Variable frequency drives: What are the benefits?

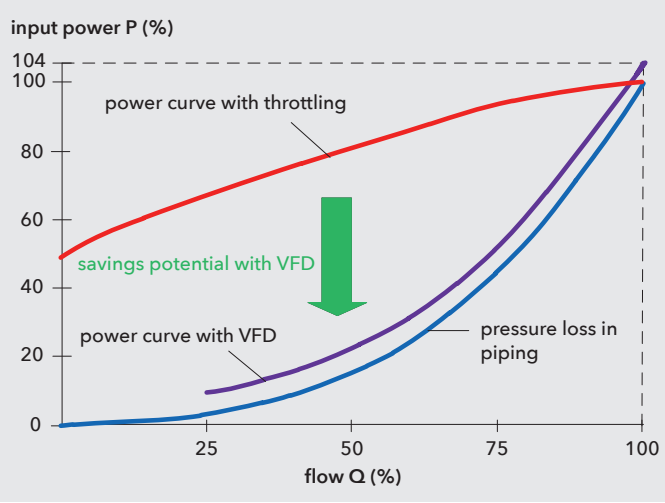
Variable frequency drives (VFD) are used to continually and electronically regulate asynchronous motors to lower and higher speeds (from 25 % to around 150 %), depending on the application. Modern standard motors can be operated in conjunction with a VFD without any problems. Older motors, on the other hand, are not always compatible with VFDs due to electric and mechanical reasons: Power surges and bearing failures could potentially damage the winding.

All pumps, fans, compressors as well conveyors and mechanical drives that are operated under variable loads are generally compatible with VFDs. Variable loads can become necessary depending on factors such as ambient temperature, volume flow rate, pressure difference, and so on. Load changes can affect the torque and/or speed. The torque is adjusted by simply reducing the motor's load. Using a VFD allows operators to change the motor speed and thereby the volume flow rate of pumps and fans as well as the speed of conveyors in a targeted manner, and to adapt these parameters to the effectively required demand.

A VFD can lead to significant savings of electrical energy if the respective application experiences frequent load changes and the adjustable volume flow rate changes proportionally to the second power of the speed or the third power of the electrical output. This is the case with closed-circuit pump systems as well as with fans. In the case of conveyors, the relation between speed and electrical power is linear, meaning energy savings are linear in proportion to the speed. In other applications, a VFD is needed solely to start up the system more easily and softly; no energy savings are to be expected. VFDs are often used incorrectly with the intention of operating an oversized motor at a reduced load. This practice is not economical: A VFD costs about the same as a motor; a smaller motor could be a simpler, safer and more affordable solution.

A VFD causes an additional load loss of around 5% at the rated operating point. Due to its pulse width modulation, it supplies the motor with a chopped sinusoidal current, which in turn leads to a loss in motor efficiency of approx. 1 %. That is why the advantages and disadvantages of using a VFD as well as additional costs must be considered carefully beforehand.

Currently, VFDs are not subject to minimum energy performance standards in the EU or in Switzerland. The testing procedures for VFDs are stipulated in IEC 61800-9-2, and the efficiency classes for VFD-driven motors in IEC 60034-31-2. Both will soon be incorporated into the revised version of EU motor regulation no. 640.



Savings potential of flow with frequency converters (VFD)

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