Selecting the Proper Size Power Wire

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In order to ensure that your amplifier is operating properly and to its full output potential, the power and ground cables need to be large enough to handle the demand for current. This means choosing the correct wire gauge, or "thickness," for your system. The more demanding the audio system, the larger gauge wire you will need to use. Using a proper gauge power wire will not just ensure proper current flow, but it will also improve the reliability of the product. This will also ensure the safety of your audio system, as smaller gauge wire under high current loads can potentially get extremely hot.

The common sizes of power wire fall under AWG (American Wire Gauge) sizes. The smallest wire thickness has a higher gauge number and vice versa. The most popular wire gauges are 10AWG, 8AWG, 4AWG, 2AWG and 1/0AWG (Zero Gauge). Choosing the correct wire gauge size for your application will depend on the overall current draw of your amplifier(s), as well as the length of wire needed.

Estimating Current Draw:

Calculating the exact current draw of an amplifier is not only difficult but also inconsistent due to multiple variables within the vehicle, such as the music being played, the volume being used and resistance in the wire. The JL Audio Technical Support team has created an equation that will provide you with a good estimate as to what your current draw will be:

((Power X Percentage) X Factor) / Voltage = Expected Average Current Draw

This equation only looks complex, but it is actually very simple when you break it down. Since the results of this equation will provide you with an estimate, we will rely on the following assumptions:

Percentage:

- An Average Listener will typically utilize only **20%** of the amplifier.
- An Aggressive Listener will typically utilize **50%** of the amplifier.
- An Audiophile will typically utilize **10%** of the amplifier.

Factor Type:

The factor for the equation used is based on the efficiency of Class A/B and Class D amplifiers in subwoofer and main speaker applications.

- Class A/B on Main Speakers - Factor of **2.0**
- Class A/B on Subwoofers - Factor of **3.0**
- Class D on Main Speakers - Factor of **1.5**
- Class D on Subwoofers - Factor of **2.0**

Voltage:

Since the vehicle won't put out the 14.4v that most amplifiers use for their ratings, we will use 12.5v to mimic real world conditions in the vehicle.

For example, lets say an "Average Listening" user will be using an RD500/1 for their system. Here is what our equation would look like:

((500 x .2) x 2) / 12.5 = 16 amps of estimated current draw

Step One: 500 Watts (12.5 Volts at 2Ω) times 20%

500 * 0.2 = 100

Step Two: Factor for amp type – Class D on subs is 2.0

100 * 2 = 200

Step Three: Account for charge voltage (12.5 Volts)

200 / 12.5 = 16 amps of expected average current draw

Let’s look at another example using the same RD500/1 amplifier in a more aggressive listening situation…

((500 x .5) x 2) / 15= 40 amps of estimated current

Step One: 500 Watts (12.5 Volts at 2Ω) times 50%

500 * 0.5 = 250

Step Two: Factor for amp type – Class D on subs is 2.0

250 * 2 = 500

Step Three: Account for charge voltage (12.5 Volts)

500 / 12.5 = 40 amps of expected average current draw

If you are using multiple amplifiers in your system, the above equation will need to be done for each amplifier. Then, each of the estimated current draws will be added together to reach an overall estimated current draw. This equation is a great starting point when determining what size power wire you will need to do the install.

Another quick way to determine a worst-case scenario for current draw is to inspect the fuse on the amplifier itself. This will provide you with a worst-case scenario for current draw. If using multiple amplifiers, add up the fuses to get a total maximum possible current draw.

Length of Wire:

Another factor to look at is the length of the wire being used.

- Are you running from a battery under the hood to amplifiers in the trunk?
- Is the battery in the trunk with the amplifiers?
- Are you running a your ground wire directly to the battery?

The length of the wire will determine how much resistance is inline. A longer wire will have more resistance that limits the current flow. To allow the current to flow as needed through that resistance, a larger wire will be needed.

Think of two water nozzles turned to the identical flow, except one has a very tiny hose and the other is larger. The larger hose will allow stronger flow of water where the smaller hose is changing the pressure of the water flow. The same goes for current passing through a large and smaller wire.

The length of the ground wire has a big part of the system as well. In a high-current system, we highly recommend that you do not ground your amplifier directly to the chassis. Instead, run your ground wire directly to the battery’s negative terminal under the hood. This extra distance for the ground wire should be considered when calculating the distance of wire needed for the “round trip”. For more information on properly grounding your amplifier, read our article on Getting Grounded and Augmented Chassis Grounds.

Choosing your Wire

Now that we know the estimated current flow for the amplifiers and length in power and ground wire that is needed it’s time to pick out the correct gauge wire for your install. The chart below is a recommended guideline for choosing the proper wire.

	0-3 ft.	**3-6 ft.**	**6-10 ft.**	**10-13 ft.**	**13-16 ft.**	**16-20 ft.**	**20-25 ft.**
0-20A	10-ga.	10-ga.	10-ga.	10-ga.	10-ga.	10-ga.	10-ga.

20-40A	10-ga.	10-ga.	8-ga.	8-ga.	8-ga.	8-ga.	8-ga.
40-60A	10-ga.	8-ga.	8-ga.	8-ga.	4-ga.	4-ga.	4-ga.
60-80A	10-ga.	8-ga.	8-ga.	4-ga.	4-ga.	4-ga.	4-ga.
80-100A	8-ga.	8-ga.	4-ga.	4-ga.	4-ga.	4-ga.	4-ga.
100-125A	8-ga.	8-ga.	4-ga.	4-ga.	4-ga.	4-ga.	2-ga.
125-150A	8-ga.	4-ga.	4-ga.	4-ga.	2-ga.	2-ga.	2-ga.
150-200A	4-ga.	4-ga.	4-ga.	2-ga.	2-ga	1/0-ga.	1/0-ga.
200-250A	4-ga.	4-ga.	2-ga	2-ga.	1/0-ga.	1/0-ga.	1/0-ga.
250-300A	4-ga.	2-ga.	1/0-ga	1/0-ga	1/0-ga.	1/0-ga.	2/0-ga.

Now that the proper gauge power and ground wire have been chosen, it's always a good idea to inspect the wire before installation. One thing you will want to look for is the thickness of the actual copper wire itself. Oftentimes, inexpensive wiring will claim to be a 4AWG wire, for example, but when you cut the wire, you will see that it has a very thick protective jacket and the wire really contains a 6 gauge run of copper wiring inside.

The thick protective jacket is misleading, since on the outside, the less expensive wire looks the same as a true 4AWG wire. However, the lack of copper inside will severely inhibit your amplifier's overall performance.

It's also a good idea to stay clear of CCA (Copper Clad Aluminum) wire because it is far less conductive than true copper and can cause significant voltage drops.

When in doubt about what power wire to choose, it's always a good idea to go a step larger. Choosing a larger cable will never hurt your system; it will only cost little bit more money. However, this is an investment in your equipment that is well worth making. If you decide to go with a smaller sized cable, this will allow less current to flow, leading to voltage drops that will limit the amplifier's output potential, as well as posing serious safety issues.