

## Current...What is it Anyway?

“Current” is a term we “wire wizards” use many times a day. But what *is* electrical current? How does it relate to our products? What do we need to know about current to help our customers select the best available products for their application?

If you “listened up” real well to your high school or college science teacher -- or if you are an electrical engineer -- you can stop reading. However, if you are among those who aren’t sure what current is, keep reading for a “crash” course on the basics.

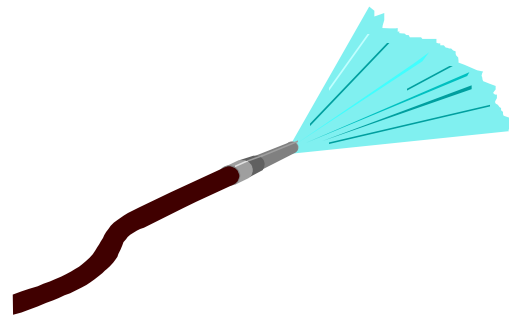
### What is Current?

An electrical current is the flow of electrons through a conductor. Electrons are sub-microscopic particles of matter that exist in all conductors such as copper and aluminum. Current flows when electrons are pushed by the force of an applied voltage. Current is measured in units of “amperes” or “amps” (usually abbreviated “A”). Engineers generally use the symbol “I” to represent current in mathematical expressions. The greater the current, the more electrons that are moving through the wire per unit of time.

The terms *current* and *voltage* are sometimes incorrectly used interchangeably. Current and voltage are no more alike than “gallons per minute” and “pounds per square inch”.  
**Current and voltage are two distinctly different components of electricity!**

### How Does Current Relate to Wire and Cable?

You can think of an insulated wire as a garden hose in which the electrical current is represented by the flow of water. Each electron is represented by the smallest drop of water you can imagine. If you wish to carry a greater volume of water (more gallons per minute) with your garden hose, you will need a larger diameter hose -- say 3/4 inch instead of 1/2 inch.



Likewise with wire, if you wish to carry more electrical current, you will need a larger diameter conductor -- say a 10 AWG instead of a 16 AWG. If you double the cross-sectional area, you approximately double the current carrying capacity (also known as the

(continued)

“ampacity”) of the wire. For example, a 2 AWG wire with 66,360 circular mils of cross-sectional area can carry more than twice as much current as a 6 AWG wire with only 26,240 circular mils.

### **What Do I Need to Know to Help My Customer Select an Appropriate Cable?**

Just make sure that the current carrying capacity (the ampacity) of the cable equals or exceeds the maximum current the cable will be expected to carry during its service life. That way the conductor will be large enough to carry the required current without overheating and causing damage to the insulation or jacket of the cable.

The ampacity of a cable is the maximum amount of current a cable can carry in a given situation without exceeding its temperature rating. The temperature rating depends on the heat resistance of the materials used for the insulation and jacket of the cable.

Additionally, the ampacity of a cable depends on many factors *external* to the cable such as ambient temperature, whether installed above or below ground, etc. That’s why there is a book published by IEEE titled Power Cable Ampacity Tables (IEEE Standard 835) that’s over 3000 pages in length and contains approximately 250,000 cable ampacities! Additional information on ampacity is contained in **Wire Wisdom** A-1.

Now, if you’re a glutton for technical punishment, turn to **Wire Wisdom** V-2 for a crash course on *voltage*. Voltage is another component of electricity that is of major importance to our customers and to you.