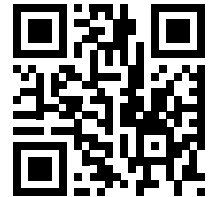
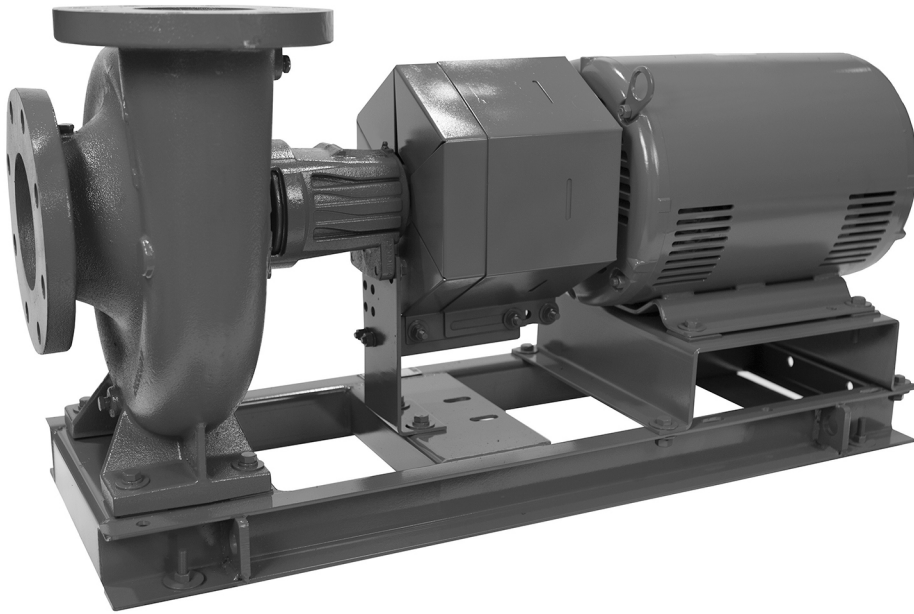


INSTRUCTION MANUAL

P2001406 Rev F



Series e-1510

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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 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
 DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury

Safety message level	Indication
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
 Electrical Hazard:	The possibility of electrical risks if instructions are not followed in a proper manner
NOTICE:	<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

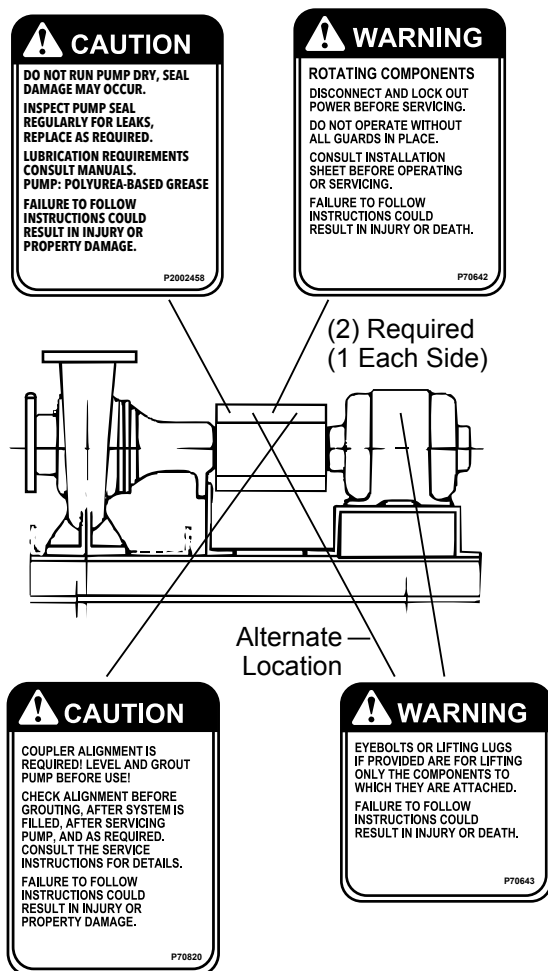
1.2.2 Safety instruction decals

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.



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

1.2.3 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

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.

1.2.3.1 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">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.
Chemicals or hazardous fluids on skin	<ol style="list-style-type: none">1. Remove contaminated clothing.2. Wash the skin with soap and water for at least 1 minute.3. Seek medical attention, if necessary.

1.2.4 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 Safe handling requirements



WARNING:

- Personal protective equipment should be worn when handling this equipment.
- Transportation & installation of this equipment should only be performed by qualified personnel.
- A professional rigging company should be consulted before lifting the pump assembly.
- Only use properly sized, certified lifting equipment & lifting devices, including slings, suitably rated for the weights to be lifted.
- Slings, when used, must be of identical materials to avoid differences in stretch rates.
- Do not use lifting devices that are frayed, kinked, unmarked, or worn.
- Lifting eyebolts fitted on single components of the assembly (pump or motor) must not be used to lift the complete assembly.
- Failure to observe these instructions could result in equipment or property damage, serious injury, or death.

The pump assembly can arrive in a variety of ways. It can be shipped as pump end only (bare pump), pump less motor, or pump, motor, & baseplate. Use the following recommended ways of handling e-1510 pump assemblies. The pump assembly should remain horizontal during transport and lifting.

Table 1: Lifting methods

Pump type	Lifting method
A bare pump without lifting handles	Use a suitable sling attached properly to solid points like the casing, the flanges, or the frames.
A base-mounted pump.	Lifting the pump less motor or the pump, motor, & baseplate should be done by using lifting lugs provided on the baseplate, or by utilizing a forklift under the entire unit. Always take extra precaution to ensure the weight is balanced & equally distributed across both forks. When the baseplate of the assembly is structural channel construction, the pump and base plate should be set in place first. The motor should then be separately lifted & mounted to the unit.

Examples

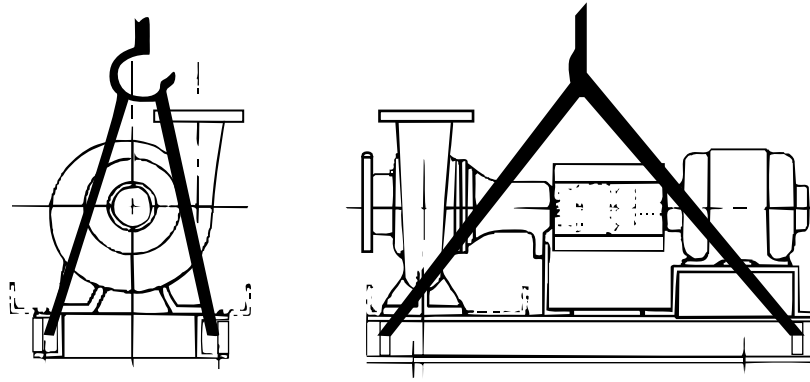


Figure 1: Example of a proper lifting method using lifting lugs

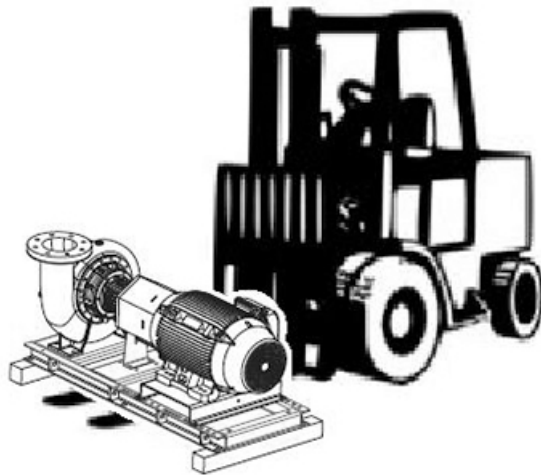


Figure 2: Lift using a forklift

2.3 Storage requirements

If the unit will not be installed and put into operation immediately upon arrival at the site, or for an extended shutdown after the unit is in operation, the following requirements for short-term storage apply:

- Store in a covered and dry location.
- Store the unit free from excessive cold or heat (below 32°F and above 110°F), dirt, and vibration.
- Rotate the shaft by hand several times (10–15 turns) at least every 30 days.

For initial storage longer than three months, or for pump shut down after being in operation longer than three months, contact your local sales and service representative for long-term storage guidelines.

3 Product Description

3.1 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 stainless steel-fitted construction
- Foot-mounted volute with back pullout bearing frame
- Center drop-out coupling
- Regreasable bearings

Intended applications



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.

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.

3.2 Operational specifications

Mechanical seal specifications

Seal type/ Parameter	Standard seal, BUNA/Carbon/ Ceramic	Optional seal, EPR/ Carbon /Tungsten Carbide	Optional seal, FKM/ Carbon /Ceramic	Optional seal, EPR/ Silicon Carbide/ Silicon Carbide	Optional seal, EPR/ Carbon /Tungsten Carbide with external flush ^{1,2,3}
Operating temperature range, °F (°C)	-20 to 225 (-29 to 107)	-20 to 250 (-29 to 121)	-10 to 225 (-23 to 107)	-20 to 250 (-29 to 121)	-20 to 250 (-29 to 121)
pH range limits	7.0 to 9.0	7.0 to 11.0	7.0 to 9.0	7.0 to 12.5	7.0 to 9.0
Resistance to dissolved solids	Low	Low-Medium	Low	Medium-High	Low-Medium
Maximum glycol/ water concentration	50/50%	50/50%	50/50%	60/40%	50/50%

Table notes

1. An external flush is required on low pressure systems that contain a high concentration of abrasives.
2. 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.
3. Flush-line filters and sediment separators are available on request.

4 Installation

4.1 Preinstallation

Precautions


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 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.

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.

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.

Guideline	Explanation/comment
If the pump location is overhead, undertake special precautions to reduce possible noise transmission.	Consider a consultation with a noise specialist.
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.

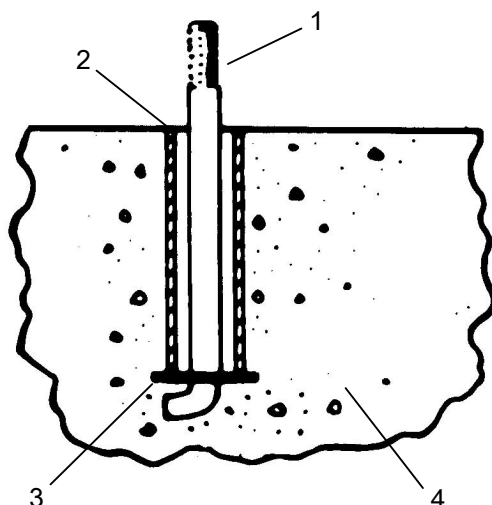
4.1.2 Foundation requirements

Requirements

- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the 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.
- Anchor bolts are preferred installed vertically, but when expansion type or chemically set anchors are installed at an angle through the base mounting holes, beveled washers with matching angles shall be used under the anchor bolt nuts.
- Tie the concrete pad in with the finished floor.
- Use foundation bolts and larger pipe sleeves to give room for final bolt location.

Diagram

- Allow enough bolt length for grout, shims, lower baseplate flange, nuts, and washers.



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

4.1.3 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.

NOTICE:

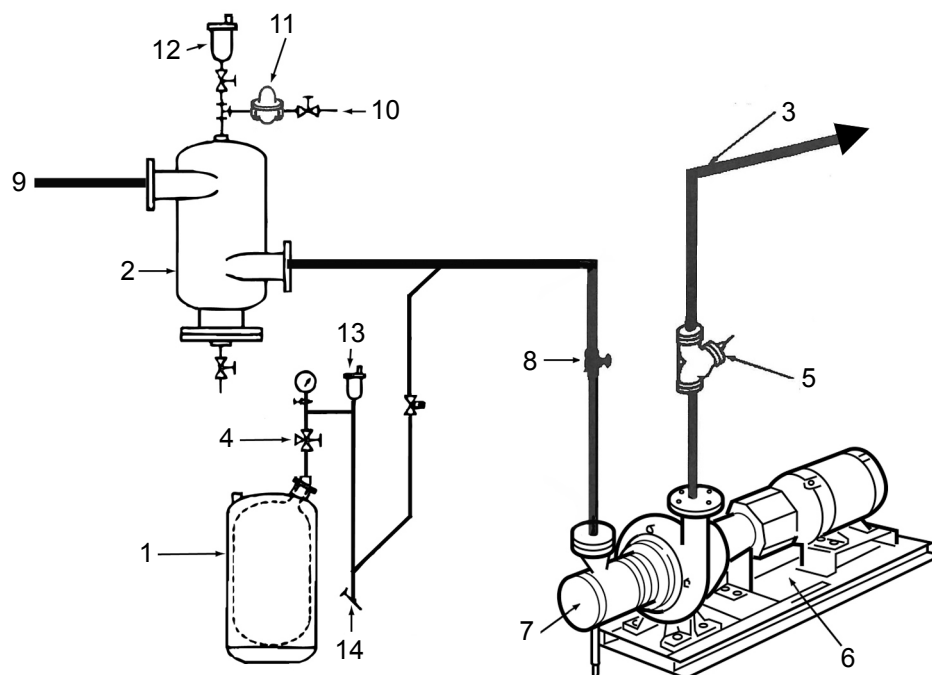
Never force piping to make a connection with a pump.

Check	Explanation/comment	Checked
Check that a section of straight pipe, with a length that is a minimum of five times its diameter, is installed between the suction side of the pump and the first elbow, or that a B&G 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 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 in 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 B&G 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 PTFE tape sealer or a high quality thread sealant when you install the suction and discharge connections to a threaded pump housing.	—	

4.1.4 Pump insulation checklist

Check	Checked
Check that the bearing assembly grease fittings are accessible and visible.	
Check that the vent slot on the bottom of the bearing assembly is uncovered and completely open.	

4.1.5 Typical installation



1. Expansion tank
2. B&G Rolairtrol® air separator
3. Supply to system
4. TPV Tank Purge Valve
5. B&G Triple Duty® valve
6. B&G Series e-1510 Pump
7. B&G Suction Diffuser
8. Isolation valve
9. Pipe from boiler, chiller, or converter
10. Cold water supply
11. B&G Pressure Reducing Valve
12. B&G Model 107A — High capacity vent
13. B&G #7 or #87 Air Vent
14. Drain valve

4.1.6 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
- Expansion tank(s)
- 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.

4.2 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. Center pump on baseplate.
2. Mount the driver on the baseplate. Use applicable bolts and hand tighten.
3. Install the coupling.

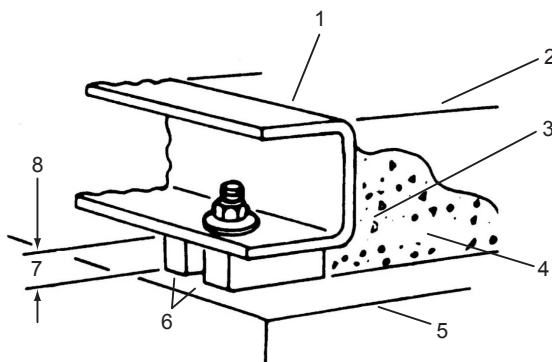
See the installation instructions from the coupling manufacturer.

4.3 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. Verify that the pump is centered on the baseplate.
2. Place 1" (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. Locate the shims to allow removal after grouting.
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.

4.4 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 outside edge of baseplate.
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 and under lower edge of base. Locate shims to allow removal after grouting.

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. It is recommended to remove shims, retighten anchor bolts, and fill shim gaps with grout.

4.5 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.

4.6 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
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.

4.7 Align a standard sleeve type coupling (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.

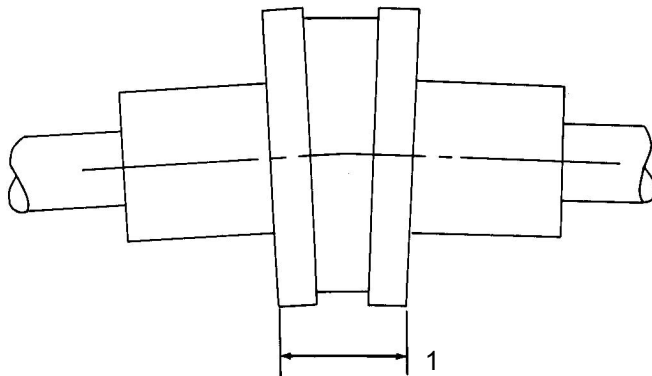
Make sure you have the following before you start this procedure:

- 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 mis-alignment value is 1/64 in. (0.397 mm) per inch of the coupling hub radius.



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

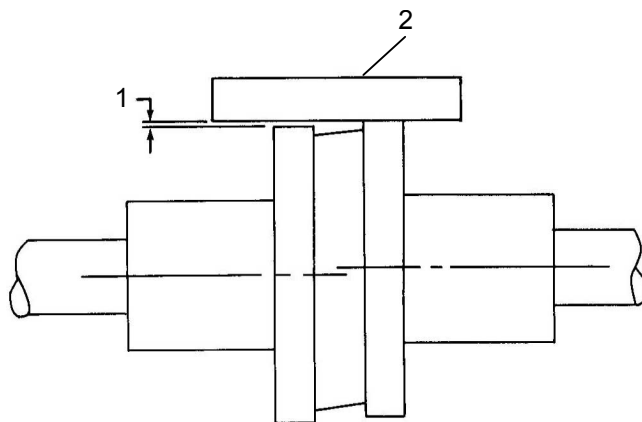
Figure 3: Example of angular misalignment

- 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.

4.8 Additional alignment instructions

- When couplings other than the standard sleeve type are used, refer to the coupling manufacturer's alignment instructions.
- Alternate alignment methods, such as dial indicator or laser alignment can be used to achieve the coupling alignment requirements.

5 Commissioning, Startup, Operation, and Shutdown

5.1 Preparation for startup



WARNING:

- Failure to follow these precautions before you start the unit will lead to serious personal injury and equipment failure.
 - Do not run the pump dry.
 - 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.
 - 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.
-

NOTICE:

- Verify the driver settings before you start any 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 clear 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.
- 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.

5.1.1 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.

5.2 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.

5.3 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.

NOTICE:

- 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.

5.4 Shut down the pump

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

5.5 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.

5.6 Vibration

After startup, vibration can be measured at the coupling end of the pump bearing frame and on the coupling end bell of the motor in the horizontal (H), vertical (V), and axial (A) directions. The maximum expected value is 0.15 in/sec (3.8 mm/sec) RMS (ANSI/HI 9.6.4) when operating in the Preferred Operating Range (POR) flows from 70% to 120% of the best efficiency point (BEP) (ANSI/HI 9.6.3). Operation outside the POR, but within the Allowable Operating Range (AOR) from minimum flow to 85% of the end of the curve increases the vibration value by 30%. If the vibration recorded exceeds these values, shut down the pump, diagnose and fix the problem, re-start, and re-check the vibration.

6 Maintenance

6.1 Bearing maintenance

Bearing lubrication schedule

Type of bearing	First lubrication, assembled pumps and replacement bearing frames	First lubrication, replacement bearings	Lubrication interval, pump, polyurea-based grease, operating hours
Grease-lubricated bearings	Not applicable, lubricated before shipment	Hand pack bearings before pressing on the shaft. After bearing frame assembly, follow relube instructions to lube bearings.	<ul style="list-style-type: none"> • 3600 hours, 2 pole • 7200 hours, 4 pole • 50% for severe conditions: dirty, wet and/or above 100°F (38°C) ambient • 50% for bearing frame temperature above 180°F (82°C) • 75% for lithium-based grease

6.1.1 Regrease the grease-lubricated bearings

It is important to lubricate pumps and motors that require regreasing with the proper grease. See the motor service instructions and nameplate for motor regreasing information. Pumps are to be regreased using the grease types listed below or approved equal. Always keep pump and motor properly lubricated.

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. With fully enclosed coupling guards, regrease pump while pump is running.
 - a) With old style open ended guards, stop pump, re-grease, and hand turn shaft before re-starting.
2. Wipe dirt from the grease fittings before greasing.
3. Fill both of the grease cavities through the fittings with the recommended grease. Stop when grease leaks out at shaft.
4. If needed, stop pump and wipe off excess grease.
5. Restart pump.

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. Maximum normal bearing housing temperature for polyurea-based grease is 225°F (107°C) and for lithium-based grease 180°F (82°C).

6.1.2 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 — grease types

Polyurea-based greases	Lithium-based greases, NLGI 2
Pumps built on or after Dec 1, 2014 use Polyurea-based greases. See date code label and lubrication label on pump or bearing frame indicating polyurea-base grease	Pumps built before Dec 1, 2014 were built with Lithium-based greases, NLGI 2, and do not have lubrication label on pump or bearing frame indicating pump grease type
ExxonMobil Polyrex™ EM	Shell Gadus® S2 V100 2 (was Alvania RL 2)
Chevron SRI NLGI 2	Chevron Multifak® EP 2
Shell Gadus® S5 T100 2	ExxonMobil Unirex™ N2

6.2 Disassembly

6.2.1 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.

6.2.2 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 .

Do not reinstall the plug or close the drain valve until the reassembly is complete.

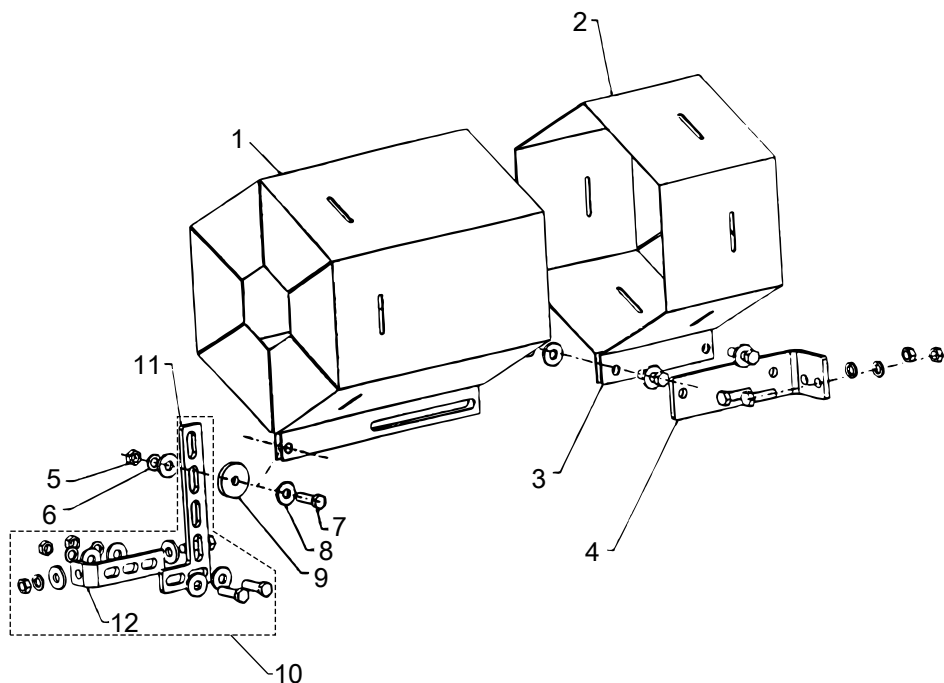
4. Drain the liquid from the piping and flush the pump if it is necessary.
5. Disconnect all auxiliary piping and tubing.

6.2.3 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

6.2.4 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.

6.2.5 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.
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 flush piping if it is used.
6. Remove the volute capscrews.
7. Remove the bearing frame and impeller assembly from the volute.

6.2.6 Remove the impeller

The following warning applies to all models except e-1510-es:

**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 e-1510-es, remove the impeller capscrew.
2. Remove these parts:
 - For all models except the e-1510-es, remove the lock washer and the washer.
 - For the e-1510-es, remove the impeller nut, turning counter-clockwise.
3. Remove the impeller.
 - For all models except e-1510-es, slide impeller off shaft.
 - For e-1510-es, remove by turning counter-clockwise. Hold the shaft at the coupling end and use a strap wrench on the impeller. If the impeller nut or threaded impeller cannot be removed by turning, heat only as necessary with a torch and disassemble while hot. Wear heat resistant gloves.
4. Remove the impeller key for all models except e-1510-es.

6.2.7 Remove the mechanical seal (e-1510 and e-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.

6.2.8 Remove the mechanical seal (e-1510-S)

1. Remove the hex nuts from the seal cap bolts.
2. Remove the coverplate screws.
3. Remove the coverplate from the bracket.
4. Remove the seal assembly.

6.3 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.

6.3.1 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.

6.3.2 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.

6.3.3 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.

6.3.4 Impeller trimming guidelines

Machining

When it is necessary to reduce the pump flow rate and generated head by trimming the impeller diameter, the following guidelines apply for stainless steel impellers:

- Review the pump hydraulic selection data and consult your local Xylem representative to select the proper reduced diameter.
- For the e-1510-4AD model, before trimming the impeller refer to the e-1510-4AD angle cut guidelines.
- The recommended machining insert is Sandvick CNMG 432-1125 or equal without coolant at 250 surface feet per minute (SFM) (76.2 surface meter per minute (SMM)).
- To calculate the spindle speed (RPM), use the formula $RPM = (SFM \times 12) / (3.1416 \times \text{diameter of cut, in.})$ ($RPM = (SMM \times 39.37) / (3.1416 \times \text{diameter of cut, mm} / 25.4)$). This results in the following:

Impeller Maximum Diameter	Recommended Maximum Spindle Speed (RPM)
7 in. (177.8 mm)	136
9.5 in. (241.3 mm)	100
11 in. (279.4 mm)	87

Impeller Maximum Diameter	Recommended Maximum Spindle Speed (RPM)
13.5 in. (342.9 mm)	71

- Recommended rough cut feed rate per revolution is 0.008 in. (0.20 mm) and depth of cut is 0.050 in. (1.27 mm).
- Recommended finish cut feed rate per revolution is 0.015 in. (0.38 mm) and depth of cut is 0.010 in. (0.25 mm).

Balancing

It is recommended that impellers trimmed more than 5% in diameter be rebalanced per ISO 1940 grade G6.3.

Angle cut guidelines

Model e-1510-4AD pump impellers must be angle cut at reduced diameters according to the following information.

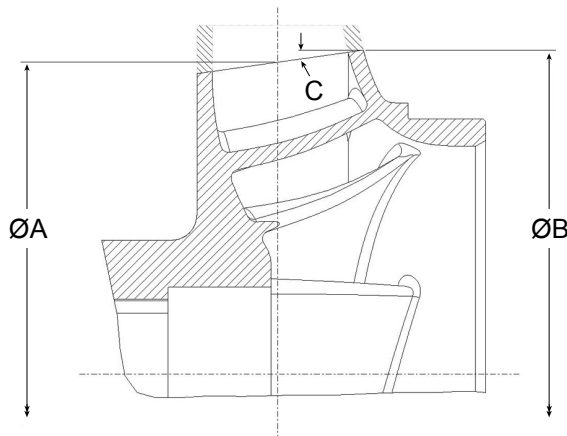


Figure 6: 4AD impeller trim — 0.125 in. (3.17 mm) increments

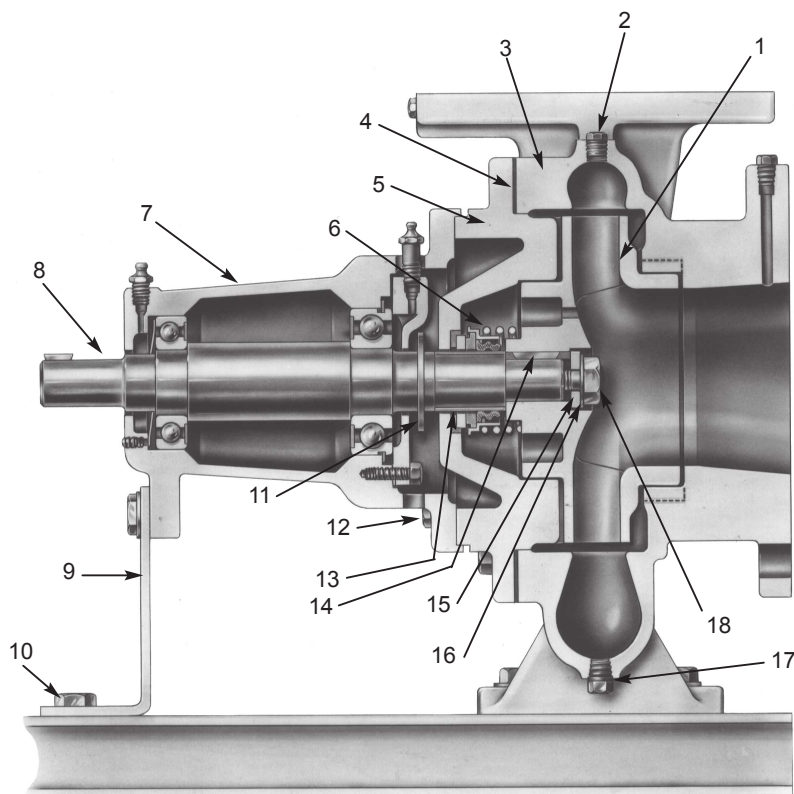
A	B	C
Hydraulic diameter, nominal, as shown on selection curves	Diameter at impeller inlet side shroud	Trim angle
From maximum diameter 7 in. (177.8 mm) to 6.125 in. (155.6 mm)	Use diameter from selection curves	0 degrees, no angle
6, 5.875, 5.75, 5.625 in. (162.4 to 142.9 mm)	B = A plus 0.250 in. (6.35 mm)	8 degrees
5.5, 5.375, 5.25, 5.125, minimum 5 in. (139.7 to 127.0 mm)	B = A plus 0.375 in. (9.53 mm)	8 degrees

6.4 Reassembly

6.4.1 Seal assembly

6.4.1.1 Assemble the standard mechanical seal (e-1510 and e-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.



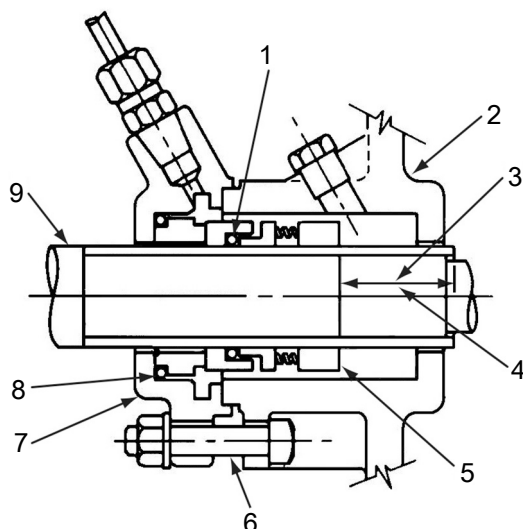
1. Impeller
2. Vent Plug
3. Volute
4. Volute Gasket
5. Coverplate
6. Seal Assembly
7. Bearing Frame
8. Shaft
9. Support Foot
10. Support Foot Capscrews
11. Slinger
12. Bearing Frame Capscrews
13. Shaft Sleeve
14. Impeller Key
15. Impeller Washer
16. Impeller Lock Washer
17. Drain Plug
18. Impeller Capscrew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

6.4.1.2 Assemble the mechanical seal (e-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

6.4.2 Impeller installation

6.4.2.1 Install the impeller (all except the e-1510-es)

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

6.4.2.2 Install the impeller (e-1510-es)

1. Apply Loctite 262 or equivalent to threads on the shaft.
2. Thread impeller on the shaft by turning clockwise until it bottoms on the sleeve.
3. Apply Loctite 262 or equivalent to the threads on the impeller nut.
4. Thread impeller nut on the shaft and tighten to 5 ft-lbs (7 Nm) or hand tight by turning clockwise.

6.4.3 Reinstall the bearing frame and impeller assembly

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 flush piping 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.

6.4.4 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.

6.4.5 Torque values

Capscrew torque

This table contains the capscrew torque values.

Table 2: Capscrew torque, ft-lb (Nm)

Capscrew type	Head marking	1/4 in.	5/16 in.	3/8 in.	7/16 in.	1/2 in.	5/8 in.
SAE grade 2		6 (8)	13 (18)	25 (34)	38 (52)	60 (81)	120 (163)
Stainless steel		4 (5)	10 (14)	17 (23)	27 (37)	42 (57)	83 (113)
SAE grade 5		10 (14)	20 (27)	35 (47)	60 (81)	90 (122)	180 (244)

Pipe plug torque values

Table 3: Pipe plug torque, ft-lb (Nm)

Size	Turns past finger tight	Approximate torque
1/8 in NPT	1.5 to 3	12 (16)
1/4 in NPT	1.5 to 3	25 (34)

6.4.6 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 Product Warranty

Commercial warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (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) be 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 greater 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 product 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. Under either 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 on the parts that were repaired or replaced. 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; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Limited consumer warranty

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (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 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 product date code, whichever shall occur first, unless a longer period is provided by law or 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 product 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. Under either 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 this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

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; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE (1) YEAR FROM THE DATE OF INSTALLATION OR EIGHTEEN (18) MONTHS FROM THE PRODUCT DATE CODE, WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

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