

VFDs, Motors, and Single Conductors

In applications where multiple motors are each powered by a separate VFD, care must be taken regarding the selection of the inverter to motor cables. Cable selection is even more critical if the cables are to be run any distance together in a raceway. Single conductor cables, while commonly used for some drive applications, can cause issues in such an installation. In addition to safety issues (see Southwire application note number 2012, VFD Cables – A Safe Bet), electromagnetic coupling can cause issues with drive performance.

Electromagnetic coupling, also known as inductive coupling, is a phenomenon that takes place in electrical circuits where the electromagnetic field in one conductor results in an electrical charge in another. It transfers electromagnetic properties from one cable to another and occurs without physical contact taking place. For electromagnetic coupling to take place, there must be a change in the electromagnetic field. Direct current (DC) circuits, which have no variation in the electromagnetic field, are immune to this effect. The amount of electromagnetic energy generated is proportional to the square of the frequency. The high frequency, pulse width modulated (PWM) waveforms generated by today's drives have significant energy and can cause serious issues. The longer the distance cables are run together, the more severe the issue can be.

When cables from one drive circuit are grouped close together, some cancelation effects take place, which limits the amount of coupling that can occur. This coupling can be reduced even more by using shielded VFD cable. Circuits are most susceptible to this effect when using non-shielded, single conductors.

If single conductor cables (such as THHN, RHH, RHHW, XHH, XHHW, and similar constructions) are laid in a tray haphazardly, electromagnetic coupling can occur. This coupling can interfere with drive system operation, causing intermittent issues with drive operation and drive trips. One procedure that may solve the problem is to de-energize the system and group the cables in triads by circuit, using cable ties to secure the cables together. Re-bundling cables is a time-consuming task, but it has been shown to work in some situations.

A better, more cost-effective solution is to use a VFD cable with an overall shield. The VFD cable “auto-groups” the circuit phases and grounds together, and the overall shield further reduces the unwanted electromagnetic coupling. It is one of the best solutions to reduce drive issues and false trips in this type of system.

VFD cable can increase production up-time and efficiency by minimizing electromagnetic coupling. VFD cable can also help in dealing with other issues like common-mode currents, electromagnetic interference, and partial discharge which can occur other cable constructions.

