

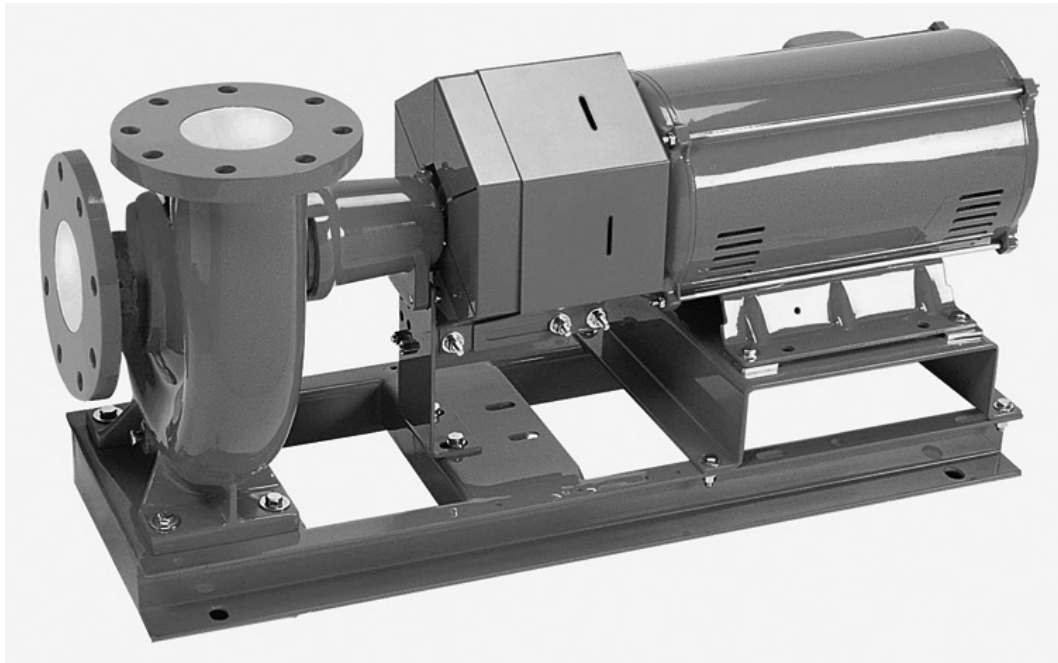


ITT

Bell & Gossett

Installation, Operation, and Maintenance Manual

Series 1510



Engineered for life

Table of Contents

| | |
|---|----|
| Introduction and Safety | 3 |
| Introduction..... | 3 |
| Inspect the package..... | 3 |
| Inspect the unit..... | 3 |
| Product warranty..... | 3 |
| Safety..... | 4 |
| Safety message levels..... | 4 |
| Safety instruction decals..... | 5 |
| User safety..... | 6 |
| Environmental safety..... | 8 |
| Transportation and Storage | 9 |
| Lifting methods..... | 9 |
| Long-term storage..... | 9 |
| Product Description | 11 |
| General description..... | 11 |
| Operational specifications..... | 11 |
| Installation | 13 |
| Preinstallation..... | 13 |
| Pump location guidelines..... | 13 |
| Foundation requirements..... | 14 |
| Piping checklist..... | 14 |
| Pump insulation checklist..... | 15 |
| Typical installation..... | 16 |
| Special installation..... | 16 |
| Install the pump, driver, and coupling..... | 16 |
| Level the base on a concrete foundation..... | 17 |
| Grout the baseplate..... | 17 |
| Pump-to-driver alignment..... | 18 |
| Alignment checks..... | 18 |
| Align a standard sleeve type coupler (black rubber sleeve)..... | 18 |
| Perform fine alignment..... | 20 |
| Commissioning, Startup, Operation, and Shutdown | 21 |
| Preparation for startup..... | 21 |
| Check the rotation..... | 21 |
| Start the pump..... | 22 |
| Pump operation precautions..... | 22 |
| Shut down the pump..... | 23 |
| Make the final alignment of the pump and driver..... | 23 |
| Note on the packed pump operation..... | 23 |
| Maintenance | 25 |
| Bearing maintenance..... | 25 |
| Regrease the grease-lubricated bearings..... | 25 |
| Lubricating grease requirements..... | 25 |
| Disassembly..... | 26 |
| Disassembly precautions..... | 26 |
| Drain the pump..... | 26 |
| Remove the hex coupling guard..... | 26 |

| | |
|---|----|
| Remove the coupling..... | 27 |
| Remove the bearing frame and impeller assembly..... | 27 |
| Remove the impeller..... | 28 |
| Remove the mechanical seal (1510 and 1510-F) | 28 |
| Remove the seal or packing rings (1510-S, 1510-D, 1510-PF, and 1510-8G) | 28 |
| Pre-assembly inspections..... | 28 |
| Replacement guidelines..... | 28 |
| Shaft and sleeve inspection..... | 29 |
| Bearing frame inspection..... | 29 |
| Reassembly..... | 29 |
| Seal assembly..... | 29 |
| Impeller installation..... | 33 |
| Assemble the packed stuffing box (1510-PF) | 33 |
| Reinstall the bearing frame and impeller assembly (all except 1510-8G) | 34 |
| Reinstall the bearing frame and impeller assembly (1510-8G)..... | 34 |
| Install the hex coupling guard..... | 34 |
| Capscrew torque values..... | 35 |
| Dealer servicing | 35 |

Introduction and Safety

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.

Inspect the package

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

If the product has been picked up at a distributor, make a claim directly to the distributor.

Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

Product warranty

Coverage

ITT undertakes to remedy faults in products from ITT under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to an ITT representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by ITT-authorized personnel.
- Genuine ITT parts are used.
- Only Ex-approved spare parts and accessories authorized by ITT are used in Ex-approved products.

Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation made without consulting ITT

- Incorrectly executed repair work
- Normal wear and tear

ITT assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

ITT products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your ITT representative.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
- Operating, installing, or maintaining the unit in any way that is not 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 ITT. If there is a question regarding the intended use of the equipment, please contact an ITT representative before proceeding.
- This manual clearly identify accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
- Do not change the service application without the approval of an authorized ITT representative.



CAUTION:

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



Safety message levels



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
- Product malfunction


Definitions

| Safety message level | Indication |
|--|--|
|  <p>DANGER:</p> | A hazardous situation which, if not avoided, will result in death or serious injury |
|  <p>WARNING:</p> | A hazardous situation which, if not avoided, could result in death or serious injury |

| Safety message level | Indication |
|--|--|
|  <p>CAUTION:</p> | A hazardous situation which, if not avoided, could result in minor or moderate injury |
|  <p>Electrical Hazard:</p> | The possibility of electrical risks if instructions are not followed in a proper manner |
| <p>NOTICE:</p> | <ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury |

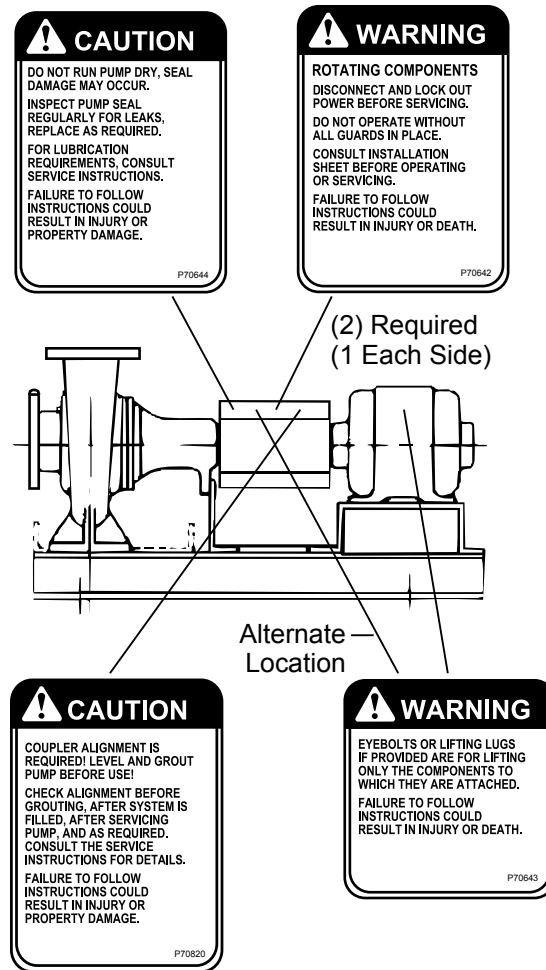
Safety instruction decals

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> |
|---|--|

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 ITT representative for a replacement.



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

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:

- Helmet
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection

- First-aid kit
- Safety devices

NOTICE:

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

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local 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.
- Always bear in mind the risk of electrical accidents and burn injuries.

Wash the skin and eyes

Do the following if chemicals or hazardous fluids have come into contact with your eyes or your skin:

| If you need to wash your... | Then... |
|-----------------------------|--|
| Eyes | <ol style="list-style-type: none"> 1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention. |
| Skin | <ol style="list-style-type: none"> 1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least one minute. 3. Seek medical attention, if required. |

Environmental safety

The work area

Always keep the station clean to avoid and/or discover emissions.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Transportation and Storage

Lifting methods



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.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- Do not attach sling ropes to shaft ends.

Table 1: Methods

| Pump type | Lifting method |
|-------------------------------------|--|
| A bare pump without lifting handles | Use a suitable sling attached properly to solid points like the casing, the flanges, or the frames. |
| A base-mounted pump. | Use slings under the pump casing and the drive unit, under the base rails, or through lifting lugs, when provided. |

Examples

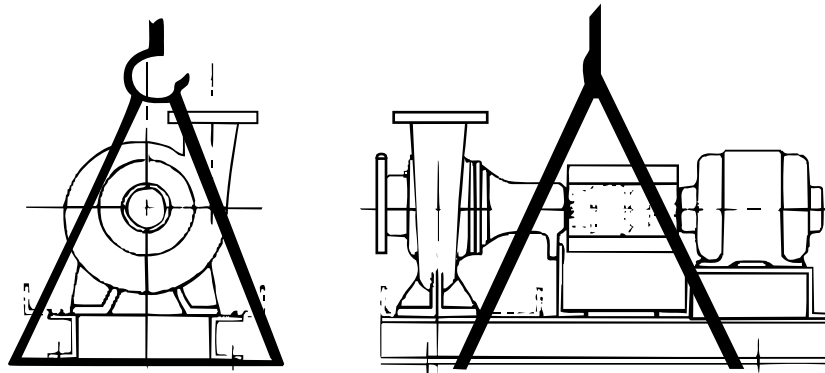


Figure 1: Example of a proper lifting method

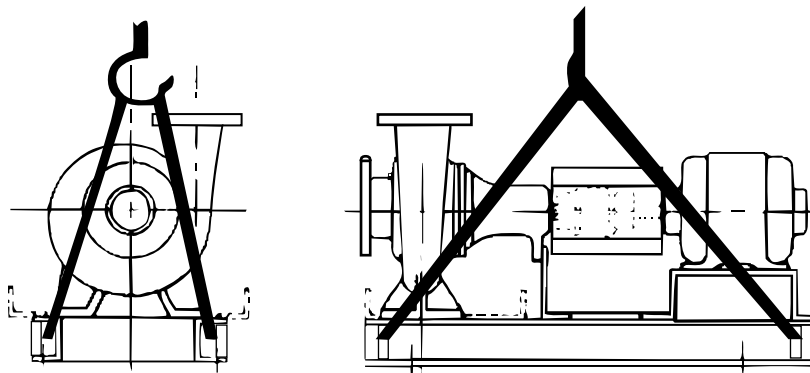


Figure 2: Example of a proper lifting method using lifting lugs

Long-term storage

If the pump is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

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

For questions about possible long-term storage treatment services, please contact your local ITT sales representative.

Product Description

General description

Description

The pump is a centrifugal, frame-mounted pump. The following pump features make it easy to install, operate, and service:

- High efficiency
- Rugged bronze-fitted construction
- Foot-mounted volute with back pullout bearing frame
- Center drop-out coupler
- Regreasable bearings

Intended applications



WARNING:

California Proposition 65 warning! This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

The pump is intended for use with these pumped fluids:

- Unheated domestic and fresh water
- Boiler feed water
- Condensate
- Hydronic cooling or heating
- Benign liquids
- Pressure boosting
- General liquid transfer

Rotation

Pump rotation is clockwise when viewed from the back of the motor. An arrow is also located on the pump to show the direction of rotation.

Operational specifications

Mechanical seal specifications

This table describes the specifications of each mechanical seal type.

| Seal type | Parameter | Value |
|---------------------------------------|--|---------------------------------|
| Standard seals, BUNA | pH range limits for BUNA | pH 7–9 |
| | Liquid temperature range that complies with the pH range limits for BUNA | -20°F to 225°F (-29°C to 107°C) |
| Standard seals, EPT | pH range limits for EPT | pH 7–11 |
| | Liquid temperature range that complies with the pH range limits for EPT | -20°F to 250°F (-29°C to 121°C) |
| Flushed single seals ^{1,3,4} | pH range limits | pH 7–9 |
| | Liquid temperature range | 0°F to 250°F (-18°C to 121°C) |
| Flushed double seals ^{1,3,4} | pH range limits | pH 7–9 |
| | Liquid temperature range | 0°F to 250°F (-18°C to 121°C) |

| Seal type | Parameter | Value |
|----------------------|--------------------------|------------------------------|
| Packing ² | pH range | pH 7–9 |
| | Liquid temperature range | 0°F to 200°F (-18°C to 93°C) |

Table notes

1. An external flush is required on low pressure systems that contain a high concentration of abrasives.
2. Use packing on open or closed systems which require a large amount of makeup water, as well as systems that are subjected to a wide variety of chemical conditions and solids buildup.
3. For operating temperatures above 250°F, a cooled flush is required and is recommended for temperatures above 225°F for optimum seal life. On closed systems, cooling is accomplished by inserting a small heat exchanger in the flush line to cool the seal flushing fluid.
4. Flush-line filters and sediment separators are available on request.

Installation

Preinstallation

Precautions


WARNING:

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

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

Evaluate the installation in order to determine that the Net Positive Suction Head Available (NPSH_A) meets or exceeds the Net Positive Suction Head Required (NPSH_R), as stated by the pump performance curve.

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.

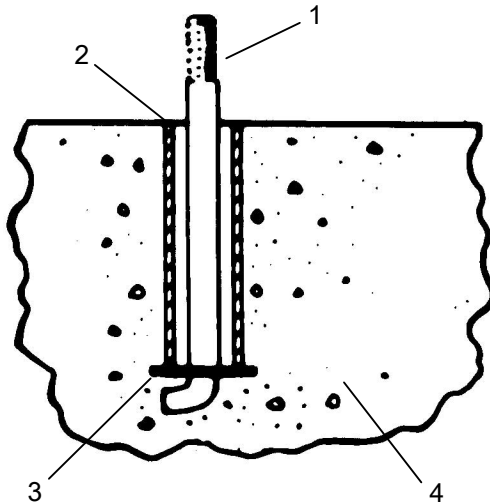
| Guideline | Explanation/comment |
|---|--|
| Keep the pump as close to the liquid source as practically possible. | This minimizes the friction loss and keeps the suction piping as short as possible. |
| Make sure that the space around the pump is sufficient. | This facilitates ventilation, inspection, 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"> • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls 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. |

Foundation requirements

Requirements

- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the pump unit.
- The foundation must weigh at least 2-1/2 times the weight of the pump unit.
- Provide a flat, substantial concrete foundation in order to prevent strain and distortion when you tighten the foundation bolts.
- Sleeve-type and J-type foundation bolts are most commonly used. Both designs allow movement for the final bolt adjustment.
- Tie the concrete pad in with the finished floor.
- Use foundation bolts and larger pipe sleeves to give room for final bolt location.

Diagram



1. Foundation bolt
2. Pipe sleeve
3. Washer
4. Built-up concrete foundation

Piping checklist



WARNING:

- The heating of water and other fluids causes volumetric expansion. The associated forces can cause the failure of system components and the release of high-temperature fluids. In order to prevent this, install properly sized and located compression tanks and pressure-relief valves. Failure to follow these instructions can result in serious personal injury or death, or property damage.
- Avoid serious personal injury and property damage. Make sure that the flange bolts are adequately torqued.

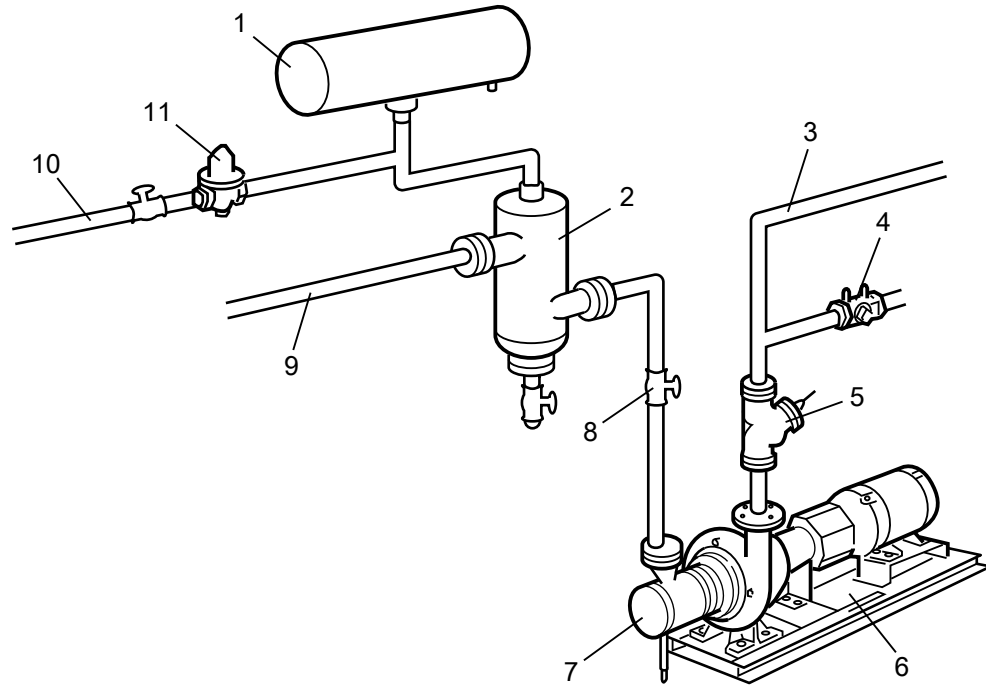
| Check | Explanation/comment | Checked |
|---|--|---------|
| Check that a section of straight pipe, with a length that is five times its diameter, is installed between the suction side of the pump and the first elbow, or that a suction diffuser is installed. | This reduces suction turbulence by straightening the flow of liquid before it enters the pump. | |
| Check that the suction and discharge pipes are supported independently by use of pipe hangers near the pump. | This eliminates pipe strain on the pump. | |

| Check | Explanation/comment | Checked |
|--|--|---------|
| Check that there is a strong, rigid support for the suction and discharge lines. | As a rule, ordinary wire or band hangers are not adequate to maintain proper alignment. | |
| For pumps with flanges, check that the bolt holes in the pump flanges match the bolt holes in the pipe flanges. | — | |
| Check that the suction or discharge lines are not forced into position. | Coupling and bearing wear will result if suction or discharge lines are forced into position. | |
| Check that fittings for absorbing expansion are installed in the system when considerable temperature changes are expected. | This helps to avoid strain on the pump. | |
| Check that you have a foot valve of equal or greater area than the pump suction piping when you use an open system with a suction lift. | Prevent clogging by using a strainer at the suction inlet next to the foot valve. Make sure that the strainer has an area three times that of the suction pipe with a mesh hole diameter of no less than 0.25 in. (0.64 cm). | |
| Check that flexible piping is used on both the suction and discharge sides of the pump when you use an isolation base. | — | |
| Check that a triple duty valve is installed in the discharge line. | This valve serves as a check valve that protects the pump from water hammer, and serves as an isolation valve for servicing and for throttling. | |
| Check that the pipeline has isolation valves around the pump and has a drain valve in the suction pipe. | — | |
| Use Teflon tape sealer or a high quality thread sealant when you install the suction and discharge connections to a threaded pump housing. | — | |

Pump insulation checklist

| Check | Checked |
|--|---------|
| Check that the bearing assembly grease fittings are accessible and visible. | |
| Check that the vent slots on the sides and bottom of the bearing assembly are uncovered and completely open. | |

Typical installation



1. Compression tank (located in the suction piping)
2. Rolairtrol air separator
3. System supply
4. Circuit setter
5. Triple duty valve
6. Pump
7. Suction diffuser
8. Isolation valve
9. Pipe from boiler, chiller, or converter
10. Cold water supply
11. Reducing valve

Special installation

Installation with suction diffuser and triple-duty valve

Do not install and operate triple-duty valves and suction diffusers in closed systems unless the system is designed with these safety and control devices:

- Pressure relief valves
- Compression tanks
- Pressure controlling equipment
- Temperature controlling equipment
- Flow controlling equipment

Check that the control and safety devices have these characteristics:

- Properly sized for their purpose
- Placed correctly in the system before putting the system into operation

Installation with isolation base

When using an isolation base, flexible piping should be used on both suction and discharge sides to reduce the strain on the flanges.

Install the pump, driver, and coupling

Perform these steps only if the unit was not installed at the factory.

1. Mount and fasten the pump on the baseplate. Use applicable bolts.

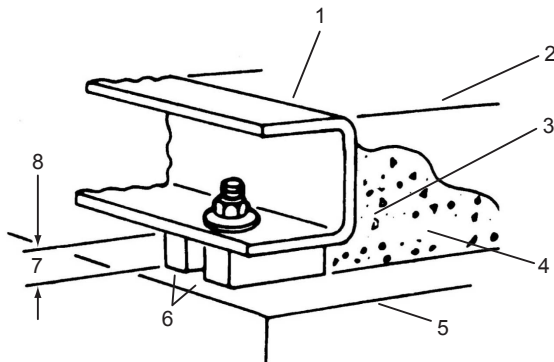
2. Mount the driver on the baseplate. Use applicable bolts and hand tighten.
3. Install the coupling.
See the installation instructions from the coupling manufacturer.

Level the base on a concrete foundation

Before leveling and grouting the base, perform an initial alignment. See Pump-to-driver alignment.

1. Place the pump on its concrete foundation.
2. 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. Pump Base Rail
2. Grout only to top of base rail
3. To keep shims in place, allow non-shrinking grout to flow around hold down lugs.
4. Grout
5. Concrete Foundation
6. Shims
7. 1" (25.40 mm) Gap
8. Allow 1" for shims. Place on both sides of anchor bolts.

Grout the baseplate

Required equipment:

- Cleaners: Do not use an oil-based cleaner because the grout will not bond to it. See the instructions provided by the grout manufacturer.
 - Grout: Non-shrink grout is required.
1. Clean all the areas of the baseplate that will come into contact with the grout.
 2. Build a dam around the foundation.
 3. Thoroughly wet the foundation that will come into contact with the grout.
 4. Pour grout into the baseplate up to top of the base rails.
To hold wedges or shims in place, allow the grout to flow around them.
- When you pour the grout, remove air bubbles from it by using one of these methods:
- Puddle with a vibrator.
 - Pump the grout into place.
5. Allow the grout to set.

Pump-to-driver alignment

Precautions



WARNING:

- Follow shaft alignment procedures in order to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow the coupling installation and operation procedures from the coupling manufacturer.
- 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: Proper alignment is the responsibility of the installer and the user of the unit. Check the alignment of frame-mounted units before you operate the unit. Failure to do so can result in equipment damage or decreased performance.

Alignment checks

When to perform alignment checks

You must perform alignment checks under these circumstances:

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

Types of alignment checks

| Type of check | When it is used |
|--|---|
| Initial alignment (cold alignment) check | Prior to operation when the pump and the driver are at ambient temperature. |
| Final alignment (hot alignment) check | After operation when the pump and the driver are at operating temperature. |

Initial alignment (cold alignment) checks

| When | Why |
|--------------------------------|---|
| Before you grout the baseplate | This ensures that alignment can be accomplished. |
| After you grout the baseplate | This ensures that no changes have occurred during the grouting process. |
| After you connect the piping | This ensures that pipe strains have not altered the alignment. If changes have occurred, you must alter the piping to remove pipe strains on the pump flanges. |

Final alignment (hot alignment) checks

| When | Why |
|---------------------|--|
| After the first run | This ensures correct alignment when both the pump and the driver are at operating temperature. |
| Periodically | This follows the plant operating procedures. |

Align a standard sleeve type coupler (black rubber sleeve)



WARNING:

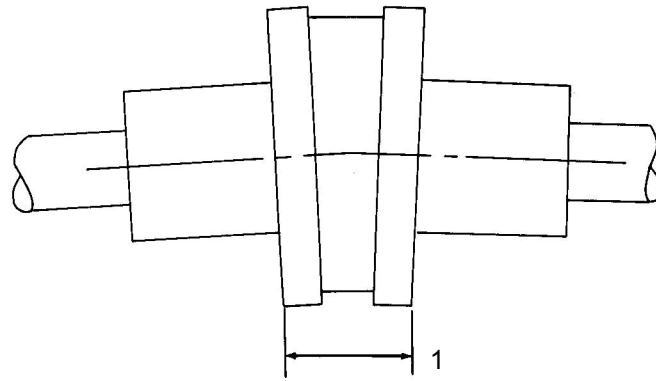
Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.

NOTICE:

- Do not rotate the coupler to make adjustments. This may result in equipment damage.
- Do not move or shim the driver unless you need to make adjustments. This may result in decreased performance.
- Black rubber sleeves have different horsepower load ratings than orange Hytrel sleeves. Do not interchange these sleeves.

Make sure you have the following before you start this procedure:

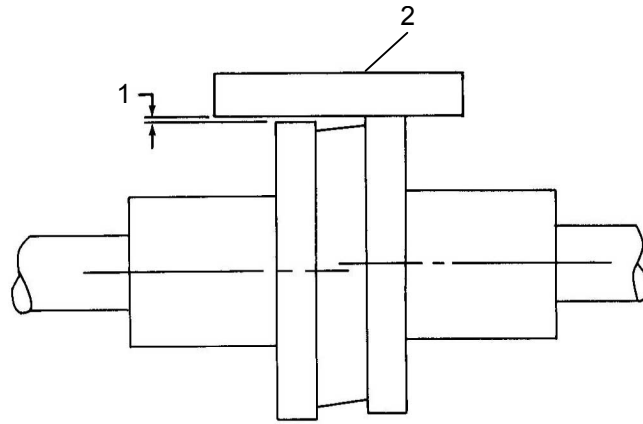
- A micrometer or a caliper
 - A maximum 1/64 in. (0.397 mm) end clearance between the sleeve and the two coupling halves
1. Check for angular misalignment:
 - a) Measure from the outside face of one flange to the outside face of the opposite flange at four points 90° apart. Use the micrometer or the caliper.
The maximum permitted reading value is 1/64 in. (0.397 mm) per inch of the coupling radius.



1. Distances Across Coupler Flanges Should Be Equal (check 4 places)

Figure 3: Example of angular misalignment

- b) Move or shim the drive unit, if necessary, until the permitted reading value is obtained.
2. Check for parallel misalignment:
 - a) Put a straight edge across one coupling half.
 - b) Measure the gap between the straight edge and the opposite coupling half. Use the micrometer or the caliper.
A gap of maximum 1/64 in. (0.397 mm) is permitted.



1. Amount of Parallel Misalignment
2. Straight Edge

Figure 4: Example of parallel misalignment

- c) Move or shim the drive unit, if necessary, until the permitted reading value is obtained.

When the procedure is complete, both the angular and parallel alignment must meet the permitted tolerances.

Note that with variable frequency drives, the angular and parallel dimensional values are reduced by 50%.

Perform fine alignment

For orange Hytrel sleeves, operation at 3500 rpm, or all other coupler types, use a dial indicator when greater alignment accuracy is required. On sleeve type couplers, make sure there is a maximum 1/64 in. (0.397 mm) end clearance between the sleeve and the two coupler halves.

1. Mount the dial indicator base to one coupler half or shaft.
2. Position the dial indicator button on the opposite coupler half:
 - For angular alignment, position the button on the front or rear face.
 - For parallel alignment, position the button on the outside diameter.
3. Set the dial to zero.
4. Rotate both coupler halves together.

Make sure the indicator button always indicates off the same spot.

Misalignment within 0.004 in. (0.102 mm) TIR is permissible.

Commissioning, Startup, Operation, and Shutdown

Preparation for startup



WARNING:

- Failure to follow these precautions before you start the pump will lead to serious personal injury and equipment failure.
- Do NOT operate the pump at zero flow or with suction and discharge valves closed. These conditions can create an explosive hazard due to vaporization of pumped fluid and can quickly lead to pump failure and physical injury.
- Never operate the pump without the coupling guard correctly installed.
- Always 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.
- Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.

Precautions

NOTICE:

- Verify the driver settings before you start the pump.
- Make sure that the warm-up rate does not exceed 2.5°F (1.4°C) per minute.

You must follow these precautions before you start the pump:

- Flush and clean the system thoroughly to remove dirt or debris in the pipe system in order to prevent premature failure at initial startup.
- Bring variable-speed drivers to the rated speed as quickly as possible.
- Run a new or rebuilt pump at a speed that provides enough flow to flush and cool the close-running surfaces of the stuffing-box bushing.
- If temperatures of the pumped fluid will exceed 200°F (93°C), then warm up the pump prior to operation. Circulate a small amount of fluid through the pump until the casing temperature is within 100°F (38°C) of the fluid temperature.

At initial startup, do not adjust the variable-speed drivers or check for speed governor or over-speed trip settings while the variable-speed driver is coupled to the pump. If the settings have not been verified, then uncouple the unit and refer to instructions supplied by the driver manufacturer.

Check the rotation



WARNING:

- Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.
- 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.

1. Lock out power to the driver.
2. Make sure that the coupling hubs are fastened securely to the shafts.
3. Unlock power to the driver.
4. Make sure that everyone is clear, and then jog the driver long enough to determine that the direction of rotation corresponds to the arrow on the pump.

5. Lock out power to the driver.

Start the pump



CAUTION:

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

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

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

Pump operation precautions

General considerations



CAUTION:

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

Operation at reduced capacity



WARNING:

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

**CAUTION:**

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

Operation under freezing conditions**NOTICE:**

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

Shut down the pump

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

Make the final alignment of the pump and driver**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.
- Follow shaft alignment procedures in order to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow the coupling installation and operation procedures from the coupling manufacturer.

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

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

Note on the packed pump operation**Tighten the gland nuts**

Before you start the pump, back off the packing gland nuts or screws until the gland is loose.

Hand tighten until the gland is snug against the first packing ring. Initially, water might freely run from the packing. This is normal and should be allowed to continue for a period of time before you continue to tighten the gland. Tighten the gland nuts slowly and one flat at a time.

Leakage rate

An adequate leakage rate is not one single value for all pumps and installations, but is the amount required to provide adequate cooling and lubrication. The required leakage is influenced by operating pressure, fluid temperature, shaft speed, and so forth. For fluid temperatures in the range of 32°F to 190°F (0°C to 88°C), average leakage rates of 60 to 80 drops per minute are recommended. However, each individual pump and installation has unique operating conditions that result in widely-variable leakage rate requirements.

Maximum fluid temperature

At fluid operating temperatures near the upper limit of 190°F (88°C), the maximum temperature rise of the leakage is important. Never operate a packed pump with steam forming at the gland. This limits the temperature rise to a maximum of about 20°F (-7°C). If the formation of steam persists at higher leakage rates, you must provide cooling water by means of an external supply, or a heat exchanger used to cool the bypass flush.

Maintenance

Bearing maintenance

Bearing lubrication schedule

| Type of bearing | First lubrication | Lubrication intervals |
|----------------------------|-------------------|---|
| Grease-lubricated bearings | N/A | Regrease bearings every 2500 operating hours or every six months. |

Regrease the grease-lubricated bearings

NOTICE:

Make sure that the grease container, the greasing device, and the fittings are clean. Failure to do this can result in impurities entering the bearing housing when you regrease the bearings.

1. Wipe dirt from the grease fittings.
2. Fill both of the grease cavities through the fittings with a recommended grease until the fresh grease comes out of the relief holes.
3. Wipe off any excess grease.
4. Recheck the alignment.

The bearing temperature usually rises after you regrease due to an excess supply of grease. Temperatures return to normal in about two to four operating hours as the pump runs and purges the excess grease from the bearings.

Lubricating grease requirements

NOTICE:

- Never mix greases of different consistencies (NLGI 1 or 3 with NLGI 2) or with different thickeners. For example, never mix a lithium-based grease with a polyurea-based grease. This can result in decreased performance.
- Remove the bearings and old grease if you need to change the grease type or consistency. Failure to do so can result in equipment damage or decreased performance.

Specifications

- Regrease the pump while the pump is running.
- Regrease the pump bearing with NLGI grade 2 lithium base petroleum grease.
- Regrease the pump every 2500 operating hours or every six months.
- Lubricate the motor per the motor manufacturer's instructions.
- Always keep the pump and motor properly lubricated.

Disassembly

Disassembly precautions



WARNING:

- This manual clearly identify accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
 - 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.

Drain the pump



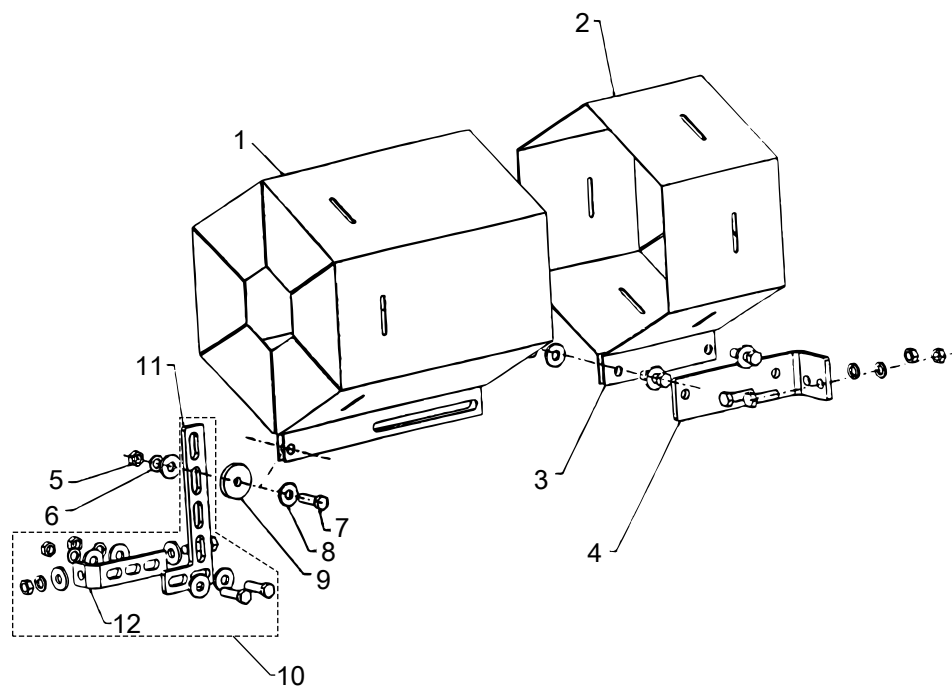
CAUTION:

- 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.
-

Remove the hex coupling guard

1. Remove the two capscrews that hold the outer (motor side) coupling guard to the support brackets.
2. Spread the outer guard apart and pull it off the inner guard.
Do not spread the outer and inner guards more than necessary to remove the guard. It could alter their fit and appearance.
3. Remove the capscrew that holds the inner guard to the support bracket.
4. Spread the inner guard apart and pull it over the coupling.



1. Outer guard
2. Inner guard
3. Attach the support bracket inline with the bolt
4. Support bracket
5. Nut
6. Lockwasher
7. Capscrew
8. Flat washer
9. Spacer washer
10. Option used instead of the spacer where overall guard length exceeds 12 in. (30 cm) or the guard width is over 10 in. (25 cm) across the flats
11. Locate the support arm between the outer guard ends. Align the arm with holes in the outer guard and holes in the saddle bracket.
12. Motor saddle bracket attached to the motor saddle

Figure 5: Hex guard exploded view for typical installation

Remove the coupling

1. Loosen the setscrews in both coupling halves.
2. Slide each half as far back as possible on the shaft.
3. Remove the sleeve.

If you use a full-diameter impeller, you might have to remove the pump-side coupler half and slide the motor back on its base. This allows you to gain sufficient clearance in order to remove the pump assembly from the volute.

Remove the bearing frame and impeller assembly

1. Remove the support foot capscrews.
2. Loosen the volute capscrews but do not remove them.
3. Use the capscrews in the jackscrew holes for all models except for the 1510-8G.
4. Loosen the bearing frame and impeller assembly from the volute.



WARNING:

Make certain that the internal pressure of the pump is relieved before you continue. Failure to follow these instructions could result in serious personal injury or death, or property damage.

5. Remove the seal flushing tube if it is used.
6. Remove the volute capscrews.

7. Remove the bearing frame and impeller assembly from the volute.

Remove the impeller



WARNING:

Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped liquid, resulting in severe physical injury and property damage.



CAUTION:

Wear heavy work gloves when you handle impellers. The sharp edges can cause physical injury.

1. For all models except the 1510-8G, remove the impeller capscrew.
2. Remove these parts:
 - For all models except the 1510-8G, remove the lockwasher and the washer.
 - For the 1510-8G, remove the impeller nut and the washer.
3. Remove the impeller.
4. Remove the impeller key.

Remove the mechanical seal (1510 and 1510-F)

1. Remove the rotating portion of the seal.
If necessary, use a screwdriver to loosen the rubber ring.
2. Remove the seal insert, the insert gasket, and the retainer if it is used.

Remove the seal or packing rings (1510-S, 1510-D, 1510-PF, and 1510-8G)

1. Remove the hex nuts from the seal cap bolts.
2. For the 1510-8G, remove the spacer sleeve and the hex nuts that hold the packing gland to the stuffing box.
3. Remove the coverplate screws.
4. Remove the coverplate from the bracket.
5. Remove the seal assembly or packing rings.

Pre-assembly inspections

Guidelines

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

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

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

Replacement guidelines

Impeller replacement

This table shows the criteria for replacing the impeller:

| Impeller parts | When to replace |
|----------------|--|
| Impeller vanes | <ul style="list-style-type: none"> When grooved deeper than 1/16 in. (1.6 mm), or When worn evenly more than 1/32 in. (0.8 mm) |
| Vane edges | When you see cracks, pitting, or corrosion damage |

Gaskets, O-rings, and seats replacement

- Replace all gaskets and O-rings at each overhaul and disassembly.
- Inspect the seats. They must be smooth and free of physical defects.
- Replace parts if the seats are defective.

Shaft and sleeve inspection

Inspection criteria

Inspect the shaft and sleeve according to this criteria:

- Thoroughly clean the shaft and sleeve.
- Thoroughly clean the coverplate seal cavity.
- Inspect the surface for damage such as pitting, corrosion, nicks, and scratches.

Replace these parts if they are damaged.

Bearing frame inspection

Check the bearing frame for these conditions:

- Visually inspect the bearing frame and support foot for cracks.
- Inspect the bearing frame for smooth and free operation.
- Inspect the bearing frame for contamination by pumped fluids.

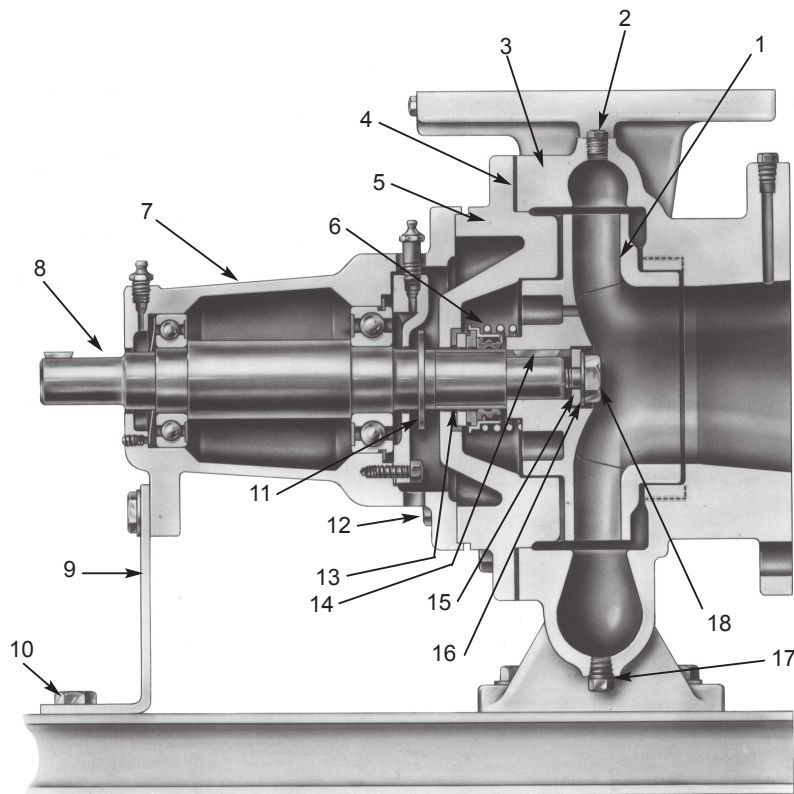
Repair or replace the bearing frame as necessary.

Reassembly

Seal assembly

Assemble the standard mechanical seal (1510 and 1510-F)

1. Lubricate the shaft sleeve and coverplate seal cavity with soapy water.
Do not use a petroleum lubricant.
2. Install a new insert gasket.
3. Install a new seal insert and make sure that the indentation is against the insert gasket.
4. Slide a new rotating seal assembly onto the shaft sleeve.
5. Push the top of the compression ring with a screwdriver until the seal is tight against the seal insert.
6. Install the seal spring and point the narrow end toward the seal.

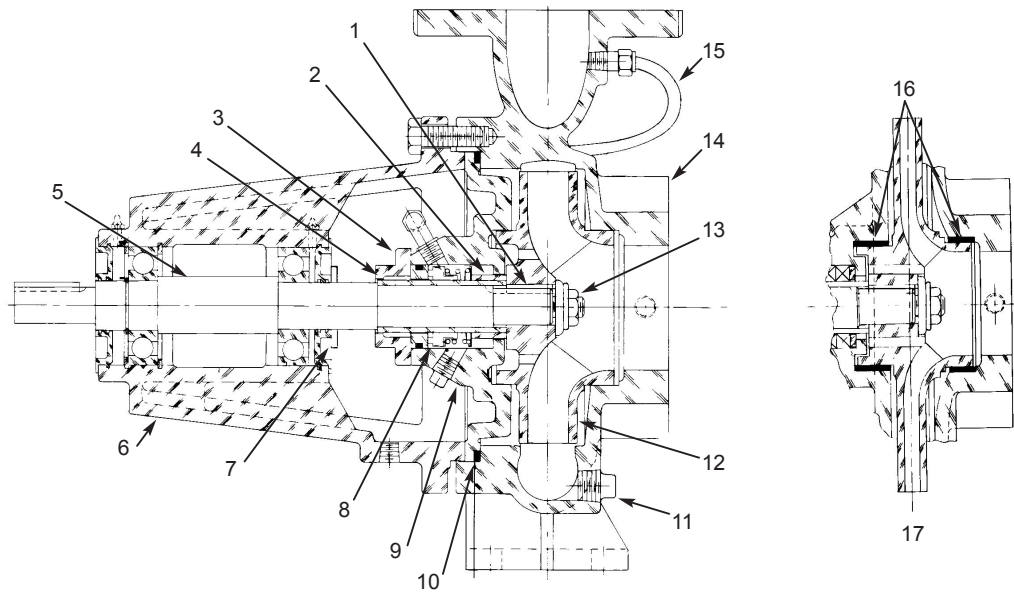


1. Impeller
2. Vent Plug
3. Volute
4. Volute Gasket
5. Coverplate
6. Seal Assembly
7. Bearing Frame
8. Shaft
9. Support Foot
10. Support Foot Capscrews
11. Slinger
12. Bearing Frame Capscrews
13. Shaft Sleeve
14. Impeller Key
15. Impeller Washer
16. Impeller Lock Washer
17. Drain Plug
18. Impeller Capscrew

Figure 6: 1510, 1510-F

Assemble the standard mechanical seal (1510-8G)

1. Lubricate the outer surface of the shaft sleeve, the interior of the stuffing box, and the seal elastomer with soapy water.
Do not use a petroleum lubricant.
2. Install the stationary element and rotating assembly of the mechanical seal on the shaft sleeve.
Make sure that the two wearing surfaces face each other and that the rotating half of the seal is installed closest to the impeller end.
3. Install the seal spring and spring retainer onto the shaft sleeve.
4. Slide the coverplate onto the bearing frame.
5. Apply Dow Corning Silicone Rubber #732 or an equivalent to the shaft at the sleeve location.
6. Slide the shaft sleeve onto the shaft and spin the sleeve in order to distribute the sealant.
7. Wipe off any excess sealant.
8. Slide the seal gland on the shaft and make sure that the flat side faces the stuffing box.



1. Impeller Key
2. Spacer Sleeve
3. Gland
4. Shaft Sleeve
5. Shaft
6. Bearing Frame
7. Slinger
8. Mechanical Seal
9. Coverplate
10. O-Ring
11. Drain Plug
12. Impeller
13. Impeller Nut
14. Volute
15. Flush Tube
16. Wearing Ring
17. View of Optional Casing Wear Ring

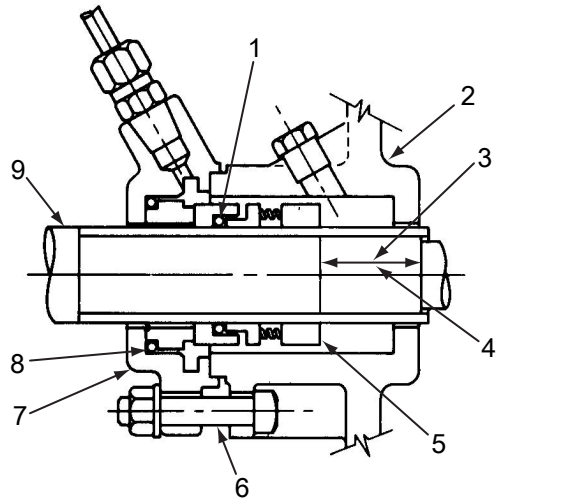
Figure 7: 1510-8G

Assemble the single mechanical seal (1510-S)

1. Lubricate the shaft sleeve and seal cap with soapy water.
Do not use a petroleum lubricant.
2. Insert a stationary seal with an O-ring into the seal cap and slide it onto the shaft.
3. Replace the seal cap gasket.
4. Slide the rotating portion of the seal assembly onto the shaft sleeve and lock it in place.

| ID seal size | Distance between collar and impeller end of the shaft sleeve |
|----------------------|--|
| 1-1/4 in. (3.175 cm) | 1-13/32 in. (3.571 cm) |
| 1-5/8 in. (4.128 cm) | 1-1/4 in. (3.175 cm) |
| 2-3/8 in. (6.033 cm) | 1-1/4 in. (3.175 cm) |

5. Assemble the coverplate onto the bracket.
6. Tighten the capscrews according to the Capscrew torque table.
7. Attach the seal cap to the coverplate.
8. Tighten the hex nuts on the seal cap bolts according to the Capscrew torque table.

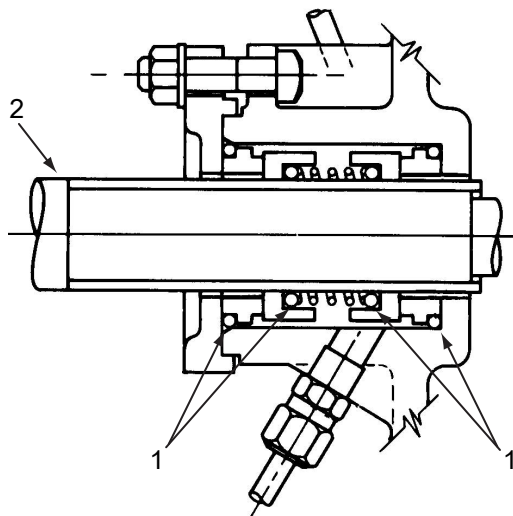


1. O-ring
2. Coverplate
3. For 1-1/4 in. seal: 1-13/32 in. (3.571 cm)
4. For 1-5/8 in. seal and 2-2/3 in. seal; 1-1/4 in. (3.175 cm)
5. Seal locking collar
6. Seal cap bolt
7. Seal cap
8. O-ring
9. Motor end

Figure 8: 1510-S

Assemble the double mechanical seal (1510-D)

1. Lubricate the shaft sleeve, seal cap, and coverplate cavity with soapy water.
Do not use a petroleum lubricant.
2. Insert a stationary seal and O-ring into the seal cap.
For the 1-1/4 in. ID seal, both parts are housed in the coverplate. A seal cap gasket is not used.



1. O-rings
2. Motor end

Figure 9: 1510-D

3. Insert another stationary seal and O-ring into the coverplate.
4. Slide the seal cap onto the shaft.

5. Replace the seal cap gasket.
6. Slide the rotating portion of the seal assembly onto the shaft sleeve.
7. Assemble the coverplate onto the bracket.
8. Tighten the capscrews according to the Capscrew torque values table.
9. Attach the seal cap to the coverplate.
10. Tighten the hex nuts on the seal cap bolts according to the Capscrew torque values table.

Impeller installation

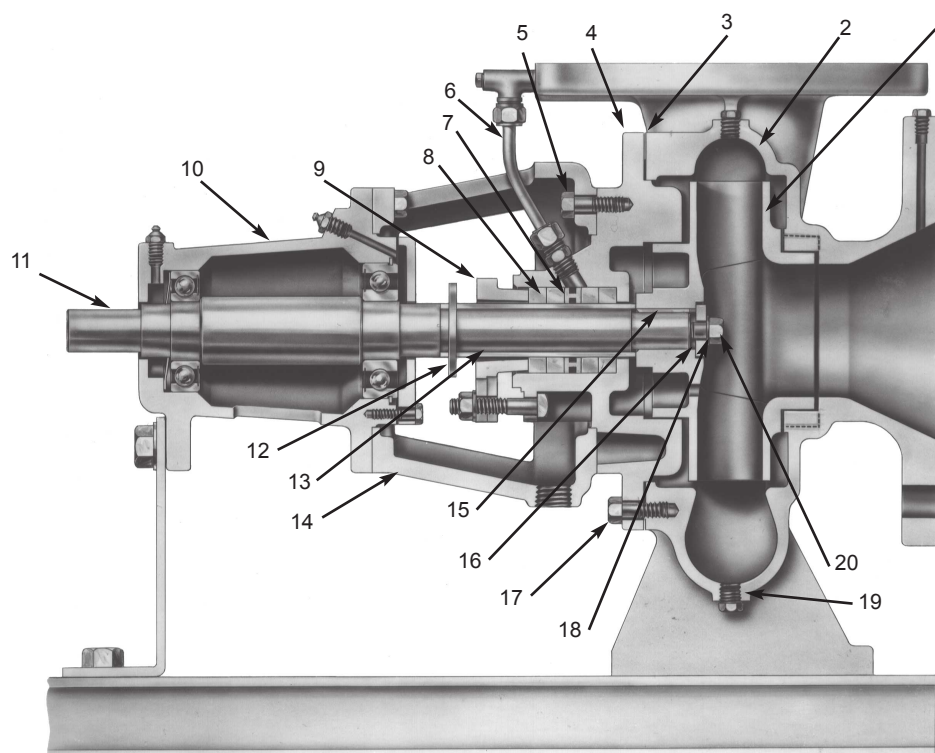
Install the impeller (all except the 1510-8G)

1. Install the impeller, impeller washer, lock washer, and capscrew.
2. Tighten the capscrew according to the Capscrew torque values table.

Install the impeller (1510-8G)

1. Install the spacer sleeve over the shaft sleeve.
2. Install the impeller key, impeller, washer, and impeller nut.
3. Tighten the impeller nut to 25-30 ft-lbs (34-41 Nm).
4. Install and tighten the gland nuts evenly against the stuffing box.

Assemble the packed stuffing box (1510-PF)



1. Impeller
2. Volute
3. Volute Gasket
4. Coverplate
5. Coverplate Capscrews
6. Flushing Tube
7. Lantern Ring
8. Packing
9. Packing Gland
10. Bearing Frame
11. Shaft
12. Slinger
13. Shaft Sleeve
14. Bracket

15. Impeller Key
16. Impeller Washer
17. Volute Capscrews
18. Impeller Lock Washer
19. Drain Plug
20. Impeller Capscrew

1. Insert two packing rings into the stuffing box.
2. Insert the lantern ring and the last two pieces of packing.
Make sure that the joints on the packing rings are staggered 90°.
3. Install, but do not tighten, the packing gland.
4. Install the coverplate over the pump shaft.
5. Tighten the capscrews according to the Capscrew torque table in the Maintenance chapter.
6. Tighten the packing gland to compress the packing.
See the note on the packed pump operation in the Operations chapter for more information.

Reinstall the bearing frame and impeller assembly (all except 1510-8G)

1. Install a new volute gasket.
2. Install the bearing frame assembly into the volute.
3. Tighten the volute capscrews according to the Capscrew torque values table.
4. Install a seal flushing tube if it is used.
5. Install the support foot capscrews and tighten them according to the Capscrew torque values table.
6. Install and align the coupling.
7. Install the drain plug and close the drain valve.

Reinstall the bearing frame and impeller assembly (1510-8G)

1. Inspect the volute O-ring for damage and replace it if necessary.
2. Install the O-ring around the coverplate seat.
3. Slide the bearing frame and impeller assembly into the volute.
The coverplate flush tube fitting must be on the top.
4. Install the volute capscrews and gradually tighten them in a star pattern.
Tighten the capscrews to 25 to 30 ft-lbs (34 to 41 Nm).
5. Install and align the coupling.
6. Install the drain plug and close the drain valve.

Install the hex coupling guard

1. Slide the inner guard into the outer guard.
2. Spread the guards and place them over the coupling.
Do not spread the inner and outer guards more than necessary for guard installation, as it can alter their fit and appearance.
3. Straddle the support bracket with the guards and install a capscrew through the hole in the support bracket and guard located closest to the pump.
Do not tighten the capscrew.
4. Install the outer guard capscrews according to the directions in this table.

| If... | Then... |
|---|--|
| The pump has a motor saddle support bracket | Ensure that the outer guard straddles the support arm and install the two remaining capscrews. Do not tighten the capscrews. |
| The pump does not have a motor saddle support bracket | Insert the spacer washer between the holes located closest to the motor in the outer guard and install the two remaining capscrews. Do not tighten the capscrews. |

5. Position the outer guard so that there is less than 1/4 in. (0.64 cm) of exposed shaft.
6. Hold the guard in this position and tighten the three capscrews.




7. Open the isolation valves and inspect the pump for leaks.
8. Return the pump to service if it is not leaking.

Capscrew torque values

Capscrew torque

This table contains the capscrew torque values.

Table 2: Capscrew torque, Ft-Lb (Nm) table

| Capscrew type | Head marking | 1/4 in. | 5/16 in. | 3/8 in. | 7/16 in. | 1/2 in. | 5/8 in. |
|--------------------|---|---------|----------|---------|----------|----------|---------|
| SAE grades 1 and 2 |  | 3 (4) | 6 (8) | 10 (14) | 16 (22) | 24 (33) | 46 (62) |
| Stainless steel |  | 3 (4) | 6 (8) | 10 (14) | 16 (22) | 24 (33) | 46 (62) |
| SAE grade 5 |  | 8 (11) | 17 (23) | 30 (41) | 50 (68) | 76 (103) | 48 (65) |

Dealer servicing

If trouble occurs that cannot be rectified, contact your local ITT 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



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