MONITORING AND CONTROLS

VARIABLE FREQUENCY CONVERTERS

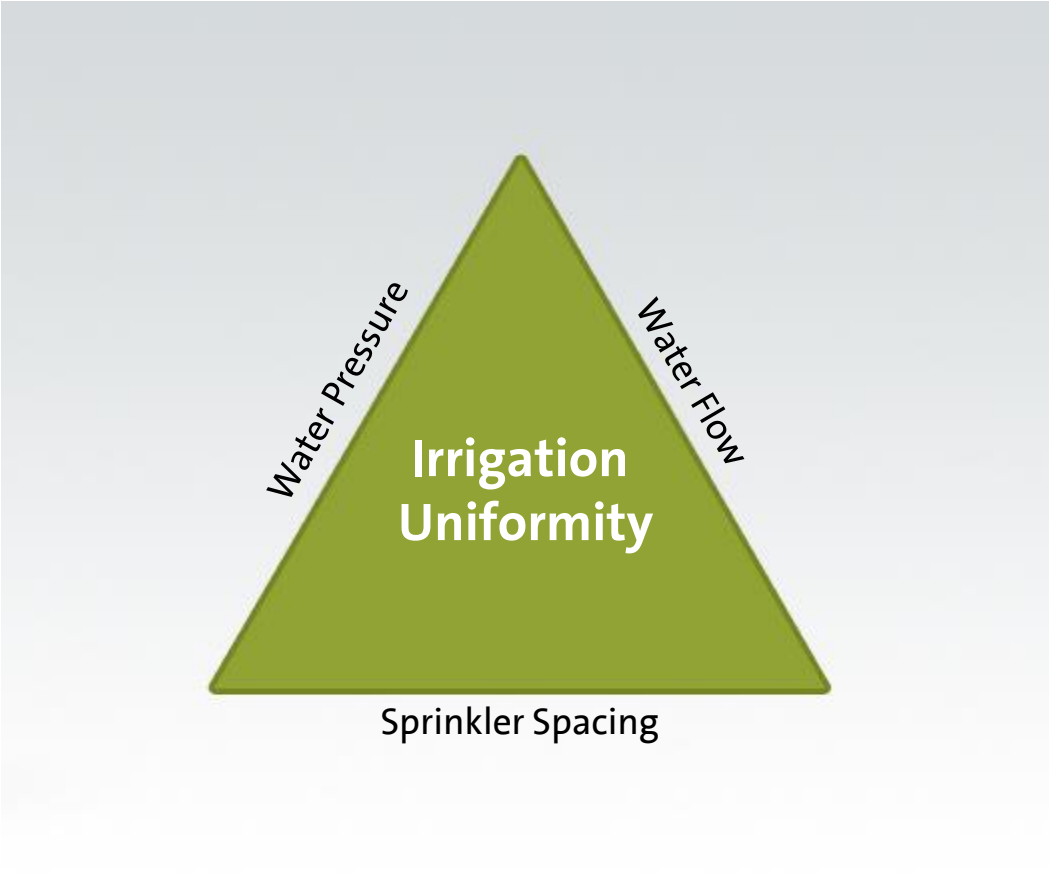
also called VARIABLE FREQUENCY DRIVE (VFD)

Irrigation uniformity

When working toward achieving efficiency in irrigation, you must understand the importance of high irrigation uniformity.

The essential parameters to achieve high uniformity in sprinkler irrigation are:

- Water pressure
- Water flow
- Sprinkler spacing



Irrigation efficiency

To achieve high efficiency in all types of irrigation, it is important to be able to control the flow and pressure.

Therefore, pumps and their regulation become important factors in irrigation.

About VFDs

A VFD is an electrical device used to change the frequency of Alternating Current (AC) electric current supplied to an electric motor.

The speed of the pump, revolutions per minute or RPM, is direct proportional with the frequency

Regulating the pump speed is advantageous because irrigation conditions will change from year to year, season to season and even on a daily basis.

Use of VFD

If an irrigation setup requires unchanged flow and pressure, the most efficient pump to use is a single-speed pump, operating at its best efficiency point.

But if either the flow or pressure requirements are variable, or if irrigation zones are opened or closed, the most efficient way to regulate flow and pressure is to use a VFD.

Advantages of VFD

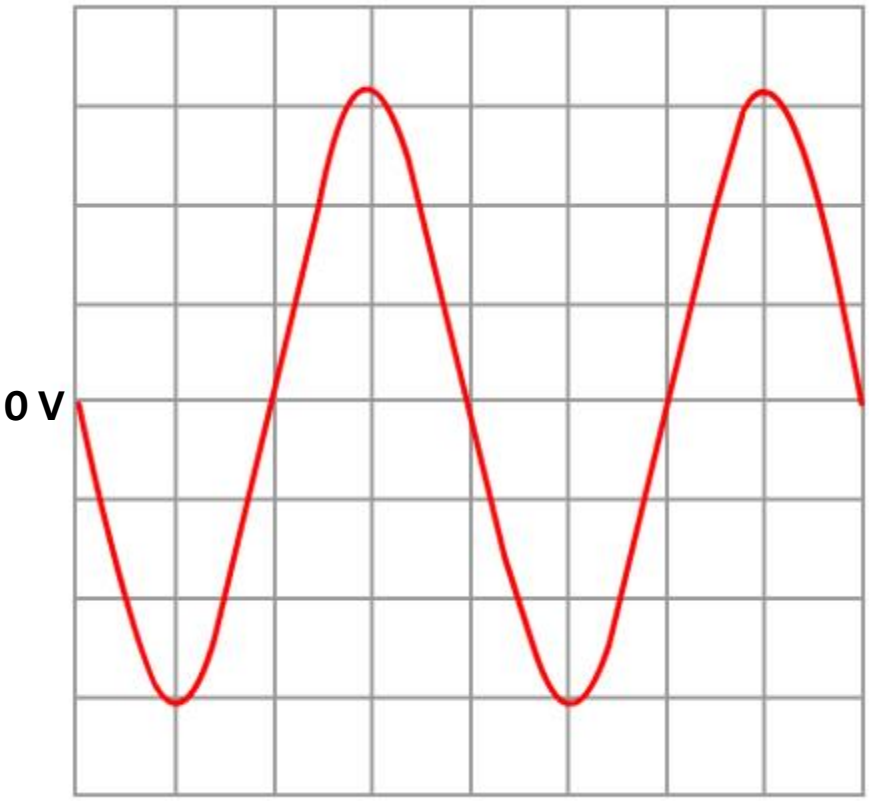
A VFD can maintain the flow and pressure at an optimal level. When reducing the speed of the pump the power to the pump motor will also be reduced.

Although flow and pressure can also be regulated by means of a valve—and this is still the most common way to adjust pump performance—this approach is similar to driving a car with full throttle, and then using the brakes to adjust the speed.

Function of VFD

A VFD converts input frequency of 50 Hz or 60 Hz to an output frequency that can vary from 0 Hz to its maximum frequency.

The default setting of maximum frequency is 50 Hz or 60 Hz, depending on the location.



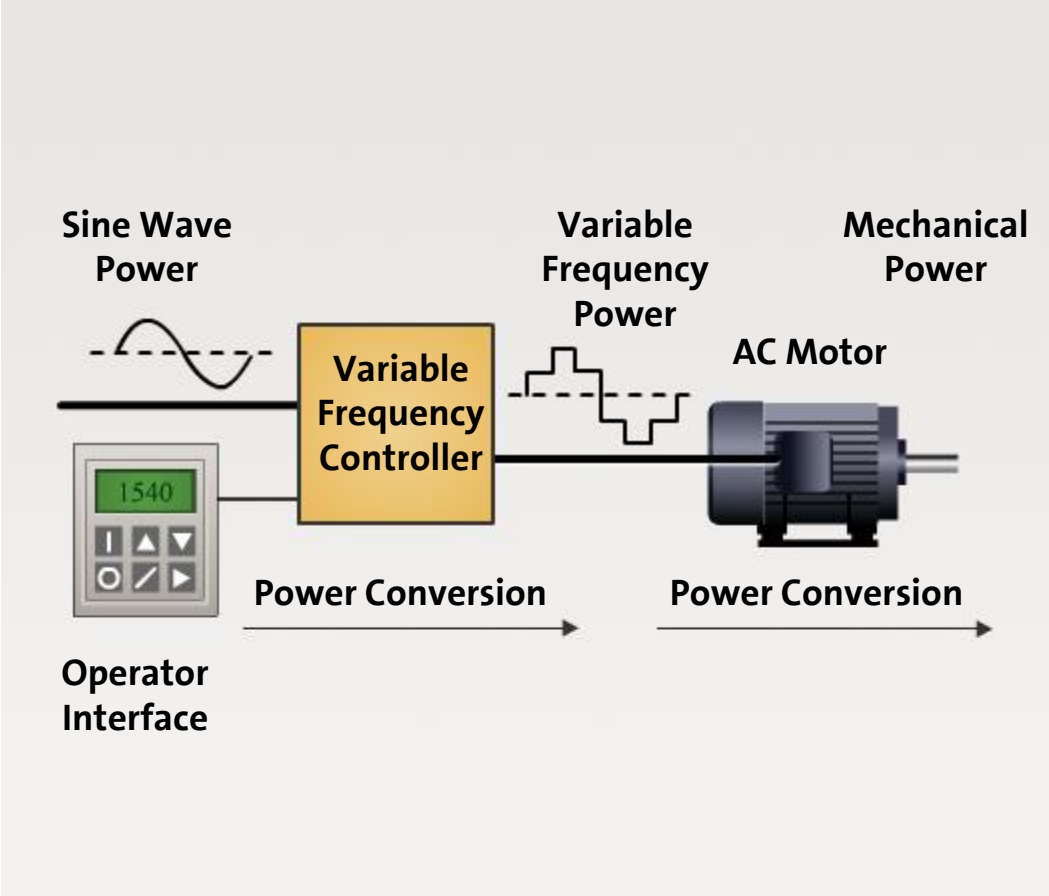
Alternating current

Performance regulation

When a VFD varies the frequency of AC current supplied to an electric motor, the speed of the motor, and thereby the pump speed, also gets changed.

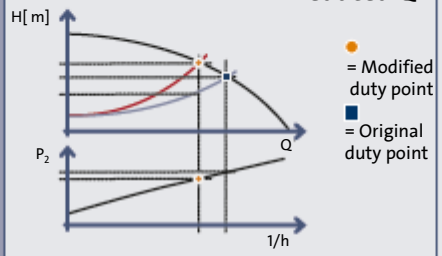
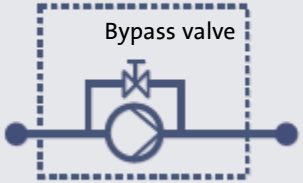
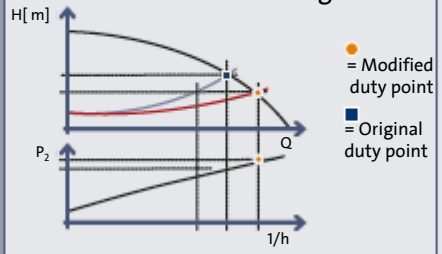
This process is referred to as speed regulation.

The speed of the motor regulates the performance of the pump, and it is one of several options of performance regulation of pumps.



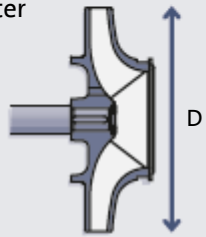
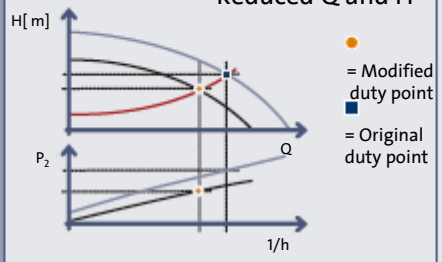
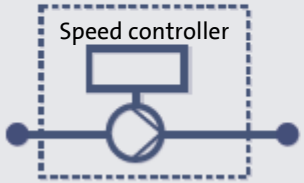
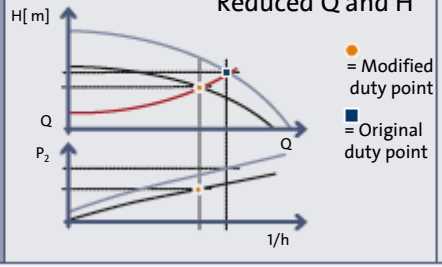
Approaches to performance regulation

The table below shows two most common approaches to performance regulation of pumps—throttle control and bypass control.

Method	Continuous adjustment possible?	The resulting performance curve will have	Overall efficiency of the pump system	Relative power consumption by 20% reduction in flow
Throttle control 	Yes	Reduced Q 	Considerably reduced	94%
Bypass control 	Yes	Reduced H and changed curve 	Considerably reduced	110%

Approaches to performance regulation (continued)

The table below shows two more approaches to performance regulation of pumps—modifying impeller diameter and speed control. From this table, it appears that impeller trimming is a good alternative to speed regulation. The disadvantage is that once the impeller diameter has been reduced, it can never be enlarged again.

Method	Continuous adjustment possible?	The resulting performance curve will have	Overall efficiency of the pump system	Relative power consumption by 20% reduction in flow
Modifying impeller diameter 	No	Reduced Q and H 	Slightly reduced	67%
Speed control 	Yes	Reduced Q and H 	Slightly reduced	65%

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