

3M

Scotchcast™

Electrical and Electronic Resins



Powder Resins Selection and Application

Introduction

3M™ Scotchcast™ powder resins are a series of one-part, 100 percent solids systems offering:

- Fast curing
- Excellent electrical properties
- Excellent thermal and mechanical shock resistance
- Superior cut-through resistance
- High adhesion

- Excellent chemical and moisture resistance
- High to low flow characteristics
- Superior electrostatic coating capability

The resins are manufactured by a fusion-blend process which ensures that each particle of powder contains all the components necessary to effect a complete cure and attain the stated performance properties. Powder resin selection depends primarily on the method of application available.

The five most commonly used methods of applying powder resins are:

- Fluid bed dip
- Manual spray
- Automated integral insulation spray system
- Electrostatic spray
- Electrostatic fluid bed



Selection process

The best way to select the proper Scotchcast powder resin is to consider the needs of the application and the proposed application method. Besides evaluating the property values and product descriptions in the chart on pages 4 and 5, consider the following:

- Does the resin selected meet the requirements of the application?
- Is UL recognition required?
- What problems have existed with other methods or products which have been used or evaluated? Will the selected resin overcome these problems?
- Which application process is best suited for the product selected?
- Can the part, by virtue of its size and configuration, be coated using this process?
- What masking and coating thickness is needed?
- Is application equipment available? Can it be used to apply the product selected?
- Is sufficient floor space available for automation, including an area for part-surface preparation, a conveying system, dust collection and powder storage (coolers)? Can air requirements, e.g., use of compressors, blowers, dryers, be met? Are ovens available?

Application

Successful coating with powder resins is accomplished in four basic steps:

1. Clean the part

One or both of the following processes may be necessary to complete this step. Removal of rust, dirt, oxide and other contaminants can be accomplished by sandblasting, vapor de-greasing, or steam cleaning.

2. Preheat the part

Preheating may be omitted if parts are to be coated electrostatically at room temperature, in which case they must be thoroughly dried before coating to prevent outgassing. Forced air ovens, induction heating, radiant heating and resistance heating are four common methods used to preheat parts, cure the resin or both.

3. Coat the part

Preheated parts

When applied to preheated parts, powder particles melt, flow together, fuse and then are cured. When dipping or spraying, the coating thickness depends on the temperature of the part, the duration of the dip/spray, and the melt rate and melt viscosity of the powder. If the powder is applied electrostatically to a preheated part, coating thickness depends on the temperature of the part, the duration of the powder application, the voltage applied to the powder, the chargeability of the powder and its melt rate and melt viscosity.

Unheated parts

When unheated parts are coated electrostatically, the charged powder resin particles cling to the grounded part. The coating thickness depends on the duration of the powder application, the voltage applied to the powder and the powder's chargeability.

4. Cure the resin

(See #2, "Preheat the Part" section for methods of supplying the required heat.)

When large, preheated parts are coated, the mass of the part may hold the heat necessary to cure the resin fully without postcuring. However, smaller parts may lose so much heat during coating that they require a postcure to obtain full cure. The time/temperature relationships necessary to obtain full cure are given in the chart and on individual product information sheets. These time/temperature relationships do not include the time necessary to heat or reheat the part to the curing temperature. The user must make this determination and start the time cycle when the temperature is reached.



UL Insulation Systems

Insulation systems established per UL 1446 and IEC 85 requirements are available for various Scotchcast resins up to class H (180°C). The major system components include Scotchcast resin as integral ground insulation, 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. The Systems are recognized in UL file E163090 (OBS2). Please refer to the separate Scotchcast Electrical Insulation Systems brochure for additional details.

Many Scotchcast powder resins are also recognized by UL as component insulation of class B per UL 746B. These are listed in UL file E35075 (QMFZ2).

Powder Resins Typical Property Data

Temp Class	Product Number	Description	UL System 1446 Approval File Number E163090	Cure Schedules (Temp/Time)
B F H	260  260CG	This widely used, well known product is used primarily in spray and fluid bed dip applications. Coarse ground version of 260 for improved fluidized bed performance. UL Recognized.	.	149°C (300°F) 30 min 177°C (350°F) 10 min 204°C (400°F) 30 sec 232°C (450°F) 20 sec
B	262 	This resin has excellent flow characteristics which produce a uniform coating in applications such as resistance heated bobbin wound coils. It is used primarily in spray and fluid bed dip applications.	.	149°C (300°F) 40 min 177°C (350°F) 20 min 204°C (400°F) 60 sec 232°C (450°F) 30 sec
B F H	263 	263 is used primarily in spray and fluid bed dip applications and has been designed for use where high temperature cut-through resistance is required. UL Recognized.	.	149°C (300°F) 30 min 177°C (350°F) 10 min 204°C (400°F) 30 sec 232°C (450°F) 20 sec
B	265 	Low melt viscosity and minimum build make this unfilled powder ideal for a variety of coating, bonding and impregnating applications, notably coating from a solvent. UL component recognition UL File E35075	.	149°C (300°F) 60 min 177°C (350°F) 20 min 204°C (400°F) 5 min 232°C (450°F) 2 min
B	270 	This UL Recognized resin is used primarily in spray and fluid bed dip applications and has been designed for higher temperature cut through and bridging gaps around shading bands on stators.	.	149°C (300°F) 30 min 177°C (350°F) 10 min 204°C (400°F) 30 sec 232°C (450°F) 20 sec
B	5096 	Liquid Patching Compound Used for patching Scotchcast powdered resins, this two-part resin is a liquid, room temperature-curing, thixotropic product. UL recognized. Hardness of 85 Shore D. Mix ratio by weight is 10:0:2.25 (A:B). UL component recognition UL File E35075	.	25°C (77°F) 24-48 hrs 60°C (140°F) 2 hrs 95°C (203°F) 1 hr
B	5133 	This product accepts a charge very easily, which makes it ideal for electrostatic coating techniques. This product is designed to permit the thin coating of cold as well as heated parts such as capacitor cans, transformer covers, and resistors.	.	149°C (300°F) 30 min 177°C (350°F) 10 min 204°C (400°F) 30 sec 232°C (450°F) 20 sec
F	5230N 	5230N is an updated version of the 5230 resin product. 5230N has superior charging capabilities and is designed to provide smooth uniform coatings using the electrostatic fluid bed application method. UL component recognition UL File E35075	.	177°C (350°F) 15 min. 204°C (400°F) 6 min. 232°C (450°F) 3 min.
B F H	5388 	Formulated specifically for use in the electrostatic fluid bed process, 5388 provides superior cut-through resistance as well as excellent heat, chemical and moisture resistance.	.	177°C (350°F) 15 min 204°C (400°F) 6 min 232°C (450°F) 3 min
B	5400 	Wire Coating Powder Resin Scotchcast 5400 was developed for continuous coating of wire products by electrostatic fluidized bed. Excellent flexibility and resistance to cracking due to heat shock or impact are just several of the very excellent characteristics this product exhibits.	.	200°C (392°F) 15 min 250°C (482°F) 5 min 300°C (572°F) 90 sec 350°C (662°F) 30 sec
B F H	5555 	Scotchcast 5555 can be applied via cold electrostatic fluid bed, hot venturi spray or hot fluid bed dip to provide a continuous, tough, moisture and chemical resistant dielectric coating for fractional horsepower motor stators and armatures. Available in three gel times.	.	204°C (400°F) 6G 90 sec 10G 150 sec 22G 4 min. (See data sheet for more information)

	Specific Gravity	Cut-Through Resistance	Edge Coverage (%)	Impact Resistance (Inch-lbs., Newton Meters)	Gel Time @ 193°C Hot Plate	Dielectric Strength (volts/mil)	Volume Resistivity (Ohm-cm at 23°C)	Color
	1.43	215°C (410°F)	35-45	100 (11.3)	12-16 Sec	1,000 (12-15 mil coating)	10 ¹⁵	Green
	1.34	130°C (266°F)	38-48	100 (11.3)	12-16 Sec	1,000 (12-15-mil coating)	10 ¹³	Red
	1.47	290°C (554°F)	40-50	100 (11.3)	8-14 Sec	1,000 (12-15 mil coating)	10 ¹⁵	Green
	1.16	Not Applicable	Not Applicable	160 (18.1)	60 Sec	1,300 (12-15 mil coating)	10 ¹⁴	Clear
	1.48	250°C (482°F)	35-40	120 (13.8)	12-16 Sec	1,000 (12-15 mil coating)	10 ¹³	Green
	1.18	See Data Sheet	Not Applicable	—	@60°C (140°F) 15 minutes	350 (v/mil) on 125 mils per Fed.Std, 406, Method 4031	10 ¹³	Light Grey
	1.45	160°C (320°F)	15-25	120 (13.8)	25-35 Sec	1000 (12-15 mil coating)	10 ¹⁵	Blue
	1.60	340°C (644°F)	50-70	160	25-30 Sec	1300 (12-15 mil coating)	10 ¹⁴	Light Blue
	1.57	> 340°C (644°F)	35-45	100 (11.3)	25-35 Sec	1300 (12-15 mil coating)	10 ¹⁴	Blue
	1.22	365°C 689°F	Not Applicable	160 ⁽¹²⁾ (Gardner 1/8 inch steel panel)	@304°C(400°F) 18-25 sec	7,000 - 9,000 volts (shot box) (12-13 mil coating)	10 ¹⁴	Yellow/Tan
	1.70	> 340°C (644°F)	30-45	100 (11.3)	6G 5-7 Sec 10G 9-11 Sec 22G 21-23 Sec	1300 (12-14 mil coating)	10 ¹⁴	Green

Powder Resins Troubleshooting

This troubleshooting chart is to assist 3M customers in identifying and solving some of the problems which may occur when using resin products. For further assistance, you may contact 3M's Customer Service Department for a qualified technical/sales representative at 1-800-722-6721.

	Problem Outgassing Bubbles or pinholes form in the coating during cure	Poor Adhesion, Resin does not adhere to part	Poor Impact Resistance, Resin cracks or chips from part upon impact	Poor Cut- through Resistance, Turns of wire cut through coating and short out when part is subjected to heat	Poor Chemical Resistance, Coating is dissolved or flakes off when exposed to solvents, etc.	Rough coating, Cured coating exhibits pinholes, is abnormally rough or has the appearance of an orange peel	Low Build, Coating thickness is too thin
Cause and Solution							
Entrapped air /Change preheat or cure temperature.	●						
Part not clean, i.e., residue, such as oil, grease, degreasing agent, solvent, oxides, on surface or between laminations /Clean before assembly.	●	●	●				
Cut-through temperature of product too low /Product with higher temperature cut-through capability should be evaluated.				●			
Moisture contamination of powder /Keep containers closed and use dry air to apply powder.	●						
Nonstick surface (Teflon, etc.) /Change materials.		●					
Resin not fully cured /Check curing temperature and/or oven accuracy. Check cure time. Is part at cure temperature at onset of cure cycle?		●	●	●	●		
Contamination of powder /Check air lines for oil, water, etc. Keep containers closed and away from moisture humidity.						●	
Storage temperature of resin too high /Store at 75°F (24°C) or lower Resin over aged /Check inventory vs. rate of usage.						●	●
Insufficient agitation /Agitate part more in fluid bed dip.						●	●
Exposure time to powder too short /Lengthen exposure time. Too much air in air/powder mixture /Decrease amount of air. Preheat temperature too low /Increase temperature. Parts cool too long before coating /Shorten exposure time. Mass of part too small to hold necessary heat /Increase preheat temperature. Use multiple applications. Apply electrostatic powder.						●	●
Electrostatic application voltage too low /Increase voltage. Part too far from applicator /Move part closer. Coating too short /Lengthen coating time. Contamination of powder (moisture, etc.) /Check air lines for oil, water, etc. Keep containers closed and away from moisture.							●



The 3M Edge

In addition to the high standard of quality that goes into 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 distributors and 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

3M's nationwide distributor network provides prompt, efficient product delivery in response to all your electrical and electronic materials requirements. 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 or a 3M authorized distributor in your area. Just call 1-800-722-6721 with any inquiries you may have about Scotchcast Electrical and Electronic

Resins.

Technical Service

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 design requirements.

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.

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 800-722-6721 for sales or
ordering information.
Fax 800-828-9329**

Important Notice

All statements, technical information, and recommendations related to 3M's products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the product which are not contained in 3M's current

publications, or any contrary statements contained on your purchase order shall have no force or effect unless expressly agreed upon, in writing, by an authorized officer of 3M.

Warranty: Limited Remedy; Limited Liability.

This product will be free from defects in material and manufacture for a period of one year from the date of purchase. 3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED

WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. Except where prohibited by law, 3M will not be liable for any loss or damage arising from this 3M product, whether direct, indirect, special, incidental or consequential regardless of the legal theory asserted.



Corrosion Protection Products

6801 River Place Blvd.
Austin, TX 78726-9000
<http://www.3M.com/corrosion>



*40% Pre-consumer waste paper
10% Post-consumer waste paper*

Litho in USA.

© 3M IPC 2000 80-6111-8021-9