

CONFORMAL COATINGS

PRINTED CIRCUIT BOARD PROTECTION
FOR EXTREME ENVIRONMENTS

Acrylic • Silicone • Polyurethane • Epoxy



mgchemicals.com

MG Chemicals[®]

Serving you since 1955

WHO IS MG CHEMICALS

MG Chemicals is a manufacturer and wholesaler of chemical products for the electronics industry. Our chemical products include dusters and circuit coolers, electronic cleaners, flux removers, contact cleaners, protective coatings, epoxies, adhesives, RTV silicones, lubricants, EMI/RFI shielding coatings, thermal management products, prototyping supplies, solders, and more. We also distribute related non-chemical products such as wipes, swabs, brushes, desoldering braids, and copper clad boards.

We specialize in the formulation and production of protective coatings for electronics: Conformal Coatings, Epoxy Potting & Encapsulating Compounds, and EMI/RFI Shielding Paints.



MG SERVICE

MG Chemicals recognizes that setting up production comes with various challenges. Our service team offers a wide variety of experience in material production, equipment, and technical issues you may encounter during planning, pilot studies, and production runs. To overcome these challenges, we offer professional services.

As a service, MG Chemicals can

- Provide advice on equipment and materials
- Assist with setup and troubleshooting
- Review your proposed application processes
- Suggest ways of optimizing and customizing processes to best meet your needs
- Offer training on the proper use of our epoxy products.

Quality Assurance

Since 1955, MG Chemicals has provided the North American electronics industry with a full line of high performance chemicals and accessories. The MG Chemicals manufacturing facility operates under the ISO 9001 Quality System Standard. All products undergo MG Chemicals' design process including the testing and analysis of each product to maximize performance, user safety, environmental safeguards and market desirability.

Customer Care

Customer care is what separates MG Chemicals from the rest. Our commitment to all of these principles focus on getting you the quality product and support you deserve.



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COMPARISON CHART - CONFORMAL COATINGS

| | 422B | 419C | 419D | 4223 | 4223D/4223F (Xylene Free) | 4224 |
|--|------------------------|-------------------------|-----------------------|------------------------|------------------------------|-------------------------|
| Type | Modified Silicone | Acrylic | Acrylic | Urethane | Urethane | Epoxy |
| Uncured Working Properties | | | | | | |
| Formats | Liquid Aerosol | Liquid Aerosol | Liquid | Liquid | Liquid | Liquid |
| Color | Clear | Clear | Clear | Clear amber | Clear amber | Clear |
| Solid% Liquid (w/w) | 25 | 16 | 29.5 | 32 | 44.8 | 88 |
| Solid% Aerosol | 15 | 8.4 | – | – | – | – |
| Density (g/mL) | 0.90 | 0.87 | 0.92 | 0.94 | 0.97 | 1.03 |
| Viscosity (cP) | 13 | 7.2 | 100 | 200 | 300 | 73 |
| VOC (Liquid g/L) | 430 | 581 | 647 | 571 | 534 | 123 |
| Shelf life (y) | ≥3 | ≥3 | ≥3 | ≥3 | ≥3 | ≥5 |
| Coverage & Application Properties | | | | | | |
| Coverage per Liter | <117 ft ² * | <67.8 ft ² * | <62 ft ² * | <136 ft ² * | <123 ft ² * | <240 ft ² ** |
| Coverage per 340g spray can | <28 ft ² * | <13.7 ft ² * | | | | |
| Dry to touch (min) | 5-7 | 3-5 | 10-15 | 60 | 10-15 | – |
| Recoat time (min) | 5 | 2 | 2 | 30 | 3 | – |
| Cure time at room temp. (h) | 48 | 24 | 24 | 24 | – | – |
| Cure time at 65 °C (min) | 20 | 30 | 60 | 60 | – | – |
| Cure time at 80°C (h) | – | – | – | – | 24 | 2 |
| Physical Properties | | | | | | |
| Solderability | Excellent | Excellent | Excellent | Good | Good | No |
| Fungus Resistance | Excellent | Excellent | Excellent | Excellent | Excellent | Good |
| Chemical Resistance | Poor | Poor | Poor | Excellent | Excellent | Excellent |
| Electrical Properties | | | | | | |
| Dielectric Strength (V/mil) | 1056 | – | 1100 | 1800 | 1020 | 600 |
| Dielectric Withstand Voltage (V) | >1500 | >1500 | >1500 | >1500 | >1500 | >1500 |
| Insulation Resistance 24 hr.(ohm) | – | 5x10 ¹² | ~10 ¹² | ~10 ¹² | ~10 ¹² | – |
| Thermal Properties | | | | | | |
| Constant Service Temp. (°C) | (-40 to 200) | (-40 to 120) | (-40 to 120) | (-40 to 145) | (-40 to 145) | (-40 to 200) |
| [°F] | [-40 to 392] | [-40 to 248] | [-40 to 248] | [-40 to 293] | [-40 to 293] | [-40 to 392] |
| Tg (°C) | 32 | 46 | 43 | – | – | 113 |
| UL 94 Flammability Classification | V-0 | V-0 | V-0 | V-1 | V-0 | – |


* based on 1 mil thickness, 65% transfer efficiency

** based on 2 mil thickness, 65% transfer efficiency

WHY USE COATING?

Protective coatings are necessary to ensure a long and effective working life of electrical and electronic components. MG Chemicals offers a wide range of coatings suitable for protecting circuit boards, windings & coils, transformers, field coils, and stator windings from electrical arcing, environmental factors, and physical force.

WHAT IS ARCING?

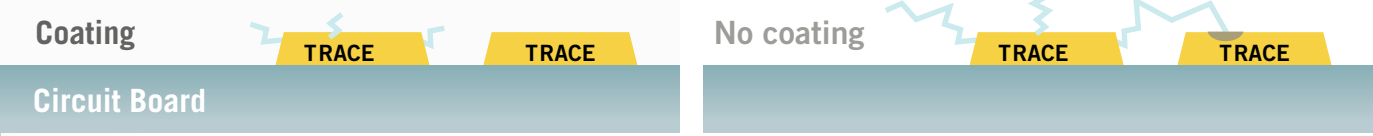


The diagram shows a cross-section of a circuit board with two yellow traces on a grey substrate. A jagged blue lightning bolt represents an electrical arc jumping between the two traces.

Arcing occurs when voltage jumps from one surface to another due to the close proximity of parallel currents. The result is a board malfunction or damaged components. It may occur on any circuitboard without a coating.

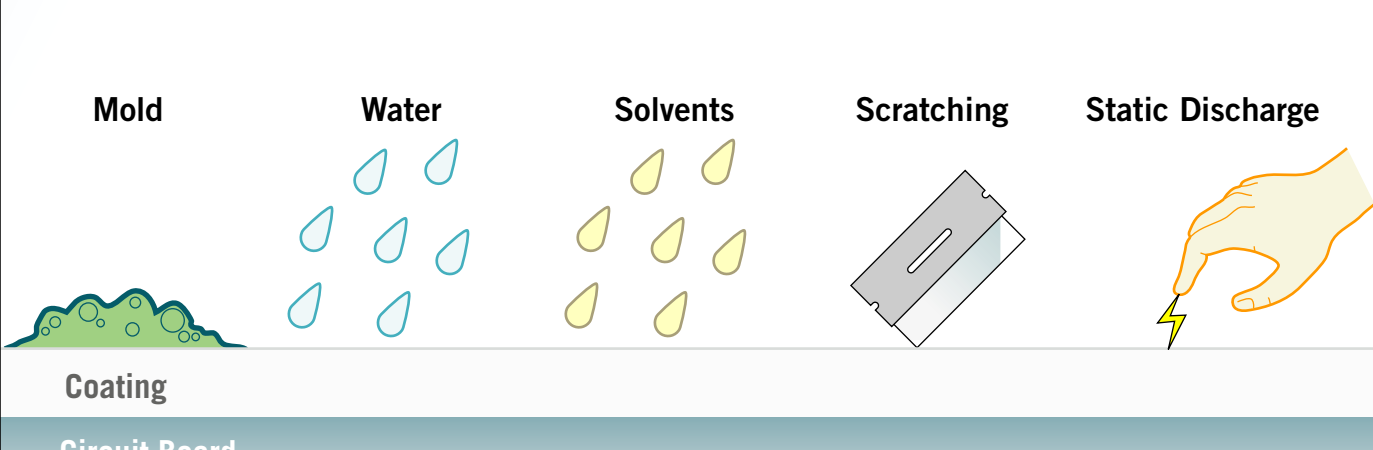
WHAT CAN COATINGS DO?

RESIST ARCING



This diagram compares two circuit board scenarios. On the left, labeled 'Coating', a grey layer is applied over the yellow traces, and small blue lightning bolts are shown being blocked by the coating. On the right, labeled 'No coating', the traces are exposed, and larger blue lightning bolts are shown jumping between them.

RESIST ARCING



This diagram illustrates various threats to a coating on a circuit board. The top row shows five categories: 'Mold' (green mold), 'Water' (blue droplets), 'Solvents' (yellow droplets), 'Scratching' (a grey razor blade), and 'Static Discharge' (a hand with a lightning bolt). The bottom row shows a cross-section of a 'Coating' layer on a 'Circuit Board' substrate.

CONFORMAL COATING APPLICATION INSTRUCTIONS

SPRAY GUN APPLICATION INSTRUCTIONS

Follow the procedure below for best results.

TO APPLY THE REQUIRED THICKNESS BY WEIGHT:

1. Mix thoroughly, and spray a test pattern. This step ensures good flow quality and helps establish appropriate distance to avoid runs.
2. At a distance of 20 to 25 cm (8 to 10 inches), hold the gun at around 45°, and spray a thin and even coat onto the horizontal board. For best results, use spray-and-release strokes with an even motion to avoid excess paint in one spot.
3. Before the next coat, rotate the board 90° to ensure good coverage.
4. Wait at least 2 minutes, and spray another coat. The delay avoids trapping solvent between coats.
5. Apply other coats until desired thickness is achieved. (Go to Step 3)
6. Let dry for 3-5 minutes (flash off time) at room temperature.

TO CURE AT ROOM TEMPERATURE:

Let air dry 24 hours

TO ACCELERATE CURE BY HEAT:

After flash off, put in oven or under heat lamp at ≤ 65 °C for 60 min

ATTENTION!

If heat curing, do not exceed 65 °C as this may cause surface defects due to solvents evaporating off too quickly.

NOTE

Coats that are very thick require more time to dry.

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ACRYLIC CONFORMAL COATING II - FAST CURE

Our 419C Acrylic Conformal Coating is an IPC 830 certified, fast drying, xylene and toluene free product that provides an excellent finish. This one part coating is easy to use and does not require special or costly equipment to apply. It is ideal for high moisture environments and applications requiring easy repair and rework.

The 419C coating protects electric circuits against moisture, dirt, dust, thermal shocks, and scratches that could corrode, short circuit, or otherwise damage the electric component. It insulates against high-voltage arcing, shorts, and static discharges. As well as, this coating provides a high dielectric withstand voltage that allows traces to be put closer together helping with miniaturization.

- **Super fast cure** — reduces production and maintenance bottlenecks
- **No Hazardous Air Pollutants** — free of toluene and xylene
- **Externally Qualified to IPC-CC-830B by Pacific Testing Laboratories, Inc.**
- **UL Recognized for Flame Class 94 V-0 (E203094)**
- **Excellent finish** — smooth, homogeneous, and durable crystal clear coat
- **Protects electronics from moisture, corrosion, fungus, and static discharges**
- **Easy to inspect** — fluoresces under UV (UV-A blacklight)
- **Easy rework and repairs** — can solder through coat; remove with MG Chemicals' Thinner/Cleaner (cat. no. 435-1L) or Conformal Coating Stripper (cat. no. 8310-100ML)

| Catalog Number | Sizes Available | Description |
|----------------|-----------------|-------------|
| 419C-55ML | 55 ml (2 oz) | Bottle |
| 419C-340G | 340 g (12 oz) | Aerosol |
| 419C-1L | 1 L (1 quart) | Liquid |
| 419C-4L | 4 L (1 gal) | Liquid |
| 419C-20L | 20 L (5.3 gal) | Liquid |



CURING & WORK SCHEDULE

| | Test Method | Result |
|---------------------------------------|-----------------|--|
| Aerosol | | |
| Tack Free | | 3–5 minutes |
| Recoat Time | | 2 minutes |
| Full Cure | @ 25 °C [77 °F] | 24 hours |
| Full Cure | @ 65°C [149 °F] | 30 minutes |
| Service Temperature | | –65 to +120 °C [–85 to +248 °F] |
| Max Coverage for 25 µm [1 mil] | | < 12,800 cm ² [< 13.7 ft ²] |
| Liquid | | |
| Tack Free | | 3–5 minutes |
| Recoat Time | | 2 minutes |
| Full Cure | @ 25 °C [77 °F] | 24 hours |
| Full Cure | @ 65°C [149 °F] | 30 minutes |
| Service Temperature | | –65 to +120 °C [–85 to +248 °F] |
| Max Coverage per 1L for 25 µm [1 mil] | | < 63,000 cm ² [< 67.8 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|--------------------|--------------------|---------------|
| Color | Visual | Crystal Clear |
| Solderability | — | Excellent |
| Weather Resistance | — | Excellent |
| Fungus Resistance | IPC-TM-650 2.6.1.1 | Excellent |
| Flexibility | IPC-TM-650 2.4.5.1 | Excellent |
| Flammability | UL registered | 94V-0 |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|--|-------------------------|------------------------|
| Dielectric Withstand Voltage per | IPC-TM-650 | > 1,500 V |
| Insulation Resistance (after 24 hours) | IPC-TM-650 Test 2.6.3.4 | 5 x 10 ¹² Ω |

ENVIRONMENTAL & AGING STUDY

| | Test Method | Result |
|---|-----------------|----------------------|
| Salt Spray Test: 7 day @35 °C +Salt/Fog | ASTM B117-2011 | |
| Cross-hatch adhesion | ASTM D3359-2009 | 5B = 0% area removed |
| Cracking, unwashed area | ASTM D661-93 | None |
| Visual Color, unwashed area | ASTM D1729-96 | No change |
| Peeling, unwashed area | ASTM D1729-96 | None |

UNCURED PROPERTIES

| | Test Method | Result |
|--------------------------|----------------|--------------------------------|
| Odor | — | Ether-like, gasoline and minty |
| Viscosity @23 °C [73 °F] | Brookfield SP1 | 7.2 cP [0.0072 Pa·s] |
| Density | MIL-STD-45662A | 0.874 g/ml |
| Flash Point | Closed Cup | –19 °C [–2.2 °F] |
| Boiling Point | | ≥ 66 °C [≥ 150 °F] |
| Solids Content (w/w) | | 15.8% |

AR+

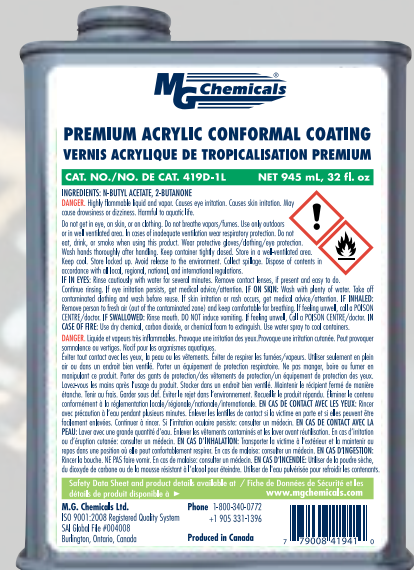
PREMIUM ACRYLIC CONFORMAL COATING

Our 419D Acrylic Conformal Coating is a fast drying, xylene and toluene free product that provides an excellent finish. This one part coating is easy to use and repair: it does not require special or costly equipment or materials. It is ideal for high moisture environments and applications requiring easy repair and rework.

The 419D coating protects electric circuits against moisture, dirt, dust, thermal shocks, and scratches that could corrode, short circuit, or otherwise damage the electric components. It insulates against high-voltage arcing, shorts, and static discharges. As well, this coating provides a high dielectric withstand voltage that allows traces to be put closer together helping with miniaturization.

- **No Hazardous Air Pollutants** — free of toluene and xylene
- **Certified UL 94V-0 (File# E202094)**
- **Excellent finish** — smooth, homogeneous, and durable crystal clear coat
- **Protects electronics from moisture, corrosion, fungus, and static discharges**
- **Easy to inspect** — fluoresces under black light (UV light)
- **Easy rework and repairs** — can solder through coat; remove with MG Chemicals' Thinner/Cleaner, Thinner 4, or Conformal Coating Stripper

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 419D-1L | 945 mL (32 fl. oz) | Liquid |
| 419D-4L | 3.8 L (1 gal) | Liquid |
| 419D-20L | 18.9 L (5 gal) | Liquid |



CURING & WORK SCHEDULE

| | Test Method | Result |
|--------------------------------|------------------|--|
| Dry to Touch | | 10–15 minutes |
| Shelf Life | | 3 years |
| Recoat time | | 2–3 minutes |
| Full Cure | @ room temp. | 24 hours |
| Full Cure | @ 65 °C [149 °F] | 60 minutes |
| Storage Temperature Limits | | –5 to +40 °C [+23 to +104°F] |
| Service Temperature | | –40 to +120 °C [–40 to +248 °F] |
| Maximum coverage per liter | | ≤ 75,500 cm ² [≤ 62 ft ²] |
| Maximum coverage per US gallon | | ≤ 286,000 cm ² [≤ 308 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|--------------------|----------------------|---------------|
| Color | Visual | Crystal Clear |
| Solderability | — | Excellent |
| Weather Resistance | — | Excellent |
| Fungus Resistance | IPC-TM-650 2.6.1.1 | Excellent |
| Flexibility | IPC-TM-650 2.4.5.1 | Excellent |
| Flammability | In-house 94V testing | 94V-0 |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|--|-------------------------|----------------------|
| Dielectric Withstand Voltage | per IPC-TM-650 | > 1,500 V |
| Insulation Resistance (after 24 hours) | IPC-TM-650 Test 2.6.3.4 | ~ 10 ¹² Ω |

UNCURED PROPERTIES

| | Test Method | Result |
|----------------------------|----------------|--------------------|
| Odor | — | |
| Viscosity at 23 °C [73 °F] | Brookfield SP1 | 100 cP [0.10 Pa·s] |
| Density | ASTM D 1475 | 0.92 g/ml |
| Flash Point | Closed Cup | –3 °C [26 °F] |
| Boiling Point | | ≥ 80 °C [≥ 176 °F] |
| Solids Content (w/w) | | 29.5% |

SR

SILICONE CONFORMAL COATING

Ideal for high temperature environments. Silicone Conformal Coating (422B) is a flexible finish product that provides a protective coating for printed circuit boards against moisture, corrosion, and thermal shock. It protects and insulates electrical and electronic components and assemblies, including generators, motors, transformers, relays, and solenoid coils. For spraying, liquid can be thinned using M.G. Thinner Cleaner. Thin up to one half part thinner to one part coating.

- **Certified UL 94V-0** (File # E203094)
- **Maximum Service Temperature of 200 °C**
- **Fast cure** — tack free in 6 min at room temperature, full cure in 20 min at 65 °C
- **Protects electronics from moisture, corrosion, fungus, thermal shock, and static discharges**
- **Easy to inspect:** fluoresces blue at 437 nm ± 65 nm under UVA light
- **Extended Shelf Life avoids worries about premature hardening and wastage**
- **Easy rework and repairs:** Solders through the coat removable with Cat. No. 435 Thinner or Cat. No. 8310 Stripper

| Catalog Number | Sizes Available | Description |
|----------------|------------------|-------------|
| 422B-55ML | 55 mL (2 oz) | Liquid |
| 422B-340G | 340 g (12 oz) | Aerosol |
| 422B-1L | 950 mL (1 quart) | Liquid |
| 422B-4L | 4 L (1 gal) | Liquid |
| 422B-20L | 20 L (5.3 gal) | Liquid |
| 422B-P | 5 mL (0.16 oz) | Pen |



CURING & WORK SCHEDULE

| | Test Method | Result |
|--|----------------|---------------------------------|
| Aerosol | | |
| Dry to Touch | | 5–7 minutes |
| Shelf life | | 5 years |
| Full Cure | @20°C [68 °F] | 48 hours |
| Full Cure | @65°C [149 °F] | 20 minutes |
| Service Temperature | | -40 to +200 °C [-40 to +392 °F] |
| Max Coverage for 25 µm [1 mil] | | < 26,000 cm² [< 28 ft²] |
| Liquid | | |
| Dry to Touch | | 5–7 minutes |
| Shelf life | | 3 years |
| Full Cure | @20°C [68 °F] | 48 hours |
| Full Cure | @65°C [149 °F] | 20 minutes |
| Service Temperature | | -40 to +200 °C [-40 to +392 °F] |
| Max Coverage per 1 L for 25 µm [1 mil] | | < 109,00 cm² [< 117 ft²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|--------------------------------|-------------------------|------------------|
| Color | Visual | Clear |
| Solderability | — | Fair |
| Flexibility | | Excellent |
| Flammability | 94V (UL File # E203094) | 94V-0 |
| UV inspection absorption max | Absorption spectrum | 375 nm (near UV) |
| UV inspection fluorescence max | Emission spectrum | 437 nm (blue) |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|--------------------------------------|-------------------------|---|
| Dielectric Strength at 0.0150 inches | IPC-TM-650 Test 2.5.6.1 | 1,056 V/mil |
| Volume Resistivity @23 °C 50% RH | ASTM D 257-07 | $1.2 \times 10^{15} \Omega \cdot \text{cm}$ |
| Surface Resistivity | ASTM D 257-07 | $4.5 \times 10^{15} \Omega / \text{sq}$ |
| Dielectric Constant @60 Hz & 25 °C | ASTM D 150-98 | 2.35 |
| Dielectric Constant @1 MHz & 25 °C | ASTM D 150-98 | 1.99 |
| Dissipation Factor @60 Hz & 25 °C | ASTM D 150-98 | 0.037 |
| Dissipation Factor @1 MHz & 25 °C | ASTM D 150-98 | 0.012 |

CURED PROPERTIES: THERMAL

| | Test Method | Result |
|----------------------------------|------------------------|-------------------|
| Coefficient of Thermal Expansion | IPC-TM-650 Test 2.4.24 | 253.3 ppm/°C |
| Softening Point | IPC-TM-650 Test 2.4.24 | 31.4 °C [88.5 °F] |

ENVIRONMENTAL & AGING STUDY

| | Test Method | Result |
|--|-----------------|----------------------|
| Salt Spray Test: 7 day @ 35 °C +Salt/Fog | ASTM B117-2011 | |
| Cross-hatch adhesion | ASTM D3359-2009 | 5B = 0% area removed |
| Cracking, unwashed area | ASTM D661-93 | None |
| Visual Color, unwashed area | ASTM D1729-96 | No change |
| Peeling, unwashed area | ASTM D1729-96 | None |

UNCURED PROPERTIES

| | Test Method | Result |
|---------------------------|----------------|-----------------------------|
| Odor | — | Ethereal |
| Viscosity at 23°C [73 °F] | Brookfield SP1 | 13 cP [0.013 Pa·s] |
| Density | | 0.90 g/mL |
| Flash Point | Closed Cup | -18°C [-0.40 °F] |
| Boiling Point | | 55 °C [131 °F] |
| Solids Content (w/w) | | 27% (liquid); 17% (aerosol) |

UR POLYURETHANE CONFORMAL COATING

Our 4223 Urethane Conformal Coating offers a highly chemical-resistant finish that meets UL standards for indoor conformal coatings. This one part coating is easy to use: it does not require special or costly equipment to apply. It is ideal for extremely corrosive environments.

The 4223 polyurethane protects electric circuits against corrosive chemicals, moisture, dirt, dust, thermal shocks, and scratches. This avoids corrosion and physical damages to electric components. It also insulates against high-voltage arcing, shorts, and static discharges.

- **Excellent Chemical and Abrasion Resistance**
- **Meets indoor UL conformal coating specifications for a 2 mil thick coat on a 0.8mm, FR-4 laminate**
- **Flammability:** meets UL 94V-1
- **Class F Temperature Rating: 160 °C [320 °F]**
- **Transparent Appearance:** the clear amber coat lets you see problems if they occur
- **Protects electronics from chemical corrosion, oil, moisture, fungus, and static discharges**
- **Good Fungus Resistance**
- **Easy to inspect:** fluoresces under UV light

| Catalog Number | Sizes Available | Description |
|----------------|------------------|-------------|
| 4223-55ML | 55 mL (2 oz) | Liquid |
| 4223-1L | 950 mL (1 quart) | Liquid |
| 4223-4L | 4 L (1 gal) | Liquid |
| 4223-20L | 20 L (5.3 gal) | Liquid |



CURING & WORK SCHEDULE

| | Test Method | Result |
|--------------------------------|-----------------------------------|--|
| Dry to Touch | | 30 minutes |
| Shelf life | | 3 years |
| Full Cure | @ 20°C [68 °F] @ 65°C [149 °F] | 24 hours 60 minutes |
| Service Temperature | | -40 to +160 °C [-40 to +320 °F] |
| Max Coverage for 25 µm [1 mil] | | < 127,000 cm ² [< 136 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|---------------------|--------------|-------------|
| Color | Visual | Clear amber |
| Solderability | — | Good |
| Flexibility | | Good |
| Flammability | UL 94 | Meets 94V-1 |
| Abrasion Resistance | — | Superior |
| Fungus Resistance | MIL-V-173C-2 | Meets |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|-----------------------------------|-------------|-------------------|
| Dielectric Strength (dry) | ASTM D 115 | 1,800 V/mil |
| (wet) | ASTM D 115 | 1,200 V/mil |
| Dielectric Withstand Voltage (V) | | >1500 |
| Insulation Resistance 24 hr.(ohm) | | ~10 ¹² |

CHEMICAL RESISTANCE

| | Test Method | Result |
|------------------------------|-------------|-----------|
| Water | — | Good |
| Acid (10% sulfuric acid) | — | Excellent |
| Alkali (1% sodium hydroxide) | — | Excellent |
| Salt water | — | Excellent |
| Oil | ASTM D-115 | Passed |
| Copper corrosion | — | None |

UNCURED PROPERTIES

| | Test Method | Result |
|----------------------------|----------------|-----------------|
| Odor | — | Aromatic |
| Viscosity at 23°C [73 °F] | Brookfield SP1 | 200 cP |
| Density | | 0.90 g/mL |
| Flash Point | ASTM D 3278 | 27 °C [81°F] |
| Boiling Point | | Not established |
| Solids Content (w/w) | | 32% |
| Dry Film Thickness per dip | | ~25 to 38 µm |
| Dry Film Thickness per dip | | ~1 to 1.5 mil |

UR+

PREMIUM POLYURETHANE CONFORMAL COATING

Our 4223D Premium Polyurethane Conformal Coating is a heat curing, one part product that provides an excellent scratch and chemical resistant finish. This one part coating is easy to use and repair: it does not require special or costly equipment or materials. It is ideal for chemically challenging environments.

The 4223D urethane protects electric circuits against aggressive chemicals, moisture, dirt, dust, thermal shocks, and scratches. This avoids corrosion and physical damages to electric components. It insulates against high-voltage arcing, shorts, and static discharges, allowing for traces to be put closer to one another.

Applications & Usages

The 4223D coating improves reliability, operational range, and lengthens the life of electrical and electronic components and assemblies. It finds application specially for corrosive environments such as those found in the farming, mining, smelting, oil exploration, and marine industries.

Common urethane conformal coatings uses are with electric generators, motors, transformers, relays, and air bag controllers. Commercial applications include fire alarms components, sensors, automotive electronics, electrical connectors, and porcelains.



- **Type UR**
- **UL Recognized conformal coating (UL 746E File # E203094)**
- **Excellent finish**—smooth, flexible, mar resistant
- **High Chemical Resistance**—resists water, solvents, and most household chemicals
- **Durable**—abrasion resistant
- **Protects electronics from moisture, corrosion, fungus, and static discharges**
- **Easy to inspect**—fluoresces under black light (UV light)
- **Easy rework and repairs**—can solder through coat
- **Removable with MG 8312 Urethane Conformal Coating Stripper**
- **Free of isocyanate**

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4223D-1L | 945 mL (32 fl. oz) | Liquid |
| 4223D-4L | 3.8 L (1 gal) | Liquid |
| 4223D-20L | 20 L (5 gal) | Liquid |

CURING & WORK SCHEDULE

| | Test Method | Result |
|--------------------------------|------------------|--|
| Dry to Touch | | 10–15 minutes |
| Recoat time | | 2–3 minutes |
| Full Cure | @ 80 °C [176 °F] | 24 hours |
| Shelf Life | | 2 years |
| Storage Temperature Limits | | -5 to +40 °C [+23 to +104°F] |
| Service Temperature | | -40 to +145 °C [-40 to +293 °F] |
| Maximum coverage per liter | | ≤ 114,000 cm ² [≤ 123 ft ²] |
| Maximum coverage per US gallon | | ≤ 435,000 cm ² [≤ 468 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|---------------------|----------------------|-------------------|
| Color | Visual | Clear, amber tint |
| Solderability | — | Good |
| Chemical Resistance | — | Excellent |
| Weather Resistance | — | Excellent |
| Fungus Resistance | IPC-TM-650 2.6.1.1 | Pending |
| Flexibility | IPC-TM-650 2.4.5.1 | Pending |
| Flammability | In-house 94V testing | 94V-0 |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|--|-------------------------|-----------|
| Dielectric Strength (Volts/mil) | | 1,020 |
| Dielectric Withstand Voltage | per IPC-TM-650 | > 1,500 V |
| Insulation Resistance (after 24 hours) | IPC-TM-650 Test 2.6.3.4 | ~101 |

UNCURED PROPERTIES

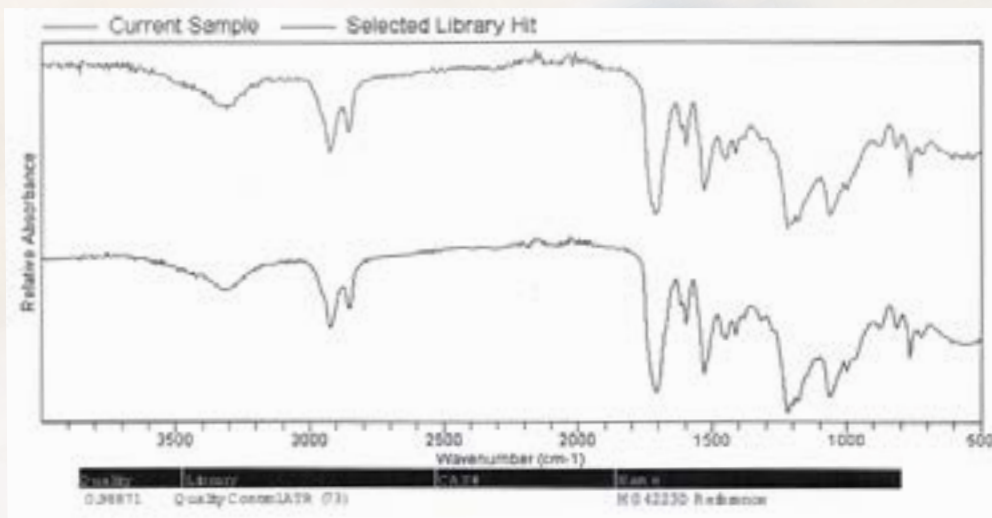
| | Test Method | Result |
|--------------------------|----------------|---------------------|
| Odor | — | Mild, pungent |
| Viscosity @25 °C [77 °F] | Brookfield SP1 | 330 cP [0.330 Pa·s] |
| Density | ASTM D 1475 | 0.97 g/ml |
| Flash Point | Closed Cup | -3 °C [26 °F] |
| Boiling Point | | ≥ 80 °C [≥ 176 °F] |
| Solids Content (w/w) | | 44.8% |

UR+

PREMIUM POLYURETHANE CONFORMAL COATING – XYLENE & TOLUENE FREE

Our 4223F Polyurethane Conformal Coating is a xylene-free version of our 4223D Polyurethane Conformal Coating. In its cured state the 4223F is identical to the 4223D coating (see figure 1) and exhibits the same performance. It is a heat curing, one part product that provides an excellent scratch and chemical resistant finish. This one part coating is easy to use and repair: it does not require special or costly equipment or materials. It is ideal for chemically challenging environments.

The 4223F urethane protects electric circuits against aggressive chemicals, moisture, dirt, dust, thermal shocks, and scratches. This avoids corrosion and physical damages to electric components. It insulates against high-voltage arcing, shorts, and static discharges, allowing for traces to be put closer to one another.



- **Certified UL 94V-0 (File # E203094)**
- **Excellent finish**—smooth, flexible, mar resistant
- **High Chemical Resistance**—resists water, solvents, and most household chemicals
- **Durable**—abrasion resistant
- **Protects electronics from moisture, corrosion, fungus, and static discharges**
- **Easy to inspect**—fluoresces under black light (UV light)
- **Easy rework and repairs**—can solder through coat; removable with MG 8312 **Conformal Coating Stripper**
- **Free of isocyanate**

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4223F-1L | 945 mL (32 fl. oz) | Liquid |
| 4223F-4L | 3.8 L (1 gal) | Liquid |
| 4223F-20L | 20 L (5 gal) | Liquid |



CURING & WORK SCHEDULE

| | Test Method | Result |
|--------------------------------|------------------|--|
| Dry to Touch | | 10–15 minutes |
| Recoat Time | | 2–3 minutes |
| Full Cure | @ 80 °C [176 °F] | 24 hours |
| Shelf Life | | 1 year |
| Storage Temperature Limits | | –5 to +40 °C [+23 to +104°F] |
| Service Temperature | | –40 to +145 °C [–40 to +293 °F] |
| Maximum coverage per liter | | ≤ 114,000 cm ² [≤ 123 ft ²] |
| Maximum coverage per US gallon | | ≤ 435,000 cm ² [≤ 468 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|---------------------|----------------------|-------------------|
| Color | Visual | Clear, amber tint |
| Solderability | — | Good |
| Chemical Resistance | — | Excellent |
| Weather Resistance | — | Excellent |
| Fungus Resistance | IPC-TM-650 2.6.1.1 | Pass |
| Flexibility | IPC-TM-650 2.4.5.1 | Pass |
| Flammability | In-house 94V testing | 94V-0 |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|--|-------------------------|---------------------|
| Dielectric Strength (Volts/mil) | | 1,020 |
| Dielectric Withstand Voltage | per IPC-TM-650 | > 1,500 V |
| Insulation Resistance (after 24 hours) | IPC-TM-650 Test 2.6.3.4 | ~10 ¹² Ω |

UNCURED PROPERTIES

| | Test Method | Result |
|--------------------------|----------------|---------------------|
| Odor | — | Mild, pungent |
| Viscosity @25 °C [77 °F] | Brookfield SP1 | 330 cP [0.330 Pa·s] |
| Density | ASTM D 1475 | 0.88 g/ml |
| Flash Point | Closed Cup | –3 °C [26 °F] |
| Boiling Point | | ≥ 80 °C [≥ 176 °F] |
| Solids Content (w/w) | | 44.8% |



OPTICALLY CLEAR CONFORMAL COATING EPOXY

Our 4224 Optically Clear Conformal Coating Epoxy offers a very strong and UV-resistant finish. This two part coating is easy to use: it does not require special or costly equipment to apply.

The 4224 epoxy coating protects electric circuits against corrosive chemicals, moisture, dirt, dust, thermal shocks, and scratches. This avoids corrosion and physical damages to electric components. It also insulates against high-voltage arcing, shorts, and static discharges.

Applications & Usages

The 4224 Optically Clear Conformal Coating Epoxy improves reliability, operational range, and lengthens the life of electronic and LED parts. You will find it mainly in corrosive environments such as farming, mining, smelting, oil exploration, and marine industries. As well, it applies to any other areas where corrosion must be avoided.

Common epoxy conformal coatings industrial uses are with electric generators, motors, transformers, relays, and equipment controllers. Commercial applications span fire alarms, sensors, automotive electronics, electrical connectors, and porcelains.

- **Excellent Chemical and Abrasion Resistance**
- **Optically Clear:** Transmission @25 μm [1 mil] <4.5% loss in optical range
- **UV light stable:** non yellowing
- **Protects electronics from chemicals corrosion, oil, moisture, fungus, and static discharges**

| Catalog Number | Sizes Available | Description |
|----------------|---------------------|-------------|
| 4224-1 | 1125 mL (38 fl. oz) | Liquid |
| 4224-2 | 4.5 L (1.2 gal) | Liquid |
| 4224-3 | 18.9 L (10.7 gal) | Liquid |



CURING & WORK SCHEDULE

| | Test Method | Result |
|---|------------------|--|
| Working Pot Life | @ 25 °C [77 °F] | 3 hours |
| Full Cure | @ 80 °C [172 °F] | 2 hours |
| Storage Temperature | | 25 °C [77 °F] |
| Service Temperature | | -40 to +100 °C [-40 to +212 °F] |
| Maximum Withstand Temperature | | +115 °C [+239 °F] |
| Maximum coverage per gallon for 50 µm [2 mil] | | < 840,000 cm ² [< 910 ft ²] |

CURED PROPERTIES: PHYSICAL

| | Test Method | Result |
|---|--------------------------|----------|
| Color | Visual | Clear |
| Solderability | — | No |
| Abrasion Resistance | — | Superior |
| Fungus Resistance | — | Good |
| UV Resistant | — | Yes |
| Optical Transmission Loss @ 25 µm (1 mil) | UV-Vis Spectrophotometer | < 4.5% |

CURED PROPERTIES: ELECTRICAL

| | Test Method | Result |
|---------------------------|-------------|---------------|
| Dielectric Strength (dry) | ASTM D149 | 600 volts/mil |

CURED PROPERTIES: THERMAL

| | Test Method | Result |
|---|-------------------|------------------|
| Glass Transition Temperature | ASTM D 115 113 °C | |
| Thermal Cycling Stability | -40 to 200 °C | Passed |
| Thermal Stability 24 h @ 80 °C on Cu/Al substrates | | No yellowing |
| Thermal Stability 96 h @ 100 °C on Cu/Al substrates | | Slight yellowing |

CURED PROPERTIES: CHEMICAL RESISTANCE

| | Test Method | Result |
|------------------------------|-------------|---------------|
| Water | — | Good |
| Acid (10% sulfuric acid) | — | Excellent |
| Alkali (1% sodium hydroxide) | — | Excellent |
| Salt Water | — | Excellent |
| Copper Corrosion | — | None expected |

UNCURED PROPERTIES

| | Part A | Part B | Mixed |
|----------------------------|--------------------|--------------------|--------------------|
| Color | Colorless | Colorless | Colorless |
| Viscosity | 120 cP [0.12 Pa·s] | 20 cP [0.020 Pa·s] | 73 cP [0.073 Pa·s] |
| Density | 1.06 g/mL | 0.92 g/mL | 1.03 g/mL |
| Flash Point | 150 °C [302 °F] | 112 °C [234 °F] | |
| % solids | ~ 85% | 100% | |
| Odor | Aromatic, sweet | Ammonia like | |
| Typical Dry Film Thickness | | | 50 µm [2 mil] |
| Mix Ratio by weight (A:B) | | | 4 : 1 |
| Mix Ratio by volume (A:B) | | | 4 : 1 |

THINNER SELECTION CHART

| Typical Properties | Thinner | Thinner 1 | Thinner 2 | Thinner 3 | Thinner 4 |
|--------------------|---|--|---|--|---|
| Stock Code Prefix | 435 | 4351 | 4352 | 4353 | 4354 |
| Evaporation Rate | Fast | Moderate | Fast | Moderate | Moderate |
| Aggressiveness | High | Low (for sensitive plastics) | Moderate | High | High |
| Key Features | Non-HAP Low VOC Fast Dry Xylene Free | Non-HAP Plastic safe Xylene Free | Non-HAP Xylene and Toluene Free Biodegradable | High solvent power Moderate dry time Great for dip and brush applications | High solvent power Moderate dry time |



T

THINNER

The 435 Thinner is a super fast drying thinner, low VOC solvent for use with the MG Chemical's conformal and EMI/RFI shielding coating products. It is designed to ensure good adherence to plastic substrates.

Applications

This fast drying time of the 435 makes it a good choice for spray application of EMI/RFI shielding and conformal coatings that require low VOC and need quick drying times.

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 435-55ML | 55 mL (2 oz) | Liquid |
| 435-1L | 945 mL (32 fl. oz) | Liquid |
| 435-4L | 3.8 L (1 gal) | Liquid |

- **Low VOC**
- **Fast Evaporation Rate**
- **Enhances Adhesion to Plastic Substrates**
- **Highly Miscible with Other Common Organic Solvents**
- **Compatible with most substrates used in electronic parts and enclosures**

PROPERTIES

| | Test Method | Result |
|--------------------------------|----------------|-------------------------------------|
| Color | | Clear |
| Odor | — | Ketone, nail polish remover |
| Density at 25°C [77 °F] | | 0.81 g/mL |
| Viscosity at 25°C [77 °F] | Brookfield SP1 | 0.5 cP [0.0005 Pa·s] |
| Flash Point | Closed Cup | -18 °C [-0.4 °F] |
| Freezing Point | | -94 °C [-70 °F] |
| Boiling Point | | 56 °C [133 °F] |
| Vapor Pressure at 25°C [77 °F] | | 21.7 kPa [163 mm of Hg] |
| Relative Evap. Rate (BuAc = 1) | | ~ 6 |
| Volatile Organic Content (VOC) | | 7.5% [60 g/mL] |
| MIR value | | 0.52 g O ³ /g of product |

SOLVATION PARAMETERS

| | Test Method | Result |
|--|------------------|----------------|
| Solubility in water | | Highly soluble |
| Hansen Solubility Parameters (cal/cm ³) ^½ ; [MPa] ^½ | Total | 9.7 [19.8] |
| | Non-Polar | 7.3 [14.9] |
| | Polar | 5.1 [10.3] |
| | Hydrogen Bonding | 3.3 [6.8] |

T1

THINNER 1

The 4351 Thinner 1 is a mild diluents designed for MG Chemical's EMI/RFI shielding products.

Applications & Usages

This thinner is used to dilute EMI/RFI shielding coatings that require mild, plastic safe solvents. When preparing a surface to be painted, this solvent is also effective at removing various contaminants like oil and greasy flux residues without harming the substrate.

- **Plastic Safe: compatible with most sensitive substrate used in electronic parts and enclosures**
- **Moderately Fast Evaporation Rate**

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4351-1L | 945 mL (32 fl. oz) | Liquid |
| 4351-4L | 3.8 L (1 gal) | Liquid |

PROPERTIES

| | Test Method | Result |
|--------------------------------|----------------|-----------------------|
| Color | | Clear |
| Odor | — | Rubbing alcohol |
| Viscosity at 25°C [77 °F] | Brookfield SP1 | ~1 cP [0.01 Pa·s] |
| Density at 25°C [77 °F] | | 0.80 g/mL |
| Flash Point | Closed Cup | 15°C [59 °F] |
| Boiling Point | | 65 °C [149 °F] |
| Vapor Pressure at 25°C [77 °F] | | 7.5 kPa [56 mm of Hg] |
| Volatile Organic Content (VOC) | | 100% [800 g/mL] |

T2

THINNER 2

The 4352 Thinner 2 is a moderately fast drying thinner for use with MG Chemical's conformal products. It is compatible with film forming paint products with acrylic, alkyd, cellulose acetate butyrate, epoxy, nitrocellulose, or polyester resins. Together with these type of resin systems, the 4352 thinner promotes good flow properties and suppresses blushing.

- **Plastic Safe: compatible with most sensitive substrate used in electronic parts and enclosures**
- **Blush Resistant**
- **Moderate Evaporation Rate**
- **Excellent Leveling and Gloss**
- **Not Classified as a "Hazardous Air Pollutant"**
- **Highly Miscible with Other Common Organic Solvents**

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4352-1L | 945 mL (32 fl. oz) | Liquid |
| 4352-4L | 3.8 L (1 gal) | Liquid |

PROPERTIES

| | Test Method | Result |
|--------------------------------|----------------|--------------------------|
| Color | | Clear |
| Odor | — | fruity |
| Density at 25°C [77 °F] | | 0.883 g/mL |
| Viscosity at 25°C [77 °F] | Brookfield SP1 | 28 cP [0.028 Pa·s] |
| Flash Point Tag | Closed Cup | 27°C [81 °F] |
| Freezing Point | | -77 °C [126 °F] |
| Boiling Point | | 127 °C [257 °F] |
| Vapor Pressure at 25°C [77 °F] | | 1.33 kPa [10.0 mm of Hg] |
| Relative Evap. Rate (BuAc = 1) | | 1 |
| Volatile Organic Content (VOC) | | 100% [883 g/mL] |
| MIR value | | 0.78 |

SOLVATION PARAMETERS

| | Test Method | Result |
|---|------------------|------------|
| Solubility in water (%wt) | | 0.7% |
| Solubility for water (%wt) | | 1.6% |
| Hansen Solubility Parameters (cal/cm ³) ^½ ; [MPa] ^½ | Total | 17.2 [8.4] |
| | Non-Polar | 15.3 [7.5] |
| | Polar | 3.2 [1.6] |
| | Hydrogen Bonding | 6.8 [3.3] |
| Dielectric constant @20 °C | | 5.07 |

T3

THINNER 3



The 4353 Thinner 3 is a moderate speed drying thinner for use with the MG Chemical's conformal products. The thinner promotes good flow properties and suppresses blushing.

Applications

The moderate speed drying time of the 4353 makes it a good choice for dip or brush application of acrylic conformal coatings like the MG 419D.

- **Blush Resistant**
- **Fast Evaporation Rate**
- **Excellent Leveling and Gloss**
- **Highly Miscible with Other**
- **Common Organic Solvents Compatible with most substrates used in electronic parts and enclosures**

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4353-1L | 945 mL (32 fl. oz) | Liquid |
| 4353-4L | 3.8 L (1 gal) | Liquid |

PROPERTIES

| | Test Method | Result |
|--------------------------------|----------------|--------------------------|
| Color | | Clear |
| Odor | — | sharp, aromatic l |
| Density at 25°C [77 °F] | | 0.85 g/mL |
| Viscosity at 25°C [77 °F] | Brookfield SP1 | 0.5 cP [0.0005 Pa·s] |
| Flash Point Tag | Closed Cup | -1 °C [30 °F] |
| Freezing Point | | ≤ 86 °C [≤ 66 °F] |
| Boiling Point | | 82 °C [180 °F] |
| Vapor Pressure at 25°C [77 °F] | | 6.05 kPa [45.4 mm of Hg] |
| Relative Evap. Rate (BuAc = 1) | | 3.77 |
| Volatile Organic Content (VOC) | | 100% [850 g/mL] |
| MIR value | | 3.15 |

SOLVATION PARAMETERS

| | Test Method | Result |
|--|------------------|------------------|
| Solubility in water | | slightly soluble |
| Hansen Solubility Parameters (cal/cm ³) ^½ ; [MPa] ^½ | Total | 9.0 [18.3] |
| | Non-Polar | 8.4 [17.2] |
| | Polar | 1.9 [3.8] |
| | Hydrogen Bonding | 1.5 [3.0] |



THINNER 4



The 4354 Thinner 4 is a slower drying thinner for use with the MG Chemical's urethane and acrylic conformal products. The thinner has excellent solvent strength, making it a good oil and grease remover. It has very low water solubility, so it is unlikely to absorb water and create blush. Its drying speed is slow enough to promote excellent leveling, but it is fast enough to accommodate a reasonable assembly line speed.

Applications

The 4354 makes is a good choice for spray application.

- Blush Resistant
- Slow Evaporation Rate
- Good Leveling and Gloss
- Highly Miscible with Other Common Organic Solvents
- Compatible with most substrates used in electronic parts and enclosures

| Catalog Number | Sizes Available | Description |
|----------------|--------------------|-------------|
| 4354-1L | 945 mL (32 fl. oz) | Liquid |
| 4354-4L | 3.8 L (1 gal) | Liquid |

PROPERTIES

| | Test Method | Result |
|--------------------------------|----------------|-----------------------|
| Color | | Clear |
| Odor | — | sharp, aromatic |
| Density at 25°C [77 °F] | | 0.87 g/mL |
| Viscosity at 25°C [77 °F] | Brookfield SP1 | ~0.6 cP [0.0006 Pa·s] |
| Flash Point Tag | Closed Cup | 27 °C [81 °F] |
| Freezing Point | | Not established |
| Boiling Point | | 137 °C [279 °F] |
| Vapor Pressure at 25°C [77 °F] | | 2.6 kPa [19 mm of Hg] |
| Relative Evap. Rate (BuAc = 1) | | 0.60 |
| Volatile Organic Content (VOC) | | 100 % [868 g/mL] |
| Product weighted MIR value | | 4.08 |

SOLVATION PARAMETERS

| | Test Method | Result |
|--|------------------|------------|
| Solubility in water | | insoluble |
| Hansen Solubility Parameters (cal/cm ³) ^½ ; [MPa] ^½ | Total | 8.8 [17.9] |
| | Non-Polar | 8.6 [17.7] |
| | Polar | 0.5 [1.0] |
| | Hydrogen Bonding | 1.3 [2.6] |

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