PROCESS GUIDE

Epoxy Powder-Coated Bus Bar Insulation

Everything you need to know.
Storm Power has the experience, capabilities, and equipment to manufacture high-dielectric epoxy powder-coated insulation for bus bars. The free-flowing powder can coat any size, shape, and type of bus bar needed, which is perfect for OEMs needing durable and tight-fitting insulation.

Ready, Right, Sure.
Storm – The Premiere Dielectric Finishing Service

*Storm has performed in-house plating since 1988, and services dielectric finishing since 2009.*

Manufacturing services are performed by experienced individuals who are dedicated to maintaining the highest quality standards for your product. This attention to detail helps minimize errors within the production cycle. Storm has a four-week lead time on new orders. First article orders can be shipped as quickly as four weeks, while production orders routinely ship within two weeks. Repeat orders can be laminated with dielectric film within two weeks. Part P surface preparation and dielectric film finish application times vary, depending on order size, and the complexity of the component's finish. Part P preparation usually requires a day prior to the dielectric coating before parts can be laminated.

Storm is continually refining its production methods associated with laminated bus assemblies. If a laminated bus structure fails or peels in an unexpectedly short time, the client can return the component, Storm’s engineering team will review the defective case material, and will determine the cause of the failure. Typically if the lamination is small, it is stripped and redone; otherwise it is scrapped, and the client receives a new product. If the cause of failure is found to be due to Storm’s process or workmanship, the assembly will be promptly repaired or replaced.

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Why Insulate Your Bus Bar?

Epoxy powder-coated insulation eliminates important critical design problems, high-voltage arcing, and current-induced magnetic fields that affect the surrounding area of the electrical bus bar. This allows for closer component location, giving the electrical network design additional space for other components, or allow for smaller-scale design. Also impervious to most outdoor elements, it can be used for reliable busses outdoors.

Applications of Powder-Coated Bus Bars

Powder-coated bus bar can be found in many industries, including chemical and nuclear plants, marine applications such as offshore oil and gas, naval applications, and any outdoor application where harsh environment may be an issue. Specific applications include switchgear, manufacturing, and motor drives.
Material Characteristics

How It Works

Epoxy is a dielectric material. When placed in an electric field, the electron charges do not flow through the material. Dielectric polarization causes the electrons to flow within the copper bus bar, improving conductivity as a result.

The powder used in this process is a thermosetting dry powder that, once heated, flows uniformly over the copper substrate (plated or un-plated). This coating can be applied in thicknesses ranging from 6 mil (.006") to 120 mil (.120"). When the epoxy cures, a cross-link occurs increasing the molecular weight and insulation capability. Reference the graph below to compare epoxy powder to other polymers.

It not only protects against corrosion, but also carries a high manufacturer's insulation rating of 800 volts/mil (0.001") at a minimum of 10 mils (0.01 inches). Due to safety considerations, it is recommended that a High-Pot test is performed, rather than rely on film thickness.

Tensile strength of the coating applied on raw and plated copper bar is in the range of 7500 PSI, and has a thermal UL rating of 130 degrees C. Epoxy powder coating's high dielectric strength can be varied based on the application process and component preparation.

Figure 4. Insulation life curves plotted according to the Arrhenius reaction theory
Two Methods in Coating

Electrostatic Spray or Fluidized Bed?

The choice between electrostatic spray or fluidized bed powder coating is determined by the dielectric strength requirement of copper component. The general rule of thumb is that a high-voltage bar should be fluid dipped to achieve a thickness greater than 0.12 inches. Complicated shapes should also be fluid dipped for even, thick coating on bends and turns. Bus bars or other components with flat, open geometry are more suitable for spraying, such as the standard preset bus bars.

Standard Variety Colors

Electrostatic Spray

Before the epoxy powder is applied to the substrate, application technicians determine how much powder is to be applied to the substrate to meet the desired dielectric characteristics of each job order. This is accomplished by varying the ratio of voltage, airflow, and powder.

Component(s) are then placed in a curing oven that has the capacity to handle parts up to 12’ in length. As the thermo set powder is heated, it begins to melt and flow out, enabling it to form a higher molecular weight polymer, fusing both to itself and the substrate.

Fluidized Bed

Parts are “dipped” into epoxy powder that is suspended in air contained in an aerated hopper. This is accomplished by releasing compressed air through a porous plate located in the bottom of the hopper. As result, the epoxy powder “floats” in the hopper in a fluidized state. This creates a smooth, continuous epoxy coating over the substrate as it is “dipped.” Greater thicknesses of epoxy can be reached with this method of application than with electrostatic spray.

As with sprayed components, coated parts are sent to a curing oven.
Design Considerations

*Storm Power sprays epoxy coatings in the 6 mil to 12 mil range. Please keep this in mind, especially when specifying thru hole diameters.*

If the thickness is too large, holes can be filled, and tapering of the coating can become a concern. Fluidized bed coverage is in the range of 10 mils to 120 mils. The larger the bend radius, the better - if allowable. This will help the powder flow more smoothly without build-up or thinning. Also, try to avoid small cutouts in the conductor, as they are more difficult to edge condition, and could create areas for test failure. Always dimension designs to the substrate, not the powder surface. And remember to carefully consider masking location tolerances.

Testing Criteria

A Hi-Pot test is performed to make sure the finished coating has no defects, such as pin holes, voids, and thin areas near sharp corners or edges. All surfaces will be Hi-Pot wiped at twice the operating voltage plus 1,000 volts as standard procedure, unless otherwise specified. For example, if the operating voltage is 700v, Storm will test at 2400v (700V + 700V +1000V = 2400V). Storm currently tests up to 14000 volts.
Storm Power Components is a fabricator of custom copper components. From back-up power systems, cell towers, and sub stations, to earth-moving equipment, motive power, and alternative energy applications, our industrial-strength parts are trusted by original equipment manufacturers around the world to power, connect, and protect their products.

As an industry veteran for more than 20 years, the company is squarely focused on delivering improved responsiveness, price advantage, and shorter distribution channels. The result is its ability to manufacture superior-quality parts with speed and accuracy, while providing customers a delightfully uncommon experience. Storm Power Components, a privately held company, and is an ISO 9001-2015 certified organization headquartered in Decatur, Tennessee. For more information, please visit www.stormpowercomponents.com.