



# Scotchcast™ Electrical Resin 251

Two-Part, Oven-Curing, Class F, Rigid, Filled, Epoxy Liquid Resin

## Data Sheet

### Product Description

3M™ Scotchcast™ Electrical Resin 251 is a medium-viscosity, rigid, class F (155°C) resin system widely used where physical strength and excellent properties at elevated temperatures are required. Resin 251 meets the requirements of MIL-I-16923A. An easy 1:1 mix ratio and good handling characteristics have contributed to the product's popularity. Warming this resin to 120°C (248°F) will lower its viscosity below 200 centipoise for maximum impregnating ability.

- High Temperature
- Excellent electrical properties

### Handling Properties

Mix Ration (A-B)	Wt 1:1 Vol (%) 50:50
Viscosity @ 23°C (73°F)	A = 175,000 cps B = 10,000 cps Mixed = 19,000 cps
Density	A = 1.53 kg/l (12.71 lbs/gal) B = 1.48 kg/l (12.32 lbs/gal)
Flash Point	A = 202°C (395°F) B = 152°C (305°F)
Gel Time	20 min. @ 121°C (250°F)
Curing Guide	75°C (167°F) 15-20 hrs 95°C (203°F) 6-8 hrs 120°C (250°F) 2-3 hrs

### Test Method

<sup>1</sup> Fed. Std. No. 406, Method 4031	<sup>5</sup> Fed. Std. No. 406, Method 1011
<sup>2</sup> MIL-I-16923E	<sup>6</sup> Fed. Std. No. 406, Method 1031
<sup>3</sup> ASTM-D-648	<sup>7</sup> Fed. Std. No. 406, Method 4021
<sup>4</sup> Fed. Std. No. 406, Method 1021	<sup>8</sup> Fed. Std. No. 406, Method 4041

Typical Properties	
*Not recommended for specification purposes. Product specifications will be provided upon request.	
Property	Value
Color	Brown
Specific Gravity (Cured)	1.50
Flammability <sup>2</sup>	Self-extinguishing
Compressive Strength <sup>4</sup> (10% Compression)	17,500 psi (1230 kb/cm <sup>2</sup> )
Tensile Strength <sup>5</sup>	5280 psi (371 kb/cm <sup>2</sup> )
Elongation (% @ break)	.7
Flexural Strength <sup>6</sup> (1/2" x 1/2" Sample)	9500 psi (668 kb/cm <sup>2</sup> )
Electric Strength <sup>7</sup> 1/8" (3.75 mm) sample	425 V/mil (16.8 kV/mm)
Hardness (Barcol)	40
Thermal Conductivity <sup>2</sup> (cal · cm/cm <sup>2</sup> · sec. °C)	8.0 x 10 <sup>-4</sup>
Coefficient of Linear Thermal Expansion <sup>2</sup> (23°C to 113°C) (length/unit length/°C)	5 x 10 <sup>-5</sup> X10 <sup>-6</sup>
Thermal Shock <sup>2</sup> 10 cycles – 55°C to 105°C 1/4" (6.35 mm) Olyphant Inserts	Passes
Moisture Absorption <sup>7</sup> % Weight Increase (240 hrs @ 96% R.H.)	.25
Heat Distortion Point <sup>3</sup> (264 psi)	130°C
Water Immersion (sample cured 2 hrs. @ 120°C) % Weight Gain (1000 hrs. @ 23°C) - % Weight Gain (500 hrs @ 70°C) - % Weight Gain (200 hrs @ 100°C)	.366 1.94 3.27
Thermal Aging 1000 hrs. @ 130°C - % Weight Loss Hardness Change, Barcol Dielectric Constant <sup>7</sup> (100 Hz @ 23°C) Dissipation Factor <sup>1</sup> (100 Hz @ 23°C) Volume Resistivity <sup>8</sup> (Ohm-cm 2 23°C)	.01 +7 4.35 .48 1x10 <sup>15</sup>

Typical Properties, <i>continued</i>	
*Not recommended for specification purposes. Product specifications will be provided upon request.	
Property	Value
<b>Thermal Aging</b>	
1000 hrs. @ 155°C - % Weight Loss	.46
Hardness Change, Barcol	+8
Dielectric Constant <sup>7</sup> (100 Hz @ 23°C)	5.61
Dissipation Factor <sup>1</sup> (100 Hz @ 23°C)	.54
Volume Resistivity <sup>8</sup> (Ohm-cm @ 23°C)	1x10 <sup>15</sup>
<b>Thermal Aging</b>	
1000 hrs. @ 180°C - % Weight Loss	1.09
Hardness Change, Barcol	+8
Dielectric Constant <sup>7</sup> (100 Hz @ 23°C)	4.80
Dissipation Factor <sup>1</sup> (100 Hz @ 23°C)	.42
Volume Resistivity <sup>8</sup> (Ohm-cm @ 23°C)	1x10 <sup>15</sup>

*Note: These are typical values and should not be used for specification purposes.*

## Usage Information

### Mixing

Mix the separate parts before removing them from their containers. They may be warmed to aid mixing. In the event of crystallization, warm part B to 95°C (302°F) and mix to dissolve the crystals. Weigh the correct proportions of the separate parts to within 2% accuracy and combine them. Thoroughly blend the mixture until the color is absolutely uniform or a homogeneous mixture is attained.

### Deaerating

Entrained air can be removed by evacuating for 5 to 15 minutes at 5 to 10 mm of mercury (Hg) absolute pressure. Warming the mixed resin to 60°C (140°F) facilitates air removal. Container side walls should be four times the height of liquid resin to contain the foaming that takes place under vacuum.

### Casting and Impregnating

Pour the warm resin into the preheated (60-100°C) mold. If no mold is used, dip the preheated part into the resin. Heating the resin and mold aids impregnation. For good impregnation of tightly wound coils, warm the resin to 120°C (248°F) thus lowering its viscosity below 200 centipoise. For maximum impregnation, evacuate for 5 to 15 minutes at 5 mm of mercury (Hg) absolute pressure, or pour under vacuum and hold for several minutes before releasing.

## Curing

Cure using one of the cycles shown under **Handling Properties**. Intermediate cycles may be used if desired. Allow enough time for the resin to reach the curing temperature. For maximum resistance to thermal shock, the resin should be gelled at 75°C (167°F) to minimize stresses in the resin. After gelation, the resin can be post-cured using any of the cure cycles shown under Handling Properties. For critical applications requiring optimum physical and electrical properties, especially at elevated temperatures, a 16-hour post-cure at 150°C (302°F) is suggested.

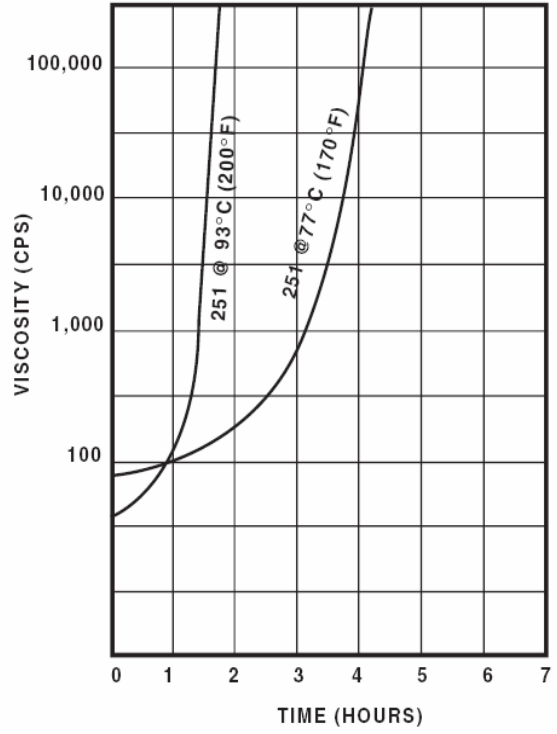
## Storage

Both parts of this resin system should be stored at temperatures between 20 to 30 degrees Celsius, and 30% to 60% relative humidity. When not in use, containers should be kept tightly closed. Storage at conditions outside those suggested may compromise the performance of the resin.

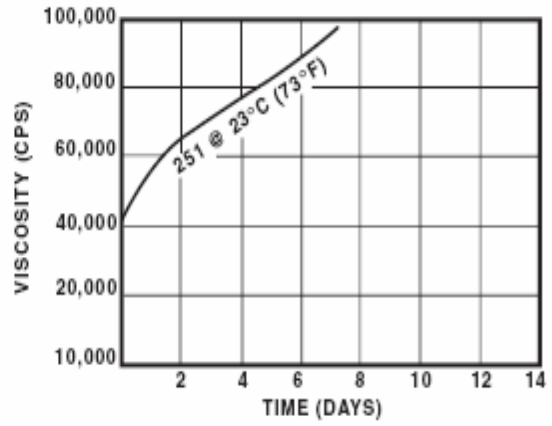
## Handling and Safety Precautions

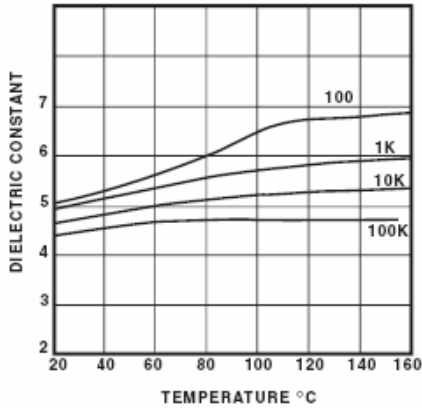
Read all health Hazard, Precautionary and First Aid statements found in the Material Safety Data Sheet (MSDS) and/or product label of chemicals prior to handling or use.

**Brookfield Viscosity vs. Time**  
@77°C (170°F) & 93°C (200°F)

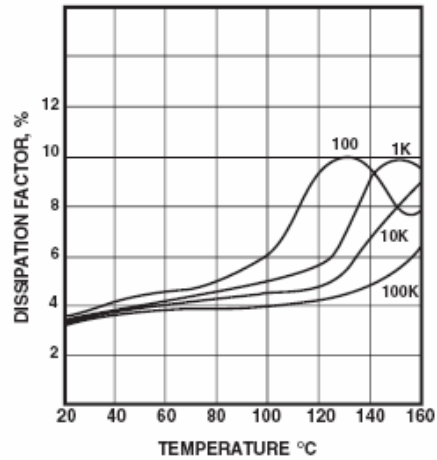


**Brookfield Viscosity vs. Time**  
@23°C (73°F)



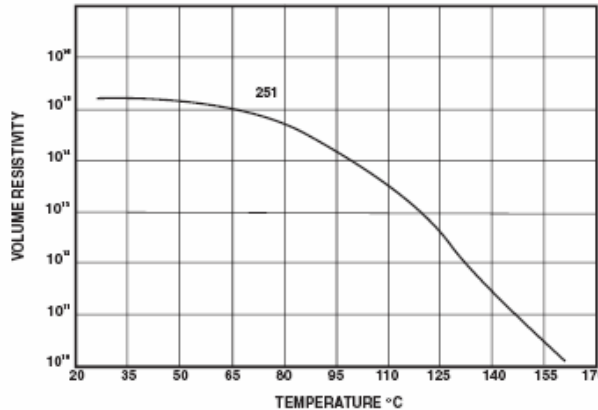


**DIELECTRIC CONSTANT**  
 Fed. Std. 406, Method 4021  
 (Test Frequencies in Hertz)



**DISSIPATION FACTOR**  
 Fed. Std. 406, Method 4021  
 (Test Frequencies in Hertz)

**VOLUME RESISTIVITY**  
 (OHM-CM)  
 Fed. Std. 406, Method 4041



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**3M**  
 Electrical Markets Division  
 6801 River Place Blvd.  
 Austin, TX 78726-9000  
 800/626-8381  
 FAX 800-828-9329  
 www.3M.com/electrical

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