Uniprise® Solutions

Tech Tips

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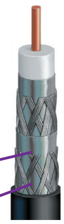
Raising the Shield

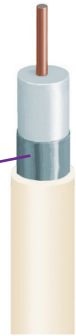
On the ancient battlefield, a soldier's shield was a vital piece of equipment that enabled him to continue advancing toward his goal by deflecting the attacks of his enemy. The same holds true with coaxial cable shielding. Shielding protects the signal's integrity as it is transmitted, by ensuring that it **stays inside** the cable and that all **other signals stay out**. It also serves as a secondary conductor or ground wire.

Shielding may be **foil or braid**, and is most often a combination of the two. Foil is almost exclusively made of aluminum, and the braided metals are aluminum (AL), bare copper (BC), silver-copper (SC) or tin-copper (TC). Braid shield coverage is designated as a percentage followed by a two-letter code representing the material of the braid (e.g., "96% TC" designates 96 percent coverage of a tin-copper braid).



Pass Interference

Shielding protects a cable against electromagnetic interference (EMI). Common sources of EMI include motors, other cables, microwave ovens, fans and other high-voltage appliances. Because many applications require different levels of protection against EMI, cable manufacturers design and produce coaxial cables with multiple levels of shielding: **standard**, consisting of foil-and-braid; **tri-shield**, consisting of foil-braid-foil; and **quad-shield**, consisting of foil-braid-foil-braid. Higher levels of EMI, such as those found in manufacturing plants, hospitals and around electrical equipment, require greater shielding effectiveness.



Foiled Again

A foil shield, also called "tape," is an aluminum sheath on one side and a plastic polymer on the other, wrapped around the dielectric (the plastic polymer adds a degree of elasticity to the shielding). This is the last line of defense against incoming – and unwanted – interference.

Foil shields are mainly used in cables that carry frequencies above 5 MHz, since these higher-frequency signals are sharp and short and can sneak through the gaps in a braid shield. Applications using foil shields – combined with a braid – include broadband/CATV (55 to 700 MHz), satellite broadband (700 to 1,800 MHz) and broadcast.

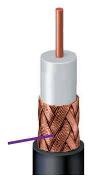
Incidentally, trunk cables, which are normally long runs, employs a thicker aluminum tube without a braid since the cable does not require a great degree of flexibility.

Weaving the Braid

Braided shields are often used alone – with no foil – in low-frequency applications such as CCTV (security), where signals are below 5 MHz. Otherwise, the majority of coaxial applications (except trunk cable, as specified above), require a combination of foil and braid shielding.

Braided shields are constructed in various **coverage percentages**, from 40% to 98%. Standard shields are a combination of a foil and braid. The braid percentage increases with the need for interference protection, until a tri-shield or quad-shield is required.

The braid also is the means of terminating the shield. The foil is necessary to get a 100% shielding but is 'fragile' and difficult to terminate. The braid, in addition to increasing the shielding effectiveness of the cable, also serves to strengthen the foil and facilitate termination.



In addition to the importance of braid coverage, the material used in braid shielding is also an important consideration. **Aluminum** is specified for the majority of applications which require only the most basic grounding properties. **Bare copper** is used in security applications, when a good conductor is needed to provide power to security cameras (pan, tilt and zoom).

Tin copper and **silver copper** are needed when high-quality terminations are required, as in a broadcast studio. There, highly trained technicians do not use conventional connectors (which allow more than desirable signal leakage), but they terminate the cable using their own techniques and equipment. Because of their metallic composition, silver-copper and tin-copper braids enable technicians to terminate the cables more effectively, with minimal signal leakage.

Choose Your Weapon

The choices among coaxial cable shielding may seem complex. But a clear understanding of the battlefield (where the cable will be used) and the enemy (sources of interference) can ensure a shielding spec that's right on target. As you can see from the table below, the more shielding you put on the cable, the better shielding effectiveness you get. For an RG6 type cable, shielding effectiveness is improved by roughly 100% when you go from a standard 60% braid and tape to a trishield. Likewise, when you go from a trishield to a quad shield, shielding effectiveness is improved by roughly another 90%

Shield Effectiveness (-dB Isolation)		
Product	Unflexed	10K Flexed
59 Series Dropcable		
RG59 (40%)	65 - 75	55 - 65
RG59 (67%)	90 - 100	80 - 90
RG59 (95%)	95 - 105	85 - 95
RG59TS (60*%)	100 - 110	90 - 100
RG59TS (77%	105 - 115	90 - 100
RG59 Quad	105 - 115	100 - 110
6 Series Dropcable		
RG6 (40%)	65 - 75	55 - 65
RG6 (60%)	80 - 90	70 - 80
RG6 (90%)	85 - 95	75 - 85
RG6TS (60%)	105 - 115	85 - 95
RG6TS (77%)	105 - 115	85 - 95
RG6 Quad	110 - 120	95 - 105
11 Series Dropcable		
RG11 (60%)	80 - 90	45 - 55
RG11 (90%)	90 - 100	70 - 80
RG11 Quad	100 - 115	80 - 90

** Shielding numbers are average range of tests "not specs."*

** Data based on "limited" actual Shielding Tests using a triaxial setup for a bandwidth of 1 to 1000 MHz.*

Shielding Effectiveness: A triaxial test chamber was used to measure the transfer impedance of each cable type in question from a frequency band of 1 1000 MHz. This information was formulated into shielding effectiveness values which is measured in decibels. Drop cables are characterized under both flexed and unflexed conditions. Flexed cables are conditioned with a flex fatigue simulator. This apparatus induces damage into a cable's outer shield in the form of radial cracks on the outer foil under laboratory conditions. This measurement technique is not a direct correlation to open area testing but has provided comparable results to anacholic measurements. A range of average values for both conditions is provided to the customer from an extensive data base.

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