

# SMI, Inc.

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Attn: Dan Reid  
HR Toughguard, LLC  
9430 SW Coral Street, Suite 202B  
Tigard, OR 97223

Date: 03-Apr-2012

SMI/REF: 1201-227

Product: **TOUGHGUARD "STEP 1 POLARIZING WASH"** (received 02-Feb-2012)

Dilution: Concentrate (neat) and 2 ounces per gallon Page 1 of 4

## AMS 1526C

Cleaner for Aircraft Exterior Surfaces  
Water-Miscible, Pressure-Spraying Type

3.2.1.1	Sandwich Corrosion	<u>Conforms</u>
3.2.1.2	Total Immersion Corrosion	<u>Conforms</u>
3.2.1.3	Low-Embrittling Cadmium Plate	<u>Conforms</u>
3.2.2	Hydrogen Embrittlement	<u>Conforms</u>
3.2.3	Flash Point	<u>Conforms</u>
3.2.4	Effect on Transparent Acrylic Plastics	<u>Conforms</u>
3.2.5	Effect on Painted Surfaces	<u>Conforms</u>
3.2.6	Effect on Unpainted Surfaces	<u>Conforms</u>
3.2.7	Storage Stability	<u>Not performed</u>

Respectfully submitted,



Patricia D. Viani, SMI Inc.

Client: HR Toughguard, LLC  
 Product: TOUGHGUARD "STEP 1 POLARIZING WASH"  
 Dilution: As received (neat) and 2 ounces per gallon  
 AMS 1526C

Date: 03-Apr-2012  
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3.2.1.1 Sandwich Corrosion: Specimens, after test, shall show a rating not worse than 1 determined in accordance with ASTM F 1110.

	2024-T3 Anodized	2024-T3 Alclad	7075-T6 Anodized	7075-T6 Alclad
<b>AS RECEIVED</b>	1	1	1	1
<b>DILUTE</b>	1	1	1	1
Control	1	1	1	1

Result Conforms

3.2.1.2 Total Immersion Corrosion: The product shall neither show evidence of corrosion of the panels nor cause a weight change of any test panel greater than the following, determined in accordance with ASTM F 483:

PANEL	Allowable Weight Change mg/cm <sup>2</sup> /24hrs	RESULTS mg/cm <sup>2</sup> /24hrs	
		AS RECEIVED	DILUTE 1.6%
AMS 4037 Aluminum Alloy, anodized per AMS 2470	0.3	+ 0.02	< 0.01
AMS 4041 Aluminum Alloy	0.3	+ 0.01	< 0.01
AMS 4049 Aluminum Alloy	0.3	< 0.01	0.01
AMS 4376 Magnesium Alloy, dichromate treated as in AMS 2475	0.2	+ 0.01	0.01
AMS 4911 Titanium Alloy	0.1	< 0.01	< 0.01
AMS 5045 Carbon Steel	0.8	0.01	< 0.01

Result Conforms

3.2.1.3 Low-Embrittling Cadmium Plate: Panels coated with low-embrittling cadmium plate shall not show a weight change greater than 0.3 mg/cm<sup>2</sup> per 24 hours, determined in accordance with ASTM F 1111.

**As received: < 0.01 mg/cm<sup>2</sup>**  
**Dilute: 0.21 mg/cm<sup>2</sup>**

Result Conforms

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AMS 1526C

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SMI/REF: 1201-227  
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3.2.2 Hydrogen Embrittlement: The product shall be non-embrittling, determined in accordance with ASTM F 519, utilizing Type 1a, 1c or 2a specimens, cadmium plated in accordance with MIL-STD-870, Class 1 Type I. Type 1a and Type 1c, specimens shall be loaded to 45% of the predetermined notch fracture strength, and Type 2a specimens loaded to 80% of the yield strength. The entire 2a stressed specimen, or just the notched area of the 1a and 1c stressed specimen, shall be immersed continuously in the solution under test for 150 hours at a temperature between 20°C -30°C (68 – 86°F).

*Specimens: Type 1c, cadmium plated*

**As received: No failures within 150 hours.**  
**Dilute: No failures within 150 hours.**

Result Conforms

3.2.3 Flash Point: The flash point shall not be lower than 60°C (140°F), determined in accordance with ASTM D 56.

**As received: No flash point observed to 141°F.**

Result Conforms

3.2.4 Effect on Transparent Acrylic Plastics: There shall be no crazing or staining of stretched MIL-P-25690 plastic, determined in accordance with ASTM F 484.

**As received: No crazing or staining**  
**Dilute: No crazing or staining**

Result Conforms

3.2.5 Effect on Painted Surfaces: The product shall neither decrease the hardness of the paint film by more than 2 pencil hardness levels nor shall it produce any streaking, discoloration or blistering of the paint film, determined in accordance with ASTM F 502.

**As received: No hardness change; no streaking, discoloration or blistering**  
**Dilute: No hardness change; no streaking, discoloration or blistering**

Result Conforms



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Product: TOUGHGUARD "STEP 1 POLARIZING WASH"  
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3.2.6 Effect on Unpainted Surfaces: The product, tested in accordance with ASTM F 485, shall neither produce streaking nor leave any stains requiring polishing to remove.

**AMS 4911:** *As received: No streaking or stains*  
*Dilute: No streaking or stains*

**AMS 4049:** *As received: No streaking or stains*  
*Dilute: No streaking or stains*

Result Conforms

3.2.7 Storage Stability: The product shall neither show separation from exposure to heat or cold nor show an increase in turbidity greater than a control sample equally diluted to use concentration with ASTM D 1193, Type IV water, determined in accordance with ASTM D 1104.

*Requires 12 months of storage*

Result Not performed



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Attn: Dan Reid  
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Tigard, OR 97223

Date: 26-Mar-2012

SMI/REF: 1201-215

Product: **TOUGHGUARD "STEP 2 PAINT PROTECTION SYSTEM"**  
(received 02-Feb-2012 / 23-Feb-2012)

Dilution: As received

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**AMS 1650C**  
Polish, Aircraft Metal  
Type 1: Liquid

## 3.2 Properties

3.2.1	Flash Point	<u>Does not conform</u>
3.2.2	Viscosity (Type I only)	<u>Does not conform</u>
3.2.3	Corrosion of Metal Surfaces	
	Sandwich Corrosion	<u>Conforms</u>
	Total Immersion Corrosion	<u>Conforms</u>
3.2.4	Effect on Plastic	<u>Conforms</u>
3.2.5	Effect on Painted Surfaces	<u>Conforms</u>
3.2.6	Effect on Unpainted Surfaces	<u>Conforms</u>
3.2.7	Settling Number (Type I only)	<u>Conforms</u>
3.2.8	Low-Temperature Stability	<u>Conforms</u>
3.2.9	Abrasive Number	<u>Conforms</u>
3.3	Quality	<u>Conforms</u>

Respectfully submitted,



Patricia D. Viani, SMI Inc.

Client: HR Toughguard, LLC  
 Product: TOUGHGUARD "STEP 2 PAINT PROTECTION SYSTEM"  
 Dilution: As received  
 AMS 1650C

Date: 26-Mar-2012  
 SMI/REF: 1201-215  
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3.2.1 Flash Point: Shall be not lower than 60°C (140°F), determined in accordance with ASTM D 56.

**Flash point: 120°F**

Result Does not conform

3.2.2 Viscosity (Type 1 Only): Shall be 50 to 70 Krebs units, determined in accordance with ASTM D 562 at 24°C ±3 (75°F ±5).

**> 5000 Krebs units**

Result Does not conform

3.2.3 Corrosion of Metal Surfaces:

3.2.3.1 Sandwich Corrosion: Specimens shall produce a rating not worse than 1, determined in accordance with ASTM F 1110.

	2024-T3 Bare Anodized	2024-T3 Alclad	7075-T6 Bare Anodized	7075-T6 Alclad
<b>As received</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>CONTROL</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

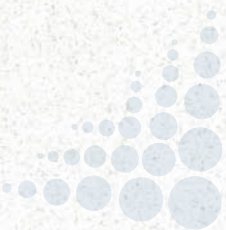
Result Conforms

3.2.3.2 Total Immersion Corrosion: Polish shall not cause a weight change greater than 0.3 mg/cm<sup>2</sup> per 24 hours for any panel of AMS 4045 and AMS 4049 aluminum alloy, determined in accordance with ASTM F 483. The product shall cause no evidence of etching, selective attack, or presence of corrosion products after any time period and only a slight dulling at the end of the test.

**AMS 4045: + 0.02 mg/cm<sup>2</sup>/24hrs**

**AMS 4049: + 0.02 mg/cm<sup>2</sup>/24hrs**

Result Conforms



Client: HR Toughguard, LLC  
Product: TOUGHGUARD "STEP 2 PAINT PROTECTION SYSTEM"  
Dilution: As received  
AMS 1650C

Date: 26-Mar-2012  
SMI/REF: 1201-215  
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3.2.4 Effect on Plastic: Polish shall not craze, stain, or discolor stretched Mil-P-25690 plastic, determined in accordance with ASTM F 484.

Result Conforms

3.2.5 Effect on Painted Surfaces: Polish shall neither decrease the hardness of the paint film by more than two pencil hardness levels nor shall it produce any staining or blistering of the paint film, determined in accordance with ASTM F 502.

Result Conforms

3.2.6 Effect on Unpainted Surfaces: Polish, tested in accordance with ASTM F 485, shall neither produce streaking nor leave any stains on AMS 4045 and AMS 4049 aluminum alloys which require polishing to remove.

***Residue evident after rinse; product did not rinse cleaning from the substrate; conformance based on no streaking or staining.***

Result Conforms

3.2.7 Settling Number (Type 1 Only): Shall be not greater than 20, determined as in 3.2.7.1.

***Settling number: 8***

Result Conforms

3.2.8 Low-Temperature Stability: The polish shall be restorable to its original appearance by vigorous shaking or by stirring after being temperature cycled as in 3.2.8.1.

3.2.8.1 Place approximately 100 mL of Type 1 polish or 100 grams of Type 2 polish in each of two 125 mL wide-mouth Pyrex jars and stopper the jars. Set aside one of the jars at 20 to 25 degrees C (68 to 77 degrees F) for the duration of the test period as a control sample. Place the second jar containing the test sample in a cold box maintained at -10 degrees C  $\pm 2$  (-14 degrees F  $\pm 4$ ) for 2 hours  $\pm 0.1$ . At the end of the two hour period, remove the jar containing the test sample and immerse in a water bath maintained at 47 degrees C  $\pm 1$  (117 degrees F  $\pm 2$ ) for 1 hour  $\pm 0.1$ . Remove the jar from the water bath, dry, and again place in the cold box at -10 degrees C  $\pm 2$  (-14 degrees F  $\pm 4$ ) for 2 hours  $\pm 0.1$ .

**3.2.8.1 (Continued):**

At the end of the second 2-hour period, remove the jar from the cold box and immerse in the water bath maintained at 47 degrees C  $\pm 1$  (117 degrees F  $\pm 2$ ) for 1 hour  $\pm 0.1$ . Remove the jar from the water bath, dry, and again place the jar in the cold box at -10 degrees C  $\pm 2$  (-14 degrees F  $\pm 4$ ) for a third 2-hour period. At the end of this period, remove the jar from the cold box and allow the jar to remain at room temperature for 16 hours  $\pm 0.5$ . For Type 1 polish, shake the jar containing the test sample vigorously by hand; for Type 2, stir the contents of the jar. Compare the appearance of the test sample with the control sample.

Result                      Conforms                     

3.2.9 Abrasive Number: Shall not exceed 5, determined as in 3.2.9.1.

3.2.9.1 Weigh two 0.04 x 3 x 6 inch (1 x 76 x 152 mm) AMS 4049 aluminum alloy panels after washing the panels thoroughly with a non-abrasive detergent, thoroughly rinsing with deionized water, and drying. Cover one of the panels with a thin coating of the polish. Place the second panel on the coated panel and rotate twenty-five times in moderate circular motion. Separate the panels and wipe clean with a soft cloth saturated with acetone. Reweigh and determine the weight loss. Report the weight loss in milligrams as the abrasive number and examine the surfaces of the panels for any evidence of scratching.

***abrasive number: 1.0 No abrasive scratching.***

Result                      Conforms                     

3.3 Quality: The polish, as received by purchaser, shall be uniform in texture, homogeneous, and free from foreign materials detrimental to usage of the polish.

Result                      Conforms                     

