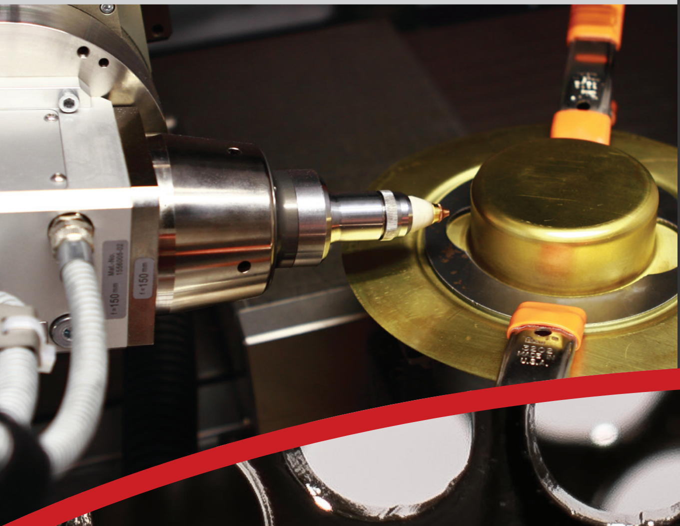
MµShield®

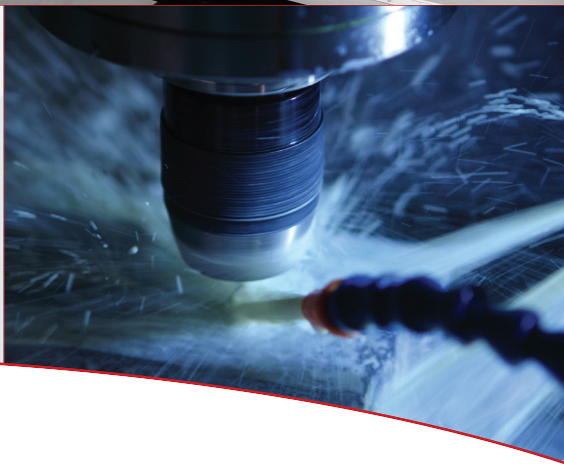
AS:9100 | ISO 9001:2015 Certified | ITAR Registered Company

Designing Your Unique Magnetic Shield

For Your Specific Application



mushield.com



Are you thinking about the need for magnetic shielding? Are you wondering how to get from the thought stage to the production and acquisition of your shielding solution?

Well, you're in the right spot.

Are you shielding a technology that is an effected or the effecting unit?

This is an important distinction when it comes to the combative measures of nullifying electromagnetic interference.

In operation, a magnetic shield **absorbs** magnetic flux by providing a path around the sensitive area and protecting the electronics found within the magnetic shield. In addition, magnetic shielding may be used to **contain** magnetic flux from leaking out and causing other sensitive electronics to malfunction. So, which is it?

- Are you looking to proactively contain the emission of electromagnetic waves? **-or-**
- Are you looking to absorb the potential existence of electromagnetic interference before it becomes an issue?

There are two main "shapes" of a magnetic shield, outside of just setting up a flat "shield" sheet of whatever material you're using.

Since a magnetic shield functions by providing a low reluctance flux path, and magnetic flux flows from its north pole to the south pole,
a flat sheet will only cover a portion of the flux path.

Spherical (Cylinders) – The most efficient magnetic shielding shape is a sphere constructed of high permeability magnetic shielding, also known as mumetal. Unfortunately, spherical shells are highly impractical, so the next best magnetic shield shape is a cylinder with a 4:1 length to diameter ratio. The rounded surface of a cylinder is conducive to the absorption of magnetic flux.

Square (Boxes) – In some cases, a box shaped magnetic shield is more practical for mechanical and/or structural reasons. In these instances, fabricated sheet metal boxes are the next best choice. Bend radii should be as large as possible because the magnetic flux permeating through the magnetic shielding material does not turn on sharp edges easily and flux leakage can occur.

Now let's talk the best approach to choosing the material to best suit your magnetic shield application.

Factors to consider when selecting the right material or your magnetic shield include:

- Determining the strength or flux density of the magnetic field to be shielded.
- Shield geometry.
- Required attenuation and mechanical stability.

The ability to conduct magnetic lines of flux is called permeability, and in a magnetic shield, the degree of permeability is expressed numerically. The standard is free space and that permeability value is one. In comparison, MuShield's magnetic shielding materials range in permeability from **200,000-350,000**. Knowing the permeability value of the shielding materials is imperative.

Once the strength, geometry, and attenuation has been determined (by direct gauss meter measurement or mathematical modeling), the appropriate alloy can be selected. **If you need help with this, our expert engineers are here to figure it out for you!**

What are typical alloys used in the construction of magnetic shielding applications?

For most **high permeability** magnetic shielding applications, MuShield uses materials that meet the industry standard specs of ASTM A753 Alloy Type 4 and MIL-N-14411 Composition 1 and are commonly referred to as mumetal, permalloy or Hy Mu 80. Materials that meet the ASTM and MIL specs are the most readily available of all the magnetic shielding alloys and provides the highest permeability

For **medium permeability** magnetic shielding applications (over 25 Gauss), MuShield uses materials that meet the industry standard specs of ASTM A753 Alloy Type 2 and MIL-N-14411 Composition 3 and are referred to as Alloy 49 or Hiperm 49.

A common application for medium permeability magnetic shielding material is in multi-stage cylinders. The outside layer is made using medium permeability material, while the inside layer is made from high permeability magnetic shielding material with a minimum of a 1/2" gap between the two layers. If the high permeability material was used on its own, it would saturate due to the strong magnetic field. The medium permeability material is used to dampen the field, allowing the high permeability material to absorb the weakened field the magnetic shield was designed to block.

In severe cases, **low permeability** materials such as low carbon steel or pure ingot iron can be used to reduce saturation. While these materials have low initial permeability, they exhibit a tremendous ability to withstand strong magnetic fields without saturating. Often times, medium or low permeability magnetic shielding materials are combined with the high permeability material, forming a multistage magnetic shield that can withstand flux densities that exceed 50 Gauss.

In some scenarios, there is a need for a magnetic shield that deploys all three types of materials. **We can help you navigate this need if it's applicable to what you're looking to achieve.**

Material

High Permeability per ASTM A753 Alloy Type 4
Medium Permeability per ASTM A753 Alloy Type 2
Low Permeability (Low Carbon Steel, Silicon Iron)

Are you thinking about the need for magnetic shielding? Are you wondering how to get from the thought stage to the production and acquisition of your shielding solution?

Well, you're in the right spot.

From consultation and planning, to design, manufacturing, and post production – MuShueld has your back when you need someone to lean on.

info@mushield.com [603.666.4433]

MuShield®

AS:9100 | ISO 9001:2015 Certified | ITAR Registered Company

Boundless Capabilities Shielded Through Innovation.

For over 60 years, MuShield has been an industry leader in the design and fabrication of magnetic shields made from high permeability mumetal. We've long developed trust and working partnerships with our customers who come to us because they know that we can analyze their issue then design and build a solution for their magnetic interference problems.

Manufacturing Capabilities

- Conventional Sheet Metal Fabrication
- 5-Axis Laser Cutting & Trimming
- CNC Machining & Turning
- Hydroforming – Deep Draw
- Hydrogen Annealing
- Laser Welding
- Rolling
- Rotary TIG Welding
- Spinning
- Spot Welding
- Stamping
- TIG Welding
- Tooling Manufacturing
- Turret Punching

Consulting + Engineering Services

- Magnetic Shielding Design
- Design for Manufacturing Efficiences - All Alloys
- Special Process Development

The Mushield Company, 9 Ricker Avenue, Londonderry, NH 03053 | Toll Free: 888.669.3539 | info@MuShield.com

mushield.com | mumetal.com | hydroformingmanufacturing.com | cryopermshielding.com