

## Description

The 4223F *Premium Polyurethane Conformal Coating* is an easy-to-use product that is UL recognized to the 746E standard for conformal coatings. This one-part product heat cures to form a protective coating that resists abrasion and chemical attacks. It is, therefore, ideal for chemically or mechanically aggressive environments. In addition, the 4223F is without isocyanates, xylenes, or other hazardous air pollutants. And lastly, the coating is easily repairable. All these characteristics make for a versatile conformal coating of premium quality.

The 4223F coating protects electronic circuits from physical, electrical, and corrosion damages. It resists dirt, dust, humidity, and chemically aggressive products. It also resists abrasion, scratches, and thermal shocks. It protects against short circuits, static discharges, and high-voltage arcing, which allows for the miniaturization of circuits by reducing the minimal spacing between traces. In summary, it efficiently protects your electronic components from several common failure modes.

## Applications & Usages

The 4223F coating improves reliability, operational range, and lengthens the life of electronic components and electrical assemblies. This protection coating is especially useful in corrosive environments such as those found in the farming, mining, smelting, oil exploration, and marine industries. Other common uses of the urethane conformal coatings are with electric relays, motors, transformers, and generators. The coating also can be found in commercial products such as sensors, automotive electronics, fire alarms components, and air bag controllers.

## Features and Benefits

- **UL certified as a conformal coating** according to **UL 746E** (file # [E203094](#))
- **Externally qualified** to the August 2002 **IPC-CC-830B**-class A standard, by Pacific Testing Laboratories
- **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-A)
- **Easy rework and repairs**
  - Can solder through the coating
  - Removable with MG 8312 Conformal Coating Stripper
- **Free of isocyanate, xylene, and other hazardous air pollutants**

**ATTENTION!** Heat curable product.  
The 4223F is not suitable for room temperature cure.

### Usage Parameters

<i>Properties</i>	<i>Value</i>
Tack Free <sup>a)</sup>	15 min
Recoat time <sup>a)</sup>	3 min
Drying Time @80 °C [176 °F]	16 h
Shelf Life	3 y
Theoretical HVLP Spray Coverage <sup>a)</sup>	$\leq 90\,000\text{ cm}^2/\text{L}$ $\leq 9\text{ m}^2/\text{L}$ $\leq 52\,900\text{ in}^2/\text{gal}$ $\leq 367\text{ ft}^2/\text{gal}$

a) Assumes a 2:1 dilution ratio with MG 4354 Thinner

b) Idealized coverage based on a coat thickness of 24.5  $\mu\text{m}$  [1.0 mil] and 65% transfer efficiency.

### Temperature Ranges

<i>Properties</i>	<i>Value</i>
Constant Service Temperature	-65 to 125 °C [-85 to 257 °F]
Storage Temperature Limits	-5 to 40 °C [23 to 104 °F]

### Properties of Cured 4223F

<i>Physical Properties</i>	<i>Method</i>	<i>Value</i>
Color	Visual	Clear, amber tint
Solderability	—	Good
Chemical Resistance	—	Excellent
Weather Resistance	—	Excellent
Fungus Resistance	IPC-TM-650 2.6.1.1	Passed
Flexibility	IPC-TM-650 2.4.5.1	Passed
Flammability	UL 94V-0	Passed
Glass Transition Temperature (T <sub>g</sub> )	Optical Dilatometer	57.1 °C
Coefficient of Thermal Expansion	" "	
Before T <sub>g</sub>	" "	130 ppm/°C
After T <sub>g</sub>	" "	190 ppm/°C
UV Inspection Absorption Max	Absorption spectrum	375 nm (near UV)
Fluorescence max	Emission spectrum	437 nm (blue)
<i>Electrical Properties</i>	<i>Method</i>	<i>Value</i>
Breakdown Voltage @1.2 mil	ASTM D 149	1 200 V      1.2 kV
Dielectric Strength @1.2 mil	"	1 000 V/mil    0.04 kV/mm
Dielectric Withstand Voltage	IPC-TM-650 Test 2.5.7.2	>1 500 V
Insulation Resistance (after 24 hours)	IPC-TM-650 Test 2.6.3.4	$9 \times 10^{12}\ \Omega$

Note: See Appendix A for UL 746E and IPC-CC-830B standards test results.

### Properties of Uncured 4223F

<i>Physical Properties</i>	<i>Method</i>	<i>Value</i>
Odor	—	Mild petroleum
Viscosity @25 °C [77 °F]	Brookfield SP1	330 cP [0.330 Pa·s]
Percent Solids	Calculated	45% (weight)
Density	ASTM D 1475	0.89 g/mL
Flash Point	Closed Cup	-104 °C [-155 °F]
Boiling Point		80 °C [176 °F]

### Compatibility

The 4223F coating is compatible with most materials found on printed circuit assemblies; however, in an uncured state it is incompatible with water, oil, and greasy flux residues. Therefore, it is extremely important to clean the printed circuit assembly thoroughly with a suitable electronic cleaner before applying the coating.

The chosen electronic cleaner must remove moisture, wax, greases, oils, and all other contaminants that are known to cause defects for this type of conformal coating (see recommended cleaners on page 5).

### Health, Safety, and Environmental Awareness

Please see the 4223F-Liquid **Safety Data Sheet** (SDS) for more details on transportation, storage, handling and other security guidelines.

#### *Hazardous Chemical Components*

<b>Name</b>	<b>CAS Number</b>
N-heptane	142-82-5
Stoddard solvent	8052-41-3
Methyl Ethyl Ketone (MEK)	78-93-3

**Environmental Impact:** The volatile organic compound percentage is 55% (489 g/L) by the US EPA and the Canadian Environmental Protection Act, 1999.

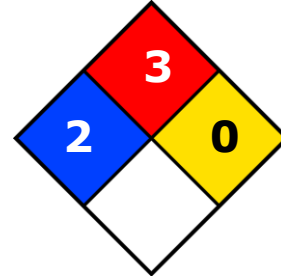


This product meets the European Directive 2011/65/EU Annex II (ROHS); recasting 2002/95/EC.

**Health and Safety:** The liquid and spray is flammable and should be kept away from flames and other ignition sources. As with most paint materials, avoid breathing in fumes or direct contact. Solvents therein can cause irritation and other symptoms like headaches, pain, as well as having long term exposure effects.

**HMIS® RATING**

<b>HEALTH:</b>	<b>* 2</b>
<b>FLAMMABILITY:</b>	<b>3</b>
<b>PHYSICAL HAZARD:</b>	<b>0</b>
<b>PERSONAL PROTECTION:</b>	

**NFPA® 704 CODES**

*Approximate HMIS and NFPA Risk Ratings Legend:*

0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)

Wear protective gloves and eye protection. Wash hands thoroughly after handling. Use only in open air or in a well-ventilated area.

The cured coating presents no known hazard.

## Application Instructions

The 4223F can be easily applied by the paintbrush, spray gun, or dip method. We recommend a final dry film thickness of at least 1.0 mil [25 µm] for most applications.

### Material & Equipment

- Mixing spatula
- Clean paint brush **OR** HVLP spray gun **OR** dip tank system
- Thinner/Solvent
- Personal protection equipment (See 4233F-Liquid SDS)

### Paint Dilution Ratios

For brush or dip applications, the MG 4223F conformal coating is ready-to-use without dilution. You may however dilute it to improve coat leveling, to facilitate brush application, to prevent brush marks, or to control the dry film thickness.

For spray application, we recommend a 2:1 paint-to-thinner ratio as a starting point. Then, adjust this dilution ratio based on the equipment, viscosity, or other operational parameters. The recommended thinner is the MG 4352 Thinner 2.

### Surface Preparation

Clean oil, dust, water, solvents, and other contaminants. Let dry fully.

### Spray Gun Application Instructions

Read the procedure fully and make necessary adjustments to get the required coat thickness for your needs. For a 2:1 dilution, one spray coat typically results in a dry film thickness of roughly 1 mil [25 µm].

#### Spray Equipment

Use a HVLP (high-volume, low pressure) spray gun using the initial settings described in the following table. Adjust these settings and recommendations as required.

#### Initial Setting Recommendations

<b>Air Cap</b>	#3 HVLP		
<b>Pressure</b>	<i>Inlet</i> 23 psi	<i>Air flow</i> <sup>b)</sup> 13.5	<i>Air cap</i> 10 psi
<b>Fluid Tip</b>	1.3 mm [0.051"]	1.5 mm [0.059"] <sup>a)</sup>	

*Note:* These recommendations are based on a generic paint gun and may differ by brands. Please consult your spray gun manufacturer's guide.

- a) If no or reduced let down is performed, this may be a better tip choice.
- b) SCFM = standard cubic foot per minute

#### To apply the required coating thickness

1. Mix the paint thoroughly with a paint shaker, mixer, or spatula.
2. Dilute by a ratio of **2:1** (Paint:Thinner) or another ratio of your choice.
3. Make a test spray. Adjust the spray settings for best flow and spray quality, and establish an appropriate distance to avoid paint runs. A distance between 23 to 30 cm (9 to 12 in) is recommended.
4. Spray a thin and even coat onto the vertical surface to be coated. For best results, start your movement off-surface, press the trigger, and only release off-surface at the end of the stroke. Use a uniform movement of the spray gun parallel to the surface.
5. Wait at least 5 minutes and spray another coat. This delay avoids trapping solvent between coats.
6. Rotate the board 90° to ensure good coverage.
7. Apply additional coats until desired thickness is achieved. (Go to Step 3.)
8. Let dry for 15 minutes (flash off time) at room temperature.

**ATTENTION!** Spraying overly thick coats may cause paint runs and hamper solvent evaporation. Prefer the application of many thin wet coats rather than fewer heavy coats.

### To cure the conformal coating

Full cure can be achieved in 16 hours by using an infrared lamp or in convection oven at 80 °C [176 °F].

**TIP!** At room temperature, the coat dries to the touch in 15 minutes. Only handle after this period of time.

**ATTENTION!** Heat curable product. Not suitable for room temperature cure.

The procedure above is based on a minimum thickness of 25 µm (1 mil) conformal coating. After full cure, measure the actual conformal coating thickness to ensure it meets the applications requirements.

### Packaging and Supporting Products

<i>Cat. No.</i>	<i>Packaging</i>	<i>Net Volume</i>		<i>Net Weight</i>	
<b>4223F-312G</b>	Aerosol	430 mL	14.6 fl oz	310 g	10 oz
<b>4223F-1L</b>	Can	945 mL	31.9 fl oz	840 g	1.8 lb
<b>4223F-4L</b>	Can	3.78 L	1 gal	3.36 kg	7.4 lb
<b>4223F-20L</b>	Pail	18.9 L	5 gal	16.8 kg	37 lb

### Thinners & Conformal Coating Removers

- *Thinner 2*: Cat. No. 4352-945ML, 4352-4L (1 gal), 4352-20L, 4352-200L
- *Conformal Coating Stripper—Liquid*: Cat. No. 8312-580ML, 8312-3.78L



# 4223F Technical Data Sheet

## Premium Polyurethane Conformal Coating

ISO 9001:2008 Registered Quality System. Burlington, Ontario, CANADA SAI Global File: 004008

4223F-Liquid

### Technical Support

Contact us regarding any questions, improvement suggestions, or problems with this product. Application notes, instructions, and FAQs are located at [www.mgchemicals.com](http://www.mgchemicals.com).

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### Warranty

*M.G. Chemicals Ltd.* warranties this product for 12 months from the date of purchase by the end user. *M.G. Chemicals Ltd.* makes no claims as to shelf life of this product for the warranty. The liability of *M.G. Chemicals Ltd.* whether based on its warranty, contracts, or otherwise shall in no case include incidental or consequential damage.

### Disclaimer

This information is believed to be accurate. It is intended for professional end users having the skills 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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## Appendix A

### Standards Qualification

Certified UL 746E (file # [E203094](#)) and qualified to IPC-CC-830B (August 2002).

<i>Qualification Criteria</i>	<i>Test Method</i>	<i>Results</i>
<b>UL approved conformal coating</b>	UL 746E	UL recognized
Indoor/outdoor rating	"	pass
Coating flammability	UL 94V-0	pass
<b>IPC-CC-830B*</b>		
Appearance	IPC-CC-830B 3.5.2	pass
Fluorescence	IPC-CC-830B 3.5.3	pass
Flammability	IPC-CC-830B 3.5.6	pass
Fungus Resistance	IPC-TM-650 2.6.1.1	pass
Flexibility	IPC-TM-650 2.4.5.1	pass
Dielectric Withstand Voltage	IPC-TM-650 2.5.7.1	pass
Moisture and Insulation Resistance	IPC-TM-650 2.6.3.4	pass
Thermal Shock	IPC-TM-650 2.6.7.1	pass
Temperature Humidity Aging	IPC-TM-650 2.6.11.1	fail

Note: The optional humidity ageing test failed due to a late stage loss of clarity that prevented color codes and identification marking to be viewed; this product thus meets the older 2002 IPC-CC-830B Class A requirements, but not the current ones.

\*Qualified independently by Pacific Testing Laboratories, Inc.