



PLTW Engineering

10-12/Electrical Wire Types, Sizes and Labeling

May 18, 2020



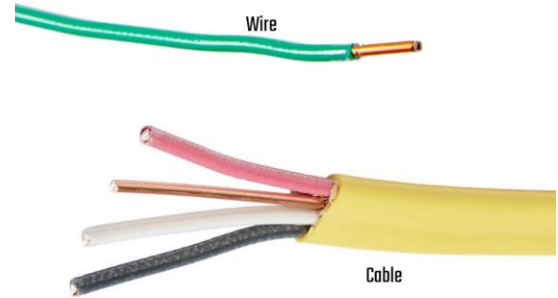
10-12/DE

Lesson: 5/18/2020

Objective/Learning Target: Students will be able to identify different cable and electrical wire types, learn more about their specific uses, and learn how to determine the size of individual electrical wires and their purpose.

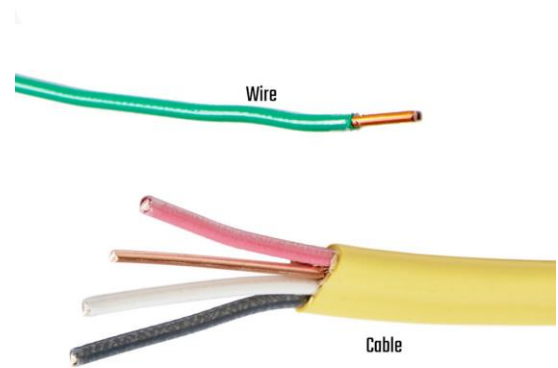
Electrical cable vs electrical wire

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Electrical cable numbering system

An electrical cable is classified by two numbers separated by a hyphen, such as 14-2. The first number denotes the conductor's gauge; the second denotes the number of conductors inside the cable.

For instance, 14-2 has two 14-gauge conductors: a hot and a neutral. This cable also contains a bare copper wire as the ground. Individual conductors are also color-coded, which tells you their purpose in the circuit.



Electrical cable outer sheath color coding

The color of a cable's outer sheath tells you the gauge of the wire inside the sheath as well as the amperage rating for the circuit.

Gray= Underground cable. Since all UF (underground feeder) cable is gray, check the sheath labeling for gauge and circuit specifics.

Black= 8- or 6-gauge wire, 45- or 60-amp circuits. Check sheath labeling for gauge and circuit specifics.

White= 14-gauge wire, 15-amp circuit

Yellow= 12-gauge wire, 20-amp circuit

Orange= 10-gauge wire, 30-amp circuit



Electrical wire color coding

This code is standard for all conductors. The colors you're most likely to find in your home are the following:

Black (or Red) = HOT. Hot wires carry current from the panel to the device, which could be a switch, receptacle, light fixture or appliance.

White = NEUTRAL. Neutral wires carry the current back to the panel, completing the circuit.

Bare (or Green) = GROUND. In the event of a ground fault, the ground wire provides a path for the fault current to return to the panel, opening the breaker or blowing the fuse, cutting off the flow of electricity.



Nonmetallic Cable

This is the most common type of electrical cable in homes built since the mid-'60s. “Nonmetallic” simply means that the outer jacket is not metal.

It's often referred to as Romex, which is a brand name. Typically, NM-B cable has either two conductors and a ground, or three conductors and a ground. The conductors are individually insulated, wrapped in paper and sheathed in plastic. Ground wires are either bare copper or insulated in green.



Nonmetallic Cable

14-2 : Used for general lighting and receptacle circuits. 15-amp circuit maximum.

14-3 : Used for three-way switches and split receptacle circuits. 15-amp circuit maximum.

12-2 : Used for 20-amp kitchen, bathroom, laundry and garage receptacles; 230-volt heating circuits up to 3,700 watts; and 115-volt circuits up to 1,800 watts. Can be used anywhere in place of 14-2.

12-3 : Same uses as 12-2, with the addition of three-way switches and split receptacle circuits.



Underground feeder cable

UF is used primarily to bring power to detached garages, outbuildings or outdoor lighting.

The insulated conductors are molded into the sheathing. Depending on the situation, UF is either direct-buried or run in conduit.

It must be protected from physical damage by conduit where it exits the ground and is exposed.



Metal-clad cable

MC cable is common in unfinished areas where the cable would otherwise be exposed and subject to physical damage.

It's also sometimes used inside walls. A bare aluminum wire is in continuous contact within the metal sheathing.

The combination of aluminum wire, sheathing and metal boxes grounds the circuit.



Stranded electrical wire vs Solid wire

Stranded wire is more flexible than solid. If you're pulling wire through conduit, stranded wire makes it easier to get around corners and bends in the conduit.

However, if the situation requires pushing wires through conduit, you'll want to use solid wire.



Quiz yourself

1. Most electrical wire is covered in a rubber or plastic coating called *insulation*. What is the purpose of having this “insulation” covering the metal wire?
2. In the early days of electrical wiring, wires used to be insulated with *cotton*. This is no longer accepted practice. Explain why.
3. Electrical wire is often rated according to its cross-sectional diameter by a *gauge* scale. Which is the larger-diameter wire size, 14 gauge or 8 gauge?
4. Describe the difference between *solid* and *stranded* wire types.
5. How many gauge American Wire Gauge sizes must you increase to (approximately) double the ampacity of any given wire gauge?



Helpful links

[Types of electrical wires and cables - homeowner's guide](#)

[Youtube video that shows types of wires and cables](#)