USING PAINT FOR EMI SHIELDING ON PLASTIC

Introduction

Several criteria must be considered in the process of deciding which paint to use for EMI shielding on plastic. This article discusses those criteria involved in choosing, applying, and measuring the conductive properties of shielding paint.

Categories of Conductive Paint

Urethanes, waterbornes, and lacquers comprise the three main categories of shielding paint. Each serves a unique function in meeting the particular requirements of either the substrate, the environmental, or application restrictions.

Urethanes require either a catalyst or accelerator to provide the cure. Urethanes also normally require baking.

Waterborne paint does not need a catalyst, but does have some limitations as to its physical properties. Most finishers are more familiar with solvent-type materials. Converting conventional solvents to waterbornes involves added time and expense.

Pressure pots must be stainless steel, or have a non-contaminating liner. Piping and spray equipment must be treated to prevent corrosion.

Waterborne paints require higher curing temperatures. Residual water compounds the curing process. Moisture accumulation prolongs curing time and causes rusting and deterioration.

Lacquers can be handled by the finisher; accelerators or special application equipment are unnecessary. Lacquers have been well accepted on all substrates, excepting thermoset materials, where urethanes are preferred.

Binders and Resins

Urethanes and acrylics are today's common binders and resin systems.

Urethanes provide an excellent durable hard surface, suitable on most plastic substrates not susceptible to hot solvents. Because a catalyst is required, urethanes have a limited pot life. The same precautions taken with urethanes or catalyzed material apply to conductive coatings. Although the end results of the product are substantial, costs rise as much as 2-2½ times as that for other systems.

Acrylics normally used in lacquer systems handle extremely well, and can be applied with conventional equipment, with no concern for pot life. When applied to most substrates, they should yield top performance.

Conductive Media

Many conductive media are available in today's market. Economics, electrical and physical requirements are the major considerations when making a selection.

Until recently, graphite and carbon were the most common conductive materials. Both, however, lack certain physical and conductive properties available in other materials. Silver offers an excellent conductive path for both urethanes and acrylics, but its cost is prohibitive. Copper is economical, but deteriorates due to oxidation. Still used exclusively in cable along with aluminum, copper is sealed inside a PVC- or EPR-insulated jacket to prevent oxidation.

The common medium which satisfies all the necessary requirements is nickel, the most widely-used conductive material in paint today. Properly applied, nickel produces a uniform shield across the entire area.

Application

Having followed the above recommendations in paint selection, application becomes the next concern. Paint should be reduced to a spray viscosity, to accommodate the equipment. Manufacturer recommendations vary, depending upon the physical characteristics of the paint and its applied substrate. Toluol and xylol, alcohol, MIBK, MEK, and water are some of the more popular thinners.

Handling Characteristics

All paints should be stored in a well-ventilated area, at temperatures between 50 and 80 degrees, in order to avoid deterioration. Proper handling during preparation is very important. Containers should be sufficiently agitated to ensure correct suspension of both resin and conductive materials. Heavier conductive materials tend to settle more rapidly, and therefore require greater agitation.

Follow the manufacturer's instructions on thinning. Better applications are made from constantly-agitated pressure pots, allowing for complete use of the entire product.

Each binder calls for different handling procedures. Urethanes, for example, require a catalyst or an accelerator for cure. Limit quantity mixture to the allotted pot lifetime. Regular checking of pH and humidity levels will guarantee the right cure for waterbornes. Air dry lacquers need constant agitation to assure the binder-to-pigment dispersion ratio.

Measuring the Conductivity

The most common method of measuring shield conductivity uses an ohmeter with probe contacts to complete the circuit. Most specifications require conductivity to be less than one ohm per square.

Variations in product performance should be factored in. Thickness applications yield different conductivity readings. For example a 1.5 mils dry film application is read at .5 ohm per square inch by one manufacturer, and at .8 by another. This difference becomes a factor in hard-to-reach areas (corners, bosses, recesses), where good continuity is assured with less paint.

The most reliable measurement technique for film thickness employs a Tooke gauge. Unfortunately, a Tooke gauge necessitates the removal of the paint with a sharp instrument. (See UPI and Twin Cities for non-destructive coating thickness measuring gauges.)

Summary

EMI shielding paint is not subject to common paint problems, but several points are worth remembering:

1. Make certain that the agitator in your pressure pot is free and in continuous rotation.
2. Check parts to make sure that all areas are covered. Improper use of solvents causes void areas, faulty drying or incomplete cure.
3. Overspray can be corrected by masking or making a fan adjustment.
4. Adhesion problems can be corrected by changing the solvent or correcting the substrate preparation.
5. Mudcracking can be prevented by regulating material applications. Too heavy a film will result in splitting or cracking.

By following proper procedures, shielding paint can offer an economical method of EMI protection to meet today's needs.

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