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3M™ Scotchcast™ Electrical Resin 281

Two-Part, Semi-Flexible, Filled, Epoxy Liquid Resin

Data Sheet **May 2014**

Product Description

3M™ Scotchcast™ Electrical Resin 281 is characterized by high temperature and electrical stability, and excellent retention of flexibility, even after prolonged heat aging. It can be cured at low temperatures, but the optimum properties are obtained with the higher temperature cure schedules. This resin should be used instead of 3M Scotchcast Electrical Resin 241 where greater mechanical strength, higher tensile strength, better thermal shock ad higher thermal conductivity are required.

Resin Features

- High temperature rating (155°C – Class F)
- Low temperature curing
- High thermal conductivity

Applications

Impregnation and encapsulation of coils, transformers, motors and other electrical and electronic components

Handling Properties

Mix Ratio (A, B)	Wt 2:3 Vol (%) 37:63
Initial Viscosity @ 23°C (73°F)	A = 320,000 cps B – 38,000 cps Mixed = 75,000 cps
Density	A = 1.53 kg/l (12.77 lbs/gal) B = 1.35 kg/l (11.26 lbs/gal)
Flash Point	A = 202°C (395°F) B = 188°C (370°F)
Gel Time	21 min. @ 121°C
Curing Guide	75°C (167°F) 24 hrs 95°C (203°F) 6-8 hrs 120°C (248°F) 2-3 hrs

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Typical Properties

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

Physical Property (*See Test Method Table)	Typical Value US units (metric)
Color	Cream
Specific Gravity (Cured)	1.43
Compressive Strength*[1] 10% Compression	3500 psi (245 kg/cm^2)
Tensile Strength*[2] (1/8" x ½'"Sample)	2100 psi 147 kg/cm^2
Elongation*[2] (% @ break)	45
Flexural Strength*[3] (1/2" x ½" Sample)	1250 psi 87.5 kg/cm^2
Hardness (Shore D instantaneous)	65
Thermal Conductivity*[4] (Ca./sec/cm^2/ °C/cm)	12 x 10^{-4}
Coefficient of Linear Thermal Expansion*[2] (23°C to 113°C) (length/unit length/°C)	15 x 10^{-5}
Thermal Shock*[5] 10 cycles - 65°C to 130°C[5] 1/4" (6,350 mm) Olyphant Inserts	Pass
Thermal Shock*[4]	Pass
Moisture Absorption (% weight increase, 240 hrs. @ 96% RH)[4]	.32
Water Immersion (sample cured 3 hrs. @120°C) 100 hrs @ 23°C - % weight gain 500 hrs @ 70°C - % weight gain 200 hrs @ 100°C - % weight gain	 0.4 6.2 8.0
Thermal Aging (2 1/4 " x 2 1/4 " x 1/8" sample, 1000 hrs @130°C) % weight loss Hardness Change (Shore D) Dielectric Constant (100 hertz @23°C) Dissipation Factor (100 hertz @ 23°C) Volume Resisitivity*[6] (ohm-cm @ 23°C)	 .17 7 3.56 .054 >10^{15}
Thermal Aging (2 1/4 " x 2 1/4 " x 1/8" sample, 1000 hrs @155°C) % weight loss Hardness Change (Shore D) Dielectric Constant (100 hertz @23°C) Dissipation Factor (100 hertz @ 23°C) Volume Resisitivity*[6] (ohm-cm @ 23°C) Urethane (itself)	 2.2 15 4.03 .032 >10^{15}
Thermal Aging (2 1/4 " x 2 1/4 " x 1/8" sample, 1000 hrs @180°C) % weight loss Hardness Change (Shore D) Dielectric Constant (100 hertz @23°C) Dissipation Factor (100 hertz @ 23°C) Volume Resisitivity*[6] (ohm-cm @ 23°C)	 3.5 18 4.71 .041 >10^{15}

Electrical Property (*See Test Method Table)	Typical Value US units (metric)
Electric Strength*[3] 1/8" (3,175 mm) sample	350 V/mil (13,8 kV/mm)
Electric Strength*[2] [Volts/mil 1/8" (3,175 mm) sample]	375 (14,800 volts/mm)

*See test method table next page

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Test Method Table

[1]Fed. Std. N. 406, Method 1021	[4]Mil-16923
[2]Fed. Std. N. 406, Method 1011	[5]3M Test Method
[3]Fed. Std. N. 406, Method 1031	[6]Fed. Std. No. 406, Method 4041

Mixing

Mix the separate parts before removing them from their containers. They may be warmed to 60°C (140°F) to aid mixing. 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 until a homogenous mixture is attained.

De-aerating

Air introduced during mixing can be removed by evacuating for 5 to 15 minutes at 5 to 10 mm of mercury absolute pressure. Warming the resin to 60°C (140°F) aids air removal. The container side wall 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 100°C mold. If no mold is used, dip the preheated part into the resin. Heating the resin and mold aids impregnation. For maximum impregnation, evacuate for 5 to 15 minutes at 5 mm of mercury absolute pressure, or pour under vacuum and hold for several minutes before releasing.

Curing

Where minimum stress and maximum shock resistance are required, the lower temperature cure cycle is recommended. Time should be added to the cure cycle to allow the resin to reach the curing temperature.

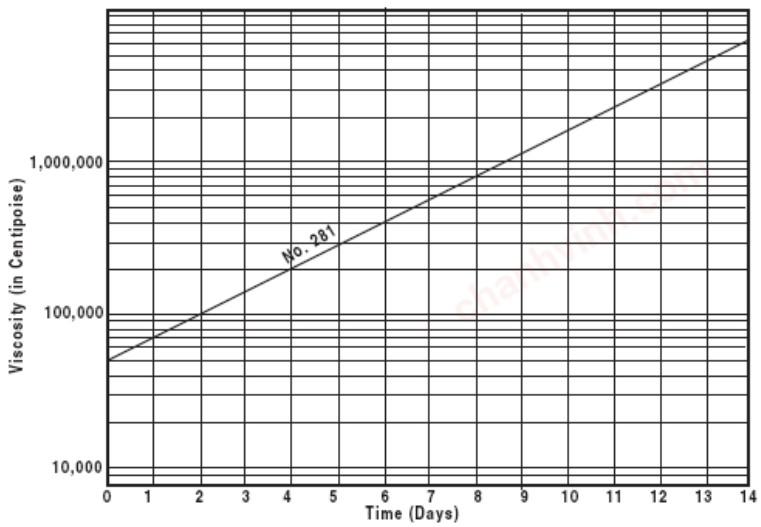
Handling & Safety

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.

Shelf-Life & Storage

These 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.

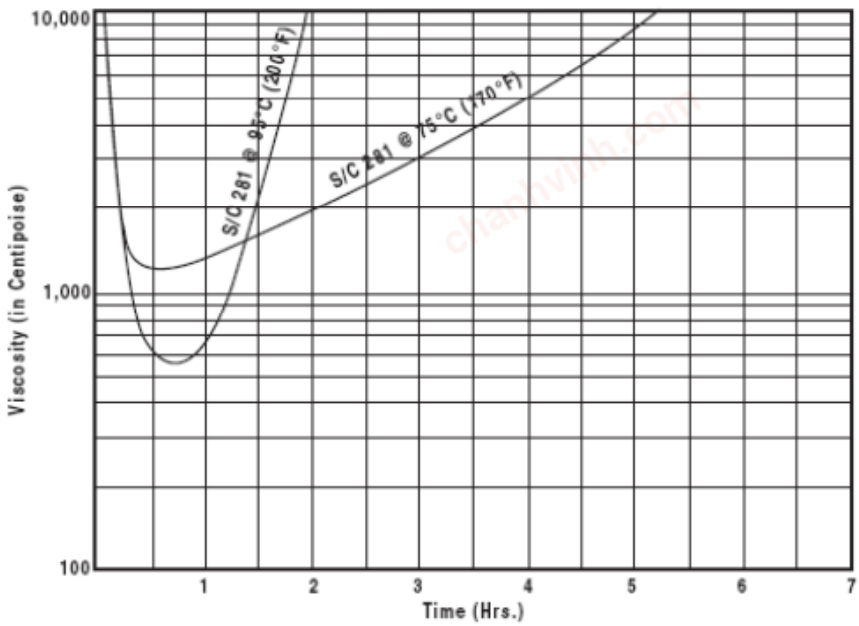
Brookfield Viscosity vs. Time @ 23°C (73°F)



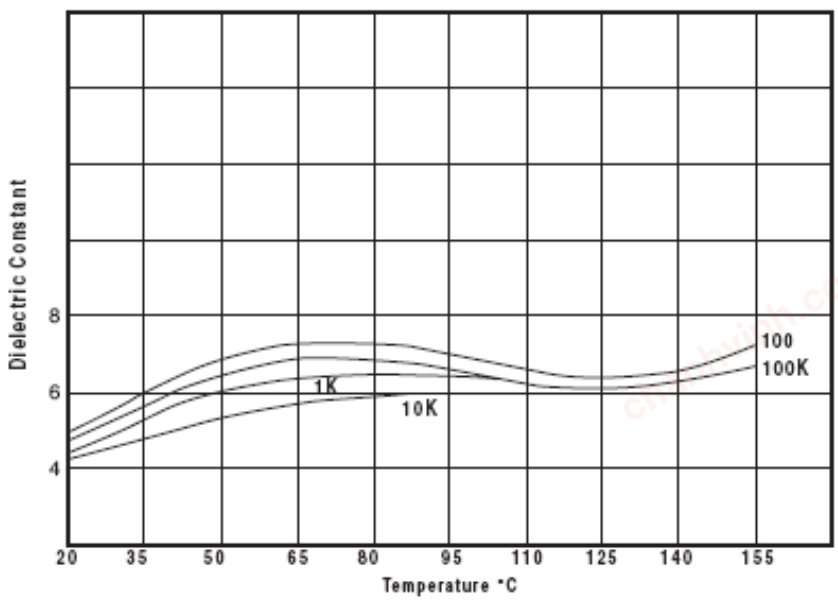
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Brookfield Viscosity vs. Time
@ 75°C (170°F) & 95°C (200°F)



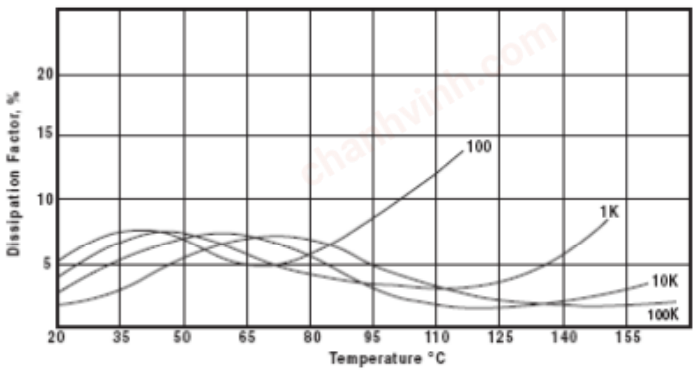
Dielectric Constant
Fed. Std. 406, Method 4021
(Test Frequencies in Hertz)



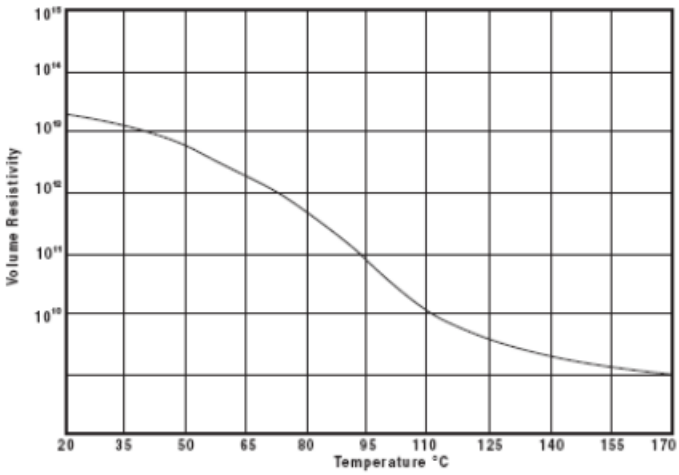
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Dissipation Factor
Fed. Std. 406, Method 4021
(Test Frequencies in Hertz)



Volume Resistivity
(OHM-CM)
Fed. Std. 406, Method 4041



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