

VFDs | How Do I Derate Three Phase Inputs For Single Phase Applications?

Often times those using a Variable Frequency Drive (VFD) may find they need to connect a higher horsepower VFD to a single phase input power source. Since most high horsepower VFDs only accept three phase input as a power source, they are left with few options or alternatives. Don't fret, there is a solution.

If you are using a Variable Frequency Drive (VFD) rated for three phase input and the only power source you have available to you is single phase input, then you can de-rate the Variable Frequency Drive (VFD) to accept the single phase input power source. You can almost always use a VFD rated for three phase input with a single phase input power source. When only a three phase input VFD is available, it is acceptable and common practice to de-rate the VFD to work with a single phase input power source.

Before you de-rate your VFD, it is most important to ensure the VFD you are using is properly suited for your application. The following are some basic guidelines to help you in determining whether or not your Variable Frequency Drive (VFD) is suitable for your application: Gather motor nameplate data including horsepower (HP), current (Amps), motor voltage, input line voltage and power source phase. Determine which type of VFD your application will require. The type will fall under the category of Volts per Hertz (V/Hz), closed-loop vector, or open-loop vector (Sensor-less Vector). The internal components of the three phase input VFD are rated for the appropriate current expected when three phase input power is applied. When using single phase input the line side current from the single phase is always higher. To "de-rate" is the process of ensuring that these components are rated for the higher current that will flow from the single phase input instead of the three phase input.

You can de-rate a VFD by:

Determining the Horsepower of the Motor the VFD will be connected too, then choosing VFD with a Horsepower higher than the Horsepower of the motor to compensate for the additional input current from the single phase power source. The simplest formula used for these types of applications is:

VFD Input Current > Motor Current Rating * 1.73

The VFD input current must be equal to or greater than the Motor Current Rating * 1.73

When installing most three phase input Variable Frequency Drives (VFDs) on an application where single phase input power is used, you will almost always connect the input line leads to L1 and L2 of the VFD. L3 will be left open with nothing connected. Consult with the VFD manufacturer or knowledgeable integrator to be sure.

Example:

An application has a 230 VAC single phase input power source and needs to connect it to a conveyor that has a Variable Frequency Drive (VFD) connected to a 10 Horsepower 230 VAC 3 phase induction motor. Let us assume it has been determined that this application will operate well with a simple Volts per Hertz (V/Hz) VFD. The issue is, since there are no VFD manufacturers that offer a 10 Horsepower (HP) single phase input Variable Frequency Drive (VFD), we will need to de-rate a VFD with a three phase input for single phase input. Most manufacturers of VFDs only offer products up to 3 Horsepower (HP) for single phase input. The 10 Horsepower (HP) AC motor nameplate reveals that the motor is rated for approximately 27 amps at 230 VAC. We must use the equation above:

VFD Input Current > Motor Current Rating * 1.73

VFD Input Current > 27 Amps * 1.73

VFD Input Current > 46.71

This application will need a 230 VAC 3 phase Volts per Hertz (V/Hz) Variable Frequency Drive (VFD) with an input current rated at or above 47.0 amps.