



VARIABLE FREQUENCY DRIVES

PUMP EXAMPLES



Deep-Well Vertical Turbine Pump

This pump type extracts water from aquifers. Its motor is on the surface, connected to a submerged pump by a long shaft. The motor is the only part above ground.

- **Energy Efficiency:** These pumps are known for high energy efficiency, especially in deep well and high-pressure applications. When including shaft and column losses, some models can reach up to about 80 percent efficiency. Regular impeller adjustments are crucial for maintaining optimal efficiency.
- **Usage:** Most common for deep well applications in the Pacific Northwest, agricultural irrigation, municipal water supply, and industrial cooling systems.



Submersible Turbine Pump

Both the pump and its motor are fully submerged in the water, eliminating the need for a long shaft to the surface. Neither part is visible without removing the pump from the well.

- **Energy Efficiency:** Submersible pumps may be more efficient than vertical turbine pumps for some situations with the elimination of the shaft. Having no shaft eliminates shaft losses and reduces friction losses in the column compared to a vertical turbine.
- **Usage:** Typically used for rural residential and small irrigation systems. For larger irrigation systems, they are often chosen if the wellbore is crooked, which prevents the use of a vertical turbine pump.



Short-Coupled Vertical Turbine Pump

Similar to a deep-well vertical turbine pump but with a shorter column, designed for shallower settings.

- **Energy Efficiency:** These pumps can achieve high efficiencies when properly matched to irrigation system flow and pressure flow requirements.
- **Usage:** Primarily used to pump water from surface sources like ditches, canals, rivers, and ponds. They are also employed when high pressures are needed, such as lifting water out of a canyon, and can be an alternative to end-suction centrifugal pumps when priming is an issue.

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End-Suction Centrifugal Pump

Water enters this type of pump and is discharged at a 90-degree angle. The impeller's spinning action uses centrifugal force to move the water.

- **Energy Efficiency:** These pumps can be very efficient, reaching 85-91 percent at their best efficiency point. A properly selected end-suction centrifugal may not need variable speed control for pressure control as flow requirements change.
- **Usage:** Commonly used for pumping water from surface sources such as ditches, canals, rivers, and ponds. They are also found in HVAC systems, water supply for buildings, chemical processes, and general industrial applications.



Split-Case Horizontal Centrifugal Pump

This is a double-suction pump where the casing splits horizontally, allowing easy access to internal components.

- **Energy Efficiency:** These pumps offer high hydraulic efficiency, often exceeding 85 percent, which can lead to significant long-term energy savings in large systems.
- **Usage:** Used in applications with moderate to high flow and pressure requirements, such as large-scale agricultural irrigation. These pumps are often used as booster pumps in sprinkler irrigated systems.



Axial Flow Pump

Also known as a propeller pump, it moves water parallel to the pump shaft using propeller-like blades. It often has a longer, curved discharge elbow compared to a vertical turbine pump.

- **Energy Efficiency:** Axial flow pumps are highly efficient for moving large volumes of water at low pressure (low head), with volumetric efficiencies potentially exceeding 90 percent at lower speeds.
- **Usage:** Ideal for low-lift applications (less than 30 feet of head) where high capacity is needed, such as moving water from a pond to a canal, or for flood control, irrigation, and wastewater treatment.



Mixed Flow Pump

This pump combines features of both radial and axial flow pumps. The impeller pushes water in a diagonal or conical direction, balancing outward and axial flow.

- **Energy Efficiency:** Mixed flow pumps offer high efficiency across varying flow conditions, designed for moderate heads and high discharge. Some submersible mixed-flow pumps can achieve hydraulic efficiencies up to 88 percent.
- **Usage:** Primarily used in industrial applications to lift high volumes of water to moderate heights (up to a couple hundred feet), including stormwater protection, irrigation, and wastewater pumping stations.

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