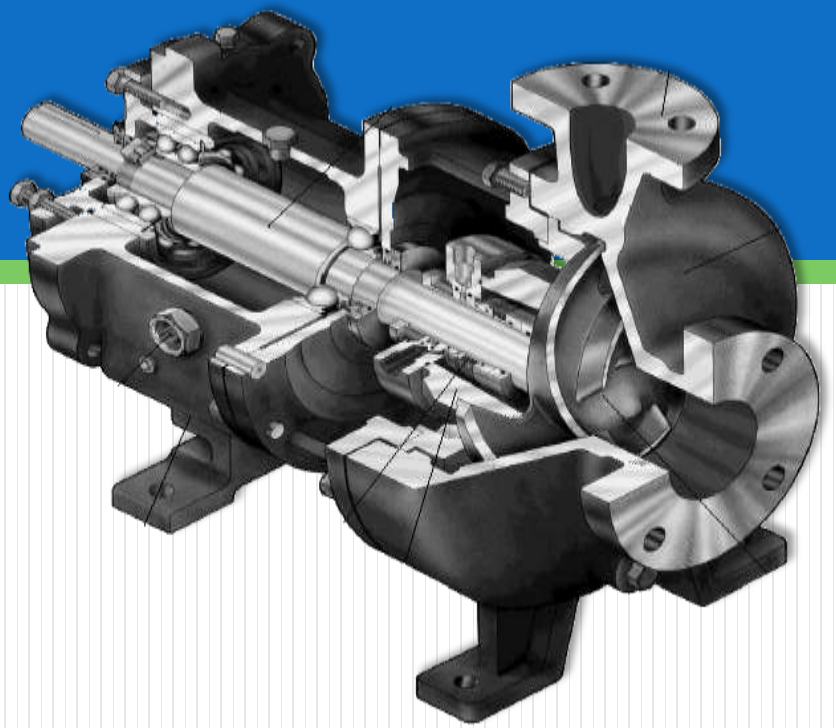
PUMPS



PRESENTED BY :

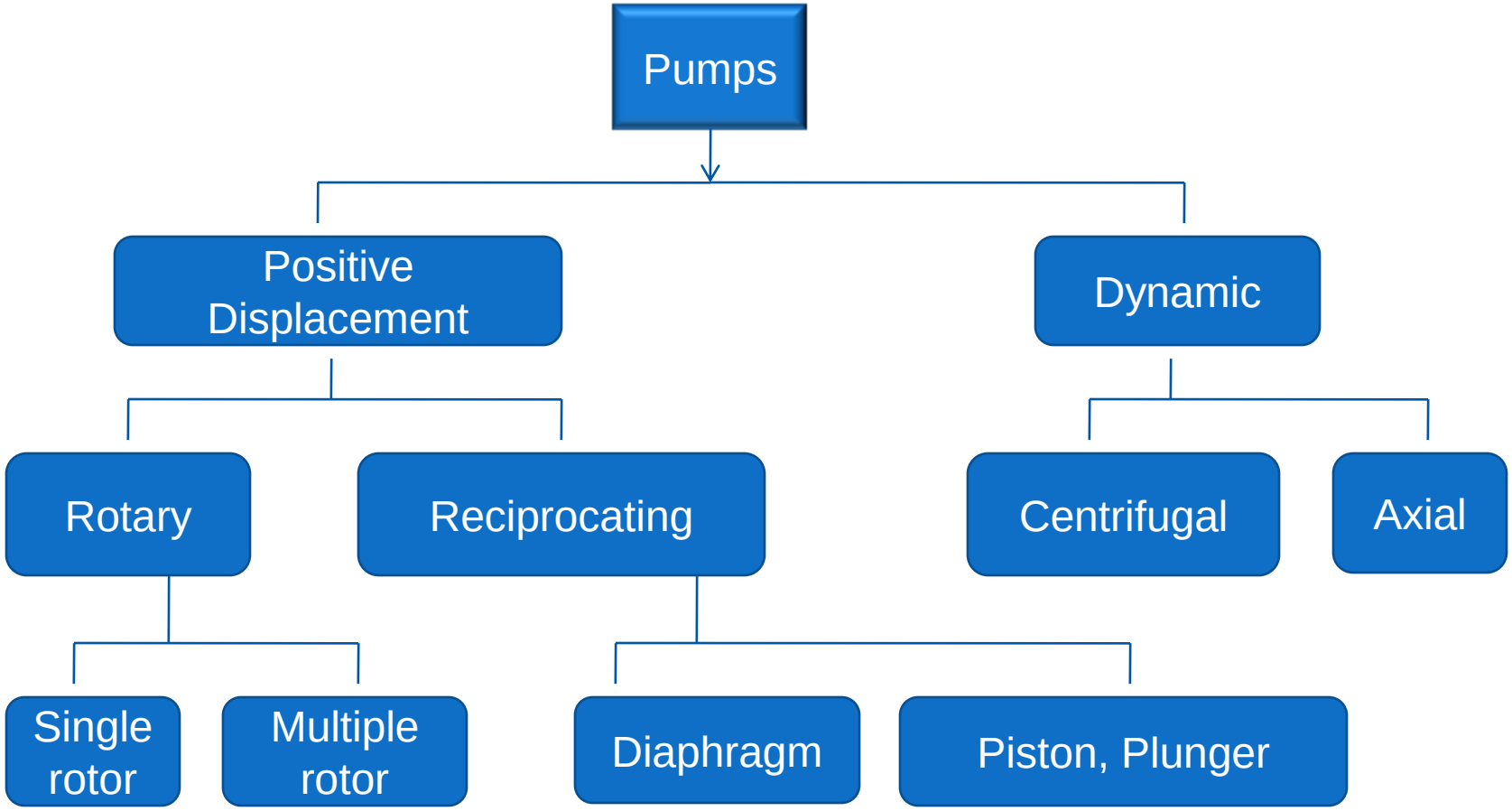
TAMANASH PRAMANICK

❑Pump

A **pump** is a device used to move fluids, such as liquids, gases or slurries. It increases the mechanical energy of the fluid. The additional energy can be used to increase -

- Velocity (flow rate)
- Pressure
- Elevation

❑Pump Classification



❑Positive Displacement Pump

Positive Displacement pumps apply pressure directly to the liquid by a reciprocating piston, or by rotating members.

Uses:

1.can handle shear sensitive liquid.

2.Use for high pressure application

3.Use for variable viscosity applications.

Types-

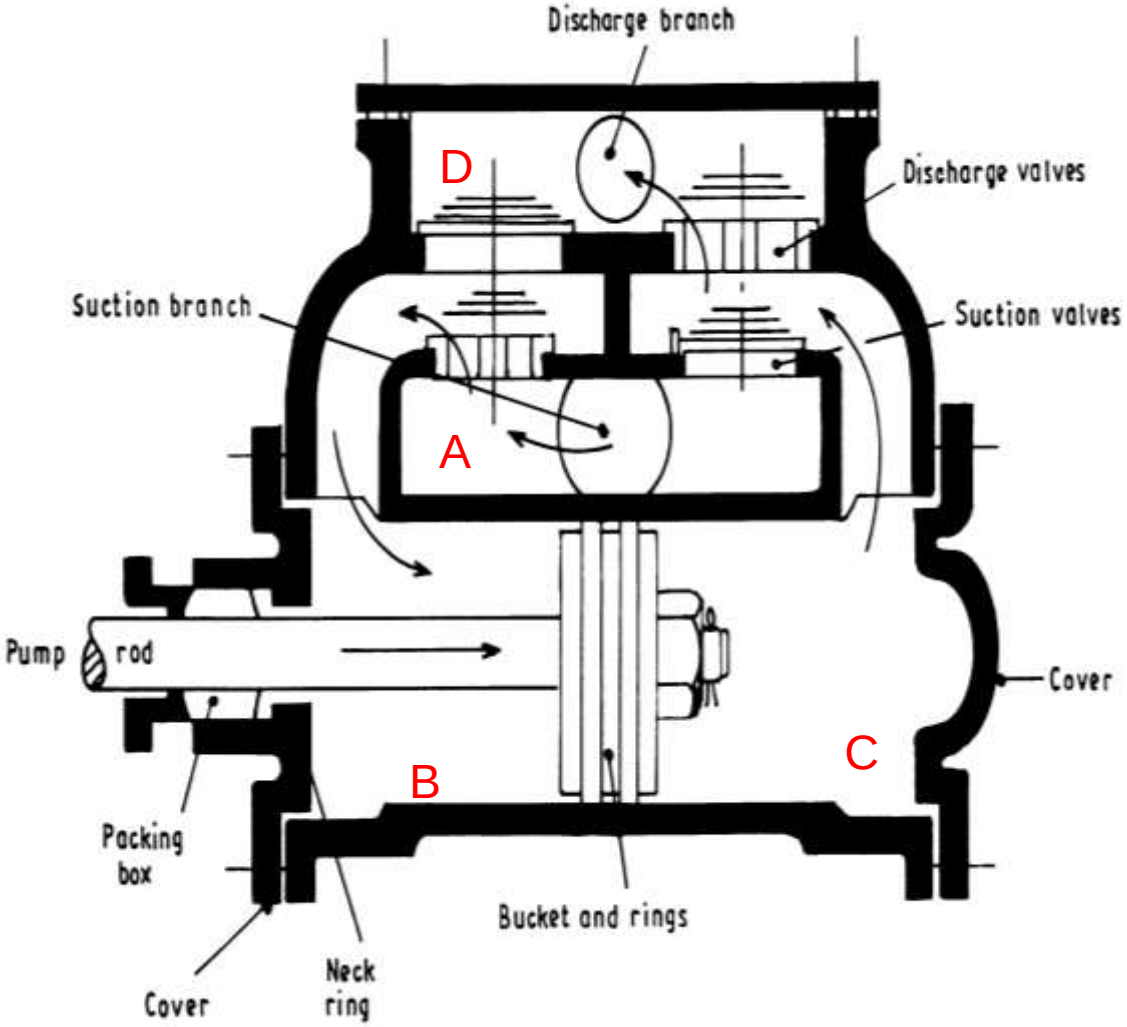
- **Reciprocating pump**
- **Rotary pump**

➢Reciprocating Pump

In Reciprocating pumps, the chamber is a stationary cylinder that contains a piston or plunger.

Types-

- **Piston Pump**
- **Plunger Pump**
- **Diaphragm Pump**



❖Piston Pump

USE=

1.transmission of fluids or gases under pressure.

2.Power consumption is low.

3.Ensure maximum safety.

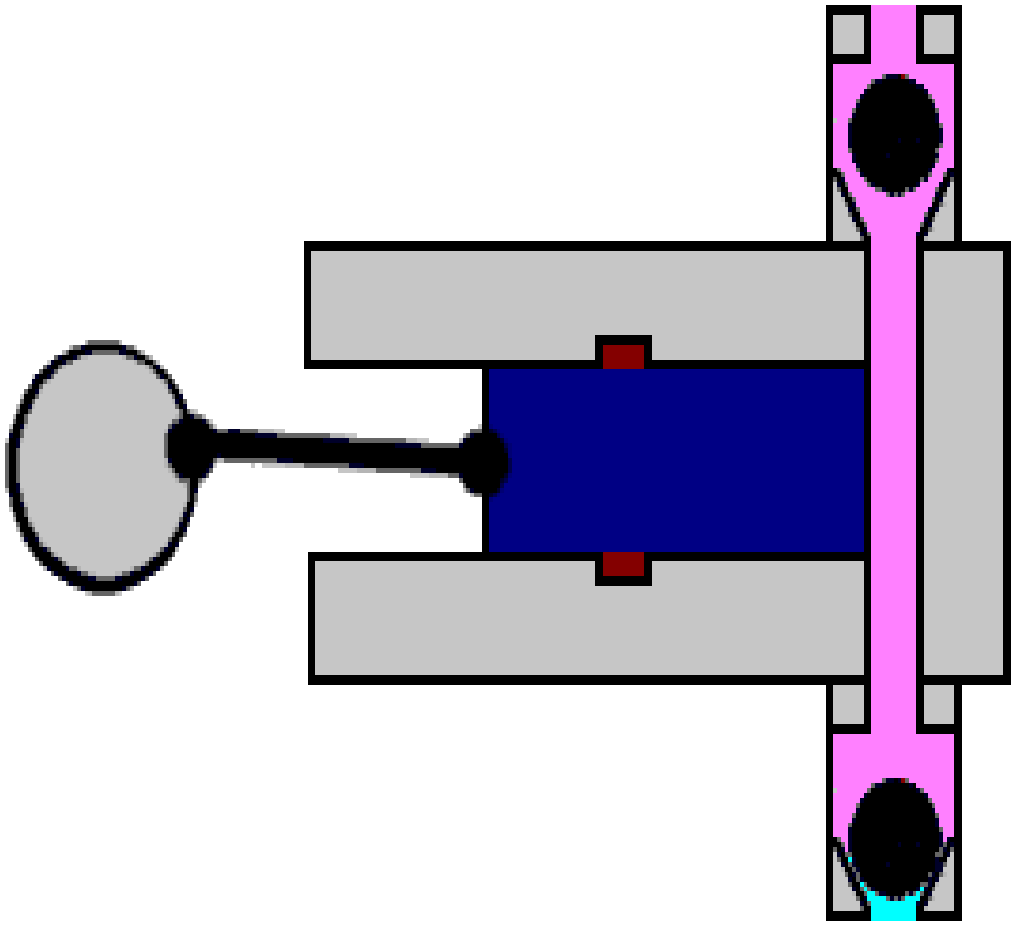
Piston Pump (double acting)

❖Plunger pump

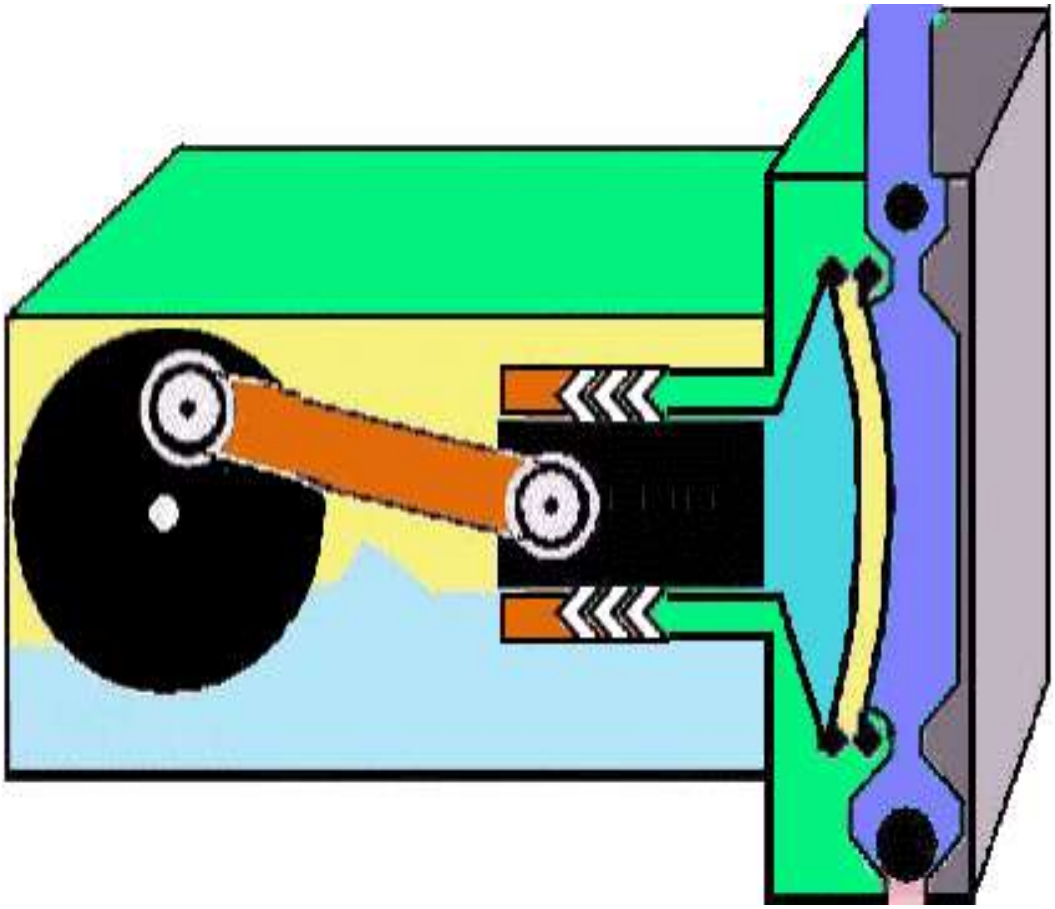
1.Have high efficiency.

2.Capable of developing very high pressures.

3.Low and easy maintenance



Plunger pump (single acting)



❖Diaphragm Pump

1.flexible diaphragm is used (rubber, thermo-plastic, metal).

2. Can be used to make artificial hearts.

3. Can handle highly viscous liquids.

4.Can handle toxic or corrosive liquids.

5. 97% efficient.

Diaphragm Pump (single acting)

➢Rotary Pump

In Rotary pumps, the chamber moves from inlet to discharge and back to the inlet. A wide variety of rotary pumps are available like

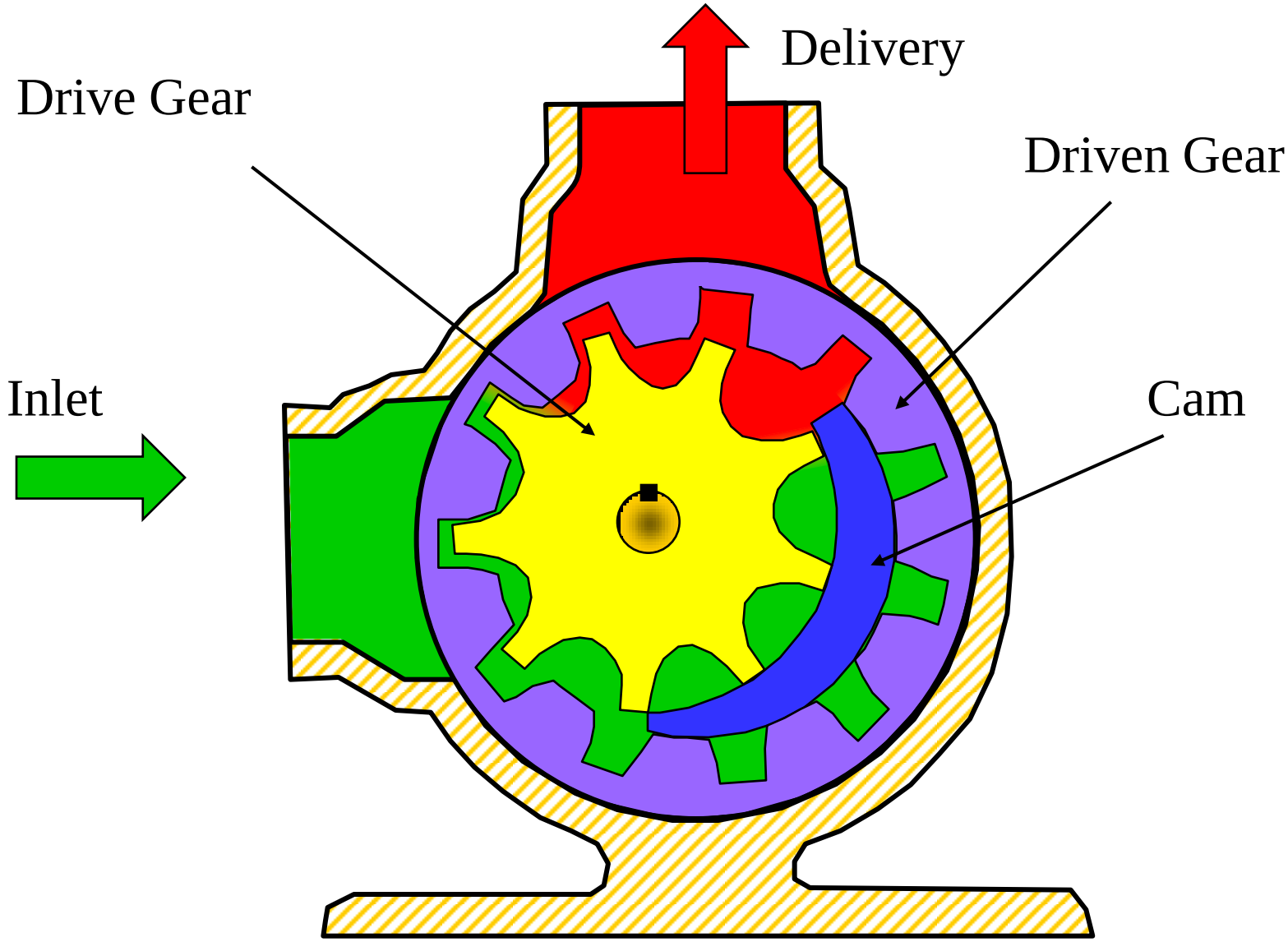
gear pumps, lobe pumps, screw pumps, cam pumps, vane pumps.

- Most popular: gear pumps
- Relatively constant output

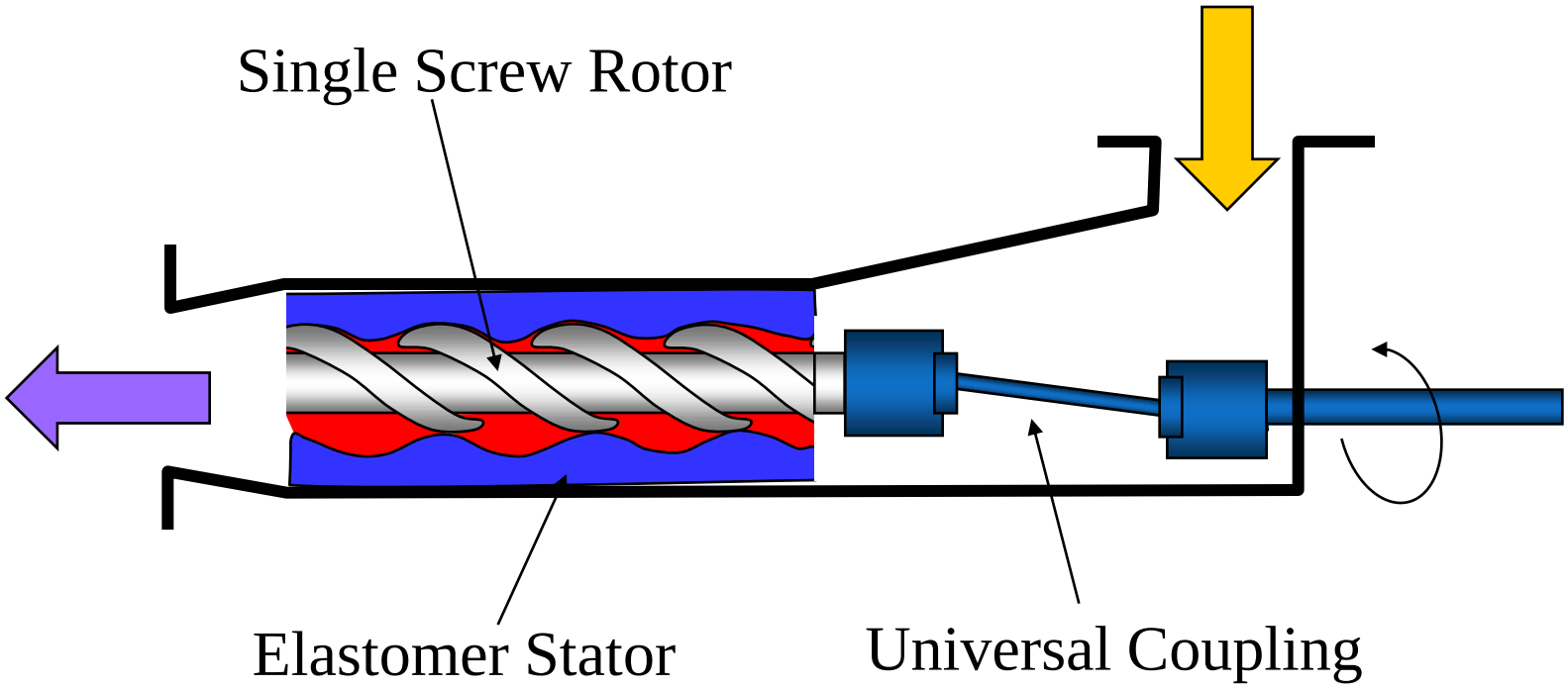
Types-

- **Single Rotor**
- **Multiple Rotor**

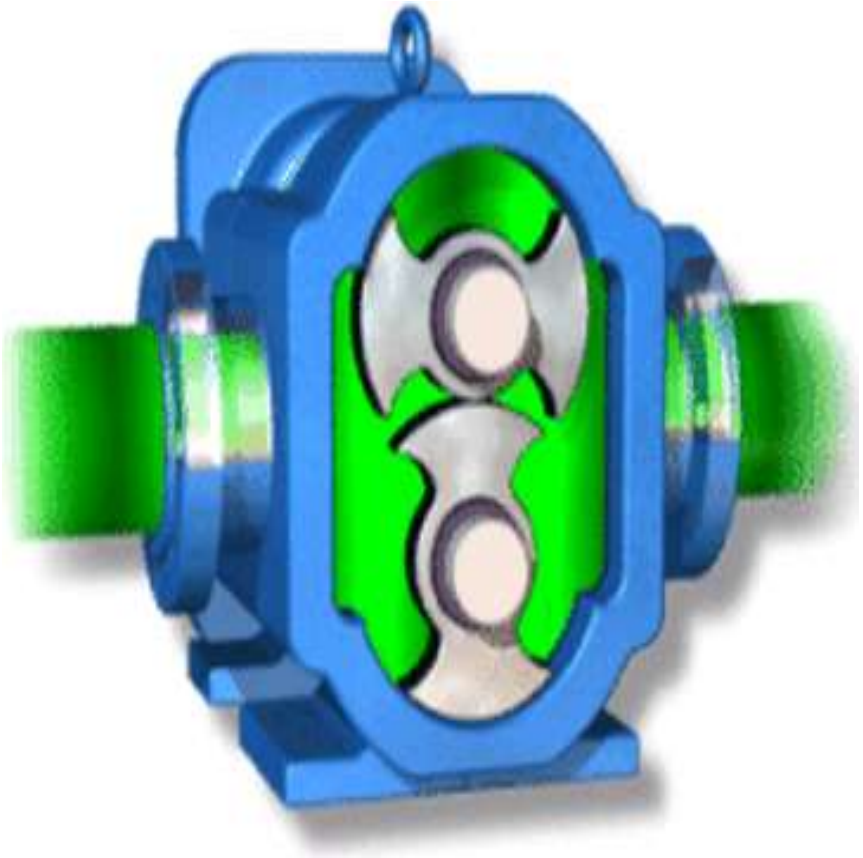
Gear Pump

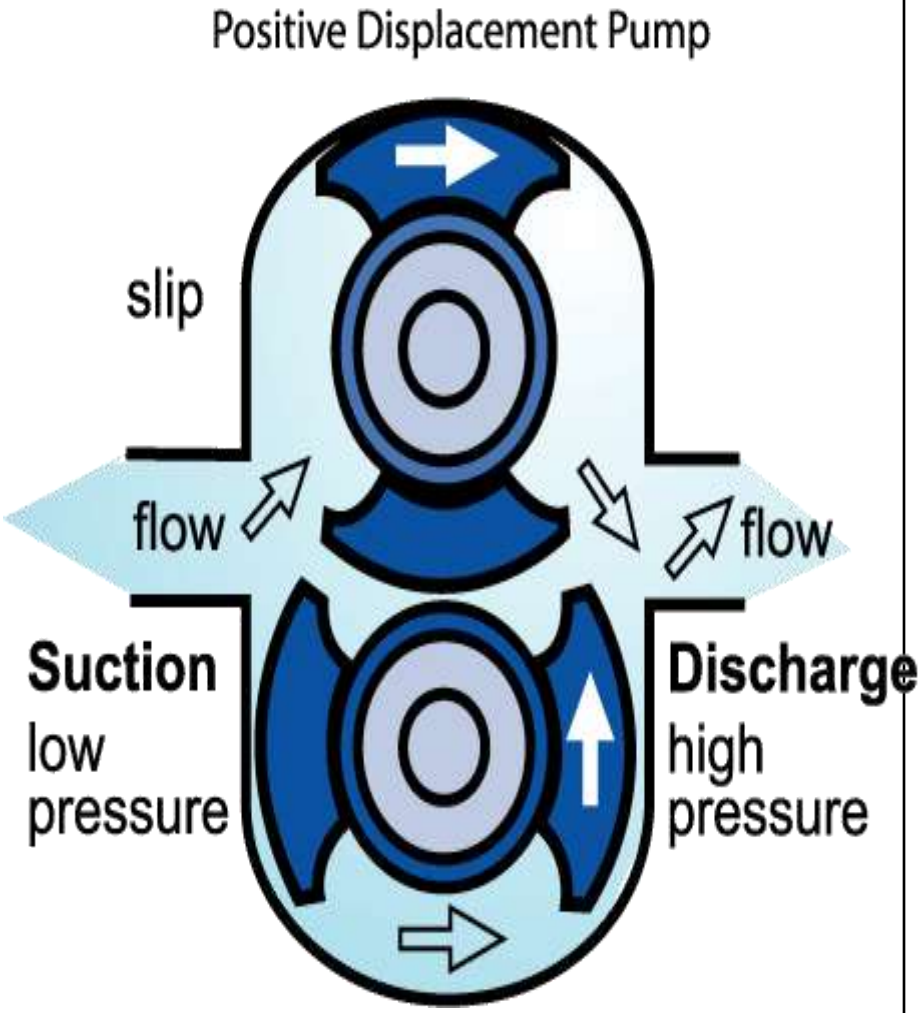


Screw Pump



Lobe Pump




Positive Displacement Pump
slip
flow
flow
Suction
low
pressure
Discharge
high
pressure

❑Dynamic Pump

- **Centrifugal Pumps**

This pumps generate high rotational velocities, then convert the resulting kinetic energy of the liquid to pressure energy.

2 parts: It contains impeller and casing.

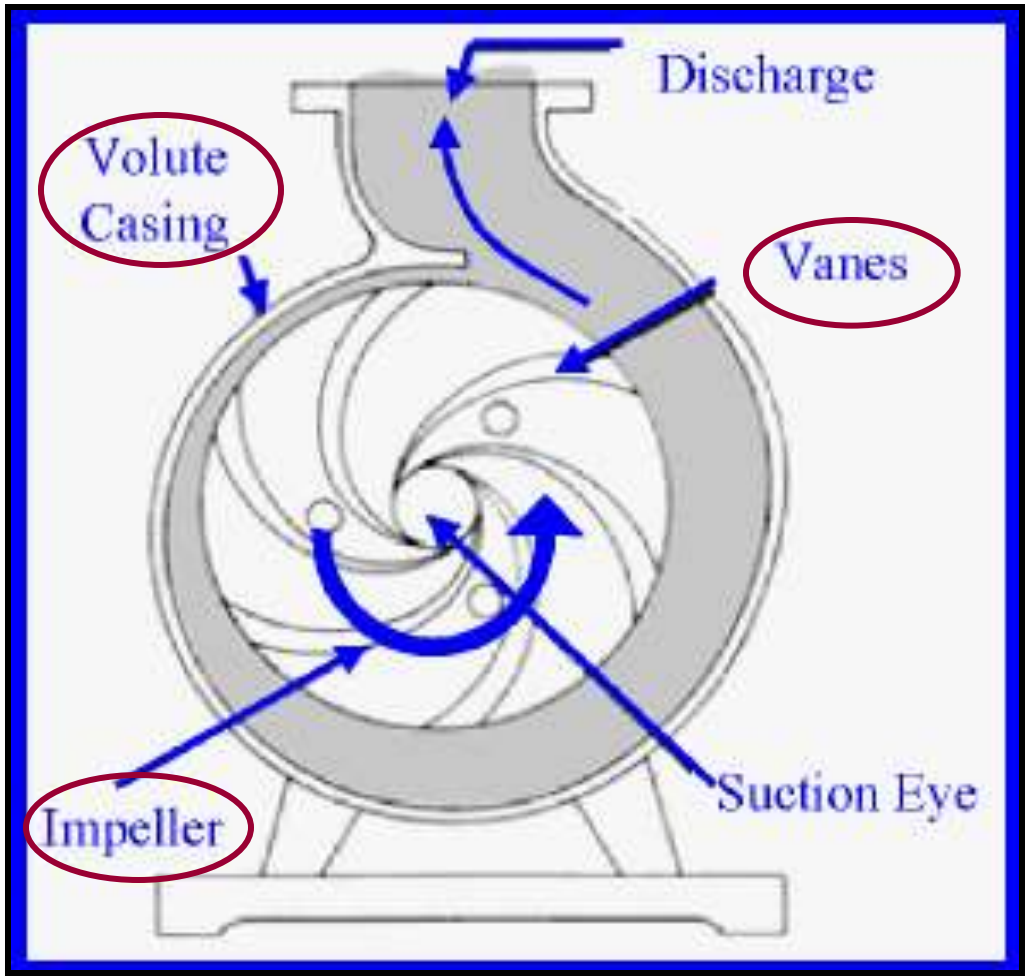
Use:

1.Centrifugal pumps are generally used where high flow rates and moderate head increases are required.

2. Can handle fluids containing suspended solids

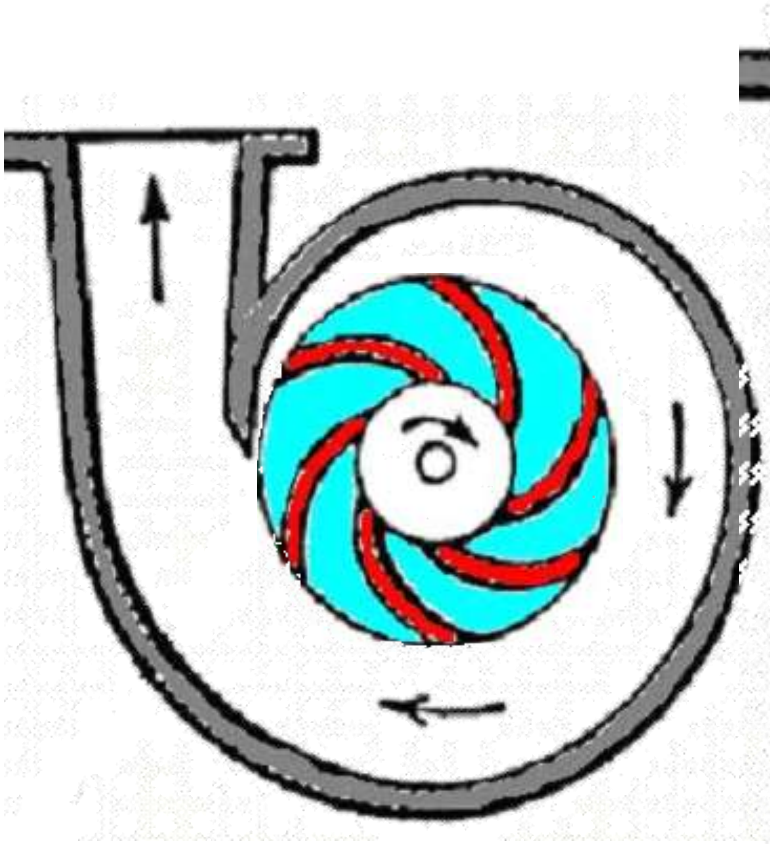
Centrifugal Pumps

How do they work?

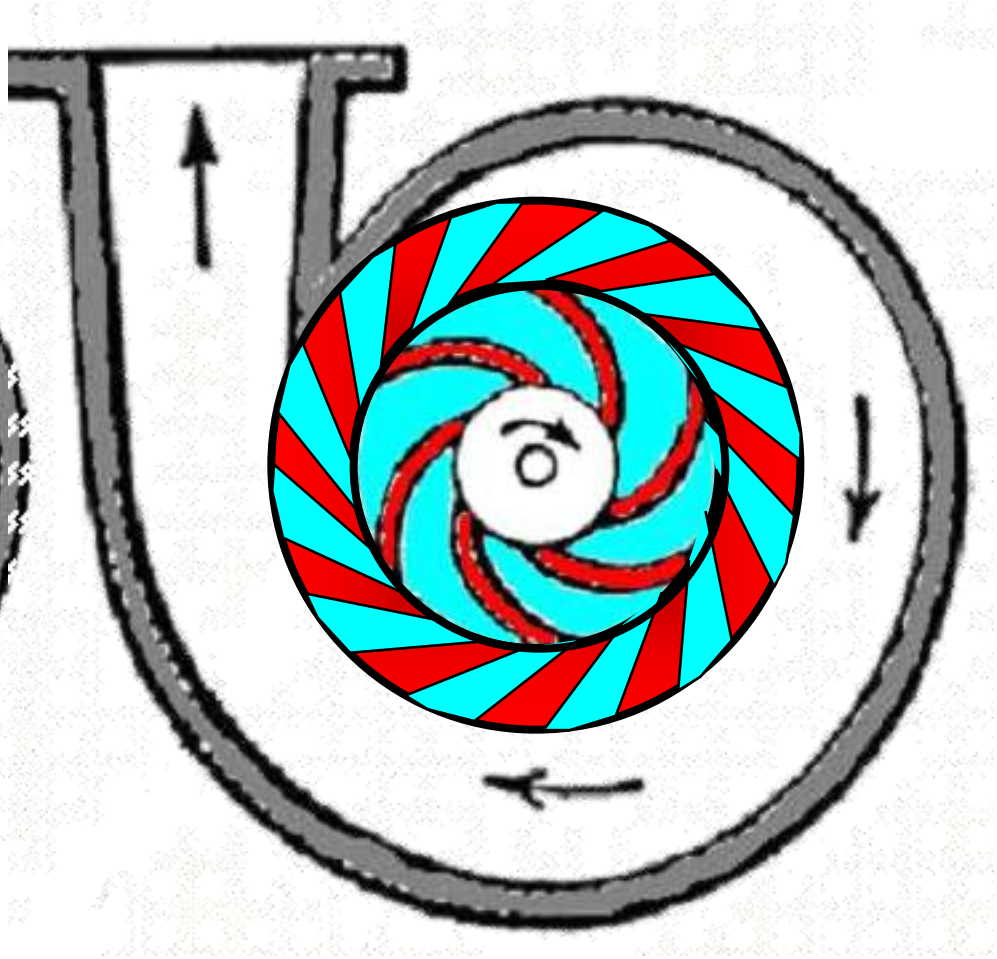


- Liquid forced into impeller
- Vanes pass kinetic energy to liquid: liquid rotates and leaves impeller
- Volute casing converts kinetic energy into pressure energy

Centrifugal Pump

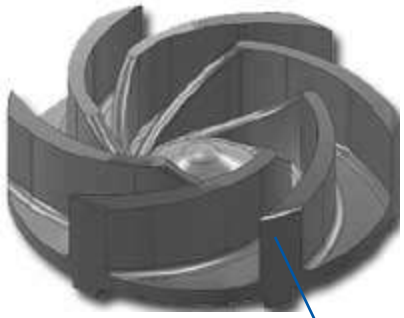


Volute



Diffuser

Centrifugal Pump



Open

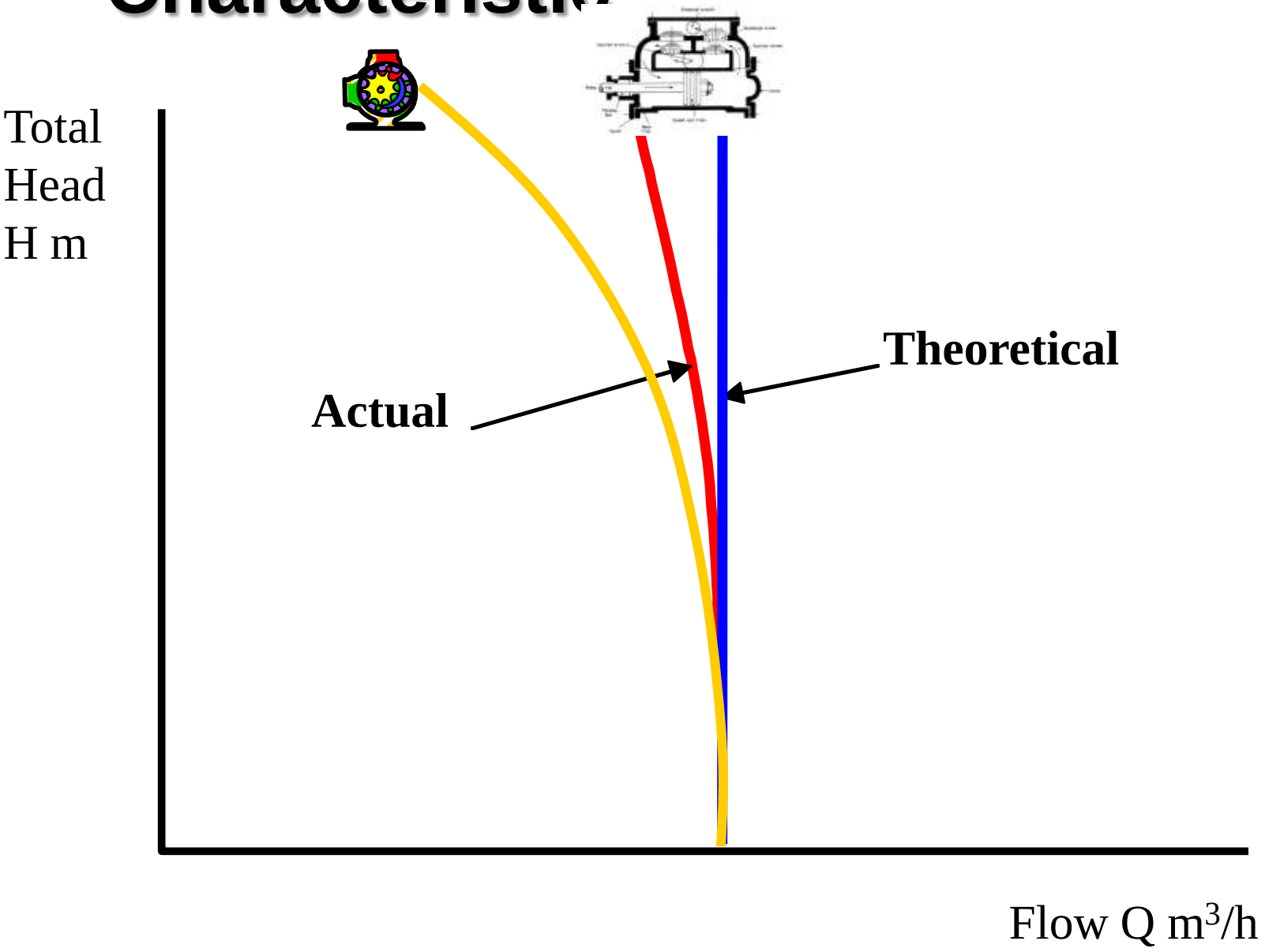
Semi-Open

Closed

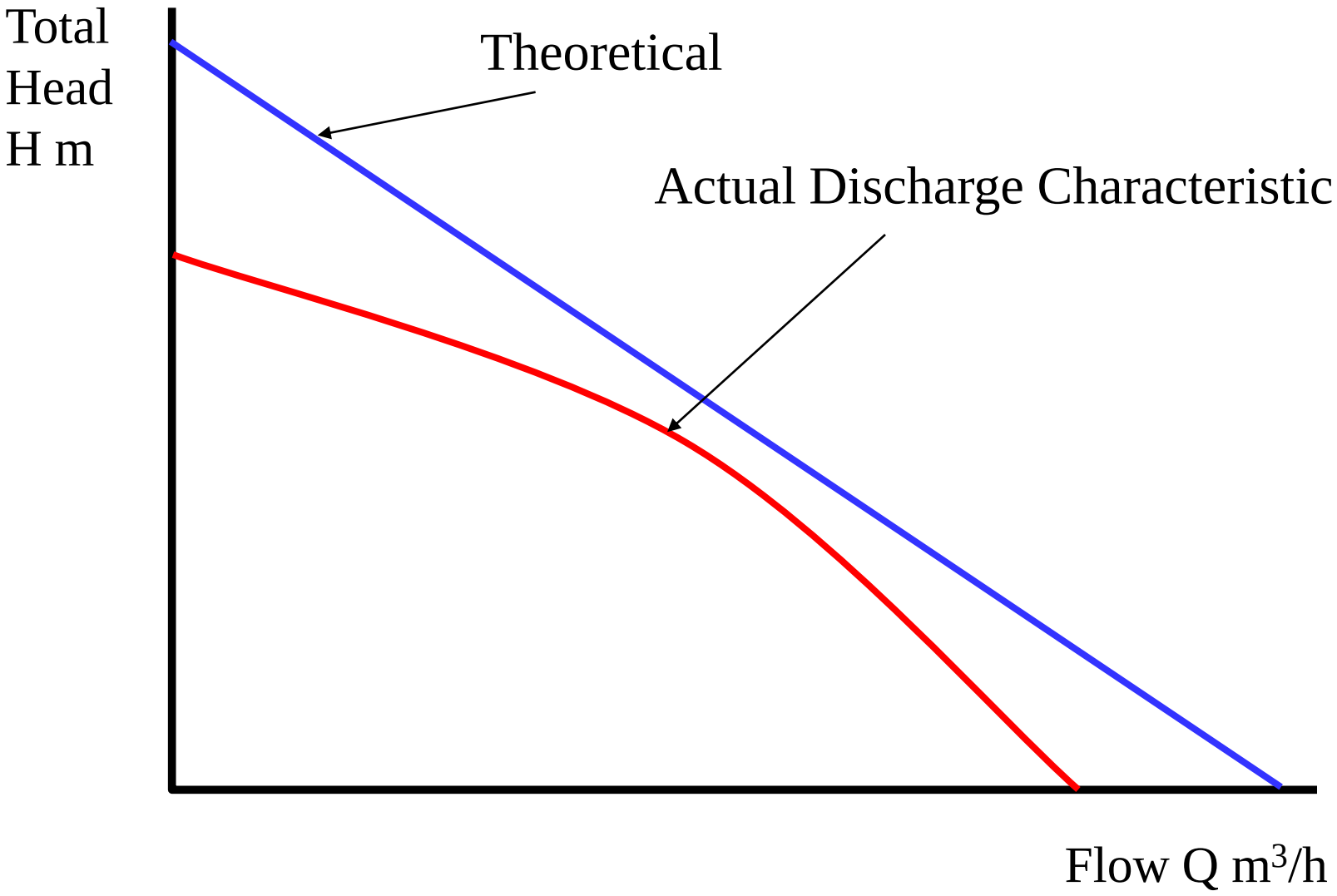
Vanes

Impellers

Positive Displacement Characteristic



Centrifugal Pump Characteristic



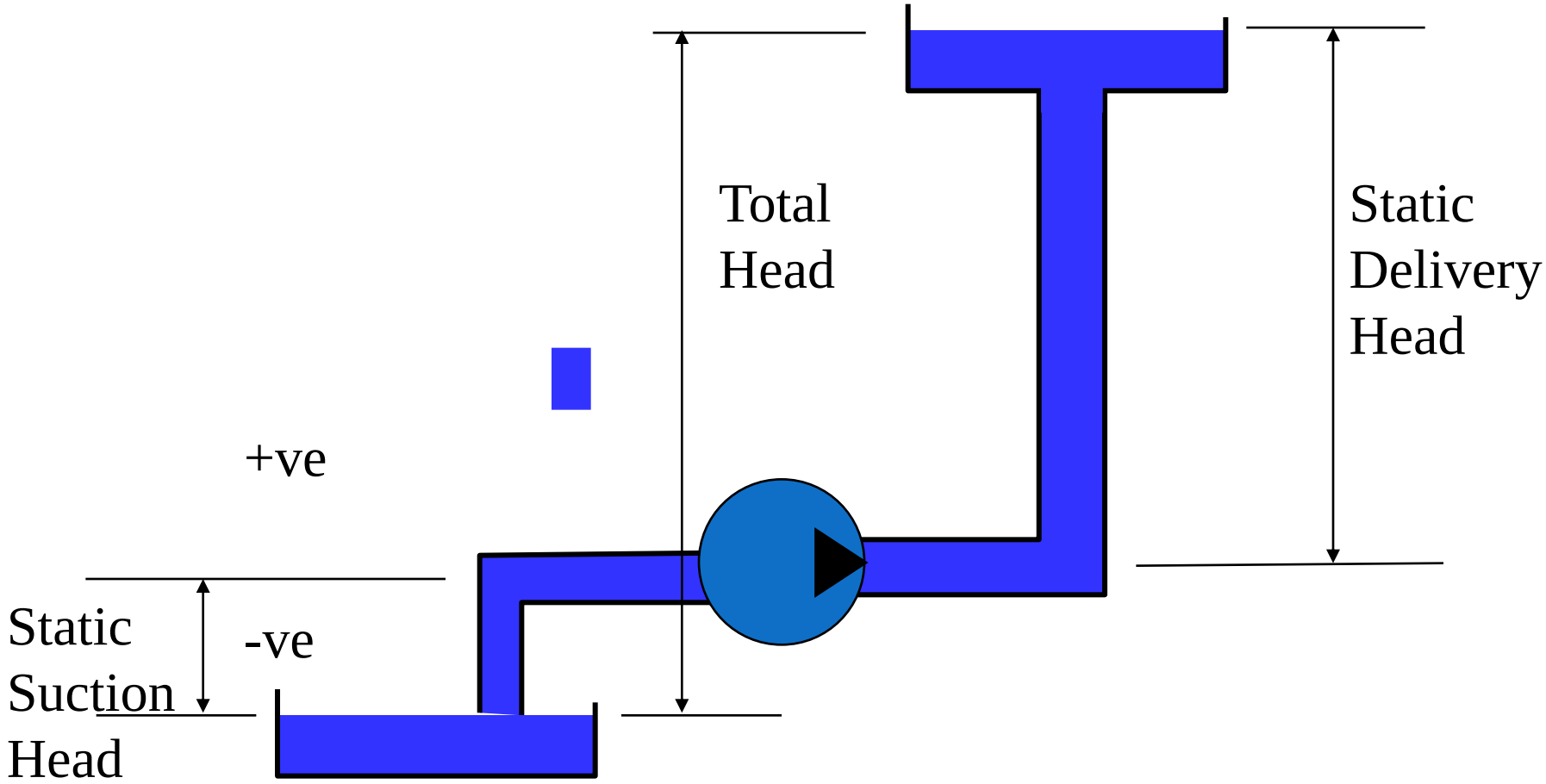
Pump Head

Head: The term *head* is used to measure the kinetic energy created by the pump.

Different Types of Pump Head

- **Total Static Head** - Total head when the pump is not running
- **Total Dynamic Head (Total System Head)** - Total head when the pump is running
- **Static Suction Head** - Head on the suction side, with pump off, if the head is higher than the pump impeller
- **Static Suction Lift** - Head on the suction side, with pump off, if the head is lower than the pump impeller
- **Static Discharge Head** - Head on discharge side of pump with the pump off
- **Dynamic Suction Head/Lift** - Head on suction side of pump with pump on
- **Dynamic Discharge Head** - Head on discharge side of pump with pump on

Pump Head



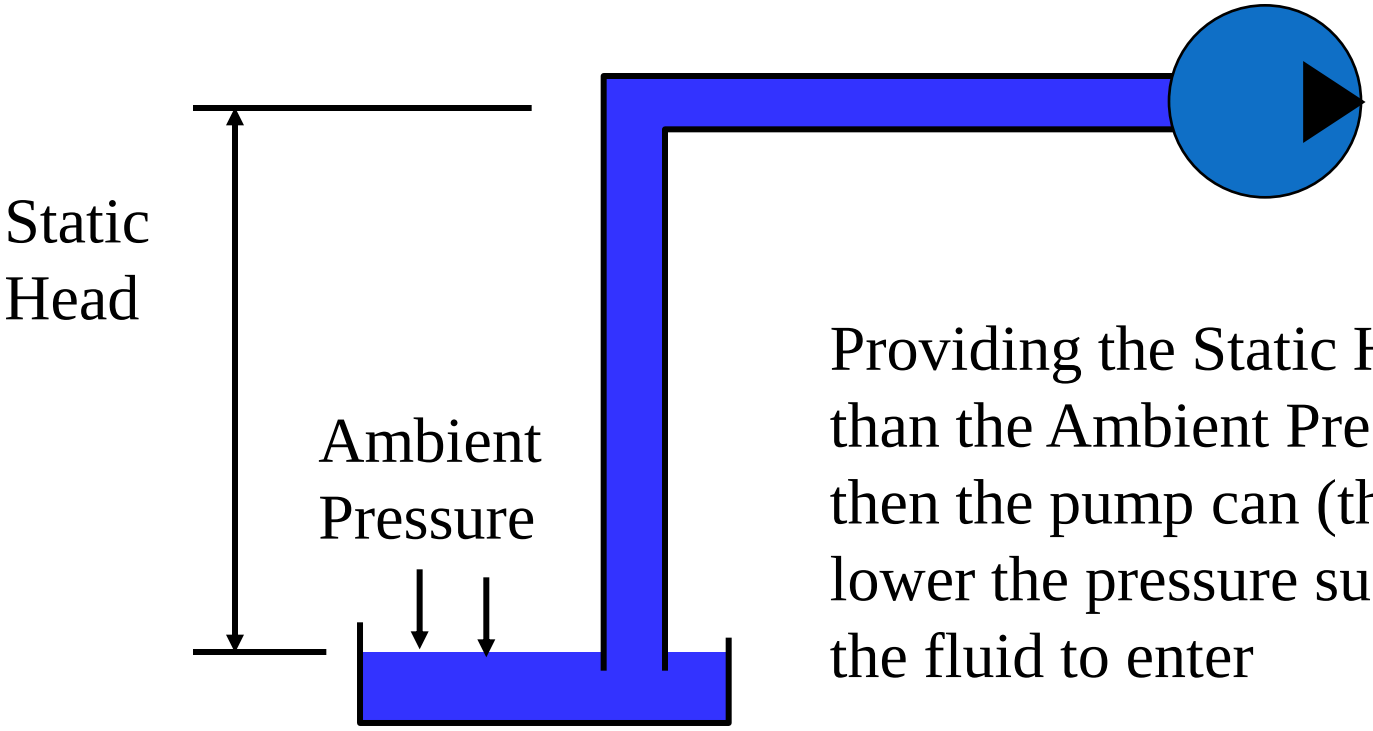
Suction Head

Pumps do not SUCK.

It is not possible to PULL a fluid

A pump simply lowers the pressure at its inlet and the fluid is pushed in

Suction Head

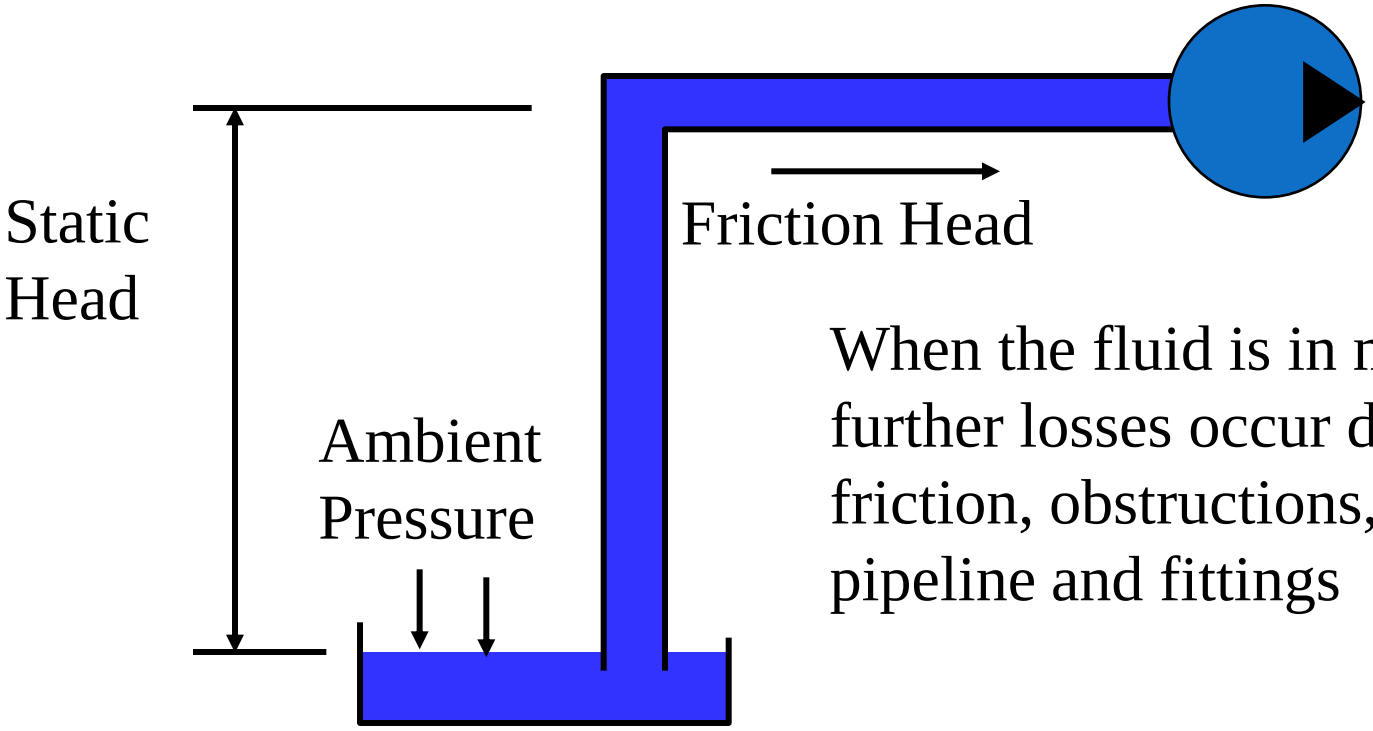


Providing the Static Head is less than the Ambient Pressure Head then the pump can (theoretically) lower the pressure sufficiently for the fluid to enter

Pressure Head at pump = Ambient Pressure Head Static Head

The Static Head is Positive if the level of the fluid is above the pump

Suction Head



When the fluid is in motion further losses occur due to friction, obstructions, in the pipeline and fittings

Pressure Head at pump =
Ambient Pressure Head Static Head – Friction Head

Net Positive Suction Head

The pump has a NPSH requirement in order to prevent cavitation damage occurring and causing severe damage.

The NPSH increases with flow due to pump internal losses - friction, impeller losses etc.

Net Positive Suction Head

The requirement is that:

$$NPSHA > NPSH$$

Otherwise (if NPSHA < $NPSH_{pump}$), the pressure at the pump inlet will drop to that of the vapor pressure of the fluid being moved and the fluid will boil.

The resulting gas bubbles will collapse inside the pump as the pressure rises again. These implosions occur at the impeller and can lead to pump damage and decreased efficiency.

Cavitation

THANK YOU