

# e-XC

## Single Stage, Double Suction Centrifugal Pumps



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# 1 Introduction and Safety

## 1.1 Introduction

### Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



### 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.

### NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

## 1.2 Safety



### WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Operating, installing, or maintaining the unit in any way that is not covered in this manual 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 Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
- Do not change the service application without the approval of an authorized Xylem representative.



### CAUTION:

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.


### 1.2.1 Safety terminology and symbols



#### About safety messages

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

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction



#### Hazard levels

Hazard level	Indication
 <b>DANGER:</b>	A hazardous situation which, if not avoided, will result in death or serious injury

Hazard level	Indication
 <b>WARNING:</b>	A hazardous situation which, if not avoided, could result in death or serious injury
 <b>CAUTION:</b>	A hazardous situation which, if not avoided, could result in minor or moderate injury
<b>NOTICE:</b>	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.


Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
 <b>Electrical Hazard:</b>	 <b>CAUTION:</b>

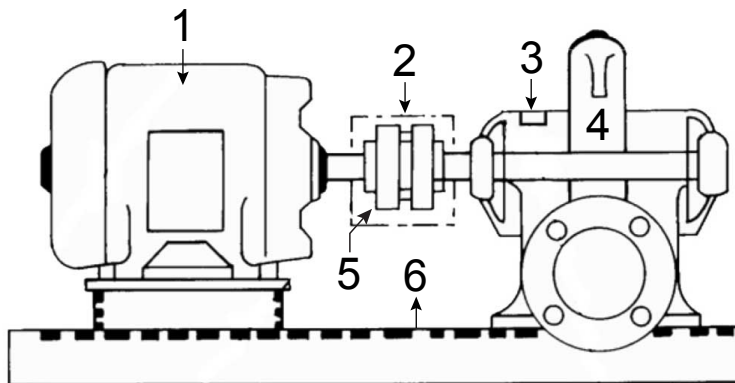
1.2.2 Safety instruction decals

Alert symbol

	<p>This safety alert symbol is used in manuals and on the safety instruction decals on the pump to draw attention to safety-related instructions.</p> <p>When used, the safety alert symbol means that failure to follow the instructions may result in a safety hazard.</p>
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Decals

Make sure your pump has these safety instruction decals and that they are located as this figure shows. If the decals are missing or illegible, contact your local sales and service representative for a replacement.



1. **WARNING.** Eyebolts or lifting lugs if provided are for lifting only the components to which they are attached. Failure to follow instructions could result in injury or death.
2. **WARNING. ROTATING COMPONENTS.** Disconnect and lockout power before servicing. Do not operate without all guards in place. Consult installation and service instruction sheet before operating or servicing.
3. **CAUTION.** Do not run pump dry. Seal damage may occur. Inspect pump seal regularly for leaks. Replace as required. Lubrication requirements consult manuals. Pump:

Polyurea-based grease. Failure to follow instructions could result in injury or property damage.

4. Nameplate location. See [Nameplate rating information](#) on page 11 for more information.
5. CAUTION. Coupler alignment is required! level and grout pump before use. Check alignment before grouting, after system is filled, after servicing pump, and as required. Consult the service instructions for details. Failure to follow these instructions could result in injury or property damage.
6. CAUTION. NO STEP. This equipment is not to be used as a step. Failure to follow instructions could result in injury or property damage.
7. PROPOSITION 65. This product contains components made of materials that are known to the State of California to cause cancer, birth defects, and other reproductive harm.

NOTE: The Proposition 65 label should accompany the container this IOM arrives in and will not be placed directly onto the pump.

Make sure that all safety instruction decals are always clearly visible and readable.

## 1.3 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.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

### Safety equipment

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

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

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#### NOTICE:

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

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### Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

### Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that 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**

Observe these safety precautions when you work with the product or are in connection with the product:

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

**1.3.1 Wash the skin and eyes**

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	<ol style="list-style-type: none"> <li>1. Hold your eyelids apart forcibly with your fingers.</li> <li>2. Rinse the eyes with eyewash or running water for at least 15 minutes.</li> <li>3. Seek medical attention.</li> </ol>
Chemicals or hazardous fluids on skin	<ol style="list-style-type: none"> <li>1. Remove contaminated clothing.</li> <li>2. Wash the skin with soap and water for at least 1 minute.</li> <li>3. Seek medical attention, if necessary.</li> </ol>

**1.4 Protecting the environment**

**Emissions and waste disposal**

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

**Exceptional sites**



**CAUTION: Radiation Hazard**

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

**Recycling guidelines**

Always follow local laws and regulations regarding recycling.

# 2 Transportation and Storage

## 2.1 Examine the delivery

### 2.1.1 Examine the package

1. Examine the package for damaged or missing items upon delivery.
2. Record any damaged or missing items on the receipt and freight bill.
3. If anything is out of order, then file a claim with the shipping company.  
If the product has been picked up at a distributor, make a claim directly to the distributor.

### 2.1.2 Examine the unit

1. Remove packing materials from the product.  
Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.  
Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

## 2.2 Pump lifting guidelines




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**WARNING:**

Only use the attached eyebolts or lifting lugs to lift the components to which they are attached. Failure to do so could result in death or serious injury.

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**CAUTION:**

Some pump, base, and driver assemblies are not safe to lift as a complete assembly. Damage to the baseplate can occur if you attempt this. If the driver was mounted on the baseplate at the factory, it is safe to lift the entire assembly. If the driver was not mounted at the factory, do not lift the entire assembly which consists of the pump, base, and driver. Instead, lift the pump and baseplate to its final location without the driver. Then, mount the driver.

The pump unit should be unloaded and handled by lifting equally at four or more points on the baseplate. Lift the pump equally at four or more points on the baseplate. Care must be taken to size the equipment for unbalanced loads that can exist if the motor is not mounted on the base when you lift it. The lugs on the upper half casing are designed for lifting the upper half casing only and not for upper casing and lower casing assembly.

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**WARNING:**

Eyebolts or lifting lugs, if provided, are for lifting only the components to which they are attached. Failure to follow these instructions could result in serious personal injury or death, or property damage.

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### Horizontal bare pump lifting procedure

- Using nylon slings, chains, or wire ropes, place the slings around the suction and discharge ports of the pump as indicated in the following figure. Lift the pump using ANSI/OSHA Standard "S" hooks.

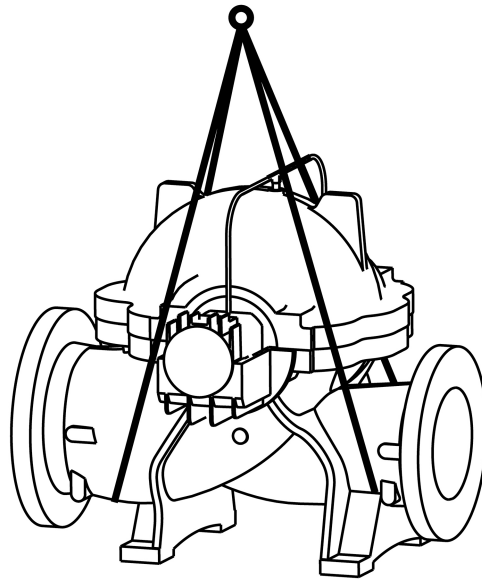


Figure 1: Sample pump end only lifting diagram

**Pump, base, and driver lifting procedure for bases with lifting holes**

1. Using ANSI/OSHA Standard "S" hooks, place the "S" hooks in the holes located in the four corners of the base. Ensure the points of the hooks do not touch the bottom of the pump base.
2. Attach nylon slings, chains, or wire rope to the "S" hooks. Size lifting equipment appropriately for the load and ensure the lift angle will be less than 45° from vertical.

**Pump, base, and driver lifting procedure for bases without lifting holes**

1. Using nylon slings, chains, or wire ropes, place the slings around the suction and discharge ports in a similar fashion as indicated in Figure 1.
2. Place another sling around the back end of the motor as close to the mounting feet as possible. Make sure the sling does not damage the housing cover or conduit box.
3. Join the free ends of the slings together and place over an ANSI/OSHA Standard "S" hook. Ensure the slings are secure such that they will not slip while lifting.

**Notes:**

- Size lifting equipment appropriately for unbalanced loading. Motors may or may not be mounted at the factory.
- Pump, base, and driver assemblies where the base length exceeds 100 in. (2540 mm) may not be safe to lift as a complete assembly. Damage to the baseplate may occur.
- If the driver has been mounted on the baseplate at the factory, it is safe to lift the entire assembly.
- If driver has not been mounted at the factory and the overall baseplate length exceeds 100 in. (2540 mm), do not lift the entire assembly consisting of pump, base, and driver. Instead, lift the pump and baseplate to its final location without the driver. Then mount the driver.
- Bases are supplied with lifting holes in the sides or ends of the base.

## 2.3 Pump storage requirements

Storage requirements depend on the amount of time that you store the unit. The normal packaging is designed only to protect the unit during shipping.

Length of time in storage	Storage requirements
Upon receipt/short-term (less than six months)	<ul style="list-style-type: none"> <li>• Store in a covered and dry location.</li> <li>• Store the unit free from dirt and vibrations.</li> </ul>

Length of time in storage	Storage requirements
Long-term (more than six months)	<ul style="list-style-type: none"><li>• Store in a covered and dry location.</li><li>• Store the unit free from heat, dirt, and vibrations.</li><li>• Rotate the shaft by hand several times at least every three months.</li><li>• Make sure that any changes in ambient temperature are slow and moderate.</li></ul>

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

# 3 Product Description

## 3.1 General description

### Description

The e-XC pump is a single stage, double-suction centrifugal pump with the following features:

- A high efficiency and rugged construction
- Horizontal grouted frame mounting
- Compact design
- Foot-mounted volute
- Regreasable bearings
- Horizontal split case
- Center drop out coupler

### Intended applications



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**WARNING:**

This product can expose you to chemicals including Lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to: [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

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Certain components of the e-XC product line may contain trace amounts of lead. As such, the product will be labeled according to California Proposition 65.

e-XC pumps are ideal for pressure boosting and general pumping with these liquids:

- Groundwater
- Process water
- Gray water
- Sea water
- Brackish water
- Industrial fluids
- Heat transfer fluids
- Produced water
- Solvents
- Oil
- Boiler-feeder water
- Condensate
- Benign liquids

**Note:**

Pumps must be tailored for their intended application. Contact a sales representative before attempting to change your pump application. Verify whether or not your current pump configuration meets the requirements relevant to the new application.

Due to the wide variety of material options available for various components within the e-XC product line, e-XC pumps may be suitable for other applications not specified in this document. Contact a sales representative to verify if an e-XC pump can satisfy requirements relevant to applications outside those listed in this document.

## 3.2 Operational limits

### Maximum working pressure

Do not operate the pump at higher pressure thresholds than the maximum working pressures listed on the pump nameplate.



## Seal operating limits

Xylem's proprietary mechanical seals are designed specifically for the e-XC product line. Therefore, seals are rated against the pump's total working pressure. The table below outlines the operating limits of both mechanical and packing seal configurations. For more mechanical seal and packing details, view the 'e-XC Performance Curves and Technical Data' brochure.

As a general rule of thumb, the pressure the mechanical seal experiences is 1.15 times the suction pressure of the pump in water applications. For fluids with greater viscosities, this multiplier is greater. Consult factory for more specific information. Allowable pump suction pressure is equal to the maximum working pressure minus the discharge pressure.

Note that the life of a mechanical seal depends on the cleanliness of the pumped fluid. Due to the diversity of operating conditions, it is not possible to provide a definitive guarantee of seal life. In clean water applications, typical mechanical seal life spans two to three years.

Table 1: Operating limits

Seal Name	Description	Max Pressure psi [bar]	Max Temperature °F [°C]
MR1	Metric metal pusher	450 [31]	250 [121]
MR2	Metric rubber bellow	232 [16]	
MR3	Imperial metal pusher	450 [31]	
MR4	Imperial rubber bellow	175 [12]	
MR5	Metric cartridge on shaft	450 [31]	
MR6	Imperial cartridge on shaft	450 [31]	
MR7	Metric cartridge on sleeve	450 [31]	
MR8	Imperial cartridge on sleeve	450 [31]	
Packing	Style 608D graphite	300 [20.7]	

## 3.3 Nameplate rating information

e-XC pumps are designated by a series of numbers. The pump nameplate gives identification and rating information.

Permanent records for this pump are referenced by the serial number. This number must be used with all correspondence and spare parts orders.

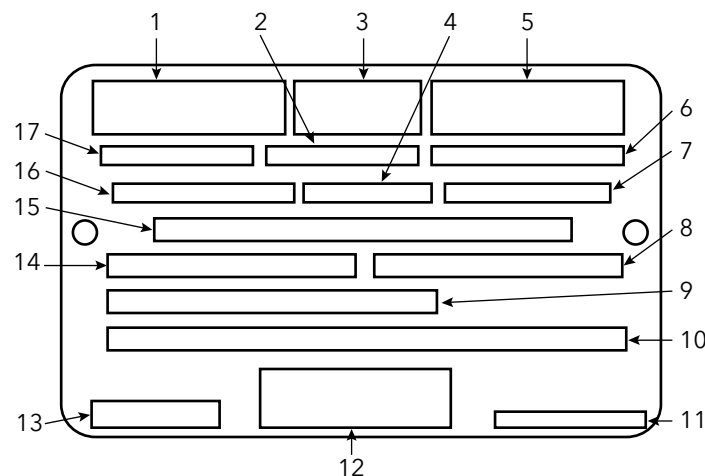


Figure 2: Rating plate

Legend

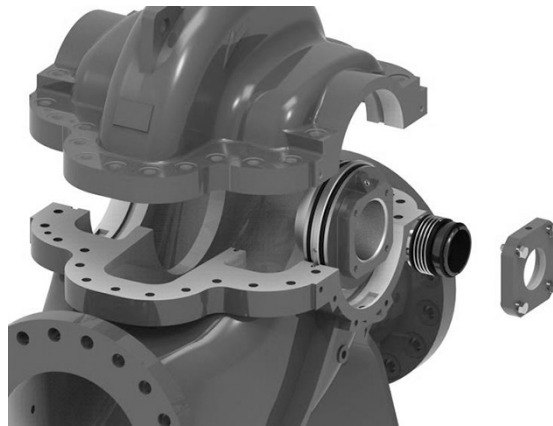
1. Xylem brand logo
2. Pump size (i.e. 150-355 or 6X8X13.5)
3. NSF-61 or NSF-372 (if applicable)
4. Total head (i.e. 36m or 118ft)
5. Manufacturing location (i.e. Morton Grove)
6. Pump rotation (clockwise or counterclockwise)
7. Required motor power (i.e. 45kW or 60HP)
8. Impeller diameter (i.e. 355mm or 14")
9. Serial number
10. Blank space for customer information
11. Nameplate part number
12. Assembled in USA
13. Manufacturing month and year (i.e. 2019)
14. Operating speed (i.e. 1470RPM or 1780RPM)
15. Max working pressure (i.e. 16bar / 230PSI)
16. Flow (i.e. 365 m<sup>3</sup>/H or 1600GPM)
17. Pump series (e-XC)

## 3.4 Casing and volute information

### 3.4.1 Pump casing variants

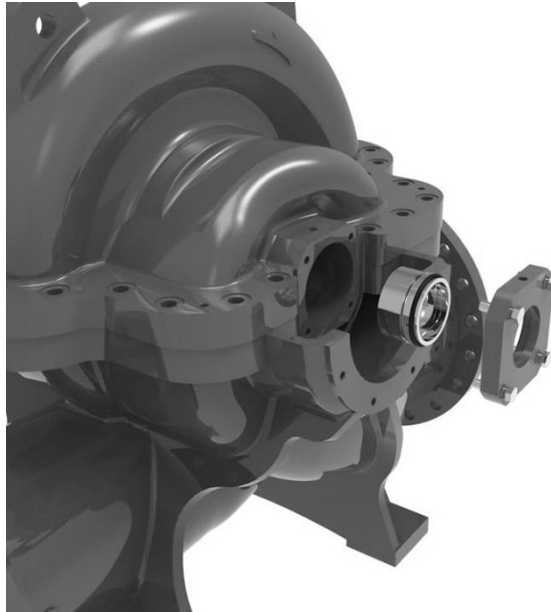
#### Drop-in Stuffing Box Design (Drop-in Seal Chamber)

The drop-in stuffing box design utilizes a removable stuffing box. Seal gland, cartridge seals, and packing glands are affixed to the stuffing box in this design variant. Flush lines connect to seal gland or stuffing box ports for all sealing configurations.



#### Integrated Stuffing Box Design (Integrated Seal Chamber)

The integrated stuffing box design omits the need for a separate stuffing box. Instead, the upper and lower casing halves form a seal chamber when the pump is assembled. Seal gland, cartridge seals, and packing glands are fastened directly to the pump casing. Flush lines connect to seal gland ports for mechanical and cartridge seal configurations. Flush lines connect to ports located on top of the upper casing for the packing seal configuration.



### 3.4.2 Pump casing data

Pump casing designs and characteristics vary within the e-XC pump family. The tables below outline casing properties by pump model. Cast iron is the standard casing material option in instances where both cast iron and ductile iron casings are available for the same pump model. Pressure ratings indicate maximum working pressure of the pump. For details regarding drop-in and integrated seal chamber designs, see [Pump casing variants](#) on page 12.

#### Pump casing data for 60 Hz applications (North America)

Number	Pump Model		Seal chamber type	Volute type	Cast Iron (175 PSI)	Ductile Iron (175 PSI)	Ductile Iron (400 PSI)	Ductile Iron (450 PSI)
1	3X5X8.5	3X5X8	Drop-in	Single	●		●	
2	3X5X11	3X5X10.5	Drop-in	Single	●		●	
3	3X5X12.5	3X5X12	Drop-in	Single			●	
4	3X5X13.5	3X5X13	Drop-in	Single	●		●	
5	4X5X6.5	4X5X6	Drop-in	Single	●		●	
6	4X5X6	4X6X9.5	Drop-in	Single	●		●	
7	4X6X13	4X6X12	Drop-in	Single	●			●
8	4X6X14.5	4X6X13.5	Drop-in	Single	●		●	
9	4X6X16	4X6X15.5	Drop-in	Single	●		●	
10	5X6X7.5	5X6X7	Drop-in	Single	●		●	
11	5X8X9	5X8X8.5	Drop-in	Single	●		●	
12	5X8X9.5	5X8X9	Drop-in	Single	●		●	
13	5X8X12	5X8X11	Drop-in	Single	●		●	
14	5X8X14	5X8X13.5	Drop-in	Single	●			●
15	5X8X15.5	5X8X14.5	Drop-in	Single			●	
16	5X8X19	5X8X18	Drop-in	Single	●		●	
17	6X8X6.5	6X8X6	Drop-in	Single	●		●	
18	6X8X12	6X8X11	Drop-in	Single	●		●	
19	6X8X14	6X8X13.5	Drop-in	Single	●		●	
20	6X8X18	6X8X17	Drop-in	Single	●		●	

Number	Pump Model		Seal chamber type	Volute type	Cast Iron (175 PSI)	Ductile Iron (175 PSI)	Ductile Iron (400 PSI)	Ductile Iron (450 PSI)
21	6X8X22	6X8X21	Drop-in	Dual			•	
22	6X10X11	6X10X10.5	Drop-in	Single			•	
23	8X8X8	8X8X7.5	Drop-in	Single	•		•	
24	8X10X10	8X10X9.5	Drop-in	Single	•		•	
25	8X10X13.5	8X10X13	Drop-in	Single	•		•	
26	8X10X17	8X10X16	Drop-in	Single	•		•	
27	8X10X21	8X10X20	Drop-in	Dual			•	
28	8X10X26	8X10X25	Drop-in	Dual				•
29	10X10X8	10X10X7.5	Drop-in	Dual	•		•	
30	10X12X15.5	10X12X14.5	Drop-in	Single	•		•	
31	10X12X19	10X12X18	Drop-in	Single	•		•	
32	10X12X24	10X12X23	Drop-in	Dual			•	
33	10X12X30	10X12X28.5	Drop-in	Dual			•	
34	12X12X9	12X12X8.5	Drop-in	Dual	•		•	
35	12X12X10	12X12X9.5	Drop-in	Dual	•		•	
36	12X14X13	12X14X12.5	Drop-in	Single	•		•	
37	12X16X18	12X16X17	Drop-in	Single	•		•	
38	12X16X22	12X16X21	Drop-in	Single			•	
39	12X16X28	12X16X27	Drop-in	Dual				•
40	14X14X12	14X14X11	Drop-in	Dual	•		•	
41	14X16X15	14X16X14.5	Drop-in	Single	•		•	
42	14X16X27.5	14X16X26	Drop-in	Dual				•
43	14X16X30.5	14X16X29	Integrated	Dual	•		•	
44	14X18X18	14X18X17	Drop-in	Dual	•		•	
45	14X18X21	14X18X20	Drop-in	Dual	•		•	
46	14X20X26.5	14X20X25.5	Integrated	Dual		•		
47	14X20X33	14X20X31.5	Integrated	Dual			•	
48	16X16X13.5	16X16X13	Drop-in	Dual	•		•	
49	16X20X20.5	16X20X19.5	Drop-in	Dual			•	
50	16X20X21	16X20X20	Drop-in	Single	•	•		
51	16X20X32	16X20X22	Drop-in	Dual			•	
52	16X24X31.5	16X24X29.5	Integrated	Dual			•	
53	16X24X38	16X24X34	Integrated	Dual			•	
54	18X20X15.5	18X20X14.5	Drop-in	Dual	•		•	
55	20X24X18	20X24X17	Drop-in	Dual	•		•	
56	20X24X20.5	20X24X19.5	Integrated	Dual		•		
57	20X24X24.5	20X24X23.5	Integrated	Dual		•		
58	20X28X28	20X28X27	Integrated	Dual			•	
59	20X28X36	20X28X34	Integrated	Dual			•	
60	24X28X22.5	24X28X21	Integrated	Dual		•		
61	24X28X24	24X28X23	Integrated	Dual		•		
62	24X32X31.5	24X32X30	Integrated	Dual		•		
63	24X32X39	24X32X37	Integrated	Dual			•	

Number	Pump Model		Seal chamber type	Volute type	Cast Iron (175 PSI)	Ductile Iron (175 PSI)	Ductile Iron (400 PSI)	Ductile Iron (450 PSI)
64	24X32X43.5	24X32X41.5	Integrated	Dual			•	
65	28X28X21	28X28X19.5	Integrated	Dual			•	
66	28X32X23.5	28X32X23	Integrated	Dual			•	
67	28X32X26	28X32X25	Integrated	Dual			•	
68	28X32X30.5	28X32X28.5	Integrated	Dual			•	
69	28X32X34	28X32X32.5	Integrated	Dual			•	
70	28X36X39	28X36X37	Integrated	Dual			•	
71	32X32X32	32X32X22	Integrated	Dual			•	

## Pump casing data for 50 Hz applications (Global)

Number	Pump Model		Seal chamber type	Volute type	Cast Iron (16 bar)	Ductile Iron (16 bar)	Ductile Iron (25 bar)	Ductile Iron (31 bar)
1	80-215	80-205	Drop-in	Single	•		•	
2	80-285	80-270	Drop-in	Single	•		•	
3	80-315	80-300	Drop-in	Single			•	
4	80-345	80-330	Drop-in	Single	•		•	
5	100-165	100-155	Drop-in	Single	•		•	
6	100-260	100-250	Drop-in	Single	•		•	
7	100-325	100-310	Drop-in	Single	•			•
8	100-365	100-350	Drop-in	Single	•		•	
9	100-410	100-390	Drop-in	Single	•		•	
10	125-195	125-185	Drop-in	Single	•		•	
11	125-225	125-215	Drop-in	Single	•		•	
12	125-245	125-235	Drop-in	Single	•		•	
13	125-300	125-285	Drop-in	Single	•		•	
14	125-355	125-335	Drop-in	Single	•			•
15	125-390	125-370	Drop-in	Single			•	
16	125-475	125-450	Drop-in	Single	•		•	
17	150-170	150-160	Drop-in	Single	•		•	
18	150-300	150-285	Drop-in	Single	•		•	
19	150-355	150-340	Drop-in	Single	•		•	
20	150-455	150-435	Drop-in	Single	•		•	
21	150-560	150-535	Drop-in	Dual			•	
22	150-280	150-265	Drop-in	Single			•	
23	200-200	200-190	Drop-in	Single	•		•	
24	200-250	200-240	Drop-in	Single	•		•	
25	200-345	200-330	Drop-in	Single	•		•	
26	200-425	200-405	Drop-in	Single	•		•	
27	200-530	200-505	Drop-in	Dual			•	
28	200-655	200-625	Drop-in	Dual				•
29	250-200	250-190	Drop-in	Dual	•		•	
30	250-390	250-370	Drop-in	Single	•		•	
31	250-480	250-455	Drop-in	Single	•		•	
32	250-610	250-580	Drop-in	Dual			•	

Number	Pump Model		Seal chamber type	Volute type	Cast Iron (16 bar)	Ductile Iron (16 bar)	Ductile Iron (25 bar)	Ductile Iron (31 bar)
33	250-770	250-730	Drop-in	Dual			•	
34	300-225	300-215	Drop-in	Dual	•		•	
35	300-255	300-245	Drop-in	Dual	•		•	
36	300-330	300-315	Drop-in	Single	•		•	
37	300-450	300-430	Drop-in	Single	•		•	
38	300-550	300-525	Drop-in	Single			•	
39	300-705	300-680	Drop-in	Dual				•
40	350-300	350-285	Drop-in	Dual	•		•	
41	350-385	350-365	Drop-in	Single	•		•	
42	350-690	350-655	Drop-in	Dual				•
43	350-780	350-745	Integrated	Dual	•		•	
44	350-450	350-430	Drop-in	Dual	•		•	
45	350-530	350-505	Drop-in	Dual	•		•	
46	350-685	350-650	Integrated	Dual	•			
47	350-845	350-805	Integrated	Dual			•	
48	400-340	400-325	Drop-in	Dual	•		•	
49	400-525	400-500	Drop-in	Dual			•	
50	400-535	400-510	Drop-in	Single	•	•		
51	400-580	400-550	Drop-in	Dual			•	
52	400-800	400-76-	Integrated	Dual			•	
53	400-970	400-9254	Integrated	Dual			•	
54	450-390	450-370	Drop-in	Dual	•		•	
55	500-450	500-430	Drop-in	Dual	•		•	
56	500-525	500-500	Integrated	Dual	•			
57	500-625	500-605	Integrated	Dual	•			
58	500-715	500-690	Integrated	Dual	•			
59	500-920	500-875	Integrated	Dual			•	
60	600-575	600-540	Integrated	Dual	•			
61	600-610	600-580	Integrated	Dual	•			
62	600-810	600-770	Integrated	Dual		•		
63	600-1000	600-950	Integrated	Dual			•	
64	600-1115	600-1060	Integrated	Dual			•	
65	700-535	700-505	Integrated	Dual	•			
66	700-615	700-585	Integrated	Dual	•			
67	700-670	700-635	Integrated	Dual	•			
68	700-775	700-735	Integrated	Dual	•			
69	700-870	700-830	Integrated	Dual	•			
70	700-995	700-945	Integrated	Dual			•	
71	800-590	800-560	Integrated	Dual	•			

# 4 Installation

## 4.1 Preinstallation

### Precautions




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**WARNING:**

- When installing in a potentially explosive environment, make sure that the motor is properly certified.
  - You must ground (earth) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the ground (earth) lead to verify that it is connected correctly.
- 

**NOTICE:**

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

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Evaluate the installation in order to determine that the Net Positive Suction Head Available (NPSH<sub>A</sub>) meets or exceeds the Net Positive Suction Head Required (NPSH<sub>R</sub>), as stated by the pump performance curve.

### 4.1.1 Pump location guidelines




---

**WARNING:**

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. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

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Guideline	Explanation/comment
Keep the pump as close to the liquid source as practically possible.	This minimizes the 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.
Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety devices and control devices.	Acceptable devices: <ul style="list-style-type: none"> <li>• Pressure relief valves</li> <li>• Compression tanks</li> <li>• Pressure controls</li> <li>• Temperature controls</li> <li>• Flow controls</li> </ul> If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.
If the pump location is overhead, undertake special precautions to reduce possible noise transmission.	Consider a consultation with a noise specialist.

Guideline	Explanation/comment
When possible, locate the pump below the fluid level.	This facilitates priming, ensures a steady flow of liquid, and provides a positive suction head on the pump.

## 4.1.2 Foundation requirements

### Pump foundation

- A substantial foundation and footing should be built to suit local conditions and form a rigid support to maintain alignment.
- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the unit.
- If the foundation is installed over the floor, it must be properly bonded and tied to the floor.

### Foundation recommendations for 300 hp [220 kW] and smaller pumps and motors

- Floor weight can be included in the Pump Foundation weight calculation within the boundary of the Pump Foundation if properly attached/bonded to the floor. Base plate grouting weight can also be included in the pump foundation weight.
- Pump Foundations should extend 3" (76 mm) or more from pump base plate edges.
- The Pump Foundation width should include sufficient width to cover a 30 degree rule.
- Pump Foundation construction minimum requirements: 3000 psi (200 bar) concrete with steel re-enforcement.
- Pump Foundations should be a min of 1" (25 mm) above the floor to prevent water collection around the pump base plate.

### Foundation recommendations for 300 hp [220 kW] and larger pumps and motors

- Floor weight can be included in the Pump Foundation weight calculation within the boundary of the Pump Foundation if properly attached/bonded to the floor. Base plate grouting weight can also be included in the pump foundation weight.
- Pump Foundations should extend 6" (152 mm) or more from pump base plate edges.
- Pump Foundation width should include sufficient width to cover a 30 degree rule.
- Pump Foundation construction minimum requirements: 3000 psi (200 bar) concrete with steel re-enforcement.
- Multiple Larger Pumps on a common Pump Foundation is not a recommended practice due to machine vibration from the operating unit possibly damaging the idle units.
- Pump Foundations should be a min of 1" (25 mm) above the floor to prevent water collection around the pump base plate.

### Pump Foundation Width 30° Rule

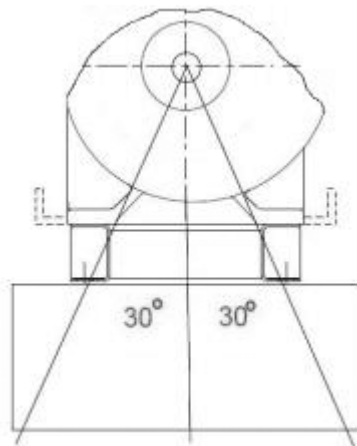


Figure 3: 30° Rule



The width of the pump foundation should be wider than the extended 30° lines.

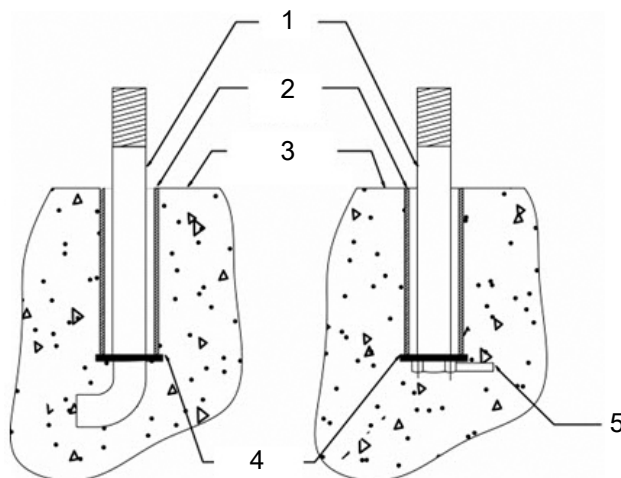
When viewing the pump from the end of the base plate establish a vertical line through the pump shaft center. On both sides of this vertical line a line that starts at the pump shaft center and extends downward at 30°. These lines must pass through the bottom of the foundation.

### Pumps on Spring Isolation Bases

- Spring mounting isolates the vibration from a pump from the floor or the foundation it is mounted on. Spring mounting can absorb piping loads from thermal expansion or reactions to internal pressure for properly supported piping systems. Be sure to anchor the piping before mounting to the pump.
- The pump unit can be installed on a spring isolated base. The spring isolators are not to be installed directly to the pump base plate given. The entire unit must be put on an isolation base that has the spring mounts attached to it. These isolation bases are welded structural steel with reinforcing and are filled with concrete or grout. The design requirements and installation of these isolation bases are the responsibility of the installing contractor.
- Use flexible piping on both suction and discharge sides with an isolation base. Flexible piping decreases the strain on the flanges.

### Anchor bolts

- Foundation bolts or anchors of the proper size and type must be used. Foundation bolts that are cast in place can be of either type shown in pump detail figure. Concrete anchors can also be used. The type selected must be consistent with local codes.
- The size of the foundation bolts or anchor should be 1/8" (3 mm) smaller diameter than the holes provided in the base plate. Refer to the pump submittal for the quantity and size.



1. Foundation bolt
2. Pipe sleeve
3. Concrete foundation
4. Washer
5. Lug

### Anchor bolt and hole sizes

- As a rule, the diameter of the anchor bolt hole should be 0.125 in (3 mm) larger than the diameter of the anchor bolt.

### 4.1.3 Requirements for setting the baseplate




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**CAUTION:**

- Use an anchor bolt and a plain, flat, type-W washer at each anchor bolt hole. Otherwise, the pump unit can shift. Failure to follow these instructions can result in serious property damage and/or moderate personal injury.
  - It is very important that the pump base is set level in order to avoid any mechanical difficulties with the motor or pump. If furnished with a motor, this pump was properly aligned at the factory. However, since all pump bases are flexible, they can spring and twist during shipment.
- 

**Base Plate Setting**

Place the pump unit on its concrete foundation, supporting it with steel wedges or shims. The wedges or shims should be machined and be put on both sides of each anchor bolt to provide a means for leveling the base. The wedge or shim length should be equal to or greater than the base rail width. The width of the wedge or shim should be at least four times the diameter of the anchor bolt. It is acceptable to place additional shims between the existing anchor bolts. Use an anchor bolt for each anchor bolt hole provided.

---


**CAUTION:**

Equipment Damage. Use an anchor bolt and flat washer at each anchor bolt hole. Otherwise, shifting of the pump unit may occur. Failure to follow these instructions could result in serious property damage and/or moderate personal injury. It is very important that the pump base be set level to avoid any mechanical difficulties with the motor or pump. This pump was properly aligned (if furnished with a motor) at the factory. However, since all pump bases are flexible, they may spring and twist during shipment. Do not pipe the pump until it is realigned. After piping is completed and after the pump is installed and bolted down, align it again. It may be necessary to re-adjust the alignment from time to time while the unit and foundation are new.

---

This pump is available in both clockwise and counterclockwise rotation. An arrow cast into the pump body shows the direction of rotation.

**Foundation checklist**

You must fulfill these requirements before the foundation is ready for pump installation:

- Place the pump unit on its concrete foundation and support it with steel wedges or shims.
- Machine the wedges or shims and then place them on both sides of each anchor bolt in order to provide a means to level the base.
- Make sure that the wedge or shim width is equal to or greater than the base rail width.
- Make sure that the length of the wedge or shim is at least four times the diameter of the anchor bolt.
- You can place additional shims between the existing anchor bolts. Use an anchor bolt for each anchor bolt hole provided and use plain, flat type-W washers with each anchor bolt.

**Baseplate checklist**

You must fulfill these requirements before the baseplate is ready for pump installation:

- Set the baseplate on the foundation and level it using shims under each rail mounting hole.
- Make sure that the size of the shims is equal to or greater than the rail width.
- Make sure that the length of the shim is at least four times the diameter of the rail mounting bolt.

- Make sure that the shim thickness is at least 0.06 in. (1.52 mm) thick. If the base is grouted then the shims need to be thicker.
- Make sure that the base is anchored to the foundation with bolts in all rail foundation holes. Optionally, you can place shims under the rail between the rail mounting bolts.

### Piping check

Do not pipe the pump until it is realigned.

After piping is completed and after the pump is installed and bolted down, align it again. You might need to re-adjust the alignment on a few occasions while the unit and foundation are new.

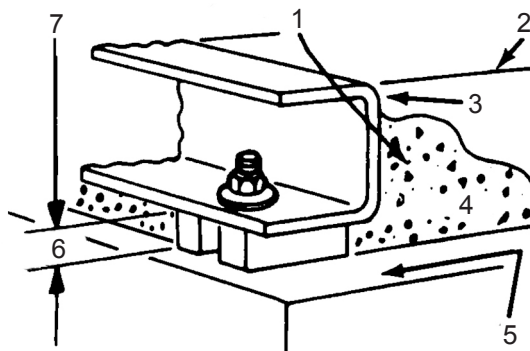
### Grouting

Grout the baseplate after the pump unit has been leveled, securely bolted to the floor, and properly aligned. Use a high precision non-shrinking grout inside the pump baseplate.

## 4.2 Level the base on a concrete foundation

Place 1.00 in. (25.40 mm) thick steel shims or wedges on both sides of each anchor bolt in order to support the pump .

This also provides a means of leveling the base.



1. Locate the shims to allow removal after grouting.
2. Grout only to top of base rail
3. Pump base rail
4. Grout
5. Concrete foundation
6. 1" (25.40 mm) Gap
7. Allow 1" for shims. Place on both sides of anchor bolts.

## 4.3 Coupling alignment



### WARNING:

Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.

### Alignment guidelines

Follow these guidelines when you align the coupling:

- Only perform alignment by moving or shimming the motor.
- Since adjustments in one direction can alter the alignment in another direction, check the alignment in all directions after you make a correction.
- Make sure that the pump and motor bolts are tight when you take all measurements.
- Perform a final alignment check after the unit reaches its final operating temperature.

### 4.3.1 Prepare for alignment

The standard coupling selection for e-XC pumps are TB Wood's® Dura-Flex® non-spacer elastomeric couplings and Falk® Steelflex® Type T10 close-coupled grid couplings. For other coupling types or brands, refer to the coupling manufacturer's installation instructions and alignment data. Always consult the coupling manufacturer's installation manual for detailed instructions and the most up-to-date service information.

1. Check the pump and motor shafts and remove any paint, burrs, and rust.
2. Slide the hubs and bushings on the shafts with keys.
3. Hold one half element on the hubs in order to determine the appropriate hub spacing.
4. If you use spacer elements with high speed rings, hold both half elements on the hubs in order to make sure the hubs do not interfere with the rings.
5. You can install the hubs with the hub extension facing in or out. Make sure the shaft extends into the hubs at least 0.8 times the diameter of the shaft.
6. Lightly fasten the hubs to the shafts in order to prevent them from moving during alignment.
7. Align the hubs to the values shown in 'Maximum allowable coupling misalignment'. Alignment may be performed with lasers, dial indicators, or with a straight edge and calipers.

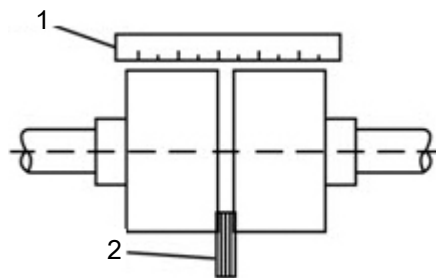
### 4.3.2 Align the pump using a straight edge and calipers

1. Check the angular misalignment:

Tool	Procedure
Calipers	<ol style="list-style-type: none"> <li>1. Gauge the distance between the two hubs at various points around the circumference. Do not rotate the shafts.</li> <li>2. Reposition the equipment until the difference between the minimum and maximum distance values is within the permissible range.</li> </ol>
Feeler gauges	<ol style="list-style-type: none"> <li>1. Insert feeler gauges between the coupling faces at various points around the circumference. Do not rotate the shafts.</li> <li>2. Reposition the equipment until the difference between the minimum and maximum distance values is within the permissible range.</li> </ol>

2. Check the parallel alignment:
  - a) Place a straight edge across the two hubs.
  - b) Measure the maximum offset at various points around the periphery of the hubs. Do not rotate the shafts.
  - c) Reposition the equipment until the offset is within the permissible range.

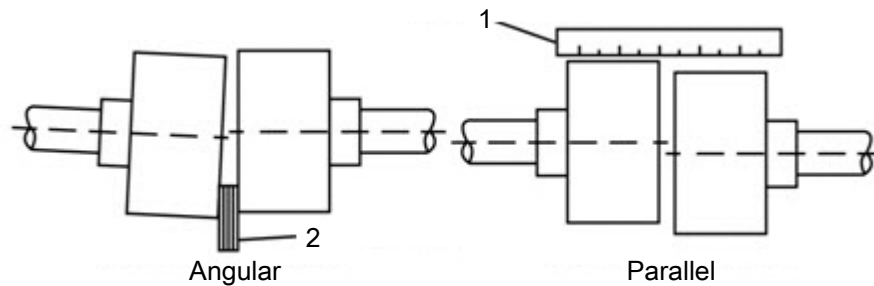
The following figure demonstrates an acceptable alignment where both the parallel and angular alignments are correct.



1. Straight edge
2. Feeler gauge

Figure 4: Check the alignment using a straight edge - correct

The following figure demonstrates a poor alignment where both parallel and angular alignments do not fall within the allowable misalignment specifications.



1. Straight edge
2. Feeler gauge

Figure 5: Check the alignment using a straight edge - incorrect

The following figure demonstrates how to measure angular misalignment using calipers. The angle between the two arrows is the degree of angular misalignment between the hubs. The difference between measurements L1 and L2 correlates to the degree of misalignment.

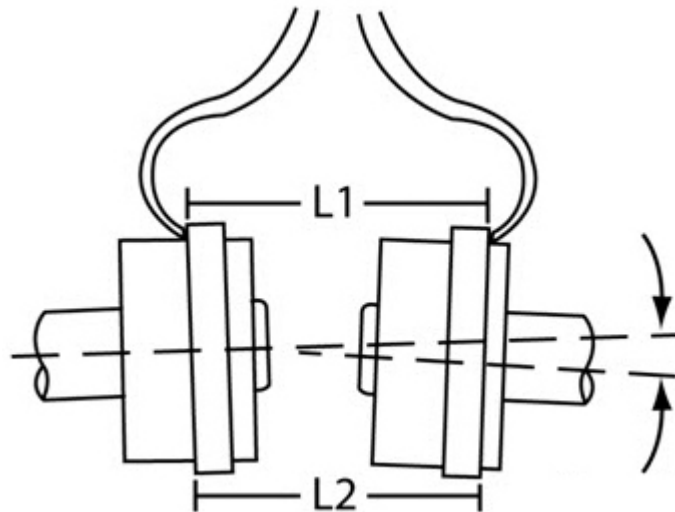
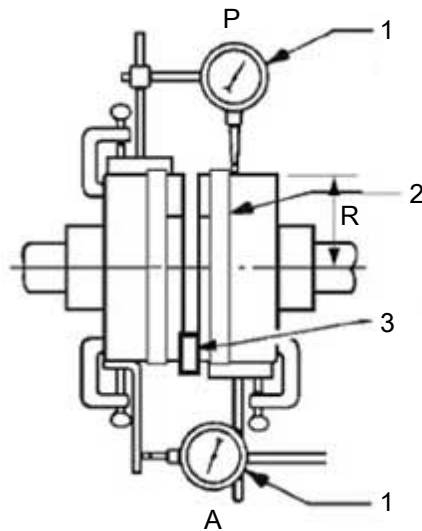


Figure 6: Check the alignment using calipers

### 4.3.3 Align the pump using a dial indicator

1. Check the angular misalignment:
  - a) Mount the dial indicator base to one coupling half, or shaft.
  - b) Position the dial indicator button on the front face or rear face of the opposite coupling half.
  - c) Mark the index lines on the coupling halves as the following Figure shows:



A	Angular alignment
P	Parallel alignment
1	Dial indicators
2	Index line
3	Resilient separator

Figure 7: Pump alignment via dial indicator

- d) Set the dial to zero.
- e) Rotate both coupling halves together and make sure that the index lines remain matched.
- f) Reposition the equipment until the offset is within the permissible value.
- 2. Check the parallel misalignment:
  - a) Mount the dial indicator base to one coupling half, or shaft.
  - b) Position the dial indicator button on the outside diameter of the opposite coupling half.
  - c) Set the dial to zero.
  - d) Rotate both coupling halves together and make sure that the index lines remain matched.
  - e) Reposition the equipment until the offset is within the permissible value.

### 4.3.4 Maximum allowable coupling misalignment

#### TB Wood's® Dura-Flex® Couplings

TB Wood's® Dura-Flex® elastomeric coupling alignment guidelines shown are also listed in the coupling service manual published by TB Wood's®. Refer to the service manual for more detailed information regarding fastener torque values, detailed installation instructions, and more.

The following figure defines the allowable parallel gap for a given degree of angular misalignment.

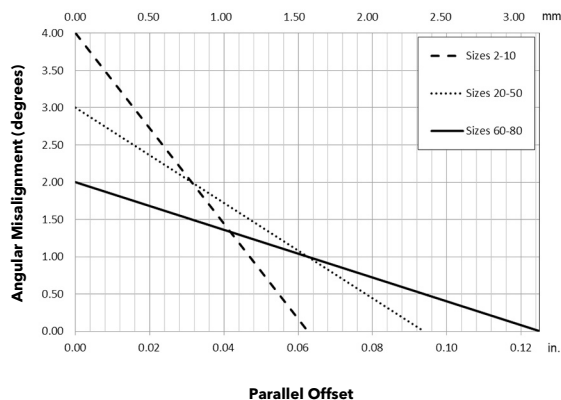


Figure 8: Acceptable parallel offset for TB Wood's® Dura-Flex® elastomeric couplings

The following table relates the difference in measurement of the L1 and L2 dimensions shown in Figure 6 of section 4.3.2 to the degree of angular misalignment between coupling hubs.

Table 2: Allowable angular misalignment gap

Hub Size	1° angular misalignment	2° angular misalignment	3° angular misalignment	4° angular misalignment
	in. (mm)	in. (mm)	in. (mm)	in. (mm)
WE2	0.03 (0.8)	0.07 (1.7)	0.10 (2.5)	0.13 (3.3)
WE3	0.04 (1.0)	0.08 (2.1)	0.12 (3.1)	0.16 (4.1)
WE4	0.05 (1.1)	0.09 (2.3)	0.14 (3.5)	0.18 (4.6)
WE5	0.06 (1.4)	0.11 (2.8)	0.16 (4.2)	0.22 (5.5)
WE10	0.06 (1.6)	0.13 (3.2)	0.19 (4.9)	0.22 (5.5)
WE20	0.08 (2.0)	0.16 (4.0)	0.23 (5.9)	N/A
WE30	0.10 (2.4)	0.19 (4.8)	0.28 (7.2)	N/A
WE40	0.12 (2.9)	0.23 (5.9)	0.35 (8.8)	N/A
WE50	0.14 (3.6)	0.28 (7.2)	0.43 (10.8)	N/A
WE60	0.15 (3.9)	0.31 (7.7)	N/A	N/A
WE70	0.16 (4.1)	0.32 (8.2)	N/A	N/A
WE80	0.20 (5.0)	0.39 (10.0)	N/A	N/A

### Falk® Steelflex® Couplings

Falk® Steelflex® T10 grid coupling alignment guidelines shown are also listed in the coupling service manual published by Rexnord Falk®. Refer to the service manual for more detailed information regarding coupling lubrication, fastener torque values, detailed installation instructions, and more.

The following table shows both parallel and angular misalignment data as recommended by the coupling manufacturer.

Table 3: Maximum parallel and angular misalignment offsets for Falk® Steelflex® T10 couplings

Hub Size	Parallel Offset	Angular Offset
	in. (mm)	in. (mm)
1020T	0.006 (0.15)	0.003 (0.08)
1030T	0.006 (0.15)	0.003 (0.08)
1040T	0.006 (0.15)	0.003 (0.08)
1050T	0.008 (0.20)	0.004 (0.10)

Hub Size	Parallel Offset	Angular Offset
	in. (mm)	in. (mm)
1060T	0.008 (0.20)	0.005 (0.13)
1070T	0.008 (0.20)	0.005 (0.13)
1080T	0.008 (0.20)	0.006 (0.15)
1090T	0.008 (0.20)	0.007 (0.18)
1100T	0.010 (0.25)	0.008 (0.20)
1110T	0.010 (0.25)	0.009 (0.23)
1120T	0.011 (0.28)	0.010 (0.25)
1130T	0.011 (0.28)	0.012 (0.30)
1140T	0.011 (0.28)	0.013 (0.33)

### 4.3.5 Final alignment

You cannot perform the final alignment until you initially operate the pump long enough to reach operating temperature. When the pump reaches the normal operating temperature, then secure the pump and re-check the alignment. Make sure that you compensate for temperature accordingly.

**NOTICE:**

Elastomeric couplings are specifically designed to accommodate angular shaft misalignment, as well as parallel offset of the pump and motor shafts. However, the amount of the offset and/or misalignment depends on the style of the applied flexible coupling. If you do not correct this coupling misalignment, there is a significant impact on the overall life of the mechanical seals and the bearings of the pump.

## 4.4 Piping checklists

### 4.4.1 General piping checklist



**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.

#### Piping guidelines

Guidelines for piping are given in the Hydraulic Institute Standards available from the Hydraulic Institute at 9 Sylvan Way, Parsippany, NJ 07054-3802. You must review this document before you install the pump.

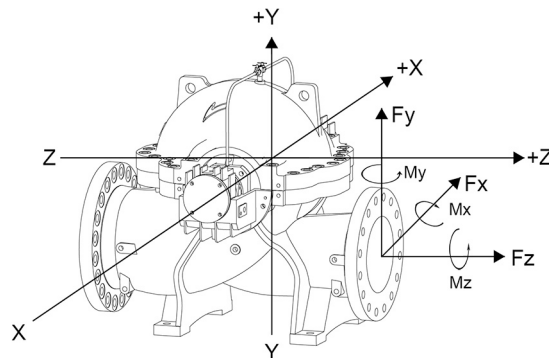


Figure 9: Forces and moments for horizontally split case pumps



## Flange loads and configuration

For a listing of all e-XC pump models, refer to the e-XC technical brochure.

Table 4: Flange Loading Ratings

Flange Loading Ratings								
Dia. in. [mm]	Force lbf [N]				Moment lbf•ft [Nm]			
	F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	ΣF	M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>	ΣM
2.5 [65]	202 [900]	225 [1000]	184 [820]	355 [1580]	354 [480]	254 [345]	288 [390]	520 [705]
3 [80]	270 [1200]	301 [1340]	243 [1080]	472 [2100]	376 [510]	277 [375]	321 [435]	575 [780]
4 [100]	319 [1420]	355 [1580]	288 [1280]	558 [2480]	465 [630]	332 [450]	420 [570]	675 [915]
5 [125]	405 [1800]	450 [2000]	364 [1620]	706 [3140]	553 [750]	387 [525]	454 [615]	808 [1095]
6 [150]	540 [2400]	602 [2680]	486 [2160]	940 [4180]	719 [975]	509 [690]	586 [795]	1062 [1440]
8 [200]	670 [2980]	751 [3340]	607 [2700]	1174 [5220]	985 [1335]	697 [945]	808 [1095]	1449 [1965]
10 [250]	805 [3580]	899 [4000]	724 [3220]	1407 [6260]	1339 [1815]	951 [1290]	1095 [1485]	1969 [2670]
12 [300]	940 [4180]	1048 [4660]	845 [3760]	1641 [7300]	1715 [2325]	1217 [1650]	1405 [1905]	2522 [3420]
14 [350]	1075 [4780]	1196 [5320]	967 [4300]	1875 [8340]	2146 [2910]	1538 [2085]	1759 [2385]	3164 [4290]
16 [400]	1209 [5380]	1344 [5980]	1088 [4840]	2109 [9380]	2644 [3585]	1881 [2550]	2168 [2940]	3894 [5280]
18 [450]	1344 [5980]	1493 [6640]	1209 [5380]	2343 [10420]	3197 [4335]	2268 [3075]	2611 [3540]	4713 [6390]
20 [500]	1479 [6580]	1641 [7300]	1331 [5920]	2576 [11460]	3784 [5130]	2699 [3660]	3109 [4215]	5598 [7590]
22 [550]	1614 [7180]	1789 [7960]	1448 [6440]	2810 [12500]	4470 [6060]	3186 [4320]	3673 [4980]	6616 [8970]
24 [600]	1879 [8360]	2095 [9320]	1691 [7520]	3282 [14600]	3430 [4650]	2434 [3300]	2810 [3810]	5045 [6840]
28 [700]	2149 [9560]	2392 [10640]	1933 [8600]	3750 [16680]	4293 [5820]	3076 [4170]	3518 [4770]	6328 [8580]
32 [800]	2419 [10760]	2689 [11960]	2176 [9680]	4217 [18760]	5288 [7170]	3762 [5100]	4337 [5880]	7789 [10560]

## Checklist

Check	Explanation/comment	Checked
Always install the piping to the pump.	Do not move the pump to the pipe. This can make the final alignment impossible.	
Check that the suction and discharge piping are supported independently near the pump and are properly aligned.	This prevents strain from being transmitted to the pump when the flange bolts are tightened. Also use pipe hangers or other supports at necessary intervals in order to provide support.	
When you use expansion joints, check that they are installed beyond the piping supports closest to the pump.	Do not install expansion joints next to the pump or in any position that would cause a strain on the pump that results from system pressure changes.	
Check that tie bolts are used with expansion joints.	This prevents pipe strain.	

Check	Explanation/comment	Checked
Check that the piping is installed as straight as possible and that any unnecessary bends are avoided. Where necessary, use 45° or long-sweep 90° fittings.	This helps to decrease friction losses.	
Check that all piping joints are leak tight.	–	
Check that the inside diameters of the flanged joints match properly.	–	
Check that burrs and sharp edges are removed when you make up the joints.	–	
When you anticipate considerable temperature changes, check that equipment for absorbing expansion is installed in the system.	This helps to avoid strain on the pump.	
When you use an isolation pad, check that flexible piping is used on both the suction and discharge sides of the pump.	–	
Check that the pipeline has isolation valves around the pump and a drain valve in the suction pipe.	–	

#### 4.4.2 Suction piping checklist

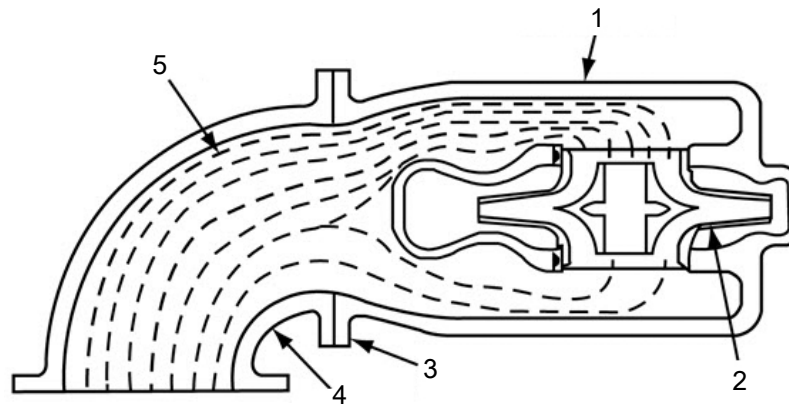
The sizing and installation of the suction piping is extremely important. It must be selected and installed so that pressure losses are minimized and sufficient liquid flows into the pump when it is started and operated. Many NPSH problems can be directly attributed to improper suction piping systems.

##### Piping checklist

Check	Explanation/comment	Checked
Keep the suction piping short in length, as direct as possible, and never smaller in diameter than the pump suction opening.	If the suction pipe is short, the pipe diameter can be the same size as the suction opening. If longer suction piping is required, pipes should be one or two sizes larger than the opening depending on piping length.	
Check that the elbows in the suction piping for horizontal double-suction pumps are installed per the Hydraulics Institute Standards since there is always an uneven turbulent flow around an elbow.	When there is an elbow in a position other than the vertical when in relation to the pump suction nozzle, this causes more liquid to enter one side of the impeller than the other. The result is highly unequalized thrust loads that overheat the bearings and cause rapid wear, which adversely affects the hydraulic performance. See the Example of unbalanced loading figure.	
Check that pipe reducers on the inlet side have no more than one pipe diameter reduction in a single reducer.	This avoids excessive turbulence and noise.	
When operating on a suction lift, check that the suction pipe slopes upward to the pump nozzle.	A horizontal suction line must have a gradual rise to the pump. Any high point in the pipe can become filled with air and prevent proper operation of the pump.	
(Optional) You can install a short section of pipe adjacent to the suction flange such as Dutchman or a spool piece that is designed so that it can be readily dropped out of the line.	This facilitates the cleansing of the liquid passage of the pump without dismantling the pump. With this arrangement, anything that clogs the impeller is accessible with the removal of the spool piece or pipe section.	

### Example of unbalanced loading

This figure shows the unbalanced loading of a double-suction impeller due to the uneven flow around an elbow that is adjacent to the pump:



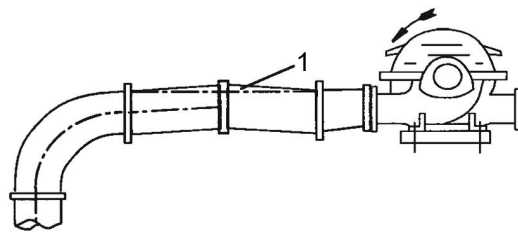
1. Pump casing
2. Impeller
3. Pump suction flange
4. Suction elbow
5. Water velocity increases here and causes a greater flow to one side of the impeller.

Figure 10: Unbalanced loading of double-suction impeller

### Examples

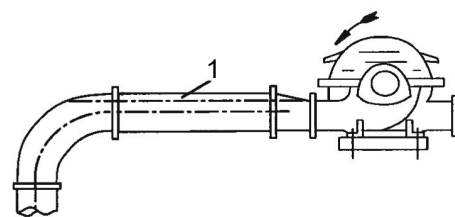
1. Level centerline of pipe
2. Check valve
3. Gate valve
4. Increaser

Figure 11: Suction pipe installed with a gradual rise to the pump - correct



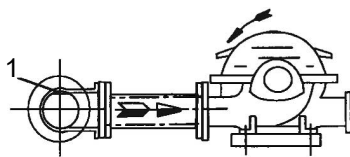
1. Air pocket

Figure 12: Suction pipe installed with a gradual rise to the pump - incorrect



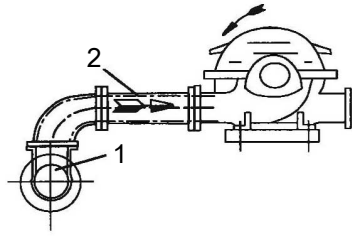
1. Air pocket

Figure 13: Suction pipe installed with a reducer - incorrect



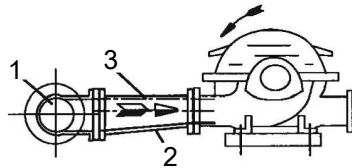
1. Air pocket

Figure 14: Incorrect



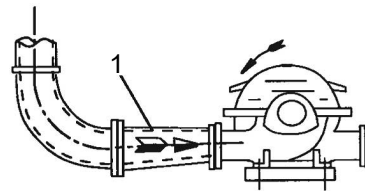
- 1. No air pockets
- 2. Gradual rise

Figure 15: Correct



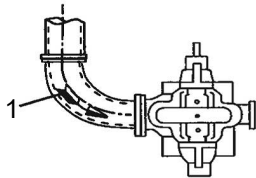
- 1. No air pockets
- 2. Eccentric reducer

Figure 16: Gradual rise to the pump - correct



- 1. Distance plus eccentric reducer straightens the flow

Figure 17: Suction pipe above the pump - correct



- 1. Path of the water

Figure 18: Suction pipe above the pump - incorrect

### 4.4.3 Suction-piping valve considerations

#### Suction valves

Before you install suction valves in the suction piping, review these considerations:

- Make sure that the suction piping valves are placed right before the run of recommended straight pipe.
- Never throttle the pump with the use of a valve on the suction side of the pump.
- Only use suction valves to isolate the pump for maintenance purposes.
- Always install the valve in a position that avoids the formation of air pockets.

#### Foot valves

If the pump operates under static suction lift conditions, you can install a foot valve in the suction line in order to avoid the necessity of priming each time you start the pump.

Before you install foot valves in the suction piping, review these considerations:

- Make sure this valve is of the flapper type, rather than the multiple spring type, and that it is sized to avoid excessive friction in the suction line.
- Size the foot valve and pipe in order to maximize  $NPSH_A$  to the pump by minimizing suction line losses.
- When foot valves are used, or where there are other possibilities of water hammer, close the discharge valve slowly before you shut down the pump.

#### Check valves

In normal applications, check valves are placed in the discharge piping. Before you use a check valve in the suction piping, consider the added pressure drop to the pump, the potential of water hammer, and the chance of allowing the entire pump volute to be exposed to the discharge pressure.

### 4.4.4 Discharge piping considerations

#### Maximum velocity

Make sure that the maximum velocity in the discharge piping does not exceed 15 feet per second (4.6 m/s). If a check valve is present in the outlet piping, this value must be reduced.

#### Discharge piping and fitting sizes

System losses, life-cycle costs, and process considerations usually determine the size of discharge piping and fittings. Some high energy pumps are sensitive to flow disturbing devices mounted close to the pump outlet. Consult Xylem when in doubt about the minimum required length of the straight pipe.

## 4.5 Pressure gauges and pump insulation

#### Installation and use of pressure gauges

Install properly-sized pressure gauges in both the suction and discharge nozzles in the gauge taps. The gauges enable easy observation of the pump operation and it is easy to determine if the pump is operating in conformance with the performance curve. Cavitation, vapor binding, or other unstable operations cause widely-fluctuating discharge pressure to be noted.



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**WARNING:**

Make sure that all components are properly guarded or insulated when operating at extremely high or low temperatures.

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### Proper pump insulation

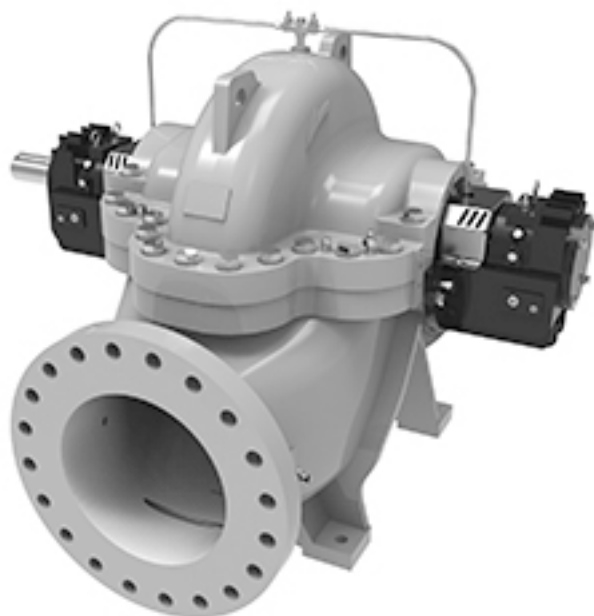


Figure 19: Proper pump insulation

You should not insulate the bearing housings, shown in dark gray, as this may cause overheating of bearings. You may insulate all other portions of the pump, shown in light gray.

# 5 Commissioning, Startup, Operation, and Shutdown

## 5.1 Preparation for startup



---

**WARNING:**

- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
  - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
  - Never operate a pump without a properly installed coupling guard. Personal injury will occur if you run the pump without a coupling guard.
  - Check the rotation of the power unit and pump in relation to that of the drive as shown by the arrows on the case. Rotate the drive manually before you apply power-checking rotation. Do not operate in the reverse direction of these arrows as serious damage or injury can occur.
- 

### System flushing

Flush new and old systems in order to eliminate all foreign matter. Heavy scale, welding splatter, and wire or other large foreign matter can clog the pump impeller. This reduces the capacity of the pump which then causes cavitation, excessive vibration, and/or damage to close clearance parts such as wear rings, seals, and sleeves.

### Pre-operation inspections

Perform these inspections before you start the pump:

- Check the alignment between the pump and motor.  
See Coupling alignment in the Installation chapter for alignment requirements.
- Check all connections to the motor and starting device against the wiring diagram.
- Check the voltage, phase, and frequency on the motor nameplate against the line circuit.
- Check the suction and discharge piping and the pressure gauges for proper operation.
- Check that you can turn the rotating element by hand in order to verify that it rotates freely.
- Check the stuffing box adjustment, lubrication, and piping.
- Check the driver lubrication.

Refer to the driver Installation, Operation, and Maintenance manual.

- Check that the pump bearings are properly lubricated.
- Check that the coupling is properly lubricated, if required.
- Check that the pump is full of liquid and that all valves are properly set and operational, with the discharge valve closed and the suction valve fully open. Purge all air from the top of the casing.
- Check the direction of the rotation.

Be sure that the driver operates in the direction indicated by the arrow on the pump casing. Serious damage can result if you operate the pump with the incorrect rotation. Check the rotation each time you disconnect the motor leads.

## 5.2 Pump priming




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**CAUTION:**

Do not run the pump dry.

---

### When to prime the pump

You must prime the pump before startup. When it is possible, locate the pump below the fluid level in order to facilitate priming and to ensure a steady flow of liquid. This condition provides a positive suction head on the pump. It is also possible to prime the pump by pressurizing the suction vessel.

### Methods for pump priming

Pump installation	Priming method
Positive head on the suction	Open the suction valve and loosen the vent plug on top of the casing. This allows air to be purged from the casing. While you vent the air from the pump body, always rotate the pump shaft a few times by hand.
Suction lift	Priming must be done by other methods such as foot valves, ejectors, or by manually filling the casing and suction line.

## 5.3 Fill the system

1. Locate the vents at the highest point so that trapped gases and air can escape. However, if the gases are flammable, toxic, or corrosive, then vent them to an appropriate place in order to prevent harm to personnel or to other parts of the system.
2. Check the pipe hangers and anchors to make sure that they are properly set to take the additional weight of the pumped fluid.
3. Close all of the drains.
4. Fill the system slowly so that excessive velocities do not cause rotation of the pumping elements.  
Rotation of the pumping elements can cause damage to the pump or its driver.
5. Check the adequacy of the anchors and hangers:
  - a) Mount a dial indicator off of any rigid structure not tied to the piping.
  - b) Set the indicator button on the pump flange in the axial direction of the nozzle.  
If the indicator moves as the filling proceeds, then the anchors and supports are not adequate or are not set properly. Take corrective measures.

## 5.4 Start the pump

---

**NOTICE:**

If the pump loses its prime during start-up, shut it down and correct the condition before you repeat this procedure.

---

1. Close the drain valves and the valve in the discharge line.
2. Fully open all valves in the suction line.
3. Prime the pump.
4. Start the pump driver.  
You might need to warm up the turbines and engines. Consult the instructions provided by the manufacturer.
5. When the pump is operating at full speed, slowly open the discharge valve.



Perform this step immediately after start-up in order to prevent damage to the pump from operating with zero flow.

## 5.5 Pump operation checklist



### 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.

Requirement	Description	Checked
Driver/pump rotation	Check the rotation each time you reconnect the motor leads. Be sure that the driver operates in the direction indicated by the arrow on the pump casing. Rough operation and extreme vibration can result if you operate the pump in the wrong direction.	
Flow	An accurate measurement of flow rate (volume/time) is difficult in the field. Venturi meters, flow nozzles, orifice plates, or timing the draw down in the wet well are all possible methods. Record any reading for future reference.	
Pressure	Check and record both suction and discharge pressure gauge readings for future reference. Also record voltage, amperage per phase, and pump speed. You can also record the kilowatts if you have an available indicating wattmeter.	
Temperature	Check and record bearing temperatures using a thermometer. Make sure that temperatures do not exceed 250°F (121°C).	
Vibration	The acceptable vibration level of a centrifugal pump depends on the rigidity of the pump and the supporting structure. Refer to the Hydraulic Institute Standards for a complete description and charts on various pumps.	
Sound	Field sound levels are difficult to measure because of background noise from piping, valves, drivers, and gears. Follow the recommendations in the Hydraulic Institute Standards.	
Output	Make all pump output adjustments with the discharge valves.	

## 5.6 Shut down the pump



### WARNING:

Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

1. Shut down the pump driver.  
Consult the manufacturer instructions for special operations.
2. Close the suction and discharge valves.

# 6 Maintenance

## 6.1 Maintenance schedule

### Maintenance inspections

A maintenance schedule includes these types of inspections:

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

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

### Routine maintenance

Perform these tasks whenever you perform routine maintenance:

- Lubricate the bearings.
- Inspect the seals.

### Routine inspections

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

- Check for unusual noise, vibration, and bearing temperatures.
- Check the pump and piping for leaks.
- Check the seal chamber and stuffing box for leaks.
  - Ensure that there are no leaks from the mechanical seals.

### Three-month inspections

Perform these tasks every three months:

- Check that the foundation and the hold-down bolts are tight.

### Annual inspections

Perform these inspections one time each year:

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

If the pump performance does not satisfy your process requirements, and the process requirements have not changed, then perform these steps:

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

### 6.1.1 Wear ring replacement

#### Maintenance schedule

It is important to monitor wear ring running clearances during annual inspections or whenever the pump is disassembled. Pump performance will be reduced as wear rings are worn down. Use feeler gauges to determine the gap size between each impeller wear ring and casing wear ring. Check multiple points around the wear rings as wear may not be uniformly distributed. The following table lists the approximate gap sizes that indicate when the wear rings should be replaced.

Table 5: Recommended replacement clearances

	Maximum untrimmed impeller diameter	Gap size where replacement is recommended	Gap size where replacement is required
Equal to or less than	16 in (410 mm)	0.012 in (0.30 mm)	0.018 in (0.45 mm)
Greater than	16 in (410 mm)	0.030 in (0.75 mm)	0.039 in (1.00 mm)

**NOTE:**

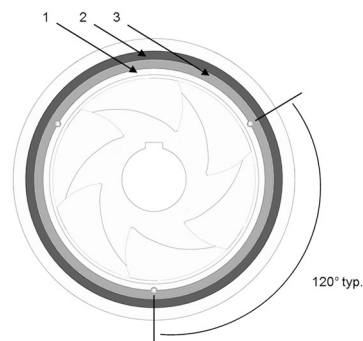
Impeller wear rings should only be replaced once during the lifetime of an impeller, assuming the impeller wear ring material is harder than the casing wear ring material. Casing wear rings may be replaced as needed.

If the casing wear ring material is harder than the impeller wear ring material, then the casing wear ring should only be replaced once per impeller lifetime. The impeller wear ring may be replaced up to two times before a new impeller assembly is required.

In both cases, identify the cause of wear before replacing the wear rings. Make sure to correct the problem after replacing the wear rings to protect the pump from future damage. If wear is nonuniform, there is likely excessive shaft deflection or misalignment present in the system.

**Impeller wear ring replacement**

Refer to the diagram below for the following instructions.



1. Impeller
2. Casing Wear Ring
3. Impeller Wear Ring

Before replacing impeller wear rings, ensure the replacement wear rings are of the same material as the impeller and new set screws are on hand for installation. Never reuse set screws from the previous wear ring installation. Thread locker, such as Loctite® 243, will be required for installation. To replace the impeller wear rings, perform the steps below for each impeller wear ring.

1. Unfasten the three (3) set screws, located 120° apart along the eye of the impeller, from the impeller wear ring.
2. Remove the old wear ring and clean the mating surface of the impeller before placing the new wear ring. Inspect the impeller for any signs of wear caused by loosening of set screws.
3. Place the new wear ring onto the impeller. Ensure the chamfered side of the wear ring faces outwards (away from the impeller). The chamfer is located along the inner diameter of the wear ring.
4. Fill the old set screw holes with thread locker.
5. Drill three new set screw locations set 120° apart and evenly spaced between the old screw locations. The holes should be centered between the mating faces of the impeller and impeller wear ring. Depending on the pump model, the hex set screws

are M6X1X8 mm or M8X1.25x10 mm. Check the size of the old set screws to confirm the drill size required.

6. Apply a bead of thread locker to each set screw and fasten them into the impeller and impeller wear ring.

### Casing wear ring replacement

Casing wear ring replacement is outlined in the standard disassembly and assembly procedures of the pump in [Disassembly](#) on page 44 and [Reassembly](#) on page 65 respectively.

It is important to note each casing wear ring utilizes two anti-rotational pins and two O-rings. O-rings and pins should be replaced whenever the casing wear rings are replaced.

## 6.2 Bearing and coupling lubrication

### Lubrication at initial startup

- Grease
  - Bearings are packed with grease at the factory.
  - Assuming the pump was stored in a clean and dry location before its first operation, the bearings will not require attention before starting the pump.
  - Monitor the bearings for an hour after pump startup to verify if they are operating correctly.
- Oil
  - Bearing housings will not be oiled at the factory prior to shipment.
  - See [Lubricate the bearings](#) on page 39 for installation instructions and lubrication guidelines.

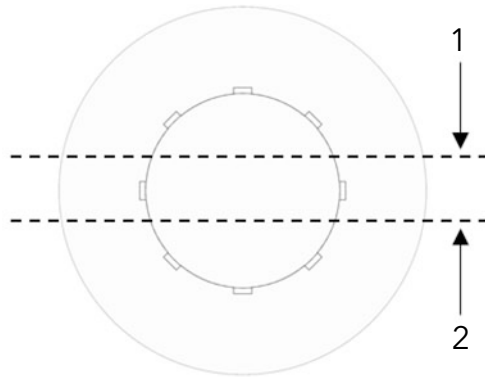


### WARNING:

Do not attempt to run the pump without first lubricating the bearings. Doing so will cause serious property damage.

### Lubrication schedule

- Grease
  - Periodic refilling of grease is not required. Regrease the bearings if the bearing housings are removed for maintenance reasons. It is recommended to hand pack grease onto the bearings before pressing them onto the shaft. Follow the standard greasing procedure, outlined in [Lubricate the bearings](#) on page 39, after assembling the bearing housing.
  - Changing out the grease is recommended every 3600 hours of operation at 2-pole speeds and 7200 hours at 4-pole speeds. If environment conditions are excessively dirty, wet, or above a 100°F (38°C) ambient temperature, then the grease should be changed at 50% of the stated timeframes. If temperatures are at or exceed 180°F (82°C) within the bearing housing, then the grease should be changed at 50% of the stated timeframes.
- Oil
  - Periodic addition of oil is required. Take care not to over or under fill the bearing cavity. Inspect the oil level of each bearing housing using the sight glasses provided with the pump. See the following figure for maximum and minimum oil level requirements.



1. Maximum fill
2. Minimum fill

**Figure 20: Recommended sight glass oil level**

- Add oil if the oil level is at or below the minimum fill line. Drain excess oil from the bearing cavity if the oil level is at or above the maximum fill line. Operating the pump at oil levels outside of the indicated range will cause bearing damage. Change the oil during routine maintenance to remove dirt and debris from the bearing cavity. For more detailed lubrication instructions, refer to [Lubricate the bearings](#) on page 39.
- In installations with moderate temperature changes, low humidity, and a clean atmosphere, the oil should be changed after 1000 hours of operation. Conditions may permit extended oil change periods anywhere from an additional 200-4000 hours. Inspect the oil frequently for moisture, dirt, or signs of breakdown especially during the first 1000 hours of operation.

### Bearing operating temperatures

The maximum operating temperature for ball bearings should not exceed 250°F (121°C). If the temperature inside the bearing housing rises above this limit, shut down the pump and determine the cause. Use the appropriate and properly calibrated equipment, such as RTDs or thermocouples, when obtaining measurements

Note: Hand-held infrared thermometers are not recommended for accurate temperature measurements of bearings or the bearing housing. IR measurements are highly sensitive to surface properties, measurement distance, humidity, and proper emissivity calibration. Furthermore, IR thermometers will only provide the surface temperature of the bearing housing. Conditions inside the bearing housing may be hotter than the surface temperature indicated by an IR thermometer

### Coupling lubrication

Coupling type	Lubrication requirements
Grid couplings	Grid or gear tooth couplings (Falk Grid Steelflex or Falk Crowned Tooth coupling for instance) are initially lubricated with Falk Long Term Grease (LTG) and do not require relubrication for up to three years. If coupling leaks grease, or is exposed to extreme temperatures or excessive moisture, more frequent lubrication may be required.  Use coupling manufacturer's recommended grease to provide trouble free performance.
Polymer and elastomeric element-type	Polymer and elastomeric element-type couplings are maintenance-free and do not require lubrication. If other types of couplings are used, follow maintenance instructions of coupling manufacturer.

## 6.2.1 Lubricate the bearings

### Grease lubrication

Before you begin this procedure, make sure that you have these items:

- New bearings
- Exxon Polyrex EM grease  
Exxon Polyrex EM grease is the only recommended grease. Do not use any other grease.
- Grease gun
- Hardware removal tools

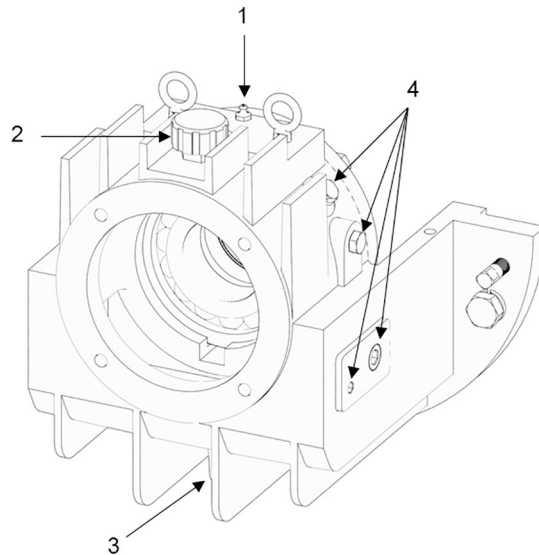


Figure 21: Standard grease lubrication components

1. Grease cup
2. Breather vent
3. Drain plug
4. Miscellaneous plugs

Thoroughly clean out the bearing housing before regreasing the bearings. Ensure all dust, debris, or other contaminants are removed.

1. Seal the bearing housing, ensure all miscellaneous plugs are fastened into place excluding the grease drain located underneath the bearing housing. This will ensure proper filling of the bearing cavity and also keep foreign debris from entering the bearing housing.
2. Insert the breather vent into the top of the bearing housing.
3. Insert the grease cup into the top of the bearing housing.
4. Using a grease gun, inject Exxon Polyrex EM grease into the grease cup. Stop adding grease when it exits the drain plug located underneath the bearing housing.
5. Run the pump for 30-60 minutes to remove excess grease from the bearing cavity.
6. Insert the drain plug beneath the bearing housing.



**WARNING:**

Do not over-grease the bearings. Too much grease may overheat the bearings and cause property damage.

**Oil lubrication**

Oil lubrication is maintained with Trico® constant level oilers which are monitored with sight glasses mounted to the side of the bearing housing. The standard Trico® oiler requires venting at the top of the bearing housing. See section 6.2 for more information on monitoring the oil level with a sight glass. The following figure demonstrates the standard oil lubrication setup.

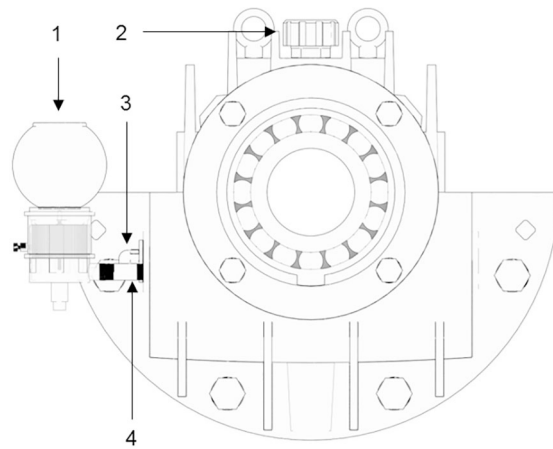


Figure 22: Oil lubrication components

1. Oiler
2. Breather vent
3. Sight glass
4. Pipe nipple connection

Before assembling oiler components onto the pump, ensure all required components are on hand. Oiler kits should include (2) glass bulb oilers, (2) pipe nipple connections, (2) sight glasses, (2) breather vents, and (4) pipe plugs. Flush the bearing housing of dirt and debris using a light oil to prevent bearing damage during pump operation.

Note: Only one bulb oiler and sight glass are required per bearing housing. Choose an appropriate side of the pump for installation of oiler components. Ensure all oiler components are easily accessible for future maintenance.

1. Thread the pipe nipple connection into the smaller diameter port along the side of the bearing housing.
2. Thread the sight glass into the larger diameter port along the side of the bearing housing.
3. Plug unused pipe connection and sight glass ports located on the other side of the bearing housing. Ensure any unused monitoring equipment ports are plugged.
  1. Note: It is important to properly seal the bearing housing to prevent foreign debris and moisture from accumulating within the bearing cavity. Follow routine maintenance guidelines outlined in [Maintenance schedule](#) on page 36 and [Bearing and coupling lubrication](#) on page 38 to ensure long bearing life.
4. Fasten the pipe plug located underneath the bearing housing into place.
5. Thread the breather vent into the top of the bearing housing.

#### Oil the bearing housing

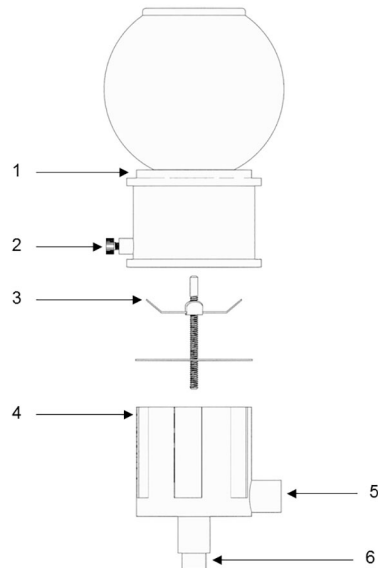


Figure 23: Oiler components

1. Upper oiler housing and bulb
2. Thumb screw
3. Oil level adjuster
4. Lower oiler housing
5. Primary process connection point
6. Alternate process connection port (plugged)

A Mobile Oil, DTE Medium, or equivalent, is recommended. See the following table for acceptable oil specifications.

Note:

- Oils from different suppliers should not be mixed.
- Engine oils are not recommended.
- The oil should be non-foaming, well refined, high grade, straight cut, filtered mineral oil. The oil must be free of water, sediment, resin, soaps, acid, and fillers of any kind.

Table 6: Recommended oil properties

Saybolt viscosity at 100°F (37.8°C)	215 SSU - 240 SSU
Saybolt viscosity at 210°F (99°C)	49 SSU
Viscosity index, minimum	95
API gravity	28 - 33
Pour point, maximum	+20°F (-6.7°C)
Flash point, minimum	400°F (204°C)
Additives	Rust and oxidation inhibitors
ISO viscosity	46

1. Disassemble the oiler by unfastening the thumb screw on the side. Separate the upper housing and bulb from the lower housing. Remove the level adjuster from the interior of the lower housing.
2. Spin the wing nut of the oil level adjuster to the desired level. The adjuster should be set such that the oil level within the bearing housing will be centered with the lowest ball of the bearing. The position of the sight glass is aligned with this level. See [Figure 20: Recommended sight glass oil level](#) on page 39 for more information.



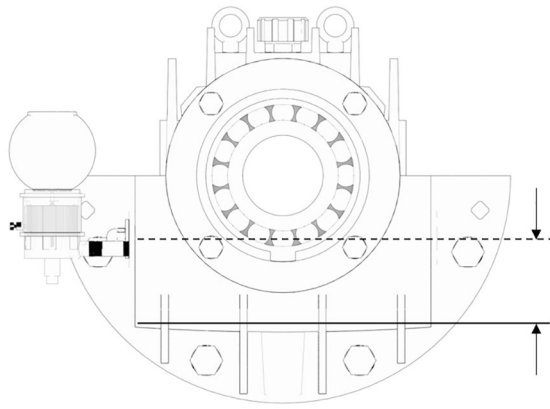


Figure 24: Recommended oil level

3. Screw the lower housing of the oiler onto the pipe connection. Make sure the alternate process connection port is plugged.
4. Place the level adjuster inside the lower housing.
5. Fill the lower housing with oil. Keep adding oil until the proper level is achieved.
6. Invert the upper housing and bulb. Fill the bulb  $\frac{3}{4}$  of its volume with oil.
7. Carefully turn the upper housing upright while blocking the oil feed line coming from the bulb. Fit the upper housing onto the lower housing. Secure the two halves together by fastening the thumb screw.

### 6.3 Mechanical-seal maintenance



**WARNING:**

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



**CAUTION:**

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

#### Mechanical seal life

The life of a mechanical seal depends on the cleanliness of the pumped fluid. Due to the diversity of operating conditions, it is not possible to give definite indications as to the life of a mechanical seal. In clean water applications, typical mechanical seal life spans two to three years.

### 6.4 Flood-damaged pump maintenance



**WARNING:**

- Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.
- Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.

Perform these maintenance tasks if your pump has been flood damaged:

- Replace bearings and grease if the pump has been subjected to flood conditions.
- Make sure that the motor is evaluated by a qualified motor shop before you place it back into service.

- Clean and inspect mechanical seals, stuffing boxes, and packing rings and replace them if it is necessary.
- Replace couplings that require lubrication.

## 6.5 Disassembly

### 6.5.1 Disassembly precautions

This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to.



---

**WARNING:**

- Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, open vent or drain valves, or disconnect the piping.
- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

---

**NOTICE:**

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

---

### 6.5.2 Drain the pump



---

**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.
  2. Open the drain valve.  
Do not proceed until liquid stops coming out of the drain valve. If liquid continues to flow from the drain valve, the isolation valves are not sealing properly and you must repair them before you proceed.
  3. Leave the drain valve open and remove the drain plug located on the bottom of the pump housing.  
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.

### 6.5.3 Remove the hex coupling guard for guards with vertical supports

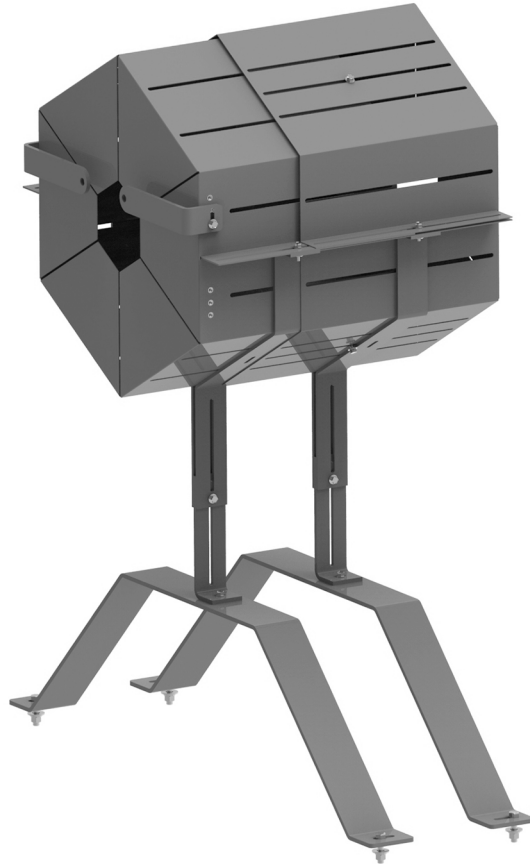


Figure 25: Fully assembled coupling guard

1. Identify the parts of the coupling guard. The following instructions will reference items in the following figure and table.

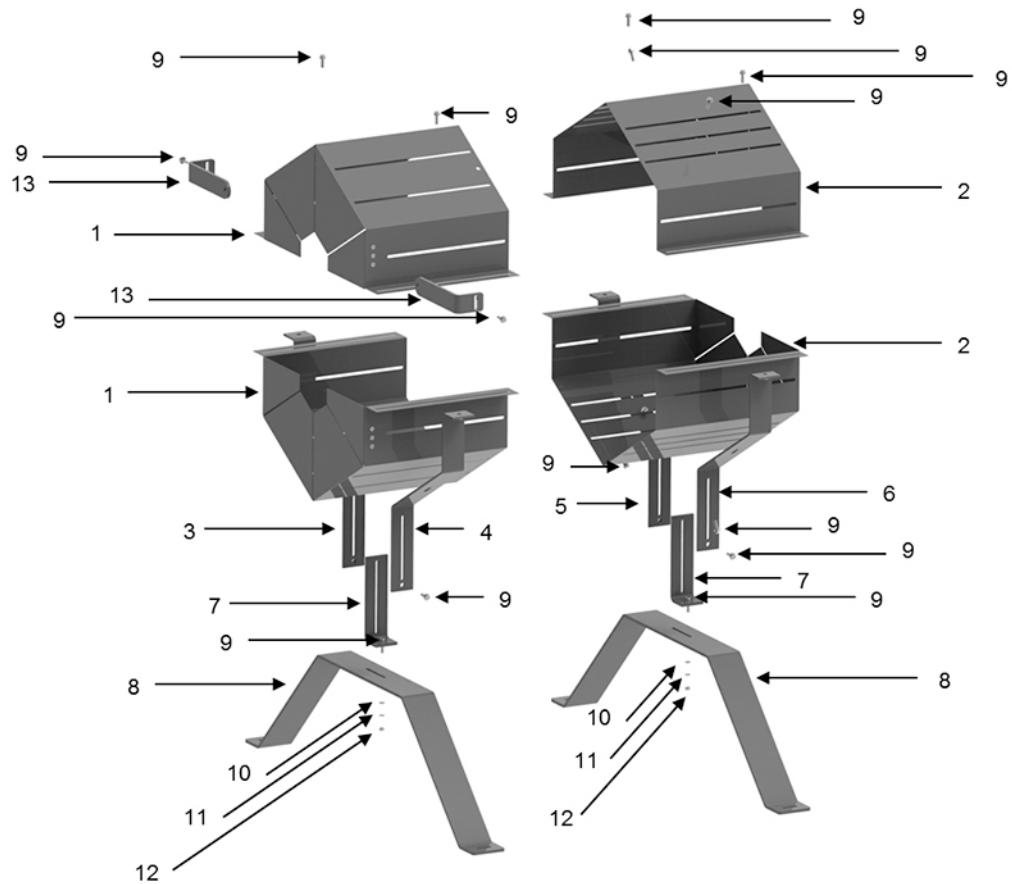


Figure 26: Coupling guard parts

Legend	Part Name
1	Coupler Guard Assembly Inner
2	Coupler Guard Assembly Outer
3	Guard Support Pump Side Left
4	Guard Support Pump Side Right
5	Guard Support Motor Side Left
6	Guard Support Motor Side Right
7	Guard Support Lower
8	Pedestal
9	Hex Bolt
10	Washer
11	Lock Washer
12	Hex Nut
13	Stiffener Clip

- Unfasten the hex bolts [9] that secure the stiffener clips [13] to the inner coupler guard assembly [1].
- Uncouple the upper halves of the outer [2] and inner [1] guard assemblies by removing the two hex bolts [9] located on the top two faces of the hex guard assembly.
- Remove the upper halves of the outer [2] and inner [1] guard assemblies by unfastening the hex head bolts [9] that fasten the flanges of the guards together and lifting the upper guard halves.

5. Uncouple the lower halves of the outer [2] and inner [1] guard assemblies by removing the two hex head bolts [9] located on the bottom two faces of the hex guard assembly.
6. Unfasten the remaining hex head bolts [9] from the various support structures [3-8] to disassemble the remainder of the hex guard assembly. Note: Not all coupling guard assemblies require pedestal pieces [8] or two guard support sets [3-6].
7. If desired, the stiffener clips [13] may be removed from the inboard bearing gland of the pump by removing the bearing gland bolts which secure the clips in place.

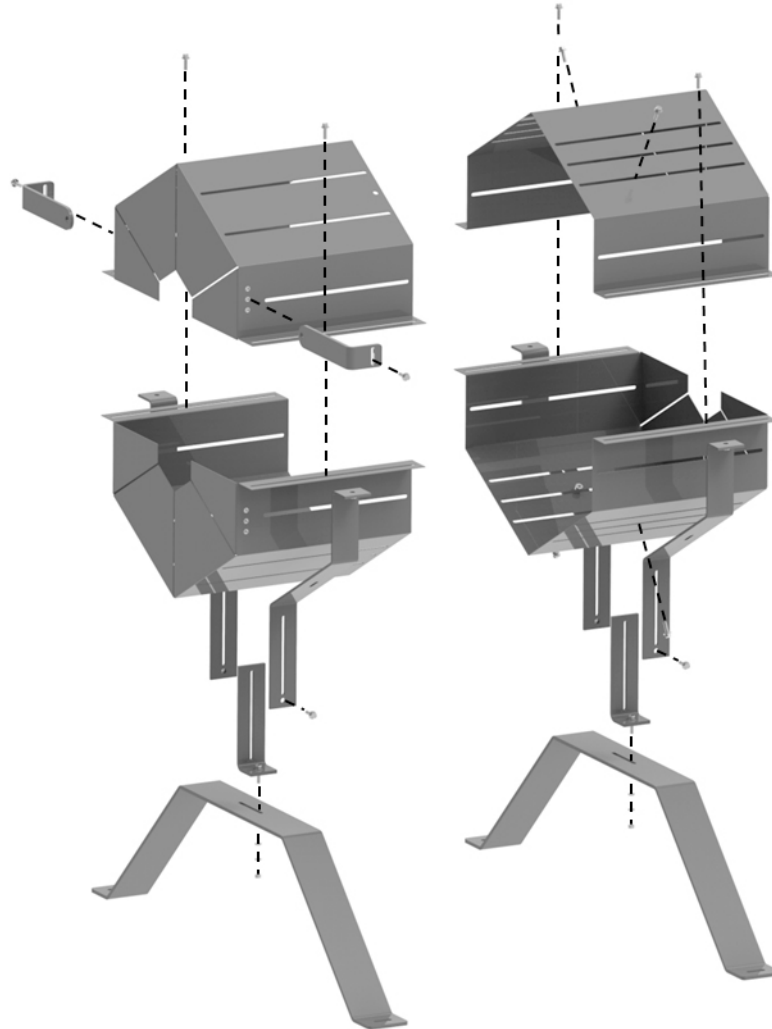


Figure 27: Coupling guard exploded view

#### 6.5.4 Remove the hex coupling guard for floating guards

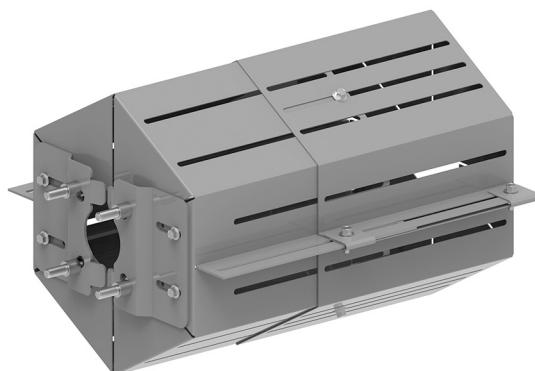


Figure 28: Fully assembled coupling guard – small bracket

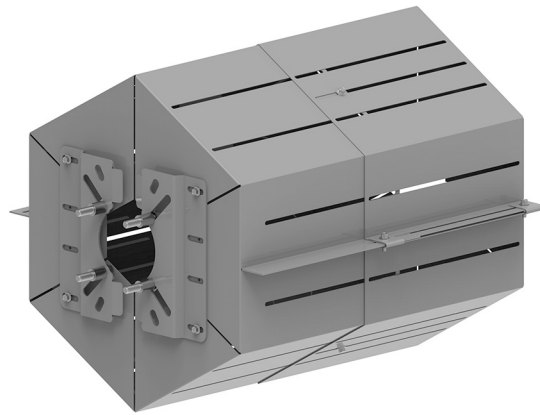


Figure 29: Fully assembled coupling guard – large bracket

Note: Disassembly instructions for the coupling guard assembly are the same regardless of which size mounting bracket is used.

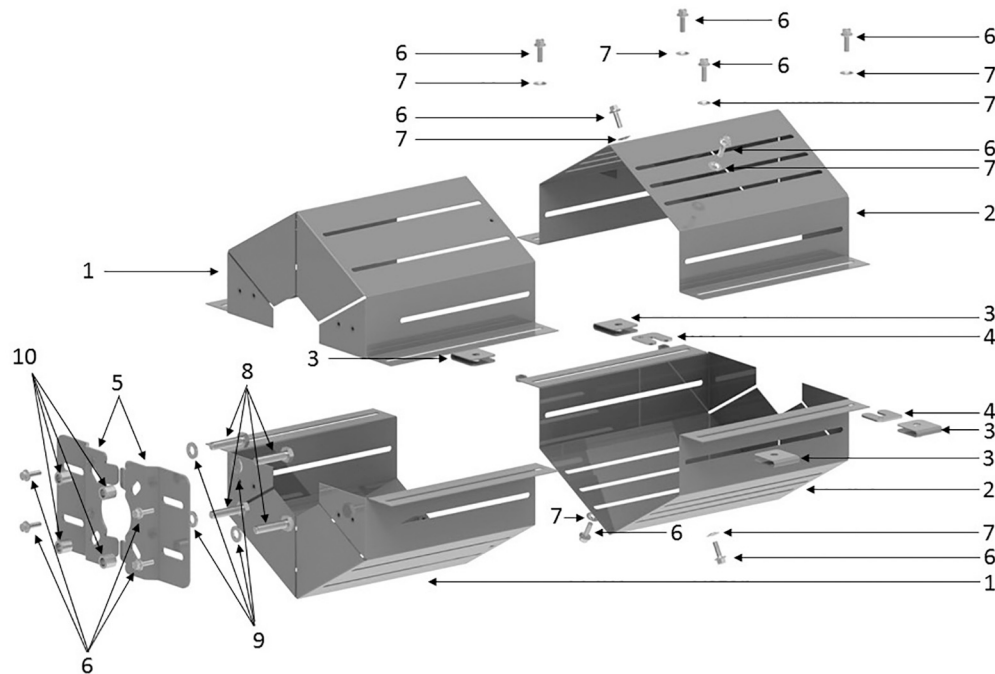


Figure 30: Coupling guard exploded view

Legend	Part Name
1	Coupler Guard Assembly Inner
2	Coupler Guard Assembly Outer
3	Clip
4	Square Spacer
5	Mounting Bracket
6	Hex Bolt
7	Self-Retaining Washer
8	Bearing Gland Bolt
9	Washer
10	Threadless Spacer

1. Unfasten the top two hex bolts [6] that secure the two mounting brackets [5] to the top half of the inner coupling guard assembly [1].
2. Unfasten the two hex bolts [6] located on the top two faces of the outer hex guard assembly [2].
3. Remove the clips [3] and two square spacers [4] which secure the upper and lower halves of the outer [2] and inner [1] guard assemblies by unfastening the four hex head bolts [6] that are threaded into each clip [4]. Remove the upper halves of the guard assemblies by lifting upwards.

Note: The coupling should now be exposed and the lower guard assembly should still be attached to the mounting bracket [5]. Coupling maintenance may be performed without further disassembly of the guard.

4. Uncouple the lower halves of the outer [2] and inner [1] guard assemblies by removing the two hex head bolts [6] located on the bottom two faces of the hex guard assembly.
5. Detach the bottom half of the inner guard [1] from the mounting bracket [5] by unfastening the two hex bolts [6] located on the bottom half of the mounting bracket.
6. If desired, the mounting bracket [5] may be removed from the inboard bearing gland of the pump by removing the four bearing gland bolts [8] which secure the brackets in place.

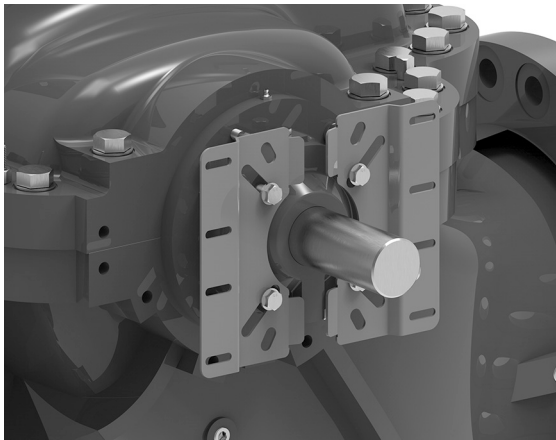


Figure 31: Large bracket mounted to pump bearing gland (without guard assembly)

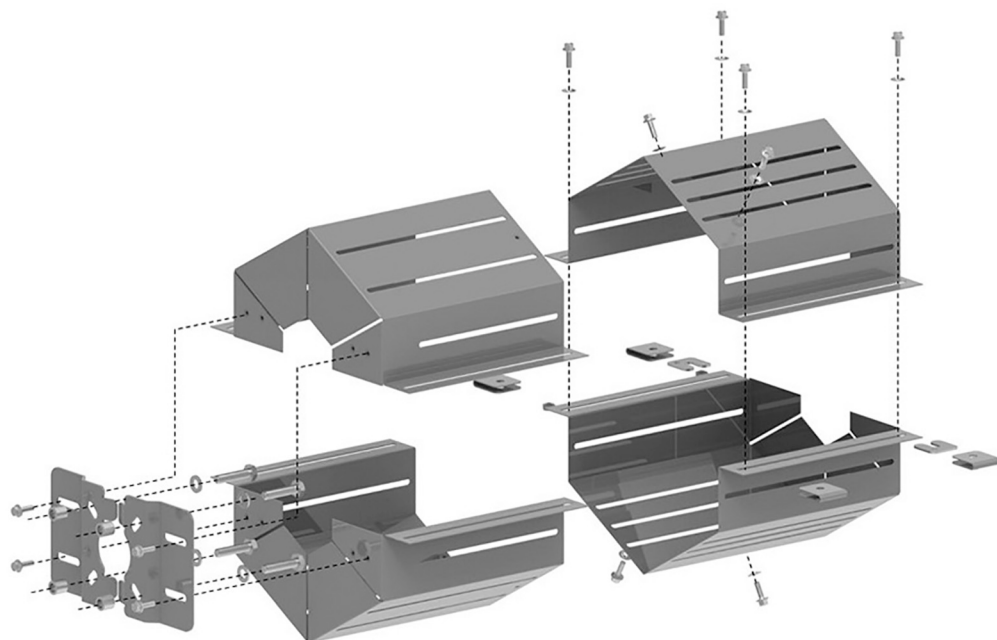


Figure 32: Coupling guard disassembly diagram

## 6.5.5 Pump disassembly

Before disassembling the pump, identify your pump configuration to ensure the correct set of disassembly instructions are adhered to. View the e-XC pump exploded view in [e-XC exploded view](#) on page 104 and become familiar with the general assembly layout of the pump as well as part names. This will allow for easier understanding of disassembly instructions.

Check which of the following characteristics apply to your pump; circle the main features within your configuration for future reference, if desired.

Characteristic	Configuration Option			
Casing Design <sup>1</sup>	Drop-in stuffing box <sup>2</sup>		Integrated stuffing box <sup>3</sup>	
Shaft Design	Shaft with sleeve (Dry Shaft)		Sleeveless shaft (Wet Shaft)	
Sealing Option	Packing	Mechanical Seal	Cartridge Seal	
Mechanical Seal Model <sup>4</sup>	MR1	MR2	MR3	MR4
Cartridge Seal Model <sup>4</sup>	MR5	MR6	MR7	MR8
Bearing Lubrication Method	Grease		Oil	
<sup>1</sup> See the e-XC Performance Curves and Technical Data document to determine which casing design applies for any given model. <sup>2</sup> The drop-in stuffing box design utilizes a removable seal chamber as the fastening point for the various sealing configurations. The stuffing box may also be known as a seal body. <sup>3</sup> The integrated stuffing box design incorporates the seal chamber into the upper and lower casing halves. Therefore, sealing components fasten directly to the pump casing. <sup>4</sup> Row is only applicable for either mechanical or cartridge seal configurations. For more information on the MR series mechanical seals, see the e-XC Performance Curves and Technical Data document.				



### WARNING:

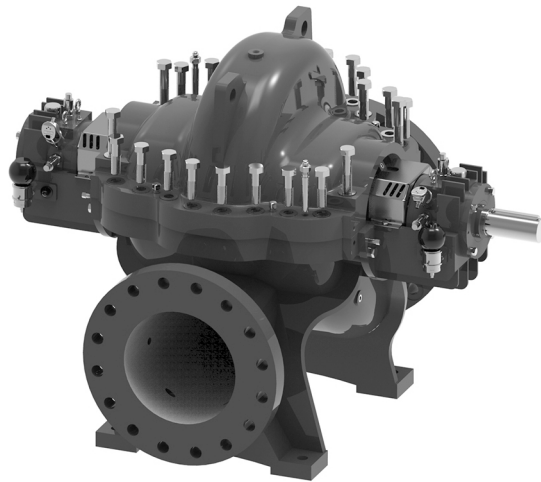
- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
- Extreme temperature hazard: Allow pump temperatures to reach acceptable levels before proceeding. Open drain valve, do not proceed until liquid stops coming out of the drain valve. If liquid does not stop flowing from drain valve, isolation valves are not sealing and should be repaired before proceeding. After liquid stops flowing from drain valve, leave drain valve open and continue. Remove the drain plug located on the bottom of the pump housing. Do not reinstall plug or close drain valve until reassembly is completed. Failure to follow these instructions could result in property damage and/or moderate personal injury.

## 6.5.6 Pump disassembly for pumps with drop-in stuffing box and sleeve over shaft (dry shaft) design

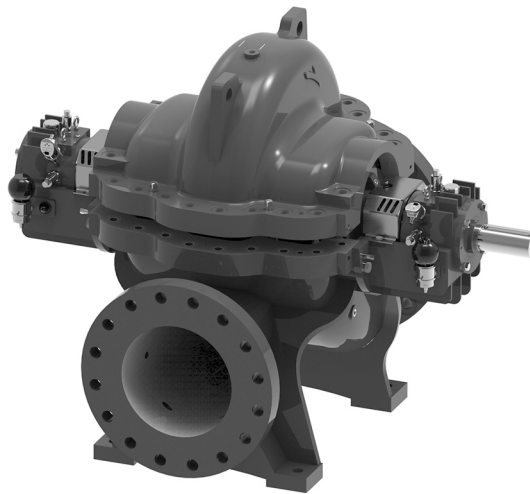
Unless stated otherwise, follow the disassembly instructions assuming the outboard end of the pump (non-drive end) must be disassembled first. The term 'inboard' refers to the coupling end (drive-end) of the pump shaft. Similarly, the term 'stuffing box' is interchangeable with 'seal body'.

1. Close valves on suction and discharge sides of pump. If no valves are installed, it will be necessary to drain the pump.
2. Remove coupling guard and disconnect coupling. Refer to [Remove the hex coupling guard for guards with vertical supports](#) on page 45 and [Remove the hex coupling guard for floating guards](#) on page 47 for specific removal instructions.
3. Disconnect and remove external flush lines and their fittings.
4. Remove parting flange bolts and tapered alignment pins.

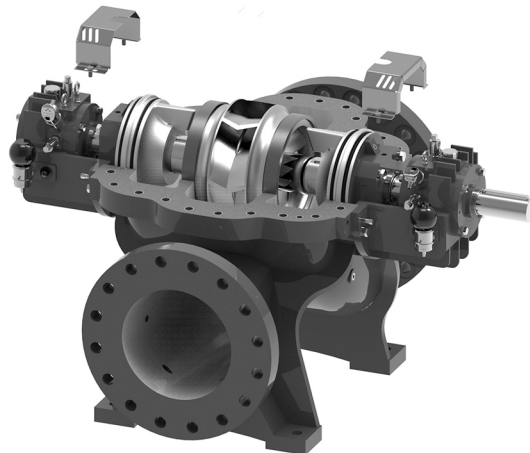




5. Use pre-installed jacking screws to separate upper and lower casing halves.
6. Remove upper casing via integrated lifting lugs located atop the upper casing.  
NOTE: Follow lifting precautions and instructions according to [Pump lifting guidelines](#) on page 7. As a general rule, only use lifting lugs or eyebolts to lift the component they are attached to. Do not lift the entire pump by its lifting lugs.

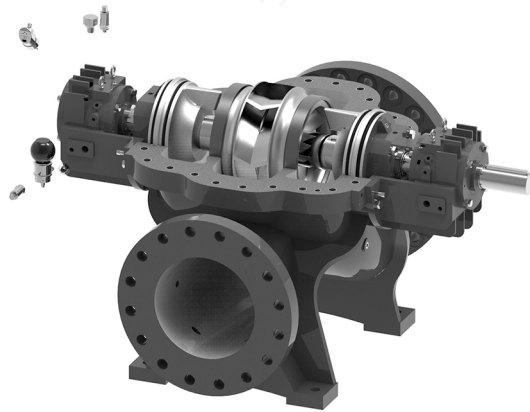
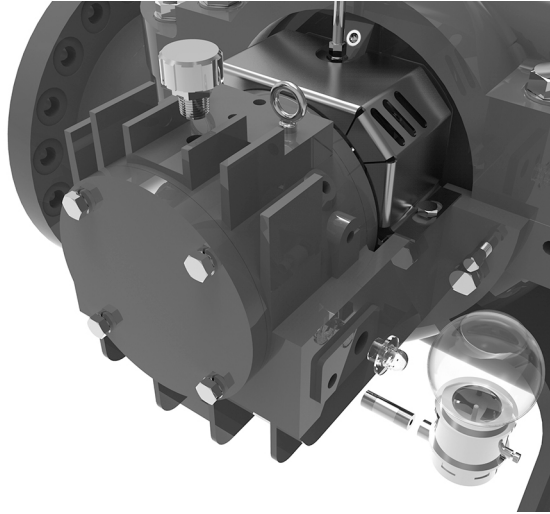


7. Unfasten shaft guard bolts and remove both shaft guards.



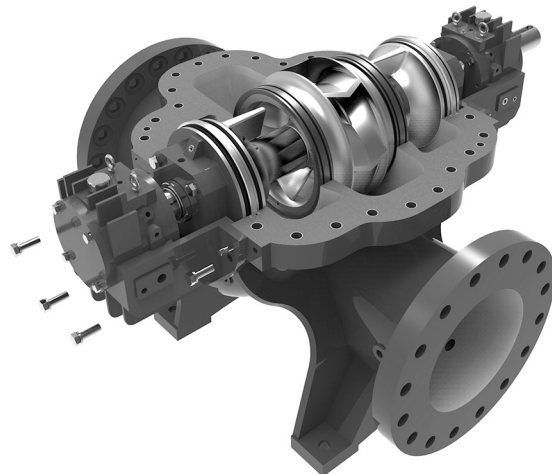
8. If using oil for bearing lubrication, drain oil from bearing housing by unfastening plugs located on the undersides of both bearing housings.

9. Disconnect and remove any sensors, monitoring equipment, or oiler components if applicable.

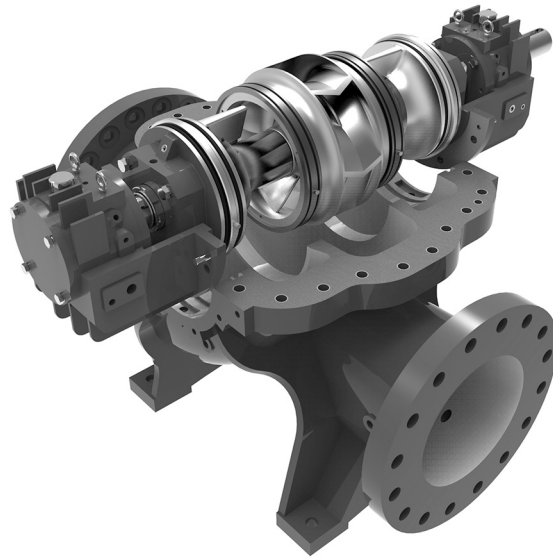


NOTE: Proceed to step 10 if the pump is currently disconnected from piping and removed from its operating location. Otherwise, continue to step 10 after removing the rotating assembly (with bearing housings) from the lower casing.

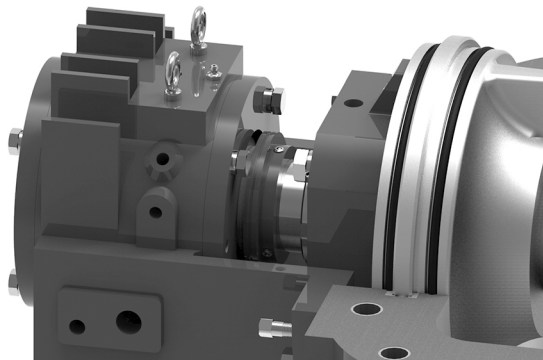
1. Remove the rotating assembly by first unfastening the four bolts which secure each bearing housing to the lower casing.



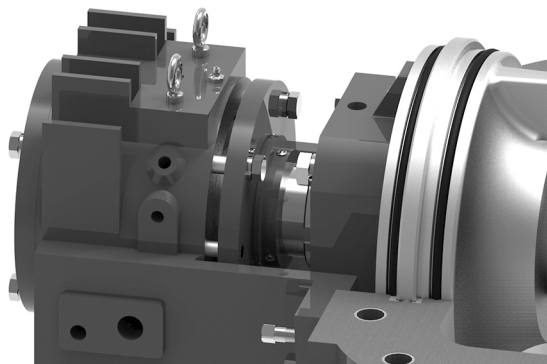
2. Once the bearing housings are no longer fixed to the lower casing, lift and remove the rotating assembly using proper lifting equipment. Do not lift the rotating assembly by the eyebolts located on each bearing housing. Place the rotating assembly on v-blocks to continue the disassembly process.



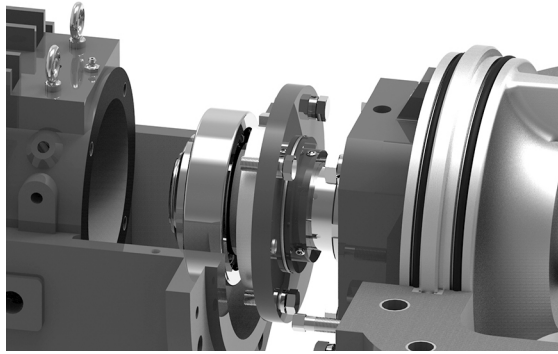
10. Unfasten the three (3) set screws of the bearing seal ring located on the outboard bearing housing. Rotate the shaft to access each set screw.



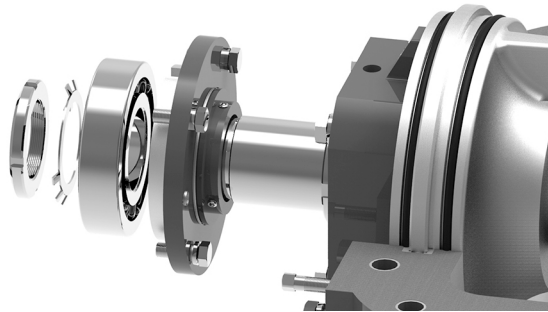
11. Partially unfasten the screws of the impeller-side bearing gland attached to the outboard bearing housing. Ensure the bearing gland is no longer attached to the bearing housing. Slide the bearing gland and bearing seal ring away from the bearing housing.



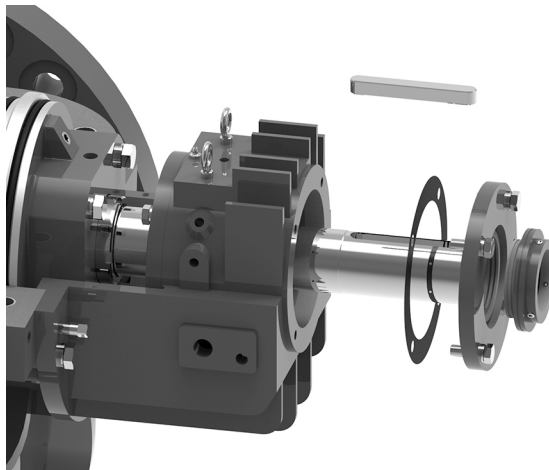
12. Prepare the outboard bearing housing for lifting and movement. Support the bearing housing from below or attach lifting equipment to the eye bolts located on top of the bearing housing.
13. Remove screws that attach the bearing housing to the lower casing.
14. Separate bearing housing from lower casing using the jacking screws located on either side of the bearing housing.
15. Remove the outboard bearing housing from the pump shaft.



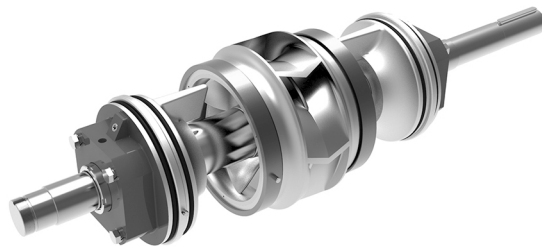
16. Remove the locknut and tab washer adjacent to the outboard bearing. Use a screw driver to bend back the tab washer tabs and a spanner wrench to remove the locknut.
17. Remove the outboard bearing using a bearing puller if necessary.
18. Remove the shoulder ring, bearing gland, and bearing seal ring from pump shaft.



19. Remove set screws from inboard bearing seal ring then slide the seal ring off the shaft. Ensure coupling key is removed from the shaft.
20. Remove bearing gland screws from inboard side of pump then slide bearing gland and gasket off the shaft.



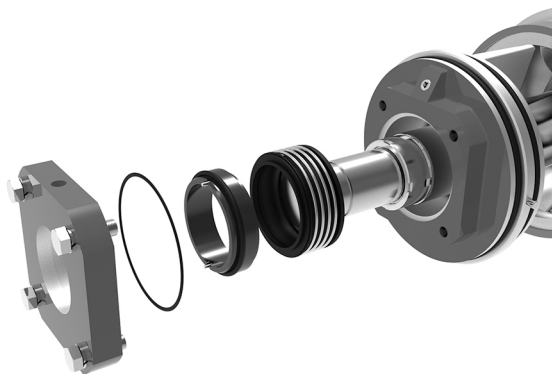
21. Repeat steps 10-18 to remove the remaining components along the inboard side of the pump.  
Note: bearing locknut, tab washer, and shoulder ring only exist on the outboard side of the pump.
22. Break the seal between lower casing and stuffing boxes by tapping on each stuffing box with a rubber mallet.
23. Lift rotating assembly out of lower casing and place on stands or V-blocks.



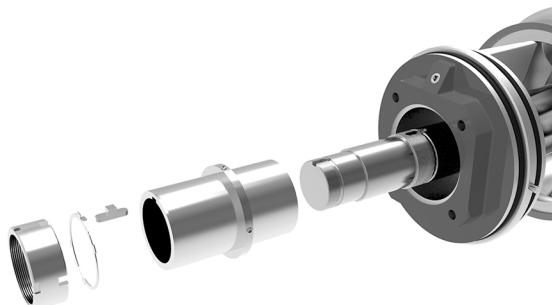
The subsequent disassembly instructions depend on your specific pump's sealing configuration. Choose the instructions suited to your pump.

#### MR2 & MR4 Mechanical Seal on Sleeve

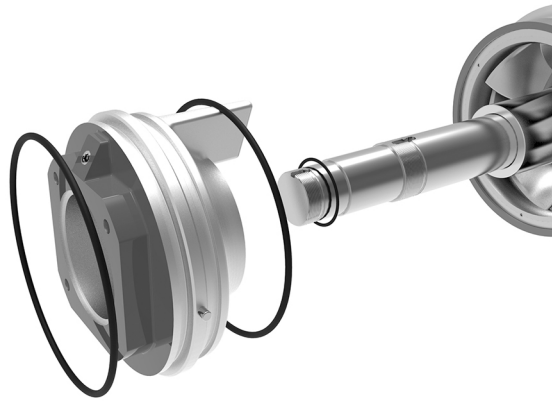
1. Remove seal gland screws from the stuffing box.
2. Remove the seal gland and seal gland O-ring.
3. Remove the stationary and rotating elements of the mechanical seal.



4. Bend back the tabs on the lock washer for the sleeve nut. Loosen and remove the sleeve locknut using a spanner wrench.
5. Remove the shaft sleeve key and then remove the shaft sleeve with the drive ring fastened to it. If the shaft sleeve does not slide off easily, apply heat to expand the metal and loosen any grease or anti-seizing agent underneath the sleeve.

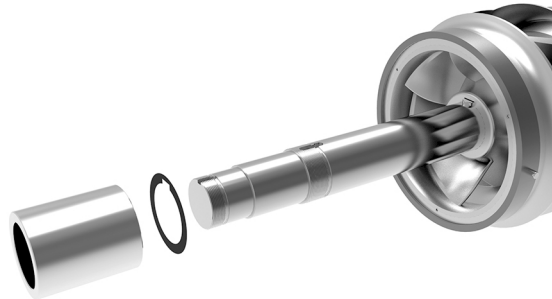


6. Separate the drive ring from the shaft sleeve by unfastening the set screws in the drive ring.
7. Remove the stuffing box from the shaft. Remove stuffing box O-rings from their respective grooves.
8. Remove the shaft sleeve O-ring if it is still on the shaft.



9. Repeat steps 1-8 for the inboard side of the pump.

10. Remove the impeller hub sleeve and gasket. Repeat for the inboard side of the pump.



11. Remove impeller assembly from shaft. Heat the impeller and slide it off of the shaft. Alternatively, press the impeller off of the shaft if a suitable press is available. Wear insulated gloves when handling hot components.

12. Remove the impeller key.

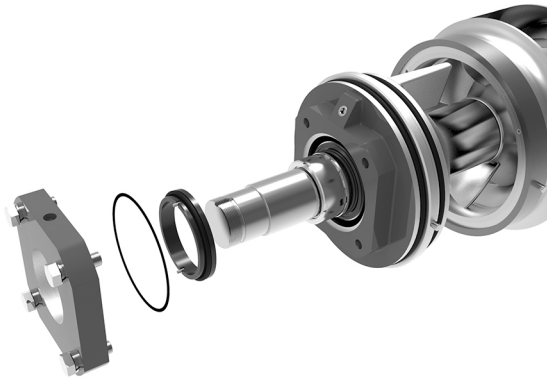
13. Remove pins and O-rings from each casing wear ring.



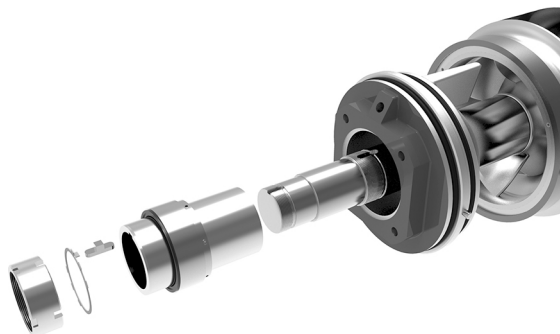


### MR1 & MR3 Mechanical Seal on Sleeve

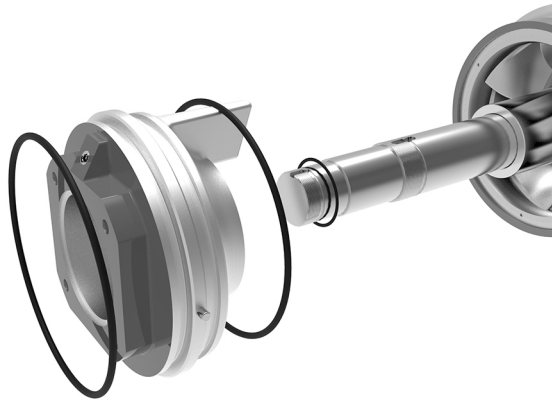
1. Remove seal gland screws from the stuffing box.
2. Remove the seal gland and seal gland O-ring.
3. Remove the static (non-rotating) seal element.



4. Bend back the tabs of the tab washer, remove the heterotype key, and unfasten the sleeve nut.
5. Pull the shaft sleeve with the rotating element off of the shaft.
6. Unfasten the set screws located on the rotating element of the seal and separate the rotating element from the shaft sleeve.



7. Repeat steps 1-6 for the inboard side of the pump.
8. Remove the stuffing box from the shaft. Remove stuffing box O-rings from their respective grooves.
9. Remove the shaft sleeve O-ring if it is still on the shaft.



10. Repeat steps 8-9 for the inboard side of the pump.

11. Remove the impeller hub sleeve and gasket. Repeat for the inboard side of the pump.



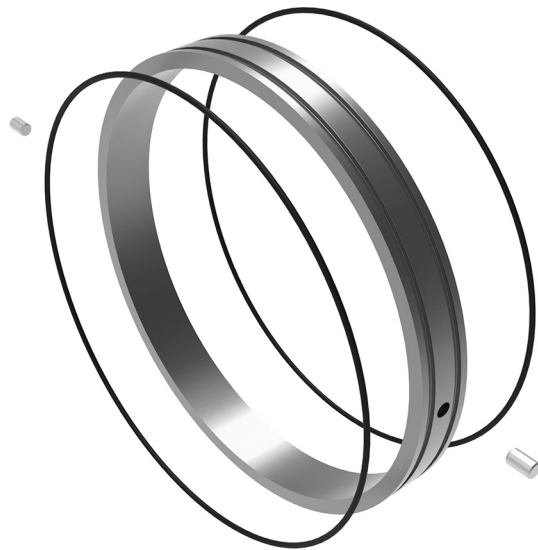
12. Remove impeller assembly from shaft. Heat the impeller and slide it off of the shaft. Alternatively, press the impeller off of the shaft if a suitable press is available. Wear insulated gloves when handling hot components.

13. Remove the impeller key.

14. Remove pins and O-rings from each casing wear ring.

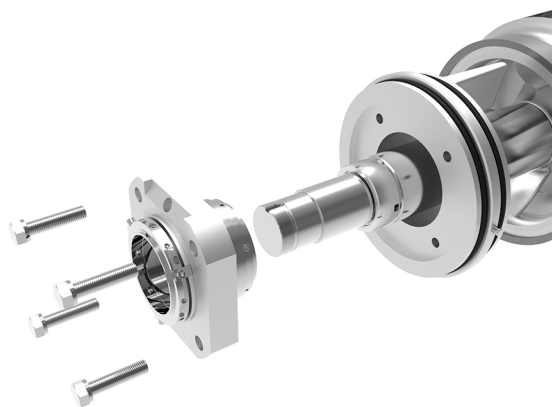






### MR7 & MR8 Cartridge Seal on Sleeve

1. Remove cartridge seal gland screws from the stuffing box.
2. Untighten cartridge seal set screws that fix the seal to the shaft sleeve. Remove cartridge seal.



3. Remove stuffing box from pump shaft. Alternatively, the stuffing box and cartridge seal may be removed from the shaft simultaneously and decoupled thereafter.
4. Repeat steps 1-3 for the inboard side of the pump.
5. Continue the disassembly process by following the instructions outlined in [Shaft Sleeve and Impeller Disassembly](#) on page 60.

### Packing on Sleeve

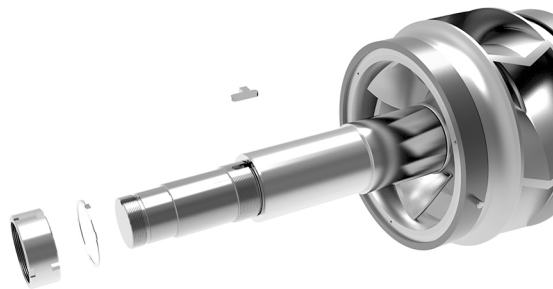
1. Remove packing gland screws which thread into the stuffing box.
2. Remove screws which hold the packing gland halves together.
3. Remove packing gland halves.
4. Remove stuffing box from pump shaft.
5. Remove packing rings and lantern ring (seal cage).



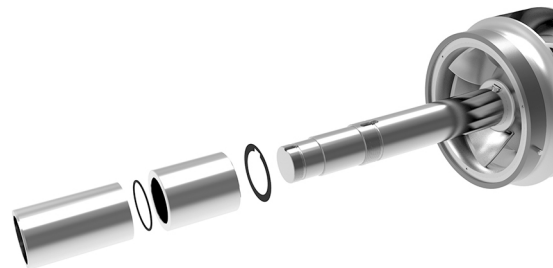
6. Repeat steps 1-5 for the inboard side of the pump.
7. Continue the disassembly process by following the instructions outlined in [Shaft Sleeve and Impeller Disassembly](#) on page 60.

### Shaft Sleeve and Impeller Disassembly

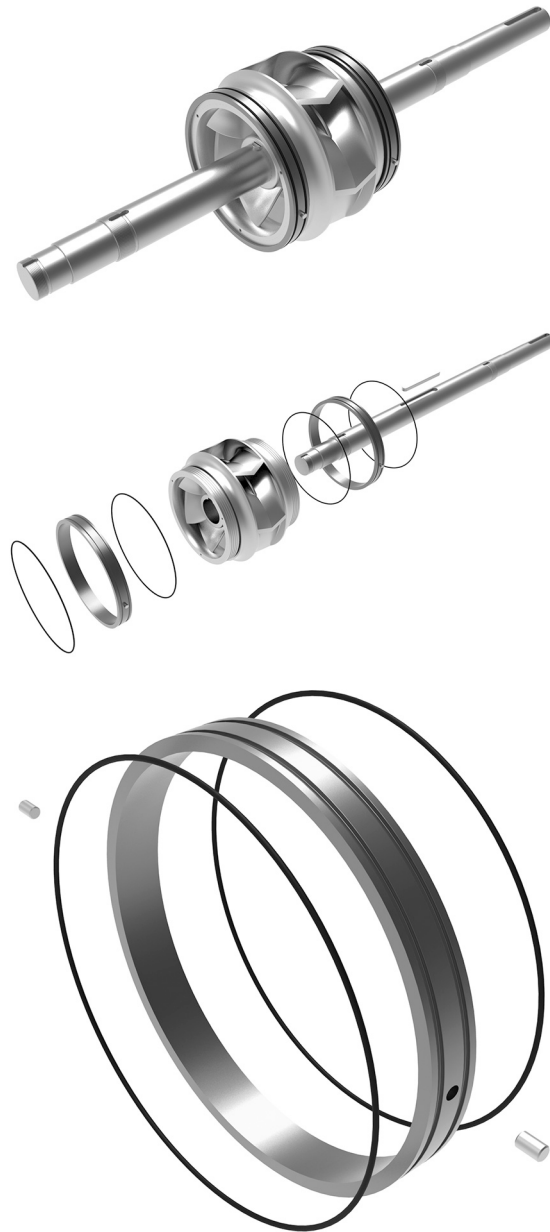
1. Remove the shaft sleeve locknut and tab washer. Bend back the tab washer tabs and use a spanner wrench to unscrew the sleeve's locknut.
2. Remove the shaft sleeve key.



3. Remove shaft sleeve and O-ring. If the shaft sleeve does not slide off easily, then heat up the sleeve to expand the metal and loosen any grease or anti-seizing agent.
4. Remove impeller hub sleeve and gasket.



5. Repeat steps 1-4 for the inboard side of the pump.
6. Remove impeller assembly from shaft. Heat the impeller and slide it off of the shaft. Alternatively, press the impeller off of the shaft if a suitable press is available. Wear insulated gloves when handling hot components.
7. Remove the impeller key.
8. Remove pins and O-rings from each casing wear ring.



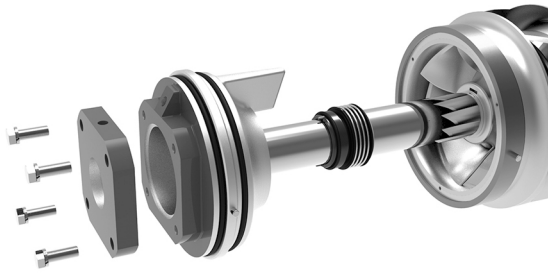
### 6.5.7 Pump disassembly for pumps with drop-in stuffing box and sleeveless shaft (wet shaft) design

Follow disassembly instructions 1-23 outlined in [Pump disassembly for pumps with drop-in stuffing box and sleeve over shaft \(dry shaft\) design](#) on page 50. Assume the outboard (non-drive end) of the pump must be disassembled first unless stated otherwise. The term 'inboard' refers to the drive-end or coupling end of the pump shaft. The term 'stuffing box' may be interchangeable with 'seal body'.

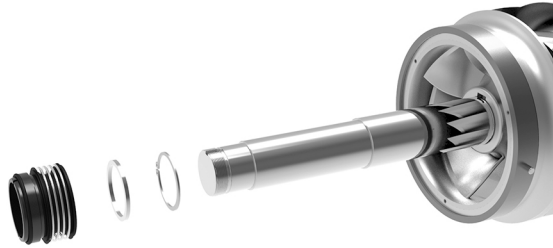
The following disassembly instructions depend on your specific pump's sealing configuration. Choose the instructions suited to your pump.

#### MR1, MR2, MR3, and MR4 Mechanical Seal on Shaft

1. Remove seal gland screws.
2. Remove seal gland. The static face of the mechanical seal may be pulled off of the shaft simultaneously with the seal gland.
3. Remove stuffing box from pump shaft.



4. Remove mechanical seal from shaft.
5. Remove drive ring from shaft (outboard end only).
6. Remove snap ring adjacent to impeller hub (outboard end only).



7. Repeat steps 1-4 for the inboard side of pump.
8. Remove impeller assembly from shaft. Heat the impeller and slide it off of the shaft. Alternatively, press the impeller off of the shaft if a suitable press is available. Wear insulated gloves when handling hot components.
9. Remove the impeller key.
10. Remove pins and O-rings from each casing wear ring.



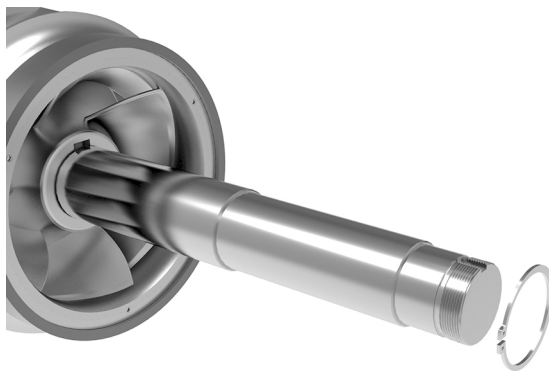


### MR5 & MR6 Cartridge Seal on Shaft

1. Remove cartridge seal gland screws.
2. Loosen cartridge seal set screws that fasten the seal to the shaft. Remove cartridge seal.

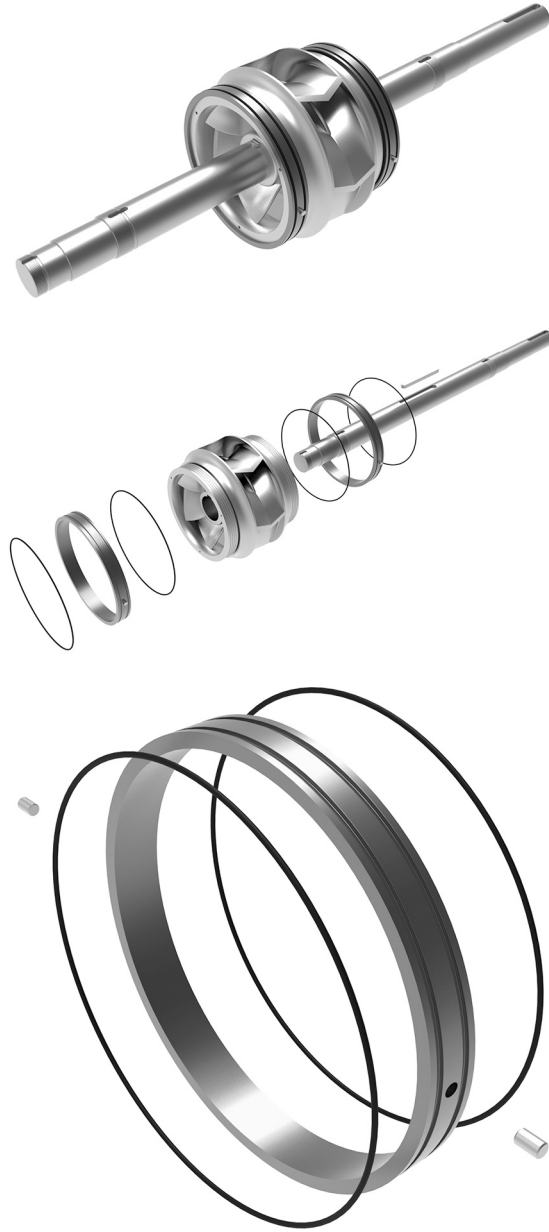


3. Remove stuffing box from pump shaft. Alternatively, the stuffing box and seal assembly may be removed from the shaft together and decoupled thereafter. Loosen the cartridge seal set screws before attempting to pull the entire assembly from the shaft.
4. Repeat steps 1-3 for the inboard side of the pump.
5. Remove snap ring adjacent to outboard end of the impeller hub.



6. Remove impeller assembly from shaft. Heat the impeller and slide it off of the shaft. Alternatively, press the impeller off of the shaft if a suitable press is available. Wear insulated gloves.

7. Remove the impeller key.
8. Remove pins and O-rings from each casing wear ring.



### 6.5.8 Pump disassembly for pumps with integrated stuffing box design

The disassembly process for pumps with an integrated stuffing box may be considered identical to the drop-in stuffing box design with a few minor differences. Please note differences outlined below and then refer to [Pump disassembly for pumps with drop-in stuffing box and sleeve over shaft \(dry shaft\) design](#) on page 50 and [Pump disassembly for pumps with drop-in stuffing box and sleeveless shaft \(wet shaft\) design](#) on page 61. Follow all safety procedures outlined in [Pump disassembly](#) on page 50.

1. Before separating the upper and lower casing, remove both pump shaft guards, all flush lines, and remove the top two seal gland bolts from the upper casing on both sides of the pump.

Note: For packing configurations, the flush line ports run through the upper casing just above the seal chamber.

## 6.6 Reassembly

### 6.6.1 Pump assembly

Before assembling the pump, identify your pump configuration to ensure the correct set of assembly instructions are adhered to. View the e-XC pump exploded view in [e-XC exploded view](#) on page 104 and become familiar with the general assembly layout of the pump as well as part names. This will allow for easier understanding of assembly instructions.

Check which of the following characteristics apply to your pump; circle the main features within your configuration for future reference, if desired.

Characteristic	Configuration Option			
Casing Design <sup>1</sup>	Drop-in stuffing box <sup>2</sup>		Integrated stuffing box <sup>3</sup>	
Shaft Design	Shaft with sleeve (Dry Shaft)		Sleeveless shaft (Wet Shaft)	
Sealing Option	Packing	Mechanical Seal	Cartridge Seal	
Mechanical Seal Model <sup>4</sup>	MR1	MR2	MR3	MR4
Cartridge Seal Model <sup>4</sup>	MR5	MR6	MR7	MR8
Bearing Lubrication Method	Grease		Oil	
<sup>1</sup> See the e-XC Performance Curves and Technical Data document to determine which casing design applies for any given model. <sup>2</sup> The drop-in stuffing box design utilizes a removable seal chamber as the fastening point for the various sealing configurations. The stuffing box may also be known as a seal body. <sup>3</sup> The integrated stuffing box design incorporates the seal chamber into the upper and lower casing halves. Therefore, sealing components fasten directly to the pump casing. <sup>4</sup> Row is only applicable for either mechanical or cartridge seal configurations. For more information on the MR series mechanical seals, see the e-XC Performance Curves and Technical Data document.				



#### WARNING:

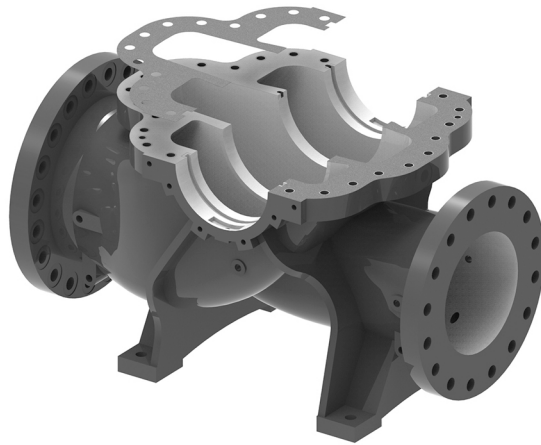
- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.

#### NOTICE:

All bearings, O-rings, gaskets and seals should be replaced with new parts during assembly. All reusable parts should be cleaned of foreign matter before assembly.

### 6.6.2 Pump assembly for pumps with drop-in stuffing box and sleeve over shaft (dry shaft) design

- All bearings, O-rings, seals and gaskets should be replaced with new parts during reassembly. Any other parts that are reused should be thoroughly cleaned before reassembly.
- The main casing joint gasket should be trimmed according to the parting flange profile of the lower casing. Ensure the gasket is flush with the inside edges of the casing. Spray 3M Super 77 adhesive on the lower casing parting flange for better gasket adhesion.
- For all assembly instructions, assemble from the outboard (non-drive end) of the pump unless stated otherwise.



### Impeller assembly

1. Place the impeller key(s) in the shaft key slot.
2. Apply anti-seizing agent along the entirety of the shaft length.
3. Place the impeller on V-blocks or stands such that the impeller bore direction is parallel to the ground. The shaft will be horizontally inserted into the impeller bore.
4. Check the impeller and casing to determine the correct rotational relationship. Insert the outboard (non-driving end) of the shaft into the impeller bore horizontally using a rubber mallet to gently tap the shaft in until the impeller is centered along the impeller key length.
5. Lightly grease casing wear ring O-rings and roll them into their respective grooves. Insert two steel pins into each casing wear ring. Slide the casing wear rings over the impeller eye.



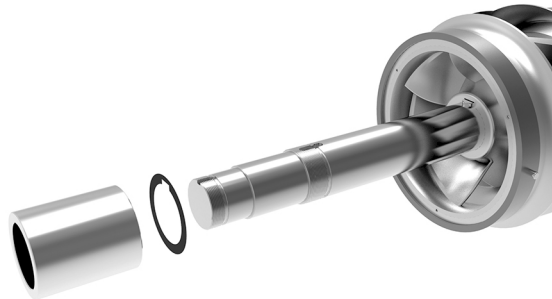




6. Thoroughly clean stuffing boxes, seal glands, and shaft sleeves to prevent dirt from entering the seal during startup.

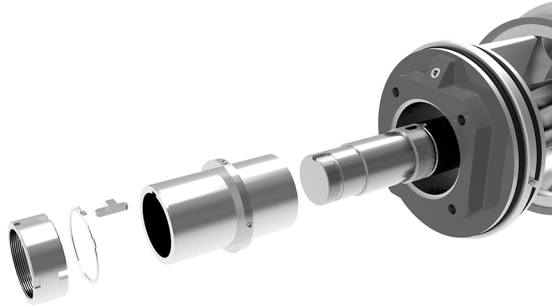
#### MR2 and MR4 mechanical seal on sleeve

1. Place the impeller hub gasket against the impeller hub. Ensure the gasket sits flush against the hub.
2. Slide impeller hub sleeve against impeller hub. Ensure the keyway slot within the impeller hub sleeve aligns with the impeller keyway. Ensure the end of the impeller hub sleeve that has a fillet faces away from the impeller. Otherwise, sharp sleeve edges may destroy the sleeve O-ring and ruin the sleeve's seal.

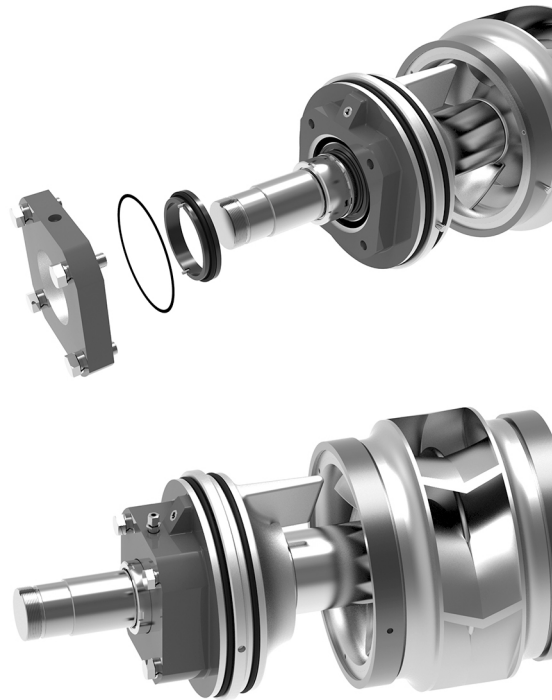


3. Place sleeve O-ring onto shaft adjacent to impeller hub sleeve.
4. Lightly grease the stuffing box O-rings and place them into their respective grooves along the outer diameter of the stuffing box. Thread in the plug at the top of the stuffing box.
5. Slide the stuffing box onto the shaft until it rests against the impeller hub sleeve.
6. Place the mechanical seal's drive ring on the shaft sleeve. Tighten the set screws on the drive ring at the inscribed location on the shaft sleeve.  
Note: The face of the drive ring furthest away from the impeller should be aligned with the inscribed line.
7. Slide the non-keyed end of the shaft sleeve, with drive ring installed, onto the shaft until it sits against the impeller hub sleeve.
8. Insert the heterotype key between the shaft sleeve and shaft.
9. Slide tab washer onto shaft against the shaft sleeve.

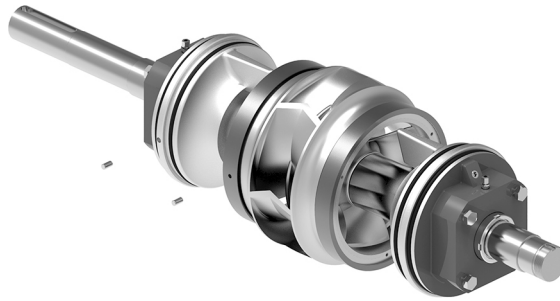
10. Thread the locknut onto the shaft. Align tab washer prongs with sleeve nut gaps. Bend tab washer prongs over the sleeve nut gaps to secure the locknut.



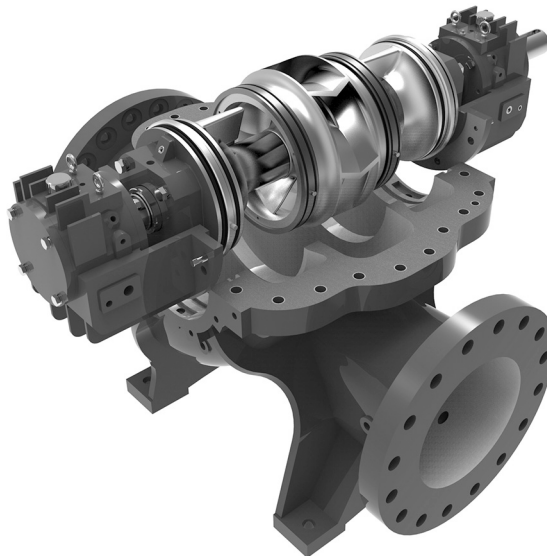
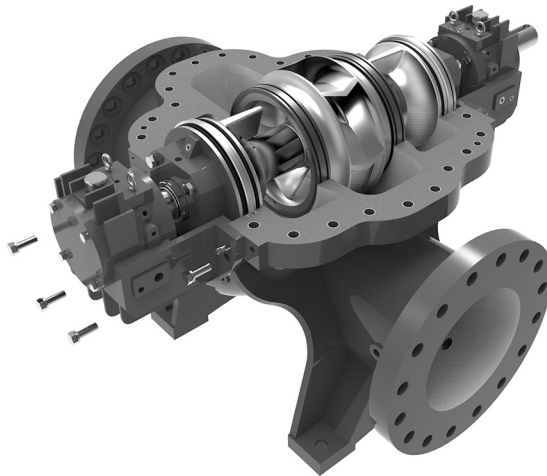
11. Repeat steps 1-10 for the inboard side of the pump.
12. Assemble the stationary face of the mechanical seal to the seal gland using its alignment pins as a guide.
13. Place the seal gland O-ring into its respective groove.
14. Slide the rotating element of the mechanical seal onto the shaft until it sits flush against the drive ring.
15. Slide the seal gland and stationary mechanical seal element assembly onto the shaft. Secure the seal gland to the stuffing box using with correctly sized hex head bolts and lockwashers.
16. Thread the external flush line fitting into the top of the seal gland.



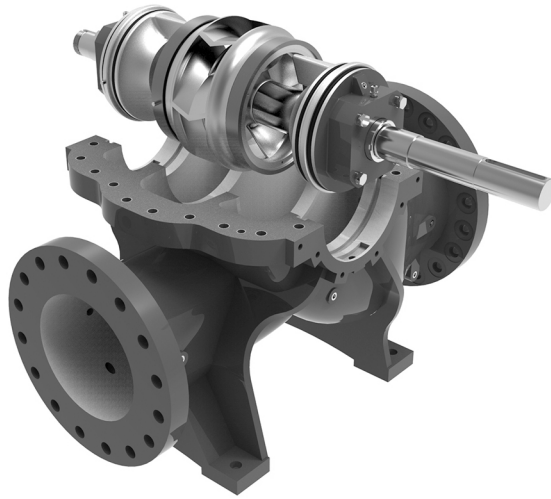
17. Repeat for the inboard side of the pump.
18. Install stuffing box pins into each stuffing box.
19. Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.



NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 20. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



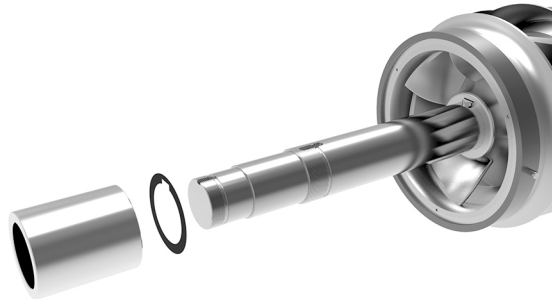
20. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.



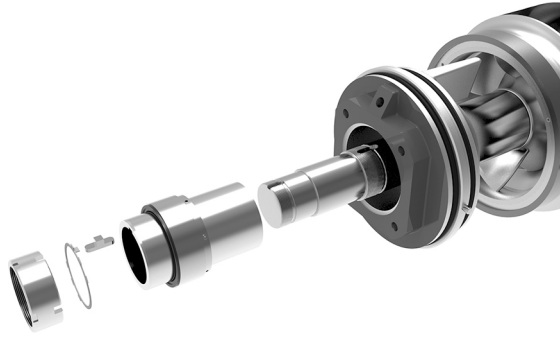
21. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.

#### MR1 & MR3 Mechanical seal on sleeve assembly instructions

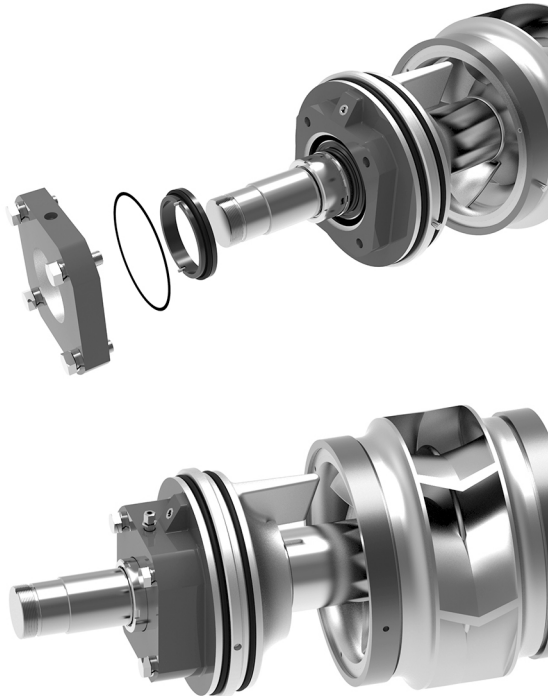
1. Place the impeller hub gasket against the impeller hub. Ensure the gasket sits flush against the hub.
2. Slide impeller hub sleeve against impeller hub. Ensure the keyway slot within the impeller hub sleeve aligns with the impeller keyway. Ensure the end of the impeller hub sleeve that has a fillet faces away from the impeller. Otherwise, sharp sleeve edges may destroy the sleeve O-ring and ruin the sleeve's seal.



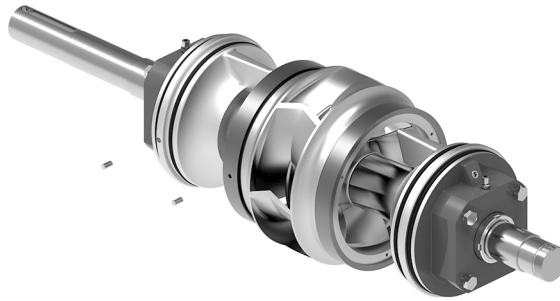
3. Place sleeve O-ring onto shaft adjacent to impeller hub sleeve.
4. Lightly grease the stuffing box O-rings and place them into their respective grooves along the outer diameter of the stuffing box. Thread in the plug at the top of the stuffing box.
5. Slide the stuffing box onto the shaft until it rests against the impeller hub sleeve.
6. Place the mechanical seal's rotating element on the shaft sleeve. Tighten the set screws on the drive ring at the inscribed location on the shaft sleeve.  
Note: The drive ring should be set before the inscribed line such that the entire mechanical seal is located between the inscribed line and the seal gland.
7. Slide the non-keyed end of the shaft sleeve, with the rotating element installed, onto the shaft until it sits against the impeller hub sleeve.
8. Insert the heterotype key between the shaft sleeve and shaft.
9. Slide tab washer onto the shaft against the shaft sleeve.
10. Thread the locknut onto the shaft. Align tab washer prongs with sleeve nut gaps. Bend tab washer prongs over the sleeve nut gaps to secure the locknut.



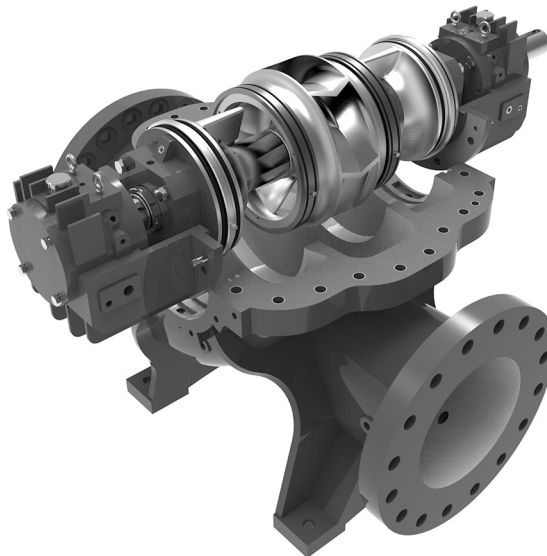
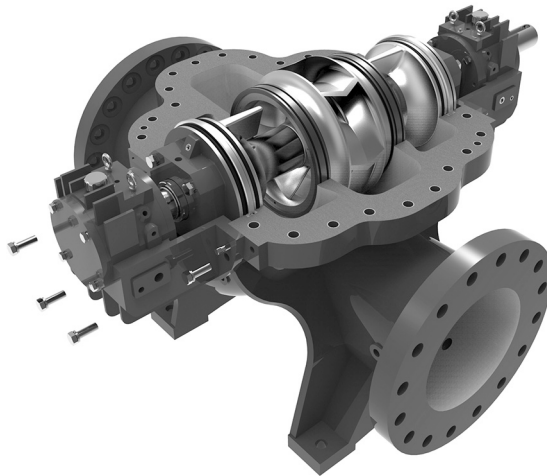
11. Repeat steps 1-10 for the inboard side of the pump.
12. Assemble the stationary face of the mechanical seal to the seal gland using its alignment pins as a guide.
13. Place the seal gland O-ring into its respective groove.
14. Slide the seal gland and stationary mechanical seal element assembly onto the shaft. Secure the seal gland to the stuffing box using with correctly sized hex head bolts and lockwashers.
15. Thread the external flush line fitting into the top of the seal gland.



16. Repeat for the inboard side of the pump.
17. Install stuffing box pins into each stuffing box.
18. Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.

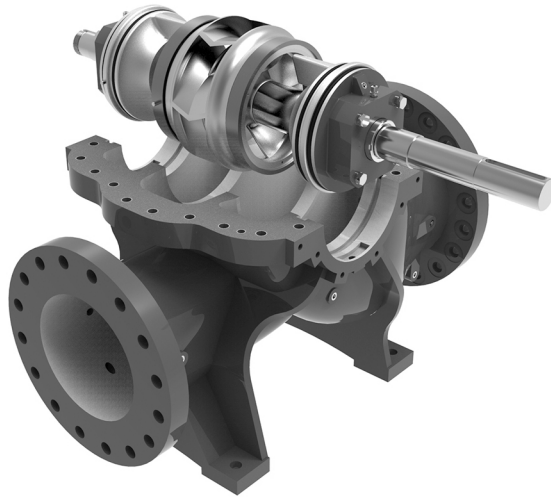


NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 19. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



19. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.

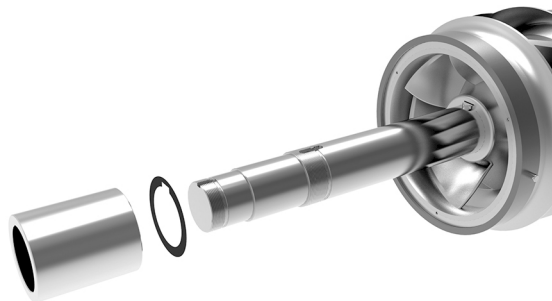
20. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.



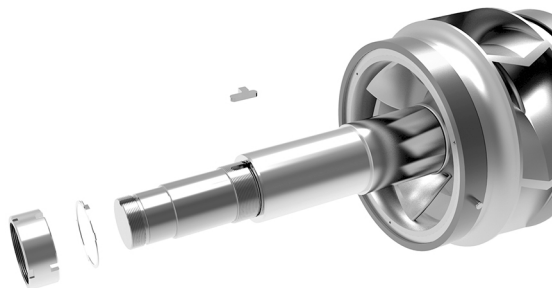
### Packing on Sleeve Assembly Instructions

#### Shaft sleeve assembly

1. Place the impeller hub gasket against the impeller hub.
2. Slide impeller hub sleeve against impeller hub. Ensure the keyway slot within the impeller hub sleeve aligns with the impeller keyway.



3. Place sleeve O-ring onto shaft adjacent to impeller hub sleeve.
4. Slide shaft sleeve onto shaft. Ensure the shaft sleeve O-ring is seated within the shaft sleeve counterbore. Ensure shaft sleeve keyway is aligned with its shaft keyway counterpart.
5. Place shaft sleeve key into the shaft keyway.
6. Slide tab washer onto shaft against the shaft sleeve.
7. Thread the locknut onto the shaft. Align tab washer prongs with sleeve nut gaps. Bend tab washer prongs over the sleeve nut gaps to secure the locknut.



8. Repeat steps 6-12 for the inboard side of the pump.

#### Stuffing box and packing assembly

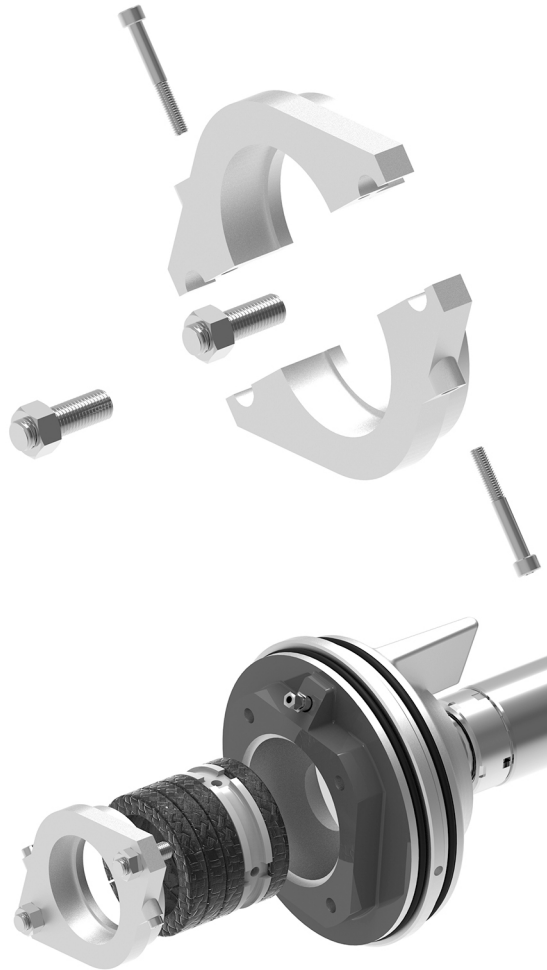
1. Screw flush line fitting into the port located on the stuffing box.
2. Lubricate and roll O-rings into the grooves along the outer diameter of the stuffing box.

3. Install four to five packing rings (number of rings varies with pump size) and one lantern ring within the stuffing box. The lantern ring is responsible for distributing external flushing to the packing seal. Ensure the lantern ring sits where the external flushing inlet is located within the stuffing box interior.

Note: Do not pull the ends of the packing rings away from one another when placing rings around the shaft. Instead, gently twist the ends of each packing ring away from one another as they are placed on the shaft.

Note: Ensure packing rings are installed at a 90 degree rotational offset from one another. This technique will mitigate leaks between rings.

4. Assemble the two packing gland halves together and lightly fasten them to the stuffing box. Do not tighten the glands until the rotating assembly is placed within the lower casing.



5. Slide the stuffing box assembly onto the shaft.

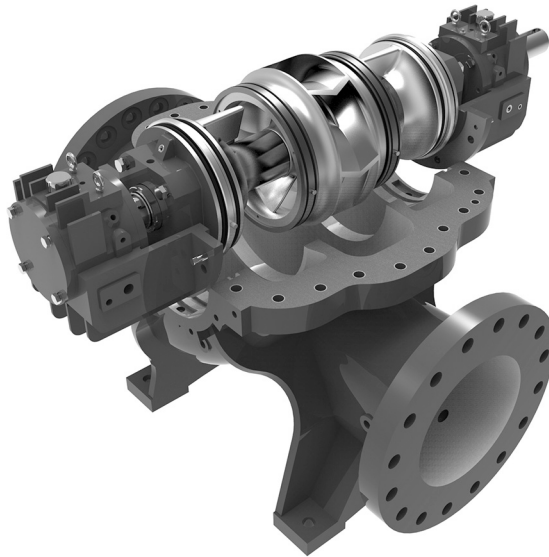
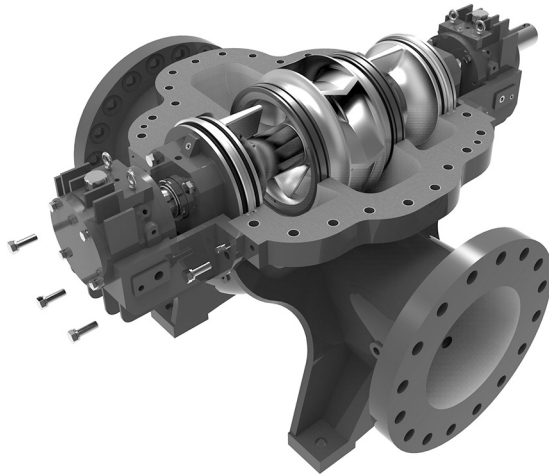




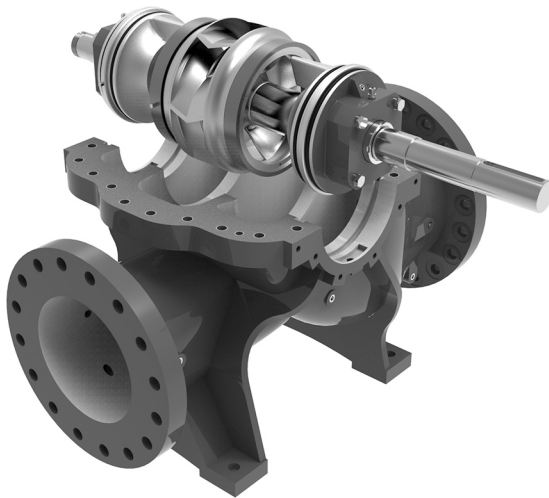
6. Repeat steps 6-10 for the inboard side of the pump.
7. Install stuffing box pins into each stuffing box.
8. Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.



NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 9. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



9. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.

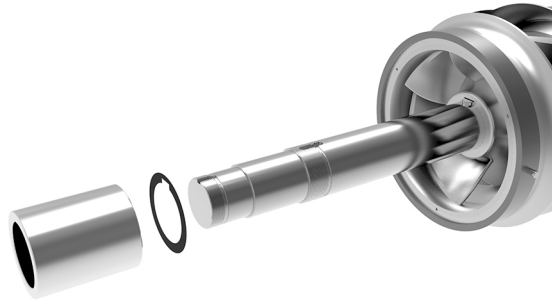


10. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.

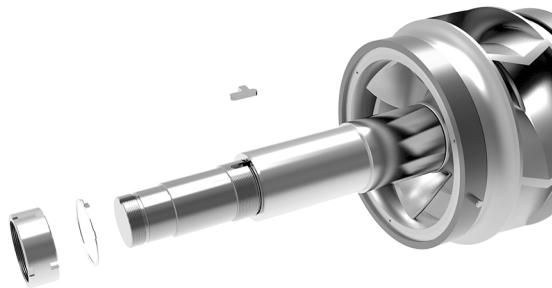
MR7 & MR8 Cartridge seal on sleeve assembly instructions

Shaft sleeve assembly

1. Place the impeller hub gasket against the impeller hub.
2. Slide impeller hub sleeve against impeller hub. Ensure the keyway slot within the impeller hub sleeve aligns with the impeller keyway.



3. Place sleeve O-ring onto shaft adjacent to impeller hub sleeve.
4. Slide shaft sleeve onto shaft. Ensure the shaft sleeve O-ring is seated within the shaft sleeve counterbore. Ensure shaft sleeve keyway is aligned with its shaft keyway counterpart.
5. Place shaft sleeve key into the shaft keyway.
6. Slide tab washer onto shaft against the shaft sleeve.
7. Thread the locknut onto the shaft. Align tab washer prongs with sleeve nut gaps. Bend tab washer prongs over the sleeve nut gaps to secure the locknut.



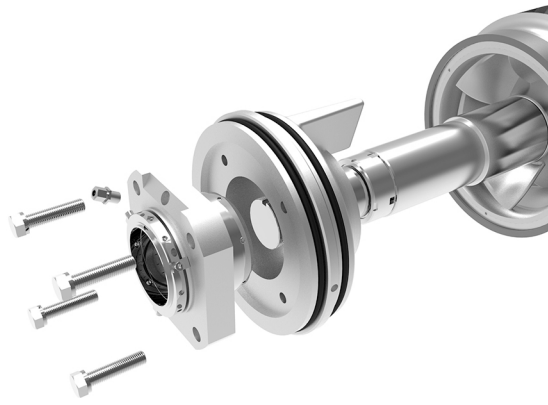
8. Repeat steps 6-8 and 1-4 of Stuffing box and cartridge seal assembly for the inboard side of the pump.

#### Stuffing box and cartridge seal assembly

1. Lubricate and roll O-rings into the grooves along the outer diameter of the stuffing box.
2. Fasten the cartridge seal to the stuffing box; ensure the flush line inlet port of the cartridge seal is oriented upwards and aligned with the stuffing box fin. Ensure O-ring is inserted in cartridge seal gland.

Note: Alternatively, the seal may be fitted onto the stuffing box after the stuffing box has been placed on the shaft.

3. Screw flush line fitting into the port located on the cartridge seal gland.
4. Slide the stuffing box assembly onto the shaft. Install cautiously to prevent damage to the seal.



5. Degrease the cartridge seal set screws and fasten them with (1) drop of thread locker such as Loctite(R) 243. Fasten the M10 set screws to a torque value of 20 N\*m (14.75 ft-lbs). Remove the three or four setup screws and their carriage clips from the back of the seal.

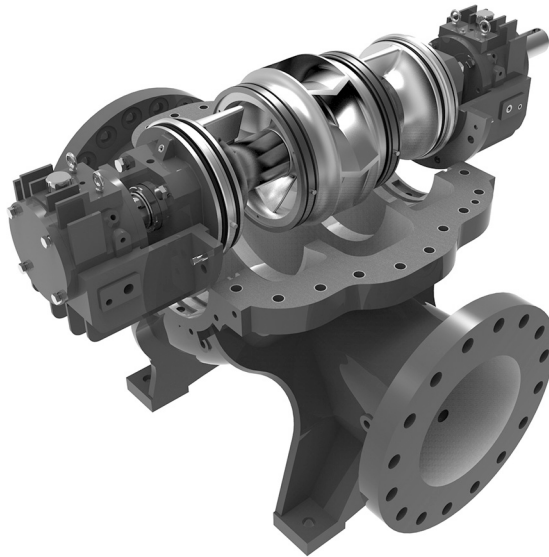
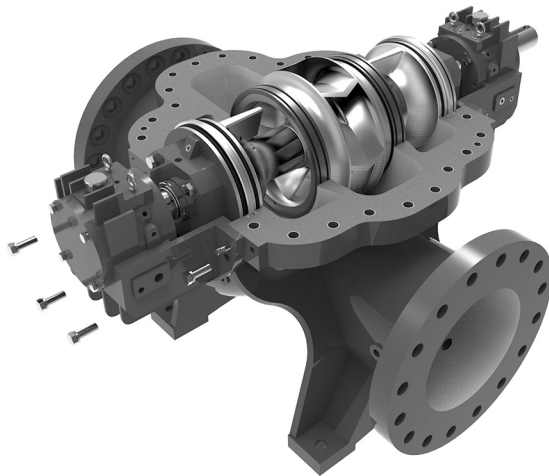
Note: Set screws should never be reused.

Note: Retain the setup screws and clip carriage for future seal maintenance.

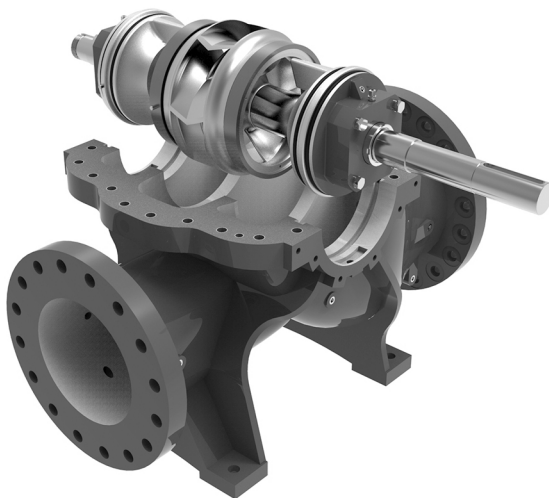
6. Repeat steps 6-10 for the inboard side of the pump.
7. Install stuffing box pins into each stuffing box.
8. Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.



NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 9. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



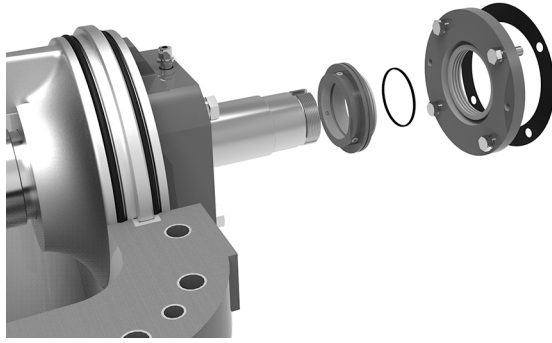
9. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.



10. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.

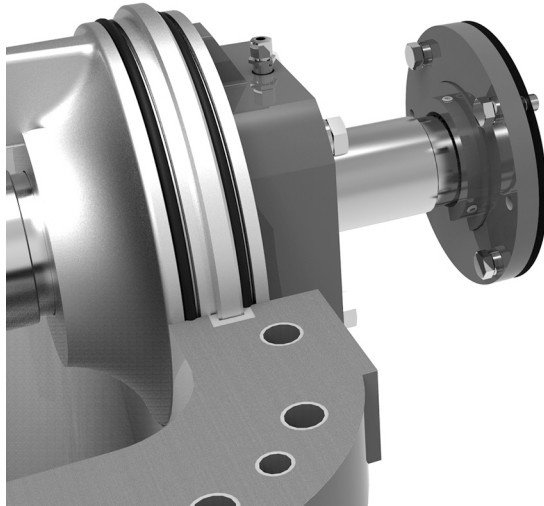
#### Bearing and bearing housing assembly

1. Prepare the bearing seal ring for installation. Lubricate O-ring and install into the groove located along the inner diameter of the bearing seal ring.

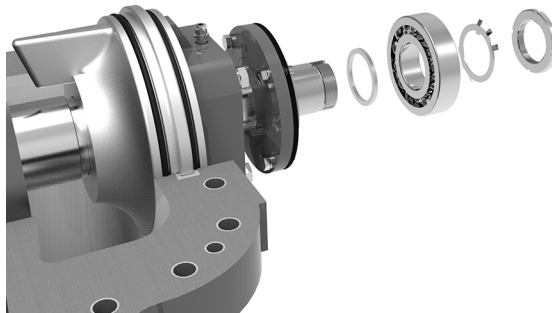


2. Insert the bearing seal ring into the bearing gland.
3. Place bearing gland gasket on the gland face opposite of the bearing seal ring.
4. Insert screws and washers into the bearing gland such that the heads of the screws sit opposite of the gasket.
5. Place bearing gland assembly onto shaft where the bearing seal ring faces the impeller.

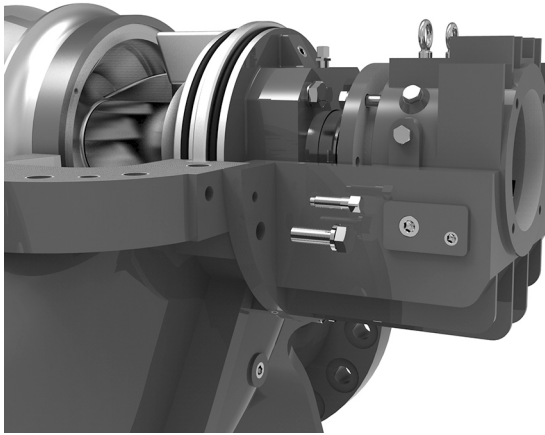
Note: Ensure the smaller diameter holes of the bearing gland are oriented horizontally to orient the grease and drainage ports of the gland correctly.



6. Place the bearing shoulder ring against the outboard end shaft step.
7. Heat the ball bearing to expand the bore.
8. Using insulated gloves, install the bearing onto the shaft against the shoulder ring. Allow the bearing to cool. Coat the exposed side of the bearing with two to three ounces (60 to 85 gm) of grease.
9. Slide tab washer adjacent to bearing.
10. Thread the locknut onto the shaft adjacent to the tab washer. Secure the locknut by bending the washer tabs over the grooves on the locknut.

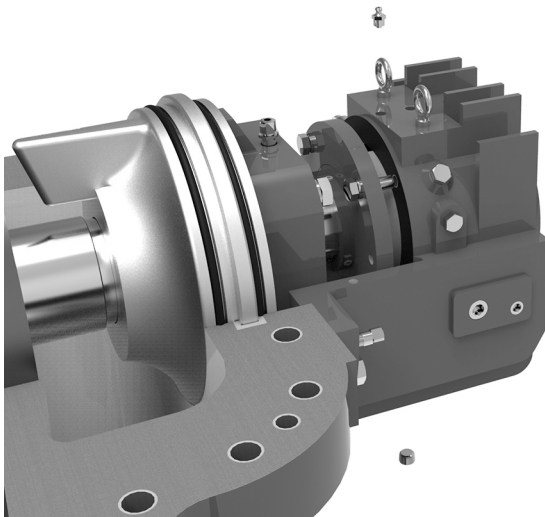


11. Prepare lifting equipment to install the bearing housing. Screw in lifting eyebolts into the top of the bearing housing. Lift the bearing housing and place it around the shaft. Align housing flange with lower casing.
12. Screw the bearing housing into the lower casing. Thread in the jacking screws for future use and to prevent thread corrosion.



13. Insert grease cup into the top of the bearing housing.
14. Insert drain plug into the bottom of the bearing housing.

Note: If using oil lubrication, see [Oil lubrication for bearings assembly](#) on page 91 for the alternative assembly process.

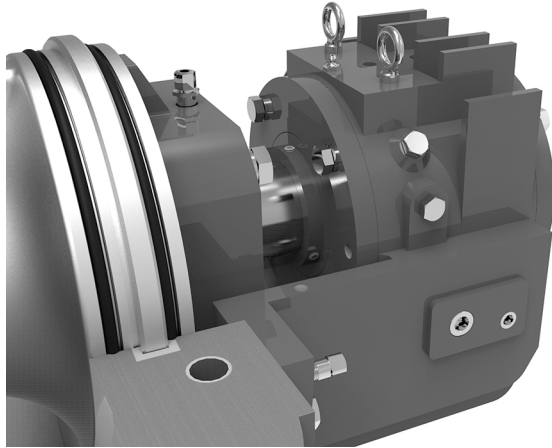


15. Plug remaining openings of the bearing housing unless vibration and temperature sensors will be installed at the end of the pump assembly.
16. Slide bearing gland, gasket and bearing seal ring against the bearing housing. Tighten the bearing gland bolts.
 

Important: Do not tighten bearing seal ring set screws until the inboard bearing housing assembly is fixed to the pump. Tightening the seal ring set screws requires the shaft to be rotated. Rotating the shaft with unbalanced loading can cause property damage.
17. Fasten the outboard bearing gland (end cap) with its gasket to the bearing housing.
18. Repeat steps 1-16 for the inboard bearing housing.
 

Note: Omit steps 6, 9 and 10.
19. Repeat steps 1-3 for the inboard bearing gland and seal ring. Install the bearing gland assembly onto the inboard face of the inboard bearing housing.

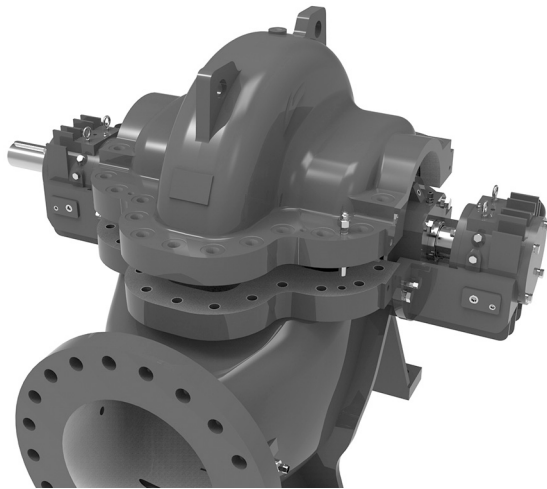
20. Check the seating of all three bearing seal rings and ensure they are firmly seated into their respective bearing glands.



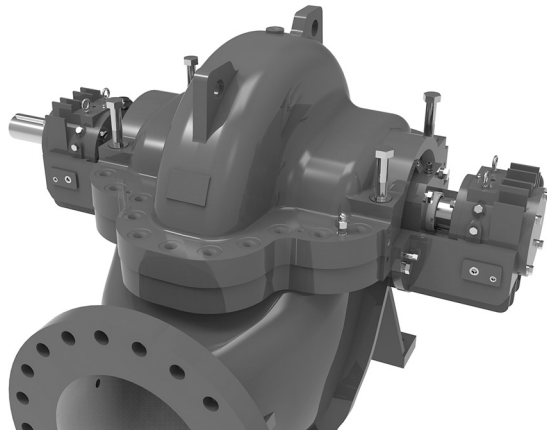
21. Starting from the outboard end, tighten the bearing seal ring set screws. Rotate the shaft to access each set screw.
22. Grease the bearings according to [Regrease the bearings](#).

#### Upper casing assembly

1. Insert tapered pins into the upper casing.
2. Using proper lifting equipment, place the upper casing onto the lower casing using the tapered pins for alignment.



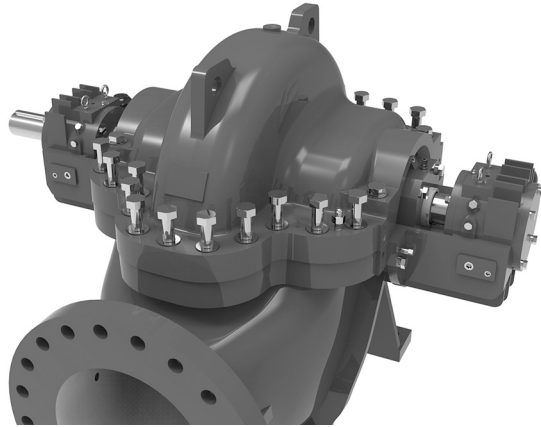
3. Once placed, fasten the four large casing bolts and washers located near the stuffing boxes in an alternating fashion.



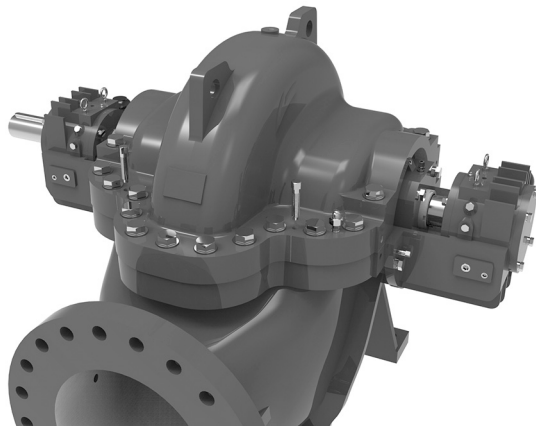


4. Fasten the remaining casing bolts and washers to the torque values specified in [Screw torque values](#) on page 99.

Important: It is important to apply the correct amount of torque to the casing bolts to establish a proper seal at the parting flange.

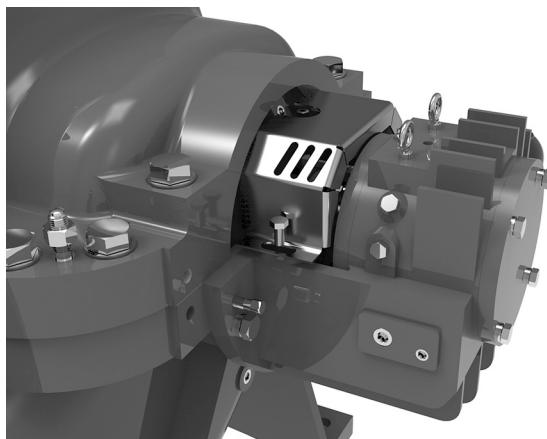


5. Thread in the casing jacking screws for future use and to prevent thread corrosion.

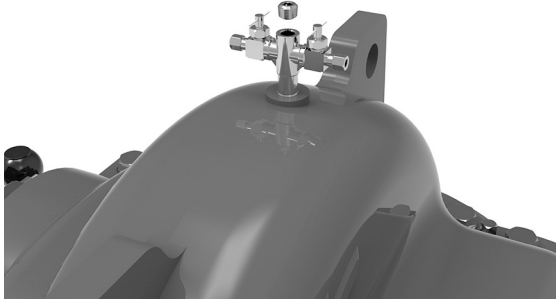


Shaft guard and flush line assembly

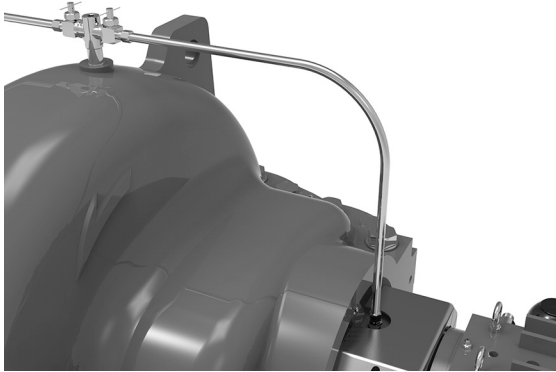
6. Place each shaft guard around the exposed shaft between the bearing housing and seal chamber. Align the slots on either side of the shaft guard with the holes located near the bearing housing flange.
7. Fasten the shaft guards to the bearing housing.



8. Fasten the four arm tube into the top of the upper casing.
9. Insert the appropriate plug into the top of the four arm tube.
10. Attach valves to the remaining two arms of the four arm tube.



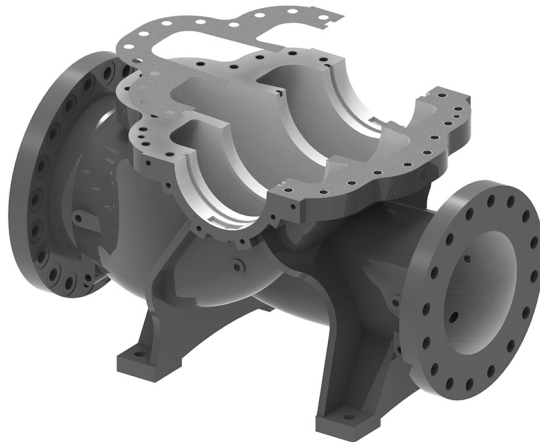
11. Route the flush line piping between the valve and the bite-type fitting located on top of the seal gland. Ensure connections are secure and water-tight.



12. Unless installing pressure sensors, ensure all plugs located on either side of the lower casing are inserted.

### 6.6.3 Pump assembly for pumps with drop-in stuffing box and sleeveless shaft (wet shaft) design

All bearings, O-rings, seals and gaskets should be replaced with new parts during reassembly. Any other parts that are reused should be thoroughly cleaned before reassembly. The main casing joint gasket should be trimmed according to the parting flange profile of the lower casing. Ensure the gasket is flush with the inside edges of the casing.



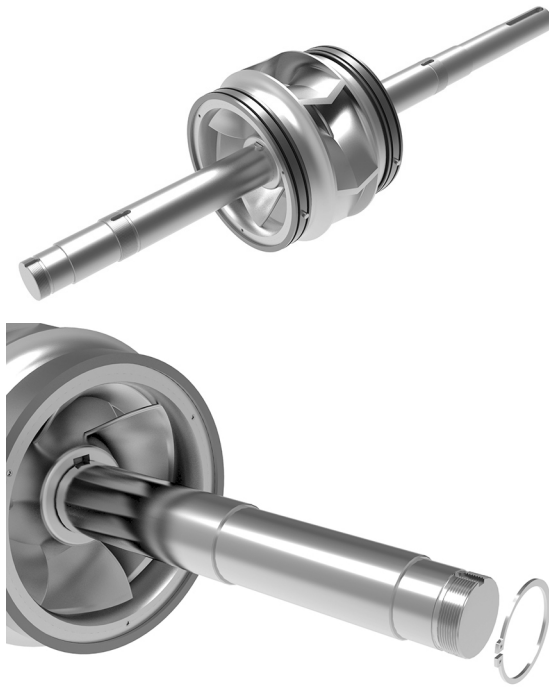
Note: Assemble the outboard side elements of the pump first for any given assembly category.

#### Impeller assembly

1. Place the impeller key(s) in the shaft key slot.
2. Place the impeller on V-blocks or stands such that the impeller bore direction is parallel to the ground. The shaft will be horizontally inserted into the impeller bore.

3. Check the impeller and casing to determine the correct rotational relationship. Insert the outboard (non-driving end) of the shaft into the impeller bore horizontally using a rubber mallet to gently tap the shaft in until the impeller is centered along the impeller key length.
4. Lightly grease casing wear ring O-rings and roll them into their respective grooves. Insert two steel pins into each casing wear ring. Slide the casing wear rings over the impeller eye.
5. Fix the impeller in place by placing the impeller snap ring adjacent to the outboard impeller hub.



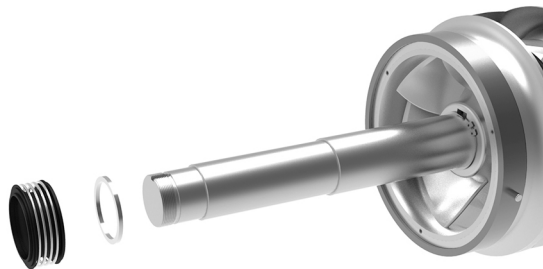


6. Thoroughly clean stuffing boxes, seal glands, and shaft sleeves to prevent dirt from entering the seal during startup.

#### MR1, MR2, MR3 & MR4 Mechanical seal on shaft assembly instructions

1. Slide the mechanical seal shoulder ring against the outboard shaft step.
2. Place the outboard mechanical seal rotating element over the shaft and adjacent to the shoulder ring.
3. Place the inboard mechanical seal rotating element over the shaft against the shaft step.

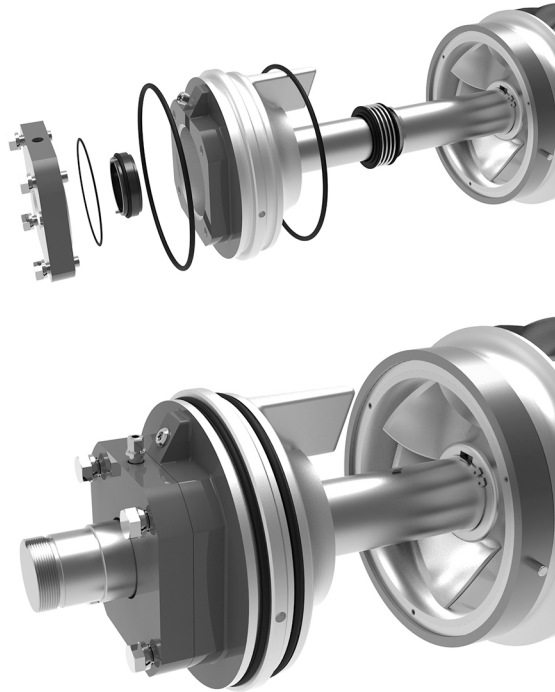
Note: Only the outboard mechanical seal requires a shoulder ring.



#### Stuffing box assembly

1. Plug the stuffing box flush line inlet port.
2. Lubricate and roll O-rings into the grooves along the outer diameter of the stuffing box.
3. Lubricate and roll O-rings into the groove along the outer diameter of the seal gland.
4. Assemble O-ring and pins onto the stationary mechanical seal face.
5. Insert the stationary face of the mechanical seal (with O-rings and pins) into the seal gland, aligning its pins with the holes located on the seal gland.
6. Screw flush line fitting into its port located on the seal gland.
7. Fasten the seal gland to the stuffing box; ensure the flush line inlet port of the seal gland is oriented upwards and aligned with the stuffing box fin.

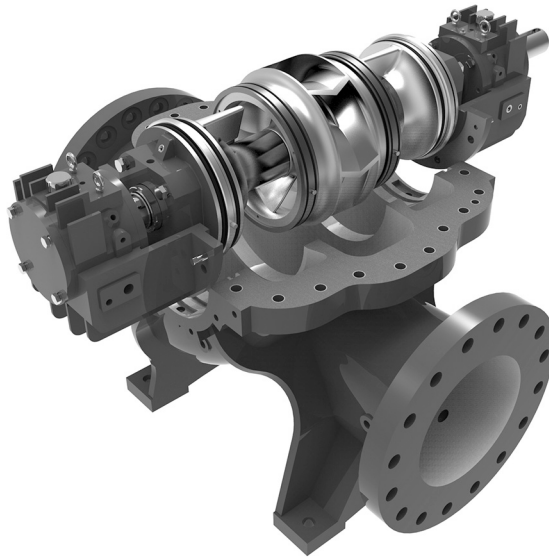
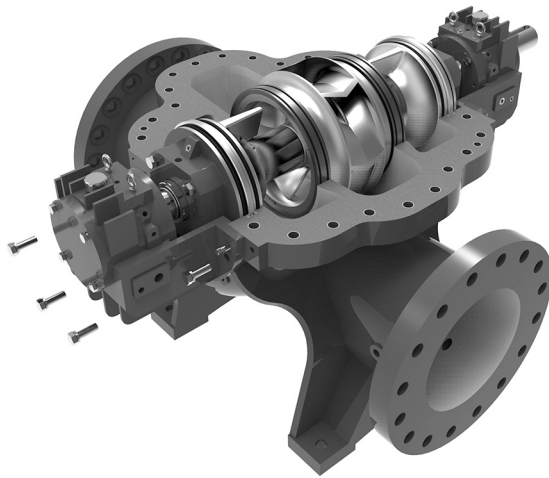
- Slide the stuffing box assembly onto the shaft. Install cautiously to prevent damage to the seal. Ensure stationary and rotating seal elements contact one another.



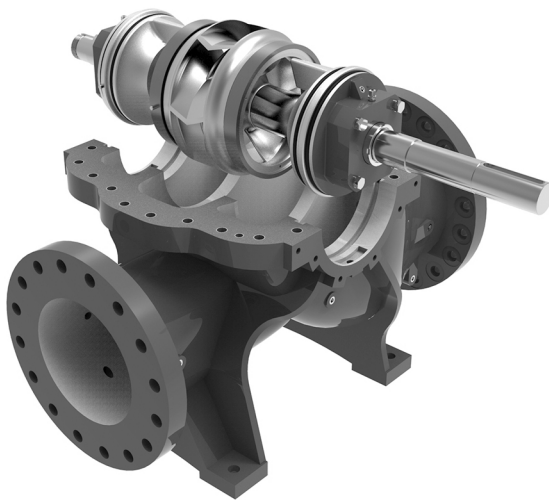
- Repeat steps 1-8 for the inboard side of the pump.
- Install stuffing box pins into each stuffing box.
- Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.



NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 12. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



12. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.

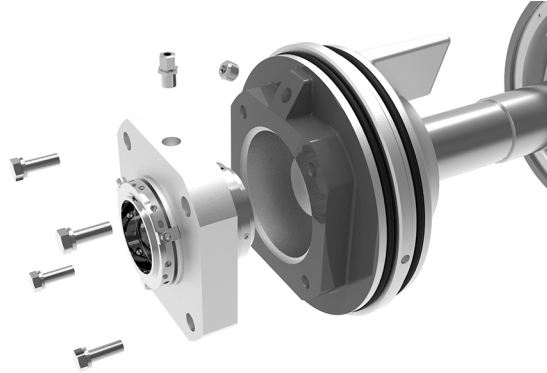


13. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.

MR5 & MR6 Cartridge seal on shaft assembly instructions

Stuffing box and cartridge seal assembly

1. Plug the stuffing box flush line inlet port.
2. Lubricate and roll O-rings into the grooves along the outer diameter of the stuffing box.
3. Screw flush line fitting into its port located on the cartridge seal gland.
4. Fasten the cartridge seal to the stuffing box; ensure the flush line inlet port of the cartridge seal is oriented upwards and aligned with the stuffing box fin.  
Alternatively, the cartridge seal may be fastened onto the stuffing box after the stuffing box has been placed around the shaft.
5. Slide the stuffing box assembly onto the shaft. Install cautiously to prevent damage to the seal.



6. Decrease the cartridge seal set screws and fasten them with (1) drop of thread locker such as Loctite(R) 243. Fasten the M10 set screws to a torque value of 20 N\*m (14.75 ft-lbs). Remove the three or four setup screws and their carriage clips from the back of the seal.

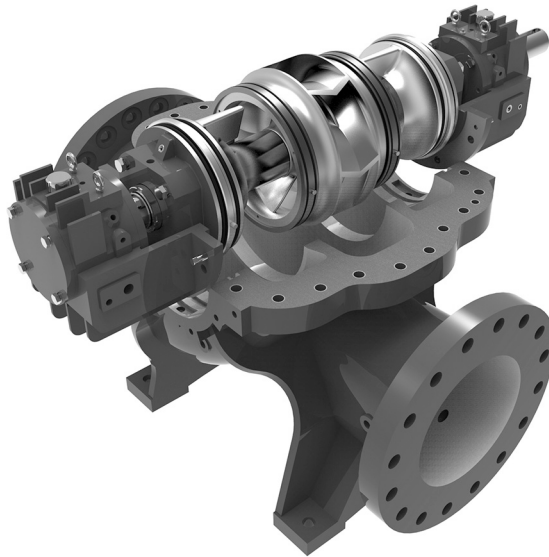
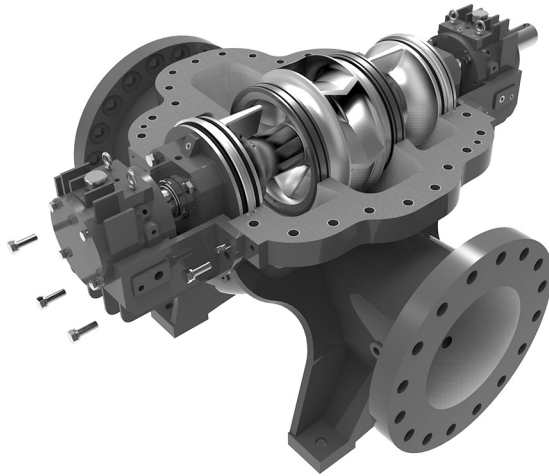
Note: Set screws should never be reused.

Note: Retain the setup screws and clip carriage for future seal maintenance.

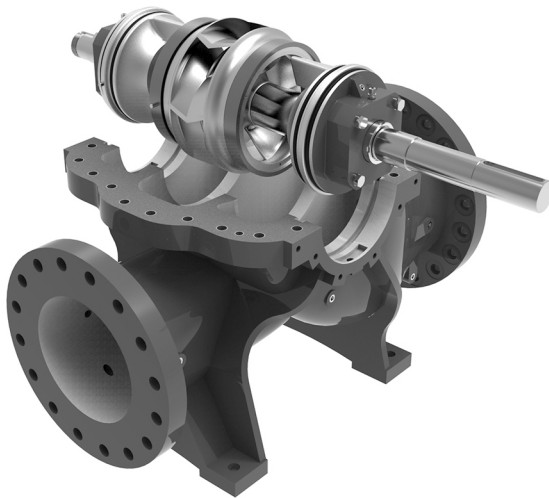
7. Repeat steps 1-6 for the inboard side of the pump.
8. Install stuffing box pins into each stuffing box.
9. Ensure pins are installed into each casing wear ring. Align casing wear ring pins to their respective grooves within the lower casing.



10. NOTE: If pump is removed from operating area and disconnected from piping, proceed to step 10. If the pump is not disconnected from its piping, follow [Bearing and bearing housing assembly](#) on page 79 and lower the entire rotating assembly, including bearing housings, into the pump. Once lowered into the pump, fasten the bearing housing to the pump casing. See the next two images for rotating assembly installation with bearing housings.



11. Lift the rotating assembly and install it within the lower casing. Ensure all pins rest within their respective grooves.



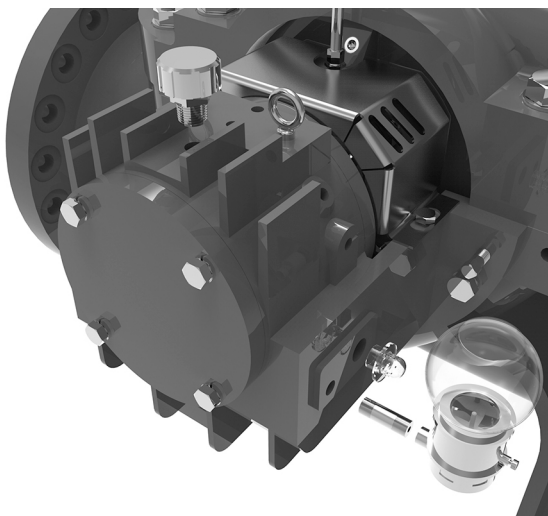
12. Continue the assembly process by following the instructions outlined in [Bearing and bearing housing assembly](#) on page 79.



### 6.6.4 Oil lubrication for bearings assembly

Before assembling oiler components ensure all required oiler kit accessories are on hand. Oiler kits should include (2) glass bulb oilers, (2) NPT pipe nipples, (2) NPT sight glasses, (2) NPT breather vents, and (4) pipe plugs.

1. Choose a side of the pump that is the most accessible for the area it is installed. The oilers and sight glasses should be installed on the chosen side.
2. Thread the NPT pipe nipple into the smaller diameter hole on the side of the bearing housing.
3. Thread the sight glass into the larger diameter hole on the side of the bearing housing.
4. Thread the breather vent into the outermost hole located on top of the bearing housing.
5. Fasten the metal oiler housing onto the pipe nipple.
6. Install the pipe plugs into the holes not being used opposite of the oiler assembly.
7. Fill the oiler to the desired amount and install the glass bulb atop the metal housing. See [Bearing and coupling lubrication](#) on page 38 for more detailed instructions



### 6.6.5 Pump assembly for pumps with integrated stuffing box design

The assembly process for pumps with an integrated stuffing box may be considered identical to the drop-in stuffing box design with a few minor differences. Please note differences outlined below and then refer to [Pump assembly for pumps with drop-in stuffing box and sleeve over shaft \(dry shaft\) design](#) on page 65 for seal on sleeve (dry shaft) configurations and [Pump assembly for pumps with drop-in stuffing box and sleeveless shaft \(wet shaft\) design](#) on page 84 for sleeveless (wet shaft) configurations. Follow all safety procedures outlined in [Pump assembly](#) on page 65.

#### MR2 & MR4 Mechanical Seals

1. When following the drop-in stuffing box assembly instructions for seal installation, lower the impeller and shaft assembly, with drive rings and shaft sleeves (if applicable), into the lower casing before attempting to install the stationary mechanical seal face and seal gland.
2. The upper casing must be fastened to the lower casing before installing both the rotating and stationary elements of the mechanical seal.

#### MR1 & MR3 Mechanical Seals

1. When following the drop-in stuffing box assembly instructions for seal installation, lower the impeller and shaft assembly, with shaft sleeves (if applicable), into the lower casing before attempting to install the stationary mechanical seal face and seal gland.

Note: The rotating face of the metal pusher seal should be assembled onto the shaft or shaft sleeve before the shaft assembly is lowered into the casing. Ensure the seal set screws are fastened to the shaft or shaft sleeve before closing the pump.

2. The upper casing must be fastened to the lower casing before installing the stationary head of the mechanical seal and seal gland.

#### MR5, MR6, MR6, and MR8 Cartridge Seals

1. When following the drop-in stuffing box assembly instructions for seal installation, lower the impeller and shaft assembly, with shaft sleeves (if applicable), into the lower casing before attempting to install the cartridge seal.
2. Close the casing before installing the cartridge seal.

#### Packing

1. When following the drop-in stuffing box assembly instructions for packing installation, lower the impeller and shaft assembly, with shaft sleeves, into the lower casing and close the pump before attempting to install the packing pings, lantern ring, and packing glands.

Note: The flush line port for packing configuration feeds through the upper casing.

### 6.6.6 Assemble the hex coupling guard for guards with vertical supports

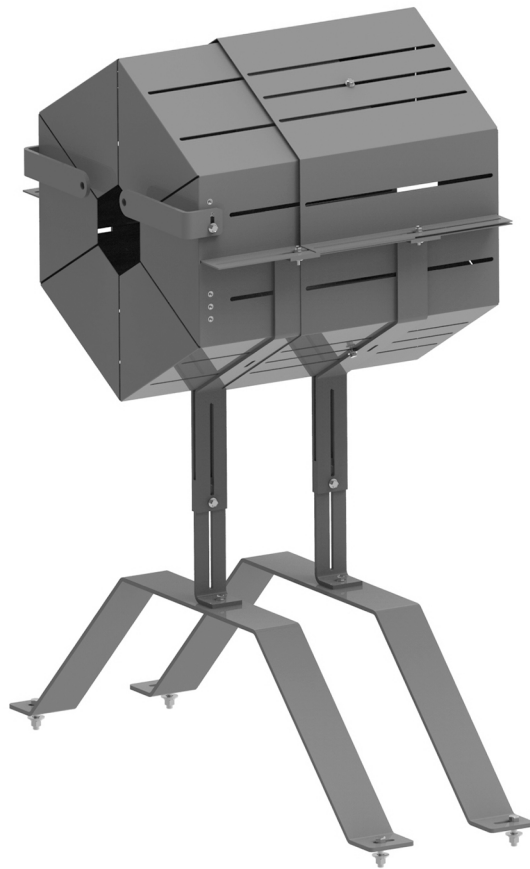


Figure 33: Fully assembled coupling guard

1. Identify the parts of the coupling guard. The following instructions will reference items in the following figure and table.

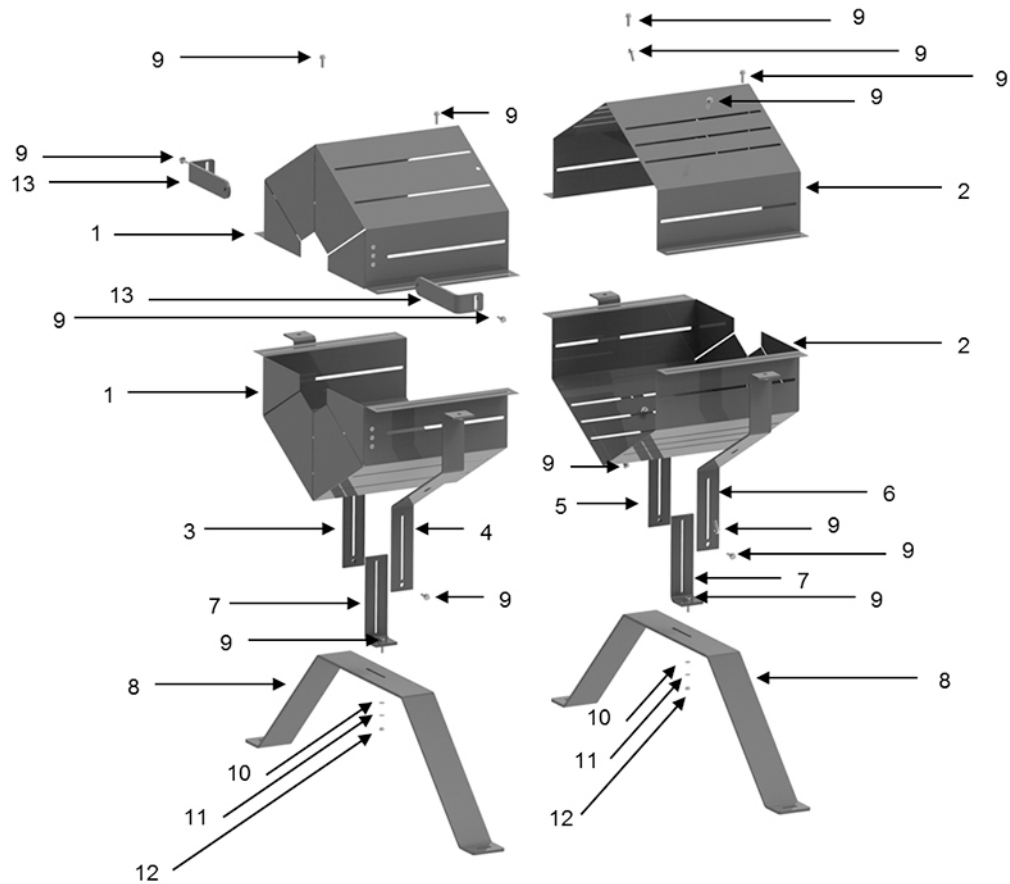


Figure 34: Coupling guard parts

Legend	Part Name
1	Coupler Guard Assembly Inner
2	Coupler Guard Assembly Outer
3	Guard Support Pump Side Left
4	Guard Support Pump Side Right
5	Guard Support Motor Side Left
6	Guard Support Motor Side Right
7	Guard Support Lower
8	Pedestal
9	Hex Bolt
10	Washer
11	Lock Washer
12	Hex Nut
13	Stiffener Clip

- Assemble the pedestal [8] to the base frame. The pedestal feet should align with pre-drilled holes in the base frame. In some cases, the coupling guard kit may not require a pedestal. In these cases, the lower guard support [7] will be fixed directly to the base frame or to a flat plate already mounted to the base frame.
- Install the lower guard support [7] on top of each pedestal [8]. Secure the guard support with the serrated hex bolt, hex nut, washer, and lock washer.

4. Assemble the stiffener clips [13] onto the bearing gland of the pump if they are not already installed. Install one clip at a time. Remove one of the top two bearing gland bolts and secure the long end of the stiffener clip to the bearing gland.
5. Attach the two motor side guard support brackets [5] and [6] to the lower guard support [7] with a serrated hex bolt [9]. The hex bolt should pass through all three parts and thread into a weld nut located at the bottom of one of the guard support brackets.
  - Note: The guard supports [5] and [6] should be identical in shape and size and hug the outside profile of the outer hex guard [2]. Ensure the correct parts are being used; otherwise, the guard support brackets will not align correctly with the outer guard assembly.
  - Note: The height of the guard support brackets may be adjusted after attaching the outer guard assembly [2].
6. Place the lower half of the outer guard assembly [2] beneath the coupling with the closed end of the outer guard facing the motor. Rest the flanges of the outer guard on the guard support brackets [5] and [6].
  - Repeat steps 2, 3, 5, and 6 for the inner guard assembly [1] using the pump-side components.
  - Note: The closed end of the inner guard assembly should face the pump.
7. Couple the bottom half of the outer [2] and inner [1] guard assemblies together by fastening two serrated hex bolts [9] through the bottom face of the outer guard [2] and into the weld nuts located inside the inner guard [1].
8. Place the upper half of the inner guard assembly [1] over the coupling with the closed end of the inner guard facing the pump. Align the flanges and faces of the upper and lower guard halves [1].
9. Secure the sides of the top half of the inner guard assembly [1] to the stiffener clips [13]. Thread in a serrated hex bolt [9] through the short end of the stiffener clip [13] and into the weld nut located on the inside of the guard assembly [1].
10. Secure the inner guard assembly [1] to the pump side guard supports, [3] and [4], with a hex bolt [9]. Pass the bolt through the flanges of the inner guard halves and thread them into the weld nuts located on the guard supports, [3] and [4].
11. Place the top half of the outer guard assembly [2] over the inner guard assembly [1]. Align the top and bottom halves of the outer guard [2] with one another. Fasten the outer guard [2] to the inner guard [1] by threading two serrated hex bolts [9] through the top face of the outer guard [2] into the weld nuts located along the inside of the inner guard [1].
12. Secure the top and bottom halves of the outer guard [2] to the motor side guard supports with two serrated hex bolts. Pass the bolt through the flanges of the outer guard halves and thread them into the weld nuts located on the guard supports, [5] and [6].

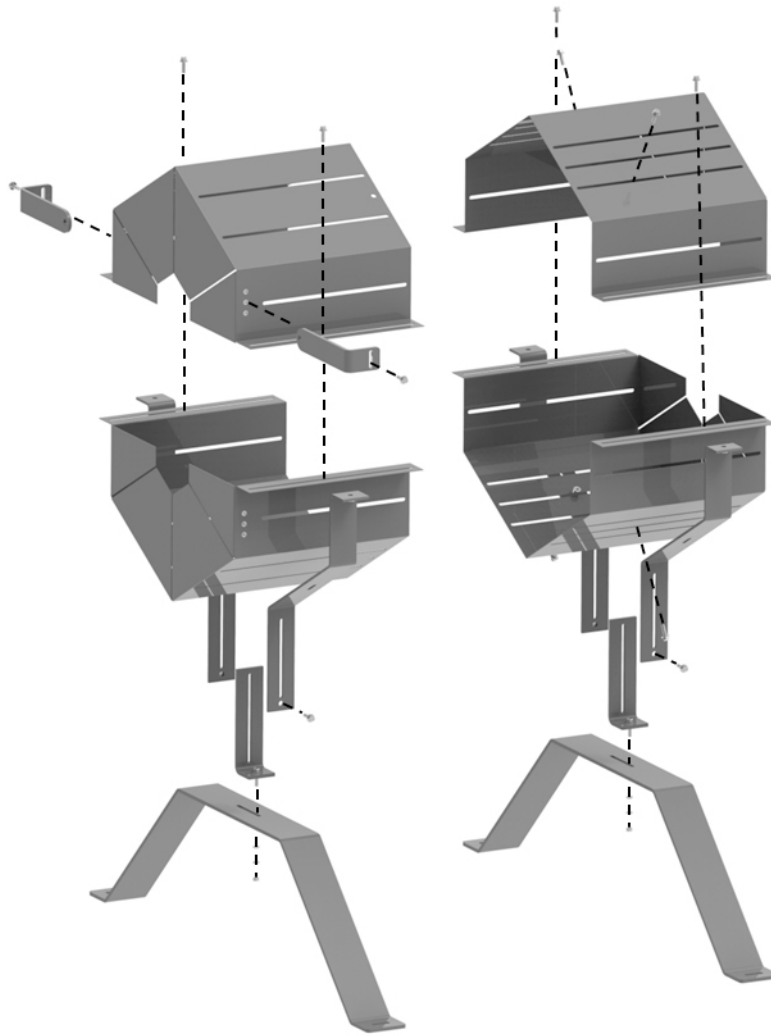


Figure 35: Coupling guard assembly diagram

### 6.6.7 Assemble the hex coupling guard for floating guards

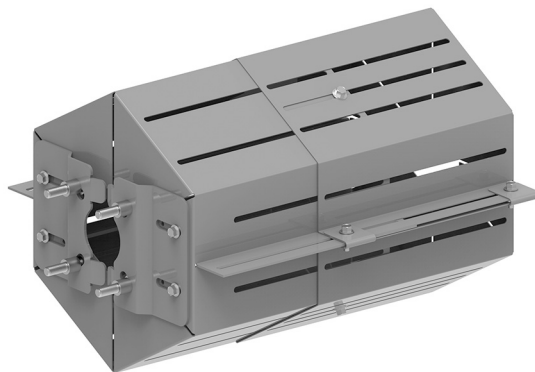


Figure 36: Fully assembled coupling guard – small bracket

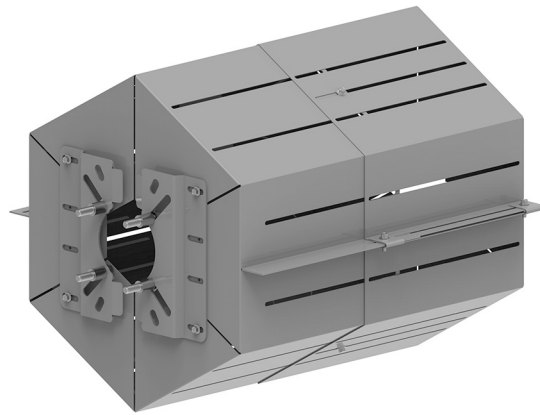


Figure 37: Fully assembled coupling guard – large bracket

Note: Assembly instructions for the coupling guard assembly are the same regardless of which size mounting bracket is used.

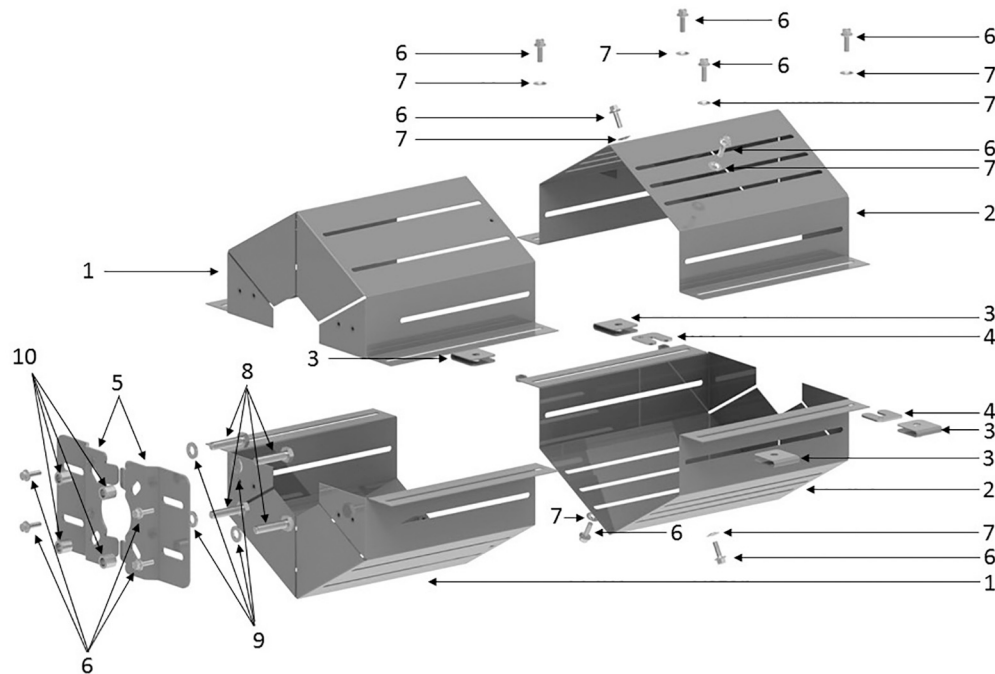


Figure 38: Coupling guard exploded view

Legend	Part Name
1	Coupler Guard Assembly Inner
2	Coupler Guard Assembly Outer
3	Clip
4	Square Spacer
5	Mounting Bracket
6	Hex Bolt
7	Self-Retaining Washer
8	Bearing Gland Bolt
9	Washer
10	Threadless Spacer

1. If the two mounting brackets [5] are not already mounted on the inboard bearing gland (see [Figure 39: Large bracket mounted to pump bearing gland \(without guard assembly\)](#) on page 97), attach them as follows:
  - a) Place one washer [9] onto each of four bearing gland bolts [8].
  - b) Feed one bolt [8] through each of the angled slots on the mounting bracket [5] such that the shaft of the bolt protrudes away from the rounded tabs (as in [Figure 36: Fully assembled coupling guard – small bracket](#) on page 95 and [Figure 37: Fully assembled coupling guard – large bracket](#) on page 96).
  - c) Place one threadless spacer [10] on each of the bolts [8].
  - d) Mount each bracket/fastener set to the inboard bearing gland, adjusting the bolts [8] in the slots to the correct gland size as needed.

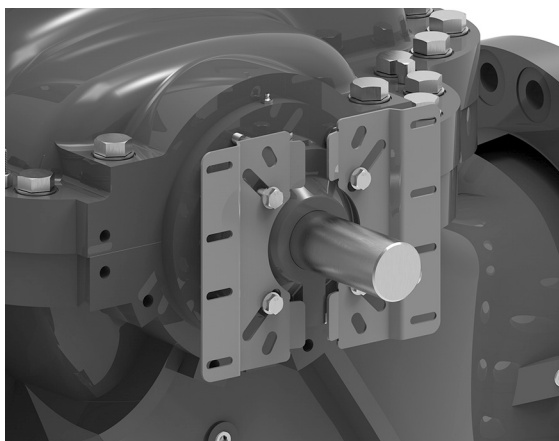


Figure 39: Large bracket mounted to pump bearing gland (without guard assembly)

2. Couple the lower halves of the outer [2] and inner [1] guard assemblies by fastening the two hex head bolts [6] into the bottom faces of the hex guard assembly.  
Be sure to thread each of the hex head bolts through a self-retaining washer [7] placed behind along the inside of the bottom outer guard [2].
3. Position the coupled assembly beneath the coupler. Attach the bottom half of the inner guard [1] to the mounting bracket [5].
  - a) Align the horizontal slots of the mounting bracket [5] with the holes located on the front of the inner guard [1].
  - b) Thread two hex bolts [6] through the mounting bracket [5] and into the weld nuts located behind the holes of the inner guard [1].  
Be sure to place a self-retaining washer [7] between the mounting bracket [5] and inner guard [1] while threading each hex bolt into the inner guard.
4. Place the top half of the inner guard [1] onto the floating lower guard assembly and attach the top half of the inner guard [1] to the mounting bracket [5] by following steps 3a and 3b.
5. Secure the outer guard assembly as follows:
  - a) Slightly thread two hex head bolts [6] into self-retaining washers [7] that should be placed along the inside of the outer guard [2]. Ensure the bolts are placed in the middle viewing slots located on top of the outer guard [2].
  - b) Place the outer guard [2] over the inner guard assembly [1] and align the two outer guard [2] halves with one another.
  - c) Place a square spacer [4] between the flanges of the outer guard assembly [1]. For best results, ensure the spacer piece [4] is aligned with the front of the outer guard assembly [2] near the motor.
  - d) Slide a fastener clip [3] over each spacer [4] location and thread a hex head bolt [6] through both the clip and spacer to secure both parts to the outer guard assembly.

- e) Slide the remaining two fastener clips [4] around the overlapping flanges of the outer [2] and inner [1] guard assemblies. Thread a hex bolt through the clip [4] to secure it in place.
- f) Fasten the two hex bolts [6] located on top of the outer guard assembly [2] into the holes located on the inner guard assembly [1].

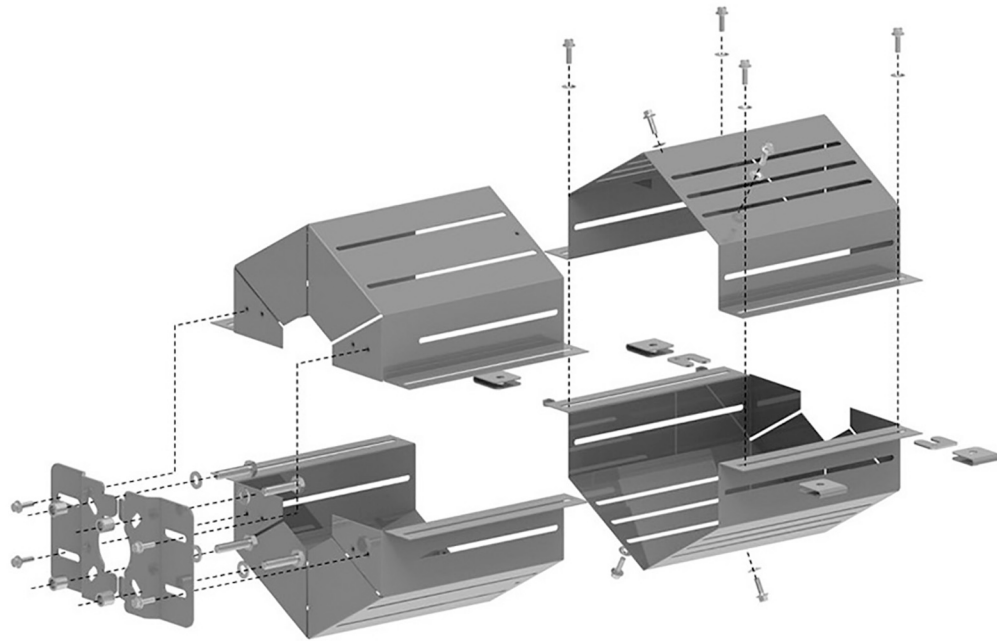


Figure 40: Coupling guard assembly diagram

## 6.7 Change the rotation



### WARNING:

- Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.
- Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
- Never operate a pump without a properly installed coupling guard. Personal injury will occur if you run the pump without a coupling guard.

1. Remove the pump from the base.
2. Follow the Disassembly procedures applicable to the pump.  
You only need to remove one of the bearing glands (bearing caps), bearing housings, and seal bodies (stuffing boxes) in order to change the rotation.
3. Press the press-fitted impeller off of the shaft.
4. Observe the direction in which the vane tips are pointing (see [Figure 41: Impeller rotation orientation diagram viewed from drive end](#) on page 99).
5. Turn the impeller 180° and press it back onto the shaft.
6. Check that the vane tips point in opposite directions.
7. Reinstall the rotating assembly.  
Refer to [Pump assembly for pumps with drop-in stuffing box and sleeve over shaft \(dry shaft\) design](#) on page 65 for instructions regarding reinstallation.
8. Check the impeller-to-volute relationship.
9. Complete the reassembly.



Unless the motor rotation is reversed, the impeller will run backward. Check the motor for proper rotation before you place the pump back in service.

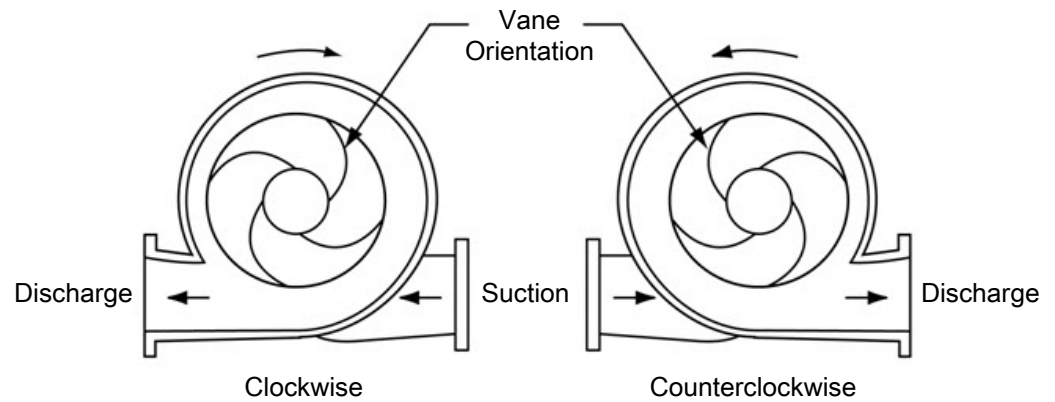



Figure 41: Impeller rotation orientation diagram viewed from drive end

## 6.8 Screw torque values

Capscrew torque in ft-lb (Nm)

\*The M6 set screw has a rating of 10 N m.

Size	Metric Class 8.8
	
M10	33.2 (45)
M12	57.5 (78)
M16	142 (193)
M20	277 (376)
M24	480 (651)
M30	954 (1293)
M36	1666 (2259)

## 6.9 Dealer servicing

If trouble occurs that cannot be rectified, contact your local sales and service representative and be prepared to provide this information:

1. Complete nameplate data of pump and motor
2. Suction and discharge pipe pressure gauge readings
3. Ampere draw of the motor
4. A sketch of the pump hook-up and piping

# 7 Troubleshooting

## 7.1 Operation troubleshooting

Between regular maintenance inspections, be alert for signs of motor or pump trouble. Correct any trouble immediately and avoid costly repair and shutdown.

Symptom	Cause	Remedy
No liquid delivered	Lack of prime	Fill pump and suction pipe completely with liquid.
	Loss of prime	Check for leaks in suction pipe joints and fittings; vent casing to remove accumulated air.
	Suction lift too high.	If no obstruction at inlet, check for pipe friction losses. Static lift may be too great. Measure with mercury column or vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered.
	Discharge head too high.	Check pipe friction losses. Large piping may correct condition. Check that valves are wide open.
	The motor speed is too low.	Check whether motor is directly across-the-line and receiving full voltage. Or frequency may be too low; motor may have an open phase.
	Wrong direction of rotation.	Check motor rotation with directional arrow on pump casing.
	Impeller completely plugged.	Dismantle pump and clean impeller.

Symptom	Cause	Remedy
Not enough liquid being delivered	Air leaks in suction piping	If liquid pumped is water or other non-explosive, and explosive gas or dust is not present, test flanges for leakage with flame or match, or by plugging inlet and putting line under pressure. A gauge will indicate a leak with a drop of pressure.
	The motor speed is too low.	Check whether motor is directly across-the-line and receiving full voltage. Or frequency may be too low; motor may have an open phase.
	Discharge head too high	Check pipe friction losses. Large piping may correct condition. Check that valves are wide open.
	Suction lift too high	If no obstruction at inlet, check for pipe friction losses. Static lift may be too great. Measure with mercury column or vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered.
	Impeller partially plugged	Dismantle pump and clean impeller.
	Cavitation; insufficient NPSH (depending on installation)	<ol style="list-style-type: none"> <li>1. Increase positive suction head on pump by lowering pump.</li> <li>2. Sub-cool suction piping at inlet to lower entering liquid temperature.</li> <li>3. Pressurization suction vessel.</li> </ol>
	Defective impeller.	Inspect impeller, bearings and shaft. Replace is damaged or vane sections badly eroded.
	Foot valve too small or partially obstructed.	Area through ports of valve should be at least as large as area of suction pipe – preferable 1½ times. If strainer is used, net clear area should be 3 to 4 times area of suction pipe.
	Suction inlet not immersed deep enough.	If inlet cannot be lowered, or if eddies through which air is sucked persist when it is lowered, chain a board to suction pipe. It will be drawn into eddies, smothering the vortex.
Too small impeller diameter. Probable cause if none of above)	Check with factory to see if a larger impeller can be used; otherwise, cut pipe losses or increase speed – or both, if needed. Be careful not to seriously overload drive.	

Symptom	Cause	Remedy
Not enough pressure	Mechanical defects	See "Defective impeller" and "Foot valve too small or partially obstructed".
	Obstruction in liquid passages.	Dismantle pump and inspect passages of impeller and casing. Remove obstruction.
	Air or gases in liquid. (Test in laboratory, reducing pressure on liquid to pressure in suction line. Watch for bubble formation.)	May be possible to over rate pump to point where it will provide adequate pressure despite condition. Better to provide gas separation chamber on suction line near pump, and periodically exhaust accumulated gas. See "Cavitation; insufficient NPSH".
	Too small impeller diameter. (Probable cause if none above.)	Check with factory to see if a larger impeller can be used; otherwise, cut pipe losses or increase speed – or both, if needed. Be careful not to seriously overload drive.
Pump operates for short time, then stops	Incomplete priming.	Free pump, piping and valves of all air. If high points in suction prevent this, they need correcting.
	Suction lift too high.	If no obstruction at inlet, check for pipe friction losses. Static lift may be too great. Measure with mercury column or vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered.
	Air leaks in suction piping.	If liquid pumped is water or other non-explosive, and explosive gas or dust is not present, test flanges for leakage with flame or match, or by plugging inlet and putting line under pressure. A gauge will indicate a leak with a drop of pressure.
	Air or gasses in liquid.	May be possible to over rate pump to point where it will provide adequate pressure despite condition. Better to provide gas separation chamber on suction line near pump, and periodically exhaust accumulated gas. See "Cavitation; insufficient NPSH".
Pump takes too much power	Head lower than rating; thereby pumping too much liquid.	Machine impeller's OD to size advised by factory.
	Cavitation	<ol style="list-style-type: none"> <li>1. Increase positive suction head on pump by lowering pump.</li> <li>2. Sub-cool suction piping at inlet to lower entering liquid temperature.</li> <li>3. Pressurization suction vessel.</li> </ol>
	Mechanical defects	See "Defective impeller" and "Foot valve too small or partially obstructed".

Symptom	Cause	Remedy
	Suction inlet not immersed enough.	If inlet cannot be lowered, or if eddies through which air is sucked persist when it is lowered, chain a board to suction pipe. It will be drawn into eddies, smothering the vortex.
	Liquid heavier (in either viscosity or specific gravity) than allowed for.	Use larger driver. Consult factory for recommended size. Test liquid for viscosity and specific gravity.
	Wrong direction of rotation.	Check motor rotation with directional arrow on pump casing.
	Casing distorted by excessive strains from suction or discharge piping.	Check alignment. Examine pump for friction between impeller and casing. Replace damaged parts.
	Shaft bent due to damage – through shipment, operation, or overhaul.	Check deflection of rotor by turning on bearing journals. Total indicator run-out should not exceed 0.002 on shaft and 0.004 on impeller wearing surface.
	Mechanical failure of critical pump parts.	Check bearings and impeller for damage. Any irregularity in these parts will cause a drag on shaft.
	Misalignment	Realign pump and driver.
	Speed may be too high (brake hp of pump varies as the cube of the speed; therefore, any increase in speed means considerable increase in power demand).	Check voltage on motor.
	Electrical defects.	The voltage and frequency of the electrical current may be lower than that for which the motor was built; or there may be defects in motor. The motor may not be ventilated properly due to poor location.
	Mechanical defects in turbine, engine or other type of drive exclusive of motor.	If trouble cannot be located, consult factory.

# 8 Parts Listings and Exploded View

## 8.1 e-XC exploded view

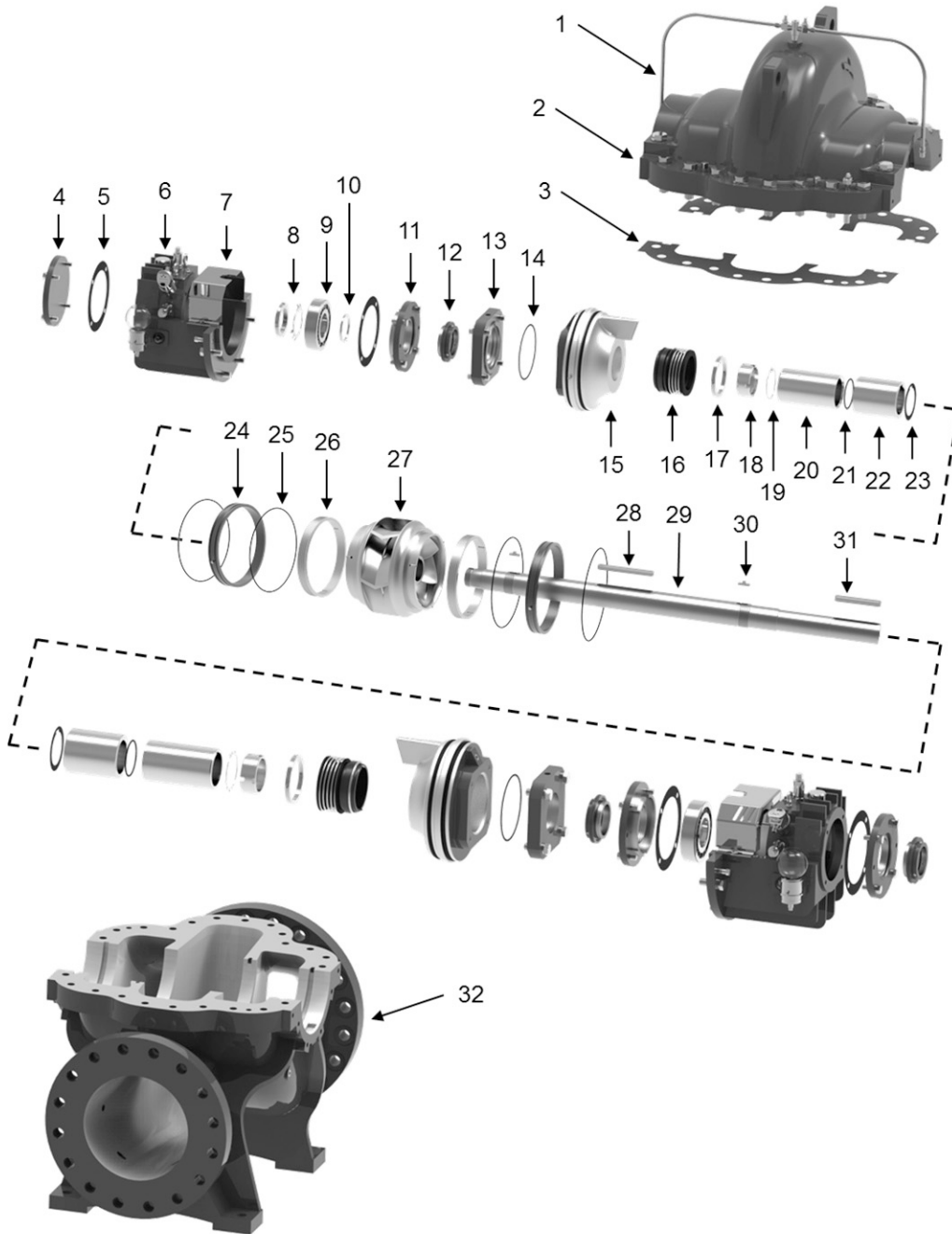


Figure 42: Seal on Sleeve Drop-in Stuffing Box Design

Table 7: Legend<sup>1</sup>

Number	Description
1	External flush line
2	Upper casing
3	Gasket (parting flange)
4	Outboard end cap

Number	Description
5	Gasket (bearing gland)
6	Bearing housing
7	Shaft guard
8	Locknut and tab washer (outboard bearing only)
9	Deep groove ball bearing (single row)
10	Shoulder ring (outboard bearing only)
11	Bearing gland
12	Bearing seal ring (labyrinth seal)
13	Seal gland
14	O-ring (seal gland)
15	Stuffing box with O-rings
16	Mechanical seal
17	Drive ring
18	Shaft sleeve nut
19	Tab washer (shaft sleeve nut)
20	Shaft sleeve
21	O-ring (shaft sleeve)
22	Impeller hub sleeve
23	Gasket (impeller hub sleeve)
24	Casing wear ring
25	O-ring (casing wear ring)
26	Impeller wear ring
27	Impeller
28	Impeller key
29	Shaft
30	Heterotype key (shaft sleeve)
31	Coupling key
32	Lower casing

<sup>1</sup>The integrated stuffing box design assembly is identical to the drop-in assembly with the exception of items related to the stuffing box (item 15).

Note: Seal chamber components for other sealing configurations, including seal on shaft (wet shaft) design, are documented within the 'Seal Chamber Interchangeability Charts' located within the e-XC Performance Curves and Technical Data brochure. The interchangeability charts also map out how to switch between different sealing configurations.

# 9 Product warranty

## 9.1 Commercial warranty

Warranty to Commercial Buyers. Seller warrants the goods sold to any Commercial Buyer ("Buyer") under this Agreement (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or eighteen (18) months from the date of shipment, which date of shipment shall not be delayed by Buyer by more than thirty (30) days after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the Warranty). Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any good(s) which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest, except in circumstances that are, or are reasonably foreseeably, urgent or exigent, in which case Buyer will provide Seller with immediate notice. Under either the repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the Warranty period. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; (g) damaged resulting from the use of accessory equipment not sold or approved by Seller; or (h) damaged or diminished by use in combination with parts subject to any above cause. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will provide to Buyer any warranty Buyer receives from Seller's supplier of such products.

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- 2) a leading global water technology company.

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