Reciprocating Pump

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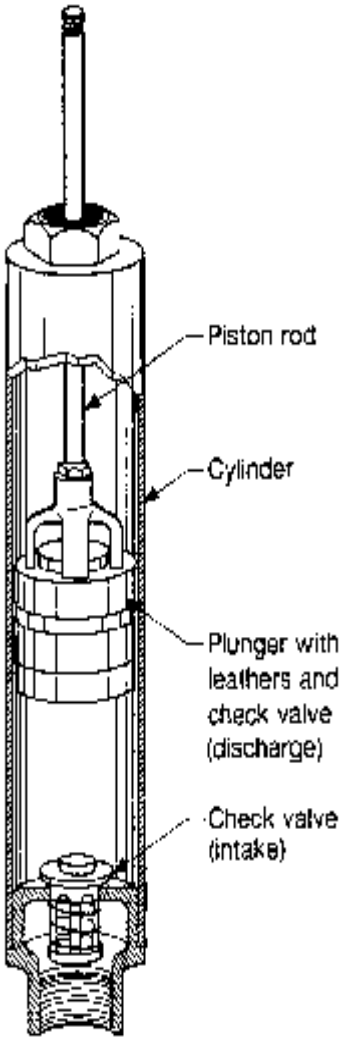
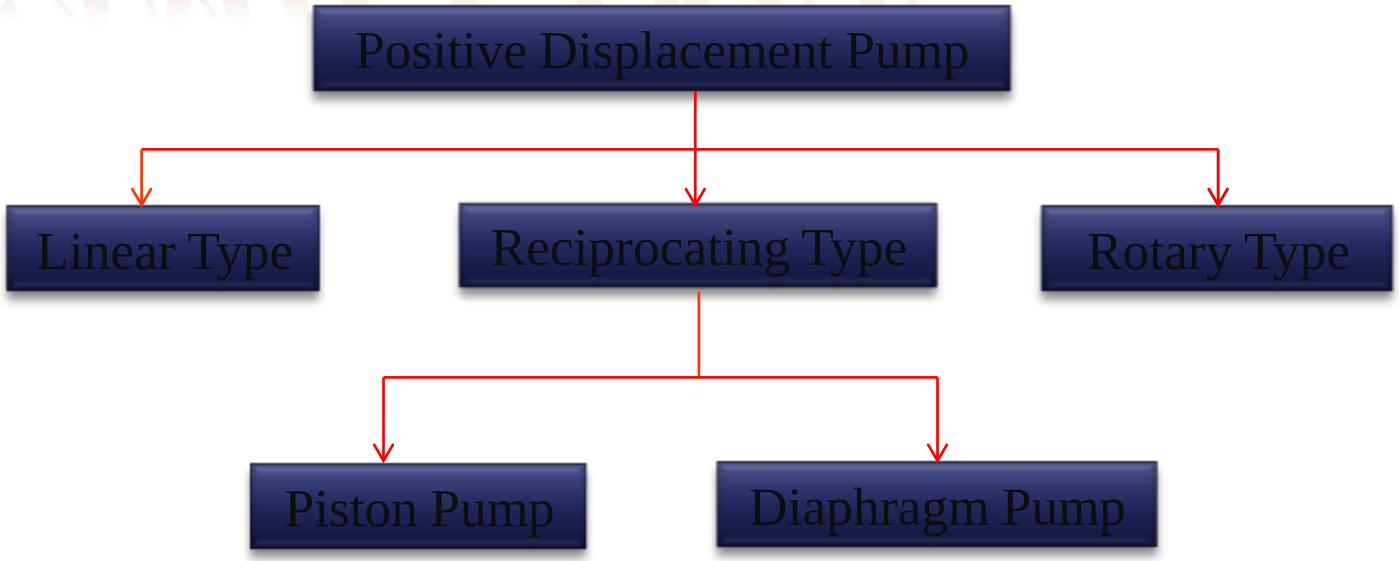
FAMILY TREE

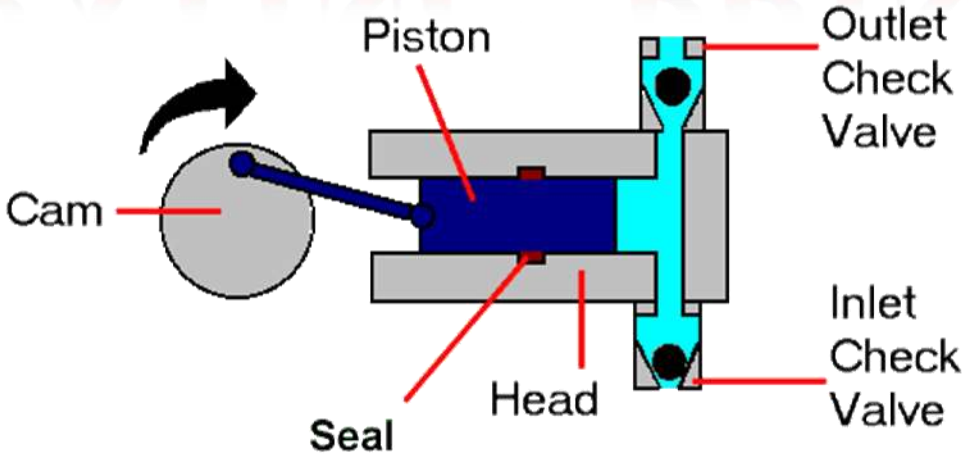




Causes a fluid to move by trapping a fixed amount of it and then forcing (displacing) that trapped volume into the discharge pipe.

Also known as "Constant Flow Machines"

OPERATING PRINCIPLE



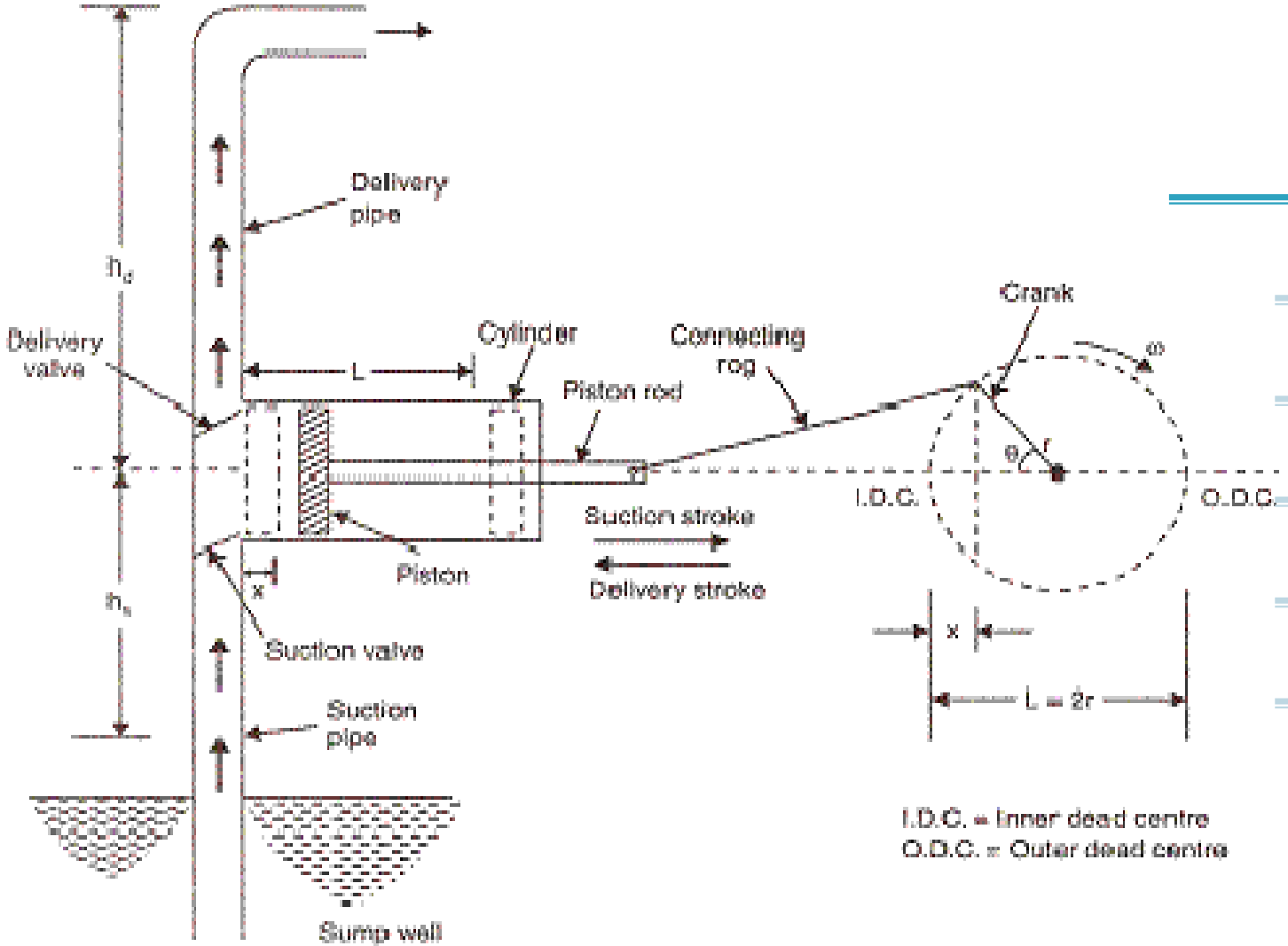
Pushing of liquid by a piston that executes a reciprocating motion in a closed fitting cylinder.

Crankshaft-connecting rod mechanism.

Conversion of rotary to reciprocating motion.

Entry and exit of fluid.

WORKING



Cylinder.

Suction Pipe.

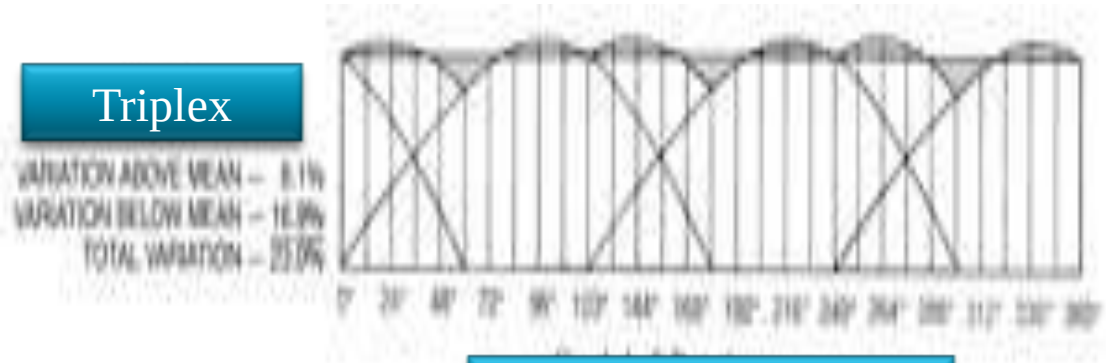
Delivery Pipe.

Suction valve.

Delivery Valve.

CHARACTERISTICS

Triplex

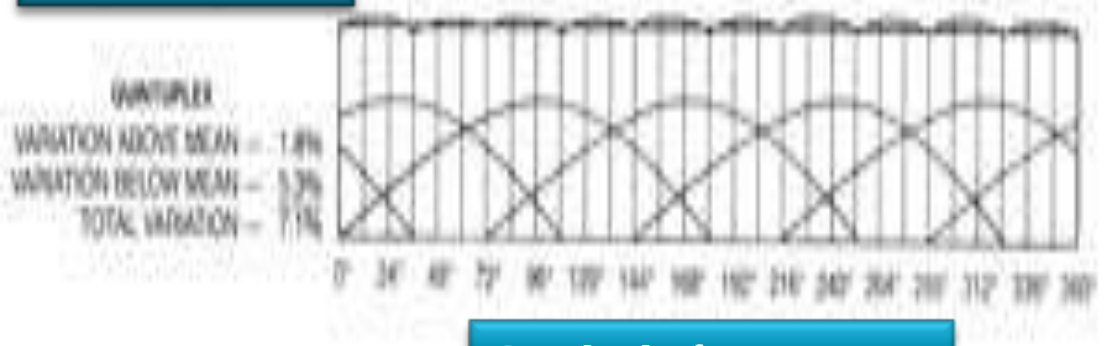


Crank-shaft Rotation

No generation of head.

Because of the conversion of rotation to linear motion, flow varies within each pump revolution.

Quintuplex

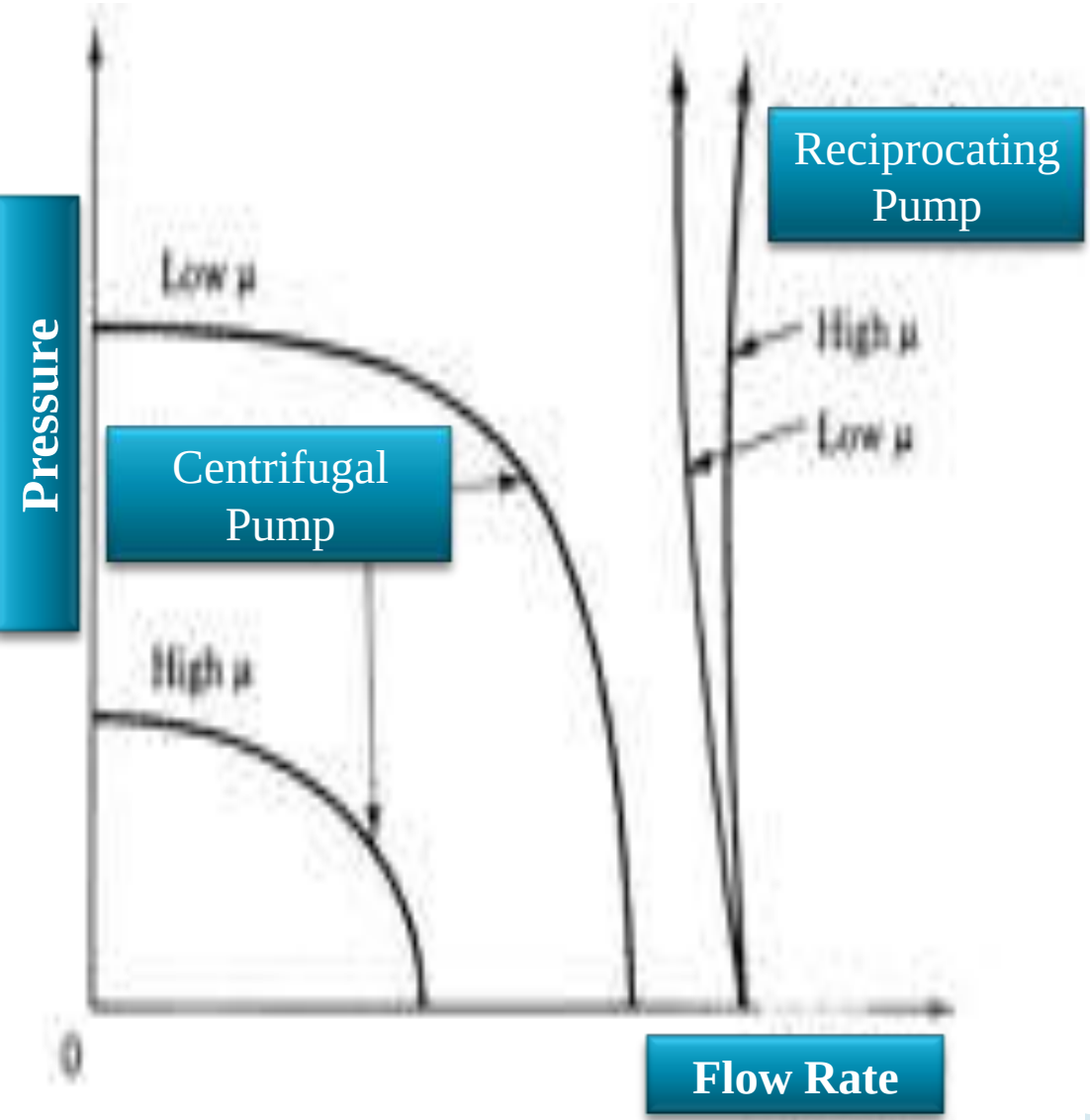


Crank-shaft Rotation

Flow variation for the triplex reciprocating is 23%.

Flow variation for the quintuplex pump is 7.1%.

EFFECT OF VISCOSITY



Provides a nearly constant flow rate over a wider range of pressure.

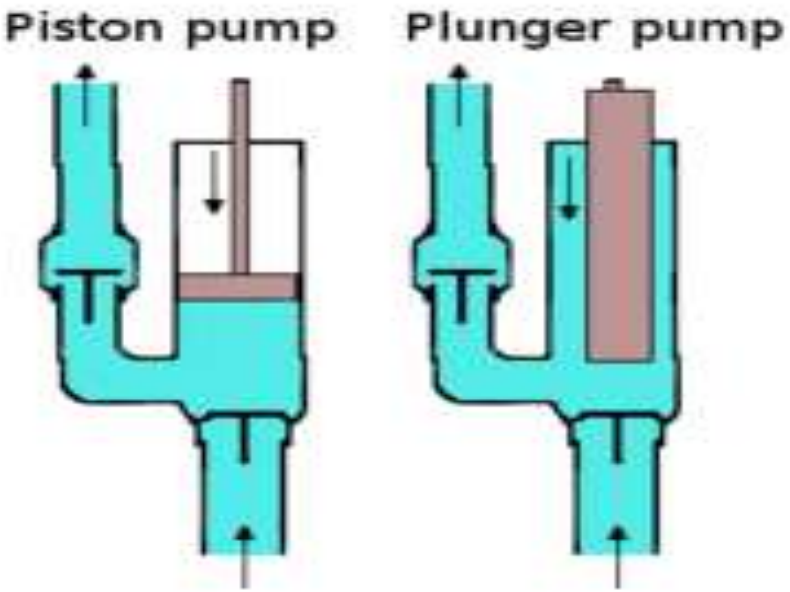
Fluid viscosity has little effect on the flow rate as the pressure increases.

PISTON/PLUNGER PUMP

They are reciprocating pumps that use a plunger or piston to move media through a cylindrical chamber.

It is actuated by a steam powered, pneumatic, hydraulic, or electric drive.

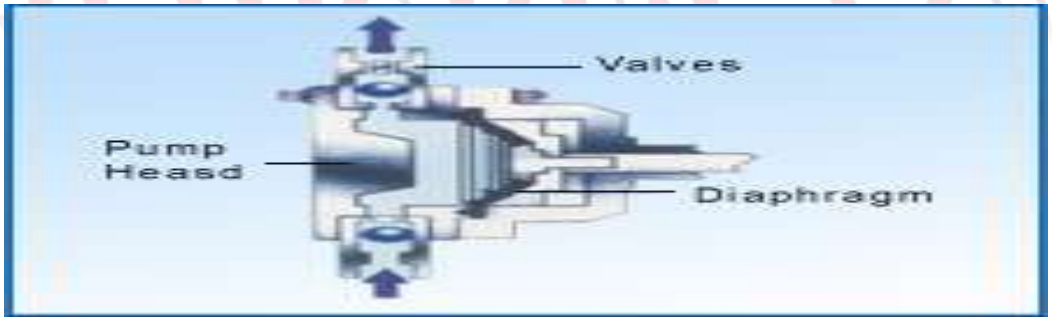
Other names are well service pumps, high pressure pumps, or high viscosity pumps.



Cylindrical mechanism to create a reciprocating motion along an axis, which then builds pressure in a cylinder or working barrel to force gas or fluid through the pump. The pressure in the chamber actuates the valves at both the suction and discharge points.

The volume of the fluid discharged is equal to the area of the plunger or piston, multiplied by its stroke length.

DIAPHRAGM PUMP



*A **diaphragm pump** is a pump that uses a combination of the reciprocating action of a rubber, thermoplastic or teflon diaphragm and suitable non-return check valves to pump a fluid.*

Has been developed for handling corrosive liquids and those containing suspensions of abrasive solids.

In one section a piston or plunger operates in a cylinder in which a non-corrosive fluid is displaced..

The movement of the fluid is transmitted by means of flexible diaphragm to the liquid to be pumped. The only moving parts of the pump that are in contact with the liquid are the valves, and these can be specially designed to handle the material.

In some cases the movement of the diaphragm is produced by direct mechanical action, or the diaphragm may be air actuated.

CHARACTERISTICS OF DIAPHRAGM PUMP

Suitable for discharge pressure up to 1,200 bar have .

Good dry running characteristics.

Are low-shear pumps.

Can be used to make artificial hearts.

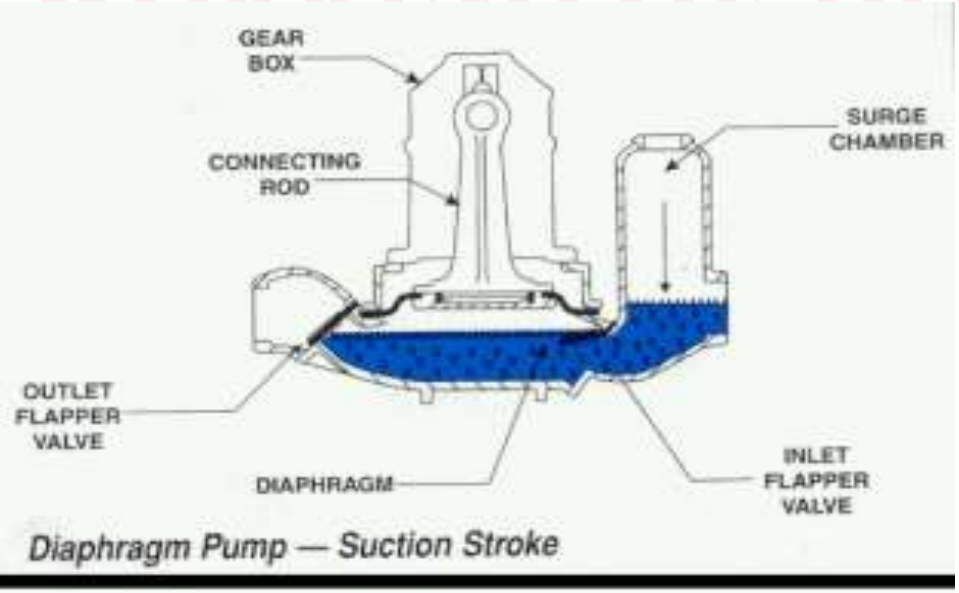
Are used to make air pumps for the filters on small fish tanks.

Can be up to 97% efficient.

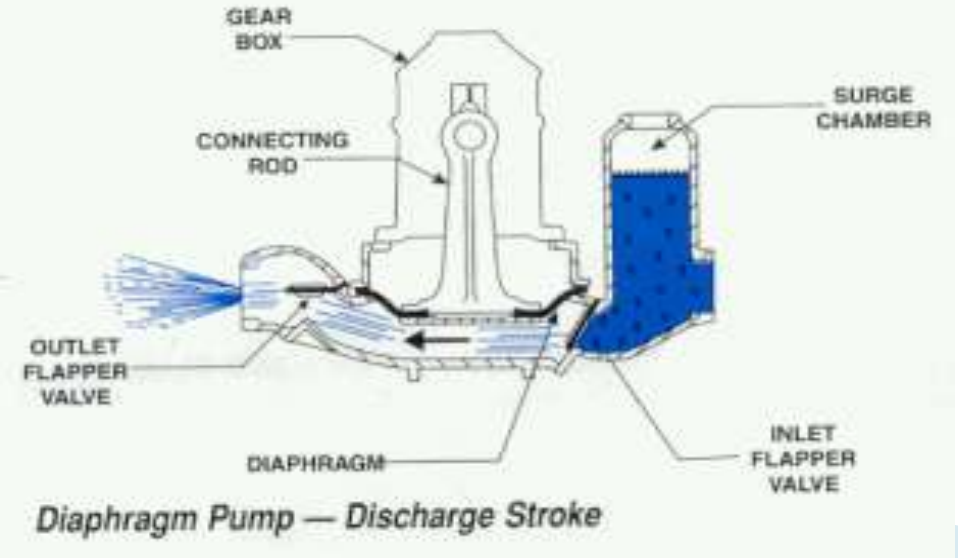
Can handle highly viscous liquids.

Are available for industrial, chemical and hygienic applications.

WORKING OF DIAPHRAGM PUMP



Diaphragm Pump — Suction Stroke



Diaphragm Pump — Discharge Stroke

A vacuum is created inside the pump casing each time the diaphragm is raised.

This opens the inlet valve and seals the discharge valve allowing water and air to enter the pump.

When the diaphragm is lowered the resulting pressure seals the inlet and opens the outlet valve purging the pump housing of water and air.

Unlike centrifugal designs the water inside the casing is *positively displaced* and no recirculation occurs.

PUMPING POWER

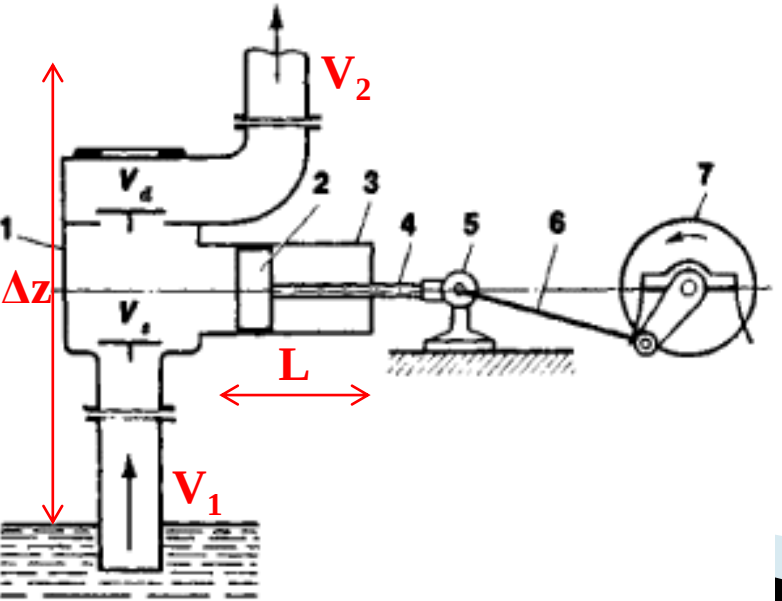
Power=(Δp*Q)/η

ΔP: Change in total pressure between the inlet and outlet.

$$\Delta P = \frac{(v_2^2 - v_1^2)}{2} + \Delta z g + \frac{\Delta p_{\text{static}}}{\rho}$$

Q: Discharge of the pump.

η: Efficiency.



Q=(ALN)/60.

Q: – Discharge of the pump, m^3/sec.

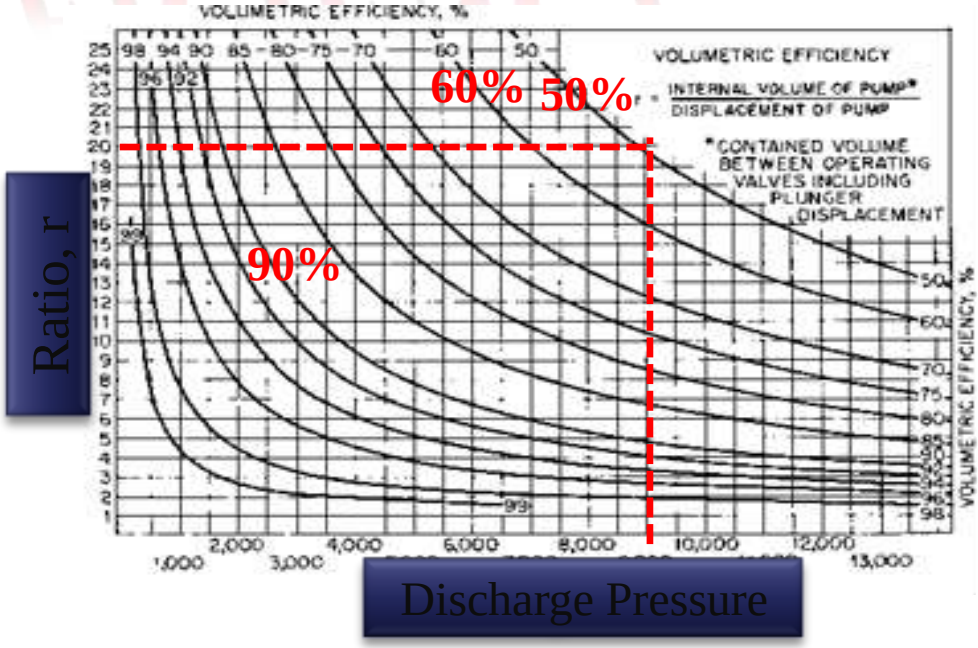
A: – Cross-section of piston or cylinder, m^2.

L: – length of stroke in meter, m.

N: – speed of crank, r.p.m.

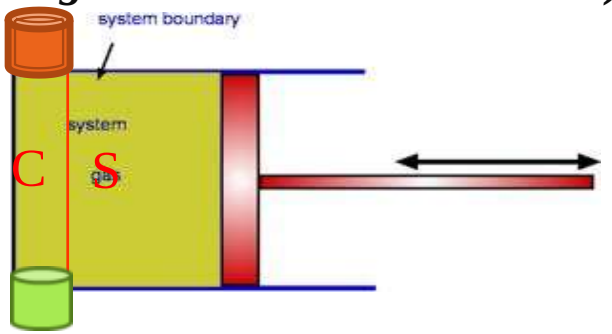
PUMP EFFICIENCY

The ratio of the power imparted on the fluid by the pump in relation to the power supplied to drive the pump.



Volumetric efficiency :

(Discharge volume / Suction volume)-slip



$$r = (V_C+V_S)/V_S = 1+(V_C/V_S)$$

Mechanical efficiency : loss occurs while overcoming mechanical friction in bearing and speed reduction.

Speed of piston= (stroke)(rpm)/(30000).*

(mm)

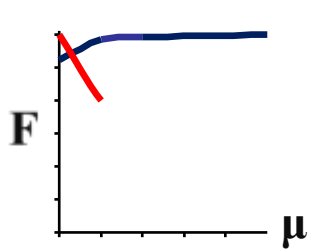
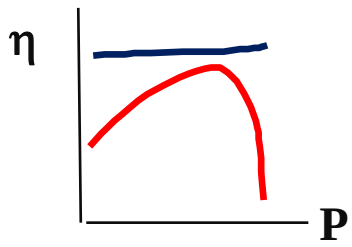
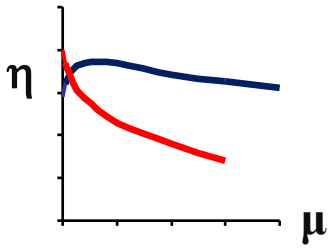
% of full speed	44	50	73	100
M.E, %	93.3	92.5	92.5	92.5

% of full-load developed pressure	20	40	60	80	100
M.E,%	82	88	90	92	92

APPLICATION

- *Agriculture.*
- *Chemical.*
- *Desalination.*
- *Horizontal Drilling.*
- *General Industries.*
- *Mining.*
- *Oil and Gas.*
- *Pulp and Paper.*
- *Sewer Cleaning.*
- *Steel.*

COMPARISON

CENTRIFUGAL(——)		RECIPROCATING(——)
Loses flow as the viscosity goes up.		*Increases flow due to thickening of the flow.*
Changes in pressure has a dramatic effect on efficiency.		*Changes in pressure has little effect on efficiency.*
Very inefficient at even modest viscosity.		*Very efficient with high viscosity.*

Thank you

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