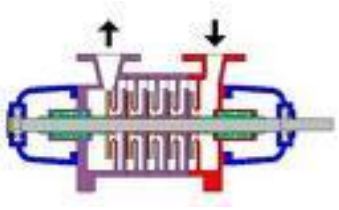
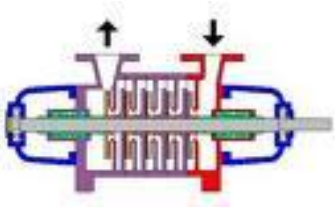
Multistage Centrifugal Pumps

A centrifugal pump containing two or more impellers is called a multistage centrifugal pump. The impellers may be mounted on the same shaft or on different shafts.If we need higher pressure at the outlet we can connect impellers in series.If we need a higher flow output we can connect impellers in parallel.All energy added to the fluid comes from the power of the electric or other motor force driving the impeller.





Pump Efficiency

Pump efficiency may be defined as the ratio of power added to the fluid in relation to the power required to drive the pump. Efficiency is never a single fixed value for any given centrifugal pump, it is a function of discharge and therefore also the operating head. The efficiency tends to increase with flow rate up to a point midway through the operating range (peak efficiency) and then declines as flow rates rise further, the resulting curve is almost parabolic in shape.

It is important that the system is designed in order that the pump will be operating at or close to its peak efficiency. This is particularly difficult for those systems with time variant flow rates, such difficulties may be overcome through the use of variable frequency drives to adjust the speed of the electric drive motor. Unless carefully designed, installed and monitored, pumps will be, or will become inefficient, wasting a lot of energy. Efficiency will decline over time due to wear of the impeller and hence should be regularly tested to ensure they are operating normally.

Single Stage Radial Flow Centrifugal Pump

Energy usage

The energy usage in a pumping installation is determined by the flow required, the height lifted and the length and friction characteristics of the pipeline. The power required to drive a pump (P_i), is defined simply using SI units by:

$$\boldsymbol{P_i} = \rho\, g\, H\, Q / \eta$$

Where:

P_i is the input power required (W)

ρ is the fluid density (kg/m^3)

g is the standard acceleration of gravity (9.80665 m/s^2)

H is the energy Head added to the flow (m)

Q is the flow rate (m^3/s)

η is the efficiency of the pump plant as a decimal

The head added by the pump (H) is a sum of the static lift, the head loss due to friction and any losses due to valves or pipe bends all expressed in metres of fluid. Power is more commonly expressed as kilowatts (10^3 W) or horsepower (multiply kilowatts by 0.746). The value for the pump efficiency η may be stated for the pump itself or as a combined efficiency of the pump and motor system.

The **energy usage** is determined by multiplying the power requirement by the length of time the pump is operating.

Source : http://nprcet.org/e%20content/mech/FMM.pdf