LIA07847

RED LEAD PAINTS
for
MARINE EXPOSURES

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Foreword

THIS Technical Letter contains suggested corrosion inhibitive paint formulations for marine use. These paints have been selected on the basis of outstanding performance under practical exposure conditions including marine atmosphere, intermittent immersion and continuous submersion.

The policy of the Lead Industries Association is to encourage the proper and economical use of lead products of all types. Through its Red Lead Technical Committee, comprised of representatives of the red lead and paint industries, it endeavors to furnish suggested formulations for high performance red lead base paints for the protection of iron and steel in various practical environments. Red Lead Technical Letters are issued from time to time to acquaint manufacturers, specifiers and users of paints with these latest developments in metal protective coatings.

A variety of high quality paint formulations has been selected for each of the three general types of marine exposure to meet a range of specific exposure demands and cost requirements.

Additional information on these formulations or information on specific paint problems can be obtained from the Lead Industries Association or from the member companies listed below.

Manufacturers of Red Lead

THE EAGLE-PICHER COMPANY.....Americana Building, Cincinnati 1, Ohio

W. P. FULLER & COMPANY.....301 Mission Street, San Francisco 1, California

Boise, Butte, Fresno, Los Angeles, Oakland, Phoenix, Portland (Ore.), Sacramento, Salt Lake City, San Diego, Seattle, Spokane, Tacoma, Yakima (Wash.)

THE GLIDDEN COMPANY.....1396 Union Commerce Building, Cleveland 14, Ohio

Atlanta, Boston, Minneapolis, New York, North Bergen (N. J.), San Francisco; Adams & Elting Division, Chicago; American Paint Works Division, New Orleans; Campbell Paint & Varnish Division, St. Louis; Nuhlsen Paint & Varnish Division, Chicago; A. Wilhelm Company Division, Reading; Canadian Division, Toronto; The Chemical & Pigment Company, Baltimore, Collinsville (Ill.), Oakland; Eastern Lead Company, Scranton; Metals Refining Company (representative), Detroit, Hammond (Ind.), Kansas City (Mo.), New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Ft. Thomas (Ky.)

HAMMOND LEAD PRODUCTS, INC.....First Trust Building, Hammond, Indiana
630 Lexington Avenue, New York 17, N. Y.

NATIONAL LEAD COMPANY.....111 Broadway, New York 6, N. Y.

Buffalo, Chicago, Cincinnati, Cleveland, Pittsburgh, St. Louis, San Francisco; National Lead Company of Mass., Boston; John T. Lewis & Bros. Company, Philadelphia

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RED LEAD PAINTS FOR MARINE EXPOSURES

TO assure best performance the synthetic vehicle paints described in this Letter should be applied only to surfaces cleaned thoroughly by some appropriate method such as sandblasting, or scraping and power wire brushing. All rust, loose mill scale and other foreign matter should be removed immediately before painting.

An especially effective protective system for bare metal comprises two or more coats of these corrosion inhibitive paints applied to a total minimum dry film thickness of three mils. For repaint work bare areas should be cleaned and spot primed before application of a full coat of the corrosion inhibitive paint.

After application of the corrosion inhibitive paint coats, topcoat paints designed for the particular environment encountered should be applied to a minimum dry film thickness of two mils.

Red Lead Paints For Marine Atmospheric Exposure

Paints made according to the following formulas are suitable for priming iron and steel surfaces on the topsides of ships, bridges situated along the seacoast or over tidewaters, dock structures and other atmospherically exposed marine installations. All of these red lead paints are of the quick drying type.

Included among these is the recently issued Bureau of Ships Formula No. 116 for the maintenance of the topsides of ships.

FORMULA 4-9

The newly authorized Navy red lead base formula No. 116 for topsides of ships, issued June 1, 1949 as "Bureau of Ships Paint Formula No. 116, Primer, Exterior, Maintenance (For Weather Surfaces)."

Components*		Percent	Pounds	Gallons
PIGMENT:	Red Lead (F. S. TT-R-191, Type I, Grade B)	25.0	200	2.15
	Zinc Yellow (F. S. TT-Z-415)	10.1	70	1.58
	Mica (Navy Dept. Spec. 52343)	9.4	65	2.77
	Indian Red (F. S. TT-I-511, Type I)	1.5	10	0.38
	Magnesium Silicate (Navy Dept. Spec. 52345, Type A)	22.1	160	6.70
	Aluminum Stearate (Navy Dept. Spec. 52418)	0.9	6	0.71
		100.0		
VEHICLE:	Alkyd Resin Solution (F. S. TT-R-266 Type I, Class A)*	24.9	415(200.5)*	32.69
	Dispersion (F. S. TT-D-576)	2.9	23	2.52
	Paint Thinner (F. S. TT-T-291, Grade I)	20.0	160	29.20
	Lead Drier (F. S. TT-D-643, Type I)	0.5	4.7	0.48
	Cobalt Drier (F. S. TT-D-643, Type II)	0.5	4.7	0.39
		100.0	1200.4	165.87

Requirements (as received):

Color – Shall be an approximate match to the standard color chip.*
Consistency – 77 ± 5 Krebs Units.
Weight per gallon – 12.0 pounds minimum.
Drying time – (0.0015 inch wet film).
Set to touch – 2 hours maximum.
Dry hard – 6 hours maximum.
Fineness of grind – Not less than 4.

Upon analysis, the paint shall contain not less than 20.0 percent (by weight) of pigment and not less than 20.5 percent (by weight) of the nonvolatile vehicle, not less than 20.0 percent by weight of the pigment shall be red lead and not less than 5.5 percent shall be zinc yellow.

* Moderate variations in the amount of indian red specified and small additions of beneficial will be permitted in order to match the color requirement.

* Chief bureau of specifications to submit on duplicate for this shall govern.

* For information to govern suppliers in regard to [illegible] to obtain the desired manufacturing test.

* For directions to manufacturers relative to volatile solids.

* Alkyd Resin Solution (Federal Specification TT-R-266, Type I, Class A).

Navy Publications-SD-7(3) Formality (Outdoor Build)—7-49 Aust Procurement-8-10 (as added)

LIA07850

FORMULA 4-2

This paint, containing a series of alkyd vehicle, has given excellent performance in rigorous marine atmosphere.

Composition	Percent	Pounds	Gallons
PIGMENT: Red Lead (97% Grade)	70.0	378	7.88
Zinc Yellow	10.0	54	0.74
Mica, Graphitic	20.0	108	0.80
	100.0		
VEHICLE: L. I. A. No. 37*	77.0	416	49.38
Mineral Spirits	21.0	113	22.56
Lead Naphthenate (24% Pb)	1.5	7.7	.88
Manganese Naphthenate (6% Mn)	0.5	2.5	.18
	100.0	140.2	100.00

Pigment = 58.1%
Vehicle = 41.9%
Wt./Gal. = 14.5 lbs.
PV = 50%

*L.I.A. Vehicle No. 37

Dehydrated Castor Oil Fatty Acids
Styrene
Phthalic Anhydride
Mineral Spirits

Cooking Procedure: Heat the first three items to 400°F. in 45 minutes with [illegible] and hold at 400°F. for 1 hour. Add the phthalic anhydride and hold at 400°F. for approximately 1½ hours. Cool and reduce.

Non-Volatile = 60% by wt.
Viscosity = [illegible]
Acid Number = 6-10 (as made)
Phthalic Anhydride = 20% (as made)

FORMULA 4-3

(United States Maritime Commission Specification 52-MC-598)

This is a government specification formula particularly well suited for both marine atmosphere and immersion immersion in sea water.

Copies of the complete Maritime Commission specifications can be obtained by writing to Chief, Materials Section, Technical Div., U. S. Maritime Commission, Washington 25, D. C.

Composition	Percent	Pounds	Gallons
PIGMENT: Red Lead (F. S. TT-P-191a, Type I, Grade C)	35.4	200	3.14
Zinc Yellow (F. S. TT-Z-413, Type I)	10.2	70	1.01
Mica	9.4	65	1.41
Indian Red	1.4	10	0.20
Magnesium Silicate (F. S. 52-MC-598, Type I)	25.5	160	4.70
Aluminum Stearate	0.2	2	0.24
	100.0		
VEHICLE: Alkyd Resin (52-MC-598, Type I)*	60.0	415	52.60
Aromatic Naphtha	14.7	105	14.60
Petroleum Spirits (F. S. TT-T-291a, Grade I) and Driers	17.8	110	17.60
	100.0	1417	100.00

Note: Litharge may be added as drier up to 8 pounds per 100 gallons just prior to application.

Pigment = 55%
Vehicle = 45%
Wt./Gal. = Not under 13.5 lbs.
PV = 57%

*F. S. Maritime Commission Specification 52-MC-598: a blend of modified glycerol phthalate alkyd with the following characteristics:

Non-Volatile = 70±1%
Oil Acid = [illegible]
Phthalic Anhydride = Not under 20%

FORMULA 4-A

This formulation is particularly well suited as a fast drying maintenance primer for surfaces exposed to marine atmospheres.

Composition	Percent	Pounds	Gallons
PIGMENT: Red Lead (97% Oxide)			
Zinc Yellow			
Zinc Oxide, Lead Free			
Mica, Graphitic			
Raw Sienna			
Magnesium Silicate			
Aluminum Stearate			
	100.0		
VEHICLE: L. I. A. Vehicle No. 5*			
Aromatic Mineral Spirits			
Lead Naphthenate (24% Pb)			
Cobalt Naphthenate (6% Co)			
Manganese Naphthenate (6% Mn)			
Anti-Skinning Agent**			
	100.0	100.0	100.00

Pigment = 65.0%
Vehicle = 35.0%
Wt./Gal. = 13.0 lbs.
PV = 50%

*L.I.A. Vehicle No. 5

A long oil modified phenolic varnish formulated as follows:

Phenolic Resin Resin	
100% Boiled Linseed Oil	
Mineral Spirits	
6% Lead Naphthenate	
Drier	

Cooking Procedure: Raw resin, phenolic resin and 20 gallons of refined soybean oil to 500°F. Hold for 1 hour (30 minutes for phenolic resin). Add 5 gallons of refined soybean oil and 10 of the mineral spirits. Blend and heat to 470°F. Hold for 10 to 15 minutes. Thin to 50% and cool and reduce to viscosity of G-H (Gardner-Holdt).

Preparation: Pre-Dispersion by weight
Titanium-Clay (Continental Clay)
Crystal 1.0
Anti Skinning Agent 0.5

**An anti-skinning agent of the aliphatic amine type.

FORMULA 4-B

This lead base corrosion inhibitive paint has given outstanding performance when exposed to the atmosphere in rigorous marine environments.

To insure keeping properties it is necessary to package the litharge separately in a double component container for admixture with the balance of the ingredients just prior to application.

Composition	Percent	Pounds	Gallons
PIGMENT: Red Lead (97% Oxide)			
Litharge			
Mica, Graphitic			
	100.0		
VEHICLE: L. I. A. No. 5*			
Mineral Spirits			
Lead Naphthenate (24% Pb)			
Manganese Naphthenate (6% Mn)			
	100.0	100.0	100.00

Pigment = 54.0%
Vehicle = 46.0%
Wt./Gal. = 13.0 lbs.
PV = 50%

* The vhcl is identical to that described under Formula 4-A on page 4.

Red Lead Paints for Intermittent Immersion in Sea Water

These anticorrosive red lead paints are suitable for the priming and undercoats on ship boot-topping areas and on parts of marine structures undergoing intermittent sea water immersion by tidal action. All of these paints are quick drying straight synthetic vehicle types with the exception of Formula 4-7.

FORMULA 4-6

Although this anticorrosive paint was designed especially for use in paint systems for intermittent seawater immersion, it has also been found highly suitable for atmospheric marine exposure.

	Composition	Percent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	35.0	420	6.00
	Zinc Yellow	10.0	78	2.57
	Zinc Oxide	10.0	72	1.24
	Iron Oxide	7.0	105	1.45
	Mica, Graphitic	18.0	180	6.56
		100.0		
VEHICLE:	L. I. A. No. 27*	73.6	481	88.87
	Mineral Spirits	23.0	149	22.20
	Lead Naphthenate (24% Pb)	1.5	7.7	0.89
	Manganese Naphthenate (6% Mn)	0.5	1.8	0.10
		100.0	1415.0	160.00

Pigment = 35.0%
Vehicle = 65.0%
Wt./Gal. = 14.2 lbs.
PV = 35%

* The alkyd vehicle is identical to that described under Formula 4-8 on page 6.

FORMULA 4-7

The higher wettability due to the free linseed oil content makes this formulation particularly suitable for general maintenance and touch-up work where very thorough surface preparation is not always feasible.

Because of the free linseed oil content of this formula, its drying time is longer than the other paints in this Technical Letter. An overnight drying period should be allowed between coats.

	Composition	Percent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	35.2	494	6.57
	Zinc Yellow	10.4	88	2.15
	Raw Sienna	4.2	37	1.00
	Mica, Graphitic	15.8	140	6.00
	Magnesium Silicate	14.8	125	5.20
	Aluminum Stearate	0.5	2.5	0.20
		100.0		
VEHICLE:	Alkyd Resin Solution*	45.8	288	35.04
	Raw Linseed Oil	20.5	185	21.20
	Mineral Spirits	22.7	151	32.00
	Lead Naphthenate (24% Pb)	2.1	11.2	1.38
	Cobalt Naphthenate (6% Co)	0.5	1.5	0.22
	Manganese Naphthenate (6% Mn)	0.5	1.5	0.22
	Anti-Skinning Agent**	0.5	1.5	0.20
		100.0	1478.0	160.00

Pigment = 60.7%
Vehicle = 39.3%
Wt./Gal. = 14.7 lbs.
PV = 60%

* Alkyd Resin Solution (Federal Specification TT-R-266, Type I, Class A)

Non-Volatile = 50-51%
Viscosity = Gal (Gardner-Holdt)
Acid Number (max.) = 7
Phthalic Anhydride (min. = 20%
Fatty Acid Content (by) = 52-56%

** An anti-skinning agent of the oximino esters type.

FORMULA 4-8

This is another outstanding anticorrosive paint for intermittent seawater immersion containing L.I.A. Vehicle No. 27.

Composition	Pounds	Pounds	Gallons
PIGMENT: Red Lead (97% Grade)	85.0	340	5.68
Zinc Yellow	15.0	60	1.00
Zinc Oxide, Lead Free	75.0	300	5.00
Mica, Graphite	125.0	500	8.33
Rare Earths	50.0	200	3.33
Magnesium Silicate	50.0	200	3.33
Aluminum Stearate	5	15	.25
	405.0		
VEHICLE: L. I. A. No. 27*	80.0	440.4	38.79
Aromatic Mineral Spirits	30.7	169	29.79
Lead Naphthenate (24% Pb)	3.0	9.0	1.00
Cobalt Naphthenate (6% Co)	1.5	3	.50
Manganese Naphthenate (6% Mn)	1.5	3	.50
Anti-Skinning Agent**	.5	1	.14
	120.0	625.5	101.00

Pigment = 21.35
Vehicle = 69.75
Wt./Gal. = 11.5 lbs.
PV = 35%

*This effect is identical to that described under Formula 4-6 on page 6.
**An anti-skinning agent of the oximine amine type.

FORMULA 4-9

This is a high quality corrosion inhibitive paint containing a mixed alkyd-phenolic vehicle.

Composition	Pounds	Pounds	Gallons
PIGMENT: Red Lead (97% Grade)	85.0	425	5.68
Zinc Yellow	15.0	75	1.00
Zinc Oxide	75.0	375	5.00
Mica (325 Mesh)	125.0	625	8.33
	300.0		
VEHICLE: L. I. A. No. 19*	72.0	457	33.00
Mineral Spirits	30.7	161	21.00
Lead Naphthenate (24% Pb)	1.5	7.7	.38
Manganese Naphthenate (6% Mn)	0.8	1.5	.14
	100.0	1400.0	101.00

Pigment = 21.35
Vehicle = 44.00
Wt./Gal. = 11.5 lbs.
PV = 35%

* L.I.A. Vehicle No. 19

Short Oil Length Phenolic Varnish 35%
Medium Linseed Oil Alkyd 35%

The short oil length phenolic varnish is formulated as follows:
Phenolic Resin (medium-hard, phenol-formaldehyde resin) 30.0%
Dehydrating Tung Oil (U. S. 137-117°C.) 30.0%
Linseed Oil (32 Centistokes Viscosity) 40.0%

Cooking Procedure: Heat all oil ingredients to 290°F. in 30 minutes. Hold at 290°F. (temperature of exotherm) until the viscosity of the cook reaches [illegible] when reduced to 50% by weight with mineral spirits (boiling range 370-400°F.) at 25°C. concentration.

The medium linseed oil alkyd is of the glycerol phthalate type and has the following characteristics:

Acid Value = 10-15
Viscosity = [illegible]
Color = [illegible]
Solids Content = [illegible]

LIA07854

Red Lead Paints For Continuous Submersion in Sea Water

The following formulations were designed for use with antifouling paints for the protection of steel ship bottoms and submerged marine structures. They are suited for use with a wide variety of antifouling coats including conventional coal tar based products and the newer cold and hot plastic types.

Paints made according to these formulations are fast drying, permitting the application of two coats in a working day.

FORMULA 4-10

	Composition	Percent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	54.5	340	7.38
	Zinc Oxide (Lead Free)	9.5	60	1.33
	Zinc Yellow	9.5	60	1.33
	Silicomon Iron Oxide	7.5	46.9	1.33
	Magnesium Silicate	15.1	94.5	3.33
	Diatomaceous Silica	3.5	21.9	0.83
	Aluminum Stearate	0.5	3.2	0.08
		100.0		
VEHICLE:	L. I. A. No. 19*	92.0	288	38.38
	Hi-Flash Naphtha	7.5	47	0.83
	Lead Naphthenate (24% Pb)	0.5	3.2	0.08
	Cobalt Naphthenate (6% Co)	0.1	1.9	0.08
		100.0	1564.3	100.00

Pigment = 61.88
Vehicle = 38.48
Wt./Gal. = 16.0 lbs.
PV = 4.25

* This vehicle is described in detail under Formula 4-0 on page 7.

FORMULA 4-11

	Composition	Percent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	47.0	282	4.51
	Zinc Oxide	8.5	51.1	1.14
	Zinc Yellow	8.5	51.1	1.14
	Mica (325 Mesh)	23.5	141.1	8.38
	Magnesium Silicate	12.5	75	3.57
	Aluminum Stearate	0.5	3	0.07
		100.0		
VEHICLE*:	Coumarone-Indene Resin (M. P. 127-137°C.)**	25.4	160	10.13
	Coumarone-Indene Resin (M. P. 5-15°C.)***	6.1	37	0.55
	Liquid Coal Tar	8.5	51.1	0.57
	Zinc Resinate	8.5	51.1	0.77
	Chlorinated Rubber	8.5	51.1	0.58
	Hi-Flash Naphtha	31.5	200	5.38
	Alphatic Petroleum Spirits (Boiling Range 160°-200°F.)	15.0	95.5	14.00
	Tung Oil	2.5	15	0.20
		100.0	1000.0	100.00

Pigment = 51.88
Vehicle = 48.75
Wt./Gal. = 15.8 lbs.
PV = 8.88

* This vehicle was prepared by cold mixing the indicated ingredients.
** A coumarone-indene resin with a melting range of 127-137°C.
*** A coumarone-indene resin with a melting range of 5-15°C.

Note: Only dark colored finishes should be applied over this primer since bleeding through of the coal tar may occur. However this does not affect its protective performance.

FORMULA 4-13

Composition		Parts	Parts	Volume
PIGMENT:	Red Lead (97% Grade)	[illegible]	[illegible]	[illegible]
	Zinc Oxide	[illegible]	[illegible]	[illegible]
	Zinc Yellow	[illegible]	[illegible]	[illegible]
	Micaceous Iron Oxide	[illegible]	[illegible]	[illegible]
	Magnesium Silicate	[illegible]	[illegible]	[illegible]
	Diatomaceous Silica	[illegible]	[illegible]	[illegible]
	Aluminum Stearate	[illegible]	[illegible]	[illegible]
		[illegible]		
VEHICLE:	L. L. A. No. 20*	[illegible]	[illegible]	[illegible]
	Mineral Spirits	[illegible]	[illegible]	[illegible]
	Hi-Flash Naphtha	[illegible]	[illegible]	[illegible]
	Lead Naphthenate (24% Pb)	[illegible]	[illegible]	[illegible]
	Cobalt Naphthenate (6% Co)	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]

Pigment = [illegible]
Vehicle = [illegible]
Wt./Gal. = [illegible] lbs.
PV = [illegible]

* L.L.A. Vehicle No. 20

[illegible]

Although the formulations contained in this Technical Letter have been established by our Red Lead Technical Committee through careful evaluation, users are urged to make additional confirmatory evaluations to meet their specific requirements.

The Lead Industries Association and its member companies will be glad to give further information on points for review or to assist on other paint problems.