



**EMI/RFI
SHIELDING
INFORMATION
FOR
HAMMOND
ENCLOSURES**

Why you may need a Shielded Enclosure.

Today's society is ever more dependant on wireless communications. Cell Phones, Wi-Fi, Cordless Phones, are just a few of the technologies widespread today, which beam data through the air, instead of over a wire.

With all these signals in the air, a designer of a new device must ensure that his device does not emit any signal, which will interfere with other transmissions. Most countries have laws, which require any electronic device to be tested and meet emissive requirements. The US has FCC, Canada has DOC, and Europe has EMC-Regulation, which must be met.

In addition, a new device must be free of interference from existing EMI/RFI radiation, otherwise the device will not work as intended.

The best way to ensure EMI/RFI compliance to regulations is to design the electronics with shielding at the component level. If this is not possible, or if there is doubt as to the effectiveness of the shielding, then using a shielded enclosure will enhance performance in respect to EMI/RFI compliance.

Hammond Manufacturing offers certain series of its enclosures specifically designed to shield internal components from EMI/RFI, or reduce the interference from outside EMI/RFI sources.

The relevant standard for measuring the shielding effectiveness of small enclosures is VG 95373. Government regulations cover the finished product only! Using an enclosure with inherent shielding will not guarantee compliance.

Shielding Basics

Enclosures can significantly enhance the electromagnetic compatibility of a product. The enclosure acts as a "Faraday Cage" to reduce the amount of transmitted energy. The frequency of the radiation dictates the enclosure design for attenuating the radiation.

Low frequencies require the use of a magnetic material. (< 100 MHz)

Mid frequencies will "re-radiate" from any conductive source. (30 – 300 MHz)

High frequencies will travel through the smallest openings. (> 300 MHz)

An enclosure will "Absorb", "Reflect", and "Transmit" a certain percentage of the radiation beamed at it. The measurement of Attenuation is in dB, a logarithmic ratio of the drop in signal strength, example:

3 dB = 50 %

20 dB = 90 %

40 dB = 99 %

60 dB = 99.9 %

The way the attenuation is measured for small enclosures is specified in VG 95373, and gives an

indication of what to expect from an enclosure at a specific frequency.

Methods of Shielding

There are many methods available for making an enclosure shielded against EMI/RFI. To produce a Faraday Cage, you need a metal enclosure, which will absorb/reflect the Electromagnetic energy. Non-magnetic metals, such as aluminum will not work at very low frequencies; a magnetic material; for example, Iron or Nickel is required. At high frequencies, the conductivity of the material dictates its effectiveness.

Most plastic is not conductive, nor magnetic!

First choice for a shielded enclosure should be a metallic enclosure, such as an aluminum box. In order to get good shielding at high frequencies, the conductivity between the lid and the box must be close to Zero, and the joint between the lid and box should have a baffle to prevent leakage.

If a metallic box is not feasible, the use of a conductive plastic enclosure will provide shielding. Hammond uses two methods of shielding, Conductive Paint, and Conductive Plastic.

The conductive paint is an older technology. The interior of the enclosure is coated with a nickel filled acrylic paint. This method works, and is still the best method for some of our enclosures. It has drawbacks such as esthetics, flaking, and consistency, corners and hidden features will not be coated, and leakage can result.

Conductive Plastic is the best solution for some styles of plastic enclosures. The plastic is compounded with stainless steel fibers, forming a 3 dimensional conductive matrix inside the base material. This method provides a consistent enclosure, with no secondary coating quality issues.

Hammond Manufacturing has invested time and money to perfect the process it uses today. The shielded enclosures have almost identical physical properties to the unshielded equivalent, Esthetics, Strength, etc. The material is UL94 – V0.

Measuring Shielding Effectiveness

Comparative graphs of a representative enclosure shielded with Nickel filled paint, as compared to Stainless Steel filled plastic is viewable on this website. Testing was performed by an independent lab to VG 95373 P15 specifications.

A graph of attenuation based on flat panel measurements (Temp – T Cell) are also viewable. Measuring the attenuation of a panel in a Tem-T Cell produces a totally different result as compared to measuring an actual enclosure in real-life equivalent!

Hammond Manufacturing offers the following series in Conductive Plastic.
1599, 1594, 1598 Please check our website for size availability.

Safety Notes

Conductive Plastic is not an insulator!!

Most people associate plastic with electrical insulation. A conductive plastic enclosure must be treated the same as a metal enclosure. The enclosure must be insulated from the user.

Conductive Plastic will act as a heating element!!

As conductive plastic has a internal resistance, any significant current flow will cause the plastic to heat and produce smoke. Care must be taken to prevent shorting any current to or through the case.

We provide the enclosures with a label, warning against shock, and provide an insert with the enclosure warning against shock. As these enclosures look identical to non-shielded enclosures, care must be exercised in the design to ensure no safety issues are overlooked.

