



A member of PENTAIR PUMP GROUP

INSTRUCTION MANUAL

OPERATION

CENTRIFUGAL PUMP

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CENTRIFUGAL PUMP OPERATION. Centrifugal pumps operate under a wide range of conditions. The pump you have selected exactly fits your specific requirements. Before putting your pump into operation however, there are certain basic ground rules that have to be followed to assure maximum efficiency, long pump life, and maintenance free service.

Centrifugal pumps should never be started or run dry. Operating a pump dry can cause burning of the packings or seal, resulting in destruction of the packings or seals, and possible scoring of the pump shaft. To prevent the pump from being run dry, the pump should be primed before starting it.

A centrifugal pump should not be throttled, or the volume controlled on the suction side of the pump. Throttling the pump on the suction side, not only reduces the capacity, but also reduces pump efficiency, and more important, can cause serious damage to the pump due to cavitation. Cavitation occurs when the pressure at any point inside the pump drops below the vapor pressure of the liquid. The liquid flashes and forms vapor bubbles. These bubbles move along with the liquid into a higher pressure area, where the bubbles collapse or implode creating an area of low pressure. The implosion phenomenon is characterized by a crackling noise and sometimes by loud knocking as the vapor bubbles are collapsed. Repetition of this action causes a wearing away of the metal on the impeller and other parts of the pump, and if allowed to continue can result in serious damage to the pump.

Pump capacity can be effectively controlled by use of a throttling valve in the discharge piping. Most centrifugal pumps can be operated for brief periods of time with the throttling valve closed without building up excessive pressure or overloading the drive unit. In fact, a centrifugal pump operating against a closed discharge line at its rated capacity, actually requires less power to operate than it does when the throttling valve is open.

The pump should never be started with the throttling valve completely closed however because a condition of water hammer could exist. The condition of water hammer is caused by an increase in pressure due to changes in velocity of the liquid flowing through the pipe line. When the velocity is changed by closing a valve or by some other means, the magnitude of the pressure produced is frequently much greater than the static pressure on the line, and may cause rupture or damage to the pump, piping, or fittings. Water hammer may be controlled by regulating valve closure, or the use of relief valves and slow closing check valves.

On pumps equipped with packings, there should be sufficient leakage from the packing to insure lubrication of the packing and effective cooling of the stuffing box. The packing glands should always be adjusted evenly and not too tightly. Over tightening the packing can generate heat which will burn the packing and cause scoring of the shaft, making it necessary to replace both the shaft and the packings.

Adequate precautions should be taken to prevent freezing of liquid in the pump when the pump is not in operation. If there is any possibility of freezing, the water should be drained off by removal of the plugs provided in the pump casing.

All mounting bolts and piping connections must be firmly tightened to prevent excessive vibration, leakage, and possible damage to the pump. The mounting bolts are particularly important. If they are not firmly tightened, the base plate upon which the pump is mounted may deflect, causing a misalignment of the pump and the driver.

STARTING THE PUMP. In order to start your pump, it will first be necessary to prime it.

PRIMING THE PUMP. Your pump will not operate satisfactorily until it is primed. All air must be

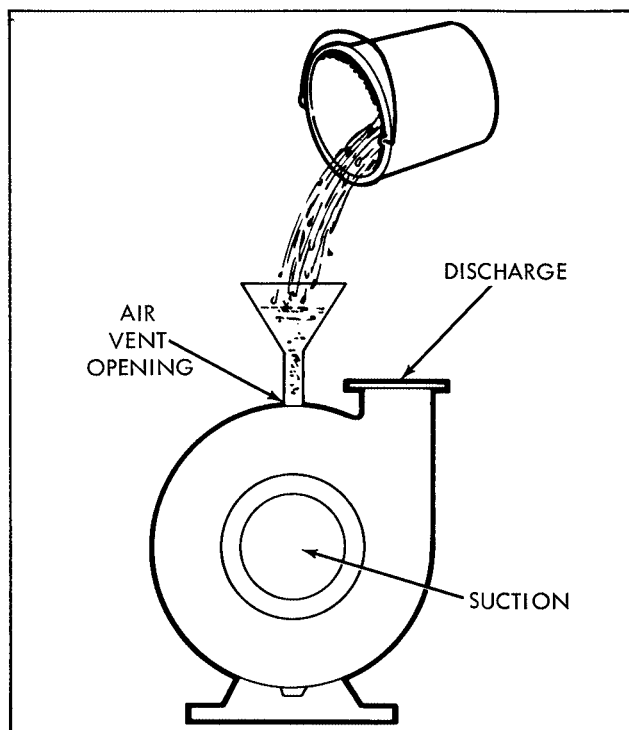


FIGURE 1. PRIMING BY HAND

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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.

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.

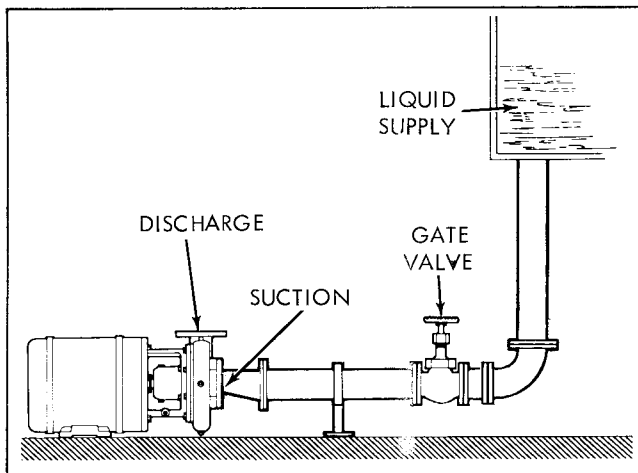


FIGURE 2. FLOODED SUCTION PRIMING

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

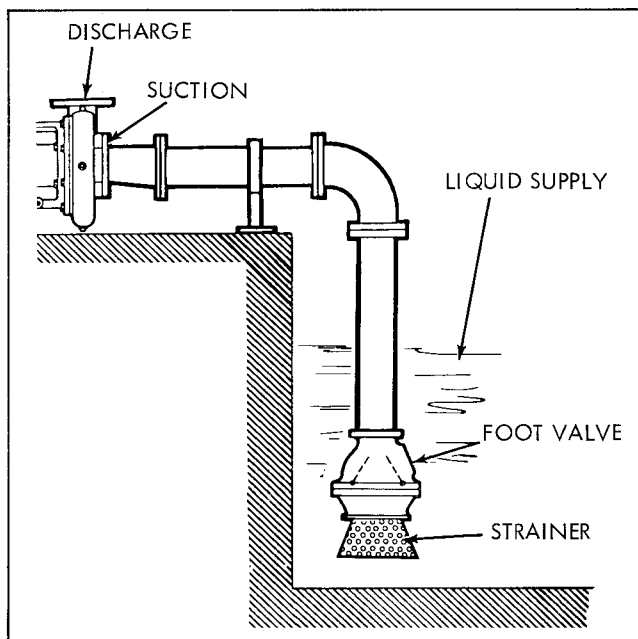


FIGURE 3. PRIMING WITH A FOOT VALVE

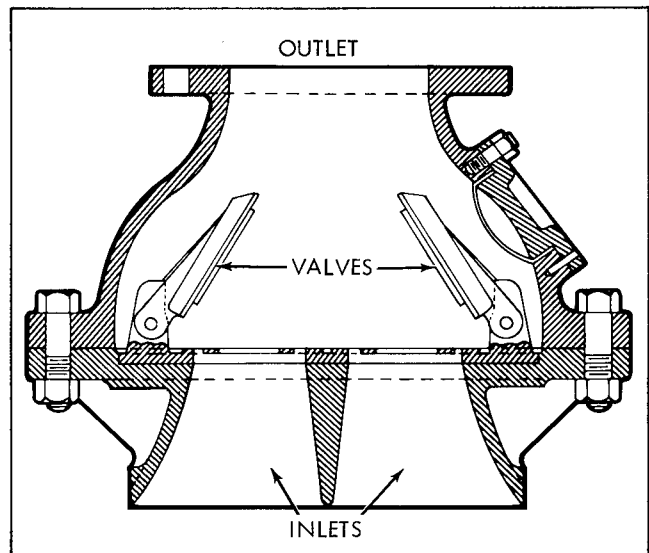


FIGURE 4. FOOT VALVE CUTAWAY

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. 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 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 valve to close. The liquid is now trapped 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 you 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.

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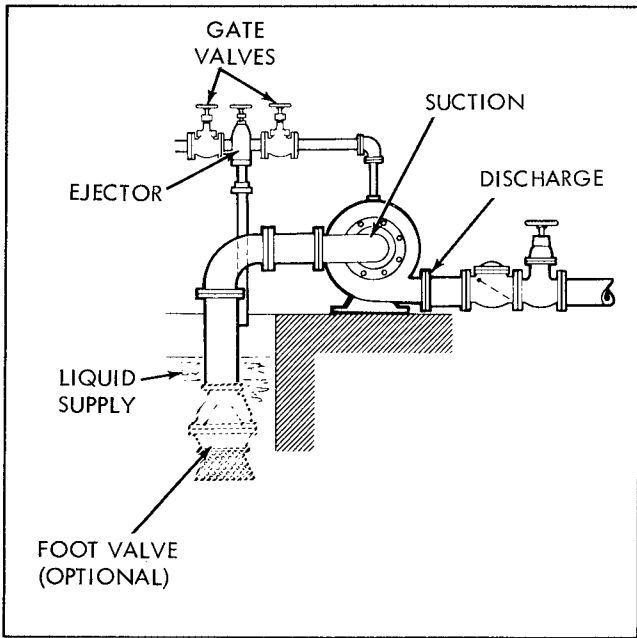


FIGURE 5. PRIMING BY EJECTOR

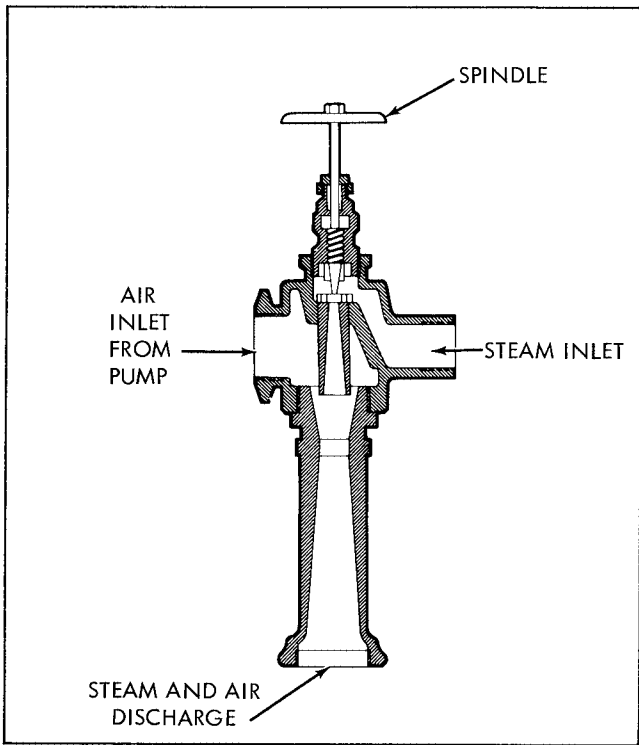


FIGURE 6. EJECTOR CUTAWAY

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-

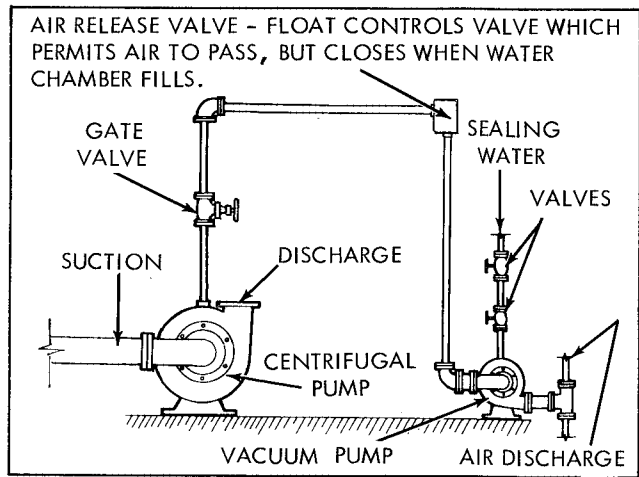


FIGURE 7. VACUUM PUMP PRIMING

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 turbine pump suction piping and casing, and draws liquid from the liquid well into the turbine 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

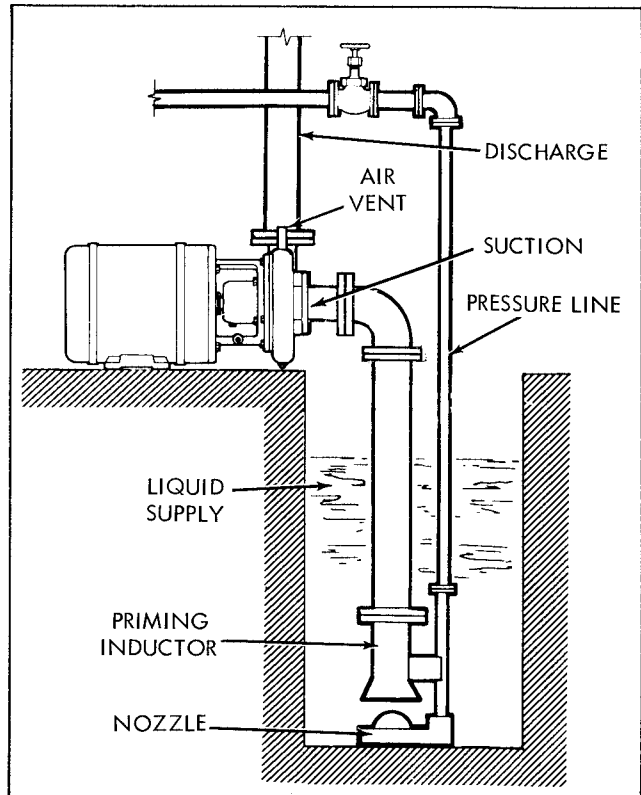


FIGURE 8. INDUCTOR PRIMING

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inductor. This type of primer is comprised of a liquid nozzle and an inductor at the foot end of the 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. This will allow the liquid to flow through the nozzle and into the inductor. The velocity of the high pressure liquid drives the liquid into the suction piping and up to the pump, thus completing the priming operation.

POSITION OF DISCHARGE GATE VALVE WHEN STARTING. The discharge gate valve should partially be closed when a high or medium head centrifugal pump is started, because this type of pump requires much less power with the gate valve closed, than when it is operated at rated capacity and head with the discharge gate valve open. As soon as the

pump is up to operating speed, the discharge gate valve should be opened to the desired position.

POSITION OF SUCTION PIPING GATE VALVE. In flooded suction applications, the gate valve is opened at the time the pump is being primed, and will remain open for starting and operation.

COOLANT VALVES. Valves in the cooling liquid line should be opened prior to the pump's being started, and will remain open while the pump is in operation, unless it is desirable to check the rate of leakage from the stuffing box.

SHUTTING DOWN THE PUMP. To shut down your pump, simply close the discharge gate valve and shut down the motor. If it is necessary for the pump to maintain its prime while it is shut down, it is advisable to install either a foot valve or a check valve in the suction piping.