

Single and Double Reciprocating Pumps

Single Acting Reciprocating Pumps

In industry, reciprocating pumps are of many sizes and designs. Their operation is similar to the bicycle pump described above.

An industrial reciprocating pump is constructed of metal and has the following main parts :

1. The cylinder

This is a metal tube-shaped casing (or body), which is generally fitted with a metal lining called a 'cylinder liner '. The liner is replaceable when it becomes worn and inefficient. The cylinder is also fitted with suction and discharge ports which contain special spring loaded valves to allow liquid to flow in one direction only - similar to check valves.

2. The piston

The piston consists of a metal drive rod connected to the piston head which is located inside the cylinder. The piston head is fitted with piston rings to give a seal against the cylinder lining and minimise internal leakage. The other end of the drive rod extends to the outside of the cylinder and is connected to the driver. (In the old days of piston pumps, the driver used to be (and still is in some cases), high pressure steam which was fed to a drive cylinder by a system of valves in a steam chest). Modern industries generally use high power electric motors, linkages and gearing to convert rotating motion into a reciprocating action.

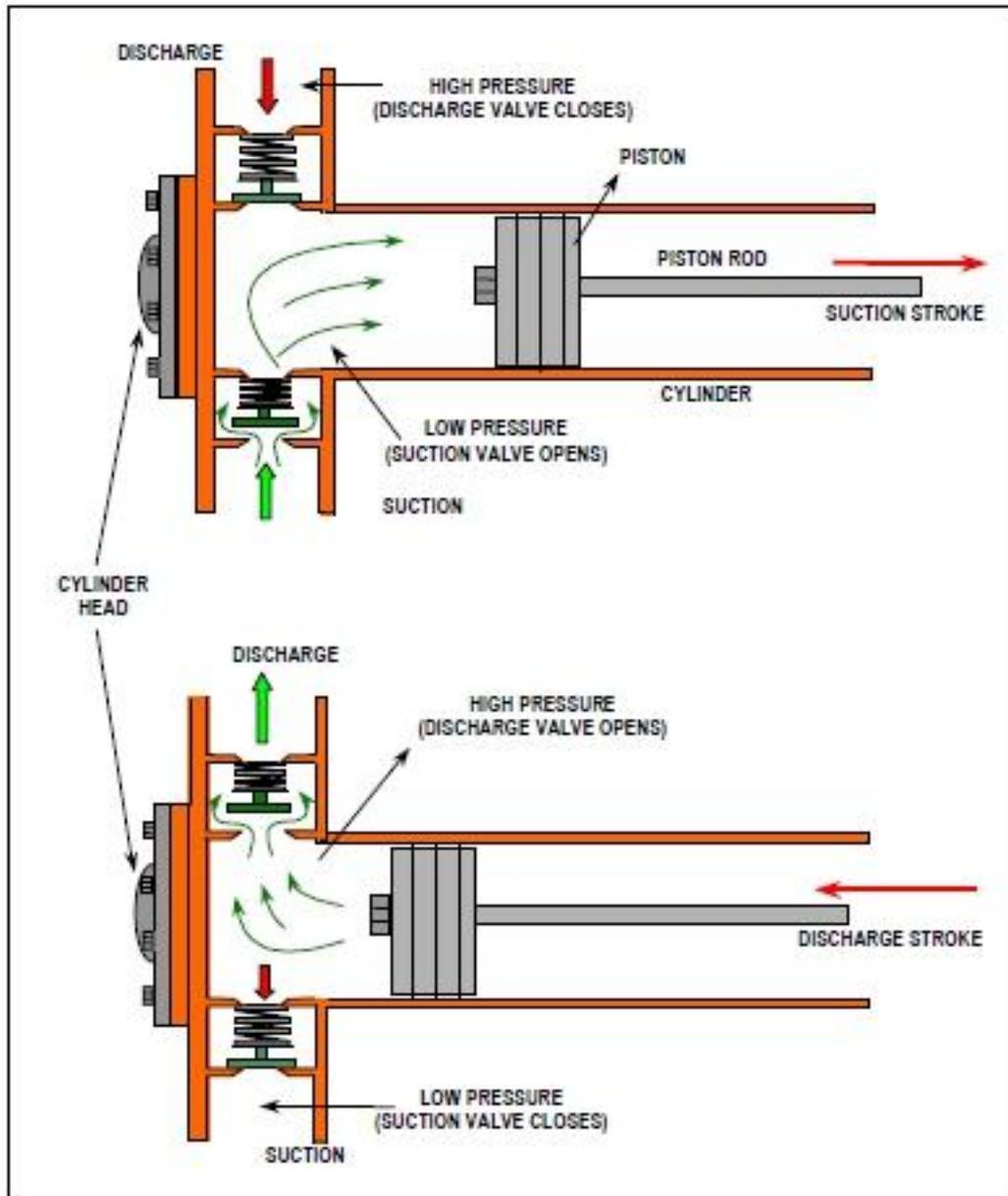
In a single acting pump, the backward stroke of the piston causes a suction which pulls in liquid through the inlet valve. (The same suction action keeps the discharge valve closed).

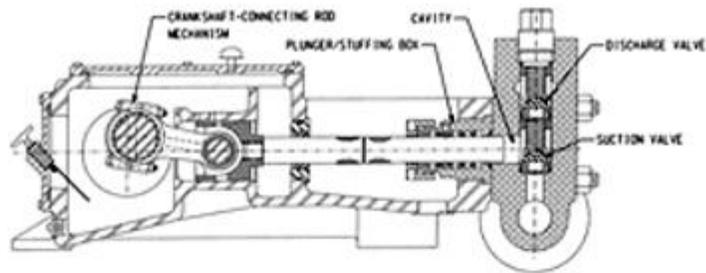
On the forward stroke, the increase in pressure generated by the piston, closes the inlet valve and opens the discharge valve. The liquid is displaced into the discharge system.

The flow from a reciprocating pump is uneven or pulsating. This can be undesirable in some applications. Flow can be smoothed out, but we will discuss this a little later.

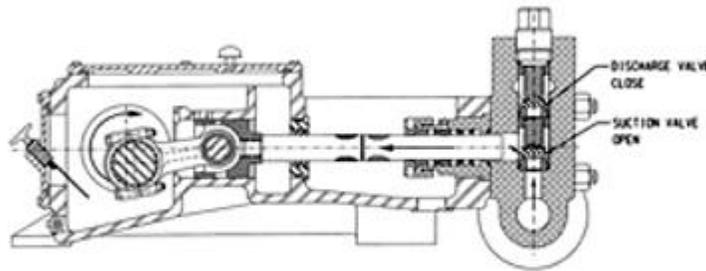
Like the rotary pumps, because the action is positive displacement, a piston pump can generate very

high pressure and therefore **MUST NEVER** be operated against a closed discharge system valve unless it is fitted with a safety relief system in order to prevent damage to the pump and/or the driver and/or other downstream equipment.

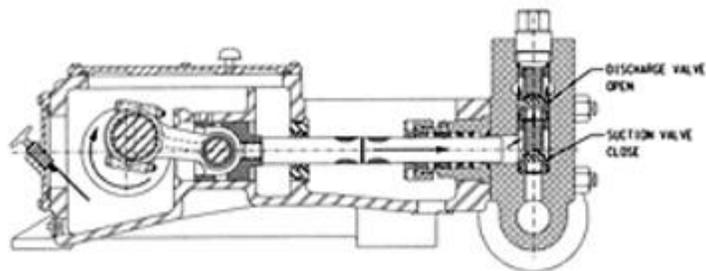




(A) TYPICAL RECIPROCATING PUMP (PLUNGER)



(B) SUCTION STROKE



(C) DISCHARGE STROKE

Double Acting Reciprocating Pumps

This type of pump operates in exactly the same way as the single acting with respect to its action. The difference is, that the cylinder has inlet and outlet ports at each end of the cylinder. As the piston moves forward, liquid is being drawn into the cylinder at the back end while, at the front end, liquid is being discharged. When the piston direction is reversed, the sequence is reversed.

With a double acting pump, the output pulsation is much less than the single acting.

In theory, a reciprocating pump will always deliver the same volume for each stroke regardless of discharge pressure. But, as discharge pressure is increased, there is more likelihood of internal leakage between the piston rings and the cylinder liner, or leaking internal valves, causing a decrease in output. A measure of this is known as the ' Volumetric Efficiency ' of the pump.

The amount of liquid which leaks internally is known as the ' Slip ' and, if the pump is in good condition, the slip should be below 1.0%. If slip is above 5.0%, the pump needs to be overhauled. However, at operating pressures, the amount of slip is relatively constant as long as wear is not rapid. The output therefore can still be classed as constant. This type of pump is useful for delivery of fixed quantities of liquid as used in metering or dosing operations.

The speed of a reciprocating pump is generally measured as ' Strokes per Minute '. This is the number of times the piston moves back and forth in one minute. Speed can also be measured as ' R.P.M.' of the drive motor.

As the cylinder(s) are of constant dimensions, the volume of liquid moved for each stroke, (discounting leakage described above), is the same and therefore the output per minute, hour or day ..etc can be calculated.

This type of pump operates in exactly the same way as the single acting with respect to its action. The difference is, that the cylinder has inlet and outlet ports at EACH END OF THE CYLINDER. As the piston moves forward, liquid is being drawn into the cylinder at the back end while, at the front end, liquid is being discharged. When the piston direction is reversed, the sequence is reversed.

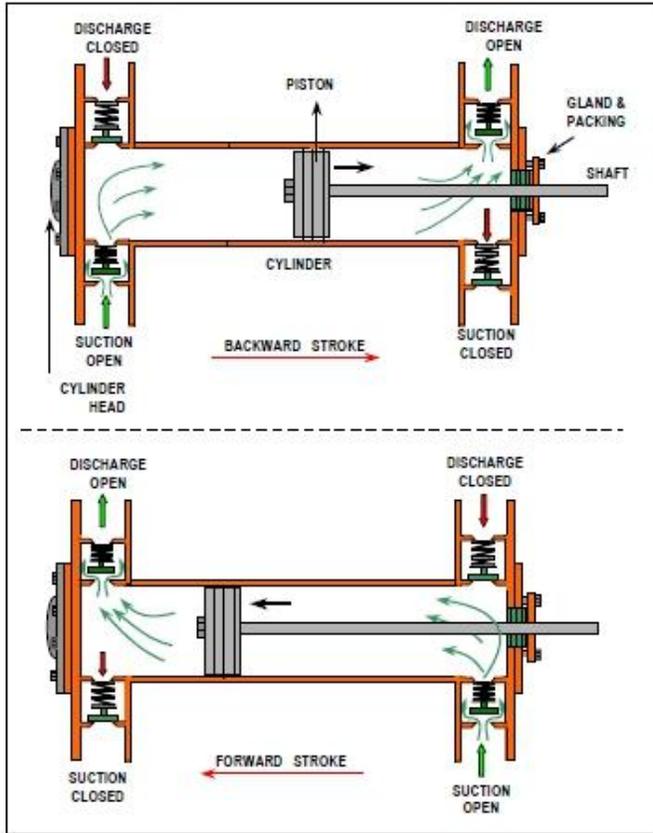
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