AWG Wire Chart

To determine the correct wire size to use on “one circuit” the following information is required:

- The voltage and current draw of lock(s) to be used.
- The distance in feet from the power source to the furthest lock.

Add together the current draw (Amps) of all locks to be in the same circuit. Cross reference the total amps with the distance between the power source and furthest lock to determine wire gauge required.

“One circuit” implies that from the power supply two wires are being run to one or more locks in parallel fashion. The last lock on that pair of wires from the power supply is not to exceed the maximum distance figure as shown on this chart for that gauge of wire, quality and type of lock. If the gauge size or maximum distance is inadequate for your application, divide the quantity of locks in that circuit to create two or more separate circuits and use the chart to figure each new circuit independently, even though the same power supply is being used. This will increase the total number of wires being run but will also allow for a smaller gauge of wire and increase the maximum distance from the power supply to the furthest lock in that circuit. The chart shows the minimum wire gauge needed from the power supply to the furthest lock in one circuit.

We recommend the use of double stranded wire for all installations. All wiring must be installed in accordance with all state and local codes.

WIRE GAUGE CHART FOR
12 VOLT AC/DC

Amp	25 ft	50 ft	75 ft	100ft	150 ft	200 ft	250 ft	300 ft	400 ft	500 ft	1000 ft
.25	22	22	22	22	22	22	18	18	18	18	16
.50	22	22	22	22	22	18	18	18	18	16	14
.75	22	22	22	22	22	18	18	18	16	14	12
1.0	22	22	22	22	18	18	18	16	14	12	
1.5	22	22	22	18	18	18	16	14	12		
2.0	22	22	18	18	18	16	14	12			
2.5	22	22	18	18	16	14	12				
3.0	18	18	16	16	14	12					
3.5	18	16	14	14	12						

WIRE GAUGE CHART FOR
24 VOLT AC/DC

Amp	25 ft	50 ft	75 ft	100 ft	150 ft	200 ft	250 ft	300 ft	400 ft	500 ft	1000 ft
.25	22	22	22	22	22	22	22	22	22	22	18
.50	22	22	22	22	22	22	22	22	22	18	
.75	22	22	22	22	22	22	22	22	18	18	
1.0	22	22	22	22	22	22	22	18	18		
1.5	22	22	22	22	22	22	22	18	18		
2.0	22	22	22	22	22	22	22	18			
2.5	22	22	22	22	22	22	18				
3.0	22	22	22	22	18	18	18				
3.5	18	18	18	18	18						

Wire Resistance and Voltage Drop Calculator

These calculators determine the resistance along a length of stranded copper wire, and if a value for current is provided, voltage drop across that same length of wire.

In a one-dimensional body, such as a wire, the relationship between current and potential can be described by Ohm's Law:

$$V = IR$$

where

V = difference of potential between two points on a wire,
I = current through a wire, and
R = resistance measured between the same two points as the potential difference.

The resistance values for the stranded copper wire sizes shown in the tables below (ones that are typically found in an automobile) are from http://www.mogami.com/e/cad/wire-gauge.html, a 2% lay factor is assumed and diameters are approximate. AWG is the American Wire Gauge (formerly Brown and Sharp) size. Also shown is the corresponding millimeter wire gauge size, which is the cross-sectional area of circular wire. Circular mils (CM) is the diameter of a *solid* wire in 1/1000th inch diameter circle (a 1 inch diameter wire would be 1 million circular mils). **Note:** Before August 6, 2005, all CM values, as well as many values in the lower table including resistance, were incorrect (my thanks go to Bill Coffel for contacting me about this). For a solid wire of the same gauge or CM the resistance will be slightly less. For example, a 12 AWG solid copper wire has a resistance of about 5.21 ohm/km compared to 5.32 ohm/km for a 12 AWG stranded wire.

Enter the wire length in either feet or meters and click on "Calculate" to display the resistance for that length of wire in the sizes shown. In addition, if you enter a value for the current draw in amps, the voltage drop along that section of wire is also displayed (volts = amps times ohms). Please remember that by using your browser to "View Source" and saving the HTML file to your local disk drive, you can have this page available offline.

The National Electric Code (NEC) specifies the following formular to determine the wires size in circular mils (**CM**) for a constant load of **I** amps, wire length **L** in feet, and voltage drop **V**.
CM = (**25** x **I** x **L**) / **V**
The CM size can be converted to AWG using the tables below or the link above. This standard is a practical limit determined by NEC. NEC has established that a 2% maximum voltage drop is acceptable. Here are two example uses of this formula in our cars.

Example - Battery move to trunk: CM = (25 x 400A x 12')/0.24v = 500,000 circular mils. This would be a 8/0 AWG wire (diameter of about 0.816"). This is an overestimation of the actual wire size that can be used. A 0 AWG wire (105,535 CM) is adequate but would have a 0.48 voltage drop, or about 4 % with a nominal 12 v potential on the wire and a 400 A draw, which *may* only occur very briefly when the starter turns a cold engine. Using a 200 A max draw and the same setup would require a 250,000 CM wire or a 5/0 AWG wire. A 0 AWG wire would have a voltage drop of 0.24 volts, which is at the 2% NEC limit. The 150-A fuse (with a 0 AWG wire) I use in my rear-compartment battery setup has not blown, suggesting current draw is less than 200 to 400 A over 1 to 5 seconds. By re-arranging the equation above, we can estimate the voltage drop resulting from using a particular wire size.
V = (**25** x **I** x **L**) / **CM**
For a constant current of 120 amps (the size of the main alternator fuse in my car), a wire CM of 105535 (0-ga wire), the voltage drop on a 12' wire would be about 0.144 volts.

Example - Power wire for 500 W (42 A @ 12 V) stereo amplifier: CM = (25 x 42A x 6')/0.24v = 26,250 circular mils. This would require a 6 AWG wire according to NEC standards. Using the "voltage drop" method, if the user wanted less than 1% voltage drop on this wire (assuming a nominal 12 v potential) in this setup then a 6 AWG wire is required. If the user can tolerate a 1.5% drop then an 8 AWG wire would suffice. A 10 AWG wire would have a 2.2% voltage drop, just over the NEC standard.