valve, close the value. The suction casing is now primed for operation.	

Liquid source above the pump

Table 5: Suction piping guidelines – Liquid source above pump

Check	Explanation/comment	Checked
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 you to close the line during pump inspection and maintenance. Do not use the isolation valve to throttle the pump. Throttling can cause these problems: • Loss of priming • Excessive temperatures • Damage to the pump • Voiding the warranty	
Make sure that the suction piping is free from vapor pockets.	This helps to prevent the occurrence of vapors and cavitation in the pump inlet.	
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	This prevents air from entering the pump through a suction vortex.	

Discharge piping checklist

Table 6: Discharge piping guidelines

Check	Explanation/comment	Checked
Check that an isolation valve is installed in the discharge line.	The isolation valve is required for: • Priming • Regulation of flow • Inspection and maintenance of the pump See Example: Discharge piping equipment for illustrations.	
Check that a check valve is installed in the discharge line, between the isolation valve and the pump discharge outlet.	The location between the isolation valve and the pump allows inspection of the check valve. The check valve prevents damage to the pump and seal due to back flow through the pump when the drive unit is shut off. See Example: Discharge piping equipment for illustrations.	
If increasers are used, check that they are installed between the pump and the check valve.	See Example: Discharge piping equipment for illustrations.	
If quick-closing valves are installed in the system, check that cushioning devices are used.	This protects the pump from surges and water hammer.	

Startup, Operation, and Shutdown

Preparation for startup

⚠WARNING

WARNING:

- *Failure to follow these precautions before you start-up the pump could lead to serious injury and equipment failure.*
- *Do not operate the pump below the minimum rated flow or with the suction or discharge valves closed.*
- *Avoid death or serious injury. Leaking fluid can cause fire and/or burns. Operating the pump above maximum rated flow shown on the pump curve leading to an increase in horsepower and vibration along with mechanical seal and/or shaft failure.*
- *Never operate the pump without the coupling guard correctly installed.*
- *Always disconnect and lock out all potential energy sources (electrical, hydraulic, pneumatic, etc) before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power could result in serious physical injury.*
- *Operating the pump in reverse rotation (clockwise while standing at the driver and facing the direction of the pump stator) will result in reverse flow and building of pressure in the suction casing and ultimately out through the suction flange.*

Precautions

NOTICE

NOTICE:

- *Verify the driver settings before you start any pump.*
- *Make sure that the pump casing warm-up rate does not exceed 5°F (2.8°C) per minute.*
- *Risk of damage to the mechanical seal on units supplied with cartridge mechanical seals is present. Prior to startup, make sure to tighten the set screws in the seal locking collar and remove the centering clips.*

You must follow these precautions before you start the pump:

- Flush and clean the system thoroughly prior to start-up to remove dirt or debris in the pipe system.
- 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 50°F (10°C) of the process fluid temperature. Soak for (2) hours at process fluid temperature.

Remove the coupling guards

1. Remove four bolts from the left guard and four bolts from the right guard.
2. Remove both guards from the pump.

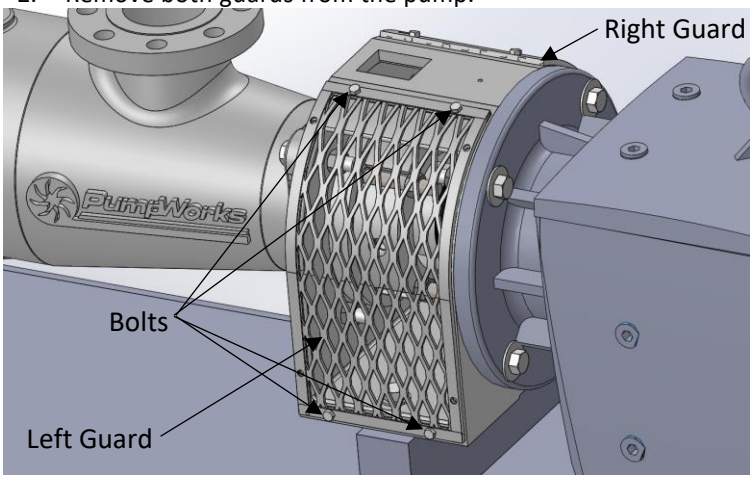


Figure 1: Guard Removal

Check the pump rotation

⚠WARNING

WARNING:

- *Operating the pump in reverse rotation (clockwise while standing at the driver and facing the direction of the pump stator) will result in reverse flow and building of pressure in the suction casing and ultimately out through the suction flange.*
- *Always disconnect and lock out all potential energy sources (electrical, hydraulic, pneumatic, etc) before you perform any installation or maintenance tasks. Failure to do so could result in serious physical injury.*

1. Lock out power to all potential energy sources (electric, hydraulic, pneumatic, etc.).
2. Make sure that the coupling pin is placed inside the shaft holes and housed inside the coupling sleeve.
3. Unlock power to the driver.
4. Make sure that everyone is clear, and then operate the driver long enough to determine that the direction of rotation corresponds to the arrow on the Stator adapter or Suction Case.

Couple the pump and driver

⚠WARNING

WARNING:

Always disconnect and lock out power to all potential energy sources (electric, hydraulic, pneumatic, etc.) before you perform any installation maintenance tasks. Failure to do so will result in serious physical injury.

Install the coupling guards

⚠WARNING

WARNING:

- *Never operate a pump without a properly installed coupling guard. Personal injury will occur if you run the pump without a coupling guard.*
- *Refer to driver and gearbox manufacturers IOMs for specific instructions and recommendations.*
- *Always disconnect and lock out power to all potential energy sources (electric, hydraulic, pneumatic, etc.) before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.*

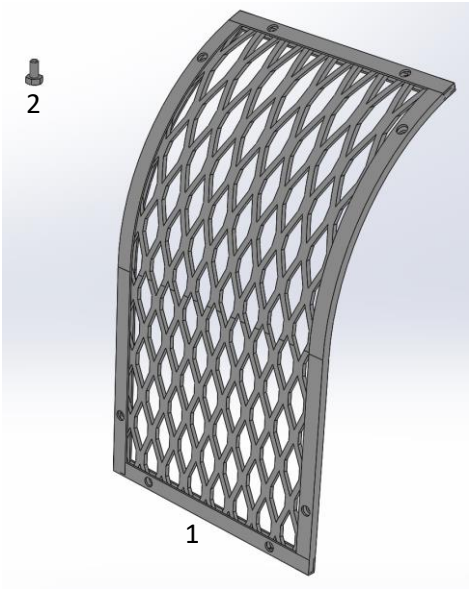


Figure 2: Required guard parts

1. Coupling Guard, 2 required
2. 1/4-20 x 1/2 in. hex head bolt, 8 required

1. Follow appropriate lock out/tag out procedures: De-energize the motor, place the motor in a locked-out position, and place a caution tag at the starter that indicates the disconnect.
2. Put one Coupling Guard in place.
3. Screw four bolts into hole accommodations provided.
4. Hand tighten each of the four bolts with an Engineers wrench.
5. Repeat steps 2-4 with the second Coupling guard and remaining four bolts.

Pump priming

⚠WARNING

WARNING:
Make sure to review MSDS regarding hazards for the pump process fluid. Personal Protective Equipment (PPE) should be worn during all activities around pump.

Prime the pump with the suction case vent

1. Slowly open the suction case vent valve.
2. Allow all gases to evacuate the suction case before closing the vent valve.

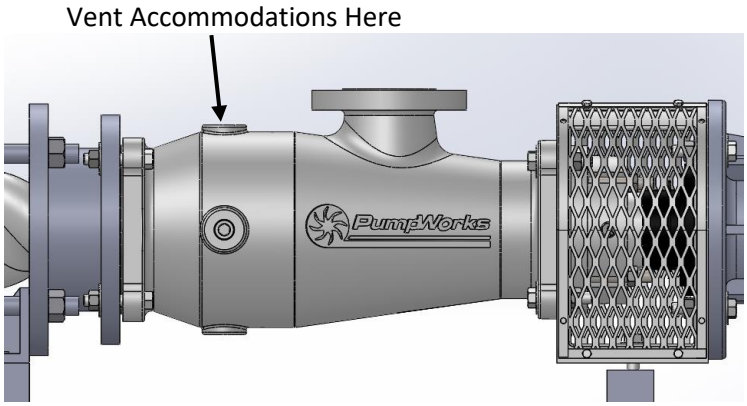


Figure 3: Pump Priming

Start the pump

⚠WARNING

WARNING:
Immediately observe the pressure gauges. If discharge pressure is not quickly attained, stop the driver immediately, re-prime, and attempt to restart the pump.

⚠CAUTION

CAUTION:

- *Observe the pump vibration levels, and excessive noise. If normal levels are exceeded, shut down the pump and resolve the issue.*

Before you start the pump, you must perform these tasks:

- Open the suction valve.
- Open any recirculation or cooling lines.

1. Open the discharge valve 100%.
2. Start the driver.
3. Slowly close the discharge valve until the pump reaches the desired pressure.
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, perform these steps:
    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 product temperature, excessive vibration, and noise.

b) If the pump exceeds normal levels, then shut down the pump immediately and correct the problem.

7. Repeat steps 5 and 6 until the pump runs properly.

Pump operation precautions

General considerations

⚠CAUTION

CAUTION:

- *Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side since this can result in decreased performance, unexpected heat generation, and equipment damage.*
- *Do not operate pump past the maximum flow for maximum pressure. For maximum pressure refer to the pump performance curve.*
- *Do not overload the driver. Driver overload can result in unexpected heat generation and equipment damage. The driver can overload in these circumstance.*
  - *The specific gravity of the pumped fluid is greater than expected.*
  - *The pumped fluid exceeds the rated flow rate.*
- *For minimum flows refer to pump performance curve.*
- *Make sure to operate the pump at or near the rated conditions. Failure to do so can result in pump damage from cavitation or recirculation.*

Operation at reduced capacity

⚠WARNING

WARNING:

Never operate any pumping system with a blocked suction and discharge. Operation, even for a brief period under these conditions, can cause confined pumped fluid to overheat and build pressure, which will result in an explosion and catastrophic failure of the pump. You must take all necessary measures to avoid this condition.

⚠CAUTION

CAUTION:

- *The pump and system must be free of foreign objects. If pump becomes plugged, shut down and unplug prior to restarting pump.*
- *Avoid excessive vibration levels. Excessive vibration levels can damage the stuffing box or seal chamber, and the mechanical seal, which can result in decreased performance and product losses.*
- *Avoid increased radial load. Failure to do so can cause stress on the shaft and seals.*
- *Avoid heat build-up. Failure to do so can cause rotating parts to score or seize.*
- *Avoid cavitation. Failure to do so can cause damage to the internal surfaces of the pump.*

Shut down the pump

1. Disengage driver.
2. Allow pump to coast down.
3. Close suction and discharge valve.

Maintenance

Maintenance schedule

It is recommended that a maintenance plan and schedule is adopted, in line with these Instructions, to include the following:

Any auxiliary systems installed must be monitored, if necessary, to ensure they function correctly.

- Check for any leaks from gaskets and seals. The correct functioning of the shaft seal must be checked regularly.
- Check gearbox bearing lubricant level, and if the hours run show a lubricant change is required.
- Check that the duty condition is in the allowable operating range for the pump.
- Check vibration, noise level and surface temperature at the Stator to confirm satisfactory operation.
- Check dirt and dust is removed from areas around close clearances, gearboxes and motors.
- Check coupling sleeve and replace if damaged.

Our field service technicians can help with preventative maintenance records and provide condition monitoring for temperature and vibration to identify the onset of potential problems.

Routine inspection (daily/weekly)

The following checks should be made and the appropriate action taken to remedy any deviations:

- Check operating behavior. Ensure noise, vibration and gearbox bearing temperatures are normal.
- Check that there are no abnormal fluid or lubricant leaks (static and dynamic seals) and that any sealant systems (if fitted) are full and operating normally.
- Check the level and condition of oil lubricant.
- Check gearbox Automatic Greaser and replace with new Greaser if running low.
- Check any auxiliary systems are functioning correctly.
- Refer to the manuals of any associated equipment for routine checks needed.

Periodic inspection (six month)

- Check foundation bolts for security of attachment and corrosion.
- Check pump running records for total operating hours since last service to determine if gearbox bearing lubricant requires changing.
- Check the Coupling Sleeve and Coupling Pin for worn driving elements.
- Refer to the manuals of any associated equipment for periodic checks needed.

Shaft seal maintenance

Mechanical-seal maintenance

⚠CAUTION

CAUTION:
Never operate the pump without liquid supplied to mechanical seal. Lack of seal flush can cause seal damage and catastrophic failure.

Cartridge mechanical seals

Cartridge 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 removal of the holding clips and engagement of the set screws prior to operation. If the seal has been installed in the pump by PumpWorks, these clips have already been removed.

Other mechanical seal types

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

Before you start the pump

Check the seal and all flush piping.

Disassembly

Disassembly precautions

⚠WARNING

WARNING:

- *This manual clearly identifies accepted methods for disassembling units. These methods must be followed to ensure safe maintenance of the pump. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to rotors or other pump components to aid in their removal unless explicitly stated in this manual.*
- *Always disconnect and lock out power to all potential energy sources (electric, hydraulic, pneumatic, etc.) before you perform any installation or maintenance tasks. Failure to do so will result in serious physical injury.*
- *Refer to driver/gearbox manufacturers installation and operation manuals (IOM) for specific instructions and recommendations.*
- *The pump can handle hazardous and toxic fluids. Identify the contents of the pump and observe proper decontamination procedures in order to eliminate the possible exposure to any hazardous or toxic fluids. Wear the proper personal protective equipment. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.*
- *A small amount of liquid will be present in the seal chamber and casing. Take proper precautions to avoid contact with hazardous fluids.*

NOTICE

NOTICE:

- *Avoid injury. Worn pump components can have sharp edges. Wear appropriate gloves while handling these parts.*

Tools required

Cleaning agents and solvents
Hex wrenches
Hydraulic press
Leveling blocks and shims
Lifting slings
Rubber mallet
Screwdriver
Shaft wrench
Torque wrench with sockets
Engineers Wrenches

Drain the pump

⚠CAUTION

CAUTION:

- *Allow all system and pump components to cool before you handle them to prevent physical injury.*

1. Close the isolation valves on the suction and discharge sides of the pump.
   You must drain the system if no valves are installed. Always disconnect and lock out all potential energy sources (electrical, hydraulic, pneumatic, etc) before you perform any installation or maintenance tasks.
2. Drain the pump.
   Do not proceed until liquid stops coming out of the drain valve.
3. Leave the drain valve open and remove the drain plug located on the bottom of the pump housing (if supplied).
   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 coupling guards.

Decouple to pump

1. Remove both coupling guards.
2. Pull back the Coupling Sleeve.
3. Disconnect the coupling pin joint by sliding the Coupling Pin out of the joint.

NOTICE

NOTICE:
Be careful with the stationary portion of the mechanical seal that is either clamped between the backplate and the gland or seated in the stuffing box/seal chamber bore. Failure to do so may result in equipment damage.

Remove the liquid end of the pump package

1. Remove four seal nuts and slide seal on shaft away from the suction flange.
2. Remove four adapter bolts to release the Suction Case.
3. Remove the four hold-down bolts of the Stator Module.
4. Reference Figure 1 for how to strap a crane to the pump.
5. Lift liquid end off pump slightly and slide liquid end away from the motor adapter a you slide the coupling sleeve and mechanical seal off the plugin shaft.

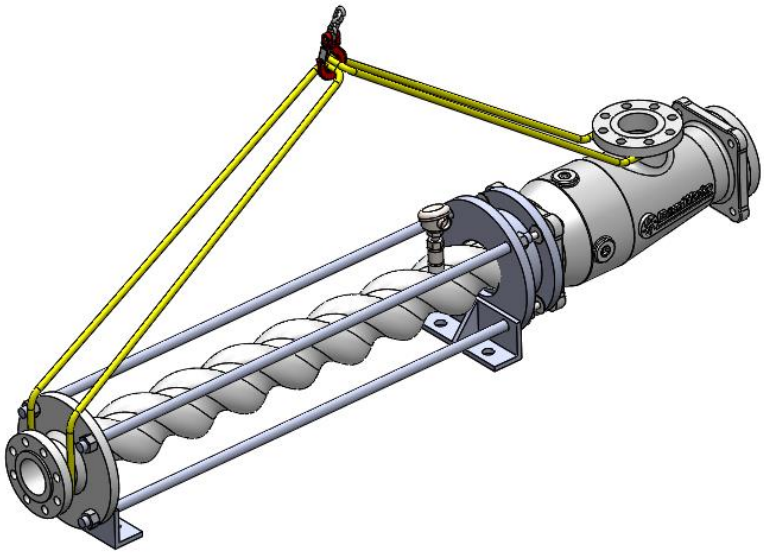


Figure 1: Liquid End Removal

⚠WARNING

WARNING:

- *Never use heat to disassemble the pump due to the risk of an explosion from trapped liquid.*

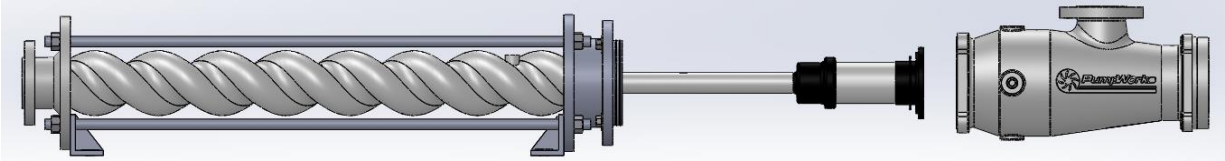


Figure 2: Suction Case Removal

6. Set the liquid end down and remove the bolts that hold the Suction Case to the Stator Adapter.
7. Remove Suction Case and send the rest of the liquid end for repair or replacement.
8. Clean all gasket and O-ring surfaces.

Remove the Motor Adapter

1. Use the driver and gearbox lifting eyes to connect and support the powertrain via crane.
2. Remove the hold down bolts from the bottom of the Motor Adapter.
3. Remove the bolts from the rear of the Motor Adapter.
4. Remove the Motor Adapter off the skid package entirely.

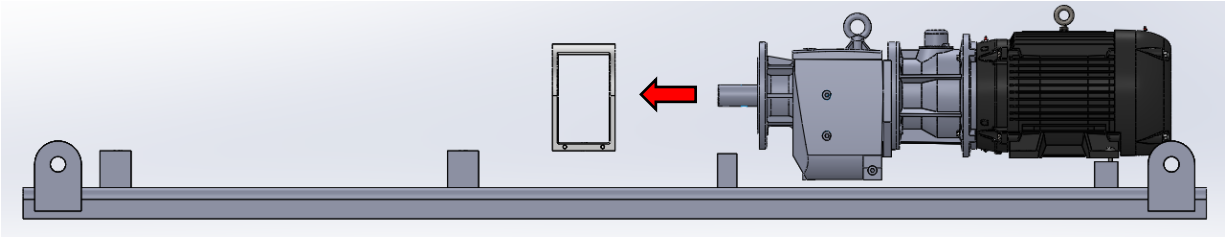


Figure 3: Motor Adapter Removal

Powertrain disassembly

General Considerations

- *Refer to driver/gearbox manufacturers installation and operation manuals (IOM) for specific instructions and recommendations.*

Remove the Driver

1. While the driver and gearbox are suspended by a crane, loosen and remove two bolts form the driver feet.
2. Set the powertrain down and secure the gearbox so that it cannot roll or tip when the crane releases the powertrain.
3. Remove the crane connection from the gearbox only.
4. Use the crane to put tension on the driver and remove the bolts that hold the driver and gearbox together.

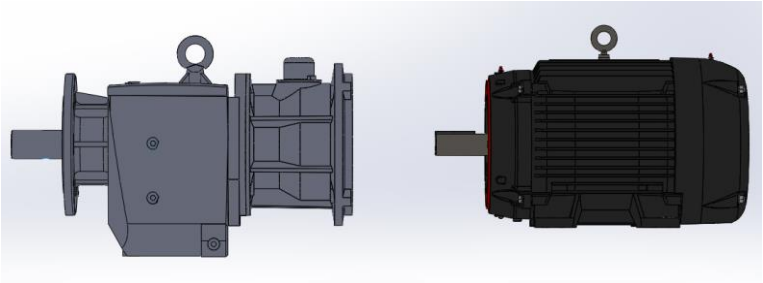


Figure 4: Motor Removal

Pre-assembly inspections

Guidelines

Before you assemble the pump parts, make sure you follow these guidelines:

- Inspect the pump parts according to the information in these pre-assembly topics before you reassemble your pump. Replace any part that does not meet the required criteria.
- Make sure that the parts are clean. Clean the pump parts in solvent in order to remove oil, grease, and dirt.

NOTICE

NOTICE:
Protect machined surfaces while you clean the parts. Failure to do so may result in equipment damage.

Replacement guidelines

Casing check and replacement

⚠WARNING

WARNING:
Avoid death or serious injury. Leaking fluid can cause fire and/or burns. Inspect and assure gasket sealing surfaces are not damaged and repair or replace as necessary.

Inspect the casing for cracks and excessive wear or pitting. Thoroughly clean sealing surfaces and alignment fits in order to remove rust and debris.

Repair or replace the casing if you notice any of these conditions:

- Localized wear or grooving that is greater than 1/8 in. (3.2 mm) deep
- Pitting that is greater than 1/8 in. (3.2 mm) deep

Casing areas to inspect

The arrows point to the areas to inspect for wear on the casing:

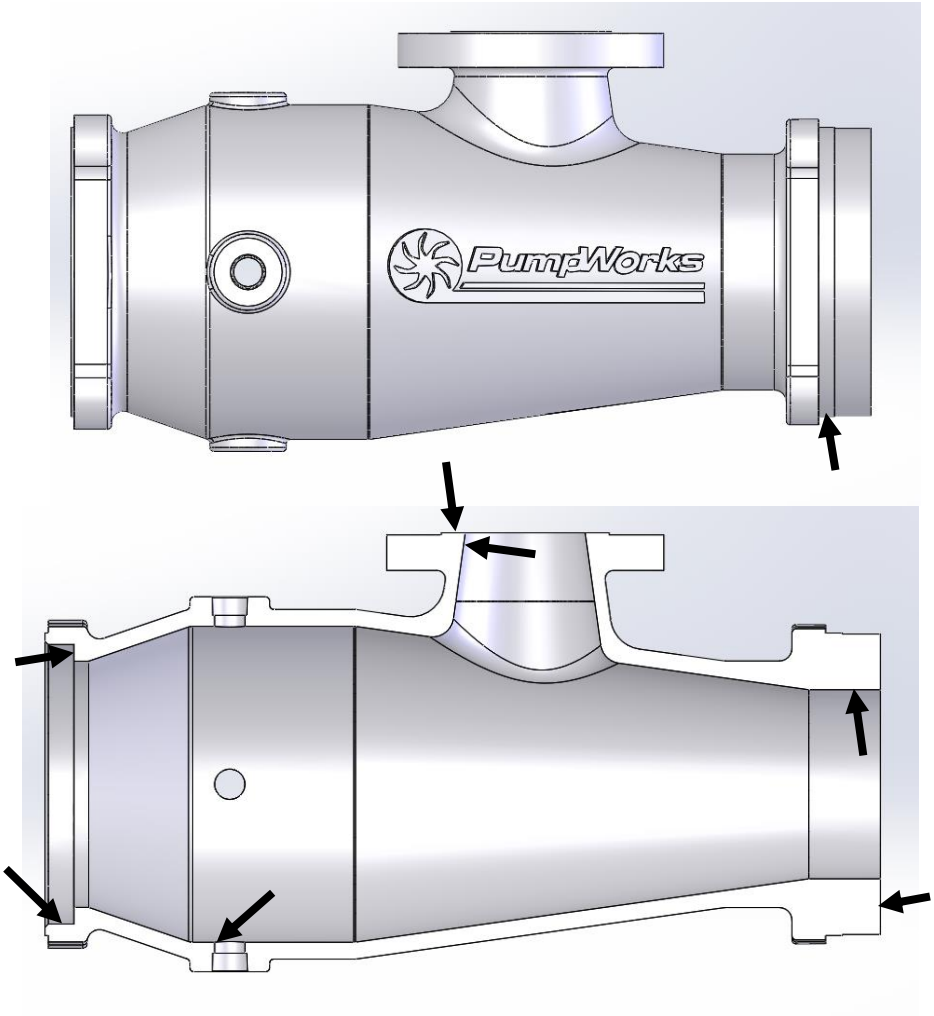


Figure 5: Case Inspection

Rotor Assembly replacement

Table 1: Rotor Inspection

Inspection Area	When to replace
Rotor OD	• When grooved deeper than 1/16 in. (1.6 mm), or • When worn evenly more than 1/16 in. (1.6 mm)
Rotor Assembly Joints	When rubber is torn and inner joint components are visible.
Rotor OD and Plugin Shaft	Cracks, pitting, or corrosion damage

Rotor Assembly areas to inspect

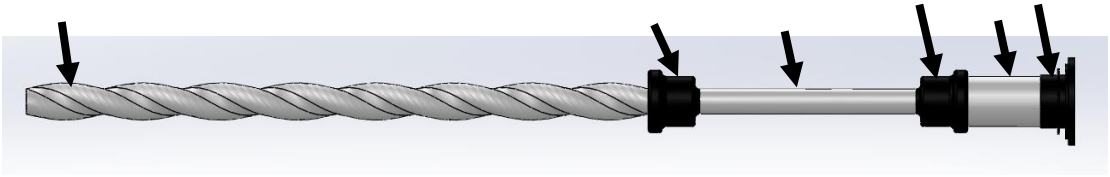


Figure 6: Rotor Inspection

Stator Adapter replacement

Table 2: Stator Adapter Inspection

Inspection Area	When to replace
Stator Adapter ID	- Grooved deeper than 1/16 in. (1.6 mm), or - Worn evenly more than 1/16 in. (1.6 mm)
Stator Adapter O-ring OD	- Either O-ring is torn or broken. - OD grooved deeper than 1/16 in. (1.6 mm), or - Worn evenly more than 1/16 in. (1.6 mm)
Stator Adapter to Stator interfaces	- Cracks, pitting, or corrosion damage

Stator Adapter areas to inspect

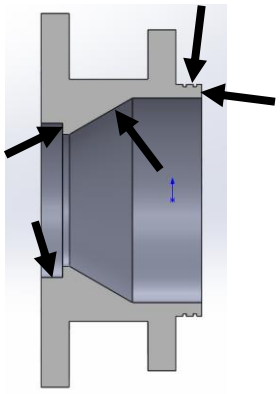


Figure 7: Stator Adapter Inspection

Seal chamber and Case stuffing box bore inspection

Checklist

Perform these checks when you inspect the seal chamber and stuffing box bore:

- Make sure that these surfaces are clean:
  1) Seal chamber and stuffing box bore
  2) Mounting
- Replace the seal chamber and stuffing box bore if pitting or wear exceeds 1/8” (3.2 mm) deep.
- Inspect the machined surfaces and mating faces noted in the figures. These images point to the areas to inspect:

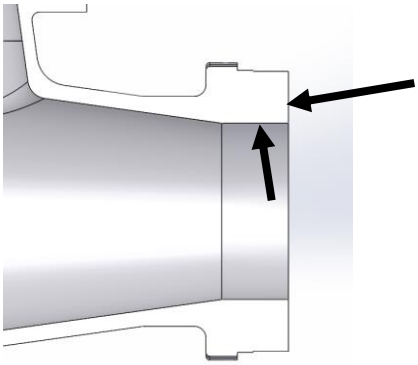


Figure 8: Casing stuffing box bore and face inspection areas

Reassembly

General Considerations

NOTICE

NOTICE:
Make sure that the pipe threads are clean, and that you apply thread sealant to the plugs and fittings. Failure to do so may result in equipment damage.

Assemble the Driver, Gearbox, and Driver Adapter

1. With gearbox secured in the upright positon, strap the driver to a crane and move drive in place for fastening.
2. Fasten the driver to the gearbox using four bolts.
3. Strap the Driver/Gearbox assembly to the crane utilizing both lifting eyes.
4. Set Driver/Gearbox assembly onto the skid and fasten the Driver feet to the skid with two bolts and hand tighten with an Engineers Wrench.

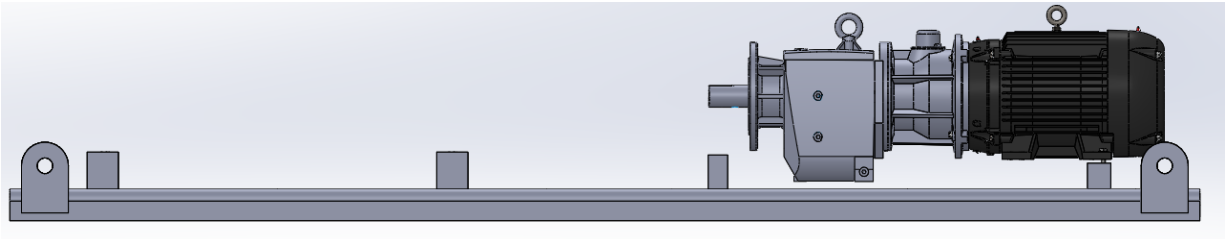


Figure 9: Driver/Gearbox assembled to Skid

5. Keep the Driver/Gearbox assembly suspended even after fastening the Driver feet bolts.

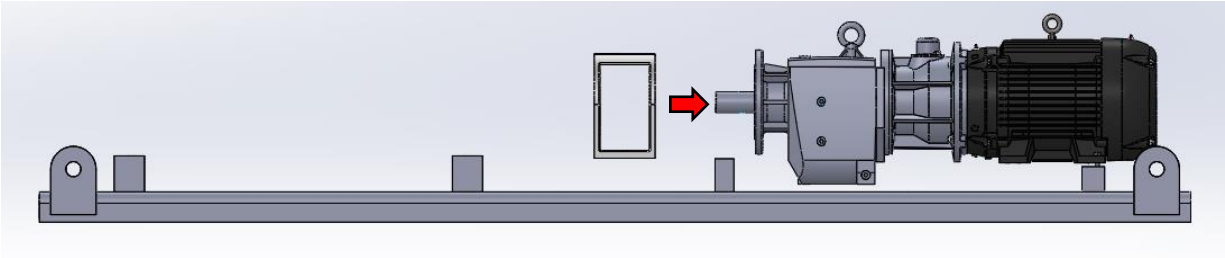


Figure 10: Motor Adapter installation

6. Place Motor Adapter on Motor Adapter pad and fasten the back face to the Gearbox using four bolts and hand tighten with an Engineers Wrench.
7. Fasten the bottom of the Motor Adapter the pad with two bolts and tighten with an Engineers Wrench.
8. Relieve the crane of the Driver/Gearbox assembly.
9. Remove grease cap of the Gearbox and screw in the Greaser activating plug until it the rotating tab breaks off.
10. Assemble the Grease Catch Assembly in the 90 degree orientation and install in the bottom of the Gearbox per Gearbox manufacturers IOM.

Assemble the Case and Mechanical Seal to the Skid

1. Hoist the Case to the installed Motor Adapter.
2. Fasten the Case to the Motor Adapter using four bolts and nuts, and hand tighten with and Engineers Wrench.
3. Using four studs and nuts lightly screw the Mechanical Seal to the sealing face of the Case.

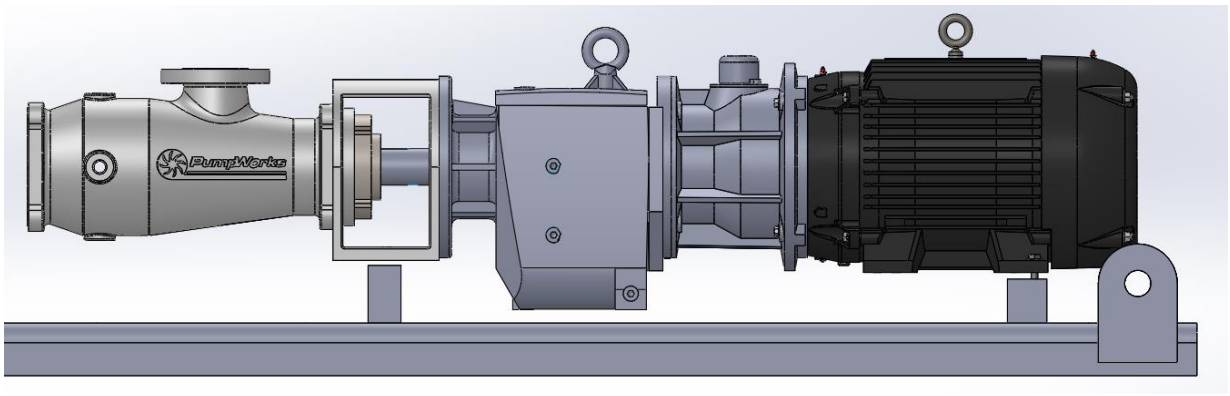


Figure 11: Case and Seal installed to the Motor Adapter

Couple the Rotor Assembly to the Gearbox

Note: Support the Case while proceeding with this part of the installation.

1. Slide the Plugin shaft end of the Rotor Assembly through the Case, Seal, and Coupling Sleeve, and slide it onto the Gearbox shaft.
2. Pull back the Coupling Sleeve and align the hole in the plug in shaft with the Gearbox shaft hole.
3. Insert Coupling pin into these holes and release Coupling Sleeve over to hold the Coupling pin in.

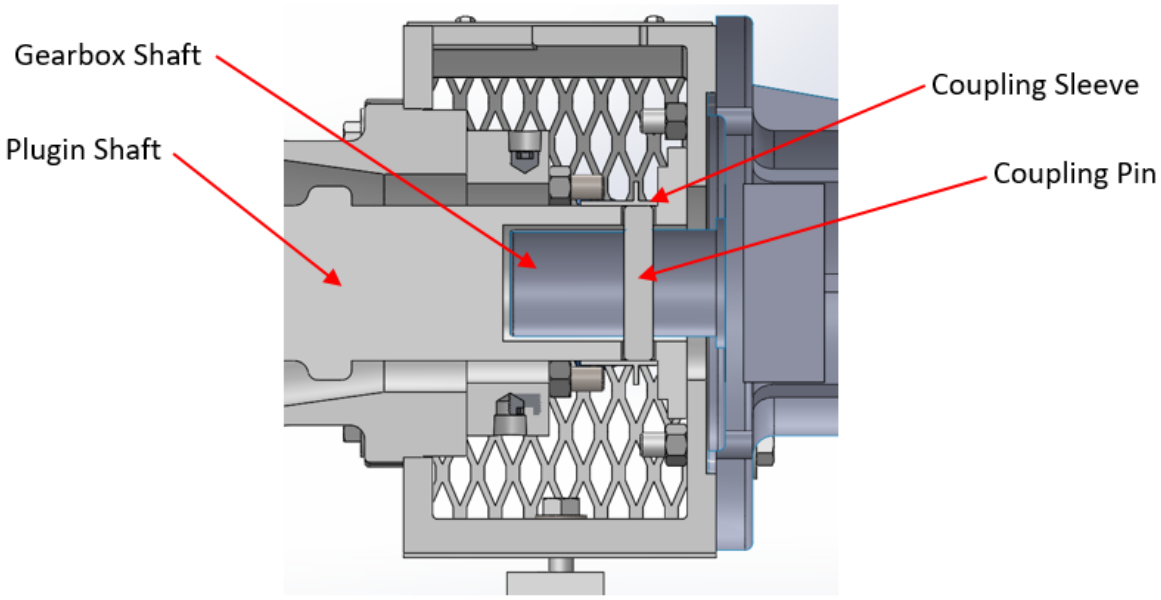


Figure 12: Coupling Details

Assemble the Stator Module Assembly to the Skid

1. Lubricate entire Rotor with Molykote 55.
2. Lubricate inner surfaces of the Stator with Molykote 55.
3. Using a crane to lift the Stator Module Assembly and a fork lift to apply axial pressure, slide the Stator Module assembly onto the Rotor Assembly until it touches the Case. Rotating the Plugin Shaft with a shaft wrench back and forth while installing may be necessary to allow Stator to slide on the Rotor.

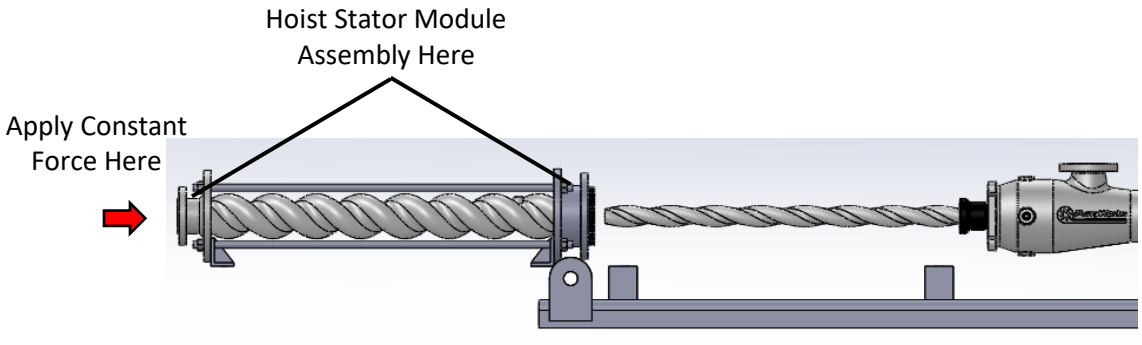


Figure 13: Stator Module Assembly Details

4. Use four bolts and nuts to fasten the Stator Adapter to the case and hand tighten with an Engineers Wrench.
5. Use four bolts and washers to fasten the Stator Module Feet to the Skid.

Shaft sealing with cartridge mechanical seal

1. Tighten the previously installed seal studs as far as they will go by hand.
2. Ensure that the seal register fit is located inside the Case register bore and hand tighten the four seal nuts using an Engineers Wrench.

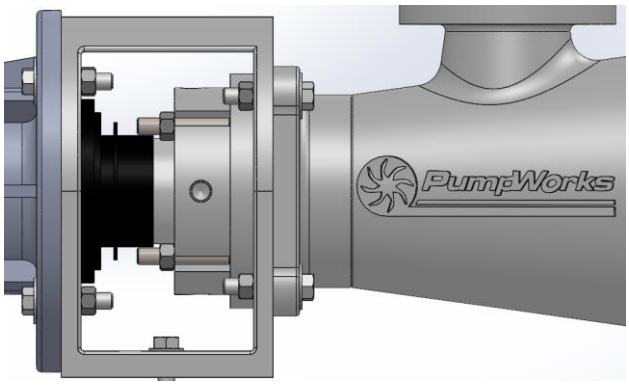


Figure 14: Mechanical Seal installation

NOTICE

NOTICE:

Risk of damage to the mechanical seal or shaft sleeve on units supplied with cartridge mechanical seals. Prior to startup, make sure to tighten the set screws in the seal locking ring and remove the centering clips.

Post-Guard assembly checks

Perform these checks after you assemble the pump and prior to assembling the coupling guards, then continue with Guard assembly:

- Rotate the shaft by hand in order to make sure that it rotates easily and smoothly and that there is no rubbing.
- Open the isolation valves and check the pump for leaks.

Assemble the Coupling Guards

1. Position each guard in its place and fasten a total of eight bolts hand tight with a socket of Engineers Wrench.

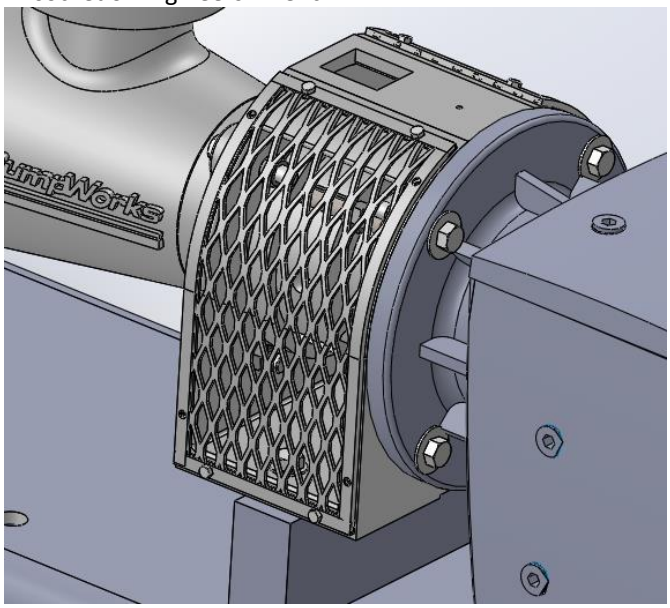


Figure 15: Coupling Guards assembled

Spare parts

Pump Serial Number is REQUIRED for all Parts Orders. This ensures the correct material and design for your specific pump unit.

Balloon Letter	Part Number	Description
A	517-00108-0000	COUPLING GUARD, LEFT, PLATE
B	517-00107-0000	COUPLING GUARD, RIGHT, PLATE
C	517-00111-0000	THERMOWELL ASSM, 100OHM, U2.0", DUAL
D	300-00109-1000	ADAPTER, MOTOR, 4X4 2S & 3X3 4S PC, CS
E	517-00110-0000	1/2"MNPT-1/2"MNPT PIPE COUPLING
F	517-00109-0000	1/2"FNPT-1/2"FNPT PIPE COUPLING
G	517-00105-0000	VALVE, BLOCK & BLEED
H	330-01522-1000	CASE, 3X3 4SPC, 300#, RF, CS
I	525-00100-0000	GEARBOX, SK72FVL-320TC NORD, 3X3 4S
J	505-00114-0000	PC, 3X3 4S, STATOR MODULE, FF
K	505-00118-0000	PC, 3X3 4S, TIE ROD ASSM
L	505-00106-0000	DISCHARGE CASING, 3X3 4STAGE
M	300-00113-1000	STATOR ADAPTER
N	505-00138-0000	PC, 3X3 4S, O-RING
O	505-00122-0000	PC, 3X3 4S, STATOR FOOT
P	505-00126-0000	PC, 3X3 4S, ROTOR ASSM
Q	505-00130-0000	PC, 3X3 4S, PLUG-IN SHAFT PIN
R	505-00134-0000	PC, 3X3 4S, PLUG-IN SHAFT SLEEVE
S	520-00100-0000	MOTOR,1800,324TC,CECP4110T,ABB, 3X3 4S
T	517-00100-0000	66B UE PRESSURE SWITCH, 1/2"MNPT
U	530-00101-0000	M SEAL 3X3 4SPC FOR PLAN 66B
V	513-00102-0000	SKID, 3X3 4S, PC
W	700-00111-0000	SCREW, CAP, HH, 5/8-11 UNC, 2" LG SS
X	780-00105-0000	WASHER, LOCK, SPLIT, 5/8", 304SS
Y	700-00150-0000	SCREW, CAP, HH, 1/2- 13 UNC, 2.50" LG SS
Z	780-00104-0000	WASHER, LOCK, SPLIT, 1/2", 304SS
AA	775-00150-0000	PLUG, WASHOUT, SOCKET HEAD, 3/4" NPT, CS
BB	700-00134-0000	SCREW, CAP, HH, 5/8-11 UNC, 3.00" LG SS
CC	725-00107-0000	STUD, 5/8-11 UNC, 4" LG, 304SS
DD	760-00113-0000	NUT, HEX, 5/8-11 UNC, 304SS
EE	700-00151-0000	SCREW, CAP, HH, 7/16-14 UNC, 2.00" LG SS
FF	780-00121-0000	WASHER, LOCK, SPLIT, 7/16", 304SS
GG	775-00110-0000	PLUG, SOCKET HEAD, 1/2" NPT, SS
HH	725-00121-0000	STUD, 3/4-10 UNC, 4.50" LG, 304SS
II	760-00123-0000	NUT, HEX, 3/4-10 UNC, 304SS
JJ	700-00122-0000	SCREW, CAP, HH, 1/4-20 UNC, .5" LG SS
KK	517-00112-0000	Auto Greaser
LL	517-00113-0000	Grease Catch Assembly

Table 3: Spare Parts List

Parts Listings and Exploded Assembly Drawings

Table 1 - Parts List

Balloon Letter	Part Number	Description	QTY
A	517-00108-0000	COUPLING GUARD, LEFT, PLATE	1
B	517-00107-0000	COUPLING GUARD, RIGHT, PLATE	1
C	517-00111-0000	THERMOWELL ASSM, 100OHM, U2.0", DUAL	1
D	300-00109-1000	ADAPTER, MOTOR, 4X4 2S & 3X3 4S PC, CS	1
E	517-00110-0000	1/2"MNPT-1/2"MNPT PIPE COUPLING	1
F	517-00109-0000	1/2"FNPT-1/2"FNPT PIPE COUPLING	1
G	517-00105-0000	VALVE, BLOCK & BLEED	1
H	330-01522-1000	CASE, 3X3 4SPC, 300#, RF, CS	1
I	525-00100-0000	GEARBOX, SK72FVL-320TC NORD, 3X3 4S	1
J	505-00114-0000	PC, 3X3 4S, STATOR MODULE, FF	1
K	505-00118-0000	PC, 3X3 4S, TIE ROD ASSM	4
L	505-00106-0000	DISCHARGE CASING, 3X3 4STAGE	1
M	300-00113-1000	STATOR ADAPTER	1
N	505-00138-0000	PC, 3X3 4S, O-RING	2
O	505-00122-0000	PC, 3X3 4S, STATOR FOOT	2
P	505-00126-0000	PC, 3X3 4S, ROTOR ASSM	1
Q	505-00130-0000	PC, 3X3 4S, PLUG-IN SHAFT PIN	1
R	505-00134-0000	PC, 3X3 4S, PLUG-IN SHAFT SLEEVE	1
S	520-00100-0000	MOTOR,1800,324TC,CECP4110T,ABB, 3X3 4S	1
T	517-00100-0000	66B UE PRESSURE SWITCH, 1/2"MNPT	1
U	530-00101-0000	M SEAL 3X3 4SPC FOR PLAN 66B	1
V	513-00102-0000	SKID, 3X3 4S, PC	1
W	700-00111-0000	SCREW, CAP, HH, 5/8-11 UNC, 2" LG SS	6
X	780-00105-0000	WASHER, LOCK, SPLIT, 5/8", 304SS	30
Y	700-00150-0000	SCREW, CAP, HH, 1/2- 13 UNC, 2.50" LG SS	2
Z	780-00104-0000	WASHER, LOCK, SPLIT, 1/2", 304SS	2
AA	775-00150-0000	PLUG, WASHOUT, SOCKET HEAD, 3/4" NPT, CS	4
BB	700-00134-0000	SCREW, CAP, HH, 5/8-11 UNC, 3.00" LG SS	8
CC	725-00107-0000	STUD, 5/8-11 UNC, 4" LG, 304SS	4
DD	760-00113-0000	NUT, HEX, 5/8-11 UNC, 304SS	16
EE	700-00151-0000	SCREW, CAP, HH, 7/16-14 UNC, 2.00" LG SS	4
FF	780-00121-0000	WASHER, LOCK, SPLIT, 7/16", 304SS	4
GG	775-00110-0000	PLUG, SOCKET HEAD, 1/2" NPT, SS	3
HH	725-00121-0000	STUD, 3/4-10 UNC, 4.50" LG, 304SS	4
II	760-00123-0000	NUT, HEX, 3/4-10 UNC, 304SS	4
JJ	700-00122-0000	SCREW, CAP, HH, 1/4-20 UNC, .5" LG SS	8
KK	517-00112-0000	AUTO GREASER	1
LL	517-00113-0000	GREASE CATCH ASSEMBLY	1

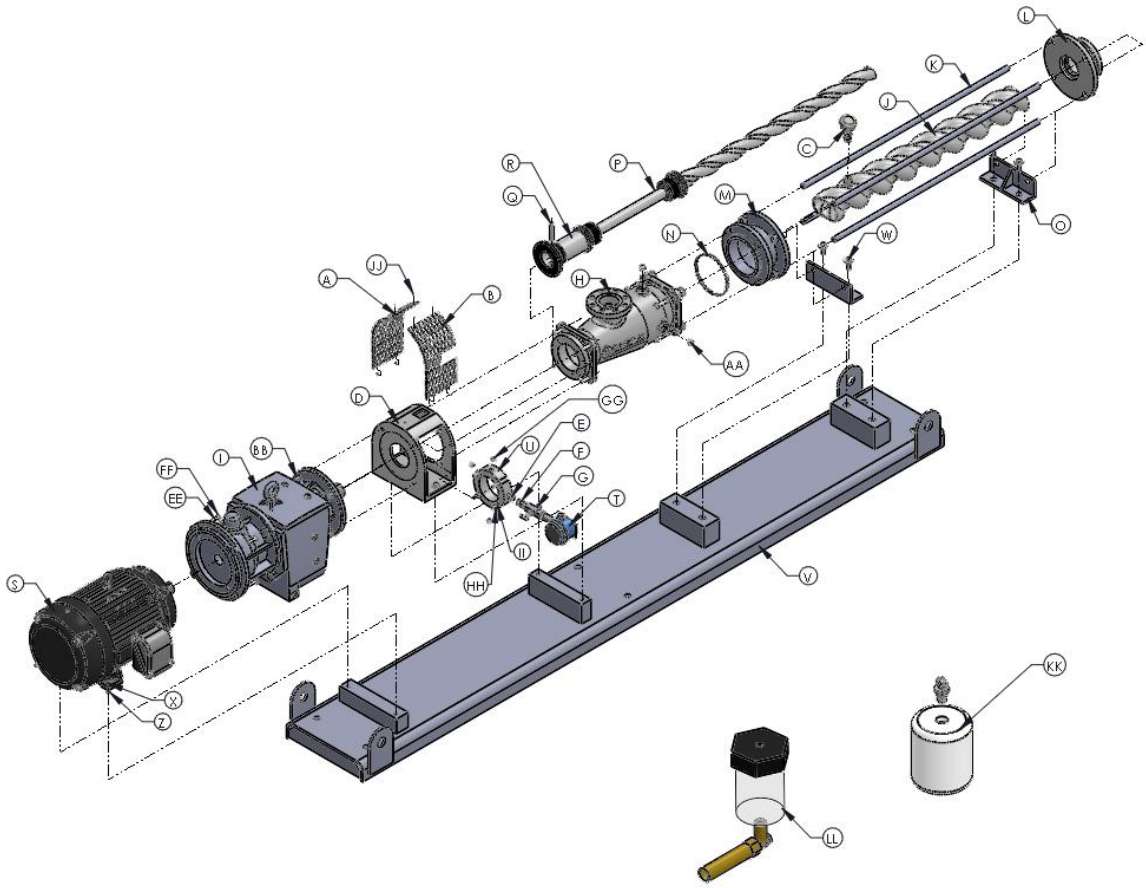
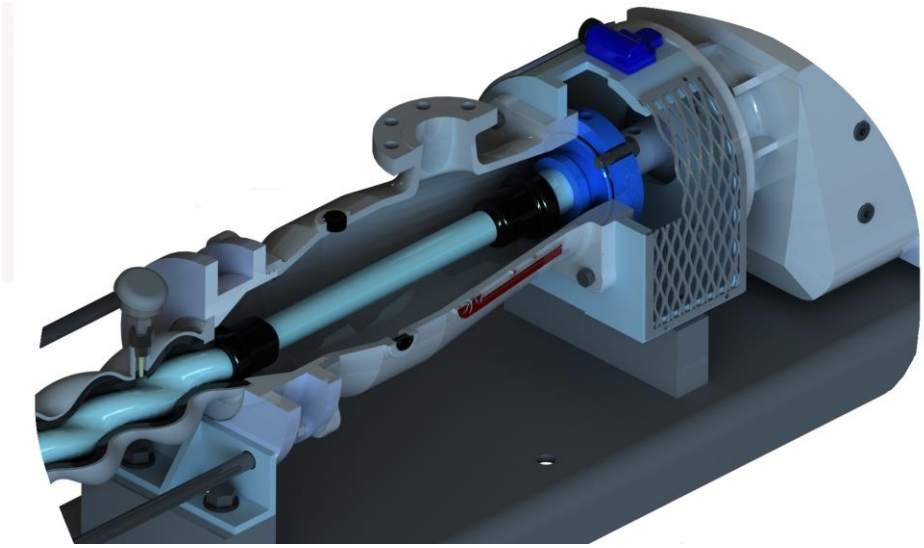


Figure 1: 3x3 4-Stage Pump Package Exploded View

Visit our website for more information and other products available.

www.pumpworks.com

ePOD
ELECTRONIC
PUMP ON
DEMAND



PumpWorks™

65 Southbelt Industrial Drive
Houston, TX 77047
U.S.A.

Ph: (713) 892-5875
Fx: (713) 343-0765