EMERSON
Industrial Automation

solutions
Energy Savings Technology

Pumps

Putting pressure on energy savings.

A pump is used for raising, transferring or compressing fluids. Pumps consume 31% of the power used by industry for motor driven equipment; more than any other application. Pressure and flow of gases and liquids have traditionally been regulated using bypass, balancing, or throttling valves and mechanical clutches. These mechanisms waste energy, require frequent maintenance, and provide inaccurate control.

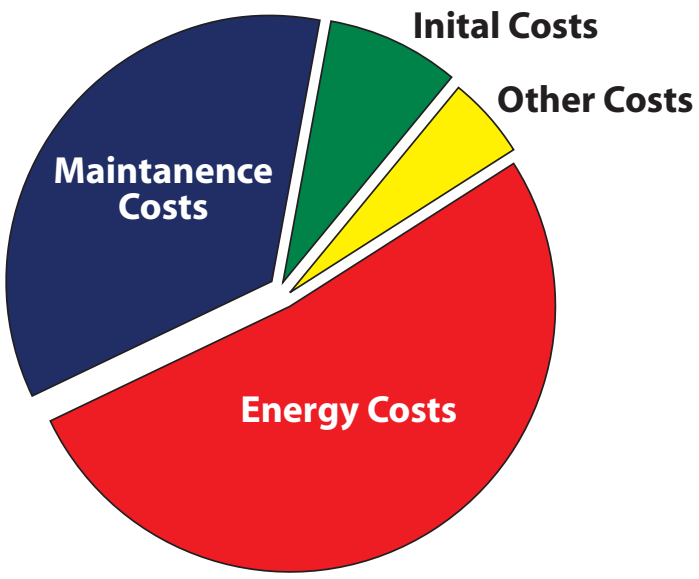
Look for large systems, systems with high operating hours, problem systems, & production critical systems.

Identify if your pumping system is experiencing any of the key symptoms:

- High energy costs
- Throttle valves (partially or mostly closed)
- Open bypass valves or recirculation lines
- Frequent failures or repair requirements
- High operating noise levels
- High level of vibration
- Systems with multiple parallel pumps with the same number of pumps always operating
- Constant pump operation in a batch environment or frequent cycle batch operation in a continuous process
- Systems that have undergone a change in function

Pumps are the #1 energy savings opportunity for motor driven equipment. Studies show average pump system efficiency is below 40%.

Life Cycle Costs



Over 80% of pump life cycle costs go towards energy and maintenance. Optimizing pump systems will greatly reduce both maintenance and energy costs.

CONTROL TECHNIQUES

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Pump Solutions

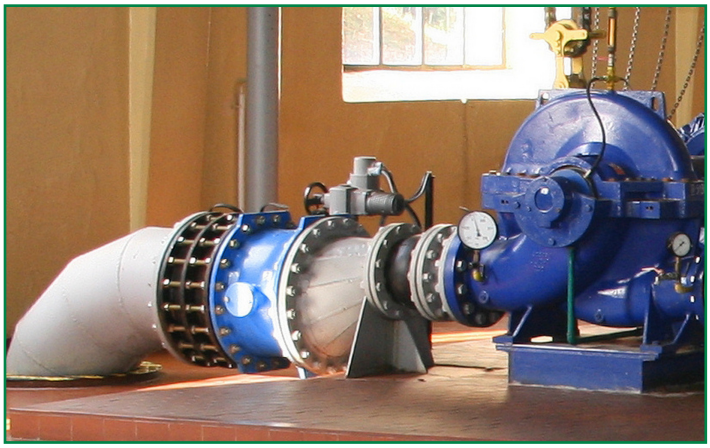
Pumps may be divided into centrifugal and positive displacement categories.

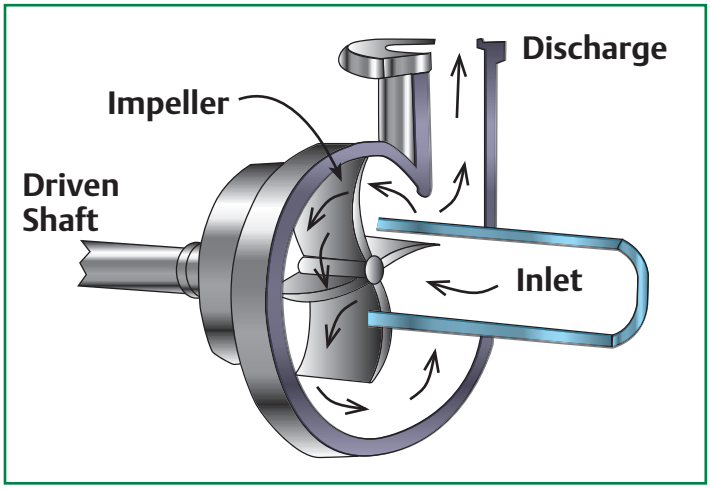
1. Centrifugal pumps:

Horsepower: Up to 2,000

Savings: Up to 60%

(Depends on duty cycle & static head.)





Over 80% of pumps use centrifugal design because it provides high flow rates, uniform pressure, and is easily driven by electric motors. They use centrifugal and axial forces to create pressure that moves the fluid from inlet to discharge.

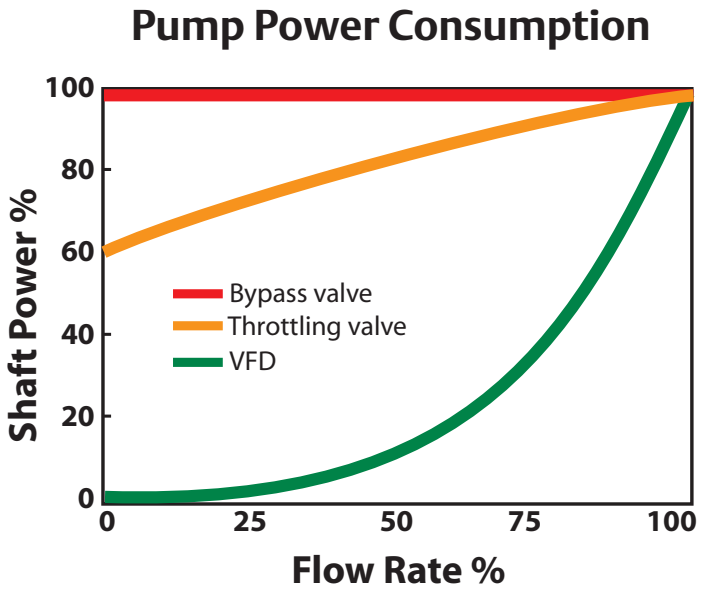
Centrifugal pump types include Radial, Mixed, and Axial (propeller). They serve in applications such as Chemical / Process, Irrigation, Booster, Cooling Tower, Condensed Water, Hot Water, Chilled Water, Municipal Water & Wastewater pump applications.

Look for centrifugal pumps with low static head pressure and many operational hours for the most energy savings!

Centrifugal pumps generally operate as a variable torque load, a load that increases as the speed increases. They follow the Affinity Laws which state:

1. Flow is proportional to speed.
2. Pressure is proportional to speed squared.
3. Power is proportional to speed cubed.

Energy usage for centrifugal pumps may be charted as follows for different control methods.



Example savings (VFD versus a Bypass Valve)* :

80% Flow uses 50% of energy, $(0.8)^3 = 0.50$

50% flow uses 12.5% of energy, $(0.5)^3 = 0.125$

Pump Solutions

2. Positive displacement pumps:

Horsepower: Up to 1,000

Savings: 10-25% (Depending on duty cycle.)

Positive displacement pumps force a fixed volume of fluid from inlet to discharge with each stroke or rotation. They generally operate as constant torque loads and are used whenever volumetric accuracy or high static pressures are required. Energy used is proportional to motor speed or flow. Designs mechanically limit back flow which helps these pumps achieve higher efficiencies than centrifugal pumps but are more likely to create a pressure spike with each release.

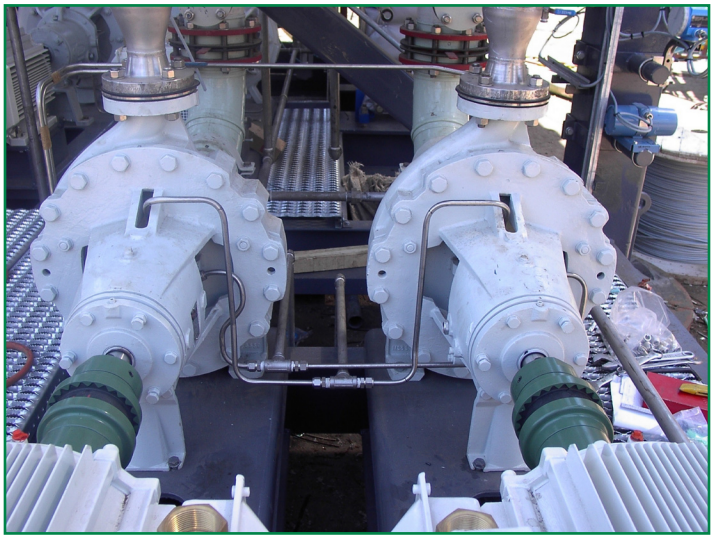
Positive displacement pump types include:

Reciprocating (fractional hp)

- Piston (metering pumps, accurate & high output pressure)
- Diaphragm (metering -diaphragm reduces contamination)

Rotary (fractional to 1000 hp)

- Cam & Piston (metering & high pressure output to 1000 hp)
- Screw (oils & compressors to 1000 hp)
- Vane (LP, ammonia, solvents, gasoline, & refrigerants)
- Gear (small oil fed heating systems, fractional hp)
- Lobular (2 or 3 spur version of gear pump, fractional hp)



Look for cam & piston or screw pumps which operate near continuously at varying flow rates.

Control Techniques Energy Savings Estimator can provide a good estimate of the cost savings available from adding an AC drive onto your existing pump system. It may be downloaded from www.emersonct.com.

For more thorough analysis, The Pumping System Assessment Tool (PSAT) is a free and useful tool for evaluating potential pumping system improvements. It was developed with the support of the U.S. Department of Energy. For more information on the PSAT and on properly matching pumps to system requirements, see Improving Pumping System Performance: A Sourcebook for Industry, which is available at www.eere.energy.gov/industry /bestpractices.

Pump Solutions

Control Techniques AC drives adjust pump speed to directly control flow and pressure. The included PID controller or optional single or multi-pump software solutions make advanced control easy to achieve.

System reliability and efficiency is greatly improved with elimination of bypass or throttling valves and reduced pump RPM. Soft starting and operation at the pump's best efficiency point prevents water hammer, pipe stress, and reduces cavitation while improving valve and pump seal life. The flying start feature allows the drive to start an already spinning motor. If it is moving backwards due to pump back pressure, it will be smoothly brought to zero speed before acceleration to the desired speed in the forward direction. This greatly reduces stress on the pump impeller. Control Techniques AC drives dramatically reduce pump life cycle costs by lowering both maintenance and energy costs.

Switching control from bypass valves to an AC drive on centrifugal pumps with low head pressures will typically save over 50% of the energy used. Dynamic V/Hz further improves efficiency by reducing motor voltage during low demand. While the greatest reduction in energy costs is realized with centrifugal pumps, most pumps will realize savings when less than full output is required. AC drives improve power factor (>0.95) and reduce motor starting current by factor of 8:1 to further reduce power demand from your utility. An integrated EMC filter reduces electrical line noise as standard. Control Techniques helps you document energy savings by including a kWh energy and running cost meters in the drive.

The Skip Frequencies feature allows the user to easily avoid resonate equipment frequencies which may cause high levels of vibration.

Standard communication options enable remote monitoring and proactive preventive maintenance triggered by pump load changes (such as clogged pump or approaching bearing failure), run time, or other criteria.

Contact Control Techniques for assistance identifying energy savings opportunities in your facility.

Drives plus...

Energy Saving Technology

World Class Products & Support

- Assistance estimating energy savings
- Worldwide Application & Field Service Network
- 24/7 support line 1-800-893-2321
- Custom software and panel configurations

AC Drives to 2,900 hp