Application Note

Correctly Sizing VFD Cables

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Correctly sizing a VFD Cable for your drive and motor is really not difficult if you know where to look. By knowing what sections of the National Electrical Code (NEC) to reference, you can correctly size cable conductor size for your system. Just follow these five simple steps to size cables for low voltage drive systems with operating voltages not greater than 575 volts.

STEP ONE: Determine the minimum temperature rating of your equipment.
Temperature ratings are important to know when derating the cable for the application as higher temperature ratings allow cables to handle more current. The NEC tables for cable ampacity for low voltage cables have columns for 60°C, 75°C and 90°C. The column you use will be based on the minimum temperature rating of your drive terminals, your motor terminals, and your VFD Cable.

Most drive terminals are rated for 75°C. All Southwire VFD Cables carry a 90°C conductor temperature rating but this is not true of all VFD Cables from other manufactures. Motor terminal temperature ratings can vary from 60°C to 90°C.

Each of these temperature ratings needs to be verified with the manufacturer's datasheets or user manuals. If other equipment is being used that is in the cable's path, like a quick disconnect, collect that devices temperature raring too. Once you have all the temperature ratings, record the minimum value.

STEP TWO: Determine the drive's horsepower rating and operating voltage.
This information can also be found in the manufacturer's literature.

STEP THREE: Determine the current your cable needs to handle.
Look at Table 430.250 in the NEC to determine the number of amps you need to size for. This number is likely higher than the full load amps (FLA) listed on your motor's nameplate. The reason for this difference is because the NEC tables take into account factors like power factor and efficiency which the motor's FLA rating does not.

STEP FOUR: Determine the Cable Size.
Go to Table 310.15(B)(16) in the 2014 edition of the National Electrical Code (Table 310.16 in previous versions of the codebook). The temperature column you use will be determined by the minimum temperature rating found in *STEP ONE*. Now look down the column for this temperature and for copper conductors until you find the first value

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greater than the current value you obtained from *STEP THREE* from Table 430.250. This will be the minimum size of cable you are allowed to use with your VFD system. The cable is sized based on three current carrying conductors in raceway, tray or buried in earth with an ambient temperature of 30°C (86°F).

STEP FIVE: Derate for other factors if needed.
If your system will be exposed to higher ambient temperatures, you will need to derate for that using Table 310.15(B)(2)(a). If you will be running more than one drive cable in a raceway you can derate for that using Table 310.15(B)(3)(a). Use Table 310.15(B)(3)(c) if you need to derate for your cable being exposed to direct sunlight or if the cable is above a rooftop.

A note about sizing cable for your drive inputs
To size cables that power your drive input you need to size your cables for 125% of the rated input current of the drive as stated in NEC 430.122(A). These cables are typically not VFD cables but drive manufacturers have been known to recommend VFD cables for this application in some circumstances for added protection.

Steve Wetzel works for Southwire and has been involved with cable for VFD systems for 20 years. Southwire Company, LLC, based in Carrollton, Georgia, is a participating Encompass™ Product Partner in the Rockwell Automation Partner Network™.
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