



PUMPS

Part 01

By

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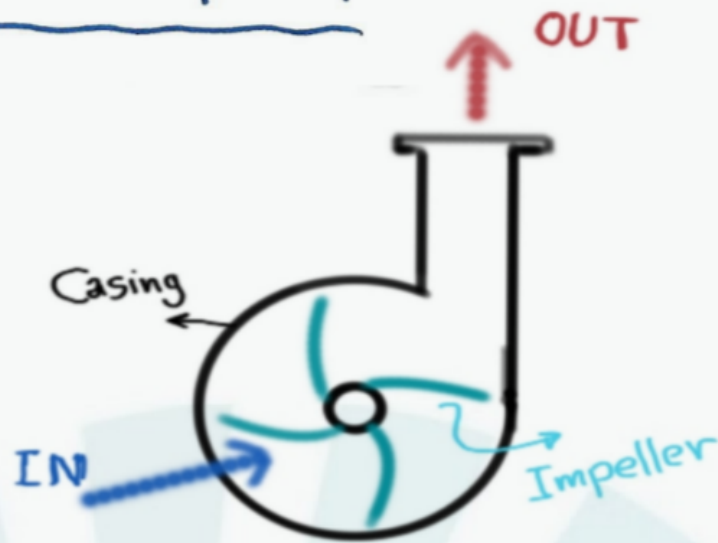
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PUMPS



Operation of pump



- Pump is a device that moves liquid or gases by mechanical ~~part~~ Action.
- Pump have
 - Inlet
 - Outlet
 - Impeller
 - Casing
- During operation, liquid enter the pump From suction side (IN)
- The pressure of liquid is lowest at this point.



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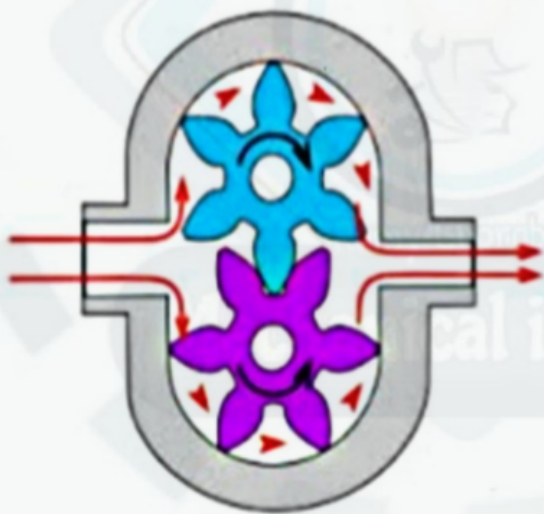
- The liquid leaves the pump from discharge side
- liquid pressure is highest at this point.



Types of Pump

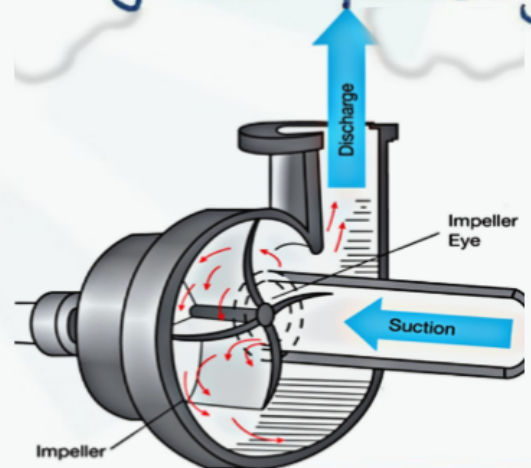
Positive Displacement

- make a fluid move by trapping a fixed amount of the fluid and forcing or displacing that trapped volume into a discharge pipe



Dynamic

- Impart velocity & pressure to the fluid as it moves past or through the impeller and subsequently,
- Called (Kinetic pump)
- pump operate by developing a high velocity and converting the velocity to pressure in a diffusing flow passage



① Positive Displacement pump



Rotary

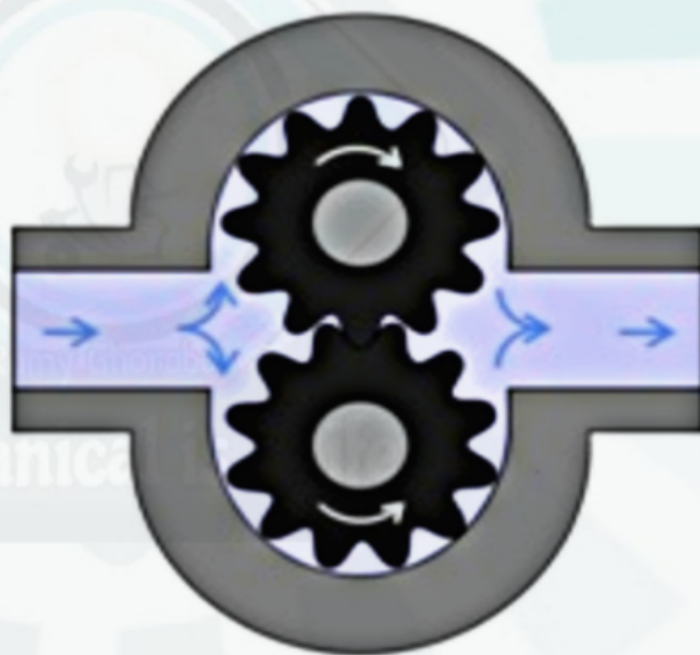
Reciprocating

Linear

① Rotary pump

→ Require very close clearance between the rotating pump & ~~other~~ outer edge making it rotate at a slow & steady speed.

→ IF it operate at high speed, The fluid cause EROSION



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Rotary pump



① Gear pump

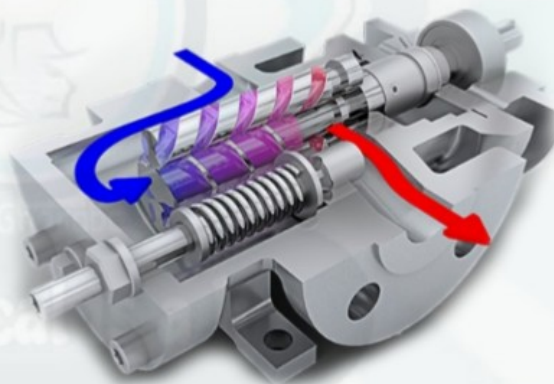
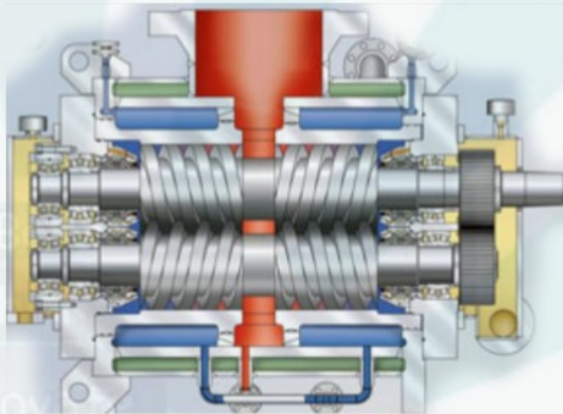
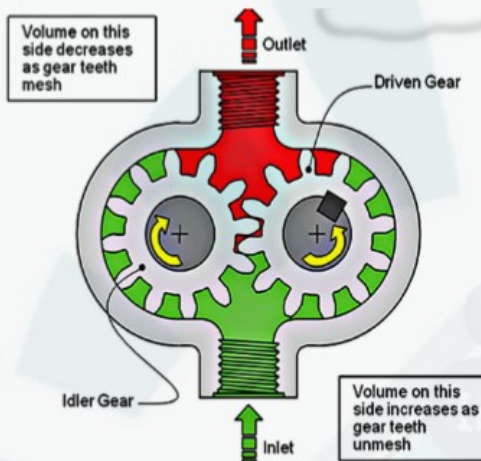
② Screw pump

③ Rotary Van pump

The liquid is pushed between two gears

Two screws turning against each other to pump the liquid

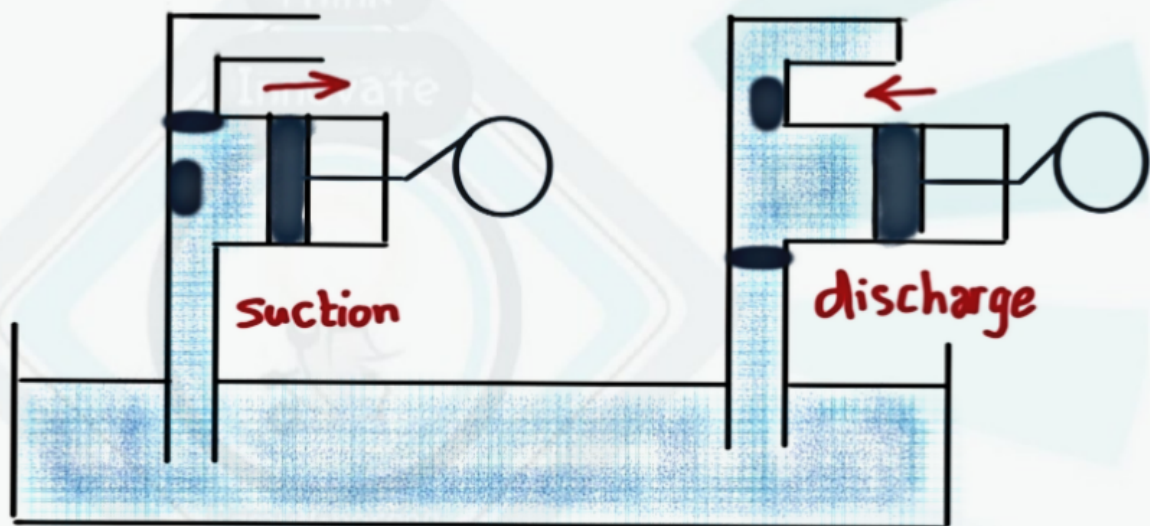
Have a cylindrical rotor encased in a similarly shaped housing



③ Reciprocating pump



- ✓ Move the Fluid using one or more oscillating pistons, while valves restrict Fluid motion to the desired direction.
- ✓ For Suction, The pump pull the piston in an outward motion to decrease pressure in chamber.
- ✓ Once the piston pushes back, It will increase the pressure chamber & the inward pressure of piston will then open the discharge valve & release the fluid into the delivery pipe at a high velocity.



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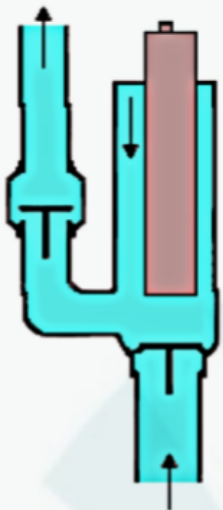
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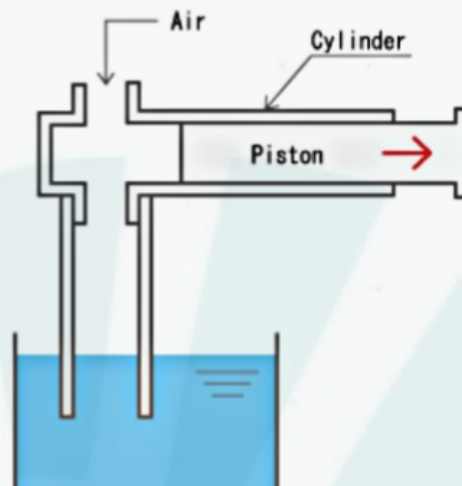
Reciprocating pump types



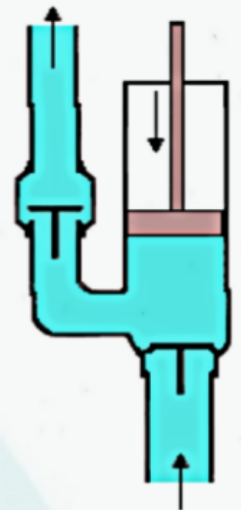
①
Plunger pump



②
Diaphragm pump



③
Piston pump



① Plunger pump plunger pushes the fluid through one or two open valves, closed by suction on the way back

② Diaphragm pump Plunger pressurizes hydraulic oil which used to flex the diaphragm in cylinder

③ Piston pump Displacement pumps usually simple devices for plumbing small amount of liquid.



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② Dynamic pump

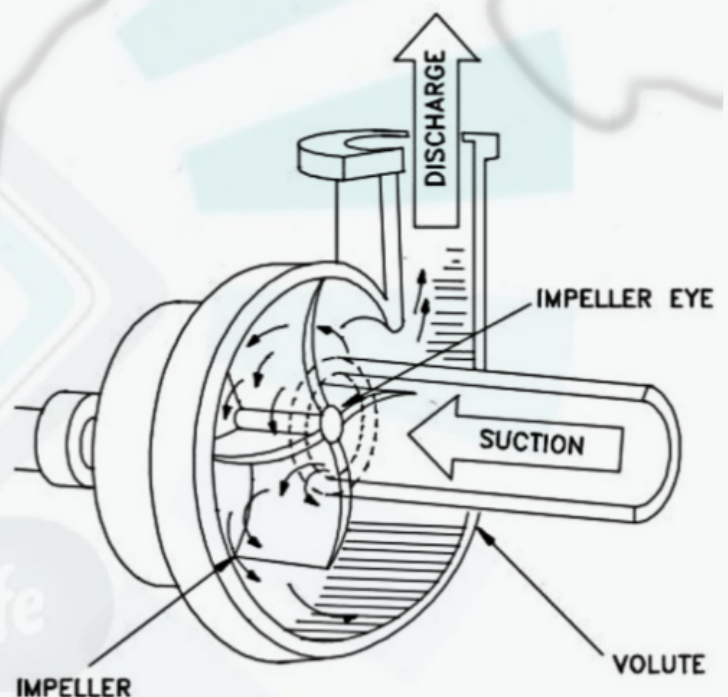


Centrifugal pump

Special pump

① Centrifugal pump

- ➡ Rotating machine in which flow and pressure are generated dynamically.
- ➡ The energy changes occur by two main parts of the pump → Impeller
→ Casing
- ➡ Casing is Collect the liquid discharged by the impeller & Convert some of velocity energy to pressure energy.



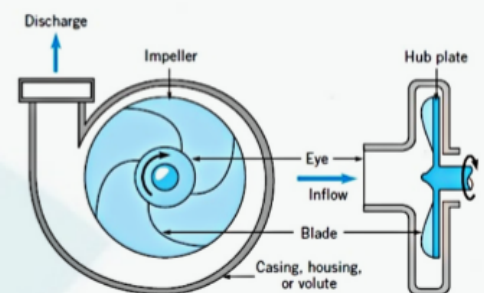
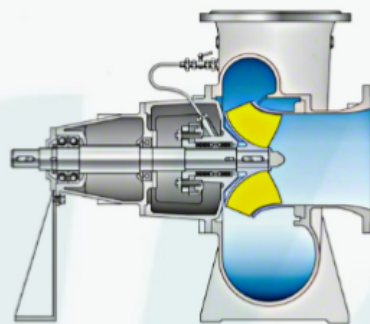
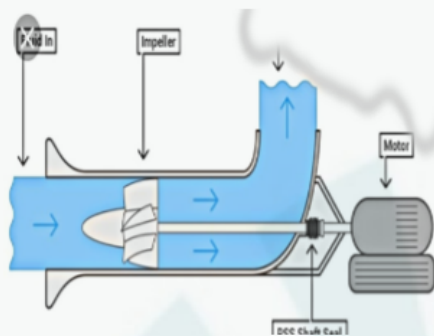
Centrifugal Pump



Axial Flow

Mixed Flow

Radial Flow



① Axial Flow

– High Flow, Low pressure

– lift fluid in a direction parallel to impeller shaft.

② Mixed Flow

– Medium Flow, Medium pressure

– Push fluid out from the pump shaft at an angle greater than 90° .

③ Radial Flow

– Low Flow, High pressure.

– Accelerate fluid along the impeller blades perpendicular to the shaft.



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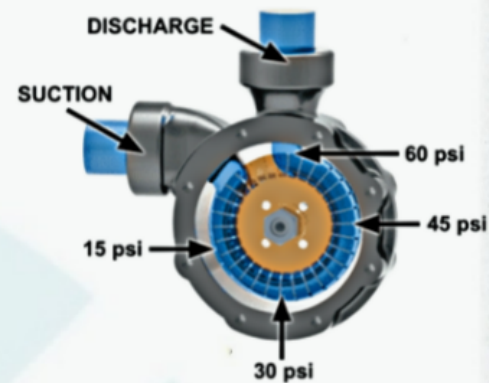
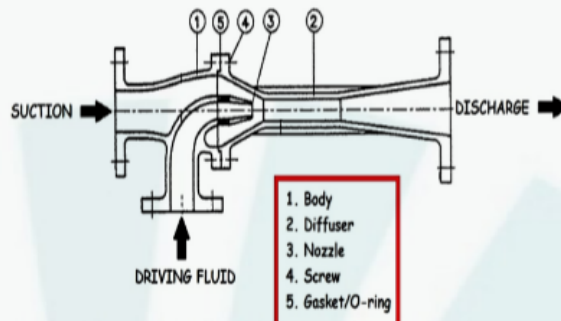
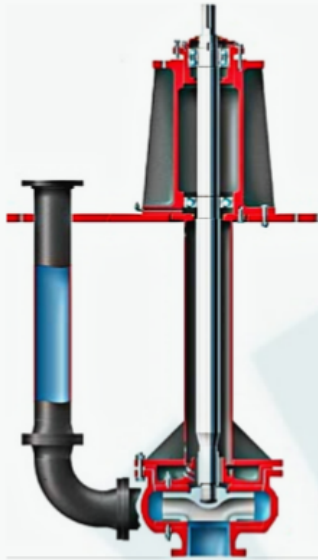
③ Special pump



Cantilever pump

Jet pump

Turbine pump



① Cantilever pump

A centrifugal pump with long cantilever design used in sump pump applications.

② Jet pump

A kinetic pump with ejector attached at discharge out let

③ Turbine pump

A centrifugal pump use the pressure in combinations with a rotary mechanism with numerous small impellers and vanes to transfer energy to a fluid.



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NPSH

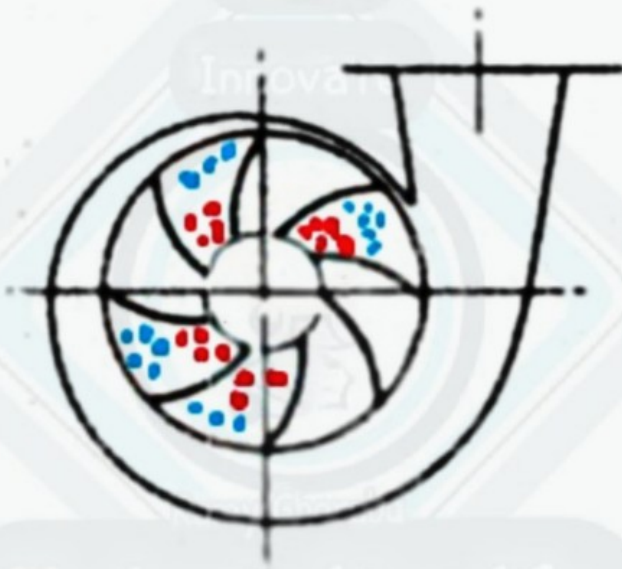


Net Positive Suction Head

- ✓ The difference between inlet pressure and the lowest pressure level inside the pump.
- ✓ NPSH is very important in order to prevent CAVITATION in the pump.

◆ Cavitation

- Formation of bubbles in liquid, developed in areas of low pressure around impeller.
- The imploding of these bubbles lead to a big shock waves inside the pump.
- Causing a big damage to the impeller or the Casing.



Bubble Collapsing / Implosion



Bubble Formation occur

NPSH $\rightarrow$ NPSH_a

(Available) as per site conditions

$\rightarrow$ NPSH_r
(Required)

The minimum pressure required at the pump.


$$\text{NPSH}_a > \text{NPSH}_r$$


$$\text{NPSH}_a = H_A - H_z - H_F + H_v - H_{vp}$$


where:

$H_A \rightarrow$ Atmospheric pressure

$H_z \rightarrow$ Vertical distance between liquid surface in the supply tank & center line of pump.

$H_F \rightarrow$ Friction losses in suction piping

$H_v \rightarrow$ Velocity head at the pump suction

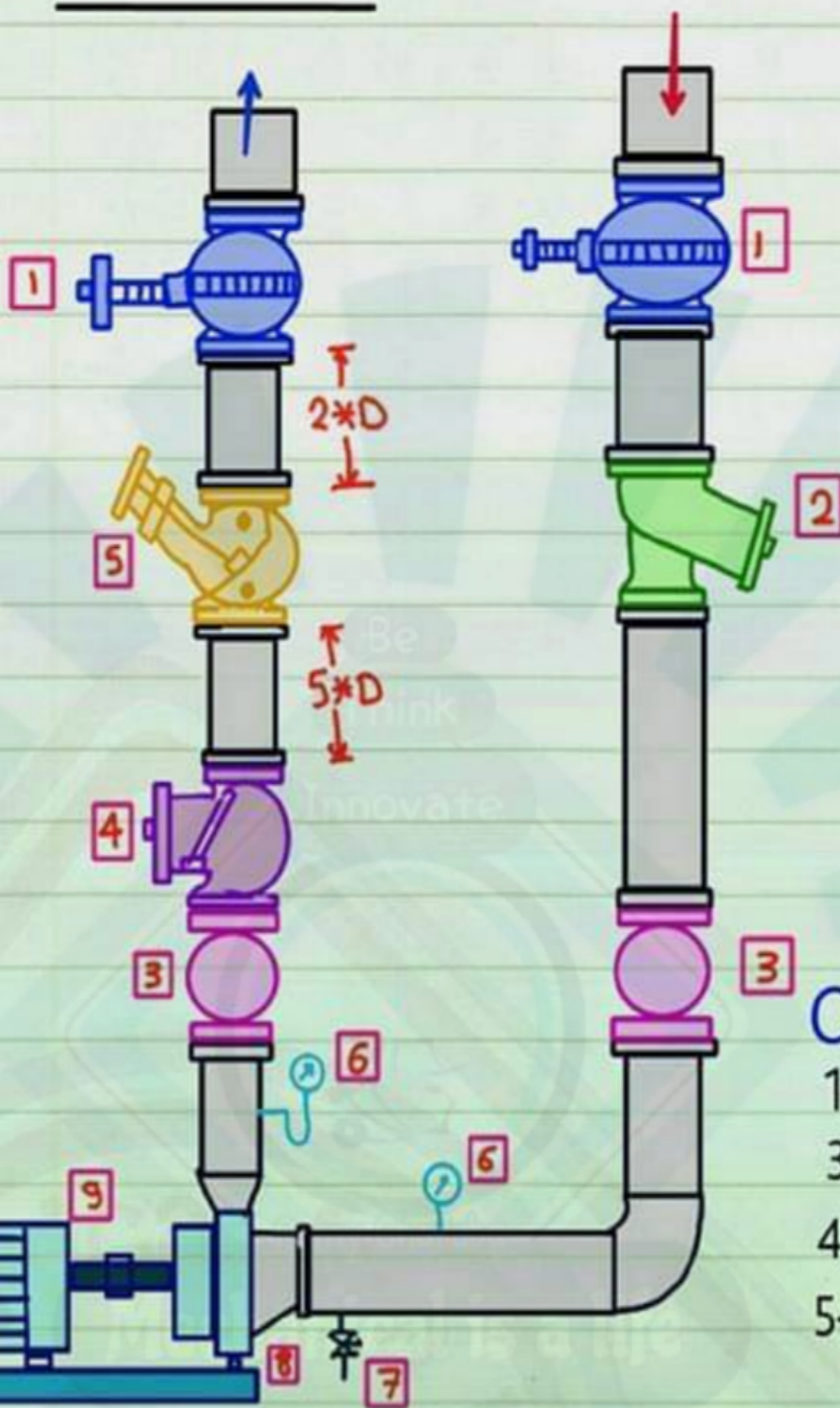
$H_{vp} \rightarrow$ Absolute vapor pressure of liquid at the pumping temperature.



Find the remaining equipment hook up in HVAC PART 02 ..



Pump hook up



Inlet line

- 1- Gate valve
- 2- Strainer
- 3- Flexible joint
- 6- Pressure gauge
- 7- Drain valve
- 8- Eccentric reducer

Outlet line

- 1- Gate valve
- 3- Flexible joint
- 4- Check valve
- 5- Balance valve (Optional)
- 6- Pressure gauge



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