



# Hydraulic Pumps



# Definition

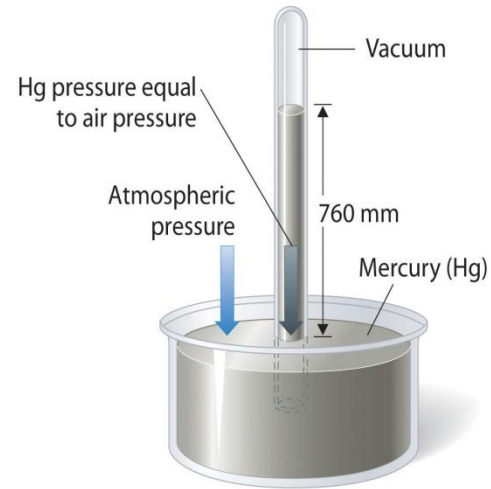
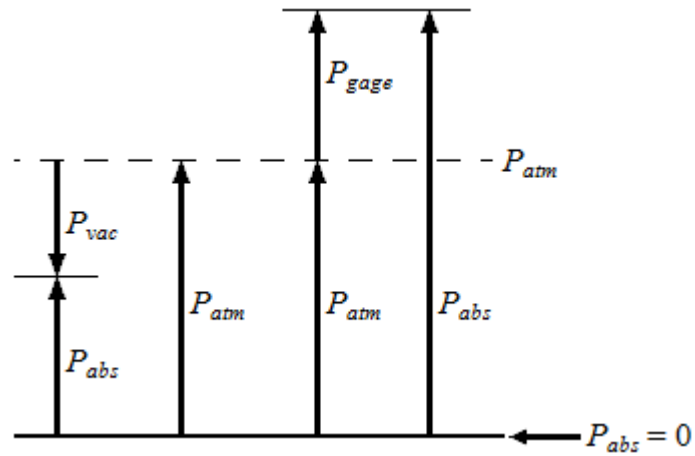
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- ▶ A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action
- ▶ Water pumps are devices designed to **convert mechanical energy to hydraulic energy**.
- ▶ They are used to move water from **lower points to higher points with a required discharge and pressure head**.
- ▶ Rotodynamic & Positive Displacement types



# Pressure



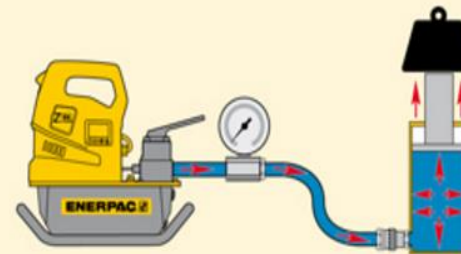
## Flow

A hydraulic pump produces flow.



## Pressure

Pressure occurs when there is resistance to flow.



# Centrifugal Pumps

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- ▶ Centrifugal pumps (radial-flow pumps) are the most used pumps for hydraulic purposes
- ▶ Centrifugal pump duties are usually for the movement of large volumes of liquid at low pressures
  
- ▶ Applications:
  - ❖ pumping the general water supply
  - ❖ for domestic water supplies.
  - ❖ pumping sewage and slurries
  - ❖ used in fire protection systems
  - ❖ for heating and cooling applications
  - ❖ Used in the beverage, dairy, food and light chemical industries



# Identify the centrifugal Pump?

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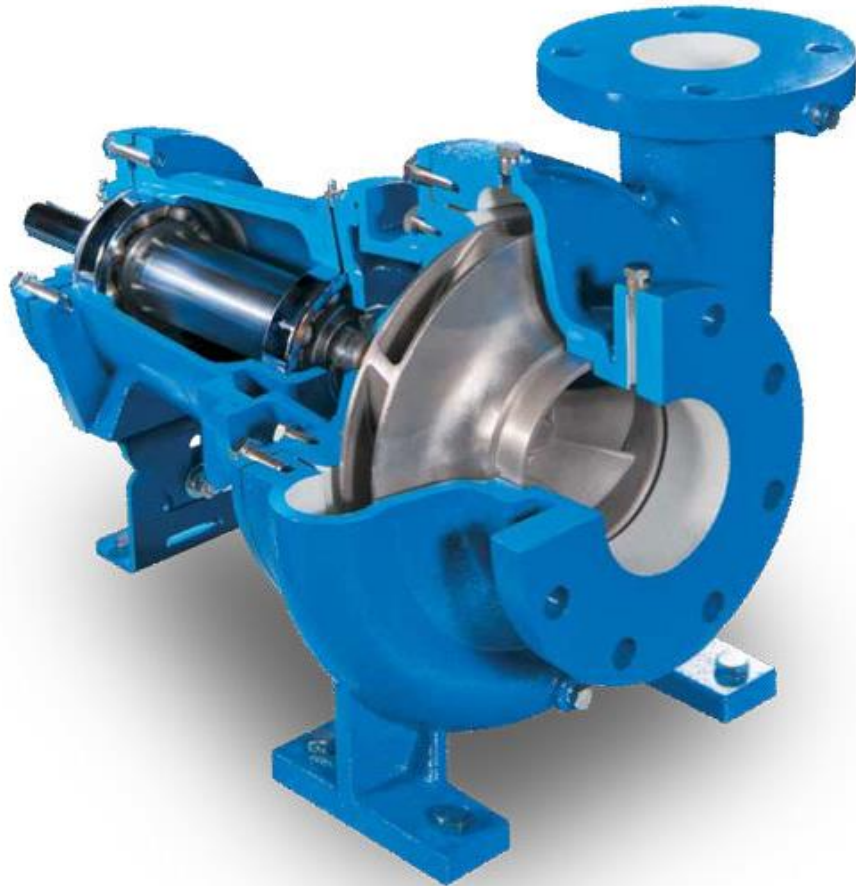
# Main Parts of Centrifugal Pumps

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1. Impeller
2. Volute casing
3. Suction pipe
4. Delivery pipe
5. Shaft
6. Strainer& foot valve



# Parts



Open impeller



Semi-open impeller



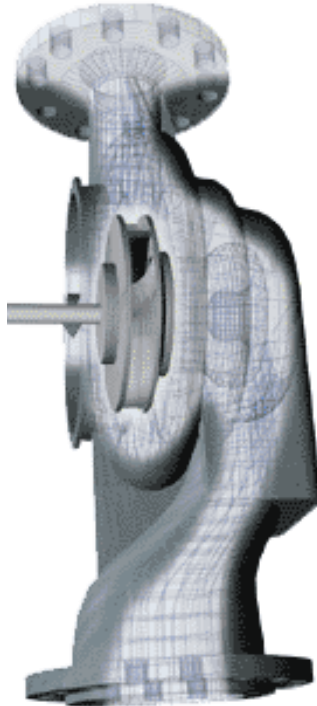
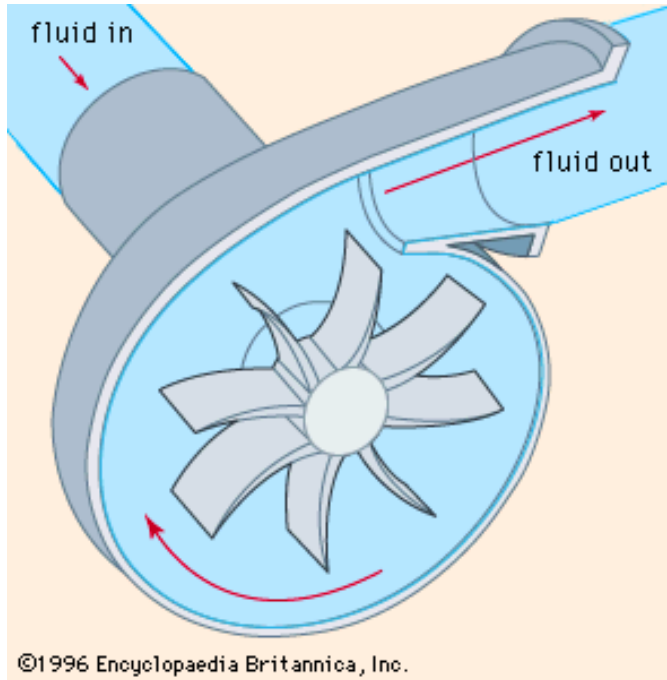
Closed impeller

Source: Jones and Vanderholm.





# Working

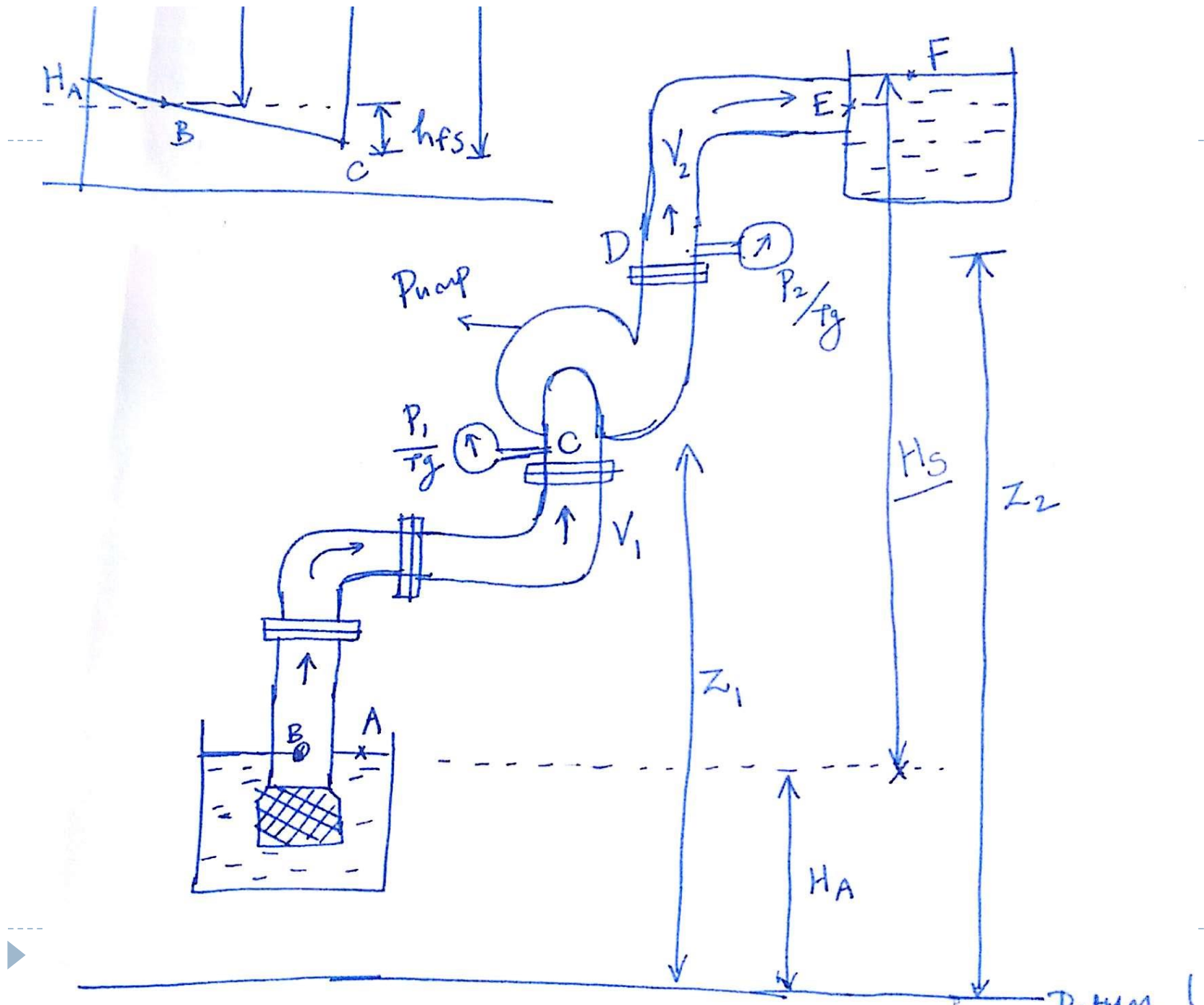


- Liquid forced into impeller
- Vanes pass kinetic energy to liquid: liquid rotates and leaves impeller
- Volute casing converts kinetic energy into pressure energy

- The rise in pressure head at any point of rotating liquid is proportional to the square of tangential velocity at that point
- In volute casing area of flow gradually increases.



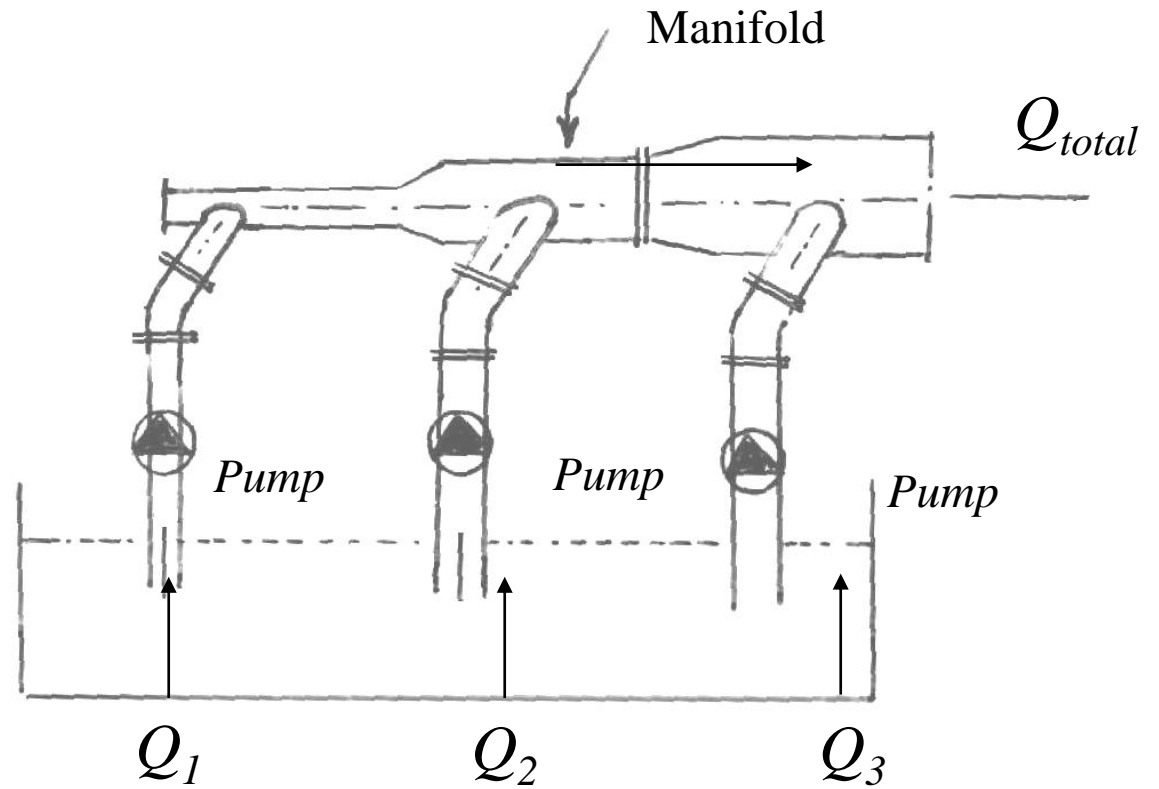




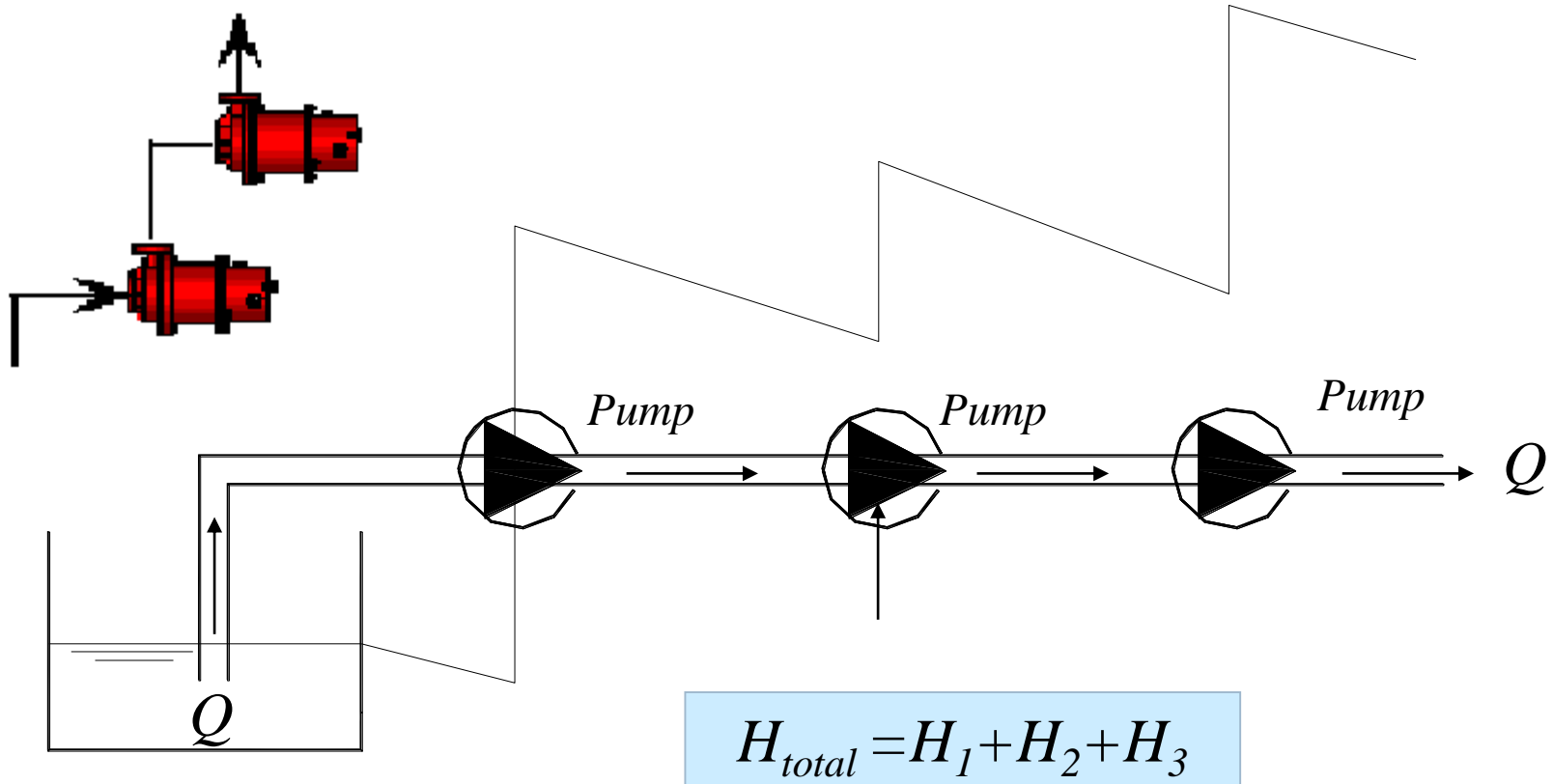


# Parallel Operation

$$Q_{total} = Q_1 + Q_2 + Q_3$$



# Series Operation



# Reciprocating Pump

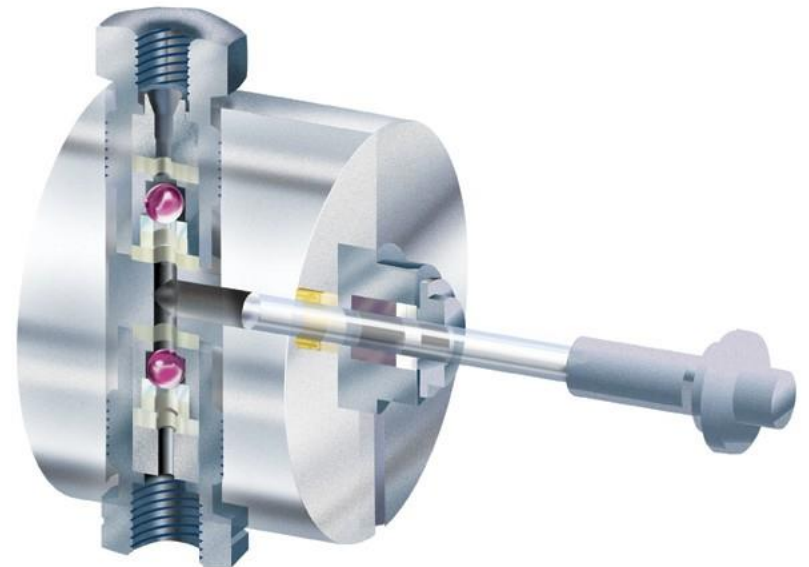
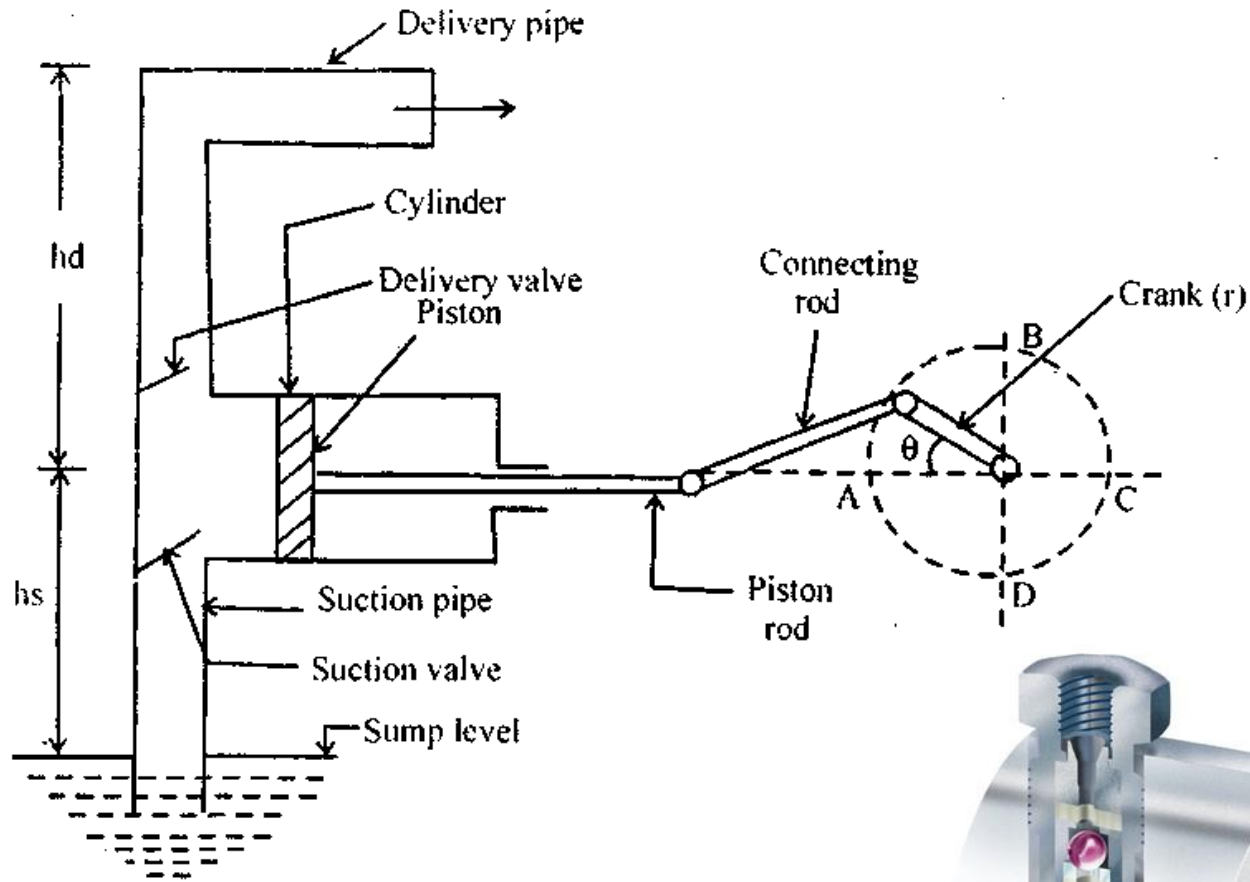
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- ▶ A reciprocating pump is a positive plunger pump. It is often used where relatively **small quantity of liquid** is to be handled and where **delivery pressure is quite large**.
  - ▶ Constant discharge
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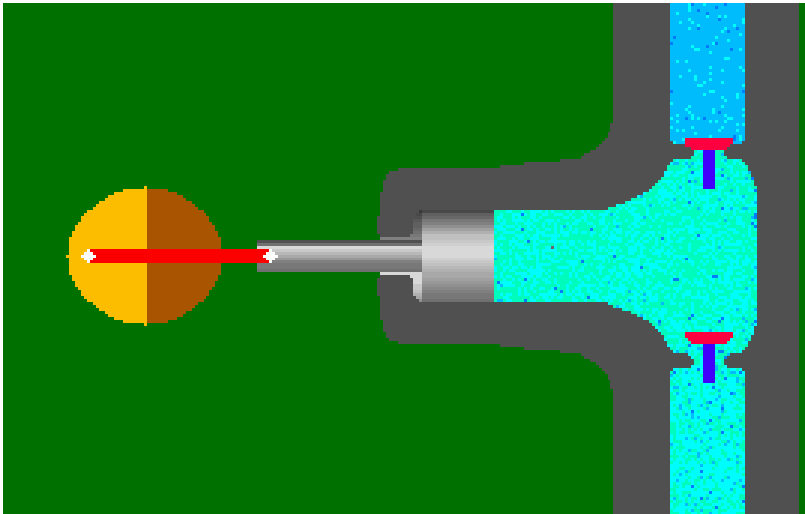
# Parts



# Working

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- ▶ In the reciprocating pump a piston sucks the fluid into a cylinder then pushes it up causing the water to rise.

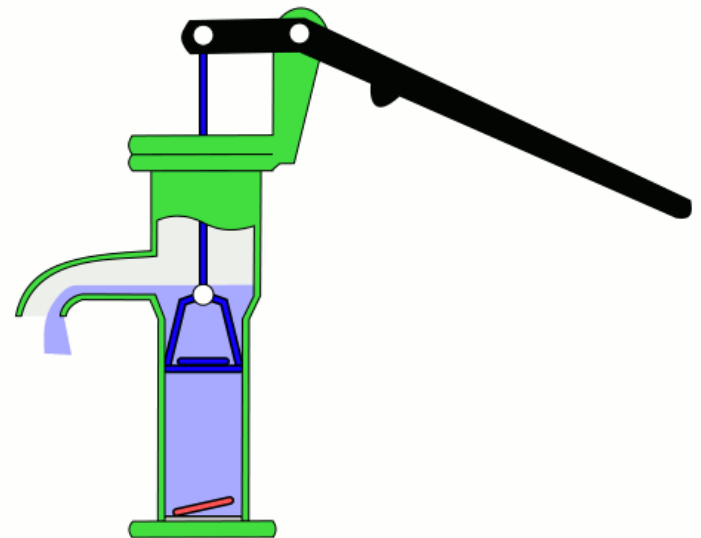




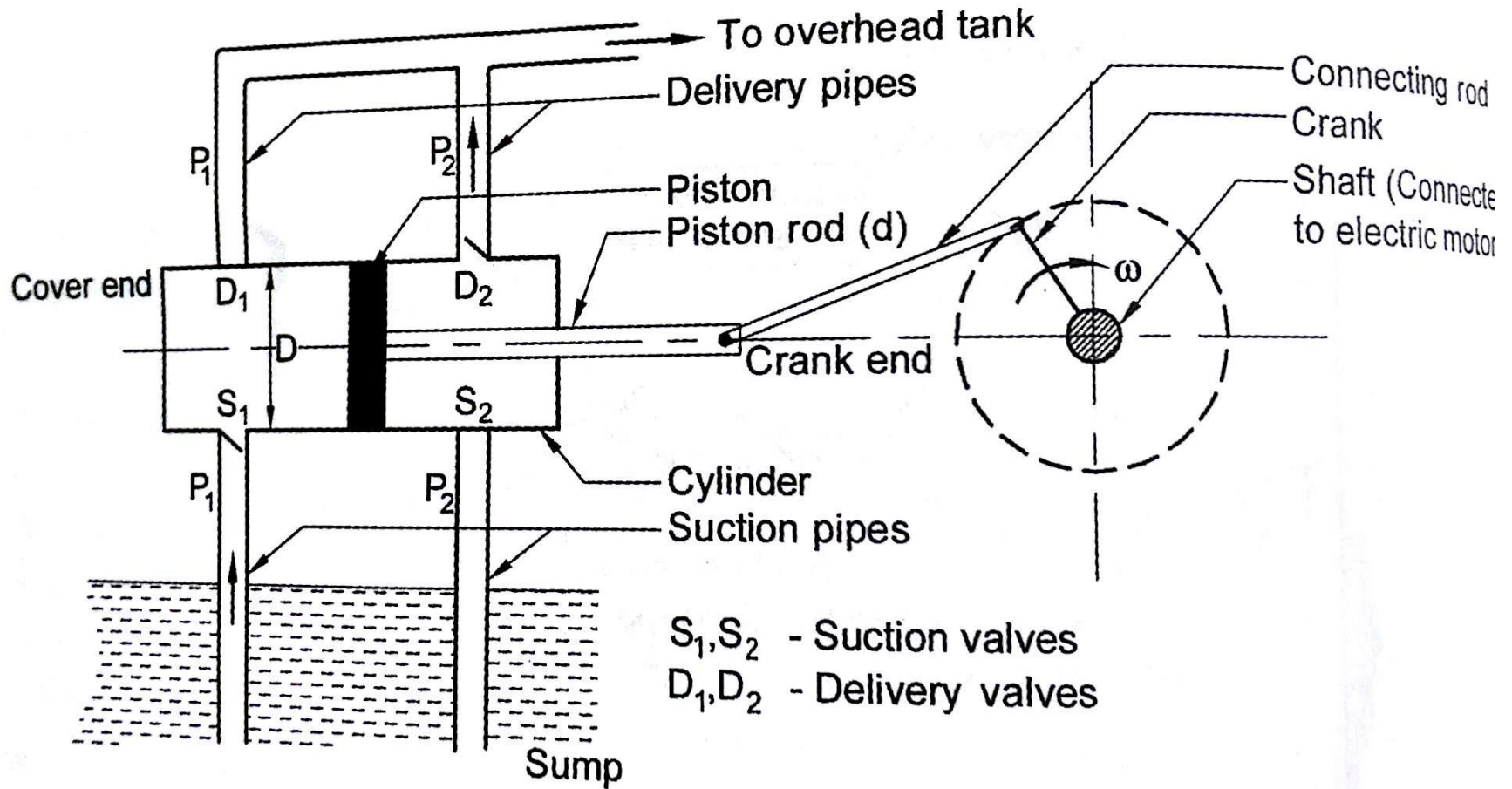
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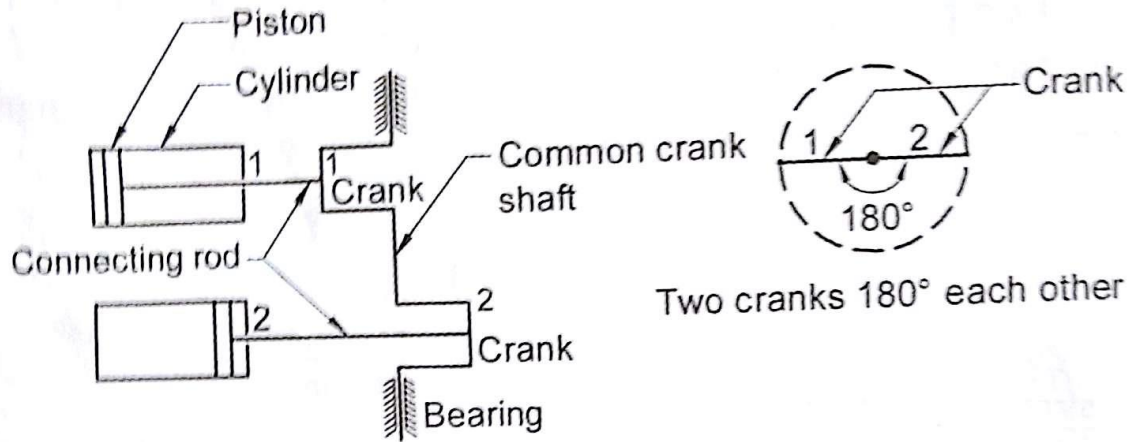
▶ Applications

- ❖ Reciprocating positive displacement pumps are widely used in chemical, petrochemical, refinery, pharmaceutical, cosmetic, food industry and water treatment industry where a high degree of accuracy and reliability under a range of conditions are required

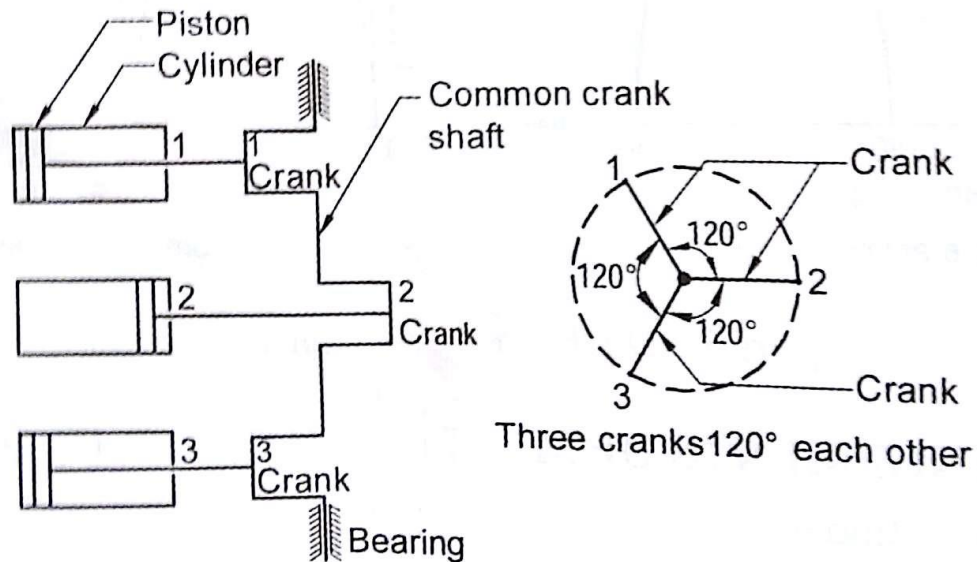


# Double acting reciprocating pump

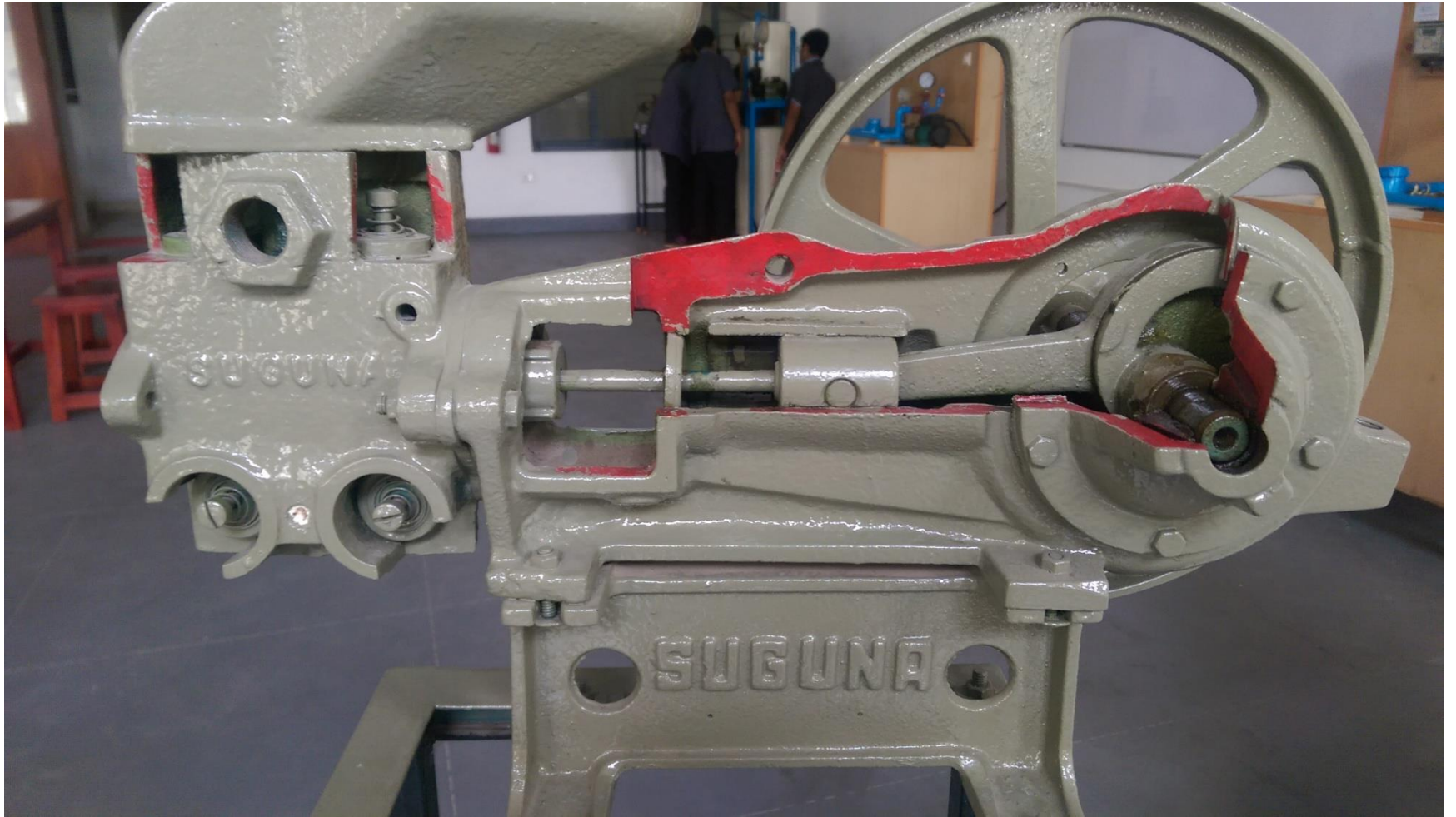




Double cylinder pump (Two throw pump)



Three cylinder pump (Three throw pump)







# Gear pump

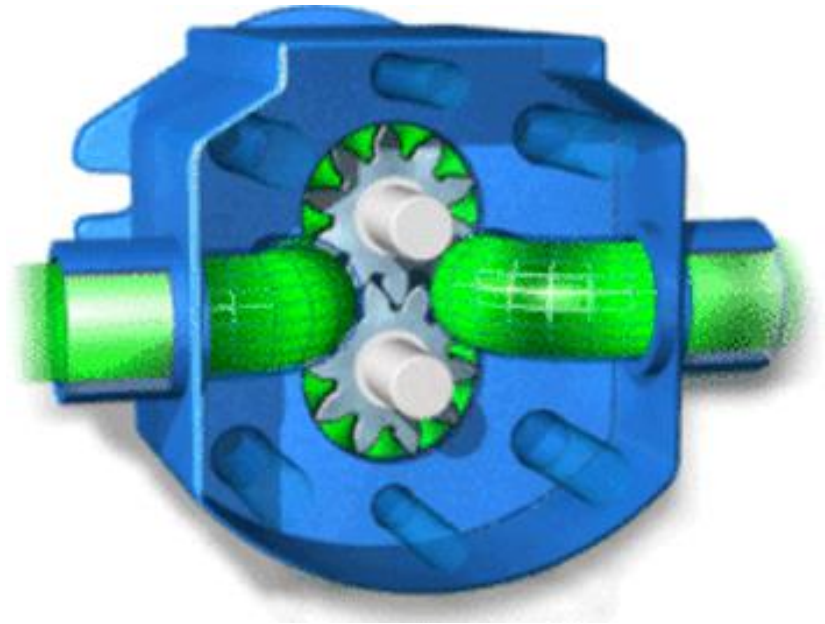
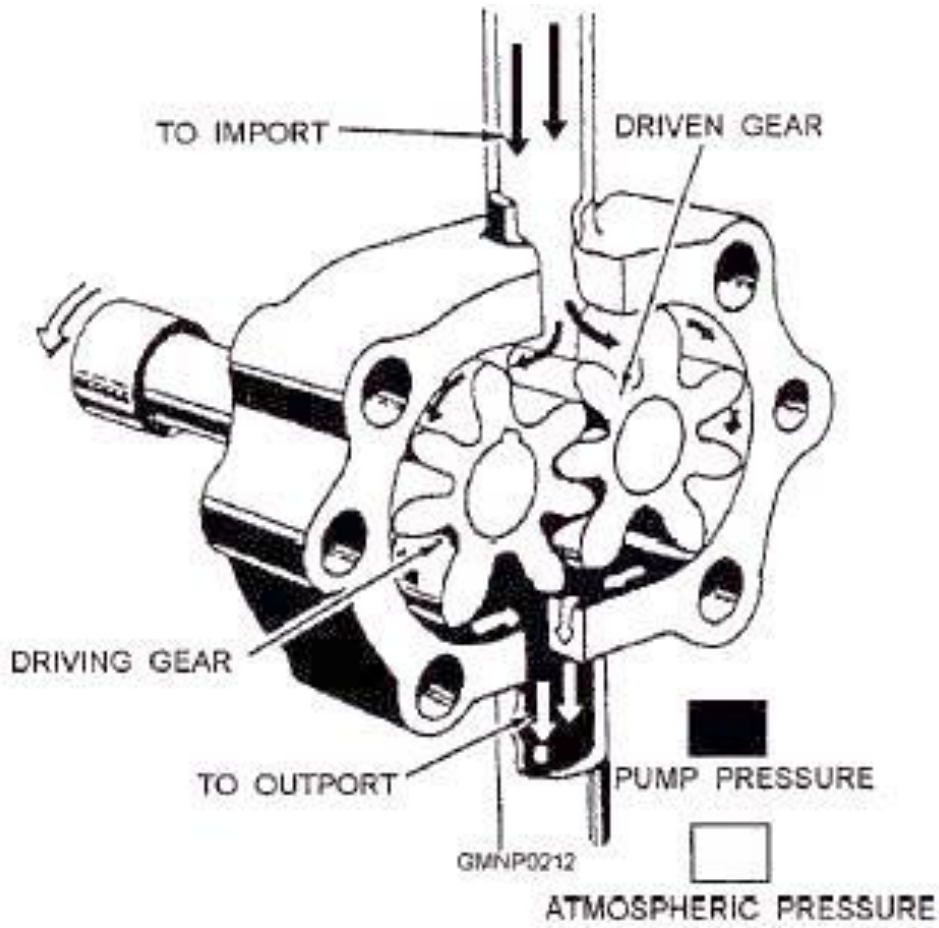
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- ▶ Positive displacement pump
- ▶ Pump output can only be changed by changing the speed of rotation
- ▶ Has a maximum operating pressure of 4000 psi.

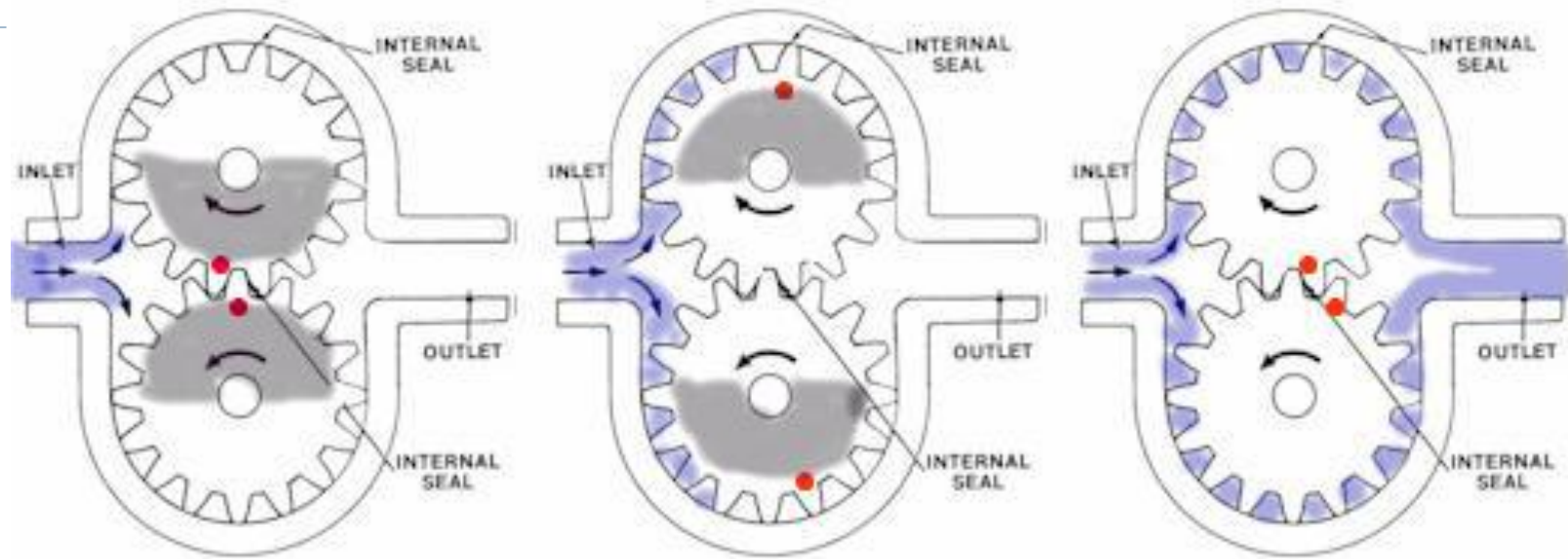


# Parts





# Working



- As the pump rotates, the oil is carried between the gear teeth and the housing from the inlet side to the outlet side of the pump.
- The direction of rotation is determined by the location of the inlet and outlet ports.
- The direction will always direct oil around the outside of the gears from the inlet port to the outlet port



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- Applications

- ❖ Oil pumps in vehicles
- ❖ Used for hydraulic transmission system
- ❖ Pump varies fuel oils and lube oils
- ❖ Used for lubrication in machines
- ❖ Handle corrosive liquids
- ❖ Chemical metering
- ❖ Metering molten plastics in forming synthetic fibers, filaments, films and pipes
- ❖ Metering fuels and chemical additives



# Vane pump

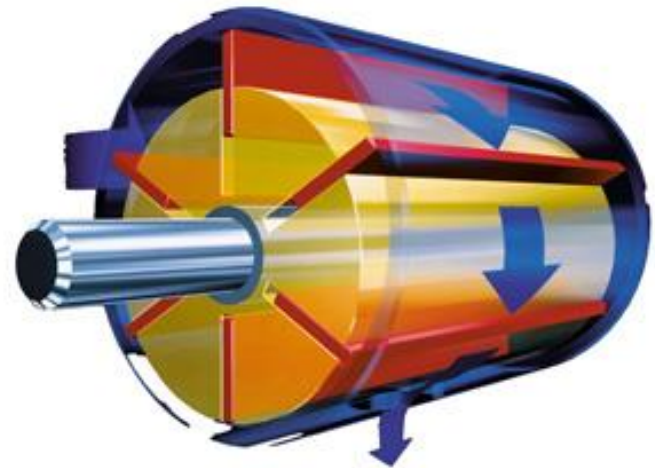
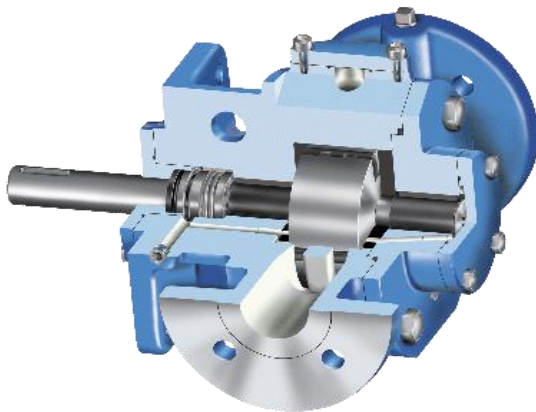
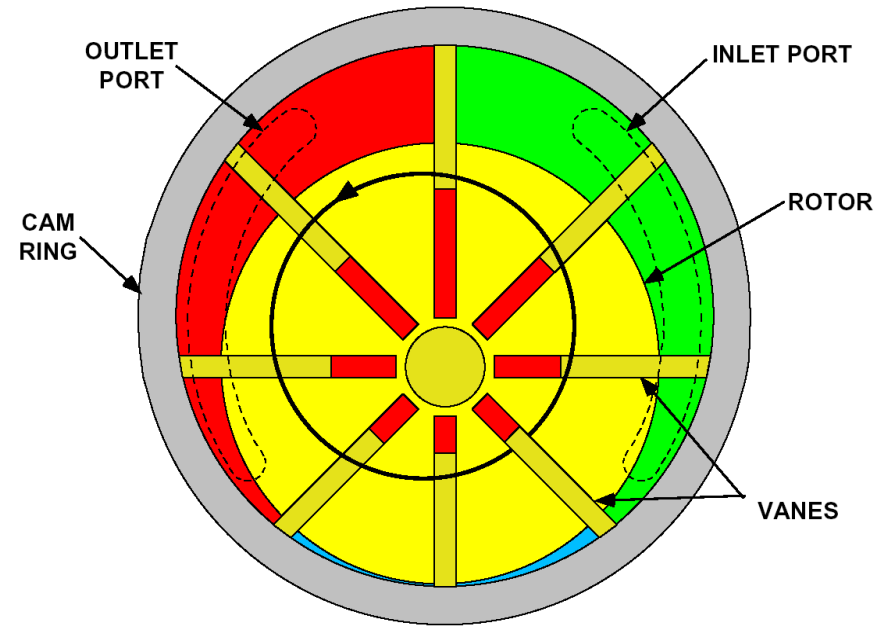
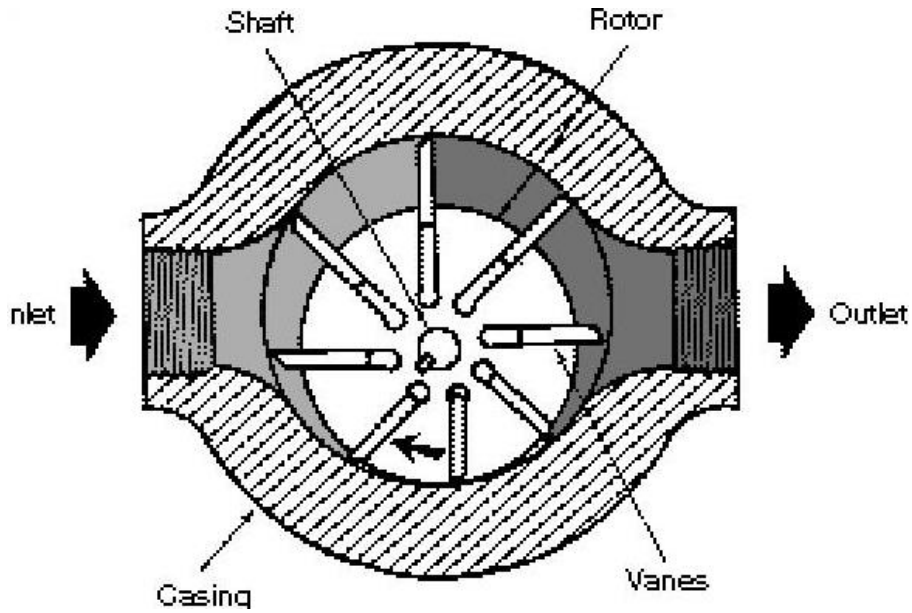
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- ▶ Vane pumps used to handle low viscosity liquids such as ammonia, solvents, alcohol, fuel oils, gasoline, and refrigerants.
  - ▶ Vane pumps have no internal metal-to-metal contact and self-compensate for wear, enabling them to maintain peak performance on these non-lubricating liquids.
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# Parts



# Working

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- When the rotor rotates inside the casing, the vanes slide in and out of the rotor slot to maintain the seal against the casing.



- ▶ As the vanes move out of the slotted rotor, the volume between the vanes increases. This creates a vacuum that allows oil to flow into the space.
- ▶ As the rotor continues to rotate, a decrease in the distance between the casing and the rotor causes a decrease in volume.
- ▶ The oil is then pushed out of that segment of the rotor into the outlet passage.



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- Applications:

- High pressure hydraulic pumps and automotive uses including, supercharging, power steering and automatic transmission pumps
- Aerosol and Propellants, Aqueous solutions
- Auto Industry - Fuels, Lubes, Refrigeration Coolants
- Bulk Transfer of LPG and  $\text{NH}_3$
- LPG Cylinder Filling
- Refrigeration - Freons, Ammonia





**Thank you!**

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