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SHELF-LIFE OF PROTECTIVE COATINGS

BY

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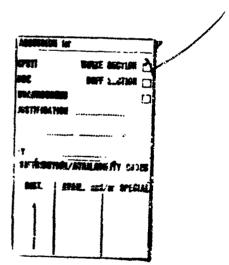
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ABSTRACT

A number of physical and chemical analyses of protective coatings are being conducted to determine their storage stability for a auration of three years. Or the 52 coating components reported, only a fav 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

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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. I-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 produced 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, fieshly 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.

<u>Condition in Container</u>. 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.

<u>Weight Per Gallon</u>. 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.

<u>Viscosity</u>. 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 Vebicle content. Percentages of total nonvolatile and nonvolatile vehicle contents of materials were determined by the FTMS No. 141, Method 4041, and Method 4053, respectively.

<u>Fineness of Grind</u>. Fineness of grind of each pignented 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.

Fiash Point of Pigmented Materials. The flash point of all coatives, except multicomponent systems, was determined by Pensky-Martens closedcup 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 sedium 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 hours

* 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 day hiding power in mils were developed. A inding 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 wit'i 40 K- and 15 ma applied to the x-ray tube. Patterns were obtained at a scanning speed of 1⁰ 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 tes 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 wellventilated oven maintained at 105° \neq 2° C (221° \neq 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 \neq 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 Indéx" was reported as the average weight loss in milligrams per 1900 cycles of abrasion.

<u>Flexibility</u>. 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 calitrated 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.

<u>Condition in Container</u>. Among the 52 specimens under consideration, J 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.

<u>Viscosity</u>. 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 (artifouling); 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 nonvolstile.

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 (ccal tar epoxy) showed a notable increase in pigment content, while No. 18 (urethanc) 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 snowed 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 shelflife 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 antifouling) 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 (epory 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 parterns 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 copcost) were reallable at this time. Both samples showed a decrease in abrasion resistance as a result of aging on the shelf (see Appendix A). The realidity of this test method will be discussed in a separate report at a later date.

<u>Flexibility</u>. 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 5 percent and wer 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 topcoac) 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.

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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.

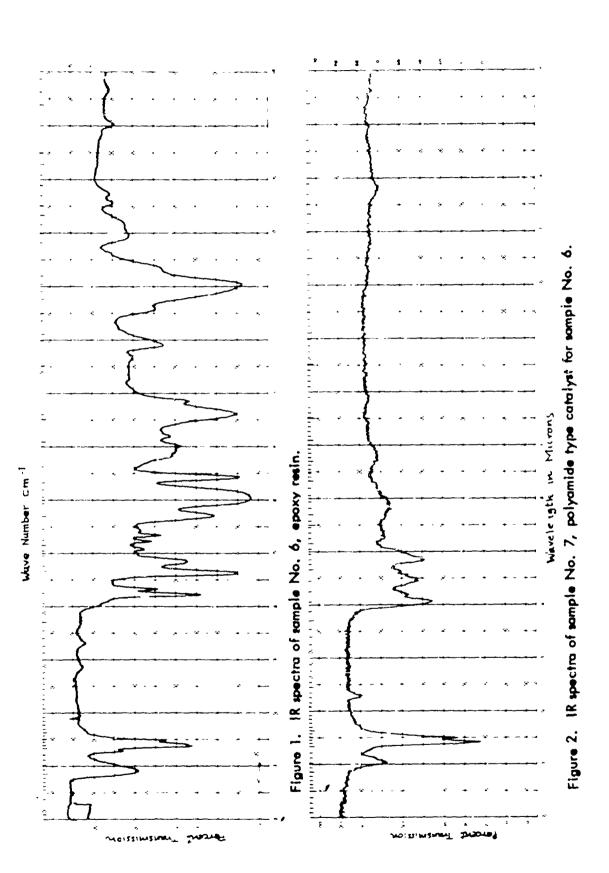
2. Almost all coatings under the study tended to increase in viscosity, but in varying degree. Samples Nos. 2 and 29 showed a rapid increase in viscosity during the storage and eventually deteriorated beyond usefulness.

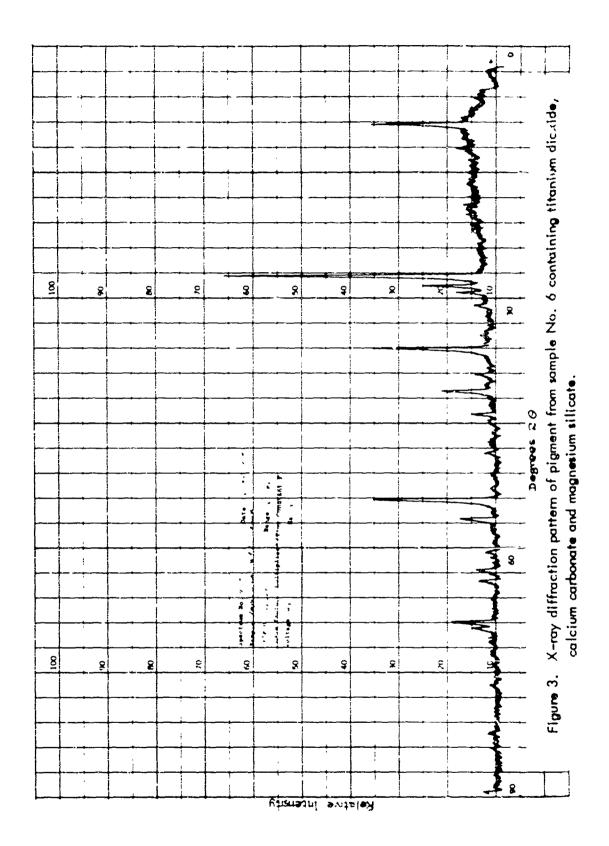
3. Host of the coatings increased slightly in nonvolatile content as they aged on the shelf, but most of the catalysts decreased in nonvolatile content.

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.





APPENDIX A

Analytical Data of Coatings on Shelf-Life Test

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0 0.0 See #4 See #4 N/A See #4 N/A See #4 N/A See #4 36 #5.0 N/A See #4 N/A See #4 N/A See #4 36 #5.0 N/A 36 #5.8 0.0 85.8 N/A 36 #5.8 0.0 85.8 N/A 36 #5.1 0.0 84.1		tpoxy Seal Coal											:	:		
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C 8.0 140 85.8 0.0 85.8 N/A C 8.0 140 84.1 0.0 84.1 N/A			2	ъ	8.0	136	87.7	0.0	87.7	;				V/N		N/N
G 8.0 140 84.1 0.0 84.1 N/A			7	G	8.0	071	85.8	0.0	85.8	1				V/N		V/N
			36	G	8.0	140	84.1	0.0	84.1	1				N/N		N/N

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a second depts a new wire strain **after set me**

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10 111 11	10 111.2 77.2 38.4 77.2 38.4 77.2 38.4 77.2 38.4 77.2 57.5 38.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.5 58.4 77.2 57.6 77.2 57.6 77.2 57.6 77.2 57.6 77.2 57.6 77.2 57.6 77.5 58.4 77.2 57.6 77.5 57.6 77.7 56.6 77.7 56.6 77.7 56.7 77.6	Epoxy 1	Cop Coat					1		. !							
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Flowy Trainer Description	Fromy Top Coart 0 See 6 See 6 See 6 See 6 See 6 See 6 See 6			9	و	0.11	0					1 1				•	
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10 <	12 C 6.9 NA 0.0<	1		c	:	;	N'N	:	0.0	!	;	N/N	N/N	V/N	N/N	N/A	N/N
Total Primer Total Primer<	Foor Filter 0.0 <			12	C	6-9	N/N	0.0	0.0	0.0	1	N/N	N/N	N/N	N/N	N/A	N/N
76 6 6,9 WA 0.0 0.0 0.0 0.0 0.0 1.0 NA	16 C 6.9 N/A 0.0 0.0 0.0 M/A N/A N/A Epoxy Primer 12 C 11.6 55 66.9 44.6 22.3 N/A N/A 12 C 11.16 65 66.9 44.6 22.3 0.0 0.1 10.3 7.0 23 C 11.1.6 65 66.9 44.5.5 22.3 0.1 10.0 0.1 10.3 7.0 36 C 11.4 69 68.5 45.9 22.6 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 0.1 10.0 11.0 0.1 10.0 10.0 10.0 10.1 <			1.1	. 0	6.9		0.0	0.0	0.0	1	N/N	N/A	N/A	N/N	N/N	V /N
Foor Fritter 0 1 66.9 44.6 22.3 1 0 1 30 7.0 1 30.9	Forry Primer 0			36	U	6'9	V/N	0.0	0.0	0.0	ł	V/N	V/N	V/N	V/N	N/A	V /N
0 11.6 65 64.6 44.6 22.3 <th< td=""><td>0 11.6 65 64.6 44.6 22.3 0.3 7.0 24 0 11.6 72 66.9 45.5 22.5 0.1 10.0 36 0 11.6 65 66.9 45.5 22.5 0.1 10.0 36 0 11.6 69 66.9 47.5 22.10 0.1 10.0 25 0 12 0 96.5 45.9 22.10 0.1 10.0 26 11.4 69 66.6 47.0 72.3 0.0 72.9 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 12 0.1 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 10.1 11 10.0<td>Factor 1</td><td>T S E S T</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></th<>	0 11.6 65 64.6 44.6 22.3 0.3 7.0 24 0 11.6 72 66.9 45.5 22.5 0.1 10.0 36 0 11.6 65 66.9 45.5 22.5 0.1 10.0 36 0 11.6 69 66.9 47.5 22.10 0.1 10.0 25 0 12 0 96.5 45.9 22.10 0.1 10.0 26 11.4 69 66.6 47.0 72.3 0.0 72.9 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 10.0 12 0.1 12 0.1 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 11 10.0 12 10.1 11 10.0 <td>Factor 1</td> <td>T S E S T</td> <td></td>	Factor 1	T S E S T														
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24 C 11.6 68 68.0 47.0 21.0 - 0.2 10.0 - - 5.3 Fory Frimer 0 - - 0.1 17.0 10.0 - 5.4 5.9 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.6	24 C 11.6 68 66.0 47.0 21.0 0.1 12.0 36 C 11.4 69 68.5 45.9 22.6 0.1 12.0 Fpoxy Frimer 12 C 7.9 85 72.9 0.0 72.9 0.1 12.0 24 C 8.0 104 72.3 0.0 72.9 0.1 12.0 25 G 8.0 104 72.3 0.0 72.9 0.1 12.0 26 8.0 104 72.3 0.0 72.9 0.1 12.0 26.0 11.2 6 69.6 69.6 47.0 72.3 0.0 72.9 0.1 12.0 26.0 112 0 12 0.0 72.3 0.0 72.3 0.3 24.0 13.7 24.0 13.7 0.0 72.3 14.0 25.0 14.0 13.2 10.0 13.2 10.0 13.2 10.0 13.7			12	U	11.6	72	68.0	45.5	22.5	;		7.0	:	:	ີ່ ຕໍ່	4.5
36 c 11.4 69 68.5 45.9 22.6 0.1 12.0 10.5 4.4 Fpoxy Filmer 12 c 7.9 85 72.9 0.0 72.9 566 9 N/A 566 9 N/A 566 9 N/A 566 9 8 72.3 0.0 72.3 9.0 72.3 72.4 10.0 10.5 74.0 74.0 74.0 74.0 74.0 74.0 74.0 74.0 7	36 6 11.4 69 68.5 45.9 22.6 0.1 15.0 Fpoxy Primer 12 c 71.9 85 77.9 0.0 72.9 21.6 0.1 15.0 Zet alyst 0 $ 0.1$ 12.0 $ 0.1$ 12.0 Zet alyst 0 $ 0.0$ 72.3 0.0 72.3 $ 0.1$ 15.0 Zet alyst 0 $ 0.0$ 72.3 0.0 72.3 $ 0.1$ 15.0 Zet alyst 0 0.0 72.3 0.0 72.3 $ 0.3$ 24.0 Epoxy build $ 11.7$ 21.0 47.7 22.16 $ 0.3$ 24.0 Zoat Catalyst 0 $ 11.7$ 47.5 24.0 0.3 24.0 0.3 24.0 0.3 24.0 0.3 24.0 <td< td=""><td></td><td></td><td>24</td><td>ც</td><td>11.6</td><td>68</td><td>68.0</td><td>47.0</td><td>21.0</td><td>1</td><td></td><td>10.0</td><td>10.0</td><td>:</td><td>2.5</td><td>2°0</td></td<>			24	ც	11.6	68	68.0	47.0	21.0	1		10.0	10.0	:	2.5	2°0
Fpory Filmer 24 26 71.9 55 72.9 0.0 72.9 0.0 72.9 $56e$ 99 NA $5ee$ 99 NA See 99 NA See 99 NA	Foury FrimerCatalyst0 0.0 72.9 85 77.9 85 77.9 $5ee 49$ 24 C 8.0 98 72.3 0.0 72.3 $$ $5ee 49$ 24 C 8.0 98 72.3 0.0 72.3 $$ $$ 24 C 8.0 98 72.3 0.0 72.3 $$ $$ 24 C 8.0 104 72.3 0.0 72.3 $$ $$ 24 C 12.2 69 69.6 47.0 22.6 $$ $$ 24 C 12.1 72 70.6 47.0 22.6 $$ $$ 24 C 12.1 72 70.6 47.0 22.6 $$ 0.3 24.0 20 0.0 $$ 12.2 69.6 47.0 22.6 $$ 0.3 24.0 24 24 22.6 27.9 27.2 $$ 0.3 74.0 22.6 $$ 24 0.0 $$ $$ 22.6 $$ $$ 0.3 74.0 20 0.0 $$ $$ 22.6 $$ $$ 0.3 74.0 24 0.0 $$ $$ $$ $$ 0.3 74.0 $$ 24 0.0 $$ $$ $$ $$ 0.3 74.0 24 0.0 $$ $$ $$ $$ 0.3 74.0 <			36	9	11.4	69	68.5	45.9	22.6	•		0.0	10.5	:	4.62	4.5
Contyst 0 <t< td=""><td>Catalyst 0 <</td><td></td><td>rimer</td><td></td><td></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td><td></td><td>04</td><td></td><td>C</td><td></td></t<>	Catalyst 0 <		rimer						4					04		C	
12 C 7.9 85 72.3 0.0 72.3 5.0 10 72.3 5.0 72.3 5.0 72.3 72.4 72.3 72.4 72.3 72.4 72.3 72.2 74.2 <td>12 C 7.9 85 72.9 0.0 74.0 <th< td=""><td>Cate</td><td> yst</td><td>0</td><td>;</td><td>;</td><td>::</td><td>: :</td><td>0.0</td><td>;;;</td><td>ļ</td><td>See 4</td><td></td><td>266 13</td><td>V/N</td><td>255 1.7</td><td></td></th<></td>	12 C 7.9 85 72.9 0.0 74.0 <th< td=""><td>Cate</td><td> yst</td><td>0</td><td>;</td><td>;</td><td>::</td><td>: :</td><td>0.0</td><td>;;;</td><td>ļ</td><td>See 4</td><td></td><td>266 13</td><td>V/N</td><td>255 1.7</td><td></td></th<>	Cate	yst	0	;	;	::	: :	0.0	;;;	ļ	See 4		266 13	V /N	255 1.7	
Coat 0.0 72.3 0.0 72.4 0.0 72.4 0.0 72.4 0.0 72.2 24.2	Cost Cost <thcost< th=""> Cost Cost</thcost<>			22	0 0	6.7	58 58	6.21	0.0	6°7/	:				V/N		
Epoxy BuildEpoxy Build $$ 12.2 69.6 47.0 22.6 $$ <	Fpoxy Build 12 0 -1 12.2 69.6 47.0 22.6 -1			9 S	ט נ	0.0 8	104	72.3	0.0	72.3	1				V/N		N/N
Coat 0 12.2 09.0 47.0 22.0 24.2 25.2 2 22.1 24.2 24.2 24.2 24.0 1.0 24.2 25.2 24.2 24.2 25.2 24.2 25.2 25.2 24.2 24.2 25.2 25.2 24.1 10 10 24.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 25.2 <th< td=""><td>Coat 0 12.2 09 99.6 47.0 22.0 0.7 24.0 0.7 24.0 0.3 24.0 1.3</td><td></td><td>bu î l d</td><td></td><td></td><td></td><td></td><td></td><td>ŗ</td><td></td><td></td><td></td><td></td><td>1</td><td>;</td><td>1</td><td>:</td></th<>	Coat 0 12.2 09 99.6 47.0 22.0 0.7 24.0 0.7 24.0 0.3 24.0 1.3		bu î l d						ŗ					1	;	1	:
Image: Section of the sectin of the section of th	Lie Control Matrix	Coat		<u>ء</u> د	:.	7.21	50	0.40 2.05	0.14	0°77				0	: 1	20.00	6
56 5 12.0 2.0 71.7 47.5 2.4.2 0.3 2.4.0 1.0 25.2 50 5 12.0 2.0 82 71.7 47.5 2.4.2 0.3 2.4.0 1.0 25.2 500 5 5 2.4.2 0.3 2.4.0 1.0 25.2 500 5 5 0.0 25.2 25.2 500 5 0 0.0 73.7 5 5 6 11 8 8 8 106 73.7 25.6 0.0 75.6 0.0 17 17 17 5 5 11 17 10 17 10 1	Epoxy Build 56 6 12.0 $\%$ 71.7 47.5 24.2 -1 0.3 24.0 Epoxy Build Coat Catalyst 0 -1 -1 -1 0.0 -1 0.3 24.0 Coat Catalyst 0 -1			27	5 נ	8.11 2.1	2 5	(°0/	1.14	0.12	: :		0.0 0 0		:	24.2	
Epoxy Build See #11 N/A See #11<	Epoxy Build See #11 Coat Catalyst 0 56 #11 Coat Catalyst 0 12 C 7.9 106 73.7 0.0 73.7 24 C 8.0 141 75.6 0.0 75.6 36 C 8.0 142 75.8 0.0 75.8			36	9 0			71.7	47.5	24.2			54.0	1.0	•	25.2	4.0
0 0.0 See #11 See #11 NA SA	0 0.0 5ee #11 12 G 7.9 106 73.7 0.0 73.7 5ee #11 24 G 8.0 141 75.6 0.0 75.6 36 G 8.0 142 75.8 0.0 75.8	ц Ц	bliu														
G 8.0 141 75.6 0.0 75.6 N/A	C 8.0 141 75.6 0.0 75.6 C 8.0 142 75.8 0.0 75.8	Coat	Catalyst		: 0		106	73.7	0.0	 1.E1	::	See #	11	See #11	V /N	See #11	₹/% ₹/%
	G 8.0 142 75.8 0.0 75.8			24	U	8.0	141	75.6	0.0	15-6	;				N/N		4/N

2	APPEDEX A (Cont'd)	(P.													
жо.	S a le	Hoe.	Condition in Containerly	Vc/Gal (1b/gal)	Viscosity (EU)	Total Non-volatile (X by vt)	Pigment (X by vt)	Non-volatile Vehicle (Z by vt)	Flash Point $(F^0) \frac{2}{2}$	Drying Time (hrs) S.T.J. D.H.	Time [,] D.H. <u>4</u> /Hid	Time) D.H.4/(dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (7)	Fineness of Grind (N.S.)
1	Epert Top Cost	1													
	•		:	12.5	69	71.0	47.6	23.4	:		;	:	1		;
		12	U	12.5	73	71.7	48.0	23.7	:	0.5	4.0	5.0	:	8	4.0
		24	U	12.5	78	73.0	49.0	24.0	:		4.0	5. 5	:	24.1	4.5
		36	IJ	12.5	102	72.6	48.6	24.0	ł		4.0	4.5	:	25.0	4.0
A I	Emoty Top Cost				-										
		0	:	;	:	;	0*0	ţ	:	See #13		See #13	N/A	See #13	V/N
		12	G	9.0	125	77.0	0.0	77.0	:				N/N		V/V
		17	0 0	0.6	041	76.4	0.0	76.4	:				N/A		N/N
		98	U	0.8	142	75.4	0.0	75.4	:				V/N		V /N
-	Antifamiline														
		0	:	5.61	79	82.7	55.2	27.5	1		:	:	;	:	:
		2	U	4.61	63	1.4	55.7	28.7	ř		:	3.0	:	بع. ر	3.0
		7	U	13.5	3	84.1	60. B	23.3	;	0.1 2	~24.0	2.5	:	4.6	2.5
	1	36	IJ	13.6	103	0,48	57.7	Z6.3	:		4.0	2.5	:	3.6	2.5
16	Pelvester			;											
		0	:	10.5	97	63.9	28.4	35.5	;	ł	:	;	:	:	:
		ជ	Z,=	:	;	:	;	;	:	;	;	:	:	:	;
		72	. :	:	ł	:	:	1		;	:	:	;	;	:
		*	:	:	ł	;	;	;	;	:	:	;	:	:	;
11	Uretheme Primer	ĥ													
			•	12.7	>143	61.4	:	6.9	1	1	:	:	:	1.1	;
		1	U I	12.6	>143	62.3	1.84	13.6	:	0.2	0.0	11.3	:		4 .0
		1 1	0 0	12.9	102	63.5 6	1. 1	14.5	::	0.3	2.0	11.0	::	•.• •.€	4.4 V.4
3	Urethese Tos														
	Cont	0	:	15.8	110	75.0	64.0	7.0	:	ł	:	;	;	·	:
		2	G	15.8	611	5.3	1 , 3	8.4	:	0.1	0.1	9.5		1	6 7
Ъл'		*	0 0	16.1	611	75.0		10.7	:	0°7		10.0	: :		6.5 2 2
		5	2							•••			•		
2	Urethane					••	•			•			0 - 4 - 1		
	Catalyst	2 2	:.	•	;;			1	1	See 718	0	See #10	246 410	266 118	V /N
		12	, .		8 4	5			: 1						V /X
		19		4	2 40 - 40		0.0	64.49	: :						. V /N
	3	1	,	•	•)	•								

Condition IJ Wr.(cal Viscolity Network (T Payer) Pair		1	Abrasi		Drying Time	Drying		Non-volatile		Total				6	(p. Juog) V XIC
Not included in field test program-failed to uset specification requirements	c Flexibility (c) (1)		Resista (mg/1000	Hiding Power (dry mils)	14 H	5.T ⁵	Flash Pgfnt (F ⁰) $\underline{\underline{2}}$	vahicle (Z by vE)	Pigment (1 by ut)	Non-volatile (X by wt)	Viscosity (XU)	Wt/Gel (1b/gel)	Condition 1 Container 1	Mos.	Saule
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$					ate	equí r emei	ification re	d to meet spec	sramfailed	field test pro	included in	Not			hrough 28
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	00		111	3.0	≤72 8.0 9.0	∜լ::	::3	28.5-3975 29.027 28.0	71.0 ² /	270 72.9	80-100 91 98	≤11.0 11.6	υυα		Phenolic Prime MIL-P-12742A
$ \begin{bmatrix} 5 \\ 1222 \\ 24$	4.4 	::	::	2.5	6.0	0.2	115	27.4	72.6	12.4	132	1.1	S.8 F.1	322	
	0 3.5 3.4	;;;;;;	:::::		2.0.27		1 1 7 6 8	36.0 38.6 37.3 33.9	43.1 41.5 41.8 43.6	2.772 79.1 1.05 1.05 1.05	80-84 82 85 83 83	211.9 12.2 12.1	11000	55 12 0 16	Cold Plastic Antifouling MIL-P-19449
$ \begin{bmatrix} 0 & & & & & & & & & & & & & & & & & &$	8.05/ 	::::	::::	: 8. : :			: : : :	17.2 15.4	14.8 21.8	370 37.2	56	661 1		36 13 0 3 5 7 0 3 5 7 0	Viny 1-Phenolic Primer
(d) 0 10.7 51 35.9 0.0 35.9 N/A N/A N/A 12 C 10.7 51 35.6 0.0 35.6 N/A N/A N/A 24 C 10.7 51 33.5 0.0 33.5 N/A N/A N/A 36 C 10.7 51 34.7 0.0 34.7 N/A N/A	.	::::	::::	9 1 9 1 1 9 1 1	0.2	0,1	::::	24.1 20.9 	32.9 36.5 	57.0 57.4 	86 C 1 1	10.4 10.3 		0 24 <u>8</u> 36	Vinyl Mastic Topcost
	A / N A / N A / N	V/8 V/8 V/8		V /2 V /2 V	V/N V/N	V/N V/N	::::	35.9 35.6 33.6	0.000	35.9 35.6 34.7	12 12 12	10.7 10.7 10.7 10.7	1000	(p	Zinc Inorganic Silicate(liqu
Zinc Inorganic Silicate (powdet) 0 N/A	V /# V/# V/#	V /N V /N V /N		V /2 2 2 2	V /N V /N	V/N V/N	V/N V/N	V/N V/N V/N	100.0 100.0 100.0	V/N V/N V/N	V /N V/N	V /N V /N	1000	er)	Zinc Inorganic Silicate(powd

APPENDIX A (Cont'd)

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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			Condition in	1-1/10		Total		Non-volatile	•	Ä			Abrasion		Fineness
	Sample	101	- 1	(15/41)		(Z by vt)	(X by wt)	Vehicle (X by wt)'	Flash Pgint $(F^0)^2$	Š	, D.H. 4/	liding Power (dry mils)	Resistance (mg/1000 cyc)	Flexibility (7)	of Grind (N.S.)
	Zinc lorganic														
	Silicate	0	;	:	:	:	0.0	:		N / N	A/a	A / A			
	(curing soln)		IJ	8.0	42	17.5		375					A/A	N/N	V/N
	•				3	19 4		7 01	1					V/N	V/N
		36		8.1	55	39.9	0.0	39.9	::	V /N	V / N	<	4 /2	V/5	V /N
	Vinyl Pretreat														
	(acid compone		U	7.4	:	18.9	0.0	N/A	;	N/A	N/N	N/N	N/N	N/A	A / A
	31L-P-15328	21	U	7.8	42	16.0	0.0	N/N	:	N/N	V/N	N/N	N/N	V/N	
$ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 &$		24	U	7.8	7	19.3	0.0	N/N	45	N/A	N/N	N/A	N/N	V/N	
$ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0$		36	o	7.8	4	18.3	0.0	N/N	45	N/N	N/N	N/N	V/N	V/N	V /2
$ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 &$	21	6/	G												
	VIRT L-ALEYO	, ^c	с с	8.6-9.0	60-67	43.0-47.0	19.0-22.0	24.0-27.0	;	₫.25	<u>8</u> .5		:	:	\$
	Lindige I	-	، ن	0.0	61	47.0	!	25.5	:	0.1	- <u>0</u> .3	:	;	: :	, -0
	900/01-J-71U		. د:	0.6	3	46.9	23.0	23.9	59	0.1	0.3	2.0	:	<u>ک</u> اک	0.7
9.1 9		•	: ف	0.6	3 :	47.5	21.4	26.1	58	0.1	0.1	2.0	:	26.1	1
1.4.7.8 0.40 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 6.04.5 19.5-35.0 1		5	3	9.1	9	47.8	22.7	25.1	58	0.1	0.1	3.0	ł	27.4	2.7
$ \begin{bmatrix} 6 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\$	aran	6	:	1.4-7.8	60-67	19-5-25-0	6 0-8 S	11 5-16 6							
$ \begin{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \\ \begin{bmatrix} 1 \\ 1 \end{bmatrix}$	MIL-L-18389	0	:	7.6	61	010		11.1	:	:	:	¥/0	1	:	~1
$ \begin{bmatrix} \mathbf{f}_{1}^{2} \mathbf{I}_{1} & \mathbf{I}_{1}, \mathbf{I}_{2} & \mathbf{I}_{2}, \mathbf{I}_{2} & \mathbf$	Type I	12	s	1.1	62	21.6	2.0	4.41 14.4	: ह	; ;			:		0.7
$\begin{bmatrix} 6 \\ 5 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$		24	F/2,L	7.3	()	23.0			96				;		0.7
$ \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	•	36	•	;	;	:	: ;	;;	; ;		1.0	4/4	:	4.62	7.5
$ \begin{bmatrix} 6 \\ 172, 16 \\ 173, 173 \\ 173, 16 \\ 173, 173 \\ 173, 16 \\ 173, 173 \\ 173, 16 \\ 173, 173 \\ 173, 16 \\ 173, 173 \\ 173, 17$		19									1	:	•	:	;
$ \begin{bmatrix} \xi_{1} & \xi_{1} & \xi_{2} \\ \xi_{1} & \xi_{2} & \xi_{3} \\ \xi_{1} & \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} & \xi_{3} \\ \xi_{1} & \xi_{1} & \xi_{2} \\ \xi_{2} & \xi_{3} & \xi_{3} \\ \xi_{1} & \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} & \xi_{3} & \xi_{3} \\ \xi_{1} & \xi_{2} & \xi_{3} & \xi_{3} & \xi_{3} \\ \xi_{2} & \xi_{3} & \xi_{3} & \xi_{3} & \xi_{3} & \xi_{3} \\ \xi_{2} & \xi_{3} & \xi_{3} & \xi_{3} & \xi_{3} & \xi_{3} & \xi_{3} \\ \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} \\ \xi_{2} & \xi_{3} \\ \xi_{3} & \xi_{3} \\ \xi_{3} & \xi$	aran	51		7.2-7.6	60-67	17.0-22.0	3-5	14.0-17.0	;	:	ł	;			,
$ \begin{bmatrix} 5 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 7 \\$	MIL-L-18389	•	;	7.3	8	17.5	3.1	14.4	ţ			E/A	: :	: :	
$ \begin{bmatrix} 6 & -7, 1 \\ -7, 2 \\ -7, 1 \\ -7, 2 \\ -7, -7, -7, -7, -7, -7, -7, -7, -7, -7,$	lype II	22	9	7.4	29	17.7	3.3	14.4	20	0.1	0.1	. V/N		<u>کر بر ا</u>	
$ \begin{bmatrix} 6 \\ -6 \\ -7 \\ -7 \\ -7 \\ -7 \\ -7 \\ -7 \\ $		47 7 C	F/2, L	7.3	63	18.6	3.7	16.7	8	0.1	0.1	N/N	:	16.2	
$ \begin{bmatrix} 6^{1} & & & \\ & & & & \\ & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & & \\ & & & & & & & & \\ & & & & & & & & \\ & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & \\ & & & & & & & & & & & \\ & & & & & & & & & & & \\ & & & & & & & & & & & & \\ & & & & & & & & & & & & & \\ & & & & & & & &$		۵ć	:	1	:	:	;	;	;	;	;	:	:	:	:
$ \begin{bmatrix} 0 & 0 & 0 & 0 \\ 28$	inyl Primer	9	;	9.2-9.8	68-78		31 0.36 0				ļ				
$ \begin{bmatrix} 0 & 0.4 & 0.5 \\ 28 & 0.4 & 0.5 \\ 28 & 0.2 & 0.4 & 0.5 \\ 0.1 & 0.2 & 0.6 & 0.3 \\ 0.1 & 0.2 & 0.1 & 0.5 & 0.1 \\ 0.1 & 0.1 & 0.5 & 0.1 & 0.5 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.5 & 0.1 & 0.5 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.5 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 &$	ML-L-15929A	0	:	8.6	3		21 7	17 1	:			¦	:	:	Ri
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		12	U	4.6	3		22.4	7 51	: 5		, , , ,	-	;	15	•
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		24	U	9.3	3	38.1	26.4		: 3				:		<u>.</u> .
$ \begin{bmatrix} 6^{1} & - & \\ - &$		36	U	4 .6	63	37.8	21.8	16.0			0.6		: :		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	inyl Antifouli		1	A.A.S.EI	65.00	0.00.0								-	
G 13.7 71 69.0 54.9 16.1 55 42.1 0.3 55 G 16.4 55 70.6 53.0 16.1 56 40.1 2.0 1.3 5.4 G 16.4 65 70.6 53.0 16.1 56 40.1 1.0 1.3 5.4 G 16.6 77 72.0 56.8 16.1 1.0 1.3 5.4	MIL-P-15931A		•	14.2	72		2. VC-U. SC	12.0-14.0	1		<u>5</u> 0.75	;	:	;	Ň
C 16.4 55 70.6 53.0 14.8 61 0.1 1.0 1.3		12	U	13.7	17	0.69			1 1		.	::	:	1.1	\$
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91 0.00 <		Nos.	Condition 1 fn Container 1	Wt/Gal (lb/gal)	1 1	Total Non-volatile (L by wt)	Pigment (I by wt)	Non-volatile Vehicle (1 by wt)	Flesh 29fat (F ⁰)2	Drying (hrs S.r.	Пте 0. н. <u>-</u> /	iding Power (dry mils)	Abrasion Resistance (mg/1000 cyc)	Flexibility (1)	Fineness of Grind (N.S.)
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	MC8481-D-11M	c	:	N/N	147	+·	*				76	с -	;		
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	•	24	0 0	V/N	E91<	83.4	1	N/N	128		12	0.1	: !	: <	0.0
No No <td< td=""><td></td><td>36</td><td>U,</td><td>N/N</td><td>[4]</td><td>10.1</td><td>:</td><td>4 / K</td><td>0 7 1</td><td></td><td>ţ</td><td>•</td><td></td><td></td><td></td></td<>		36	U,	N/N	[4]	10.1	:	4 / K	0 7 1		ţ	•			
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26 6 6 9 35 6 1 1 1 1<		: :	с [,]	8.0	12	97.9	ۍ د ه	4.75 0.75	:				V/N		
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10 10 <td< td=""><td>2 Phenolic Prime: Boundar</td><td></td><td>1</td><td>A / M</td><td>V/N</td><td>A/4</td><td>0 001</td><td>V/M</td><td>V / N</td><td>See</td><td>644</td><td>See #43</td><td>N/N</td><td>See #43</td><td>N/N</td></td<>	2 Phenolic Prime: Boundar		1	A / M	V /N	A/4	0 001	V /M	V / N	See	644	See #43	N/N	See #43	N/N
24 C WA WA WA WA WA WA 36 C WA WA WA WA WA WA WA 36 C WA WA WA WA WA WA WA 212 C 7.1 0.0 0.0 0.0 0.0 MA WA 36 C 7.1 0.0 0.0 0.0 0.0 MA MA 36 C 7.1 0.0 0.0 0.0 0.0 MA MA 36 C 7.1 20.0 0.0 0.0 0.0 MA MA 36 C 7.1 20.0 0.0 0.0 0.0 1 1 1 2 2 2 1		2		V/N	A/A	V/N	100.0	V/N	N/N	1			N/N		N/A
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		77	0	N/A	N/A	N/A	100.0	N/N	V/N				N/N		N/N
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		36	U	N/N	V/N	V /N	0.001	N/A	N/N				N/N		V/N
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3 Phenolic Prime:														
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Phenolic Top Coat 13.3 >143 94.6 46.5 48.1		24	ט נ	1.1	4 (7	0.0	0.0	0.0	: :				V/N		V/N
Phenolic Top Coat Phenolic Top Coat		5	2		i										1
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Iz C 13.4 743 95.9 47.2 46.7 13.4 743 95.9 47.2 46.7 13.4 743 95.9 47.7 14.0 13.1 14.0 13.1 14.0 13.1 14.1 94.6 46.0 47.7 10.5 10.6 10.5 10.0 10.5 10.6 13.1 4.0 36 G 13.3 >143 94.6 46.0 47.7 10.4 2.5 7.0 10.4 10.0		0 9	: .	13.3	>143	94.6	46.5	1.84	1	; ;	, c	c i v	: :	<u>'5'</u> '	
Coal Tar Epsxy 0 0.4 2.5 7.0 4.0 Coal Tar Epsxy 0 15.5 >143 94.6 46.0 47.7 0.4 2.5 7.0 4.0 Coal Tar Epsxy 0 15.5 >143 91.3 4.0 4.0 12 C 15.7 >143 91.8 62.5 29.3 5.9 24 C 15.6 >143 93.6 62.6 31.0 0.5 10.0 1.5 5.9		2 2		13.4		0 20	4 4 	4. /4 7 2 7	: :				;	<u>, e</u> ,	
Coal Tar Epoxy 0 15.5 >14.3 91.3 6.15.7 12 C 15.7 >14.3 91.8 62.5 29.3 0.2 9.0 1.0 6.15.7 24 G 15.6 >14.3 93.6 62.6 31.0 0.5 16.0 1.5 5.9		2	00	13.3	>143	9, 46	46.0	47.7	;	0.4	2.5	7.0	:	4.0	5.5
$\begin{array}{cccccccccccccccccccccccccccccccccccc$															
C 15.7 /143 91.8 62.5 29.3 0.2 9.0 1.0 4.12/ C 15.6 2143 93.6 62.6 31.0 0.5 10.0 1.5 5.9		0	:	15.5	>143	91.3	;	;	;	:	:	:	;	:	;
G 15.6 2143 93.6 62.6 31.0 0.5 10.0 1.5 0.9		12	U	15.7	~143	91.8	62.5	29.3	;		0.6	1.0	:	4.12/	0.0
		24	U	15.6	>143	93.6	62.6	31.0	:		16.0	1.5	;	6.0	0.0

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APPENDIX A (Cont'd)				-			- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Drutna Time	Ahrasion
vo Sample		Condition ₁ \$n Mds. Container-	Wt/Sal (1b/gal)	Viscosity (KU)	Total Wt/Cal Viscosity Non-volatile (1b/gal) (KU) (X by vt) (Pigment (7 by wt)	Non-volative Vehicle (1 by wt)	Pignent Vehicle Flash Point $(\xi by wt)$ $(f^O)^{2/2}$	S.T. ^{3/} D.H. ^{4/} (dty mils) (mg/1000 cyc	ower Resistand 1
ů	0 24 36	1000	 5.7 5.7	1444	 0.2 0.1	0.0	 0.2 0.1		See #45 See #45	5 N/A N/A N/A
47 Phenolic Seal Coat	0	10	12.2	92 100 100	89.8 91.5 92.7	 48.7 47.3	43.2 42.8 45.4	;;;;		:::

APPEN	APPENDIX A (Cont'd)	ĺ				Total		Non-volatile		Drying Time		Abrasion Prestance	Flexibility	Fineness of Grind
No.	Sample	Mos.	Condition_1^n Container_1	Wt/Sal (1b/gal)	Viscosity (KU)	Non-volatile (% by wt)	Pigment (1 by wt)	Vehicle (1 by wt)	Flash Zgint (F ⁰)29int	(nrs) s.1. <u>3</u> / D.	D.H.4/ (dry mils)		(1)	(N.S.)
97	Coal Tar Epoxy						0.0	:		See #45	See #45	N/N	See #45	N/N
	Catalyst	•	:	:		; `		0.2	;			N/N		V/N
		12	ن		7		0.0	0.2	;	19 '		V/N		V /N
		24	0 (; ;	0.1	0.0	0.1				V / N		
		5	2	•										
d 17	Phenolic Seal				1			6 1 7	;	;		;		:
	Coat	0		12.2	92	8.48 9.68	 787	47.8	:		~	:		4.5
		12		12.4	3	1.0	47.3	45.4	:			:	8.0 2	0.0 • •
		36	00	12.3	8	91.2	44.6	9.97	;			1	2	
										44	7 Con 447	N/A	See 447	N/A
87	Phenolic Seal Load Caralwat	0.00	:	;	8	:	0.0	۲ ۲	: :	200 44		V/N		V/N
		12		C.7	24	0.7	0.0		: 1			N/N		N/N
		24		7.3	7	0.9			1			V /N		V/N
		36		7.3	245		5	2						
04	theselfs Top Coat	oat							!	1	;	;		:
				12.1	105	83.7	5. 2 V	36.0	; ;			•	<u>لم</u> الم	6.N
		21		12.3			49.8	36.0	; 1	0.4 5	5.0 4.5	!		6.0 4
		4 %	5 5	12.4	3.8	66.1	46.1	0.04	;			•		
		ţ			2					,	622 460	V/N	See #50	N/N
2	Phenolic top cum			;	;	:	0.0	:	;	See YOU		N/N		V/N
		12		7.4	4	0.5	0.0	0.5	;			N/N		V/N
		54	U I	7.5	4		0.0	• • •	! !			V/N		N/N
		9		?	j .									
51	Vinyl Primer				;							:		1
		0		8.5 •	tt	4.95	14.7	16.9	35		0.1 0.5	:		0.9 •
		22			K 7	0.16	14.0	17.0	35			:		
		5 8	10-5/ 10-5/ 10-5/	;;	1		:	;	:	1		:		
22	Vinyl sody Coat			•	58	50.5	36.5	14.0				; ;	2.2	1.0
		0 Z	: u	10.0	3	51.8	39.4	12.4	6 y 1	9 5	0.1 3.5	: :	12.1	1.5
		24		10.0	82	50.6	36.4	1.61	2 I			:	;	1
		×		:	ţ	:	;							

APPENDIX A (Cont'd)

Way I Top Cost 1 33 13.3 13.5 13.3 13.5	Xo.	Sample	, sy	Condition in Container ^{1/}	WE/Gal (16/gal)	Viscosity (EU)	Total Non-volctile (I by wt)	Pigment (3 by vt)	Non-volatile Vehicle (1 br vt)	Flash Point	Drying Time (hjg) g.T.J.	71me	Time Hiding Fower D.M <u>4</u> / (dry mile)	Abrasion Resistance	Flexibility	Fineness of Grind
1 1 1 3 23 7,6 15,7 1 30 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10 <th10< th=""> 10 10 <th< th=""><th>1 0</th><th>the factor</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>77</th><th>1.0.01</th></th<></th10<>	1 0	the factor													77	1.0.01
Floory Pretainer 0 7.3 8.3 7.3 8.4 0	3.	100 dot tint	Ċ		- -	S		1	r							
24/2 C 7.0 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1 50 7.1<			2	י ני ו		25		9 r - r	4 41	1 7	:		; ;	1	:	ч • • •
Set			24		7.8		22.9	~ ~	16.0	; =				:	V. 1	1.5
Foory Primer 0					: :	: 1				;	;		0.0	;	1.1	1.5
Fory Frier Fory Frier 10 -1 12, -1 13, -1 14, -1 13, -1 14, -1 13, -1 14, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1		•	ł		1	:	:	;	•	:	1,	:		:	ţ	:
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Å	Epoxy Primer														
12 G 12.1 63 72.5 50.1 22.6 12 9.0 3.8 Poory Friext 36 C 12.6 63 72.5 50.1 23.9 9.3 9.5 3.0 Poory Friext 0 1 0 1 1 9.5 3.0 3.0 3.0 3.5 3.0 3.0 3.0 3.5 3.0			•	:	12 5	3	71.2	49.2	22.0	!		:	:	ļ		
24 C 12.6 69.0 69.0 30.4 0.1 9.5 3.0 Pory Frier 12 C 12.6 69 69.0 69.0 69.0 69.0 69.0 69.0 95.0 9.0 9.5 3.0 Pory Frier 12 - - - - - - 0.1 8.5 3.0 Pory Frier 12 - - - - - - 0.1 8.5 3.0 12 - - - - - - - - 0.1 8.5 3.0 12 - - - - - - - 10.0 10.1 8.1 3.0 13 C 10 - - - 10.0 10.0 10.1 10.1 14 0.0 10 10 10.0 10.0 10.1 10.1 10.1 140 0.0 10 10 10.0 10.0 10.0 10.1 10.1 150 0.1 10 10 10.0 10.0 10.0 10.0 10.0 150 0.1 10.0 10.0 10			12	U	12.7	5	72.5	50.1	22.4	:	0.2	0	8		15, 3	: :
36 G 12.6 62 (2.0) (0.1) 19.5 0.1 8.5 3.0 Poory Friewr 12 0 0.0 W/A 0.1 8.5 3.0 Poory Friewr 36 1.4 0.0 W/A 0.1 8.5 3.0 Poory Frencilc 0.0 W/A 0.1 8.5 3.0 0.1 8.5 3.0 0.1 8.5 3.0 0.1 8.5 3.0 0.1 8.5 3.0 0.1 8.5 3.2 3.0 0.1 8.5 1.0 0.0 W/A 1.0 1.0 1.0 0.0 W/A 1.0 0.1 0.0 0.0 W/A 1.0 0.0 W/A 1.0 0.0 W/A 1.0			24	U	12.6	63	69.4	0.64	20.4	:	0.3	5.0	0.6	2.6		
Poory Frier See #54 See #56			36	U	12.6	62	0.63	49.)	19.5	:	0.1	8.5	3.0	28	3.7	0.4
Cutalyst 0 See #54 See #56	25	Epoxy Primer					:								٠	1
12 6 H/A 0.0 W/A		Catalyst	0	:	;	:	M/A	0.0	N/A	;		454	Can #56	6 A5A	6 a 466	
24 C W/A 0.0 W/A 36 C W/A 0.0 W/A Top Cost 0 W/A 0.0 W/A 10 H 70.9 36.5 34.4 24 C 10.9 61 70.9 36.6 37.3 0.2 8.0 0.8 24 C 10.7 61 63.4 36.6 37.3 0.2 8.0 0.8 10 Cost 0 0.0 W/A 0.2 8.0 0.8 10 Cost 1 61.6 63.4 36.6 37.3 0.2 8.0 0.8 10 C 0 W/A 0.2 8.0 0.6 10 Cost 1 0 0 W/A 5ee #3.6 5ee #3.6 5ee #3.6 5ee			12	U	;	ł	B/A	0.0	N/A	:	5	ţ		ACL 330		× / ×
36 C NA 0.0 NA Fpory Phenolic 12 C 10.9 61 72.9 36.5 34.4 0.2 6.5 1.0 Top Coat 12 C 10.9 61 72.9 36.5 34.4 0.2 6.5 1.0 See 0 - 0 - 0.1 56.1 36.5 36.3 57.3 1.0 0.7 1.0 <			37	IJ	ţ	:	N/A	0.0	N/N	:						
Fpoxy Phenolic 10 61 70.9 36.5 34.4 11 0.2 6.5 1.0 10 12 6 10.9 61 72.9 36.5 36.4 10 10 61 72.9 36.5 36.4 10 10 61 72.9 36.5 36.5 10			36	IJ	:	:	N/A	0.0	N/A	:						N/A
Top Coat 0 61 70.9 36.5 34.4 10 23.5 10 36.5 36.7 36.5 36.4 10 36.5 36.7 36.5		Epoxy Phenolic														•
12 6 12.9 56.7 36.7 36.8 32.3 0.2 6.5 1.0 24 6 10.3 61 69.4 36.6 32.3 0.2 8.0 0.3 1.0 36 6 10.3 61 69.4 36.6 32.3 0.2 8.0 0.3 Top Coat 0 0.4 36.6 32.3 0.2 8.0 0.8 Top Coat 0 0.2 8.0 0.8 12 6 5ee #56 5ee #56 </td <td></td> <td>Top Coat</td> <td>•</td> <td>:</td> <td>ł</td> <td>61</td> <td>20.9</td> <td>36.5</td> <td>¥4.4</td> <td>:</td> <td>1</td> <td>ł</td> <td>!</td> <td>:</td> <td></td> <td></td>		Top Coat	•	:	ł	61	20.9	36.5	¥4.4	:	1	ł	!	:		
24 C 10.4 61 69.1 36.8 32.3 $$ 0.7 $$ 1.0 36 6 10.7 61 69.4 36.6 32.3 $$ 0.7 $$ 1.0 Top Coat 0 $$ $$ $$ 0.7 $$ 0.7 $$ 0.7 $$ 0.7 $$ 0.7 $$ 0.2 8.0 0.8 Top Coat 12 G $$ $$ $$ $$ 0.7 $$ 0.2 8.0 0.8 24 G $$			12	9	10.9	. 19	72.9	36.7	36.2	:	6.0	2		1 2		
36 G 10.7 61 69.4 36.6 32.3 0.2 8.0 0.8 Fpory Phenolic Top Coat 0 0.0 W/A 0.2 8.0 0.8 Top Coat 0 5ee #56 See #56 See #56 Top Coat 12 G W/A 5ee #56 See #56 See #56 24 G W/A See #56 See #56 See #56 36 G W/A See #56 See #56 24 G N/A See #56 See #56 26 G N/A See #56 See #56 1// N/A N/A See #56			24	U	10.8	- 19	1.69	36.8	-32.3	:	0.7	;	0.1	24		• • • •
Epoxy PhenolicTop Coat0See #36See #36See #36Top Coat12GN/ASee #36See #3624GN/A0.0N/ASee #36See #3636GN/A0.0N/ASee #36See #361/N/A0.0N/ASee #36See #3627N/A0.0N/ASee #36See #3624GN/A0.0N/ASee #36See #3624GN/A0.0N/ASee #36See #3624N/A0.0N/ASee #36See #3624N/A0.0N/A26N/ASee #36See #3627N/ASee #3627N/ASee #3626N/A			36	U	10.7	61	4.69	36.6	32.3	;	0.2	8.0	0.8	56	Q.5	6.0
K'A 0.0 N/A See #56 See #.6 N/A 0.0 N/A See #56 See #.6 N/A 0.0 N/A M/A 0.0 N/A See #.6 See #.6 See #.6 See #.6		Epoxy Phenolic														
		Top Coat	•	:	:	•	R.'A	0.0	M/A	!	See	4 56	A. 4	Cas 456	222 466	
X/A 0.0 K/A		Catalyst	12	IJ	;	;	M/A	0.0	N/N	;						
N/A 0.0			24	U	:	;	N/N	0.0	N / N	:						
			36	U	ţ	;	V/N	0.0	N/N	;						4 /2
		/1							-/4	Dry hard						
			on of c	ondition in com	ntainer				1 2							
C - Conforme to specification										Tin plate as	ubstrat	÷				
		C - Confoi	2	specification												

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F - Failed (F/2 used when half of remaining cans failed) and removed from programs a - Skinning L - Livering or gelling R - Gel-bodies m - Solidified mass с m

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

3/ - Set-to-touch

 $\underline{6}/$ - Data in this row are specification requirements

 $\underline{I}/-$ These data are based on percent of total non-volatile as required by the specification rather than on the percent of total paint

B/- failed during field exposure and removed from program

APPENDIX B

F

Statistics.

SOURCES OF COATING MATERIALS

Numb e r	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 S∻a-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 Coatin gs
11	Proline 3002, Buildcoat	San Diego Coatings
12	Proline 3002, Buildcoat Catalyst	San Diego Costings

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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	Nacional 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	AJercoat 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 Antıfouling 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 Topcoar	Carboline Company (see No. 43 for address)
45	Carbomastic No. 3	Carboline Company
46	Carbomastic No. 3 Catalyst	Carboline Company
47	Phenolic 305-2	Carboilne Company
48	Phenolic 305-2	Carboline Company
49	Phenoline 305	Carbolire Company
50	Phenoline 305 Catalyst	Carboline Company

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Number	Coatings	Source
51	Super Vyúel 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