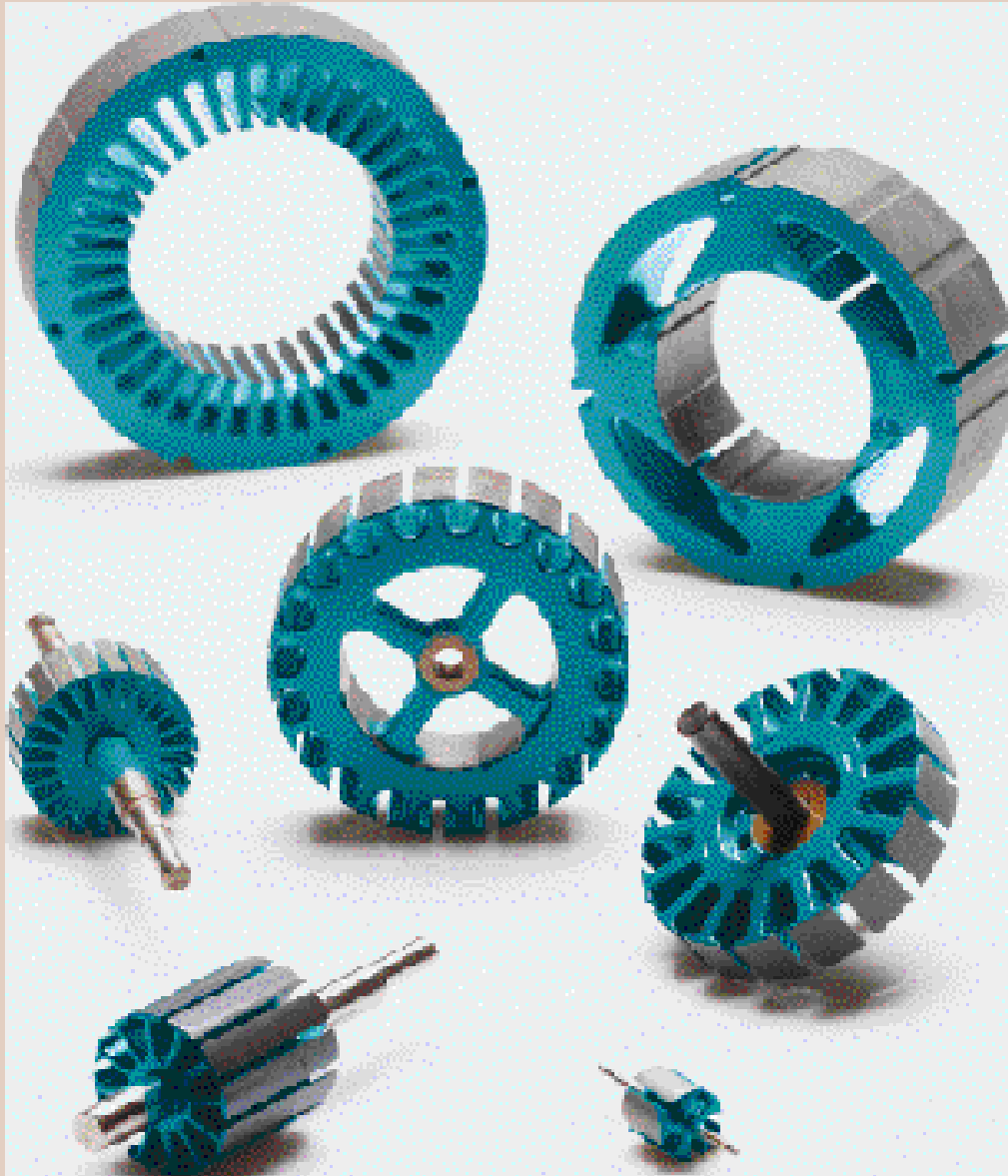




Scotchcast™

Electrical Insulation Systems



Jump start your electric motor design with 3M™ Scotchcast™ Epoxy Powder Resins

The electric motor market is heating up. Demands for smaller, more efficient, faster and lighter electric motors are pushing design teams to their limits. And with competition from every corner of the globe, competitive product manufacturing using cost-effective materials is critical to survival. How can you compete? 3M has the answers. With Scotchcast™ Epoxy Powder Resins, you can:

Meet Industry Standards



3M™ Scotchcast™ Epoxy Powder Resins are recognized by Underwriters Laboratories (UL) and the International Electrochemical Commission (IEC) as integral ground insulation for coils, motors and transformers in their Electrical Insulation Systems. See IEC Publication 85 and ULStandard 1446.

Use Less Magnet Wire

Scotchcast resins are bonded directly to the steel surface in a thin coating, taking less space. You get a smaller, more compact design. Molded spiders and “cuffs” can be eliminated by winding directly on the powder coated motor iron core, thus reducing turn-to-turn length. Less copper wire also results in less resistance and a cooler running motor. Alternatively, more wire can be added to the design to increase power output.

Use Less Steel



Scotchcast resins possess excellent thermal conductivity. This allows a device to run cooler, which increases device reliability. Higher thermal conductivity also permits a smaller device footprint. Tests have shown that traditional insulation systems consisting of varnishes, polyester, plastics and insulating papers needlessly retain heat in devices because of relatively low thermal conductivity and the potential for thermally insulating air gaps. Air gaps are not possible when using Scotchcast resins since they are directly bonded onto the steel laminations. Bulky steel—more expensive than

copper—can be reduced if it is to serve as a heat sink to counter this effect. To further reduce the size of the device, higher “hot spot” temperatures can be considered as Scotchcast Electrical Insulation Systems are available for 155(F) and 180(H) temperature classes. Alternatively, increased power output can be obtained for any given device size.

Use Fewer Components

Scotchcast resins eliminate tubes, fiber or plastic parts, slot liners, etc. from the device design. This introduces another advantage of Scotchcast resins: less moisture absorbing materials are used in the Electrical Insulation System.



Get Greater Production Yield

Scotchcast resins eliminate the possibility of “wind-downs” which occurs when magnet wire gets under inserted insulation. You get higher overall yield. With Scotchcast resins, it is also possible to hi-pot devices prior to magnet wire winding.



Powder Advantage Over Slot Liners

Core balance of a motor can be affected by shifting laminations that make up the armature. Scotchcast resins minimize core balance problems as the resin assists in keeping the laminations together, providing additional mechanical support as well as reducing vibration noise.





3M™ Scotchcast™ Epoxy Powder Resins passed the UL and IEC tests with flying colors

Because insulation systems are a means of ensuring reliable and safe operation of electrical equipment, UL 1446 and IEC 85 recognition is a requirement in most markets today. You have three choices:

- ◆ test the complete motor design
- ◆ substitute a General Purpose Model (GPM or “motorette”)
- ◆ incorporate a recognized Electrical Insulation System through a company that has already done the testing for you—like 3M

Electrical Insulation System testing is extensive and requires 8 to 18 months to complete. There are no short-cuts. GPMs in Electrical Insulation System testing represent typical constructions of a motor, generator, transformer or basic coil. Electrical Insulation System testing incorporates heat aging, cold shock, vibration and moisture exposure.

Scotchcast Epoxy Powder Resins have been tested and meet both UL 1446 and IEC 85 requirements. 3M Electrical Insulation Systems may be used without any further testing by the electrical equipment manufacturer. Electrical Insulation

Systems incorporate 3M Scotchcast resin as the integral ground insulation, commonly referred to as slot insulation on motors or window insulation on transformers.

Other major system components include magnet wire, interlayer insulation and molding material. “Minor” components such as 3M™ Electrical Tapes, sheet insulation, tie cords, lead wires, varnish, etc. have been added, making the 3M Electrical Insulation Systems ideal for most applications. Additional minor components may be added for specific requirements through use of “sealed tube” testing as discussed in UL1446. Sealed tube testing enables the incorporation of additional materials to the 3M Electrical Insulation Systems. This relatively simple two-week thermal test is used to confirm material compatibility with the 3M Electrical Insulation Systems.

The 3M Electrical Insulation Systems are recognized in UL “yellow cards” under, “Plastic Materials and Electrical Insulation Systems” (OBS2) file E163090. The 3M Electrical Insulation Systems are also recognized under IEC 85 in UL “yellow card” under, “Insulation System Components, Electrical, Evaluated in Accordance with IEC Publications” (OCTU2).

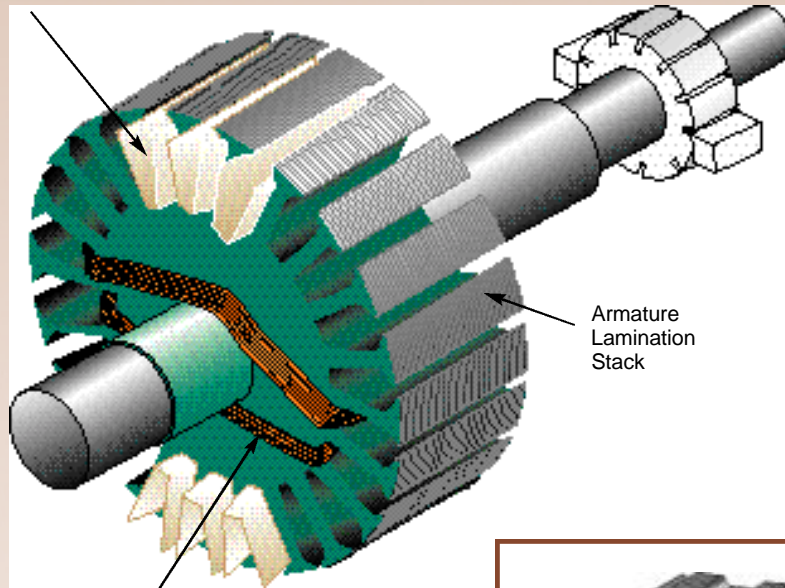
From automotive to consumer applications... real cost savings

The majority of automotive motor manufacturers use powder epoxy resins as integral insulation because of the cost saving benefits (see page 1). Now, the same cost advantages are available to the consumer appliance industry where UL and IEC recognition are desired.

As a major manufacturer and supplier of powder for electrical insulation applications, 3M offers four Electrical Insulation Systems to cover a broad range of operating temperatures:

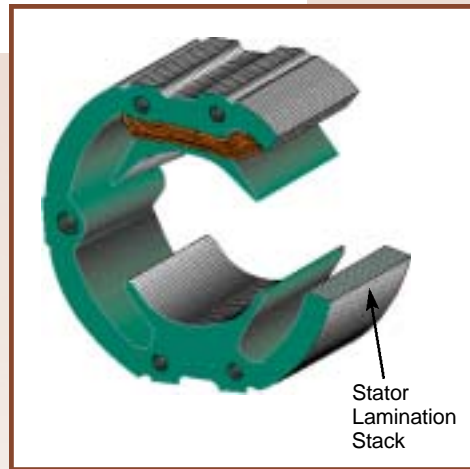
System Designation	Temperature Class	Maximum Voltage
3M 120-1	120 (E)	600
3M 130-1	130 (B)	600
3M 155-1	155 (F)	600
3M 180-1	180 (H)	600

Ordinary Slot Liner



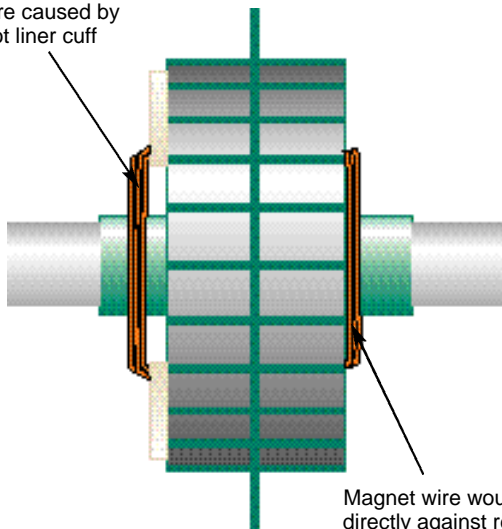
Armature Lamination Stack

Armature Coil



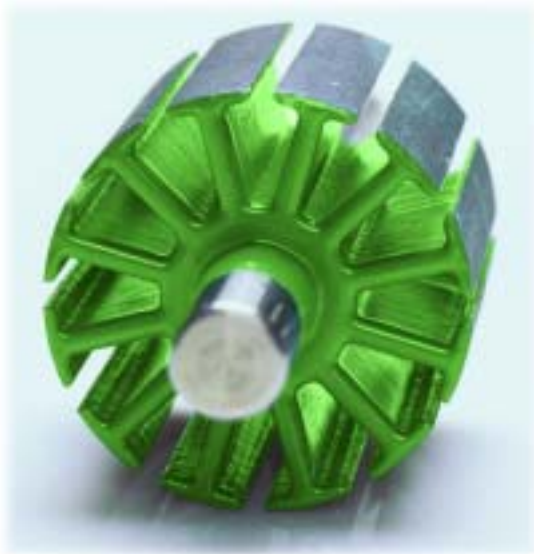
Stator Lamination Stack

Excessive magnet wire caused by slot liner cuff



Magnet wire wound directly against resin coated lamination – slot liners eliminated

3M™ Scotchcast™ Electrical Resin 260



- ◆ Fast curing
- ◆ Excellent electrical properties
- ◆ Excellent thermal shock and impact resistance
- ◆ Excellent heat, chemical and moisture resistance
- ◆ Good cut-through resistance
- ◆ Excellent flow
- ◆ Also available as Scotchcast 260CG, a coarse ground version for improved fluid bed performance
- ◆ UL 1446 Electrical Insulation System approval at Class 120(E), 130(B), 155(F), and 180(H)

3M™ Scotchcast™ Electrical Resin 260 is applied to a part that has been heated to a temperature above the melting point of the resin. On contact with the preheated application surface, the resin melts, flows to a controlled extent, then cures, bonding to the substrate and coalescing into a smooth, continuous, essentially uniform, thick coating. It effectively coats flat surfaces and corners, and provides good edge coverage. Uses for Scotchcast Resin 260 include insulating armatures, stators, bus bars and toroid cores.

3M™ Scotchcast™ Electrical Resin 263



- ◆ Excellent cut-through resistance
- ◆ Fast curing
- ◆ Excellent electrical properties
- ◆ Excellent thermal shock and impact resistance
- ◆ Excellent heat, chemical and moisture resistance
- ◆ Excellent flow
- ◆ UL 1446 Electrical Insulation System approval at Class 120(E), 130(B), 155(F), and 180(H)

3M™ Scotchcast™ Electrical Resin 263 is a high cut-through resistance version of Scotchcast Resin 260. Resin 263 is a green pigmented, rapid heat-curing product offering superior chemical resistance. It is designed to provide a continuous, tough, moisture and chemical resistant dielectric coating to a variety of substrates.

Scotchcast Resin 263 is applied to an object that has been heated to a temperature above the melting point of the resin. On contact with the preheated application surface, the resin melts, flows to a controlled extent, and then cures; bonding to the substrate and coalescing into a smooth, continuous, uniform, thick coating. It coats flat surfaces and corners, and provides good edge coverage. Uses for Scotchcast Resin 263 include insulating armatures, stators, bus bars and toroid cores.

3M™ Scotchcast™ Epoxy Powder Resins are designed for multiple application methods. These resins are also specially formulated for specific application methods. (See chart, page 6.)

Scotchcast Electrical Resin 5555

Four application methods available



- ◆ Fast curing
- ◆ Excellent electrical properties
- ◆ Superior cold flow resistance
- ◆ Excellent heat, chemical and moisture resistance
- ◆ Superior cut-through resistance
- ◆ UL 1446 Electrical Insulation System approval at Class 120(E), 130(B), 155(F), and 180(H)

3M™ Scotchcast™ Resin 5555 can be applied via electrostatic fluid bed, electrostatic spray, venturi spray or fluid bed dip. When applied electrostatically to a room temperature part, induction heat is recommended to melt and flow the powder to a tough, moisture and chemical resistant dielectric coating for various electrical devices.

Resin 5555 is available in three gel times in order to accommodate those applications that need slightly higher flow, or faster cure speed: 6G, 10G, and 22G. The standard 10G version is generally preferred for most applications.

Scotchcast Electrical Resin 5388

Specially formulated for use in electrostatic fluid bed process



- ◆ Superior cold flow resistance
- ◆ Excellent heat, chemical and moisture resistance
- ◆ Superior cut-through resistance
- ◆ UL 1446 Electrical Insulation System approval at Class 120(E), 130(B), 155(F), and 180(H)

3M™ Scotchcast™ Resin 5388 is applied to a room temperature part via the electrostatic fluid bed process. Negatively charged resin particles are attracted to the grounded object to be coated. Because of its superior charging capabilities, Scotchcast Resin 5388 exhibits excellent slot penetration on motor stators and armatures. Uses for Resin 5388 include insulating armatures, stators, bus bars and toroid cores.

The cure of Scotchcast Resin 5388 is accomplished by heating the coated part to a temperature above the melting point of the resin. The resin then melts, flows to a controlled extent, and coalesces into a smooth, continuous, essentially uniform coating which cures and bonds to the substrate. The coating provides excellent edge coverage and maintains its uniformity on flat surfaces. Either convection oven or induction or resistance heating may be used as a heat source for curing the resin.

Curing

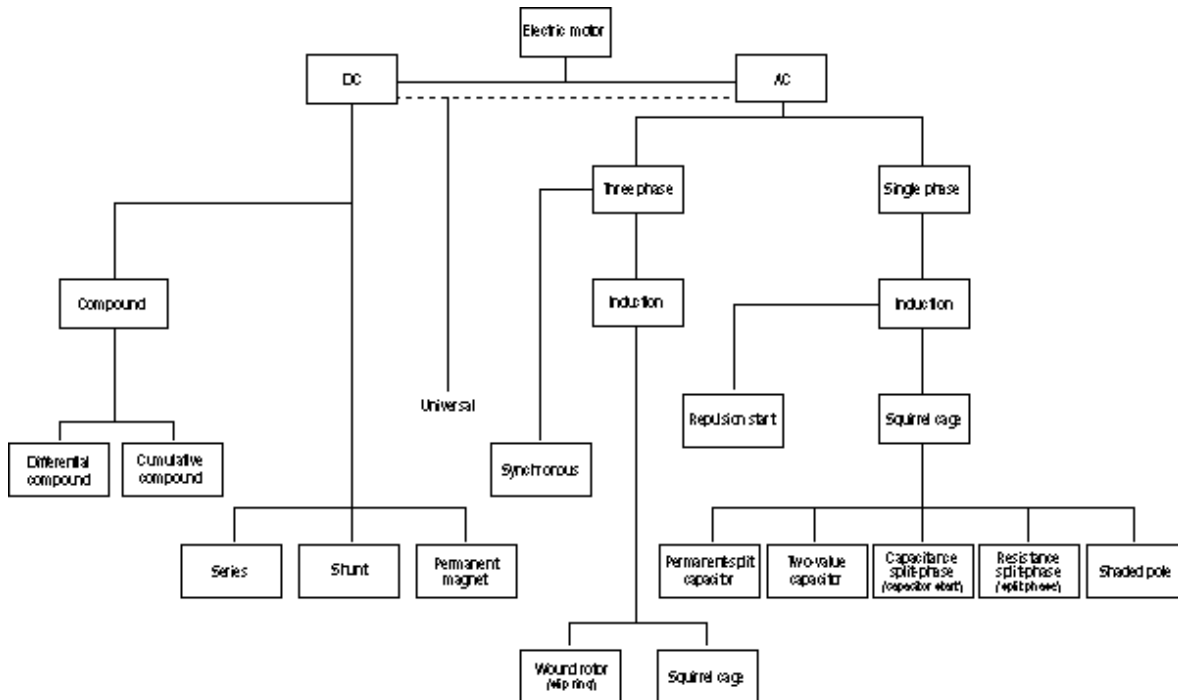
The curing of 3M™ Scotchcast™ Resins to a thermoset condition involves a time/temperature relationship. The retained heat in some parts is sufficient in many cases to effect a cure of the resin without the need for post-curing facilities. Small articles, or those with large surface-to-mass

ratio, lose heat rapidly and may require a higher preheat temperature and/or additional oven-curing.

Curing time does not include time required to reach the cure temperature. The user must determine the time required for the coated substrate to reach listed temperatures.

Product Number	Electrostatic Fluid Bed	Fluid Bed Dip	Venturi Spray	Electrostatic Spray	Time/ Temperature
5555-6G	✓	✓	✓	✓	177°C (350°F)/5 minutes 204°C (400°F)/90 seconds 232°C (450°F)/45 seconds
5555-10G	✓	✓	✓	✓	177°C (350°F)/6 minutes 204°C (400°F)/150 seconds 232°C (450°F)/90 seconds
5555-22G	✓	✓		✓	177°C (350°F)/8 minutes 204°C (400°F)/4 minutes 232°C (450°F)/2 minutes
5388	✓				177°C (350°F)/15 minutes 204°C (400°F)/6 minutes 232°C (450°F)/3 minutes
260, 260CG, 263		✓	✓	✓	149°C (300°F)/30 minutes 177°C (350°F)/10 minutes 204°C (400°F)/30 seconds 232°C (450°F)/20 seconds

Typical Electric Motor Design



In addition to more than 30 years of experience and the high standard of quality that goes into 3M™ Scotchcast™ Resins, 3M customers receive other important value-added benefits. Manufacturing, customer service and technical resources are dedicated to making service, quality and delivery easier when working with 3M and its products. In constant communication with its customers, 3M maintains an innovative approach to resin systems to meet present and future electrical/electronic requirements, ensuring product quality, consistency, and performance effectiveness.

Customer Service

Technical sales representatives are always accessible to aid your engineering and purchasing personnel by answering technical questions or guiding resin product selection. And 3M's Customer Service Department can put you in touch with a qualified sales representative.

Locally based technical/sales representatives are your connection to 3M research and product development laboratories. Trained to understand and evaluate your resin application needs, this select group will draw upon all 3M capabilities at their disposal to help solve your technical problems, and to optimize your electrical or electronic resin usage, as well as to develop new product applications to meet your specific needs.

Your How-To-Resource

Whether your need is developing a resin system to meet a specific production requirement or identifying a resin which will help you increase product performance and productivity, our technical expertise is at your service. The advantages of using Scotchcast Electrical and Electronic Resins include not only superior products but also a source for technical solutions. In addition, powder application equipment manufacturers' names can be suggested upon request.

Handling and Safety Precautions

Read all Health Hazard, Precautionary, and First Aid statements found in the Material Safety Data Sheet and/or product label of chemicals prior to handling or use.

Call 1-800-328-1368 for sales, ordering or technical service information.

Important Notice

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Corrosion Protection Products

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Austin, TX 78726-9000



Recycled paper
40% pre-consumer waste paper
10% post-consumer waste paper

Litho in the USA.

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