



BULLETIN

MADISON CHEMICAL INDUSTRIES INC.

InfoTech Bulletin #25

Performance Properties of No-Blast Protective Coating Systems Moderate to Heavy Atmospheric Service

February 2010



Madison Chemical Industries Inc.

“The World Leader For Infrastructural Coatings”™

490 McGeachie Drive Milton, Ontario, Canada L9T 3Y5

Phone (905) 878-8863

Fax (905) 878-1449

Email: sales@madisonchemical.com

Web Site: www.madisonchemical.com

Performance Properties of No-Blast Protective Coating Systems for Moderate to Heavy Atmospheric Service

Evaluation of Adhesion under Conditions of Intermittent (Ponding) Water Exposure

INTRODUCTION AND BACKGROUND

A multi layer coating system must exhibit both high adhesion to its substrate as well as high interlayer (coating-to-coating) adhesion. This level of adhesion is a primary indicator of the system's ability to provide a satisfactory service life. With coating systems designed for exterior applications this provides resistance to the corrosive effects of sunlight, rain, snow, ice, debris and pollutants.

Typical surface preparations for coating systems needing water resistance include abrasive blasting for continuous immersion and hand/power tool cleaning for intermittent exposure.

When Madison developed its newest coatings systems and FerroGrip, a no blast surface preparation compound, we recognized a particular need to demonstrate that the coatings had a satisfactory resistance to intermittent ponding water following rainfall or melting ice and snow. **(This is different, it is important to note, from continuous immersion service. In these conditions, we recommend our fast setting, 100% solids plural component polyurethanes).** Please refer to InfoTech Bulletins 19, 20, 24 and 25 as well as Madison's product information sheets for details about the new product systems.

We identified the following characteristics as necessary for success for moderate to heavy duty service atmospheric environments:

1. The coating system must exhibit a satisfactory level of intercoat and substrate adhesion immediately following exposure to ponding water.
2. It must exhibit high intercoat and substrate adhesion when the water is removed (the 'recovery'), similar to that prior to exposure.
3. It must not exhibit blisters, peeling, staining or corrosion 'bleed through' during the exposure periods.

This InfoTech bulletin describes the test methods, results and conclusions derived from this investigation.

METHODOLOGY

Products evaluated in this test:

1. FerroGrip - proprietary adhesion-enhancing compound
2. Alumizinc 'S' - 'Next Generation' zinc-rich polyurethane primer
3. FusionClad TC Ultra - advanced waterborne polyurethane topcoat
4. AcrylaThane 5200 - high performance acrylic aliphatic polyurethane

Sample Preparation:

1. FerroGrip was applied to a 12" x 12" steel plate according to its application instructions.
2. A primer coat of Alumizinc 'S' was applied to the plate to a total dry film thickness of 3-5 mils.
3. After allowing for a sufficient interval, a selection of topcoats were applied, each to a thickness of 3-5 dry mils: AcrylaThane 5200, FusionClad TC Ultra and Alumizinc 'S'.
4. The topcoats were cured for a period of 48 hrs at 70°F (22°C)

Exposure Cycles:

1. Each topcoat system was covered with a clean, water saturated cloth for a period of 24 hrs. The cloth was tightly covered with plastic to prevent drying out.
2. The 'wet cloth' period was followed by 24 hrs. of air dry 'recovery'. This was a complete 48 hr. cycle.
3. The cycle was repeated twice more for a total of 3 cycles.

Testing Regime:

1. Following each 24 hr. 'wet cloth' period the coatings were subjected to a visual inspection, dolly pull adhesion (ASTM D4541) and for the 3rd cycle a crosshatch adhesion (ASTM D3359).
2. The adhesion tests were repeated after the 'recovery' period.
3. Three testing cycles were completed.

RESULTS

	FusionClad TC Ultra		AcrylaThane 5200		Alumizinc 'S'	
	Adhesion Pull (psi)	Failure Mode	Adhesion Pull (psi)	Failure Mode	Adhesion Pull (psi)	Failure Mode
Initial 48 hr. Adhesion	1600	90% GF 10%CF primer	1800	100% CF primer	1700	100% CF
1 st Cycle Wet	1220	50% CF primer 50% CF Ultra	1500	100% CF primer	1640	100% CF
1 st Cycle Recovery	1840	50% CF primer 50% GF	1900	90% CF primer 10% GF	1700	90% CF, 10% AF
2 nd Cycle Wet	1200	100% GF	1640	95% CF primer 5% AF	1640	95%CF 5% AF
2 nd Cycle Recovery	1800	60% CF primer 40% GF	1800	95% CF primer 5% AF	1720	95% CF 5% AF
3 rd Cycle Wet	1000 Crosshatch Adhesion 4B	50% GF 50% CF topcoat	1800 Crosshatch Adhesion 4B	100% CF primer	1700 Crosshatch Adhesion 5B	100% CF
3 rd Cycle Recovery	1980	80% GF 20% CF primer	2000	95% CF primer 5%GF	1800	100% CF

NOTES:

1. In all tests, there was no evidence of surface staining of the topcoat, rust bleed through or blisters.
2. CF is cohesive failure (within the coating layer), GF is glue failure (between dolly and topcoat), and AF is adhesive failure (between primer and steel)
3. Cross Hatch adhesion 4B represents <5% removal of coating from substrate (5B is 0)
4. The results of the initial adhesion and 3rd cycle tests are illustrated in attached Figures 1-3.

DISCUSSION AND CONCLUSIONS

The coating systems exhibit high adhesion through both the wet and dry cycles. (The wet adhesion for Ultra exhibits high glue failure, so it is clear that the adhesion of the system is well over 1000 to 1200 psi. This glue failure is likely the result of sufficiently high moisture content in the film immediately after the wet cloth to weaken the bond through an excessively fast cure. This is a common phenomenon with cyanoacrylate adhesives.) This suggests that even at relatively early stages of cure (48 hrs. vs. 5-7 days for ultimate cure) the coating systems hold up to water ingress.

The lack of blistering or coating bleed through is also indicative of good wet adhesion and is of paramount importance to corrosion protection ⁽¹⁾.

Cohesive failure in the primer is predominate as a failure mode. This is significant as cohesive failure is preferred to adhesive or intercoat failure ⁽²⁾. It is especially important that the primer have high adhesion to the substrate as this interface is where corrosion cells initiate.

The Alumizinc 'S' primer bond strength is comparable (cross hatch adhesion rating of 4B) to that specified in SSPC - Paint System 20 for an organic zinc-rich primer (which requires an SP-5 abrasive blast). This SSPC spec'n qualifies this type of primer for a wide variety of service environments. Consequently, it follows that a considerable cost saving by replacing blasting with FerroGrip is possible for a variety of moderate to heavy duty service requirements.

(1) *Paint Film Degradation - Mechanisms and Control*, Clive Hare, SSPC, 2001 p. 246

(2) *Corrosion Prevention by Protective Coatings*, Charles C. Munger, NACE International, 1999 pp.199-200

Footnote: The following are Trademarks and/or Registered Trademarks of Madison Chemical Inc.: Madison, FerroGrip, AlumiZinc, FusionClad and AcrylaThane.

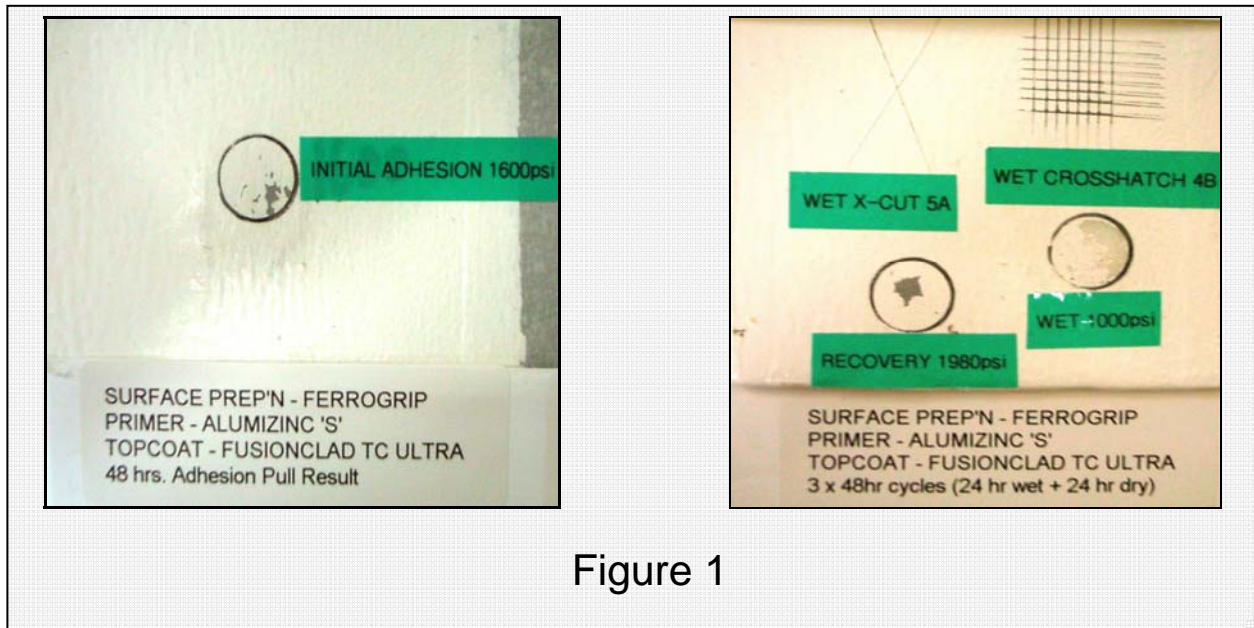


Figure 1

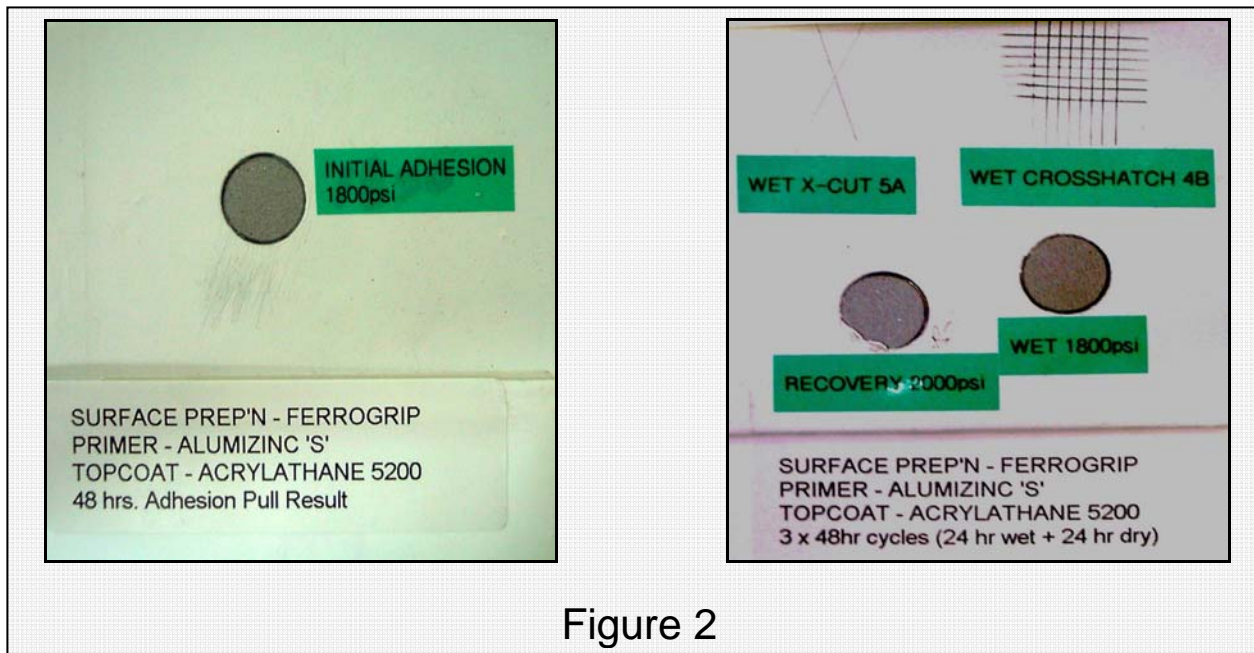


Figure 2

