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CAT PUMPS®
The Pumps with Nine Lives

Pump Style Comparison

Positive Displacement Triplex Pumps vs. Pitot Tube Centrifugal Pumps

Product Quality, Reliability and Support You Expect

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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.

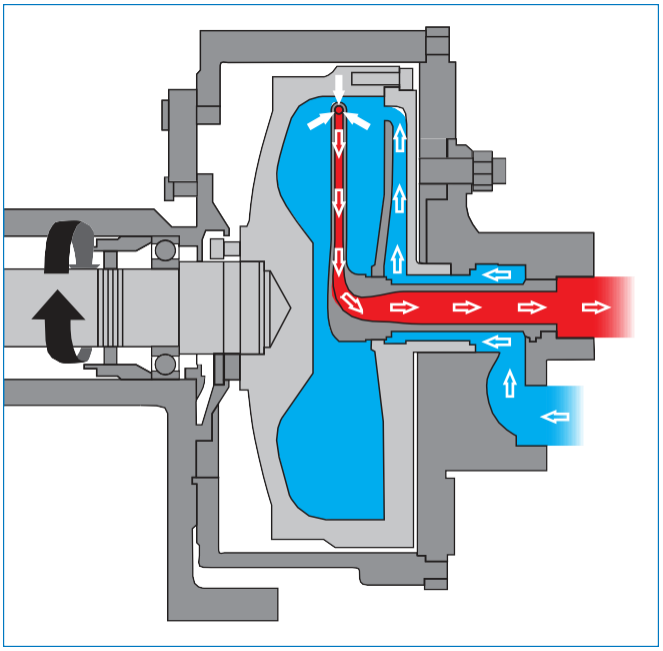
Cat Pumps produces triplex positive displacement high-pressure pumps used worldwide in a variety of applications requiring high-pressure water, cleaning solutions, and other liquids. Designed for industrial duty, Cat Pumps products are used extensively in washdown, cleaning, homogenisation and other 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, with power generation and mining are two typical markets.

Operational Characteristics

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

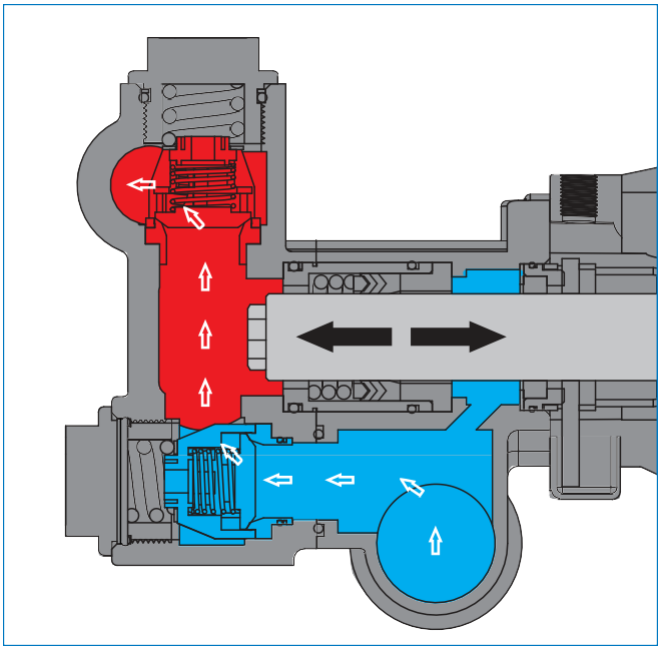
Pitot Tube Centrifugal Pump



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 Plunger pump	Pitot Tube Centrifugal Pump
Pump Type Description and Principle of Operation	Positive Displacement Reciprocating Plunger	Kinetic Rotordynamic Rotating Casing
Operating Pressure (Typical)	10 bar to 700 bar (145 psi to 10,150 psi)	2 bar to 200 bar (29 psi to 2,900 psi)
Flow Range (Typical)	1 l/min to 900 l/min	1 l/min to 300 l/min or greater
Pump Efficiency	85%	45% to 60%
Motor power requirement (150 l/min and 70 bar)	20.6 kW @ 85% efficiency	38.9 kW @ 45% efficiency 29.1 kW @ 60% efficiency
Pump energy consumption/week (150 l/min @70 bar for 60 hrs/week)	1,236 kWh	2,334 kWh @ 45% efficiency 1746 kWh @ 60% efficiency
Energy Costs per week at £0.105 per Kw/hr	£129.78	£245.1 @ 45% efficiency £183.3 @ 60% efficiency
Energy Costs per year basedon 50 working weeks/year	£6,489	£12,255 @ 45% efficiency £9,195 @ 60% efficiency
Pump Maintenance*	In-plant service; pumps can be serviced without distributing plumbing or mounting removal; no special tools required.	Often pumpmust be returnedto manufacturer for service; 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

Energy and Maintenance Costs Reduced at Food Processing Plant

A Cat Pumps Model 6831 high-pressure pump is cutting energy and maintenance costs at a leading food processing plant in the UK. The triplex positive displacement plunger pump has replaced two aging and troublesome Pitot Tube pumps used for washing filter screens and supplying high-pressure wash-down hoses.

In its first year of operation, the Cat Pumps unit has reduced the energy costs from £45,200 per annum to just £13,300, and maintenance costs from £30,000 per annum to £2,800. Of equal note is that the payback period for this change-out was just 9.9 months.

The original Pitot Tube pumps (one duty and one standby) had been in operation for some time supplying high-pressure water from a holding tank to the filter screen pressure jets and the wash-down lances around the plant. The duty specified was 105 l/min. at 140 bar and the pump installed was running at 5,900 rpm via a geared-up drive. This was fitted with a 132 kW, 3,000 rpm 415/3/50 motor complete with soft start, and was estimated as absorbing 112kW at the duty point. Having been run for a period of time, the pumps had become increasingly unreliable and were suffering two to three failures a year. These failures were costing the food processing company an estimated £30,000 annually in parts and labour.

With annual running costs in the region of £75,200, the food company implemented a project to look into replacing these two pumps with the Cat Pumps triplex pump. Being a true positive-displacement reciprocating pump, this offers excellent energy efficiency, consistent flow rate unaffected by discharge pressure, and field-proven reliability.

The Model 6831 pump was selected for an enhanced duty pressure of 160 bar at the required flow rate of 105 l/min. and a water temperature up to 45°C, achieved at a shaft speed of just 440 rpm. A further influential factor in the selection of this particular pump was the significant reduction in required footprint area. The complete skid unit was ordered, delivered to site within eight weeks from PO placement, and after initial commissioning adjustments the unit ran without incident.

Application Specifications

Filter Screen Cleaning and Washdown	
Cat Pumps Model	6831 (popular choice in the industry)
Pressure	160 bar
Flow	105 l/min
Fluid	Water
Temperature	45° C
Drive	132 kW, 3 phase, electric motor with belt and pulley

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