

PUMPS:

The function of pump is to leave the water or any fluid to higher elevation or at higher pressure. Pumps are driven by electricity, diesel or steam power. They are helpful in pumping water from the sources that is from intake to the treatment plant and from treatment plant to the distribution system or service reservoir. In homes also pumps are used to pump water to upper floors or to store water in tanks over the buildings. Based on the mechanical principle of water lifting pumps are classified as the Following

CENTRIFUGAL PUMPS

Centrifugal force is made use of in lifting water. Electrical energy is converted to potential or pressure energy of water.

COMPONENT PARTS OF CENTRIFUGAL PUMP

Centrifugal pump consists of the following parts

1. Casing: The impellor is enclosed in the casing, which is so designed that kinetic energy of the liquid is converted into pressure energy before it leaves the casing.
2. Delivery pipe
3. Delivery valve
4. Impeller
5. Prime mover
6. Suction pipe
7. Strainer and foot valve

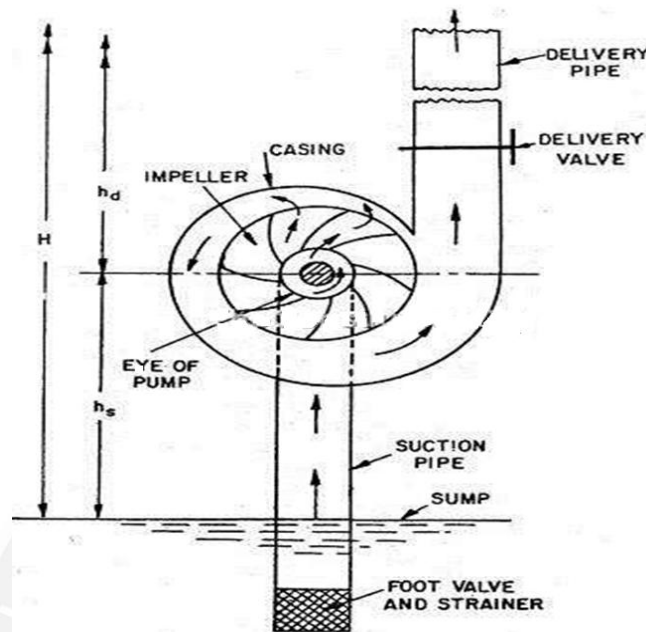
DESCRIPTION

The pump consists of a Impeller is enclosed in a water tight casing. Water at lower level is sucked into the impellor through a suction pipe. Suction pipe should be air tight and bends in this pipe should be avoided. A strainer foot valve is connected at the bottom of the suction pipe to prevent entry of foreign matter and to hold water during pumping . Suction pipe is kept larger in diameter than delivery pipe to reduce cavitations and losses due to friction. An electric motor is coupled to the central shaft to impart energy.

WORKING PRINCIPLE

When the impellor starts rotating it creates reduction of pressure at the eye of the impellor, which sucks in water through the suction pipe. Water on entering the eye is caught between the vanes of the impeller. Rapid rotation of the impellor sets up a centrifugal force and forces the water at high velocity outwards against the causing

convert the velocity energy into pressure energy which is utilized to overcome the delivery head



OPERATION AND MAINTENANCE

Priming – Priming means filling up of the suction and casing completely with water. Pressure and suction developed by the impellor is proportional to the density of the fluid and the speed of rotation. Impellor running in air will produce only negligible negative pressure on the head. Hence it is required that is the casing and impellor is filled with water through a funnel and cock. Trapped air is released through pet cock. Initially the delivery valve is closed and the pump started. The rotation impellor pushes the water in the casing into the delivery pipe and the water in the casing into the delivery pipe and the resulting vacuum is filled by water raising through the suction pipe. The pass valve is opened while closing the bypass valve , while stopping the pump delivery valve is closed first and the pump switched off. Maintenance may be

1) Preventive maintenance 2) Break down maintenance.

Preventive maintenance

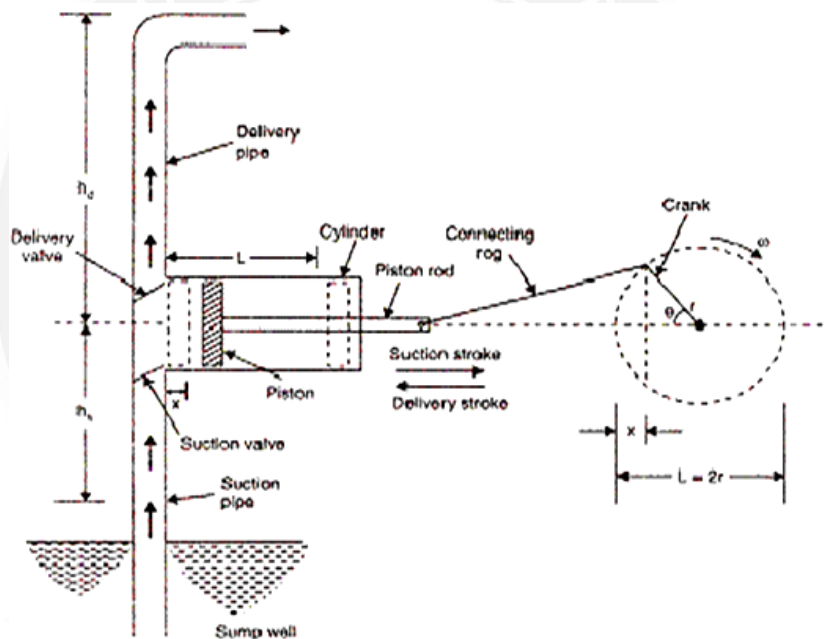
Locates the sources of trouble and keep the equipment in good operating condition. It involves oiling, greasing of stuffing boxes, observing the temperature of the motor and the pump bearings, checking the valves, strainer, electrical contacts, earthings etc.

Break down maintenance

Involves replacement of worn out components and testing . Sufficient amount of spares of impellers, bearings, slip-ring brushes, stater-contacts, gland packing, greases, oils, jointing materials, valves are to be kept in stock to attend to the emergencies. It is usual to have one stand by pump in addition to the required number of pumps.

RECIPROCATING PUMP

- A reciprocating pump consists of a plunger or a piston that moves forward and backward inside a cylinder with the help of a connecting rod and a crank. The crank is rotated by an external source of power.
- The cylinder is connected to the sump by a suction pipe and to the delivery tank by a delivery pipe.
- At the cylinder ends of these pipes, non-return valves are provided. A non-return valve allows the liquid to pass in only one direction.
- Through suction valve, liquid can only be admitted into the cylinder and through the delivery valve, liquid can only be discharged into the delivery pipe.



Working of Reciprocating pump

- When the piston moves from the left to the right, a suction pressure is produced in the cylinder. If the pump is started for the first time or after a long period, air from the suction pipe is sucked during the suction stroke, while the delivery valve is closed. Liquid rises into the suction pipe by a small height due to atmospheric pressure on the sump liquid.
- During the delivery stroke, air in the cylinder is pushed out into the delivery pipe by the thrust of the piston, while the suction valve is closed. When all the air from the suction pipe has been exhausted, the liquid from the sump is able to rise and enter the cylinder.
- During the delivery stroke it is displaced into the delivery pipe. Thus the liquid is delivered into the delivery tank intermittently, i.e. during the delivery stroke only.

Following are the main types of reciprocating pumps:

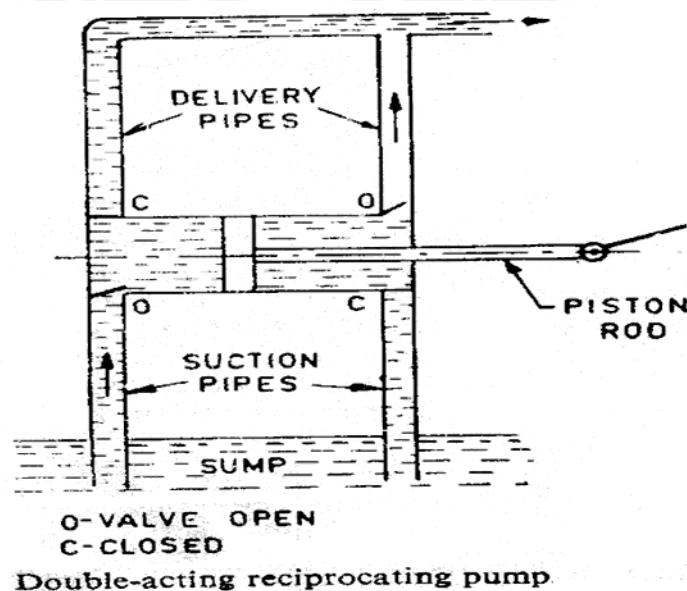
According to use of piston sides:

- Single acting Reciprocating Pump:

If there is only one suction and one delivery pipe and the liquid is filled only on one side of the piston, it is called a single-acting reciprocating pump.

- Double acting Reciprocating Pump:

A double-acting reciprocating pump has two suction and two delivery pipes, Liquid is receiving on both sides of the piston in the cylinder and is delivered into the respective delivery pipes.



AIR LIFT PUMP

Its main function is to lift water from a deep well or sump by using compressed air. By buoyancy the air, which has a lower density than the liquid, rises quickly. By fluid pressure, the liquid is taken in the ascendant air flow and moves in the same direction as the air.

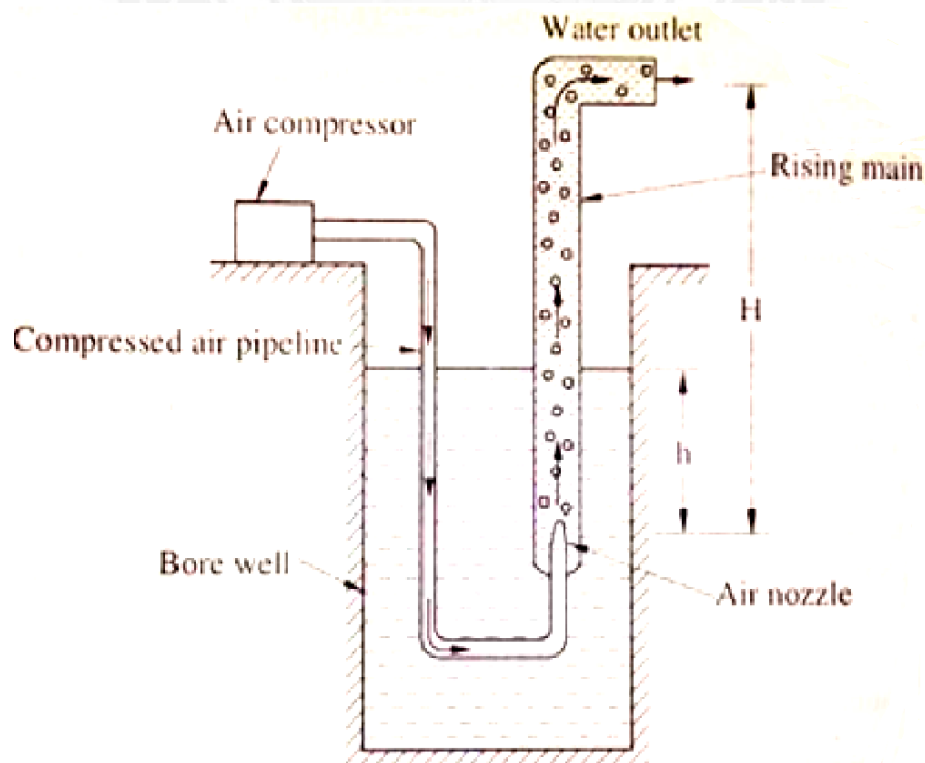
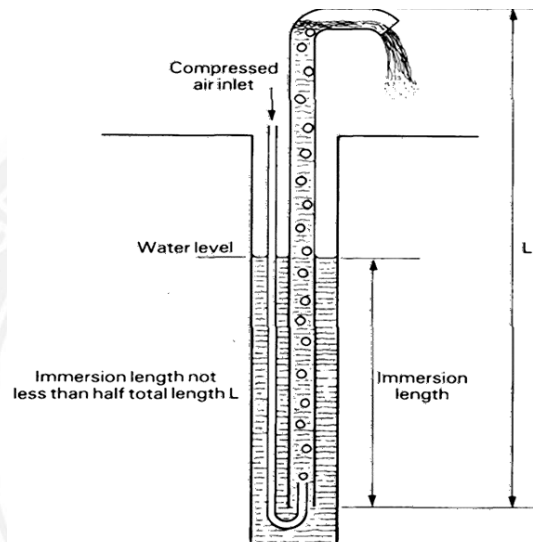
The main components are:

1. Air compressor to supply compress air
2. Air pipe fitted with one or more nozzles
3. Delivery pipe

The lower portion of delivery pipe dips into well and water gets discharge from the upper end of the delivery pipe.

Working:

The compressed air from compressor is bottom end of delivery pipe through air pipeline as a fine spray. Then, air gradually mixes with water in delivery pipe, so from that inside the delivery pipe density of air - water mixture decrease. As soon as pressure in delivery pipe of height H becomes less than the pressure due to the height of water column h in outlet of the delivery pipe. As per this reason rising begins in the delivery pipe above the level of water outside the delivery pipe. And other reason that the water in delivery pipe lighter than outside of the delivery pipe.



Advantages:

The air lift pump is not having any moving parts below water level and hence there are no chances of suspended solid particles damaging the pump.

This pump can raise water through a bore hole of given diameter than any other pump.

This pump is very suitable where decompressed air is available.

Disadvantages:

Conventional airlift pumps have a flow rate that is very limited.

Very low efficiency, only 20 to 40% energy available in form of useful water horse-power.

It cannot lift water when the level of water in deep well goes down below limit.

The suction is limited.

Application:

Airlift pumps are often used in deep dirty wells where sand would quickly abrade mechanical parts.

It is also sometimes used in part of the process on a wastewater treatment plant if a small head is required (typically around 1 foot head).

POINT TO BE OBSERVED IN SELECTING A PUMP

1. Capacity and efficiency - The pump should have the capacity required and optimum efficiency.
2. Lift - Suction head from the water level to the pump level
3. Head – It is also called delivery head. Generally the total head (suction and delivery head) should meet all possible situations with respect to the head.
4. Reliability – A reputed manufacture or similar make pump already in use may give the failure rate and types of troubles.
5. Initial cost: The cost of the pump and its installation cost should be minimum.
6. Power – Power requirements should be less for operation
7. Maintenance – Maintenance cost should be minimum. Availability of spares and cost of spares are to be ascertained.