



## **The importance of good power wire.**

We all know that it takes wires to make electronics work. But what is the reason there are different sizes of wires? Does it make any difference? Can the same size of wire be different internally? To sum it up, it does make a big difference on the size of the wire and what it is made of. Using the wrong wire can lead to poor quality sound reproduction, damaged electronics, and in severe cases...FIRE! You don't want that do you? We will explain the differences in power wire for the 12 volt industry.

### **The car's electrical system and how it operates.**

Just a quick lesson on how power works in a car... Most vehicles (except hybrids) use a 12 volt battery to power the electronics while the car is not running. Yes, that includes the starter. You need a way to store energy to power the starter to get the car running. That is what batteries do, they store energy. They can be large or small and will have various storage capacities depending on what the designers of the vehicle need it to do. Let's use a bucket of water to represent a battery. Buckets come in all sizes and can hold various amounts of water for use later when you have no water source. If you put a small hole in the bucket it will begin to drain the water out. If you have no way to refill the bucket, it will eventually drain completely. This would be just like putting a small load on a battery. It will take a relatively long time to drain the battery. A battery will power a small electrical device for quite a long time. If you put a larger hole in the bucket, the water will drain out faster. This would be similar to putting a greater load on the battery like starting the vehicle. The starter requires a lot of energy to crank the engine over. The battery will provide a lot of current (amps) very quickly to the starter but will not be able to do this nearly as long before it is out of energy without recharging.

The wire in an electrical system is similar to a water pipe in your house. Small pipes provide small amounts of water and bigger pipes can provide more water assuming the same pressure in each pipe. It all depends on the amount of water you need to a particular faucet. The same is true for electricity. The more power you need to a device, the more energy you will have to provide. If your wire is not large enough for the device's requirements, two things will happen. The voltage will drop in the circuit because the small wire is restricting it. Most automotive electronics will shut down if the voltage gets too low. The wire will also begin to heat up as you require more energy. If it gets too high, you get smoke and fire...not good. So basically we are saying that if you have a very powerful amplifier, it will require larger wire than a less powerful amplifier.



There is a difference between water in a pipe and power in a wire. Water flow in a pipe will not change with length of the pipe or what material the pipe is made of. With any type of wire, it will have more resistance as it gets longer. That means that the farther you mount the equipment from the battery, the larger wire you will need to get the required amount of energy to the device. There are wire tables that will reference the amount of current needed for a device and how long the wire is. This will tell you the gauge, or size of wire required for safe operation.

**Example:**

Amperes	250-300	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.	1/0-ga.	2/0-ga.
	200-250	4-ga.	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.	1/0-ga.
	150-200	6 or 4-ga.	4-ga.	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.
	125-150	8-ga.	6 or 4-ga.	4-ga.	4-ga.	2-ga.	2-ga.	2-ga.
	105-125	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.	2-ga.
	85-105	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.	4-ga.
	65-85	10-ga.	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.
	50-65	10-ga.	10-ga.	8-ga.	8-ga.	6 or 4-ga.	6 or 4-ga.	4-ga.
	35-50	10-ga.	10-ga.	10-ga.	8-ga.	8-ga.	8-ga.	6 or 4-ga.
	20-35	12-ga.	10-ga.	10-ga.	10-ga.	10-ga.	8-ga.	8-ga.
	0-20	12-ga.	12-ga.	12-ga.	12-ga.	10-ga.	10-ga.	10-ga.
	0-4 ft.	4-7 ft.	7-10 ft.	10-13 ft.	13-16 ft.	16-19 ft.	19-22	
	Length in feet							

It is acceptable to use larger wire for a device that what is needed. There will be no down side to using wire that is larger than recommended. Larger wire does cost more and can sometimes be harder to bend or hide in a car's interior.

**Charging the battery:**

To charge the battery after the car starts is the job of the alternator. It is often considered the most important component of car audio. Without an alternator, you will soon have no sound at all. It is the alternator's job to charge the battery after the vehicle is started and to power all the electronics in the vehicle while it is running. Alternators are designed specifically for each vehicle. They will vary in output depending on the manufacturer and how much power is required in each specific vehicle. The automotive manufacturers design the alternator specifically to meet the needs of the specific vehicle very closely. Basically, they will not install larger alternators than they feel necessary to run the vehicles electronics that come in the car from the factory. If you add high power electronics, the stock alternator and its wiring may not be enough to power everything adequately so an upgrade is necessary.

**Power wire types:**



Typically, you will want to use oxygen free copper wire for automotive electronics. It has the best conductivity vs cost and is the most popular in the industry. This wire may have a silver oxide coating to help eliminate long-term corroding.

There is another type of wire that is gaining market share in car audio. This is called copper clad aluminum wire commonly called CCA wire. It is cheaper and lighter than pure copper wire. It is aluminum wire that sometimes has a copper coating to make it appear it is made of copper. Aluminum has approximately ½ the current capability as copper. This is because it has almost double the resistance per foot that the same size copper wire. With CCA wire, you will have to use larger wire to get the same capacity as copper. This will sometimes negate the savings because you will have to buy thicker wire than the recommended copper wire. With more resistance in aluminum wiring, you will get more heat buildup in the wire and you will have more voltage drop at the amplifier causing loss of power or more current consumption. The extra buildup of heat is dangerous. It can melt the coating on the wire, melt carpet, and in extremely rare cases it may catch on fire. To sum it up, there is no substitute for oxygen free copper wire for automotive electronics.

In either case, you should also be aware that having smaller strands within the wire will carry more current and be much easier to bend and install in the car audio environment.

**Example:**

CHARACTERISTICS	COPPER	ALUMINUM
Tensile strength (lb/in <sup>2</sup> )	50,000	32,000
Tensile strength for same conductivity (lb)	50,000	50,000
Weight for same conductivity (lb)	100	54
Cross section for same conductivity	100	156
Specific resistance (ohms-cir/mil ft)(20°C ref)	10.6	18.52
Coefficient of expansion (per deg. C x 10 <sup>-6</sup> )	16.6	23