Wire Size

Recently, there has been numerous questions on this board concerning the proper type or size of AC power cable to use with different amounts of equipment. It is very important to use the correct size cable to insure all the power will be available to your equipment and there is no danger of a fire or short from your cables.

Here is a Cable/Current table to help you select the proper one to use in your application.

Wire Size (AWG)	2 Conductor	3 Conductor	4 Conductor
10	30Amp	25	20
12	25	20	16
14	18	15	12
16	13	10	8
18	10	7	6

Notice that the smaller the AWG number, the more current it can handle. All Extension Cords are required to list the wire gauge. That will tell you the amount of current they can safely handle.

The wire in the above example is Copper type and of the same temperature rating. All currents listed are for Ambient temperature. Keep in mind that there are also many different type of insulation material that will determine the temperature rating. The wire may not be pure copper but an alloyed of aluminum, nickel, tin and copper.

Standard cable, as used in home and general construction, is classified by the wire size, number of wires, insulation type and dampness condition of the wire environment.

Example: a cable with the code "12/2 with Ground – Type UF – 600V – (UL)" has the following specifications:

1. Wire size is 12 gauge (minimum required size for homes today).
2. The "/2" indicates there are two wires in the cable.
3. "Ground" indicates there is a third wire in the cable to be used as a grounding wire.
4. "Type UF" indicates the insulation type and acceptable dampness rating.
5. "600V" means the wire is rated at 600 volts maximum.

6. "UL" indicates the wire has been certified by Underwriters Laboratory to be safe.

Standard wire color codes are very different between electronic circuitry and household 110 Volt AC wiring.

Household wiring (or other AC applications in the 100+ volt range) use the following color codes:

BLACK "Hot" wire. Connected to Brass colored terminal.
GREEEN "Ground" wire. Also called chassis ground.
RED "Traveler" wire. Used for 3-ways switches.
WHITE "Neutral" wire. Connected to silver colored terminal.

VOLTAGE DROP vs. WIRE SIZE

Voltage drop is the amount of voltage lost over the length of a circuit. Voltage drop changes as a function of the resistance of the wire and should be less than 2% if possible. If the drop is greater than 2%, efficiency of the equipment in the circuit is severely decreased and life of the equipment will be decreased. As an example, if the voltage drop on an incandescent light bulb is 10%, the light output of the bulb decreases over 30%!

Voltage drop can be calculated using Ohms's Law, which is: Voltage Drop = Current in amperes x Resistance in ohms.

For example, the voltage drop over a 200 foot long, #14 copper wire, power line supplying a 1000 watt floodlight is calculated as follows:

Current = 1000watts/120volts = 8.33 amperes
Resistance of #14 copper wire = 2.58ohms/1000feet
Resistance of powerline=2 x 200ft x 0.00258ohms/ft=1.032ohms
Voltage drop = 8.33 amperes x 1.032 ohms = 8.60 volts
Percent voltage drop = 8.60volts/120volts = 7.2%

The 7.2% drop is over the maximum 2% so either the wattage of the bulb must be decreased or the diameter of the wire must be increased (a decrease in wire gauge number). If #9 copper wire were used in the above example, the voltage drop would have only been 2.2%.

A more commonly used method of calculating voltage drop is as follows: Using values from the Ohm's Law example above: #14 copper wire has an area of 4110 circular mils, then voltage drop = (11 x 2 x 200 x 8.33) / 4110 = 8.92volts = 8.92volts/120volts = 7.4%.

An interesting corollary to the above example is that if the line voltage doubles (240 volts instead of 120volts), the voltage drop decreased by a factor of 4. That means that a line can carry the same power 4 times further! Higher voltage lines are more efficient. That's why voltage is so high (50,000volts) for power transmission lines.

Source: http://www.co-bw.com/Audio_Wire_Specs.htm