Technical Report

R 776

Sponsored by

NAVAL FACILITIES ENGINEERING COMMAND

November 1972

NAVAL CIVIL ENGINEERING LABORATORY

Port Hueneme, California 93043

ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE

ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE

Technical Report R-776

YF 54.543.006.01.008

by

Carl V. Brouillette and A. F. Curry

ABSTRACT

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California ($34^{o}7'$N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

CONTENTS

INTRODUCTION

The Navy is continually in need of coatings that can be used to give long-term protection to steel structures in remote areas where maintenance is at a minimum. Zinc inorganic silicate coatings have been shown to be suitable for this purpose.[1] However, if the structural design is such that wet sea spray can lie for long periods on the coated surface, these coatings will fail rapidly.

In 1964, the Naval Civil Engineering Laboratory (NCEL) initiated an evaluation of zinc inorganic silicate coatings with and without a variety of organic topcoats. From a list of zinc inorganic coatings found in the journal *Chemical and Engineering News*, 10 zinc inorganic silicate coatings were selected for testing.[2] Two types of these zinc coatings were available: one required application of a postcuring solution after initial drying, and the other was self-curing. If a topcoat was applied to the postcured variety, a thorough washing was required to remove any residual curing solution.

The importance of the coating study was emphasized by an article published by the National Association of Corrosion Engineers in which it was stated that of the top 10 military corrosion problems, finding an effective topcoat for zinc inorganic silicate coatings was number one.[3]

This report covers the results of 5 years of exposure in various marine atmospheric environments of 10 zinc inorganic silicate coatings with and without topcoats. The results of 2 years of exposure of these coatings were previously reported.[4]

EXPOSURE SITES

Mild steel specimens, 6 x 12 x 1/8 inches, were used for the coating study. After the coatings were applied, some with topcoats and some without, an X-shaped cut was made on one side of half the panels coated with each system. The cuts were through to the steel surface. Two coated specimens of each system, one containing the X cut facing upward and one unscribed, were exposed to a marine atmosphere at five locations selected to give varying degrees of severity.

At Port Hueneme, one location makes for a mild exposure; the specimens were placed at a 45-degree angle facing south and about 200 feet from the surf. The prevailing west wind carries only a small amount of spray to the specimens. The other location at Port Hueneme is on an abandoned pier, where the specimens were exposed at a 45-degree angle facing west; they were subjected to a salt water spray which frequently contained hydrogen sulfide pollution.

The two sites at Marine Corps Air Station, Kaneohe, Hawaii, expose the specimens at a 45-degree angle facing east northeast (66^{O}) into the prevailing wind. One location is about 200 to 300 feet from the surf, which washes around the base of the supporting racks during stormy weather. The other is back from this location about 200 feet and up a slight rise of about 75 feet above sea level. The Kaneohe lower level test site was completely wiped out during a storm after the 4-year inspection period; thus, rating data was unobtainable at the 5-year inspection period. Reference to coating performance will relate to 4 years maximum for the Kaneohe Lower Site and 5 years for the Kaneohe Upper Site.

The one location at Kwajalein, Marshall Islands, exposes the specimens at a 45-degree angle facing east northeast (66^{O}) into the prevailing wind about 100 feet from the surf (Figure 1).

Inspections were made of the exposed coatings annually, at which time photographs were taken and the coating performances were rated.

RATING OF COATING SYSTEMS

Ratings were assigned by NCEL personnel in accordance with American Society for Testing Materials (ASTM) standards, where applicable. A numerical rating system was used for recording the degree of protection given by a coating; a rating of 10 indicated complete protection, and a rating of 0 indicated no protection. For example, if the metal substrate had lost protection over 10 to 20% of its surface, the coating was given a rating of 8. A protection rating of 7 indicated coating failure; this rating indicates that maintenance or recoating is necessary.

Chalking is evident as a removable powder evolving from the coating film at or just beneath the surface. During the tests, chalking was determined by making a 4-inch stroke with a clean, dry cloth across the surface of the coating. Comparison of the powder spot on the cloth with photographic reference standards (ASTM Designation D659-44)[5] made it possible to rate the degree of chalking from 10 (no powder on the cloth) to 2 (the spot on the cloth completely covered with powder). Chalking on the coating film at the rating time was affected by recent rainfall. The recorded rating represented a maximum value for chalking.

Figure 1. Kwajalein exposure site.

Degree of rusting was rated in accordance with ASTM Designation D610-43.[5] Both Type I and Type II rusting were rated.

The degree of blistering was also rated in accordance with photographic standards (ASTM Designations D714-56 and D610-43).[5] The blister size was designated within a range of 10 to 2; 10 indicated no blisters, 8 indicated the smallest blister easily seen with the unaided eye, and 6, 4, and 2 represented progressively larger sizes. Size 2 represented a blister diameter of about 1/8 inch or larger. The blister frequency was reported as dense (D), medium dense (MD), medium (M), and few (F), where "dense" represented complete surface coverage and "few" only occasional blisters. Thus, a rating of 2(M) would represent blisters of 1/8 inch or larger occurring over possibly one-third of the surface.

Undercutting is a form of deterioration where adhesion of the coating film to the metal panel is destroyed by the formation of corrosion products. Undercutting was rated light (occurring over less than 2% of the panel), medium (occurring over 2 to 10% of the panel), or heavy (occurring over 10% or more of the panel). This type of deterioration usually occurred at the edges of the panel or along the scribe. Rating data is tabulated in Appendix A.

TEST PROCEDURE

Ten zinc inorganic silicate coatings were selected for testing and were exposed with and without the manufacturer's recommended topcoating. Four of the 10 zinc inorganic silicate coatings were also topcoated with Government specification coatings to determine compatibility. These systems were Systems 65 and 68 self-curing coatings and Systems 62 and 69 postcuring coatings. The specification systems used were alkyd (TT-E-489d), oil-base (TT-P-102a), aluminum varnish (TT-V-81d), and vinyl (MIL-E-15936). The vinyl system over sandblasted steel was used as a control standard. It was also applied over System 70.

A list of all systems tested is found in Appendix B; sources appear in Appendix C.

Each proprietary material was subjected to a chemical analysis at NCEL. Each MIL-SPEC coating was sent to the San Francisco Bay Naval Shipyard for conformance analyses. The analyses and conformance were reported in Reference 4.

RESULTS*

Without Topcoats

All postcured zinc inorganic silicate coatings (Systems 62, 64, 69, and 72) have given good to excellent protection to steel test panels at each test location during 5 years of exposure (Figures 2 and 3). Also, three of the six self-cured coatings (Systems 63, 66, and 67) gave good to excellent protection during this period. The three remaining self-cured coatings gave unsatisfactory protection. System 65 failed at Kwajalein in less than 2 years, at both the Upper and Lower Sites at Kaneohe during 3 years, and at Port Hueneme Site 2 during 4 years of exposure (Figure 4). At Port Hueneme Site 1, the protection of the steel test panels by System 65 was excellent after 5 years. System 68 failed at Kwajalein in 1 year of exposure and at Kaneohe, both sites, during 2 years of exposure; the protection is excellent at Port Hueneme, however, after 5 years. System 70 failed at Kwajalein and Kaneohe in about 6 months and at Port Hueneme Site 2 during 2 years. At Port Hueneme Site 1, System 70 failed rapidly during the fourth year of exposure.

* Note that the Kaneohe Lower Site was washed away after the fourth year of exposure.

Figure 2. System 69 (postcured, without topcoat) exposed 5 years at Kwajalein. Protection is excellent.

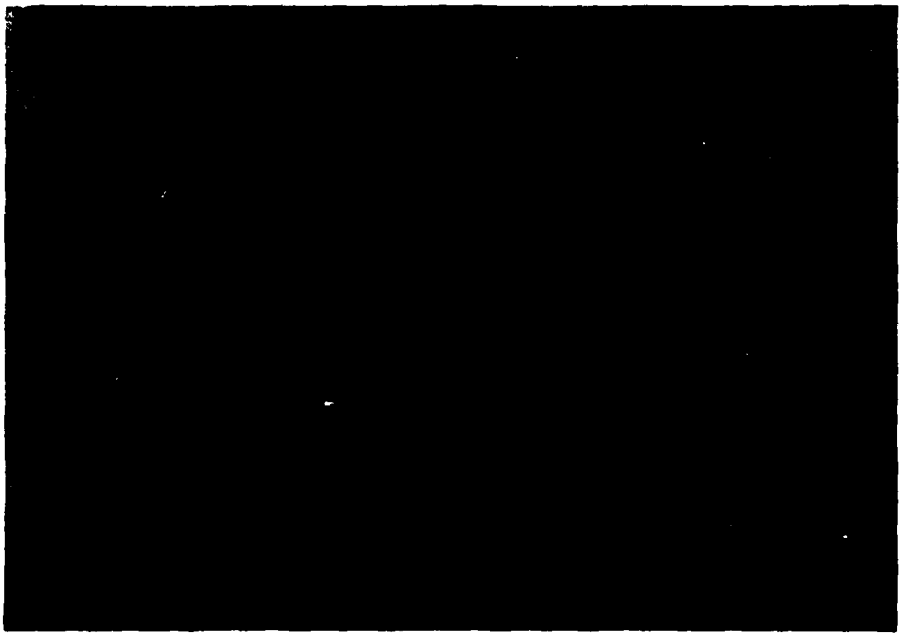

Figure 3. System 67 (self-cured, without topcoat) exposed 5 years at Kwajalein. Protection is excellent.

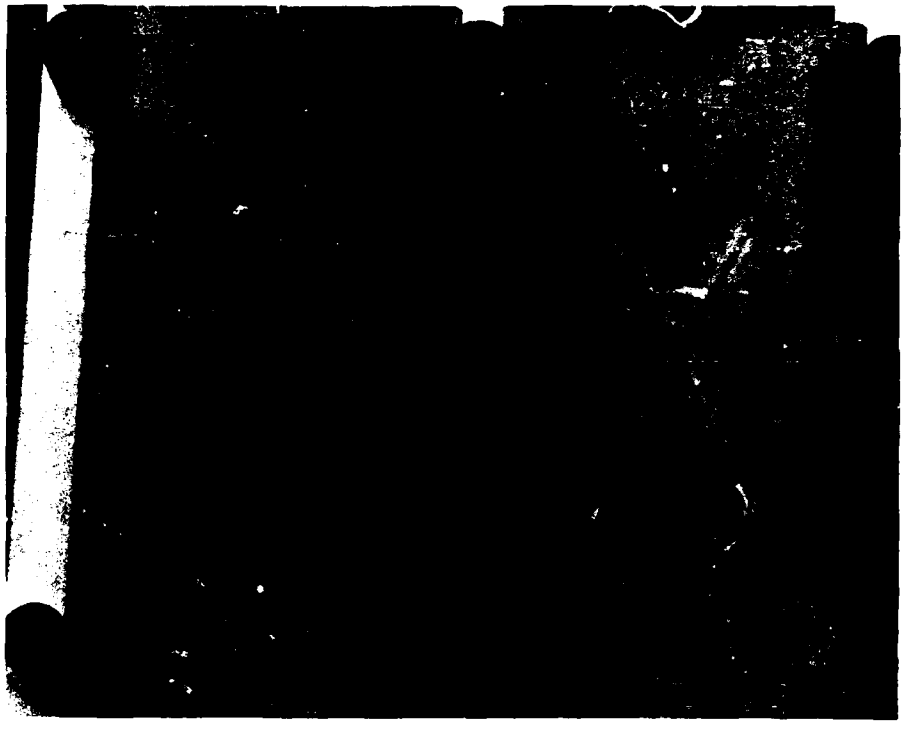

Figure 4. System 65 (self-cured, without topcoat) exposed 3 years at Kaneohe. Note zinc bulges, cause of failure.

During weathering, each of the zinc inorganic silicate coatings developed a mottled appearance to varying degrees. Systems 63, 66, 68, and 70 showed this type of deterioration to a greater extent than did the other coatings. These four coatings are self-cured. The self-cured coatings are reportedly slightly less dense than are the postcured varieties.[6] Also, zinc oxidation products eventually form small white bumps on the surface of some coatings if the zinc dust was not completely dispersed during mixing prior to application. These zinc bumps are often focal points for further deterioration and eventual failure of the coating.

With Manufacturer's Recommended Topcoats

The 10 zinc inorganic silicate coatings were topcoated with proprietary topcoats as recommended by the manufacturer of the respective zinc inorganic silicate coating; five topcoats were epoxies, three were vinyls, one was an inorganic bimetallic alkoxide complex, and one was not topcoated because the manufacturer did not recommend a topcoat for his product.

Epoxy Topcoats. The epoxy topcoat over System 65-1 (self-cured) gave excellent protection to the unscribed panels during 5 years of exposure but is approaching failure on the scribed panels at Kaneohe and Kwajalein. Undercutting and blistering are causing the failure. The epoxy topcoat over System 63-1 (self-cured) has given good to excellent protection during 5 years except for the scribed panel at Kwajalein, which failed during this period. Slight blistering is occurring along the scribed cut on the panels exposed at Kaneohe. Also, this topcoat has eroded somewhat, and the zinc inorganic silicate coating is exposed slightly. The epoxy topcoats over Systems 66-1 and 67-1 (both self-cured) have given excellent protection at all test sites for 5 years except for slight deterioration of the scribed panels at Kwajalein. The epoxy coating over System 62-1 (postcured) has given good to excellent protection for 5 years to all panels at each test site except the scribed panel at Kwajalein, which failed during 4 years of exposure.

The curing agent for the epoxy topcoat of System 66-1 was an amine adduct; the curing agents for the other four epoxy topcoats were polyamides (Systems 62-1, 63-1, 65-1, and 67-1).

Vinyl Topcoats. The vinyl topcoat over System 69 (postcured) has given excellent protection to all test panels at each exposure site during 5 years of exposure. The vinyl applied over System 64-1 (postcured) also gave excellent protection except for the scribed panel at Kwajalein. The protection to this panel was rated 9, or good, after 5 years of exposure. System 68-1 (self-cured) with a vinyl topcoat was giving good protection to the test panels at Kwajalein and Kaneohe and excellent protection at Port Hueneme.

Only light rusting had occurred along the scribe cut of any of the panels with no undercutting. Erosion of the zinc bumps, which appear as blisters, has caused some pinpoint rusting, especially in System 68-1.

Bimetallic Alkoxide Topcoat. The manufacturer-recommended topcoat over System 70-1 (self-cured) was very unsatisfactory. It failed at Kwajalein within 6 months of exposure and at Port Hueneme Site 2 and both Kaneohe sites during 3 years of exposure. The failures were caused by cracking and flaking of the coating. At Port Hueneme Site 1, the protection given to the scribed and unscribed panels was good (rating of 8+); however, the coating was cracking and light rusting was occurring.

Government Specification Topcoats

The specification topcoats were applied over two self-curing zinc inorganic silicate coatings (Systems 65 and 68) and two postcured materials (Systems 62 and 69). The four specification topcoat systems were an alkyd, an oil-base paint, an aluminum-filled varnish, and a vinyl.

Alkyd Topcoat. The alkyd system consisted of a wash primer (MIL-P-15328B, Formula 117), an alkyd primer (TT-E-485d, Type II), and an alkyd topcoat (TT-E-489c, Class A).

The System 65-A (self-cured) did not receive a coat of wash primer at the request of the manufacturer of this zinc inorganic silicate coating. This system failed at Kwajalein along the scribe cut in less than 2 years of exposure (Figure 5). The unscribed test specimen failed during 5 years of exposure. At Kaneohe (both test sites) the alkyd failed on the scribed panel during 3 years; the protection of unscribed panels after 5 years was rated as very good. At Port Hueneme Sites 1 and 2 the protection to both types of panels was good to excellent during the 5 years of exposure. The alkyd topcoat, System 68-A (self-cured), gave good to excellent protection to the scribed and unscribed steel test panels at all test sites during the 5-year test period (Figure 6). Equal protection was observed from System 69-A (postcured) except that the scribed panel at Kwajalein was rated fair after both the 4- and 5-year exposure periods. System 62-A (postcured) was giving good to excellent protection to the steel test specimens at each test site except that the scribed panel failed along the scribe between 4 and 5 years of exposure. After 5 years no undercutting had occurred along the scribe of Systems 68-A or 69-A. Bonding of the alkyd topcoat to the zinc inorganic silicate substrate was very good after 5 years.

Oil-Base Topcoat. The oil-base coating consisted of one coat of wash primer (MIL-P-15328B, Formula 117), an oil-base primer (TT-P-86a, Type I), and an oil-base topcoat (TT-P-102a, Class A).

The manufacturer of the zinc inorganic silicate System 65 (self-cured) requested that the MIL-P-15328B wash primer not be used over this coating. The scribed panels of this system failed at Kwajalein during 18 months of exposure, at the Kaneohe Upper Site during 2 years, at the Kaneohe Lower Site during 4 years. After 5 years the scribed panel of System 65-0 was giving good protection at Port Hueneme Site 1. The unscribed panel of System 65-0 failed at Kwajalein during 4 years, but the oil-base coating is giving good to excellent protection to all panels at Port Hueneme and Kaneohe except for the scribed panel of System 62-0, which failed at Kaneohe after 4 years of exposure. At Kwajalein the scribed panels failed in 4 years for Systems 68-0 and 69-0 and in 3 years for System 62-0. The unscribed panel of System 62-0 was giving good protection after 5 years at Kwajalein. The unscribed panels failed at Kwajalein for System 68-0 in 5 years and for System 69-0 in 4 years. The failures were related to cracking and flaking of the topcoat system, and probably to the alkaline conditions originating at the zinc bulges beneath the topcoating (Figure 7).

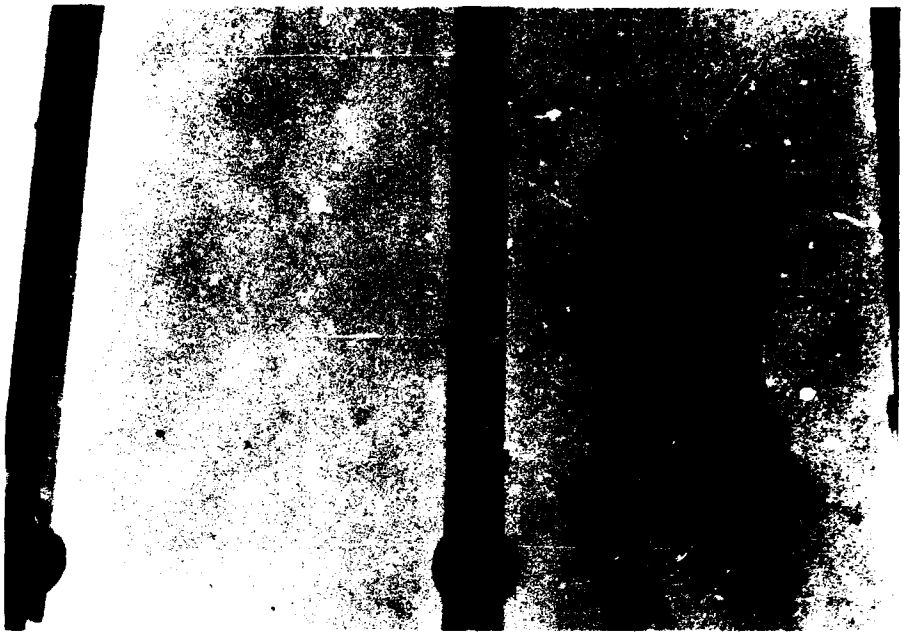

Figure 5. System 65-A (self-cured, with alkyd topcoat) exposed 1-1/2 years at Kwajalein. Blistering and undercutting at scribe caused failure.

Figure 6. System 68-A (self-cured, with alkyd topcoat) exposed 5 years at Kwajalein. Protection is excellent.

Figure 7. System 68-0 (self-cured, with oil-base topcoat) exposed 5 years at Kwajalein. Note flaking of topcoat from zinc inorganic primer.

Aluminum Varnish Topcoat. This system consisted of one coat of wash primer (MIL-P-15328B, Formula 117), a primer (TT-P-86a, Type I), and a topcoat consisting of a mix of 2 pounds of aluminum paste (TT-P-468a, Type II—present designation TT-P-320c, Type II) in 1 gallon of varnish (TT-V-81d, Type I).

The aluminum varnish topcoat Systems 68-L and 69-L gave good to excellent protection to all test panels at Kwajalein, Kaneohe, and Port Hueneme for 5 years. System 62-L gave good to excellent protection to all panels at Port Hueneme and Kaneohe. At Kwajalein this system failed on both the scribed and unscribed panels after 4 years. System 65-L, which contained no wash primer (MIL-P-15328B), failed along the scribe at the Kaneohe Lower Site in 4 years and at Kwajalein in 3 years. The protection afforded by this system along the scribe at the Kaneohe Upper Site and at both Port Hueneme sites was rated good to excellent after 5 years. In most instances if the topcoat was damaged (especially along the scribe), the aluminum varnish topcoat would delaminate or peel from the TT-P-86a primer.

Navy Vinyl. This system consisted of one coat of wash primer (MIL-P-15328B, Formula 117), a primer (MIL-P-15929B, Formula 119), and a vinyl topcoat (MIL-E-15936B, Formula 122-27). The wash primer was not used over System 65.

System 69-V was giving excellent protection to all test panels at each test site after 5 years of exposure (Figure 8). System 68-V was also giving excellent protection except for the scribed panel in Kwajalein, which received a protection rating of 9, or good, after 5 years. Only light rusting was occurring along the scribes with these systems. Also, negligible blistering had occurred along the scribes. System 62-V had rendered good to excellent protection to all panels except for the scribed panel at Kwajalein, which had failed during 4 years of exposure. System 65-V gave excellent protection to all unscribed panels during the 5-year exposure. However, the scribed panel had failed at Kwajalein during 2 years and at Kaneohe during 5 years. At Port Hueneme the protection of the scribed panel was good at Site 2 and excellent at Site 1. Failure along the scribe was caused by blistering and rusting. Again, System 65-V did not contain the benefit of the wash primer (Formula 117). System 70-V (self-cured) failed along the scribe in 4 years at Kwajalein, at Kaneohe after 3 years at the Lower Site and at the Upper Site, and at Port Hueneme Site 2 during 4 years. The failure along the scribe was caused by blistering and rusting. Excellent protection to the scribed panel was observed after 5 years at Port Hueneme Site 1. The protection of the unscribed panels was rated failure after 4 years at Kwajalein and fair at Kaneohe and good to excellent at Port Hueneme after 5 years.

Control Standard

The control standard, System 71-V, consisted of wash primer (MIL-P-15328B), vinyl red-lead primer (MIL-P-19529B), and vinyl–alkyd topcoat (MIL-E-15936B). This system was applied over sandblasted steel to 7.5 mils (0.075 inch). The protection given to the unscribed steel panels by this system was excellent during the 5-year exposure period. The scribed panel at Port Hueneme Site 1 received excellent protection during this period. However, System 71-V failed during 3 years at Port Hueneme Site 2 and during 1 year at Kaneohe and Kwajalein (Figures 9 and 10). Heavy rusting and blistering along the scribe caused the failures. Some undercutting was observed along the scribe. A primer which will better inhibit corrosion appears desirable. In previous field exposures of test coatings, both the saran system, Vinylidene Resin, White and Orange (MIL-L-18389), and the alkyd system, Pretreatment Primer (MIL-P-15328B), Enamel, Rust-Inhibiting (TT-E-485d, Type II) and Enamel Topcoat (TT-E-489c, Class A), have been

used. The presently used control standard is the alkyd topcoat described above but using Primer, Paint, Zinc Chromate, Alkyd-Type (TT-P-645) in place of the Enamel, Rust-Inhibiting (TT-E-485), with the wash primer (MIL-P-15328) as the first coat.

DISCUSSION

Without topcoats, the zinc inorganic silicate coatings, Systems 65, 68, and 70 gave very poor protection to the steel test panels at all test sites. System 70, even with a topcoat, gave very poor protection during the test period. The remaining systems without topcoats, Systems 62, 63, 64, 66, 67, 69, and 72, gave satisfactory protection during the 5-year test period. Systems 69 and 72 gave excellent protection (rate 10) to all steel test panels at each test site throughout this 5-year period.

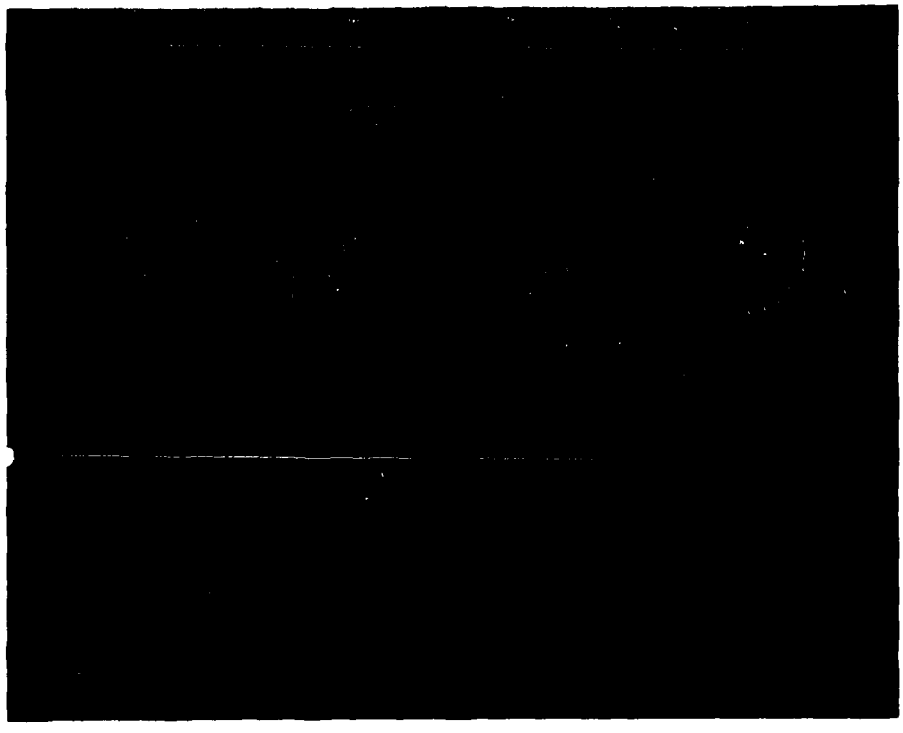

Figure 8. System 69-V (postcured, with vinyl topcoat) exposed 5 years at Kwajalein. Protection is excellent.

Figure 9. System 71-V (control system, MIL-SPEC vinyl) exposed 1 year at Kwajalein. Failure at scribe because of blistering.

Figure 10. System 71-V (control system, MIL-SPEC vinyl) exposed 1 year at Kaneohe. Failure at scribe because of blistering.

The proprietary epoxy, proprietary vinyl, specification alkyd, and specification vinyl coating systems gave satisfactory performance when applied over the various zinc inorganic silicate coatings and exposed to the marine atmospheric environments of Port Hueneme, Kaneohe, or Kwajalein. The benefit of using the wash primer (MIL-P-15328 Formula 117) with the specification systems was clearly shown. Although two zinc inorganic silicate coatings, Systems 65 and 68 (both self-cured), gave very poor protection without topcoats, System 68 gave very good protection when topcoated with the specification coatings, whereas System 65 gave poor protection when topcoated with these coatings without benefit of wash primer.

The specification oil-base coating, as expected, is not a satisfactory topcoat for zinc inorganic silicate coatings. This topcoat appeared to deteriorate and flake off of the surface of the zinc inorganic substrate. Although the zinc inorganic silicate primer coat continued to protect the steel test panel, the condition of the oil-base topcoat gave a poor appearance to the coated surface.

The specification aluminum varnish topcoat system in several instances peeled completely off of the zinc inorganic silicate coating. In other instances, the aluminum varnish topcoat peeled away from the red-lead oil-base primer. These failures usually originated along the scribe or at a spot which had been mechanically damaged. In these areas, weathering of the exposed zinc inorganic silicate resulted in deterioration of the oil-base primer.

The vinyl control standard, System 71-V, gave very poor protection to to the scribed panels at each test site, failing within 1 year at Kaneohe and Kwajalein. The alkyd system using the Enamel, Rust-Inhibiting (TT-P-485) as the primer coat has been used as a control standard previously. The alkyd control standard failed along the scribe at Kwajalein in less than 2 years and at Kaneohe in 3 years.[7]

CONCLUSIONS

For exposure in a marine atmosphere:

1. In general, postcuring zinc inorganic silicate coatings and superior self-curing zinc inorganic silicate coatings (such as Systems 63, 66, and 67) without topcoats will give long-term protection to steel.

2. The specification vinyl system (Formulas 117, 119, and 122) and the specification alkyd system (Formula 117, TT-E-485, and TT-E-489) are both satisfactory for topcoating a zinc inorganic silicate.

3. The pretreatment primer (MIL-P-15328) should be applied to zinc inorganic silicate coatings before application of specification vinyl or alkyd primers and topcoats.

4. Compatible proprietary vinyls and amine- or amide-cured epoxy coating systems are satisfactory topcoats for zinc inorganic coatings.

5. A compatible topcoat will improve the protective properties of an inferior zinc inorganic silicate coating.

6. Neither the Government specification oil-base system nor the aluminum varnish coating system is a satisfactory topcoat over zinc inorganic silicate coatings.

RECOMMENDATIONS

1. The following zinc inorganic silicate coatings are recommended as one-coat systems for long-term protection of steel in marine atmospheric exposure:

   a. System 69, Dimetcote No. 3 (postcured)
   b. System 72, Zincilate 101 (postcured)
   c. System 63, Rust Ban 191 (self-cured)
   d. System 62, Catha-Coat 300 (postcured)
   e. System 67, Carbo Zinc 11 (self-cured)
   f. System 64, Rust Ban 190 (postcured)
   g. System 66, Copon SCZ (self-cured)

2. The following systems are recommended for application over zinc inorganic silicate coatings for marine atmospheric exposure:

   a. Compatible amine- or amide-cured epoxies
   b. Compatible vinyls
   c. Specification vinyl (Formulas 117, 119, and 122)
   d. Specification alkyd (Formula 117, TT-E-485, and TT-E-489)

ACKNOWLEDGMENTS

The authors express appreciation to Messrs. Warren Chun and Raymond Goo, of the Materials Testing Branch, Pearl Harbor Naval Shipyard, and Mr. Herb McClellan, of the Kwajalein Missile Range, for their assistance in expediting work during inspection visits at the Kaneohe and Kwajalein test sites.

Appendix A

RATING DATA

Rating Code	
①	Zinc bumps
②	General blistering
③	Zinc bumps at scribe
④	Pinpoint rusting
⑤	Topcoat eroding, primer showing
⑥	Primer showing
⑦	Filiform blistering
⑧	Pinholes
⑨	Tuberculation

L	Light
H	Heavy
E	Edges
S	Along scribe

Blistering

F = Few

M = Medium

MD = Medium dense

D = Dense

Port Hueneme

Site 1 Southern exposure

Site 2 West jetty exposure

Size

8 Smallest easily seen

6, 4, and 2 are progressively larger

10 None

Coating Systems*

1. Single numbers, e.g., 62, means without topcoat
2. Numbers followed by "1", e.g., 62-1, means with manufacturer's recommended topcoat
3. Numbers followed by "A", e.g., 62-A, means FED-SPEC alkyd topcoat
4. Numbers followed by "L", e.g., 62-L, means FED-SPEC aluminum topcoat
5. Numbers followed by "O", e.g., 62-O, means FED-SPEC oil-base topcoat
6. Numbers followed by "V", e.g., 62-V, means MIL-SPEC vinyl topcoat

* See Appendix B for complete listing.

System No. 62

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	9+	10	10	9+	10	9+	10	9(L)	10	
	3	9+	10	10	9+	10	9+	10	9(L)	10	
	4	9+	10	10	9+	10	9+	10	9(L)	10	
	5	9+	10	10	9+	10	9	10	9(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	9(L)	10	
	3	10	10	10	10	10	10	10	9(L)	10	
	4	10	10	10	10	10	10	10	9(L)	10	
	5	10	10	10	10	10	10	10	9(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	5(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	O(VL)	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
Kwajalein	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	7(L)	10	
	3	10	10	10	10	10	10	10	7(L)	10	
	4	10	10	10	10	10	9	10	7(L)	10	
	5	10	10	10	10	10	9-	10	6(L)	10	Slight rust, edges of scribe

System No. 63

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	8(MD)(1)	10	10	10	10	8(MD)(3)	9(L)	10	
	2	10	8(MD)(1)	10	10	10	10	8(MD)(3)	9(L)	10	
	3	10	8(MD)(1)	10	10	10	10	10	9(L)	10	
	4	10	8(MD)(1)	10	10	10	10	10	9(L)	10	
	5	10	6(MD)(1)	10	10	10	10	10	9(L)	10	
Port Hueneme Site 2	1	10	8(MD)(2)	10	10	10	10	10	10	10	
	2	10	6(MD)(1)	10	10	10	10	10	10	10	
	3	10	6(MD)(1)	10	10	10	10	10	10	10	
	4	10	6(MD)(1)	10	10	10	10	10	10	10	
	5	10	4(MD)(1)	10	10	10	10	10	9(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	6(L)	10	
	3	10	10	10	10	10	9+	10	6(L)	10	
	4	10	10	10	10	10	9+	10	5(L)	10	
	5	10	10	10	10	10	9+	10	O(L)	10	
Kaneohe Lower Level	1	10(1)	O(D)(1)	10	10	10	10	10	O(L)	10	
	2	10(1)	O(D)(1)	10	10	10	10	10	O(L)	10	
	3	10	2(D)(1)	10	10	10	9+	10	O(L)	10	
	4	10	2(D) [1]	10	10	10	9+	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	8(L)	10	
	3	10	10	10	10	10	9	10	8(L)	10	
	4	10	10	10	10	10	9	10	7(L)	10	
	5	10	10	10	10	10	9	10	7(L)	10	Slight rust, edges of scribe

System No. 64

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	9(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	6(F)③	8(L)	10	
	3	10	10	10	10	10	10	10	8(VL)	10	
	4	10	10	10	10	10	10	10	6(VL)	10	
	5	10	10	10	10	10	10	10	6(VL)	10	
Kaneohe Lower Level	1	10	O(M)	10	10	10	10	10	10	10	
	2	10	O(M)①	10	10	10	10	10	10	10	
	3	10	O(M)	10	10	10	10	10	10	10	
	4	10	O(M)	10	10	10	10	10	10	10	
Kwajalein	1	10①	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	9(L)	10	
	3	9	10	10	9+	10	9+	8(F)③	6(L)	10	
	4	9	10	10	9+	10	9+	10	6(L)	10	
	5	9	10	10	9+	10	9	10	6(L)	10	

System No. 65

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10(1)	10	O(M)	10	
	2	10	10	10	10	10	10	10	O(M)	10	
	3	10	10	10	10	10	10	10	O(M)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	10	10	10	10	10	10	10	O(M)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	O(M)	10	
	2	9	6(F)(1)	10	9(E)	10	9	10	O(M)	10	
	3	8	6(F)	10	8	10	8	10	O(M)	10	Pinhole rust over surface; failed
	4	7	6(M)	10	7	10	7	10	O(M)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	9(L)	10	
	2	9+*	10(1)	10	9(3)	10	9	10(1)	9(L)	10	* Heavy rust right edge and bottom
	3	7	10	10	7	10	7	10	O(M)	7	Pinhole rust over surface; failed
Kaneohe Lower Level	1	10	10	10	10	10	10	10	9(VL)	10	
	2	9*	10	10	8	10	9(5)	10	9(VL)*	10	* Edges rusting; slight flaking on edges
	3	7	2(M)	10	7	8	7	10	O(M)	L	Failed
Kwajalein	1	10	10	10	10	10	10	6(MD)	10	8	
	2	4*	10	10	4	10	4*	O(D)	O(H)	8	* Severely rusted

System No. 66

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10(1)	10	10	10	10	10(3)	O(L)	10	
	4	10	10(1)	10	10	10	10	10(3)	O(L)	10	
	5	10	10(1)	10	10	10	10	10(3)	O(L)	10	
Port Hueneme Site 2	1	10	8(MD)(1)	10	10	10	10	10	10	10	
	2	10	8(MD)(1)	10	10	10	10	10	10	10	
	3	10	6(MD)(1)	10	10	10	10	10	10	10	
	4	10	6(MD)(1)	10	10	10	10	10	10	10	
	5	10	6(D)(1)	10	10	10	10	10	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10(2)	10	10	10	10(2)	10	10	10	
	3	10	10	10	10	10	10	10	10(3)	10	
	4	10	7(1)	10	10	10	10	10	10(3)	10	
	5	10	7(1)	10	10	10	9	10	10(3)	10	
Kaneohe Lower Level	1	10	O(MD)(1)	10	10	10	10	10	10	10	
	2	10	O(D)(1)	10	10	10	10	10	9(L)	10	
	3	10	O(D)(1)	10	10	10	10	10(3)	10	10	
	4	10	O(D)(1)	10	10	10	10	10(3)	10	10	
Kwajalein	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	9(L)	10	
	3	9	10	10	9	10	10	10	9(L)	10	
	4	9	10	10	9	10	9	10	9(L)	10	
	5	9	10	10	9	10	9	10	8(L)	10	One panel failing

System No. 67

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	7(L)	10	
	3	10	10	10	10	10	10	10	7(L)	10	
	4	10	10	10	10	10	10	10	7(L)	10	
	5	10	10	10	10	10	10	10	6(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
Kwajalein	1	10	10	10	10	10	10	4(F)(1)	8(L)	9+	
	2	10	10	10	10	10	10	4(F)(1)	8(L)	9+	
	3	10	10	10	10	10	9	4(M)	6(L)	9+	
	4	10	10	10	10	10	9	10(3)	O(L)	9+(3)	
	5	10	10	10	10	1	9-	9	O(M)	9+(3)	

System No. 68

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	4(D)(1)	10	10	10	10	10	9(L)	10	
	3	10	4(D)(3)	10	10	10	10	10(3)	8(L)	10	
	4	10	4(D)(3)	10	10	10	10	10(3)	8(L)	10	
	5	10	4(D)(3)	10	10	10	10	10(3)	8(L)	10	
Kaneohe Upper Level	1	9	10	10	8(4)	10	9	10	9(L)	10	
	2	7	10	10	7(4)	10	7	10	O(L)	10	
Kaneohe Lower Level	1	9	2(D)(1)	10	8(4)	10	9	10	8	10	
	2	7	2(D)(1)	10	7(4)	10	7	10	7	10	
Kwajalein	1/2	7	10	10	5	10	7	10	10	10	

System No. 69

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	8(D)(1)	10	10	10	10	10	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	6(L)	10	
	5	10	10(3)	10	10	10	10	10(3)	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	O(VL)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	9(L)	10	
	3	10	10	10	10	10	10	10	8(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	

System No. 70

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(VL)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	7	10	8	7	10	7	10	O(M)	7	
Port Hueneme Site 2	1/2	5			5		5	10	O(L)		Failed
Kaneohe Upper Level	1/2	0					0				Failed
Kaneohe Lower Level	1/2	0					0				Failed
Kwajalein	1/2	0			0		0				Failed

System No. 72

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	9	10	10	9(E)	10	9	10	O(M)	10	
	2	9	10	10	9(E)	10	9(E)	10	O(M)	10	
	3	9	10	10	9(E)	10	9	10	O(M)	10	
	4	9	10	10	9(E)	10	9	10	O(M)	10	
	5	9	10	10	9(E)	10	9	10	O(M)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	7(L)	10	
	2	10	10	10	10	10	10	10	7(L)	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	10	10	
	5	10	10	10	10	10	10	10	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10(1)	10	10	10	10	10	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(M)	10	
	3	10	10	10	10	10	10	10	O(M)	10	
	4										Gone
Kwajalein	1	10	10	10	10	10	10	10	7(L)	10	
	2	10	10	10	10	10	10	10	5(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	

System No. 62-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme	1	10	10	10	10	10	10	10	O(L)	10	
Site 1	2	10*	10	10	10	10	10*	10	O(L)	10	* Topcoat eroding off
	3	10	10	10	10	10	10	10	O(L)	10	Very light erosion
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	9	10	O(L)	10	
Port Hueneme	1	10	10	10	10	10	10	10	4(L)	10	
Site 2	2	10	10	10	10	10	10	10	2(L)	10	
	3	10	10	10	10	10	10	10	4(L)	10	
	4	10	2(F)*	10	10	10	9	6(F)	4(L)	10	* One panel
	5	10	2(F)*	10	10	10	9	4(F)	4(L)	10	* One panel
Kaneohe	1	10	10	10	10	10	10	10	O(L)	10	
Upper Level	2	10	10	10	10	10	9*	8(F)	O(L)	10	* Rusting Type I on edges—scribed panel only
	3	10	10	10	9(E)	10	10⑤	2(F)	O(VL)	10	
	4	10	10	10	9(E)	10	10⑤	2(F)	O(VL)	10	
	5	10	10	10	9(E)	10	10⑤	2(F)	O(VL)	10	
Kaneohe	1	10	10	10	10	10	10	10	O(L)	10	
Lower Level	2	10	10	10	10	10	10	4(F)	O(L)	10	
	3	10	10	10	10	10	10	4(M)	O(L)	9(S)	
	4	9	10	10	9	10	9	2(M)	O(L)	9(S)	
Kwajalein	1	10	10	10	10	10	10	6(F)	O(M)	10	
	2	10	10	10	10	10	9	4(M)	O(M)	10	
	3	10	10	10	10	10	8	4(MD)	O(M)	L(S)	
	4	9⑤	10	10	10	10	7	2(D)	O(H)	M(S)	
	5	9⑤	10	10	10	10					

System No. 63-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Topcoat eroding off
	3	10*	10	10	10	10	10*	10	O(L)	10	* Slight erosion
	4	10*	10	10	10	10	10*	10	O(L)	10	
	5	10*	10	10	10	10	10*	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	4(L)	10	
	2	10	10	10	10	10	10*	10	4(L)	10	* Very light edge rust
	3	10	10	10	10	10	10*	10	4(L)	10	
	4	10	10	10	10	10	9+	8(F)	4(L)	10	
	5	10*	10	10	10	10	9*	8(F)	O(L)	10	* Slight erosion
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	8(F)	O(L)	10	
	3	10Ⓢ	10	10	10	10	10Ⓢ	8(F)	O(VL)	10	
	4	10Ⓢ	10	10	10	10	10Ⓢ	8(F)	O(VL)	10	
	5	10Ⓢ	10	10	10	10	10Ⓢ	8(F)	O(VL)	10	
Kaneohe Lower Level	1	10*	10	10	10	10	10*	O(F)	O(L)	10	* Erosion of topcoat occurring
	2	10	10	10	10	10	9+	O(M)	O(L)	10	
	3	10Ⓢ	10	10	10	10	9Ⓢ	O(M)	O(L)	10	
	4	10Ⓢ	10	10	10	10	9Ⓢ	O(M)	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	8(VF)	O(L)	10	
	2	10Ⓢ	10	10	10	10	10Ⓢ	4(F)	O(L)	10	
	3	10Ⓢ	10	10	9(E)	10	9Ⓢ	4(M)	O(L)	L(S)	
	4	10Ⓢ	10	10	9(E)	10	8Ⓢ	2(M)	O(M)	M(S)	
	5	10Ⓢ	10	10	8(E)	10	7Ⓢ	2(D)	O(M)	M(S)	

System No. 64-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Erosion of topcoat occurring
	3	10*	10	10	10	10	10*	10	O(L)	10	* Light erosion
	4	10*	10	10	10	10	10*	10	O(L)	10	
	5	10*	10	10	10	10	10*	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	4(L)	10	
	3	10	10	10	10	10	10	10	5(L)	10	
	4	10	10	10	10	10	10	10	5(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10*	10	O(L)	10	* Topcoat has slightly bumpy appearance
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10*	10	10	10	10	10*	10 [3]	O(L)	10	* Light erosion
	4	10*	10	10	10	10	10*	10	O(L)	10	
	5	10*	10	10	10	10	10*	10	O(L)	10	Pinholing
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Topcoat pitting
	3	10*	10	10	10	10	10*	10	O(L)	10	* Topcoat pitting
	4	10*	10	10	10	10	10*	10	O(L)	10	
Kwajalein	1	10	2(F)①	10	10	10	10	6(M)③	8(L)	10	
	2	10	2(F)①	10	10	10	10	6(M)③	8(L)	10	
	3	10*	10	10	10	10	10*	6(M)	O(L)	10	* Topcoat pitting
	4	10*	10	10	10	10	10*	4(MD)	O(L)	10	
	5	10*	10	10	10	10	9*	4(MD)	O(L)	10	

System No. 65-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Erosion of topcoat occurring
	3	10*	10	10	10	10	10*	10	O(L)	10	* Light erosion
	4	10*	10	10	10	10	10*	10	O(L)	10	
	5	10*	10	10	10	10	9*	10	O(L)	9-	
Port Hueneme Site 2	1	10	10	10	10	10	10	4(F)	5(L)	10	
	2	10	10	10	10	10	10	4(D)⑦	O(L)	10	
	3	10	10	10	10	10	10	4(D)*	O(L)	10	* Filiform
	4	10	10	10	10	10	9	4(D)*	O(L)	10	
	5	10	10	10	10	10	8	4(D)*	O(L)	9(H)	
Kaneohe Upper Level	1	10	10	10	10	10	10	O(D)	O(M)	10	Filiform 1/4" out from scribe
	2	10⑥	10	10	10	10	9⑥	O(D)	O(M)	10	Filiform 1/2" out from scribe
	3	10⑤	10	10	10	10	7	O(D)	O(H)	10	
	4	10⑤	10	10	10	10					
	5	10⑤	10	10	10	10					
Kaneohe Lower Level	1	10	10	10	10	10	9	O(D)	O(L)	10	
	2	10*	10	10	10	10	8	O(D)⑦	O(M)	1/2"	* Very light pitting of topcoat
	3	10⑤	10	10	10	10	7	O(D)	O(H)	M(S)	
	4	10⑤	10	10	10	10					
Kwajalein	1	10	10	10	10	10	8	O(D)	O(L)	9	
	2	10	10	10	10	10	8-	O(D)	O(H)	1/2"	
	3	10	10	10	10	10	5	O(D)	O(H)	1"(S)	
	4	10	10	10	10	10					
	5	10	10	10	10	10					

System No. 66-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10*	10	10	10	10	10*	10	10	10	* Erosion of topcoat occurring
	3	10⑤	10	10	10	10	10⑤	10	10	10	
	4	10⑤	10	10	10	10	10⑤	10	10	10	
	5	10⑤	10	10	10	10	10⑤	10	9(VL)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	5(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	10	10	
	2	10⑥	10	10	10	10	10⑥	10	10	10	
	3	10⑤	10	10	10	10	10⑤	10	10	10	
	4	10⑤	10	10	10	10	10⑤	10	10	10	
	5	10⑤	10	10	10	10	10⑤	10	10	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Slight pitting of topcoat
	3	10⑧	10	10	10	10	10⑧	10	O(L)	10	
	4	10⑧	10	10	10	10	10⑧	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	4(L)	10	
	3	10⑧	10	10	10	10	10⑧	10	O(L)	10	
	4	10⑧	10	10	10	10	9⑧	10	O(L)	10	
	5	10⑧	10	10	10	10	9⑧	10	O(L)	10	

System No. 67-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(M)	10	* Erosion of topcoat
	2	10*	10	10	10	10	10*	10	O(M)	10	
	3	10Ⓢ	10	10	10	10	10Ⓢ	10	O(M)	10	
	4	10Ⓢ	10	10	10	10	10Ⓢ	10	O(M)	10	
	5	10Ⓢ	10	10	10	10	10Ⓢ	10	O(M)	VL(S)	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	3(L)	10	
	2	10	10	10	10	10	10	10	3(L)	10	
	3	10	10	10	10	10	10	10	3(L)	10	
	4	10	10	10	10	10	10	6(MD)	O(L)	10	
	5	10	10	10	10	10	10	6(D)	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10*	8(F)	O(M)	10	* Slight erosion
	2	10	10	10	10	10	10*	8(F)	O(M)	10	
	3	10	10	10	10	10	10	8(F)	O(M)	10	
	4	10	10	10	10	10	10	8(F)	O(M)	10	
	5	10*	10	10	10	10	10*	6(M)	O(M)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	10*	10	O(L)	10	* Slight erosion
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	4(M)	O(L)	9	
	2	10	10	10	10	10	10	4(M)	O(L)	9	
	3	10	6(M)①	10	10	10	9	4(MD)③	O(L)	9(S)	
	4	10	6(M)①	10	10	10	9	4(D)③	O(L)	9(S)	
	5	10	6(MD)①	10	10	10	9	4(D)③	O(L)	8(S)	

System No. 68-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	10	10	
	4	10	2(D)①	10	10	10	10	2(D)③	10	10	
	5	10	2(D)①	10	10	10	10	2(D)③	10	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10*	10	10	* Topcoat bumpy; zinc salts in scribe
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10④	10	10	10	10	9④	10	O(L)	10	
	4	10④	10	10	9(E)	10	9④	10	O(L)	10	
	5	9④	10	10	9(E)	10	9④	2(F)	O(M)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	4(D)①	10	10	10	10	4(D)①	O(L)	10	
	3	9④	4(D)①	10	10	10	9④	4(D)③	O(L)	10	
	4	9④	4(D)①	10	9	10	9④	4(D)③	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	10	10	
	2	10	2(D)①	10	10	10	10	2(D)①	9(L)	10	
	3	10	2(D)①	10	10	10	10	10	8(L)	10	
	4	9	2(D)①	10	9(E)	10	9	10	5(L)	10	
	5	9	2(D)①	10	8(E)	10	9	10	5(L)	10	

System No. 69-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	6(L)	10	
	3	10	10	10	10	10	10	10	5(L)	10	
	4	10	10	10	10	10	10	10	5(L)	10	
	5	10	10	10	10	10	10	10	O(VL)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10*	10	10	10	10	10*	10	O(L)		* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	8(F)	5(L)	10	
	2	10*	10	10	10	10	10	8(M)**	3(L)	10	* Rust at porcelain knob damage ** Barely discernible
	3	10	10	10	10	10	10	8(M)	O(L)	10	
	4	10	10	10	10	10	10	8(M)	O(L)	10	
	5	10	10	10	10	10	10	8(MD)	O(L)	10	

System No. 70-1

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	9	10	O(L)	10	
	4	9*	10	10	9	10	9*	10	O(L)	10	* Cracking
	5	8+*	10	10	8	10	8+*	10	O(L)	10	
Port Hueneme Site 2	1	9+	10	10	9+	10	5*	10	8(L)	10	* Failed at scribe
	2	8**	10	10	8	10					** Flaking; rusting at cracks in coating
	3	7*					5*				* Cracking and flaking
Kaneohe Upper Level	1	9	10	10	8④	10	9④	10	O(M)	10	
	2	9	10	10	8④	10	9④	10	O(M)	10	
	3	7④⑤	10	10	7	10	7④⑤	10	O(M)	10	
Kaneohe Lower Level	1	8*	10	10	8④	10	8④*	10	O(L)	10	* Topcoat gone
	2	8	10	10	8④	10	8④	10	O(L)	10	
	3	7④⑤	10	10	7	10	7④⑤	10	O(L)	10	
Kwajalein	1/2	6			6		6		O(L)		Failed

System No. 62-A

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	9+	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	8(F)	7(L)	10	
	3	10	10	10	10	10	10	8(M)	5(L)	10	
	4	10	10	10	10	10	9+	8(MD)	O(L)	10	
	5	10	10	10	10	10	9+	6(D)	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)*	10	* Very slight edge rust
	2	10	10	10	10	10	10	10	O(L)*	10	
	3	10	10	10	9(E)	10	10	4(F)	O(L)	10	
	4	10	10	10	9(E)	10	10	4(F)	O(M)	10	
	5	10	10	10	8(E)	10	9	4(M)	O(M)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10*	10	8(D)	O(L)	10	
	3	10	10	10	10	10	10	8(D)	O(L)	10	
	4	10	10	10	9(E)	10	9+	8(D)	O(M)	10	
Kwajalein	1	10	10	10	10	10	9	8(MD)*	6(L)	10	* Blisters broken; rust showing
	2	10	10	10	9*	10	9	6(MD)	O(L)	10	
	3	10	10	10	9(E)	10	8	4(MD)	O(M)	L(S)	
	4	9	10	10	9(E)	10	8-	2(MD)	O(H)	L	
	5	9	10	10	8(E)	10	7	2(D)	O(H)	M	

System No. 65-A

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme	1	10	10	10	10	10	10	10	O(L)	10	
Site 1	2	10	10	10	10	10	10	10	O(M)	10	
	3	10	10	10	10	10	10	10	O(M)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	9+	10	10	9	10	9	10	O(M)	10	
Port Hueneme	1	10	10	10	10	10	10	8(F)	O(L)	10	
Site 2	2	10	10	10	9+(E)		10	8(M)	O(M)	10	
	3	10	10	10	9(E)	10	10	8(M)	O(M)	10	
	4	10	10	10	9(E)	10	9	8(MD)	O(M)	10	
	5	10	10	10	9(E)	10	9	8(D)	O(M)	10	
Kaneohe	1	10	10	10	10	10	10	10	O(M)	10	
Upper Level	2	10	10	10	9(E)	10	9(E)	6(D)	O(H)	10	
	3	10	10	10	9(E)	10	7+	2(D)	O(H)	H	
	4	9+	10	10	9(E)	10					
	5	9	10	10	8(E)	10					
Kaneohe	1	10	10	10	10	10	9+	O(MD)	O(M)	10	
Lower Level	2	10	10	10	10	10	8	O(D)	O(M)	10	
	3	10	10	10	8(E)	10	7	O(D)	O(H)	10	
	4	9+	10	10	8(E)	10					
Kwajalein	1	10	10	10	10	10	8	2(D)	O(L)	10	
	2	10	10	10	9+*	10					* Pinhole rust
	3	9	2(F)	10	9	9					
	4	8	2(F)	10	9	9					
	5	7	2(M)	10	8	8					

System No. 68-A

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	8(F)	9(L)	10	
	2	10	10	10	10	10	10	8(F)	9(L)	10	
	3	10	10	10	10	10	10	8(F)	9(L)	10	
	4	10	10	10	10	10	9+	8(M)	O(L)	10	
	5	10	8(D)①	10	10	10	9	6(D)	O(M)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(M)	10	
	2	10	10	10	10	10	10	8(MD)	O(M)	10	
	3	10	10	10	10	10	10	8(MD)	O(VL)	10	
	4	10	10	10	10	10	10	8(MD)	O(L)	10	
	5	10	10	10	10	10	10*	6(D)	O(M)	10	* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	8(M)	8(L)	10	
	2	10	10	10	10	10	10	8(MD)	8(VL)	10	
	3	10	10	10	10	10	10	8(MD)	O(L)	10	
	4	10	10	10	10	10	10	8(MD)	O(M)	10	
Kwajalein	1	10	10	10	10	10	10	8(F)*	9(L)	10	* Barely discernible
	2	10	10	10	10	10	10	8(MD)	7(L)	10	
	3	10	10	10	10	10	10	8(MD)	O(L)	10	
	4	10	10	10	10	10	10	8(MD)	O(M)	10	
	5	10	10	10	10	10	9	8(D)	O(M)	10	

System No. 69-A

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	8(F)	O(L)	10	
	4	10	10	10	10	10	10	8(M)	O(L)	10	
	5	10	10	10	10	10	10	8(D)	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	8(MD)	O(L)	10	
	3	10	10	10	10	10	10	8(D)	O(L)	10	
	4	10	10	10	10	10	10	8(D)	O(M)	10	
	5	10*	10	10	10	10	9	6(D)	O(M)	10	* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	8(M)	O(L)	10	
	3	10	10	10	10	10	10	8(M)	O(L)	10	
	4	10	10	10	10	10	9	8(MD)	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	8(M)	O(L)	10	
	2	10	10	10	10	10	10	8(MD)	O(M)	10	
	3	10	10	10	10	10	9-	8(D)	O(M)	10	
	4	10	10	10	10	10	8	4(D)	O(H)	10	
	5	10	10	10	10	10	8	4(D)	O(H)	10	

System No. 62-L

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	4(F)*	O(L)	10	* One panel
	5	10	10	10	10	10	10	2(F)*	O(M)	10	* One panel
Port Hueneme Site 2	1	10	10	10	10	10	10	4(F)	O(L)	10	
	2	10	10	10	10	10	10	4(F)*	O(L)	10	* One blister each panel
	3	10	10	10	10	10	10	4(F)	O(M)	10	
	4	10	10	10	10	10	9+	4(M)	O(M)	10	
	5	10	10	10	10	10	9+	4(D)	O(M)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	10	10	10	9	10	10	10	O(M)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(M)	10	
	2	10	10	10	10	10	9	O(M)	O(M)	10	
	3	10	10	10	10	10	9	O(M)*	O(M)	10	* One panel
	4	10	10	10	10	10	9	O(M)*	O(M)	10	* One panel
Kwajalein	1	10	10	10	10	10	10	10	O(M)	10	
	2	9	2(F)	10	9	10	9	10	O(M)	10	
	3	9	2(F)	10	9(E)	10	9	O(MD)	O(H)	10	
	4	8-	2(F)	10	9	10	8-	2(MD)	O(H)	10	Removed

System No. 65-L

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	8(F)	O(M)	10	
	4	10	10	10	9+(E)	10	9+	4(F)	O(M)	10	
	5	10	10	10	9+(E)	10	9	2(F)	O(M)	9(M)*	* One panel
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	8(D)	O(L)	10	
	3	10	10	10	10	10	10	4(MD)	O(L)	10	
	4	10	10	10	10	10	10	4(MD)	O(L)	10	
	5	10	10	10	10	10	10	4(MD)	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	6(F)	O(M)	10	
	2	10	10	10	10	10	9	2(M)	O(M)	10	
	3	10	10	10	10	10	9	2(M)	O(M)	L	
	4	10	10	10	10	10	7	2(M)	O(H)	H	
Kwajalein	1	10	10	10	10	10	10	8(M)	8(D)	10	
	2	10	10	10	10	10	9	2(D)*	O(H)	10	* Blisters extending 1/16" each side of scribe
	3	10	10	10	9(E)	10	7	2(D)	O(H)	10	
	4	10	10	10	9(E)	10					
	5	10	10	10	8(E)	10					

System No. 68-L

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	8(L)	10	
	2	10	10	10	10	10	10	10	8(L)	10	
	3	10	10	10	10	10	10	10	8(L)	10	
	4	10	10	10	10	10	10*	10	O(L)	10	* One panel, topcoat lost adhesion
	5	10	10	10	10	10	10	10	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10①	10	10	10	10	10	4(MD)①	O(L)	10	
	4	10①	10	10	10	10	10	4(MD)①	O(L)	10	
	5	10①	10	10	10	10	10	4(MD)①	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	6(VF)	O(L)	10	
	3	10①	10	10	10	10	10①	6(VF)	O(L)	10	
	4	10①	10	10	10	10	10①	6(VF)	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	2(L)	10	
	2	10	10	10	9+*	10	10	4(F)	O(L)	10	* Damaged spots at edges
	3	10	10	10	9+(E)	10	10	4(M)	O(M)	10	
	4	9	10	10	9(E)	10	10	4(M)	O(H)	10	
	5	9	2(F)	10	9(E)	10	9	4(M)	O(H)	10	

System No. 69-L

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	7(L)	10	
	2	10	6(F)	10	10	10	10	10	4(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10*	10	O(L)	10	* Very slight wrinkling of topcoat
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	8(MD)	O(L)	10	
	2	10*	10	10	10	10	10	8(MD)	O(L)	10	* One damaged spot
	3	10	10	10	10	10	10	10	O(M)	10	
	4	9	10	10	10	10	9	10	O(M)	10	
	5	9	10	10	10	10	9	2(F)	O(M)	10	

System No. 62-0

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(M)	10	
	3	10	10	10	10	10	10	10	O(M)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	9+④	10	10	9(E)	10	9	10	O(M)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	8(M)	4(L)	10	
	2	10	10	10	10	10	10	8(M)	O(L)	10	
	3	10	10	10	10	10	10	8(M)	O(M)	10	
	4	10	10	10	10	10	9	6(M)	O(M)	10	
	5	10⑤	10	10	10	10	9	6(M)	O(M)	9(L)	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10*	10	10	10	10	9	8(M)	O(L)	10	* Pinholes in topcoat
	3	10⑧	10	10	10	10	9⑧	8(M)	O(M)	10	
	4	10⑧	10	10	10	10	8⑧	8(M)	O(H)	10	
	5	10⑧	10	10	10	10	8⑧	6(M)	O(H)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(M)	10	
	2	10	10	10	10	10	9	4(MD)	O(M)	10	
	3	10	10	10	10	10	8	2(MD)⑨	O(M)	10	
	4	10	10	10	10	10	8-	2(MD)⑨	O(M)	10	
Kwajalein	1	10	10	10	10	10	9	4(D)	O(H)	10	
	2	10	10	10	10	10	8	2(D)	O(H)*	M	* Heavy tuberculation
	3	10	10	10	10	10	7	2(D)	O(H)	M	
	4	10	10	10	10	10					
	5	9	10	10	9	10					

System No. 65-0

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	4(M)	O(M)	10	
	3	10	10	10	10	10	10	4(M)	O(M)	10	
	4	10	10	10	10	10	10	4(M)	O(M)	10	
	5	9+④	10	10	9+(E)	10	9	2(M)	O(M)	9	
Port Hueneme Site 2	1	10	10	10	10	10	10	4(M)	4(L)	10	
	2	10	10	10	10	10	9	2(M)	O(L)	10	
	3	10	10	10	10	10	8	2(M)	O(M)	10	
	4	10	10	10	10	10	7	2(MD)	O(H)⑨	1"	
	5	10*	10	10	10	10					* Slight scaling
Kaneohe Upper Level	1	10	10	10	10	10	10	8(F)	O(M)	10	
	2	10	10	10	10	10	8	2(D)	O(H)	10	
	3	10⑤	10	10	10	10	5	O(D)	O(H)	9	
	4	10⑤*	10	10	9	10					* Removed; topcoat gone
Kaneohe Lower Level	1	10	10	10	10	10	9	O(MD)	O(M)	10	
	2	10	10	10	10	10	7*	O(D)	O(D)**	1"	* Very slight erosion of topcoat
											** Heavy tuberculation
	3	10	10	10	10	10	8	O(D)	O(H)	H	
	4	9*	10	10	10	10	7	O(D)	O(H)	H	* Removed; topcoat gone
Kwajalein	1	10	10	10	10	10	8*	O(M)	O(D)	10	* Failed during 1-1/2 years
	2	10	10	10	10	10					
	3	9	10	10	9	10					
	4	7	2(F)	10	8	10					

System No. 68-0

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	9(L)	10	
	3	10	10	10	10	10	10	10	9(L)	10	
	4	10	10	10	10	10	10	10	9(L)	10	
	5	10④	10	10	10	10	9④	10	9(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	9(L)	10	
	4	10	10	10	10	10	10	10	9(L)	10	
	5	10④	10	10	10	10	10④	10	9(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	8(D)	O(L)	10	
	2	10	10	10	10	10	10*	8(D)	O(L)	10	* Dense bumps in undercoat
	3	10	10	10	10	10	10	8(D)	O(L)	10	
	4	10⑤	10	10	10	10	10⑤	8(D)	O(L)	10	
	5	10④	10	10	10	10	10⑤	8(D)	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	8(D)	O(L)	10	
	3	10	10	10	10	10	10	8(D)	O(L)	10	
	4	10	10	10	10	10	10	4(D)	O(L)	10	
Kwajalein	1	9	4(M)	10	10	10	8	8(D)	10	10	
	2	9*	4(MD)⑦	10	10	10	8*	4(D)	10	10	* Topcoat 1/3 gone
	3	9	4(D)	10	10	10	8	4(D)	10	10	
	4	8	4(D)	10	10	10	7*	4(D)	9(M)	10	* Topcoat flaking and nearly gone
	5	6*	4(D)	10	10	10					* Topcoat flaking and nearly gone

System No. 69-0

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	O(M)	10	
	3	10	10	10	10	10	10	10	O(M)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	9	10	10	9④	10	10	10	O(M)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	8(F)	5(L)	10	
	2	10	10	10	10	10	10	8(F)	O(L)	10	
	3	10	10	10	10	10	10	8(F)	O(L)	10	
	4	10	10	10	10	10	10	8(F)	O(L)	10	
	5	10	10	10	10	10	10	8(F)	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(M)	10	
	2	10	10	10	10	10	10	8(D)	O(M)	10	
	3	10	10	10	10	10	10	8(D)	O(M)	10	
	4	10	10	10	10	10	10	8(D)	O(M)	10	
	5	10*	10	10	10	10	10*	8(D)	O(M)	10	* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	8(MD)	O(L)	10	
	2	10	10	10	10	10	10	8(MD)	O(L)	10	
	3	10	10	10	10	10	10	8(MD)	O(L)	10	
	4	10	10	10	10	10	10	8(MD)	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	O(L)	10	
	2	9*	2(F)	10	10	10	9	4(F)	O(M)**	10	* Three spots flaked off ** Pinpoint rusting
	3	9	2(F)	10	9	10	8	4(D)	O(M)	10	
	4	7*	2(F)	10	8	10	6*	4(D)	O(M)	10	* Topcoat peeling

System No. 62-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	9+	8(M)	O(L)	10	
	5	10	10	10	10	10	9	6(F)	O(M)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	8(F)	O(M)	10	
	4	10	10	10	10	10	10	8(F)	O(H)	10	
	5	10*	10	10	10	10	9+*	8(M)	O(H)	10	* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	6(F)	O(L)	10	
	4	10	10	10	10	10	9	6(F)	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	4(F)	O(L)	10	
	2	9	4(F)*	10	10	10	9	4(MD)	O(M)	10	* One panel
	3	9	4(F)	10	9*	10	8-	2(MD)	O(H)	10	
	4	9	4(F)	10	9*	10	7	2(D)	O(H)	10	
	5	9	2(F)	10	9*	10					

System No. 65-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	6(L)	10	
	2	10	10	10	10	10	10	8(D)⑦	O(L)	10	
	3	10	10	10	10	10	10	8(D)⑦	O(L)	10	
	4	10	10	10	10	10	9	8(D)⑦	O(L)	10	
	5	10	10	10	10	10	9	4(D)⑦	O(M)	9	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(M)	10	
	2	10	10	10	10	10	9	8(D)⑦	O(M)	10	
	3	10	10	10	10	10	8	4(D)	O(M)	10	
	4	10	10	10	10	10	8	O(D)	O(H)	10	
	5	10*	10	10	10	10	7	O(D)	O(H)	6(H)	* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	10	O(MD)⑦	O(M)	10	
	2	10	10	10	10	10	9	O(D)⑦	O(M)	10	
	3	10	10	10	10	10	8	O(D)	O(M)	L	
	4	10	10	10	10	10	8-	O(D)	O(M)	M	
Kwajalein	1	10	10	10	10	10	9	9⑦	O(L)	9	
	2	10	10	10	10	10	7	2(D)	O(H)*	1"	* Tuberculation at scribe
	3	10	10	10	10	10					
	4	10	10	10	10	10					
	5	10	10	10	10	10					

System No. 68-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	4(D)①	10	10	10	10	4(D)①	O(L)	10	
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10①	10	10	10	10	10①	O(L)	10	
	4	10	10①	10	10	10	10	10①	O(L)	10	
	5	10	10①	10	10	10	10	10①	O(L)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	O(VL)	10	
	3	10	10①	10	10	10	10	6(D)①	O(VL)	10	
	4	10	10①	10	10	10	10	6(D)①	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	9+(L)*	10	* Dense formation of #8 bumps
	2	10	10	10	10	10	10	10	9+(L)*	10	
	3	10	10	10	10	10	10	10	9(L)	10	
	4	10	10	10	10	10	10	4(D)①	9(L)	10	
	5	10	4(D)①	10	10	10	9	4(D)①	9(L)	10	

System No. 69-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting		Protection	Blistering	Rusting	Undercutting	
					Type I	Type II					
Port Hueneme Site 1	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	6(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	8(F)	O(L)	10	
	5	10	4(F)*	10	10	10	10	8(F)	O(M)	10	* One panel
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(M)	10	
	5	10	10	10	10	10	10	10	O(M)	10	
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
Kwajalein	1	10	10	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	2(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	10	10	10	4(M)	O(L)	10	

System No. 70-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	10	9(L)	10	
	2	10	10	10	10	10	10	10	O(L)	10	
	3	10	10	10	10	10	10	10	O(L)	10	
	4	10	10	10	10	10	10	10	O(L)	10	
	5	10	10	10	9+	10	10	10	O(L)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	10	O(L)	10	
	2	10	10	10	10	10	9	2(F)	O(L)	10	
	3	10	10	10	10	10	9	2(F)	O(L)	10	
	4	10	10	10	10	10	7	2(D)	2(H)	M	
	5	9+	10	10	9+(E)	10					
Kaneohe Upper Level	1	10	10	10	10	10	10	10	O(L)		
	2	10*	10	10	9(E)	10	9*	2(M)	O(M)		* Topcoat pitting slight
	3	9⑧	10	10	9(E)	10	8	2(D)	O(H)	10	
	4	9⑧	10	10	8(E)	10	7	2(D)	O(H)	M	
	5	8⑧	10	10	8(E)	10					
Kaneohe Lower Level	1	10	10	10	10	10	10	10	O(L)	10	
	2	9*	10**	10	9	10	8	O(D)	O(M)	10*	* Edge rusting and blistering ** Topcoat pitting
	3	8	10	10	8(E)	8(E)	8-	O(D)	O(H)⑨	M	
	4	8-	10	10	8(E)	8(E)	6	O(D)	O(H)⑨	M	
Kwajalein	1	10	10	10	10	10	10	4(F)	O(L)	10	
	2	9(E)*	10	10	9(E)**	9(E)**	9	4(MD)	O(M)	10	* Topcoat pitting ** Edge blistering and rusting
	3	8	10	10	8(E)	8(E)	8	4(D)	O(M)	10	
	4	7	10	10	7(E)	7(E)⑨	7	2(D)	O(H)⑨	10	

System No. 71-V

Location	Years Exposed	Unscribed Panels					Scribed Panels				Comments
		Protection	Blistering	Undercutting Edges	Rusting Type I	Rusting Type II	Protection	Blistering	Rusting	Undercutting	
Port Hueneme Site 1	1	10	10	10	10	10	10	8(M)	O(M)	10	
	2	10	10	10	10	10	10	8(M)	O(M)	10	
	3	10	10	10	10	10	10	8(M)	O(M)	10	
	4	10	10	10	10	10	10	4(M)	O(M)	10	
	5	10	10	10	10	10	10	2(F)	O(M)	10	
Port Hueneme Site 2	1	10	10	10	10	10	10	2(M)	O(M)	10	
	2	10	10	10	10	10	8	2+(D)	O(MD)	M	
	3	10	10	10	10	10	7	2(D)	O(MD)	H	
	4	10	10	10	10	10					
	5	10	10	10	10	10					
Kaneohe Upper Level	1	10	10	10	10	10	7	O(D)	O(D)	1"	
	2	10	10	10	9(E)	10					
	3	10	10	10	9(E)	10					
	4	10	10	10	9(E)	10					
	5	10*	10	10	9(E)	10					* Slight erosion
Kaneohe Lower Level	1	10	10	10	10	10	7	O(D)	O(H)	10	
	2	10	10	10	10	10					
	3	10	10	10	10	10					
	4	10	10	10	9(E)	10					
Kwajalein	1	10	10	10	10	10	7	O(D)*	O(H)	1/4"	* 1/2 inch blisters at scribe
	2	10	10	10	10	10					
	3	10	10	10	9(E)	10					
	4	10	10	10	9(E)	9(E)					
	5	10	10	10	9(E)	9(E)					

Appendix B

COATING SYSTEMS

System	Coating	No. of Coats	Thickness, mils
62	Zinc inorganic silicate (postcured) (brown)	1	2.5
			Total 2.5
62-1	Catalyzed epoxy (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	Lead chromate epoxy-catalyzed primer	2	4.0
	Epoxy catalyzed finish	1	3.0
			Total 9.5
62-A	Alkyd (gray)		
	Zinc inorganic silicate (postcured)	1	3.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-E-485d, Type II primer	2	2.5
	TT-E-489c, Class A finish	2	2.5
			Total 9.0
62-L	Aluminum (aluminum)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I primer	1	1.0
	TT-P-468a, Type II + TT-V-81d Type I finish	2	4.5
			Total 8.5
62-O	Oil base (white)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I primer	1	1.0
	TT-P-102a, Class A, Type I finish	2	5.0
			Total 9.0

System	Coating	No. of Coats	Thickness, mils
62-V	Vinyl alkyd (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	MIL-P-15929B (formula 119) vinyl red lead primer	3	3.0
	MIL-E-15936B (formula 122-27) vinyl alkyd finish	2	3.0
			Total 9.0
63	Zinc inorganic silicate (self-cured) (gray)	1	2.5
			Total 2.5
63-1	Epoxy (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	Epoxy mastic-strontium-chromate primer with catalyst	2	4.5
	Epoxy-catalyzed finish	1	3.0
			Total 10.5
64	Zinc inorganic silicate (self-cured)	1	2.5
			Total 2.5
64-1	Vinyl (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	Vinyl-lead silico-chromate primer	1	1.0
	Vinyl intermediate	1	3.5
	Vinyl finish	1	4.0
			Total 11.0
65	Zinc inorganic silicate (self-cured) (green)	1	3.0
			Total 3.0
65-1	Epoxy (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	Lead chromate epoxy catalyzed primer	2	4.0
	Epoxy catalyzed finish	1	3.0
			Total 10.0
65-A	Alkyd (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	TT-E-485d, Type II, alkyd primer	2	2.5
	TT-E-489c, Class A, alkyd finish	2	2.5
			Total 8.0

System	Coating	No. of Coats	Thickness, mils
65-L	Aluminum (aluminum)		
	Zinc inorganic silicate (self-cured)	1	3.0
	TT-P-86a, Type I, red lead linseed oil primer	1	1.0
	TT-P-468a, Type II + TT-V-81d Type I aluminum finish	2	4.5
			Total 8.5
65-O	Oil base (white)		
	Zinc inorganic silicate (self-cured)	1	3.0
	TT-P-86a, Type I, red lead linseed oil primer	1	1.0
	TT-P-102a, Class A, oil base finish	2	4.0
			Total 8.0
65-V	Vinyl-alkyd (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	MIL-P-15929B (formula 119) vinyl-red lead primer	3	3.0
	MIL-E-15936B (formula 122-27) vinyl-alkyd finish	2	3.0
			Total 9.0
66	Zinc inorganic silicate (self-cured) (gray)	1	4.0
			Total 4.0
66-1	Epoxy (gray)		
	Zinc inorganic silicate (self-cured)	1	3.5
	Zinc chromate-zinc oxide acrylic primer	1	1.0
	Epoxy catalyzed finish	1	9.5
			Total 14.0
67	Zinc inorganic silicate (self-cured) (gray)	1	3.0
			Total 3.0
67-1	Epoxy (gray)		
	Zinc inorganic silicate (self-cured)	1	2.5
	Epoxy catalyzed finish	2	3.5
			Total 6.0
68	Zinc inorganic silicate (self-cured) (brown)	1	4.0
			Total 4.0

System	Coating	No. of Coats	Thickness, mils
68-1	Vinyl (gray)		
	Zinc inorganic silicate (self-cured)	1	4.0
	Modified phenolic-epoxy noninhibiting tie coat	1	1.0
	Titanium dioxide-vinyl copolymer resin finish	3	5.0
			Total 10.0
68-A	Alkyd (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-E-485d, Type II, alkyd primer	2	3.0
	TT-E-489c, Class A finish	2	2.0
			Total 8.5
68-L	Aluminum (aluminum)		
	Zinc inorganic silicate (self-cured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I, red lead oil primer	1	1.0
	TT-P-468a, Type II + TT-V-81d-Type I aluminum finish	2	4.0
			Total 8.0
68-O	Oil base		
	Zinc inorganic silicate (self-cured)	1	4.0
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I, red lead oil primer	1	1.0
	TT-P-102a, Class A, oil base finish	2	3.0
			Total 8.5
68-V	Vinyl alkyd (gray)		
	Zinc inorganic silicate (self-cured)	1	3.0
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	MIL-P-15929B (formula 119) vinyl red lead primer	3	3.0
	MIL-E-15936B (formula 122-27) vinyl alkyd finish	2	3.5
			Total 10.0
69	Zinc inorganic silicate (postcured) (brown)	1	2.5
			Total 2.5

System	Coating	No. of Coats	Thickness, mils
69-1	Vinyl (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	Modified phenolic-epoxy noninhibiting tie coat	1	1.0
	Titanium dioxide-vinyl copolymer resin finish	2	5.0
			Total 8.5
69-A	Alkyd (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-E-485d alkyd primer	2	2.5
	TT-E-489c alkyd finish	2	2.5
			Total 8.0
69-L	Aluminum (aluminum)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I, red lead oil primer	1	1.0
	TT-P-468a, Type II + TT-V-81d aluminum finish	2	3.5
			Total 7.5
69-O	Oil base (white)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	TT-P-86a, Type I, red lead oil primer	1	1.0
	TT-P-102a, Class A, oil base finish	2	5.0
			Total 9.0
69-V	Vinyl alkyd (gray)		
	Zinc inorganic silicate (postcured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	MIL-P-15929B (formula 119) primer	3	3.0
	MIL-E-15936B (formula 122-27) finish	2	3.0
			Total 9.0
70	Inorganic zinc filled coating (self-cured)	1	2.5
			Total 2.5

System	Coating	No. of Coats	Thickness, mils
70-1	Bimetallic alkoxide (gray)		
	Inorganic zinc-filled coating (self-cured)	1	2.0
	Bimetallic alkoxide complex finish	4	5.0
			Total 7.0
70-V	Vinyl alkyd (gray)		
	Inorganic zinc-filled coating (self-cured)	1	2.5
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	MIL-P-15929B (formula 119) primer	3	3.0
	MIL-E-15936B (vinyl alkyd) finish	2	4.0
			Total 10.0
71-V	Vinyl alkyd (gray)		
	MIL-P-15328B (formula 117) pretreatment primer	1	0.5
	MIL-P-15929B (formula 119) vinyl red lead primer	3	3.5
	MIL-E-15936B (formula 122-27) vinyl alkyd finish	2	3.5
			Total 7.5
72	Inorganic zinc silicate (postcured)	1	2.0
			Total 2.0

Appendix C

COATING SOURCES

System	Coating	Source
62-1	Catha-Coat 300 (postcured) zinc Devran Formula 201 – epoxy primer Devran Formula 209 – epoxy finish	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
62-A	Catha-Coat 300 (postcured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-E-485d, Type II TT-E-489c, Class A	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
62-L	Catha-Coat 300 (postcured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-P-86a, Type I primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	TT-P-468a, Type II + TT-V-81d, Type I finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
62-O	Catha-Coat 300 (postcured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507

System	Coating	Source
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-P-86a, Type I primer TT-P-102a, Class A finish	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
62-V	Catha-Coat 300 (postcured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	MIL-E-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
63-1	Rust Ban #191 (self-cured) zinc Humble #9664 epoxy mastic primer Humble #671 epoxy finish	Enjay Chemical Company P. O. Box 3272 Houston, Texas 77001
64-1	Rust Ban #190 (postcured) zinc Humble #520 primer Humble #9512 intermediate Humble #516 finish	Enjay Chemical Company P. O. Box 3272 Houston, Texas 77001
65-1	Catha-Coat 302A (self-cured) zinc Devran Formula #201 epoxy primer Devran Formula #209 epoxy finish	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
65-A	Catha-Coat 302A (self-cured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507

System	Coating	Source
	TT-E-385d, Type II, primer TT-E-489c, Class A, finish	Andrew Brown 5431 District Blvd. Los Angeles, Calif. 90022
65-L	Catha-Coat 302A (self-cured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	TT-P-86a, Type I primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	TT-V-81d, Type I + TT-P-468a, Type II finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
65-O	Catha-Coat 302A (self-cured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	TT-P-86a, Type I, primer TT-P-102a, Class A, finish	Sinclair Paint Co. 3960 Washington Blvd. Los Angeles, Calif. 90023
65-V	Catha-Coat 302A (self-cured) zinc	Celanese Coating Co. 2625 Durahart Street Riverside, Calif. 92507
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 Washington Blvd. Los Angeles, Calif. 90023
	MIL-E-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
66-1	Copon SCZ (self-cured) zinc Copon P. B. C. #510 acrylic primer Chemicure #75 epoxy finish	Reliance Universal Inc. P. O. Box 1113 6901 Cavalcade Houston, Texas 7701

System	Coating	Source
67-1	Carbo Zinc 11 (self-cured) zinc Carboline #190 (polyamide) finish	Margar Company 1613 Pacific Coast Highway Hermosa Beach, Calif.
68-1	Dimetcote No. 4 (self-cured) zinc Amercoat 86 phenolic-epoxy tie coat Amercoat 99 vinyl finish	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
68-A	Dimetcote No. 4 (self-cured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-E-485d, Type II, primer TT-E-489c, Class A, finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
68-L	Dimetcote No. 4 (self-cured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-P-86a, Type I primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	TT-V-81d, Type I + TT-P-468a, Type II finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
68-O	Dimetcote No. 4 (self-cured)	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023

System	Coating	Source
	TT-P-86a, Type I, primer TT-P-102a, Class A, finish	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
68-V	Dimetcote No. 4, (self-cured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	MIL-P-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
69-1	Dimetcote No. 3 (postcured) zinc Amercoat 86 phenolic-epoxy tie coat Amercoat 99 vinyl finish	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
69-A	Dimetcote No. 3 (postcured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-E-485d, Type II, primer TT-E-489c, Class A, finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
69-L	Dimetcote No. 3 (postcured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328A (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023

System	Coating	Source
	TT-P-86a, Type I, primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	TT-V-81d, Type I + TT-P-468a, Type II finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
69-O	Dimetcote No. 3 (postcured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	TT-P-86a, Type I, primer TT-P-102a, Class A, finish	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
69-V	Dimetcote No. 3 (postcured) zinc	Amercoat Corporation 201 N. Berry Street Brea, Calif. 92621
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	MIL-E-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
70-1	Zinc-ite B (self-cured) zinc Ceram-ite finish	The Systems Company 143 Alta Street Arcadia, Calif. 91006
70-V	Zinc-ite B (self-cured) zinc	The Systems Company 143 Alta Street Arcadia, Calif. 91006

System	Coating	Source
	MIL-P-15328B (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	MIL-E-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
71-V	MIL-P-15328A (formula 117) wash primer	National Lead Co. 3113 E. 26th Street Los Angeles, Calif. 90023
	MIL-P-15929B (formula 119) primer	Sinclair Paint Co. 3960 E. Washington Blvd. Los Angeles, Calif. 90023
	MIL-P-15936B (formula 122-27) finish	Andrew Brown Co. 5431 District Blvd. Los Angeles, Calif. 90022
72	Zincilate 101 (postcured) zinc	Industrial Metal Protective, Inc. 333 West First Street Dayton, Ohio 45402

REFERENCES

1. Naval Civil Engineering Laboratory. Technical Report R-501: Nine year program on marine atmospheric exposures of protective coatings for steel, by C. V. Brouillette. Port Hueneme, Calif., Jan. 1967. FOUO (AD 808292L)

2. "Zinc silicates attract coating makers," Chemical and Engineering News, vol. 40, no. 16, June 25, 1962, pp. 57-58.

3. "Ten top military corrosion problems," Materials Protection, vol. 5, no. 1, Jan. 1966, p. 19.

4. Naval Civil Engineering Laboratory. Technical Report R-557: Zinc inorganic coatings, with and without topcoats, exposed to a marine atmosphere, by C. V. Brouillette. Port Hueneme, Calif., Dec. 1967. (AD 824226L)

5. American Society for Testing and Materials. Designation D610-43: "Standard method of evaluating degree of resistance to rusting obtained with paint on iron or steel surfaces," in 1964 book of ASTM standards, pt. 21. Philadelphia, Pa., Jan. 1964, pp. 113-118.

————. Designation D659-44: "Standard method of evaluating degree of resistance to chalking of exterior paints," in 1964 book of ASTM standards, pt. 21. Philadelphia, Pa., Jan. 1964, pp. 123-124.

————. Designation D714-56: "Standard method for evaluating degree of blistering of paints," in 1964 book of ASTM standards, pt. 21. Philadelphia, Pa., Jan. 1964, pp. 138-147.

6. R. W. Drisko. "Zinc-rich coatings for marine application," Materials Protection, vol. 9, no. 3, Mar. 1970, pp. 11-12.

7. Naval Civil Engineering Laboratory. Technical Note N-1092: Zinc-rich organic coating systems exposed to a marine atmosphere, by C. V. Brouillette. Port Hueneme, Calif., May 1970. (AD 871186L)

DISTRIBUTION LIST

SNDL Code	No. of Activities	Total Copies	
–	1	2	*Defense Documentation Center*
FKAIC	1	10	Naval Facilities Engineering Command
FKNI	6	6	NAVFAC Engineering Field Divisions
FKN5	9	9	Public Works Centers
FA25	1	1	Public Works Center
–	9	9	RDT&E Liaison Officers at NAVFAC Engineering Field Divisions and Construction Battalion Centers
–	357	357	NCEL Special Distribution List No. 5 for Government activities interested in reports on Deterioration Control

Naval Civil Engineering Laboratory
ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE (Final), by Carl V. Brouillette and A. F. Curry
TR-776 68 p. illus November 1972 Unclassified

1. Zinc inorganic silicate coatings I. YF 54.543.006.01.008

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California (34°7'N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

Naval Civil Engineering Laboratory
ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE (Final), by Carl V. Brouillette and A. F. Curry
TR-776 68 p. illus November 1972 Unclassified

1. Zinc inorganic silicate coatings I. YF 54.543.006.01.008

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California (34°7'N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

Naval Civil Engineering Laboratory
ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE (Final), by Carl V. Brouillette and A. F. Curry
TR-776 68 p. illus November 1972 Unclassified

1. Zinc inorganic silicate coatings I. YF 54.543.006.01.008

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California (34°7'N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

Naval Civil Engineering Laboratory
ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE (Final), by Carl V. Brouillette and A. F. Curry
TR-776 68 p. illus November 1972 Unclassified

1. Zinc inorganic silicate coatings I. YF 54.543.006.01.008

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California (34°7'N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
Naval Civil Engineering Laboratory Port Hueneme, California 93043	Unclassified
	2b. GROUP

3. REPORT TITLE

ZINC INORGANIC SILICATE COATINGS: FIVE YEARS MARINE ATMOSPHERIC EXPOSURE

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final; October 1967–October 1970

5. AUTHOR(S) (First name, middle initial, last name)

Carl V. Brouillette and A. F. Curry

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
November 1972	68	7

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. YF 54.543.006.01.008	TR-776
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Distribution limited to U. S. Government agencies only; Test and Evaluation; November 1972. Other requests for this document must be referred to the Naval Civil Engineering Laboratory.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Naval Facilities Engineering Command Washington, D. C. 20390

13. ABSTRACT

Ten zinc inorganic silicate coatings were exposed for 5 years at the three atmospheric environmental test sites of the Naval Civil Engineering Laboratory. These test sites are Kwajalein, Marshall Islands; Kaneohe, Hawaii (both tropical environments); and Port Hueneme, California (34°7'N latitude). The zinc inorganic silicate coatings were exposed with and without topcoats. It was found that, in general, postcuring and superior self-curing zinc inorganic silicate coatings without topcoats will give long-term protection to steel. A compatible topcoat will improve the protective properties, especially of an inferior zinc inorganic silicate coating. Compatible vinyl, epoxy, or alkyd coatings are effective topcoats for the zinc inorganic silicate coatings.

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6801

Unclassified

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Protective coatings						
Mild steel						
Zinc inorganic silicate						
Salt spray atmosphere						
Topcoatings						
Epoxy						
Vinyl						
Alkyd						
Oil base						
Corrosion						
Marine atmosphere						