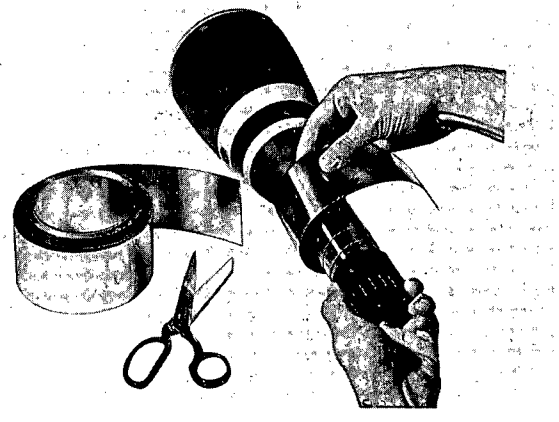
The Need For Magnetic Shielding

Without magnetic shielding much of today's sophisticated electronic gear would be larger, less efficient and in some magnetic environments, impossible to function at all. As components are made more sensitive and packaging more dense, susceptibility to electromagnetic interaction increases dramatically even in the best engineered layouts.

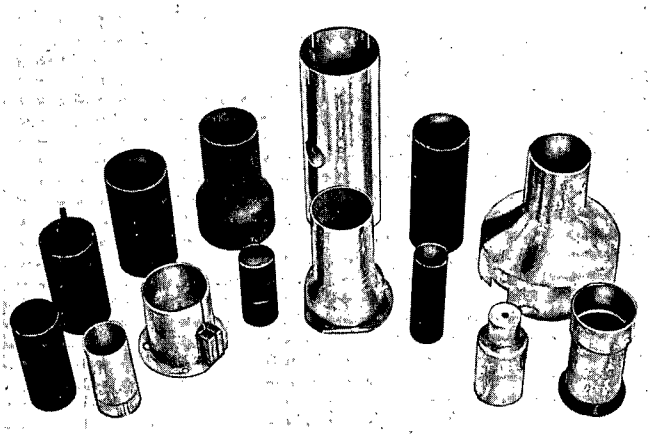
Magnetic interference with proper functioning can originate from various sources. These could include permanent magnets or electromagnets, coil components such as transformers, solenoids and reactors, AC or DC motors and generators, and cables carrying large DC or AC current at power frequencies. In many cases, even the normal earth's magnetic field can affect proper functioning.

To assure optimum performance, stray magnetic fields must be directed around critical electronic components as a rock in a river diverts running water. This is accomplished by a magnetic shield of high permeability (indicative of the ability of a material to carry a flux) which provides a low reluctance path guiding the magnetic flux around the critical area. Field intensities encountered will usually be under 10 oersteds, and field frequencies from DC to 800 Hertz although AD-MU alloys are effective at much higher frequencies.

Shielding is accomplished by placing a material with a permeability much greater than one between the field source and the sensitive components affected. Such material must be conductive to prevent passage of electric fields and highly permeable to prevent passage of magnetic fields. Shielding materials commonly used have permeabilities from 300 to over 500,000 depending on flux density. Magnetic shield effectiveness is directly proportional to shield thickness because the shield's reluctance to magnetic flux is inversely proportional to its thickness. It is essential to minimize joints or air gaps which can reduce shielding effectiveness not only by enabling magnetic interference to leak through but significantly affecting the path's reluctance, resulting in a lower effective permeability. The degree of shielding achieved by a given total thickness of material can be increased by dividing it into two or more concentric shields separated by at least the thickness of the material. In such case, a medium permeability material should be used for one layer and a high permeability material for the other layer. The lower permeability material should be located closest to the field source. Thus the medium permeability laminae acts as a buffer and sufficiently diverts the magnetic field to enable the lower reluctance (higher permeability) material to attain the required attenuation. When the external field is strong enough to cause the medium permeability material to approach saturation, an additional diverting shield of low permeability high flux carrying capability may be needed.

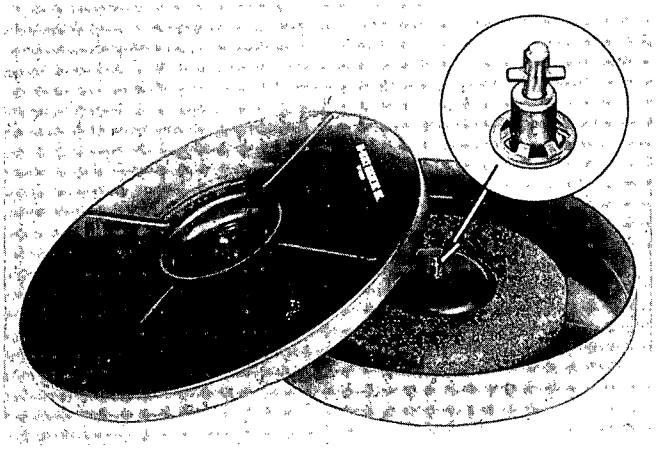


Time Saving, Convenient Foil is easily cut with ordinary scissors into magnetic shields, solving many shielding problems. After cutting, foil is quickly hand trimmed to the correct outline and fitted around the component to be shielded. Simple trial and error determines whether one, two, or more layers are needed to achieve the desired attenuation. Ideal for experimental applications or where relatively few shields are needed. Especially practical for hard-to-get-at places, and for making assemblies more compact by placing magnetically reacting components closer together without performance degradation.



High Permeability PM Magnetic Shields are fully hydrogen annealed, ready for use. Shields to fit several hundred types of photomultiplier tubes are available from stock. For a special application or specific environment, either a stock shield can be modified or a custom shield designed to the exact requirement.

From the simplest component to the most complex system a magnetic shield can be designed and fabricated to specification. A variety of shield configurations is illustrated.



Provides maximum magnetic and physical protection for a single tape reel 1" wide max. or 2 tapes each ½" wide. Extremely low cost. Ultra rugged construction due to its unique configuration. The loaded tape protector could be dropped 4 feet to a concrete surface without damage to the tape. Foolproof snaptwist fastener lock (inset) prevents opening when dropped.

We wish to thank Richard D. Vance, President, Ad-Vance Magnetics Inc. for his contribution to the above article.