

SMI, Inc.

12219 SW 131 Avenue
Miami, Florida 33186-6401 USA

Phone: (305) 971-7047
Fax: (305) 971-7048

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

Date: 22-Mar-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

British Aerospace
AIRBUS AIMS09-00-002 (Issue 3, July 2011)
EVALUATION OF MAINTENANCE MATERIALS
Exterior and General Cleaners

5.3.1 Sandwich Corrosion Test	<u>Conforms</u>
5.3.2 Total Immersion Test	<u>Conforms</u>
5.3.3 Hydrogen Embrittlement Test	<u>Conforms</u>
5.3.4 Paint Softening Test	<u>Conforms</u>
5.3.5 Acrylic Crazing Test	<u>Conforms</u>
5.3.6 Polycarbonate Crazing Test	<u>Conforms</u>

Respectively submitted,



Patricia D. Viani,
SMI Inc.

5.3.1 Sandwich Corrosion Test: Testing shall be in accordance with ASTM-F-1110 using:

- aluminium alloy 2024 T3 clad against
- anodised aluminium alloy 2024 T3 unclad and
- anodised aluminium alloy 7075 T6 unclad.

After the test the aluminium alloy specimens shall show a rating less than or equal to 1 or no worse than a control sample prepared with distilled water.

	Aluminium alloy 2024 T3 clad against Anodised alum. 2024 T3 unclad	Aluminium alloy 2024 T3 clad against Anodised alum. 7075 T6 unclad
AS RECEIVED	2024 T3 clad: 1 2024 T3 unclad anodised: 1	2024 T3 clad: 1 7075 T6 unclad anodised: 1
DILUTE	2024 T3 clad: 1 2024 T3 unclad anodised: 1	2024 T3 clad: 1 7075 T6 unclad anodised: 1
CONTROL	2024 T3 clad: 1 2024 T3 unclad anodised: 1	2024 T3 clad: 1 7075 T6 unclad anodised: 1

Result Conforms

5.3.2 Total Immersion Test: Testing shall be in accordance with ASTM-F-483 using:

- aluminium alloys as per 5.3.1. above
- low carbon steel, e.g. AMS 5045, XC18 or equivalent
- cadmium plated steel, e.g. AMS 5045, XC18 (or equivalent), plated in accordance with AMS QQ-P-416 Type I Class 1 (or equivalent)

The immersion time shall be (24 ± 0.5) h. The immersion temperature shall be $(23 \pm 2)^{\circ}\text{C}$.

No significant visual change shall be evident. The max. permitted weight changes are as follows:

- Aluminum alloy = **0.02 mg/cm²** maximum.
- Low carbon steel = **0.8 mg/cm²** maximum
- Cadmium plated steel = **0.3 mg/cm²** maximum

ALLOY	WEIGHT CHANGE	
	AS RECEIVED	DILUTE
Aluminum alloy 2024-T3 clad	0.01 mg/cm ² /24 hrs	< 0.01 mg/cm ² /24 hrs
Anodized aluminum alloy 2024-T3 unclad	+ 0.02 mg/cm ² /24 hrs	< 0.01 mg/cm ² /24 hrs
Anodized aluminum alloy 7075-T6 unclad	+ 0.01 mg/cm ² /24 hrs *	< 0.01 mg/cm ² /24 hrs
Low carbon steel AMS 5045	0.01 mg/cm ² /24 hrs	< 0.01 mg/cm ² /24 hrs
Cadmium plated steel AMS 5045 plated i.a.w. AMS-QQ-P-416 Type I Class 1	< 0.01 mg/cm ² /24 hrs	< 0.01 mg/cm ² /24 hrs

Result Conforms

5.3.3 Hydrogen Embrittlement Test: The product shall be non-embrittling as determined in accordance with ASTM F 519, using 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 20-30°C (68-86°F).
The maintenance material being tested shall not cause embrittlement of the test specimens.

Specimens: Type 1c, cadmium plated

As received: **Specimen #1: No failures occurred within 150 hours.**
 Specimen #2: No failures occurred within 150 hours.
 Specimen #3: No failures occurred within 150 hours.
 Specimen #4: No failures occurred within 150 hours.

Dilute: **Specimen #1: No failures occurred within 150 hours.**
 Specimen #2: No failures occurred within 150 hours.
 Specimen #3: No failures occurred within 150 hours.
 Specimen #4: No failures occurred within 150 hours.

Result _____ Conforms _____

5.3.4 Paint Softening Test: Maintenance material compatibility shall be tested with Airbus approved paints and/or customer specific systems. Testing shall consist of three specimens for each of the following combinations. The substrate shall be clad aluminium alloy 2024 suitably pre-treated:

- Epoxy primer of polyurethane primer with or without polyurethane topcoat (interior paint scheme according to TN A.007.10050 OR epoxy primer to MIL-PRF-23377 Type I with or without polyurethane topcoat to MIL-PRF-85285 Type I or customer specific system).
- Basic primer plus relevant exterior paint scheme according to TN A.007.10050 OR epoxy primer to MIL-PRF-23377 Type I with polyurethane topcoat to MIL-PRF-85285 Type I OR external paint scheme conforming to AMS 3095 OR customer specific system.

The thickness and drying times of individual coats shall be in accordance with the manufacturer's instruction sheets. Testing shall be in accordance with ISO 1518 "Scratch Test" using the following test sequence: one hour immersion in the maintenance material at an ambient temperature (23 ± 2)°C, rinsing with water immediately after the immersion and drying for 1 hour at room temperature. The material shall not soften the paint coat and the Scratch Test shall have 90% of the original value after the immersion.

The agent being tested shall not produce any blistering, discoloration or staining.

5.3.4 Paint Softening Test:continued

Paint System		Weight required to produce scratch	
		Before exposure	After exposure
AS RECEIVED	Epoxy Primer without topcoat: Primer: MIL-PRF-23377 Type I, Epoxy, High Solids	No scratch*	No scratch*
	Epoxy primer with polyurethane topcoat: Primer : MIL-PRF-23377 Type I, Epoxy, High Solids Topcoat: MIL-PRF-85285 Type I, Polyurethane, High solids	No scratch*	No scratch*
DILUTE	Epoxy Primer without topcoat: Primer: MIL-PRF-23377 Type I, Epoxy, High Solids	No scratch*	No scratch*
	Epoxy primer with polyurethane topcoat: Primer : MIL-PRF-23377 Type I, Epoxy, High Solids Topcoat: MIL-PRF-85285 Type I, Polyurethane, High solids	No scratch*	No scratch*

* utilizing a 2-kg weight

No blistering, discoloration or softening of any panel; scratch of exposed portion occurred within 90% of the original value, or was over the 2000 gram threshold of testing.

Result Conforms

5.3.5 Acrylic Crazeing Test: Material conforming to MIL-P-25690 Type C shall be tested in accordance with ASTM-F-484. The maintenance materials shall not craze, crack, stain or discolor the test specimens.

As received: No evidence of craze, crack, stain or discolor.

Dilute: No evidence of craze, crack, stain or discolor.

Result Conforms

5.3.6 Polycarbonate Crazeing Test: Material conforming to ASTM-D-3935 or AMS-P-83310 shall be tested in accordance with the method for the determination of stress crazeing detailed in ASTM F 484.

Specimens shall be stressed for (30 ± 2) minutes to an outer stress of 21MPa (3000 psi) at a temperature of (23 ± 2)°C.

As received: No evidence of craze, crack, stain or discolor.

Dilute: No evidence of craze, crack, stain or discolor.

Result Conforms

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Attn: Dan Reid
HR Toughguard, LLC
9430 SW Coral Street, Suite 202B
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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British Aerospace
AIRBUS AIMS09-00-002 (Issue 3, July 2011)
EVALUATION OF MAINTENANCE MATERIALS
Exterior and General Cleaners

Waxes, Polishing Compounds and Protective Surface Coatings

5.3.1 Sandwich Corrosion Test	<u>Conforms</u>
5.3.2 Total Immersion Test	<u>Conforms</u>
5.3.3 Hydrogen Embrittlement Test	<u>Conforms</u>
5.3.4 Paint Softening Test	<u>Conforms</u>

Respectively Submitted,



Patricia D. Viani, SMI Inc.

5.3.1 Sandwich Corrosion Test: Testing shall be in accordance with ASTM-F-1110 using aluminium alloy 2024 T3 clad against anodized aluminum alloy 2024 T3 unclad, and aluminium alloy 2024 T3 clad against anodized aluminum alloy 7075 T6 unclad. After the test the aluminium alloy specimens shall show a rating less than or equal to 1 or no worse than a control sample prepared with distilled water.

	aluminium alloy 2024 T3 clad against anodized aluminum alloy 2024 T3 unclad	aluminium alloy 2024 T3 clad against anodized aluminum alloy 7075 T6 unclad
As received	clad/unclad: 1/1	clad/unclad: 1/1
CONTROL	clad/unclad: 1/1	clad/unclad: 1/1

Result Conforms

5.3.2 Total Immersion Test: Testing shall be in accordance with ASTM-F-483 using aluminium alloys as per 5.3.1. above and low carbon steel e.g. AMS 5045, XC18 or equivalent, cadmium plated steel, XC18 (or equivalent), plated in accordance with AMS QQ-P-416 Type I Class 1 (or equivalent) The immersion time shall be (24 ± 0.5) h. The immersion temperature shall be $(23 \pm 2)^{\circ}\text{C}$. No significant visual change shall be evident. The maximum permitted weight changes are as follows:

Aluminum alloy = **0.02 mg/cm²** maximum.
 Low carbon steel = **0.8 mg/cm²** maximum
 Cadmium plated steel = **0.3 mg/cm²** maximum

ALLOY	WGT LOSS mg/cm ² /24hrs
	As received
Aluminum alloy 2024-T3 clad	+0.02 mg/cm ² /24 hrs
Anodized aluminum alloy 2024-T3 unclad	<0.01 mg/cm ² /24 hrs
Anodized aluminum alloy 7075-T6 unclad	0.01 mg/cm ² /24 hrs
Low carbon steel AMS 5045	+0.01 mg/cm ² /24 hrs
Cadmium plated steel AMS 5045 plated in accordance with AMS_QQ-P-416 Type I Class 1	0.03 mg/cm ² /24 hrs

Note: weight changes are reported as mg/cm²

Result Conforms

5.3.3 Hydrogen Embrittlement Test: The product shall be non-embrittling as determined in accordance with ASTM F 519, using 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 20-30° C (68-86° F).

The maintenance material being tested shall not cause embrittlement of the test specimens.

As received: No failures occurred within 150 hours.

Result Conforms

5.3.4 Paint Softening Test: Maintenance material compatibility shall be tested with Airbus approved paints and/or customer specific systems. Testing shall consist of three specimens for each of the following combinations. The substrate shall be clad aluminium alloy 2024 suitably pre-treated:

- Epoxy primer of polyurethane primer with or without polyurethane topcoat (interior paint scheme according to TN A.007.10050 OR epoxy primer to MIL-PRF-23377 Type I with or without polyurethane topcoat to MIL-PRF-85285 Type I or customer specific system).
- Basic primer plus relevant exterior paint scheme according to TN A.007.10050 OR epoxy primer to MIL-PRF-23377 Type I with polyurethane topcoat to MIL-PRF-85285 Type I OR external paint scheme conforming to AMS 3095 OR customer specific system.

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Paint System		Weight required to produce scratch	
		Before exposure	After exposure
As received	Epoxy Primer without topcoat: Primer: MIL-PRF-23377 Type I, Epoxy, High Solids	No scratch*	No scratch*
	Epoxy primer with polyurethane topcoat: Primer : MIL-PRF-23377 Type I, Epoxy, High Solids Topcoat: MIL-PRF-85285 Type I, Polyurethane, High solids	No scratch*	No scratch*

* utilizing a 2-kg weight

No blistering, discoloration or softening of any panel; scratch of exposed portion occurred within 90% of the original value, or was over the 2000 gram threshold of testing.

Result Conforms