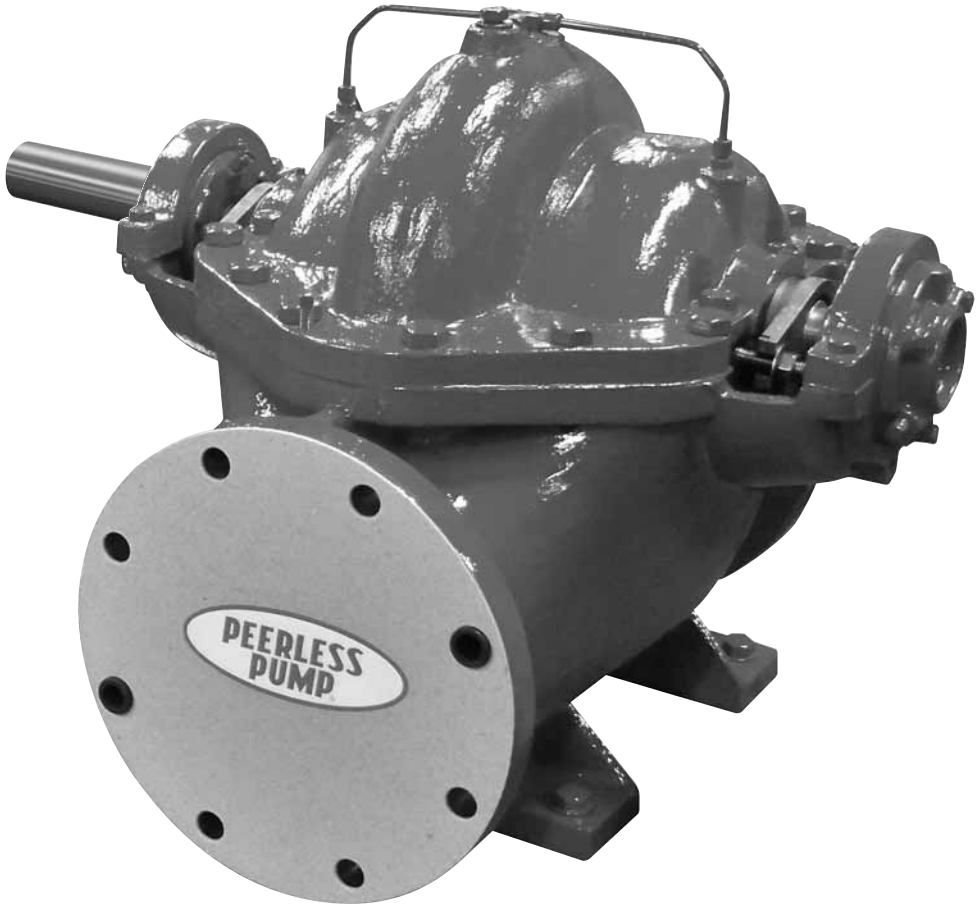
Horizontal Split Case

Model AEF

Installation, operation and maintenance manual



Horizontal Split Case

English (US)

Original installation and operating instructions

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1. General information

1.1 Limited warranty

New equipment manufactured by seller or service supplied by seller is warranted to be free from defects in material and workmanship under normal use and service for a minimum of twelve (12) months from date of installation, eighteen (18) months from date of shipment, unless otherwise stated in product warranty guide (available upon request). In the case of spare or replacement parts manufactured by seller, the warranty period shall be for a period of twelve months from shipment. Seller's obligation under this warranty is limited to repairing or replacing, at its option, any part found to its satisfaction to be so defective, provided that such part is, upon request, returned to seller's factory from which it was shipped, transportation prepaid. Parts replaced under warranty shall be warranted for twelve months from the date of the repair, not to exceed the original warranty period. This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment. This warranty does not cover parts repaired outside seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture. If purchaser or others repair, replace, or adjust equipment or parts without seller's prior written approval, seller is relieved of any further obligation to purchaser under this paragraph with respect to such equipment or parts, unless such repair, replacement, or adjustment was made after seller failed to satisfy within a reasonable time seller's obligations under this paragraph. Seller's liability for breach of these warranties (or for breach of any other warranties found by a court of competent jurisdiction to have been given by seller) shall be limited to: (a) accepting return of such equipment exw plant of manufacture, and (b) refunding any amount paid thereon by purchaser (less depreciation at the rate of 15% per year if purchaser has used equipment for more than thirty [30] days), and canceling any balance still owing on the equipment, or (c) in the case of service, at seller's option, redoing the service, or refunding the purchase order amount of the service or portion thereof upon which such liability is based. These warranties are expressly in lieu of any other warranties, express or implied, and seller specifically disclaims any implied warranty of merchantability or fitness for a particular purpose, and in lieu of any other obligation or liability on the part of the seller whether a claim is based upon negligence, breach of warranty, or any other theory or cause of action. In no event shall seller be liable for any consequential, incidental, indirect, special or punitive damages of any kind. For purposes of this paragraph, the equipment warranted shall not include equipment, parts, and work not manufactured or performed by seller. With respect to such equipment, parts, or work, seller's only obligation shall be to assign to purchaser the warranties provided to seller by the manufacturer or supplier providing such equipment, parts or work. No equipment furnished by seller shall be deemed to be defective by reason of normal wear and tear, failure to resist erosive or corrosive action of any fluid or gas, purchaser's failure to properly store, install, operate, or maintain the equipment in accordance with good industry practices or specific recommendations of seller, including, but not limited to seller's installation and operation manuals, or purchaser's failure to provide complete and accurate information to seller concerning the operational application of the equipment.

1.2 Hazard statements

The symbols and hazard statements below may appear in Peerless installation and operating instructions, safety instructions and service instructions.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.3 Notes

The symbols and notes below may appear in Peerless installation and operating instructions, safety instructions and service instructions.

Observe these instructions for explosion-proof products.

A blue or gray circle with a white graphical symbol indicates that an action must be taken.

A red or gray circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

If these instructions are not observed, it may result in malfunction or damage to the equipment.

Tips and advice that make the work easier.

1.4 Target group

These installation and operating instructions are intended for professional installers and operators of the product.

We recommend that installation be carried out by skilled persons with technical qualifications required by the specific legislation in force.

1.5 General safety warnings

DANGER

Electric shock

Death or serious personal injury

- The electrical installation must be carried out by a qualified electrician in accordance with local regulations and the manuals provided with the electrical accessories.
- Before starting any work on the product, make sure that the power supply has been switched off and that it cannot be accidentally switched on.
- Never do maintenance work on the pump when it is connected to the power supply.

WARNING

Automatic startup

Death or serious personal injury

- Before any inspection, maintenance, service or repair of the product, make sure that the motor controls are in the "OFF" position, locked and tagged.
- Pumping equipment, especially fire pumps, can start up at any time. It is imperative to isolate the engine before doing any maintenance work. Switch off the main power supply, remove fuses, secure fuel lines, apply lock-outs where applicable, and affix suitable isolation warning signs to prevent inadvertent re-connection.
- Isolate the fuel supply to the engine before working on any part of the fuel supply or control system.
- Disconnect the batteries by removal of the negative terminal connector.
- Do not place tools on or near the batteries. This could result in a short circuit.
- Inspect all cables for damage or signs of failure and replace immediately if damaged.

WARNING

Hazardous and flammable fumes

Death or serious personal injury

- Never refuel the engine when it is running or is still hot from recent running.
- Avoid breathing fuel fumes when refueling the product, especially if the product is installed in an enclosed pump room. Maintain maximum ventilation to clear fumes quickly.
- Do not start the engine while fuel fumes remain evident or may be present.
- Battery gasses are hazardous and flammable. The battery area must be well ventilated to clear these gasses quickly.
- Exhaust gases are hazardous and may contain carbon monoxide and other poisonous gasses. The exhaust system must be maintained free from leaks and directed to discharge in a safe area.

WARNING

Large openings

Death or serious personal injury

- If the site is left unattended before the installation is complete, all openings must be covered to prevent entry of children, animals, stones or any other foreign objects.
- Use unbreakable covers that cannot be removed without tools.

WARNING

Hot surface

Death or serious personal injury

- Do not allow skin contact with pump components that have heated above 108 °F (42 °C).
- Wear protective gloves when necessary to touch hot surfaces. Surfaces may remain hot after unit has been shut off.
- Ensure that drain water from stuffing box is cool before contact. The stuffing box and bearing bracket areas on the pump can become hot in the event of a malfunction or maladjustment.

WARNING

Hot or freezing surfaces

Death or serious personal injury

- Protect persons from contact with hot or freezing components or auxiliary heating supplies.
- If complete protection is not possible, limit access to maintenance staff only, with clear visual warnings to those entering the immediate area.

WARNING

Chemical hazard

Death or serious personal injury

- When the pump handles hazardous liquids, avoid exposure to the liquid. Limit personnel access and ensure that operators are properly trained. If the liquid is flammable and/or explosive, strict safety procedures must be required.
- Gland packing must not be used when pumping hazardous liquids.

WARNING

Overhead load

Death or serious personal injury

- Do not lift components by the lifting lugs or eye bolts on the motor. Unload and handle components with a sling.
- Complete pump units must be lifted by fork truck from beneath the pump's steel base.
- When manually lifting pump components, use proper lifting techniques and never bend at the waist. Keep the component close to your body with your back straight, and lift with your legs.

WARNING

Crushing of hands

Death or serious personal injury

- Do not work under a suspended object unless you have taken precautions to stop its fall in the event of sling failure. Do not place hands under a component in such a way that it could fall on your hands if it were dropped.

WARNING

Sharp and moving machine parts or blades.

Death or serious personal injury

- Ensure an approved coupling guard is in place before operating the product. Failure to observe this warning could result in injury to operating personnel.
- Wear appropriate protective safety equipment including gloves when handling parts and components.
- Read and follow all recommended guarding and safety instructions for accessories, if any.

WARNING

Rotating equipment and sharp objects

Death or serious personal injury

- Do not place fingers, hands, arms, etc. into any opening (such as the air relief valve hole).
- Do not wear loose or frayed clothing or jewelry that could catch on equipment or become trapped in the equipment.
- Do not touch the impeller or other rotating elements, if rotated, this can cause severe injury. The area between the stuffing box and bearing bracket is left open to allow for inspection and adjustment of packing. Never place your hands or fingers into this area while the equipment is in operation. Do not wear loose clothing, long hair, or jewelry around this area.

WARNING

Excessive noise

Death or serious personal injury

- If the operating noise level of the product exceeds local code or safe levels (over 85 dBA), the product must be installed in a controlled access area. Provide ear protection to persons authorized to be in this area.
- Fire pumps can start unexpectedly at any time. Ear protection should be carried by, or readily available to, all persons authorized to be in the pump room with these pumps. Observe health and safety regulations limiting exposure of personnel to excessive noise.

WARNING

Explosive environment

Death or serious personal injury

- Do not store lubricants or other volatile substances near the engine. Store these in a designated, suitable storage enclosure.

Partial decomposition of fluoro-elastomers (when fitted) will occur if equipment reaches temperatures above 400 °F (205 °C).

For applications involving potentially explosive atmospheres, contact Peerless for more information.

Avoid rapid temperature change in the pumped liquid. Thermal shock from sudden temperature changes can damage pump components.

Pumps are not designed to accept external loads from belt-driven arrangements. A separate jackshaft with a bearing structure suitable for belt loading is required.

Do not remove or paint over any safety labels. If labels are lost or damaged, contact your Peerless representative for replacement.

Do not use gland packing when pumping hazardous liquids.

Do not use the pump as a support for pipes. Do not mount expansion joints, so that their force, due to internal pressure, acts on the pump flange, without written authorization from Peerless.

1.6 Material safety data sheet

Material safety data sheets (MSDS) are not supplied with pumps unless required. You may request them from your Peerless representative.

2. Receiving the product

2.1 Unpacking the product

Do not unpack more than required to verify that the equipment is complete and undamaged unless installed immediately. Look through all packaging material that is to be discarded to ensure no parts or instructions are discarded accidentally. In some shipments, small boxes containing additional parts are bound to pump skids. Leave small parts in their shipping container until installation. While unpacking, make sure that pump unit accessories are clearly marked indicating the exact pump unit they should be used with.

2.2 Inspecting the product

The product must be inspected after transport and before installation.

To complete the inspection, follow the steps below:

1. Check the product for transport damage. Contact the transporter immediately in case of damage.
2. Check that the delivered products correspond to the order.
3. Check the positions and sizes of fittings.
4. Retighten various connections, as they may have become loose during transport.

2.3 Transporting the product

The pump has been prepared for shipment at the factory so as to minimize potential damage due to handling and transport.

WARNING

Crushing hazard

Death or serious personal injury

- Make sure all persons stand clear of the load and the lifting equipment while product is lifted, lowered, loaded and unloaded. Do not allow anyone to stand on, under, or near the load.

Do not subject the pump to excessive g-forces during handling or transport.

2.4 Scope of delivery

A typical shipment will include:

- one skid with the fire pump and the driver mounted on the base plate
- one skid with the controller and accessories, if any
- installation and operating instructions.

Refer to the original order in case of questions about shipping, for example, special arrangements with third-party vendors for shipping and storage.

3. Installing the product

3.1 Factory support

For Engineered to Order (ETO) products, Peerless recommends that you invite a Peerless service engineer to supervise the installation and startup. This is to ensure a proper installation.

Peerless recommends that you review the instructions provided with the pump.

3.2 Location

Install the product in a location that meets the following requirements:

3.2.1 Minimum space

Always allow sufficient accessibility space for maintenance and inspection. Provide a clearance of 24 inches (610 mm) with ample head room for use of overhead lifting equipment strong enough to lift the product.

3.2.2 Seismic analysis

When the pump is located in a seismically active area or in certain critical installations, ensure that the pumps, supports, and accessories are earthquake-resistant. The design specifications for earthquake resistance vary depending on the geographical area and the class of the equipment. The class of the equipment depends on defining how critical is the survival of the equipment, the characteristics of the structure's response to accelerations, and the foundation supporting the pump.

If a seismic analysis is required, please refer to the governing bodies recommended for grouting and foundation requirements.

The customer must supply complete specifications for earthquake-resistance requirements including seismic criteria, acceleration, magnitudes, frequency spectrum, location and direction relative to the pump and qualification procedure.

3.3 Mechanical installation

3.3.1 Recommendation for pump foundation

All rotating equipment generates vibrations when turning at high speeds. Proper installation and anchorage of the pumps and installation accessories are critical to limit vibrations and achieve reliable installation. To ensure acceptable vibration levels in the field, all parts of the system must be sufficiently stiff and firmly anchored to minimize vibrations:

This applies for pumps above 13 hp (10 kW).

- The foundation and concrete should be of adequate strength to support the weight of the pump including accessories, the weight of the liquid passing through the pump, and the forces generated by the pump.
- The mass of the concrete foundation should be a minimum of three to five times the mass of the supported equipment and should have sufficient rigidity to withstand the axial, transverse, and torsional loadings generated by these machines.
- The foundation should be 5.9 in (15 cm) wider than the base plate for pumps up to 469 hp (350 kW) and 9.8 in (25 cm) wider for larger pumps.
- The concrete used in the foundation should have a minimum tensile strength of 362 lb_f/in^2 (250 N/cm^2).
- Always use a non-shrink epoxy grout to fasten the pump base plate to the foundation.

3.3.2 Pump foundation

Large pumps will be mounted on a steel base anchored to two concrete pillars.

Install the pump permanently on a firm, raised concrete foundation of sufficient size to dampen any vibration and prevent any deflection or shaft misalignment. The foundation may float on springs or be a raised part of the floor.

Proceed like this:

1. Pour the foundation without interruption to 0.75- 1.5 in (20-40 mm) below the final pump level. Leave the top of the foundation rough. Then clean and wet it down.
2. Scour and groove the top surface of the foundation before the concrete sets to provide a suitable bonding surface for the grout.
3. Place anchor bolts in pipe sleeves for positioning allowance.
4. Allow enough bolt length for grout, base flange, nuts, and washers.
5. Allow the foundation to cure several days before proceeding to install the pump.

3.3.2.1 Foundation, grout and anchor bolt installation

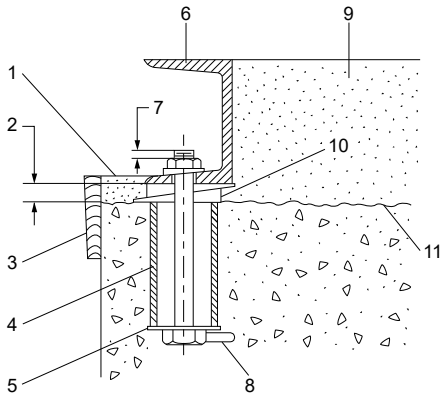

Fig. Foundation, grout, and anchor bolt installation

Position	Description
1	Finished grouting
2	0.75-1.25 in (19-32 mm) allowance for grout
3	Formwork
4	Pipe sleeve
5	Washer
6	Base plate
7	0.2-0.4 in (5-10 mm)
8	Lug
9	Grout
10	Wedges or shims left in place
11	Top of foundation

3.3.3 Positioning the pump

When the raised concrete foundation has been poured and allowed to set, proceed as follows:

WARNING

Overhead load

Death or serious personal injury

- Never attempt to lift the entire pump by means of eyebolts screwed into the driver mounting holes. This attachment point may not be strong enough to carry the weight of the entire unit.

Adequate space above the installation site must be provided to accommodate rigging and the longest section of the pump to be handled.

1. Lower the base plate over the anchor bolts and rest it on loose adjustment wedges or shims placed near each anchor bolt and at intervals not exceeding 24 in (610 mm) along each side.
2. Place the shims or wedges so that they raise the bottom of the base plate 0.75-1.25 in (19-32 mm) above the foundation, allowing clearance for grout.
3. Level the pump shaft, flanges, and base plate using a level, adjusting the wedges or shims, as required.

   If the pump is equipped with jacking screws, use them to lift the pump and adjust the wedges or shims.

4. Make sure that the pipes can be aligned to the pump flanges without placing any strain on either flange.
5. After pump alignment has been established, put nuts on the anchor bolts and tighten them just enough to keep the base plate from moving.
6. Construct a formwork around the concrete foundation and pour grout inside the base plate. The grout will compensate for the uneven foundation, distribute the weight of the pump, and prevent shifting.

   Use an approved, non-shrinking grout.

7. Allow for the grout to cure fully before proceeding with torquing the anchor bolts and the pipe connections.
8. After the grout has thoroughly hardened, check the anchor bolts and tighten them if necessary. Recheck the pump alignment after tightening the anchor bolts.

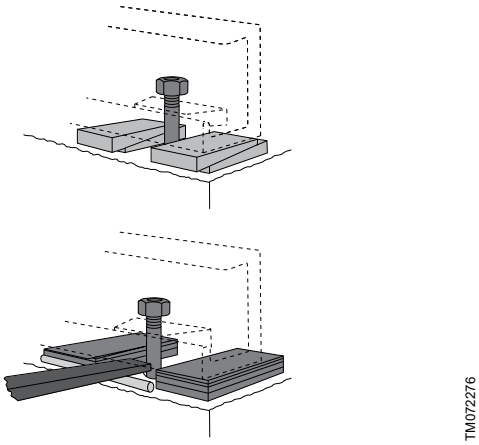

Fig. Raising the base plate with wedges or shims

3.3.4 Dowel pins

To comply with the Hydraulic Institute recommendations, all pumps should be dowelled.

The pump feet can be drilled for dowels at the factory or in the field.

Doweling the pump feet accomplishes the following:

- Prevents lateral movement.
- Eases realignment if the pump is removed from the base.
- Temporarily holds the pump if the hold-down bolts loosen.

3.3.5 Installing dowel pins

If dowel holes were not drilled in the pump feet at the factory then determine the dowel and hole size by measuring the diameter of the mounting hole in the pump foot and subtract 3/8".

Peerless recommends the use of straight dowel pins as described in the following steps:

1. Check the coupling alignment and correct if necessary.
2. Drill holes in opposite pump feet. The holes should be 1/64" smaller than the dowel diameter.
3. Clear the debris.
4. Ream the holes in the pump feet and base to the correct diameter. Allowing for a push fit.
5. Clear the debris.
6. Insert the dowels to a depth that leaves sufficient thread to attach a nut.
7. Thread the nuts onto the dowel and tighten.

3.4 Installation preparation

3.4.1 Engine preparation

The following installation requirements help to ensure safe and efficient operation of a pumping unit driven by a diesel engine:

1. Ensure that the operator is familiar with the installation and service manual supplied with the engine.
2. Ventilate the area around the engine to keep the ambient temperature as low as possible. With 60 °F (15.6 °C) as a data point, every Δ 10 °F (Δ 6 °C) rise in temperature reduces the horsepower of the engine by approximately 1%.
3. Provide adequate air for efficient combustion.
4. Provide the engine with an efficient exhaust system so that the combustion gasses discharge with a minimum of back pressure.
5. Ensure that the fuel system is of adequate capacity and meets codes and regulations.
6. Provide ample space to access the engine for maintenance.
7. Provide correct rotation of the pump. Engine rotation is determined at the factory, and no change to engine rotation can be made in the field.

3.5 Mechanical installation

3.5.1 Pipes and connections

3.5.1.1 Inlet pipe

The inlet pipe must be installed in a manner that minimizes pressure loss and permits sufficient liquid flow into the pump during starting and operation.

At no point must the diameter of the inlet pipe be smaller than that of the pump inlet port.

Observe the following precautions when installing the inlet pipe:

- Run the inlet pipe as direct as possible, and ideally, make sure the length is at least ten times the pipe diameter. A short inlet pipe can be the same diameter as the inlet port. A long inlet pipe must be one or two sizes larger than the inlet port, depending on the length, and with a reducer between the pipe and the inlet port.
- Use an eccentric reducer, with the tapered side down.
- If possible, run a horizontal inlet line along an even gradient. We recommend a gradual upward slope to the pump operating in suction lift conditions, and a gradual downward slope operating in positive inlet pressure conditions.
- Avoid any high points, such as pipe loops, as this may create air pockets and throttle the system or cause erratic pumping.
- Install a gate valve in the inlet line to be able to isolate the pump during shutdown and maintenance, and to facilitate pump removal. Where two or more pumps are connected to the same inlet pipe, install two gate valves to be able to isolate each pump from the pipe.

Always install isolation valves in positions that prevent air pockets.

Do not use globe valves, particularly when NPSH is a critical operating factor.

- During pumping operation, the valves on the inlet line must always be fully open.
- Install properly sized pressure gauges in the tapped holes on the pump inlet and outlet flanges or pipes

Pressure gauges will enable the operator to monitor the pump performance and determine whether the pump conforms to the parameters of the performance curve

If cavitation, vapor binding, or other unstable operating situations occur, the pressure gauges will indicate with wide fluctuation in the inlet and outlet pressures.

3.5.1.2 Vibration dampers

To prevent the transmission of vibrations to foundations and surrounding structures, isolate the pump and foundation from connected structures by means of vibration dampers. The selection of the correct vibration damper requires the following data:

- forces transmitted through the damper
- motor speed(s)
- required dampening in %.

The selection of a vibration damper differs from installation to installation. In certain cases, a wrong damper may increase the vibration level. Peerless recommends that the vibration dampers be sized by the supplier. If you install the pump on a foundation with vibration dampers, always fit expansion joints on the pump flanges.

Install expansion joints on the pump flanges to prevent the pump from "hanging" in the flanges.

3.5.1.3 Inlet pipe

The inlet pipe must be installed in a manner that minimizes pressure loss and permits sufficient liquid flow into the pump during starting and operation.

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Always install isolation valves in positions that prevent air pockets.

Do not use globe valves, particularly when NPSH is a critical operating factor.

- During pumping operation, the valves on the inlet line must always be fully open.
- Install properly sized pressure gauges in the tapped holes on the pump inlet and outlet flanges or pipes

Pressure gauges will enable the operator to monitor the pump performance and determine whether the pump conforms to the parameters of the performance curve

If cavitation, vapor binding, or other unstable operating situations occur, the pressure gauges will indicate with wide fluctuation in the inlet and outlet pressures.

3.5.1.4 Outlet pipe

- A short outlet pipe can be the same diameter as the pump outlet port. A long outlet pipe must be one or two sizes larger than the outlet port, depending on the length.
- It is best to use long horizontal outlet pipes.
- Install a non-return valve to protect the pump from backflow and excessive backpressure. The check valve should be installed between the isolation valve and pump.

Pump backspin and hydraulic shock can cause severe damage to the pump and driver.

- Install a gate valve near the outlet port to be able to isolate the pump during shutdown and maintenance, and to facilitate pump removal.
- Any high points in the outlet pipe may entrap air or gas and thus reduce pump operation.

Operating pumps against a closed valve will cause an increase in pressure and power.

If an increaser is used on the outlet pipe to increase the pipe size then it should be placed between the non-return valve and the pump. If expansion joints are used then they should be placed between the pipe support or anchor and the non-return valve.

3.5.1.5 Nozzle load

The pipes should be aligned with the pump nozzles to minimize pump nozzle loads. Refer to ANSI/HI 9.6.2 for assessment of applied nozzle loads.

3.5.2 Impeller clearance

To achieve optimal performance and service life, the impeller clearance must be centered in the volute. Pumps are shipped from the factory with the impeller clearance set.

3.5.3 Alignment

Misalignment of the pump and driver can cause product failure.

Reliable, trouble-free, and efficient operation requires accurate alignment of pumps and drivers mounted on a common base plate. Shipping and installation can alter the factory alignment. Therefore, check the alignment after:

- mounting.
- the grout has hardened.
- the foundation bolts are tightened or adjusted.
- the pipes to the product are connected.
- pump, driver or base plate is moved.

To check alignment, mount a dial indicator to measure shaft movement before and after tightening the flange bolts.

To facilitate accurate field alignment, we do not dowel the pumps or drivers on the base plates before shipment.

If the product does not stay in alignment after installation, possible causes of misalignment are:

- setting, seasoning or springing of the foundation.
- excessive force on the pipes distorting or shifting the machine.
- settling of the building.
- shifting of pump or driver on the base plate or foundation.

Misalignment may be the cause of:

- noisy pump operation
- vibration
- premature bearing failure
- excessive coupling wear.

3.5.3.1 Checking the alignment

The procedure for verifying the alignment of a pump and driver connected by a flexible coupling, mounted on a common base plate are:

1. Disconnect the coupling halves.
2. Set the coupling gap to the recommended alignment dimension.
3. Test for parallel and angular alignment with a straight edge and feeler gauge.
4. An alternate test for parallel and angular alignment may be made as follows with a dial indicator mounted:
   - Scribe the index lines on the coupling halves or set the indicator dial to zero.
   - Slowly turn both coupling halves so that the index lines match.
   - Observe the dial reading to determine whether pump or driver
   - Acceptable parallel and angular alignment occur when total indicator reading (complete turn) does not exceed limits shown on either a tag or decal on the unit or on the unit outline drawing.
5. When a significant operating temperature differential exists between the pump and driver (i.e. a steam turbine driver with a pump handling cold liquid), thermal growth causes the hotter component to rise. You can compensate for this by initially setting the hotter unit 0.003 to 0.005 in. (0.076 to 0.127 mm) lower. When both units are at normal operating temperature, make a final check and correct the alignment if necessary.

   Check for correct electric motor rotation while coupling halves are disconnected.

6. Correct for excessive parallel and angular misalignment by slightly shifting the leveling wedges under the base plate. Tap lightly (in or out) with a hammer. Retest alignment each time after you shift a wedge.
7. It may be necessary to change the shims under the pump or driver or even relocate the pump or driver on the base plate. Make such changes only after you are sure that shifting the wedges do not achieve alignment.
8. If wedges are shifted or shims are shifted, recheck the pipe alignment and the level of the shafts.

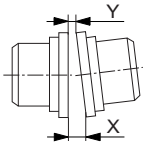

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Fig. Angular misalignment

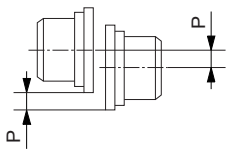

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Fig. Parallel misalignment

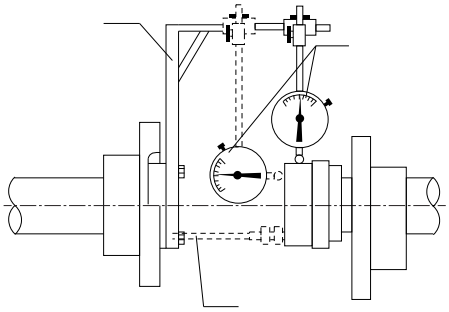

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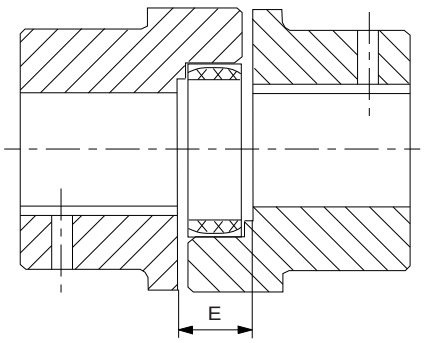
Fig. Using a dial indicator to check alignment

3.5.3.2 Coupling gap settings, Falk/Clarke/Dodge

Coupling	Max. RPM	Parallel	Angularity	Weight	Torque
		[in (mm)]	[in (mm)]	[lb (kg)]	[lb-in (Nm)]
1020	4500	0.006 (0.15)	0.003 (0.08)	4.2 (1.9)	460 (52)
1030	4500	0.006 (0.15)	0.003 (0.08)	5.7 (2.6)	1320 (149)
1040	4500	0.006 (0.15)	0.003 (0.08)	7.4 (3.4)	2200 (249)
1050	4500	0.008 (0.2)	0.004 (0.1)	12 (5.4)	3850 (435)
1060	4350	0.008 (0.2)	0.005 (0.13)	16 (7.3)	6050 (684)
1070	4125	0.008 (0.2)	0.005 (0.13)	23 (10.4)	8800 (994)
1080	3600	0.008 (0.2)	0.006 (0.15)	39 (17.7)	18150 (2051)
1090	3600	0.008 (0.2)	0.007 (0.18)	56 (25.4)	33000 (3729)
1100	2440	0.01 (0.25)	0.008 (0.2)	93 (42.2)	55550 (6276)
1110	2250	0.01 (0.25)	0.009 (0.23)	120 (54.4)	82500 (9321)
1120	2025	0.011 (0.28)	0.01 (0.25)	179 (81.2)	121000 (13671)
1130	1800	0.011 (0.28)	0.012 (0.3)	266 (120.7)	176000 (19885)
1140	1650	0.011 (0.28)	0.013 (0.33)	392 (177.8)	253000 (28585)

3.5.3.3 Coupling gap and maximum misalignment, KTR

ROTEX size	E distance	Max. parallel	Max. angularity	Max. axial
	[in (mm)]	[in (mm)]	[in (mm)]	[in (mm)]
14	0.51 (13)	0.006 (0.15)	1.1 (28)	-0.02 (-0.5) + 0.04 (1)
19	0.63 (16)	0.007 (0.18)	1 (25)	-0.02 (-0.5) + 0.05 (1.3)
24	0.71 (18)	0.008 (0.2)	0.08 (2)	-0.02 (-0.5) + 0.06 (1.5)
28	0.79 (20.1)	0.009 (0.23)	0.09 (2)	-0.03 (-0.8) + 0.06 (1.5)
38	0.94 (23.9)	0.01 (0.25)	0.09 (2)	-0.03 (-0.8) + 0.07 (1.8)
42	1.02 (25.9)	0.011 (0.28)	1 (25)	-0.04 (-1) + 0.08 (2)
48	1.1 (27.9)	0.013 (0.33)	1.1 (28)	-0.04 (-1) + 0.08 (2)
55	1.18 (30)	0.014 (0.36)	1.1 (28)	-0.04 (-1) + 0.09 (2.3)
65	1.38 (35.1)	0.015 (0.38)	1.1 (28)	-0.04 (-1) + 0.1 (2.5)
75	1.57 (39.9)	0.017 (0.43)	1.1 (28)	-0.06 (-1.5) + 0.12 (3)
90	1.77 (45)	0.018 (0.46)	1.2 (30)	-0.06 (-1.5) + 0.13 (3.3)
100	1.97 (50)	0.019 (0.48)	1.2 (30)	-0.06 (-1.5) + 0.15 (3.8)
110	2.17 (55.1)	0.02 (0.51)	1.2 (30)	-0.08 (-2) + 0.17 (4.3)
125	2.36 (59.9)	0.021 (0.53)	1.2 (30)	-0.08 (-2) + 0.18 (4.6)
140	2.56 (65)	0.022 (0.56)	1.2 (30)	-0.08 (-2) + 0.2 (5.1)
160	2.95 (74.9)	0.022 (0.56)	1.2 (30)	-0.1 (-2.5) + 0.22 (5.6)
180	3.35 (85.1)	0.024 (0.61)	1.2 (30)	-0.12 (-3) + 0.25 (6.4)



TM061156

Fig. E (Distance)

3.5.3.4 Aligning the engine drivers

Engine-driven units are typically supplied with the pump and drive on a common base plate. For units that are supplied separately, contact Peerless.

If a universal drive is installed, contact the manufacturer for instructions.

1. Check the angular alignment between the pump and engine shafts.
2. Check the parallel alignment between the pump and engine shafts.
3. When coupled, verify that the angle between the pump and drive shaft is less than three degrees. For assistance, contact Peerless.
4. Verify that at least 3/4 of the key is engaged with the coupler and shaft.

3.5.4 Lubrication, priming and cooling systems

If supplied, please refer to additional documents attached to the pump, or contact Peerless.

3.6 Electrical connection

All electrical connections must be carried out by a qualified electrician in accordance with local regulations.

DANGER

Electric shock

Death or serious personal injury

- Switch off the power supply before you start any work on the product.
- Make sure that the power supply cannot be switched on accidentally.

Locate the electrical conduit and boxes so as to avoid obstruction of the pump.

Check speed versus torque requirements during the starting phase of a pump against the speed versus torque curve of the driving motor.

In order to accelerate the pump up to rated speed, the driver should be capable of supplying more torque at each speed than required by the pump. In general, this condition is easily attainable with standard induction or synchronous motors, except under certain conditions when a motor with high pull-in torque may be required, such as high specific speed pumps over 5000 US units (100 metric units) or reduced voltage startup.

To achieve a smooth start for the pumping equipment, consider connecting autotransformers to the starting panel or using solid-state starters. These provide a gradual increase in voltage up to rated voltage ensuring even acceleration.

Control, monitoring and alarm equipment

All control and alarm systems should be checked for correct installation and functioning in accordance with the manufacturer's instructions. All alarm point settings should be checked.

Stopping the unit/reverse runaway speed

A sudden power and/or discharge valve failure during pump operation against a static head will result in a flow reversal, and the pump will operate as a hydraulic turbine in a direction opposite to that of a normal pump operation. If the driver offers little resistance while running backward, the rotational speed may approach the pump specific speed. This condition is called runaway speed and causes mechanical problems. Contact Peerless for aid in preventing this condition.

3.7 Control, monitoring, and alarm equipment

Check control and alarm systems for correct installation and function according to the manufacturer's instructions.

Check all alarm point settings.

3.7.1 Stopping the unit/reverse runaway speed

A sudden power and/or discharge valve failure during pump operation against a static head will result in a flow reversal, and the pump will operate as a hydraulic turbine in a direction opposite to that of a normal pump operation.

If the driver offers little resistance while running backward, the rotational speed may approach the pump specific speed.

4. Preparing the pump for startup

4.1 Lubricating the pump

Before attempting to start the pump, check the following items:

- lubrication fitting at packing, if applicable
- lubrication for pump bearing
- lubrication of the driver
- oil-cooling connections for the driver, if applicable
- coupling, refer to the manufacturer's instructions.

Good practice includes the following:

- Keep lubricant clean, and use a dust-tight cover on the storage container.
- Use the oldest lubricant first.
- Clean the pump lubricant fittings before re-lubricating with grease.
- Use clean dispensing equipment.
- Remove 0.25 in (6.4 mm) of drain pipe plug on the bottom outside of the bearing housing cover. Inject clean, new grease forcing out the old grease through the drain opening.
- Start and run the pump for a short time to eject any excess grease. Reinstall 0.25 in (6.4 mm) of pipe plug. Wipe off any ejected grease.
- Use the proper amount of lubricant. Too much lubricant results in churning, unnecessary power consumption, rapid heating to a high temperature and inadequate lubrication.

Normal bearing temperatures vary with the seasons and environment and may range from 0 to 250 °F (-18 to 121 °C). A continuous rise from the established, normal operating temperature indicates trouble and probable failure of the bearing. Shut down the pump immediately.

4.2 Checking rotation

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply before you start any work on the product.

Three-phase motor shaft rotation can be reversed by switching any two of the three power leads.

Do not attempt to switch any leads in a single-phase motor to change the direction of rotation. The rotation of most single-phase motors is determined by internal wiring and cannot be changed easily.

1. Disconnect the power supply.
2. Lockout-Tagout the power supply.
3. Disconnect the coupling from the motor and pump shaft. Motor shaft spins without driving or contacting the pump shaft.
4. Rotate the motor shaft by hand in both directions.
   Verify that the motor spins without binding.
5. Momentarily energize the motor.
   Verify that the motor spins in the direction indicated on the pump volute.
6. Install the coupling and guards.

4.3 Guards

WARNING

Moving machine parts or blades

Death or serious personal injury

- Guards must not be removed while the pump is operational. Ensure an approved coupling guard is in place before operating the pump.

Refer to the accessory manufacturer's safety instructions.

4.4 Flushing the system

Before the pump is installed, we recommend that you clean the system to remove debris, for example, stubs of welding rod, welding slag, and loose scale. Protect the pump and other sensitive parts with startup strainers.

4.5 System decontamination

After the system has been flushed to remove debris, determine if the system needs to be decontaminated. If the system needs to be decontaminated, it must be done before priming and filling the pump.

4.6 Priming

The pump should not be run unless it is completely filled with liquid, as there is danger of damaging some of the pump components.

If the system has suction pressure, follow these steps:

1. Bleed all air from the pump casing and suction pipe by the opening of the automatic relief valve at the top of the pump.
2. Rotate the shaft a few times, if possible, to evacuate any air trapped inside the impeller passages.

4.7 Stuffing box

The stuffing box gland must be loose when the pump is first put into operation.

Tightly pressed packing will result in burnt packing and scoring of the shaft or shaft sleeve.

The stuffing box should slowly leak fluid, 40-60 drops per minute, during operation. When the leak can no longer be controlled by adjusting the stuffing box gland, add one additional ring of packing and ensure the gland is loose. When the leak can no longer be controlled, all packing rings must be replaced.

- The stuffing box is packed at the factory.
- Each ring is cut to the proper length.

The end of the rings must come together and not overlap.

- The rings are placed in the stuffing box so that the joints of the packing rings are staggered.
- The stuffing box is furnished with a lantern or seal ring.
- The box has a tapped connection for grease lubrication, if applicable.
  - 3 oz. (89 mL) of grease must be injected into the stuffing box every 24 hours of operation.

Automatic grease seal lubrication systems can be installed as an accessory.

After the stuffing box housing and stuffing box gland reach approximately the same temperature as the pump parts, the running-in of the stuffing box gland has been completed. If the stuffing box leaks too much, tighten it slightly and evenly while the pump is running. To ensure continuous lubrication, a few drops should always drip from the stuffing box to protect the packing or shaft sleeve against damage. See *4.7.1 Recommended packing* for recommendations for leakage rate. If the pump is to be left idle for a long period of time, we recommend that you replace the packing before starting the pump.

4.7.1 Recommended packing

Recommended stuffing box packing arrangements for use with water:

Inlet pressure range	Packing shaft/ sleeve	Leakage rate
6.0 - 100 psi (0.41 - 6.9 bar)	PTFE braided graphite synthetic-lattice	60 drops/minute
100 - 175 psi (6.9 - 12 bar)	Continuous carbon filament yarn, braided lattice packing containing colloidal graphite	1/3 pint/minute (0.16 liters/minute)
175 - 250 psi (12 - 17 bar)	Continuous carbon filament yarn, braided lattice packing containing colloidal graphite	1 pint/minute (0.47 liters/minute)

4.8 Starting up the product

4.8.1 Starting the pump

1. Open the inlet valve completely, and close the outlet valve completely.
2. Switch the power supply on.
3. Start the pump.
4. Immediately make a visual check of the pump and inlet pipe.
5. Allow the pump to ramp up to full speed.
6. Slowly open the outlet valve until the operational flow is achieved.
7. Check the outlet pipe for leaks.
8. Open the isolating valves for the pressure gauges.
9. Record the pressure readings.
10. Verify that the pump performance is within the tolerance of the pump performance curve.

4.8.1.1 Air in the system

Entrained air reduces pump total head and flow rate.

Use an eccentric reducer on the inlet pipe.

Return lines into tanks should terminate a minimum of two pipe diameters below the low liquid level.

4.8.1.2 Checking the driver lubrication

Before running the drivers either separately or connected to the pump:

1. Follow the driver manufacturer instructions for lubrication requirements.
2. Ensure that the grease-lubricated bearings in the driver have been properly greased with the grade of grease recommended by the driver manufacturer.

4.8.1.3 Driver settings

Refer to the manufacturer's instructions.

4.8.1.4 Pump performance

Initial field test data becomes a valuable baseline for future troubleshooting and maintenance. It may not be possible to match the factory performance due to differences in system resistance.

Once the pump is operating, verify the following:

1. The pipe connections are tight, and no leaks are present.
2. The following attributes match the pump nameplate:
   a. operating speed
   b. flow rate
   c. inlet and outlet pressure
   d. power input, P1.

5. Storing and handling the product

5.1 Short-term storage

Standard factory packaging is suitable for protection during shipment and during covered storage at a job site for a short period between installation and startup. The preservatives applied at the factory have an effective life of two to three months from the date of shipment from the factory, depending on the severity of the environment in which the equipment is exposed. For international destinations, this will vary depending on the seaworthiness of export boxing.

5.1.1 Controlled storage

Storage facilities should be maintained at an even temperature with a relative humidity lower than 50%, and little or no dust. Inspect and recoat the equipment periodically with water displacement rust inhibitor, vapor phase inhibitor, or rust preventive coating.The equipment must be inspected weekly to ensure that all preservatives are intact, and internals are protected.

5.1.2 Uncontrolled storage

For uncontrolled storage periods of three months or less, inspect the equipment weekly to ensure preservatives are intact and internal parts are protected.

Preparing the product for uncontrolled storage

- Periodically inspect and recoat the equipment with rust and vapor phase corrosion inhibitors.
- Seal all pipe threads and flanged pipe covers with tape. Place an adequate amount of desiccant near the center of the pump.
- If the pump is assembled, place and securely fasten additional desiccant in the outlet of the pump.
- Cover the equipment with black polyethylene or equivalent, with a minimum thickness of 0.006 in (0.15 mm).
- Provide a ventilation hole approximately the size of a small coin.
- Provide protection from direct exposure to the environment.
- If applicable, connect space heaters on equipment such as motors, engines or controls.

5.1.3 Short-term storage

- The pump and equipment, as shipped, have adequate protection for short-term storage for up to three months.
- If the product is not to be installed and operated immediately after receiving it, store it in a clean, dry area at a moderate ambient temperature.
- For packed-type pumps, the packing glands may be left on the pump shaft and securely fastened in position. All exposed machined surfaces should be thoroughly coated with a film of rust preventative material.
- For packed-type pumps, the stuffing box packing must be removed and stored in a sealed plastic bag. Seal the end of the stuffing box with rolled vapor phase inhibitor paper and seal with weatherproof tape.
- Rotate the shaft by hand periodically, at least monthly, to coat the bearing with a lubricant to retard oxidation and corrosion.
- Make sure the pump cannot roll or fall over.
- Follow the motor manufacturer's storage recommendations where applicable.

5.1.4 Long-term storage

- Long-term storage protection provided by the factory does not extend the warranty in any manner.
- The warranty is valid only if the equipment is properly handled and stored.
- In case of storage up to six months or longer, the pump must be protected against heat and moisture as described in the previous sections.
- Periodically, at least monthly, manually rotate the shaft to coat the bearing with a lubricant to retard oxidation and corrosion.
- Ensure that the pump cannot roll or fall over.
- Follow the motor manufacturer's storage recommendations where applicable.
- Inspect the pump before putting it into operation. Make sure that the impeller can rotate freely. Pay special attention to the condition of the shaft seals or the packing and O-rings.

5.1.5 Accessories storage

Store accessories according to the manufacturer's instructions.

5.2 Handling the product

When storing and handling the product:

- Use properly sized and rated lifting equipment.
- Handle and lift the product according to the local regulations.
- Ensure that point loads do not occur.

DANGER

Crushing hazard

Death or serious personal injury

- Place the product on a level surface to prevent overturning.

If the product is equipped with lifting points, use the points during handling.

6. Product introduction

6.1 Product description

Peerless AEF pumps are horizontal split case fire pumps with appropriate fittings for providing water supply to fire protection systems in buildings, plants, and yards.

6.1.1 Pump components

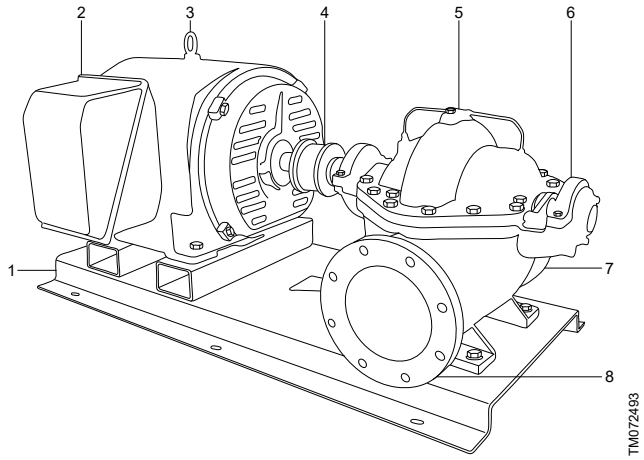


Fig. Pump components, AEF

Pos.	Description
1	Base frame (pump mounted with driver)
2	Driver (electric motor)
3	Eyebolt
4	Coupling
5	Pump
6	Outboard bearing
7	Outlet
8	Inlet

6.2 Intended use

The Horizontal Split Case Model AEF is intended for use in fire protection systems. If there is any doubt as to the suitability of the product for the application intended, contact Peerless.

6.3 Identification

6.3.1 Nameplate

Each pump has a nameplate with the pump's serial number. You will find an example of the pump nameplate in the figure below. Reference the serial number when contacting Peerless with questions or a service request.

A nameplate can also be found on the driver, if supplied. When requesting information about the driver, both the driver serial number and the pump serial number will be required.

If the pump has a flange nameplate, it will include the pump's equipment order number and pump model.

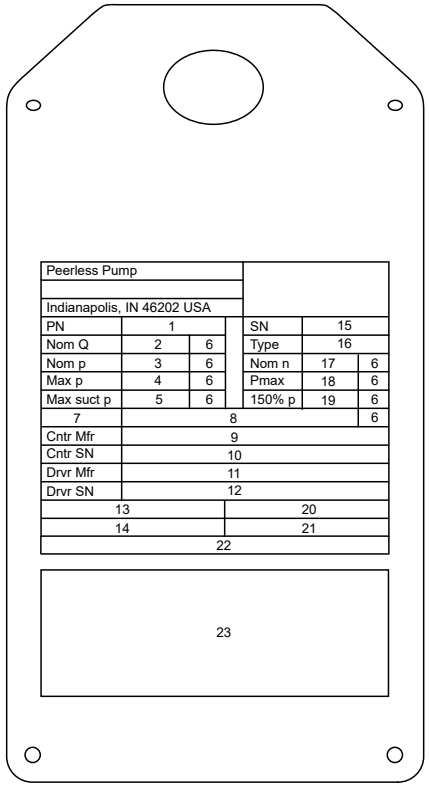


Fig. Flange nameplate

Pos.	Description	Pos.	Description
1	Product number	13	Description
2	Nominal flow	14	Description
3	Nominal pressure	15	Serial number
4	Max. pressure	16	Pump type/model
5	Maximum inlet pressure	17	Tested speed
6	Unit of measure	18	Maximum power
7	Number of stages	19	150% maximum power
8	Impeller diameter	20	Country of origin
9	Controller manufacturer	21	Production code
10	Controller serial number	22	Packaging location
11	Driver manufacturer	23	Marks of approval
12	Driver serial number		

6.3.2 Type key

This type key is applicable to the configurator in Peerless Product Center.

Example: 6AEF16G-1-UF-1/7-P-M-US-R

Code	Example	Designation
6	6 inches	Outlet flange [inch]
AEF	Horizontal split case fire pump	Pump type
16	16 inches	Maximum impeller diameter [inch]
[ ]	Not relevant	Impeller design
G		
....		
....		
1	125 lb, inlet; 125 lb, outlet	Inlet and outlet flange rating
2	125 lb, inlet; 250 lb, outlet	
3	250 lb, inlet; 250 lb, outlet	
4	125 lb, inlet; 400 lb, outlet	
X	Special	
UF	UL listed and FM approved	Approvals
UC	UL Canada listed approved	
UL	UL listed approved	
FM	cFMus approved	
1	Cast iron (ASTM 48 CL 35A or 40A)	Casing material
2	Ductile iron (ASTM A536 60-40-18)	
3	316SS	
4	316LSS	
5	CD4MCu/A84	
9	Nickel-aluminum-bronze (ASTM B148)	
X	Special	
1	Cast iron (ASTM 48 CL 35A or 40A)	Impeller material
3	316SS	
4	316LSS	
5	CD4MCu/A84	
7	Silicon brass or bronze (ASTM B584)	
9	Nickel-aluminum-bronze (ASTM B148)	
X	Special	
P	Packing	Seal
S	Split seal, single	
C	Cartridge seal, single	
X	Special	
M	Mounted on base with driver	Mounting options
B	Bare-shaft pump	
L	Mounted on base without driver	
BA	Baldor	Driver manufacture
CL	Clarke	

Code	Example	Designation
MA	Marathon	
US	Nidec	
WE	WEG	
	Cummins	
	Caterpillar	
	Deutz	
	No driver	
X	Special	
R	Right hand (Clockwise)	Rotation
L	Left hand (Counterclockwise)	
A	No panel	Controller type
C	Firetol	
D	Tornatech	
E	Metron	
F	Cutler Hammer	
G	Peerless	
M	Master	
N	None	
Z	Special	

6.3.3 Approvals

These installation and operating instructions apply to Horizontal Split Case AEF model with the following approvals:

- UL and FM
- FM only
- UL only
- NFPA compliant
- ULC
- CCC.

The approval for your specific product is indicated on the nameplate as described in the type key.

7. Taking the product out of operation

1. Always close the outlet gate valve before stopping the pump. Close the valve slowly to prevent hydraulic shock.
2. Switch off and lock off the power supply to the motor.
3. For overnight or temporary shutdown periods under non-freezing conditions, the pump may remain filled with liquid. Make sure that the pump is fully primed before restarting.
4. For long shutdown periods or to isolate the pump for maintenance, close the inlet and outlet gate valves. If no inlet gate valve is used and the pump has positive inlet pressure, drain all liquid from the inlet line to stop the liquid flow into the pump inlet.
5. If applicable, uninstall water flush lines.
6. Remove the plugs in the pump drain and vent holes, as required, and drain all liquid from the housing.
7. In case of freezing conditions during long shutdown periods, drain the pump completely and remove the packing, if applicable. Blow out all liquid passages and pockets with compressed air. Freezing of the pumped liquid can also be prevented by filling the pump with an antifreeze solution.
8. Rotate the shaft by hand monthly to coat the bearings with lubricant and impede oxidation and corrosion.
9. Follow the motor manufacturer's storage recommendations where applicable.

8. Servicing the product

8.1 Maintenance

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply before you start any work on the product.

WARNING

Overhead load

Death or serious personal injury

- Do not attempt to lift the system or pump by the lifting lugs or eyes of the driver or pump.
- No point loads must occur.
- Do not work under a suspended system or pump.

8.2 Maintenance schedule

To ensure satisfactory operation of the pumping equipment, frequent inspection and periodic maintenance are required.

An inspection and maintenance log should be kept, and the inspector must report any problems immediately. A suggested guide for preventative maintenance for normal applications is given below. Unusual applications with abnormal heat, moisture, dust, etc., may require more frequent inspection and service.

Item	Action	Frequency
Packing, packing box	Inspect for excessive leakage	First 150 hours of operation, then every 2000 hours of operation or quarterly
Packing, packing box	Adjust gland and replace packing	As necessary
Pump-motor alignment	Check for change in alignment	Frequently (at every start and stop)
Vibration	Check for change in vibration	Annually
Bearings	Lubricate (grease)	
	• Light Duty, approx. 10 hours/week	• Every 2000 hours or at least once a year
	• Normal Duty, approx. 8 hours/day	• Every 2000 hours or at least every six months
	• Severe Duty, approx. 24 hours/day	• Monthly
Fasteners	Check for loose fasteners	Annually

8.2.1 Lubricant and sealant properties

For sealing low-pressure flange joints and similar applications, use a product similar to Loctite® 515.

Lubricants with the properties mentioned in the tables below must be selected for lubrication in standard applications.

Components	Maximum RPM	Ambient operating temperature	NLGI grade	Kinematic viscosity, ASTM D 445	Food grade
Shaft bearings	3600	-10 to +250 °F (-23 to 121 °C)	2	160 cST, [104 °F (40 °C)]	H-1
Inlet manifold bearings					
Stuffing box packing					

8.2.2 Recommended spare parts

The list of recommended spare parts will depend on factors such as:

supplier lead times, if the pump is used for normal or severe duty operation, and if a backup pump is available for use.

A suggested list of spare parts for intermittent or no-critical operation:

- stuffing box packing (13)
- ball bearing set (16 & 18)
- bearing seal set (47 & 169)
- bearing cover gaskets (73B)
- set of shaft sleeves (14 & 14A)
- set of sleeve O-rings (14B)
- set of volute rings (7)
- set of impeller rings, if supplied (8)
- Volute gasket (73A)
- packing gland
- studs and gland bolts.

In addition to the above list, a suggested spare part for continuous or critical operation:

- complete rotating element, preassembled.

8.2.3 Consumables

The following items are normally used in the maintenance of pumping equipment:

- lubricant (grease or oil)
- cleaning materials
- touch-up coating
- hand tools
- measuring equipment (feeler gauges, dial indicator, etc.).

Some items may vary depending on the type of unit.

8.2.4 Tightening torques

Proper tightening of fasteners is very important. The torque values depend on the size and grade of the fasteners used. The values in the table below apply to non-lubricated parts.

Fastener size	Torque [lb-ft (Nm)]	Torque [lb-ft (Nm)]
	Medium carbon steel SAE J429 Grade 5 105-120,000 psi Tensile	Medium carbon alloy steel SAE J429 Grade 8 150,000 psi Tensile
1/4-20	8 (10.8)	9 (12.2)
3/8-16	25 (33.9)	34 (46.1)
1/2-13	62 (84)	83 (112.5)
5/8-11	125 (169.5)	166 (225.1)
3/4-10	225 (305)	295 (400)
7/8-9	325 (441)	477 (646.7)
1-8	465 (630.5)	715 (969.4)

When assembling a pump, cross-tighten the screws in order to avoid misalignment, binding and leakage.

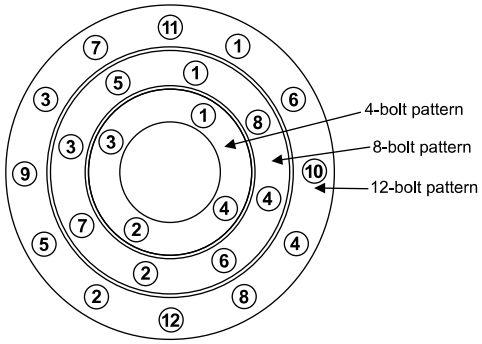


Fig. Tightening pattern for 4-, 8-, or 12-bolt flange

Shaft sleeve set screws: 10.8 lb-ft (14.7 Nm)

The shown torque value is for clean lubricated threads and gasket joints.

8.3 Dismantling the pump

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply before you start any work on the product.

WARNING

Flammable material

Death or serious personal injury

- Contact Peerless for help related to removal of impellers.
- Occasionally, the impeller has either been shrunk-fit onto the pump shaft or has become difficult to remove due to corrosion.
- If heat is applied to remove the impeller, it must be applied cautiously. Before applying heat, ensure that any residual hazardous liquid trapped between the impeller and shaft has been drained and thoroughly cleaned.

Peerless does not recommend reusing gaskets, O-rings, packing rings, or ball bearings.

Before dismantling the pump, obtain a set of spare parts.

1. Shut down the pump.
2. Disconnect the power supply.
3. Drain the pump and isolate the pipes.
4. Clear a space adjacent to the pump for storing components.
5. Remove the couplings. Follow the coupling manufacturer's instructions.
6. Remove the water seal piping (127).
7. Remove the nuts from the gland bolts (17B), and remove the packing glands (17) from the shaft (6).
8. Remove all fasteners from the upper casing (1B).
9. Remove the bearing end cover (123) from the outboard bearing side.
10. Remove all fasteners from the bearing caps (41 & 43) located on the lower casing (1A).
11. Create marks on the lower casing (1A) and bearing caps (41 & 43) for matching upon reassembly.
12. Screw the jack screws on the bottom of the lower casing (1A) split flange to separate the upper and lower casing.
13. Unscrew the jack screws below the split flange surface to avoid interference during reassembly.
14. For the 12AEF21, follow step a, for all other models follow step b.
    a. Optional removal: the bearing bracket, bearing, and bearing housing can be removed for easier access to the packing and lantern rings without having to remove the upper casing.
    b. Remove the upper casing by using a 1/2-13 UNC thread eyebolt into the threaded hole.
15. Secure lifting straps around the shaft near the bearing housings, and lift the rotating element from the volute.

    Tap lightly on the underside of the bearing housings to separate the housings from the brackets.

16. Place the rotating element on a convenient work surface.
17. Loosen the set screws, and remove the coupling.

    Tap from the back of the hub or use a puller.

18. Remove coupling key (46) and outboard deflector (40B).
19. Take out the cap screws to remove the bearing covers (35 & 37) and the gaskets (73B).
20. Remove inboard bearing cover seal (47) from cover (35).

    Required only if replacement of the seal is necessary.

21. Remove the retaining ring (18A) from the outboard end of the shaft.

22. Remove housings (31 & 33), bearings (16 & 18), and bearing housing seals (169).

    Use a bearing puller.

23. Remove the deflectors (40A).
24. Remove the casing rings (7).
25. Remove the packing rings (13), lantern rings (29), and stuffing box bushings (63).

    Lantern rings may not be present.

26. For the 12AEF21, follow step a, and for all other models follow step b.
    a. Loosen the shaft sleeve set screws and remove the shaft sleeves and shaft sleeve nuts.
    b. Loosen the shaft sleeve set screws and then the shaft sleeves (14 & 14A).

    Use a spanner wrench to remove the shaft sleeves. Sleeve (14) has a right-hand thread, and sleeve (14A) has a left-hand thread.

27. Remove the sleeves (14 & 14A) from the shaft.

    Do not damage the O-ring (14B) between the shaft and the sleeve.

28. Remove the impeller (2) from the shaft.

    Use an arbor press. The tolerance for the fit between the impeller hub inner diameter and shaft outer diameter is within the ANSI B4.1 [LC] standard.

29. Remove the impeller key (32).
30. Clean all parts:
    a.

    Do not clean the bearings. Do not use a metal or wire brush.

    Clean metal parts with a solvent.

    Use a bristle brush.

    b. Scrape gasket and lubricant from flanges.
31. Replace or recondition worn or defective parts if the following is observed:
    a. O-rings and bearing cover gaskets have cracks, nicks, or tears.
    b. Packing rings are excessively compressed, fraying or shredding, or embedded with particles (dirt or metal).
    c. Check the entire shaft length for eccentricity with a dial indicator. Runout must not exceed 0.003 in (0.08 mm).

    Mount the shaft between centers or V-blocks on a level surface.

    d. Check that threads are clean and sharp.
    e. Check bearing surfaces for smoothness, and verify that the finish is within 32 µin (0.81 µm) or less.
    f. Verify that the shaft shoulders are square and free from nicks.
    g. Examine passages for cracks, dents, gouges, or embedded material.

8.3.1 Accessories

Please see the manuals supplied with the accessories.

8.4 Wear ring

Wear rings decrease the clearance between the impeller and volute to reduce the quantity of liquid leaking from the high-pressure zone, outlet, and the low-pressure zone, inlet. The rings are designed to use the pumped liquid for lubrication and to be replaced when worn to maintain optimal pump performance and service.

As the rings wear, the clearance between the impeller and the volute increases as does the amount of liquid leaking from the high-pressure to the low-pressure zone. The rate of wear depends on the characteristics of the pumped liquid. The pump will typically have a volute wear ring and can also have an impeller wear ring.

Badly worn wear rings will result in severe degradation of pump performance: head and flow rate, especially on small pumps. Examination of wear patterns can provide valuable information to diagnose pump performance or maintenance issues and determining the source of a problem.

8.5 Replacing the wear ring

Standard pumps are not supplied with impeller wear rings, and they can be installed in the field. The wear surface of the impeller is an integral part of the impeller. Impellers with worn surfaces that cannot be fitted with wear rings must be replaced.

Use the following steps to determine if the wear rings must be replaced:

1. Measure the outer diameter (OD) of the impeller wear surface or wear ring (8) and the inner diameter (ID) of the volute wear ring (7).
2. Compute the diametrical clearance, ID minus OD, and compare them with the allowed diametrical clearance.
3. If the measured clearance is out of tolerance, proceed as follows:

   Ensure the ID of the volute ring is concentric with the wear ring OD, and the surface is smooth.

   a. Replace the volute wear ring and impeller wear ring if the measured clearance is two times the maximum allowed clearance.

   Machining the impeller wear surface may be necessary to install or replace the impeller wear rings. Ensure that the impeller OD is not reduced and is concentric with the bore of the impeller.

   Bronze impeller rings are shrink-fitted onto the hub according to ANSI B4.1 [FN-4].

   Hardened impeller rings are installed according to ANSI B4.1 [FN-1].

   b. Replace the volute wear ring if the measured clearance is out of tolerance.

8.6 Diametrical clearance

Clearances are for the standard bronze or cast iron fitted pumps. For materials with a tendency to gall such as stainless steel, increase clearances by 0.01 in (0.25 mm).

Pump size	Diametrical clearance [in (mm)]
Typical	0.015 to 0.019 (0.381 to 0.48)
10AEF16, 10AEF20	0.018 to 0.022 (0.457 to 0.559)
6AEF17	0.025 to 0.029 (0.635 to 0.737)

8.7 Inspecting the product

Before installation:

1. Take inventory of the shipment to ensure that the received parts match the list of parts on your order.
2. Note the extent of damage or shortage on the freight bill and bill of lading. Failure to note damage or missing parts may result in declined warranty or refusing replacement of parts.
3. It is important that all the pump and system components are identified and properly stored until installation, see *5.1.4 Long-term storage*. There may be many small parts (such as line shaft couplings or hardware) that are best left in their shipping container until installation.

8.8 Repairing the product

Visually inspect parts for damage that affects serviceability or sealing. Pay special attention to mating parts with relative motion, for example, the wear rings.

Inspection

Perform a detailed inspection as follows:

- Check O-rings and bearing cover gaskets for cracks, nicks, or tears.
- Check packing rings for excessive compression, fraying or shredding, embedded particles (dirt or metal). Replace them if they are defective in any way.
- Mount the shaft between centers or on V-blocks. Check for eccentricity throughout the entire length with a dial indicator. Eccentricity must not exceed 0.003 in (0.08 mm) total indicator reading.
- Mount the shaft between centers or on V-blocks. Check for eccentricity throughout the entire length with a dial indicator. Eccentricity must not exceed 0.003 in (0.08 mm) total indicator reading.
- Examine the volute for cracks, dents, gouges or embedded material.

Repairs

Make needed repairs in the following manner:

- If the inner diameter (ID) of casing rings (7) is grooved, scored or eccentric, replace the casing rings.
- If the impeller wear surfaces or impeller rings (8) are defective, the impeller must be machined to install new impeller rings. Be sure machining is concentric with the impeller bore. Use care NOT to reduce hub outer diameter (OD) when machining off old impeller rings.
- Install new impeller rings (8) on the impeller (shrink or press depending on the material).
- Replace worn shaft sleeves.
- Replace shafts having excessive run-out (eccentricity).

8.9 Assembling the pump

Take care not to damage any components and avoid contamination (dirt, debris, moisture, etc.) of the unit.

Peerless does not recommend reusing gaskets, O-rings, packing rings, or ball bearings.

1. Support the pump shaft in blocks and rails to protect it from bending or being damaged during the re-assembly process.
2. Check that the shaft is straight and free of nicks and scratches. Remove all burrs and scratches with a fine file.
3. Coat the shaft (6) lightly with oil.
4. Place impeller key (32) in shaft keyway.
5. Align impeller (2) on the shaft and install with an arbor press or brass tubular sleeve and hammer. When assembled, the impeller vanes must rotate in the proper direction.
6. Impeller hub must be centered on shaft journal.
7. Apply a thread locker on the shaft sleeve, set screws and install them in the shaft sleeves. Assemble shaft sleeves to the shaft and hand tighten against the impeller. Tighten the set screws to a minimum torque of 12 ft-lbs.

   We recommend using Loctite 242 thread locker. Apply a 360° bead of thread locker to the first few threads, leaving the first thread-free.

8. Install the stuffing box bushings (63).
9. Locate casing rings (7) on the impeller.
10. If casing and or impeller wear rings are required, fit wear rings into the casing or onto the impeller skirt. Contact Peerless if rings should be pressed or secured to part as needed. The final clearance of rings should provide the clearance shown in the table in section *8.6 Diametrical clearance*. If clearance is not achieved, machine rings before proceeding.
11. Insert board deflectors (40A) on the shaft.
12. If previously removed, install bearing housing seals (169) into housings (31 and 33).
13. Press housing-bearing-seal assemblies on the shaft to seat bearings against shaft shoulder fillet.
14. Install bearing retaining ring (18A) in the groove against the outboard bearing.
15. Install gaskets (73B) on bearing covers. Use factory supplied parts or cut replacement gaskets from 0.06 in (1.52 mm) No. 444 Vellumoid. (SAEP3415A). EXCEPTION: For all models using 3306 size outboard bearing, gasket 73B is 0.03 in (0.8 mm).
16. Install outboard deflector (40B) and coupling key (46).
17. Affix the new casing gasket (73A) to the lower casing (1A) with lubricant.

    It is very important that the specified material and thickness are used for casing gasket. Machined surfaces of both casings must be perfectly clean and free from burrs or nicks.

18. For the 12AEF21, follow step a before step b, for all other models follow step b only:
    a. If the bearings bracket has been removed, install it before setting the rotating element into the lower casing.
    b. Use slings around the shaft near the bearings to set the rotating element into the lower casing.
19. Position the casing rings (7) and both bearing housings so that all dowel pins engage in slots in the lower case split surface.
20. Assemble both bearing caps per match marks, and tighten the cap screws.
21. Adjust the shaft sleeves (14 and 14A) to center the impeller in the lower casing, and tighten both shaft sleeves with a spanner wrench, then add Locktite to the shaft sleeve set screws. Then tighten shaft sleeve set screws according to section *8.2.4 Tightening torques*.
22. Cover the top side of the casing gasket with a lubricant.
23. Install the gland bolts (17B). Carefully locate the upper casing on the lower casing, making certain the dowel pins engage.

24. Install cap screws and tighten working from the center of the casing to each end, to the torque values in section *8.2.4 Tightening torques*. If any cap screws require replacement, use only parts with equal or greater tensile strength. See *8.2.4 Tightening torques*.
25. Rotate shaft by hand to check that it turns freely.
26. Push the stuffing box bushings (63) to the rear of the stuffing boxes.
27. The stuffing box is not packed from the factory, it should be packed prior to startup according to the guide below.
28. Clean the stuffing box.
29. Check that the packing rings are of proper cross-section and length.
30. Stagger the joints 90° apart.
31. The rings should butt tightly, but not overlap at the joints.
32. Tamp down the individual packing rings, but not too tightly, as this may result in burning the packing and scoring the shaft or shaft sleeve.
33. Where compatible, lightly lubricate the inner and outer packing diameter with a suitable lubricant. When a lantern ring is required, make sure that sufficient packing is inserted below the lantern ring so that the bypass line intersects the packing container bore adjacent to the lantern ring and is not blocked by the packing.
34. Replace the water seal piping.

    The pipe supplying sealing liquid should be fitted tightly so that no air enters. If the pumped liquid is dirty or gritty, clean sealing liquid should be piped to the stuffing box in order to prevent damage to the packing and shaft sleeves.

    Clear sealing liquid is also required if the stuffing box materials are not completely compatible with the pumped liquid. The sealing liquid should be at a pressure sufficient to ensure a flow of clean liquid into the pump, but not so high as to require excessive tightening of the packing.

35. Insert two packing rings, lantern ring (29), if provided, and three packing rings. Insert each ring separately, and stagger the joints of successive rings 90°.
36. Insert the packing glands (17), and set the gland bolt nuts finger tight.

    The stuffing box gland must not be too tight during startup in order to let sufficient liquid lubricate the shaft and the packing.

37. Rotate shaft by hand to check that it turns freely.
38. Replace all drain plugs if removed during disassembly.
39. Re-lubricate the bearings. See section *4.1 Lubricating the pump*.
40. Make sure that the pump shaft spins freely.

9. Parts list and sectional drawings

9.1 AEF

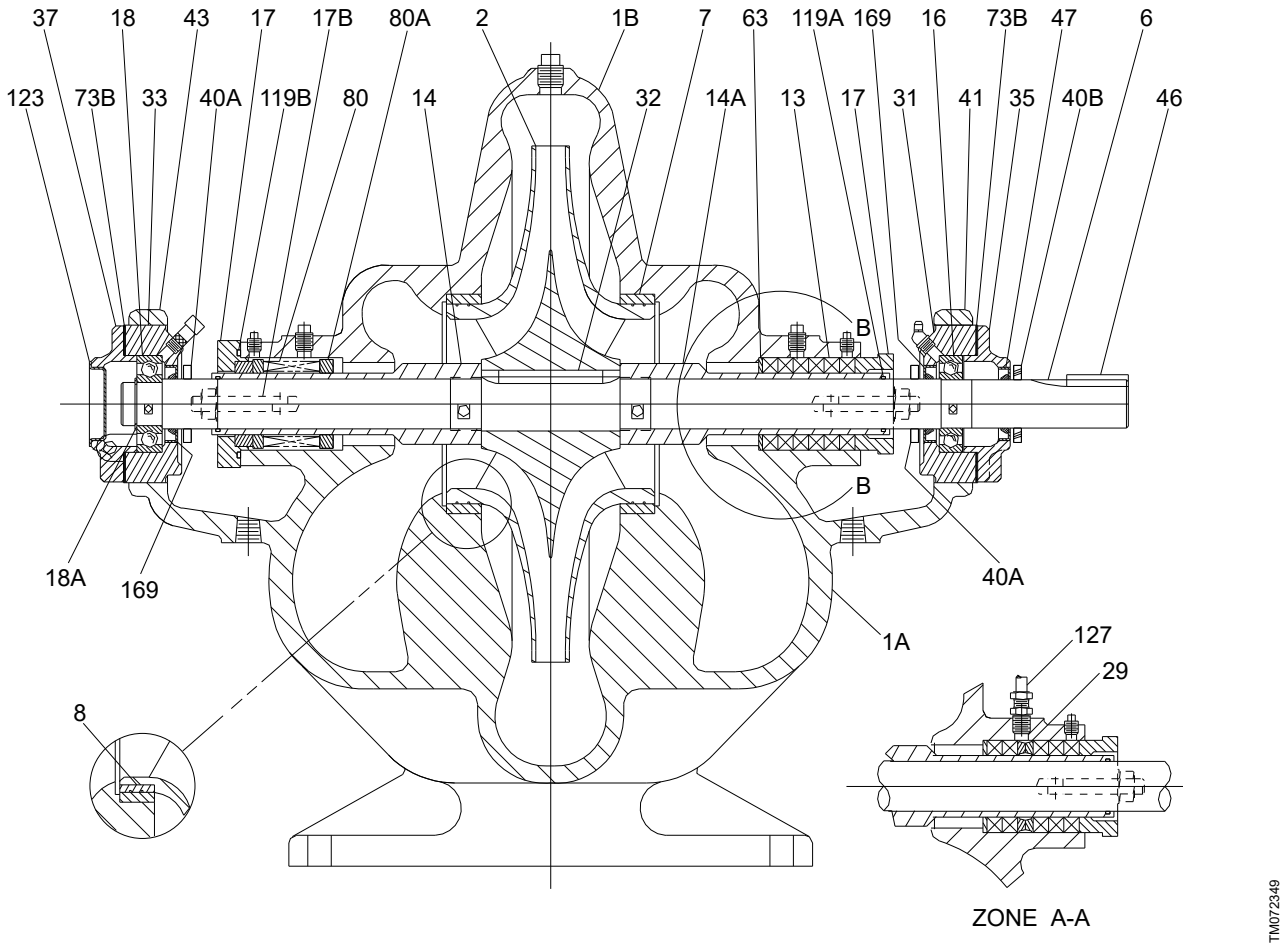


Fig. AEF, packed type

Item No.	Description	Item No.	Description
1A, 1B	Upper and lower casing	33	Outboard bearing housing
2	Impeller	35	Inboard bearing housing cover
6	Shaft	37	Outboard bearing housing cover
7	Casing wear ring	40A	Inboard deflector
8	Impeller wear ring (optional)	40B	Outboard deflector
13	Packing ring	41	Cap, bearing, inboard
14, 14A	Shaft sleeve RH LH	43	Cap, bearing, outboard
14B	Shaft sleeve O-ring	46	Coupling key
16	Inboard ball bearing	47	Inboard bearing cover seal
17	Packing gland	63	Stuffing box bushing
17B	Gland bolt	73A	Volute gasket (not shown)
18	Outboard ball bearing	73B	Bearing cover gasket
18A	Bearing lock washer	123	Bearing end cover
29	Lantern ring (optional)	127	Water seal piping
31	Inboard bearing housing	169	Bearing housing seal
32	Impeller key		

9.2 AEF with double row thrust bearing

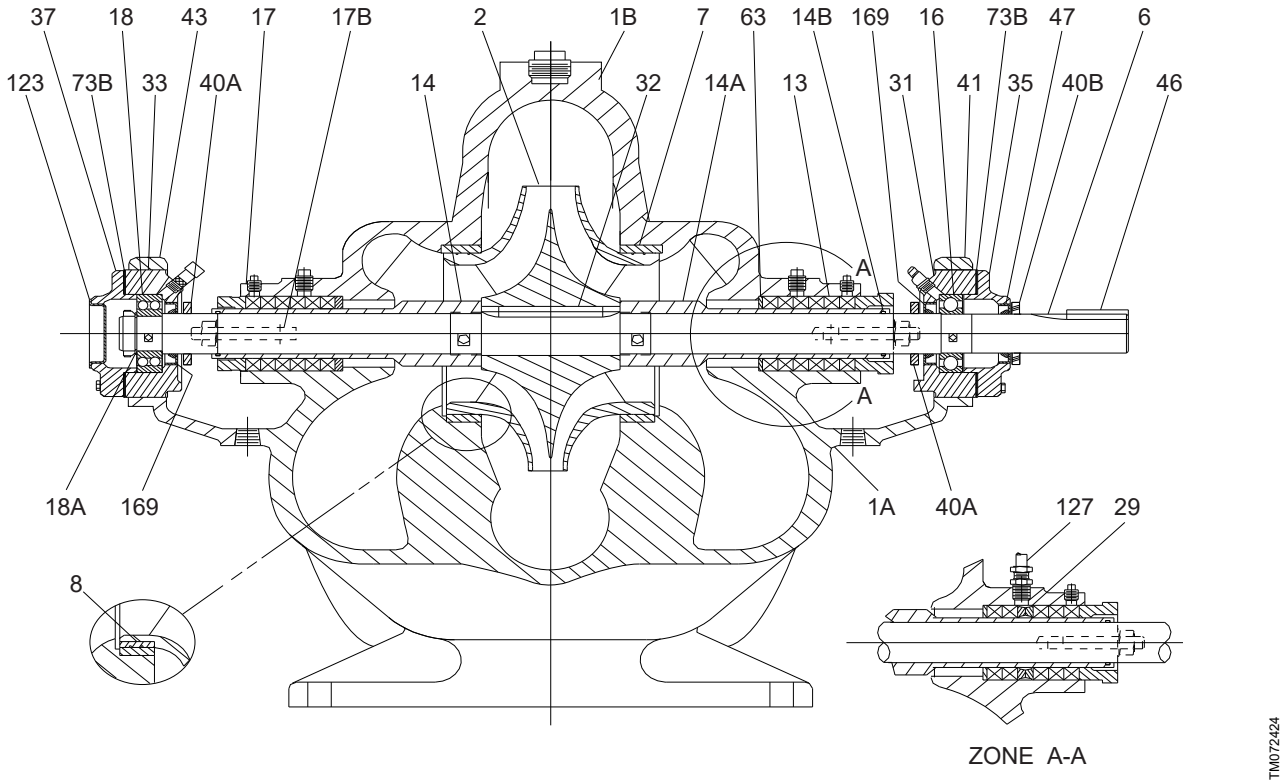


Fig. AEF, packed type with double row thrust bearing

Item No.	Description	Item No.	Description
1A, 1B,	Upper and lower casing	32	Impeller key
2	Impeller	33	Outboard bearing housing
6	Shaft	35	Inboard bearing housing cover
7	Casing wear ring	37	Outboard bearing housing cover
8	Impeller wear ring (optional)	40A	Inboard deflector
13	Packing ring	40B	Outboard deflector
14, 14A	Shaft sleeve RH LH	41	Cap, bearing, inboard
14B	Shaft sleeve O-ring	43	Cap, bearing, outboard
16	Inboard ball bearing	46	Coupling key
17	Packing gland	47	Inboard bearing cover seal
17B	Gland bolt	63	Stuffing box bushing
18	Outboard ball bearing	73A	Volute gasket (not shown)
18A	Bearing lock washer	73B	Bearing cover gasket
29	Lantern ring (optional)	123	Bearing end cover
31	Inboard bearing housing	127	Water seal piping
		169	Bearing housing seal

9.3 12AEF21

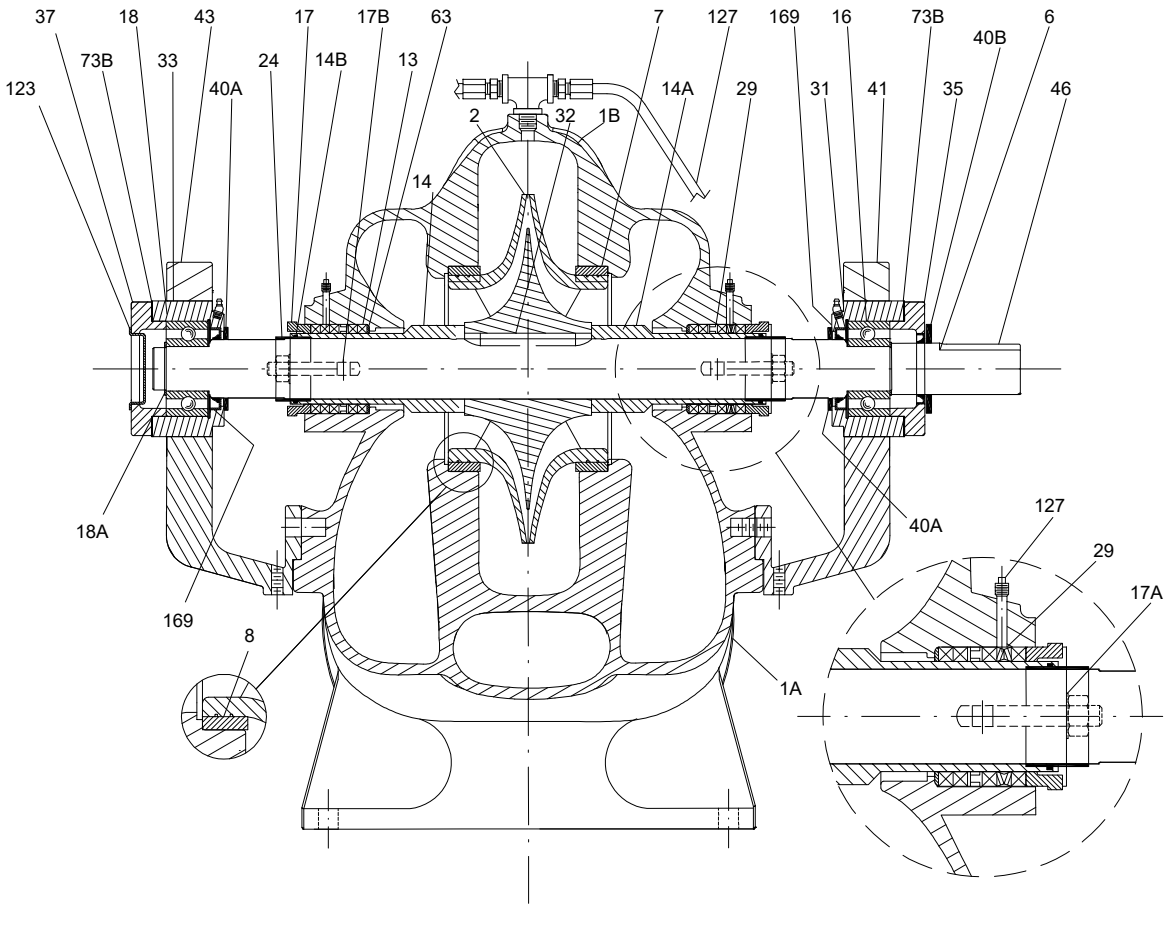


Fig. 12AEF21

Item No.	Description	Item No.	Description
1A, 1B	Upper and lower casing	32	Impeller key
2	Impeller	33	Outboard bearing housing
6	Shaft	35	Inboard bearing housing cover
7	Casing wear ring	37	Outboard bearing housing cover
8	Impeller wear ring (optional)	40A	Inboard deflector
13	Packing ring	40B	Outboard deflector
14, 14A	Shaft sleeve RH LH	41	Cap, bearing, inboard
14B	Shaft sleeve O-ring	43	Cap, bearing, outboard
16	Inboard ball bearing	46	Coupling key
17	Packing gland	47	Inboard bearing cover seal
17B	Gland bolt	63	Stuffing box bushing
18	Outboard ball bearing	73A	Volute gasket (not shown)
18A	Bearing lock washer	73B	Bearing cover gasket
24	Shaft sleeve nut	123	Bearing end cover
29	Lantern ring (optional)	127	Water seal piping
31	Inboard bearing housing	169	Bearing housing seal

10. Fault finding the product

Fault	Cause	Remedy
The outlet pressure is too low.	The speed of rotation is too low.	Reestablish the correct speed and direction of rotation.
	The system pressure is lower than anticipated.	Check the system curve.
	There is air or gas in the pumped liquid.	Remove the air from the pumped liquid.
	The wear rings are worn.	Replace the wear rings.
	The impeller is damaged.	Repair or replace the impeller.
	The impeller diameter is too small.	Replace the impeller with one of the correct diameter.
	The direction of rotation is wrong.	Interchange two wires in the power supply.
	The pump has lost its prime.	Re-prime the pump.
	There is insufficient NPSH.	Restore required NPSH.
	Passages are restricted.	Clean the impeller and pump housing passages.
	Joints or the stuffing box are leaking.	• Tighten the joints or the stuffing box gland. • Replace the shaft sleeve. • Replace the gaskets.
The inlet pressure is insufficient.	The inlet line is drawing air.	Tighten the connections.
	The suction lift is too high, or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
	Air or gas is trapped in the pumped liquid.	Remove the trapped air or gas from liquid.
	The strainer is clogged.	Clean the strainer.
The noise level has increased.	Poor alignment of the pump. The inlet and outlet pipe clamps are loose.	• Reestablish proper alignment of the pump and the motor. • Support the inlet and outlet pipes. • Make sure the vibration dampers, flexible pipes, and conduit connectors are installed correctly.
	The foundation is cracked.	Repair the foundation.
	The ball bearings are worn.	Replace the worn bearings, and renew the lubrication.
	The motor is unbalanced.	• Disconnect the motor, and operate it alone. • Remove large pieces of debris, such as wood or rags, from the pump. • Clean out the pump, if necessary.
	Hydraulic resonance.	• Alter the resonant pipes. • Change the pump speed. • Insert a pulsation damper on the pump or the pipes. • Insert a flow straightener.
Insufficient flow.	The pump is not primed.	Prime the pump.
	The system pressure exceeds the shut-off pressure.	• Increase the liquid level on the inlet side. • Open the isolating valve in the inlet pipe.
	The speed of rotation is too low.	Reestablish the correct speed of rotation.
	The suction lift is too high, or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
	The strainer or the impeller is clogged.	Clean the strainer and the impeller passages.
	Wrong direction of rotation.	Reestablish the correct direction of rotation.

Fault	Cause	Remedy
	The joints are leaking.	Tighten the joints.
	The shaft or coupling are broken.	Repair or replace damaged parts.
	The inlet valve is closed.	If the inlet valve is closed, open it slowly.
	There is not enough inlet pressure for hot or volatile liquids.	Reestablish required inlet pressure.
	The foot valve is too small.	Replace the foot valve.
	Worn or damaged hydraulic parts.	Repair or replace the worn parts.
	Excessive clearance between the wear surfaces.	Repair or replace the wear rings.
The pump loses its prime after starting.	Joints or the stuffing box are leaking.	• Tighten the joints or the stuffing box gland. • Replace the shaft sleeve. • Replace the gaskets.
	The suction lift is too high, or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
Excessive power is required.	The speed of rotation is too high.	Reduce the speed of rotation.
	The pump is operating beyond its recommended performance range.	Set the duty point in accordance with the recommended performance range.
	The specific gravity or viscosity of the pumped liquid is too high.	If less flow is sufficient, reduce the flow on the outlet side, or fit the pump with a more powerful motor.
	The shaft is bent.	Replace the whole rotation element, and possibly the pump.
	The stuffing box is too tight.	Retighten the stuffing box, if possible. Alternatively, repair or replace the stuffing box.
	The impeller clearance is too small causing rubbing or worn wear surfaces.	Adjust the impeller clearance, if possible, or replace the wear ring.
	There is an electrical or mechanical defect in the motor.	Contact your local service center for diagnostics.
	The pump is restricted in its rotation.	Remove any obstacles, or replace any worn parts.
	Incorrect lubrication of the motor.	Reestablish correct lubrication of the motor.

11. Technical data

Ambient temperature:

The maximum ambient temperature is 120 °F (49 °C) unless otherwise approved by Peerless.

The minimum ambient temperature is 40 °F (4.5 °C).

Liquid temperature:

Minimum liquid temperature: 40 °F (4.5 °C).

Maximum liquid temperature: 150 °F (65.5 °C).

Electrical data:

The supply voltage and frequency are marked on the pump nameplate.

12. Disposing of the product

This product, or parts of it, must be disposed of in an environmentally sound way.

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Peerless Pump company or service workshop.

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ECM: 12687209

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