



Enhanced PCB Protection

Features and Benefits

- Clear, thin, flexible, and durable
- Protects against dust, humidity, salt spray, corrosion, and chemical fogs
- Protects against electrical arcing, shorts, static discharges, and thermal shocks
- Contains a UV indicator for optical inspection
- Applied by brushing, dipping, manual and selective spraying
- Available in liquid, aerosol, and pen
- IPC and UL certified versions

Applications

- Improves reliability, and lengthens the life of electronic circuitry
- Protects circuitry in coastal, tropical, marine, and other humid environments
- Allows electronic devices to operate in harsh environments
- Allows traces to be placed closer together by preventing arcing

Acrylic - One-part conformal coating which is cost-effective, and easily reworkable.

419D – Certified to IPC-CC-830B and UL94 V-0

419E – Certified to IPC-CC-830C and UL746E

Silicone-Modified Acrylic - One-part conformal coating that is both soft and flexible, and provides a wide service temperature range.

422B – Certified to UL94 V-0

422C – Certified to UL94 V-0

Polyurethane - One-part conformal coating that provides strong protection against solvents, and corrosive gases.

4223F – Certified to IPC-CC-830B and UL746E

Epoxy - Two-part conformal coating that is flexible, and provides strong protection against chemicals.

4225 – Certified to IPC-CC-830C

UV Curable - One-part UV curable conformal coating suitable for high-throughput applications.

4200UV – Certified to IPC-CC-830C and UL746E

Conformal Coatings



	419D	419E	422B	422C	4223F	4225	4200UV
BINDER SYSTEM	Acrylic	Acrylic	Silicone-modified Acrylic	Silicone-modified Acrylic	Polyurethane	Epoxy	Urethane Acrylate
UNCURED PROPERTIES							
Solids %	30	29	28	30	45	41	96
Viscosity @ 25 °C	115 cP	160 cP	10 cP	14 cP	290 cP	20 cP	160 cP
Recoat time	3 min	3 min	3 min	2 min	5 min	15 min	N/A
Dry time to handle	10 min	15 min	8 min	10 min	15 min	7 h	N/A
Cure time @ 22 °C	24 h	24 h	48 h	24 h	Heat cure only	48 h	UV cure
Cure time @ 65 °C	30 min	30 min	20 min	30 min	—	4 h	UV cure
Cure time @ 80 °C	20 min	15 min	—	10 min	16 h	2 h	UV cure
Cure time @ 100 °C	10 min	5 min	—	5 min	2 h	40 min	UV cure
CURED PROPERTIES							
IPC-CC-830	B revision	C revision	—	—	B revision	C revision	C revision
UL	94 V-0	746E	94 V-0	94 V-0	746E	Meets UL 94 V-0	746E
Dielectric strength	1 000 V/mil	1 100 V/mil	1 056 V/mil	1 076 V/mil	1 000 V/mil	566 V/mil	1000 V/mil
Dielectric withstand volt.	> 1 500 V	> 1 500 V	> 1 500 V	> 1 500 V	> 1 500 V	> 1 500 V	> 1 500 V
Resistivity	$4.6 \times 10^{14} \Omega\text{-cm}$	$3.5 \times 10^{13} \Omega\text{-cm}$	$1.2 \times 10^{15} \Omega\text{-cm}$	$3.5 \times 10^{13} \Omega\text{-cm}$	$3.5 \times 10^{13} \Omega\text{-cm}$	$1.8 \times 10^{12} \Omega\text{-cm}$	$3.4 \times 10^{14} \Omega\text{-cm}$
Constant service temp.	-65 — 125 °C	-65 — 130 °C	-40 — 200 °C	-40 — 200 °C	-65 — 125 °C	-40 — 140 °C	-65 — 150 °C
Glass transition temp. (T _g)	27 °C	38 °C	29 °C	31 °C	57 °C	42 °C	72 °C
CTE prior T _g	72 ppm/°C	160 ppm/°C	275 ppm/°C	111 ppm/°C	130 ppm/°C	210 ppm/°C	78 ppm/°C
Solderability	Excellent	Excellent	Fair	Fair	Good	Poor	Poor
Chemical resistance	Poor	Poor	Poor	Poor	Excellent	Excellent	Excellent
Pencil hardness (ABS)	HB, soft	H, hard	F, hard	F, hard	HB, soft	2H, hard	2H, hard
AVAILABLE PACKAGING							
Net contents	55 mL bottle	—	1 L can	55 mL bottle	55 mL bottle	1.35 L 2-can kit	—
	945 mL can	945 mL can	3.78 L can	945 mL can	945 mL can	10.8 L 3-can kit	945 mL can
	3.78 L can	3.78 L can	20 L pail	3.78 L can	3.78 L can	60 L 3-pail kit	3.78 L can
	18.9 L pail	18.9 L pail	340 g aerosol	18.9 L pail	18.9 L pail	540 L 3-drum kit	—
	340 g aerosol	340 g aerosol	—	340 g aerosol	312 g aerosol	—	—
	5 mL pen	—	—	5 mL pen	—	—	—



Conformal Coating Overcoat Pens



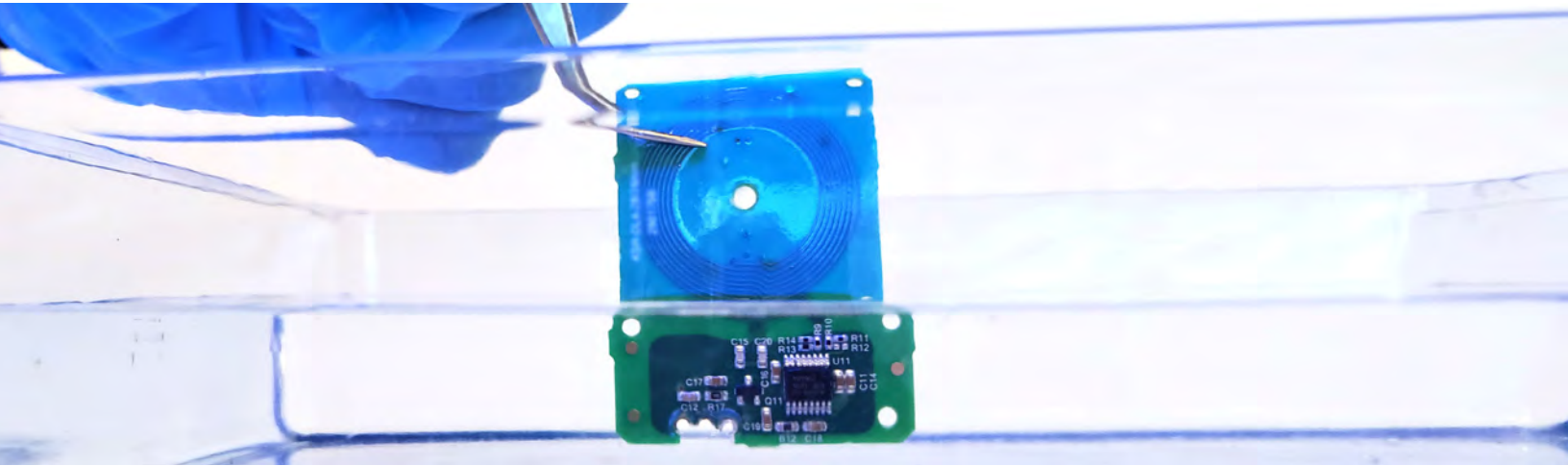
Improve reliability, operational range, and lengthen the life of electronic components with MG Chemicals Conformal Coating Overcoat Pens

MG Chemicals Overcoat Pens are easy to use conformal coating acrylic one part resin systems. They are fast drying and provide an excellent finish in multiple colors. They are ideal to repair or rework damaged coated areas and protect electronic circuits against moisture, dirt, dust, thermal shocks, scratches and other environmental hazards that could corrode, or otherwise damage the electronic components. They also insulate against arcing, shorts, and static discharges.

- ***Protects and insulates circuit boards traces***
- ***For repairs or rework of solder masks and circuit boards***
- ***Excellent finish—smooth, homogeneous, and durable***
- ***Protects electronics from moisture, corrosion, fungus, and static discharges***
- ***Clear Overcoat Pen (#419D-P-CL) is certified to UL 94-V0 and IPC-CC-830B***
- ***No Hazardous Air Pollutants—free of toluene and xylene***
- ***Comes in variety of colors—blue, black, clear, green, and white***
- ***Tack free in only 10-15 minutes***
- ***Removable with Cat. No. 435, 4352 thinner, and 8312 stripper***

Products by color: Black (#419D-P-BK), Blue (#419D-P-BL), Clear (#419D-P-CL), Green (#419D-P-GR), and White (#419D-P-WH)

Conformal Coating Strippers



Easy Removal of Conformal Coatings for Repair and Rework

MG Chemicals features conformal coating strippers that are helpful when rework or repair is necessary. These strippers are effective at removing many different types of coatings including acrylics, alkyds, polyurethanes, silicones, and some epoxies.

Features and Benefits

- Contains no SVHC
- Effectively removes many coating types, including polyurethanes, and some epoxies
- Available in both liquid and gel format
- Fully biodegradable and environmentally safe
- HAPs-Free

Applications

- Spot removal of coating
- Full removal of coating for rework
- Removal of some adhesives

8309 - Liquid stripper effective for coating removal of large surfaces

8310A - Gel stripper effective for spot removal of coating, and some adhesives

Available Packaging

8309

850 mL (metal can)
10 mL (pen)

8310A

55 mL (bottle)
225 mL (metal can)
850 mL (metal can)



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Insulative Varnish for High Voltage Electrical Parts

MG Chemicals Insulation Coatings line is a unique line of varnish for electronics products intended to provide added insulation to high voltage parts such as transformer coils, motor windings and sheathing for wires. Characterized by high dielectric strength, these 1-part coatings adhere to a variety of substrates and offer exceptional protection against corrosion.

Features & Benefits

- High dielectric strength
- Excellent resistance to moisture and salt water
- Excellent finish—tough, flexible, glossy, and durable

Applications

- Replacement for shrink wrap or electrical tape
- Arc and corona resistance for transformer coils and motor windings
- Insulation coatings for electrical generators

Clear Insulating Varnish

- 4226 • Meets UL EIS standards. Class H insulation up to 180 °C
- Dielectric strength: 4 100 V/mil
- 4226A • Low VOC and HAP-free
- Toluene, xylene and MEK-free
- Dielectric strength: 3 000 V/mil

Dielectric Coating

- 4228 • Meets UL EIS standards. Class H insulation up to 180 °C
- Dielectric strength: 3 000 V/mil
- Direct cross to Glyptal 1201A

Red Insulating Varnish

- 4228A • Dielectric strength: 3 700 V/mil
- Low VOC and HAP-free
- Available as both a liquid and aerosol

Insulation Coatings



PROPERTIES

	4226	4226A	4228	4228A
Dielectric Strength (dry)	4 100 V/mil	3 000 V/mil	3 000 V/mil	3 700 V/mil
(wet)	3 000 V/mil	—	1 500 V/mil	—
Insulation Class	130 (B) 150 (F) 180 (H)	—	—	—
Service Temperature Range	-40–180 °C	-30–180 °C	-40–180 °C	-40–180 °C
Dry to Touch	20 min	1 h	30 min	1 h
Recoat Time	4 h	15 min	4 h	10 min
Recommended Film Thickness	25–38 µm	25–38 µm	25–38 µm	25–38 µm
Theoretical Coverage @ 25 µm (based on 65% transfer efficiency)	95 ft²/L	100 ft²/L	130 ft²/L	130 ft²/L
Viscosity @ 25 °C	77 cP	50 cP	590 cP	800 cP
Density	0.93 g/mL	0.96 g/mL	1.1 g/mL	1.0 g/mL
Percent Solids	35%	45%	52%	55%
Shelf Life	5 y	5 y	5 y	5 y
Calculated VOC	604 g/L	520 g/L	514 g/L	561 g/L

PACKAGING

Format	4226	4226A	4228	4228A
	55 mL (Bottle) 945 mL (Bottle)	55 mL (Bottle) 426 mL (Aerosol) 945 mL (Can) 3.78 L (Can)	55 mL (Bottle) 225 mL (Can) 850 mL (Can) 3.60 L (Can)	55 mL (Bottle) 225 mL (Can) 850 mL (Can) 3.60 L (Can)



Conformal Coatings

This application guide describes the equipment and processes recommended for applying MG Chemicals conformal coating products. It is the user's responsibility to determine the chemical, mechanical and thermal compatibility of substrates prior to using any of the suggested methods.

All of our conformal coatings can be applied by paint brush, manual spray gun, dipping, and selective coating equipment. Several products are also available in aerosol format for ease and convenience. For large to moderate scale production runs, selective coating equipment and manual spray guns provide superior coating surfaces. The paint brush method can be used for repairs or for small scale applications, but usually will not achieve the same level of consistency and film aesthetic as spray methods. Similarly, dipping is an ideal method for low-volume projects as it is simple, yet achieves high-precision results.

The application of a conformal coating requires several subsequent processes to achieve an aesthetic finish with proper coverage.

Substrate Preparation

Most coating defects result from the presence of moisture, grease, oil, dirt, flux, and other board contaminants. Therefore, it is highly recommended that the user ensures the cleanliness and dryness of a surface prior to coating it.

1. Wipe the surface with a clean cloth, wash with soap and water, then rinse and dry.
2. Put on disposable gloves and clean the surface with MG's 824 Isopropyl Alcohol or any other degreasing solvent.
3. Let the surface dry completely. Elevated temperatures can accelerate drying.

Highly resistant plastics and non-plastics may require mechanical sanding or primers to enhance adhesion. After sanding and etching, clean the surface by



following the previously listed steps. Mask areas that should not be coated by using MG's 862 Solder Mask or painter's tape. Unintended coating can be removed using MG's 8309 or 8310A Conformal Coating Strippers.

Dilution

For most brush applications, dilution is not required. However, when applying certain coatings either by manual or selective spray equipment, we recommend thinning to improve film coverage and precision. The choice of thinner will depend on the selected coating and the application method (manual or automated).

If an automated spray method is used, both the platform and individual valves must be taken into account. Refer to Table 1 (page 2) for suggested starting dilution ratios.

Dilution Ratio

	Brush	Dipping	Manual Spray	PVA 650		Nordson SL 940E	
				FCS300-ES	FC100-CF	SC280 N	SC350
419C	None	None	None	N/A	N/A	N/A	N/A
419D	None	None	1:1 (4352)	3:2 (4352)	2:1 (4352)	8:3 (4352)	N/A
419E	None	None	1:1 (4352)	1:1 (4352)	1:1 (4352)	4:1 (4352)	N/A
422B	None	None	1:1 (435)	N/A	N/A	None	N/A
422C	None	None	None	N/A	N/A	None	N/A
4223F	None	None	1:1 (4352)	2:1 (4354)	2:1 (435)	5:1 (4352)	N/A
4225	None	None	None	N/A	N/A	N/A	N/A
4200UV	None	None	None	None	N/A	N/A	None

Table 1: Suggested dilution ratios of MG Conformal Coatings to MG Thinners by application methods
Recommended MG Thinners are shown in brackets

Paint Brush

1. Load the brush by dipping it into the coating (one-third of the bristle length).
2. Tap both sides of the brush lightly against the side of the can. This prevents drips and runs.
3. Brush the coating onto the board using long, smooth strokes. This reduces air bubbles, helps create an even coat, and minimizes brush marks.
4. Reload the brush as soon as the coating flow begins to break.
5. Keep subsequent brush strokes in the same direction; work strokes back into the edges of previously applied, still-wet coating, but do not recoat wet areas.
6. Wait at least 3 minutes, then apply a second coat. Keep the brush from curing by dipping it in thinner and drying it before reloading.
7. Apply additional coats until the desired thickness is achieved.

Manual Spray Guns

Dilute paint as recommended in Table 1 (above). Use a standard fluid nozzle gun to spray the diluted paint. The recommended settings are listed in Table 2 (below). However, performances will vary between brands.

	LVMP	HVLP
Inlet pressure (psi)	20–40	20–40
Air flow (SCFM)	10–15	10–15
Air cap (psi)	8–10	8–10
Nozzle tip diameter (mm)	0.8–1	0.8–1

Table 2: Recommended manual spray guns setting

For best results, keep the gun-to-surface distance constant at about 20-25 cm (8-10"). To ensure full coverage, tilt the board at a 45° angle and apply the coating using spray-and-release strokes that extend slightly beyond the edges of the substrate. Move the gun in a straight line along the surface, avoiding arcing motions. Upon completion, or before extended stoppages, purge fluid lines and clean the spray gun.

Selective Coating Equipment

For higher volume applications, coatings can be applied using selected spray equipment. MG Chemicals has worked with companies such as PVA and Nordson Asymtek to test the compatibility of various conformal coatings using PVA's 650 platform and Nordson Asymtek's SL940E. Table 1 (page 2) provides starting points with respect to dilution ratios and suggested thinners using different valves. More in-depth information such as air pressure, fluid pressure and dispensing heights for different machine and valve systems can be found for each conformal coating (where applicable) on each product's Technical Data Sheet (TDS).

Aerosol Cans

Several of our conformal coatings also come in a convenient aerosol format. These cans are ready to spray.

1. Shake the can vigorously.
2. Spray a test pattern to ensure good flow quality.
3. Tilt the board at 45° and spray a thin, even coat from a distance of 20–25 cm (8–10"). Use spray-and-release strokes with an even motion to avoid paint buildup in one spot. Start and end each stroke off the surface.
4. To avoid trapping solvent, wait the recommended recoat time before applying each subsequent coat.
5. To ensure good coverage, rotate the board 90° and spray again.
6. Apply additional coats until desired thickness is achieved (return to step 3).
7. Allow each new coat to cure at room temperature until dry to the touch before applying heat cure.
8. After use, clear the nozzle by inverting the can and spraying short bursts until the propellant turns clear.

Curing Process

The MG Chemicals Conformal Coating portfolio comprises many chemistries which subsequently influences their cure behaviour. Thermoplastic materials such as acrylics and silicone acrylic hybrids, cure by solvent evaporation and can be cured either at room temperature or at elevated temperatures to accelerate drying. Thermoset materials such as polyurethane and epoxy conformal coatings undergo chemical reactions where new chemical bonds are formed that link polymer chains. These systems require elevated temperatures to facilitate curing within a practical time frame. UV conformal coatings cure upon exposure to certain frequencies of UV light. Cure time for these systems depends on both the wavelength and power output of the light source used. Table 3 (page 4) summarizes the cure behaviours for MG Chemicals Conformal Coatings.

Cure Times

	25 °C	65 °C	80 °C	100 °C	1 W/cm ² @ 25 °C*	1 W/cm ² @ 35 °C*
419C	24 hours	30 minutes	20 minutes	10 minutes	N/A	N/A
419D	24 hours	30 minutes	20 minutes	10 minutes	N/A	N/A
419E	24 hours	30 minutes	15 minutes	5 minutes	N/A	N/A
422B	48 hours	20 minutes	10 minutes	N/A	N/A	N/A
422C	24 hours	20 minutes	10 minutes	N/A	N/A	N/A
4223F	N/A	N/A	16 hours	2 hours	N/A	N/A
4225	N/A	4 hours	2 hours	40 minutes	N/A	N/A
4200UV	N/A	N/A	N/A	N/A	8 seconds	4 seconds

Table 3: Cure times for MG Chemicals Conformal Coatings under different curing conditions

* UV lamp frequency 320-500 nm

Coating Thickness

Conformal coatings work optimally at a dry film thickness of between 1 and 3 mils (25-76 µm), in line with the thickness recommendations of the IPC-CC-830C Standard. Film builds beyond this range do not provide additional protection and may cause brittleness, film delamination and solvent entrapment. Table 4 (below) summarizes the typical dry film thickness of each coating for a single coat.

	Dry Film Thickness
419C	20–30 µm
419D	20–30 µm
419E	20–30 µm
422B	20–30 µm
422C	20–30 µm
4223F	20–30 µm
4225	25–50 µm
4200UV	65–85 µm

Table 4: Typical dry film thickness for a single coat

Disclaimer

This information is believed to be accurate. It is intended for professional end-users who have the skills required to evaluate and use the data properly. M.G. Chemicals Ltd. does not guarantee the accuracy of the data and assumes no liability in connection with damages incurred while using it.

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