FLAT COPPER BRAID

Braid's greatest advantage is its flexibility.

Braid is the conductor of choice where flexibility is required. It is sometimes used for electrically bonding parts of a vehicle, for example an exhaust pipe, door, or hood. At tower sites, braid is good for bonding swinging gates or doors to a ground system - flexibility is a must in such an application. Braid also has some degree of popularity for bonding amateur radio equipment to a common ground buss because of its flexibility.

Some people question the effectiveness of braid at radio frequencies. The argument is that each strand of the braid weaves in and out, back and forth across the braid. Currents must either follow that inductive weaving path, or "jump" from strand to strand where strands touch. There are of course many individual strands in parallel, so overall inductance should be low. And another question to consider is, with so many points of contact between strands within a length of braid, could there be a potential for noise in a critical RF environment?

In braid's defense, one should keep in mind that coaxial cables for RF applications have traditionally been made with a braided outer conductor (for its flexibility), and it has worked well. On the other hand, it is interesting to note that high performance, low-loss coaxial cables use a solid outer conductor rather than a braided outer conductor.

You may notice we stock only tinned braid at Georgia Copper. That's because we feel that oxidation between various strands of bare (untinned) copper braid could seriously degrade its performance.

FLAT COPPER STRAP

Strap's greatest advantage is its surface area.

Copper strap (or strip) is the conductor of choice for low impedance RF ground connections. Due to the skin effect, RF currents tend to flow along the outside "skin" of a conductor. Copper strap has a large, smooth surface area to take full advantage of this effect. For decades, copper strap has been widely used in the RF ground systems of broadcast sites.

Lightning - Assuming lightning current is strictly DC, any copper conductor of similar cross-sectional area should conduct lightning current equally well. However, research has shown that lightning is a series of DC pulses with a fast rise time. Conductors with lowest inductive reactance and largest surface area, such as copper strap, should be strongly considered when choosing conductors to handle the fast pulses of lightning current.

There's one great benefit of copper strap that is seldom mentioned. In a typical ground system, multiple ground rods are driven and interconnected with bare copper wire or copper strap buried just below the surface of the soil. If copper strap is used for this purpose, the large surface area of copper strap in contact with the soil can enhance any system of ground rods and help lower overall ground resistance. For example, an 8-foot length of 2-inch copper strap would have just as much surface area in contact with the soil as an 8-foot, 5/8" ground rod! And that's only considering one side of the strap!

Copper strap's greatest disadvantage is that it is slightly more difficult to install and connect than wire - for example, to go through a wall, one simply has to drill a hole for wire and push it through. Strap requires a little more effort.

COPPER WIRE

Wire's greatest advantage is that it is readily available and easy to use.

Wire is the conductor with which we are all most familiar. Of the three types of conductors described on this page, wire is the easiest to install and the easiest to connect. Wire is readily available. Bare copper wire that is solid (as opposed to stranded) in the sizes of 4 awg and 6 awg is commonly used as safety grounds for home electrical panels. These sizes of wire are also convenient for basic grounding of amateur radio equipment and for very basic lightning protection grounds. Larger sizes, such as 2 awg and up, are often used for lightning grounding and bonding. Larger wires are typically stranded instead of solid because a large wire that is solid is difficult to bend.

Smaller wire (typically 10awg) is commonly used for radials around vertical antennas. An am broadcast tower usually has 120 radials made of 10awg bare copper wire, each at least 1/4 wavelength long, buried around the base of the tower in a pattern like the spokes of a wheel.

Wire's main disadvantage is that it is round! It has less surface area than strap or braid, and therefore is less efficient at handling RF currents where a low impedance ground path is needed, such as from a common ground buss or antenna tuner to a ground system. For example, a 4awg wire and a 1.5" x .022" strap have the same cross-sectional area (equivalent circular mils), and they're made from the same amount of copper, but the 1.5" strap has 4.7 times the surface area of the wire!