SUBMERSIBLE PUMP

A submersible pump (or electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between the pump and the fluid surface. Submersible pumps push fluid to the surface, rather than jet pumps, which create a vacuum and rely upon atmospheric pressure. Submersibles use pressurized fluid from the surface to drive a hydraulic motor downhole, rather than an electric motor, and are used in heavy oil applications with heated water as the motive fluid.

Electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser, where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps. In the HSP, the motor is a hydraulic motor rather than an electrical motor, and may be closed cycle (keeping the power fluid separate from the produced fluid) or open cycle (mingling the power fluid with the produced fluid downhole, with surface separation).

The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump. Fluids enter the pump through an intake screen and are lifted by the pump stages. Other parts include the radial bearings (bushings) distributed along the length of the shaft, providing radial support to the pump shaft. An optional thrust bearing takes up part of the axial forces arising in the pump, but most of those forces are absorbed by the protector's thrust bearing.

There are also screw-type submersible pumps, there is a steel screw which is used as a working element in them. The screw allows the pump to work in water with a high sand content and other mechanical impurities.

jet pump

A jet pump is a device in which a fluid flows through a driving nozzle which converts the fluid pressure into a high-velocity jet stream; fluid is continuously entrained from the suction section of the jet pump by the jet stream emerging from the nozzle. In the mixing tube the entrained fluid acquires part of the energy of the motive fluid. In the diffuser the velocity of the mixture is reconverted to pressure

A basic jet pump is a very simple device without any moving parts that utilizes a source of higher pressure Figure 1: Basic jet pump geometry and notation. fluid to pump a stream of another fluid that may be the same or different or a multiphase mixture. The basic components are depicted in Figure 1. The high velocity stream of primary fluid produced by the nozzle entrains and thereby pumps the stream of secondary fluid by utilizing the Venturi effect. Since there are no moving parts, the jet pump is very reliable and needs little maintenance. Moreover, it can be fitted into confined spaces where access is very difficult if not impossible. They are also useful for pumping heavy multiphase fluid mixtures such as occur in oil wells. As a result jet pumps have been used in a variety of technical contexts including inside nuclear reactor vessels and submerged in oil wells. Figure 2 exemplifies the deployment in an oil well..

AIR LIFT PUMP

An airlift pump is a pump that has low suction and moderate discharge of liquid and entrained solids. The pump injects compressed air at the bottom of the discharge pipe which is immersed in the liquid. The compressed air mixes with the liquid causing the air-water mixture to be less dense than the rest of the liquid around it and therefore is displaced upwards through the discharge pipe by the surrounding liquid of higher density. Solids may be entrained in the flow and if small enough to fit through the pipe, will be discharged with the rest of the flow at a shallower depth or above the surface. Airlift pumps are widely used in aquaculture to pump, circulate and aerate water in closed, recirculating systems and ponds

Principle

The only energy required is provided by compressed air. This air is usually compressed by a compressor or a blower. The air is injected in the lower part of a pipe that transports a liquid. 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 calculation of the volume flow of the liquid is possible thanks to the physics of two-phase flow.

Advantages and disadvantages

Advantages

The pump is very reliable. The very simple principle is a clear advantage. Only air with a higher pressure than the liquid is required.

The liquid is not in contact with any mechanical elements. Therefore, neither the pump can be abraded (which is important for sandwater wells), nor the contents in the pipe (which is important for archeological research in the sea).

Act as a water aerator and can in some configurations lift stagnant bottom water to the surface (of water tanks).

Since there are no restrictive pump parts, solids up to 70% of the pipe diameter can be reliably pumped.

Disadvantages

while in some specific cases the operational cost can be manageable, most of the time the quantity of compressed air, and thus the energy required, is high compared to the liquid flow produced.

Conventional airlift pumps have a flow rate that is very limited. The pump is either on or off. It is very difficult to get a wide range of proportional flow control by varying the volume of compressed air.

the suction is limited.

this pumping system is suitable only if the head is relatively low. If one wants to obtain a high head, one has to choose a conventional pumping system.

because of the principle, air (oxygen) dissolves in the liquid. In certain cases, this can be problematic, as, for example, in a waste water treatment plant, before an anaerobic basin.

RECIPROCATING PUMP

If the mechanical energy is converted into hydraulic energy (or pressure energy) by sucking the liquid into a cylinder in which a piston is reciprocating (moving backwards and forwards), which exerts the thrust on the liquid and increases its hydraulic energy (pressure energy), the pump is known as reciprocating pump

Working principle

If the mechanical energy is converted into hydraulic energy (or pressure energy) by sucking the liquid into a cylinder in which a piston is reciprocating (moving backwards and forwards), which exerts the thrust on the liquid and increases its hydraulic energy (pressure energy), the pump is known as reciprocating pump

Main ports of a reciprocating pump

1.A cylinder with a piston, piston rod, connecting rod and a crank,

2. Suction pipe

3.Delivery pipe,

4. Suction valve and

5.Delivery valve.

Slip of Reciprocating Pump

Slip of a reciprocating pump is defined as the difference between the theoretical discharge and the actual discharge of the pump.

Characteristic Curves Of Reciprocatring Pumps

1.According to the water being on contact with one side or both sides of the piston

(i.) Single acting pump (ii.) Double-acting pump

2.According to the number of cylinders provided

(i.) Single acting pump

(ii.) Double-acting pump

(iii.) Triple-acting pump

Rotary Pumps

The rotary pump is g ood for handling viscous liquids, nut because of the close tolerances needed, it can not be manufactured large enough to compete with centrifugal pumps for coping with very high flow rates.

Rotary pumps are available in a variety of configurations.

- Double lobe pump
- Trible lobe pumps
- Gear pump
- Gear Pumps
- Spur Gear or Extern al-gear pump

Reciprocating pumps Vs centrifugal pumps

The advantages of reciprocating pumps in general over centrifugal pumps may be summarized as follows:

1. They can be designed for higher heads than centrifugal pumps.
2. They are not subject to air binding, and the suction may be under a pressure less than atmospheric without necessitating special devices for priming.
3. They are more flexible in operation than centrifugal pumps.
4. They operate at nearly constant efficiency over a wide range of flow rates.

External-gear pump (called as gear pump) consists essen tially of two intermeshing gears which are identical and which are surrounded by a closely fitting casing. One of the gears is driven directly by the prime mover while the other is allowed to rotate

freely. The fluid enters the spaces between the teeth and the casing and moves with the tee th along the outer periphery until it reaches the outlet where it is expelled from the pump.

External-gear p umps are used for flow rates up to about 400 m3/hr working against pressures as high as 170 atm. The volumetric efficiency of gear pumps is in the order of 96 percen t at pressures of about 40 atm but decreases a s the pressure rises.

SLUDGE PUMP

A pump used to process and move waste fluids with high solids content. Sludge pumps require a high-powered mechanism to move fluids that are often very heavy and sometimes viscous and full of volatile or corrosive content.

A sludge pump is a type of centrifugal pump designed to move liquids containing solid particles, also known as sludges. Sludge pumps are typically used in wastewater treatment plants and facilities and can handle thick liquids with high solids content. They can move thick sludges or slurries from one place to another with the help of their powerful motor and impeller. Sludge pumps have wide applications in the industrial sector, such as mining, paper mills, steel industries, and food processing plants for transferring waste materials like mud or sewage.

Basic Components of Sludge Pump

A sludge pump is a device that transfers and moves viscous, semi-solid materials from one location to another. It consists of a motor, impeller, and a volute chamber which helps create suction for the material to be pumped. Sludge pumps can handle a variety of materials, including sewage and wastewater, manure, industrial waste

products, and slurries. Sludge pumps can be powered by electricity, gasoline, diesel, or hydraulic power sources.

The motor that powers the sludge pump is typically an asynchronous induction motor. This type of motor produces a rotating magnetic field within the armature, which drives the impeller. The impeller is typically a centrifugal pump designed to create suction in the volute chamber and draw material into the pump. The impeller then pushes the material through the motor and out of the discharge port.

Sludge Pump Work

A sludge pump is an industrial pumping system that moves waste materials and other liquids through a pipe. It is designed to move thick, viscous fluids that would normally not flow easily, such as those found in sewage treatment plants or the pulp and paper industries. The pumps contain powerful impellers that spin high speeds and create enough pressure to force the fluid through the pipes. This allows them to transfer large amounts of material quickly and efficiently while minimizing clogs or damage caused by debris buildup in the line. Sludge pumps come in various sizes, from small portable units to large industrial-grade systems.

Types of Sludge Pump

Sludge pumps are an important tool for wastewater treatment and come in various types.

Submersible Sludge Pump

Submersible sludge pumps are designed to be submerged in the liquid being pumped and are usually used in larger-scale operations; these pumps typically have a great deal of power, allowing them to pump large volumes of liquid quickly and efficiently.

Immersible Sludge Pump

Immersible sludge pumps are designed to be partially submerged in the liquid and are often used in smaller-scale operations where a larger pump is unnecessary.

Centrifugal Sludge Pump

Centrifugal sludge pumps are designed to use centrifugal force to move liquids through a pipe or tube. These pumps can be highly efficient and require less maintenance than other sludge pumps.

Finally, air-operated sludge pumps are designed to use compressed air to move liquids through a pipe or tube. They can be used in various applications and require little maintenance or upkeep.