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# Installation and operating instructions

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## Commercial pumps Series 4300, 4360 and 4380 Vertical In-Line pumps

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## 1.0 INTRODUCTION

This document contains specific information regarding the safe installation, operating and maintenance of Vertical In-Line pumps and should be read and understood by installing, operating and maintenance personnel. The equipment supplied has been designed and constructed to be safe and without risk to health and safety when properly installed, operated and maintained. The following instructions must be strictly adhered to. If clarification is needed on any point please contact Armstrong quoting the equipment serial number.

### WARNING SYMBOLS



Safety instruction where an electrical hazard is involved.



Safety instruction where non-compliance would affect safety risk.



Safety instruction relating to safe operation of the equipment. (ATTENTION)

## 1.1 INSTRUCTIONS FOR SAFE USE



No installation of this equipment should take place unless this document has been studied and understood. Handling, transportation and installation of this equipment should only be undertaken by trained personnel with proper use of lifting equipment. See later diagrams for lifting advice. Refer to the pump nameplate for pump speed, pressure and temperature limitations. The limits stated must not be exceeded without written permission from Armstrong.

## 1.2 TEMPERATURE

Where under normal operating conditions the limit of 68°C/155°F (restricted zone) for normal touch, or 80°C/176°F (unrestricted zone) for unintentional touch, may be experienced, steps should be taken to minimize contact or warn operators/users that normal operating conditions will be exceeded. In certain cases where the temperature of the pumped liquid exceeds the above stated temperature levels, pump casing temperatures may exceed 100°C/212°F and not withstanding pump insulation techniques appropriate measures must be taken to minimize risk for operating personnel.

## 1.3 NOISE LEVELS

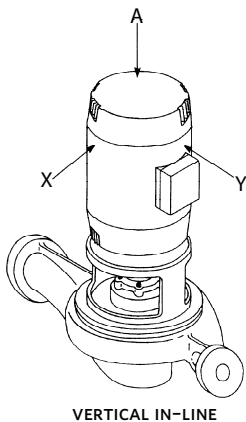
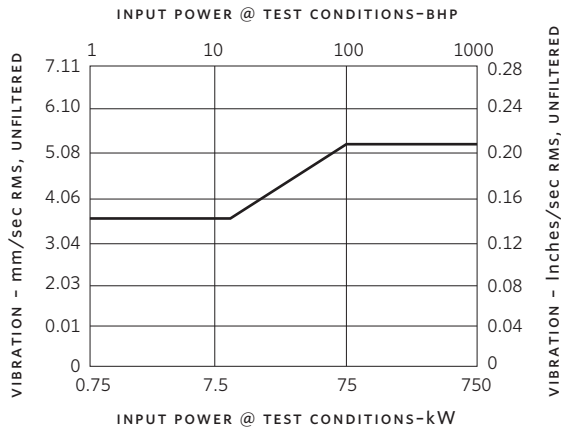
Typical Pumping Unit Sound Pressure Level, Decibels, A-Weighted, at 1 m (3 ft.) from unit.

FIG. 1 Noise levels.

FRAME DESIGNATION	1200 RPM				1800 RPM				3600 RPM			
	ODP		TEFC		ODP		TEFC		ODP		TEFC	
	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A
140	0.75 - 1	59	0.75 - 1	58	1 - 3	64	1 - 2	64	1.5 - 3	70	1.5 - 2	79
180	1.5 - 2	61	1.5 - 2	61	3 - 5	66	3 - 5	68	5 - 7.5	74	3 - 5	82
210	3 - 5	66	3 - 5	65	7.5 - 10	70	7.5 - 10	73	10 - 15	76	7.5 - 10	85
250	7.5 - 10	70	7.5 - 10	69	15 - 20	74	15 - 20	78	20 - 25	78	15 - 20	88
280	15 - 20	75	15 - 20	74	25 - 30	74	25 - 30	82	30 - 40	80	25 - 30	89
320	25 - 30	77	25 - 30	77	40 - 50	78	40 - 50	83	50 - 60	83	40 - 50	94
360	40 - 50	80	40 - 50	80	60 - 75	80	60 - 75	89	75 - 100	88	60 - 75	95
400	60 - 75	82	60 - 75	84	100 - 125	83	100	92	125 - 150	92	100	96
440	100 - 125	85	100 - 125	88	150 - 200	87	125 - 150	96	200 - 250	95	125 - 150	98

### 1.4 VIBRATION LEVELS

Armstrong Vertical In-Line pumps are designed to meet vibration levels set by Hydraulic Institute Standard HI Pump vibration 9.6.4. standard levels are as detailed below:



### 1.5 STORAGE

Pumps not immediately placed into service, or removed from service and stored, must be properly prepared to prevent excessive rusting. Pump port protection plates must not be removed until the pump is ready to connect to the piping.

Rotate the shaft periodically (at least monthly) to keep rotating element free and bearings fully functional.

For long term storage (longer than 3 months), the pump must be placed in a vertical position in a dry environment.

Internal rusting can be prevented by removing the plugs at the top and bottom of the casing and drain or air blow out all water

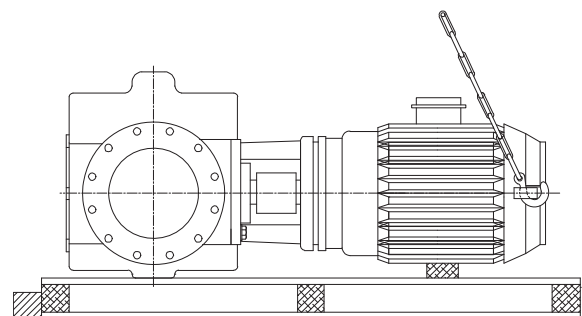
to prevent rust buildup or the possibility of freezing. Be sure to reinstall the plugs when the unit is made operational. Rust-proofing or packing the casing with moisture absorbing material and covering the flanges is acceptable. When returning to service be sure to remove the drying agent from the pump.

### 1.6 UNCRATING

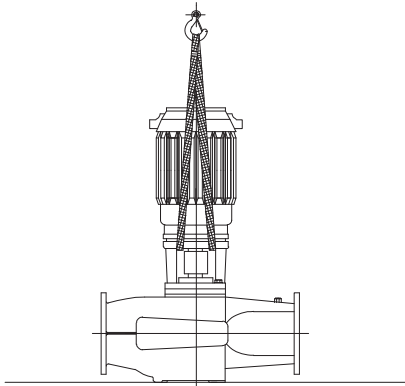
Armstrong Vertical In-Line pumps are thoroughly inspected before shipment to assure they meet with your order requirements. After removing the pump from the crate, make sure the equipment is in good order and that all components are received as called for on the packing list. Any shortages or damage should be reported immediately. Use extreme care in handling the unit, placing slings and hooks carefully so that stress will not be imposed on the pump. **Never place cable slings around the pump shaft.** The eye bolts or lifting lugs on the motor are intended for lifting the motor only and not the complete unit.

### 1.7 HANDLING LARGE VIL UNITS

One effective way of lifting a large Series 4300 unit from the shipment pallet following uncovering the unit is to place lifting hooks through the motor lifting rings or straps around the upper part of the motor and carefully lift sufficiently to stand the pump vertically. Lift only enough to remove the pallet then lower onto a flat surface. The pump and motor unit will free-stand on the casing ribs. Remove the coupling guard and place (2) lifting straps through the pump/motor pedestal (one on each side of the motor shaft) and secure to the lifting device. With the straps in place, using a spacer bar if necessary to protect the motor fan cover, the whole assembly can now be lifted securely and placed in position in the piping.



Secure pallet and lift pump vertical using motor eye-bolts lift only to clear pallet then sit on the flat surface.



Remove coupling guard and place lifting straps on each side of coupling, use spacer bar if necessary to protect motor fan cover.

**IMPORTANT:**



Do not run the pump for any length of time under very low flow conditions or with the discharge valve closed. This could cause the water in the casing to reach super heated steam conditions, cause premature failure and cause serious and dramatic damage to the pump and surrounding area.

**2.0 INSTALLATION**

**2.1 LOCATION**

In open systems, locate the unit as close as practical to the liquid being pumped, with a short, direct suction pipe. Ensure adequate space is left above and around the unit for operation, maintenance, service and inspection of parts.

In closed systems, where possible, the pumps should be installed immediately downstream of the expansion tank/make-up connection. This is the point of zero pressure change and is necessary for effective pump operation. Do not install more than one expansion tank connection into any closed hydronic system.

Electric motor driven pumps should not be located in damp or dusty locations without special protection.

Airflow into the motor and/or motor fan should not be obstructed.

**2.2 INSTALLATION**

When installing Vertical In-Line pumps, an important consideration to accrue full added-value from the pump design is to ensure that the pump is pipe-mounted and free to 'float' with any movement, expansion and contraction of the piping. Should any Vertical In-Line pump use supports to the structure it is imperative that no pipe strain is imposed on the pump flanges. Telltale pieces of equipment such as springs or 'waffle' style neoprene isolation pads that distort with pressure to indicate added piping weight, should be used under pump supports should the pump not be truly pipe mounted.

Various installation arrangements are detailed on Pages 6 and 7:

**2.2.1**

Vertical In-Line pumps may be installed directly in the system piping with no additional support. Pipe hangers are simply sized for the additional weight of the pumping unit. Many pumps are installed in this manner and are mounted at sufficient height to take zero floor space. (Fig. 2.1)

**2.2.2**

Piping, in many mechanical rooms, is hung close to the ceiling and larger pumps are mounted near ground level for ease of maintenance. Fig 2.2 illustrates such an arrangement with the piping supported at the ceiling and the VIL unit installed with an Armstrong Suction Guide and triple function Flo-Trex valve. Many very large VIL pumps are installed in this manner.

**2.2.3**

Should additional space saving be required the discharge spool piece and Flo-Trex valve may be replaced by a long-radius elbow and the Flo-Trex valve field converted to a straight-through valve and installed in the vertical discharge pipe. (Fig. 2.3)

**2.2.4**

Fig 2.4 illustrates a similar arrangement to Fig 2.2 with additional floor mounted pipe-stools isolated from the structure by 'waffle' style neoprene isolation pads under the Armstrong Suction Guide and Flo-Trex valve.

**2.2.5**

Floor mounted saddle supports (Fig. 2.5) are typical for condenser water pumps where the cooling tower base is near mechanical room elevation.

### 2.2.6

Where required, additional floor support may be used as shown in Fig. 2.6. Note that the pump should not be rigidly attached to the column. Leave a small gap between pump and column or install a 'waffle' isolation pad under the pump. It is critical that piping be installed in such a manner that the pump does not become a pipe support.

### 2.2.7

Fig. 2.7 illustrates stanchion plates at the pump inlet and outlet ports that may be supplied for installation convenience. Isolation pads must be used under the legs and monitored as pipe hangers are adjusted to ensure the pump flanges are not supporting the piping. Bolting to the floor or housekeeping pad is not recommended. If the stanchions are bolted down the bolts must be isolated from the stanchion or an inertia base and flexible pipe connectors should be used.

### 2.2.8

Fig. 2.8 illustrates installations with stanchion plates for seismically active regions. Seismically rated isolation pads or snubbers with bolts isolated from the stanchion plates are installed to restrain the pump during a seismic event. Pipe hangers carry the weight of the equipment as seismic components are designed only to restrain the equipment during a seismic event.

### 2.2.9

Close coupled in-line units (Series 4360 & 4380) up to 15 hp / 11 kW may be installed with the shaft horizontal. (Fig. 2.9) For horizontal mounting of large units or Series 4300 Split-Coupled style consult the factory. (Fig. 2.9)

### 2.2.10

Many Vertical In-Line pumps are piped successfully into grooved piping systems. In-line pumps are supported well by grooved piping however flange adapter locking devices or a welded flange at the pump should be used to prevent the possibility of pipe mounted pumps rotating in the piping. Armstrong offers grooved suction guides with cast-in outlet flanges and triple function Flo-Trex valves with inherent locking devices to prevent this possibility. (Fig. 2.10)

### 2.2.11

**Do not** support the unit by the motor eye bolts (Fig. 2.11) or by any other part of the motor.

### 2.2.12

Connecting the pump to a permanent rigid base (Fig. 2.12). is not recommended unless isolated from the piping by flexible

connectors and the base isolated from the building structure on an inertia base. (Fig. 2.12 is generally acceptable when using plastic piping).

### IMPORTANT:

All Series 4300 pumps contain a tapped hole in the motor bracket above the discharge flange (see Fig. 2.13) for draining the well. Pipe this drain hole to a floor drain to avoid overflow of the cavity caused by collecting chilled water condensate or from seal failure.

## 2.3 PUMP PIPING - GENERAL

Never connect a pump to piping, unless extra care is taken to measure and align the piping flanges well. Always start piping from pump.

Use as few bends as possible and preferably long radius elbows.

Do not use flexible connectors on the suction or discharge of a Vertical In-Line pump, unless the pump is rigidly mounted to a foundation.

Ensure piping exerts no strain on pump as this could distort the casing causing breakage or early failure due to pump misalignment.

All connecting pipe flanges must be square to the pipework and parallel to the pump flanges.

Suction and discharge pipes may be increased or decreased at pump nozzle to suit pump capacity and particular conditions of installation. Use eccentric reducers on suction connection with flat side uppermost.

Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets that may prevent the pump from operating effectively.

A strainer of three or four times the area of the suction pipe, installed in the suction line, will prevent the entrance of foreign materials into the pump.  $\frac{3}{16}$ " (5 mm) diameter perforations in the strainer is typical.

In open systems, test suction line for air leaks before starting; this becomes essential with long suction line or static lift. Install, at the pump suction, a straight pipe of a length equivalent to 4 or 6 times its diameter; this becomes essential when handling liquids above 120°F (49°C). Armstrong suction guides may be used in place of the straight pipe run and in-line strainer.

Install an isolation valve in both suction and discharge lines on flooded suction application; these valves are used primarily to isolate the pump for inspection or repair.

Install a non-slam non-return check valve in discharge line between pump and isolation valve to protect pump from excessive back pressure and to prevent water running back through the pump in case of driver failure on open systems. An Armstrong Flo-Trex valve may be used in place of non-return check valve and isolation valve on pump discharge.

**CAUTION:**



Only the discharge valve is to be used to throttle pump flow, not the suction valve. Care must be taken in the suction line layout and installation, as it is usually the major source of concern in centrifugal pump applications.

**2.4 ALIGNMENT**

Alignment is unnecessary on close-coupled pumps, Series 4360 & 4380, as there is no shaft coupling.

Series 4300 units are accurately aligned at the factory prior to being shipped and do not need re-aligning when installed.

Alignment on a Series 4300 unit may be verified by assuring an equal and parallel gap between coupling halves on both sides of the coupling.

**OPERATION**

**2.5 STARTING THE PUMP**



Ensure that the pump turns freely by hand, or with some gentle mechanical help such as a strap or Allen key in coupling bolt.

Ensure that all protective guarding is securely fixed in position.

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. On Series 4300 any air trapped in the casing as the system is filled must be removed by the manual air vent in the seal flush line. **Ensure entrained air is removed from series 4300 pumps, prior to starting, through the air vent on the seal flush line. Open vent until clear of air.**

Series 4360 & 4380 units are fitted with seal flush/vent lines piped to the pump suction area. When these units operate residual air is drawn out of the pump towards the suction piping.

'Bump' or energize the motor momentarily and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be open slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de-energize the motor.

**Do not** run the pump against a closed discharge valve for an extended period of time (a few minutes maximum).

Star-Delta motor starters should be fitted with electronic/mechanical interlocks that have a timed period of no more than 40 milliseconds before switching from star (starting) to delta (run) connection yet allow the motor to reach full star (starting) speed before switching to delta (run).

Should the pump be noisy or vibrate on start-up a common reason is overstated system head. Check this by calculating the pump operating head by deducting the suction pressure gauge value from the discharge gauge reading. Convert the result into the units of the pump head as stated on the pump nameplate and compare the values. Should the actual pump operating head be significantly less than the nameplate head value it is typically permissible to throttle the discharge isolation valve until the actual operating head is equal to the nameplate value. Any noise or vibration usually disappears. The system designer or operator should be made aware of this as some adjustment may be required to the pump impeller diameter or drive settings, if applicable, to make the pump suitable for the system as installed.



**CAUTION:**



Check rotation arrow prior to operating the unit. The rotation of all Armstrong Vertical In-Line units is clockwise when viewed from the drive end. (Looking from on top of/behind the motor).

**2.6 GENERAL CARE**

Vertical In-Line pumps are built to operate without periodic maintenance, other than motor lubrication on larger units. A systematic inspection made at regular intervals, will ensure years of trouble-free operation, giving special attention to the following:

- Keep unit clean.
- Provide the motor with correctly sized overload protection.
- Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor.
- Avoid operating the unit in overheated surroundings (above 100°F/40°C).

**WARNING:**



Whenever any service work is to be performed on a pumping unit, disconnect the power source from the driver, **lock it off** and tag with the reason. Any possibility of the unit starting while being serviced must be eliminated.

- If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended. (See Armstrong files 43.85 & 43.86 for seal environmental instructions).

**2.7 LUBRICATION**

**Pump**

Lubrication is not required. There are no bearings in the pump that need external lubrication service.

Large Series 4300 units are installed with a shaft bushing located beneath the impeller that is lubricated from the pump discharge. This bearing is field removable for service on the 20 x 20 x 19 size without disturbing the motor or other major pump components.

Service instructions for the lower bearing is to be found in File no: 43.805.

**Motor**

Follow the lubrication procedures recommended by the motor manufacturer. Many small and medium sized motors are permanently lubricated and need no added lubrication. Generally if there are grease fittings evident the motor needs periodic lubrication. None if not.

Check the lubrication instructions supplied with the motor for the particular frame size indicated on the motor nameplate.

**Mechanical Seal**

Mechanical seals require no special attention. The mechanical seal is fitted with a flush line. The seal is flushed from discharge of the pump casing on Series 4300 pumps and is flushed/vented to the suction on close coupled pumps, Series 4360 & 4380.

The Series 4300 pump is flushed from the pump discharge because the mechanical seal chamber is isolated from the liquid in the pump by a throttle bushing. Because the seal chamber is isolated, seal environmental controls such as filters and separators, when installed in the Series 4300 flush line are very effective, as only the seal chamber needs cleansing, and will prolong seal life in HVAC systems.

Do not run the pump unless properly filled with water as the mechanical seals need a film of liquid between the faces for proper operation.

Mechanical seals may 'weep' slightly at start-up. Allow the pump to continue operating for several hours and the mechanical seal to 'seat' properly prior to calling for service personnel.

The following Armstrong files are available for mechanical seal replacement instructions:

- Series 4360 & 4380: File no. 43.81
- Series 4300: P-Base and TCZ Motor Frame – File no. 43.84  
TC Motor Frame – File no. 43.88

## 2.8 SYSTEM CLEANLINESS

Before starting the pump the system must be thoroughly cleaned, flushed and drained and replenished with clean liquid.

Welding slag and other foreign materials, Stop Leak and cleaning compounds and improper or excessive water treatment are all detrimental to the pump internals and sealing arrangement.

Proper operation cannot be guaranteed if the above conditions are not adhered to.

### NOTE:

Particular care must be taken to check the following before the pump is put into operation:

- A Pump primed?
- B Rotation OK?
- C Lubrication OK?
- D Pipe work properly supported?
- E Voltage supply OK?
- F Overload protection OK?
- G Is the system clean?
- H Is the area around the pump clean?

### WARRANTY

Does not cover any damages to the equipment resulting from failure to observe the above precautions. Refer to Armstrong General Terms and Warranty sheet. Contact your local Armstrong representative for full information.

## 2.9 INSTALLATION LAYOUTS

FIG. 2.1 Hanger supported pipe mounted.

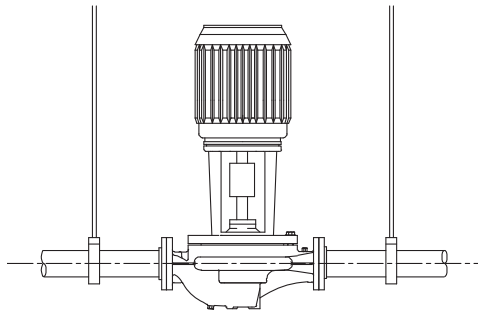
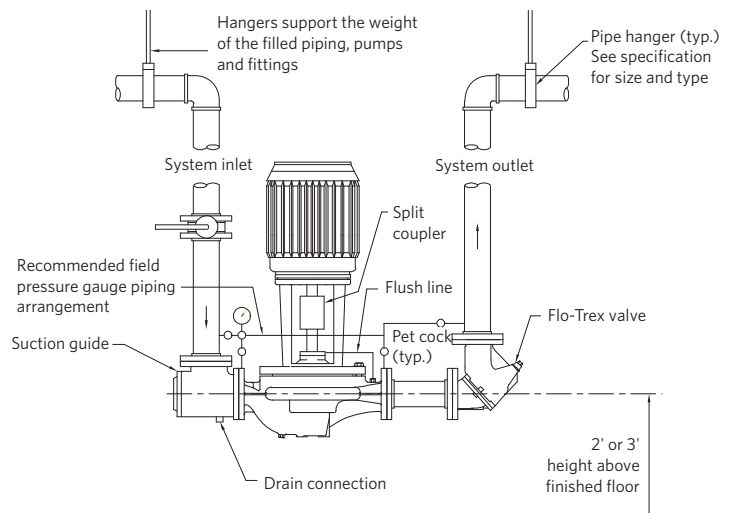
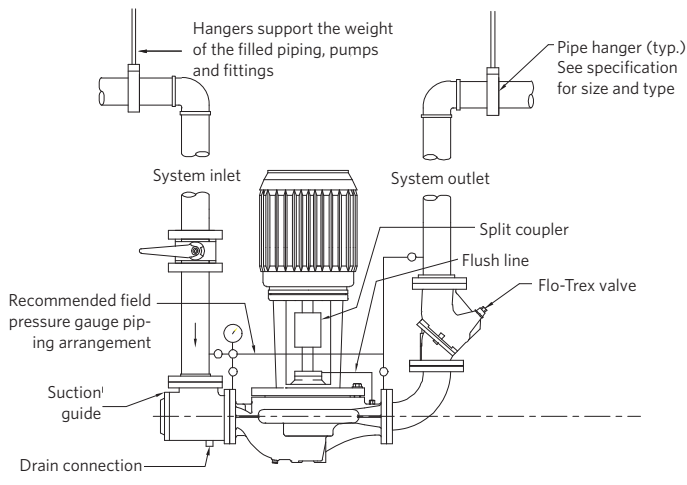


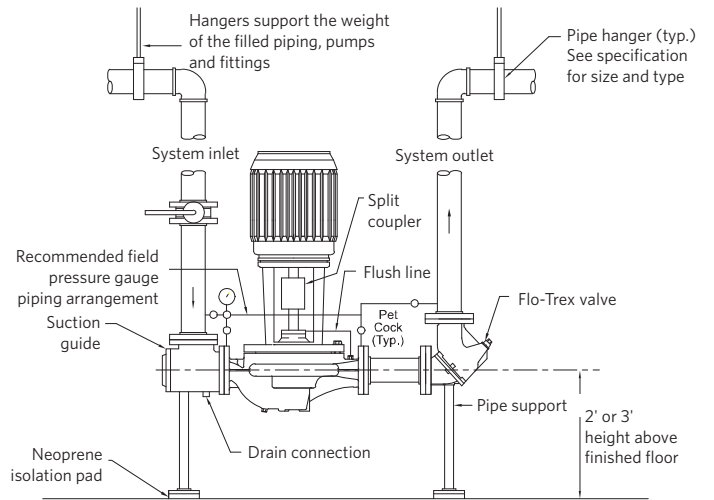
FIG. 2.2 Pipe mounted supported at ceiling.



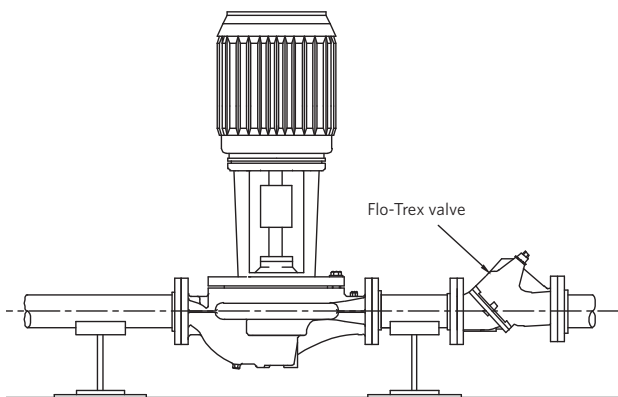
**FIG. 2.3** Discharge elbow for minimum footprint.



**FIG. 2.4** With additional pipe supports.



**FIG. 2.5** Floor saddle support.



**FIG. 2.6** Additional floor support.

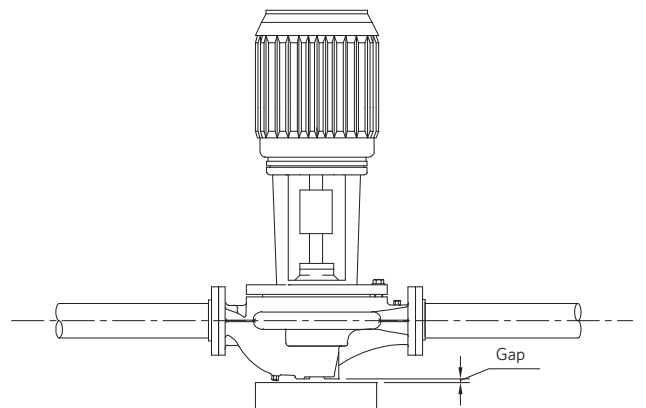


FIG. 2.7 With stanchion plates.

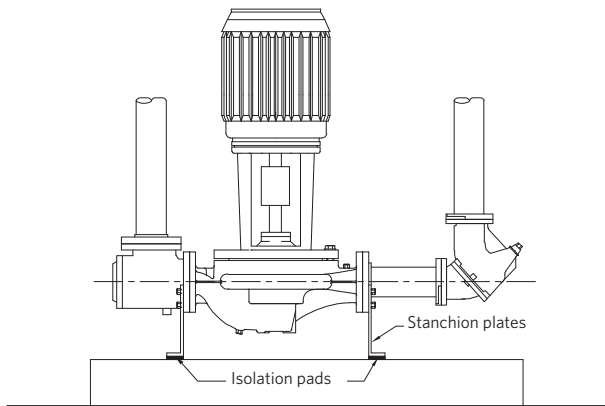


FIG. 2.9 Horizontal mounting - 4360/4380 only to 15 hp (11 kW).

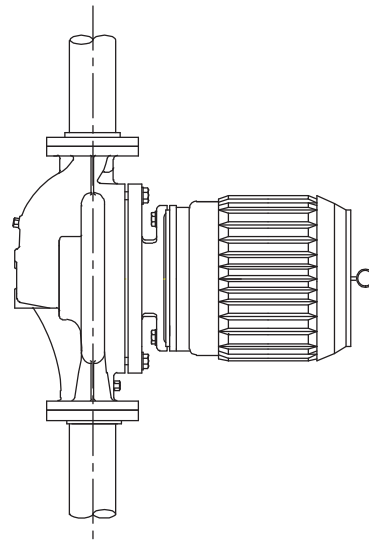


FIG. 2.8 Seismic region installation.

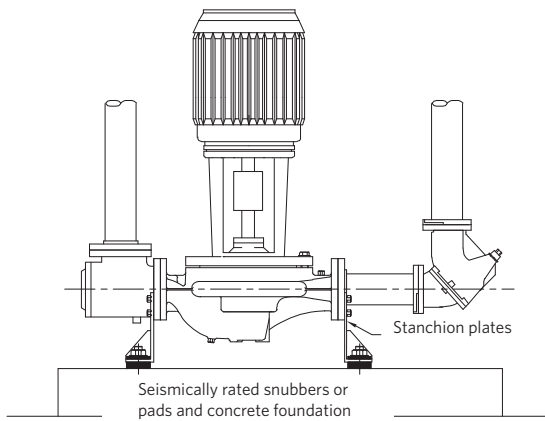
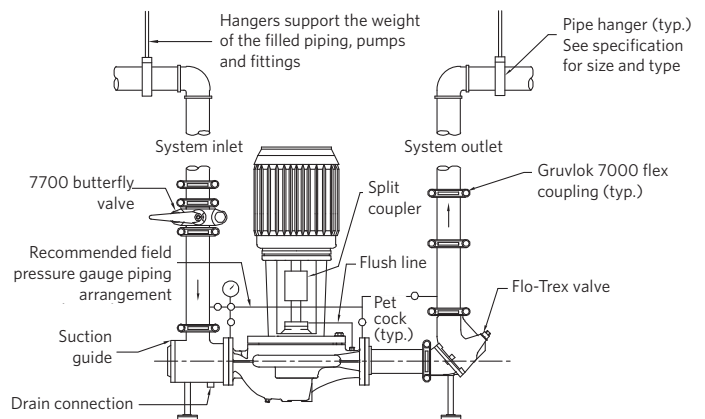
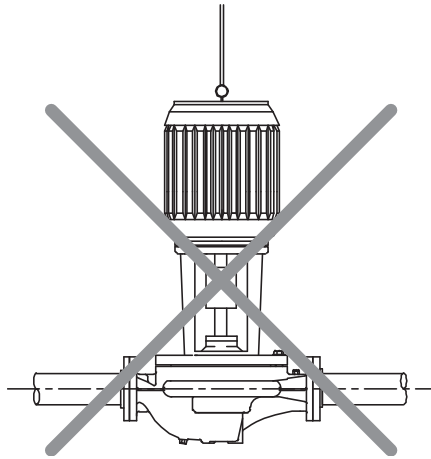


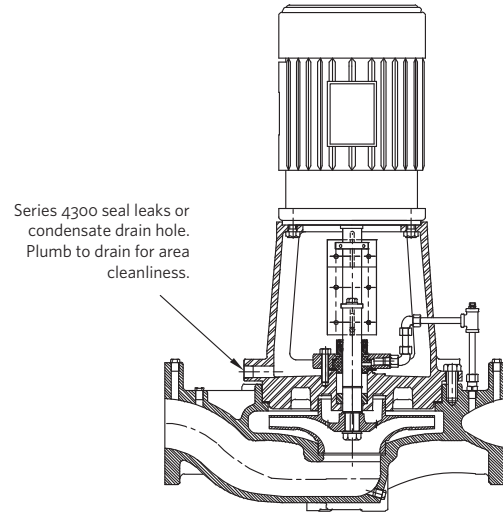
FIG. 2.10 Mounting in grooved pipe systems.



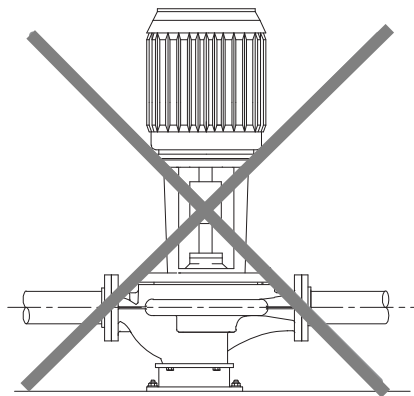
**FIG. 2.11** Motor lifting hook supported.



**FIG. 2.13** Tapped collection well.



**FIG. 2.12** Mounted on rigid base without flexible connectors.



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