



**AURORA<sup>®</sup>**

# **FRAME MOUNTED**

## **INSTRUCTION AND INSTALLATION MANUAL**

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.

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**CALIFORNIA PROPOSITION 65 WARNING:**

**Warning:** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

**GENERAL.** The life of your Aurora pump can be extended considerably by carefully following the installation instructions contained herein. Each step of the pump installation instructions plays a vital part in assuring long life, efficient operation, and reduced maintenance, from the initial location of the pump through prestarting directions.

**UNPACKING YOUR PUMP.** The crate containing your pump should be opened immediately upon receipt from the factory, and the pump generally inspected for damage and shortage of parts. Particular attention should be given to the discharge and suction nozzle threads or flanges. Any damage or shortage of parts should be reported to the carrier immediately.

**CLEANING.** If your pump is to be installed immediately, it will be necessary to remove the protective covers from all openings, and to clean the exposed metal parts thoroughly with white gasoline

or other suitable solvent to remove the preservative coating.

**STORAGE.** If your pump is not to be put in service immediately it should be covered and stored in a clean dry area. The protective covers and preservative should be left intact until the pump is put into service. For extended storage, the pump should be dried internally with hot air or some other suitable means, and once free of moisture, filled with a protective fluid such as light oil or kerosene. Accordingly, at time of installation, the pump will have to be completely dismantled and thoroughly cleaned.

**PLANNING THE PUMP LOCATION.** You probably have spent considerable time planning where your pump will be located. However you may have overlooked some factor which may affect your pump operation or efficiency.

The pump should be located as close to the liquid source as possible so that the suction line can be

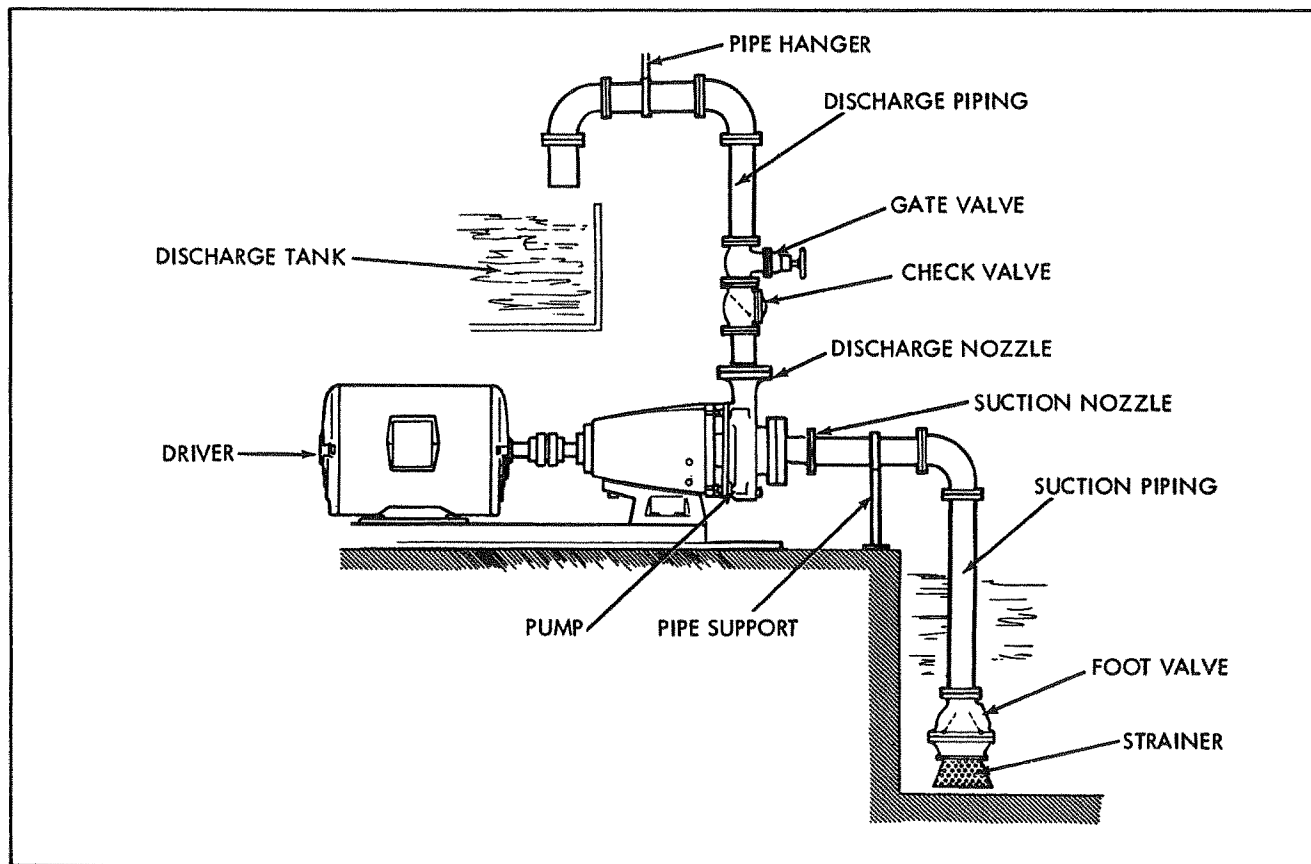


FIGURE 1. RECOMMENDED LOCATION - SHORT DIRECT SUCTION

## FRAME MOUNTED INSTALLATION

short and direct. It should be located in a clean, open area, where it is easily accessible for inspection, lubrication, and repair. Pumps installed in dark, dirty areas or in cramped locations are often neglected which can result in premature failure of both the pump and the driver.

Your pump should be located so that a hoist or crane can be used to move it without interference from piping. This factor is often overlooked in the advance planning stage.

Protect your pump against the possibility of flooding. Although water will not seriously damage the pump, the drive motor can be damaged.

The pump should be located in an area where moisture, either from leakage through the packing or from condensation, can be adequately drained off. Moisture dripping on exposed metal or wood can cause rapid deterioration of the area. Also, wet floors produce safety hazards.

Adequate provisions should be made for electrical wiring to the pump motor. A switch and overload protection should be installed near the pump unless it is impractical. The electrical conduit should be positioned in such a way as to preclude the possibility of moisture entering the conduit or the motor and causing short circuits.

Outdoor installation will normally provide all of the above mentioned conditions. However it is advisable to provide a weather shelter for your pump.

**FOUNDATION.** The foundation for your pump must be sufficiently rigid to absorb any vibration and stress encountered during pump operation. A raised

foundation of concrete is preferable for most floor mounted pumps. The raised foundation assures a satisfactory base, protects against flooding, simplifies moisture drainage, and facilitates keeping the area clean.

Your pump should be firmly bolted to the foundation, whether it is a raised concrete base, steelwork wall, or structural member. The mounting bolts or studs should be accurately located per the applicable Aurora dimension sheet. Foundation bolts should be enclosed by a sleeve 2 to 4 diameters larger than the bolt to allow movement for proper alignment with the pump mounting holes. Refer to figure 3.

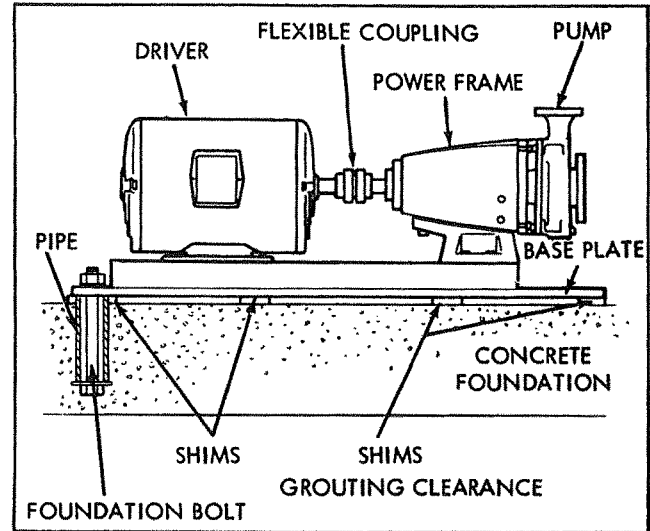


FIGURE 3. FOUNDATION FOR FRAME MOUNTED PUMPS

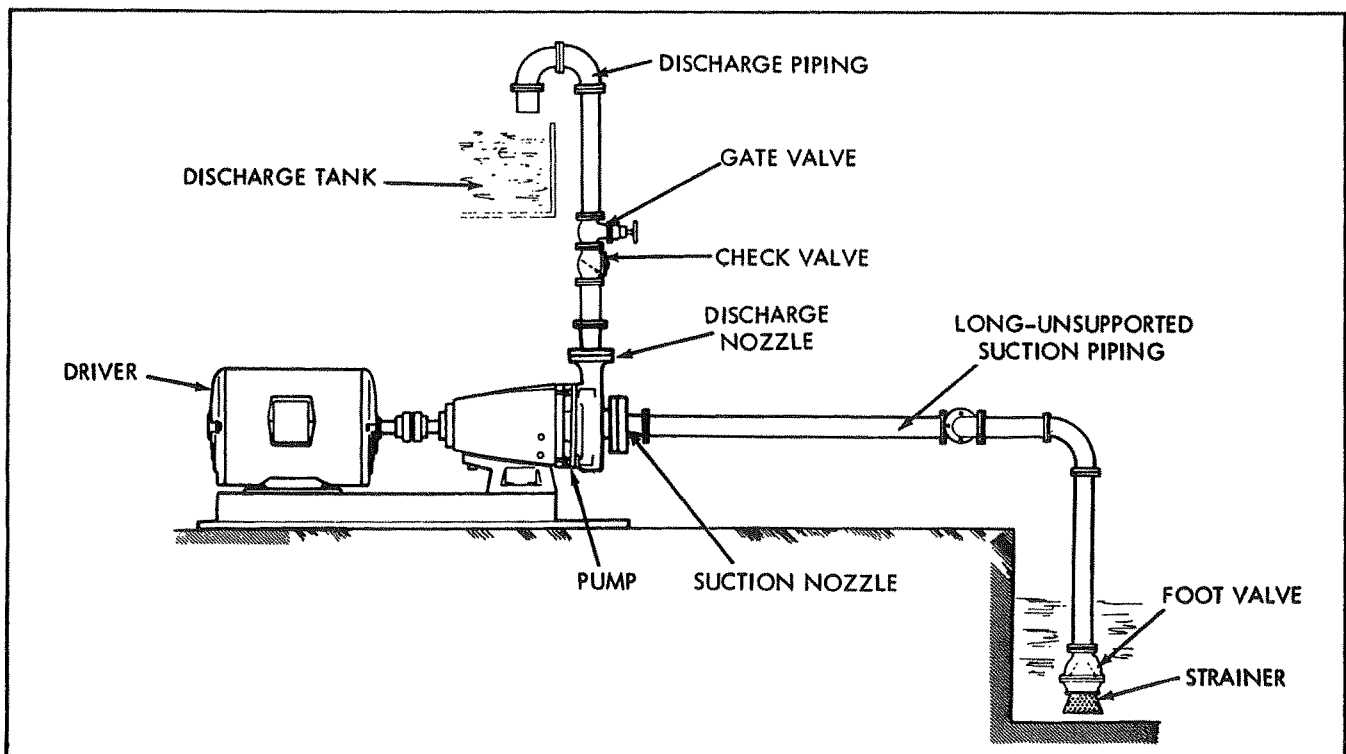


FIGURE 2. UNSATISFACTORY LOCATION - LONG INDIRECT SUCTION WITH NO SUPPORT

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If the pump is to be mounted on steelwork or other structure, adequate support should be provided to prevent distortion of the base plate or the structure, which could produce excessive strain on the pump casing and piping, and seriously affect alignment of the pump and driver.

**PREPARING TO INSTALL YOUR PUMP.** Your pump and driver unit will normally be mounted on a common base plate. The unit has been accurately aligned and securely mounted to the base plate at the factory. However, the alignment cannot be maintained during shipping and the complete unit must be leveled and realigned at the time of installation.

**LEVELING THE PUMP.** Leveling the pump will require enough shims to support the base plate near the foundation bolts, and at any points of the base plate carrying a substantial weight load. The shims should be large enough to allow a gap of 3/4" to 1-1/2" between the base plate and foundation for grouting.

The pump unit should be set on the foundation, being careful not to damage the threads on the foundation bolts. The flexible coupling halves should then be disconnected. The shims should be inserted and the pump leveled. A spirit level should be used on the faces of the flexible coupling halves, and on the suc-

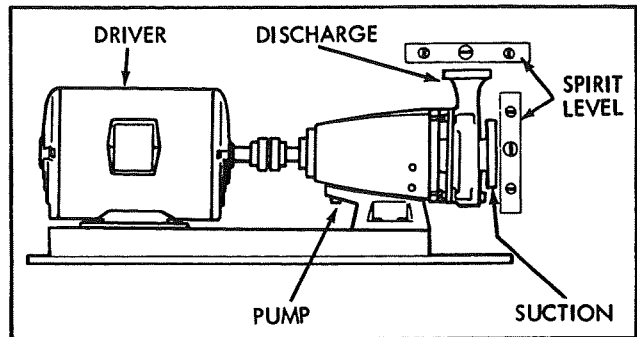


FIGURE 5. LEVELING PUMP UNIT WITH SPIRIT LEVEL ON PUMP FLANGES

tion and discharge flanges. If your pump has threaded nozzles, a short piece of pipe inserted in the nozzles will serve as a smooth surface for a leveling reference point. The shims should be adjusted until the pump is leveled horizontally and vertically. Tighten the foundation bolts finger tight.

**INITIAL ALIGNMENT OF THE FLEXIBLE COUPLING.** The pump and driver were accurately aligned at the factory. However, it is impossible to maintain this alignment during shipping and handling. Therefore it will be necessary for you to realign the pump and driver. Flexible couplings are not universal joints. They should not be used to compensate for misalignment of the pump and motor shafts. Their function is to transmit power from the driver to the pump while compensating for thermal expansion and shaft end movement. The coupling faces should be far enough apart so that they do not make contact when the motor shaft is forced to the limit of the bearing clearance toward the pump shaft.

In order to properly align the coupling, you will need a taper gauge or set of feeler gauges, and a straight edge, or if available, a dial indicator.

There are two types of misalignment encountered with flexible couplings: angular misalignment, in which the shafts are not parallel, and parallel misalignment where the shafts are parallel but not on the same axis.

To check angular alignment, insert a feeler gauge or taper gage at any four places 90° apart around the

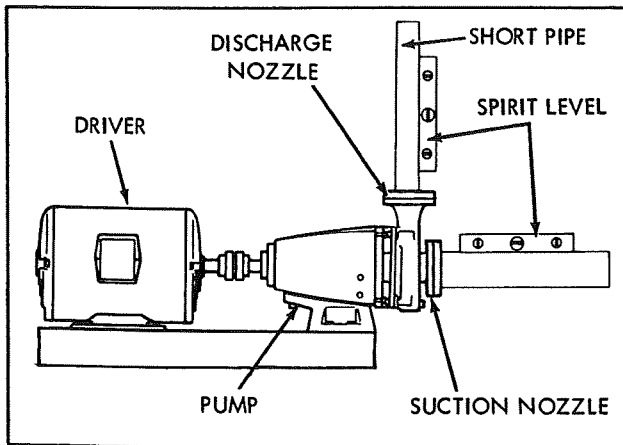


FIGURE 4. LEVELING PUMP UNIT WITH SPIRIT LEVEL AND SHORT LENGTHS OF PIPE

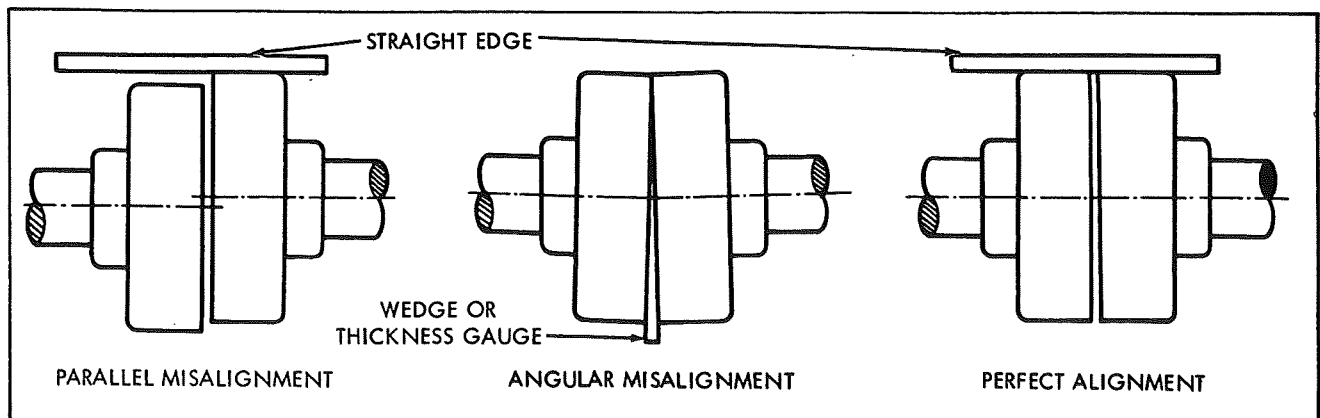


FIGURE 6. FLEXIBLE COUPLING ALIGNMENT

## FRAME MOUNTED INSTALLATION

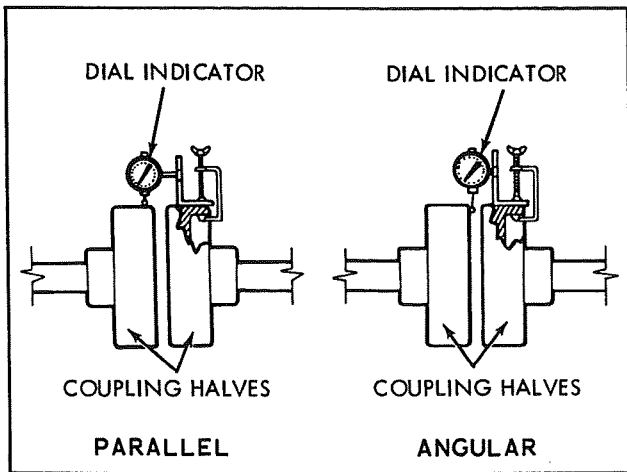


FIGURE 7. CHECKING ALIGNMENT WITH DIAL INDICATOR

coupling halves. Insert shims under the driver feet until the same reading is obtained at all four check points. The pump and driver will then be in angular alignment.

To check angular alignment with a dial indicator, clamp the dial indicator to the pump coupling half so that ball on the indicator just rests on the face of the motor coupling half. A chalk mark should be made at the point where the ball contacts the coupling half. Both the pump shaft and the motor shaft should be rotated an equal amount so that the reading is taken at all check points with the ball on the chalk mark. Insert shims as required.

To check parallel alignment, a straight edge should be held against the edges of the coupling halves at any four places 90° apart around the coupling. The straight edge should be parallel to the pump and driver shafts at all times. Insert shims until the straight edge lies flat against both coupling halves at all four check points. The pump and driver will then be in proper parallel alignment.

To check parallel alignment with the dial indicator, the ball should rest on periphery of the motor coupling half. A chalk mark should be made at the point of contact, and the shafts rotated equally so that the reading is taken with the ball on the chalk mark at all check points. Insert shims as required.

### NOTE

Any adjustment to correct one direction of alignment may affect the other direction. Therefore, it is necessary to recheck both angular and parallel alignment after each adjustment.

When the unit is properly aligned, the foundation bolts should be tightened, but not too firmly. Waste material should be stuffed into the sleeves around the foundation bolts, to prevent grout from filling the sleeves during grouting.

**GROUTING THE INSTALLATION.** Grouting the base plate prevents lateral movement of the base plate, and improves the vibration absorbing characteristics of the foundation by increasing its mass. A wooden dam should be constructed around the base plate to contain the grout while it is being poured. The dam can be built tight against the base plate, or slightly removed from it as desired.

The entire base plate should be completely filled with grout. A non-shrinkable type grout, such as manufactured by EMBCO is recommended. The grout should be puddled frequently to remove any air bubbles from the grout.

The leveling shims can be grouted in place, or they can be removed after the grout has set usually from 48 to 72 hours after pouring.

After the grout has set, alignment of the unit should be checked and the foundation bolts firmly tightened down.

**PIPING.** Your pump unit is now ready to be piped. The piping practices you follow will directly affect the efficiency and power consumption of your pump.

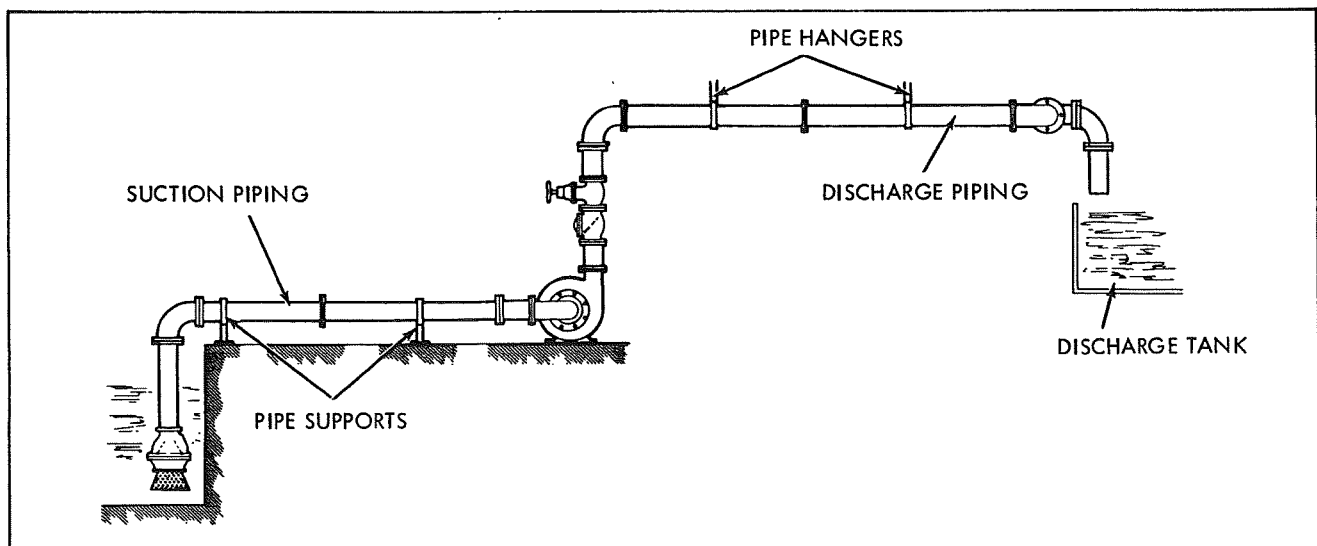


FIGURE 8. SUPPORTING PIPING

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Pay particular attention to the seemingly insignificant details involved in piping your pump for they make the difference between a good and bad installation.

**SUPPORTING THE PIPE.** Both the suction and the discharge piping should be independently supported near the pump. Liberal use of pipe hangers and support blocks will prevent excessive strain on the pump casing and on the pipe joints.

**SUCTION PIPING.** The suction piping should be short, but no less than ten pipe diameters in length, and direct with as few elbows and fittings as possible, to keep head loss from friction at a minimum. However, the suction pipe should provide a minimum uninterrupted length, equal to ten pipe diameters, to the pump suction flange. A horizontal suction line should have a gradual rise to the pump, and pass under any interfering piping.

**PIPE.** The suction pipe diameter should be at least the same diameter as the suction nozzle on the pump, and preferably larger. Use of a smaller diameter pipe will result in loss of head due to friction. All joints must be tight to maintain prime on the pump.

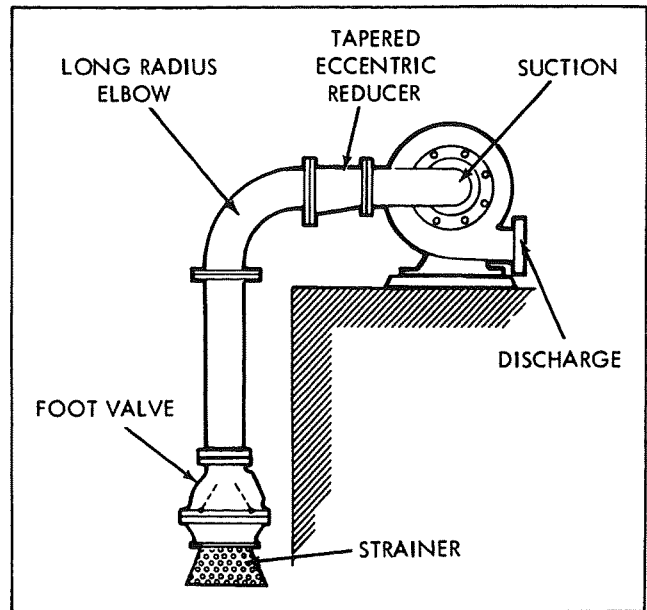


FIGURE 9. RECOMMENDED SUCTION LIFT PIPING - SHORT AND DIRECT

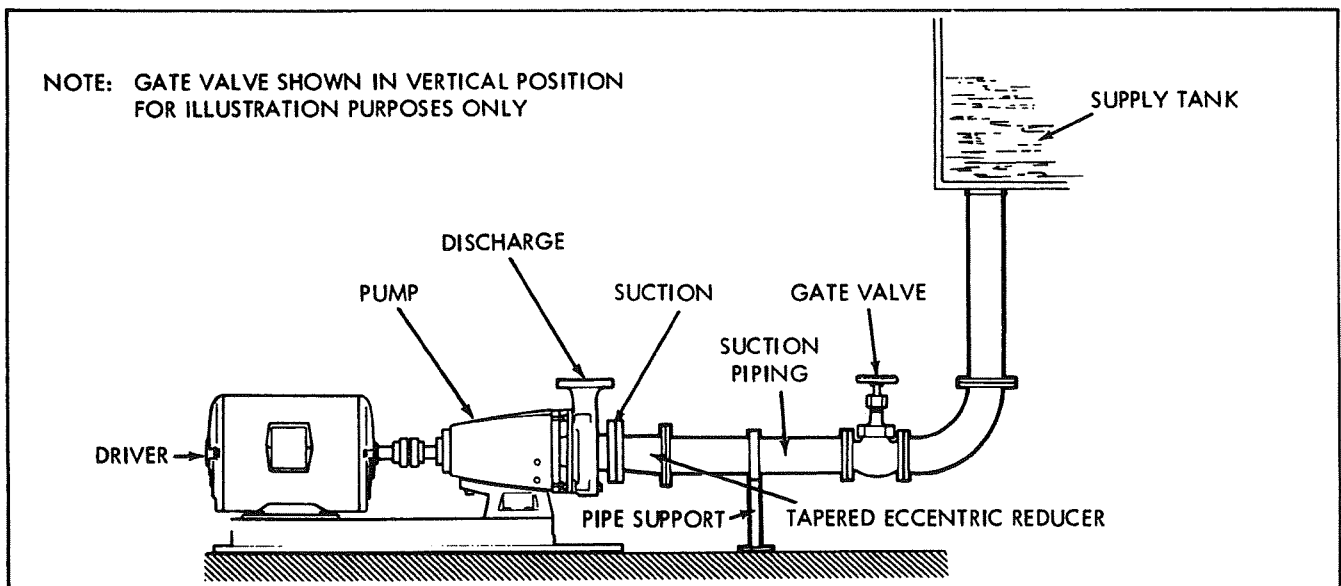


FIGURE 10. RECOMMENDED FLOODED SUCTION PIPING - SHORT AND DIRECT

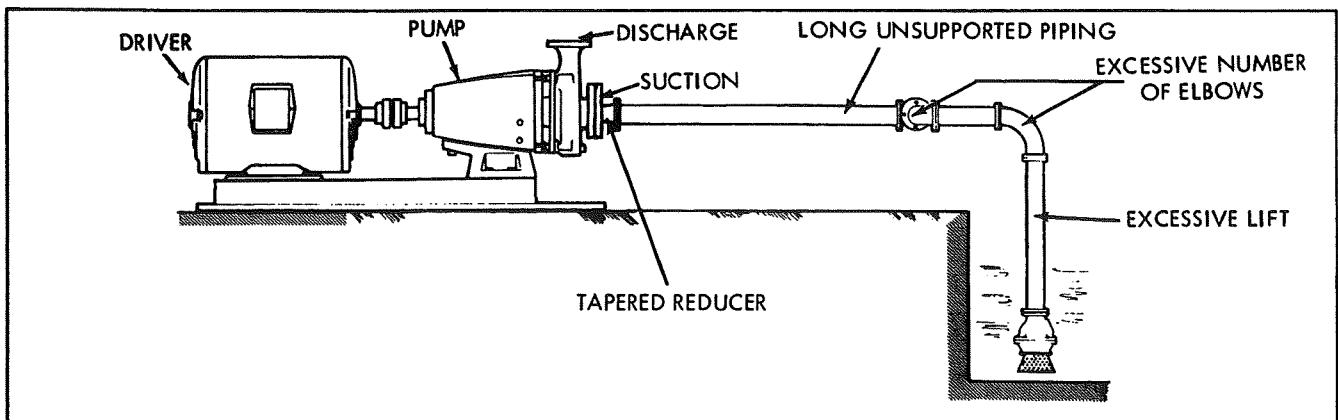


FIGURE 11. UNSATISFACTORY SUCTION LIFT PIPING - LONG AND INDIRECT WITH NO SUPPORT

FRAME MOUNTED INSTALLATION

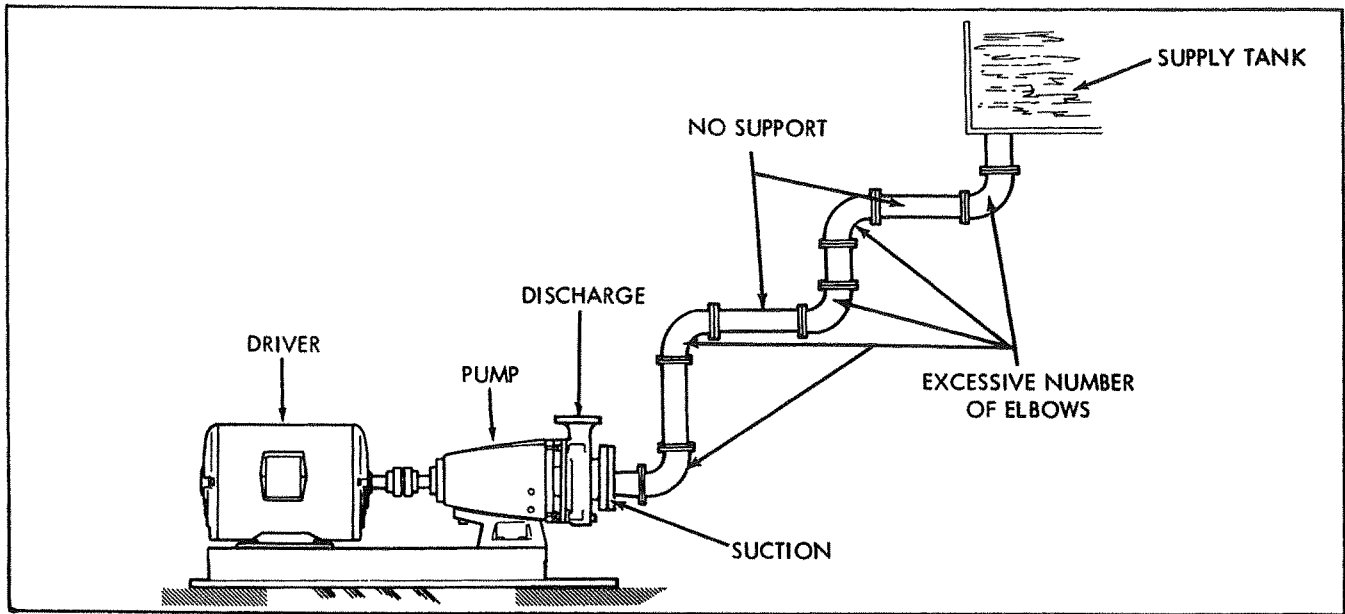


FIGURE 12. UNSATISFACTORY FLOODED SUCTION PIPING - LONG AND INDIRECT WITH NO SUPPORT

**ELBOWS.** Long radius elbows should be used in place of standard elbows wherever possible, because of their superior flow characteristics. For instance, head loss in a standard four inch elbow is equivalent to the head loss in a piece of pipe 11 feet long, while the head loss in a long radius elbow is approximately half as much. Elbows should not be used at the suction nozzle, but if it is unavoidable, they should be installed in a vertical position. Elbows installed in any position at the suction nozzle have a tendency to distribute the liquid unevenly in the impeller chamber, causing a reduction in capacity, and creating an undesirable thrust condition.

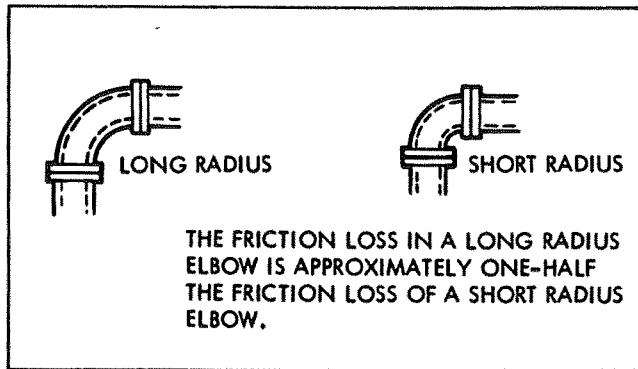


FIGURE 13. LONG VERSUS SHORT RADIUS ELBOWS

**REDUCERS.** Eccentric reducers should be installed directly at the suction nozzle, with the taper at the bottom to prevent air pockets from forming. Straight taper reducers should never be used in a horizontal suction line because of the air pocket that is formed at the leg of the reducer and the pipe.

**DISCHARGE PIPING.** Discharge piping should also be short and direct as possible, with few elbows and fittings, to reduce head loss from friction.

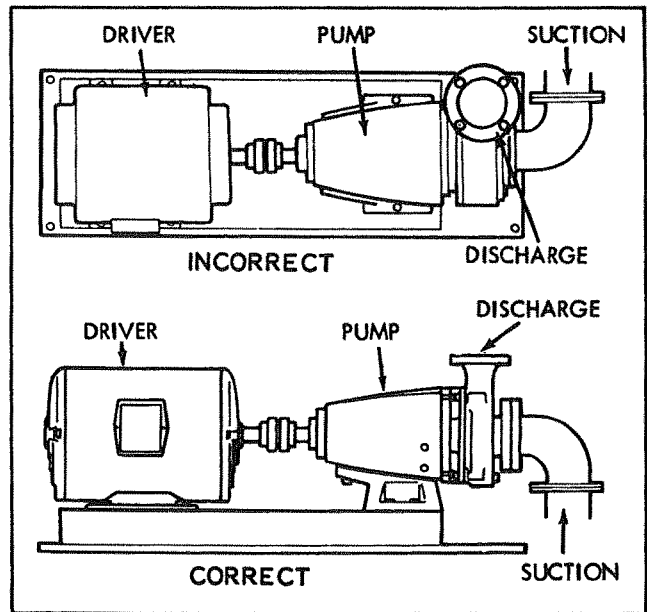


FIGURE 14. ELBOW INSTALLATION IN SUCTION NOZZLE

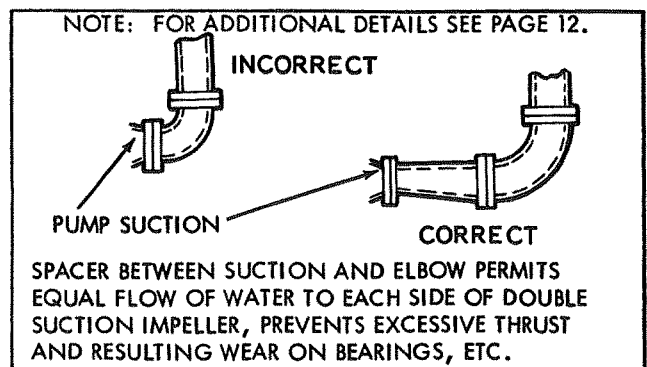
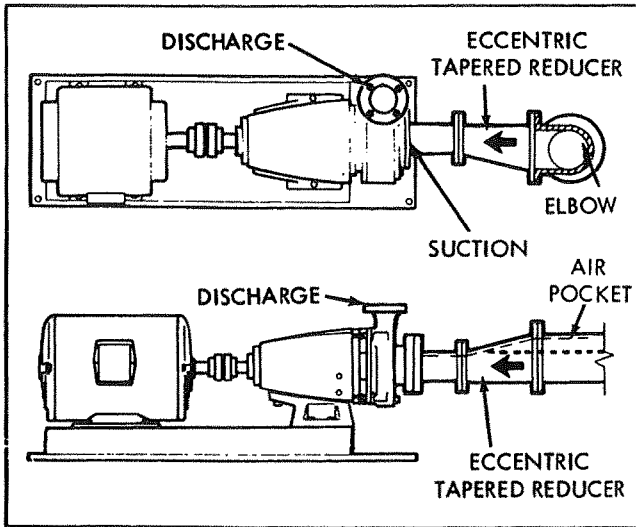


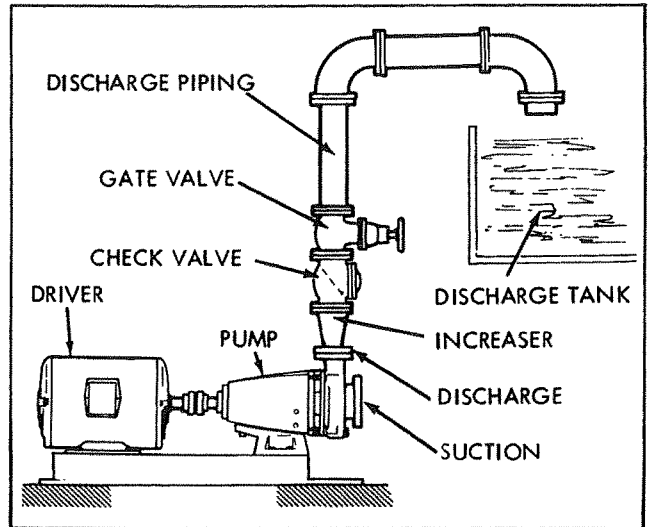
FIGURE 15. REDUCER BETWEEN ELBOW AND PUMP SUCTION NOZZLE



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**FIGURE 16. UNSATISFACTORY INSTALLATION OF TAPERED REDUCER**



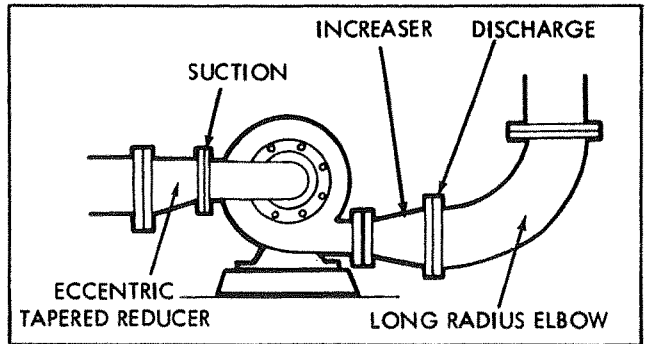
**FIGURE 17. RECOMMENDED DISCHARGE PIPING - SHORT AND DIRECT**

**PIPE.** The discharge pipe diameter should be the same as, or larger than, the discharge nozzle diameter. The size of discharge pipe to be used is dependent upon its application.

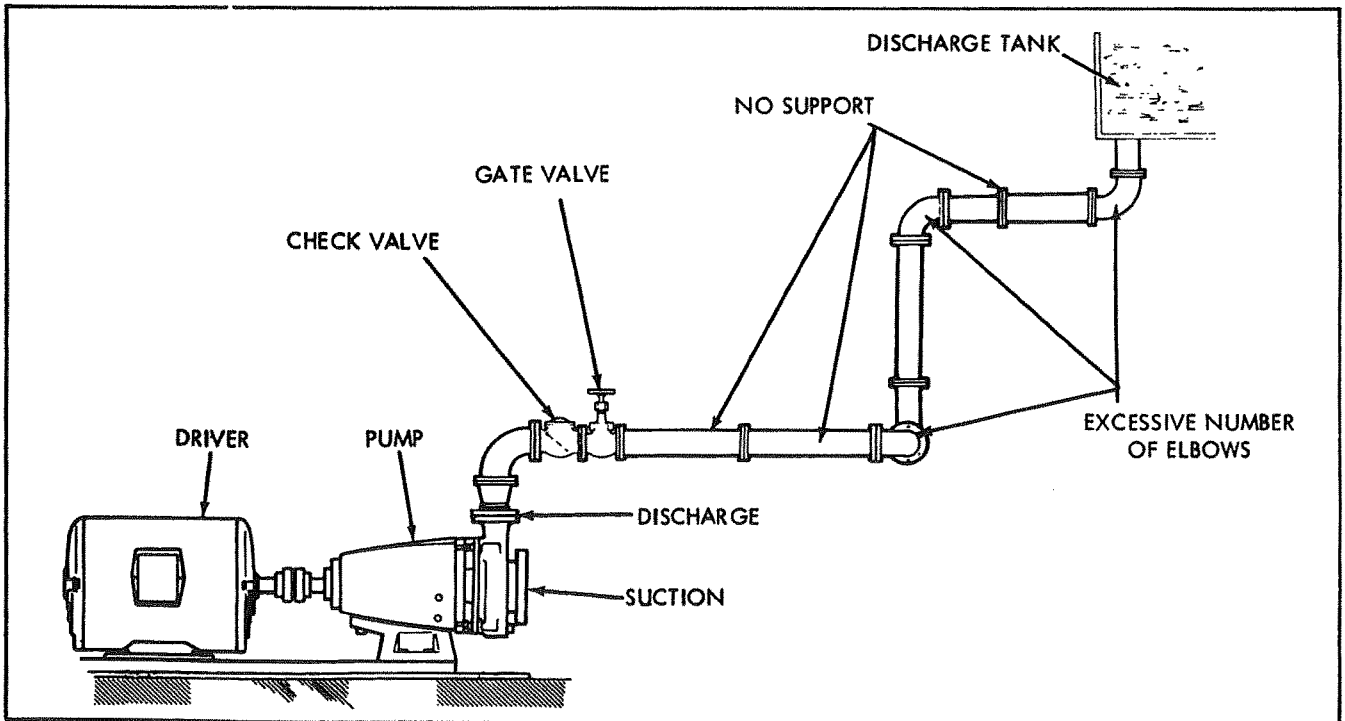
The recommended pipe diameter can be obtained from your nearest Aurora Pump Sales Office.

**ELBOWS.** Long radius elbows should be used in the discharge piping as well as in the suction piping to prevent excessive head loss due to friction. Whenever possible, elbows should not be installed directly at the discharge nozzle as the turbulence created by the elbow will affect pressure gauge readings.

**REDUCERS AND INCREASERS.** An increaser should be installed at the discharge nozzle if larger diameter



**FIGURE 19. REDUCER AND INCREASER INSTALLATION**



**FIGURE 18. UNSATISFACTORY DISCHARGE PIPING - LONG WITH EXCESSIVE ELBOWS AND JOINTS AND NO SUPPORT**

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discharge piping is used. Straight taper increasers and/or reducers are satisfactory in discharge applications.

**EXPANSION JOINTS.** Expansion joints are used primarily to prevent the transmission of piping strain, caused by thermal expansion and contraction, piping misalignment, pressure changes, or other causes, to the pump casing. They are also used to suppress any noise that may be transmitted through the piping.

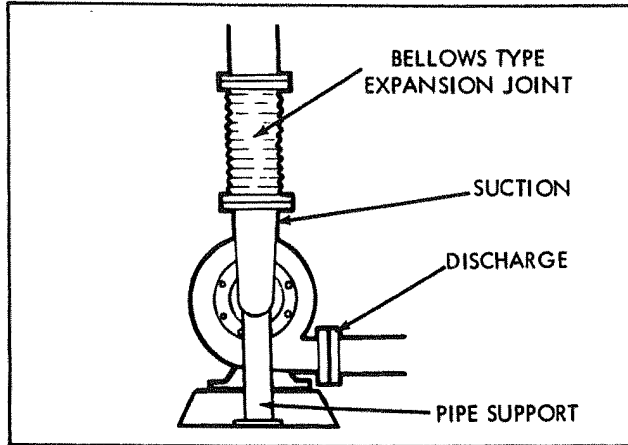


FIGURE 20. EXPANSION JOINT IN SUCTION LINE

It is recommended that the flexible metal type of expansion joint be used, because rubber expansion joints, while costing less, have a tendency to deteriorate, making frequent replacement necessary.

If an expansion joint must be used, an anchor or restraining device should be installed between the joint and the pump to prevent objectional forces from being transmitted to the pump. If an anchor is not installed at this point, a force equal to the area of the joint times the pressure in the pipe is developed and transmitted to the pump. This force may exceed the allowable flange loading, and could result in damage to the pump or piping.

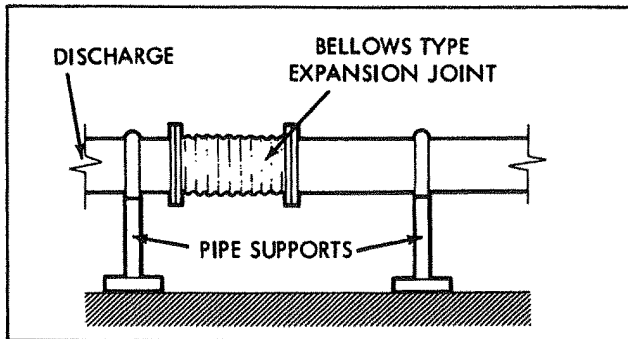


FIGURE 21. EXPANSION JOINT IN DISCHARGE PIPING

**PIPE ALIGNMENT.** Proper piping alignment is essential before connection is made. Piping alignment should never be achieved by force, this could produce strain on the piping and the pump casing. Proper

supports should be installed for the piping to keep its weight off the pump casing.

When flange bolts are used, line up the piping first, then loosely install flange bolts. Check the piping alignment, and tighten the flange bolts until all bolts are tightened securely.

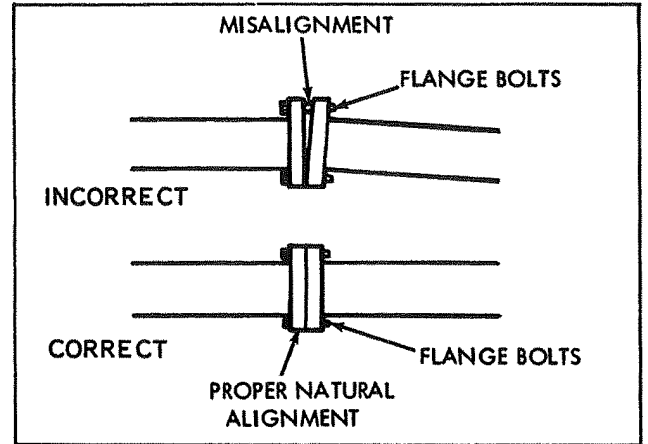


FIGURE 22. PIPE ALIGNMENT

**AIR IN PIPING.** One of the most common conditions affecting pump efficiency is the formation of air pockets in the suction line. The air pockets are a result of high points and improper installation of elbows, reducers, and valves in the suction piping.

For suction lift applications, lantern rings are required to prevent air from leaking into the pump through the stuffing box, or at the joints.

The pump packings or seal depend on the liquid being pumped for lubrication. Excessive air can prevent proper lubrication with resultant damage to them.

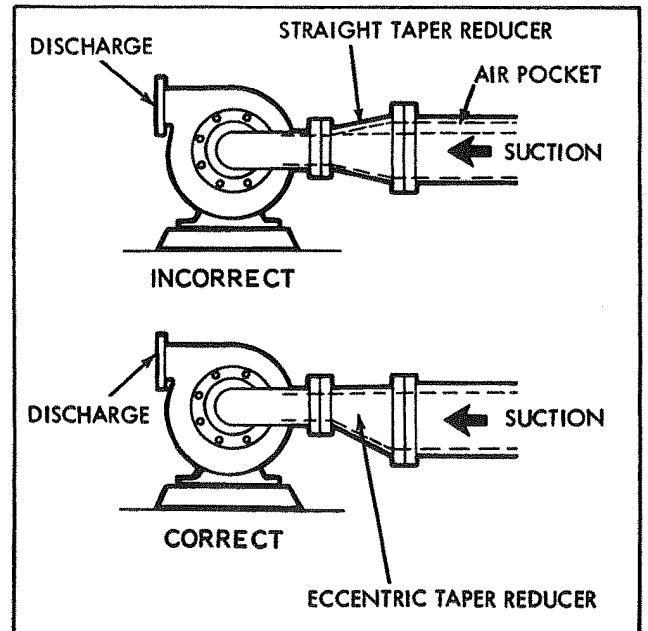


FIGURE 23. AIR POCKETS IN REDUCER

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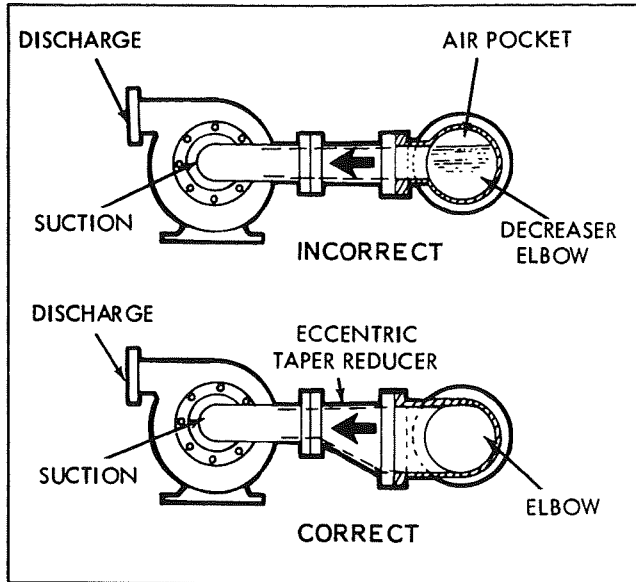


FIGURE 24. AIR POCKET IN ELBOW

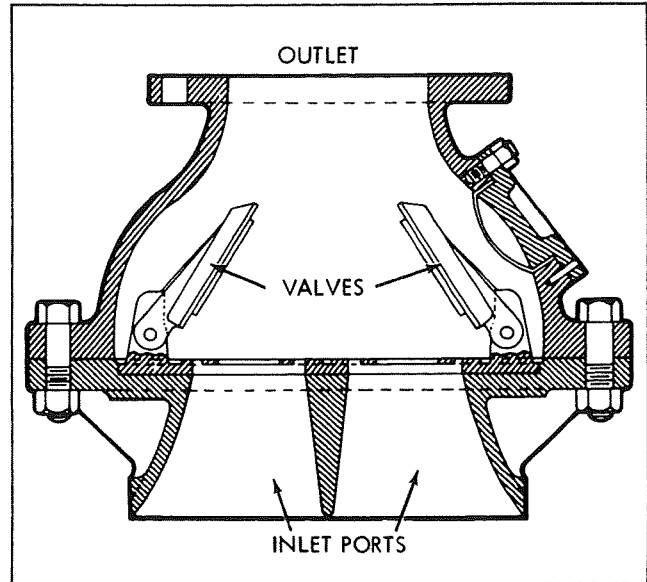


FIGURE 26. FOOT VALVE

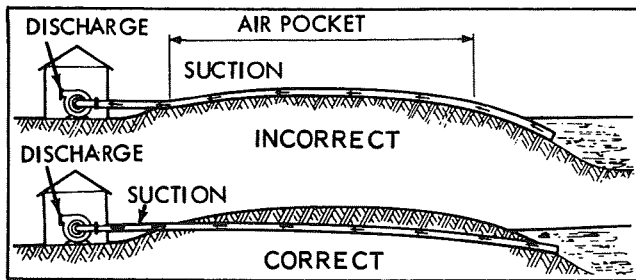


FIGURE 25. AIR POCKET IN HORIZONTAL SUCTION PIPING

In suction lift applications the suction pipe in the liquid well must be sufficiently submerged to prevent exposure of the end of the pipe when the well is at its minimum level and to prevent vortexing action (whirlpool effect) of the liquid at the suction pipe, which will draw air into the pipe. Also, care should be taken to keep the suction pipe located away from the well inlet since the incoming liquid may be carrying air bubbles. Another cause of air in the liquid is dropping of the liquid from too high a point into the well.

**VALVES.** Valves are an important part of your installation, for they facilitate priming of the pump, and control the volume of the pumped liquid.

**SUCTION LIFT.** In suction lift applications where the suction lift is low a foot valve can be installed, to maintain the prime on the pump. A foot valve is essentially a check valve, allowing flow in one direction only toward the pump. When the pump is shut down, the pressure of the liquid returning to the well, causes the valve to close, retaining the liquid in the suction line.

A slow closing check valve should be installed when the static discharge head is high. A foot valve should not be used under these conditions, as failure of the driver would allow the water to rush back rapidly thus causing a heavy water hammer.

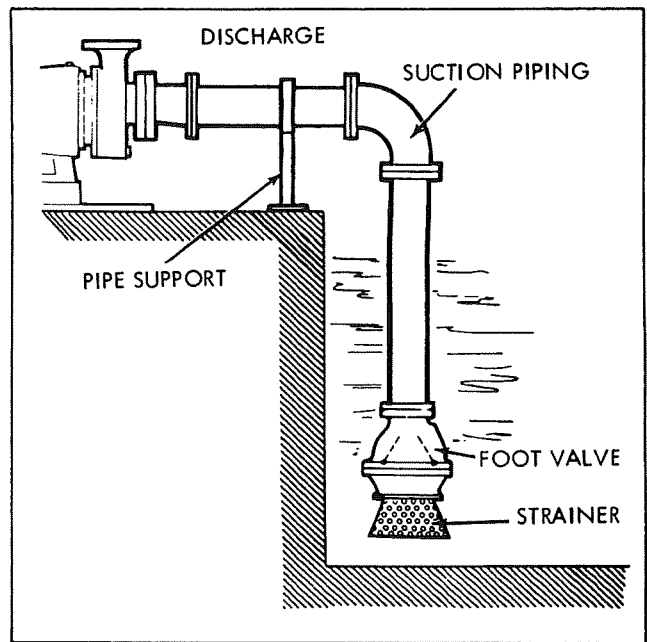


FIGURE 27. FOOT VALVE INSTALLED WITH SCREEN

Foot valves, when used, should be of the flat type rather than multiple spring type. The valve should have a large inlet area, because the friction loss in a foot valve is high. Install check and foot valves as indicated by arrow to ensure proper installation.

**FLOODED SUCTION.** When the liquid source is above the pump centerline, a flooded suction condition exists, and a gate valve is required to shut off the liquid supply for pump inspection and maintenance. The gate valve should be installed with the stem in a horizontal or downward position to prevent formation of an air pocket in the valve.

**DISCHARGE VALVES.** The discharge piping should include a check valve and a gate valve. The check

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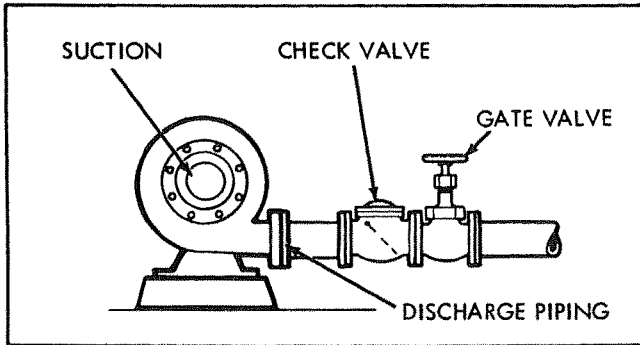


FIGURE 28. GATE VALVE AND CHECK VALVE

valve should be located between the gate valve and the pump. If an increaser is used in the discharge piping, the increaser should be installed between the pump nozzle and the check valve. The check valve protects against a reverse flow of the liquid if the driver fails.

The gate valve is used in the priming operation, as a throttling valve to control pump volume, and to shut down the pump for inspection and maintenance.

**AIR VENT VALVE.** Vent valves are installed at the high points in the pump casing to allow air or vapor to escape. These valves are used to release trapped air from the pump casing during priming and when pump becomes air bound.

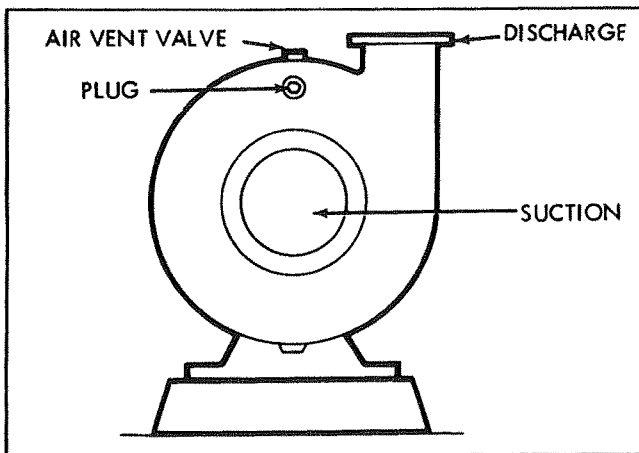


FIGURE 29. AIR VENT VALVE OR PLUG

**STRAINERS AND SCREENS.** It is important to screen the suction piping to remove foreign matter that can clog the pump and impair its capacity, or stop it completely. Small particles such as sand, dirt, scale from inside pipe and other extraneous materials can get into the close clearance parts of the pump and cause considerable damage to the parts.

Strainers should be selected so as to have a total area of holes equal to at least four times the suction pipe area.

In applications where sticks, twigs, leaves and other large debris are present, a larger outside screen

should be placed around the suction inlet to prevent choking of the strainer. This screen should have sufficient openings so that flow velocity does not exceed two feet per second.

**PRIMING THE PUMP.** Your pump will not operate satisfactorily until it is primed. All air must be expelled from the suction piping and pump casing, and replaced by the liquid to be pumped. There are several methods of priming pumps. The one you select will depend on your specific requirements.

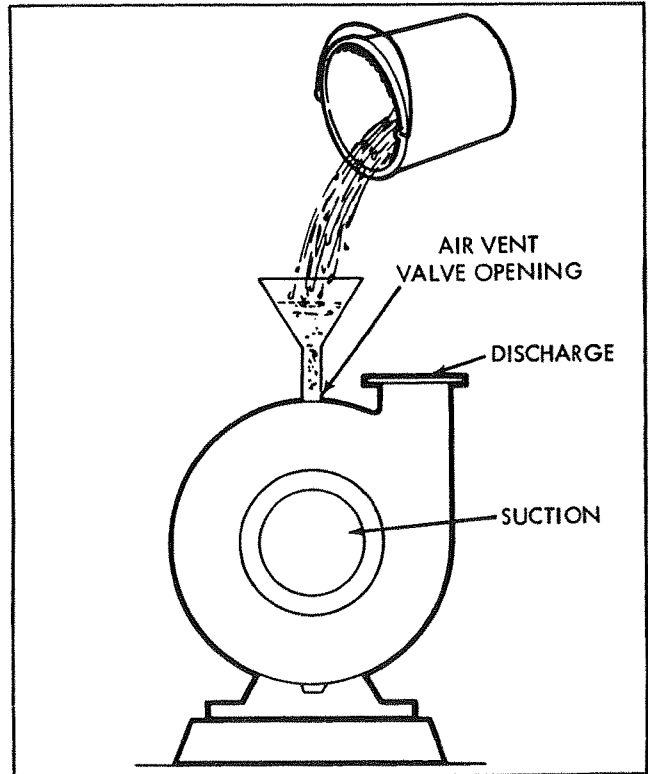


FIGURE 30. PRIMING BY HAND

**FLOODED SUCTION PRIMING.** This method of priming a pump is relatively simple. The liquid source is located above the pump, and all that is necessary to prime the pump is to open the air vent valve or plug in the pump casing, and to crack the gate valve in the suction line. The suction line and pump should be filled slowly until a steady stream of liquid is observed flowing from the air vent. After your pump is operating, it is recommended that the air vent valve or plug be opened again to insure that all air has been expelled from the pump casing.

**FOOT VALVE PRIMING.** A foot valve can be used for priming on suction lift applications. The foot valve located at the bottom end or foot of the suction piping, functions as a check valve which allows flow in one direction only, toward the pump.

Initial priming is accomplished by completely filling the suction piping and pump casing with the liquid to be pumped. This can be done by removing the air vent valve or plug at the top of the pump casing and inserting a pipe nipple in the orifice, with an appropriate increaser to accommodate a hose connection.

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A priming line can also be inserted in the discharge piping between the check valve and the pump or the priming can be done with a bucket and funnel. The important thing is to completely fill the suction pipe and pump casing with liquid.

When the pump is started, the vacuum created by pumping the priming fluid, combined with atmospheric pressure in the liquid well, forces liquid into the suction piping, thus opening the foot valve and keeping it open until the pump is shut down. When the pump is shut down, the liquid being pumped reverses its flow, causing the foot valve to close, trapping the liquid in the suction piping and pump casing, thus maintaining a prime on the pump.

**VACUUM PRIMING.** Vacuum priming consists of removing air from the pump casing and suction piping and drawing liquid into them by means of a vacuum creating device. The types of vacuum equipment range from a simple hand pump to complex central priming systems. Your specific priming requirements will govern what type of vacuum primer to use.

**AIR EJECTOR.** One type of vacuum primer is the air ejector. If liquid under pressure or steam is available, an ejector can be used. The ejector is connected to the air vent orifice. A stream of the ejecting medium is passed through the ejector creating a vacuum in the ejector, and drawing air from the pump casing and suction piping. When liquid flows steadily from the ejector discharge pipe, the pump is primed.

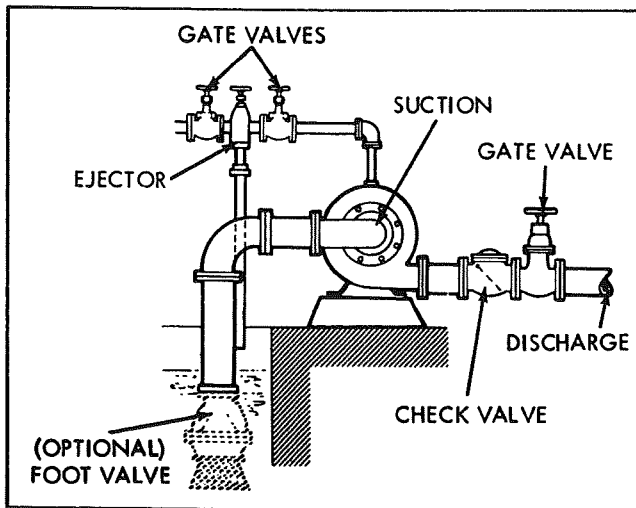


FIGURE 31. PRIMING BY EJECTOR

**VACUUM PUMPS.** Rotary or reciprocating pumps are frequently used as vacuum pumps. They fall into two categories, wet-vacuum and dry-vacuum. The principle of operation is essentially the same, however, the dry-vacuum pump cannot accommodate a liquid and air mixture while the wet-vacuum pump can accommodate liquid, air or a combination of both.

Vacuum pumps can be installed as part of a central priming system servicing many pumps, as an auto-

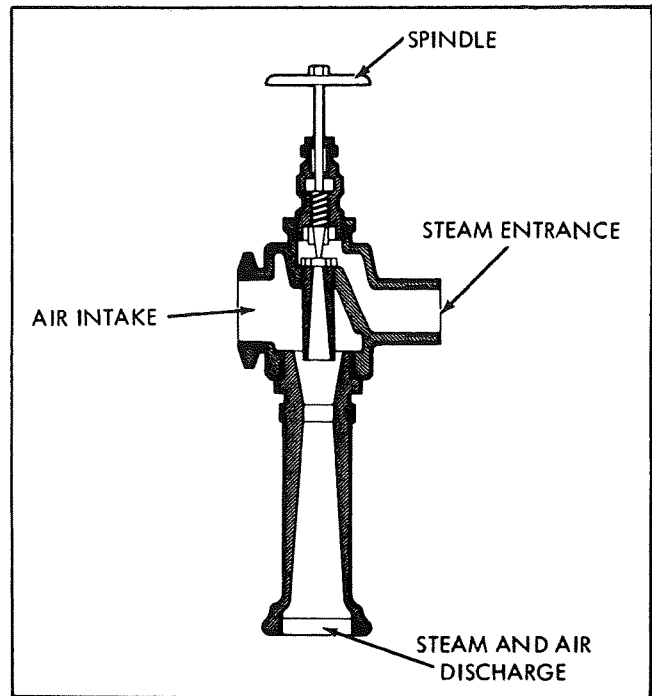


FIGURE 32. EJECTOR CUTAWAY

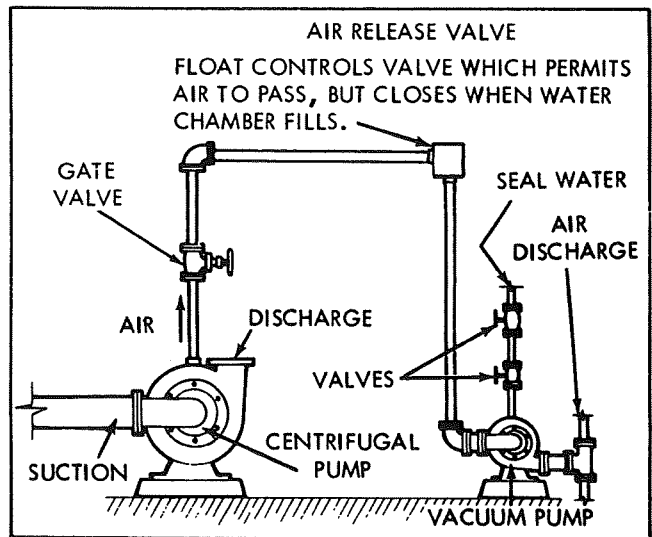


FIGURE 33. PRIMING BY VACUUM PUMP

matic priming system, or as a manually controlled independently driven pump.

The suction piping of the vacuum pump is connected to the air vent orifice on the pump to be primed. The vacuum produced by the vacuum pump removes air from the centrifugal pump suction piping and casing, and draws liquid from the liquid well into the centrifugal pump. Dry-vacuum pumps must be installed so that no liquid is taken into the air pump. Installation of a water trap, or use of a vacuum tank are recommended for dry vacuum pumps.

**INDUCTOR PRIMING.** On suction lift applications it may be desirable to prime your pump with a priming inductor. This type of primer is comprised of a liquid nozzle and an inductor at the foot end of the

## FRAME MOUNTED INSTALLATION

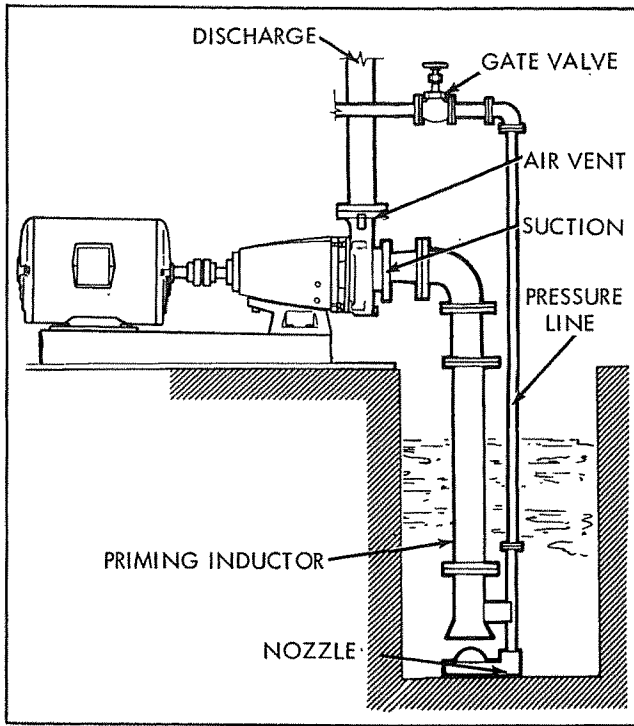


FIGURE 34. PRIMING BY INDUCTOR

suction piping. The nozzle and inductor are connected to a high pressure liquid supply such as a city water service.

The pump is primed by opening the valve in the pressure line, which allows the liquid to flow through the nozzle into the inductor. The velocity of the high pressure liquid drives the liquid into the suction piping and up to the pump, priming it.

**ELECTRICAL WIRING.** Normally, your pump will be supplied with an attached drive motor. The motor should be wired in accordance with the wiring diagram found on the motor name plate. Be sure the

voltage, frequency, and phase of your power supply corresponds with the name plate data. It is advisable to provide a separate switch and overload protection for your pump motor to protect against power failure in some other area. Conversely, if the pump motor develops electrical problems, it will be isolated from other equipment.

**PRESTARTING INSTRUCTION.** The coupling halves should be connected. Prior to connection however, the drive motor should be started to make sure the direction of rotation is the same as the direction indicated by the arrow on the pump casing.

**WARNING:** On all 350 series pumps and the 364A with a 15" impeller on a #21 power frame, reverse rotation will destroy the pump.

After you are sure the motor is rotating clockwise you can couple the motor to the pump. Again, after coupling but **BEFORE** starting it is important to check coupling and shaft alignment. Use a standard dial indicator to align the motor shaft and pump shaft to within .003"-.005".

The suction and discharge piping should now be connected to the pump, and the pump primed.

### CAUTION

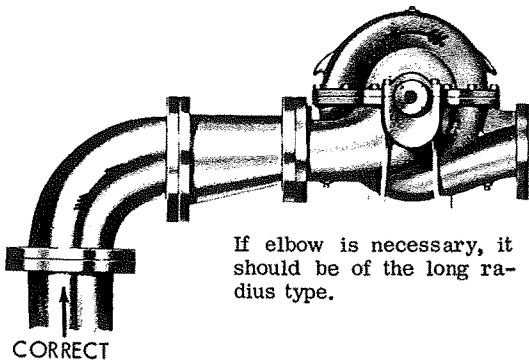
Do not operate the pump without liquid. Pump seals or packing depend on the liquid being pumped for lubrication.

Open or close the various valves as required by your specific application. Start the pump and bring it up to operating temperature. After the temperature has stabilized, the pump should be shut down and the alignment rechecked. It will be necessary to check the alignment with the coupling halves both connected and disconnected.

Remember, any alignment adjustment made in one direction may affect the other direction so extreme care should be taken when final adjustment is made.

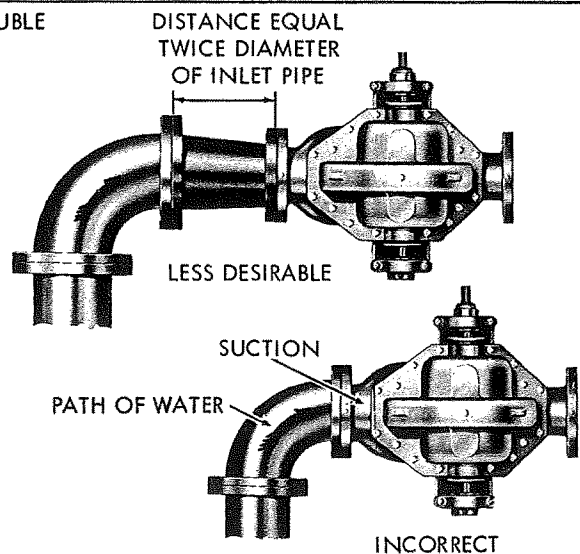
Make sure all pump, motor and base plate mounting bolts are firmly tightened down.

### SPECIAL SUCTION PIPING SPECIFICATIONS FOR HORIZONTAL DOUBLE SUCTION PUMPS FOR ADDITIONAL DETAILS SEE PAGE 6



Discharge piping and suction piping should be supported close to the pump flange to prevent vibration and strain on pump casing.

The suction pipe on horizontal double suction pumps, should not be installed so that there is an elbow close to the suction nozzle unless the elbow is mounted vertically. There is always an uneven flow of liquid through an elbow and when the elbow is installed at any angle other than vertical more water will enter one side of the impeller than enters the other side. This causes a reduction in capacity and efficiency and creates an axial thrust load which may over heat and possibly cause rapid wear of the thrust bearing.



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## WARRANTY

Seller warrants equipment (and its component parts) of its own manufacture against defects in materials and workmanship under normal use and service for one (1) year from the date of installation or start-up, or for eighteen (18) months after the date of shipment, whichever occurs first. Seller does not warrant accessories or components that are not manufactured by Seller; however, to the extent possible, Seller agrees to assign to Buyer its rights under the original manufacturer's warranty, without recourse to Seller. Buyer must give Seller notice in writing of any alleged defect covered by this warranty (together with all identifying details, including the serial number, the type of equipment, and the date of purchase) within thirty (30) days of the discovery of such defect during the warranty period. No claim made more than 30 days after the expiration of the warranty period shall be valid. Guarantees of performance and warranties are based on the use of original equipment manufactured (OEM) replacement parts. Seller assumes no responsibility or liability if alterations, non-authorized design modifications and/or non-OEM replacement parts are incorporated. If requested by Seller, any equipment (or its component parts) must be promptly returned to Seller prior to any attempted repair, or sent to an authorized service station designated by Seller, and Buyer shall prepay all shipping expenses. Seller shall not be liable for any loss or damage to goods in transit, nor will any warranty claim be valid unless the returned goods are received intact and undamaged as a result of shipment. Repaired or replaced material returned to customer will be shipped F.O.B., Seller's factory. Seller will not give Buyer credit for parts or equipment returned to Seller, and will not accept delivery of any such parts or equipment, unless Buyer has obtained Seller's approval in writing. The warranty extends to repaired or replaced parts of Seller's manufacture for ninety (90) days or for the remainder of the original warranty period applicable to the equipment or parts being repaired or replaced, whichever is greater. This warranty applies to the repaired or replaced part and is not extended to the product or any other component of the product being repaired. Repair parts of its own manufacture sold after the original warranty period are warranted for a period of one (1) year from shipment against defects in materials and workmanship under normal use and service. This warranty applies to the replacement part only and is not extended to the product or any other component of the product being repaired. Seller may substitute new equipment or improve part(s) of any equipment judged defective without further liability. All repairs or services performed by Seller, which are not covered by this warranty, will be charged in accordance with Seller's standard prices then in effect.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its component parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part. Under the terms of this warranty, Seller shall not be liable for (a) consequential, collateral, special or liquidated losses or damages; (b) equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; (c) the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; (d) damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper voltage, mishandling, or other similar conditions; (e) any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; (f) any labor costs or charges incurred in repairing or replacing defective equipment or parts, including the cost of reinstalling parts that are repaired or replaced by Seller; (g) any expense of shipment of equipment or repaired or replacement parts; or (h) any other loss, damage or expense of any nature.

The above warranty shall not apply to any equipment which may be separately covered by any alternate or special warranties.

**PERFORMANCE:** In the absence of Certified Pump Performance Tests, equipment performance is not warranted or guaranteed. Performance curves and other information submitted to Buyer are approximate and no warranty or guarantee shall be deemed to arise as a result of such submittal. All testing shall be done in accordance with Seller's standard policy under Hydraulic Institute procedures.

**LIABILITY LIMITATIONS:** Under no circumstances shall the Seller have any liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses or for loss of production or progress of construction, regardless of the cause of such damages or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price.

**ACTS OF GOD:** Seller shall in no event be liable for delays in delivery of the equipment or other failures to perform caused by fires, acts of God, strikes, labor difficulties, acts of governmental or military authorities, delays in transportation or procuring materials, or causes of any kind beyond Seller's control.

**COMPLIANCE WITH LAW:** Seller agrees to comply with all United States laws and regulations applicable to the manufacturing of the subject equipment. Such compliance shall include: The Fair Labor Standards Acts of 1938, as amended; Equal Employment Opportunity clauses of Executive Order 11246, as amended; Occupational Safety and Health Act of 1970 and the standards promulgated thereunder, if applicable. Since compliance with the various Federal, State, and Local laws and regulations concerning occupational health and safety, pollution or local codes are affected by the use, installation and operation of the equipment and other matters over which Seller has no control, Seller assumes no responsibility for compliance with those laws and regulations, whether by way of indemnity, warranty, or otherwise. It is incumbent upon the Buyer to specify equipment which complies with local codes and ordinances.



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