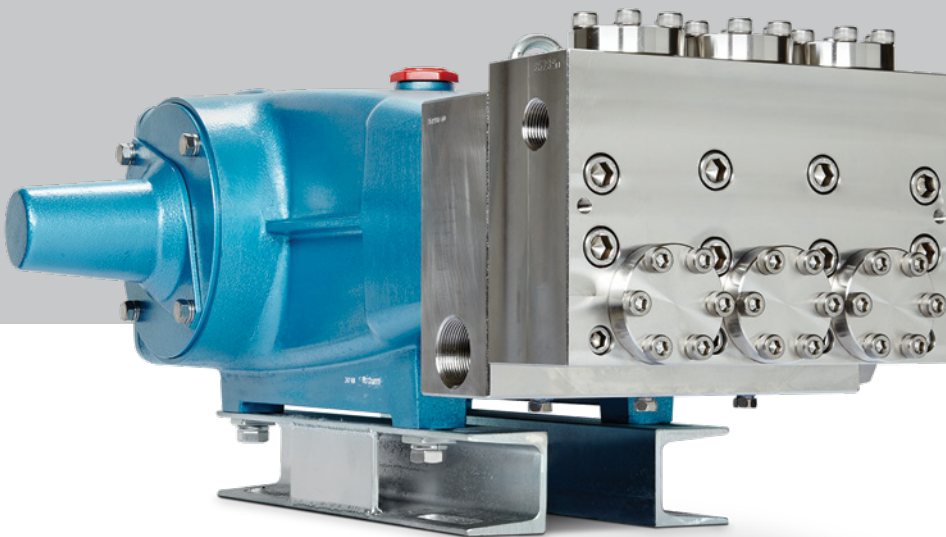




Pump Style Comparison

Positive Displacement Triplex Pumps vs. Pitot Tube Centrifugal Pumps



Product Quality, Reliability and Support You Expect

www.b-k.com

Triplex Plunger vs. Pitot Centrifugal Pumps

Two pump styles commonly used in industrial high-pressure applications include triplex positive displacement pumps and pitot centrifugal pumps (pronounced “pee-toh”). While both styles produce high flow rates and are rated at high pressures, there are a few differences in the operation and maintenance of each.

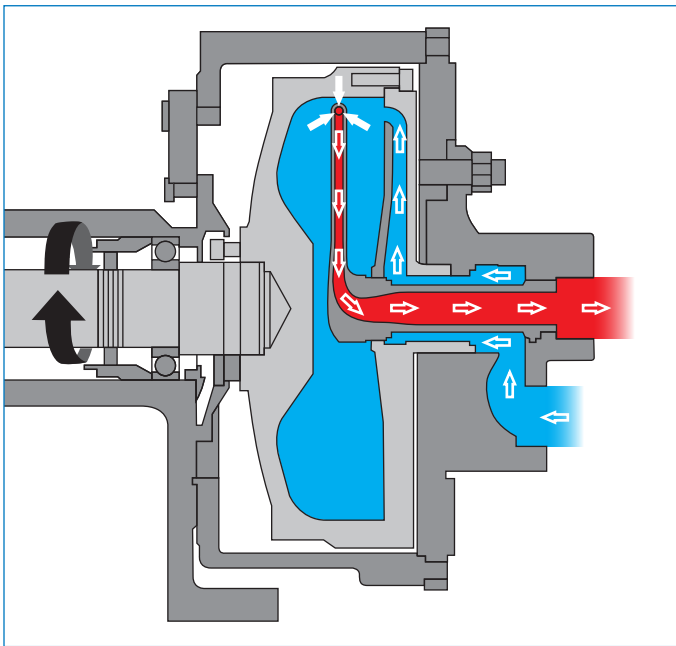
Cat Pumps produces triplex positive displacement high-pressure pumps used worldwide in a variety of applications requiring high-pressure water, cleaning solutions, and other liquids. Designed for industrial duty, Cat Pumps products are used extensively in washdown, cleaning, homogenization and other high-pressure applications.

The pitot style pump is based on Bernoulli’s principle; by combining the action of a high speed centrifugal pump and this principle, it is possible to produce high flow rates at relatively high pressure. Pitot style pumps are typically found in a variety of high flow applications, like power generation and mining.

Operational Characteristics

Cut-away views show the operational characteristic of each style. Both produce flow against system restrictions to develop pressure, even though the design principles are different.

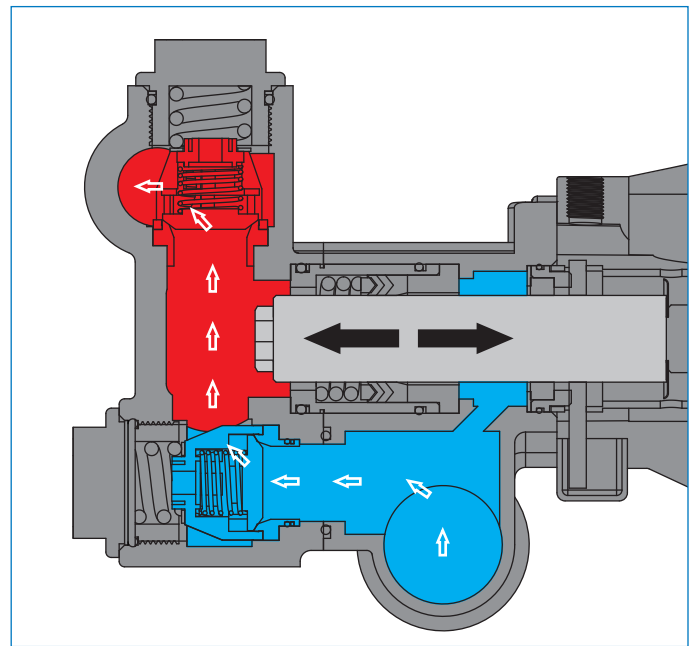
Pitot Tube Centrifugal Pump



Pitot tube pumps are single stage centrifugal pumps in which liquid enters the pump through the suction line, passing over the mechanical seal. Liquid enters the rotor where it is accelerated to the rotor speed and picks up kinetic energy. Due to the relative mass involved, the efficiency of such a pump design is generally in the range of 45% to 60%.

A stationary wing-shaped pitot tube with a circular opening is located inside the rotor assembly. Liquid enters the pitot tube at high velocity due to the centrifugal force created by the rotor casing. The kinetic energy of the liquid is converted into pump flow. As liquid meets system resistance, pressure is created.

Triplex Positive Displacement Pumps



Triplex pumps employ a mechanical crankshaft to convert rotary input power to linear action to drive three plungers or pistons. With the positive displacement design, each revolution of the crankshaft creates a direct motion in the plunger rods, resulting in a positive output of flow from the pump. This output is in direct relation to the rpm of the pump. Pumps of this style operate at 85% efficiency.

At the beginning of the stroke, the plunger displaces the liquid in the manifold chamber and forces the discharge valve open. As the plunger rod begins its backward stroke, the inlet valve opens to allow more liquid into the manifold chamber, thereby keeping a smooth forward flow of liquid.

Pump Direct Comparison

Pump/System Variable	Positive Displacement Triplex Pump	Pitot Tube Centrifugal Pump
Pump Type Description and Principle of Operation	Positive Displacement Reciprocating Plunger	Kinetic Rotordynamic Rotating Casing
Overall Pump Efficiency	85%	45% to 60%
Typical Power Source (Industrial Applications)	Electric Motor; Direct or belt drive with or without Variable Frequency Drive (VFD)	Electric Motor; Uses a gearbox speed increaser with or without VFD; Switched Reluctance Motor (SRM) option
RPM Range (Typical)	100 to 3,450 Note: pressure is independent of motor rpm.	Up to 10,000 Note: high speeds required to produce higher pressure.
Operating Pressure (Typical)	100 to 10,000 psi	25 to 3,000 psi
Flow Range (Typical)	1 to 240 gpm	1 to 800 gpm (or greater)
Horsepower Requirement (100 gpm at 1,000 psi)	68.6 hp (85% pump efficiency)	129.6 hp to 97.2 hp (45% to 60% pump efficiency)
Energy Consumption Example: 100 gpm @ 1,000; 60 hrs/wk; \$0.07 kWh	kWh/Month: 12,289 (42% to 88% less) Yearly Cost: \$10.3K Savings: \$4.3K to \$9.1K per pump	45% Efficiency kWh/Month: 23,212 (88% more) Yearly Cost: \$19.4K Additional cost of \$9.1K per pump
		60% Efficiency kWh/Month: 17,409 (42% more) Yearly Cost: \$14.6K Additional cost of \$4.3K per pump
Pump Maintenance*	In-plant service; pumps can be serviced without disturbing plumbing or mounting removal; no special tools required	Often pump must be returned to manufacturer for servicing; cannot be serviced in-place

*Cat Pumps standard service kit requires only (1) seal kit, (1) inlet valve kit, and (1) discharge valve kit. Based on industry feedback, Cat Pumps can be serviced for 1/8 of the cost compared to a pitot tube pump.

Sizing the System and Pump

A properly sized pump and system will provide adequate flow and pressure to meet current and anticipated future needs. It is important to consider peak load requirements and times in which there is no flow demand. The result is a well-designed system that reduces initial equipment costs as well as water and energy usage. Cost-of-use factors, such as system and pump maintenance, are also part of the selection process.

Cat Pumps offers a variety of advanced control options designed to provide maximum system performance. Options include:

- Variable Frequency Drives (VFD)
- PID Loop (varies speed of pump to maintain system pressure)
- Multiple Pump Systems
- Low-Pressure Seal Monitors
- Auto Shutdowns (Temperature and Low Inlet Pressure)
- Other control options available to meet your application needs

Cat Pumps technical support team offers complete sizing and selection assistance. With over 30 years of system design and build experience, customers worldwide trust Cat Pumps for their high-pressure pump and system needs.

Case Study

Food Processing Plant Reduces Energy and Maintenance by Replacing Pumps on Central Cleaning Washdown System

Many large food processing production sites use centralized cleaning systems that feature one or more high-pressure pumps to feed a variety of washdown guns and lances. Using high-pressure water demonstrates advantages over lower pressure systems and chemical-based cleaning.

At this customer's site, original central cleaning systems were installed at a time when energy and water consumption were not the major considerations they are today. The use of a rotary pitot tube pump had been a common practice under these circumstances. But with changes in the industry, this customer initiated a project to upgrade its central cleaning systems by replacing the pitot style pump.

At issue were two factors experienced with the use of pitot style centrifugal pumps: 1.) mechanical inefficiency; 2.) cost to operate and maintain. Pitot style pumps operate in the range of 45% to 60% efficiency due to its inherent mechanical design of rotating a water-filled casing at high speeds (4,500 to 5,500 rpm) to achieve desired flow and pressure.

For pitot pumps, high-speeds and contamination build-up can throw the rotor out of balance, leading to early seal and bearing failure. Often, the pitot tube pump requires servicing at its manufacturer's site, resulting in a lengthy and expensive repair.

This customer selected a Cat Pumps model 6831 high-pressure triplex pump to replace two pitot tube pumps used for washing filter screens and supplying high pressure water for washdown applications.

In its first year of operation, the Cat Pumps system reduced the energy costs from \$50.6K to \$14.8K, and maintenance costs from \$33.5K per year to \$3.1K. These are 70% energy and 92% maintenance savings respectively – per year. Payback for the Cat Pumps system upgrade was just 9.9 months.

The Cat Pumps model 6831 pump was selected for a rating of 28 gpm at 2,300 psi, achieved at a shaft speed of just 440 rpm. The Cat Pumps power unit system also offered a significant reduction in required footprint area.

Reduced maintenance and energy costs with less downtime were decisive factors in the selection of Cat Pumps. Given the reliable performance of the model 6831 and the fact that servicing the pump could be performed in-house, the customer decided that a standby (backup) pump was not required. In the final analysis, the risk of change was proven to be a non-issue.

Decision Factor	Pitot Style Pump	Cat Pumps Triplex	Net Saving
Energy Cost (Year)	\$50.6K	\$14.8K	\$35.8K / 70%
Maintenance Cost (Year)	\$33.5K	\$3.1K	\$30.4K / 92%
Annual Operating Cost	\$84.1K	\$17.9K	\$66.2K / 78%

Customers worldwide trust Cat Pumps for their high-pressure pump and system needs.

Beckwith & Kuffel – Seattle
1313 South 96th Street
Seattle, WA 98108

Beckwith & Kuffel – Vancouver
1614 NE 99th Street
Vancouver, WA 98665

Beckwith & Kuffel – Spokane
11327 E. Montgomery Drive, Suite 5
Spokane, WA 99206