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Development of Coatings Performance Specifications for Steel Exposed to the Atmosphere

Aluminum Epoxy Mastic and Epoxy/Urethane Systems

by
Timothy D. Race and Mark A. Kelly

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The study recommends that the Corps submit the draft CIDS to General Services Administration for review and authorization. Further, it is recommended that the Corps implement the authorized documents by inclusion in CWGS-09940, *Painting: Hydraulic Structures and Appurtenant Works.*

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Foreword

This study was conducted for the Electrical and Mechanical Branch, Engineering Division, Directorate of Civil Works, Headquarters, U.S. Army Corps of Engineers (HQUSACE) under "Civil Works Investigations and Studies"; Work Unit 31205, "Developing High Performance Coatings." The technical monitors were R. Kinsel and J. Gilson, CECW-EE

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1 Introduction

Background

Historic Perspective

Structures operated and maintained by the U.S. Army Corps of Engineers contain millions of square feet of steel.* Protective coatings are used to extend the useful life of the steel and ultimately the structures they comprise. Any of a number of surface preparations and coatings may be used to protect a steel surface depending on the environment and intended use of the painted structure. A steel surface immersed in water, for example, will have distinctly different requirements from one exposed to the atmosphere.

Cost-effective corrosion protection in immersion requires rigorous surface preparation as defined in various specifications. Generally, the level of surface preparation that will be specified under given circumstances is the lowest level that will provide good coating performance. SSPC-SP 5, *White Metal Blast Cleaning*, or SSPC-SP 10, *Near-White Metal Blast Cleaning*, are typically specified for surfaces that will be immersed in fresh or salt water. Lesser degrees of surface preparation such as specified in SSPC-SP 2, *Hand Tool Cleaning*, SSPC-SP 3, *Power Tool Cleaning*, SSPC-SP 7, *Brush-Off Blast Cleaning*, or SSPC-SP 6, *Commercial Blast Cleaning* are usually specified for atmospheric exposures. Historically, the Corps of Engineers has specified SSPC-SP 3 and SSPC-SP 7 for atmospheric painting (CWGS-09940 June 1993; CW-09940 October 1992; CW-09940 August 1989; CW-09940 August 1981; CW-09940 April 1981; CW-09940 November 1979; CW-09940 January 1977; CE-1409 June 1973; and CE-1409 March 1968).

Coatings formulated for use on steel surfaces cleaned in accordance with SSPC-SP 2, SSPC-SP 3, or SSPC-SP 7 are often called "surface-tolerant coatings" (Kapsanis and Appleman 1992). This term derives from the fact that these surface preparation methods may leave traces of surface contaminants such as rust, salts, and old paint. Specific types of surface-tolerant coatings are formulated to provide good protection over these types of contaminated surfaces. Oil-based, long oil alkyd, and modified versions of these coatings containing inhibitive pigments are traditional types of

* 1 sq ft = 0.093 m^3.

surface-tolerant coatings (Thomas 1989). Red-lead linseed oil primer is a classic example of an oil-based surface-tolerant coating containing an inhibitive pigment.

Historically, the Corps has used coatings such as "TT-P-86 Paint, Red Lead-Based, Ready-Mixed" and "TT-P-615 Primer Coating: Basic Lead Silico Chromate" for priming steel exposed to the atmosphere (CW-09940 [August 1989, August 1981, April 1981, November 1979, January 1977], CE-1409 [June 1973, March 1968]). However, the use of TT-P-615 was discontinued in the August 1989 guide specification revision. The use of TT-P-86 was limited to maintenance painting in 1989 and was also discontinued in 1992. Use of these primers was curtailed because of worker safety and environmental concerns surrounding lead and chromium-pigmented coatings. "SSPC-Paint 25 Red-Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer" was added to the guide specification in 1989. Oil-based, alkyd, and modified versions of these resins are used to topcoat surface-tolerant primers of similar resin chemistries. Traditionally the Corps has used "TT-P-38 Paint, Aluminum, Ready Mixed" and "TT-E-489 Enamel, Alkyd, Gloss," as topcoats for TT-P-86, TT-P-615, and SSPC-Paint 25. TT-P-38 is a tung oil-modified phenolic material pigmented with leafing aluminum. TT-E-489 is used when colors such as black, white, or yellow are required.

Technology Drivers

Most of the research dollars in both the coatings industry and government are spent on developing new coating technologies with reduced levels of organic solvents. Local and state environmental regulations place limits on the volatile organic compound (VOC) content of architectural and industrial maintenance coatings. In response to the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency (USEPA) is developing a national rule governing VOCs in architectural and industrial maintenance coatings. The private sector is leading the effort to produce low-VOC technologies, but recently, government paint specifications have generally fallen behind the state-of-the-science and the government has been slow to adopt new paint technologies.

Today the hazards associated with lead and chromium pigments are well known. The Corps response to these hazards has been to eliminate the use of these materials on Corps jobs. SSPC-Paint 25 has replaced lead- and chromium-pigmented paints. Paint 25 is a good coating material, but is based on a relatively old technology. Like the traditional Federal Specification and Corps of Engineers paints, Paint 25 is a "formula specification." Such specifications, which are based primarily on the content of the coating, circumscribe the introduction of new and innovative products.

Federal procurement reform favors the use of performance-based specifications and commercially available materials. Materials made to conform to Military and other material specifications are rarely sold to the general public; in other words, they are not manufacturers' shelf products.

Rationale for Performance Specifications

The Corps has traditionally used paint specifications that are based on a material's composition, known as "formula specifications." Formula specifications used by the Corps include those prepared by the Corps, Army, Air Force, General Services Administration (GSA), Navy, and the Steel Structure Painting Council (SSPC).* Acquisition reform will largely phase out military specifications prepared by the Army, Navy, and Air Force for use within the Corps by the end of 1995.

Procuring items without specific requirements is risky; unless requirements are properly defined and specified, one may choose a paint that is unsuitable in terms of the quality, performance, or fitness for a given application. The Corps needs an alternative to the traditional formula-based military specifications. Specifications based on a material's performance may provide the required alternative to formula specifications. A public sector procurement system based on performance specifications would offer the dual advantage of promoting competition while providing for a high quality product. However, government procurement documents must specify requirements without favoring individual manufacturers or proprietary products. Requiring the use of specific proprietary products in procurement documents is usually not allowed because it does not promote full and open competition.

GSA is the preparing activity for a number specifications known as Commercial Item Descriptions (CIDs), which may be based solely on performance, but often incorporate some compositional requirements. CIDs are intended for use in procurement documents for a class of commercially available products. SSPC is in the process of developing performance specifications similar to GSA's CIDs. The American Society for Testing and Materials (ASTM)** has some existing standards for coated items that are based on performance of the coated end product.

Accelerated tests are the most practical tool available to quickly assess coating performance. Field exposures and fence tests, while more reliable, take too long to be practical. Accelerated test methods, if used wisely, can reliably predict the relative performance of coatings and can thereby help produce performance specifications for

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* Steel Structure painting Council, 4516 Henry St., Pittsburgh, PA 15213

** American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19102-1187.

generic classes of coatings such as barrier epoxy coatings, as a practical alternative to formula specifications.

Corps of Engineers Requirements for Paints for Atmospheric Steel

The factors driving technology within the coatings industry as well as current trends in procurement propelled by acquisition reform have combined to form the basis for most of the requirements for paints designed for use on steel exposed to atmospheric corrosion. New specifications adopted for use by the Corps should not be military specifications. Ideally, coatings specified by the Corps will be free of hazardous lead and chromium pigments, will contain low levels of VOCs, and will be based on performance rather than formula specifications.

Objective

The objective of this research was to develop performance-based material specifications to describe commercially available products that:

1. Are suitable for painting atmospheric steel
2. Are compatible with current Corps painting practices
3. Meet the demands of acquisition reform
4. Meet the requirements of air pollution regulations.

Approach

Twenty commercial products representing two generic coating systems were evaluated in accelerated weathering tests. The performance envelope for each generic system was determined, performance requirements were established, and draft performance specifications were developed.

Scope

The results of this study are applicable to Civil Works painting of steel surfaces exposed to atmospheric weathering. The research was not conducted to validate the performance of, or to qualify individual products for use within the Corps of Engineers. The results of the research are intended solely to develop performance-based materials specifications for use by the Corps and other Federal agencies. The results contained herein do not represent an endorsement of any manufacturer or specific product.

Mode of Technology Transfer

The appended draft performance specifications will be submitted to General Services Administration (GSA Center, ATTN: 9FTE-10, Auburn, WA 98001, TEL: 206/931-7929, FAX: 206/931-7544) for review and adoption as CIDs. It is recommended that on implementation by GSA, the CIDs become standard coating systems within the Corps by adoption and reference in CWGS-09940, *Painting: Hydraulic Structures and Appurtenant Works*.

2 Evaluation of Aluminum Epoxy Mastic Coating Systems

Selection of Test Coatings

Epoxy coatings pigmented with aluminum offer an alternative to the use of traditional surface-tolerant coatings (Thomas 1989, Hare 1989, Hare 1990). Ten commercially available aluminum epoxy coatings were selected for evaluation. The selected coatings are manufactured in the United States and have a maximum VOC as applied of 340 grams per liter (g/L). The selected test coatings are compatible with minimally prepared rusted steel substrates. Table 1 lists the 10 aluminum epoxy mastic systems evaluated in this study.

Preparation of Test Specimens

Cold-rolled steel test panels measuring 3.0 x 9.0 in. were initially abrasive blast cleaned to SP-10 to promote the formation of uniform corrosion.* The test panels were then rusted to an initial condition approximating Hand Tool Cleaned (SP-2) steel prepared from steel of condition C of SSPC-Vis 1, by spraying atomized deionized water onto the test panels 10 times a day for 5 days. The test panels were allowed to dry completely prior to rewetting.

The 10 coating systems were applied in accordance with manufacturers' recommended procedures. Where the manufacturer provided an option to apply the coating system in one or two spray applications, two were used. Test panels were scribed prior to exposure in such a manner that the coating was uniformly removed down to the substrate along the entire length of the scribe. The dry film thickness of each coat of each system was measured using a nondestructive magnetic dry film thickness gage. Average dry film thicknesses for each system are listed in Table 1. Dry film thicknesses for individual panels can be found in Appendix A.

* 1 in. = 25.4 mm.

Table 1. Aluminum epoxy mastic coating system.

Manufacturer	Product Name	VOC (g/L)	Dry Film Thickness (0.001 in)
Davis Industrial Paint	SSPC Paint 25 TT-P-38 (2 coats)	~290 ~430	2.2 1.3 2.1 5.6 (total)
Sherwin-Williams	Epoxy Mastic Aluminum II (2 coats)	173	6.8 5.3 12.1 (total)
Sherwin-Williams	Surface Tolerant Epoxy Coating (2 coats)	174	6.0 5.5 11.5 (total)
Devoe	Bar Rust 239 Aluminum Epoxy Mastic (2 coats)	86	6.2 8.2 14.4 (total)
Sigma Coatings	Colturiet TCP Aluminum (2 coats)	239	5.9 6.5 12.4 (total)
International	Magna Mastic 7900 (1 coat)	121	5.5 (total)
International	Intergard Universal Aluminum (1 coat)	192	7.3 (total)
Caboline	Carbomastic 15LO (2 coats)	88	5.0 5.4 10.4 (total)
Carboline	Carbomastic 90 (2 coats)	84	5.2 6.0 11.2 (total)
Sherwin-Williams	Macropoxy Aluminum (2 coats)	175	6.3 4.1 10.4 (total)
Hempel	Hempadur 4515-1987 (2 coats)	180	7.8 8.7 16.5 (total)

Test Methods

Recent advancements have been made in developing more reliable accelerated test methods. One such method is the use of a cyclic corrosion chamber that incorporates a drying cycle and uses a dilute aqueous salt solution. This cyclic test is described in ASTM G 85, *Standard Practice for Modified Salt Spray (Fog) Testing, Annex A5. Dilute Electrolyte Cyclic Fog/Dry Test* (1994). This test procedure, coupled with ASTM G 53, *Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials* (1991), reportedly produces coating failure modes similar to those observed in actual atmos-

pheric weathering and results in improved rank correlations between exterior-exposed and laboratory-exposed test panels (Simpson, Ray, and Skerry 1991).

Six test panels from each system were exposed in a slightly modified version of a G 53/G 85 cyclic test. The concentration of the dilute salt solution was 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature was 30 °C and the dry-off temperature was 40 °C. The UV-condensing cabinet was run at 60 °C during the 4h UV cycle (UV-A bulbs) and at 50 °C during the 4h condensation cycle. Samples were exposed for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet. Coating system Number 2 from CWGS-09940 was used as an internal control. This system consists of "SSPC-Paint 25" (1st coat) and "TT-P-38, Paint, Aluminum, Ready Mixed" (2d and 3d coats).

The aluminum epoxy coatings were also evaluated for ease of application, mixing properties, sag resistance, leveling properties, film build properties, and ease of cleanup.

Inspection and Evaluation of Test Coupons

The coatings were periodically evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D610, SSPC-Vis. 2, ASTM D714, and ASTM D1654. A transparent grid overlay was used to enhance the results of the visual examination. Panels were rated at 336, 672, 1344, 2016, 2688, 3360, and 4032 hours.

Aluminum Epoxy Mastic Test Results and Discussion

The results of the periodic evaluations of the aluminum epoxy mastic coating systems exposed in the cyclic salt spray test are detailed in Appendix A and summarized in Table 2. Column 2 of Table 2 indicates the first appearance of blistering and the number of panels affected. Blistering at subsequent intervals is similarly indicated. Unless otherwise indicated, blistering occurred adjacent to the scribe and not over the entire face of the panel. First appearance of surface rusting is indicated in column 3 along with number of panels affected. Early rusting is often a good indicator of poor long-term performance. Column 4 shows the results of the rust undercutting analysis performed after completing the cyclic salt spray test. The first number indicates the lowest rating of the six test panels and the second number is the average numerical rating for all six panels. Column 5 lists the average numerical ratings and composite score for each coating system. The numerical rating for blistering is based only on the area adjacent to the scribe and not on the entire facial area of the test panels. The

Table 2. Aluminum epoxy mastic performance in cyclic salt spray test (4032 h).

Coating System	Blister – Occurrence at Scribe (# Panels)	Rust – First Occurrence (# Panels)	Scribe – Worst / Average Numerical Rating	Numerical – Blister / Rust / Scribe / Total
SSPC Paint 25 TT-P-38	3360 (6) 4032 (6)	672 (6)	7 / 8.8	7.2 / 9.2 / 8.8 / 25.2
S-W Ep Mastic Alum II S-W Ep Mastic Alum II	4032 (0)	672 (4)	6 / 6.3	10.0 / 9.0 / 6.3 / 25.3
S-W Sur Tol Epoxy S-W Sur Tol Epoxy	3360 (6) 4032 (6)	672 (2)	5 / 5.8	5.2 / 9.5 / 5.8 / 20.5
Devoe Bar Rust 239 Devoe Bar Rust 239	4032 (6)	672 (3)	6 / 6.8	7.3 / 9.3 / 6.8 / 23.5
Sigma Colturiet TCP Sigma Colturiet TCP	3360 (6) 4032 (6)	672 (1)	6 / 6.8	5.2 / 9.5 / 6.8 / 21.5
International Magna Mastic 7900 (1 coat)	2016 (2) not just at scribe 2688 (4) 3360 (6) 4032 (6)	672 (6)	9 / 9.0	5.3 / 1.7 / 9.0 / 16.0
International Intergard Universal Alum (1 coat)	3360 (6) 4032 (6)	672 (1)	6 / 8.0	6.5 / 9.5 / 8.0 / 24.0
Carbomastic 15LO Carbomastic 15LO	3360 (2) 4032 (5)	672 (1)	8 / 9.0	6.7 / 9.3 / 9.0 / 25.0
Carbomastic 90 Alum Carbomastic 90 Alum	4032 (3)	672 (1)	9 / 9.7	9.0 / 9.3 / 9.7 / 28.0
S-W Macropoxy Alum S-W Macropoxy Alum	3360 (6) 4032 (6)	none at 4032	4 / 5.7	4.2 / 10.0 / 5.7 / 19.9
Hempadur 4515-1987 Hempadur 4515-1987	2016 (1) 2688 (1) 3360 (6) 4032 (6)	none at 4032	5 / 6.0	3.8 / 10.0 / 6.0 / 19.8
Totals all AEM	2016 (0.3) 2688 (0.5) 3360 (3.8) 4032 (5.0)	672 (1.9)	6.6 / 7.3	6.3 / 7.8 / 7.3 / 21.4
Control	3360 (6) 4032 (6)	672 (6)	7 / 8.8	7.2 / 9.2 / 8.8 / 25.2

numerical blister rating is the average of the sum of the numerical ratings for blister frequency and size. Blister frequency is converted as follows: none = 10, few = 8, medium = 6, medium dense = 4, dense = 2, complete = 0. Averages for the 10 aluminum epoxy mastic systems are shown at the bottom of Table 2.

Early blistering is also known to correlate well with inferior long-term performance. On the average, first blistering occurred after 3360 hours of testing. This is true of 5 of the 10 epoxy systems as well as the control. First blistering occurred later (4032 h) or not at all for 3 epoxies and earlier for 2 others. One epoxy system experienced blistering over the entire panel and not just adjacent to the scribe. The final average

blister rating for the group of epoxies was slightly lower than that observed for the control system, 6.3 versus 7.2. Three of the epoxy systems were more resistant to blistering than the control and two of these also had high composite scores.

First rusting typically appeared at the second inspection interval (672 h). This is true of all but two epoxy systems that did not exhibit surface rusting for the duration of the test exposure. Appearance of first rusting did not differ greatly between the control system and epoxy coatings. The average final rust rating of the epoxies was much lower than observed for the control system. However, all but one epoxy system scored near or above the control system while one product offered little corrosion protection in this test. The average rust rating of the nine best epoxies was 9.6.

The average rating for rust undercutting did not deviate drastically between test specimens for a given coating system. The average numerical rating for undercutting the epoxy systems was significantly lower than for the control system, 7.3 versus 8.8. However, three epoxy systems had better resistance to undercutting than the control system and two of these had excellent composite scores.

The average composite score of the aluminum epoxy mastics was significantly lower than the control system, 21.4 versus 25.2. Only two of the epoxy systems outperformed the control system. Overall, six of the aluminum epoxy mastic systems exhibited good to excellent performance, three fair, and only one poor.

3 Evaluation of Epoxy Primer/Urethane Topcoat Systems

Selection of Test Coatings

Ten commercially available epoxy/urethane coating systems were selected for evaluation. The selected systems are American made. The test coatings have a maximum VOC as applied of 340 g/L for the epoxy primer and 450 g/L for the urethane topcoat. The selected coatings are compatible with minimally prepared rusted steel substrates. Table 3 lists the epoxy/urethane coating systems.

Preparation of Test Specimens

Test panels were prepared and coatings were applied in the same manner as described above for the aluminum epoxy mastic coating systems. Standard Corps of Engineers coating system number 16 was applied as a control. This system, described in CWGS-09940, consists of SSPC Paint No. 25 (1st coat) and TT-E-489 (2d and 3d coats). Average dry film thicknesses for each system are listed in Table 3. Dry film thicknesses for individual panels can be found in Appendix B.

Test Methods

Test panels were exposed as described above for the aluminum epoxy mastic coating systems.

Inspection and Evaluation of Test Coupons

The coatings were periodically evaluated as described for the aluminum epoxy mastic coating systems except that panels were rated at 336, 672, 1344, 2016, 2688, and 3360 hours. In addition to corrosion degradation, each test system was evaluated for percent gloss retention. Gloss retention is primarily an appearance consideration and is not necessarily an indicator of coating performance.

Table 3. Epoxy/urethane coating systems.

Manufacturer	Product Name	VOC (g/L)	Dry Film Thickness (0.001 in)
Davis Industrial Paint	SSPC Paint 25 TT-P-489 (2 coats)	~290 <420	2.0 2.6/3.2 7.8 (total)
Carboline	Carbomastic 90 Carbothane 134HS	84 288	6.0 4.7 10.7 (total)
International	Intergard HS Universal Epoxy Interthane	192 414	6.1 3.4 9.5 (total)
Devoe	Bar Rust 236 Devthane 379	170 327	5.0 3.6 8.6 (total)
Sherwin-Williams	Surface Tolerant Epoxy High Solids Polyurethane	174 289	6.7 3.0 9.6 (total)
Devoe	Bar Rust 239 Devthane 379	86 327	5.7 3.3 9.0 (total)
Hempel	Hempadur 4515/1987 Hempathane 5521/1148	180 450	8.0 1.9 9.9 (total)
Sherwin-Williams	Macropoxy Acrothane	175 346	5.5 2.2 7.7 (total)
Sigma Coatings	EPTCP Aluminum VHSA Polyurethane	240 372	6.5 3.9 10.4 (total)
Carboline	Carbomastic 15LO Carbothane 134HS	88 288	5.4 6.8 12.2 (total)
Devoe	Devran 224 Devthane 379	340 327	5.1 3.0 8.1 (total)

Epoxy/Urethane Test Results and Discussion

The results of the periodic evaluations of the epoxy/urethane coating systems exposed in the cyclic salt spray test are detailed in Appendix B and summarized in Table 4. Column 2 of Table 4 indicates the first appearance of blistering and the number of panels effected. Blistering at subsequent intervals is similarly indicated. Column 3 shows the percent gloss retention. Column 4 shows the results of the rust undercutting analysis performed after completion of the cyclic salt spray test.

Table 4. Epoxy/urethane performance in cyclic salt spray test (3360h).

Coating System	Blister - Occurrence at Scribe (# Panels)	Gloss Retention	Scribe – Worst and Average Numerical Rating	Numerical – Blister / Rust / Scribe / Total
SSPC 25 TT-E-489	1344 (4) 2016 (6) 2688 (6) 3360 (6)	58.0%	5 / 6.7	3.6 / 10 / 6.7 / 20.3
Carbomastic 90 Carbothane 134HS	1344 (0) 2016 (0) 2688 (3) 3360 (3)	90.4%	8 / 8.7	8.7 / 10 / 8.7 / 27.4
Intergard HS Interthane	1344 (0) 2016 (0) 2688 (2) 3360 (2)	94.1%	8 / 9.0	9.0 / 10 / 9.0 / 28.0
Bar Rust 236 Devthane 379	1344 (5) 2016 (6) 2688 (6) 3360 (6)	92.3%	5 / 6.7	3.7 / 10 / 6.7 / 20.4
S-W Sur Tol Epoxy S-W Hi Sol PU	1344 (1) 2016 (1) 2688 (2) 3360 (2)	38.1%	8 / 8.8	9.3 / 10 / 8.8 / 28.1
Bar Rust 239 Devthane 379	1344 (5) 2016 (5) 2688 (6) 3360 (6)	13.7%	6 / 6.5	4.0 / 10 / 6.5 / 20.5
Hempadur 1987 Hempathane 1148	1344 (6) 2016 (6) 2688 (6) 3360 (6)	99.3%	6 / 6.8	2.8 / 10 / 6.8 / 19.6
S-W Macropoxy S-W Acrothane	1344 (6) 2016 (6) 2688 (6) 3360 (6)	70.3%	5 / 6.2	2.7 / 10 / 6.2 / 18.9
Sigma EPTCP Sigma VHSA PU	1344 (5) 2016 (5) 2688 (5) 3360 (6)	92.1%	8 / 8.5	5.8 / 10 / 8.5 / 24.3
Carbomastic 15LO Carbothane 134HS	1344 (0) 2016 (0) 2688 (3) 3360 (3)	95.4%	6 / 7.8	8.3 / 10 / 7.8 / 26.1
Devran 224 Devthane 379	1344 (5) 2016 (6) 2688 (6) 3360 (6)	99.3%	5 / 6.5	4.5 / 10 / 6.5 / 21.0
	1344 / 2016 / 2688 / 3360			
Totals all e/u coatings Control	3.30 / 3.50 / 4.20 / 4.30 4 / 6 / 6 / 6	78.5% 58.0%	6.5 / 7.5 5.0 / 6.7	5.9 / 10 / 7.5 / 23.4 3.6 / 10 / 6.7 / 20.3

The first number indicates the lowest rating of the six test panels and the second number is the average numerical rating for all six panels. Column 5 lists the average numerical ratings and composite score for each coating system. The numerical rating

for blistering is based only on the area adjacent to the scribe and not on the entire facial area of the test panels. Averages for the 10 epoxy/urethane systems are shown at the bottom of Table 4.

Early blistering is known to correlate well with inferior long-term performance. On average first blistering occurred after 1344 hours of testing. This is true of seven of the 10 epoxy/urethane systems as well as the control. First blistering occurred later (2688 h) for three epoxy/urethane systems. The final average blister rating for all of the epoxy/urethane systems was significantly higher than that observed for the control system, 5.9 versus 3.6. Eight of the epoxy/urethane systems are more resistant to blistering than the control system. Blistering was only observed adjacent to the scribe and general blistering was not seen for any of the coating systems.

Early rusting in accelerated testing is often a sign of poor long-term performance. None of the epoxy/urethane systems or the control exhibited any surface rusting for the duration of the test.

The average numerical rating for rust undercutting did not deviate drastically between test specimens for a given coating system. The average numerical rating for undercutting for the epoxy/urethane systems was slightly better than for the control system, 7.5 versus 6.7. Seven epoxy/urethane systems have as good or better resistance to undercutting than the control system.

The average percent gloss retention for the epoxy/urethane systems is significantly better than the control system, 78.5 versus 58.0 percent. All but two of the test systems have gloss retentions superior to the control.

The average composite score of the epoxy/urethane systems was significantly higher than the control system, 23.4 versus 20.3. Only two of the epoxy/urethane systems failed to outperform the control system. Overall, five of the epoxy/urethane systems exhibited good to excellent performance and five fair performance.

4 Determination of Coating System Salient Characteristics

Commercial Item Descriptions

GSA authorizes the use of a wide variety of CIDs including those for protective coatings and related materials. GSA is usually the preparing activity for these CIDs, but this is not a requirement. In some cases, a DOD agency is the preparing activity; for example the Navy is the preparing activity for "CID, A-A-50542, Coating System: Reflective, Slip-Resistant, Chemical-Resistant Urethane for Maintenance Facility Floors."

CIDs are flexible procurement documents. There is no single format or prescription, although CIDs prepared by GSA follow a fairly well established format, including a title, description of salient characteristics, certification, regulatory, and packaging, packing, and marking requirements, and in some cases, quantitative requirements. A-A-50542, prepared by the Navy, is much longer than the average GSA-prepared CID and includes additional sections on quality assurance and supply sources. The description of the salient characteristics is the heart of the CID.

Salient Characteristics for Aluminum Epoxy Mastic and Epoxy/Urethane Systems

Appendixes C and D contain draft CIDs for aluminum epoxy mastic and epoxy/urethane systems for use on minimally prepared atmospherically exposed steel surfaces. The draft CIDs closely follow the format of the Navy prepared CID, A-A-50542, and include an abstract, salient characteristics, notes, and sections on quality assurance and packaging.

The abstract presents a brief description of the product and its intended use. The salient characteristics section presents the requirements for the basic properties and performance requirements for the coating system. The quality assurance section spells out responsibilities, and inspection and certification requirements. The packaging section contains provisions for labeling and packaging, and safety and application data requirements. The notes provide additional relevant information including usage constraints, timeliness for qualification, and sources of products.

The salient characteristics are the most important part of the CID and the rationale behind each of the requirements is therefore also important. The application properties and appearance of the dried paint film provide for defect-free application and curing at the manufacturers' recommended film thickness as applied by commonly used application methods. The dry time requirements are consistent with applying a two-coat system in a 2-day period. The pot life requirements provide for a material that remains usable over a reasonable period of time. Intercoat adhesion requirements ensure that the coating can be successfully topcoated even after a moderate delay in the painting schedule. Requirements for accelerated corrosion assure a level of corrosion protection consistent both with existing Corps painting practices and superior products of the type being evaluated. Requirements for volatile organics ensure compliance with environmental regulations where applicable and with DOD goals associated with pollution prevention.

5 Conclusions and Recommendations

Performance of Aluminum Epoxy Mastics Versus Standard Corps System

Four of the 10 aluminum epoxy mastic systems evaluated meet the performance criteria established in the draft CID. Three of these materials exhibit better overall performance in accelerated corrosion testing than does the standard Corps system for this application. The four products meeting the draft criteria have slightly superior resistance to blistering and slightly inferior resistance to rust undercutting in comparison with the standard Corps system. Rust inhibitive primers, such as those used in the standard Corps system, are more effective at reducing undercutting at film discontinuities and damaged areas than are thick film barrier systems such as epoxies. Conversely, barrier epoxy coatings often provide superior moisture and blister resistance. Overall, coatings complying with the requirements of the draft CID should provide excellent corrosion protection over minimally prepared steel surfaces.

Performance of Epoxy/Urethane Systems Versus Standard Corps System

Four of the 10 epoxy/urethane systems evaluated meet the performance criteria established in the draft CID. Each of these materials exhibit better overall performance in accelerated corrosion testing than does the standard Corps system for this application. Four other systems also outperformed the Corps standard; however, each of these systems exhibited early blistering adjacent to the scribe that progressed to a greater extent than the systems meeting the criteria. Overall, coatings complying with the requirements of the draft CID should provide excellent corrosion protection over minimally prepared steel surfaces.

Commercial Availability

Aluminum epoxy mastic and epoxy/urethane systems are widely available. The products evaluated here represent a small cross section of the available products. CIDs for these systems should make these products widely available to the Corps as well as to other federal end users.

Air Pollution Regulations

Air pollution regulations stemming from the Clean Air Act Amendments of 1990 and earlier legislation place limitations on the amount of volatile organic solvents that paints may contain. The USEPA is working to establish a rule with a national scope for architectural and industrial maintenance coatings. However, at this time the USEPA has not produced a final rule and the exact categorization and allowable VOC contents are subject to speculation. Existing and proposed rules in California and other states offer a more well-defined target. A review of USEPA deliberations and proposed and existing state and local rules suggests an upper limit of 340 g/L for industrial maintenance coatings. This limit is recommended for the aluminum epoxy mastic system and the epoxy primer of the epoxy/urethane system. Half of the urethane topcoats evaluated either approach or exceed the 340 g/L level. An interim VOC level of 420 g/L for the urethane topcoat is recommended.

General Services Administration

It is recommended that the draft CIDs for aluminum epoxy mastic and epoxy/urethane systems be submitted to GSA for coordination, review, and authorization.

Corps of Engineers

It is recommended that the Corps revise CWGS-09940 to include the subject CIDs. The CIDs should be established as alternatives to systems number 2 and 16 of CWGS-09940.

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Appendix A: Aluminum Epoxy Mastic Test Results

US ARMY CORP OF ENGINEERS	ALUMINUM EPOXY MASTIC PROGRAM		
COATING SYSTEM DATA			
COATING ID	CARBOMASTIC 15LO		
MANUFACTURER	CARBOLINE		
VOLUME % SOLIDS	90% +/- 2%		
VOC	0.74 LB/GAL (88 G/L)		
POT LIFE	4 HOURS @ 75F		
INDUCTION TIME	NONE		
DRYING TIME MINIMUM	RECOAT 24 HOURS @ 75F / FULL CURE 5 DAYS @ 75F		
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 5.7 / WET 5.5-7.5		
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME		
THINNING			
APPLICATION DATA	**1st COAT**	**2nd COAT**	
DATE/TIME	3/9/93 @ 1:00 P.M.	3/10/93 @ 2:00 P.M.	
RH	55%	63%	
TEMPERATURE	72F	73F	
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE	CARBOMATIC 15LO	
COATING BATCH NUMBERS	A: 23A7722L / B: 3A7697L	A: 3A7722L / B: 3A7697L	
THINNING	#76 @ 20%	#76 @ 20%	
EQUIPMENT	DEVILBISS MBC 704E	DEVILBISS MBC 704E	
NUMBER OF COATS	1ST	2ND	
SAG INDEX	>24 MILS / 9 MILS THINNED 20%	9 MILS THINNED 20%	
DRY FILM THICKNESS, MILS	**1st COAT**	**2nd COAT**	**TOTAL**
SAMPLE 55	4.6	6	10.6
SAMPLE 56	5.3	6	11.3
SAMPLE 57	5.4	5	10.4
SAMPLE 58	5.2	4.4	9.6
SAMPLE 59	4.8	5.6	10.4
SAMPLE 60	4.7	5.3	10

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							
							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	9	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	9	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	9	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0.10%	0	0	0	0.10%	0.10%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0.10%	0	0	0.03%	0.10%	0.10%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

PANEL EVALUATION

CARBOMASTIC 15LO

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/6/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	55	56	57	58	59	60	
ASTM D610 RUST GRADE	0.10%	0	0	0.03%	0.10%	0.10%	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	6	4	4	4	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	Few	Few	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	0	1/64"	1/64"	1/64"	1/32"	1/64"	Loss of adhesion and underfilm rust creepage from scribe has occurred only under blisters.
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	10	9	9	9	8	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

US ARMY CORP OF ENGINEERS	ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA		
COATING ID	CARBOMASTIC 90 ALUMINUM (REPLACES KOPCOTE ALUMINUM MASTIC)	
MANUFACTURER	CARBOLINE	
VOLUME % SOLIDS	90% +/- 2%	
VOC	0.70 LB/GAL (84 G/L)	
POT LIFE	4 HOURS @ 75F	
INDUCTION TIME	NONE	
DRYING TIME MINIMUM	RECOAT 12 HOURS @ 75F / FULL CURE 2 DAYS @ 75F	
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 5 / WET 5.5	
MIXING RATIOS	1 PART A : 1 PART B BY BOLUME	
THINNING	#2 THINNER @ 25% MAXIMUM	

APPLICATION DATA	**1st COAT**	**2nd COAT**
DATE/TIME	3/11/93 @ 1:00 P.M.	3/12/93 @ 1:00 P.M.
RH	52%	61%
TEMPERATURE	72F	75F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2-2.5 MILS PROFILE	CARBOMASTIC 90 ALUMINUM
COATING BATCH NUMBERS	A: 2K3751M / B: 2H3301M	A: 2K3751M / B: 2H3301M
THINNING	#2 @ 25%	#2 @ 25%
EQUIPMENT	DEVILBISS MBC 704E	DEVILBISS MBC 704E
NUMBER OF COATS	1ST COAT	2ND COAT
SAG INDEX	20 MILS	20 MILS

DRY FILM THICKNESS, MILS	**1st COAT**	**2nd COAT**	**TOTAL**
SAMPLE 61	5.2	6	11.2
SAMPLE 62	5.1	6.2	11.3
SAMPLE 63	4.48	5.4	9.88
SAMPLE 64	5.2	5	10.2
SAMPLE 65	5.8	6.8	12.6
SAMPLE 66	5.4	6.4	11.8

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0	0	0	0.10%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0.03%	0	0.03%	0.10%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	0	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	10	9	9	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0.10%	0.03%	0.10%	0.10%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0.10%	0.03%	0.10%	0.10%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

PANEL EVALUATION

CARBOMASTIC 90 ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/6/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	61	62	63	64	65	66	
ASTM D610 RUST GRADE	0	0.10%	0.03%	0.10%	0.10%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	0	0	0	Bl;istering has occurred only along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	0	1/64"	1/64"	0	0	0	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	10	9	9	10	10	10	The only loss of adhesion and underfilm rusting from the scribe has occurred under blisters.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA		
COATING ID	METAL PRIMER SSPC25 RED OXIDE	INDUSTRIAL ALUMINUM TT-P-38
MANUFACTURER	DAVIS INDUSTRIAL COATING	DAVIS INDUSTRIAL COATING
VOLUME % SOLIDS	NOT AVAILABLE	NOT AVAILABLE
VOC	NOT AVAILABLE	NOT AVAILABLE
POT LIFE	NOT AVAILABLE	NOT AVAILABLE
INDUCTION TIME	NOT AVAILABLE	NOT AVAILABLE
DRYING TIME MINIMUM	NOT AVAILABLE	NOT AVAILABLE
RECOMMENDED FILM THICKNESS	NOT AVAILABLE	NOT AVAILABLE
MIXING RATIOS	SINGLE COMPONENT	SINGLE COMPONENT
THINNING	T-120 SPRAYING THINNER	t-120 SPRAYING THINNER

APPLICATION DATA	1ST COAT	2ND COAT	3RD COAT
DATE/TIME	3/11/93 @ 9:00 AM	3/12/93 @ 2:00 PM	3/13/93 @ 2:00 PM
RH	61%	55%	60%
TEMPERATURE	75F	70F	71F
SUBSTRATE CONDITION	SSPC VIS1-C@2 MILS	SSPC SP5 RED OXIDE	TT-P-2-38 Aluminum
COATING BATCH NUMBERS	07172139, LOT 793	UHA10993C	UHA10993C
THINNING	NONE	NONE	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	BINKS CONENTIONAL
NUMBER OF COATS	1	1ST	2ND
SAG INDEX	4 MILS	3 MILS	3 MILS

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	3rd COAT	TOTAL
SAMPLE 33	2	1.3	1.9	5.2
SAMPLE 34	2.4	1.1	2.4	5.9
SAMPLE 35	2.1	1.3	2	5.4
SAMPLE 36	2.5	1.4	2.2	6.1
SAMPLE 37 B*	2.2	1.6	1.9	5.7
SAMPLE 38 B	2.2	1.2	2.1	5.5

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There is no visible changes on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	There are no visible changes on any panels in this set since previous (1344 hr.) evaluation.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.10%	0.10%	0.03%	0.03%	0.03%	Blistering has occurred only along the edges of the scribe.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	8	8	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Med	Dense	Med	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

SSPC 25 / TT-P-38

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/6/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA

							COMMENTS
TEST PANEL NUMBER	33	34	35	36	37B	38B	
ASTM D610 RUST GRADE	0.03%	0.10%	0.10%	0.03%	0.03%	0.03%	All blistering occurred along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	8	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Med	Dense	Med	Few	

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,	IC/Steel		IC/Steel		IC/Steel		IC/Steel		IC/Steel		IC/Steel		
TABLE 1, INCHES	>5/8	0	5/8+	1/64	5/8+	1/64	5/8+	1/64	5/8+	1/64	>5/8+	1/64	Blistering along scribe
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	0	10	0	9	0	9	0	9	0	7	0	9	edges was between primer and top coat. Loss of adhesion between primer and steel as well as under film rust creepage was very minimal.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%		<1%		<1%		<1%		<1%		<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9		9		9		9		9		10		

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	BAR RUST 239 EPOXY ALUMINUM MASTIC
MANUFACTURER	DEVOE COATINGS
VOLUME % SOLIDS	90%
VOC	0.72 LB/GAL (86 G/L)
POT LIFE	4 HOURS @ 77F
INDUCTION TIME	15 MIN @ 77F
DRYING TIME MINIMUM	RECOAT 8 HOURS @ 77F / FULL CURE 24 HOURS @ 77F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 6-8 / WET 6.7-8.9
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME
THINNING	T-4 THINNER @ 10% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/12/93 @ 10:00 A.M.	3/13/93 9:00 A.M.
RH	61%	59%
TEMPERATURE	75f	71F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE	BAR RUST 239
COATING BATCH NUMBERS	A: N210202 / B: N210161	A: N210202 / B: N210161
THINNING	T-4 @ 10%	T-4 @ 10%
EQUIPMENT	DEVILBISS MBC 704E	DEVILBISS MBC 704E
NUMBER OF COATS	1ST COAT	2ND COAT
SAG INDEX	>22 MILS	>22 MILS

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 19	5.5	7.4	12.9
SAMPLE 20	7	8.4	15.4
SAMPLE 21	5.5	8.8	14.3
SAMPLE 22	6.6	11.1	17.7
SAMPLE 23	7.6	8.2	15.8
SAMPLE 24	5.1	5.4	10.5

PANEL EVALUATION

BAR RUST 239 EPOXY ALUMINUM MASTIC

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/19/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	10	10	

PANEL EVALUATION

BAR RUST 239 EPOXY ALUMINUM MASTIC

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

PANEL EVALUATION

BAR RUST 239 EPOXY ALUMINUM MASTIC

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

PANEL EVALUATION

BAR RUST 239 EPOXY ALUMINUM MASTIC

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	9	

PANEL EVALUATION

BAR RUST 239 EPOXY ALUMINUM MASTIC

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	19	20	21	22	23	24	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0	Blistering has occurred only along the scribe edges
ASTM D714 DEGREE OF BLISERING, SIZE	8	8	4	6	8	8	on this set of panels.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Medium	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	>1/16"	1/16"	<1/8"	1/8"	<1/16"	1/64	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	6	7	6	6	7	9	Loss of adhesion and underfilm rust creepage from scribe has occurred under blisters.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	HEMPADUR 4515-1987
MANUFACTURER	HEMPEL
VOLUME % SOLIDS	82%
VOC	1.5 LB/GAL (180 G/L)
POT LIFE	3 HOURS @ 68F
INDUCTION TIME	NONE
DRYING TIME MINIMUM	RECOAT 8 HOURS @ 68F / FULL CURE 7 DAYS @ 68F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 8 / WET 10
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME
THINNING	#0846 THINNER @ 5% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/12/93 @ 3:00 P.M.	3/13/93 @ 8:00 A.M.
RH	55%	59%
TEMPERATURE	70f	71F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE	HEMPADUR 4515/1987 (1ST COAT)
COATING BATCH NUMBERS	A: UH2820323 / B: UH1030166	A: UH2820323 / B: UH1030166
THINNING	#0846 @ 5%	#0846 @ 5%
EQUIPMENT	DEVILBISS MBC 704E	DEVILBISS MBC 704E
NUMBER OF COATS	1	1
SAG INDEX	14 MILS	14 MILS

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 72	8	9	17
SAMPLE 73	7.5	7.9	15.4
SAMPLE 74	8	9.2	17.2
SAMPLE 75	7	9.3	16.3
SAMPLE 76	8.5	7.5	16
SAMPLE 77	8	9	17

PANEL EVALUATION	HEMPADUR 4515/1987						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/5/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	in this set after 672 hours of exposure
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels in this set after 1344 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	2	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	HEMPADUR 4515/1987						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 7/12/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	2	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only at the edge of the scribe.
ASTM D714 DEGREE OF BLISTERING, SIZE	6	2	6	6	4	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	Med.	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/6/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	72	73	74	75	76	77	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	2	2	4	2	2	2	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Dense	Med	Med.	Med	Med-Den	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/16"	1/8"	>1/16"	1/8"	>1/8"	1/8"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	6	6	6	5	6	Loss of adhesion and underfilm rusting has occurred only under blisters.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	INTERGARD UNIVERSAL ALUMINUM
MANUFACTURER	PORTER INTERNATIONAL
VOLUME % SOLIDS	80% +/- 2%
VOC	1.60 LB/GAL (192 G/L)
POT LIFE	4 HOURS @ 75F
INDUCTION TIME	15 MINS @ 75F
DRYING TIME MINIMUM	RECOAT 6 HOURS @ 75F / FULL CURE NOT STATED
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 4-8 / WET 6.3-10.0
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME
THINNING	#T-5 THINNER @ 12% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/10/93 @ 4:00 P.M.	N/A
RH	63%	N/A
TEMPERATURE	73F	N/A
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.2 MILS PROFILE	N/A
COATING BATCH NUMBERS	A: UHA 10055B / B: UHN 12602M	N/A
THINNING	#T-5 @ 12%	N/A
EQUIPMENT	DEVILBISS MBC 704E	N/A
NUMBER OF COATS	1	N/A
SAG INDEX	>24 MILS / 7 MILS THINNED 12%	N/A

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 49	7.3	N/A	7.3
SAMPLE 50	6.9	N/A	6.9
SAMPLE 51	7.8	N/A	7.8
SAMPLE 52	6.7	N/A	6.7
SAMPLE 53	7.1	N/A	7.1
SAMPLE 54	8	N/A	8

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	9	

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	9	

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0	0	0.03%	0	0	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	<1%	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	9	10	10	9	

PANEL EVALUATION	INTERGARD UNIVERSAL ALUMINUM						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE 712/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0	0	0.03%	0	0	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	<1%	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	9	10	10	9	

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0.03%	0	0.03%	0.03%	0	0.03%	Blistering has occurred only at the edge of the scribe.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	8	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	<1%	<1%	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	9	9	10	9	

PANEL EVALUATION

INTERGARD UNIVERSAL ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	49	50	51	52	53	54	
ASTM D610 RUST GRADE	0.03%	0	0.03%	0.03%	0	0.03%	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	4	8	6	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med/Den	Few	Med/Den	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/64"	1/16"	1/32"	>1/16"	1/64"	1/64"	Loss of adhesion and underfilm rust creepage from the scribe has occurred only under blisters.
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	9	7	8	6	9	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	<1%	<1%	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	9	9	10	10	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	MAGNA MASTIC 7900
MANUFACTURER	PORTER INTERNATIONAL
VOLUME % SOLIDS	84% +/- 2%
VOC	1.01 LB/GAL (121 G/L)
POT LIFE	4 HOURS @ 75F
INDUCTION TIME	15 MINS @ 75F
DRYING TIME MINIMUM	RECOAT 24 HOURS @ 75F / FULL CURE NOT STATED
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 5 / WET 6
MIXING RATIOS	1 PART A: 1 PART B BY VOLUME
THINNING	#T-5 THINNER @ 12% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/10/93 @ 3:00 P.M.	N/A
RH	59%	N/A
TEMPERATURE	72F	N/A
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.3 MILS PROFILE	N/A
COATING BATCH NUMBERS	A: 2213639 / B: 2213681	N/A
THINNING	T-5 @ 12%	N/A
EQUIPMENT	DEVILBISS MBC 704E	N/A
NUMBER OF COATS	1	N/A
SAG INDEX	15 MILS THINNED 12%	N/A

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 43	8	N/A	8
SAMPLE 44	5.7	N/A	5.7
SAMPLE 45	4.5	N/A	4.5
SAMPLE 46	5.5	N/A	5.5
SAMPLE 47	4.8	N/A	4.8
SAMPLE 48	4.4	N/A	4.4

PANEL EVALUATION	MAGNA MASTIC 7900						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/5/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	0.03%	0.03%	0.10%	0.03%	0.03%	0.30%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	0.03%	0.03%	0.10%	0.03%	0.03%	0.03%	There are no visible changes in this set of panels since previous (672 hours) evaluation.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	0.10%	3.00%	10%	10%	5%	20%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	8	0	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	3%	10%	10%	5%	20%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	8	6	6	7	5	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	10%	16%	50%	50%	10%	50%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	8	8	8	0	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	Few	Med	0	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	16%	50%	50%	10%	50%	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	5	2	2	6	2	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	10%	40%	90%	90%	16%	95%	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	8	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Med	Med	Dense	Few	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	40%	90%	90%	16%	95%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	3	0	0	5	0	

PANEL EVALUATION

MAGNA MASTIC 7900

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	43	44	45	46	47	48	
ASTM D610 RUST GRADE	10%	60%	90%	90%	32%	95%	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	6	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med.	Dense	Dense	Dense	Few	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/64"	1/64"	1/64"	1/64"	1/64"	1/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	9	9	9	9	9	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	60%	90%	90%	32%	95%	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	1	0	0	3	0	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	EPOXY MASTIC ALUMINUM II
MANUFACTURER	SHERWIN-WILLIAMS
VOLUME % SOLIDS	80% +/- 2%
VOC	1.43 LB/GAL (173 G/L)
POT LIFE	3 HOURS @ 77F
INDUCTION TIME	15 MIN @ 77F
DRYING TIME MINIMUM	RECOAT 18 HOURS @ 77F / FULL CURE 10 DAYS @ 77F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 4-6 / WET 5-7.5
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME
THINNING	R2K4 XYLENE @ 10% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/2/93 @ 8:00 A.M.	3/3/93 @ 3:00 P.M.
RH	63%	60%
TEMPERATURE	73F	73F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE	EPOXY MASTIC ALUMINUM II
COATING BATCH NUMBERS	PART A T0692 / PART B T0992	A: T0692 B: T0992
THINNING	R2K4 XYLENE @ 10%	R2K4 XYLENE @ 10%
EQUIPMENT	DEVILBISS MCB 704E	DEVILBISS MCB 704e
NUMBER OF COATS	1	1
SAG INDEX	14 MILS / 7 MILS THINNED	7 MILS THINNED 10%

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 1	6.6	5.9	12.5
SAMPLE 2	6.7	4.7	11.4
SAMPLE 3	6.8	5.2	12
SAMPLE 4	6.8	5.2	12
SAMPLE 5	6.7	5.8	12.5
SAMPLE 6	7.2	4.9	12.1

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	There is no visible effect from 336 hours of exposure on any of the panels in this set.
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0.03%	0.03%	There have been no noticable changes in
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	any of these panels since the previous (1344 hour)
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	evaluation.
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	There are no visible changes in any panels in this set since the previous (2688 hr) evaluation.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

PANEL EVALUATION

EPOXY MASTIC ALUMINUM II

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/16"	3/32"	>1/16"	<1/16"	>1/16"	>1/16"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	6	6	7	6	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	MACROPOXY ALUMINUM
MANUFACTURER	SHERWIN-WILLIAMS (COOK)
VOLUME % SOLIDS	80%
VOC	1.5 LB/GAL (175 G/L)
POT LIFE	40 MIN @ 75F
INDUCTION TIME	15 MIN @ 75F
DRYING TIME MINIMUM	RECOAT 18-24 HOURS @ 75F / FULL CURE 7 DAYS @ 75F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 6 / WET 7
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME
THINNING	250-C357 XYLENE (MAXIMUM NOT STATED)

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/2/93 @ 1:00 P.M.	3/3/93 21:00 P.M.
RH	57%	60%
TEMPERATURE	72F	73F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.4 MILS PROFILE	MACROPOXY ALUMINUM (1ST COAT)
COATING BATCH NUMBERS	A: 38-1991010140-1017/B: 38-199120522164	A: 38-1991010140-1017/B: 38-199120522164
THINNING	XYLENE @ 5%	XYLENE 5%
EQUIPMENT	BINKS	BINKS
NUMBER OF COATS	1	1
SAG INDEX	9 MILS / 7 MILS THINNED 5%	7 MILS THINNED 5%

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 7	6	4.5	10.5
SAMPLE 8	5.8	4.5	10.3
SAMPLE 9	5.7	3.5	9.2
SAMPLE 10	6.2	4.3	10.5
SAMPLE 11	6.8	4.1	10.9
SAMPLE 12	7.3	3.4	10.7

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	There are no visible changes on any panels in this set after 672 hours of exposure.
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes only any panels in this set after 1344 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels in this set after 2016 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 7/12/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	4	6	6	All blistering is right at the edges of the scribe.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Med.	Med.	Few.	Few.	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION — MACROPOXY ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	2	2	4	6	4	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med.	Med/Den	Dense	Med/Den	Med.	Med.	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	<1/16"	>3/16"	>3/16"	1/8"	<1/16"	1/8"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	4	4	6	7	6	Loss of adhesion and underfilm rust creepage along the scribe has occurred only under the blisters.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	SURFACE TOLERANT EPOXY COATING
MANUFACTURER	SHERWIN-WILLIAMS
VOLUME % SOLIDS	80% +/- 2%
VOC	1.45 LB/GAS (174 G/L)
POT LIFE	4 HOUR @ 77F
INDUCTION TIME	15 MIN @ 77F
DRYING TIME MINIMUM	RECOAT 18 HOURS @ 77f / FULL CURE 10 DAY @ 77F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 6 / WET 7
MIXING RATIOS	4 PARTS A : 1 PART B BY VOLUME
THINNING	R2K4 XYLENE @ 10% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/2/93 @ 9:00 A.M.	3/13/93 @ 4:30 P.M.
RH	63%	59%
TEMPERATURE	74F	72F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.5 MILS PROFILE	SURFACE TOL. EPOXY COATING (1ST COAT)
COATING BATCH NUMBERS	A: T2211/ B: T2340	A: T2211 / B: T2340
THINNING	R2K4 XYLENE @ 10%	R2K4 XYLENE 10%
EQUIPMENT	DEVILBISS MCB 704e	DEVILBISS MCB 704e
NUMBER OF COATS	1	1
SAG INDEX	15 MILS / 7 MILS THINNED	7 MILS THINNED 10%

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 13	5.5	5.5	11
SAMPLE 14	6.9	5.3	12.2
SAMPLE 15	5.9	5.7	11.6
SAMPLE 16	5.5	4.2	9.7
SAMPLE 17	5.5	5.8	11.3
SAMPLE 18	6.8	6.4	13.2

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	9	

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 5/17/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.035	No visible changes in this set of panels since previous (1344 hr.) evaluation.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

PANEL EVALUATION	SURFACE TOLERANT EPOXY						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 7/12/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	6	8	8	6	8	Blistering is occurring only at the edge of the scribe.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med.	Dense	Med.	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

PANEL EVALUATION

SURFACE TOLERANT EPOXY

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS 4032-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.03%	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	2	4	8	6	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Medium	Medium	Medium	Medium	Medium	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	>1/8"	>1/8"	<1/8"	<1/8"	<1/8"	1/16"	Loss of adhesion and underfilm rust creepage has occurred only under
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	5	5	6	6	6	7	blisters along the scribe edges.
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9	

US ARMY CORP OF ENGINEERS

ALUMINUM EPOXY MASTIC PROGRAM

COATING SYSTEM DATA	
COATING ID	COLTURIET TCP ALUMINUM
MANUFACTURER	SIGMA COATINGS
VOLUME % SOLIDS	80% +/-2%
VOC	2.0 LB/GAL (239 g/L)
POT LIFE	6 HOURS @ 68F
INDUCTION TIME	NONE
DRYING TIME MINIMUM	RECOAT 14 HOURS @ 68F / FULL CURE 5 DAYS @ 68F
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 5-8 / WET 6-9.6
MIXING RATIOS	77 PARTS A: 23 PARTS B BY VOLUME
THINNING	#91-92 THINNER @ 15% MAXIMUM

APPLICATION DATA	1st COAT	2nd COAT
DATE/TIME	3/11/93 @ 8:00 A.M.	3/12/93 @ 11:00 A.M.
RH	58%	61%
TEMPERATURE	70F	75F
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE	COLTURIET TCP ALUMINUM
COATING BATCH NUMBERS	A: 188052 / B: 069112	A: 188052 / B: 069112
THINNING	#91-92 @15%	#91-92 @ 15%
EQUIPMENT	DEVILBISS MBC 704E	DEVILBISS MBC 704E
NUMBER OF COATS	1	1
SAG INDEX	>24 MILS / 16 MILS THINNED	16 MILS THINNED 15%

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	TOTAL
SAMPLE 37A	6.5	6.5	13
SAMPLE 38A	5.5	6.3	11.8
SAMPLE 39	6	5.8	11.8
SAMPLE 40	5.5	6.3	11.8
SAMPLE 41	6	7.5	13.5
SAMPLE 42	5.7	6.6	12.3

PANEL EVALUATION

COLTURIET TCP ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/5/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There is no visible effect
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	on any panel in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

COLTURIET TCP ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 4/19/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	10	10	

PANEL EVALUATION	COLTURIET TCP ALUMINUM						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 5/17/93							
EVALUATION HOURS: 1344							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	10	10	

PANEL EVALUATION

COLTURIET TCP ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 6/14/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	0	<1%	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	10	9	10	10	

PANEL EVALUATION	COLTURIET TCP ALUMINUM						
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 7/12/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	0	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	10	9	9	10	

PANEL EVALUATION

COLTURIET TCP ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 8/9/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0.03%	0	Blistering has occurred only at the edges of the scribe.
ASTM D714 DEGREE OF BLISTERING, SIZE	6	6	8	8	8	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	0	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	10	9	9	10	

PANEL EVALUATION

COLTURIET TCP ALUMINUM

CLIENT: U.S. Army Corp of Eng.
ALUMINUM/EPOXY MASTIC PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 4032-Final

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	37A	38A	39	40	41	42	
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0.03%	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	2	2	4	8	6	4	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med.	Med/Den	Med/Den	Few	Few	Med.	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	>1/16"	1/8"	1/16"	1/32"	1/32"	1/8"	Loss of adhesion and underfilm rusting has occurred only under blisters at scribe edges.
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	6	6	7	8	8	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	0	<1%	<1%	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	10	9	9	10	

Appendix B: Epoxy/Urethane System Test Results

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	CARBOMASTIC 90	CARBOTHANE 134HS
MANUFACTURER	CARBOLINE	CARBOLINE
VOLUME % SOLIDS	90% +/- 2%	66% +/- 2%
VOC	0.70 LB/GAL 984 G/L)	2.4 LB/GAL (288 G/L)
POT LIFE	4 HOURS AT 75F	6 HOURS AT 75F
INDUCTION TIME	NONE	NONE
DRYING TIME MINIMUM TO RECOAT	12 HOURS AT 75F	8 HOURS AT 75F FULL CURE - 7 DAYS
RECOMMENDED FILM THICKNESS, DRY	5 MILS PER COAT DRY	2-4 MILS DRY / 3-6 MILS WET
MIXING RATIOS	1:1 BY VOLUME	8 PARTS A : 1 PART B BY VOLUME
THINNING	CARBOLINE NO. 2	CARBOLINE NO. 214
APPLICATION DATA		
DATE/TIME	4/8/93 @ 2:00 PM	4/13/93 @ 2:00 P.M.
RH	55%	50%
TEMPRATURE	73F	74F
SUBSTRATE CONDITION	SSPC VIS. -1C	N/A
COATING BATCH NUMBERS	A: 2K375M B: 2H3301M	A: 2F2797M B: 2K0112C
THINNING	10% WITH NO. 2 THINNER	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	20 MILS	9 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 1	6.9 MILS	5.5 MILS	12.4 MILS
SAMPLE 2	5.4 MILS	5.3 MILS	10.7 MILS
SAMPLE 3	5.8 MILS	4.6 MILS	10.4 MILS
SAMPLE 4	5.6 MILS	4.3 MILS	9.9 MILS
SAMPLE 5	6.2 MILS	3.5 MILS	9.7 MILS
SAMPLE 6	6.4 MILS	4.8 MILS	11.2 MILS

PANEL EVALUATION

CARBOMASTIC 90 / CARBOTHANE 134HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There ar no visible effects on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	CARBOMASTIC 90 / CARBOTHANE 134HS						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/24/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects
							on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 672 hours of expsoure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 90 / CARBOTHANE 134HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 1344 hours of expsoure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	CARBOMASTIC 90 / CARBOTHANE 134HS						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 7/19/93							
EVALUATION HOURS: 2016							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 90 / CARBOTHANE 134HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	4	8	8	Blistering on this set of panels is localized along
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	Few	Few	scribe edges.
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 90 / CARBOTHANE 134HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	1	2	3	4	5	6	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edge in this set of panels throughout the exposure period.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	4	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	1/32"	1/64"	1/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	8	9	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Retention (Avg. of all panels) 90.4%

Yellowing Index: 3.0% more yellow

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	CARBOMASTIC 15LO	CARBOTHANE 134 HS
MANUFACTURER	CARBOLINE	CARBOLINE
VOLUME % SOLIDS	90% +/- 2%	66% +/- 2%
VOC	0.74 LB/GAL (88 G/L)	2.4 LB/GAL (288 G/L)
POT LIFE	4 HOURS AT 75F	6 HOURS AT 75F
INDUCTION TIME	NONE	NONE
DRYING TIME MINIMUM TO RECOAT	24 HOURS TO RECOAT	8 HOURS AT 75F FULL CURE - 7DAYS
RECOMMENDED FILM THICKNESS, DRY	5-7 MILS DRY / 5.5-7.5 WET	2-4 MILS DRY 3-6 MILS WET
MIXING RATIOS	1:1 BY VOLUME	8 PARTS A : 1 PART B BY VOLUME
THINNING	CARBOLINE NO. 76	

APPLICATION DATA		
DATE/TIME	4/9/93 @ 9:00 AM	4/13/93 @ 9:00 PM
RH	55%	50%
TEMPRATURE	73F	74F
SUBSTRATE CONDITION	SSPC VIS. -1C	N/A
COATING BATCH NUMBERS	A: 3A7722L B: 3A7697L	A: 2F2797M B: 2K0112C
THINNING	15% WITH NO. 76	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	>24 MILS	9 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 7	5.8 MILS	6.0 MILS	11.8 MILS
SAMPLE 8	6.1 MILS	6.0 MILS	12.1 MILS
SAMPLE 9	5.6 MILS	7.5 MILS	13.1 MILS
SAMPLE 10	5.3 MILS	6.7 MILS	12.0 MILS
SAMPLE 11	5.0 MILS	7.3 MILS	12.3 MILS
SAMPLE 12	4.4 MILS	7.4 MILS	11.8 MILS

PANEL EVALUATION	CARBOMASTIC 15LO / CARBOTHANE 134HS						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/10/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no effects visible
							on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 15LO / CARBOTHANE 134 HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 672 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	CARBOMASTIC 15LO / CARBOTHANE 134HS						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 6/21/93							
EVALUATION HOURS: 1344							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects
							on any panels in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 1344 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 15LO / CARBOTHANE 134 HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 15LO / CAROTHANE 134 HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering on this set of panels is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	8	8	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Few	Few	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

CARBOMASTIC 15LO / CARBOTHANE 134 HS

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	7	8	9	10	11	12	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering on this set of panels has occurred only along the scribe edges throughout the exposure period.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	8	8	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Few	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	3/32"	1/16"	1/32"	1/64"	1/64"	1/32"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	6	7	8	9	9	8	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	
% Gloss Retention (Average of all panels) 95.4%	Yellow Index: 64.1% more yellow						

US ARMY CORP OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	METAL PRIMER SSPC-25 RED OXIDE	INDUSTRIAL ENAMEL TTE489
MANUFACTURER	DAVIS INDUSTRIAL COATING	DAVIS INDUSTRIAL COATING
VOLUME % SOLIDS	N/A	N/A
VOC	N/A	N/A
POT LIFE	N/A	N/A
INDUCTION TIME	N/A	N/A
DRYING TIME MINIMUM	N/A	N/A
RECOMMENDED FILM THICKNESS	N/A	N/A
MIXING RATIOS	SINGLE COMPONENT	SINGLE COMPONENT
THINNING	T-120 SPRAYING THINNER	

APPLICATION DATA	1ST COAT	2ND COAT	3RD COAT
DATE/TIME	4/12/93 @ 10:00 AM	4/13/93 @ 10:00 AM	4/14/93 @ 10:00 AM
RH	64%	60%	60%
TEMPERATURE	75F	73F	73F
SUBSTRATE CONDITION	SSPC VIS. 1-C	SSPC-25 RED OXIDE	TTE489 ENAMEL
COATING BATCH NUMBERS	07172139 LOT 793	01133123 NONE	01133123 NONE
THINNING	NONE	NONE	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1ST	2ND
SAG INDEX	5 MILS	6 MILS	6 MILS

DRY FILM THICKNESS, MILS	1st COAT	2nd COAT	3rd COAT	TOTAL
SAMPLE 51	2.1 MILS	2.4 MILS	3.5 MILS	8.0 MILS
SAMPLE 52	2.1 MILS	2.0 MILS	3.6 MILS	7.7 MILS
SAMPLE 53	1.8 MILS	2.3 MILS	3.3 MILS	7.4 MILS
SAMPLE 54	2.3 MILS	2.5 MILS	3.0 MILS	7.8 MILS
SAMPLE 55	2.1 MILS	3.3 MILS	3.1 MILS	8.5 MILS
SAMPLE 56	1.9 MILS	2.9 MILS	2.9 MILS	7.7 MILS

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-E-489 ENAMEL

CLIENT: U.S. Army Corp of Eng.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-E-489 ENAMEL

CLIENT: U.S. Army Corp of Eng.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-E-489 ENAMEL

CLIENT: U.S. Army Corp of Eng.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blisters on Panel No. 51
ASTM D714 DEGREE OF BLISTERING, SIZE	8	0	6	4	0	6	are in scattered dense groups. Others are
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	0	Med	Med	0	Med	localized along edges of the scribes.
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	10	10	10	10	10	

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-E-489 ENAMEL

CLIENT: U.S. Army Corp of Eng.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Except for Panel No. 51
ASTM D714 DEGREE OF BLISTERING, SIZE	6*	6	6	4	6	6	all blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Dense	Med	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	10	10	10	10	10	

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-3-489 ENAMEL

CLIENT: U.S. Army Corp of Eng.
EXPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Except for Panel No. 51 blistering is along the scribe edges only.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	4	4	2	4	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	10	10	10	10	10	

PANEL EVALUATION

SSPC-25 RED OXIDE / TT-P-489

CLIENT: U.S. Army Corp of Eng.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	51	52	53	54	55	56	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Except for Panel 51, all
ASTM D714 DEGREE OF BLISTERING, SIZE	8	6	4	4	4	4	blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Dense	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/8"	1/8"	3/16"	1/8"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	6	6	5	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	6	10	10	10	10	10	

% Gloss Retention (average of all panels): 58%

Yellowing Index: 40% yellowing

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	BAR RUST 236	DEVTHANE 379
MANUFACTURER	DEVOE	DEVOE
VOLUME % SOLIDS	80%	62%
VOC	1.4 LB/GAL (170 G/L)	2.7 LBS/GAL (327 G/L)
POT LIFE	4 HOURS AT 77F	8 HOURS AT 77F
INDUCTION TIME	15 MINS AT 77F	NONE
DRYING TIME MINIMUM TO RECOAT	5 HOURS	FULL CURE 16-24 HOURS AT 77F
RECOMMENDED FILM THICKNESS, DRY	5-8 MILS DRY, 6.2-10 MILS WET	2-3 MILS DRY, 3-3.5 MILS WET
MIXING RATIOS	4 PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME
THINNING	10% MAXIMUM WITH T-10 THINNER	5% MAX WITH T-9 THINNER
APPLICATION DATA		
DATE/TIME	4/16/93 @ 9:30 AM	4/17/93
RH	60%	62%
TEMPRATURE	74F	73F
SUBSTRATE CONDITION	SSPC VIS. 1-C	BAR RUST 236
COATING BATCH NUMBERS	A: N302089A B: N302135A	A: N212141C B: C208157
THINNING	NONE	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	13 MILS	6 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 25	5.6 MILS	4.03 MILS	9.9 MILS
SAMPLE 69	5.3 MILS	3.97 MILS	9.3 MILS
SAMPLE 70	5.0 MILS	4.62 MILS	9.6 MILS
SAMPLE 71	5.1 MILS	2.80 MILS	7.9 MILS
SAMPLE 96	4.8 MILS	2.93 MILS	7.0 MILS
SAMPLE 97	4.4 MILS	3.00 MILS	7.3 MILS

PANEL EVALUATION	BAR RUST 236 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/10/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 236 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 236 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	0	6	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	0	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 236 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	6	8	8	6	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Med	Med	Med	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 236 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	6	6	6	6	6	All blistering is localized along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Med	Med	Dense	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINA L EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 236 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	25	69	70	71	96	97	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges
ASTM D714 DEGREE OF BLISTERING, SIZE	4	6	6	6	6	4	throughout the exposure period.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Dense	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	5/32"	1/16"	1/32"	1/32"	1/32"	>1/16"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	5	7	8	8	6	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Retention (average of all panels): 92.3%

Yellowing Index: 82.6% more yellow

US ARMY CORPS OF ENGINEERS	EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA		
COATING ID	BAR RUST 239	DEVTHANE 379
MANUFACTURER	DEVOE	DEVOE
VOLUME % SOLIDS	90%	62%
VOC	0.72 LB/GAL (86 G/L)	2.7 LB/GAL (327 G/L)
POT LIFE	4 HOURS AT 77F	8 HOURS AT 77F
INDUCTION TIME	15 MIN AT 77F	NONE
DRYING TIME MINIMUM TO RECOAT	8 HRS. RECOAT / 24 HRS FULL CURE	16-24 HRS. FULL CURE
RECOMMENDED FILM THICKNESS, DRY	6-8 MILS DRY / 6.7-8.9 MILS WET	2-3 MILS DRY / 3-3.5 WET
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME
THINNING	12 MILS	T-9 THINNER AT 5% MAX.
APPLICATION DATA		
DATE/TIME	4/6/93 @ 10:00 AM	4/7/93 @ 10:30 AM
RH	60%	62%
TEMPRATURE	74F	73F
SUBSTRATE CONDITION	SSPC VIS. 1-C	BAR RUST 239
COATING BATCH NUMBERS	A: N210202 B: N21061	A: N212141-C B: C208157B
THINNING	10% WITH T-4 THINNER	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	12 MILS	6 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 31A	4.8 MILS	5.1 MILS	9.9 MILS
SAMPLE 32A	6.1 MILS	2.6 MILS	8.7 MILS
SAMPLE 33	6.1 MILS	2.5 MILS	8.6 MILS
SAMPLE 34	5.9 MILS	3.1 MILS	9.0 MILS
SAMPLE 67	5.6 MILS	3.3 MILS	8.9 MILS
SAMPLE 68	5.7 MILS	3.3 MILS	9.0 MILS

PANEL EVALUATION

BAR RUST 239 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There were no visible effects on any panels in this set after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	BAR RUST 239 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/24/93							
EVALUATION HOURS: 372							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There were no visible
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	effects on any panels in this set after 672 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 239 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							
							COMMENTS
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering on these panels is localized along
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	6	8	0	8	the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Med	Med	Med	0	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 239 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							
							COMMENTS
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	6	6	6	0	6	All blistering is localized along scribe edge.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Med	Med	0	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

BAR RUST 239 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	6	6	6	6	6	Blistering is localized along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Dense	Dense	Dense	Med	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	BAR RUST 239 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 9/13/93							
EVALUATION HOURS: 3360							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	31A	32A	33	34	67	68	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges throughout the testing period.
ASTM D714 DEGREE OF BLISTERING, SIZE	6	6	6	6	6	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Dense	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/16"	1/16"	5/64"	5/64"	5/64"	1/16"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	7	6	6	6	7	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	
% Gloss Retention (average of all panels): 13.7%	Yellowing Index: 82.4% yellowing						

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	DEVRAN 224	DEVTHANE 379
MANUFACTURER	DEVOE	DEVOE
VOLUME % SOLIDS	60%	62%
VOC	2.84 LB/GAL (340 G/L)	2.7 LBS/GAL (327 G/L)
POT LIFE	8 HOURS AT 77F	8 HOURS AT 77F
INDUCTION TIME	30 MIN AT 77F	NONE
DRYING TIME MINIMUM TO RECOAT	5 HOURS	FULL CURE 16-25 HOURS
RECOMMENDED FILM THICKNESS, DRY	4-6 MILS DRY, 6.7-10 MILS WET	2-3 MILS DRY, 3.3-5 MILS WET
MIXING RATIOS	1PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME
THINNING	10% MAXIMUM WITH T-10 THINNER	5% MAX WITH T-9 THINNER
APPLICATION DATA		
DATE/TIME	4/6/93 @ 9:00 AM	4/7/93 @ 9:00 AM
RH	60%	62%
TEMPRATURE	74F	73F
SUBSTRATE CONDITION	SSPC VIS. 1-C	DEVRAN 224
COATING BATCH NUMBERS	A: N010092C B: C008007	AI N212141C B: C208157
THINNING	NONE	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	13 MILS THINNED 5%	6 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 90	4.3 MILS	2.8 MILS	7.1 MILS
SAMPLE 91	5.2 MILS	3.0 MILS	8.2 MILS
SAMPLE 92	5.0 MILS	3.2 MILS	8.2 MILS
SAMPLE 93	5.5 MILS	2.9 MILS	8.4 MILS
SAMPLE 94	4.9 MILS	3.4 MILS	8.3 MILS
SAMPLE 95	5.6 MILS	2.9 MILS	8.5 MILS

PANEL EVALUATION	DEVRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/10/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	DEVRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/24/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	DEVRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 6/21/93							
EVALUATION HOURS: 1344							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	4	0	4	4	4	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	0	Med	Few	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

DEVRAN 224 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0.03%	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	4	8	4	4	4	Blistering is along the scribe edges only.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Few	Med	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	10	10	

PANEL EVALUATION	DEVRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 8/16/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	4	6	2	4	4	All blistering on this set of panels is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Med	Med	Med	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

DEVRAN 224 / DEVTHANE 379

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	90	91	92	93	94	95	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	6	4	6	2	4	4	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Med	Med	Med	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/16"	1/8"	1/64"	3/16"	1/8"	1/8"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	6	9	5	6	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Retention (average of all panels): 99.3%

Yellowing Index: 81.5% yellowing

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	HEMPADUR 4515/1987	HEMPATHANE 5521/1148
MANUFACTURER	HEMPEL	HEMPEL
VOLUME % SOLIDS	82%	53%
VOC	1.5 LB/GAL (180 G/L)	3.8 LBS/GAL 450 G/L
POT LIFE	3 HOURS AT 68F	2 HOURS AT 68F
INDUCTION TIME	NONE	NONE
DRYING TIME MINIMUM TO RECOAT	RECOAT 8 HOURS, 6 DAYS MAX.	8HRS TO TOUCH, 7 DAYS FULL CURE
RECOMMENDED FILM THICKNESS, DRY	8 MILS DRY 10 MILS WET PER COAT	2 MILS DRY, 4 MILS WET
MIXING RATIOS	1 PART A : 1 PART B	7 PARTS A : 1 PART B
THINNING	5% MAX WITH NO. 0846 THINNER	0808/0888 5% MAX.

APPLICATION DATA		
DATE/TIME	4/13/93 @ 8:00 AM	4/14/93 @ 9:00 AM
RH	55%	60%
TEMPRATURE	72f	73F
SUBSTRATE CONDITION	SSPC VIS.1-C	HEMPADUR 4515-1987
COATING BATCH NUMBERS	A: UH2820323 B: UH1030166	A: UH392086 B: UH4320918
THINNING	5% WITH NO. 0846 THINNER	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	20 MILS	9 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 39	10.1 MILS	1.7 MILS	11.8 MILS
SAMPLE 40	7.75 MILS	1.9 MILS	9.6 MILS
SAMPLE 41	7.10 MILS	1.9 MILS	9.0 MILS
SAMPLE 42	7.90 MILS	1.5 MILS	9.4 MILS
SAMPLE 43	8.00 MILS	1.9 MILS	9.9 MILS
SAMPLE 44	7.10 MILS	2.2 MILS	9.3 MILS

PANEL EVALUATION	HEMPADUR 4515-1987 / HEMPATHANE 5521-1148						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/10/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515-1987/HEMPATHANE 5521-1148

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							
							COMMENTS
TEST PANEL NUMBER	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515-1987 / HEMPATHANE 5521-1148

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL #	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	6	2	6	All blistering is localized along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Med	Med	Few	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	0	0	0	0	0	10	

PANEL EVALUATION

HEMPADUR 4515-1987 / HEMPATHANE 5521-1148

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	6	2	6	Blistering is localized along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Med	Few	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

HEMPADUR 4515-1987 / HEMPATHANE 5521-1148

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	6	2	2	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Med-Den	Med	Med	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	HEMPADUR 4515-1987 / HEMPATHANE 5521-1148						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 9/13/93							
EVALUATION HOURS: 3360							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	39	40	41	42	43	44	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering is locallized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	6	2	2	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Dense	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/16"	1/8"	1/32"	1/8"	1/8"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	7	6	8	6	6	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	
% Gloss Retention (average of all panels) : 99.3%	Yellowing Index: 75.1% yellowing						

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	INTERGARD H.S., UNIVERSAL EPOXY	INTERTHANE
MANUFACTURER	PORTER INTERNATIONAL	PORTER INTERNATIONAL
VOLUME % SOLIDS	80% +/- 2%	57% +/- 2%
VOC	1.6 LB/GAL (192 G/L)	
POT LIFE	4 HOURS AT 75F	10 HOURS AT 75F
INDUCTION TIME	15 MIN AT 75F	NONE
DRYING TIME MINIMUM TO RECOAT	6 HOURS	24 HOURS AT 75F
RECOMMENDED FILM THICKNESS, DRY	4-8 MILS DRY / 6-10 MILS WET	1.5-2.0 DRY 3-5 WET
MIXING RATIOS	4 PARTS A : 1 PART B BY VOLUME	KIT
THINNING	THINNER #T-44 AT 6% MAX.	GTA415
APPLICATION DATA		
DATE/TIME	4/19/93 @ 8:00 A.M.	4/20/93 @ 8:00 A.M.
RH	60%	58%
TEMPRATURE	74F	73F
SUBSTRATE CONDITION	SSPC VIS. -1C	N/A
COATING BATCH NUMBERS	A: UHA10993C B: UHA13313C	NOT LEGIBLE
THINNING	6%	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	13 MILS THINNED 6%	6 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 13	6.3 MILS	3.6 MILS	9.9 MILS
SAMPLE 14	6.9 MILS	2.7 MILS	9.6 MILS
SAMPLE 15	6.5 MILS	2.6 MILS	9.1 MILS
SAMPLE 16	6.0 MILS	3.5 MILS	9.5 MILS
SAMPLE 17	5.7 MILS	3.2 MILS	8.9 MILS
SAMPLE 18	5.3 MILS	4.7 MILS	10.0 MILS

PANEL EVALUATION

INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/24/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 6/21/93							
EVALUATION HOURS: 1344							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	INTERGARD H.S. UNIVERSAL EXPOXY/INTERTHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 8/16/93							
EVALUATION HOURS: 2688							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	6	0	0	0	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	0	0	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	10	10	10	9	

PANEL EVALUATION

INTERGARD H.S. UNIVERSAL/INTERTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360 - FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	13	14	15	16	17	18	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges throughout the exposure
ASTM D714 DEGREE OF BLISTERING, SIZE	0	6	0	0	0	8	period.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	0	1/64"	1/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	10	9	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Rention (average of all panels): 94.1%

Yellowing Index: 80.6% more yellow

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	SURFACE TOLERANT EPOXY	HI SOLIDS POLYURETHANE
MANUFACTURER	SHERWIN-WILLIAMS	SHERWIN-WILLIAMS
VOLUME % SOLIDS	80% +/- 2%	65% +/- 2%
VOC	1.45 LB/GAL (174 G/L)	2.40 LB/GAL (289 G/L)
POT LIFE	4 HOURS AT 77F	4 HOURS AT 77F
INDUCTION TIME	15 MIN AT 77F	NONE
DRYING TIME MINIMUM TO RECOAT	18 HOURS	RECOAT: 18HRS FULL CURE: 10 DAYS
RECOMMENDED FILM THICKNESS, DRY	6 MILS DRY / 7 MILS WET	2 MILS DRY / 4.5 MILS WET
MIXING RATIOS	6 PARTS A : 1 PART B	4 PARTS A : 1 PART B
THINNING	R2K4 XYLENE AT 10% MAX.	R7K69 AT 15% MAX

APPLICATION DATA		
DATE/TIME	4/10/93 @ 10:00 A.M.	4/14/93 @ 10:00 AM
RH	52%	56%
TEMPRATURE	72F	73F
SUBSTRATE CONDITION	SSPC VIS. 1-C	N/A
COATING BATCH NUMBERS	A: T2592 B: t592	A: 620-4978 B: 630-4281
THINNING	R2K4 XYLENE AT 5%	nONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	8 MILS THINNED 5%	5 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 27	6.5 MILS	3.4 MILS	9.9 MILS
SAMPLE 28	7.6 MILS	3.3 MILS	10.9 MILS
SA,MPLE 29	6.5 MILS	3.5 MILS	10.0 MILS
SAMPLE 30	6.4 MILS	2.4 MILS	8.8 MILS
SAMPLE 31B	7.2 MILS	2.9 MILS	10.1 MILS
SAMPLE 32B	6.0 MILS	2.6 MILS	8.6 MILS

PANEL EVALUATION

SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There was no visible effect on any panel in this set
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 336 hours of exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION	SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/24/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering on Panel 32B occurred at the edges
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	8	of the scribe.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering on Panel 32B is still localized along the
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	8	scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Med.	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	8	0	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	<1%	0	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	9	10	9	

PANEL EVALUATION	SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 9/13/93							
EVALUATION HOURS: 3360-FINAL							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	27	28	29	30	31B	32B	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blisters have occurred only along the scribe edges throughout the testing period.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	8	0	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	0	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	0	1/32"	1/32"	0	1/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	10	8	8	10	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	
% Gloss Retention (average of all panels): 38.3%	Yellowing Index: 53.2% more yellow						

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	MACROPOXY ALUMINUM	ACROTHANE
MANUFACTURER	SHERWIN WILLIAMS (COOK)	SHERWIN WILLIAMS (COOK)
VOLUME % SOLIDS	80%	61% +/- 2%
VOC	1.5 LB/GAL ((175 G/L)	2.88 LB/GAL (346 G/L)
POT LIFE	40 MIN @ 75F	1.5 HOURS @ 75F
INDUCTION TIME	15 MIN @ 75F	NONE
DRYING TIME MINIMUM TO RECOAT	RECOAT 18-24 HOURS	7 DAYS FULL CURE
RECOMMENDED FILM THICKNESS, DRY	6 MILS DRY, 7 MILS WET	1.2-2.5 DRY, 2.5-4.0 WET
MIXING RATIOS	1 PART A : 2 PARTS B BY VOLUME	7 PARTS A : 1 PART B
THINNING	250-C-357 (XYLENE)	5% MAX WITH #A19 THINNER

APPLICATION DATA		
DATE/TIME	4/10/93 @ 9:00 AM	4/11/93 @ 10:30 AM
RH	51%	55%
TEMPRATURE	73F	72F
SUBSTRATE CONDITION	SSPC VIS. 1-C	MACROPOXY
COATING BATCH NUMBERS	A: 38-1991010140/1-017 B: 3819912052164	A: 38199115507 B: 700c505
THINNING	10% WITH 250-C-357 XYLENE	NONE
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	12 MILS	6 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 45	5.0 MILS	2.1 MILS	7.1 MILS
SAMPLE 46	5.1 MILS	2.1 MILS	7.2 MILS
SAMPLE 47	5.4 MILS	1.8 MILS	7.2 MILS
SAMPLE 48	5.8 MILS	2.9 MILS	8.7 MILS
SAMPLE 49	5.8 MILS	2.2 MILS	8.0 MILS
SAMPLE 50	5.9 MILS	2.1 MILS	8.0 MILS

PANEL EVALUATION	MACROPOXY ALUMINUM - ACROTHANE						
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 5/10/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							**COMMENTS**
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM / ACROTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM / ACROTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	6	6	4	6	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Few	Dense	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM / ACROTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	4	6	6	4	6	6	All blistering is along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Med	Dense	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM / ACROTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	2	4	2	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Dense	Med	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

MACROPOXY ALUMINUM / ACROTHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360-FINAL

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	45	46	47	48	49	50	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	4	4	4	2	4	2	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Dense	Dense	Dense	Dense	Dense	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	7/64"	3/64"	5/64"	9/64"	5/64"	3/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	6	7	6	5	6	7	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Retention (average of all panels): 70.3%

Yellowing Index: 94.1% yellowing

US ARMY CORPS OF ENGINEERS

EPOXY / URETHANE PROGRAM

COATING SYSTEM DATA		
COATING ID	EPTCP ALUMINUM	VHSA POLYURETHANE
MANUFACTURER	SIGMA COATINGS	SIGMA COATINGS
VOLUME % SOLIDS	80% +/- 2%	
VOC	2 LBS/GAL (239.6 G/L)	3.10 LB/GAL (371.5 G/L)
POT LIFE	6 HOURS AT 68F	4 HOURS AT 68F
INDUCTION TIME	NONE	NONE
DRYING TIME MINIMUM TO RECOAT	5 HOURS	12HRS MIN 5 DAYS @ 77F FULL CURE
RECOMMENDED FILM THICKNESS, DRY	5-8 MILS DRY	2-3 MILS DRY
MIXING RATIOS	3.35:1 BY VOL 5.66 BY WT.	4.88 : 1 BY VOLUME 5.25:1 BY WT
THINNING	10% MAX. WITH #9192 THINNER	6% MAX WITH #91-88 THINNER

APPLICATION DATA		
DATE/TIME	4/19/93 @ 8:00 AM	4/19/93 @ 4:00 PM
RH	65%	64%
TEMPRATURE	75F	76F
SUBSTRATE CONDITION	SSPC VIS. -1C	EPTCP ALUMINUM
COATING BATCH NUMBERS	A: 232-052 B: 136-023	A: 035-023 B: 088-112
THINNING	10% WITH #91-92 THINNER	NONE
EQUIPMENT	CONVENTIONAL	BINKS CONVENTIONAL
NUMBER OF COATS	1	1
SAG INDEX	14 MILS	7 MILS

DRY FILM THICKNESS, MILS	1ST COAT	2ND COAT	TOTAL
SAMPLE 57	5.3 MILS	4.3 MILS	9.6 MILS
SAMPLE 58	6.0 MILS	3.4 MILS	9.4 MILS
SAMPLE 59	6.9 MILS	4.5 MILS	11.4 MILS
SAMPLE 60	8.1 MILS	4.0 MILS	12.1 MILS
SAMPLE 61	5.9 MILS	3.7 MILS	9.6 MILS
SAMPLE 62	7.0 MILS	3.2 MILS	10.2 MILS

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE FINISH

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/10/93
EVALUATION HOURS: 336

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE FINISH

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 5/24/93
EVALUATION HOURS: 672

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE FINISH

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 6/21/93
EVALUATION HOURS: 1344

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	0	8	8	8	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	0	Few	Few	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 7/19/93
EVALUATION HOURS: 2016

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	8	0	6	6	8	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	0	Few	Med	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 8/16/93
EVALUATION HOURS: 2688

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	0	0	6	6	4	Blistering is along the scribe edges only.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	0	0	Med-Den	Med	Few	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION

EPTCP ALUMINUM / VHSA POLYURETHANE FINISH

CLIENT: U.S. ARMY CORPS OF ENG.
EPOXY URETHANE PROGRAM
DATE: 9/13/93
EVALUATION HOURS: 3360

COATING EVALUATION DATA							COMMENTS
TEST PANEL NUMBER	57	58	59	60	61	62	
ASTM D610 RUST GRADE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	8	4	6	6	4	All blistering is localized along scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Med	Med	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	1/32"	1/32"	1/64"	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	8	8	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

% Gloss Retention (average of all panels): 92.1%

Yellowing Index: 86.7% yellowing

Appendix C: Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel–Aluminum Epoxy Mastic

Abstract

This commercial item description covers the requirements for a high build aluminum pigmented epoxy coating system. The product shall be suitable for application at temperatures of 40 °F (4.4 °C) and above to minimally prepared rusted and/or painted ferrous metal substrates. Wide latitude is afforded the formulator provided the product meets the specification requirements when tested as described herein. The coating shall not contain lead, chromium, cadmium, or chlorinated solvents. In addition to the manufacturers standard label, the product shall be labeled with the title and number of this commercial item description.

Salient Characteristics

The coating shall comply with the following requirements.

Application Properties[1]

The coating shall not sag, run, or streak when applied by brush, spray, or roller at the manufacturer's recommended thickness.

Appearance of the Dried Paint Film[2]

The dried paint film shall have no visible cracks or fractures.

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[1] The coating shall be applied at the manufacturer's recommended film thickness by brush, roller, and conventional and airless spray.

[2] The applied paint shall be inspected under 30X magnification after drying for 1 week.

Dry Time[3]

The coating shall dry hard in not more than 16 hours.

Pot Life[4]

The viscosity of the mixed coating shall not increase by more than 10 Krebs units (KU) in 3 hours.

Intercoat Adhesion[5]

When tested as specified, the coating shall exhibit no intercoat delamination.

Accelerated Corrosion Resistance[6]

None of the six test panels shall blister adjacent to the scribe earlier than the inspection at 2688 hours. No more than 1, 4, and 6 test panels shall blister adjacent to the scribe at 2688, 3360, and 4032 hours respectively. For all six test panels, the average numerical blister rating for the area adjacent to the scribe shall not be less than 6.5. The blister rating shall be the average of the sum of the average numerical ratings for frequency and size. Frequency ratings shall be converted as follows: 10 = none, 8 = few, 6 = medium, 4 = medium dense, 2 = dense, 0 = total. Any blistering not immediately adjacent to the scribe shall be cause for rejection. The average rust rating for the six panels and the minimum rust rating for any one test panel shall not be less than 9.0. The rust undercut rating for any panel shall not be less than 6.0 and the average rust undercut rating for all six panels shall be greater than 6.0. The sum of the average rust, blister, and undercut scores shall not be less than 23.0.

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[3] The time to dry hard shall be determined for the epoxy coating applied at the recommended film thickness in accordance with ASTM D 523-89.

[4] The initial viscosity of a 1-qt (0.095 L) sample of thoroughly mixed coating shall be determined by ASTM D 562. The viscosity shall be measured a second time after 3 hr.

[5] Two successive coats of the test material shall be spray-applied to the designated dry film thickness. The applied paint shall be cured and aged at 70 to 75 °F (21 to 24 °C) and 50 ±10 percent relative humidity for 72 hr between coats and for 7 days after the application of the second coat. A sharp knife shall be used to produce two parallel scribes through the coating approximately 1 in. long and 1/4-in. apart. A third scribe shall be made perpendicular to and through the parallel scribes. The knife shall be used to determine the intercoat adhesion by attempting to delaminate the second coat from the first along the perpendicular scribe.

[6] The corrosion resistance of the aluminum epoxy mastic system shall be evaluated using this test procedure.

Volatile Organics[7]

The volatile organic content of the mixed and thinned coating shall not exceed 350 g/L.

Preparation of Test Specimens

Pre-rusted test specimens measuring 3.0 x 9.0 x 0.125 in. shall be prepared in accordance with SSPC Coatings Test Panel Preparation Specification No. 1, *Uncontaminated Rusted Steel* (SSPC Draft Specification No. 2, January 1995).

Application of Paint System

The first coat of aluminum epoxy mastic shall be spray-applied to the recommended dry film thickness and allowed to cure for 18 to 24 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity. The second coat of epoxy shall be spray applied and allowed to dry for a minimum of 7 days prior to testing. Prior to exposure, test panels shall be scribed in accordance with ASTM D1654 such that the coating is uniformly removed down to the substrate along the entire length of the scribe.

Cyclic Test Exposure

Six test coupons of the aluminum epoxy coating system shall be exposed in accordance with ASTM G 85, Annex A5, and ASTM G 53 with the following modifications and conditions. The concentration of the dilute salt solution shall be 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature shall be 30 °C and the dry-off temperature 40 °C. The UV-condensing cabinet shall use UV-A bulbs and be run at 60 °C during the 4h UV cycle and at 50 °C during the 4h condensation cycle. Samples shall be exposed alternately for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet for a total of 4032h.

Inspection and Evaluation of Test Coupons

The coatings shall be evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D610, SSPC-Vis. 2, ASTM D714, and ASTM D1654. A transparent grid overlay shall be used to enhance the results of the visual examination. Panels shall be evaluated after 332, 672, 1344, 2016, 2688, 3360, and 4032 hours of exposure, except that undercutting at the scribe shall only be determined after 4032 hours.

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[7] The VOC content of the mixed, ready-to-apply material shall be determined in accordance with USEPA method 24.

Quality Assurance

Responsibility

Unless otherwise specified, the contractor is responsible for the performance of all inspection requirements specified herein. The Government reserves the right to perform any of the inspections set forth when deemed necessary to assure that the material conforms to the prescribed requirements.

Inspection

Sampling shall be in accordance with ASTM D 3925. Testing shall be conducted in a Government-approved testing facility using the manufacturer's designated dry film thickness applied in the recommended number of coats. Generally this system will be applied in two coats with a total dry film thickness of 8 to 14 mils. Failure to meet any requirement specified herein shall be cause for rejection.

1. First article inspection when specified shall include all tests of salient characteristics, and may be standard production material from the supplier's current inventory.
2. Quality conformance inspection shall include all of the requirements specified herein with the exception of the provisions for accelerated corrosion resistance and volatile organics unless otherwise specified.
3. Coatings shall be subject to inspection for requalification purposes every 3 years, or at which time that the product is reformulated. The requirements shall be the same as for first article inspection.

Certification

The contractor shall certify, and maintain substantiating evidence, that the products conform to the producer's own specifications, standards, and quality assurance practices. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for by the contract.

Packaging

Materials shall be packaged and marked as specified in ASTM D 3951. The manufacturer of the material shall provide material safety data sheets and instructions for application of the product.

Further Notes

Note 1

This coating system is primarily for use on hand- or power tool-cleaned exterior steel substrates in normal or industrial atmospheres. It may also be used for interior areas that are dry or subject to high humidity and condensation. In some cases this system may be used to overcoat existing coating systems as a means of extending their service life. An assessment of the current coating condition and the application of a test patch of the proposed overcoat material must be conducted before scheduling the painting contract. Higher grades of surface preparation, such as commercial blast cleaning, may be selected at the discretion of the specifier. Commercial blast cleaning may be appropriate for complete removal of a heavily deteriorated coating system. Grades of surface preparation higher than SP-6 will not significantly improve the performance of the coating system and do not warrant the added expense.

Note 2

At least 6 months should be allowed for the qualification of any manufacturers brand of aluminum epoxy mastic paint. Because of the long time necessary to qualify coatings, the purchaser should consider selecting a previously qualified coating.

Suggested Sources

Source	Product
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Carbomastic 15LO
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Carbomastic 90 Aluminum
Devoe Coatings Company 4000 DuPont Circle Louisville, KY 40207	Bar Rust 239
Sherwin-Williams 101 Prospect Ave., NW Cleveland, OH 44115-1075	Epoxy Mastic Aluminum II

Appendix D: Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel–Epoxy Primer/Urethane Topcoat

Abstract

This paint system consists of a commercially available epoxy mastic primer and urethane topcoat produced by a single manufacturer and marketed for use as a system. The coating system is suitable for use on minimally prepared rusted and/or painted ferrous metal substrates. Wide latitude is afforded the formulator, provided the system meets the requirements as specified herein. The coatings shall not contain lead, chromium, cadmium, or chlorinated solvents. As a minimum, the topcoat shall be available in white, black, grey, and safety yellow. Qualification testing shall be performed on systems using the white topcoat.

Salient Characteristics

The coating system shall comply with the following requirements when tested.

Application Properties[1]

The primer and topcoat shall not sag, run, or streak when tested as specified.

Appearance of the Dried Paint Film [2]

When tested as specified the primer shall have no visible cracks.

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[1] The primer and topcoat shall be applied by brush, roller, and conventional and airless spray at the manufacturer's recommended thicknesses.

[2] The dried coatings shall have a smooth uniform appearance. A dried film of the epoxy primer shall exhibit no cracks or fractures when examined under 30X magnification.

Dry Time[3]

The primer shall dry-hard in less than 8 hours and the topcoat in less than 6 hours.

Pot Life[4]

The viscosities of the mixed primer and mixed topcoat shall not increase by more than 10 Krebs units (KU) over a 4-hr period.

Intercoat Adhesion[5]

When tested as specified, the topcoat shall show no intercoat delamination from the primer.

Volatile Organics[6]

The volatile organics content of the ready to apply primer and topcoat shall not be greater than 350 g/L and 420 g/L respectively.

Cyclic Corrosion Test[7]

No more than two panels shall exhibit blistering adjacent to the scribe after 1344 and 2016 hours of testing. No more than four panels shall exhibit blistering adjacent to the scribe after 2688 and 3360 hours of testing. The average of the sum of the final numerical blister ratings shall not be less than 8.0. The blister rating shall be the average of the sum of the average numerical ratings for frequency and size. Frequency ratings shall be converted as follows: 10 = none, 8 = few, 6 = medium, 4 = medium dense, 2 = dense, 0 = total. Blistering not immediately adjacent to the scribe shall be cause for rejection. The final rust rating for each of the six test panels shall be 10. No single test panel shall have a rust undercut rating of less than 5.0 and the average

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[3] The time to dry-hard shall be determined for the primer and topcoat applied at the recommended film thicknesses in accordance with ASTM D 1640-83 (Reapproved 1989).

[4] The viscosity of 1-qt samples of epoxy primer and urethane topcoat shall be determined immediately after mixing and 4 hours later in accordance with ASTM D 562-82 (Reapproved 1990).

[5] The primer/topcoat system shall be spray applied to the recommended film thickness. The primer shall be air dried for 72 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity prior to application of the topcoat. The topcoat shall be allowed to dry 7 days prior to testing. A sharp knife shall be used to produce two parallel scribes through the coating approximately 1 in. long and 1/4-in. apart. A third scribe shall be made perpendicular to and through the parallel scribes. The knife shall be used to determine the intercoat adhesion by attempting to delaminate the urethane topcoat from the epoxy primer along the perpendicular scribe.

[6] The volatile organic content of the primer and topcoat shall be determined in accordance with the requirements of USEPA Method 24.

[7] The corrosion resistance of the epoxy/urethane coating system shall be evaluated using this test procedure.

scribe rating for the six test panels shall not be less than 7.0. The sum of the average blister, rust, and undercut ratings shall not be less than 25.0.

Preparation of Test Specimens

Prerusted test specimens measuring 3.0 x 9.0 x 0.125 in. shall be prepared in accordance with SSPC Coatings Test Panel Preparation Specification No. 1, *Uncontaminated Rusted Steel* (SSPC Draft Specification No. 2, January 1995).

Application of Paint System

The primer shall be spray-applied to the recommended dry film thickness and allowed to cure for 18 to 24 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity. The topcoat shall be spray applied and allowed to dry for a minimum of 7 days prior to testing. Prior to exposure test panels shall be scribed in accordance with ASTM D 1654 such that the coating is uniformly removed down to the substrate along the entire length of the scribe.

Cyclic Test Exposure

Six test coupons of the epoxy/urethane coating system shall be exposed in accordance with ASTM G 85, Annex A5, and ASTM G 53 with the following modifications and conditions. The concentration of the dilute salt solution shall be 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature shall be 30 °C and the dry-off temperature 40 °C. The UV-condensing cabinet shall use UV-A bulbs and be run at 60 °C during the 4h UV cycle and at 50 °C during the 4h condensation cycle. Samples shall be exposed alternately for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet for a total of 3360h.

Inspection and Evaluation of Test Coupons

The exposed test coupons shall be evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D 610, SSPC Vis. 2, ASTM D 714, and ASTM D 1654 after 1344, 2016, 2688, and 3360 hours of exposure except that rust undercutting at the scribe shall only be rated at the completion of testing.

Quality Assurance

Responsibility

Unless otherwise specified, the contractor is responsible for the performance of all inspection requirements specified herein. The Government reserves the right to perform any of the inspections set forth when deemed necessary to assure that the material conforms to the prescribed requirements.

Inspection

Sampling shall be in accordance with ASTM D 3925. Testing shall be conducted in a Government-approved testing facility using the manufacturer's designated dry film thickness applied in the recommended number of coats. Generally this system will be applied in two coats with a total dry film thickness of 8 to 14 mils. Failure to meet any requirement specified herein shall be cause for rejection.

1. First article inspection when specified shall include all tests of salient characteristics, and may be standard production material from the supplier's current inventory.
2. Quality conformance inspection shall include all of the requirements specified herein with the exception of the provisions for accelerated corrosion resistance and volatile organics unless otherwise specified.
3. Coatings shall be subject to inspection for requalification purposes every 3 years, or at which time that the product is reformulated. The requirements shall be the same as for first article inspection.

Certification

The contractor shall certify, and maintain substantiating evidence, that the products conform to the producer's own specifications, standards, and quality assurance practices. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for by the contract.

Packaging

Materials shall be packaged and marked as specified in ASTM D 3951. The manufacturer of the material shall provide material safety data sheets and instructions for application of the product.

Further Notes

Note 1

This coating system is intended primarily for use on hand- or power tool-cleaned exterior steel substrates exposed to rural or industrial atmospheres where finish colors other than aluminum are desired. It may also be used for interior surfaces that are dry or subject to high humidity and condensation. In some cases this coating system can be used to overcoat existing coating systems as a means of extending their service life. An assessment of the current coating condition and the application of a test patch of the proposed overcoat material must be conducted to determine the viability of the overcoat option. Higher grades of surface preparation, such as SSPC-SP 6, *Commercial Blast Cleaning*, may be selected at the discretion of the specifier. SP 6 may be appropriate for the complete removal of a deteriorated coating system. Better grades of surface cleaning than SP 6 will not significantly improve the performance of the coating system and do not warrant the higher cost.

Note 2

At least 6 months should be allowed for the qualification of any manufacturers system. Because of the long time period required for qualification, the Contractor should consider selecting a previously qualified system.

Suggested Sources

Source	Product
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Primer: Carbomastic 90 Topcoat: Carbothane 134HS
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Primer: Carbomastic 15LO Topcoat: Carbothane 134HS
International /Courtalds Coatings 6001 Antoine Houston, TX 77210-4806	Primer: Intergard H.S. Universal Epoxy Topcoat: Interthane
Sherwin-Williams 101 Prospect Ave, NW Cleveland, OH 44115-1075	Primer: Surface-Tolerant Epoxy Topcoat: Hi Solids Polyurethane

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