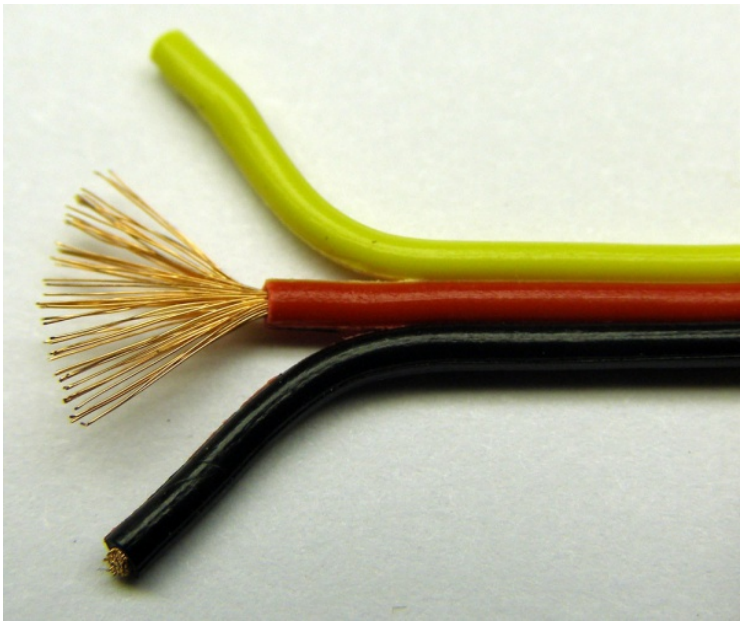
WORKING WITH WIRE

Introduction

When someone mentions the word wire, they are more than likely referring to a flexible, cylindrical piece of metal that can vary in size from just a few millimeters in diameter to several centimeters. Wire can refer to either a mechanical or electrical application. An example of a mechanical wire could be a Guy-wire, but this this guide will focus on electrical wiring.

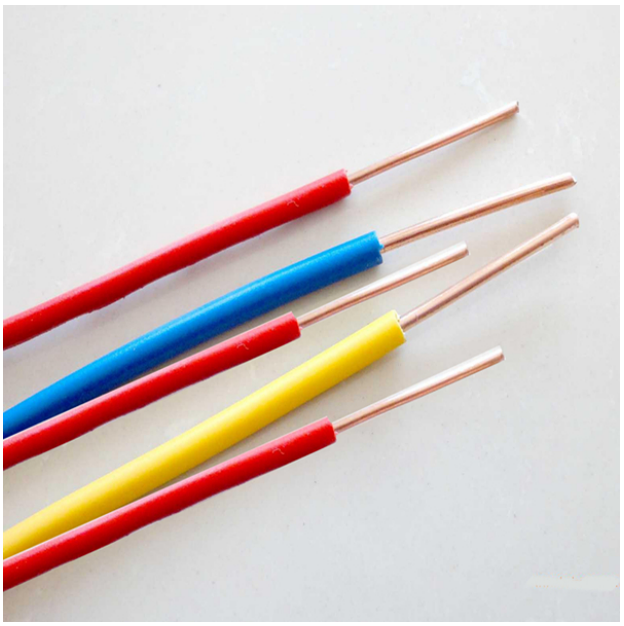


Inside a stranded wire

Electrical wire is a backbone of our society. There is wire in houses to turn on lights, heat the stove, and even talk on the phone. Wire is used to allow current to flow from one place to another. Most wires have insulation surrounding the metallic core. An electrical insulator is a material whose internal electric charges do not flow freely and, therefore, does not conduct an electric current. A perfect insulator does not exist, but some materials such as glass, paper and Teflon, which have high resistivity, are very good electrical insulators. Insulation exists because touching a bare wire could allow current to flow through a persons body (bad) or into another wire unintentionally.

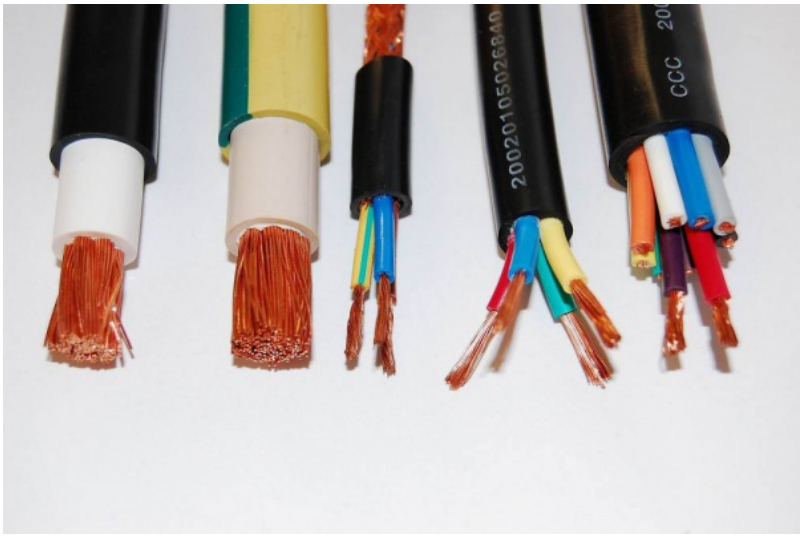
Stranded vs Solid

Wire can come in one of two forms, stranded or solid core.



Various colors of solid core wire

Solid wire is composed of a single piece of metal wire, also known as a strand. One very common type of solid wire is known as wire wrap. Stranded wire is composed of many pieces of solid wire all bundled into one group.

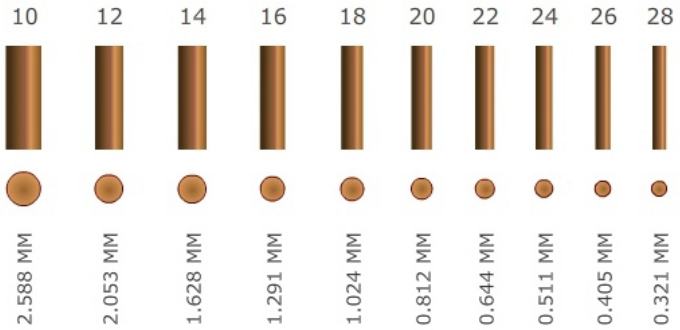


Various colors and sizes of stranded wire

Stranded wire is much more flexible than solid wire of equal size. For this reason, stranded wire is used when the wire needs to move around frequently, in a robot arm for example. Conversely, solid wire is used when little or no movement is needed, such as prototyping circuits on a breadboard. Using solid core wire makes it easy to push the wire into a breadboard. Trying to use stranded wire on a breadboard can be very difficult, as the strands want to separate as they are pressed in.

Wire Thickness

The term ‘gauge’ is used to define the diameter of the wire. The gauge of a wire is used to determine the amount ofcurrent a wire can safely handle. Wire gauge can refer to both electrical and mechanical. This tutorial will only cover electrical. There are two main systems for measuring gauge, American Wire Gauge (AWG) and Standard Wire Gauge (SWG). The differences between the two are not critical to this guide.



An approximate scale of several different gauges of wire

The amount of current that a wire can carry depends on a few different factors, for example the composition of the wire, wire length, and condition of the wire. In general, thicker wire can carry more current.

Conductor Size for 3% Drop in Voltage

	Round-Trip Length of Conductor (Feet)								
Current (Amps)	10	20	30	40	60	80	100	120	140
	Minimum Wire Size (AWG)								
1	16	16	16	16	16	14	14	14	12
2	16	16	16	14	14	12	10	10	8
5	16	14	12	10	10	8	6	6	6
10	14	10	10	8	6	6	4	4	2
15	12	10	8	6	6	4	2	2	1
20	10	8	6	6	4	2	2	1	0
25	10	6	6	4	2	2	1	0	2/0
30	10	6	4	4	2	1	0	2/0	3/0
40	8	6	4	2	1	0	2/0	3/0	4/0
50	6	4	2	2	0	2/0	3/0	4/0	
60	6	4	2	1	2/0	3/0	4/0		
70	6	2	1	0	3/0	4/0			
80	6	2	1	0	3/0	4/0			
90	4	2	0	2/0	4/0				
100	4	2	0	2/0	4/0				

An approximate wire thickness to current capability chart

Here at SparkFun we typically use 22 AWG wire for prototyping and breadboarding. When using a breadboard, the solid core is perfect because it fits nicely into the breadboard holes. For other prototyping/building involving soldering, the stranded core is #1, just be sure not to let too much current run through a single wire, it will get hot and could melt!

Source : https://learn.sparkfun.com/tutorials/working-with-wire#introduction