3 Types of Positive Displacement Pump + Name & PDF

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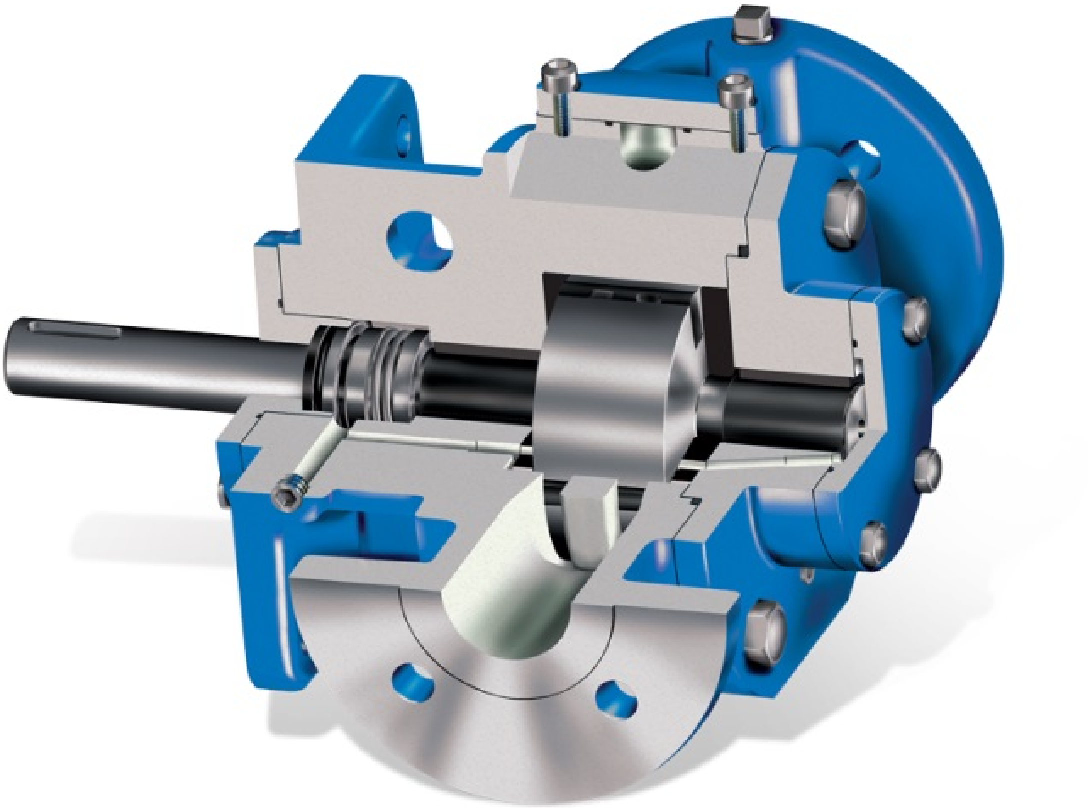

Types of Positive Displacement Pump – A Positive Displacement pump is a mechanical device that displaces a specified amount of liquid with each revolution or cycle it completes. A positive displacement pump's flow rate is related to its speed and the number of cycles it performs in a given amount of time.

You will find all the information you need about positive displacement pumps at Linquip. When it comes to a pump, our experts are available to assist you whenever necessary. Explore Linquip's article "**What is Positive Displacement Pump & How Does It Works?**" for a basic understanding of these industrial devices.

Do you have any experience with them? Discover the pump you need from Linquip's selection of **Positive Displacement Pump Products**. Is there a particular type of positive displacement pump you require? Linquip offers no-cost access to all available **Positive Displacement Pumps for Sale**. In addition, if you are interested in finding Positive Displacement Pump prices, you can use Linquip to submit an inquiry/request for quotes to all **Positive Displacement Pump Suppliers and Companies** for free.

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What is a Positive Displacement Pump?

Although variations within the counter force, the PD pump, or positive displacement pump, delivers an approximated steady flow at a speed. The pump's pumping action is cyclic and is driven by screws, pistons, rollers, gears, diaphragms, and vanes.

The functioning principle of a positive displacement pump is that the flowing liquid in the pump may be collected inside a cavity and discharged in a predetermined quantity. A few pieces, including the piston, diaphragm, and plunger, might cause liquid dislocation. The pumps have an expanding cavity on the suction side and a diminishing cavity on the discharge side. Because the fluid may be sucked on the inlet side as the cavity expands and then released when the cavity shrinks.

A positive displacement pump (Reference: **elprocus.com**)

Working Principle of Positive Displacement Pump

A positive displacement pump pushes a fluid by capturing a certain volume of it and pushing (displacing) it into a discharge pipe or system.

An expanding cavity is used on the suction side of some positive displacement pumps, while on the discharge side, a decreasing cavity is used. As the cavity on the suction side extends, liquid flows into the pump, and as the cavity collapses, liquid flows out of the discharge. Throughout each pumping cycle, the volume remains constant.

Positive displacement pumps do not employ impellers, instead relying on spinning or reciprocating elements to force liquid into an enclosed chamber until enough pressure is built up to push the liquid into the discharge system. The pump does not rely on passing the liquid through the impeller to increase the velocity of the fluid, as a centrifugal pump does. As a result, a positive displacement pump's fluid velocity is substantially lower than a centrifugal pump's. For particular applications, such as pumping a fluid containing fragile solids, this is frequently a desirable quality.

Characteristics of Positive Displacement Pump

Unlike centrifugal or roto-dynamic pumps, positive displacement pumps may theoretically provide the same flow at a certain speed (RPM) regardless of discharge pressure. Positive displacement pumps can thus be considered constant flow devices. However, when the pressure rises, a minor increase in internal leakage can preclude a totally constant flow rate.

Because it lacks the shutdown head of a centrifugal pump, a positive displacement pump should not be permitted to run against a closed valve on the discharge side of the pump. When a pump is running against a closed discharge valve, it continues to create flow and the pressure in the discharge line grows until the pipeline fractures or the pump is badly damaged, or both.

A relief or safety valve on the discharge side of a positive displacement pump is frequently required to prevent this. This relief valve can be installed either inside or outside the pump. Internal relief or safety valves are usually available from the pump manufacturer. An internal valve is often used solely as a safety precaution, but an exterior relief valve in the discharge line, with a return connection to the suction line or supply tank, will give enhanced safety.

How Does a Positive Displacement Pump Work and What Are Its Main Features?

Positive displacement and centrifugal pumps are the two primary types of pumps. Centrifugal pumps can handle larger flows and operate with liquids with lower viscosity. Centrifugal pumps will account for 90% of the pumps in some chemical facilities. On the other hand, positive displacement pumps are favored in a variety of applications. They can, for example, handle greater viscosity fluids and work more effectively at high pressures and low flows. They're also more precise when metering is a factor to consider.

What are The Limitations of a Positive Displacement Pump?

Positive displacement pumps, in general, are more complicated and hard to service than centrifugal pumps. They're also incapable of producing the high flow rates that centrifugal pumps are known for.

Positive displacement pumps are less capable than centrifugal pumps at handling low viscosity fluids. A rotary pump depends on the seal between its spinning parts and the pump casing to provide suction and prevent slippage and leaks. Low viscosity fluids significantly diminish this. Similarly, due to the high pressures created during the pumping operation, it is more difficult to prevent valve slippage in a reciprocating pump with a low viscosity feed.

Positive displacement, and particularly reciprocating, pump types have pulsating discharges as well. Pulsation in pipe systems can produce noise and vibration, as well as cavitation issues, which can lead to damage or failure. The use of several pump cylinders and pulsation dampeners can decrease pulsing, although this necessitates careful system design. Centrifugal pumps, on the other hand, create a constant, smooth flow.

A reciprocating pump's back-and-forth action can also cause vibration and noise. As a result, it is critical to build very solid foundations for this sort of pump. Because of the high pressures created throughout the pumping cycle, pressure relief in either the pump or the discharge line is essential in the event of a blockage. Over-pressure protection is not required for centrifugal pumps; in this case, the fluid is simply recirculated.

Feeds with a high percentage of abrasive materials can produce excessive wear on all sorts of pump components, particularly valves and seals. Despite the fact that positive displacement pumps' components run at far lower rates than centrifugal pumps', they are nonetheless susceptible to these issues. This is especially true with piston and plunger reciprocating pumps, as well as gear rotary pumps. A lobe, screw, or diaphragm pump may be suited for more demanding applications with this sort of input.

Types of Positive Displacement Pumps

3 Types of Positive Displacement Pumps are:

- **Reciprocating Positive Displacement Pumps**
- **Rotary Positive Displacement Pumps**
- **Linear Pumps**

Reciprocating Positive Displacement Pumps

The repetitive back-and-forth movement (strokes) of a piston, plunger, or diaphragm drives a Reciprocating Positive Displacement pump. Reciprocation is the term for these cycles.

The initial piston stroke generates a vacuum, opens an intake valve, closes the exit valve, and pulls fluid into the piston chamber of a piston pump (the suction phase). The intake valve, which is now under pressure, closes when the piston reverses motion, and the outlet valve opens, allowing the fluid in the piston chamber to be emptied (the compression phase). A basic example is a bicycle pump. Double-acting piston pumps have intake and exit valves on both sides of the piston. On one side, the piston is in suction, while on the other, it is in compression. In industrial applications, more complicated radial variants are frequently employed.

Plunger pumps work in the same way. With a piston pump, the volume of fluid moved is determined by the cylinder volume; with a plunger pump, the volume of fluid pushed is determined by plunger size. To keep the pumping motion going and minimize leaks, the seal surrounding the piston or plunger is critical. Plunger pumps have a seal that is stationary at the top of the pump cylinder, whereas piston pumps have a seal that moves up and down constantly within the pump chamber.

Diaphragm pumps move fluid via a flexible membrane instead of pistons or plungers. The capacity of the pumping chamber is expanded by extending the diaphragm, and fluid is sucked into the pump. During compression, the diaphragm's volume decreases, and some fluid is expended. Diaphragm pumps are appropriate for pumping hazardous fluids since they are hermetically sealed devices.

Reciprocal pumps' cyclic activity causes pulses in the discharge, with the fluid speeding up during compression and slowing down during suction. This might generate harmful vibrations in the installation, hence damping or smoothing is frequently used. The use of two (or more) pistons, plungers, or diaphragms, one in compression and the other in suction, can help reduce pulsing.

Reciprocal pumps are useful for applications requiring precise metering or dosing due to their repetitive and predictable operation. It is feasible to give measurable amounts of pumped fluid by changing the stroke rate or length.

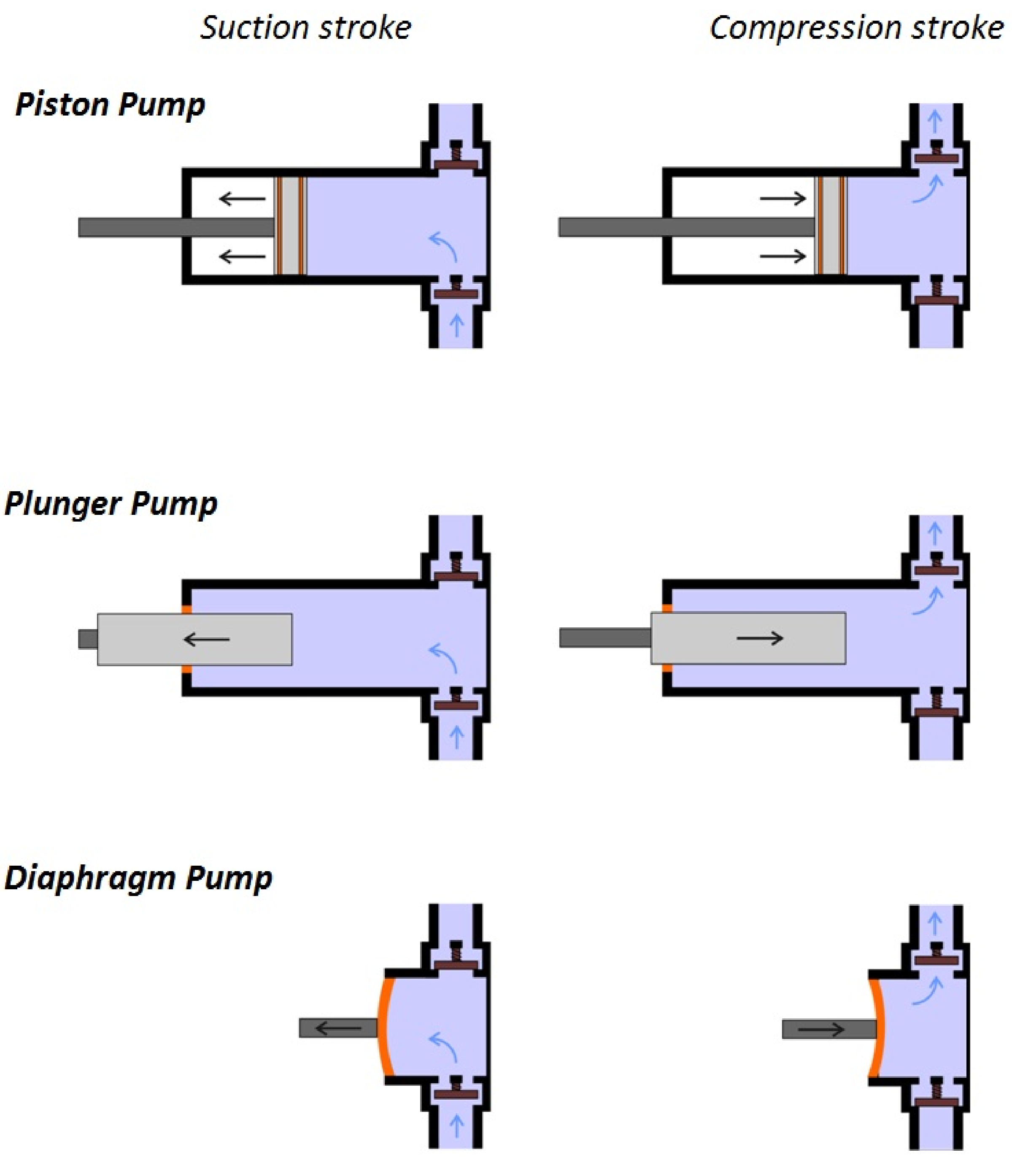


Figure 1. Basic reciprocating pump designs

Function of a reciprocating positive displacement pump (Reference: **michael-smith-engineers.co**)

Rotary Positive Displacement Pumps

Rotating cogs or gears, rather than the backward and forward motion of reciprocating pumps, are used to transport fluids in rotary positive displacement pumps. The revolving element provides suction at the pump intake by forming a liquid seal with the pump casing. Fluid is taken into the pump and encased in the teeth of its moving cogs or gears before being discharged. The gear pump is the most basic type of rotary positive displacement pump. External and internal gear pumps are the two most common types.

Two interlocking gears are supported by independent shafts in an external gear pump (one or both of these shafts may be driven). The fluid is trapped between the teeth as the gears rotate, transporting it from the intake to the discharge and around the casing. Because the gears are interlocked, no fluid is transported back through the center. Close tolerances between the gears and the casing enable the pump to create suction at the intake while preventing fluid leakage from the discharge side. Low viscosity liquids are more prone to leakage or "slippage."

Internal gear pumps work on the same principle as external gear pumps, but the two interlocking gears are of various sizes and rotate inside each other. At the intake, fluid is pumped into the cavities between the two gears, which is then conveyed around to the discharge port, where it is discharged by the smaller gear.

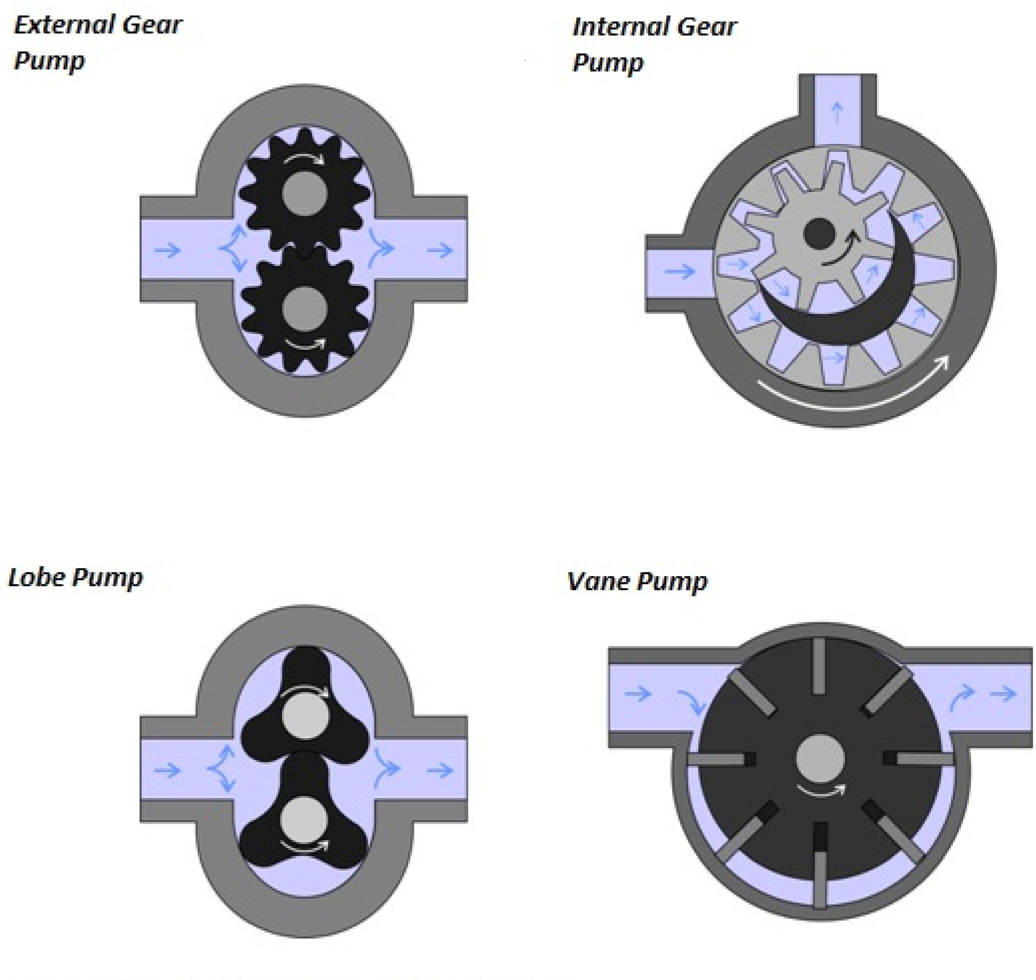


Figure 2. Rotary positive displacement pump designs

Function of a rotary positive displacement pump (Reference: **michael-smith-engineers.co**)

Gear pumps require the pushed fluid to lubricate them, making them suitable for pumping oils and other viscous liquids. As a result, a gear pump should never be left running empty. When utilized with abrasive fluids or feeds, including entrained materials, these pumps are sensitive to wear due to the near tolerances between the gears and casing.

The lobe pump and vane pump are two other designs similar to the gear pump.

The spinning parts of the lobe pump, rather than gears, are lobes. The lobes of this design do not come into touch with each other during the pumping operation, which reduces wear, contamination, and fluid shear. Vane pumps have a rotor with a set of moving vanes (either spring-loaded, under hydraulic pressure, or flexible). The vanes keep a tight seal against the casing wall, transporting trapped fluid to the discharge point.

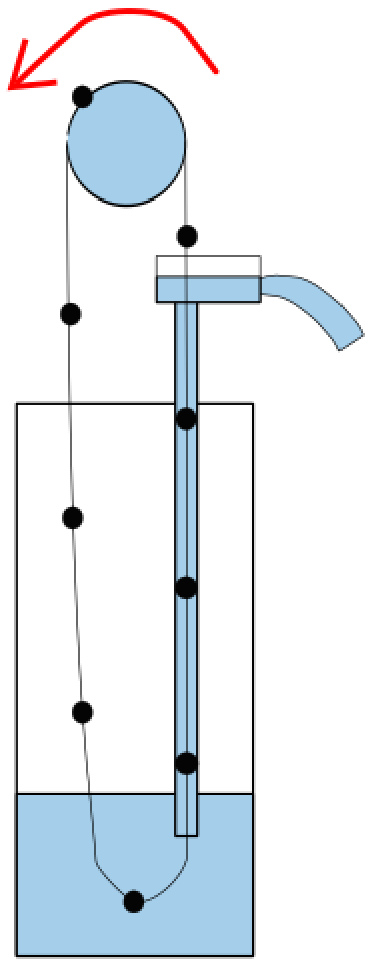
Another type of rotary pump transfers fluid along the screw axis using one or more meshed screws. These pumps are based on the Archimedes screw, a device that has been used for irrigation for thousands of years.

Linear Pumps

The dislocation of the liquid in linear pumps occurs in a straight line or linearly. Rope and chain pumps are two of the most common types of these pumps. Calibration is not required in this type of pump. This sort of pump may be used in a static environment. The primary difficulty with this pump, though, is volume. These pumps will create a lot of noise due to the piston withdrawal within the cavity, hence they must be placed far away from people's homes. Rope pumps and chain pumps are the two types of pumps available.

A rope pump is a linear pump in which a loose hanging rope is lowered into a well and hauled up with the aid of a long pipe, the base of which is submerged in water. The spherical disks are tied to the rope, which will send the water toward the outside. This type of pump is commonly used for both self-supply and communal water supply. These pumps may be installed in boreholes that would normally be drilled by hand.

The chain pump is a linear pump that uses a continuous chain to connect a number of circular discs. One division of the chain is submerged in water, and the chain goes through a pipe with a diameter slightly larger than the disc diameter. The water becomes caught within the discs and is released at the peak once the chain is dragged up the pipe. For millennia, these pumps were employed in the early Middle East, China, and Europe.



Linear pump (Reference: **wikiwand.com**)

Applications of Positive Displacement Pumps

These pumps are frequently used to pump high viscosity fluids that need accurate dosing or a high force output. These pumps, unlike centrifugal pumps, do not have their outputs impacted by force, hence they may be used in any situation where the supply is uneven. Piston, plunger, diaphragm, gear, lob, screw, and vane are some of the greatest positive displacement pump examples.

- Pumping low viscosity fluids, paint spraying, oil production, and high force cleaning are all done with piston and plunger pumps.
- Metering, spraying, and treatment of water, oils, and paints may all be done with diaphragm pumps.
- Pumps for high viscosity fluids are used in the petrochemical, food, paint, and oil sectors, among others.

- Lobe pumps are utilized in the food and chemical industries, as well as in pharmaceutical, biotechnology, and sanitary applications.
- Screw pumps are used for transporting fuel, producing oil, and irrigation, among other things.
- Vane pumps are utilized for low viscosity liquids, fuel loading, and transmission, among other applications.

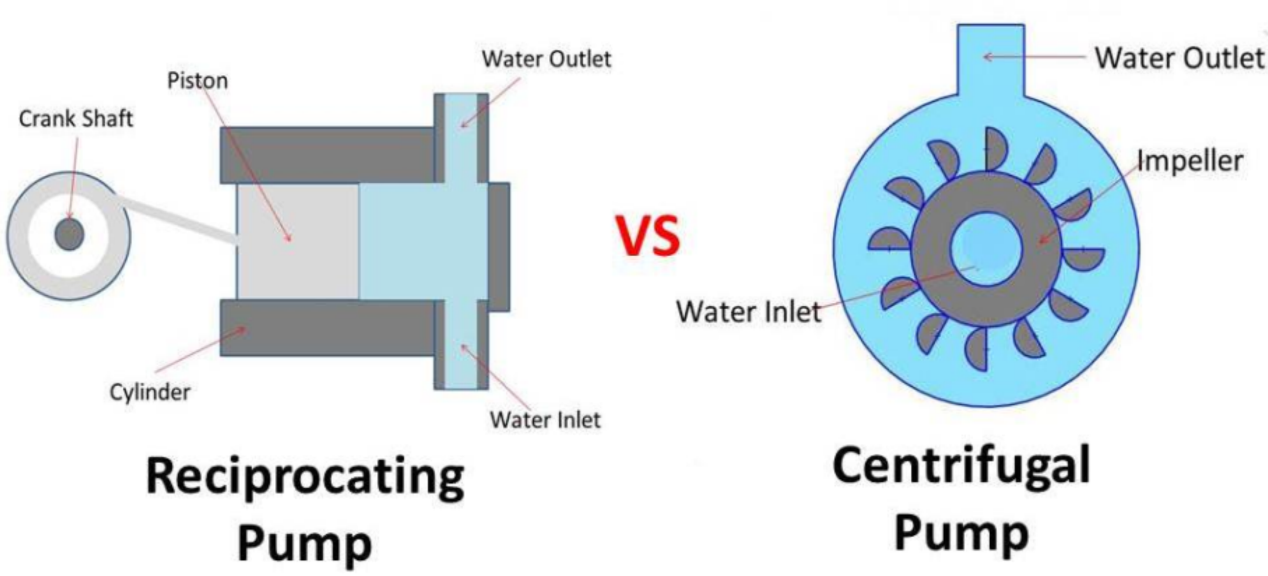
A positive displacement pump is used to transfer a liquid with a specified volume regularly and automatically across the system with the use of valves that would otherwise seal it. Screws, pistons, gears, lobes, vanes, and diaphragms can all be used to drive the pumping motion. These pumps are primarily utilized in applications that need very viscous fluids.

How do Positive Displacement Pumps and Centrifugal Pumps Differ?

Positive displacement pumps have the benefit of being able to handle very viscous fluids, whereas centrifugal pumps are inefficient and require large driving horsepower. PD pumps have high volumetric efficiency and need less driving power. Because the flow rate is directly related to its speed, it can be simply adjusted using speed control. Because the pump will supply the same amount of fluids regardless of system back pressure, driver size is less important than with a centrifugal pump (losses). In the case of delicate fluids, a Positive Displacement Pump can create a very modest shear action.

The fundamental drawback of a Positive Displacement Pump over a Centrifugal Pump is that dry running can be disastrous owing to small clearances between components or, in the case of progressive cavity pumps, interference between the rotor and stator. All PD pumps must have a pressure relief valve installed to avoid pump or pipe failure in the event of an accident, delivery valve closure, or piping obstruction.

Pulsations from main PD pumps can have unwanted consequences such as vibration, product damage, and water hammer. The flow range of PD pumps is restricted (1000m3/hr versus 180,000m3/hr for centrifugal pumps). PD pumps have a smaller variety of accessible materials for construction than Centrifugal Pumps, and ultimately, PD pumps have restricted solids handling capacity in terms of size and/or content.



Positive Displacement Pumps vs Centrifugal Pumps (Reference: **learnmechanical.com**)

Conclusion

By physically pushing fluid through a system, positive displacement pumps transfer fluid by containing a defined volume with seals or valves. Pumps can be propelled by pistons, screws, gears, lobes, diaphragms, and vanes. The two most common types are reciprocal and rotary.

The various types of positive displacement pumps have been briefly described here but a more detailed discussion of each is needed to fully understand the advantages and limitations of each technology. You are encouraged to visit **Positive Displacement Pump For Sale** in Linquip website to find suitable devices based on your application.

FAQs about Positive Displacement Pump

1. Does a Positive Displacement Pump require priming?

Due to the very small clearances within the pump, Positive Displacement Pumps self-prime naturally. The vacuum it creates will allow it to expel the air through the pump until the liquid reaches the pump. A “goose neck” should be installed on the suction line, as it will ensure there is some liquid inside the pump during the priming cycle, preventing dry running & failure.

2. Can Positive Displacement Pumps run dry?

Positive Displacement in Certain Situations Pumps can operate without lubrication or close clearances between parts, i.e., Air Operated Diaphragm Pumps. Because the hose is lubricated in a bath of its own fluid, peristaltic pumps might run dry. PD pumps of other sorts should not be run empty.

3. Is NPSH required for Positive Displacement Pumps?

Every pump needs an NPSH (Net pressure suction head) to provide dependable and trouble-free operation without cavitation damage, hence the system should be built with a suitable margin between NPSHA (Net pressure suction head available) and NPSHR (Net pressure suction head needed) (Net pressure suction head required).

4. What is the Positive Displacement pump discharge pressure control?

A positive displacement pump, unlike a centrifugal pump, does not produce pressure; instead, the system develops pressure from the pressure drop, which then creates a back pressure that is largely dependent on the flow rate through the system, i.e., higher flow rates will result in higher losses and, as a result, a higher back pressure.

Back pressure is also affected by the pressure in the vessel at the discharge point, such as a hydrogen blanket or steam. Because the pumping rate determines a substantial part of the pressure, pressure is regulated by changing the pump's speed. When the variable speed drive is not used, the system pressure is regulated to some extent by the pressure relief valve setting.

5. What are Positive Displacement Metering Pumps?

Possibility of Positive Displacement Metering pumps is typically employed in applications requiring great precision, such as dosing applications requiring pH control, such as Waste Water Treatment Plants, or filling lines requiring accuracy of amounts of fluid dispersed into containers.

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