EMC Materials and Technologies

In interconnect cable assemblies, conductive wires and cables act as antennas to pick up and/or radiate noise. Cables can couple electrical or magnetic fields, or even radiated energy from another cable (known as "crosstalk"). The most basic of all material requirements is therefore to apply a conductive shielding around cable conductors to take electrical and magnetic field voltages to ground. Braided shielding provides the cable assembly with strength, durability and flexibility with just a slight sacrifice to effectiveness (compared to a solid conduit, conductive tape or other material). But at higher frequencies, braided shielding can lose effectiveness as the windows in the braid can become relatively large compared to the wavelength of the EMI. This is why other materials, such as metal-core conduit, conductive junction and equipment boxes, conductive gaskets, and so on also play important roles in EMC applications.

Many of the EMC materials and technologies supplied by Glenair are full-fledged product lines. Others are innovative techniques we can apply to a broad range of interconnect products. External and internal grounding springs are one such example. These gold-plated springs offer lower shell-to-shell resistance and are compatible with standard mating receptacles. Most of the connectors produced by Glenair can be equipped with grounding fingers for improved EMI shielding and grounding.

Most military grade interconnect devices and equipment housings are made of materials that accept conductive plating to provide some EMI protection outright and simultaneously facilitate grounding through the use of attached metallic or metallized textile studs and straps. While plated aluminum is the most common material for EMC applications, plated composite thermoplastic offers the ability to reduce weight and corrosion while still maintaining an effective ground path. The following section describes the many individual Glenair materials and technologies used for effective EMC.

Conductive Braided Shielding

Low frequency waves in the 1 to 30 kHz range can be absorbed into permeable conductive materials, such as shielding placed around individual conductors within a cable assembly or wire harness. This shielding material either captures the EMI taking it to ground or dissipates it as heat. Metallic braids and high-tech plated fabrics also shield cable conductors from line-of-sight penetration or escape, again by taking EMI to ground.

A wide range of cable shield termination technologies are available—the effectiveness of each style, and the complete shielding solution, can be measured using a transfer impedance test to evaluate the cable shield performance against electrostatic discharge and radiated emissions at various frequencies up to the gigahertz range. Shielding effectiveness can be calculated for a range of frequencies by taking the ratio of transfer impedance for an unprotected device or system compared to transfer impedance of a protected device or system, with the result expressed in decibels. Glenair cable shielding is manufactured in a wide range of designs and configurations. Materials include tin-plated copper, nickel-plated copper and tin-plated iron/copper. AmberStrand® is metallized composite thermoplastic material that matches metal shield performance at a fraction of the weight. Each material has specific performance advantages ranging from strength, to conductivity and corrosion protection.

Braided shields provide exceptional structural integrity while maintaining good flexibility and flex life. They also minimize low-frequency interference at audio and RF ranges. The material's ability to contrib-

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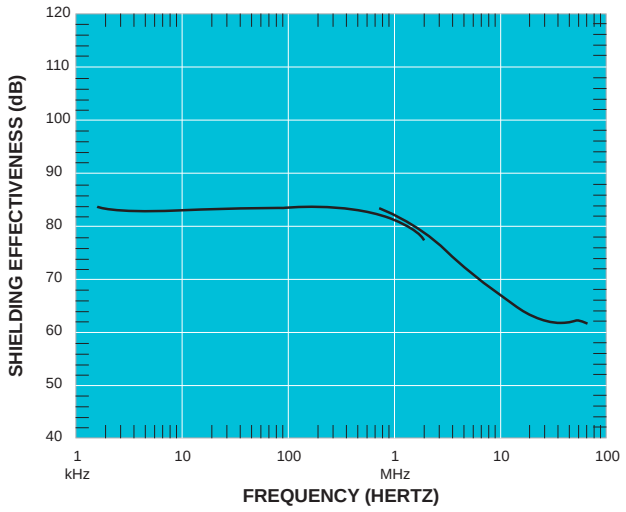
ute to EMI reduction depends on the signal amplitude and frequency in relation to braid mesh count, wire diameter and material. Generally, the tighter the mesh and the higher the percentage of braid coverage, the more effective the shield is against high-frequency emissions. An alternative is to use more than one braid shield.

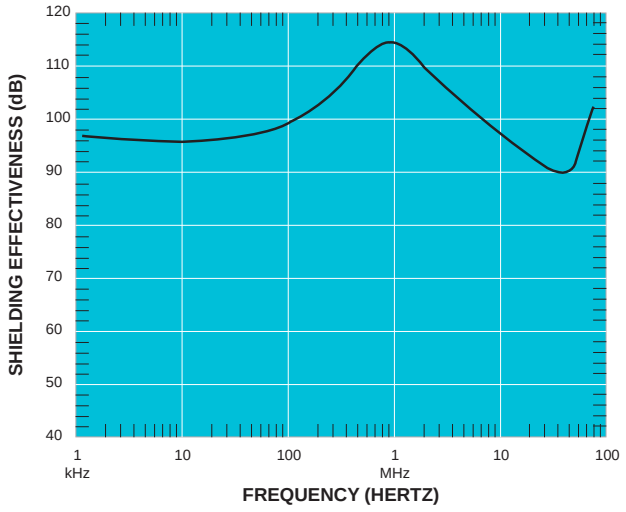
Metal Braid is offered in Tubular or Flat configurations in a variety of sizes from 1/32 inch (0.8 mm) to 2-1/2 inches (63.5 mm), and can easily be slipped over convoluted tubing and conduit as well as wire bundles, cables or similar constructions. Glenair's in-house braiding production capacity is truly impressive: More than 50 braiders, ranging from 16 to 96 carriers, provide the capability to produce large quantities of precise metal and non-metallic braid and expandable sleeving in tubular, tapered, and flat configurations.

An alternative to braided shielding, foil shields are made from aluminum laminated to a polyester or polypropylene film. Foil shields provide 100 percent cable coverage, improving protection against radiated emission and ingress at audio and radio frequencies. Because of their small size, foil shields are commonly used to shield individual pairs in multiconductor cable to reduce crosstalk. Foil shields may also be bonded to a coaxial cable insulation or cable jacket with a layer of adhesive, allowing for faster, easier and more reliable termination.

Shield Effectiveness Series 74 Tubing
with External Tin/Copper Braid – 1 Inch Diameter



Shield Effectiveness Series 74 Tubing
with Two External Tin/Copper Braid – 1 Inch Diameter



Glenair Braid Solutions

- **Complete range of QQ-B-575B/A-A and ASTM B conductive braided shielding solutions**
- **Tubular, tapered tubular, and overbraided application options**
- **Every size from 1/32" to 3¾"**
- **High performance tubular fabric braided sleeving for every mechanical and wire-protection application requirement**

Dimensions in inches (millimeters) and are subject to change without notice.

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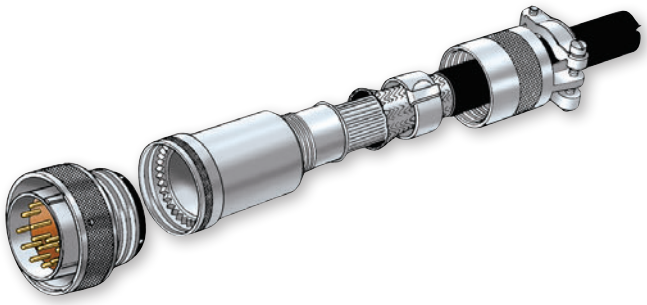
Swing-Arm Shield Sock Backshells

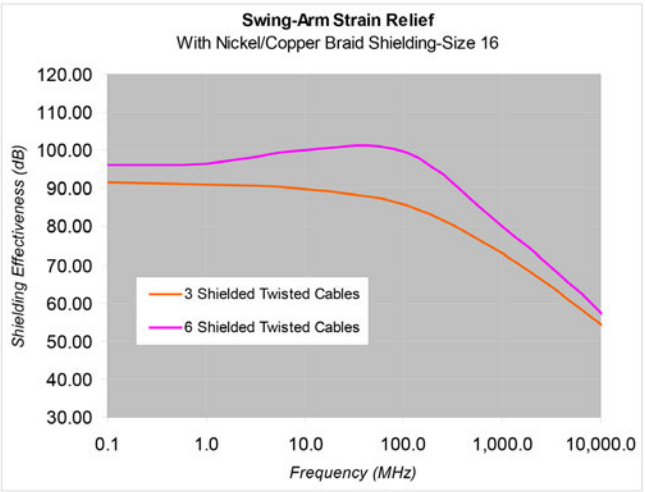
The selection of an appropriate shield termination backshell depends on many factors, including ease of assembly, cost, repairability, shield type and construction, cable diameter and type, cable jacket thickness, weight and corrosion resistance. Often the choice boils down simply to customer preference, although certainly cable construction, i.e., type of shielding and other mechanical factors is the most significant technical consideration.

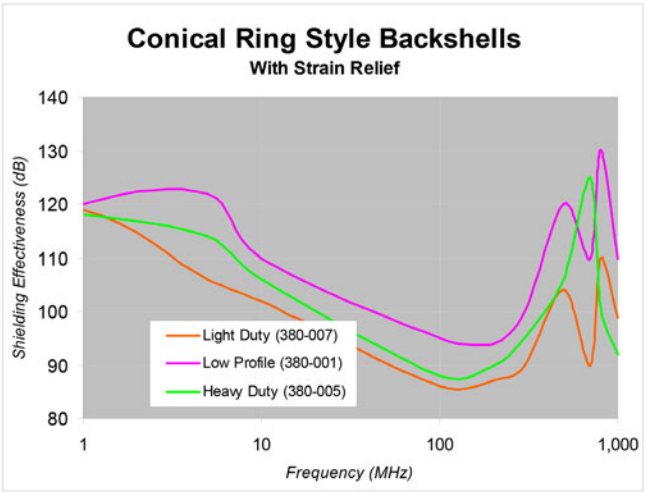
As there is no single shield termination technology or methodology that will meet every customer requirement, Glenair supports every popular shield termination method with the full range of sizes and materials. Currently Glenair is able to produce an innovative backshell product, called the Swing-Arm that resolves a significant number of design problems—including EMC. The composite thermoplastic Swing-Arm features an integrated EMI shield sock and configurable cable clamp—available with nickel/copper, tinned copper, metal-clad stainless steel or metallized composite thermoplastic shielding. The articulating arm can be configured to straight, 45° or 90° positions, reducing stock keeping requirements. The Swing-Arm also offers extremely fast, simple and trouble-free shield terminations.

Conical Ring Style Backshells

Glenair Series 38 and 39 EMI/RFI conical ring backshells provide reliable individual and overall shield termination by securing the shield under pressure between a conically shaped backshell and ground ring. Supplied in both environmental and non-environmental versions, this venerable backshell design accomodates both individual as well as overall shields and delivers low DC resistance across the termination area.







Appendix

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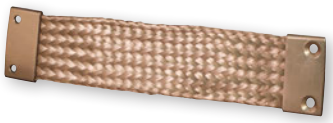
Glenair Band-Master™ ATS

The unique low profile and smooth inside diameter of the Band-Master™ ATS steel clamping band virtually eliminates EMI leakage paths, providing reliable and repairable shield terminations. Cylindrical banding backshells are available for all Military Standard type connectors.

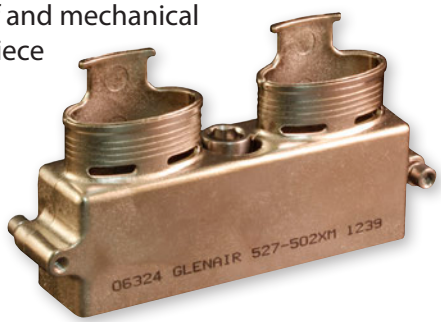
EMI/RFI Braided Grounding Straps



The opportunity to reduce weight and improve the flexibility and performance of grounding jumpers and straps has led many engineers to choose braided material configurations. Braided ground straps are typically supplied with either nickel-clad copper braid, or nickel-clad microfilament stainless steel braid (ArmorLite ™). Ground lugs are fabricated from copper nickel plate per MIL-C-26074. The assemblies withstand flexure of 25,000 cycles and are current rated to a minimum of 50 amps.

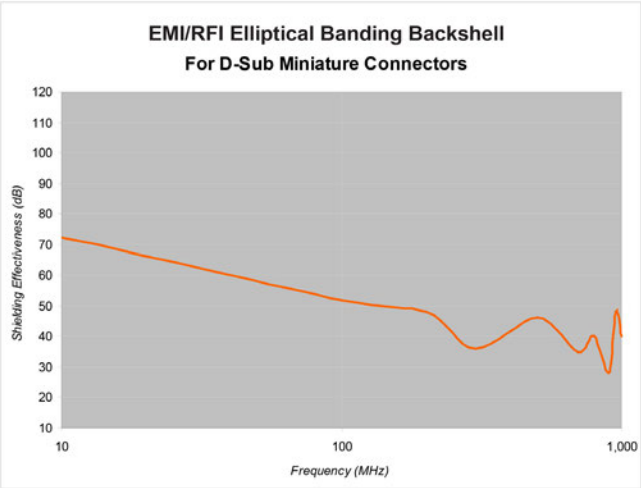
EMI/RFI Elliptical Banding Backshells

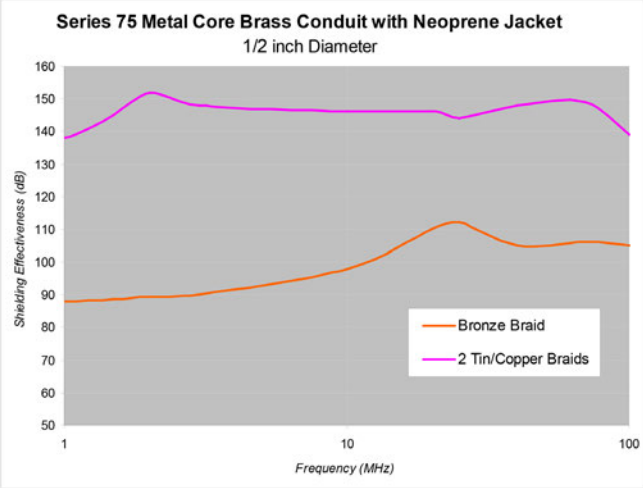
EMI Backshells provide shield termination as well as strain relief and mechanical protection. One-piece or split elliptical shells are chosen for rectangular connectors when the wire bundle diameter is too big to fit in a circular cable entry.



Metal-Core Conduit

Glenair helically-wound metal conduit, overbraided with bronze, stainless steel or tinned copper shielding provides high levels of EMI protection across all radiation fields and frequencies. Metal-Core Conduit is the material of choice for TEMPEST secure communications and other applications involving sensitive electronic equipment and intense levels of EMI.





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