

**Testing Results for RUST GRIP Coating After 1000,
5000, and 10000 Hours of Exposure in Ultraviolet and
Salt-Spray Chambers—Blistering and Rusting
Evaluation**

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1 Introduction

This report documents testing data and results of coupons coated with RUST GRIP coating after 1000, 5000, and 10000 hours of exposure. The average dry film thickness of the coating on the coupons was 6 mils (150 μm). The coated coupons have been exposed to the ultraviolet (UV) radiation and a salt solution for up to 10000 hours (60 weeks). The testing has been conducted according to ASTM D5894, Standard Practice for Cyclic Salt Fog/ UV Exposure of Painted Metal. This test simulate realistic test conditions to evaluate the outdoor corrosion of painted metal, including the synergistic effects of multiple factors including condensation, UV exposure, wet/dry cycling, and temperature cycling. The results of this test can be used to assess corrosion performance of coatings subjected to outdoor environmental conditions.

The testing was conducted in two week increment which consists of one week of UV exposure and one week of salt fog exposure. For each two week increment, the testing was conducted according to the following procedure. The testing started with fluorescent UV-Condensation exposure, per Section 8.1 of ASTM D5894. Southwest Research Institute[®] (SwRI[®]) placed three coupons for the coating type in UV-Condensation exposure chamber (here after called UV chamber). The coupons were placed in coupon holders that exposed a part of the coated surfaces of the coupons to the UV light. The coupons were exposed to the UV conditions for 4 hours followed by a 4-hour condensation period. The coupons were exposed for a total of 168 hours (1 week) in this UV chamber. Following UV exposure, the coupons were transferred to the salt spray chamber. The salt fog-dry exposure was conducted in accordance with Section 8.2 of ASTM D5894. The coupons are placed a coupon holder which directly exposed the coupons surfaces to the salt solution which is sprayed on the coupons. The coupons were exposed to a 1 hour fog cycle followed by a 1 hour dry cycle. The salt solution, as per ASTM D5894, consisted of 0.05 percent sodium chloride and 0.35 percent ammonium sulfate by mass. The coupons were exposed to the cyclic salt spray-dry conditions for a total of 168 hours (one week). The two week increment was repeated for 30 weeks.

2 Testing Data and Results

The testing data is presented in form of coupons images after 1000, 5000, and 10000 hours (6, 30, and 60 weeks) of exposure. Images of the coupons are presented in Figures 1. The testing data is analyzed to determine the blistering and degree of rusting on the coupon.

2.1 Blistering Evaluation: As seen in Figure 1, the coupons shows no signs of blistering after 1000, 5000, and 10000 hours of exposure throughout the their surfaces except on edges of the two coupons. The blistering is so minor that it is not even visible in the images presented in Figure 1. This minor blistering is due to the edge effects and not due to the coating characteristics. The coating pass according to ASTM D714–02 because of no signs of blistering in the three coupons' surfaces which are not affected by the edge effect.

2.2 Discoloration: The UV exposure causes discoloration in the coating but does not affects its corrosion performance. Figure 1 shows visible signs of discoloration in the coupons after 1000, 5000, and 10000 hours of exposure. The coupons surfaces after 5000 and 10000 hours of exposure show visible signs yellowish red color through their surfaces. This is due to the leaching of a paint solution which was applied on the edges of the coupons. The paint solution was applied to minimize edge effect during the testing. The applied paint solution is red in color, and its leachate due to its interaction with the salt solution is yellowish red.



Figure 1. Images of the Three RUST GRIP Coupons After (a) 1000, (b) 5000, and (c) 10000 Hours of Exposure

Overtime, the paint releases the leachate due to its chemical interaction with the salt solution. The leachate causes the yellowish red color on the coupons' surfaces in Figures 1(b) and 1(c).

The coupons' surfaces are only partially exposed to the UV radiation in the UV chamber. If there is any effect of UV radiation on corrosion performance, it should produce a marked change in coating color and can be distinguished by two shades on a coupon surface. In Figure 1, there are two visible shades of coating colors on all three coupons after 1000, 5000, and 10000 hours of exposure. The UV exposure does not affect its corrosion performance as there . The coating does not show any marked change in rusting where discoloration due to UV exposure has occurred. This proves that even though UV exposure causes discoloration of the coating, it does not affect its corrosion performance.

2.3 Rusting Evaluation: The degree of rusting on the three coupons is evaluated in accordance with ASTM D610–08. After 1000 hours of exposure, none of the three coupons show rusting and the three coupons are rated 10. This rating means that up to 0.01 percent of the coupon surface has rusted. After 5000 hours of the exposure, the top coupon in Figure 1(b) shows signs of rusting with pin point corrosion spots. Similarly, the middle coupon of Figure 1(b) also shows few pin point corrosion spots, but less compared to the top coupon in Figure 1(b). As seen in top coupon of Figure 1(b), few pinpoint corrosion spots are noticed. The bottom coupon in Figure 1(b) does not show any rusting which is visible with bare eyes. Considering the rusting in the three coupons after 5000 hours of exposure, the top coupon of Figure 1(b) is rated 9-P, and the remaining two coupons are rated 10. After 10000 hours of the exposure, the corrosion spots seen in Figure 1(b) persist, but no new corrosion spots could be located on the coupons' surfaces that were un affected by the edge effect. Considering this, the top coupon of Figure 1(c) is rated 9-P, and the remaining two coupons are rated 10. The rating data is summarized in Table 1.

Exposure Time (hours)	Rating of the Three Coupons as Per ASTM D610-08	Notes
1000	10, 10, and 10	Up to 0.03 percent rusting on the coupons with rust grade 9-P, and up to 0.01 percent rusting on the coupons with rust grade 10
5000	9-P, 10, and 10	
10000	9-P, 10, and 10	

3 Conclusions

Three coupons coated with RUST GRIP coating were tested according to ASTM D5894 for 10000 hours of exposure. The average dry film thickness of the coating on the coupons was 6 mils.

The coating show no signs of blistering after 1000, 5000, and 10000 hours of exposure. Some blistering is noted on the edges of the two coupons, however, this is due to the edge effect and not due to the deficiency in the coating.

The UV radiation causes discoloration of the coating but does not affect its corrosion resistance characteristics.

The coating shows minimal signs of rusting which is barely visible with bare eyes. This indicates that rusting is due to coating defects during coating preparation process and not due to deficiency in the coating. Therefore, it is concluded that the coating has excellent corrosion resistance characteristics.

4 References

ASTM International. ASTM D5894 – 10, “Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet).” West Conshohocken, Pennsylvania: ASTM International. 2010.

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