

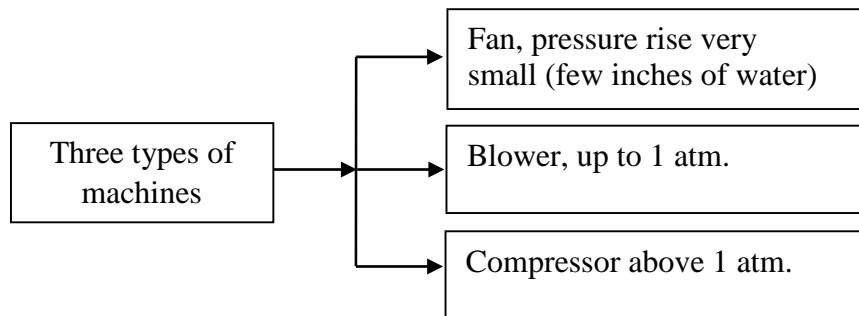
Lecture-Eleven

Introduction to Turbomachinery

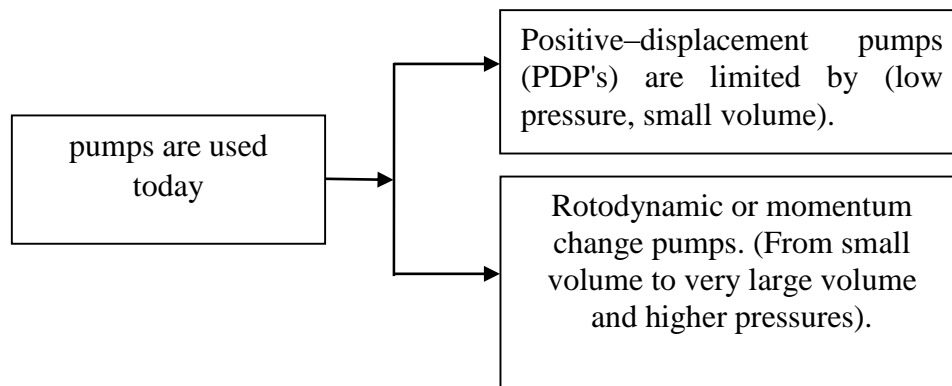
1- Introduction.

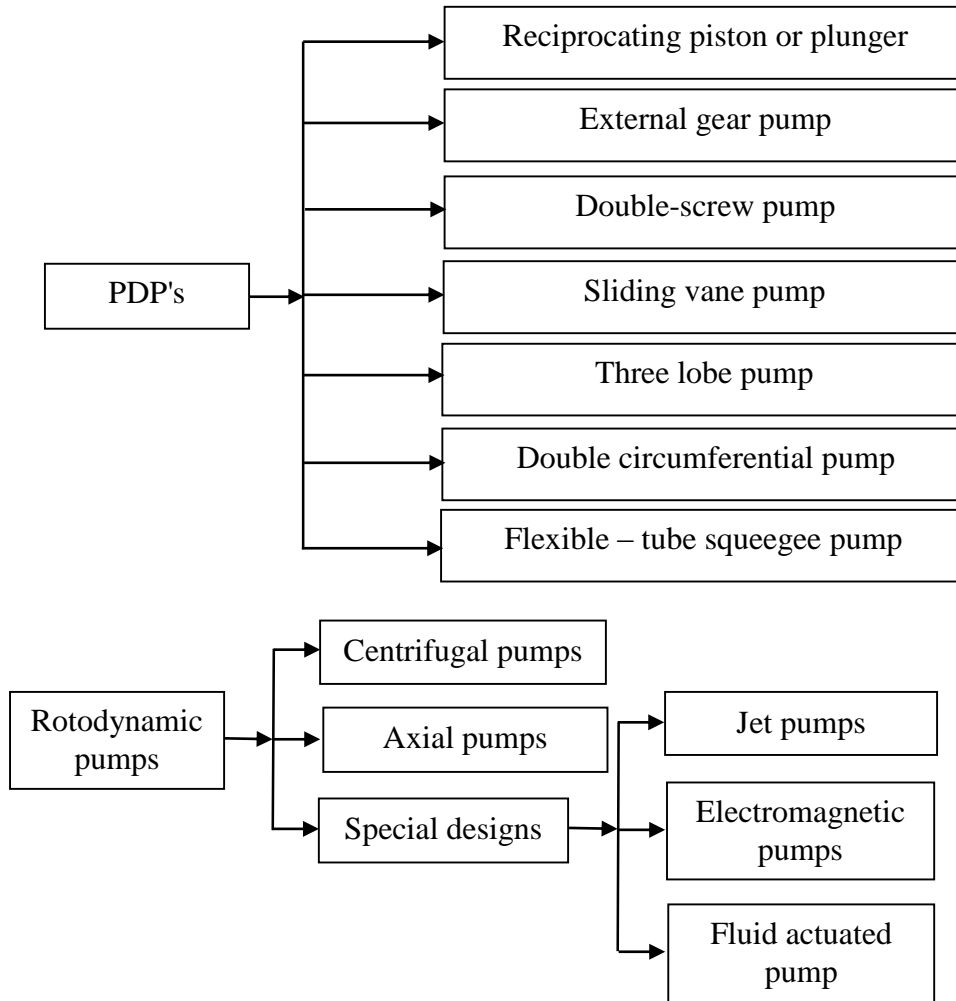
The pump family is a machine which is designed to add energy to the fluid, but the turbines family which extract energy from the fluid. Both types are usually connected to a rotating shaft, hence this is the turbomachinery.

Machine which deliver liquid are called pump, if machine delivers gases can be classified into the categories as follows

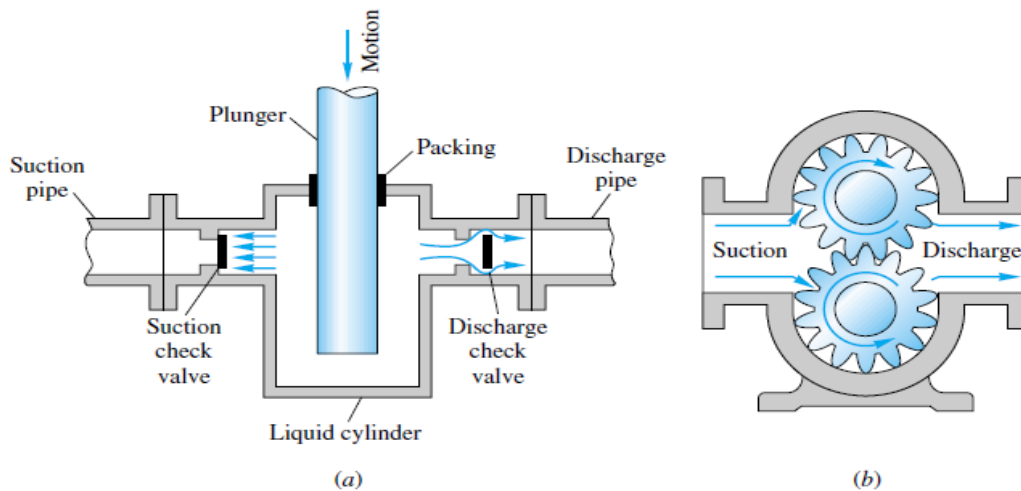


If machine delivers liquid can be classified into two type as follows





All types of pumps can be shown in Fig. (1), but this chapter is concerned with the centrifugal pump type, which are explained in detail in the next sections.



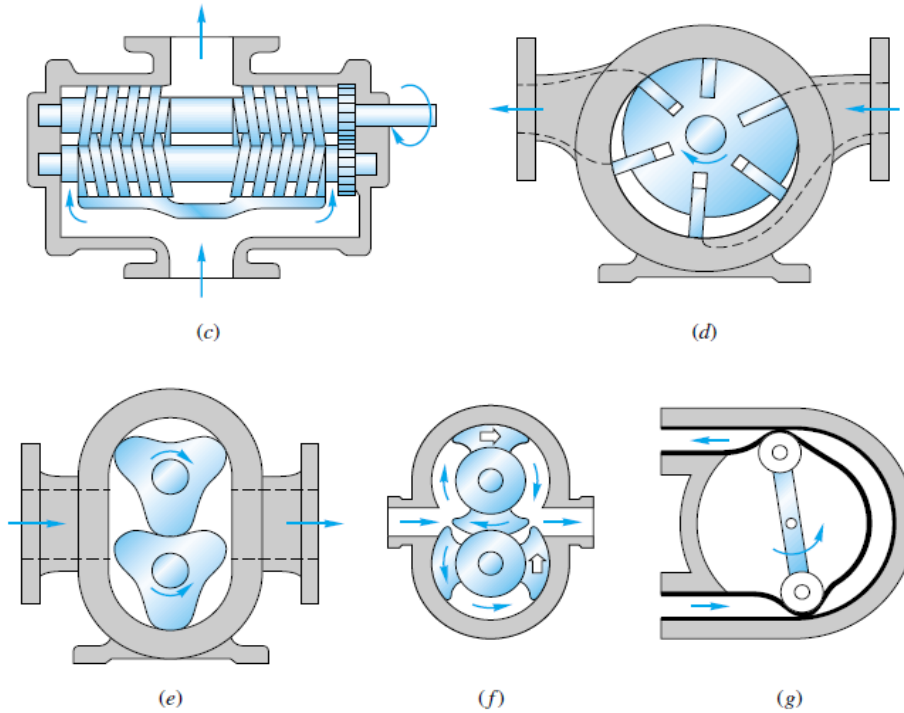
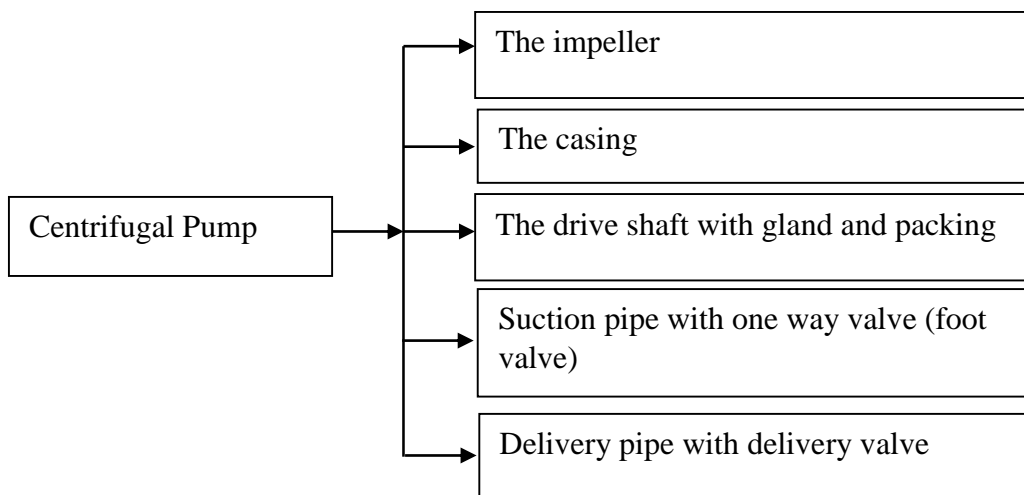


Figure 1: Schematic design of positive-displacement pumps: (a) reciprocating piston or plunger, (b) external gear pump, (c) double-screw pump, (d) sliding vane, (e) three lobe pump, (f) double circumferential piston, (g) flexible-tube squeegee.

2- Centrifugal Pump.

The main components of centrifugal pumps are



The liquid enters the eye of the impeller axially due to the suction created by the impeller motion as shown in Fig (2). The impeller blades guide the fluid and impart momentum to the fluid, which increase the total head (or pressure) of the fluid. The casing can be simple volute type or diffuser can be used as desired as in Fig. (3).

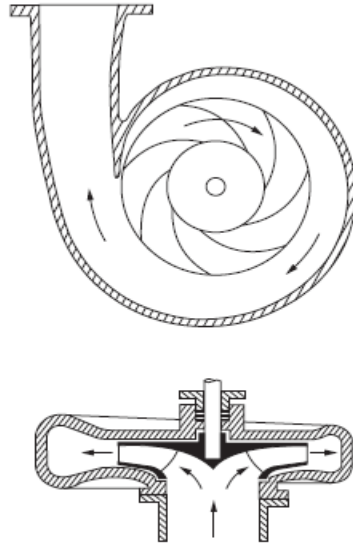


Figure 2: Volute type centrifugal pump.

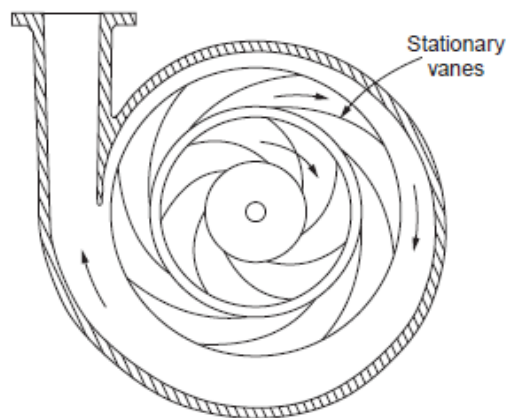


Figure 3: Diffuser pump.

The volute is a spiral casing of gradually increasing cross section. A part of the kinetic energy in the fluid is converted to pressure in the casing.

I- Impeller.

The impeller consists of two disc plates with blades mounted perpendicularly on its surface in between. The blades of the rotating impeller transfer energy to the fluid there by increasing pressure and velocity. The fluid enters the impeller eye through fluid sucking then flow through the impeller channels formed by the blades between hub plate and shroud plate. Fig.(4) shows the impeller components and the flow direction relatively to the impeller.

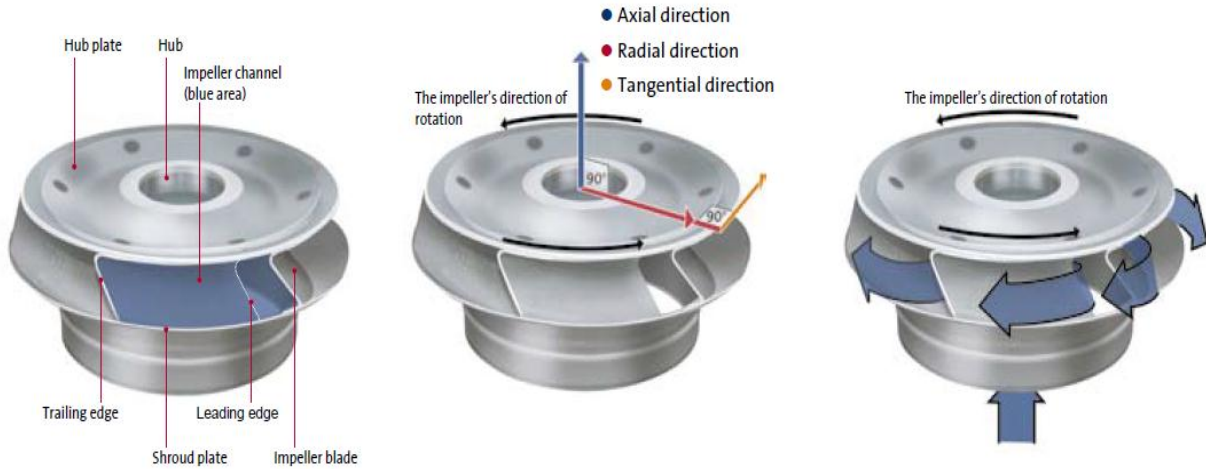


Figure 4: The impeller components and the flow directions.

The blades may be of three different orientations

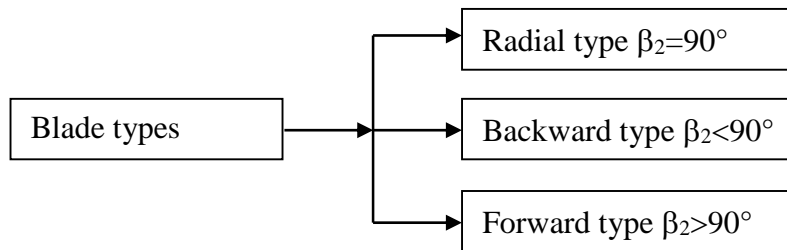


Fig. (5) Shows the blade type orientations can be used.

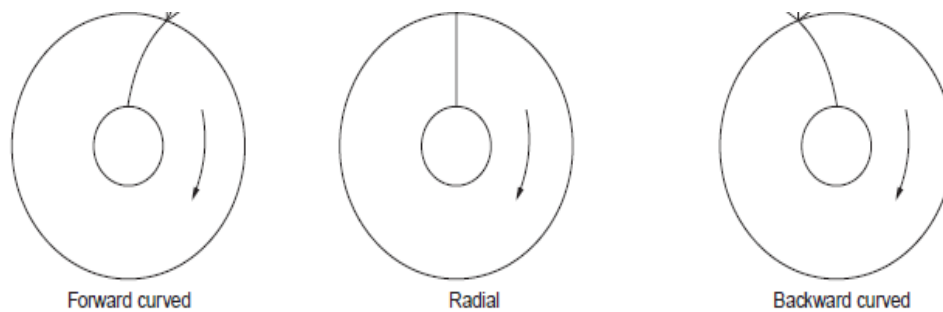
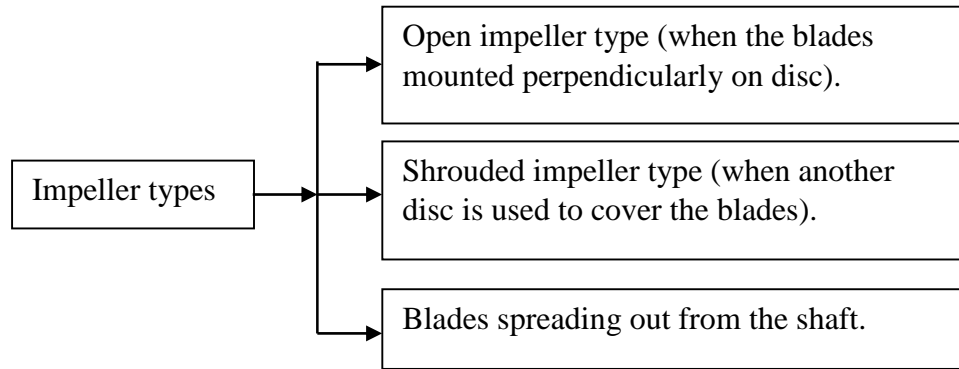


Figure 5: Different blade arrangements.

Also the impeller can be classified as follows,



II- Classification of centrifugal pump.

Centrifugal pump may be classified in several ways as follows,

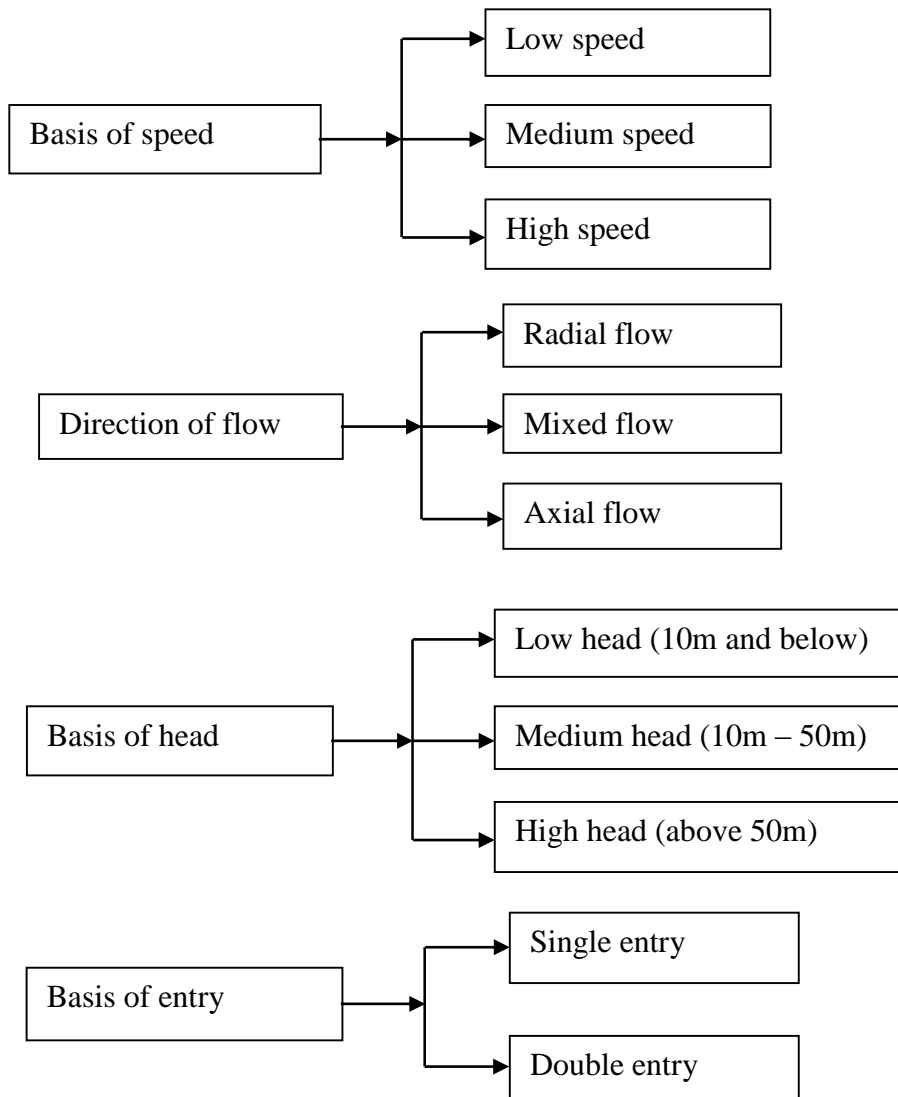


Fig. (6) Shows the single and double entry of centrifugal pump.

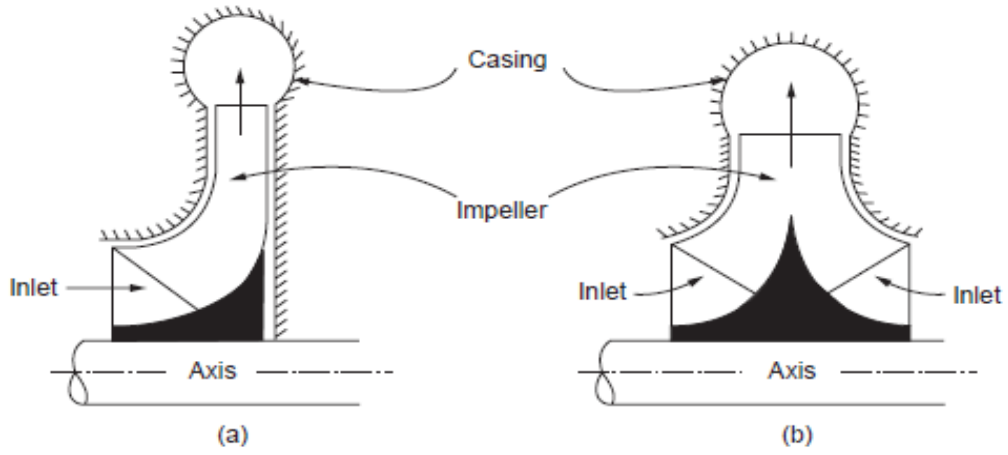


Figure 6: (a) Single entry, (b) Double entry pumps .