

RED LEAD PAINTS for MARINE EXPOSURES

	PAGE
FOREWORD	2
MANUFACTURING OF RED LEAD	2
RED LEAD PAINTS FOR MARINE ATMOSPHERE	
EXPOSURE	3
FORMULA 4-1	3
FORMULA 4-2	4
FORMULA 4-3	4
FORMULA 4-4	5
FORMULA 4-5	5
RED LEAD PAINTS FOR INTERMITTENT IMMERSION	
IN SEA WATER	6
FORMULA 4-6	6
FORMULA 4-7	6
FORMULA 4-8	7
FORMULA 4-9	7
RED LEAD PAINTS FOR CONTINUOUS SUBMERSION	
IN SEA WATER	8
FORMULA 4-10	8
FORMULA 4-11	8
FORMULA 4-12	9

Red Lead Technical Committee
LEAD INDUSTRIES ASSOCIATION
430 LEXINGTON AVENUE
NEW YORK 17, N. Y.

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 SABLE-PYCHE COMPANY..... American Building, Cincinnati 1, Ohio

W. P. FULLER & COMPANY..... 301 Mission Street, San Francisco 1, California
 Butte, Butte, Fresno, Los Angeles, Oakland, Phoenix, Portland (Ore.), Sacramento,
 Salt Lake City, San Diego, Seattle, Spokane, Tacoma, Yakima (Wash.)

THE GLENN COMPANY..... 1296 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, Nelson Paint & Varnish Division,
 Chicago, A. Wilhelm Company Division, Reading, Canadian Division, Toronto,
 The Chemical & Pigment Company, Baltimore, Collierville (Ill.), Oakland,
 Eastern Lead Company, Scranton, Metals Refining Company (representative),
 Detroit, Hammond (Ind.), Kansas City (Mo.), New Orleans, New York, Philadel-
 phia, Pittsburgh, St. Louis, Ft. Thomas (Ky.)

HAMMOND LEAD PRODUCTS, INC...... First Trust Building, Hammond, Indiana
 620 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 & Son Company,
 Philadelphia

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 tidewater, 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 4-8

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, Prime, Exterior, Maintenance (For Weather Surfaces)."

Constituents	Pounds	Pounds	Gallons
PIGMENT: Red Lead (F. S. TT-2-191, Type I, Grade B).....	85.0	300	5.13
Zinc Yellow (F. S. TT-2-415).....	10.1	70	2.30
Mica (Navy Dept. Spec. 32343).....	0.4	05	2.77
Indian Red (F. S. TT-2-311, Type I).....	1.8	10	0.26
Mayanum Silicate (Navy Dept. Spec. 32343, Type A).....	23.1	100	0.70
Aluminum Stearate (Navy Dept. Spec. 32343).....	0.9	0	0.21
	100.0		
VEHICLE: Alkyd Resin Solution (F. S. TT-2-200 Type I, Class A).....	04.0	415(100.5)*	22.00
Dipentene (F. S. TT-2-276).....	3.0	25	0.32
Pink Thinner (F. S. TT-2-291, Grade I).....	20.0	100	20.00
Lead Drier (F. S. TT-2-443, Type I).....	0.8	4.7	0.09
Cobalt Drier (F. S. TT-2-444, Type II).....	0.8	4.7	0.09
	100.0	120.4	100.00

Requirements (as received):

- | | |
|--|--|
| Color - Shall be an approximate match to the standard color chip.* | Drying time - (60015 inch wet film).
Set to touch - 2 hours maximum.
Dry hard - 6 hours maximum. |
| Consistency - 77 ± 5 Kuhn Units. | Flammability of dried - Not less than 4. |
| Weight per gallon - 12.5 pounds minimum. | |

Upon analysis, the paint shall contain not less than 80.0 percent (by weight) of pigment and not less than 20.0 percent (by weight) of the nonvolatile vehicle; not less than 80.0 percent by weight of the pigment shall be red lead and not less than 0.5 percent shall be zinc yellow.

* Methods applicable to the amount of lead and spirit and small addition of linseed oil to permit in paint to meet the color requirements.

* The amount of spirit added in dry of painting for job shall govern.

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FORMULA 4-2

This paint, containing a carrier of alkyl vehicle, has given excellent performance in rigorous marine atmospheres.

Composition	Pounds	Pounds	Gallons
PIGMENT: Red Lead (97% Grade).....	70.0	570	7.00
Zinc Yellow.....	10.0	84	2.74
Mica, Graphite.....	20.0	168	6.50
	100.0		
VEHICLE: L. I. A. No. 57 ^a	77.0	400	20.00
Miscellaneous Solvents.....	21.0	187	22.00
Lead Naphthenate (50% Pb).....	1.5	7.7	.00
Manganese Naphthenate (50% Mn).....	0.5	1.0	.10
	100.0	1051.0	100.00

Pigment = 28.1%
Vehicle = 45.2%
Wt./Gal. = 14.5 lbs.
PV = 500

^aL.I.A. Vehicle No. 57

Distilled Water Oil Pump Acid.....	1.5
Distilled Water.....	1.5
Distilled Water.....	1.5
	100.0

Coating Procedure: Heat the Red Lead to 250°F. in oil vehicle with good stirring and add the other ingredients in the order given. Stir for approximately 100 minutes. Cool and strain.

Non-Volatile = 45% by wt.
Vehicle = 45.2%
Wt./Gal. = 14.5 lbs.
PV = 500

FORMULA 4-3

(United States Maritime Commission Specification 25-MC-500)

This is a government specification formula particularly well suited for both marine atmospheres and international 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	Pounds	Pounds	Gallons
PIGMENT: Red Lead (F. S. TT-F-191a, Type I, Grade C).....	25.4	200	2.14
Zinc Yellow (F. S. TT-Z-413, Type I).....	10.0	70	2.31
Mica.....	0.4	05	0.41
Indian Red.....	1.4	10	0.30
Magnesium Silicate (F. S. 25-MC-500, Type I).....	25.3	100	0.70
Aluminum Oxide.....	0.5	5	0.24
	100.0		
VEHICLE: Alkyl Resin (25-MC-500, Type II) ^a	60.0	415	20.00
Aromatic Naphthenes.....	14.7	105	14.00
Petroleum Spirits (F. S. TT-T-591a, Grade I) and Diluent.....	17.5	110	17.00
	100.0	1517	100.00

Note: Litharge may be added at rates up to 5 pounds per 100 gallons just prior to application.

Pigment = 50%
Vehicle = 45%
Wt./Gal. = Not under 14.5 lbs.
PV = 575

^aU. S. Maritime Commission Specification 25-MC-500, a blend of modified glyceryl phthalate alkyl with the following characteristics:

Non-Volatile = 70%
Wt./Gal. = 14 lbs.
Vehicle Alkyl Resin = Not under 500

	Composition	Pounds	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade) ..	22.0	200	4.00
	Zinc Yellow ..	12.0	22.5	2.15
	Zinc Oxide, Lead Free ..	7.9	22.5	1.97
	India, Graphite ..	12.1	24.2	2.20
	Raw Sienna ..	2.9	24.2	.26
	Magnesium Silicate ..	10.0	22.5	2.25
	Aluminum Stearate ..	2	1.0	.20
		100.0		
VEHICLE:	L. I. A. Vehicle No. 57 ..	21.0	201.5	21.20
	Aromatic Mineral Spirits ..	27.1	224.5	11.20
	Lead Naphthenate (50% Pb) ..	.7	4.5	.44
	Cobalt Naphthenate (25% Co) ..	.1	.7	.20
	Manganese Naphthenate (25% Mn) ..	.1	.7	.20
	Anti-Skinning Agent ** ..	.1	1	.17
		100.0	100.0	100.00

Figurement	==	42.5%
Vehicle	==	30.5%
Wt./Col.	==	11.8%
TV	==	15%

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Properties: Non-Volatile 99% by weight
 Viscosity: C-III (Gearless-Mixing)
 Color: L-8
 Acid Number: 0

²² An anti-dumping report of the Ministry of Commerce.

FORMULA 4.8

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

	<u>Composition</u>	<u>Powder</u>	<u>French</u>	<u>Gillette</u>
PICNIC:				
	Red Lead (97% Grade)	50.0	425	1.55
	Litharge	14.0	167	1.30
	Mica, Graphite	50.0	250	0.57
		100.0		
VEHICLE:				
	L. I. A. No. 57°	71.0	452	52.00
	Mineral Spirits	57.0	170	54.00
	Lead Naphthate (54% Pb)	1.3	7.7	0.50
	Manganese Naphthate (65 Mn)	0.2	1.2	0.10
		100.0	100.0	100.00

Personnel	==	64.50
Materials	==	64.50
Wages	==	14.90
TV	==	2.00

* This subject is identical to that described under Formulas 4-4 on page 6.

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 (975 Grade).....	85.0	420	6.00
Zinc Yellow.....	10.0	70	2.37
Zinc Oxide.....	10.0	70	1.04
Iron Oxide.....	7.0	35	1.40
Mica, Graphite.....	14.0	120	5.00
	100.0		
VEHICLE: L. I. A. No. 27 ^a	75.0	401	28.87
Mineral Spirits.....	25.0	140	22.00
Lead Naphthenate (545 Pb).....	1.2	7.7	0.00
Manganese Naphthenate (65 Mn).....	0.8	1.3	0.10
	100.0	1415.0	100.00

Pigment = 85.0%
Vehicle = 45.0%
Wt./Gal. = 142.5 lbs.
PV = 325

^aThe oil vehicle is identical to that described under Formula 4-5 on page 4.

FORMULA 4-7

The higher waterblow due to the free based 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 based 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 (975 Grade).....	85.0	404	6.07
Zinc Yellow.....	10.4	90	3.15
Raw Sienna.....	4.2	37	1.40
Mica, Graphite.....	15.0	140	6.00
Magnesium Silicate.....	14.0	120	5.00
Aluminum Stearate.....	0.8	2.5	0.20
	100.0		
VEHICLE: Alkyd Resin Solution ^a	45.0	200	28.04
Raw Linseed Oil.....	20.0	100	21.00
Mineral Spirits.....	22.7	131	20.00
Lead Naphthenate (545 Pb).....	2.1	11.5	1.30
Cobalt Naphthenate (65 Co).....	0.8	1.3	0.20
Manganese Naphthenate (65 Mn).....	0.8	1.3	0.20
Anti-Blowing Agent ^{aa}	0.8	1.3	0.20
	100.0	1478.0	100.00

Pigment = 65.7%
Vehicle = 30.3%
Wt./Gal. = 147 lbs.
PV = 325

^aAlkyd Resin Solution (Paint Specification TT-3-500, Type I, Class A)

Raw Vehicle = 50.7%
Varnish = 5.0%
L.I. Number (Type I) = 100 (Barlow-2400)
Pigment Loadings (Parts) = 100
Parts per gallon (Type I) = 325
Poly Acid Content (Type I) = 10.7%

^{aa}An anti-blowing agent of the aliphatic ester type.

FORMULA 4-8

This is another outstanding automotive paint for international weather resistance containing L.I.A. Vehicle No. 27.

Composition	Pounds	Pounds	Ounces
PIGMENT: Red Lead (97% Grade).....	85.0	280	4.50
Zinc Yellow.....	2.0	6.0	0.20
Zinc Oxide, Lead Free.....	7.0	21.1	1.10
Mica, Graphite.....	15.1	100	4.50
Rare Resins.....	2.0	27	1.00
Magnesium Silicate.....	2.0	60.0	2.50
Aluminum Peroxide.....	.5	1.0	.20
	100.0		
VEHICLE: L. I. A. No. 27 ^o	60.0	400.4	25.70
Aromatic Mineral Spirits.....	20.7	100	25.70
Lead Naphthenate (54% Pb).....	.9	2.0	.01
Cobalt Naphthenate (6% Co).....	.1	.2	.10
Manganese Naphthenate (6% Mn).....	.1	.2	.10
Anti-Chalking Agent ^o	.5	1	.10
	100.0	1000.0	100.00

Pigment = 51.25
Vehicle = 60.75
Wt./Gal. = 12.0 lbs.
PV = 500

^oThis effect is identical to that described under Formula 4-6 on page 6.
^oAn anti-chalking agent of the aliphatic ester type.

FORMULA 4-9

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

Composition	Pounds	Pounds	Ounces
PIGMENT: Red Lead (97% Grade).....	85.0	450	5.50
Zinc Yellow.....	10.0	70	2.00
Zinc Oxide.....	10.0	70	1.00
Mica (225 Mesh).....	25.0	150	5.50
	100.0		
VEHICLE: L. I. A. No. 19 ^o	72.0	407	20.00
Mineral Spirits.....	20.7	101	21.00
Lead Naphthenate (54% Pb).....	1.0	7.0	.20
Manganese Naphthenate (6% Mn).....	0.5	1.0	.10
	100.0	1000.0	100.00

Pigment = 55.45
Vehicle = 44.05
Wt./Gal. = 14.0 lbs.
PV = 500

^oL.I.A. Vehicle No. 19

Short Oil Low-Viscosity Vehicle..... 250

The short oil low-phenolic vehicle is formulated as follows:
Resin Base (methyl-ethyl-phenolic)..... 50 lb.
Carboxylic Anhydride (M. E. 187-187-C)..... 7 lb.
Lithium Oil (25 Chlorine-Base Vehicle)..... 7 lb.

Coating Procedure: Heat oil and resin to 200°F. in 50 minutes, hold for 10 minutes (approximately 45 minutes), cool to 100°F. and drop. The above temperature is drop to 100°F. and add pigment. The 100°F. is immediately previous to pigment (Drying Range 170-200°F.) in 50% conversion.

The finished blend of short oil is of the phenolic plastic type and has the following characteristics:

Res. Vehicle = 50.0%
Viscosity = 1.0 (in 200°F.)
PV = 1.0 (in 200°F.)

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	Pounds	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	54.5	54.5	7.25
	Zinc Oxide (Lead Free)	0.5	0.5	0.10
	Zinc Yellow	0.5	0.5	0.10
	Stannous Iron Oxide	7.0	7.0	1.25
	Magnesium Silicate	10.4	10.4	1.51
	Diatomaceous Earth	2.0	2.0	0.25
	Aluminum Stearate	0.1	0.1	0.01
		105.0		
VEHICLE:	L. I. A. No. 19 ^a	92.0	92.0	12.25
	Ni-Flush Naphthalene	7.5	7.5	0.95
	Lead Naphthenate (50% Pb)	0.4	0.4	0.05
	Cobalt Naphthenate (25% Co)	0.1	0.1	0.01
		100.0	100.0	13.26

Pigment = 61.55
Vehicle = 38.45
Wt./Gal. = 13.0 lbs.
PV = 415

^a The vehicle is described in detail under Formula 4-9 on page 7.

FORMULA 4-11

	Composition	Pounds	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	47.0	47.0	6.25
	Zinc Oxide	0.5	0.5	0.10
	Zinc Yellow	0.5	0.5	0.10
	Mica (333 Mesh)	0.5	0.5	0.05
	Magnesium Silicate	27.0	27.0	3.57
	Aluminum Stearate	0.1	0.1	0.01
		100.0		
VEHICLE ^a :	Cammarone-Indane Resin (M. R. 127-127°C) ^{b,c}	25.4	25.4	3.25
	Cammarone-Indane Resin (M. R. 5-15°C) ^{b,c}	0.1	0.1	0.01
	Liquid Coal Tar	0.5	0.5	0.07
	Zinc Naphthenate	0.5	0.5	0.07
	Chlorinated Rubber	0.5	0.5	0.07
	Ni-Flush Naphthalene	0.1	0.1	0.01
	Aliphatic Petroleum Spirits (Boiling Range 160°-200°F.)	12.0	12.0	1.50
	Pure Oil	0.0	0.0	0.00
		100.0	100.0	13.00

Pigment = 51.10
Vehicle = 48.90
Wt./Gal. = 13.0 lbs.
PV = 500

^a This vehicle was prepared by cold casting the indicated ingredients.
^b Cammarone-Indane resin with a melting range of 127-127°C.
^c Cammarone-Indane 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	Pound	Pound	Gallon
PIGMENT:	Red Lead (97% Grade)	85.5	855	4.81
	Zinc Oxide	10.0	100	1.40
	Zinc Yellow	10.0	100	1.21
	Magnesium Iron Oxide	5.0	50	1.34
	Magnesium Silicate	10.0	100	1.77
	Dioctadecyl Sulfate	7.5	75	2.15
VEHICLE:	Aluminum Stearate	0.5	5	0.30
		100.0		
	L. I. A. No. 80*	85.5	855	47.80
	Mineral Spirits	7.5	75	7.21
	Hi-Flash Naphtha	0.5	5	0.04
	Lead Naphthenate (94% Pb)	0.5	5	0.20
	Cobalt Naphthenate (60% Co)	0.5	5	0.20
		100.0	1000	100.00

Pigment on 85.5
Vehicle on 85.5
Wt./Gal. on 12.1 lbs.
PV on 855

* L.I.A. Vehicle No. 80

Medium Lead Oil Adhesives 85.5
Short Oil Length, Potent, Viscous 85.5
The medium based oil adhesives in Federal Specification TT-S-555, Type II
and is of the general plastic type having the following characteristics:

Non-Volatile 85.5%
Viscosity 1.0 (in tube)
Hardness 1.0 (in tube)
Potent Adhesivity 85.5% (in tube)

The above all length plastic adhesives is formulated as follows:
Potent Base (medium based adhesive) 85.5
Intermediate Carrier Oil (C-8 Carrier-Base mixture) 7.5
Short Potent Lead Oil Adhesives 0.5

Casting Procedure: Heat oil and resin to 200°F. in approximately 60 minutes, hold
for 10 minutes (approximately 45 minutes), heat to 200°F. and then to
250°F. while with potting machine (holding temp. 250°F. for 10 minutes).

Oil Length 10.0
Viscosity 1.0
Potent Adhesivity 85.5% (in tube)

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 marine exposure or to assist on other paint problems.

