Monday, February 20, 2023

Variable Frequency Drives (VFD) and Single-Phase Power

Monday Morning Minutes | by Norm Hall, February 20, 2023

As a representative for Danfoss VLT variable frequency drives (VFD), we often are asked about the use of the VFD when single-phase power is the only source available. This is a viable option that is relatively simple. The engineer using single-phase power must be careful to coordinate not only the electrical and mechanical trades, but the pump supplier and the drive supplier too.

Can You Use a VFD on Single-Phase Power?

Every month our customer service and engineering teams are asked about using a variable frequency drive (VFD) when only single-phase power is available. Many drive manufacturers provide drives for this power source. There are some limitations, and we can look to Danfoss, a premiere drive manufacturer as an example.

The **Danfoss series FC102** is the drive with the standard trim normally specified in the HVAC industry. The single-phase drives are available for use with 200-240 V input power. The standard cataloged range is 1-1/2 Hp to 30 HP. If the motor is lower than 1-1/2 HP we would simply use the 1-1/2 HP drive. I use the word cataloged as an important distinction.

There are drives by various manufacturers at 115 Volt and nameplated for lower amp draw. The issue is whether they come with the standard trim the engineers specify in HVAC applications. For our purposes, we will say they are only available in 200-240 Volt.

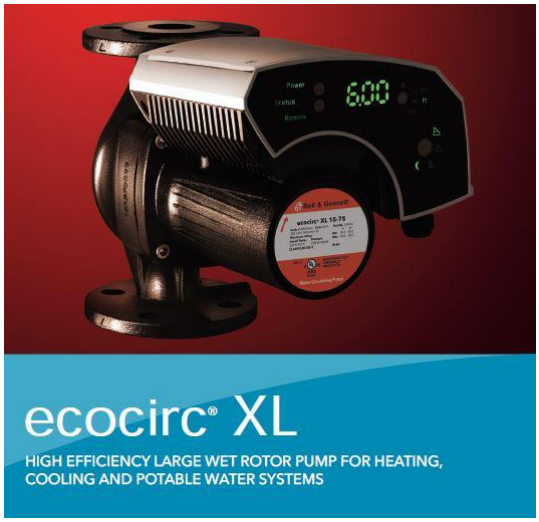
The Pump Must Have a Three-Phase Motor!

Here is one of those coordination issues. Although the input power could be 230/60/1, the motor that the drive is controlling must be three-phase. Repeat, **the pump motor must be three-phase even though the incoming power is single-phase.** This requires the pump schedule to show, for example, 230/60/3 even though the electrical shows 230/60/1 going to the drive.

The engineer **must** make notes on both the pump schedule and the drive schedule so there is no confusion. These notes will also help the engineering firm employee checking submittals.

Why does the motor need to be three-phase? Without starting a blog on how drives work, a simple statement is needed. A VFD takes the input AC and converts it to DC, then changes it back to a stepped function that mimics AC. That stepped function in the normal HVAC product is three-phase.

Other Options With Single-Phase Power



There are other options when you have singe phase power and prefer a variable-speed pump. You may look at an ECM smart pump such as the **Bell & Gossett Eco-circ XL**. These pumps have an ECM motor with control built in to accept a signal from the building automation system or use the internal programmed formula to become a self-contained variable speed pump. Here are a few links for your review.

- Smart ECM Pump Applications - Variable Speed Heating & Cooling System
- Using ECM Smart Circulator Pumps in Primary Pump Applications
- Using ECM Smart Pumps in Secondary Hydronic Systems

Contact your R. L. Deppmann engineering sales rep for more information on single-phase drives or smart pumps.