

MAGNETIC SHIELDING: A RUDIMENTARY SYNOPSIS

FIRST THERE WAS MAGNETIC INTERFERENCE

In the beginning there was earth's field.

The pervasive earth's magnetic field can be a detrimental factor in achieving accurate results from some experiments, research, and testing. Equipment operation can also be adversely affected.

Structural steels and an abundance of other man-made ferromagnetic objects contribute to undesirable environmental magnetic conditions.

Modern building construction, with its lower ceilings and increased number of reinforced steel beams, has created magnetic problems. The lower ceilings bring steel beams closer to sensitive equipment, thereby presenting magnetic fields that affect performance. Laboratory researchers and production technicians frequently mull over the cause of interference, especially when they had no such problem with the same equipment or identical equipment at a previous location.

THEN CAME ELECTROMAGNETIC INTERFERENCE

Electromagnetic interference can originate from various sources. These sources include components such as motors, transformers, solenoids, coils, electromagnets, high-current cables, power generating equipment, and a variety of mobile or nearby radiating electronic and electrical gear.

A NEED FOR MAGNETIC SHIELDING

Magnetic shielding is a properly selected metal alloy placed around or adjacent to a circuit component to suppress radiated magnetic fields interfering with other nearby components, or vice versa. 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 conduct magnetic flux) which provides a low reluctance path guiding the magnetic flux around the critical area.

More and more, engineers are learning the necessity of using magnetic shielding to achieve the performance desired from components and systems. Denser packaging has incited much of the recent interest in magnetic shields. With components positioned ever closer together, and radiating components affecting adjacent components, increased electromagnetic interference frequently occurs.

To shield out a magnetic field, its source or sources must first be determined. Usually, this is not difficult, but sometimes the source seems to elude discovery. For example, interfering magnetic fields are several times

greater in modern, low-ceilinged concrete structures than in older, higher-ceilinged buildings of different construction. This can be immensely perplexing until the realization dawns that numerous reinforcing steel beams are incorporated into concrete construction, and that low ceilings bring the resulting steel beams' extraneous magnetic interference much closer to sensitive equipment than in higher-ceilinged rooms of different construction.

Electromagnetic components within the same housing must be investigated as a prime source of interference. Also, other equipment in close proximity must be considered as a possible source.

Multiple sources of interference are often present and must be evaluated.

Once the unwelcome field's source is discovered, consideration is given whether to shield the source or the affected components. When it is practical to do so, it is preferable to shield the affected component or components, rather than the offending source.

Other factors to consider in specifying the optimum shield are the strength of the field, the number of shielding layers required, whether to use a high or low permeability alloy or a combination thereof, the shape of the shield and the accessibility of the component to be shielded. It is vital that the shielding alloys selected do not saturate when properly used, do not suffer excessive permeability loss from shock, display minimum retentivity, and exhibit relatively stable permeability characteristics after final anneal, avoiding the expense and inconvenience of regularly repeated annealings.

For lighter fields, a single layer shield can suffice. Two or more layers must be used for stronger fields. The shielding material which best matches a particular application should be chosen after analyzing the field. Among the major factors considered are permeability, saturation, shock sensitivity, and proper annealing after fabrication.

After the magnetic requirements have been established there remains the annealing, the mechanicals, and the aesthetics.

Shield shapes may range from simple to quite complex. In complex applications, shields are tailored to fit exactly and can consist of many unusual configurations.

Cylindrical, conical, and box-shaped configurations constitute the most common shielding enclosures. The cylindrical design is best for scan converter and photomultiplier tubes, degaussed rock transports, isolation chambers, storage tubes, motors, meters, and tiny vacuum tubes. Cathode ray tube shields usually are conical. The box-shaped shields are suited for video recorder head assemblies, magnetic tape containers, transformers, aircraft weather radar, power supplies, and reactors.

The most effective magnetic shielding enclosures are designed and fabricated to meet specific requirements.

Magnetic field interference usually is discovered when the completed assembly is tested. Shielding becomes imperative but not enough space has been allowed by the designer. Jamming some shielding into the inadequate area helps but doesn't produce the full performance desired.

In accordance with the time-tested "ounce of prevention," the shield should be incorporated at the equipment manufacturing stage whenever possible. CRTs are a good example. Retrofitting the optimum shield is often expensive and sometimes impossible if the designer hasn't allowed sufficient space. If the shield is designed into the assembly at the very beginning, optimum shielding is easily attained.

AN OUNCE OF DESIGN IS WORTH A POUND OF RETROFIT

Magnetic shielding techniques are most valuable and more economical in the design and prototype stages.

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 denser, susceptibility to electromagnetic interaction increases dramatically even in the best engineered layouts.

As a final consideration, assistance with shielding problems is available from experienced reputable manufacturers of magnetic shielding.

This article was prepared by Lester Dant, Vice President, Ad-Vance Magnetics, Inc., Rochester IN, and is published with permission.

YOUR MAGNETIC SHIELDING PROBLEMS END HERE!



Request AD-VANCE Magnetics' new 84-Page Procurement Catalog Engineering Manual; offers magnetic shielding users the major technical guideline data needed to design or choose the optimum magnetic shielding solution for a given application.

CUSTOM FABRICATED SHIELDS FOR COMPONENTS AND SYSTEMS

Any Specified Configuration or Shielding Requirement

From the simplest component to the most complex system, Ad-Vance Magnetics can design and fabricate an AD-MU shield incorporating your magnetic shielding performance requirements.

These include magnetic isolation chambers, shields for low field research, magnetic shielding components required in systems (such as CRT's), transformers, motors, tachometers, reed relays and computers, dewars for cryogenic research, various test chambers, video cameras, scan converter tubes, photomultiplier tubes, storage tubes, aircraft weather radar display tubes, etc.

Lasting shielding protection is provided because AD-MU alloys do not saturate when properly used, will not suffer excessive permeability loss from shock, and display minimum retentivity. Accordingly, there is no need for repeated time consuming costly re-annealings.

AD-MU CUSTOM FABRICATED SHIELDS FOR CATHODE RAY TUBES



Enhance CRT performance by eliminating effects of external magnetic fields on the electron beam.

Ad-Vance already owns tooling for many types of magnetic shields used during the past quarter century, making tooling savings possible. Or, our Engineering Dept. will gladly help design and produce the optimum shield for your application.

AD-MU TAPE DATA PROTECTORS ASSURE FIDELITY OF VALUABLE TAPES

1. Assure fidelity of vital recorded information by keeping data on magnetic tapes free from distortions caused by unforeseen external magnetic fields.
2. Minimize erasure accidents during safekeeping or transport.
3. Discourage and deter the covert saboteur or vandal.
4. Excellent insurance against possible expensive, or irreparable losses.

8 ROUND SIZES

Part No.	A Inches	B Inches	C Inches	D Inches
TDP 72627	7.14	18.42	3.4	1.37
TDP 72615	7.14	18.42	1.12	2.37
TDP 86627	8.58	21.31	3.4	1.37
TDP 86615	8.58	24.45	1.38	3.49
TDP 10908	10.0	26.19	7.8	2.27
TDP 10915	10.0	26.69	1.12	3.47
TDP 11645	11.52	29.53	1.12	3.47
TDP 11645P				

Model of AD-MU 30 (30" thick with protective 125% polyethylene foam over it) built for a gas boiler.

16 SQUARE RECTANGULAR SIZES

Part No.	A Inches	B Inches	C Inches	D Inches
CDP 23540	2.8	5.888	5.8	10.48
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TDP 2	32	30.48	12	30.48
TDP 3	32	30.48	12	30.48
TDP 4	32	30.48	12	30.48
TDP 5	32	30.48	12	30.48
TDP 6	32	30.48	12	30.48
TDP 7	32	30.48	12	30.48
TDP 8	32	30.48	12	30.48
TDP 9	32	30.48	12	30.48
TDP 10	32	30.48	12	30.48
TDP 11	32	30.48	12	30.48
TDP 12	32	30.48	12	30.48
TDP 13	32	30.48	12	30.48
TDP 14	32	30.48	12	30.48
TDP 15	32	30.48	12	30.48
TDP 16	32	30.48	12	30.48

Model of AD-MU 30 (30" thick) finished in double anodized aluminum.

INEXPENSIVE INSURANCE IN THESE UNCERTAIN TIMES

Proven AD-MU Tape Data Protectors, and Cassette Tape Data Protectors provide inexpensive insurance against such hidden hazards.

Satisfied customers include all branches of the armed forces, NASA, and numerous private firms as well as other governmental organizations.

There is not a single reported instance in which tapes enjoying such secure protection have ever been affected by stray magnetic fields. The investments in such tapes have remained uniformly safe from harm.

"WHY TAKE MY MAGNETIC SHIELDING PROBLEMS TO AD-VANCE MAGNETICS?"

Over 90% past and present magnetic shield designs have been created and fabricated by engineers and production personnel with Ad-Vance. With such a record of experience, it seems likely that Ad-Vance people are the logical ones to solve your particular problem.

"What facilities does Ad-Vance have?"

Two modern, fully equipped plants in Rochester, Indiana, are across the street from each other. They contain up-to-date equipment for:

- All types of metal forming
- helical and spot welding
- complete in-house tool room
- deep drawing
- CNC equipment
- processing control of heat treating and finishing
- in-house quality control

"What's Ad-Vance's industry and market position?"

Ad-Vance is the industry's largest, oldest and most experienced firm exclusively manufacturing magnetic shielding. Products from its factory are used off-planet in spacecraft and satellites as well as world-wide in exacting industrial, military, laboratory and consumer applications.

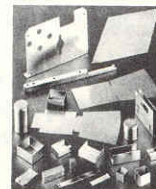
AD-MU SHEET STOCK — DELIVERY FROM STOCK

- For your in-house designing and manufacturing convenience.
- Easy to work, bend, stamp, draw, finish, etc. on ordinary sheet metal working equipment. SHIELDS MUST BE HEAT TREATED before end use or further finishing by plating, painting, etc.

JUST CUT AD-MU FOILS TO THE EXACT SHAPE YOU NEED

These Time-Saving High and Low Permeability Foils offer convenient, economical magnetic shielding. In many applications, their use can eliminate the costs of designing and manufacturing pre-fabricated shields. Foil shielding is also useful in hard-to-get-at-places. In addition, it permits more compact assemblies, accomplished by placing magnetically reacting components closer together with no performance degradation.

The foils exhibit useful ductility, so are readily hand formed to your desired outline on an ordinary cutting board, or with shears. They are then easily hand formed around the structure or component to be shielded. Simple adhesive tape can be used to hold them in place. They have already been properly heat treated so are ready for immediate use.



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The Problem Solving Magnetic Shielding Specialists—4 Decades of Magnetic Shielding Leadership