LONG TERM (4400 HOUR) SALT FOG EXPOSURE
RG-2400® ON PRE-RUSTED PIPES

By
D. Crosby, W. Soucie
Moberly, MO 65270

ABSTRACT

RG-2400® was tested over pre-rusted pipes. Performance was tested for 4400 hours using ASTM B 117 salt fog testing.

INTRODUCTION

The RG-2400® coating was developed to be a maintenance coating that can be applied on oxidized iron surfaces (rusted substrates), where cleaning, sandblasting, etc., to bare metal was not economically feasible. RG-2400® offers four key benefits:

1) Requires minimal surface preparation
2) Wide range of operating temperatures (0° - 200°F)
3) High tack and non bleed-out coating characteristics
4) Environmentally benign formula, nontoxic and safe for shoreline and other applications close to marine environments (i.e.; bridges or above water platforms).

Testing has been performed to identify RG-2400® characteristics and performance. These tests include exposure at 300° F for prolonged periods (>four months); hydrothermal pressure testing for oil bleed-out and stability of material; and standard ASTM tests which included Dropping Point, Separation, Total VOC's, and ASTM B 117 Salt Fog. Tests for specific applications were developed "in-house" to replicate specialized customer defined field environments. The following is an example of a test developed to simulate a customer defined failure mode observed in field corrosion environments.

TEST OBJECTIVE

Evaluate the performance of RG-2400® on a pre-rusted, irregular surface which would be subjected to a corrosive environment for a prolonged period of time (>2000 hrs.). The test incorporated hand application of material at a thickness between .045 and .060 inches. Part of the tested substrate was left uncoated to act as a control area, and to observe the material peeling back or undercutting at the edge of material application.

TEST METHOD

Materials Used:
Three pipe segments, 2 1/4" OD. X 7" length, were used for the test. Pre-rusting consisted of subjecting the three previously non-rusted pipes to 3 weeks in an ASTM B-117 salt spray environment. Once completed, the pipes were cleaned of scale and loose oxidized material, wiped clean with alcohol, and allowed to dry for 24 hours prior to applying coatings. Pipe surfaces were irregular and pitted due to pretest exposure and removal of rust/scale. (see fig. A-1, A-2, A-3).

Coating Strategy:
Three types of coating strategies were used. Due to the heavy scale and irregular pitted surface of the pipes, it was decided to incorporate a prep coat and complete a comparative test using a polybutene prep coat experimental formulation, in conjunction with a non prep coated pipe. Previous observation under heat had indicated the potential for mud-cracking of RG-2400® on heavily rusted surfaces that also saw long term exposure to temperatures at 300°F. All pipes would have the RG-2400® applied after the prep-coat stage. The pipes with prep coat and the pipes without prep coat were allowed to sit for 24 hours before the application of the RG-2400® (see figs. B-1 and B-2 for prep coat).

The RG-2400® coating was hand applied at approximately 0.045 to 0.060 inches thick using a small lab spatula. The coating on each pipe was reproduced as near as possible using 30 grams of material. Coating was applied around the pipe at approximately 80% coverage of pipe surface leaving a gap of 1 - 1.5 inches of exposed surface. 'This exposed area had also been left unprotected on the prep coated pipes. The exposed area would serve two purposes;
    (1) as an adequate control
    (2) to determine if the coating would peel back or undercut at the edge areas. The top inch of each pipe was covered with yellow tape and marked for pipe identification and location of the exposed, non-coated area. Photos were taken before and after each of the coating strategies. (see figs. C-1, C-2, and C-3 for final RG-2400® coats').

Corrosion Test:
The coated pipe segments were conditioned at ambient temperature for 24 hours prior to initiating ASTM B-117 exposure. Pipe segments were hung on plastic coated wire and placed in standard ASTM B-117 neutral salt fog

Periodic checks were made of the coated pipes to evaluate corrosion activity and other potential failure modes (i.e., cracking or drying out of the surface, and/or peeling back (loss of material adhesion) of the coated material from the surface, especially where the non-coated area met the coated surface. At 2000 hours into the test, the surfaces of the pipes were sprayed in an attempt to dislodge any loose RG-2400®. No material was removed.

Test Duration:
Initially, the test plan was to be run in excess of 2000 hours or failure. Based upon apparent observable performance, the test continued for approximately six months. It was determined that 'in excess' of 4,400 hours was adequate for comparison. The test was initiated on the morning of 5/4/98 when the pipes were placed into the B 117 chamber, and ended at days end on 11/4/98. Total time : 4400+ hours (see figs. D-1, and D-2 for final coat appearances).

RESULTS AND DISCUSSIONS

The RG-2400® showed no physical breakdown on the surface. All surface areas remained smooth with no appearance of visible damage except in the areas of the non-coat which were extensively rusted. Appreciable invasion of rust into the coated areas from the non-coated area was not observed. There was no peeling back of any of the RG-2400® material.

The RG-2400® had appeared to change in hardness on the surface; however, upon removal the material, it was tacky and pliable underneath the thin surface layer. Adhesion of the RG-2400® to the pipes was excellent, as evidenced by the effort required to accomplish complete removal, indicating no destruction of RG-2400® composition. Separation of materials was not observed, even when under water spray at 2000 hours into the test.

The performance was exceptional for 4400 hours of B 117 salt fog exposure and demonstrates the material can be applied to a rusted surface providing superior protection (see figs. E-1, E-2, E-3 photos for test results with coating removed).

CONCLUSIONS

The RG-2400® coating over a pre-rusted surface adheres to the surface and provides protection on the broad surface without breakdown, and no under cutting or peeling back occurred at the interface between the control un-coated section and the coated test areas. RG-2400® performed as well without the pre-coat as with the prepcoat, leading to a conclusion that at ambient temperatures the RG-2400® is adequate by itself on a rusted surface.

The exposed areas showed extensive rust and breakdown, serving as a good control and making this particular test viable for future use. It was also concluded that the use of part of the original pipe as a control is better than a different pipe left unprotected
as a control. This eliminated any material differences in the individual substrates are eliminated from the test.

RG-2400® in this test, coupled with its non-toxic and non-hazardous properties (reference Wildlife International report # 486A-106), make it an excellent choice for coating pre-rusted flat, rounded or metal to metal surfaces, where further corrosion prevention is necessary and/or environmental acceptance is warranted.

An independent lab, also tested the RG-2400® products. InterCorr International (reference CLI project # L983475K), ran tests in which the products performed extremely well in Crevice Corrosion protection. Those results, plus the performance of RG-2400®.