Energy and Environmental Engineering
CEME 102

Dr. Kamlesh Sorate

Assistant Professor, MED

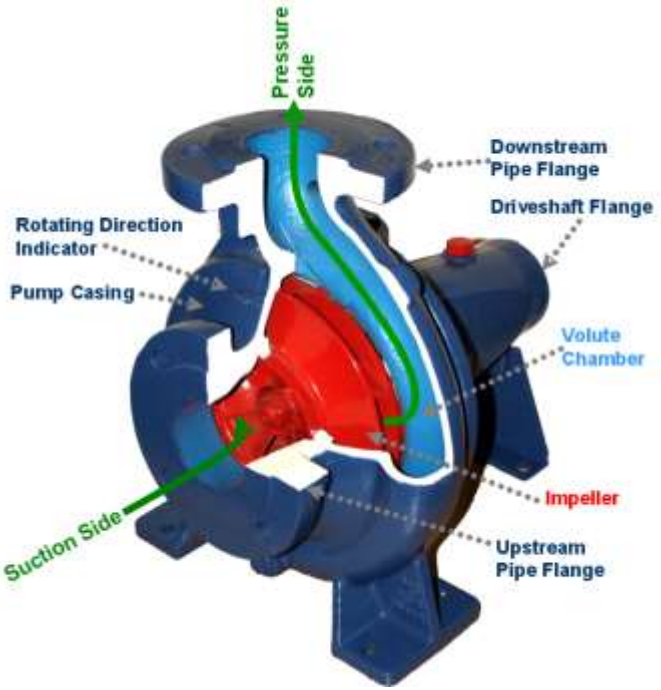
SVNIT Surat

Content

- Basic Terms/Terminology
- Definition
- Types
- Principle of operation
- Major components and their function

Basic Terms

- Volumetric Flow rate
- Suction head
- Discharge head
- Pump Speed
- Power



Pump

- The pump definition is, it is a typical mechanical apparatus, and the main function of this device is to force a gas otherwise liquid to move ahead in a pipeline.
- These are also used for compressing gases otherwise fill air into tires.
- Pumps use mechanical energy to draw the liquid inside and to discharge them throughout the exit by pressurizing them.
- The energy sources of pumps mainly include wind power, manual operation, electricity & engines.

Working Principle

- The working principle of a pump is, it enhances the fluid’s pressure to provide the driving strength which is necessary for flow.
- Usually, the pressure filter supply pump is a centrifugal type pump, and the working principle is that slurry penetrates the pump during the rotating impeller’s eye which informs a circular motion

Specification of Pumps

- These are normally rated with volumetric flow rate, horsepower, opening pressure within meters of the head, inlet suction in meters of the head. Here, the head can be simplified because the no. of feet can move up otherwise lesser a column of water at atmospheric force.
- From an early design end of observation, engineers frequently employ a quantity named the exact speed to recognize the most appropriate pump for an exact flow rate combination as well as the head.

Classification of Pump

Pump can be classified into two categories:

1. Positive displacement pumps and

https://www.youtube.com/watch?v=fHLkZV2_Cb4

1. Non-positive displacement pumps.

https://www.youtube.com/watch?v=BaEHVpKc-1Q

POSITIVE DISPLACEMENT PUMP

- Positive-displacement pump can operate by forcing a fixed volume of fluid from inlet pressure section of the pump into the discharge zone of the pump. It can be classified into two types:
- Rotary-type positive displacement pump: Example-Internal gear pump & Screw pump
- Reciprocating-type positive displacement pump: Example-Piston pump & Diaphragm Pump

NON - POSITIVE DISPLACEMENT PUMP

- With this pump, the volume of the liquid delivered for each cycle depends on the resistance offered to flow.
- A pump produces a force on the liquid that is constant for each particular speed of the pump.
- Resistance in a discharge line produces a force in the opposite direction.
- When these forces are equal, a liquid is in a state of equilibrium and does not flow.
- If the outlet of a non positive-displacement pump is completely closed, the discharge pressure will rise to maximum for a pump operating at a maximum speed.

Example of it is centrifugal pump.

- A centrifugal pump is a rotodynamic pump that uses a rotating impeller to increase the pressure and flow rate of a fluid.
- Centrifugal pump are most common type of pump used to move liquids through a piping system.
- The fluid enters the pump impeller along or near to the rotating axis and it is accelerated by the impeller, flowing radially outward or axially into a diffuser or volute chamber, from where it exits into the downstream piping system.
- Centrifugal pump are typically used for large discharge through smaller heads.

TYPES OF ROTODYNAMIC FLOW PUMP

- Radial, mixed and axial-flow pump belongs to a class of machines known as rotodynamic.
- As a class, are suitable for most of the liquid pumping applications but notable exceptions include metering, handling of highly viscous liquids and very high pressure or low flow rate requirement.
- For these applications normally, positive displacement pumps are used.

Types of Flow in the Pump

- **Axial-flow pump** differ from radial-flow pump in that the fluid enters and exits along the same direction parallel to the rotating shaft. The fluid is not accelerated but instead "lifted" by the action of the impeller. Axial-flow pump operate at lower pressure and higher flow rates than radial flow pump.
- **Mixed-flow pump** function as a compromise between radial and axial-flow pump. The fluid experiences both radial acceleration and lift and exits the impeller somewhere between 0 and 90 degrees from the axial direction. As a consequence mixed-flow pump operate at higher pressures than axial-flow pump while delivering higher discharge than radial-flow pump.
- **Radial-Flow Pump** -The fluid that enters along the axial plane is accelerated by the impeller and exits at right angles to the shaft (radially). Radial-flow pump operate at higher pressures and lower flow rates than axial and mixed-flow pumps.

Characteristics of positive displacement and non-positive displacement pump

S.No.	Positive- displacement pump	Non positive- displacement pump
1.	For every stroke pumping chamber opens to an outlet port.	It provides a smooth and continuous flow.
2.	Pressure affects the output only to extent that it increases internal leakage.	Pressure can reduce the delivery due to high pressure the liquid simply recirculates inside the pump.
3.	These are self-priming when started properly.	It cannot create a vacuum sufficient for self-priming.

SUBMERSIBLE PUMP

- A submersible pump is a device which has a hermetically sealed motor close-coupled to the pump body. 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 pump are more efficient than jet pumps.

AIR CONDITIONING SYSTEMS

- What is AC
- Unit?
- Classification
- Construction details of commonly used AC
- Properties of Air Like Humidity, Relative Humidity, DBT, WBT etc
- Introduction to psycrometry