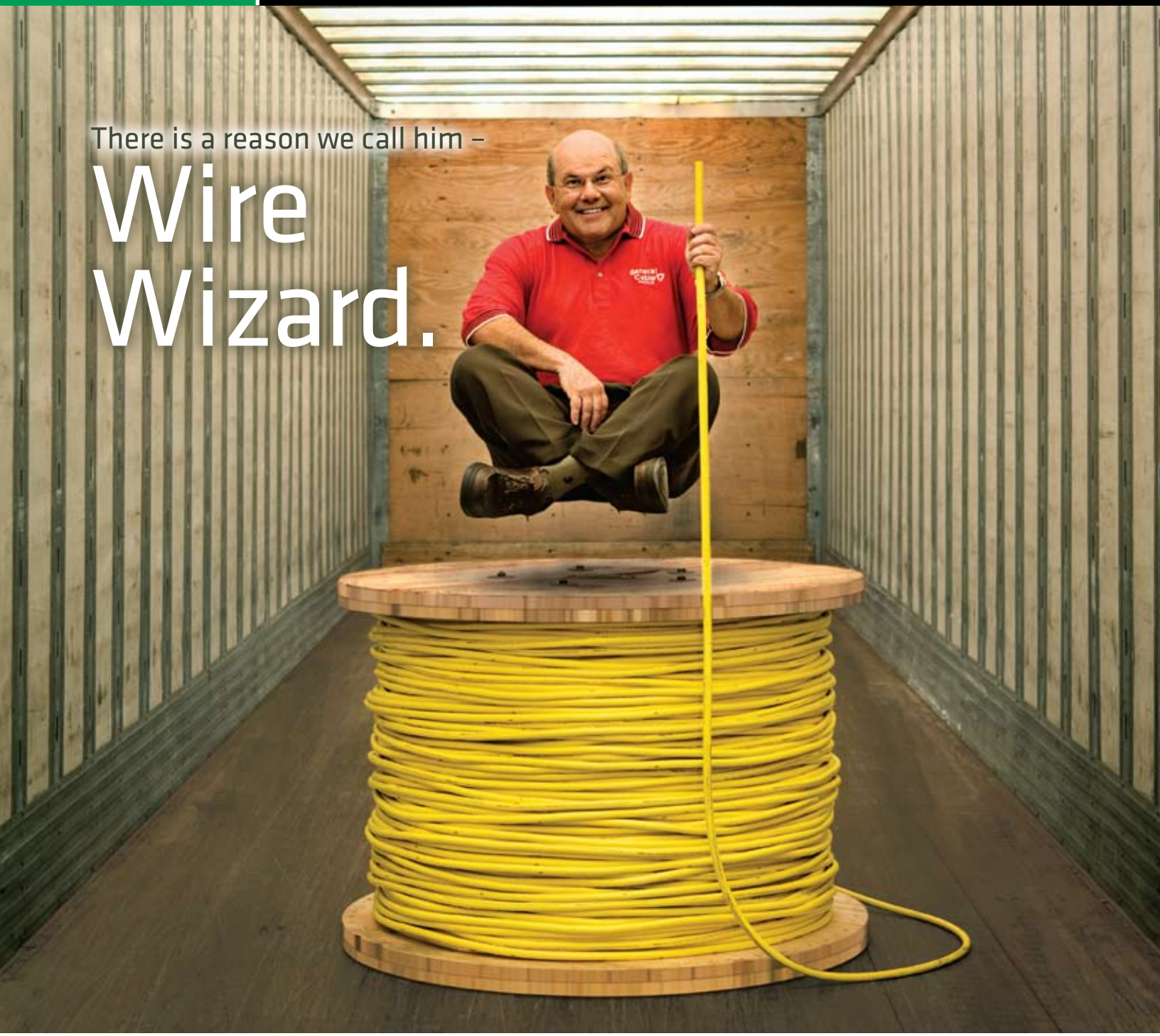

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Voltage Drop: Picking the Right Cable for the Long Run

BY SAM FRIEDMAN, DIRECTOR, TECHNICAL SERVICES — CAROL® BRAND CORD PRODUCTS — GENERAL CABLE

Reliability may not be a tangible item that's installed alongside a new furnace or wired into a dock-side crane, but nonetheless, it is an essential "accessory" that can mean the difference between overtime and lost time; in-stock and out-of-stock; perfect fits and refits. Being labeled as "unreliable" can mean ruin for a business, regardless of what you're making, installing or servicing. That's why it is vital to understand simple yet often overlooked problems, like voltage drop, in product applications.

Voltage drop is the reduction in voltage in an electrical circuit between the source and load. For equipment to operate properly, it must be supplied with the right amount of power, which is measured in watts: current (amps) times voltage (volts). Motors, generators, tools — anything that runs on electricity is rated for power, as in a 100-watt light bulb. The correct amount of power enables equipment to meet its designed power rating and operate efficiently. Incorrect or insufficient power amounts can result in inefficient operation, wasteful power usage, and even equipment damage. That is why understanding voltage drop calculations and selecting the correct cable for each application is so important.

The National Electrical Code (NEC) catalogs the requirements for safe electrical installations and represents the primary document for guidance in the United States. Providing direction for both trained professionals and end users, these codes set the foundation for the design and inspection of electrical installations. So how does the Code treat voltage drop issues? For branch circuits, look to NEC (NFPA 70) Section 215.2(A)(3) footnote 2 and Section 210.19(A)(1) footnote 4. Both advise that conductors for feeders to dwelling units should be sized to prevent voltage drop exceeding 3% and maximum total voltage drop on both feeders and branch circuits should not exceed 5% for "reasonable efficiency of operation."

In addition, look to NEC (NFPA 70) Section 647.4 (D) when dealing with sensitive electronic equipment. It states that voltage drop on any branch circuit shall not exceed 1.5% and the combined voltage drop on branch-circuit and feeder conductors shall not exceed 2.5%. It is important to note that much of the equipment manufactured today contains sensitive electronics.

Ampacity, a cable's electric current-carrying capacity, is also connected to voltage drop. The Code stresses the importance of accounting for voltage drop when considering a cable's ampacity rating and the need to satisfy both requirements. NEC Section 310.15 (A)(1) states that ampacity tables do not take voltage drop into consideration.

For DC current, voltage drop is proportional to amount of current flow and wire resistance. In AC circuits, total impedance and power factor (power loss ratio) also need to be considered. Since wire resistance is a factor of wire size, material and length of run, it is important to choose the proper wire size for length of run to keep voltage drop at the desired level.

To simplify your voltage drop calculations, turn to the *Carol Brand Cord & Cordset Catalog* and/or our online resources. Use either the "Voltage Drop Calculations" table on page 83 in the catalog or download a PDF of the catalog by visiting:

www.generalcable.com/GeneralCable/en-US/Products/CordandCordsetProducts/Catalog/

Wherever you find it — in print or online — this table makes calculating project voltage drop straightforward and easy. For example, let's say your project involves a 100-foot run of 12/3 SOOW wire, 12 amps line current for equipment, line circuit of 120 volts AC, 3 phase, 100% power factor. According to the calculation table, the factor is 3190. Next, multiply current times distance (feet) times factor: 12 x 100 x 3190 = 3,828,000. Finally, place a decimal in front of the last six figures, and the result is the volts lost — voltage drop = 3.8 volts (3.2% of overall voltage).

So, to ensure the reliability of your products/installations/service calls, be sure to account for voltage drop when making your cable selections. While it is mainly a nuisance issue, voltage drop can affect equipment efficiency, power consumption and potential damage to sensitive electronics and other systems. Fortunately, these issues are easily avoided, especially when you rely upon the NEC codes and standards that relate to voltage drop — each of which provides useful guidance in ensuring the success of your application.

By selecting a cable with the correct voltage drop characteristics, you will optimize the operation of your connected equipment, increase your efficiencies and prevent equipment damage. And that's a pretty good payoff, in the short term or the long run.

Still need help? Carol's Wire Wizards are ready with first-class customer support, printed catalog materials and detailed product specifications. Please give us a call at 1.800.243.8020, send us an e-mail at info@generalcable.com or visit www.generalcable.com.

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