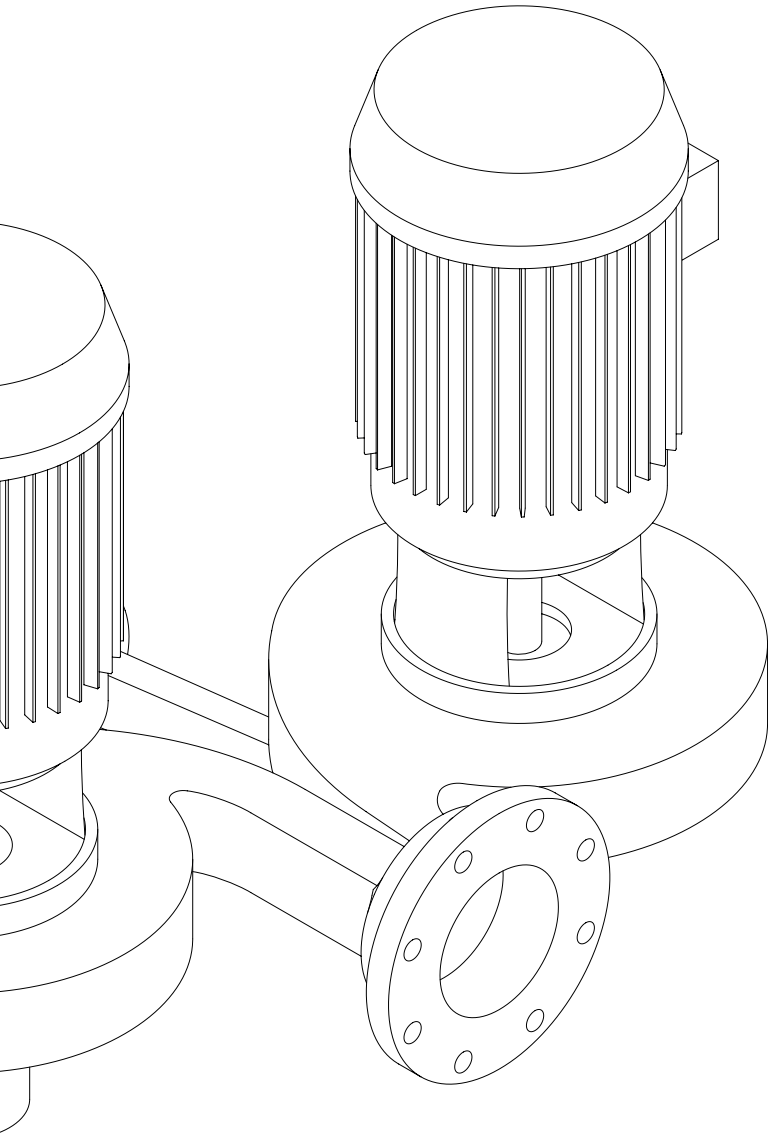
ARMSTRONG



Series 4312 and 4392

Vertical In-Line twin pumps

Installation and operating instructions

File No: 43T.86
Date: JANUARY 27, 2015
Supersedes: 43T.86
Date: JULY 16, 2012

CONTENTS

1.0 INTROUCTION

This document contains specific information regarding the safe installation, operating and maintenance of Series 4312 and 4392 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.

1.1 WARNINGS SYMBOLS

Safety instruction where an electrical hazard is involved.

Safety instruction where non-compliance would affect safety.

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

1.2 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.

Caution: The pump has been evaluated for use with clean water only. Glycols up to 40% wt. are also acceptable for use based on appropriate motor sizing and chemical compatibility with materials of pump construction. This pump is **not** recommended for handling any other liquids without written approval from Armstrong.

1.3 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.

1.4 WARNING

Risk of electric shock: this pump has not been investigated for use in swimming pool or marine areas.

Reduced risk of electric shock during operation of this pump requires the provision of acceptable grounding:

When the means of connection to the supply-connection box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit conductors supplying the pump, to the grounding screw provided within the wiring compartment.

The equipment-grounding lead, is the conductor that has an outer surface of insulation that is green with or without one or more yellow stripes.

1.5 NOISE LEVELS

For pumping unit sound pressure levels, see motor technical data sheet (file no. 48.11L).

1.6 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 shafts periodically (at least monthly) to keep rotating elements free and bearings fully functional. For long term storage, 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. Rustproofing 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.

1.7 UNCRATING

Armstrong series 4312 and 4392 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 only the motor and not the complete unit.

1.8 LIFTING METHOD

Series 4312 and 4392 are handled in a similar manner as the dualARM units. For 4312 units, remove the coupling guard and insert lifting straps through the pump/motor pedestal on either side of the coupling. For 4392 units, tie lifting straps around each motor with the loop positioned on the inner side of each motor. As the lifting device is engaged (using a spacer bar if necessary) and the straps tighten ensure no part of the strapping is touching any part of the motor fan cover. Lift the pump unit carefully from the pallet in this manner and allow the unit to stand upright on a flat surface and re-position the straps, if necessary, to ensure safe and damage free transportation into the installation.

FIG. 1.1 Series 4392

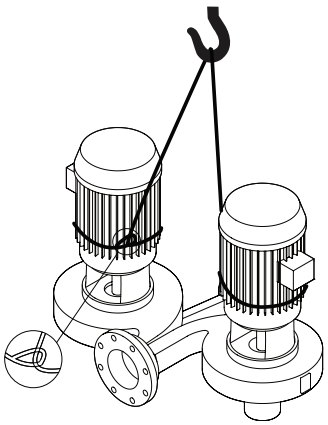
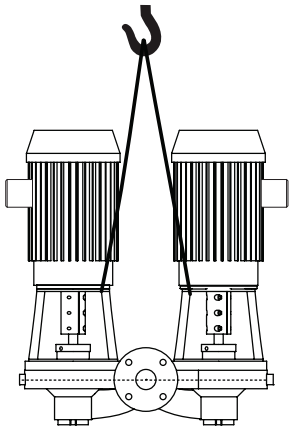


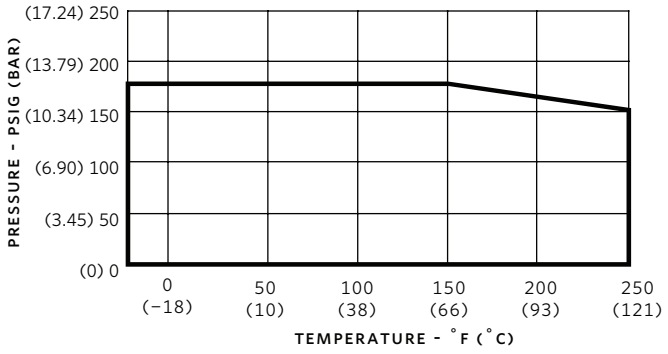
FIG. 1.2 Series 4312



1.9 LIMITATIONS

See pump nameplate for speed, duty and maximum pressure/temperature limitations. These limits must not, under any circumstances, be exceeded without prior consultation with Armstrong. The ambient air temperature must **not** exceed 52°C (125.6°F) for ventilation and air movement shall **not** be restricted.

The pumped liquid pressure and temperature must **not** exceed the limits shown in the chart below.



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 location 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. Tell-tale 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 7 and 8:

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 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 the 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 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
Series 4312 and 4392 should not be installed with the shaft horizontal (**FIG. 2.9**)

2.2.10
Many Vertical In-Line pumps are piped successfully into grooved piping systems. In-Line pumps are supported by grooved piping very well 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).

CAUTION

The discharge valve is only to be used to throttle pump flow, do not use 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.

2.3 ALIGNMENT

- Alignment is unnecessary on Series 4392 as there is no shaft coupling.
- Series 4312 units are accurately aligned at the factory prior to being shipped and do not need re-aligning when installed.
- Alignment on a Series 4312 unit may be verified by assuring an equal and parallel gap between coupling halves on both sides of the coupling.

2.4 STARTING PUMP

- Ensure that pump turns freely by hand, or with some mechanical help such as a strap and lever on larger pumps.
- Ensure that all protective guarding is securely fixed in position.
- The pump must be fully primed on start up. Fill the pump with liquid and rotate the shaft by hand to remove any air.
- Energize the motor momentarily and check 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 interocks that have a timed period of no more than 40 miliseconds 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 immediately 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

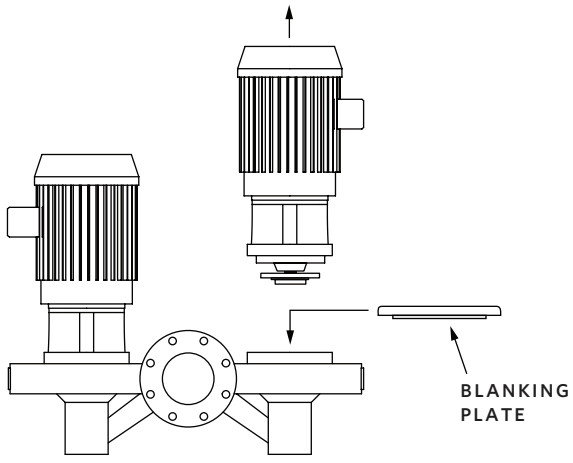
Check the direction of rotation against the rotation arrow prior to operating the unit.

IMPORTANT

Do not run the pump for any length of time under very low flow conditions or with the discharge valve closed. To do so could cause the water in the casing to reach super heated steam conditions and will cause premature failure. It could also cause serious or drastic damage to the pump and surrounding area. The minimum recommended flow rate is 1 gpm/hp.

2.5 GENERAL CARE

- Series 4312 and 4392 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.
- If one pump requires service, install the blanking plate to allow the other pump head to continue operating.



WARNING

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

2.6 LUBRICATION

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

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.

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.
- 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.

2.7 SYSTEM CLEANLINESS

- Before starting the pump the system must be thoroughly cleaned, flushed, drained and replenished with clean liquid.
- Welding slag, other foreign material, “Stop Leak”, cleaning compounds and improper or excessive water treatment are all detrimental to the pump's internal parts and sealing arrangement.
- Proper operation cannot be guaranteed if the above conditions are not adhered to.

CAUTION

Under no circumstances should the pump be used for flushing out the system. The pump should be out of line or bypassed during flushing.

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 System clean?
H 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.

3.0 FAULT FINDING CHART

SYMPTOMS	REASONS
Pump fails to deliver	• Pump not primed. • Suction line not filled. • Air or vapour pocket in suction line. • Inlet of suction pipe insufficiently submerged. • Available N.P.S.H too low. • Suction lift too high. • Air leaks in suction line, seal or pump joints. • Blocked suction. • Incorrect rotation. • Speed too low. • Total system head higher than that of the pump.
Pump vibrates	• Misalignment. • Air or vapour pocket in suction line. • Inlet of suction pipe insufficiently submerged. • Available N.P.S.H too low. • Suction lift too high. • Blocked suction. • Impeller damaged. • Misalignment of pipework. • Operation at low capacity. • Rotating element out of balance. • Shaft bent. • Poor foundations.
Seal leaks or fails	• Misalignment. • Impurities in water. • Entrained air. • Cavitation. • Water treatment not allowed for.
Low delivery rate	• Air or vapour pocket in suction line. • Inlet of suction pipe insufficiently submerged. • Available N.P.S.H too low. • Suction lift too high. • Air leaks in suction line, seal or pump joints. • Blocked suction. • Incorrect rotation. • Speed too low. • Excessive system friction. • Impeller damaged.
Insufficient pressure	• Incorrect rotation. • Speed too low. • Excessive system friction. • Impeller damaged.
Pump delivery fails after start	• Suction line not filled. • Air or vapour pocket in suction line. • Inlet of suction pipe insufficiently submerged. • Available N.P.S.H too low. • Suction lift too high. • Air leaks in suction line, seal or pump joints. • Blocked suction. • Impeller damaged.
Pump seized	• Pump not primed. • Misalignment of pipework. • Operation at low capacity.
Pump does not prime	• Pump not primed. • Inlet of suction pipe insufficiently submerged. • Suction lift too high. • Blocked suction. • Incorrect rotation.
Pump noisy	• Misalignment. • Air or vapour pocket in suction line. • Inlet of suction pipe insufficiently submerged. • Available N.P.S.H too low. • Air leaks in suction line, seal or pump joints. • Blocked suction. • Impeller damaged. • Operation at low capacity. • Rotating element out of balance. • Shaft bent. Poor foundations. • Operation at high capacity.
Motor overloading or overheating	• Misalignment. • Speed too high. • Low system friction. • Pumped liquid density is greater than anticipated.

4.0 INSTALLATION LAYOUTS

FIG. 2.1 Hanger supported pipe mounted

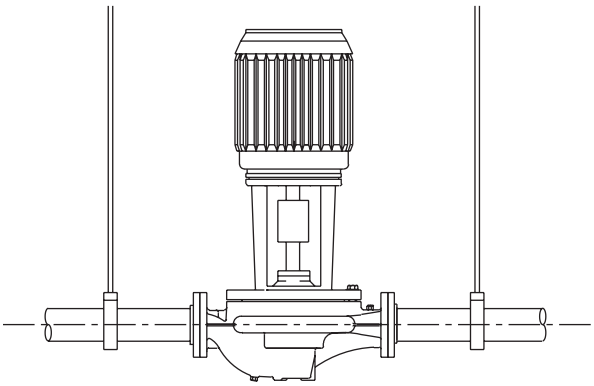


FIG.2.2 Pipe mounted supported at ceiling

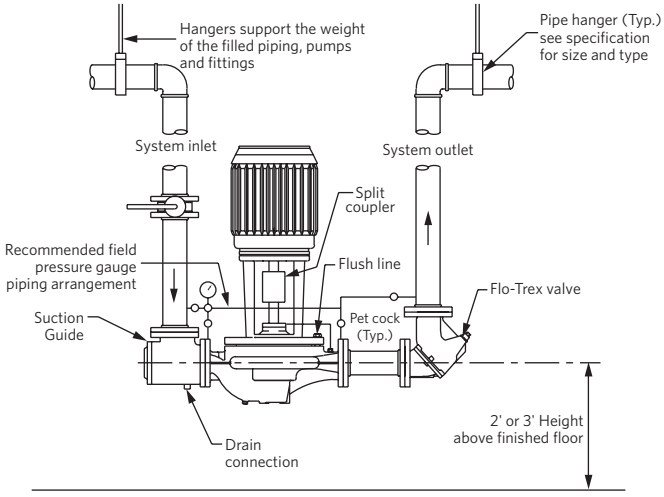


FIG.2.3 Discharge elbow for minimum footprint

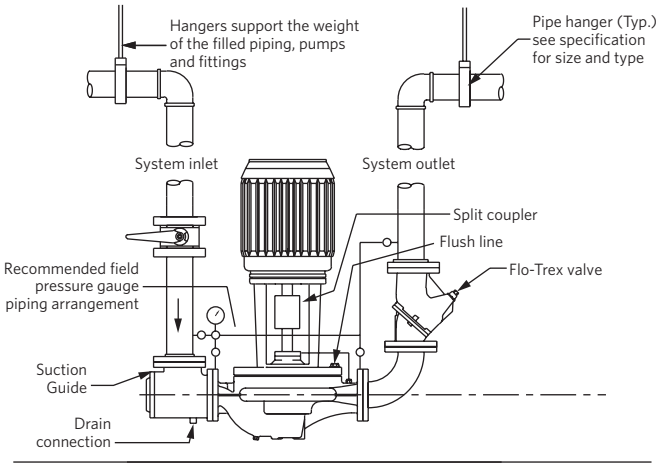


FIG.2.4 With additional pipe supports

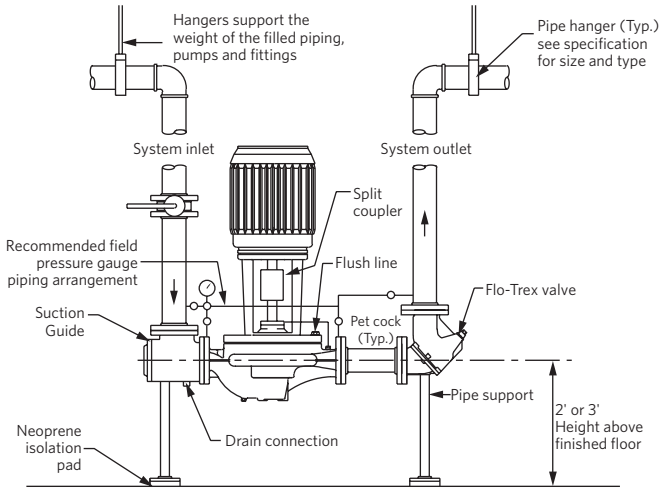


FIG.2.5 Floor saddle support

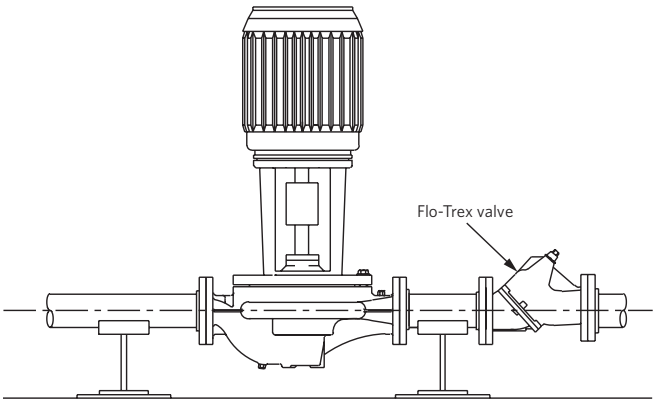


FIG.2.6 Additional floor support

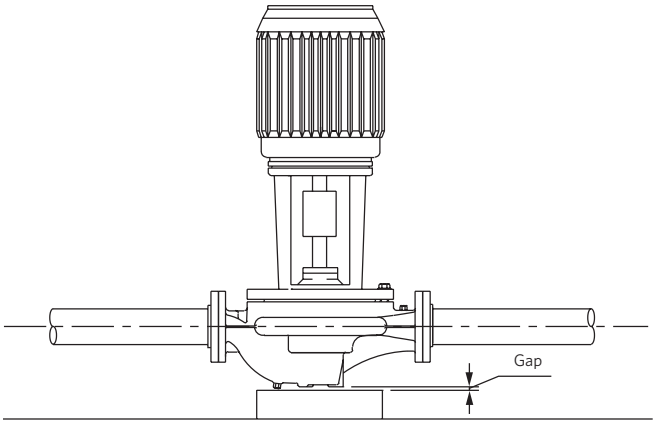


FIG.2.7 With stanchion plates

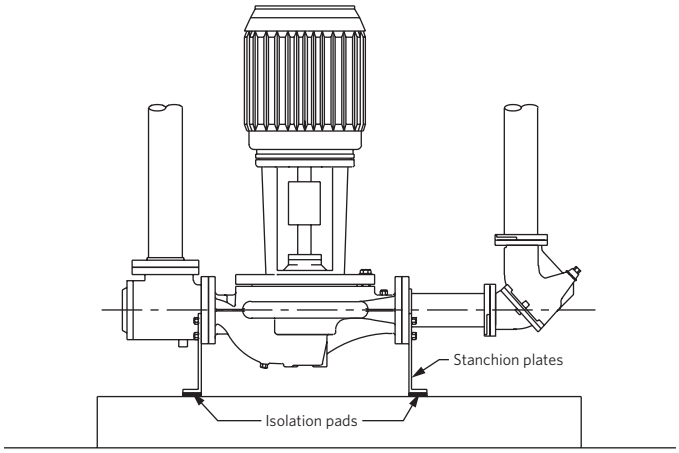


FIG.2.8 Seismic region installation

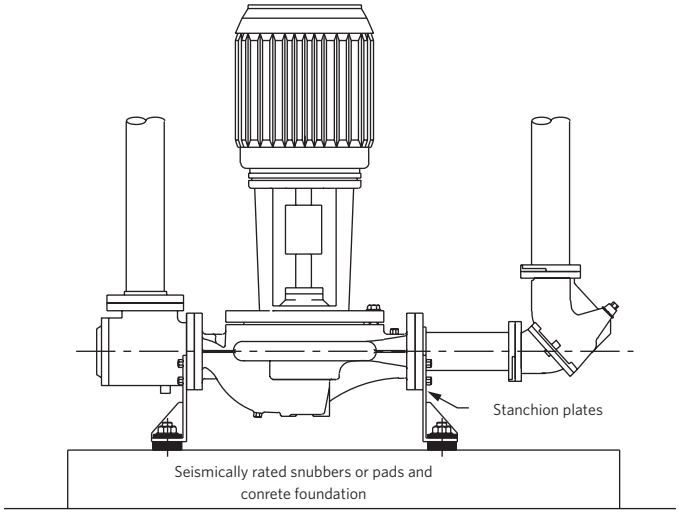


FIG.2.9 Horizontal mounting

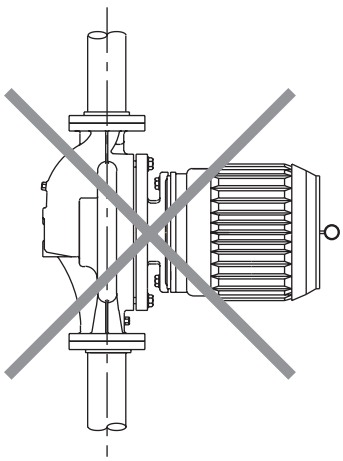


FIG.2.10 Mounting in grooved pipe systems

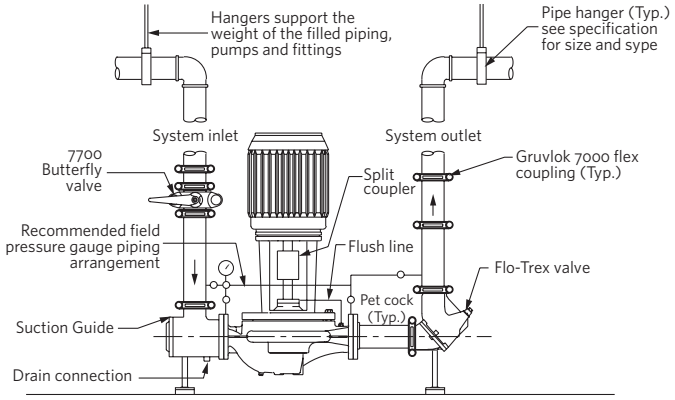


FIG.2.11 Motor lifting hook supported

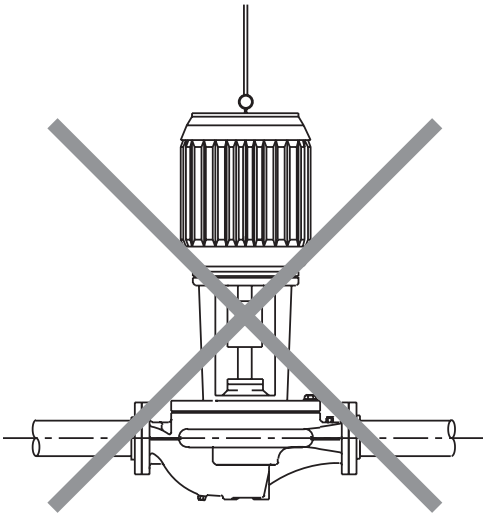


FIG.2.12 Mounted on rigid base without flexible connectors

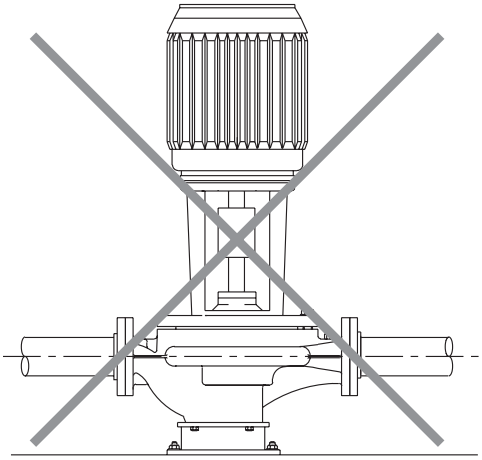


FIG.2.13 Tapped collection well on Series 4312