



Test Report Rev.02

Referred to:	AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
Client:	IGP Pulvertechnik AG Ring Str. 30 9500 Wil Switzerland
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Samples receipt:	2020-10-26
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End of testing:	2021-04-26
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The expanded measurement uncertainty is not taken into account in the conformity assessment unless otherwise agreed. Irrespectively, the measurement uncertainty is stated if possible.



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The accredited test methods are marked with an **asterisk ***.



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1 FORMULATION

The Institute was instructed by the client to perform all necessary tests acc. to AAMA 2605-20, Chapter 8.1 to 8.9.

1.1 Status and type of samples/sampling

<u>Label / No.:</u>	<u>Number:</u>	<u>Material / Surface:</u>
Test panel (140 x 70 x 1.0 mm)	33 pieces	Aluminum / powder coated Powder: IGP- DURA@sky 95 Color: RAL 1011
Test panel (140 x 70 x 2.0 mm)	12 pieces	

The preparation of the aluminum samples and the coating was performed as follows:

Aluminium substrate: Aluminium panel, alloy: EN AW-5005
(Dimensions: 140 mm x 70 mm x 1.0 mm)
Aluminium panel, alloy: EN AW-6060
(Dimensions: 140 mm x 70 mm x 2.0 mm)

Pre-treatment: Alternative Pretreatment
Manufacturer: Co. Henkel
Product: Bonderite M-NT 400

Powder System: Supplier: IGP Pulvertechnik AG
Product: IGP-Superfluor 95
Color: RAL 1011

Coater: Company: Institut für Oberflächentechnik
Cure: 200 °C / 15 min
Coating date: 2020-11-04

Date testing started: 2020-11-10
Date testing completed: 2021-04-26

2 TEST RESULTS

2.1 AAMA 2605-20, Chapter 8.1 – Color Uniformity

2.1.1 Procedure according to AAMA 2605-20, Chapter 8.1.2

- Check random samples visually under a uniform light source. Viewing should be done at multiple angles.

2.1.2 Requirements according to AAMA 2605-20, Chapter 8.1.3 and Results

- Color uniformity shall be consistent with the color range

Sample:

Results:

Sample 1	Uniform color
Sample 2	Uniform color
Sample 3	Uniform color

2.2 AAMA 2605-20, Chapter 8.2 – Specular Gloss

2.2.1 Procedure according to AAMA 2605-20, Chapter 8.2.2

- Gloss measurement according to ASTM D 523 using a 60-degree gloss meter
- Samples must meet minimum dry film thickness requirements

2.2.2 Requirements according to AAMA 2605-20, Chapter 8.2.3 and Results

- Gloss values shall be within ± 5 units of the manufacturer's specification

Sample:

Manufacturer's
gloss specification:

Gloss value (60°):

Dry film thickness:

Sample 1	N/A	30 GU	75 μm
Sample 2		31 GU	70 μm
Sample 3		30 GU	76 μm



2.3 AAMA 2605-20, Chapter 8.3 – Dry Film Hardness

2.3.1 Procedure according to AAMA 2605-20, Chapter 8.3.2

- Pencil hardness test according to ASTM D 3363

2.3.2 Requirements according to AAMA 2605-20, Chapter 8.3.3 and Results

- Grade F minimum hardness: No rupture of film according to ASTM D 3363

Sample:

Results:

Sample 1	Grade F: No rupture of film
Sample 2	Grade F: No rupture of film
Sample 3	Grade F: No rupture of film

2.4 AAMA 2605-20, Chapter 8.4 – Film Adhesion

2.4.1 Procedure according to AAMA 2605-20, Chapter 8.4.2

- Dry Adhesion and Tape Pull-Off according to AAMA 2605-20, Chapter 8.4.2.1
- Boiling Water Adhesion according to AAMA 2605-20, Chapter 8.4.2.2
- Wet Adhesion according to AAMA 2605-20, Chapter 8.4.2.3

2.4.2 Requirements according to AAMA 2605-20, Chapter 8.4.3 and Results

- Classification per ASTM D 3359:
 - Method A: X-Cut (if coating thickness > 125 µm): Level 4A or better
 - Method B: Cross-Cut (if coating thickness ≤ 125 µm): Level 4B or better

Sample:

Results:

Sample 1	Adhesion classification: 5B
Sample 2	Adhesion classification: 5B
Sample 3	Adhesion classification: 5B



2.5 AAMA 2605-20, Chapter 8.5 – Impact Resistance

2.5.1 Procedure according to AAMA 2605-20, Chapter 8.5.2

- Impact testing according to AAMA 2605-20, Chapter 8.5.2

2.5.2 Requirements according to AAMA 2605-20, Chapter 8.5.3 and Results

- No removal of film from substrate

Sample:

Results:

Sample 1	Slight cracks, no removal of film
Sample 2	Slight cracks, no removal of film
Sample 3	Slight cracks, no removal of film

2.6 AAMA 2605-20, Chapter 8.6 – Abrasion Resistance

2.6.1 Procedure according to AAMA 2605-20, Chapter 8.6.2

- Falling sand test according to ASTM D 968

2.6.2 Requirements according to AAMA 2605-20, Chapter 8.6.3 and Results

- The coating shall withstand a volume of 80 L of sand or the abrasion coefficient value of the coating shall be calculated and recorded.

Sample:

Results:

Sample 1	Withstood a volume of 80 L of sand
Sample 2	Withstood a volume of 80 L of sand
Sample 3	Withstood a volume of 80 L of sand



2.7 AAMA 2605-20, Chapter 8.7 – Chemical Resistance

2.7.1 Procedure according to AAMA 2605-20, Chapter 8.7.1 to 8.7.5

- Muriatic Acid Resistance (15-Minute Spot test) acc. to AAMA 2605-20, Ch. 8.7.1.1
- Mortar Resistance (24-Hour Pat test) acc. to AAMA 2605-20, Chapter 8.7.2.1
- Nitric Acid Resistance acc. to AAMA 2605-20, Chapter 8.7.3.1
- Detergent Resistance (72-Hour Immerse test) acc. to AAMA 2605-20, Ch. 8.7.4.1
- Window Cleaner Resistance acc. to AAMA 2605-20, Chapter 8.7.5.1

2.7.2 Requirements according to AAMA 2605-20, Chapter 8.7.1 to 8.7.5 and Results

- Muriatic Acid Resistance requirements acc. to AAMA 2605-20, Chapter 8.7.1.2:
 - No blistering when examined by the unaided eye
 - No visual change in appearance when examined by the unaided eye
- Mortar Resistance requirements acc. to AAMA 2605-20, Chapter 8.7.2.2:
 - Mortar shall dislodge easily
 - Any residue shall be removable with a damp cloth
 - Any lime residue should be easily removed with the 10% muriatic acid solution
 - No loss of film adhesion
 - No visual change in appearance

- Nitric Acid Resistance requirements acc. to AAMA 2605-20, Chapter 8.7.3.2:
 - No color change more than 5 ΔE calculated according to ASTM D 2244

- Detergent Resistance requirements acc. to AAMA 2605-20, Chapter 8.7.4.2:
 - Solution prepared according to ASTM D 2248
 - Pull off of the tape according to ASTM D 3359
 - No loss of adhesion of the film
 - No blistering
 - No significant visual change in appearance

- Window Cleaner Resistance requirements acc. to AAMA 2605-20, Chapter 8.7.5.2:
 - No blistering
 - No visual change in appearance
 - No removal of film

Muriatic Acid Resistance according to AAMA 2605-20, Chapter 8.7.1:

Sample: Results:

Sample 1	No blistering, no visual change in appearance
Sample 2	No blistering, no visual change in appearance
Sample 3	No blistering, no visual change in appearance

Mortar Resistance according to AAMA 2605-20, Chapter 8.7.2:

Sample: Results:

Sample 1	No residue, no loss of film adhesion, no visual change in appearance
Sample 2	No residue, no loss of film adhesion, no visual change in appearance
Sample 3	No residue, no loss of film adhesion, no visual change in appearance

Nitric Acid Resistance requirements according to AAMA 2605-20, Chapter 8.7.3:

Sample: Results:

Sample 1	$\Delta E = 2.5$
Sample 2	$\Delta E = 2.8$
Sample 3	$\Delta E = 1.9$

Detergent Resistance requirements according to AAMA 2605-20, Chapter 8.7.4:

Sample: Results:

Sample 1	No blistering, no loss of film adhesion, no visual change in appearance
Sample 2	No blistering, no loss of film adhesion, no visual change in appearance
Sample 3	No blistering, no loss of film adhesion, no visual change in appearance

Window Cleaner Resistance requirements according to AAMA 2605-20, Chapter 8.7.5:

Sample: Results:

Sample 1	No blistering, no removal of film, no visual change in appearance
Sample 2	No blistering, no removal of film, no visual change in appearance
Sample 3	No blistering, no removal of film, no visual change in appearance

2.8 AAMA 2605-20, Chapter 8.8 – Corrosion Resistance

2.8.1 AAMA 2605-20, Chapter 8.8.1 – Humidity Resistance

2.8.1.1 Procedure according to AAMA 2605-20, Chapter 8.8.1.1

- Constant humidity test for 4,000 h according to ASTM D 2247

2.8.1.2 Requirements according to AAMA 2605-20, Chapter 8.8.1.2 and Results

- No formation of blisters to extent greater than “Few” blisters Size No. 8, as shown in ASTM D 714, Figure No. 4

Sample: Results:

Sample 1	No blisters, no visual change
Sample 2	No blisters, no visual change
Sample 3	No blisters, no visual change

2.8.2 AAMA 2605-20, Chapter 8.8.2 – Cyclic Corrosion Testing

2.8.2.1 Procedure according to AAMA 2605-20, Chapter 8.8.2.1

- Cyclic Corrosion test for 2,000 h according to ASTM G 85, Annex A, dilute electrolyte cyclic fog/dry test

2.8.2.2 Requirements according to AAMA 2605-20, Chapter 8.8.2.2 and Results

- Minimum rating of 7 on scribe or cut edges
- Minimum blister rating of 8 within the test specimen field

Sample:

Results:

Sample 1	Rating of failure at scribe: 10 Rating of unscribed areas: 10
Sample 2	Rating of failure at scribe: 10 Rating of unscribed areas: 10
Sample 3	Rating of failure at scribe: 10 Rating of unscribed areas: 10

2.9 AAMA 2605-20, Chapter 8.9 – Weathering

2.9.1 AAMA 2605-20, Chapter 8.9.2 – South Florida Exposure

2.9.1.1 Procedure according to AAMA 2605-20, Chapter 8.9.2.1, 8.9.2.2, 8.9.2.3, 8.9.2.4, 8.9.2.5

- On-fence testing Florida exposure South of latitude 27 degrees North at a 45-degree angle facing South for a minimum of ten years and operated in accordance with ASTM G7.
- Color Retention procedure acc. to AAMA 2605-20, Chapter 8.9.2.2.1: Color change shall be measured on the exposed painted surface which has been cleaned of external deposits with clear water and a soft cloth and corresponding values shall be measured on the original retained panel or the unexposed flap area of the panel. A portion of the exposed panel may be washed lightly to remove surface dirt only. Heavy scrubbing or any polishing to remove chalk formation or restore the surface is not permitted where color measurements are made.
- Chalk Resistance procedure acc. to AAMA 2605-20, Chapter 8.9.2.3.1: Chalking shall be measured on an exposed, unwashed painted surface.
- Gloss Retention procedure acc. to AAMA 2605-20, Chapter 8.9.2.4.1: Gloss measurement according to ASTM D 523 using a 60-degree gloss meter of exposed and unexposed areas after weathering exposure. The exposure panel may be washed lightly with clear water and a soft cloth to remove loose surface dirt. Heavy scrubbing or any polishing to restore the surface is not permitted where gloss measurements are made.
- Resistance to Erosion procedure acc. to AAMA 2605-20, Chapter 8.9.2.5.1: Measure dry film thickness of exposed and adjacent unexposed areas of exposure panels using an Eddy Current meter as defined in ASTM B 244.

2.9.1.2 Requirements according to AAMA 2605-20, Chapter 8.9.2.2, 8.9.2.3, 8.9.2.4, 8.9.2.5 and Results

- Color Retention requirements acc. to AAMA 2605-20, Chapter 8.9.2.2.2:
No color change more than 5 ΔE units calculated according to ASTM D 2244
- Chalk Resistance requirements acc. to AAMA 2605-20, Chapter 8.9.2.3.1:
Chalking shall be greater than or equal to that represented by a No. 8 rating based on ASTM D4214, Test Method A.
- Gloss Retention requirements acc. to AAMA 2605-20, Chapter 8.9.2.4.2:
Gloss retention shall be a minimum of 50 % after the exposure
- Resistance to Erosion requirements acc. to AAMA 2605-20, Chapter 8.9.2.5.2:
Less than 10 percent film loss after the exposure test

Sample:

Results:

Sample 1	Test results are still pending.
Sample 2	
Sample 3	
Sample 4	
Sample 5	
Sample 6	

3 REMARK


This test report supersedes IFO-31676 Rev.01 of September 15th, 2021. The runtime of the constant humidity test in chapter 2.8.1.1 has been corrected (4,000 hours).

4 RESULTS

The samples fulfill the requirements acc. to AAMA 2605-20, Chapter 8.1 up to 8.8.2.

The Weather Exposure acc. to AAMA 2605-20, Chapter 8.9 is still pending.

Schwaebisch Gmuend,
2022-02-02


P. Malchow
Project Engineer


J. Sahin
Project Engineer



5 IMAGE DOCUMENTATION

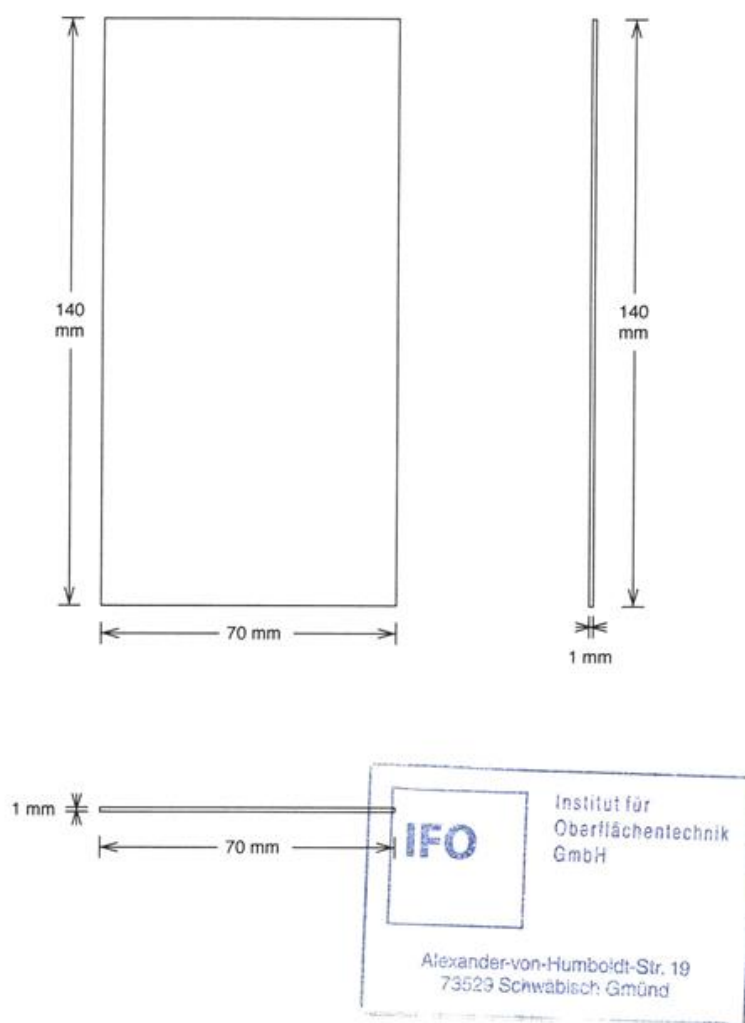


Figure 1 – Sample Drawing (140 x 70 x 1.0 mm panels)

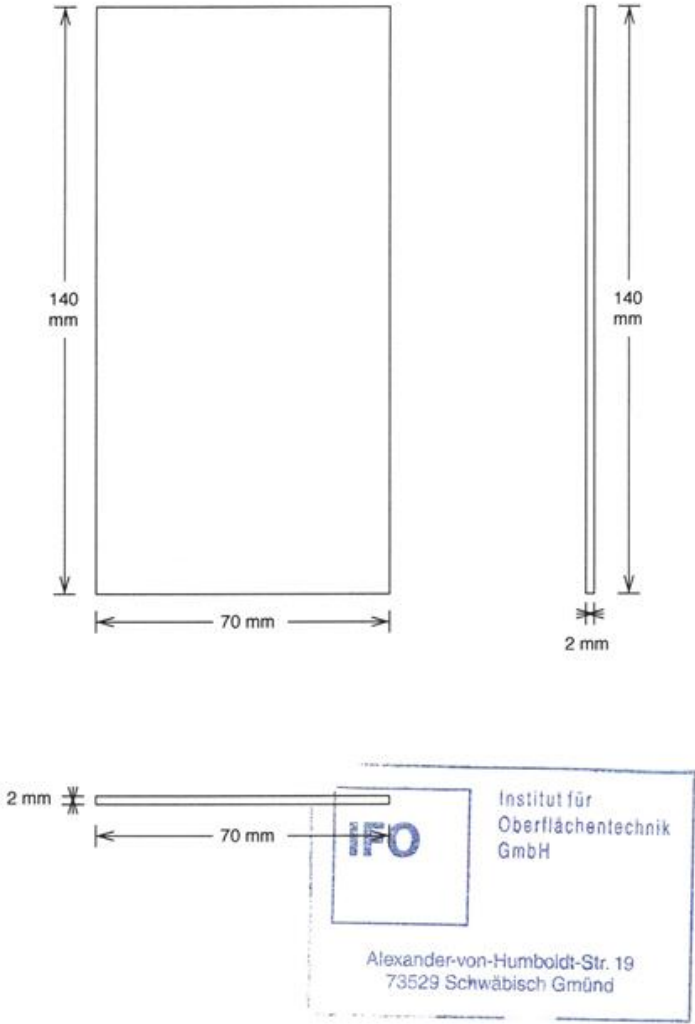


Figure 2 – Sample Drawing (140 x 70 x 2.0 mm panels)

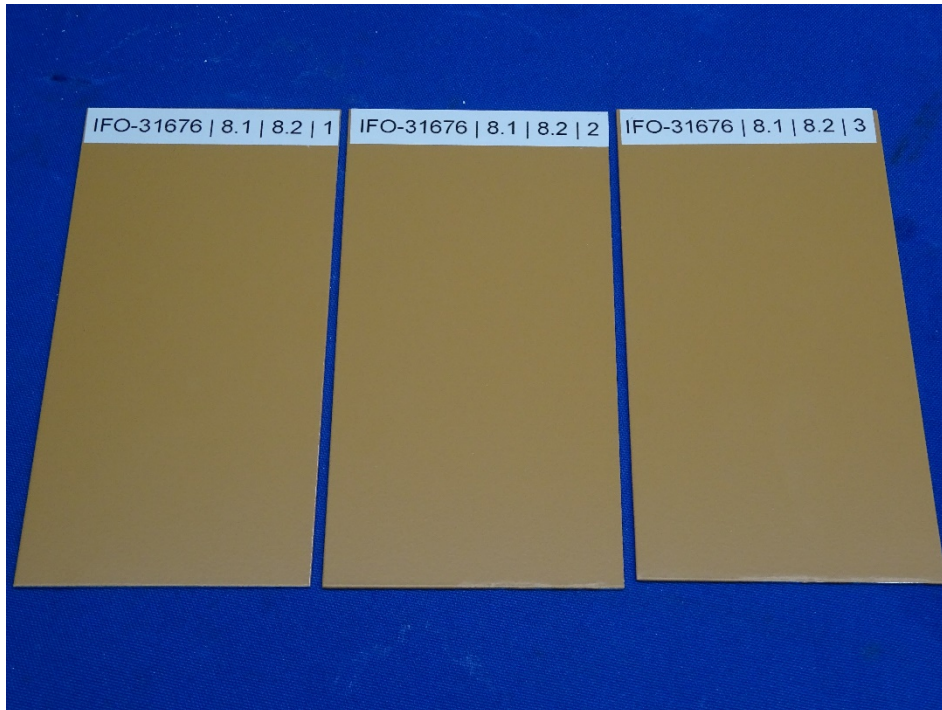


Figure 3 – Samples for Color Uniformity and Specular Gloss
(see Ch. 2.1 and 2.2: Tests acc. to AAMA 2605-20, Ch. 8.1 and 8.2)

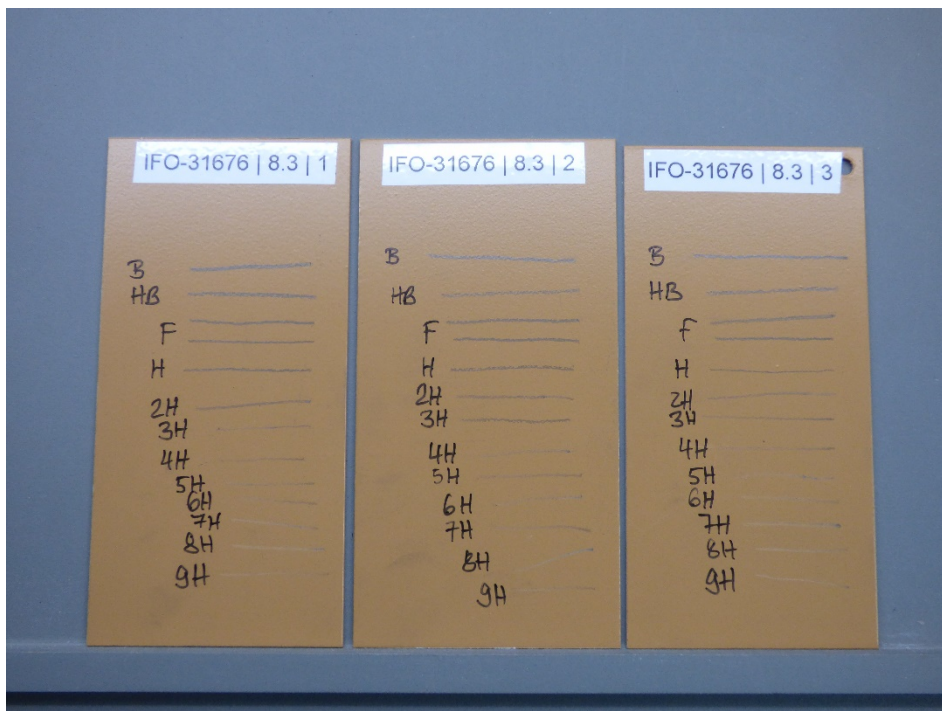


Figure 4 – Samples after Dry Film Hardness test
(see Ch. 2.3: Test acc. to AAMA 2604-20, Ch. 8.3)

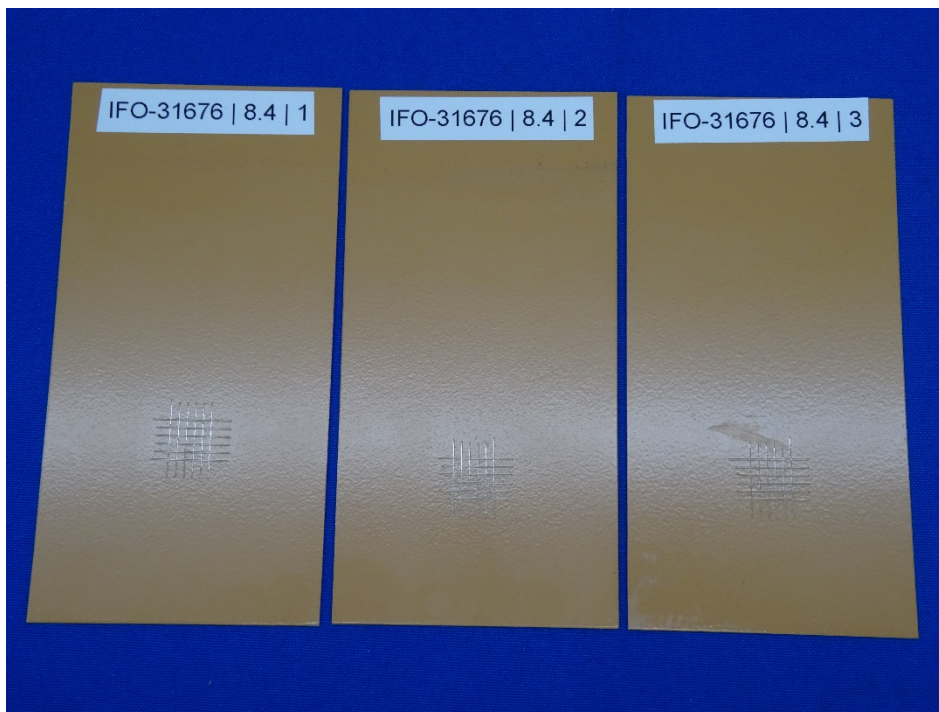


Figure 5 – Samples after Film Adhesion test
(see Ch. 2.4: Test acc. to AAMA 2605-20, Ch. 8.4)

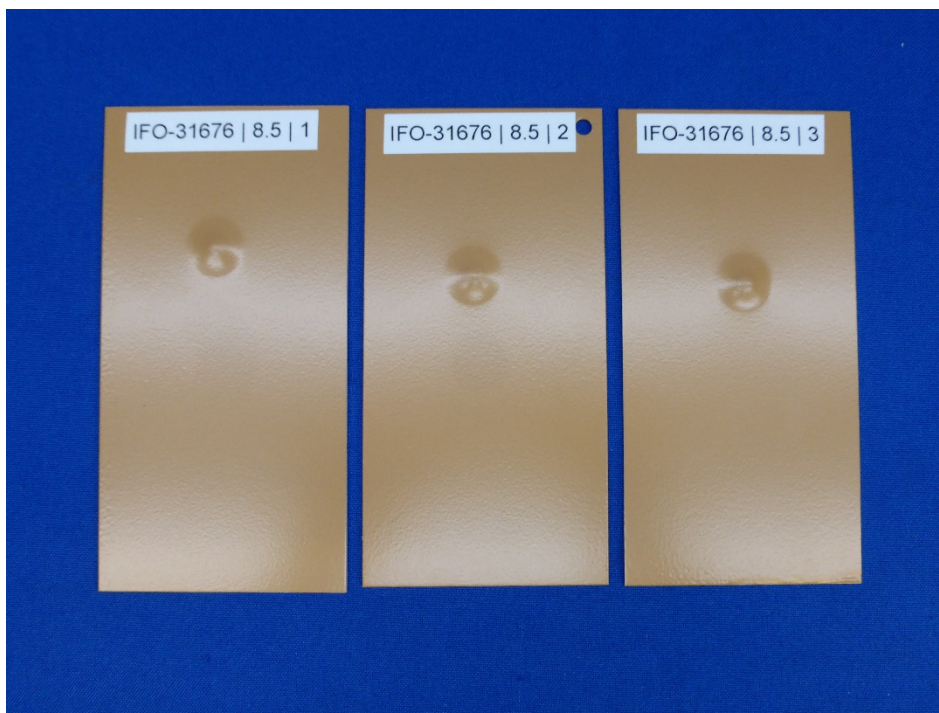


Figure 6 – Samples after Impact Resistance test
(see Ch. 2.5: Test acc. to AAMA 2605-20, Ch. 8.5)

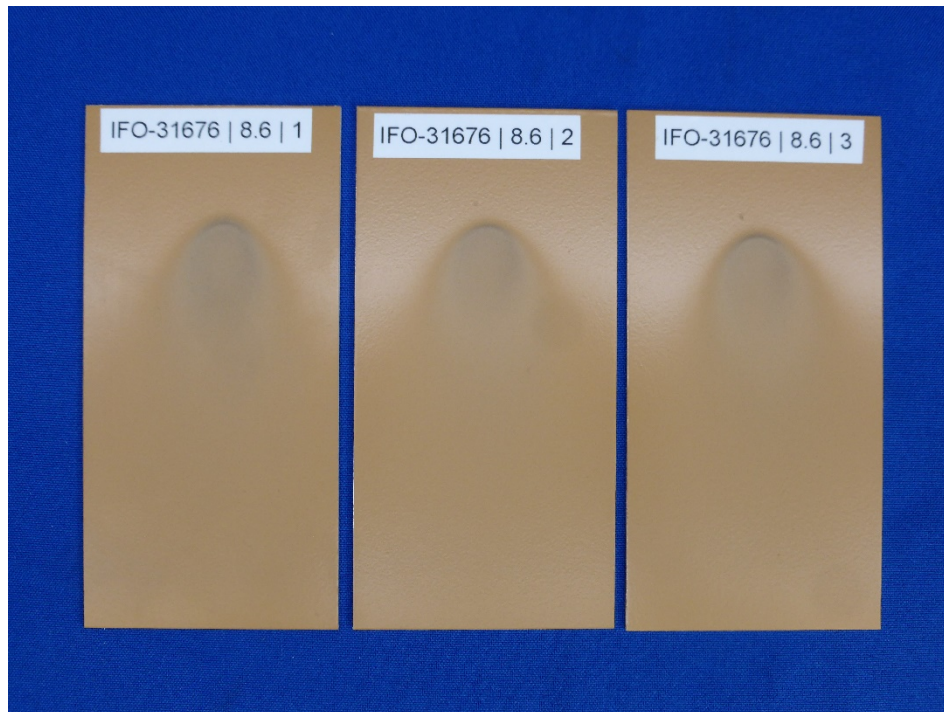


Figure 7 – Samples after Abrasion Resistance test
(see Ch. 2.6: Test acc. to AAMA 2605-20, Ch. 8.6)



Figure 8 – Samples after Muriatic Acid Resistance test
(see Ch. 2.7.1: Tests acc. to AAMA 2605-20, Ch. 8.7.1)

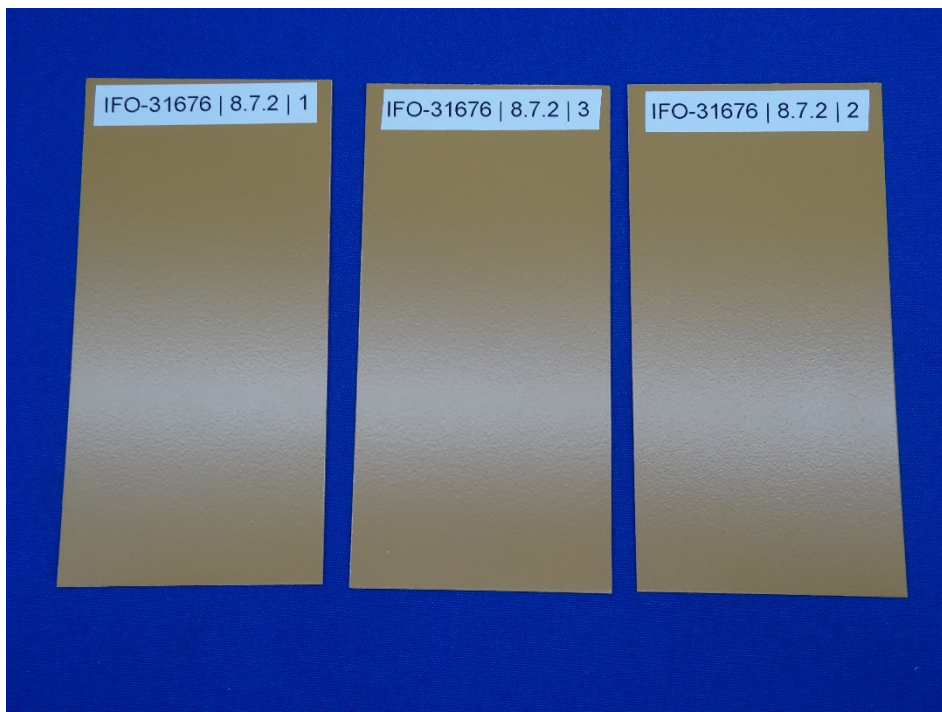


Figure 9 – Samples after Mortar Resistance test
(see Ch. 2.7.2: Test acc. to AAMA 2605-20, Ch. 8.7.2)

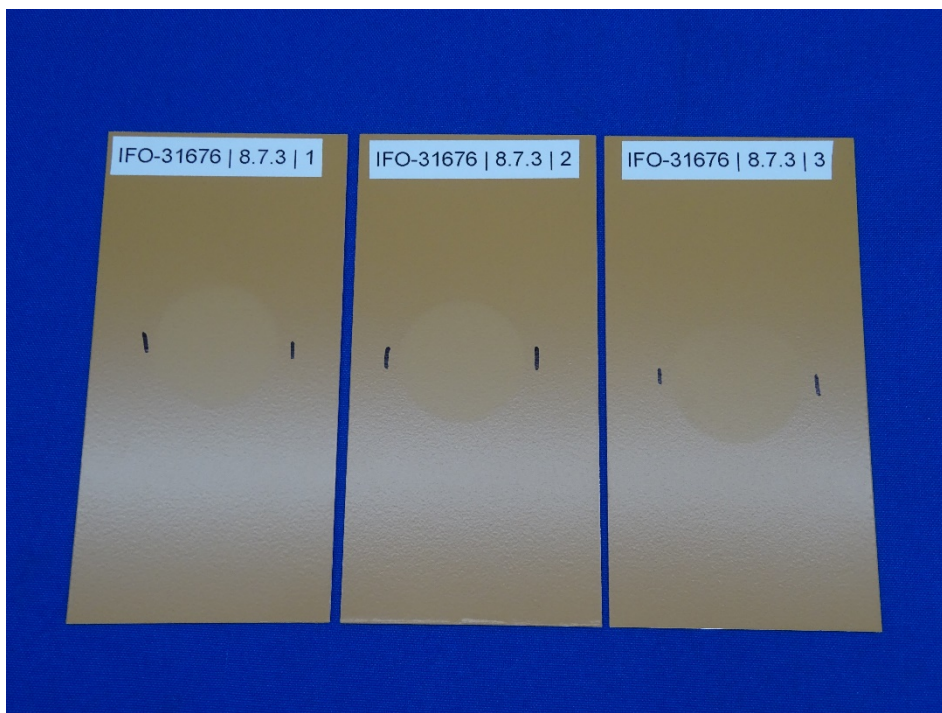


Figure 10 – Samples after Nitric Acid Resistance test
(see Ch. 2.7.3: Test acc. to AAMA 2605-20, Ch. 8.7.3)

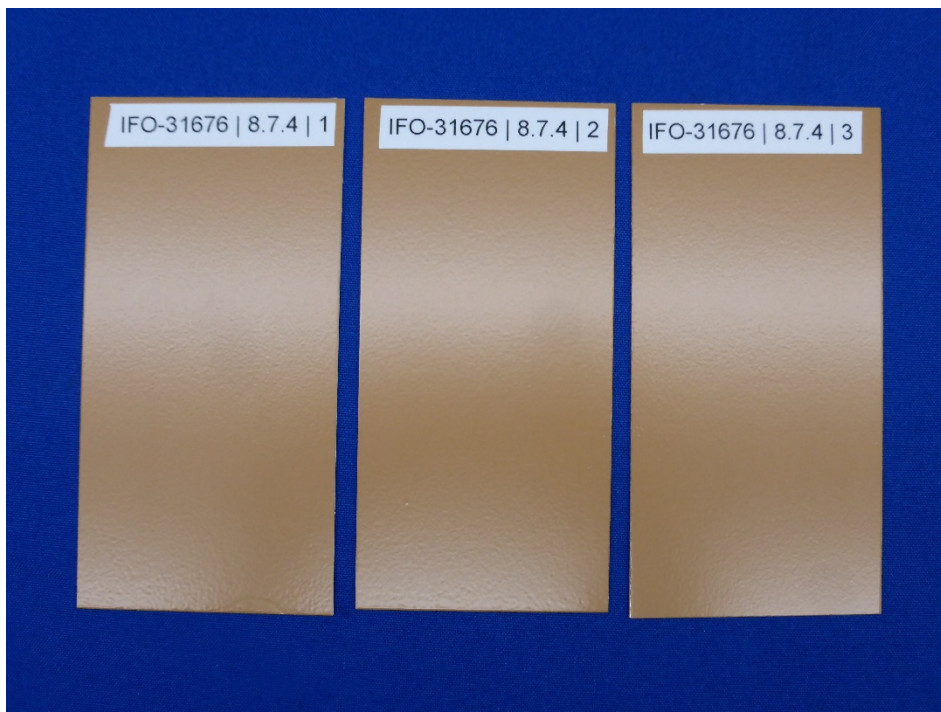


Figure 11 – Samples after Detergent Resistance test
(see Ch. 2.7.4: Test acc. to AAMA 2605-20, Ch. 8.7.4)

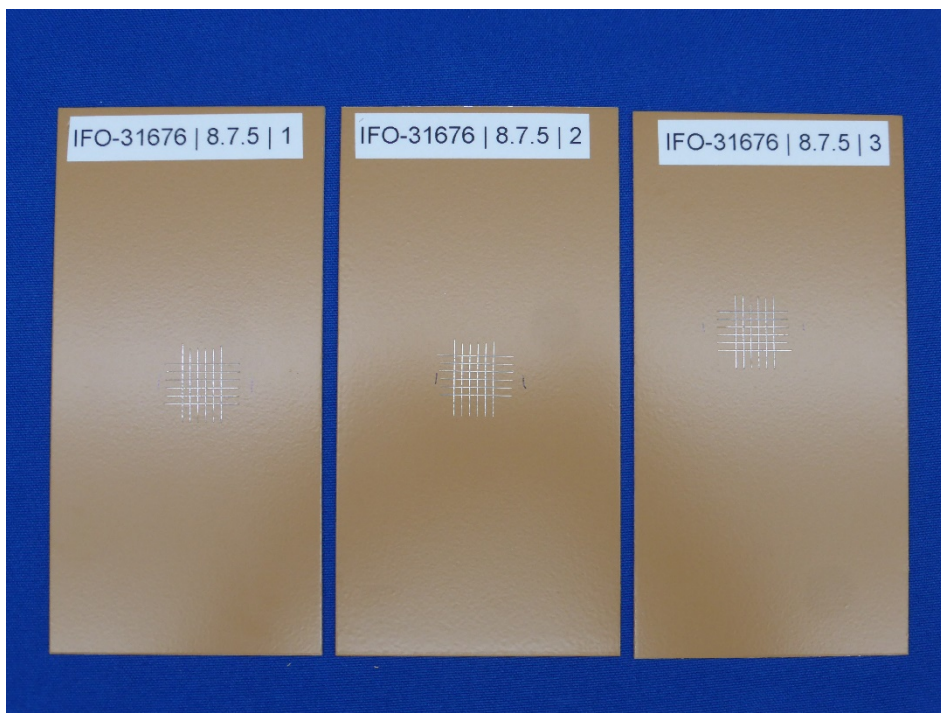


Figure 12 – Samples after Window Cleaner Resistance test
(see Ch. 2.7.5: Test acc. to AAMA 2605-20, Ch. 8.7.5)



Figure 13 – Samples after Humidity Resistance test
(see Ch. 2.8.1: Test acc. to AAMA 2605-20, Ch. 8.8.1)

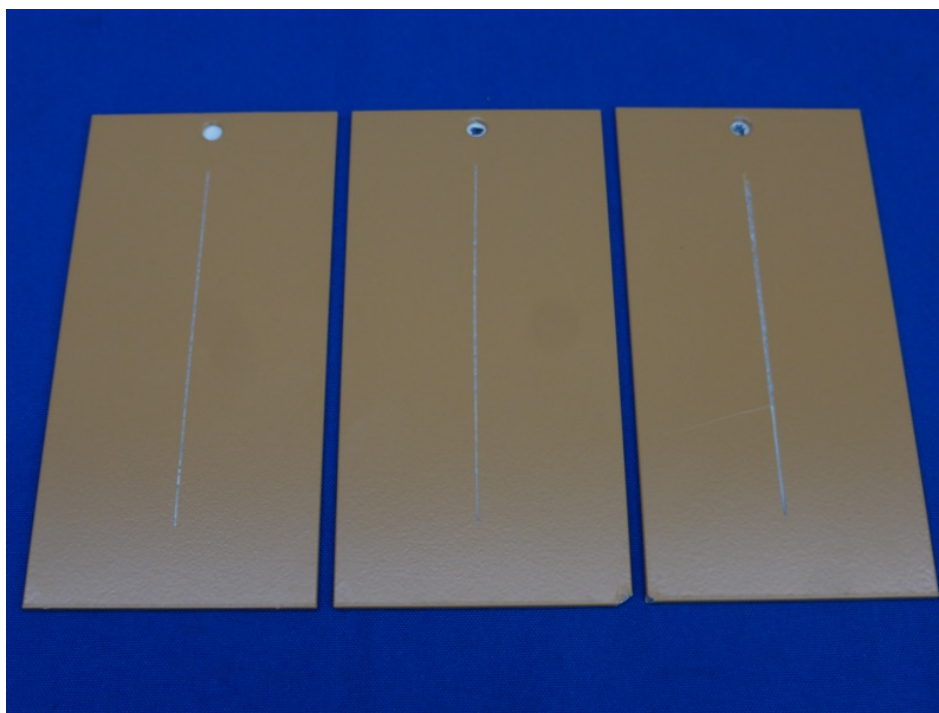


Figure 14 – Samples after Cyclic Corrosion test
(see Ch. 2.8.2: Test acc. to AAMA 2605-20, Ch. 8.8.2)