Rotary Pump Family Tree

Positive displacement (PD) pumps are divided into two broad classifications, reciprocating and rotary (Figure 1). Pump School currently focuses on rotary pumping principles.

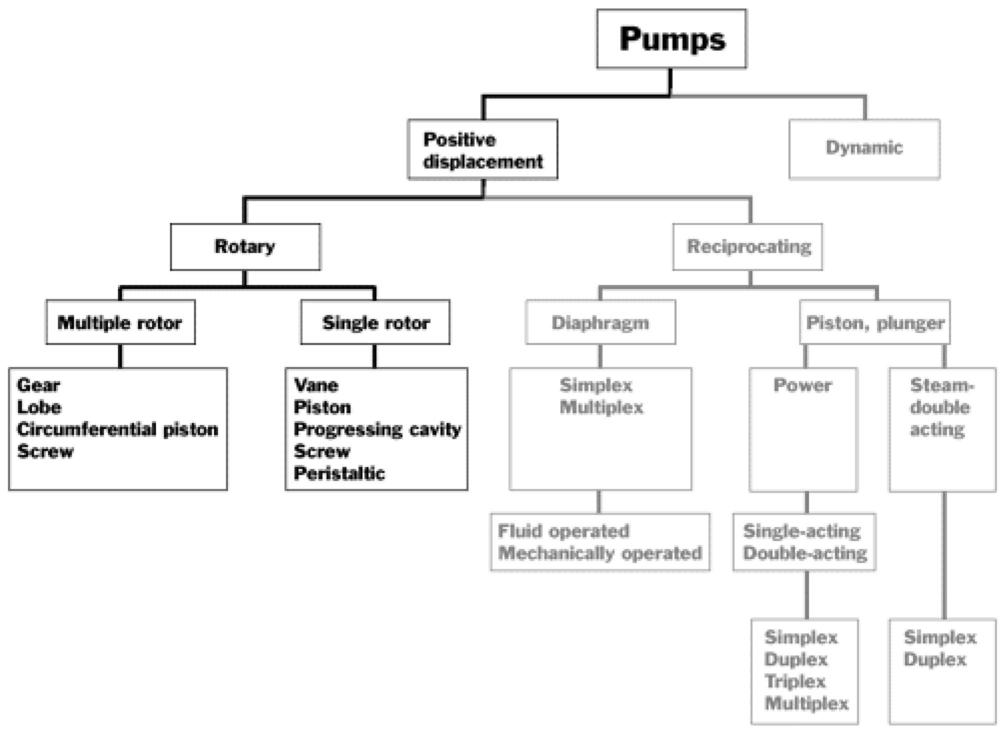
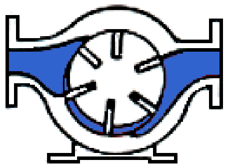
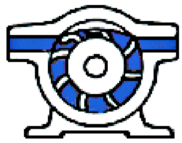
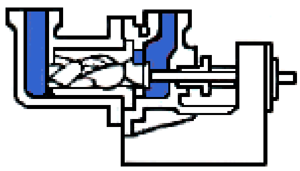
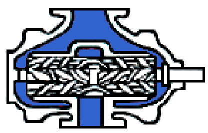


Figure 1

By definition, PD pumps displace a known quantity of liquid with each revolution of the pumping elements (i.e., gears, rotors, screws, vanes). PD pumps displace liquid by creating a space between the pumping elements and trapping liquid in the space. The rotation of the pumping elements then reduces the size of the space and moves the liquid out of the pump. PD pumps can handle fluids of all viscosities up to 1,320,000 cSt / 6,000,000 SSU, capacities up to 1,150 M^3/Hr / 5,000 GPM, and pressures up to 700 BAR / 10,000 PSI. Rotary pumps are self-priming and deliver a constant, smooth flow, regardless of pressure variations.

The following information is taken from Hydraulic Institute's, *Pump Types and Nomenclature, 1994*. For more detailed information about the rotary pumping principles, see the specific pumping principles under Pump School's Pumping Principles page.

Internal Gear. Internal gear pumps (Figure 2) carry fluid between the gear teeth from the inlet to outlet ports. The outer gear (rotor) drives the inner or idler gear on a stationary pin. The gears create voids as they come out of mesh and liquid flows into the cavities. As the gears come back into mesh, the volume is reduced and the liquid is forced out of the discharge port. The crescent prevents liquid from flowing backwards from the outlet to the inlet port.	 **Figure 2**
External Gear. External gear pumps (Figure 3) also use gears which come in and out of mesh. As the teeth come out of mesh, liquid flows into the pump and is carried between the teeth and the casing to the discharge side of the pump. The teeth come back into mesh and the liquid is forced out the discharge port. External gear pumps rotate two identical gears against each other. Both gears are on a shaft with bearings on either side of the gears.	 **Figure 3**
Vane. The vanes - blades, buckets, rollers, or slippers - work with a cam to draw fluid into and force it out of the pump chamber. The vanes may be in either the rotor or stator. The vane-in rotor pumps may be made with constant or variable displacement pumping elements. Figure 4 shows a sliding vane pump.	 **Figure 4**
Flexible Member. This principle is similar to the Vane principle except the vanes flex rather than slide. The fluid pumping and sealing action depends on the elasticity of the flexible members. The flexible members may be a tube, a vane, or a liner. Figure 5 shows a flexible vane pump.	 **Figure 5**
Lobe. Fluid is carried between the rotor teeth and the pumping chamber. The rotor surfaces create continuous sealing. Both gears are driven and are synchronized by timing gears. Rotors include bi-wing, tri-lobe, and multi-lobe configurations. Figure 6 is a tri-lobe pump.	 **Figure 6**
Circumferential Piston. Fluid is carried from inlet to outlet in spaces between piston surfaces. Rotors must be timed by separate means, and each rotor may have one or more piston elements. See Figure 7.	 **Figure 7**
Screw. Screw pumps carry fluid in the spaces between the screw threads. The fluid is displaced axially as the screws mesh. Single screw pumps (Figure 8) are commonly called progressive cavity pumps. They have a rotor with external threads and a stator with internal threads. The rotor threads are eccentric to the axis of rotation.	 **Figure 8**
Multiple screw pumps have multiple external screw threads. These pumps may be timed or untimed. Figure 9 shows a three-screw pump.	 **Figure 9**

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