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**Marine priming paints for Canadian Government Specifications Board  
(development test work for specification 1-GP-48P)**  
Harris, J.

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NATIONAL RESEARCH COUNCIL

CANADA

DIVISION OF BUILDING RESEARCH

MARINE PRIMING PAINTS FOR CANADIAN GOVERNMENT

SPECIFICATIONS BOARD

(Development Test Work for Specification 1-GP-48P)

by

J. Harris

ANALYZED

Report No. 63

of the

Division of Building Research

OTTAWA

May 1955

## PREFACE

This report is the record of the first part of a program being carried out for the Canadian Government Specifications Board by the Paint Laboratory of the Division's Building Materials Section. The overall program involves the evaluation of several priming paints for ships to obtain a suitable formulation as the basis for improving specification 1-GP-48P of the C.G.S.B. This report records the formulation of the test priming paints, the methods of test, and laboratory test results. In addition, panels were prepared for exposure at Shearwater, N.S., and Sayville, New York. As sufficient data on the panels are obtained, further reports will be issued.

Ottawa  
May 1955

N.B. Hutcheon  
Assistant Director

# MARINE PRIMING PAINTS FOR CANADIAN GOVERNMENT

## SPECIFICATIONS BOARD

(Development Test Work for Specification 1-GP-48P)

by J. Harris

This work was undertaken on behalf of the Canadian Government Specifications Board for the purpose of evaluating a number of priming paints for ships from which a suitable formulation could be selected to form the basis for an improvement in marine priming paint specification 1-GP-48P.

U.S. Navy formula 116 was selected as a starting point, the details of which are included in Appendix A. Seven modifications of this formula were devised and made up accordingly. In five of these, the vehicle was varied by extending the oil length of the medium oil length alkyd resin either internally or externally to produce a final total fatty acid content of 60 to 70%. The pigmentation and pigment content were left unchanged.

In two other modifications pigment M50 was substituted for 50% of the red lead portion of formula 116.

Three additional paints were made up with vehicles unrelated to that specified in formula 116. These were: a 20-gallon phenolic tung-oil varnish; a phenolic varnish modified alkyd and a coumarone-indene varnish. Formulae for these three paints are given in Appendix A.

Information relating to composition, identification and coding of these paints is given in Table I.

This report covers the first phase of the program, namely, the formulation of the ten priming paints made up for test, the methods of test, and the results of the laboratory tests conducted on them. Also included, as Appendix B, is a description of the panels prepared for exposure at the marine test basin of the Naval Research Establishment at Shearwater, N.S. and at the National Lead Corporation test basin at Sayville, Long Island, N.Y. Data pertaining to these panels are included in this report for reference purposes. When the results of their exposure at these locations are known a report covering this phase of the work will be prepared.

## General

Test panels were prepared to evaluate the ten priming paints in the laboratory with regard to their hardness, salt spray corrosion resistance, and water resistance.

## Procedure for Laboratory Tests

Hardness. - Scratch hardness was determined on clean steel panels coated to a thickness of  $1.4 \pm 0.2$  mils. Panels were cleaned in accordance with method 100.1 of schedule 1-GP-71. Films were conditioned for 14 days under standard conditions (method 103.1) and tested for scratch hardness using a motor-driven scratch hardness machine equipped with a borundum needle having a 1 mm. diameter hemispherical tip.

Water Immersion. - Steel panels cleaned and prepared as described in method 100.1 of schedule 1-GP-71 were coated with the priming paint under test to a film thickness of  $1.4 \pm 0.2$  mils by dipping. The edges were protected by dipping them in the same paint. After a conditioning period of 14 days under standard conditions (103.1) the panels were immersed in distilled water to half length for thirty days. Observations were made at appropriate intervals. Tests were run in duplicate.

Salt Spray Corrosion. - Steel panels  $2 \frac{3}{4}$  by 6 inches were cleaned and prepared as described in method 100.1 of schedule 1-GP-71. Priming paint was applied by dipping to a film thickness of  $1.4 \pm 0.2$  mils. Films were conditioned for 14 days under standard conditions (103.1). The edges were protected by an additional dip in the same paint. Six panels were prepared. Three of these were scored diagonally and three were left unscored.

These panels were placed at an inclination of  $15^\circ$  in a salt spray cabinet operated in accordance with A.S.T.M. specification B117 and using 20% salt solution. Exposures in each case were carried out to the point of failure.

## Observations

Observations are recorded in Tables II, III, and IV which give the results of scratch hardnesses, water immersion, and salt spray cabinet exposures respectively. Table V lists comparisons of ratings.

To facilitate description, salt spray exposure panels were divided into 4 sections by two diagonal lines and numbered. This scheme is illustrated in Fig. 1. A.S.T.M. ratings were

used for assessing size and density of blisters in the water immersion and salt spray tests. A photograph illustrating these ratings is included in Fig. 2.

## SUMMARY

### Laboratory Tests

Priming paints 10979 and 10985 show a tendency to blister. Development of blisters is slow but is marked after 30 days' immersion. All the other paints resist blistering.

The corrosion resistance of the priming paints determined by the salt spray may be classified in the order of resistance given below; number 1 being the best:

1.	Laboratory Number	11146	
2.	" "	11191	
3.	" "	10985	
4.	" "	11077	
5.	" "	10980	
6.	" "	11189)	equal
		11076)	
7.	" "	11190	
8.	" "	10979	
9.	" "	11147	

The first three paints in this list (11146, 11191 and 10985) show marked superiority over the rest of the priming paints in salt spray resistance. Paint 10985, however, blisters on water immersion when applied to steel.

These paints have been evaluated on clean panels. Similar results for corrosion resistance ratings may not occur under less favourable circumstances.

### Tidewater Exposure Tests

Panels described in Appendix B were prepared and set out for exposure at tidewater level at Shearwater, N.S. and Sayville, Long Island, N.Y.

TABLE I

Composition, Identification, and Coding of Paints Tested

<u>Lab. No.</u>	<u>Type of Vehicle</u>	<u>Pigmentation</u>	<u>Code Designation</u>
11147	Medium Soya Oil Alkyd	Formula 116	S
11146	Medium Linseed Oil Alkyd	Formula 116	L
10980	Medium Soya Oil Alkyd	Formula 116 using pigment E	SE
10979	Medium Linseed Oil Alkyd	Formula 116 using pigment E	LE
10985	Extra Long Linseed Oil Alkyd *	Formula 116	SS
11077	Medium Soya Oil Alkyd** with added Linseed Oil	Formula 116	SO
11076	Medium Soya Oil Alkyd *** with added Linseed Oil	Formula 116	SSO
11189	20 gallon Pure Phenolic Tung Oil Varnish (NRP 213)	Formula 116	P
11190	Phenolic Varnish Modified Alkyd Resin (NRP 228)	Formula 116	PA
11191	Coumarone-Indene Varnish (NRP 299)		C

\* General Electric L 7901

Type	: Linseed
Non-volatile	: 69-71%
Oil	: 70% on resin
Solvent	: Mineral spirits
Viscosity	: W - Y
Acid No.	: 5-7

\*\* General Electric G-2509

Type	: Soya
Non-volatile	: 50% $\pm$ 1
Fatty Acids	: 46% on resin solids
Phthalic Anhydride	: 35%
Solvent	: Mineral spirits
Viscosity	: Z - Z3
Acid No.	: 3 - 5

This resin solution was modified with linseed oil to produce 62% fatty acids in the final vehicle solids.

\*\*\* General Electric G-2475

Type	: Soya
Non-volatile	: 60% $\pm$ 1
Fatty Acids	: 54% on resin solids
Phthalic Anhydride	: 30%
Solvent	: Mineral spirits
Viscosity	: Z - Z2
Acid No.	: 4-6

This resin solution was modified with linseed oil to produce 62% fatty acids in the final vehicle solids.

TABLE II

Scratch Hardnesses of Priming Paints

<u>Lab. No.</u>	<u>Maximum load in grams with no breakthrough</u>
10980	1300
11190	1800
11076	1800
11189	1200
10985	1800
10979	1300
11146	1300
11147	2100
11077	1400
11191	2500



TABLE III

Observed Results of Water Immersion Tests on Priming Paints

<u>Lab. No.</u>	<u>10 days</u>	<u>20 days</u>	<u>30 days</u>
10979	V. few #8 blisters	Blisters increasing in number	Dense #6 blisters
10985	V. few #8 blisters	Increasing in density	Med. dense #6 blisters
11189	n.c.	n.c.	Slight lightening in colour
10980	n.c.	n.c.	n.c.
11191	n.c.	n.c.	Medium lightening in colour
11077	n.c.	n.c.	n.c.
11147	n.c.	n.c.	Slight lightening in colour
11146	n.c.	n.c.	Medium lightening in colour
11076	n.c.	Medium lightening in colour	Marked lightening in colour
11190	n.c.	Slight lightening	Marked lightening in colour

n.c. = no change

TABLE IV

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
10985	S-54-244	Unscored	5	No change.
			7	Few #8 blisters.
			12	8 $\frac{1}{2}$ " diameter scattered groups of tiny blisters.
			14	8 large blisters. Failure complete.
	S-54-245	Unscored	5	No change.
			7	Few medium #8 blisters
			12	3 or 4 large blisters 2" in diam. Failure.
	S-54-246	Unscored	5	No change.
			7	Few #8 blisters.
			12	1/2" clusters of small blisters (12 in all).
			14	12 large blisters. Failure.
	S-54-247	Scored	5	No change.
			7	Medium #6 blisters.
			12	Two 1" blisters in section 1. Three sections have large blisters $1\frac{1}{2}$ " in diam. Failure.
	S-54-248	Scored	5	No change.
			7	Few #8 blisters.
			12	Large 2" blisters in every section. Failure.
	S-54-249	Scored	5	No change.
			7	Medium #8 blisters.
			12	Large blisters in sections 1, 2, and 4. Failure.
10980	S-54-250	Unscored	3	Blistering 1/2" down from top.
			5	Few #6 blisters.
			10	Medium #6 blisters.
			13	Dense #6 blister and one large water blister. Exceed 9-1 rusting.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
10980	S-54-251	Unscored	3	Blistering 1/2" from top.
			5	Few #6 blisters.
			10	Medium #6 blisters.
			13	Dense blistering. Rust coming through large blisters. Loss of adhesion.
				Failure.
	S-54-252	Unscored	3	Large blisters 1/2" from top.
			5	Few #8 blisters.
			10	Medium dense #8 blisters.
			13	Dense #8 blisters. Complete loss of adhesion. Rust showing through in spots. Failure.
	S-54-253	Scored	3	Blisters 1/2" from top.
			5	Medium #6 blisters.
			10	Medium dense. Large blisters in sections 1 and 4. Slight rusting.
				Failure.
	S-54-254	Scored	3	Blisters 1/2" from top.
			5	Medium #6 blisters in section 1, 1-inch blister.
			10	Medium #6 blisters. No. 1 section badly blistered. Rust within 1/4" along line. Failure.
	S-54-255	Scored	3	Blistering 1/2" from top.
			5	Medium #6 blistering. Two 1/2" blisters top of sections 2 and 4,
			10	Medium dense #6 blisters. Sections 2 and 4 large blisters. Rust showing slightly. Failure.
11189	S-54-256	Unscored	5	Small clusters of blisters scattered over surface; 9 groups.
			8	Large blisters over most of the surface; loss of adhesion.
	S-54-257	Unscored	5	Small clusters of blisters (1/4" diam.).
			8	Increase in above condition to large blisters. Loss of adhesion.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
11189	S-54-258	Unscored	5 8	No change. Blisters (1/2") with rust through film; loss of adhesion. Failure.
	S-54-259	Scored	5 8	Loss of adhesion bottom of section 1. Loss of adhesion. Wrinkles over 60% area. Rust showing. Failure.
	S-54-260	Scored	5 8	Four 1/4" clusters of tiny blisters. Loss of adhesion. Large blister areas. Some rust showing through. Failure.
	S-54-261	Scored	5 8	No change. Blistering over most of area. Complete loss of adhesion; slight recovery. Failure.
10979	S-54-313	Scored	3 5 7 10	No change. Few #4 blisters. Few medium #4 blisters. Starting to show loss of adhesion. Section 1 has two large blisters 1 1/2" long. Sections 3 and 4 severely blistered. Failure.
	S-54-314	Scored	3 5 7 10	No change. Few #4 blisters. Few-medium #4 blisters. Some loss of adhesion. Dense #4 blisters. Each section has large water blisters. Failure.
	S-54-315	Scored	5 7 10	Few #4 blisters. Medium #4 blisters. Slight loss of adhesion. Section 1 has 2 large blisters. One long area along right side is blistered. Section No. 4 has dense #4 blisters. Failure.
	S-54-316	Unscored	5 7	Few #4 blisters. Medium #4 blisters. Failure.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
10979	S-54-317	Unscored	5 7	Few #4 blisters. Medium #4 blisters. Loss of adhesion. Failure.
11146	S-54-361	Scored	7 9 12 15	No change. Few #8 blisters. A small number of rust spots appearing on blister heads. Medium dense #8 blisters. Exceeds 9-1 rusting. Failure.
	S-54-362	Scored	7 9 12 15	No change. Few #8 blisters. A few rust spots appearing through blister points. Rust areas slightly larger. Exceeds 9-1 rusting. Failure.
	S-54-363	Scored	7 9 12 15	No change. Very few #8 blisters. Rust at blister heads. Medium-few. Increase in rust. Exceeds 9-1. Failure.
	S-54-364	Unscored	7 9 12 15	No change. Few #8 blisters. Small rust spots showing. 9-1 rusting.
	S-54-365	Unscored	7 9 12 15	No change. Few #8 blisters. Rust spots on blister heads. Exceeds 9-1 rusting. Failure.
	S-54-366	Unscored	7 9 12 15	No change. Few #8 blisters. Rust spots showing through on blister heads. Exceeds 9-1 rusting. Failure.
11076	S-54-380	Scored	5 8	Few #6 blisters. Medium #6 blisters. Rust spread 1/4" from score line. Exceeds 9-1 rusting. Failure.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
11076	S-54-381	Scored	5 8	Medium #6 blisters. Medium-dense #6 blisters. Rust spread 1/4" from score line. Rusting through blisters. Failure.
	S-54-382	Scored	5 8	Few #8 blisters. Rust spread 1/4" from score line. Rust through blister heads. Failure.
	S-54-383	Unscored	5 8	Few #8 blisters. Medium #8 blisters. Rust showing through.
	S-54-384	Unscored	5 8	Few #8 blisters. Medium #8 blisters. Rust through blister heads. Exceeds 9-1 rusting. Failure.
11190	S-54-351	Scored	4 8 10	Few # 6 blisters. Section 1 failed due to loss of adhesion. Very large blisters plus marked loss of adhesion over all of panel.
	S-54-352	Scored	4 8 10	Few #6 blisters. Section 1 failed. Large blisters. Marked loss of adhesion. Failure.
	S-54-353	Scored	4 8 10	Few blisters. Medium #6 blisters. Section 1 badly affected. Marked loss of adhesion. Badly blistered. Failure.
	S-54-354	Unscored	4 8 10	#6 blisters. #6 blisters. Two huge blisters along both sides. Failure.
	S-54-355	Unscored	4 8 10	Few #6 blisters. Medium #6 blisters. Loss of adhesion. Large blisters. Film is brittle after time is allowed for recovery. Failure.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored	Days of Exposure	Observations
11077	S-54-356	Scored	3 6 9	2 or 3 small blisters. Small ( $\frac{1}{8}$ " ) areas have poor adhesion. Medium #2 blisters. Rust appearing. Failure.
	S-54-357	Scored	6 9	Small circular weakly adhering areas. Medium #2 blisters. $\frac{1}{4}$ " wide blister along score lines. Rust showing. Failure.
	S-54-358	Scored	6 9	Small circular weakly adhering areas (6). Medium #2 blisters. $\frac{1}{4}$ " wide blister along score lines. Rust showing. Failure.
	S-54-359	Unscored	6 9	3 or 4 small weak areas. Medium #2 blisters. Rust through blisters. Failure.
	S-54-360	Unscored	3 6 9	One or two small blisters. Small $\frac{1}{4}$ " circular areas weak in adhesion. Medium #2 blisters. Rust showing through. Failure.
11147	S-54-389	Scored	3 6	No change. Medium #6 blisters. Rust showing through blister heads. Rust spreading along score line $\frac{1}{4}$ ". Failure.
	S-54-390	Scored	3 6	No change. Medium #8 blisters. Rust spreading along score line $\frac{1}{4}$ ". Some rust spots showing on blister heads. Failure.
	S-54-391	Scored	3 6	No change. Few #8 blisters. Rust coming through blister heads. $\frac{1}{4}$ " rust spread along score line. Failure.
	S-54-393	Unscored	3 6	No change. Few #6 blisters. Rust appearing through blister heads. Failure.

Observed Results on Salt Spray Exposure Tests on Priming Paints

Lab. No.	Panel No.	Scored Unscored	Days of Exposure	Observations
11147	S-54-394	Unscored	3 6	No change. Medium #6 blisters. Rust coming through blister heads. Failure.
11191	S-54-395	Scored	6 10 16	2 or 3 small blisters showing. Medium #4 blisters. 19 rust heads showing. Rust streaking through. Failure.
	S-54-396	Scored	6 10 16	2 or 3 small blisters appearing. About a dozen medium-sized blisters appearing. 8 or 9 rust heads showing. Failure.
	S-54-397	Scored	6 10 16	2 or 3 very small blisters. Medium #4 blisters. 12 rust spots showing through.
	S-54-398	Unscored	6 10 16	2 or 3 small blisters. Medium #4 blisters. 6 rust heads showing. Failure.
	S-54-399	Unscored	6 10 16	4 or 5 tiny blisters. A few more blisters appearing. 16 rust heads showing (using ten-power microscope). Failure.
	S-54-400	Unscored	6 10 16	3 tiny blisters. Medium #4 blisters. 9 rust heads showing through. Failure.



TABLE V

Rates of Failure of Priming Paints  
Subjected to Salt Spray Exposure Test

<u>Lab No.</u>	<u>Panel</u>	<u>Type</u>	<u>Days no change</u>	<u>Days slight change</u>	<u>Days failure</u>
10985	S-54-244	Unscored	5	7	12
	S-54-245	"	5	7	12
	S-54-246	"	5	7	12
	S-54-247	Scored	5	7	12
	S-54-248	"	5	7	12
	S-54-249	"	5	7	12
10980	S-54-250	Unscored	-	3	13
	S-54-251	"	-	3	13
	S-54-252	"	-	3	13
	S-54-253	Scored	-	3	10
	S-54-254	"	-	3	10
	S-54-255	"	-	3	10
11189	S-54-256	Unscored	-	5	8
	S-54-257	"	-	5	8
	S-54-258	"	5	-	8
	S-54-259	Scored	-	5	8
	S-54-260	"	-	5	8
	S-54-261	"	5	-	8
10979	S-54-313	Scored	3	5	7
	S-54-314	"	3	5	7
	S-54-315	"	-	-	-
	S-54-316	Unscored	-	5	7
	S-54-317	"	-	5	7
11146	S-54-361	Scored	7	9	15
	S-54-362	"	7	9	15
	S-54-363	"	7	9	15
	S-54-364	Unscored	7	9	15
	S-54-365	"	7	9	15
	S-54-366	"	7	9	15

<u>Lab. No.</u>	<u>Panel</u>	<u>Type</u>	<u>Days No Change</u>	<u>Days Slight Change</u>	<u>Days failure</u>
11076	S-54-380	Scored	-	5	8
	S-54-381	"	-	5	8
	S-54-382	"	-	5	8
	S-54-383	Unscored	-	5	8
	S-54-384	"	-	5	8
11191	S-54-351	Scored	-	4	8-10
	S-54-352	"	-	4	8-10
	S-54-353	"	-	4	8-10
	S-54-354	Unscored	-	4	10
	S-54-355	"	-	4	10
11077	S-54-356	Scored	-	6	9
	S-54-357	"	-	6	9
	S-54-358	"	-	6	9
	S-54-359	Unscored	-	6	9
	S-54-360	"	-	6	9
11147	S-54-389	Scored	3	-	6
	S-54-390	"	3	-	6
	S-54-391	"	3	-	6
	S-54-392	Unscored	3	-	6
	S-54-393	"	3	-	6
	S-54-394	"	3	-	6
11191	S-54-395	Scored	6+	-	10-16
	S-54-396	"	6+	-	10-16
	S-54-397	"	6+	-	10-16
	S-54-398	Unscored	6+	-	10-16
	S-54-399	"	6+	-	10-16
	S-54-400	"	6+	-	10-16

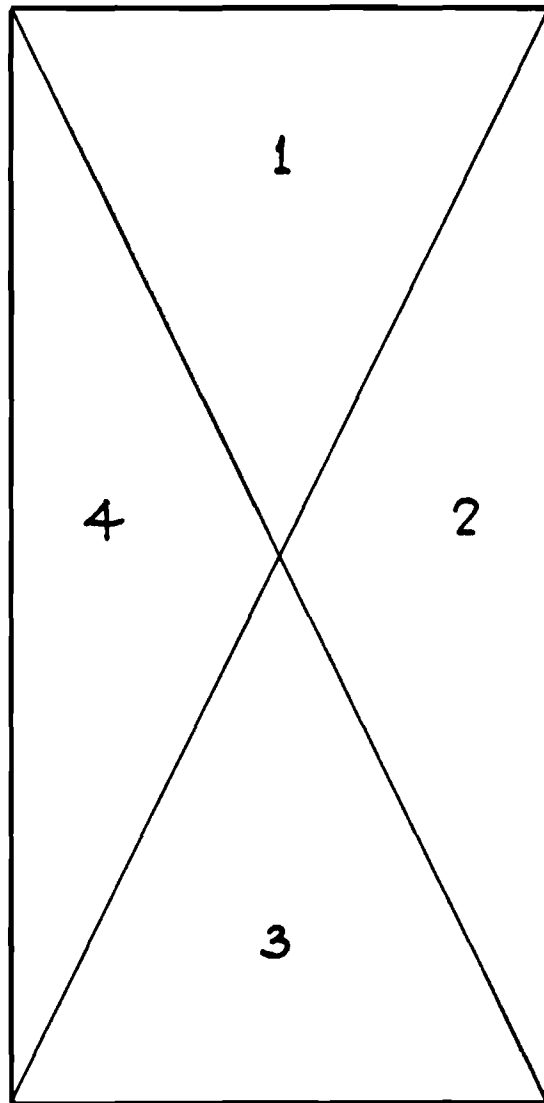


FIGURE 1

DIVISION of SALT SPRAY EXPOSURE  
PANELS

# PROPOSED A.S.T.M. BLISTER RATINGS

BLISTER  
SIZE  
No. 2



FEW



MEDIUM



MEDIUM DENSE



DENSE

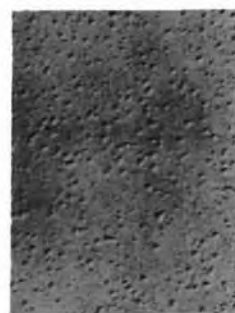
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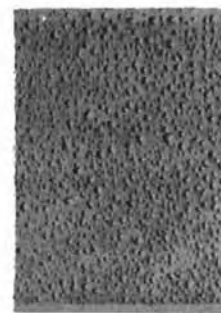
FEW



MEDIUM



MEDIUM DENSE



DENSE

No. 6



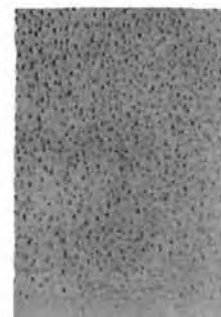
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MEDIUM



MEDIUM DENSE



DENSE

No. 8



FEW



MEDIUM



MEDIUM DENSE



DENSE

Fig. 2. ASTM Blister Ratings (Scale:  $1\frac{1}{4}" = 3"$  on original chart)

# APPENDIX A

## Formulations

U.S. Navy Formula 116: PRIMER, EXTERIOR, MAINTENANCE, June 1, 1949.

(For Weather Surfaces)

<u>Ingredients</u>	<u>Specifications</u>	<u>Pounds/100 gals</u>
Red Lead	TT-R-191, Type 1, grade B	380
Zinc Yellow	TT-Z-415	70
Mica	MIL-M-15176 (Ships)	65
Indian Red	TT-I-511, Type 1	10
Magnesium Silicate	MIL-M-15173 (Ships), Type A	160
Aluminum Stearate	MIL-A-15206 (Ships)	6
Alkyd Resin Solution	TT-R-266, Type 1, Class A	415 (290.5) <sup>1</sup>
Dipentene	TT-D-376	25
Paint Thinner	TT-T-291, Grade 1	190
Lead Drier	TT-D-643, Type 1	4.7
Cobalt Drier	TT-D-643, Type 11	4.7
Total		1330.4

1. - Vehicle Solids.

PRIMING PAINT, MARINE  
Coumarone - Indene Vehicle  
Formula 116 Pigmentation

Lab. No. 11191  
(NRP 299)

### Parts by weight

Red Lead	: 98%	380
Zinc Chromate Yellow	: Imperial X2127	70
Mica	: T-W Triple A	65
Iron Oxide	: Indian Red	10
Magnesium Silicate	: Asbestine 3X	160
Aluminum Stearate	: Witco 132	6
Coumarone - Indene Resin	: Cumar V $\frac{1}{2}$	141
Coumarone - Indene Resin	: Cumar P10	48.2
Liquid Coal Tar U.S. 52T5a	: Barrets	49.4
Zinc Resinate	: Newport - Zinar	17.7
Chlorinated Rubber 10 cp.	: Parlon	35
Hi-Flash Naphtha	: Bronoco	125
Mineral Spirits	: Varsol	71.9
Pine Oil		5

7 x formula (in grams) makes 3/4 gallon

PRIMING PAINT, MARINE  
 Phenolic Varnish Vehicle  
Formula 116 Pigmentation

Lab. No. 11189  
(NRP 213)

<u>Parts by weight</u>		
Red Lead	: 98%	760
Zinc Chromate Yellow	: Imperial X2127	140
Mica	: T-W Triple A	130
Iron Oxide	: Indian Red	20
Magnesium Silicate	: Asbestine 3X	320
Aluminum Stearate	: Witco 132	12
100% Phenolic Varnish	: NRP 210	830
Dipentene		50
Mineral Spirits	: Varsol	380
Driers: Pb Naphthenate	: Nuodex 24%	20
Co "	: " 6%	8
Anti-skinning Agent	: Exkin #1	1

2 x formula (in grams) makes 1 gallon

100% PHENOLIC-TUNG OIL VARNISH  
(20-gallon length)

NRP 210

<u>Parts by weight</u>		
100% Phenolic Resin	: Durez 550	460
Tung Oil		900
Mineral Spirits		850
Dipentene		50

Heated oil and resin to 465°F (240.5°C) in 40 minutes with continual stirring under N<sub>2</sub> blanket. Held at 465°F (240.5°C) for 40 minutes. Cooled to 150°C and thinned with mineral spirits.

PRIMING PAINT, MARINE  
Phenolated Alkyd Vehicle  
Formula 116 Pigmentation

Lab. No. 11190  
(NRP 228)

Parts by weight

Red Lead	: 98%	380
Zinc Chromate Yellow	: Imperial X2127	70
Mica	: T-W Triple A	65
Iron Oxide	: Indian Red	10
Magnesium Silicate	: Asbestine 3X	160
Aluminum Stearate	: Witco 132	6
Alkyd Resin Solution	: Glyptal G2458	207
Phenolic Varnish	: NRP 224	340
Dipentene		25
Mineral Spirits	: Varsol	190

4 x formula (in grams) makes about 3/4 gallon

PHENOLIC VARNISH

NRP 224

Parts by weight

100% Phenolic Resin	: BR 254	400
Coumarone - Indene Resin	: Cumar V 1/2	400
Linseed Oil	: Z2 Viscosity	384

Heated oil and resins to 288°C in 30 minutes with continual stirring under N<sub>2</sub> blanket. Held at 288°C for 45 minutes. Cooled to 204°C and thinned.

Viscosity K

Yield 2 qt.

## APPENDIX B

### Procedure for Preparation of Tidewater Exposure Panels

Steel panels prepared for outdoor exposure tests were of hot rolled  $3/16$ " steel plate and were cut to 6" by 12" in size. Two  $17/32$ " D holes were drilled in the upper corners of the panel with centres  $1/2$ " from the edges of the panel. These holes were required for mounting at the exposure site.

Panels were coated with priming paints by dipping. The whole panel was given a single coat of primer paint. After a 24-hour drying period, the bottom half of the panel was given an additional coat of priming paint. These coated panels were then allowed to dry for 3 days. One vertical half of the panel was masked off and the other half of the panel was coated with a light grey enamel (MIL-P-15130). This was done on both faces of the panel. All edges were dipped for added protection.

It was intended that all film thickness fall within the range  $1.4 \pm 0.2$  mils as measured by the G.E. Film Thickness Gauge. Some minor divergences from this standard occurred unavoidably. All film thicknesses are recorded in Tables B-1 and B-2. The distribution of coats over the panel is illustrated in Fig. B-1.

Panel surfaces were of two types:

- (1) with mill scale retained
- (2) with mill scale removed by sandblasting.

All panels were cleaned by degreasing. Sandblasted panels were also pretreated with a phosphoric acid solution similar to that covered by specification 1-GP-89. This treatment lasted 30 seconds. Mill scale panels were not pretreated because of the removal of the mill scale by phosphoric acid.

Panels were identified by letters and numbers stamped at the top of the panels prior to coating. These letters and numbers consisted of the code representing the paint, panel number of the series, and a letter designating type of surface (B being blasted; M being with mill scale intact).

One set of panels was prepared for each of two sites one at Sayville, Long Island and one at Shearwater, N.S.

Sayville panels were exposed at the tidewater basin of the National Lead Company on December 2, 1954. The panels at Shearwater were mounted at the tidewater exposure site of the Naval Research Establishment.



TABLE B-1

Average Thickness of Paint Coats on Panels Sent to the  
Sayville Tidewater Exposure Site

Lab. No.	Code	One coat Primer	Two coats Primer	1 coat Primer & 1 Top coat	2 coats Primer & 1 Top Coat
10980	SE 4M	1.2	2.7	3.0	4.5
	SE 5M	1.3	2.8	2.9	4.2
	SE 6M	1.3	2.8	3.0	4.5
	SE 4B	1.4	2.7	3.1	4.6
	SE 5B	1.3	2.8	2.8	4.2
	SE 6B	1.3	3.0	3.2	5.1
11147	S 4M	1.5	3.5	2.6	4.7
	S 5M	1.5	3.4	2.9	4.5
	S 6M	1.6	3.5	3.0	4.6
	S 4B	1.5	3.5	3.0	4.8
	S 5B	1.6	3.5	3.0	4.7
	S 6B	1.6	3.6	3.0	5.0
10979	LE 4M	1.3	3.0	3.0	4.6
	LE 5M	1.3	3.0	2.9	4.3
	LE 6M	1.3	3.0	2.8	4.5
	LE 4B	1.4	3.2	2.9	4.6
	LE 5B	1.4	3.3	3.0	4.7
	LE 6B	1.4	3.1	3.0	4.7
11146	L 4M	1.4	3.3	2.4	4.7
	L 5M	1.5	3.8	2.5	4.5
	L 6M	1.5	3.8	2.0	4.5
	L 4B	1.5	3.6	2.6	5.0
	L 5B	1.5	3.9	2.9	5.0
	L 6B	1.5	3.7	2.8	4.8
10985	SS 1M	0.8	2.0	1.6	3.0
	SS 2M	0.8	2.0	1.6	3.1
	SS 3M	1.0	2.2	1.6	3.0
	SS 1B	1.0	2.4	1.7	3.5
	SS 2B	1.0	2.5	1.6	3.2
	SS 3B	1.0	2.6	2.1	3.6

## Sayville Site (cont'd)

Lab. No.	Code	One Coat Primer	Two Coats Primer	1 coat Primer & 1 Top coat	2 coats Primer & 1 Top coat
11077	SO 4M	1.3	3.0	2.5	4.5
	SO 5M	1.4	3.1	2.6	4.5
	SO 6M	1.3	3.0	2.1	4.2
	SO 4B	1.4	3.3	2.4	4.2
	SO 5B	1.6	3.5	2.7	4.6
	SO 6B	1.5	3.4	2.8	5.0
11076	SSO 4M	1.4	3.4	2.5	4.5
	SSO 5M	1.3	3.1	2.2	4.2
	SSO 6M	1.3	3.4	2.0	4.1
	SSO 4B	1.3	3.1	2.4	4.5
	SSO 5B	1.5	3.8	2.8	5.0
	SSO 6B	1.6	3.7	2.7	5.0
11189	P 4M	1.3	3.0	3.0	4.5
	P 5M	1.4	3.0	3.0	4.7
	P 6M	1.2	2.9	3.0	4.5
	P 4B	1.3	3.2	3.1	5.0
	P 5B	1.4	3.2	3.4	5.2
	P 6B	1.4	3.1	3.8	5.4
11190	PA 4M	1.3	3.5	2.3	5.2
	PA 5M	1.2	3.2	2.8	5.1
	PA 6M	1.2	3.3	3.0	5.0
	PA 4B	1.3	3.5	2.2	5.1
	PA 5B	1.2	3.2	2.6	5.0
	PA 6B	1.2	3.2	2.8	5.0
11191	C 4M	1.3	4.1	2.1	5.2
	C 5M	1.3	4.0	2.3	5.5
	C 6M	1.3	4.2	2.2	5.4
	C 4B	1.4	4.2	2.5	5.5
	C 5B	1.5	4.3	2.8	6.0
	C 6B	1.4	4.5	2.4	5.8

Note: Lab. No. 10985 shows film thicknesses which are under the standard range; however, when measured mechanically the thickness was 1.5 at a single coat and 3.0 at a double coat.

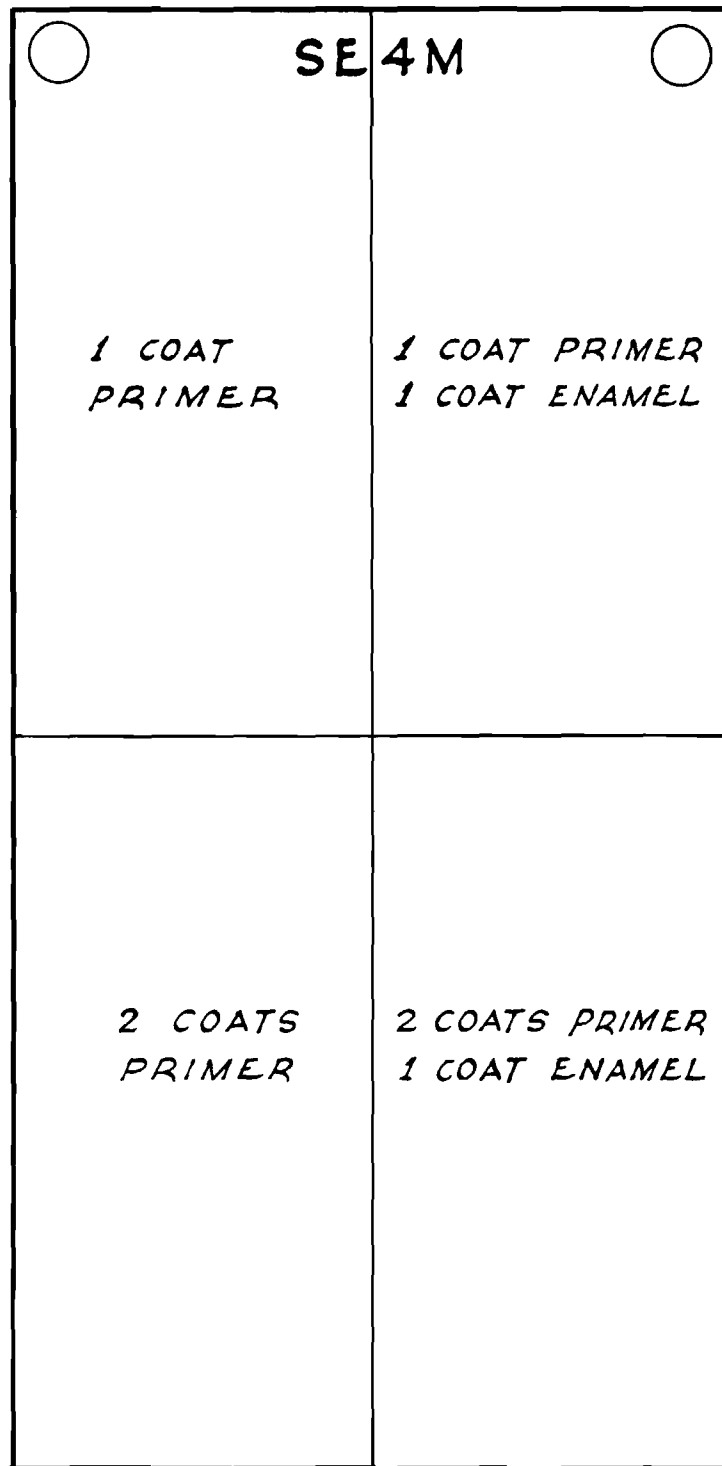
TABLE B-2

Average Thicknesses of Paint Coats on  
Panels Sent to the Shearwater, N.S.  
Tidewater Exposure Site

Lab. No.	Code	One coat Primer	Two coats Primer	1 coat Primer & 1 Top coat	2 coats Primer & 1 Top coat
10980	SE 1M	1.3	3.0	2.7	4.1
	SE 2M	1.3	2.8	2.6	3.9
	SE 3M	1.3	3.0	3.0	4.5
	SE 1B	1.4	3.0	2.7	4.2
	SE 2B	1.3	2.7	3.0	4.5
	SE 3B	1.3	2.8	3.0	4.5
11147	S 1M	1.5	3.1	2.7	4.3
	S 2M	1.6	3.4	2.9	4.5
	S 3M	1.5	3.3	2.8	4.5
	S 1B	1.6	3.4	2.9	4.5
	S 2B	1.7	3.6	3.2	5.0
	S 3B	1.6	3.4	3.0	4.9
10979	LE 1M	1.3	3.0	3.0	4.5
	LE 2M	1.3	3.0	2.9	4.8
	LE 3M	1.4	3.0	3.0	4.6
	LE 1B	1.4	3.2	3.0	4.7
	LE 2B	1.3	3.0	2.7	4.3
	LE 3B	1.4	3.0	3.0	4.6
11146	L 1M	1.3	3.3	2.2	4.5
	L 2M	1.3	3.2	2.3	4.1
	L 3M	1.3	3.2	2.1	4.0
	L 1B	1.5	3.5	2.9	4.7
	L 2B	1.5	3.3	2.5	4.5
	L 3B	1.5	3.6	2.7	4.5
10985	(Mill V scale)	1.5	3.2	3.0	4.5
	VV	1.5	3.0	2.9	4.4
	VVV	1.3	2.9	2.3	4.1
	U Blasted	1.5	3.0	2.9	4.5
	UU	1.5	3.0	2.8	4.4
	UUU	1.5	3.0	2.5	4.2

## Shearwater Site (cont'd)

Lab. No.	Code	One Coat Primer	Two coats Primer	1 coat Primer & 1 Top coat	2 coats Primer & 1 Top coat
11077	SO 1M	1.3	2.7	2.0	4.0
	SO 2M	1.3	3.1	2.3	4.1
	SO 3M	1.4	3.1	2.3	4.3
	SO 1B	1.4	3.2	2.8	4.6
	SO 2B	1.4	3.2	2.8	4.2
	SO 3B	1.5	3.2	2.6	4.5
11076	SSO 1M	1.3	3.0	2.2	4.2
	SSO 2M	1.3	3.1	2.0	4.0
	SSO 3M	1.4	3.2	2.4	4.5
	SSO 1B	1.4	3.2	2.8	4.4
	SSO 2B	1.4	3.3	2.5	4.5
	SSO 3B	1.4	3.2	2.4	4.4
11189	P 1M	1.2	2.7	2.6	4.1
	P 2M	1.2	2.8	2.5	4.5
	P 3M	1.2	3.0	3.0	4.9
	P 1B	1.4	3.1	2.9	4.7
	P 2B	1.4	3.3	3.1	5.0
	P 3B	1.3	2.8	2.8	4.5
11190	PA 1M	1.3	3.3	3.0	5.0
	PA 2M	1.2	3.3	2.9	5.0
	PA 3M	1.2	3.1	2.8	5.0
	PA 1B	1.2	3.1	2.7	4.9
	PA 2B	1.3	3.3	3.0	5.0
	PA 3B	1.4	3.8	2.9	5.0
11191	C 1M	1.3	4.0	1.8	4.5
	C 2M	1.3	3.9	1.8	4.6
	C 3M	1.3	4.0	1.9	5.0
	C 1B	1.3	4.0	2.3	5.0
	C 2B	1.4	4.0	2.5	5.1
	C 3B	1.4	4.1	2.5	5.1



SCALE: 1" = 1½"

FIGURE B-1

SKETCH ILLUSTRATING DISPOSITION of  
PAINT COATS ON A SAMPLE EXPOSURE PANEL