The advantages of frequency drive operation in submersible pumps

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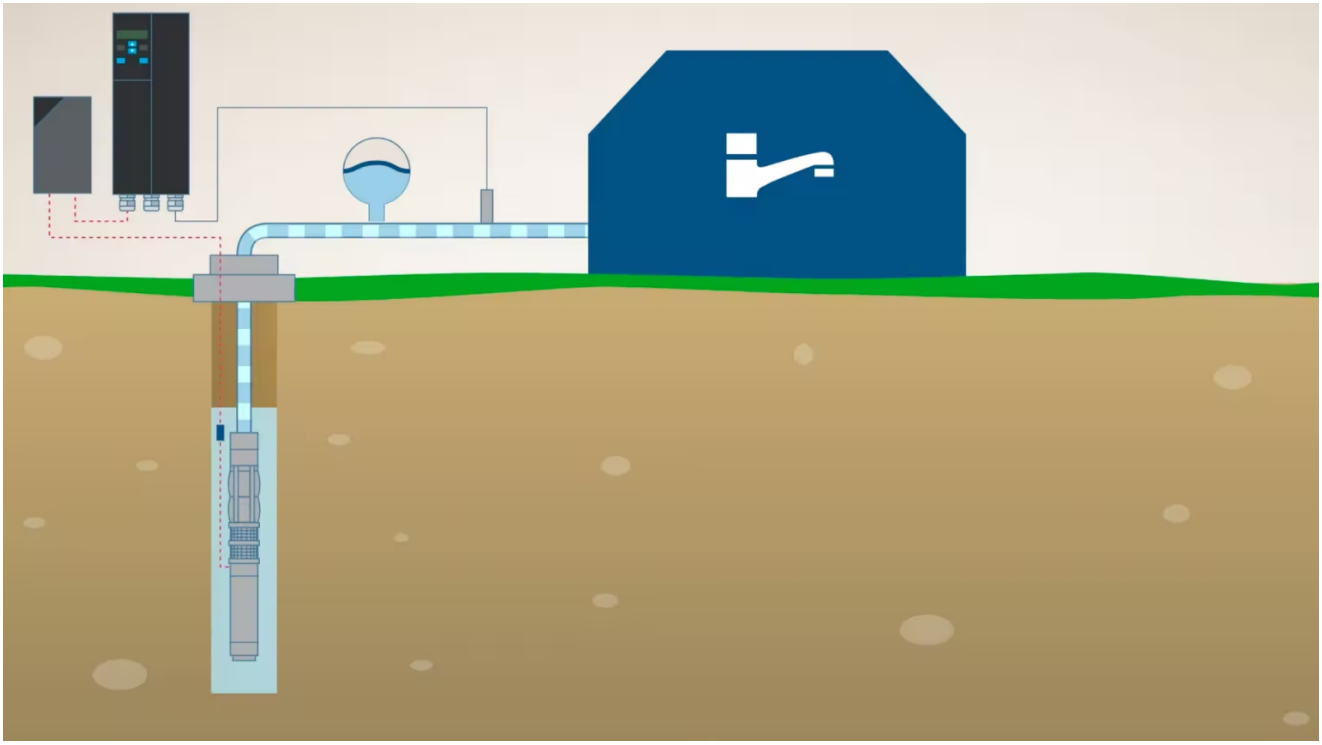

Find out about the benefits of variable frequency drives and output filters, when to select them and how to do it correctly.

Variable frequency drives can be used with submersible motors in a number of installations and applications.

In this module, we will present a few examples of applications in which it is particularly relevant to use a VFD. We will also introduce you to the benefits of output filters. Let's get started.

Generally speaking, the main advantage of using a variable frequency drive in submersible pumps is the ability it gives you to regulate your installation.

Regardless of whether you need to keep a pump parameter constant by adjusting the pump speed, or adapt to a varying pump demand over time, VFD operation brings benefits aplenty. Let's take a look at a few examples.

In mines or construction sites, there is often a need to lower groundwater and keep it at a constant level during, for instance, the construction of buildings, roads and tunnels, or ensuring that mines do not flood. Thanks to a VFD, this can easily be done.

VFD operation can also be used in domestic water supply applications, in which tap water is pumped directly from the well to the tap. Here, the typical aim is to reduce the quantity of stagnant water in pressurised reservoir tanks as well as keep a constant water pressure, independent of varying water demands and well conditions.

Another VFD-friendly application is geothermal wells, in which there is a need of providing constant temperature to buildings. This is achieved by varying the pump flow to the heat exchanger, thereby obtaining the optimal flow through the heat exchanger.

In water supply applications, there is often a varying demand over the course of a day or a year. For instance, if your consumption is higher in the summer than in the winter, you can easily regulate the pump speed according to the required demand.

Another application in which you need a fluctuating pump output is dancing fountains. Here, the water pressure constantly changes in order to achieve the variations in the water columns.

Finally, regulating your installation allows you to utilise the aquifer in the most efficient way possible. By doing so, you can extract the exact amount of water the well is capable of giving, ensuring that the well isn't damaged by overpumping.

Now that we've covered some of the applications that benefit from VFD operation, let's take a look at a few things you need to be aware of during the installation process.

First of all, you need to size the system properly. When dealing with VFD's, you need to know that increasing the speed of the pump has a huge impact on the required motor output.

For instance, if the speed is doubled, the flow is doubled, the pressure is increased by four, and the output demand is increased by eight.

Next, we're going to turn our attention to the installation itself

– more specifically, output filters. At Grundfos, we recommend installing an output filter in your submersible pump installation if the net supply is above 380 volts. If the voltage exceeds this limit, the signal can damage the motor and reduce its lifetime. An output filter eliminates that risk.

There are three different types of output filters: Line choke, dV/dt and sine wave. While the first two are basic offerings, our recommendation would be to use a sine wave filter. Let's take a closer look.

A sine wave filter is the recommended output filter for frequency drives of 380 volts or higher. In a typical submersible installation with a VFD, the frequency drive will send sinusoidal waves overlaid with interference signals.

With the addition of a sine wave filter, however, the interfered signal is converted into a pure sinusoidal signal. This not only helps to extend the lifetime of your motor, it also means that your drop cables don't need to be screened, which cuts installations costs.

Finally, let's briefly touch upon the cables in a submersible installation. In a typical submersible installation, there are both unscreened and screened cables.

The cable running from the mains supply to the VFD is unscreened, the cable running between the VFD and the output filter is screened, and finally, the cable running from the filter to the pump motor is unscreened.

That sums up variable frequency drives and output filters in submersible pump installations. Let's go over the main points one more time:

VFD operation brings significant benefits, regardless of whether you need to keep a pump parameter constant or adapt to a varying pump demand.

VFD operation is beneficial in a number of applications, including domestic water supply, mines, and construction sites.

Finally, there are three types of output filters, of which the sine wave filter is the recommended solution. It extends motor lifetime and cuts installation costs.