Types of Pumps and Pump Terms Explained

Mechanical pumps are the second most common machine in the world (after the electric motor). This document is focused on low-voltage miniature pumps, specifically the pumps offered by Simply Pumps and listed on our website at [www.simplypumps.com](http://www.simplypumps.com). This document is intended to inform and assist potential pump buyers interested in increasing their basic understanding of miniature pumps. Although it may be a great tool for making an informed pump purchase, it is not intended to be a substitute for obtaining professional engineering assistance.

**TYPES OF PUMPS:**

**Centrifugal Pumps** – Centrifugal pumps have been around for hundreds of years. If you have ever ridden a bicycle without a fender after it rains, you already have a good understanding of how a centrifugal pump works. The centrifugal force of the spinning impeller or the bicycle tire propels the water or fluid in a specific direction. In the bicycle example, the rain water is propelled onto the riders back. Centrifugal pumps use a volute chamber or housing to control the flow of fluid and direct it to the outlet receptacle.

Centrifugal pumps work best when they are submersed into the fluid to be pumped. This eliminates any concerns with priming. Priming simply establishes the required suction for the pump to operate the way it was designed and intended. You could say that this type of pump is self-priming when it is submersed but generally we do not use the term “self-priming” when referring to centrifugal pumps. More about the term “self-priming” can be found below. When submersing is not possible or desirable, the next best solution to avoid manual priming is to situate the pump in such a
way that the volute chamber is flooded. This is called “flooded suction” and you can learn more about this technique in the section with the same name.

The miniature HP pumps, the Dynamax line, the Specialty pumps, and the VPII pump are all based on the centrifugal design. Even though most centrifugal pumps work best when submersed, not all of our centrifugal pumps are submersible. A few of our HP pumps fall into this category. The flooded suction technique is the best solution for this style of pump.

The advantages of centrifugal pumps include:

- Reasonably priced and readily available
- Long life expectancy
- The best pump when submersing is desired
- Can handle some particulate in the fluid
- Generally has higher flow rates

The disadvantages of centrifugal pumps include:

- Do not self-prime unless submersed
- Do not have reversible (bi-directional) flow capability
- Generally has lower PSI ratings

**Gear Pumps** – Gear pumps use meshing gears to pump the fluid by positive displacement or fixed displacement, meaning they deliver a constant amount of fluid for each revolution.

The gears and gear housing are machined to extremely tight tolerances allowing this design to generate much higher PSI than say centrifugal pumps.

As shown in the diagram, the fluid is trapped between the rotating gears and the gear housing as it is forced from the inlet side to the discharge side.

Gear pumps work extremely well with moderately
viscous fluids such as oils. Many gear pumps are specifically designed to pump oils and contain wetted parts that will rust if used with water or water based fluids.

The advantages of gear pumps include:

- Bi-directional flow capability
- Higher PSI capability
- Self-priming

The disadvantages of gear pumps include:

- Fluid must be free of particulates
- Lower flow rates
- Only a few quality, miniature gear pump manufacturers
- Cannot run dry for extended periods

Membrane Pumps – Also known as a diaphragm pump, membrane pumps are very versatile. Some are designed to pump both fluid and gases and some air pumps are manufactured specific for pressure or vacuum applications.

The advantages of membrane pumps include:

- Good dry running characteristics
- Can pump fluid and gas/air
- Self-priming
- Small footprints possible
- Larger designs have high PSI capability

The disadvantages of membranes pumps include:

- Fluid must be free of particulates
- Micro sizes have lower flow rates
- Not as quiet as other pump types
Peristaltic Pumps –

Peristaltic pumps are very interesting in their design and capabilities, perfect for intermittent and specialty pump applications. Sometimes referred to as tubing pumps, they have a long list of advantages. Their larger size and lower flow rates are the primary disadvantages. The largest peristaltic pump that we stock is rated at 1 liter per minute.

Our peristaltic pumps are self-priming (from 12 to 25 feet), variable flow, reversible, chemical resistant, and can handle fluids with particulates or higher viscosities. The fluid only contacts the inside of the tubing. Change the tubing to renew the pump and/or change compatibility.

Choose from a large selection of variations on each pump series we offer. All of our peristaltic pumps are available with several different tubing materials, tubing sizes, motor RPMs and control packages. Laboratory versions are available as well as many different AC and DC voltage options.

The advantages of peristaltic pumps include:

- Excellent dry running characteristics
- Can pump fluid and gas/air
- Self-priming
- Bi-directional and variable flow capability
- Can generate 30 PSI
- Fluid only contacts the inside of the tubing
- Large selection of options and variations
- Can pump slurries and fluids with high particulate content
- Extremely accurate for dispensing or metering applications
- Compatible with most chemicals and aggressive fluids
- Pumps extremely hot or cold fluids
The disadvantages of peristaltic pumps include:

- Very low flow rates
- Not as compact as other pump types
- Not submersible
- The flow may pulse, particularly at low RPMs

**Self-Priming** – Self-priming capability is extremely valuable when the pump must be located above the liquid level. This capability enables the pump to draw the liquid to the level of the pump. Another way to help understand this term is that self-priming pumps have the ability to evacuate air, which is essentially what is taking place while the liquid is being sucked toward the inlet side of the pump. The distance the pump would need to draw the liquid is referred to as the self-priming height or suction lift.

**Flooded Suction** – The term flooded suction usually refers to centrifugal pumps in a non-submersible application. As mentioned previously, centrifugal pumps work best when submersed. When submerging is not possible, the flooded suction is the next best choice.

In a flooded suction arrangement, the pump is physically located as far below the fluid level as possible. The desired result simply allows the fluid to gravity feed to the impeller chamber (volute) of the pump. It is common to mount the pump to the bottom or side of the reservoir with the inlet port penetrating the reservoir as shown in these two illustrations.
Additionally, the pump can be located far away from the reservoir with tubing or pipe connecting the two as shown in the third illustration below. Either way, make certain that the pump is located below the level of the fluid.

In any flooded suction application it is also prudent to check for “air locks” or trapped air that prevents the gravity flow of fluid to the pump. Unlike other types of pumps, miniature centrifugal pumps do not contain valves or any similar restrictive devices that would prevent the natural flow of the fluid. When a centrifugal pump is not energized, fluid can freely pass through the volute as easily as it can pass through a section of tubing. With this knowledge, the only
concern in a simple system or application is trapped air. If your system utilizes clear tubing on the outlet of the pump, you should be able to see your fluid at some point along its path.

Editor’s note: Choosing the most appropriate pump for any given application can be complex and should only be made in consultation with experienced and knowledgeable pump application professionals. Before you order your pump, we strongly recommend you call the pump professionals at Simply Pumps for a consultation to enable you to find the most appropriate pump for your unique application. As the pump is usually a small part of the cost of the end product, we work with our customers to help them make sound investments in pumps based on the cost/performance tradeoff decisions most manufacturers are forced to confront when choosing pumps and other components for their final products. We are here to help you avoid those potentially costly and time consuming purchasing decisions associated with failures in the field or poor performance that comes with choosing the wrong pump for the wrong application.

Scott Beresford is the owner and founder of Simply Pumps, a Pittsburgh, Pennsylvania based business specializing in miniature low voltage DC pumps. Scott has been involved with pumps in various capacities for over thirty years and is passionate about solving the worlds pump problems. Comments, feedback, and inquiries are always welcomed and Scott can be reached directly at scott@simplypumps.com.