

WHAT WIRE SIZE DO I NEED?

Choosing the right conductor size for a given application can be a daunting task. This Wire Wisdom will highlight critical considerations that influence the selection of a conductor size.

ELECTRICAL CONSIDERATIONS

The dominant factor in determining a safe and efficient wire size is ampacity, the amount of current the wire can carry. The second most common consideration is voltage drop, or the amount of voltage reduced due to losses. For more information regarding these specific issues, see Wire and Cable Ampacity Ratings.

WIRE SIZING CHECKLIST

Ampacity-related considerations

Current passing through a wire causes energy to be released in the form of heat due to resistance. Cable insulation only performs satisfactorily up to the upper temperature rating of a cable. Even if a cable had no insulation at all, the conductor would melt with excessive current or ambient temperatures (copper melts at 1,085°C). The following temperature factors can affect the maximum current:

- Temperature rating of wire or cable
- Short-circuit requirements
- Ambient operating temperature
- Installation environment
- Free airflow
- Thermal resistance of surroundings
- Adjacent current-carrying conductors
- Solar radiation
- Other sources of external heat (steam pipes, coils, etc.)
- Maximum expected current
- Temperature rating of termination

Voltage-drop considerations

Because a real-world wire has resistance, the voltage at the load end of the circuit is not the same as the voltage at the source end. Consider the following when voltage drop becomes a factor when selecting wire size:

- Circuit length
- Required current of circuit
- Type of circuit (single-phase or three-phase)
- Operating frequency (DC, 50 Hz, 60 Hz, or non-sinusoidal)
- Circuit power factor
- Installation type (aluminum conduit, plastic conduit, steel conduit, etc.)

Other electrical considerations

In communication and other signal-transmission products, it is important that the signal is able to be properly transmitted to the receiver. The following factors can degrade the quality of a signal and may influence the choice of wire size:

- Resistance
- Inductance
- Impedance
- Attenuation
- Capacitance

PHYSICAL AND OTHER CONSIDERATIONS

Sometimes, a variety of choices will satisfy electrical needs of the selection process, but the physical characteristics of the product will be the dominant factor. Consider how the following factors may affect the ease of installation or the ability to be used due to other influences:

- Flexibility
- Conductor material
- Durability
- Termination size range
- Space limitations
- Standards requirements: NFPA, NEC, IEC, CEC, BS, etc.
- Bend radius
- Price and availability
- Ease of handling
- Pulling tension