diecast solutions no. 24

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More densely packed housings, faster processing speeds, and new EMI regulations call for changes in electronic housing design

Achieving Superior Electromagnetic Shielding with Die Cast Housings

In designing electronic product housings, especially those for smaller hand-held units, product engineers are facing new pressures in resolving basic cost-performance decisions.

Government electromagnetic compatibility regulations are growing more numerous and restrictive. A directive from the European Union now regulates not only the amount of EMI that certain electronic products can emit, but also an EMI immunity requirement—the first such regulation ever.

Industry estimates claim that this EU directive could add approximately 30 dB of shielding to existing requirements.

Even without such world-wide regulatory mandates, however, housing designers are contending with an increasing number of internal components, with processors operating at faster and faster speeds, inside the same or smaller envelope.

The Conductive Envelope Challenge

Beyond measures such as special filters and the slowing down of a system's high clock speeds, designers must look to providing EMI shielding improved over present practice.

Superior shielding was one of the main reasons for selection of a die cast case for this digital camera.

Most engineers would agree that the ideal electronic housing would be a single, continuous metal enclosure. In the real world, a working housing without openings, joints or seams is impossible to achieve. The value of designing for shielding early in project planning is obvious; shielding fixes even at the prototype stage can be costly and frustratingly ineffective.

The specification by product designers of molded plastics for housings and enclosures has proliferated based on highly valued material characteristics: the freedom to execute non-rectangular shapes and built-in features, production of cosmetic surfaces without secondary operations, inherent material color, and low part weight, all at reasonable cost.

With the exception of molded-in color, today's high-technology die casting process is capable of providing these material and production advantages—with hot-chamber Mg die casting also able to match the weight and costs of many plastic parts.

Shielding the Electronic Housing

EMI product shielding works by reflecting and absorbing undesirable electromagnetic waves. Plastics are essentially transparent to these waves and must be "metallized" to provide effective levels of shielding.

Most engineers evaluate a number of alternatives to achieve their EMI and aesthetic external design objectives: basically shielded molded plastic or die cast metal. Listed here are the strengths of these options:

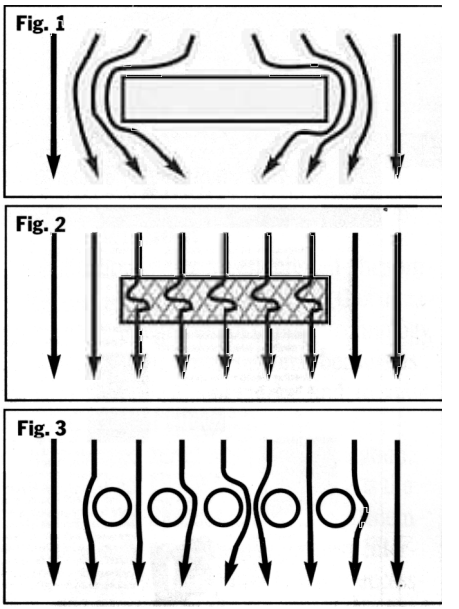
- Conductive Coatings on Plastic
- Metal Foil or Formed Liners inside Plastic
- Metallized Plastic Resins
- Plastic Housing with Metal Subchassis
- Die Cast Al, Mg and Zn Housings

Conductive Coatings on Plastic

Conductive spray paint offers shielding but the critical orientation of the metal particles is unpredictable. While arc spraying is an improvement, nickel-over-copper electroless plating appears to provide the best results, but at the highest cost, and coating uniformity on internal features can often be a problem. No EMI coating alternative is compatible with current product recyclability objectives.

Metal Foil & Molded Metallized Liners

Die cut metal foil has been widely used for lower-cost shielding inside a plastic housing with relatively simple shapes, but foil slippage out of position must be guarded against, particularly in field maintenance. Molded or formed metallized fabric liners are more expensive alternatives. All such liners can usually be removed for product recycling.



To minimize the degraded shielding effects in discontinuity of induced currents caused, for example, by a required housing vent opening (Fig. 1), proven vent covers such as conductive wire mesh (Fig 2) can be used, or aperture geometry can be redesigned as in Fig. 3.

Metallized Plastic Resins

Metallic fillers in plastic have been the subject of resin experimentation for many years. Such resins theoretically offer inherent conductivity, but the essential orientation and contact between the internal particles is an unknown with every part molded. Likewise, such unpredictability makes continuity across a seam a difficult problem. If sufficient conductive filler is added to guarantee internal

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Fig. 4 While effective EMI gasketing is being used for integrity at enclosure seams, design of an integrally die cast overlapping edge-joint can provide an assured conductive path between housing sections, eliminating gaskets.

CWM Technology for the New Millennium

Highlighting CWM's commitment to die casting process advancement in the next millennium, the full-page advertisement, shown at left, is appearing as a full-color message in the September issue of Product Design & Development magazine and the October issue of Design News. Appearances will continue in 1999-2000 in leading OEM design engineering publications, as part of Chicago White Metal Casting's continuing communications program to product designers, engineers and component specifiers. The new ad emphasizes that while many exciting new design and production developments are in the offing, many innovations are already being put to use by CWM in current product production. Examples are described and illustrated in the message.

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Achieving Superior Electromagnetic Shielding

shielding, the strength of the material can be compromised. Higher costs and faster tooling wear can be expected, and post-consumer recyclability of the housing will be a concern.

Plastic Housing with Metal Subchassis

For assurance of shielding within a plastic exterior, design engineers have also turned to incorporating a complete metal enclosure inside their resin housing.

This is a superior solution from the shielding perspective, although it comes at increased cost and, in the case of small portable and hand-held products with tightly packed interiors, often at a sacrifice to innovative exterior housing design.

Light-weight, thin-wall CWM die cast subchassis have been used effectively in such hand-held units to enable enhanced design of fully-shielded injection molded plastic cases. Both production and post-consumer recyclability is practical with such designs.

The Die Cast Exterior Housing

For those designers who have familiarized themselves with designing-for-die casting principles and the process advantages that closely parallel those of injection molded plastics, a die cast housing of any thickness can offer an optimum design solution.

In the case of many professional products, as well as consumer products which require durability and the impact strength to survive rough handling, a die cast exterior housing can be the ideal choice. Assured integral shielding is an added bonus *(see digital camera enclosure on previous page)*.

Avoiding Shielding Degradation

As with plated or metallized plastic housings, die cast enclosures require the designer to pay close attention to the treatment of any openings or seams.

Small component holes usually will not effect shielding integrity. The impact of larger openings can be reduced by the use of fully conductive wire mesh covers or reconfiguring an aperture's function into an array of smaller openings, preferably circular *(see figures 1,2 & 3 on previous page)*.

The negative effects of joints or seams can be addressed through the use of special EMI gaskets, or the design of integrally die cast, overlapping edge seams which can achieve shielding integrity without the use of gasketing *(see figure 4, previous page)*.

For a bibliography of reference materials on Enclosure Shielding and Electromagnetic Compatibility, contact the CWM Sales Dept. ■