



## Test Report

<b>Referred to:</b>	AAMA 2604-20, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
<b>Client:</b>	IGP Pulvertechnik AG Ring Str. 30 9500 Wil Switzerland
<b>Job number:</b>	31845-1
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The accredited test methods are marked with an **asterix** \*.



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## 1 FORMULATION

The Institute was instructed by the client to perform all necessary tests acc. to AAMA 2604-20, 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)	42 pieces	Aluminum / powder coated Powder: IGP-HWF superior 571T 571TA7021A10 Color: RAL 7021 HR

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

<u>Aluminium substrate:</u>	Aluminium panel, alloy: EN AW-5005 (Dimensions: 140 mm x 70 mm x 1.0 mm)
<u>Pre-treatment:</u>	Alternative Pretreatment Manufacturer: Co. Henkel Product: Bonderite M-NT 400
<u>Powder System:</u>	Supplier: IGP Pulvertechnik AG Product: IGP-HWF superior 571T fine texture Color: RAL 7021 HR
<u>Coater:</u>	Company: IGP Pulvertechnik AG Cure: 190 °C / 15 min Coating date: 2020-10-28
<u>Date testing started:</u>	2020-11-13
<u>Date testing completed:</u>	2021-09-16



## 2 TEST RESULTS

### 2.1 AAMA 2604-20, Chapter 8.1 – Color Uniformity

#### 2.1.1 Procedure according to AAMA 2604-20, 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 2604-20, 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 2604-20, Chapter 8.2 – Specular Gloss

#### 2.2.1 Procedure according to AAMA 2604-20, 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 2604-20, Chapter 8.2.3 and Results

- Gloss values shall be within  $\pm 5$  units of the manufacturer's specification

Sample:

Manufacturer's  
gloss specification:

Gloss value (60°):

Dry film thickness:

Sample 1	n/a	7.9 GU	71 $\mu\text{m}$
Sample 2		7.5 GU	70 $\mu\text{m}$
Sample 3		8.9 GU	73 $\mu\text{m}$



## 2.3 AAMA 2604-20, Chapter 8.3 – Dry Film Hardness

### 2.3.1 Procedure according to AAMA 2604-20, Chapter 8.3.2

- Pencil hardness test according to ASTM D 3363

### 2.3.2 Requirements according to AAMA 2604-20, 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 2604-20, Chapter 8.4 – Film Adhesion

### 2.4.1 Procedure according to AAMA 2604-20, Chapter 8.4.2

- Dry Adhesion and Tape Pull-Off according to AAMA 2604-20, Chapter 8.4.2.1
- Boiling Water Adhesion according to AAMA 2604-20, Chapter 8.4.2.2
- Wet Adhesion according to AAMA 2604-20, Chapter 8.4.2.3

### 2.4.2 Requirements according to AAMA 2604-20, 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: 4B
Sample 2	Adhesion classification: 5B
Sample 3	Adhesion classification: 5B



## 2.5 AAMA 2604-20, Chapter 8.5 – Impact Resistance

### 2.5.1 Procedure according to AAMA 2604-20, Chapter 8.5.2

- Impact testing according to AAMA 2604-20, Chapter 8.5.2

### 2.5.2 Requirements according to AAMA 2604-20, Chapter 8.5.3 and Results

- No removal of film from substrate

Sample:

Results:

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

## 2.6 AAMA 2604-20, Chapter 8.6 – Abrasion Resistance

### 2.6.1 Procedure according to AAMA 2604-20, Chapter 8.6.2

- Falling sand test according to ASTM D 968

### 2.6.2 Requirements according to AAMA 2604-20, Chapter 8.6.3 and Results

- The coating shall withstand a volume of 40 L of sand or the abrasion coefficient value of the coating shall be calculated and recorded.

Sample:

Results:

Sample 1	Withstood a volume of 40 L of sand
Sample 2	Withstood a volume of 40 L of sand
Sample 3	Withstood a volume of 40 L of sand



## **2.7 AAMA 2604-20, Chapter 8.7 – Chemical Resistance**

### **2.7.1 Procedure according to AAMA 2604-20, Chapter 8.7.1 to 8.7.5**

- Muriatic Acid Resistance (15-Minute Spot test) acc. to AAMA 2604-20, Ch. 8.7.1.1
- Mortar Resistance (24-Hour Pat test) acc. to AAMA 2604-20, Chapter 8.7.2.1
- Nitric Acid Resistance acc. to AAMA 2604-20, Chapter 8.7.3.1
- Detergent Resistance (72-Hour Immerse test) acc. to AAMA 2604-20, Ch. 8.7.4.1
- Window Cleaner Resistance acc. to AAMA 2604-20, Chapter 8.7.5.1

### **2.7.2 Requirements according to AAMA 2604-20, Chapter 8.7.1 to 8.7.5 and Results**

- Muriatic Acid Resistance requirements acc. to AAMA 2604-20, 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 2604-20, 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 2604-20, Chapter 8.7.3.2:
  - No color change more than 5  $\Delta E$  calculated according to ASTM D 2244
- Detergent Resistance requirements acc. to AAMA 2604-20, 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 2604-20, Chapter 8.7.5.2:
  - No blistering
  - No visual change in appearance
  - No removal of film

Muriatic Acid Resistance according to AAMA 2604-20, 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 2604-20, 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 2604-20, Chapter 8.7.3:

Sample:

Results:

Sample 1	$\Delta E = 0.75$
Sample 2	$\Delta E = 1.03$
Sample 3	$\Delta E = 0.94$



Detergent Resistance requirements according to AAMA 2604-20, Chapter 8.7.4:

<u>Sample:</u>	<u>Results:</u>
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 2604-20, Chapter 8.7.5:

<u>Sample:</u>	<u>Results:</u>
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 2604-20, Chapter 8.8 – Corrosion Resistance**

**2.8.1 AAMA 2604-20, Chapter 8.8.1 – Humidity Resistance**

**2.8.1.1 Procedure according to AAMA 2604-20, Chapter 8.8.1.1**

- Constant humidity test for 3,000 h according to ASTM D 2247

**2.8.1.2 Requirements according to AAMA 2604-20, 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

<u>Sample:</u>	<u>Results:</u>
Sample 1	No blisters
Sample 2	No blisters
Sample 3	No blisters

**2.8.2 AAMA 2604-20, Chapter 8.8.2 – Salt Spray Resistance**

**2.8.2.1 Procedure according to AAMA 2604-20, Chapter 8.8.2.1**

- Salt Spray test for 3,000 h according to ASTM B 117 using a 5 % salt solution

**2.8.2.2 Requirements according to AAMA 2604-20, 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 2604-20, Chapter 8.9 – Weathering**

**2.9.1 AAMA 2604-20, Chapter 8.9.1 – South Florida Exposure**

**2.9.1.1 Procedure according to AAMA 2604-20, Chapter 8.9.1.1, 8.9.1.2, 8.9.1.3, 8.9.1.4, 8.9.1.5**

- On-fence testing Florida exposure South of latitude 27 degrees North at a 45-degree angle facing South for a minimum of five years and operated in accordance with ASTM G7.
- Color Retention procedure acc. to AAMA 2604-20, Chapter 8.9.1.2.1: 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 2604-20, Chapter 8.9.1.3.1: Chalking shall be measured on an exposed, unwashed painted surface.
- Gloss Retention procedure acc. to AAMA 2604-20, Chapter 8.9.1.4.1: 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 2604-20, Chapter 8.9.1.5.1: 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 2604-20, Chapter 8.9.1.2, 8.9.1.3, 8.9.1.4, 8.9.1.5 and Results**

- Color Retention requirements acc. to AAMA 2604-20, Chapter 8.9.1.2.1:  
No color change more than 5 ΔE units calculated according to ASTM D 2244
- Chalk Resistance requirements acc. to AAMA 2604-20, Chapter 8.9.1.3.1:  
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 2604-20, Chapter 8.9.1.4.2:  
Gloss retention shall be a minimum of 30 % after the exposure
- Resistance to Erosion requirements acc. to AAMA 2604-17a, Chapter 8.9.1.5.2:  
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 RESULTS**

The samples fulfill the requirements acc. to AAMA 2604-20, Chapter 8.1 to 8.8.2.

The Weather Exposure acc. to AAMA 2604-20, Chapter 8.9 is still pending.

Schwaebisch Gmuend,  
2021-10-08

  
\_\_\_\_\_  
P. Malchow  
Project Engineer

  
\_\_\_\_\_  
J. Sahin  
Project Engineer

**4 IMAGE DOCUMENTATION**

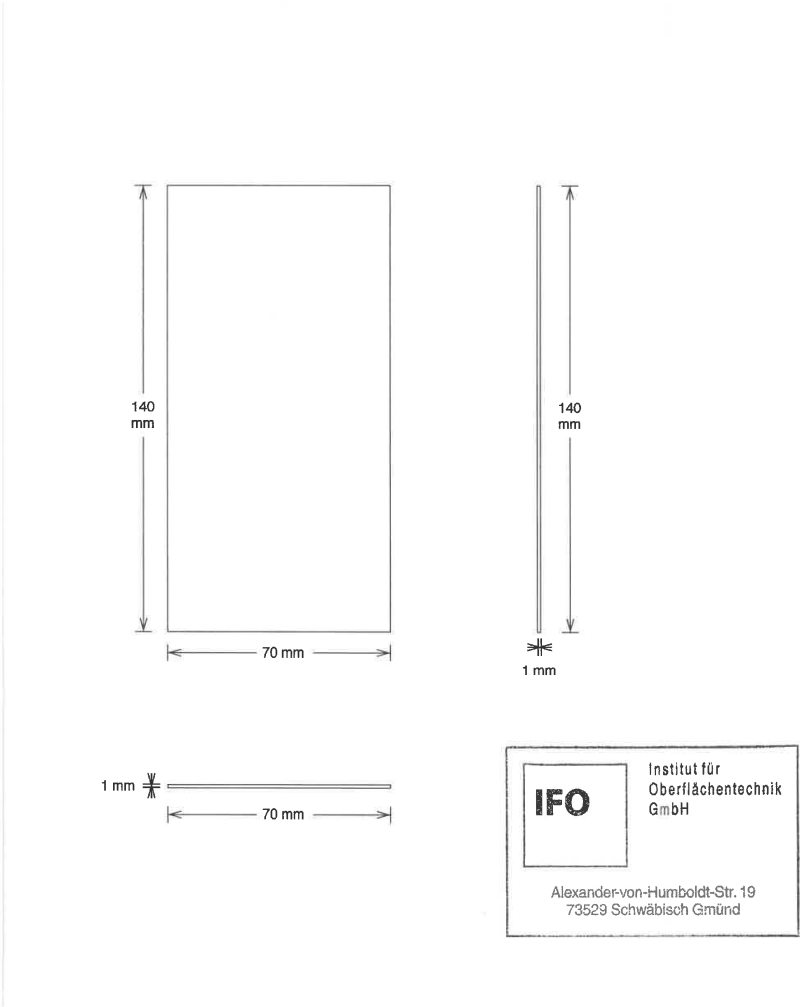


Figure 1 – Sample Drawing

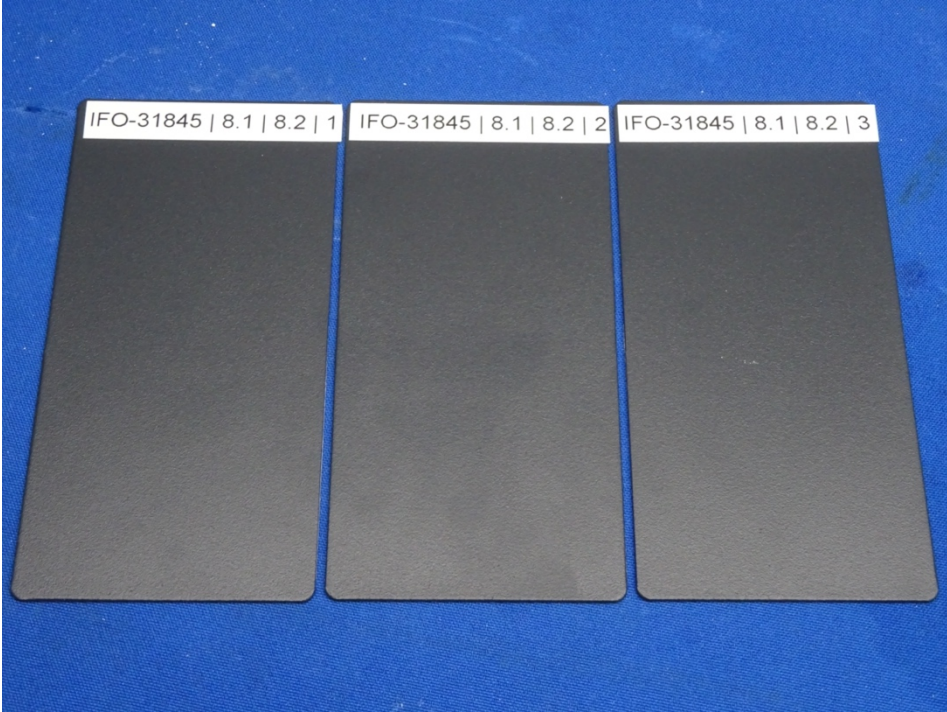


Figure 2 – Samples for Color Uniformity and Specular Gloss (see Ch. 2.1 and 2.2: Tests acc. to AAMA 2604-20, Ch. 8.1 and 8.2)



Figure 3 – Samples after Dry Film Hardness test (see Ch. 2.3: Test acc. to AAMA 2604-20, Ch. 8.3)



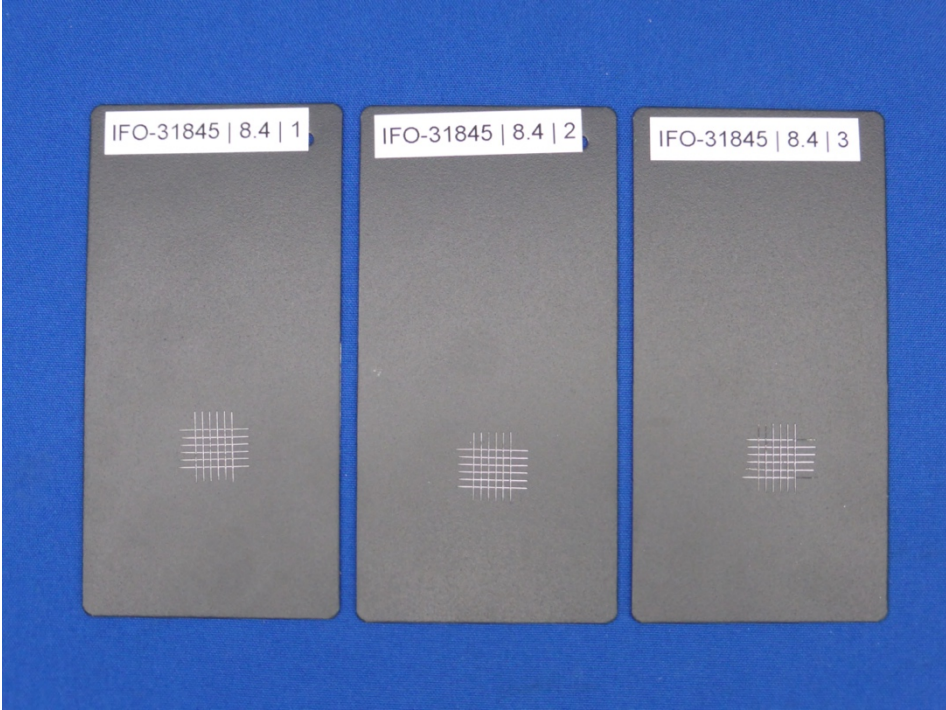


Figure 4 – Samples after Film Adhesion test  
(see Ch. 2.4: Test acc. to AAMA 2604-20, Ch. 8.4)

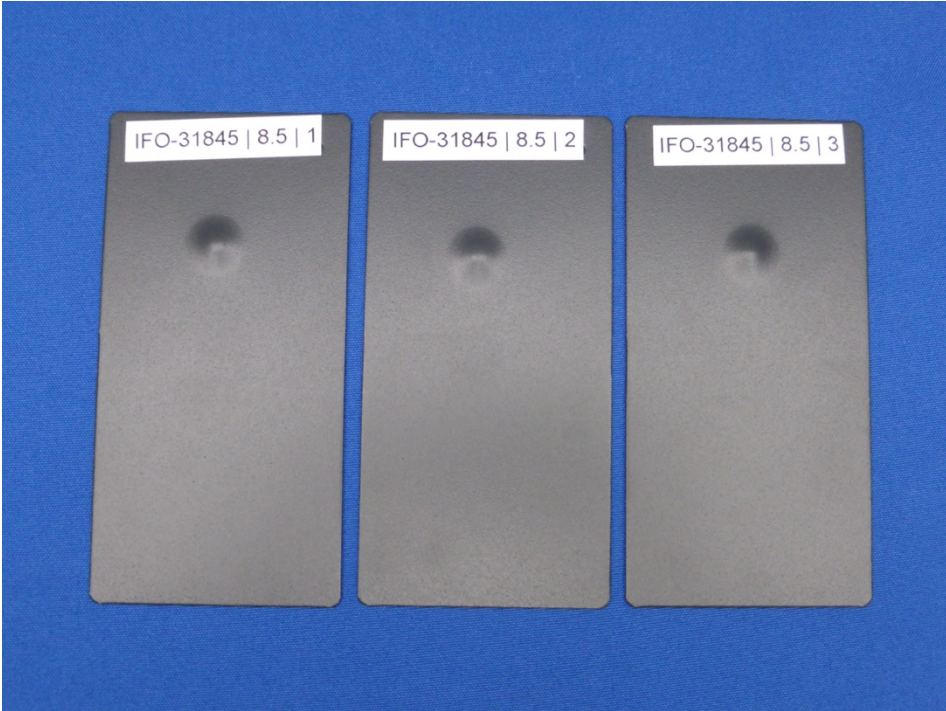


Figure 5 – Samples after Impact Resistance test  
(see Ch. 2.5: Test acc. to AAMA 2604-20, Ch. 8.5)



Figure 6 – Samples after Abrasion Resistance test  
(see Ch. 2.6: Test acc. to AAMA 2604-20, Ch. 8.6)

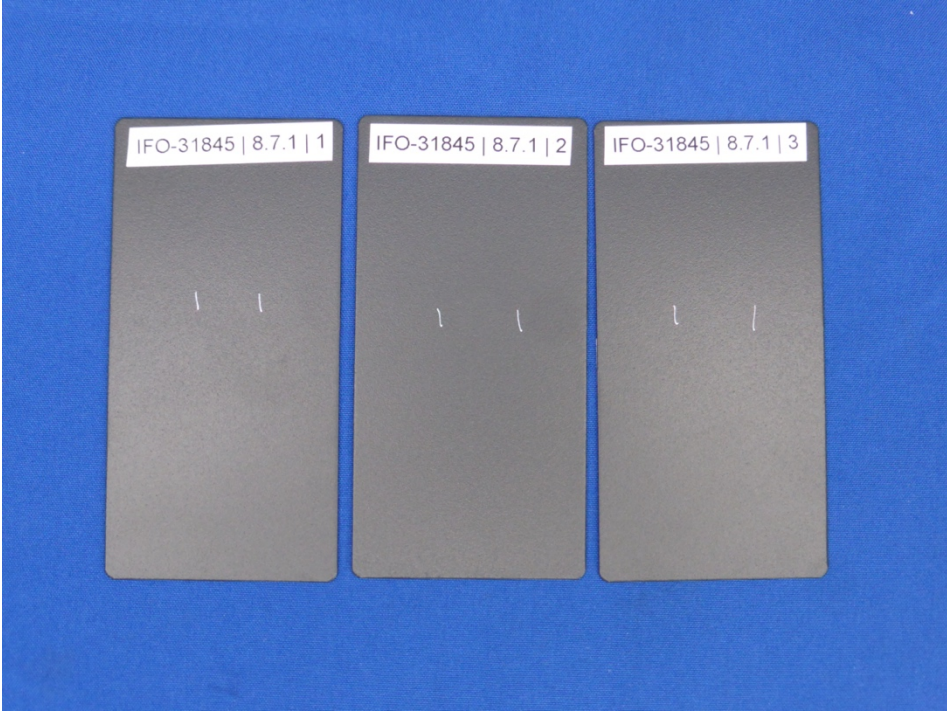


Figure 7 – Samples after Muriatic Acid Resistance test  
(see Ch. 2.7.1: Tests acc. to AAMA 2604-20, Ch. 8.7.1)





Figure 8 – Samples after Mortar Resistance test  
(see Ch. 2.7.2: Test acc. to AAMA 2604-20, Ch. 8.7.2)



Figure 9 – Samples after Nitric Acid Resistance test  
(see Ch. 2.7. 3: Test acc. to AAMA 2604-20, Ch. 8.7.3)



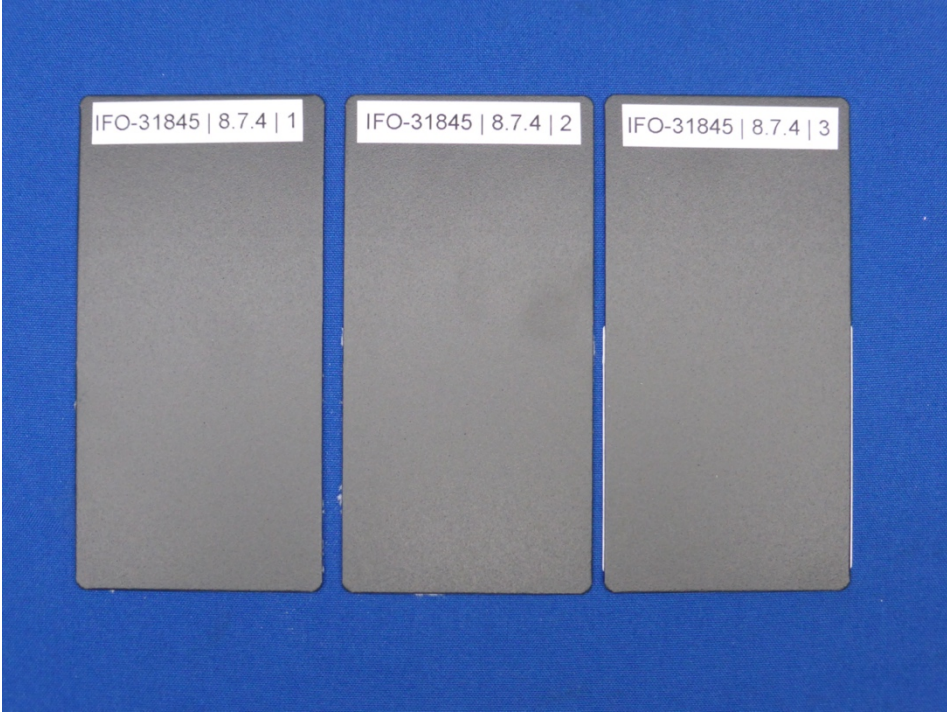


Figure 10 – Samples after Detergent Resistance test  
(see Ch. 2.7.4: Test acc. to AAMA 2604-20, Ch. 8.7.4)

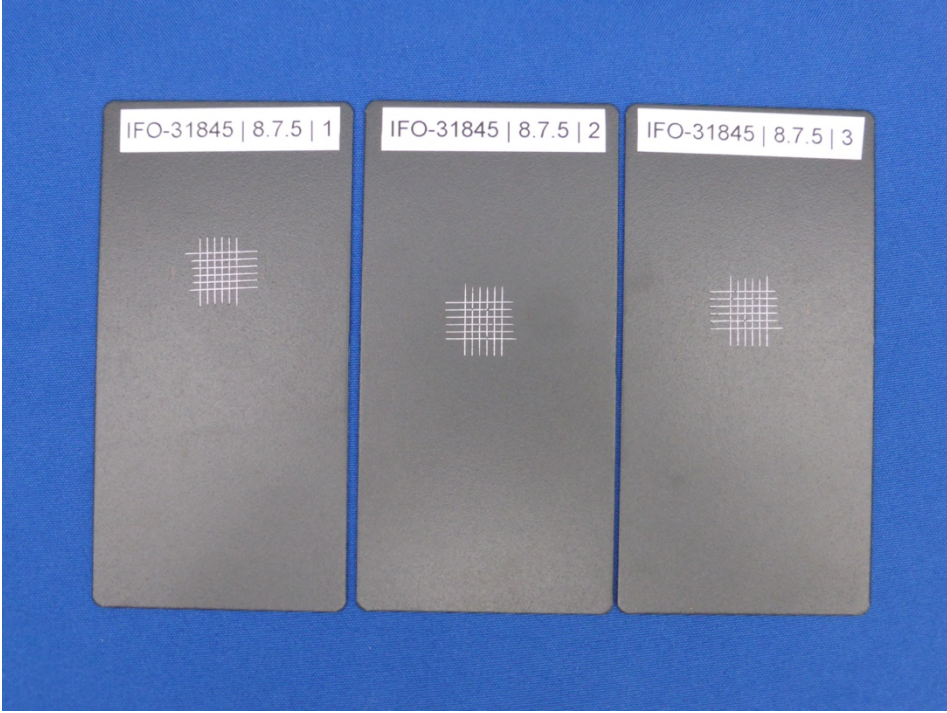


Figure 11 – Samples after Window Cleaner Resistance test  
(see Ch. 2.7.5: Test acc. to AAMA 2604-20, Ch. 8.7.5)

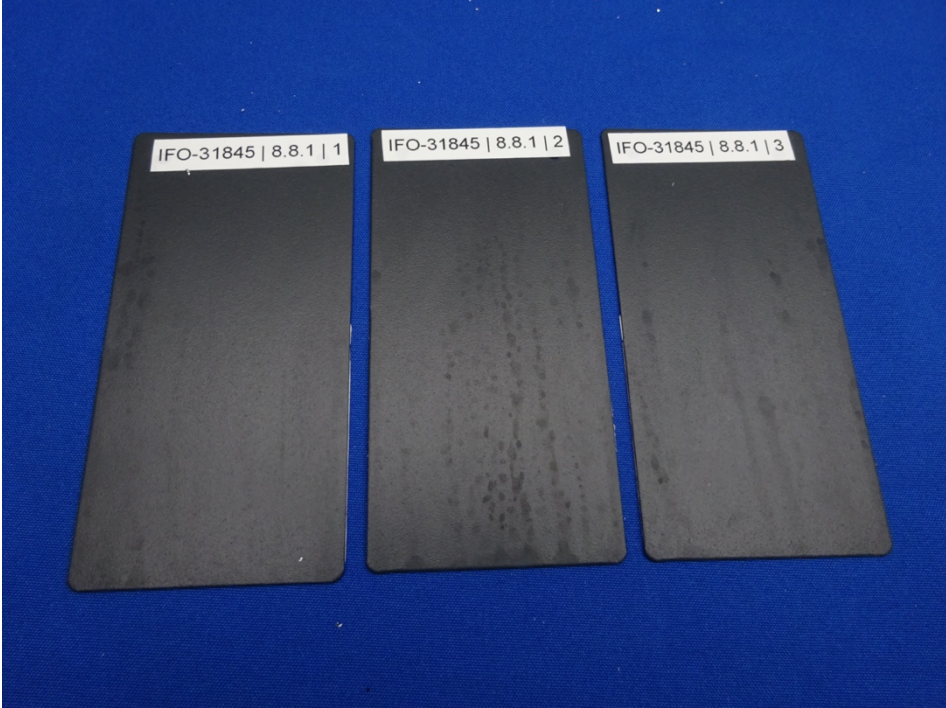


Figure 12 – Samples after Humidity Resistance test  
(see Ch. 2.8.1: Test acc. to AAMA 2604-20, Ch. 8.8.1)



Figure 13 – Samples after Salt Spray Resistance test  
(see Ch. 2.8.2: Test acc. to AAMA 2604-20, Ch. 8.8.2)