AD 638410

Technical Note N-802

SHELF-LIFE OF PROTECTIVE COATINGS

BY

Eddy S. Matsui

8 March 1966

~~INTERNAL WORKING PAPER~~

[redacted]

U. S. NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

SHELF-LIFE OF PROTECTIVE COATINGS

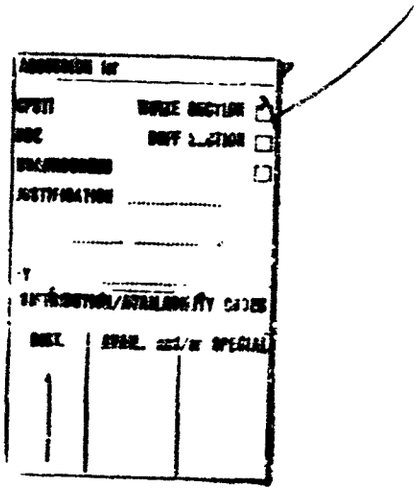
Y-F020-03

by

Eddy S. Matcui

ABSTRACT

A number of physical and chemical analyses of protective coatings are being conducted to determine their storage stability for a duration of three years. Of the 52 coating components reported, only a few were found to fail as the result of developing an unacceptable condition in container, but all changed in viscosity, nonvolatile contents, and drying time in varying degree during the three-year storage period. There are some indications that the two-component systems are more susceptible to aging than the one-component systems.



INTRODUCTION

The Bureau of Yards and Docks is responsible for the maintenance and operation of the Naval Shore Establishment, including many installations located in distant parts of the world. Structures at these establishments are subject to deterioration from the natural forces, environmental and service conditions, and sometimes to attack from industrial effluents. Some environments are especially corrosive or damaging to various materials. Structures must be protected to minimize costly repairs.

Paint is one of the oldest and most widely used protective measures against corrosion and deterioration. The United States Naval Civil Engineering Laboratory, Port Hueneme, California, has initiated several studies to find improved paint and coating systems for different specific end uses. In these studies, a number of proprietary paints and coatings are being evaluated relative to products that were procured to meet definite government specifications.

In the summer of 1962, personnel from the Bureau and this Laboratory agreed that several different tests and instrumentation techniques would be used to obtain different properties of each of the proprietary products introduced into the research, development, test and evaluation programs. This was done to: (1) assure an acceptable shelf-life stability of proprietary materials that are found to perform in a superior manner so that government specifications can be written to incorporate new products into the Navy's supply system; (2) obtain characteristic properties of each proprietary material to aid in the writing of a specification about products found to perform in a superior manner. If during the three year storage stability program, a proprietary product gives evidence of poor storage properties or exhibits early failure during field exposures, this product is removed from the shelf-life testing program.

The Bureau and NCEL agreed to include the following test parameters in the shelf-life studies of paints and coatings;

1. Condition in container.

2. Weight per gallon.

3. Viscosity.

4. Total nonvolatile and nonvolatile vehicles.

5. Fineness of grind.

6. Pigment content.

7. Flash point (where appropriate).

8. Infrared spectra of:

   a. Nonvolatile vehicle

   b. Catalyst (where appropriate).

   c. Volatile vehicle.

9. Drying time.

10. Dry hiding power.

11. X-ray diffraction of pigments.

12. Abrasion resistance (where appropriate).

13. Flexibility.

During the first three years of this shelf-life testing program, more than two hundred samples were introduced into the program. This report presents the analytical results of the first 52 samples (each component of multipackage coatings considered as a separate item), which have completed the fourth shelf-life test cycle covering a three-year storage period. Most of these coatings were procured and placed on field exposure a few months before beginning the shelf-life testing program, and therefore, some of the initial analytical data were not available. Also, such factors as manpower availability and other scheduling problems resulted in some irregularities in the total program.

EXPERIMENTAL WORK

Sampling

Four one-quart samples were taken randomly from each batch of paint received. Paints from large containers were thoroughly agitated using a paint shaker and then properly divided among four clean dry containers in such a manner that each container was representative of the paint in the original container. The samples were then tightly capped and identified numerically in chronological order. The samples were placed on the shelf in a building where conditions appear comparable to those which might be expected in warehouse storage.

An original set of analytical data was obtained for newly received samples after dividing into the four one-quart cans. Thereafter, freshly opened quart was analyzed at one-year intervals up to a maximum of three years.

Tests Used

Most of the analyses reported were determined in accordance with methods specified in Federal Test Methods Standard (FTMS) No. 141 when applicable.

Condition in Container. The condition of paints in a container was determined by the method given in FTMS No. 141, Method 3011. All proprietary coatings were rated "good" (G), if there was no sign of deterioration in container when examined by the above method. Specification paints were rated "conform" (C), if they met their specification requirements. All undesirable conditions noted in containers were recorded as skinning (s), livering (L), caking (k), gel-bodied (g) and/ or solidified mass (m). Samples that had deteriorated to an unacceptable condition during storage were reported as "failed" (F). If the condition of a can opened at a given time failed in some respect, the remaining cans were opened and the fraction failing was reported, e.g., as F/2.

Weight Per Gallon. Weight per gallon of material was obtained by the procedure given in FTMS No. 141, Method 4184. Particular care was taken to preclude entrapping air bubbles in very viscous material.

Viscosity. A Krebs-Stormer viscosimeter was employed to measure the viscosity of the samples in Krebs Unit (KU), as described in FTMS No. 141, Method 4281. In cases of two component systems, each component was measured separately. The results are based on measurements obtained within the 27 to 33 seconds per 100 revolution range to achieve good reproducibility.

Total Nonvolatile and Nonvolatile Vehicle Content. Percentages of total nonvolatile and nonvolatile vehicle contents of materials were determined by the FTMS No. 141, Method 4041, and Method 4053, respectively.

Fineness of Grind. Fineness of grind of each pigmented coating material was determined by the method set forth in FTMS No. 141, Method 4411.

Pigment Content. Percentage of pigment by weight of each sample was obtained by the method described on FTMS No. 141, Method 4021.

Flash Point of Pigmented Materials. The flash point of all coatings, except multicomponent systems, was determined by Pensky-Martens closed-cup tester as given in FTMS No. 141, Method 4203.

Infrared (IR) Spectra of Nonvolatile Vehicle, Catalyst and Volatile Vehicle. Because there is no Federal Standard Test Method for obtaining IR spectra of nonvolatile vehicles, the spectra were obtained in the following manner. Vehicles were separated by FTMS No. 141, Method 4021 (for pigment content), but all decanted liquid portions were retained and combined. Two or more drops of the liquid were placed on a warm sodium chloride window, spread into a uniform film, and allowed to dry under a heat lamp. The thickness of sample used was adjusted in order to record characteristic absorption peaks in the 20 to 80 percent transmission range. The spectra were obtained with a Beckman IR-5 Infrared Spectrophotometer. IR spectra for catalysts and unpigmented samples were obtained in a similar manner by simply diluting them with a suitable solvent.

Drying Time. Unless stated otherwise a uniform film of 1.5 mils wet thickness was applied onto a glass plate with a motor-driven applicator.* In the case of two component systems, the film was applied immediately after properly mixing the components unless an induction period is required. Although FTMS No. 141, Method 4061 prescribes a procedure for determining the drying time, a Gardner Circular Drying Time Recorder was employed because it does not require continuous attention and yields numerical results which are more objective. This procedure is described in Gardner and Sward "Physical and Chemical Examination of Paint, Varnish, Lacquer and Color" 12th Ed. 1960. Drying times for set-to-touch and dry-hard were recorded to the nearest 0.1 hour.

* This equipment is sold by the Gardner Laboratory, Bethesda 14, Maryland.

Dry Hiding Power in Mils. Since there is no Federal Standard Test Method available for measuring hiding power in terms of dry film thickness, a method to determine the dry hiding power in mils were developed. A hiding power chart* which is a smooth-surfaced heavy paper with a suitable varnish or lacquer to render the surface impervious and resistant to penetration by paint vehicles, was placed in a horizontal position on the base plate of a motor-driven film applicator. An adjustable doctor blade** with two barrel-type micrometers and a 6-inch gate-width, was used to apply paint on the chart. The micrometers were adjusted so that the blade was closed at one end, and the other opened to a known clearance, thus forming a triangular shaped opening above the chart. This produced a graduated film thickness, zero to the predetermined thickness, in a single application operation. The coated charts were placed in a horizontal position and air dried for 24 hours in a well ventilated room where the temperature was maintained between 21° and 32° C (70° and 90° F). The minimum thickness of the dry film on the chart which completely hid the striped background of the hiding-power chart was measured with a micrometer. The hiding power in dry mils was reported as the difference between the coated and the uncoated chart thickness.

X-ray Diffraction of Pigment. X-ray diffraction patterns of pigments were obtained in the following manner since there is no Federal Standard Test Method available.

Pigment specimens were prepared in the manner described in the FTMS No. 141, Method 4021. Each pigment so obtained was crushed and ground with a mortar and pestle until it passed through a No. 200 sieve. The fine powder was then packed into the cavity of a flat aluminum holder and mounted on the Norelco Geiger Counter X-ray Diffractometer. This powder mounting technique is described in Klug and Alexander, "X-ray Diffraction Procedure", 1954. CuK_{α} (K_{α} radiation from copper target) radiation with a 0.0006 inch nickel filter was used as the X-ray source with 40 Kv and 15 ma applied to the x-ray tube. Patterns were obtained at a scanning speed of 1° per minute and a chart speed of 10-inches per hour with the counting rate meter adjusted to keep peaks within the chart range.

Abrasion Resistance. Abrasion resistance of a coated film was determined by the FTMS No. 141, Method 6192. All test specimens were prepared in the following manner.

* Chart (Form No. 03-B obtained from the Morest Co., 211 Centre St., New York City.

**A Doctor blade of this description is sold by the Gardner Laboratory, Bethesda 14, Maryland.

The coating was applied on the steel plates prepared according to Method 2011, FTMS No. 141., using a motor-driven film applicator. The doctor blade was adjusted to produce a dry film thickness of 2 mils. All samples were prepared in quadruplicate. After the film was applied, the test plates were air dried in a horizontal position for 72 hours, in a well-ventilated room where the temperature was maintained at 21° to 32° C (70° to 90° F). The test plates were then placed in a well-ventilated oven maintained at 105° ± 2° C (221° ± 3.6° F) for 4 hours. They were then aged for a minimum of 7 days to assure complete cure of the coating in a humidity chamber where the relative humidity was maintained at 50 ± 4 percent. A resilient calibrase wheel No. CS-17 with a load pressure of 500 grams was used with a Taber Abraser* for all coatings. "Wear Index" was reported as the average weight loss in milligrams per 1000 cycles of abrasion.

Flexibility. The percentage of elongation of a coated film was determined by the method set forth in FTMS No. 141, Method 6222. All test specimens were prepared in the following manner unless otherwise specified in the product specifications. Triplicate samples of steel plates were coated using a motor-driven film applicator with the doctor blade adjusted to form a 2 mil dry film thickness. After application of the film, the test plates were air dried and cured in the same manner as the abrasion test method in the proceeding section. The test panels which had been so prepared were bent over a conical mandrel* and the percentage of elongation was determined from a calibrated curve. The average of the results were reported in terms of percentage of elongation.

RESULTS

Due to the large number of specimens involved in this program, each test coating was identified by number or by generic type rather than by trade name. Trade names and sources of the coatings are listed in Appendix B.

Coatings No. 31 (vinyl-phenolic primer) and No. 32 (vinyl mastic topcoat) were removed from the shelf-life program after 12 months. No. 51 (vinyl primer), No. 52 (vinyl body coat) and No. 53 (vinyl topcoat) were also removed from the testing program after 24 months on the shelf. Although the above coatings appeared to be in good condition in the container at the time of the removal, the system containing each failed during field exposures.

* A mandrel of this type may be obtained from the Gardner Laboratory, Inc., Bethesda 14, Maryland.

Condition in Container. Among the 52 specimens under consideration, 5 samples failed and were therefore removed from the shelf-life testing before the end of the three year program. They were: No. 2 (coal tar epoxy) which livered between 24 and 36 months; No. 16 (polyester) which solidified completely in less than 12 months; No. 29 (phenolic primer) which livered between 24 and 36 months; and half of the samples of No. 38 and No. 39, both saran, which gelled between 12 and 24 months. All of the other paints appeared to be in good condition at the end of the three-year cycle.

Weight per Gallon. Generally speaking, little or no change in weight per gallon was noted during the three year span of the shelf-life testing program. As shown in Appendix A, No. 1 (epoxy primer) increased somewhat during the test cycle. There was only one container of No. 41 (vinyl anti-fouling coating) for the shelf-life test program, and the increase in "weight per gallon" was probably due to the repeated opening of the same container for each successive testing cycle.

Viscosity. Almost all specimens tended to increase in viscosity to some degree during storage. No. 17 (urethane primer) was an exception in that the viscosity decreased with time. Generally, all epoxy samples increased in viscosity, while with a few exceptions the viscosity of their catalysts remained more or less constant. Coating No. 2 (coal tar epoxy); No. 10 (epoxy primer catalyst); No. 12 (epoxy build coat catalyst); No. 13, (epoxy topcoat); No. 14 (epoxy topcoat catalyst); No. 15 (anti-fouling); No. 19 (urethane catalyst); No. 29 (phenolic primer); and No. 31 (vinyl phenolic primer) increased in viscosity much more rapidly than the rest of the samples. Samples No. 2 and No. 29 eventually thickened beyond their usefulness, and No. 31 failed to function satisfactorily during field exposure.

Total Nonvolatile and Nonvolatile Vehicle Content. The changes in percentage of nonvolatile content in the samples was slight, but sufficient to reveal a trend as the samples aged during the shelf-life testing program. The results in Appendix A indicate that most of the coatings tended to increase slightly in nonvolatile content. However, No. 54 (epoxy primer) and No. 56 (epoxy phenolic topcoat) appeared to decrease slightly. Contrary to the tendency of other samples, most of the epoxy catalysts decreased steadily in nonvolatile content during the storage period. No. 35 (zinc inorganic silicate curing solution) appeared to increase as it aged. No. 12, (epoxy build coat catalysts) also increased somewhat though other catalysts with the same chemical composition did not increase.

For one component systems and the base component of two component systems, the nonvolatile vehicle (and pigment content) varied more independently and irregularly than their sum, the total nonvolatile.

Fineness of Grind. During the three-year span of shelf-life testing, most of the samples displayed no change in fineness of grind. An exception was No. 47 (phenolic seal coat) which showed some variation as shown in Appendix A.

Pigment Content. Sample No. 2 (coal tar epoxy) showed a notable increase in pigment content, while No. 18 (urethane) and No. 47 (phenolic seal coat) showed a decrease in pigment content. All other coatings increased slightly, or not at all, as shown in Appendix A. Overall results indicate that the pigment content of the one component systems were somewhat more stable than that of the two component systems. The greater variation of the pigment content of the two component systems during the storage may have been caused by the difficult separation of pigments from their more complex vehicles rather than due to the storage.

Flash Point. Flash points determined showed little or no change during storage, except No. 29 (phenolic primer) which almost doubled between 12 and 24 months.

Infrared Spectra of Nonvolatile Vehicle and Catalyst. The initial IR spectra of samples were not obtained because they were received before this phase of the program was started. During the three years of shelf-life study, no changes were noted in successive IR spectra obtained. One each of IR spectra from samples No. 6 and 7, base and catalyst, respectively, (Figure 1 and 2) are given for illustration. Within the sets of sample indicated below, the following nonvolatile vehicles have similar IR spectra: Nos. 1, 2, 4, 6, 9, 11, 13, 43, 44, 45, 47, 49, 54, and 56, which were epoxies; Nos. 17 and 18, (urethane), Nos. 38 and 39, (Saran); Nos. 51, 52, and 53, (vinyl). Within the sets, the following catalysts have similar IR spectra; Nos. 1-a, 3, 5, 7, 10, 12 and 14, of which were polyamides; Nos. 46, 48, 50, 55, and 57, (polyamine). No other similarities were noted.

Drying Time. The results in Appendix A indicate that the one component systems generally maintain more constant drying time than do two component systems. Among the one component systems, No. 30, (cold plastic anti-fouling) did display rapid increase, while No. 40 (vinyl primer) increased to a lesser degree in the drying time during the shelf-life testing. No. 42 (coal tar) did not reach the dry-hard stage in 24 hours. Among the two component systems, several samples displayed a marked increase in drying time during the storage, i.e., No. 1 (epoxy primer), No. 2 (coal tar

epoxy), No. 4 (epoxy seal coat), No. 11 (epoxy build coat) and No. 13 (epoxy topcoat). No. 43 (phenolic primer) gradually decreased its drying time during the shelf-life testing. All other samples were unchanged within the limits of accuracy of this test.

Dry Hiding Power. There were no notable changes in dry hiding power during the shelf-life testing.

X-ray Diffraction of Pigment. X-ray diffraction patterns are not presented in this report because no significant changes in patterns were noted during the shelf-life testing. One pattern is given from sample No. 6 (Figure 3) for illustration. Initial X-ray diffraction patterns were not obtained because the samples were received before this phase of the program was started.

The patterns of X-ray diffraction obtained here indicate that the following coatings probably contain similar pigments: Nos. 1 and 54; Nos. 30 and 41; Nos. 37, 38 and 53; Nos. 40, 43 and 45; and Nos. 44 and 49. All other coatings contain varied pigments. Although a number of pigments have been identified, complete identification of all pigments by X-ray diffraction is beyond the scope of this report.

Abrasion Resistance. The results for only two samples, No. 54 (epoxy primer) and No. 56 (epoxy phenolic topcoat) were available at this time. Both samples showed a decrease in abrasion resistance as a result of aging on the shelf (see Appendix A). The validity of this test method will be discussed in a separate report at a later date.

Flexibility. Initially, tin plated steel was used as a base for the test coatings. However, tin plates were unsatisfactory for investigating samples with a percentage of elongation greater than 8 percent and were later replaced by steel plates which provided a wider range of measurement. However, the value obtained from the two different base plates are not comparable, and evaluations must be made separately. The results in Appendix A indicate that the flexibility of the two component systems are somewhat more susceptible to change with aging than are the one component systems. The flexibilities of No. 6 (epoxy topcoat), No. 17 (urethane primer), No. 45 (coal tar epoxy), No. 57 (vinyl topcoat) and No. 54 (epoxy primer) decreased as they aged. Most of the other samples did not change appreciably within the accuracy of this test. A few samples gave an irregular result and thus could not be evaluated. No. 4 (epoxy seal coat) and No. 47 (phenolic seal coat) increased in flexibility with time, but these variations may be due to the many parameters involved.

FINDINGS

1. No significant changes were noted in weight per gallon, fineness of grind, dry hiding power, IR spectras of nonvolatile vehicles and catalysts, and X-ray diffraction patterns of pigments for all coatings during the three year span of the shelf-life testing program.

2. Almost all coatings under the study tended to increase in viscosity, but in varying degree. Samples Nos. 2 and 29 showed a rapid increase in viscosity during the storage and eventually deteriorated beyond usefulness.

3. Most of the coatings increased slightly in nonvolatile content as they aged on the shelf, but most of the catalysts decreased in nonvolatile content.

4. Generally, the flexibility and drying time characteristics of the two component systems are more susceptible to change on aging than those of the one component systems.

ACKNOWLEDGEMENT

The author wishes to express his appreciation to Mr. R. L. Alumbaugh, Mr. C. V. Brouillette, and Dr. R. W. Drisko, project scientists of this Laboratory, for many valuable discussions during the course of this work.

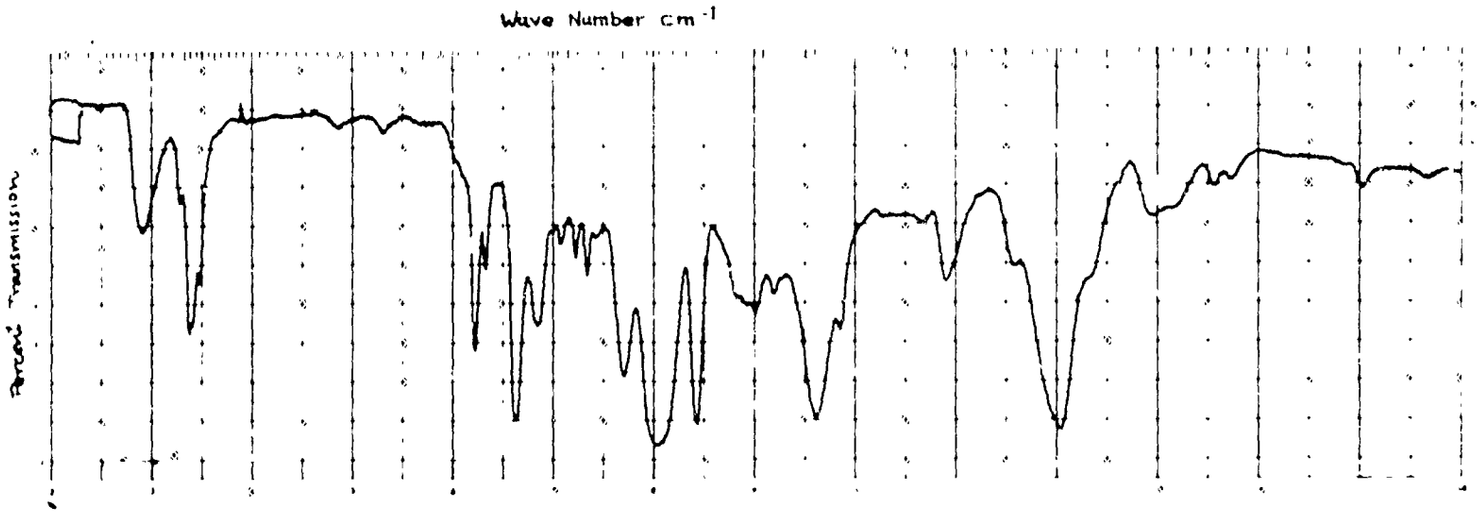


Figure 1. IR spectra of sample No. 6, epoxy resin.

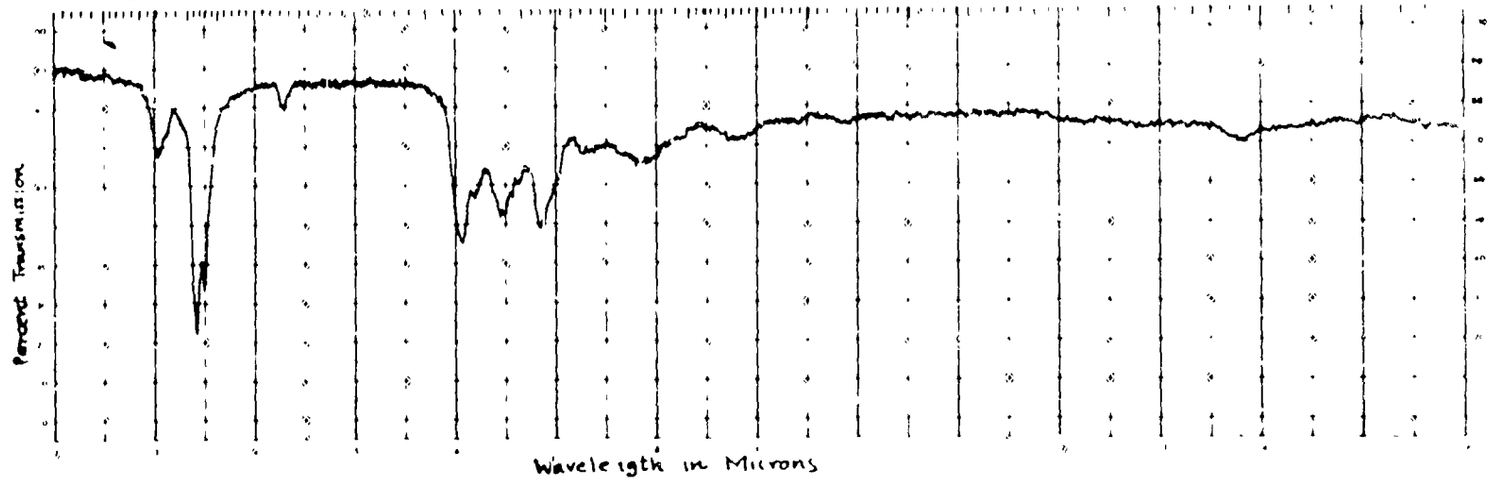


Figure 2. IR spectra of sample No. 7, polyamide type catalyst for sample No. 6.

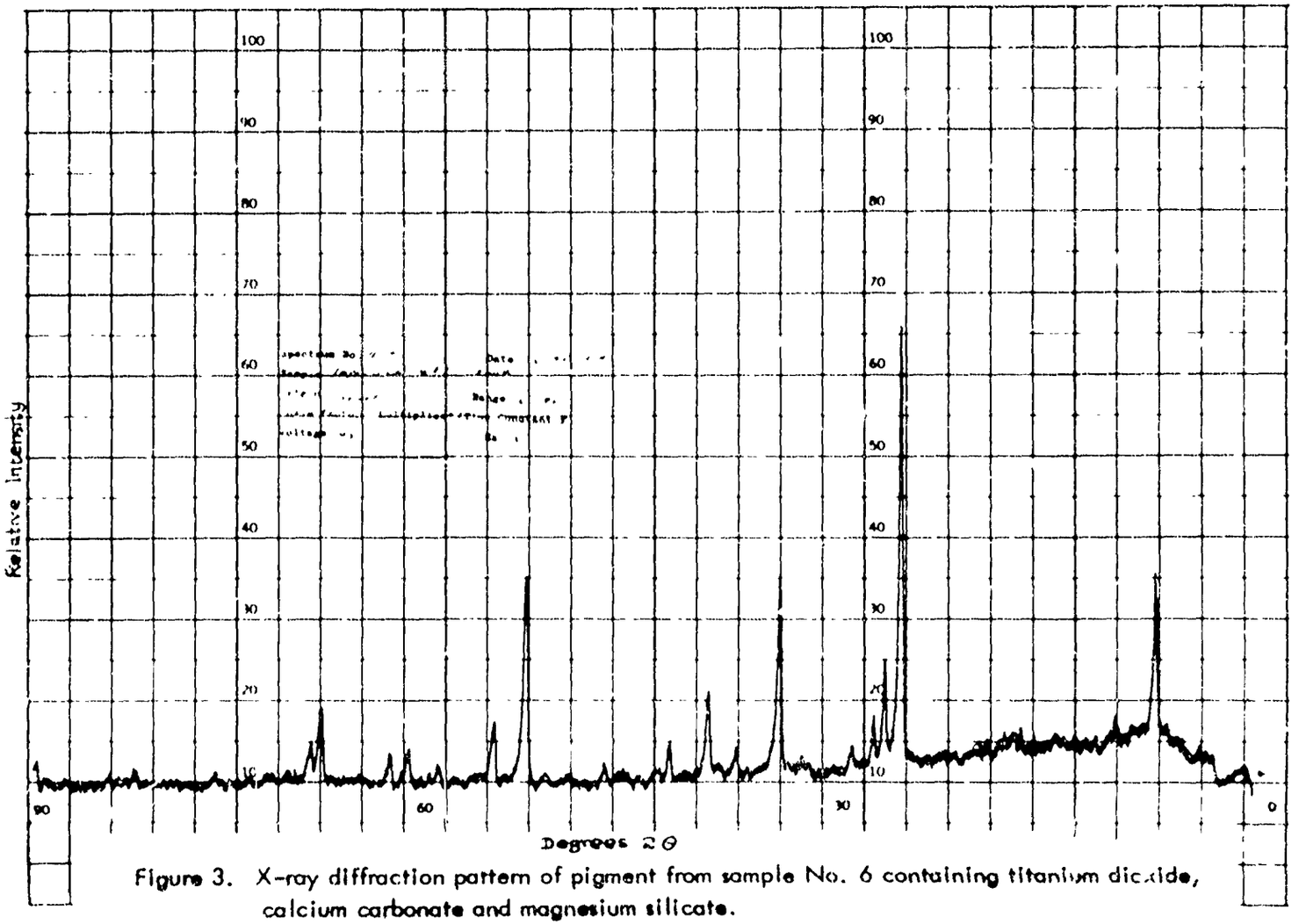


Figure 3. X-ray diffraction pattern of pigment from sample No. 6 containing titanium dioxide, calcium carbonate and magnesium silicate.

APPENDIX A

Analytical Data of Coatings on Shelf-Life Test

No.	Sample	Mos.	Condition in Container 1/	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°) 2/	Drying Time (hrs) S.T. 3/	Drying Time (hrs) D.H. 4/	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
1	Epoxy Primer														
		0	-	14.3	80	77.0	62.5	14.5	--	--	--	--	--	-- 5/	--
		12	G	14.8	85	77.6	63.1	14.5	--	0.5	4.5	4.8	--	~~8.0~~ 5/	4.5
		24	G	15.2	86	77.8	64.3	13.6	--	0.1	7.0	5.0	--	6.8	4.5
		36	G	15.2	88	77.7	63.8	15.0	--	0.1	11.0	5.5	--	6.0	4.5
-e	Epoxy Primer Catalyst	0	--	--	--	--	0.0	--	--	See #1		See #1	N/A	See #1	N/A
		12	G	7.6	54	55.3	0.0	55.3	--				N/A		N/A
		24	G	7.6	54	53.9	0.0	53.9	--				N/A		N/A
		36	G	7.6	54	53.6	0.0	53.6	--				N/A		N/A
2	Coal Tar Epoxy														
		0	--	11.4	110	82.3	--	--	--	--	--	--	--	-- 5/	--
		12	G	11.5	>143	84.3	44.9	39.4	--	0.5	8.0	1.0	--	~~8.0~~ 5/	0.0
		24	G	11.2	>143	83.4	49.8	33.6	--	0.3	14.0	1.0	--	5.9	0.0
		36	F,L	--	--	--	--	--	--	--	--	--	--	--	--
3	Coal Tar Epoxy Catalyst	0	--	--	--	--	0.0	--	--	See #2		See #2	N/A	See #2	N/A
		12	G	7.7	60	66.6	0.0	66.6	--				N/A		N/A
		24	G	7.7	63	65.3	0.0	65.3	--				N/A		N/A
		36	G	7.8	63	62.7	0.0	62.7	--				N/A		N/A
4	Epoxy Seal Coat														
		0	--	--	79	87.5	--	62.6	--	--	--	--	--	-- 5/	--
		12	G	10.5	85	88.3	29.3	59.0	--	3.0	14.0	2.0	--	~~8.0~~ 5/	0.0
		24	G	10.8	82	88.4	30.7	57.7	--	8.0	24.0	2.0	--	<3.5	0.0
		36	G	10.7	86	88.1	29.6	58.5	--	6.0	8.0	2.3	--	5.5	0.0
5	Epoxy Seal Coat Catalyst	0	--	--	--	--	0.0	--	--	See #4		See #4	N/A	See #4	N/A
		12	G	8.0	136	87.7	0.0	87.7	--				N/A		N/A
		24	G	8.0	140	85.8	0.0	85.8	--				N/A		N/A
		36	G	8.0	140	84.1	0.0	84.1	--				N/A		N/A

APPENDIX A (Cont'd)

Sample	Hos.	Condition in Container [1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°) [2]	Drying Time (hrs) S.T. [3]	Drying Time (hrs) D.H. [4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
Epoxy Top Coat														
	0	--	11.3	77	75.5	38.0	37.5	--	--	--	--	--	-- [5]	--
	12	G	11.2	80	76.5	38.6	37.9	--	0.3	5.0	6.5	--	>8.0 [5]	5.5
	24	G	11.5	86	77.2	41.1	36.1	--	0.5	5.0	6.8	--	7.7	5.0
	36	G	11.0	86	77.0	38.5	38.4	--	0.3	5.0	7.0	--	6.2	5.0
Epoxy Top Coat Catalyst	0	--	--	--	--	0.0	--	--	See #6		See #6	N/A	See #6	N/A
	12	G	7.7	62	61.3	0.0	61.3	--				N/A		N/A
	24	G	7.7	65	60.5	0.0	60.5	--				N/A		N/A
	36	G	7.7	66	60.4	0.0	60.4					N/A		N/A
Epoxy Reducer														
	0	--	--	N/A	--	0.0	--	--	N/A	N/A	N/A	N/A	N/A	N/A
	12	G	6.9	N/A	0.0	0.0	0.0	--	N/A	N/A	N/A	N/A	N/A	N/A
	24	G	6.9	N/A	0.0	0.0	0.0	--	N/A	N/A	N/A	N/A	N/A	N/A
	36	G	6.9	N/A	0.0	0.0	0.0	--	N/A	N/A	N/A	N/A	N/A	N/A
Epoxy Primer														
	0	--	11.6	65	66.9	44.6	22.3	--	--	--	--	--	-- [5]	--
	12	G	11.6	72	68.0	45.5	22.5	--	0.3	7.0	--	--	>8.0 [5]	4.5
	24	G	11.6	68	68.0	47.0	21.0	--	0.2	10.0	10.0	--	<3.2	5.0
	36	G	11.4	69	68.5	45.9	22.6	--	0.1	10.0	10.5	--	<3.4	4.5
Epoxy Primer Catalyst	0	--	--	--	--	0.0	--	--	See #9		See #9	N/A	See #9	N/A
	12	G	7.9	85	72.9	0.0	72.9	--				N/A		N/A
	24	G	8.0	98	72.3	0.0	72.3	--				N/A		N/A
	36	G	8.0	104	72.3	0.0	72.3	--				N/A		N/A
Epoxy Build Coat	0	--	12.2	69	69.6	47.0	22.6	--	--	--	--	--	-- [5]	--
	12	G	11.8	72	70.5	47.7	22.8	--	0.5	5.0	1.0	--	>8.0 [5]	3.8
	24	G	12.1	73	71.6	49.5	22.1	--	0.7	24.0	1.0	--	24.2	4.0
	36	G	12.0	82	71.7	47.5	24.2	--	0.3	>24.0	1.0	--	25.2	4.0
Epoxy Build Coat Catalyst	0	--	--	--	--	0.0	--	--	See #11		See #11	N/A	See #11	N/A
	12	G	7.9	106	73.7	0.0	73.7	--				N/A		N/A
	24	G	8.0	141	75.6	0.0	75.6	--				N/A		N/A
	36	G	8.0	142	75.8	0.0	75.8	--				N/A		N/A

APPENDIX A (Cont'd)

No.	Sample	Mos.	Condition in Container[1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°)[2]	Drying Time (hrs) S.T.[3]	D.H.[4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
13	Epoxy Top Coat														
		0	--	12.5	69	71.0	47.6	23.4	--	--	--	--	--	--[5]	--
		12	G	12.5	73	71.7	48.0	23.7	--	0.5	4.0	5.0	--	8.0[5]	4.0
		24	G	12.5	78	73.0	49.0	24.0	--	0.5	>24.0	5.5	--	24.1	4.5
		36	G	12.5	102	72.6	48.6	24.0	--	0.4	>24.0	4.5	--	25.0	4.0
14	Epoxy Top Coat														
		0	--	--	--	--	0.0	--	--	See #13		See #13	N/A	See #13	N/A
		12	G	8.0	125	77.0	0.0	77.0	--				N/A		N/A
		24	G	9.0	140	76.4	0.0	76.4	--				N/A		N/A
		36	G	8.0	142	75.4	0.0	75.4	--				N/A		N/A
15	Antifouling														
		0	--	13.5	79	82.7	55.2	27.5	--	--	--	--	--	--[5]	--
		12	G	13.4	83	84.4	55.7	28.7	--	0.1	--	3.0	--	7.5[5]	3.0
		24	G	13.5	88	84.1	60.8	23.3	--	0.1	>24.0	2.5	--	4.6	2.5
		36	G	13.6	103	84.0	57.7	26.3	--	0.2	>24.0	2.5	--	3.6	2.5
16	Polyester														
		0	--	10.5	97	63.9	28.4	35.5	--	--	--	--	--	--	--
		12	F,m	--	--	--	--	--	--	--	--	--	--	--	--
		24	--	--	--	--	--	--	--	--	--	--	--	--	--
		36	--	--	--	--	--	--	--	--	--	--	--	--	--
17	Urethane Primer														
		0	-	12.7	>143	61.4	--	9.9	--	--	--	--	--	--[5]	--
		12	G	12.6	>143	62.3	48.7	13.6	--	0.2	1.0	11.3	--	3.0[5]	4.0
		24	G	12.9	105	63.3	48.8	14.5	--	0.1	2.0	12.0	--	4.6	4.5
		36	G	12.7	102	63.8	48.0	15.8	--	0.3	2.0	11.0	--	<3.4	4.5
18	Urethane Top Coat	0	--	15.8	118	75.0	68.0	7.0	--	--	--	--	--	--[5]	--
		12	G	15.8	119	75.3	66.9	8.4	--	0.1	1.0	9.5	--	7.4[5]	6.0
		24	G	16.1	119	75.0	64.3	10.7	--	0.2	1.5	10.0	--	3.8	6.5
		36	G	15.9	120	74.9	64.2	10.7	--	0.2	1.0	10.5	--	<3.5	6.5
19	Urethane Catalyst	0	--	--	--	--	0.0	--	--	See #18		See #18	See #18	See #18	N/A
		12	G	9.4	66	64.0	0.0	64.0	--						N/A
		24	G	9.4	76	63.6	0.0	63.6	--						N/A
		36	G	9.4	86	64.0	0.0	64.8	--						N/A

TABLE A (Cont'd)

No.	Sample	Mos.	Condition in Container [1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°) [2]	Drying Time (hrs) S.T. [3]	Drying Time (hrs) D.H. [4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
20 through 28			Not included in field test program--failed to meet specification requirements												
29	Phenolic Primer MIL-P-12742A	6 [6]	C	≤11.0	80-100	≥70		28.5-30.5	--	≤6	≤72	--	--	C	≥5
		0	C	11.6	91	72.9	71.0 [7]	29.0 [7]	--	--	8.0	--	--	C	5
		12	C	11.7	98	72.9	72.0	28.0	66	--	9.0	3.0	--	--	6.3
		24	S,g	11.7	132	72.4	72.6	27.4	115	0.2	6.0	2.5	--	4.9	7.0
		36	F,L	--	--	--	--	--	--	--	--	--	--	--	--
30	Cold Plastic Antifouling MIL-P-19449	6 [6]	--	≥11.9	80-84	≥77.5			--	≤0.17	≤3.5	--	--	C	≥4
		0	--	12.2	82	79.1	43.1	36.0	--	0.2	2.7	--	--	--	6
		12	G	12.1	85	80.1	41.5	38.6	74	0.1	2.0	0.5	--	1.5 [5]	5.0
		24	G	12.3	83	79.1	41.8	37.3	87	0.4	4.0	0.5	--	3.5	6.5
		36	G	11.8	82	79.5	43.6	33.9	84	0.1	>24.0	0.5	--	3.4	6.5
31	Vinyl-Phenolic Primer	0	--	9.4	67	37.0	19.8	17.2	--	--	--	--	--	--	--
		12	G	9.4	97	37.2	21.8	15.4	--	0.2	0.5	0.8	--	8.0 [5]	6.0
		24 [8]	--	--	--	--	--	--	--	--	--	--	--	--	--
		36	--	--	--	--	--	--	--	--	--	--	--	--	--
32	Vinyl Mastic Topcoat	0	--	10.4	98	57.0	32.9	24.1	--	--	--	--	--	--	--
		12	G	10.3	103	57.4	36.5	20.9	--	0.1	0.2	6.8	--	8.0 [5]	3.3
		24 [8]	--	--	--	--	--	--	--	--	--	--	--	--	--
		36	--	--	--	--	--	--	--	--	--	--	--	--	--
33	Zinc Inorganic Silicate(liquid)	0	--	10.7	51	35.9	0.0	35.9	--	N/A	N/A	N/A	N/A	N/A	N/A
		12	G	10.7	51	35.6	0.0	35.6	--	N/A	N/A	N/A	N/A	N/A	N/A
		24	G	10.7	51	33.5	0.0	33.5	--	N/A	N/A	N/A	N/A	N/A	N/A
		36	G	10.7	51	34.7	0.0	34.7	--	N/A	N/A	N/A	N/A	N/A	N/A
34	Zinc Inorganic Silicate(powder)	0	--	N/A	N/A	N/A	100.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		12	G	N/A	N/A	N/A	100.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		24	G	N/A	N/A	N/A	100.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		36	G	N/A	N/A	N/A	100.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

APPENDIX A (Cont'd)

No.	Sample	Mos.	Condition in Container[1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°)[2]	Drying Time (hrs) S.T.[3]	Drying Time (hrs) D.H.[4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
5	Zinc Inorganic Silicate (curing soln)	0	--	--	--	--	0.0	--	--	N/A	N/A	N/A	N/A	N/A	N/A
		12	G	8.0	<42	37.5	0.0	37.5	--	N/A	N/A	N/A	N/A	N/A	N/A
		24	G	8.1	<42	39.4	0.0	39.4	--	N/A	N/A	N/A	N/A	N/A	N/A
		36	G	8.1	<42	39.9	0.0	39.9	--	N/A	N/A	N/A	N/A	N/A	N/A
6	Vinyl Pretreatment (acid component) MIL-P-15328	0	C	7.4	--	18.9	0.0	N/A	--	N/A	N/A	N/A	N/A	N/A	N/A
		12	G	7.8	<42	18.0	0.0	N/A	--	N/A	N/A	N/A	N/A	N/A	N/A
		24	G	7.8	<42	19.3	0.0	N/A	45	N/A	N/A	N/A	N/A	N/A	N/A
		36	G	7.8	<42	18.3	0.0	N/A	45	N/A	N/A	N/A	N/A	N/A	N/A
7	Vinyl-Alkyd Enamel MIL-P-16738B	6/	C	8.6-9.0	60-67	43.0-47.0	19.0-22.0	24.0-27.0	--	≤0.25	≤0.5	--	--	--	≥5
		0	C	9.0	61	47.0	--	25.5	--	0.1	0.3	--	--	--	6
		12	G	9.0	60	46.9	23.0	23.9	59	0.1	0.3	2.0	--	>8.0[5]	7.0
		24	G	9.0	60	47.5	21.4	26.1	58	0.1	0.1	2.0	--	26.1	7.5
		36	G	9.1	60	47.8	22.7	25.1	58	0.1	0.1	3.0	--	27.4	7.5
8	Saran MIL-L-18389 Type I	6/	--	7.4-7.8	60-67	19.5-25.0	6.0-8.5	13.5-16.5	--	--	--	N/A	--	--	≥7
		0	--	7.6	61	21.0	6.6	14.4	--	--	--	N/A	--	--	7.0
		12	S	7.7	62	21.6	7.1	14.5	<20	0.1	0.2	N/A	--	8.0[5]	7.0
		24	F/2, L	7.3	63	23.0	7.5	15.5	<20	0.1	0.1	N/A	--	23.6	7.5
		36	--	--	--	--	--	--	--	--	--	--	--	--	--
9	Saran MIL-L-18389 Type II	6/		7.2-7.6	60-67	17.0-22.0	3-5	14.0-17.0	--	--	--	--	--	--	≥7
		0	--	7.3	60	17.5	3.1	14.4	--	--	--	N/A	--	--	7.0
		12	G	7.4	59	17.7	3.3	14.4	<20	0.1	0.1	N/A	--	>8.0[5]	7.5
		24	F/2, L	7.3	63	18.6	3.7	16.7	<20	0.1	0.1	N/A	--	16.2	7.5
		36	--	--	--	--	--	--	--	--	--	--	--	--	--
10	Vinyl Primer MIL-L-15929A	6/	--	9.2-9.8	68-78	37.0-41.0	21.0-24.0	15.0-18.0	--	≤0.25	≤0.5	--	--	--	≥6
		0	--	9.8	68	38.8	21.7	17.1	--	<0.1	0.2	--	--	--	6
		12	G	9.4	65	36.0	22.4	13.6	47	<0.1	0.5	4.0	--	>8.0[5]	7.5
		24	G	9.3	66	38.1	26.4	18.0	42	<0.1	1.2	5.0	--	4.2	7.5
		36	G	9.4	63	37.8	21.8	16.0	45	<0.1	3.0	4.0	--	4.4	7.0
11	Vinyl Antifouling MIL-P-15931A	6/	--	13.8-14.6	65-80	67.0-70.0	53.0-57.5	12.0-14.0	--	≤0.25	≤0.75	--	--	--	≥5
		0	--	14.2	72	68.8	54.9	13.9	--	<0.1	0.5	--	--	--	5
		12	G	13.7	71	69.0	54.9	14.1	56	<0.1	2.0	1.3	--	3.4[5]	4.5
		24	G	14.4	65	70.6	53.0	14.8	61	<0.1	1.0	1.3	--	<3.4	4.5
		36	G	14.6	77	72.0	56.8	13.8	67	<0.1	0.1	1.3	--	<3.3	1.0

APPENDIX A (Cont'd)

No.	Sample	Mos.	Condition in Container[1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°)[2]	Drying Time (hrs) S.D.[3]	Drying Time (hrs) D.H.[4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
42	Coal Tar MIL-C-18480A	6/	--	--	--	--	--	--	≥95	≤4.0	--	--	--	--	--
		0	--	N/A	>143	77.4	--	N/A	--	--	--	--	--	--	0.0
		12	G	N/A	>143	78.4	--	N/A	113	0.2	>24	1.0	--	--	0.0
		24	G	N/A	>143	83.4	--	N/A	106	0.1	>24	1.0	--	--	0.0
		36	G	N/A	>143	76.1	--	N/A	128	0.2	>24	1.0	--	--	0.0
43	Phenolic Primer	0	--	17.5	N/A	96.9	65.6	31.3	--	--	--	--	--	--	--
		12	G	17.9	N/A	96.9	65.6	31.3	--	0.1	4.0	6.8	--	>8.0[5]	0.0
		24	G	17.5	N/A	97.3	67.1	30.2	--	0.1	3.0	8.0	--	8.6	0.0
		36	G	17.8	N/A	96.7	65.1	31.6	--	0.1	2.0	8.0	--	7.7	0.0
43-1	Phenolic Primer Catalyst	0	--	--	--	--	0.0	--	--	See #43		See #43	N/A	See #43	N/A
		12	G	8.0	51	37.9	0.0	37.9	--				N/A		N/A
		24	G	8.0	53	36.0	0.0	36.0	--				N/A		N/A
		36	G	8.0	50	33.6	0.0	33.6	--				N/A		N/A
43-2	Phenolic Primer Powder	0	--	N/A	N/A	N/A	100.0	N/A	N/A	See #43		See #43	N/A	See #43	N/A
		12	G	N/A	N/A	N/A	100.0	N/A	N/A				N/A		N/A
		24	G	N/A	N/A	N/A	100.0	N/A	N/A				N/A		N/A
		36	G	N/A	N/A	N/A	100.0	N/A	N/A				N/A		N/A
43-3	Phenolic Primer Thinner	0	--	--	--	--	0.0	--	--	See #43		See #43	N/A	See #43	N/A
		12	G	7.1	<42	0.0	0.0	0.0	--				N/A		N/A
		24	G	7.1	<42	0.0	0.0	0.0	--				N/A		N/A
		36	G	7.1	<42	0.0	0.0	0.0	--				N/A		N/A
44	Phenolic Top Coat	0	--	13.3	>143	94.6	46.5	48.1	--	--	--	--	--	--	--
		12	G	13.4	>143	94.9	47.5	47.4	--	0.5	2.0	6.0	--	4.4[5]	5.0
		24	G	13.4	>143	95.9	47.2	48.7	--	0.5	3.0	8.0	--	<3.7	5.5
		36	G	13.3	>143	94.6	46.0	47.7	--	0.4	2.5	7.0	--	4.0	5.5
45	Coal Tar Epoxy	0	--	15.5	>143	91.3	--	--	--	--	--	--	--	--	--
		12	G	15.7	>143	91.8	62.5	29.3	--	0.2	9.0	1.0	--	4.1[5]	0.0
		24	G	15.6	>143	93.6	62.6	31.0	--	0.5	10.0	1.5	--	5.9	0.0
		36	G	15.5	>143	93.2	65.2	28.0	--	0.3	11.0	1.5	--	<3.6	0.0

APPENDIX A (Cont'd)

No.	Sample	Mos.	Condition in Container[1]	Wt/gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°)[2]	Drying Time (hrs) S.T.[3]	Drying Time (hrs) D.H.[4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (%)	Fineness of Grind (N.S.)
46	Coal Tar Epoxy Catalyst	0	--	--	--	--	0.0	--	--	See #45		See #45	N/A	See #45	N/A
		12	G	7.3	<42	0.2	0.0	0.2	--				N/A		N/A
		24	G	7.3	<42	0.2	0.0	0.2	--				N/A		N/A
		36	G	7.3	<42	0.1	0.0	0.1	--				N/A		N/A
47	Phenolic Seal Coat	0	--	12.2	92	89.8	--	43.2	--	--	--	--	--	-- [5]	--
		12	G	12.4	100	91.5	48.7	42.8	--	0.8	6.0	1.0	--	7 [5]	4.5
		24	G	12.2	100	92.7	47.3	45.4	--	0.9	--	1.0	--	5.8	4.0
		36	G	12.3	100	91.2	44.6	46.6	--	0.6	5.5	1.5	--	10.0	6.0
48	Phenolic Seal Coat Catalyst	0	--	--	--	--	0.0	--	--	See #47		See #47	N/A	See #47	N/A
		12	G	7.3	<42	0.7	0.0	0.7	--				N/A		N/A
		24	G	7.3	<42	0.3	0.0	0.3	--				N/A		N/A
		36	G	7.3	<42	0.3	0.0	0.3	--				N/A		N/A
49	Phenolic Top Coat	0	--	12.1	105	83.7	45.7	38.0	--	--	--	--	--	-- [5]	--
		12	G	12.3	108	85.5	49.3	36.2	--	0.2	4.0	4.0	--	7.9 [5]	6.0
		24	G	12.3	106	84.8	48.8	36.0	--	0.4	5.0	4.5	--	<3.5	6.0
		36	G	12.4	106	86.1	46.1	40.0	--	0.4	4.0	5.0	--	<3.6	6.0
50	Phenolic Top Coat Catalyst	0	--	--	--	--	0.0	--	--	See #50		See #50	N/A	See #50	N/A
		12	G	7.4	<42	0.5	0.0	0.5	--				N/A		N/A
		24	G	7.5	<42	0.4	0.0	0.4	--				N/A		N/A
		36	G	7.5	<42	0.5	0.0	0.5	--				N/A		N/A
51	Vinyl Primer	0	--	8.2	54	30.4	--	--	--	--	--	--	--	-- [5]	--
		12	G	8.3	54	31.6	14.7	16.9	35	<0.1	0.1	0.5	--	>8.0 [5]	6.0
		24 [2]	G	8.2	55	31.0	14.0	17.0	35	<0.1	0.1	0.5	--	>8.0 [5]	6.5
		36 [2]	--	--	--	--	--	--	--	--	--	--	--	--	--
52	Vinyl Body Coat	0	--	9.9	85	50.5	36.5	14.0	--	--	--	--	--	-- [5]	--
		12	G	10.0	88	51.8	39.4	12.4	49	<0.1	0.1	3.5	--	2.6 [5]	1.0
		24	G	10.0	82	50.6	36.5	14.1	50	<0.1	0.1	3.5	--	1.7 [5]	1.5
		36 [8]	--	--	--	--	--	--	--	--	--	--	--	--	--

APPENDIX A (Cont'd)

No.	Sample	Kos.	Condition in Container[1]	Wt/Gal (lb/gal)	Viscosity (KU)	Total Non-volatile (% by wt)	Pigment (% by wt)	Non-volatile Vehicle (% by wt)	Flash Point (F°)[2]	Drying Time (hrs) S.T.[3]	Drying Time (hrs) D.H.[4]	Hiding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (T)	Fineness of Grind (N.S.)
53	Vinyl Top Coat														
		0	--	7.7	53	23.3	7.6	15.7	--	--	--	--	--	--	--
		12	C	7.8	53	23.9	7.3	16.6	31	<0.1	0.1	3.0	--	23.9	7.5
		24	G	7.8	53	22.9	6.7	16.2	31	<0.1	0.1	3.0	--	<3.3	7.5
		36[8]	--	--	--	--	--	--	--	--	--	--	--	--	--
54	Epoxy Primer														
		0	--	12.5	66	71.2	49.2	22.0	--	--	--	--	--	--	--
		12	G	12.7	65	72.5	50.1	22.4	--	0.2	9.0	3.8	48	4.4[5]	4.3
		24	G	12.6	63	69.4	49.0	20.4	--	0.3	9.5	3.0	26	6.4	4.0
		36	G	12.6	62	69.0	49.1	19.9	--	0.1	8.5	3.0	28	<3.7	4.0
55	Epoxy Primer Catalyst	0	--	--	--	N/A	0.0	N/A	--	See #54		See #54	See #54	See #54	N/A
		12	G	--	--	N/A	0.0	N/A	--						N/A
		24	G	--	--	N/A	0.0	N/A	--						N/A
		36	G	--	--	N/A	0.0	N/A	--						N/A
56	Epoxy Phenolic Top Coat	0	--	--	61	70.9	36.5	34.4	--	--	--	--	--	--	--
		12	G	10.9	61	72.9	36.7	36.2	--	0.2	6.5	1.0	17	3.4[5]	5.5
		24	G	10.8	61	69.1	36.8	32.3	--	0.7	--	1.0	24	<3.4	5.5
		36	G	10.7	61	69.4	36.6	32.3	--	0.2	8.0	0.8	56	<3.3	6.0
57	Epoxy Phenolic Top Coat Catalyst	0	--	--	--	N/A	0.0	N/A	--	See #56		See #56	See #56	See #56	N/A
		12	G	--	--	N/A	0.0	N/A	--						N/A
		24	G	--	--	N/A	0.0	N/A	--						N/A
		36	G	--	--	N/A	0.0	N/A	--						N/A

1/ - Description of condition in container

C - Conforms to specification
G - Good
F - Failed (F/2 used when half of remaining cans failed) and removed from program
s - Skinning
L - Livering or gelling
g - Gel-bodies
m - Solidified mass

2/ - Flash points of 2-component systems not determined

3/ - Set-to-touch

4/ - Dry hard

5/ - Tin plate as substrate

6/ - Data in this row are specification requirements

7/ - These data are based on percent of total non-volatile as required by the specification rather than on the percent of total paint

8/ - Failed during field exposure and removed from program

APPENDIX B

SOURCES OF COATING MATERIALS

Number	Coatings	Source
1	Proline 2001 L-S Orange Primer	San Diego Coatings 2646 Main Street San Diego California
1-a	Proline 2001 L-S Orange Primer Catalyst	San Diego Coatings
2	Proline 2002 Seal-Tex Dielectric Black	San Diego Coatings
3	Proline 2002 Seal Coat	San Diego Coatings
4	Proline 2003 Seal Coat	San Diego Coatings
5	Proline 2003 Seal Coat Catalyst	San Diego Coatings
6	Proline 2004 Impervium White	San Diego Coatings
7	Proline 2004 Impervium White Catalyst	San Diego Coatings
8	Proline 2005 Epoxy Reducer	San Diego Coatings
9	Proline 3001, Primer	San Diego Coatings
10	Proline 3001, Primer Catalyst	San Diego Coatings
11	Proline 3002, Buildcoat	San Diego Coatings
12	Proline 3002, Buildcoat Catalyst	San Diego Coatings

Number	Coatings	Source
13	Proline 3003 Impervium White	San Diego Coatings (see No. 1 for address)
14	Proline 3003 Impervium White Catalyst	San Diego Coatings
15	White Antifouling	San Diego Coatings
16	Polyester	San Diego Coatings
17	Laminar No. 4-G-14	Magna Coatings & Chemical Corporation 1785 North Eastern Ave. Los Angeles, Calif.
18	Metalox X-500 White 11W6	Magna Coatings & Chemical Corporation
19	Hardener 50-C-3	Magna Coatings & Chemical Corporation
29	Phenolic Primer MIL-P-12742A	National Lead Company 3113 East 26th Street Los Angeles, Calif.
30	Antifouling, Cold Plastic shipbottom, black MIL-P-19449	American Marine Paint Company 311 California Street San Francisco, Calif.
31	Amercoat 86, Primer	Amercoat Corporation 4809 Firestone Boulevard South Gate, Calif.
32	Amercoat 87 Vinyl Mastic White	Amercoat Corporation
33	Dimetcote No. 3	Amercoat Corporation
34	Dimetcote No. 3 Powder	Amercoat Corporation
35	Dimetcote No. 3 D-3 Curing Solution	Amercoat Corporation

Number	Coatings	Source
36	Pretreatment Primer MIL-P-15328B	National Lead Company (see No. 29 for address)
37	Vinyl-alkyd Enamel MIL-P-16738B	National Lead Company
38	Vinylidene Resin Lacquer MIL-L-18389, Type I	National Lead Company
39	Vinylidene Resin Lacquer MIL-L-18389, Type II	National Lead Company
40	Vinyl-red Lead Primer MIL-P-15929A	National Lead Company
41	Vinyl Antifouling MIL-P-15931A	National Lead Company
42	Coal Tar Base MIL-C-18480A	National Lead Company
43	Phenolic 300 Orange Primer	Carboline Company 32 Hanley Industrial Court St. Louis, Missouri
44	Phenolic 300 White Topcoat	Carboline Company (see No. 43 for address)
45	Carbomastic No. 3	Carboline Company
46	Carbomastic No. 3 Catalyst	Carboline Company
47	Phenolic 305-2	Carboline Company
48	Phenolic 305-2	Carboline Company
49	Phenoline 305	Carboline Company
50	Phenoline 305 Catalyst	Carboline Company

Number	Coatings	Source
51	Super Vynal Primer 21-01	National Lead Company (see No. 29 for address)
52	Super Vynal Bodycoat 21-02	National Lead Company
53	Super Vynal Seal Coat 21-03	National Lead Company
54	Plasite #7103 Primer, White	Wisconsin Protective Coating Corporation Green Bay, Wisconsin
55	Plasite #7103 Primer, White Catalyst	Wisconsin Protective Coating Corporation
56	Plasite #7122-H Cold Set Coating Medium Gray	Wisconsin Protective Coating Corporation
57	Plasite #7122-H Cost Set Coating Medium Gray Catalyst	Wisconsin Protective Coating Corporation