EXPANDED METAL FOILS IN SHIELDING APPLICATIONS

Choosing a shielding material requires serious mechanical considerations as well as attention to electrical properties. Today's engineer has a wide variety of shielding products from which to select. The shielding material must perform its shielding function, but most importantly, must allow the finished product to serve its intended use, and survive life in the field for many years. Expanded metal foil offers engineers a unique mesh material that is thin and very flexible. Its unit structure contributes to its integrity and makes it easily formed. Expanded metal foil can be produced with very high or low coverage, in long coils, from very narrow to wide widths or die cut into shapes. A well designed configuration can be produced inexpensively from a variety of metals.

This article will present an overview of some applications where expanded metal foil is presently used, and explain mechanical characteristics that could help solve difficult or unusual shielding problems.

Precision Expanded Metal Foil

Expanded metal foil is one of several mesh (or open area) materials used in eliminating interference. It is made from solid foil gauge metals to precision tolerances. The process involves a shaped tool lancing and stretching a ductile metal in one motion. The resulting holes are diamond-shaped with a large variety of hole sizes. Dimensions range from a $^{1}/_{32}$" in the long way of the diamond (LWD) to approximately ½" LWD. In shielding applications an LWD of ⅛" or less is most common, although different shape holes can also be created. Material options include selvage edge, solid sections and annealing.

Mechanical Considerations

One obvious advantage expanded metal foil offers over other mesh type materials is its unit structure. Because the openings are created from solid metal, there is complete electrical conductivity at all joints. In addition there will be no unravelling when the material is slit, or die cut into shapes. These factors assure more uniform grounding over the entire structure, improve handling in production and contribute to a reliable product.

In comparison to similar thickness solid foil, expanded metal foil offers more flexibility. In applications where a shield must easily or repeatedly flex, or be formed into a shape, a crack or separation can destroy shielding effectiveness. Expanded metal foil can be designed to withstand many flexes and forming, both in installation or in use. Expanded metal foil can also be valuable where many materials having different co-efficients of thermal expansion are combined, because it will stretch somewhat to flow and return with the other components. This characteristic has been particularly valuable in the manufacture of photovoltaic panels.

Where air flow is required through the shielding material, expanded metal can be very cost-effective. The precision nature of the process offers consistency of open area and hole size to achieve proper attenuation. The process is also cost-effective because expanded metal foil does not generate scrap, but actually stretches the metal.

Many shielding problems involve laminating or extruding. Here expanded metal foil is useful because the overall thickness can be carefully controlled, and the mesh is very flexible. Often some open area in the shield is required for insulating material flowthrough, or physical contact between layers, to improve laminating characteristics. The fine holes can accomplish this, while still providing adequate shielding.

In some shielding applications, a substrate is necessary to support polymers or other materials that cannot stand alone. Expanded mesh serves as an excellent material for this purpose. The expanding process creates a "pocket" that actually helps to hold this type of material in the mesh. This pocket can be eliminated by flattening, or enhanced by pulling, to create very great overall thickness in relationship to the thin foil. This characteristic is particularly valuable to the battery industry, where expanded mesh is used extensively. After the mesh has been "filled," secondary operations, such as calendaring, slitting, or blanking can be performed while retaining mesh integrity.

Expanded mesh also has the advantage of being pleasing to the eye, an important factor when the shielding material is exposed, such as in office equipment, or consumer products.

Obviously, where no open area can be tolerated for proper shielding effectiveness, an expanded metal foil is not suitable. Where open area is allowable, or perhaps desirable, the ability to create a large number of variations in the mesh structure makes expanded metal foil a material to include in an engineer's testing.

Product Applications

Expanded mesh provides excellent shielding properties in flat cable and solves the difficult problems of termination to ground easily and positively. Expanded copper is slit to width, in long coils. Flexibility is critical in this application, where any fracture of shielding material will cause failure in the field.

Several characteristics of expanded metal foil contribute to use in silicone elastomer gaskets. The mesh securely holds the elastomer, is easily die cut without unravelling, and contributes to a positive connection between parts.

Designers of cabinets and housings have found expanded metal also aids in UL compliance for venting. Because the mesh cannot unravel, there are no dangers of a loose wire from the screen dislodging and falling inside. The material is available in roll form or delivered to the cabinet fabricator cut to size.

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