

CHO-SHIELD® 2000 SERIES CORROSION-RESISTANT CONDUCTIVE COATINGS

Customer Value Proposition:

Parker Chomerics' CHO-SHIELD® 2000 Series electrically conductive coatings provide a corrosion resistant conductive surface coating on aluminum or composite substrates. By reducing moisture penetration, CHO-SHIELD 2000 Series coatings offer corrosion protection for enclosure flanges which mate with particular EMI shielding gaskets.

These tough, urethane coatings offer a highly conductive interface which improves overall EMI shielding performance. When used as a coating on a composite or other non-conductive surface, they provide the conductivity necessary to achieve excellent shielding effectiveness while maintaining their electrical and mechanical stability in hostile environments.

CHO-SHIELD 2000-series coatings are three-part, copper-filled urethane coating systems which have been formulated with special additives and stabilizers to maintain their electrical stability, even at elevated temperatures, which prevent aluminum surfaces from corroding in high humidity and/or marine environments.

In particular, CHO-SHIELD 2001 and 2003 contain soluble chromates to minimize the effects of galvanic corrosion of the aluminum substrate, even in the event of a coating scratch. The CHO-SHIELD 2002 coating, mainly intended for composite substrates or as a 2001 repair coating, is chromate-free. CHO-SHIELD 2003 is a dark pigmented version of CHO-SHIELD 2001.

The CHO-SHIELD 2001 and 2003 coatings are designed to be used with CHO-SHIELD 1091 primer on chromate conversion coated (MIL-DTL-5541 Type I, Class 3) aluminum substrates. CHO-SHIELD 2002 is designed to be used with

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CHO-SHIELD 1091 primer on non-aluminum substrates such as MIL-P-18177 glass-filled epoxy composites and will typically deliver 0.1 ohm/square surface resistance when cured for 2 hours at room temperature 70°F (21°C) followed by 30 minutes at 250°F (121°C).

Features and Benefits:

- Urethane binder provides exceptional physical properties such as hardness and adhesion.
- Excellent chemical resistance, including jet fuel (JP8), hydraulic fluids and motor oil.
- High abrasion resistance even after jet fuel immersion.
- Excellent coating hardness and scratch resistance.
- Significantly more cost effective than silver-filled epoxies.
- No degradation of shielding effectiveness after 500 hours of salt fog.
- Pre-measured kits allow easy mixing of components in one container.

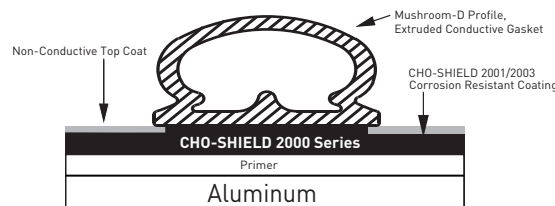
Design Considerations:

Flange design and surface preparation have significant impact on the corrosion resistance offered by the CHO-SHIELD 2000-series of coatings. All three coatings best adhere to MIL-DTL-5541, Type 1, Class 3 treated aluminum and most plastics and composites. Chomerics provides CHO-SHIELD 1091 primer for enhancing the adhesion of CHO-SHIELD 2000-series coatings on all substrates.

Chomerics' Applications Department will also provide assistance with your design and material requirements.

Figure 1:

Recommended Flange Treatment Application of CHO-SHIELD 2001/2003



CORROSION RESISTANT FLANGE DESIGN WITH CHO-SEAL® 1298 CONDUCTIVE ELASTOMER, EMI SHIELDING GASKETS

The combination of the CHO-SHIELD 2000 series of conductive flange coatings and CHO-SEAL 1298 conductive elastomer gaskets can form a virtual corrosion resistant EMI sealing system for passivated aluminum enclosures. CHO-SEAL 1298 is a fluorosilicone elastomer filled with silver plated aluminum filler. Figure 1 shows this application for an aluminum enclosure.

First, the aluminum flange is typically treated with a MIL-DTL-5541, Type I, Class 3, hexavalent chromate treatment, or alternatively with Type II, Class 3, trivalent, chromate corrosion treatment. After first applying the CHO-SHIELD 1091 primer to ensure adhesion, the CHO-SEAL 2000 series coating is applied according to the instructions contained in this document to mask the flange area for the EMI gasket landing area. The CHO-SHIELD 2000 coating is then masked while the non-conductive topcoat is applied to the aluminum enclosure. However, note that the topcoat must be overlapped onto the CHO-SHIELD coating as shown in Figure 1 to ensure that the CHO-SHIELD coating and aluminum interface is not exposed to moisture that could intrude under the coating. Note also in that when choosing a topcoat and the gasket, that the maximum temperature for the CHO-SHIELD 2000 coatings is 185°F (85°C).

Application

Surface preparation has a significant impact on the corrosion resistance offered by the CHO-SHIELD 2000-series of coatings. CHO-SHIELD 1091 primer should be used to ensure good adhesion of CHO-SHIELD 2000-series coatings on all substrates. CHO-SHIELD 1091 primer is a one-component, air-drying system, which cures at ambient temperatures.

Recommended Surface Preparation

1. Clean the substrate:

The substrate surface should be clean, dry and free of oils, release agents, dirt and lint. Clean surfaces to be painted with methyl ethyl ketone (MEK) for aluminum or isopropyl alcohol/ethanol for solvent sensitive substrates. Let the substrate air dry for 15 minutes.

2. Apply CHO-SHIELD 1091 primer:

Wet a lint-free cotton cloth with CHO-SHIELD 1091 primer.

Apply primer to the surface in horizontal and vertical strokes. Keep the surface wet at all times. After the entire surface has been coated, air-dry at room temperature for 1 hour or at 190°F (88°C) for 30 minutes.

Note: If primed surfaces are not coated within 4 hours of the primer application, repeat the cleaning and primer application procedures before coating. To eliminate the risk of an increase in surface resistance, only a light coating of the primer is recommended, typically less than one mil thick when cured.

Table 1: Primer Ordering Info

Product	Part Number	Unit Size
CHO-SHIELD 1091	50-00-1091-0000	4 fluid ounces
	50-01-1091-0000	8 fluid ounces

CHO-SHIELD 1091 is provided with selected kits of CHO-SHIELD 2003. It is not provided with any kits of CHO-SHIELD 2001 or 2002 and must be purchased separately.

3. Mix the material:

Mix the CHO-SHIELD 2000 series coating according to the weight mix ratio in Table 2. Combine Part A and Part C. Weigh the components if the entire kit is not to be used. Shake on a paint shaker for 3 minutes. Check the homogeneity of the mixture by feeling the sides and bottom of the container with a spatula to assure all the filler and resin are well dispersed.

Note: If the coating mixture is not homogeneous, shake for an additional 3 minutes and check for non-dispersed material. DO NOT screen or filter the mixed coating.

Add the Part B. Shake or mix for an additional 3 minutes.

Wet Coating Painting System Options

Use a pressure pot (20 psi (138 kPa) typical) with large diameter, paddle-type agitator at low mixing speed to keep the metal fillers in uniform suspension.

Conventional spray equipment such as HVLP (High Volume, Low Pressure) or LVMP (Low Volume Medium Pressure) all work well with CHO-SHIELD 2000 series coatings. Binks SD-2 with propeller agitator pressure pots may be used for spray application with approximately 20-50 psi (138-345 kPa) atomizing air. Use lowest pressure possible.

Re-circulation of the paint from the mixing pot through the spray gun and back via a pump delivery system is recommended for greater filler uniformity.

For large volume applications, a robotic spray system with an HVLP spray gun should be used to minimize material loss due to overspray and maximize paint transfer efficiency.

Siphon or gravity feed equipment can be used for small or prototype runs.

Spray Gun and Pressure Painting System Option

Use a standard air gun with approximately 20-50 psi (138-345 kPa) atomizing air. A fluid nozzle with an orifice diameter of 0.040 to 0.070 inch (1.016 to 1.778 mm) is recommended.

To obtain maximum adhesion and conductivity, dry spraying should be avoided. Adjust the spray pressure to achieve a proper wet film.

Nominal Dry Film Thickness

A nominal dry film thickness of between 0.003 inches (0.076 mm, 3 mils) and 0.005 inches (0.127 mm, 5 mils) is recommended to obtain typical shielding effectiveness from 80 MHz to 10 GHz and corrosion protection published by Chomerics.

Curing Conditions

The CHO-SHIELD 2000 Series coatings may be cured using one of the following cure schedules:

- Cure cycle 1 - 2 hours at room temperature followed by 0.5 hour at 250°F (121°C)
- Cure cycle 2 - 2 hours at room temperature followed by 2 hours at 130°F (60°C)
- Cure cycle 3 - Room temperature for 7 days

To prevent blistering and possible adhesion issues, always allow the sprayed coating to dry a minimum of 2 hours at ambient conditions before using an elevated temperature cure.

For optimum corrosion resistance and electrical performance, Chomerics recommends curing the CHO-SHIELD 2000 Series coatings using cure cycle 1, 2 hours at room temperature and 0.5 hours at 250°F (121°C).

Clean-up

The spray system, including spray gun, mixing pot, and containers can be cleaned with MEK or Acetone (VOC exempt solvent). Masks can be powerwashed with Challenge 485S barrier coat.

Storage and Handling

CHO-SHIELD 2000 Series coatings should be stored at 50°F to 86°F (10°C to 30°C) and have a 9 month shelf life from the date of manufacturing in the original sealed container. CHO-SHIELD 2000 Series coatings are flammable liquids. Please consult the material safety data sheet for proper shipping and handling procedures before use.

Table 2:

Product Information

Typical Properties	Test Method	CHO-SHIELD® 2001	CHO-SHIELD® 2002	CHO-SHIELD® 2003
Binder	N/A	Three Part Urethane		
Fillers	N/A	Stabilized Copper Soluble Chromate Salts	Stabilized Copper	Stabilized Copper Soluble Chromate Salts
Color	N/A	Light Brown	Light Brown	Dark Brown
Cure Cycle	N/A	Cure cycle option 1: 2 hours at room temperature (70°F/21°C) followed by 0.5 hour at 250°F (121°C) Cure cycle option 2: 2 hours at room temperature (70°F/21°C) followed by 2 hours at 130°F (55°C) Cure cycle option 3: 7 days at room temperature (70°F/21°C)		
Surface Resistance (max. @ recommended thickness of 0.003 inches (0.0762 mm))	CEPS-0002 ³	0.1 ohm/sq. (Cure 1) 0.1 ohm/sq. (Cure 2) 0.1 ohm/sq. (Cure 3)	Aluminum 0.1 ohm/sq. (Cure 1) 0.1 ohm/sq. (Cure 2) 0.1 ohm/sq. (Cure 3) ----- G-10 Composite 0.01 ohm/sq. (Cure 1) 0.1 ohm/sq. (Cure 2) 0.35 ohm/sq. (Cure 3)	0.1 ohm/sq. (Cure 1) 0.1 ohm/sq. (Cure 2) 0.3 ohm/sq. (Cure 3)
Pencil Hardness	ASTM D3363	6H @ 250°F (Cure 1); 5H 130°F (Cure 2); 4H @ Room Temperature (Cure 3)		
Adhesion	ASTM D3359	5B		
Surface Resistance after Salt Fog Exposure (max. @ recommended thickness of .003 inches (3 mils) (.076 mm))	ASTM B117, CEPS-0002 ³	0.5 ohm/sq. (No substrate degradation after 500 hrs.)	Aluminum: 0.5 ohm/sq. (Minimal substrate degradation after 500 hrs.) ----- G-10 Composite: 1.0 ohm/sq. (Minimal substrate degradation after 500 hrs.)	0.5 ohm/sq. (No substrate degradation after 500 hrs.)
Abrasion Resistance ¹	ASTM D4060	60mg	60mg	80mg
Shielding Effectiveness ³ (10 MHz to 18 GHz) (Figure 2)	CHO-TP09 ³	>80 dB ⁴		
JP8 Fluid Resistance ² (max. @ recommended thickness of 0.003 inches (3 mils) (.076 mm))	CEPS-0002 ³	0.5 ohm/sq. (Cure 1); 0.5 ohm/sq. (Cure 2); 0.5 ohm/sq. (Cure 3)		
MIL-H-5606 Hydraulic Fluid Resistance (max. @ recommended thickness of 0.003 inches (3 mils) (.076 mm))		0.1 ohm/sq. (Cure 1); 0.1 ohm/sq. (Cure 2); 0.1 ohm/sq. (Cure 3)		
Continuous Operating Temperature	N/A	-65°C to + 85°C (- 85°F to 185°F)		
VOC	N/A	543 g/L	540 g/L	541 g/L
Working Life	N/A	2 hours		
Tack Free Time	ASTM D1650	1 hour		
Theoretical Coverage @ Recommended Thickness of 0.003 inch (3 mils) (.076 mm)	N/A	0.029 ft ² /g (3 mils) (0.0027 m ² /g (0.076 mm))		
Shelf Life (from date of manufacture)	N/A	9 months		
Mix Ratio (by weight)	N/A	100 : 10.06 : 41.96	100 : 10.34 : 42.18	100 : 10.06 : 41.96
Mix Ratio (Touch-Up Version) (by weight)	N/A	100 : 10.03 : 16.11	100 : 10.34 : 16.78	100 : 10.11 : 16.50

^(S) Properties tested on 2024 T-3 aluminum with chromate conversion coating per MIL-DTL-5541, Type 1, Class 3, applied after 30 second alkaline etch, except where noted. Samples Primed with CHO-SHIELD 1091.

¹ Taber Abrasion per ASTM D 4060. The weight of the sample coupons were recorded before and after 1000 cycles on the taber abrader with 500gm CS-10 wheels

² Retested post immersion resistance after 6 days at room temperature followed by 176°F (80°C) for 2 hours

³ Copies of CEPS-0002 and CHO-TP09 are available at www.chomerics.com, under TECH INFO.

⁴ Copies of shielding effectiveness curves available on www.chomerics.com.

Table 3:

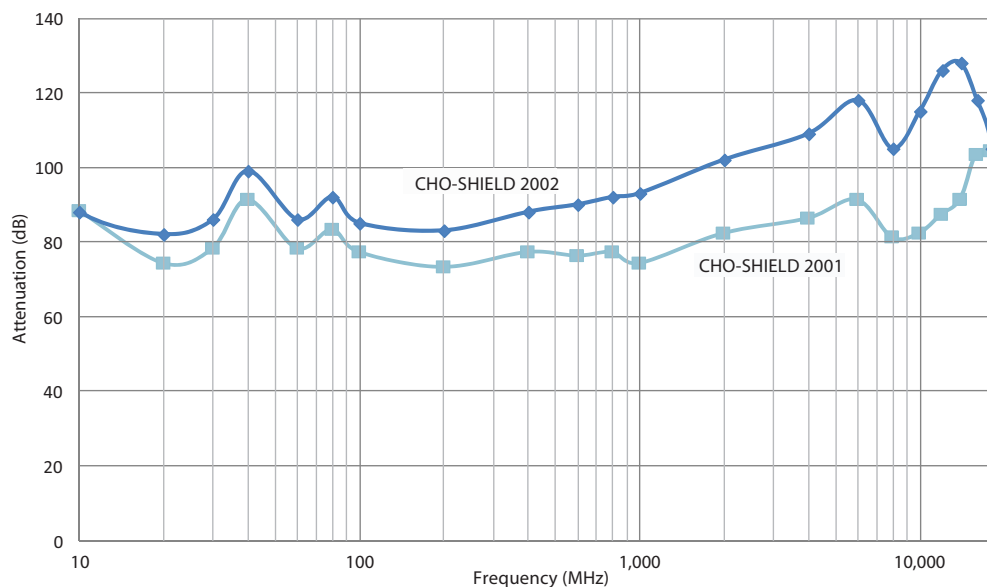
Conductive Coatings - Ordering Information

Product	Weight (grams)	Packaging	Chomerics Part No.	Primer Included
CHO-SHIELD 1091	95	4 fluid ounce glass bottle	50-00-1091-0000	N/A
	375	8 fluid ounce plastic bottle	50-01-1091-0000	N/A
CHO-SHIELD 2001*	250	3 component, 1/2 pint aluminum can kit	52-00-2001-0000	No
	250	3 component, 1/2 pint aluminum can "touch-up" kit	52-00-2001-1000	No
	700	3 component, 1 pint aluminum can kit	52-01-2001-0000	No
	1378	3 component, 1 quart aluminum can kit	52-04-2001-0000	No
CHO-SHIELD 2002*	250	3 component, 1/2 pint aluminum can kit	52-00-2002-0000	No
	250	3 component, 1/2 pint aluminum can "touch-up" kit	52-00-2002-1000	No
	700	3 component, 1 pint aluminum can kit	52-01-2002-0000	No
	1378	3 component, 1 quart aluminum can kit	52-04-2002-0000	No
CHO-SHIELD 2003*	250	3 component, 1/2 pint aluminum can kit	52-00-2003-0000	1091
	250	3 component, 1/2 pint aluminum can "touch-up" kit	52-00-2003-1000	No
	700	3 component, 1 pint aluminum can kit	52-01-2003-0000	1091
	1378	3 component, 1 quart aluminum can kit	52-04-2003-0000	1091

* Requires the use of 1091 Primer.

Figure 2:

Shielding Effectiveness*



* CHO-SHIELD 2003 is a black pigmented version of CHO-SHIELD 2001
Chomerics Shielding Effectiveness Test Method CHO-TP09 is available at www.Chomerics.com.

www.chomerics.com
www.parker.com/chomerics

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