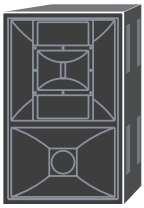
CHOOSING THE RIGHT SPEAKER CABLES



Speaker cables hook audio amplifiers to speaker cabinets.

Benchmark

The ideal speaker cable has zero-length wire, with no resistance, no capacitance, no inductance, and no change in sound from amplifier to speaker.

The ideal speaker cable does not exist. In its place are literally dozens of hi-fi speaker cable companies touting that their tech-babble-supported cable is a lot better than those other pseudo-voodoo-audio guys. Most of these companies know nothing about live sound and stay out of our hair. A couple of them have wandered into our market, clouding the main issues with lots of technical nonsense.

Speaker cable selection depends on the output connectors on your power amplifier and the input connectors on your speaker cabinet, which have been pre-determined by their manufacturers.

Regardless of which connectors you need on either end, cable manufacturers make cables with all the combinations you will need. Your responsibility is to buy the absolute shortest speaker cables you can use with the absolute largest conductors you can afford.

The speaker cable situation:

Because live performance has acoustics (often rotten) to deal with — acoustics that you do not have in your home hi-fi or home theatre, there are lots of problems to deal with besides exotic cables. We believe that current needs copper and lots of it. More about this later.

At Pro Co we believe in two basic rules for speaker cables:

- Less is best. Buy the shortest cable possible for the application.
- More is best. Buy the largest gauge speaker cables you can afford (the smaller the gauge number, the bigger the wire. Go figure.)

The three basic types of connectors used for speakers in live performance are: 1/4" connectors (the same ones used in your guitar's output), dual banana plugs (designed 50 years ago to connect test leads to diagnostic equipment, many of which are too small or cheaply made in the orient and will not hold together), and Neutrik Speakons, wonderful connec-tors designed specifically for speaker applications. There are other methods of connecting amplifiers to speakers (spade lugs, bare wire) but these three connectors, 1/4" phone plugs, dual banana plugs and Speakons are the three standards. We suggest you use only G & H Industries Show Savers 1/4" plugs and their Boss dual banana plugs with all speaker cables needing these connectors.

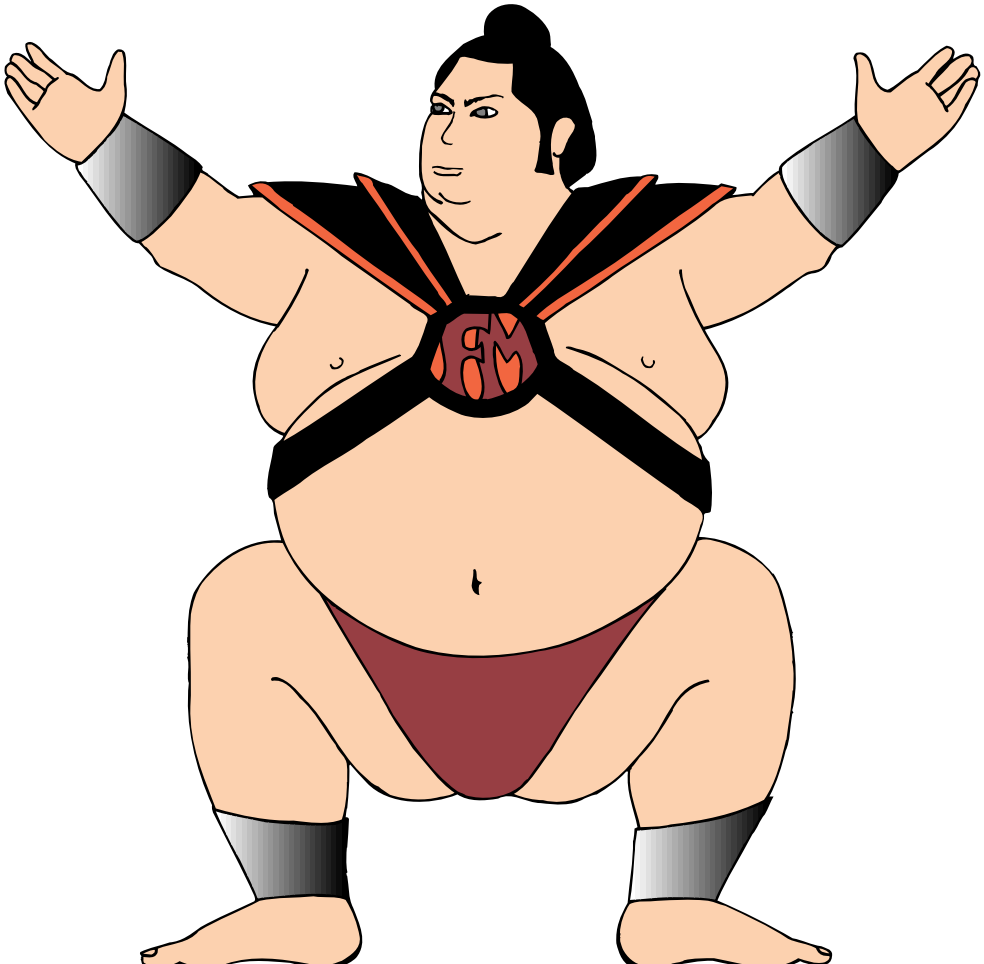
The ideal speaker cable has zero-length wire, with no resistance, no capacitance, no inductance, and no change in sound from amplifier to speaker.

Speaker level is not the place to buy cheap cables. If a speaker cable shorts out, the amplifier's protection circuit will turn on (hopefully) during performance to protect the amplifier from damage. Also, (hopefully) the amp's protection circuit will turn off after the cable is replaced so the show can go on.

Having intermittent signal at speaker level because of faulty cables is a very bad thing to have happen to your audience.

Besides being reliable, speaker cables need to be flexible. Flexibility comes from using more (smaller) stranding in the conductors of the wire. The smaller copper stranding has to be drawn through smaller and plugs and new banana plugs and we

One of my problems is teaching technicians that "Current Needs Copper."



smaller dies, taking longer to manufacturer than larger strands thus they cost more. Flexibility also is enhanced by using fillers in the cable to make the wire round and easy to coil and uncoil. Using larger strands of copper and no filler is cheaper, but creates handling problems that just aren't worth the few extra bucks difference.

The real world problems with speaker cables

Getting back to **current needs copper**, there are two basic specifications to discuss regarding speaker cables:

- Loss of power in the wire as heat (because of resistance).

  This loss of SPL (sound pressure level) caused by different gauges of speaker cables is basically unnoticeable in live performance, yet loss of power is talked about all the time because it is an easy concept to discuss.
- What is more important to discuss is damping factor, a complex concept which matters more to your sound and is not easy to discuss.

Mackie Designs, says, "Damping factor is a number that represents the ratio of the impedance of the load (speaker) to the output impedance of the amplifier. In practical terms, it is a measure of how well the amplifier can control the movement of a speaker's cone. The greater the damping factor, the better its ability to control the cone's movement. A low damping factor (under 20) allows a woofer to continue to move after the signal stops, resulting in an indistinct and mushy low frequency response.

Once the damping factor increases beyond 200, the audible effects of the damping become vanishingly small.

Community Professional Loudspeakers' Chuck McGregor continues the explanation:

"The main effect of damping in a loudspeaker is to reduce the SPL produced by the loudspeaker's diaphragm moving because of its own inertia after the signal stops. The frequency of the sound it produces with this movement will be at the resonant frequency of the moving system. A common term for this is "overhang". In severe cases this can translate into "one note bass". Your bass guitar no longer sounds like you bass guitar; it sounds like the free air resonance of your speaker cabinet. Yuck.

Your responsibility is to buy the absolute shortest speaker cables you can use with the absolute largest conductors you can afford.

The Solution

To repeat this for the third time, "Current Needs Copper". We make cables using wires with these gauges: 16 ga., 14 ga., 13 ga., 12 ga., 11 ga., 10 ga. and 8 ga.

Pro Co makes 8 gauge cable for all industry standard connectors normally used. However, G & H Industires had to design new 1/4"

Let's get technical about speaker cables:

Flexibility in speaker cables comes from using high strand count conductors. Pro Co uses the highest standard strand count available in all its speaker cables to enhance flexibility. Underneath the outer jacket, the two (or four) conductors are twisted about each other. The length of each twist helps to determine the flexibility of the assembly.

In an emergency, if the connectors are compatible, a guitar cable can be substituted for a speaker cable for a short period of time. It's tiny center conductor will cause great resistance compared to its larger shield gauge, and will cause power loss and poor damping factor. It may cause damage to your power amp as well.

Conversely, if a guitar cable goes bad, never, never, never use a speaker cable to replace it. The hum (the speaker cable has no shield) will be so bad that you will not be able to stand it. This will give you a real good indication of why we need good shields in microphone, instrument and digital cables.

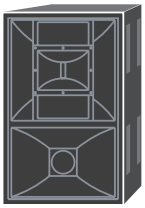
Pro Co is heading, as quickly as possible, away from soldering as a termination technique. Solder is not a particularly good conductor and the ability to make good quality solder joints is an art that takes many years to perfect (as least we spend that much time with our assemblers working on improvement).

Two relatively new termination techniques have gained interest in audio cables. The first is currently used in microphone cables and is called IDC (insulation displacement connector), and we have had excellent results in the past five years with our Excellines mic cables using this construction.

The other is ultrasonic welding, a cold weld process where the plug terminal and the wire are scrubbed and compressed at the same time, literally bonding the brass terminals to the copper wires (brass is 70% copper) in under a second. All 8 gauge Pro Co cables are ultrasonically welded to their terminals.

Both techniques create solid connections (IDC connectors require a sturdy strain relief), take very little time for human beings to master, and sound better than their soldered counterparts.

CHOOSING THE RIGHT SPEAKER CABLES



had to create methods to allow us to fit the 8 gauge Fat Max wire into Neutrik Speakons. Also, because we know that getting as much DC (direct current) resistance out of our speaker cables is best for you, we do not solder the 8 gauge cables. We ultrasonically weld our 8 gauge cable to its especially-designed terminals. This reduces DC resistance in the cables to an immeasurable number, and creates a cable worthy of a place on any stage on earth.

So, what kind of speaker cable do I need?

		Pro Co Brand	50' Model #	MSRP
	**Advanced**	Fat Max	FM-50	$185.00 8 gauge
		PowerPlus	S12-50	$75.95 12 gauge
	**Intermediate**	Excellines	S14-50	$50.78 14 gauge
	**Beginner**	Excellines	S16-50	$37.73 16 gauge

These prices are for 1/4" to 1/4" cables only. Dual bananas cost about the same as the quarter inch products. Neutrik Speakons are a few dollars more.

Here are the statistics, if you are interested

Pounds of copper in 25' of speaker cable (both conductors):

Gauge	Pounds of Copper
16 gauge	0.39 lbs.
14 gauge	0.62 lbs.
12 gauge	0.99 lbs
10 gauge	1.53 lbs
8 gauge	2.50 lbs

Length of cable that can be made with one pound of Copper:

Gauge	Length of Cable
16 gauge	64.0'
14 gauge	40.2'
12 gauge	25.3'
10 gauge	15.9'
8 gauge	10.0'

	Damping Factor at 8 ohms				Damping Factor at 4 ohms			
Gauge	**10'**	**25'**	**50'**	**100'**	**10'**	**25'**	**50'**	**100'**
16 gauge	90	38	21	10	45	19	10	5
14 gauge	138	60	31	16	69	30	16	8
12 gauge	201	91	48	25	101	46	24	12
8 gauge			113	64			56	30

Damping factor must be 20 or above to optimize live performance. Damping factor over 200 will add no appreciable performance to the system. Note: the damping factors noted above in red are acceptable for use at the stated length and impedance (in ohms), but they are in no way optimized for reduction in power loss.

Damping factor at the outputs of the amplifier must be added to the damping factor of the cables to arrive at the system damping factor (alas, there are also more factors to consider that just these to determine an optimum system, but this represents the lion's share need to make a decision).

Gauge acceptability for run lengths are noted above in red. Pro Co's recommendations are to use 16 gauge under 25 feet, 12 gauge under 100 feet, and if you can afford it, use 8 gauge everywhere.