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# 3M™ Scotchcast™ Electrical Resin 251

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

**Data Sheet** **April 2013**

**Description**

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

- High temperature
- Excellent electrical properties

**Handling Properties**

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

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**Typical Properties** Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (23°C) unless otherwise stated.

| **Physical Properties (*See Test Method Table)** | **Typical Value** US units (metric) |
|---|---|
| **Color** | Brown |
| **Hardness (Barcol)** | 40 |
| **Specific Gravity (cured)** | 1.50 |
| **Compressive Strength*[4]**<br>10% Compression | 17,500 psi<br>(1230 kg/cm$^2$) |
| **Tensile Strength*[5]** | 5280 psi<br>(371 kg/cm$^2$) |
| **Elongation*[5] (% at break)** | .7 |
| **Flexural Strength*[6]**<br>**1/2" x1/2" sample** | 9500 psi<br>(668 kg/cm$^2$) |
| **Electric Strength*[1]**<br>1/8" (3,75 mm) sample | 425 v/mil<br>(16,8 kV/mm) |
| **Thermal Conductivity*[2]**<br>Cal • cm/cm$^2$ • sec • °C | 8.0 x 10$^{-4}$ |
| **Coefficient of Linear Thermal Expansion*[2]**<br>(23-113°C (73.4-235.4°F)<br>(length/unit length/ºC) | 5 x 10$^{-5}$<br>X 10$^{-6}$ |
| **Thermal shock*[2]**<br>10 cycles – 55-105°C (131-221°F)<br>1/4" (6,35 mm) Olyphant Inserts | Passes |
| **Moisture Absorption*[2]**<br>% Weight increases<br>(240 hrs @ 96% R.H.) | .25 |
| **Heat Distortion Point*[3]** (264 psi) | 130ºC (266 ºF) |
| **Flammability*[2]** | Self-Extinguishing |
| **Water Immersion** (sample cured 2 hrs. @120°C)<br>% Weight Gain<br>1000 hrs @ 23°C - % weight gain<br>500 hrs @ 70°C - % weight gain<br>200 hrs @ 100°C | <br><br>,366<br>1.94<br>3.27 |
| **Thermal Aging**<br>1000 hrs @ 130°C - % Weight Loss<br>Hardness Change, Barcol<br>Dielectric Constant*[7], 100 Hz @23ºC)<br>Dissipation Factor*[1], (100 Hz @23ºC)<br>Volume Resistivity*[8], (Ohm-cm @23ºC | <br>.01<br>+7<br>4.35<br>.48<br>1 x 10$^{15}$ |

*See test method table next page

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**Typical Properties, *continued***

Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (23°C) unless otherwise stated.

| **Physical Properties, *continued* (See Test Method Table)** | **Typical Value** US units (metric) |
|---|---|
| **Thermal Aging** | |
| 1000 hrs @ 155°C - % Weight Loss | ,46 |
| Hardness Change, Barcol | +8 |
| Dielectric Constant*[7], 100 Hz @23ºC) | 5.61 |
| Dissipation Factor*[1], (100 Hz @23ºC) | .54 |
| Volume Resistivity*[8], (Ohm-cm @23ºC | 1 x $10^{15}$ |
| **Thermal Aging** | |
| 1000 hrs @ 180°C - % Weight Loss | 1.09 |
| Hardness Change, Barcol | +8 |
| Dielectric Constant*[7], 100 Hz @23ºC) | 4.80 |
| Dissipation Factor*[1], (100 Hz @23ºC) | .42 |
| Volume Resistivity*[8], (Ohm-cm @23ºC | 1 x $10^{15}$ |

**Test Methods**

| | |
|---|---|
| [1] – Fed. Std. No. 406, Method 4031 | [5] – Fed. Std. No. 406, Test Method 1011 |
| [2] – MIL-I-16923E | [6] – Fed. Std. No. 406, Test Method 1031 |
| [3] – ASTM D-648 | [7] – Fed. Std. No. 406, Test Method 4021 |
| [4] – Fed, Std, No, 406, Method 1021 | [8] – Fed. Std. No. 406, Test Method 4041 |

**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 ºC (302 ºF) 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.

### De-aerating

Entrained air can be removed by evacuating for 5 -15 minutes at 5-10mm of mercury (Hg) absolute pressure. Warming the resin to 60ºC (140ºF) aids air removal. The container sidewalls should be four times the height of the liquid resin to contain the foaming that takes place under vacuum.

### Casting and Impregnating

Pour the warm resin into the preheated 60-100ºC (140-212ºF) 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 120ºC (248ºF), thus lowering its viscosity below 200 centipoise. For maximum impregnation, evacuate for 5-15 minutes at 5mm of mercury (Hg) absolute pressure, or pour under vacuum and hold for several minutes before releasing.

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**Usage Information, *continued***

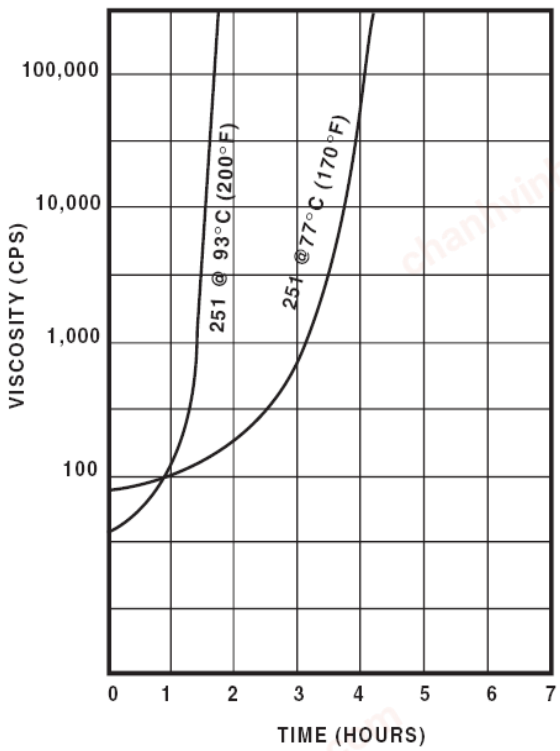
## Curing

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 75ºC (167ºF) 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 150ºC (302ºF) is suggested.

## 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.

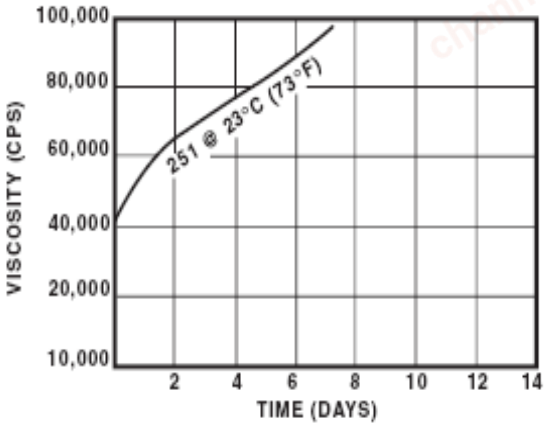
**Brookfield Viscosity vs. Time**
@77°C (170°F) & 93°C (200°F)

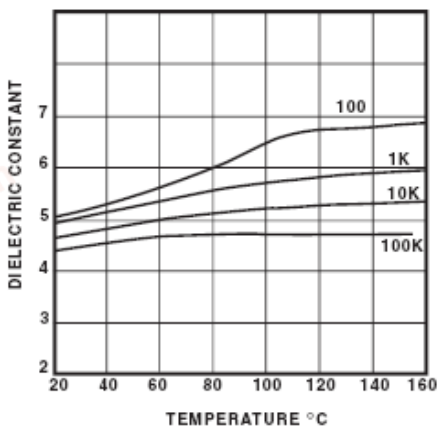


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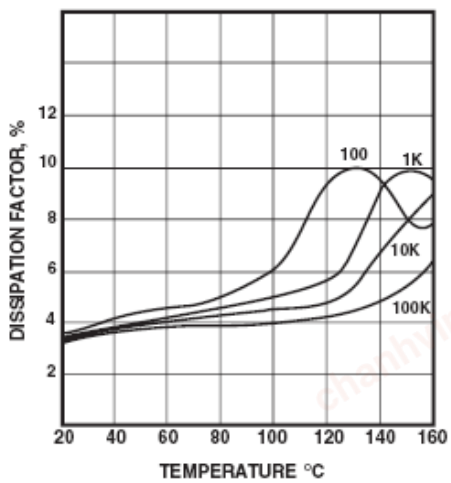
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**Brookfield Viscosity vs. Time**
@23°C (73°F)



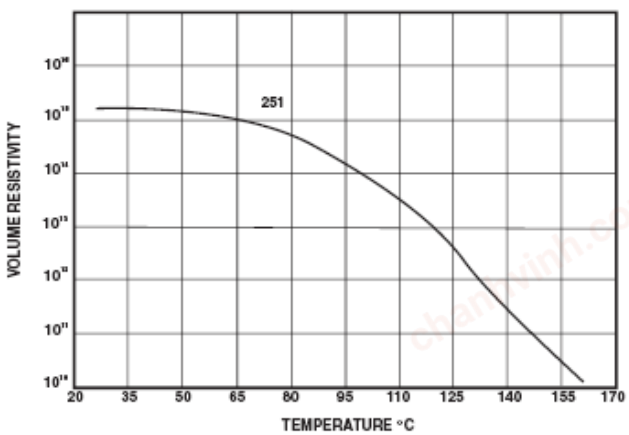




**DIELECTRIC CONSTANT**
Fed. Std. 406, Method 4021
(Test Frequencies in Hertz)




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

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



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| | |
|---|---|
| **Shelf Life & Storage** | All resins have a 2 year shelf life following the date of manufacture when stored in a humidity controlled storage (10°C/50°F to 27°C/80°F and <75% relative humidity). It is 3M's standard procedure to ship any resin product with at least 50% of its shelf life remaining. Any special request for a specific shelf life requirement may require a larger than stated MOQ that justifies a non-scheduled product run. Contact your 3M sale representative or Customer Service for specific shelf life MOQ requirements. No product returns will be accepted on special shelf life request orders. |
| **Availability** | Please contact your local distributor; available from 3M.com/electrical/oem [Where to Buy] or call 1-800-676-8381. |

| | |
|---|---|
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