



Anticorrosion Test of Metals Treated with Xp³RB5100

Lab Test Conducted by:

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Testing Procedure

A total of 34 painted panels were provided for testing. The panels had been prepared using different surface preparation and paint application methods. From the 34 panels available, panels 18, 24, 31 and 42 were painted with Xp³RB5100, all others were painted with other products available in the market.

Tests Conducted

- a) Resistance to Salt Spray (ASTM B 117). Samples were exposed to a mist of 5% salt water for 500 hours. The samples are set up so that salt water can condense and drip from samples, but so no water can drip from one sample onto other. (Plate # 18 was coated with Xp³RB5100)

- b) Xenon Arc Test (ASTM G 155). Samples were exposed to ultraviolet light by xenon arc. The exposure cycle was commonly used .35W/m², with 17 minutes of light followed by 3 minutes of light plus water at 63°C. This cycle was repeated over 500 hours. (Plate # 24 was coated with Xp³RB5100)

- c) Saltwater Immersion (ASTM D 870). Samples were subject to saltwater immersion in which samples are placed approximately half immersed in water, which is circulated to make sure that no portion of the tank is subject to a larger or smaller than average oxygen concentration. (Plate # 31 was coated with Xp³RB5100)

- d) Taber Abrasion ASTM D 4060. Taber abrasion was performed per ASTM D 4060. This test determines the resistance of a coating to abrasion by rubbing the coating against a stylus of standard roughness. (Plate # 42 was coated with Xp³RB5100)

Results

ASTM B 117 Approved
ASTM G 155 Approved
ASTM G 870 Approved
ASTM D 460 Reduction: 0.0852 gr. x 1000 cycles

Enclosed is a copy of the complete test report

Date of the Test Report: September, 2005

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Report: Evaluation of corrosion resistant coating

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Background

A total of 34 painted panels were provided for testing by several methods. The panels had been prepared using different surface preparation and paint application methods, which were not disclosed in order to ensure a blind test. Samples were tested for resistance to salt spray, saltwater immersion, xenon arc, and Taber abrasion.

Testing:

Salt spray, per ASTM B 117

Samples numbered 11-20 were exposed to a mist of 5% salt water for 500 hours. The samples are set up so that salt water can condense and drip from samples, but so no water can drip from one sample onto other. The samples are rotated in the cabinet to ensure even exposure. Samples are described with an "X", which provides an opportunity for corrosion to occur. Some samples are checked for "scribe creep", or the amount of paint that is undercoat by corrosion. No pass/fail or evaluation criteria are dictated by the spec, and so results offered are qualitative evaluations compare to other samples.

Some of the samples showed a good amount of blistering. Although very few peeled or delaminated. None of the samples showed significant scribe creep. Samples showing blistering were checked for liquid in the blisters and the condition of the substrate. Liquid in blisters, typically along with a rusted substrate, is often an indication of transports of saltwater through the coating.

A description of each panel is listed in the table below.



Panel #	Description after salt spray weathering	Liquid in blisters?
11	Some blistering, no rust at scribe.	No liquid
12	Some blistering along edges, minor rusting at scribe.	Some blisters had liquid.
13	(Unpainted steel) Moderate to heavy scale on some areas, but rusting is uneven and does not cover the whole exposed surface.	No blisters.
14	Some blistering and rust-through at edges. No rusting at scribe.	No liquid
15	Blistering and slight rusting along edges, minor rusting at scribe	No liquid
16	Blistering over the surface, minor spot rusting	No liquid
17	Good adhesion, no blistering, some rusting at scribe	No blisters.
18	Slight blistering, minor rusting at scribe, good adhesion elsewhere	No liquid
19	Wholesale blistering and rust-through, but exposed substrate is clean. No liquid in blisters, blisters open to the air.	
20	Wholesale blistering, some relatively minor rusting at scribe.	Liquid in blisters

Xenon arc exposure per ASTM G 155

Samples 21-30 were exposed to ultraviolet light by xenon arc. The exposure cycle was commonly used .35W/m², with 17 minutes of light followed by 3 minutes of light plus water at 63°C. This cycle was repeated over 500 hours. Due to size limitations in the exposure cabinet, samples 21, 22, 24 and 25 were cut in half, and had 3"x3" surface exposed. Cut or unpainted edges of all panels were covered in tape to prevent rusting from substrate. In general, the panels performed better in terms of appearance in xenon arc exposure than in salt spray. Most of the panels showed some degree of loss of gloss, but the paint film did not generally appear to show damage in terms of blistering, rust trough, loss of adhesion, or other defects.

The test panels are described in the table below.



Panel #	Description after xenon arc weathering
21	Slight loss of gloss, no obvious film damage
22	Loss of gloss, no obvious film damage
23	(Unpainted steel) rusting, light scale
24	Loss of gloss, no obvious film damage
25	Loss of gloss, no obvious film damage
26	Loss of gloss, some spot rusting in places where paint texture was removed did not extend beyond those spots
27	Loss of gloss, no obvious film damage
28	Loss of gloss, no obvious film damage
29	Loss of gloss, some spot rusting in places where paint texture was removed did not extend beyond those spots
30	Loss of gloss, some minor rust through along bottom edge of panel

Saltwater immersion ASTM D 870

Samples 31-40 were subject to saltwater immersion test bases on ASTM D 870. That test specifies a method for water immersion in which samples are placed approximately half immersed in water, which is circulated to make sure that no portion of the tank is subject to a larger or smaller than average oxygen concentration. This test was modified in that it used 5% NaCl salt solution, the same as what was used for salt spray, rather than deionized water. Samples were maintained as closely as possible to half immerse, allowing for a portion of the sample to be unexposed to salt water. The surfaces above the waterline did, however have some growth of salt crystals on the surface, and were in a humid environment. As with the salt spray and xenon arc weathering, a specific pass/fail criteria in not established by the specification, requiring a general comparative analysis of the samples after weathering.

Results are similar to those for slat spray.



Sample #	Description after saltwater immersion testing
31	Slight loss of gloss, no apparent rust
32	Some rusting and blistering
33	(Bare steel) Rusting with heavy scale both above and below water line
34	Localized spot rusting and blistering
35	Some blisters at the bottom of panel, away from textured area. Some loss of gloss
36	Rust at waterline
37	Rust at waterline and in some low-lying areas below waterline
38	Blistering and rust spots in low areas under the water line
39	Large blistering and peeling in bottom areas of the panel
40	Spot blistering and localized rust spotting in localized areas

Taber abrasion per ASTM D 4060

Taber abrasion was performed per ASTM D 4060. This test determines the resistance of a coating to abrasion by rubbing the coating against a stylus of standard roughness. The sample is placed on a rotating pad similar to a record player, with the stylus in place of the needle. The sample is weighted, rotated against the stylus for a set number of rotations, and weight. The reporting quantity is typically weight loss per revolution, or weight loss per thousand revolutions. This testing was performed using a CS-10 abrasion wheel and 1000g load for 1000 cycles.

Results are tabulated below:

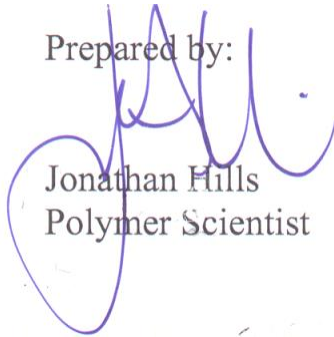
Sample #	Initial weight, grams	Final weight, grams	Weight change, grams per 1,000 cycles
41	65.6715	65.5783	0.0932
42	65.9625	65.8773	0.0852
43	65.5179	65.4328	0.0851
44	65.7205	65.6217	0.0988



Conclusions

Samples were exposed to various conditions, including salt spray, saltwater immersion, xenon arc weathering, and Taber abrasion. The samples in xenon arc fared the best of the weathering samples, generally only showing some loss of gloss. The saltwater immersion and salt spray samples varied in their resistance, with some samples showing blistering and rust-tough while others did not appear to be significantly affected.

Prepared by:

A handwritten signature in blue ink, appearing to read "J. Hills", is written over the printed name and title.

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Reviewed by:

A handwritten signature in blue ink, appearing to read "George T. Bayer", is written over the printed name and title.

George T. Bayer, PhD
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**IMPORTANT NOTICE: It is the policy of MATCO Associates that samples submitted as part of contracted investigations are the responsibility of MATCO for only one month after final reports on those samples have been issued. They may then be discarded or otherwise disposed of. If you would like samples returned or safeguarded for longer than one month, please make such arrangements with this office in writing (include shipping provider and account number). If the submitted samples are part of a claim or potential lawsuit it is the client's responsibility to make arrangements to have the samples returned. Any testing not performed in MATCO's facility has been performed by established laboratories used by MATCO Associates*



Plates tested



Figure 8: Sample 18 after
salt spray exposure

Matco Project #905-50521, Exhibit Page 1 of 3



Figure 14: Sample 24 after
xenon arc weathering



Figure 21: Samples 31
Saltwater Immersion



Matco Project #905-50521, Exhibit Page 3 of 3