Pins 1 and 6
and Engineering & Purchasing
Personnel

LEAD INDUSTRIES ASSOCIATION
292 MADISON AVENUE
NEW YORK 17, N. Y.

November 23, 1961

SUBJECT: LEAD PIGMENTS
TECHNICAL LETTER NO. 15

To Members of the Lead Industries Association:

A copy of our new "Lead Pigments Technical Letter No. 15 - Red Lead Based Paint Systems" is enclosed.

This Letter contains recommended paint formulations and paint systems for a wide variety of exposure conditions and is basically a compilation of the data that appeared in earlier Letters in this series.

Approximately 10,000 copies are being distributed to individuals in the following groups:

Construction Engineers
Corrosion Engineers
Highway Engineers
National Paint Varnish & Lacquer Association members
Paint Production Clubs
Shipyards
Railroads
Water and Sewage Engineers

Additional copies of "Lead Pigments Technical Letter No. 15" are available in quantity at our printing cost of approximately 30 cents per copy.

Sincerely yours,

Secretary

RED LEAD BASED PAINT SYSTEMS

LEAD PIGMENTS TECHNICAL COMMITTEE
LEAD INDUSTRIES ASSOCIATION
292 Madison Avenue
New York 17, N. Y.

FOREWORD

This Lead Pigments Technical Letter contains recommended paint formulations and paint systems for a wide variety of exposures. These recommendations include various specification paints as well as paints that have been developed by the Lead Pigments Technical Committee of the Lead Industries Association. All of the paints and paint systems included in the Letter have been extensively *field tested by the committee.*

In the opinion of the Lead Pigments Technical Committee proper surface preparation of the steel prior to the application of the primer coat is of extreme importance. For this reason an extensive section on this subject is included and it is hoped that this will aid the industrial user in getting the longest possible service life out of his paint.

A new paint numbering system that will indicate immediately the type of vehicle, has been adopted and will be used in this and subsequent publications by the Lead Pigments Technical Committee. For the details and a correlation between new and old L.I.A. paint numbers, please refer to page 31.

This Letter is basically a compilation of the data that appeared in all previous Letters in this series and earlier ones can now be discarded.

Inquiries on these recommended paints or paint systems or on specific painting problems are welcome and should be addressed to the Lead Industries Association or to the designated individuals in the member companies listed below:

THE BUNKER HILL COMPANY — 660 Market Street, San Francisco 4, Cal.
1336—16th Street, Oakland 7, Cal.
2151 Yates Avenue, Los Angeles 22, Cal.
2700—16th Avenue, S.W., Seattle 4, Wash.

For technical information write John W. Caldwell, Pacific Division 2700—16th Avenue, S.W., Seattle 4, Wash.

THE EAGLE-PICHER COMPANY — American Building, Cincinnati 1, Ohio

For technical information write Paul Whitford, Research Dept., P.O. Box 290, Joplin, Mo.

Chicago 2, Cincinnati 1, Cleveland 13, Dallas 26, Kansas City 6 (Mo.), New York 17, Philadelphia 4, Pittsburgh 22, New Orleans 12, Atlanta

HAMMOND LEAD PRODUCTS, INC. — 5231 Hohman Avenue, Hammond, Ind.
420 Lexington Avenue, New York 17, N.Y.
40 East Main Street, Carnegie, Pa.

For technical information write E. H. Butzow at Hammond, Ind.

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

For technical information write R. P. Bates at above address.

Atlanta, Buffalo 3, Chicago 8, Cincinnati 3, Cleveland 13, Dallas 2, Philadelphia 23, Pittsburgh 12, St. Louis 1, San Francisco 10, Boston 6, Charleston 25 (W. Va.), Seattle 4, Los Angeles 28

WESTERN LEAD PRODUCTS COMPANY — P.O. Box 2291, City of Industry, Cal.

For technical information write Thomas B. Blair at above address.

GENERAL PROPERTIES AND FORMULATION INDEX OF RECOMMENDED PAINTS

L.J.A. Formula Number	Page	Wt./Gal. (lbs Pounds)	PV	Vehicle Type	Approx. Drying (Hrs.) For Handling	Approx. Drying (Hrs.) For Recoating	Meets Specifications	Suggested Uses
100	20	24	36	Linseed Oil	6	36	Federal TT-P-86a, Type I A.A.S.H.O.-M72, Type II	Initial and maintenance priming of structural steel surfaces, shop priming, bridges and similar structures.
101	20	17.8	35	Linseed Oil	24	36	—	
102	21	15.5	32	Linseed Oil	24	36	SSPC-P4	
103	21	24.5	29	Linseed Oil	6	36	A.A.S.H.O.-M72, Type I	
140	22	14.75	30	Linseed Oil		18	A.A.S.H.O.-M70, Type I, Class B	White lead based paints for first and/or second field coat or top coat for structural steel surfaces, bridges and similar structures.
141	22	19.7	28	Linseed Oil		18	A.A.S.H.O.-M70, Type II	
142	22	18.1	26	Linseed Oil		24	A.A.S.H.O.-M67, Type II Foliage Green	Foliage green top or finish coat for structural steel surfaces, bridges and similar structures.
200	23	16.7	38	Oil-Resin Fortified	4	16	Federal TT-P-86a, Type II A.A.S.H.O.-M72, Type III	Priming and intermediate coats on structural steel, bridges and similar structures where overnight dry is required.
201	23	22	35	Oil-Resin Fortified	16	24	SSPC-P2	
202	23	21.4	38	Oil-Resin Fortified	6	16	A.A.S.H.O.-M72, Type IV	
300	24	19	38	Alkyd	1	4	Federal TT-P-86a, Type III	Equipment in chemically contaminated atmospheres, storage tank exteriors, window sash, air conditioning conduits, transmission towers, factory guard rails, iron fencing, bottling plant equipment, ship interiors, engine room equipment.
301	24	16	30	Alkyd	2	6		Railroad cars, storage tank exteriors, window sash, air conditioning conduits, transmission towers, iron fencing, ship interiors
302	25	12.5	35	Alkyd	2	6	Bureau of Ships, Formula 116, MIL-P-17545	Ships, (topsides, interiors, boot-topping), bridges over tidewater, docks, surfaces in dilute brine, surfaces intermittently immersed in sea water.

GENERAL PROPERTIES (cont'd.)

L.I.A. Formula Number	Page	Wt./Gal. (In Pounds)	PV	Vehicle Type	Approx. Drying (Hrs.) For Handling	Approx. Drying (Hrs.) For Recoating	Meets Specifications	Suggested Uses
303	25	14	36	Alkyd	2	6		Railroad cars, transmission towers, ships (topsides, interiors), bridges over tidewater.
304	26	13.1 (without zinc dust)	44	Alkyd				Rusted, weathered or new galvanized steel primer of outstanding performance.
305	26	13.2	40	Alkyd	1	24		Steel surfaces exposed in chemically contaminated atmospheres and marine environments such as storage tanks, ship superstructures, bridges and dock installations.
400	27	17	41	Phenolic	2	6	Federal TT-P-86a Type IV AWWA-D-102	Primer for steel surfaces exposed to moisture condensation as well as surfaces immersed intermittently or continuously in fresh water such as dams and adjacent equipment, ships in fresh water, water storage tank interiors and heavy industrial equipment.
401	27	8.3	22.5	Phenolic			Corps of Engineers P-3	Aluminum finish paint for interior and exterior ferrous surfaces adjacent to water but exposed to normal atmospheric exposure.
500	28	9.7	17.4	Vinyl	0.5	1	Corps of Engineers V-101 MIL-P-15929	Equipment in chemically contaminated atmospheres, oil storage tanks, ship surfaces in brine, (bottoms, boot-topping), surfaces intermittently immersed in sea water, surfaces submerged in sea water, ship hulls (salt or fresh water), dam structures.
501	28			Vinyl				Aluminum finish paint for ferrous surfaces which are in whole or in part subjected to immersion in fresh water.
900	29	13.6	35	Coumarone-Indene and Coal Tar				Ship bottoms, buoys, surfaces in brine, surfaces submerged in sea water.
901	29						MIL-P-15328	Metal conditioning wash coat primer.
902	30	12.6	38	Ester Gum Varnish and Oil	6	18		Low cost primers for steel railroad rolling stock and other ferrous surfaces.
903	30	11.4	39	Ester Gum Varnish and Oil	6	18		

RECOMMENDED SURFACE PREPARATION OF STEEL

Proper surface preparation can not be stressed too strongly. The success or failure of a paint system very often depends upon the adequacy of such preparation. It is hoped therefore that these recommendations will aid the industrial user in getting the longest possible service life out of his paint.

Why Surface Preparation?

THE reason for surface preparation is to remove contaminants and improve adhesion of a priming paint. Adhesion is the bonding of the primary paint to the surface to which the paint is applied. Paint will fail in direct proportion to its lack of adhesion.

Mill scale, rust, dirt, grit, oil, grease, chemicals, and other surface contaminants make good paint performance impossible by preventing wetting of the metal. Rust, when it is painted over, continues to form and eventually destroys the adhesion of the paint film. Likewise mill scale is likely to be undermined by rust.

Mill Scale

Most structural steel is hot formed. It is covered with a mixture of iron oxides called mill scale, which is of variable thickness, continuity and adhesion. Mill scale is brittle and is mainly magnetic iron oxide, Fe_3O_4. Due to flexing or the difference in coefficient of expansion between the mill scale and the base metal, the mill scale cracks when changes in temperature take place. If moisture enters a crack in mill scale, rusting of the base metal begins. As the rust creeps under the mill scale, adhesion is destroyed.

Loose or semi-loose mill scale in time becomes completely detached from the base metal. Rupture and scaling of the paint coat follows. Tightly adhering areas of mill scale, through electrochemical action may provide sufficient localized corrosion to produce pits, which may in time penetrate the base metal.

Grease and Oil

Grease and oil are detrimental to adhesion between the priming paint and the metal surface. Small objects may have the grease and oil removed by a number of vapor degreasing commercial techniques. On large objects, due to their size and shape, the grease and oil are removed by washing or wiping with a suitable solvent.

Welds

Weld deposits such as weld flux slag, weld flux fumes, weld heat oxides, and weld metal spatter, are surface contaminants. Electric arc weld seams in particular and, to a somewhat lesser extent, the acetylene weld seams must be cleaned before painting.

The weld flux slag remaining adjacent to the weld seam is strongly alkaline. Under humid conditions it saponifies the paint vehicle, forming fatty acid soaps which reduce adhesion of the paint film and, either through actual pores in the film or by osmotic action, water is drawn through the film to promote further corrosion.

The weld flux fumes after condensation are deposited noticeably in a band 2 to 8 in. on either side of the weld seam. Spray painting fails to disturb the condensate, which in conjunction with weld flux slag may cause corrosion to spread a considerable distance from the weld seam. Brush applied paint dilutes the weld flux fume condensate and lessens the intensity and area of action.

The weld heat oxides are concentrated on the weld seam in a band about 2 in. wide on either side of the seam. These oxides form irregular and rough deposits and create unequal paint film thickness. The thin spots in the paint thereby promote early film failure and serve as corrosion centers.

The weld metal spatter deposits range from microscopic particles to particles $\frac{1}{4}$ in. in diameter. The larger the spatter the more firmly the spatter is welded to the surface. Paint films over these spatters fail prematurely due to inadequate film thickness on the top of the metal spatter or to the inability of paint to enter the junction between the spatter and the metal.

Since paint film failure, in general, radiates from

pinhead rust spots often associated with flux, slag and spatters, these deposits must be removed by grinding or blasting or both before painting if an adequate, uniform film thickness is desired. When cleaned, the weld seams may be expected to give almost as good service as the adjacent metal surface.

What to Consider in Selecting a Method of Surface Preparation

The question of selecting a method of surface preparation depends upon a number of factors other than the economic conditions involved. Among these are:

1. Condition of the surface to be painted,
2. Type of service to which the metal and paint will be subjected,
3. Practicality of using a particular method because of environment, and
4. The type of paint which is to be applied.

The requirements for surface preparation are more severe as the wetting ability of the paint decreases. One reason why the anticorrosive red lead pigment in linseed oil paint, Formula L.I.A. No. 100 (the same as Fed. Spec. TT-P-86a, Type I, or SSPC Paint 1) has achieved an eminent reputation for protection of steel is its superior wetting characteristic. It has demonstrated excellent anticorrosion performance when used over steel where small amounts of rust and tightly adherent mill scale are present. A surface condition such as this is often the best that can practically be obtained in the field. Equally good results are being obtained by similar high red lead in oil systems, which have good wetting characteristics, as used by railroads, public utilities, highway departments, and others.

The linseed oil vehicle, however, is slow drying and it is often necessary to use a faster drying oil-resin vehicle combination such as Formula L.I.A. No. 200 (TT-P-86a, Type II). Such a paint is limited in its wetting ability by the presence of synthetic resins. Therefore, surfaces receiving paints of this type must be more carefully cleaned of corrosion products and contaminants if maximum performance is expected.

Going still further, painting requirements may necessitate the use of the very rapid drying synthetic vehicle type paints, such as Formula L.I.A. No. 300, (TT-P-86a, Type III) L.I.A. 305 or Formula L.I.A. No. 302 (MIL-P-17545) (Bu Ships Paint Formula No. 116). These paints are useful and excellent when applied over carefully prepared surfaces.

The following are the recommended methods for the surface preparation of steel to which red lead paint is to be applied, along with a table indicating the type of structural steel, the exposure, drying time, L.I.A. recommended red lead paint and specification for the recommended cleaning methods.

Surface Preparation Methods

Factors to be considered in selection of any metal protective paints are surface preparation and the condition of the surface at the time of application, the character of the base metal and the environmental exposure.

Only those surface preparation methods which are pertinent to structural steel cleaning and which are most generally used are considered in this Technical Letter. The major methods of surface preparation of steel may be classed under three categories:

I. Mechanical surface preparation
   1. Hand cleaning
   2. Power tool cleaning
   3. Sand or shot blasting
   4. Flame cleaning

II. Chemical surface preparation
   1. Weathering
   2. Chemical cleaning
      a. Alkali cleaning
      b. Pickling
      c. Steam cleaning
   3. Phosphate surface treatment

III. Solvent cleaning and degreasing

The following are general descriptions of the more common surface preparation methods. Under each heading will be found a reference to the detailed specification for that method, adopted by Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh 13, Pa.

MECHANICAL SURFACE PREPARATION

Hand Cleaning (SSPC-SP 2)

Hand cleaning is best adapted to spot cleaning for maintenance repainting and is not recommended for use over large areas where more effective methods are available. It hits only the high spots of a surface. The operation is most commonly accomplished with stiff, springy wire brushes, abrasive paper or cloth, scrapers, knives, chisels, or chipping hammers.

The hand cleaning operation varies with the type of mill scale and depth of corrosion. Wire brushing is one of the oldest methods of mechanical surface preparation and generally partially removes only loosely adhering mill scale, rust, old paint films, and dried or caked soil. It does not remove adhering mill scale. If stratified rust is present, it should first be removed by chipping and scraping before hand brushing. A surface which is flat and free of obstructions and irregularities may be hand brushed at a rate of two square feet per minute.

Chipping hammers remove most of the mill scale, but if the action is too vigorous over thin metal, it may deform or even pierce the metal. Chipping may drive mill scale or corrosion products into a soft metal surface. Chipping is usually followed by either wire brushing or scraping or both to remove loose mill scale or paint films. Unless care is exercised, some imbedded mill scale may remain which may cause localized early paint failure.

Hand scraping alone with a sharp-edged scraper is probably one of the least effective methods of surface cleaning of metal as it removes only semi-adhering mill scale and old paint films.

If oil or grease are present, solvent cleaning with frequent changes of the solvent should precede hand cleaning; otherwise oil or grease will be spread over the descaled base metal. Should explosive vapors be present, a special non-sparking wire or tool must be employed.

Power Tool Cleaning (SSPC-SP 3)

Hand cleaning methods are duplicated by power tools designed for brushing, sanding, grinding, scaling, impact cleaning or chipping. The general sequence of operational techniques is the same as under hand cleaning. Power tool cleaning is more effective and more economical than hand cleaning for larger surfaces.

A large variety of shapes and sizes of brushes, grinders and sanders are available and are mostly of the rotary type. The electrically operated rotary brushes are effective at operational speeds of 300 to 3000 r.p.m. under load, while the rotational speed of the pneumatic driven brushes is regulated by the air pressure and the volume of the air. Power brushes may cut through thin mill scale but the wear on the brush is excessive. The power brush must be kept moving to prevent burnishing which produces a poor surface for painting.

Grinders and sanders are effective in the preparation of a surface when the abrasive grit size is carefully selected for the job at hand.

While power operated scaling and chipping hammers are faster than the hand operated type, they are slow as compared to other available methods. For very thick surface accumulations, they have merit. The tool must be kept sharp. The operator must be careful not to remove sound metal, drive mill scale into soft metal, or leave metal burrs on the surface. The latter two conditions contribute to early paint failure.

Oil and grease should be removed by solvent cleaning before power tool cleaning to prevent spreading.

In either hand cleaning or power tool cleaning a primer coat of red lead paint should be applied before any rusting becomes visible. A paint system of two initial coats of red lead primer followed by suitable finish coats will give excellent service.

Sand or Shot Blasting (SSPC-SP 5)

Sand or shot blasting procedures are employed where all the mill scale, rust, rust-scale, foreign matter (except heavy deposits of grease or oil), or paint are to be removed and the base or "white" metal exposed for paint application. Both processes are based upon the abrasive action on the surface of various sized particles of sand, shot, grit or other abrasives being discharged, either wet or dry, at high pressure. Metal or non-metallic synthetic shot or grit is usually employed where recovery of the abrading agent is possible, while sand is used primarily for operations in which the abrading agent is expendable.

Successful blasting techniques require careful consideration of pressures, size of nozzle, distance of nozzle from the surface, kind of material to be removed, type of abrasive, loss of abrasive, health hazard, cost of abrasive, and type of surface preparation required.

The grit should be of sufficiently small size to remove effectively the surface contaminants without excessive working of the metal surface or the formation of crater-like surface depressions, ridges or metal hairs. The paint may not provide adequate film thickness over the ridges or tips of the metal hairs, and thus they become focal points of premature paint film failure. Excessive surface working of the metal may develop unequal stresses in some surface areas and these become cathodic to adjacent areas. This will accelerate corrosion as the paint film commences to fail.

Dry sandblasting, although widely used, should be done with due health precautions, not only to protect the operator from fine abrasive dust but also to protect other workmen in the immediate environment. Machinery in the vicinity of sandblasting operations should be shielded.

Wet or hydraulic sand or shot blasting eliminates abrasive dust hazards, but if water soluble inhibitors such as chromate or phosphate types are used, they present different health hazards which must be met with proper precautions.

The time lag between completion of blasting and priming is dependent upon the type of blasting, the humidity of the surroundings or the presence of soluble inhibitors in the wet blasting fluid. Any blasted surface should be further chemically treated or primed with red lead paint before any visible rusting occurs.

On surfaces prepared by sand or shot blasting two primer coats of red lead paint followed by a suitable finish coat should give 10 to 12 years of service.

Flame Cleaning (SSPC-SP 4)

Flame cleaning may be used on many fabricated shapes where the structural sections are of proper stock thickness, are readily accessible, not subject to warping, and where dehydration of the surface is mandatory. Flame cleaned surfaces must be painted before condensation commences; hence, they should be painted while still warm and dry. Recommended practice requires painting within two hours.

Flame cleaning is used to remove unbonded mill scale and old mill scale which has not been previously painted. Rarely does flame cleaning remove all the mill scale. It must be followed by wire brushing and dusting before priming. Flame cleaning should not be used on stock less than $\frac{3}{16}$ in. thick.

CHEMICAL SURFACE PREPARATION

Weathering (SSPC-SP 9)

Possibly the oldest surface cleaning operation is atmospheric weathering, a process whereby the removal of the mill scale is primarily dependent upon the corrosion of the metal and the subsequent loosening of the mill scale by creeping of the rust between the mill scale and the base metal. In six months to a year most of the loosened mill scale will have fallen off. Any remaining products of corrosion and partially loosened mill scale must be removed by sandblasting, wire brushing, scraping, or chipping before the surface is primed. Areas of tightly adhering mill scale can only be completely removed by sandblasting. Once the base metal is exposed, it should be immediately coated with a red lead primer. Usually, in clear weather, six hours or less will serve as a safe time interval between completion of sandblasting and application of a red lead primer.

Field reports indicate this method of surface preparation followed by two coats of a red lead primer paint and a suitable top coat will provide from 8 to 10 years of adequate protection.

Chemical Cleaning

Alkali Cleaning

Alkali cleaning is more efficient and less hazardous than solvent cleaning. Alkali cleaners include soak tank cleaning, pressure spray cleaning, electrolytic cleaning, scrubbing and brushing for structural steel assemblies.

Alkali cleaning removes oil, grease and soluble rust stimulators. Alkali cleaning does not remove heavy or carbonized oils or rust inhibitive oils. The surface is left alkaline and before painting it must be rinsed in a dilute acid water solution to prevent saponification of a primer vehicle.

Pickling (SSPC-SP 8)

Pickling is an effective method of surface preparation for painting. Mill scale and corrosion products are completely removed by pickling degreased iron or steel in dilute acid solution.

The main disadvantage of this method lies in the necessity for following the pickling with a neutralizing and water rinsing operation to remove all free acid and reaction products, and then a rinsing in either dilute phosphoric acid or chromic acid solution or mixtures of these to create an inhibited metal surface. This must be followed by a thorough drying of the metal surface prior to painting.

The undesirable attack of the base metal by the pickling acid is minimized and regulated by the use of suitable inhibitors which may be dissolved in the pickling bath. These inhibitors create and regulate a preferential selective attack on the mill scale and corrosion products. The surface should not be etched excessively, but slight etching of the surface aids in the mechanical adhesion of the paint film.

This type of surface preparation is limited mainly to either small size objects or structural shapes that are easily handled.

Red lead primer painting of the pickled surface should be done before the thin film left by the chemical treatment shows any visible signs of corrosion.

After this type of surface preparation, two coats of red lead primer paint followed by a suitable top coat should give adequate service for 10 to 12 years.

Steam Cleaning

Where the size, shape or location makes it impossible to solvent wipe the surface, steam cleaning is becoming quite general in field surface preparation. Steam cleaning removes dirt, grime, grease and loose oxidized paint, but does not remove rust or mill scale.

The most efficient steam cleaning includes the addition of detergents to the steam-water mixture. If the detergent-steam-water mixture is sufficiently alkaline, it will also remove grease.

The surface after steam cleaning is usually alkaline and must be adequately rinsed to prevent saponification of the paint vehicle.

Phosphate Surface Treatment (SSPC-PT 2)

Phosphate treatment leaves the surface in a satisfactory condition for maximum paint life, but it does not remove mill scale. Therefore, for the most efficient treatment the surface should be pickled or blasted prior to phosphate treatment. Insoluble metal phosphates resulting from the phosphate treatment extend the life of the paint film by improving adhesion, retarding underfilm corrosion, reducing electrochemical action and the decomposition of the paint vehicle by corrosion products. The metal phosphate surface is strong and flexible enough to withstand thermal shock.

The phosphate treatment has been applied by spray process, immersion, brushing, or portable spray equipment.

The MIL-C-10578 specification may be consulted for details. The U. S. Corps of Engineers Manual for Painting (1953) refers to cold phosphate or chemical metal conditioners.

When properly applied, phosphate surface treatment has been successfully used on ship plates, river dam gates, locks, etc. The paint application and service are the same as for pickled iron or steel.

SOLVENT CLEANING AND DEGREASING (SSPC-SP 1)

Structural steel may be solvent cleaned by wiping, dipping, or spraying, depending upon the size of the members. Wiping is widely used. It removes the oil and grease readily and rapidly and requires a minimum of floor space.

In the use of solvent cleaning by wiping the solvent must be changed frequently to prevent spreading of the oil and grease, and due precaution, depending upon the solvent employed, must be observed to guard against fire hazards and toxicity of the solvent. Solvent cleaning does not remove rust or mill scale.

Military Specification, MIL-P-116a, gives cleaning methods for steel and mentions the type of petroleum solvent to use. Federal Specification P-S-661 or ASTM Specification D484-52 cover the use of "Stoddard Solvent." Federal specifications are available for most of the important solvents.

Surface Preparation of Steel Recommended for Red Lead Paints

(Quick Reference Summary)

If You Have to Paint:	*For This Type of Exposure:*	*And the Drying Time Required is:*	*Then the Recommended Red Lead Primer is: (see note)*	*And the Following Surface Preparation is Recommended: (see note)*	*But These Steps May Also Be Required:*
Structural Steel	Atmospheric	36 Hr.	L.I.A. No. 100	Hand Cleaning SSPC-SP 2 or Power Tool Cleaning SSPC-SP 3	Solvent Cleaning to Precede Other Cleaning SSPC-SP 1
Structural Steel, Oil Storage Tanks	Chemically Contaminated Atmospheres and Marine Environments	24 Hr.	L.I.A. No. 305	Blast Cleaning SSPC-SP 5 or Pickling SSPC-SP 8	
Structural Steel	Atmospheric	16 Hr.	L.I.A. No. 200	Blast Cleaning SSPC-SP 5 or Pickling SSPC-SP 8	
Structural Steel	Atmospheric	24 Hr.	L.I.A. No. 102	Hand Cleaning SSPC-SP 2 or Power Tool Cleaning SSPC SP 3	Solvent Cleaning to Precede Other Cleaning SSPC-SP 1
Structural Steel	Atmospheric	4 Hr.	L.I.A. No. 300	Commercial Blast Cleaning SSPC-SP 6 or Pickling SSPC-SP 8	
Structural Steel, Especially Building Frames	Atmospheric, Temporary (6 mos.)	8 Hr.	SSPC 13	Solvent Cleaning SSPC-SP 1 and Wire Brushing SSPC-SP 2	
Hydraulic Structures, e.g. Crest Gates, Sluice Gates, Tainter Gates, Exposed Structural Steel at Pumping Stations	Partial or Continuous Immersion in Fresh Water	6 Hr.	L.I.A. No. 400	Blast Cleaning SSPC-SP 5 and Coating Pre-treatment MIL-C-15328A	
Hydraulic Structures, e.g. Crest Gates, Sluice Gates, Tainter Gates, Exposed Structural Steel at Pumping Stations	Partial or Continuous Immersion in Fresh Water	1 Hr.	L.I.A. No. 500	Blast Cleaning SSPC-SP 5 and Coating Pre-treatment MIL-C-15328A	

NOTE: All L.I.A. paint formulations will be found on pages 20 to 30.
SSPC specifications can be obtained from Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh 13, Penna.
MIL specifications may be obtained from any General Services Administration regional office.

Surface Preparation of Steel Recommended for Red Lead Paints

(Quick Reference Summary)

If You Have to Paint:	*For This Type of Exposure:*	*And the Drying Time Required is:*	*Then the Recommended Red Lead Primer is: (see note)*	*And the Following Surface Preparation is Recommended: (see note)*	*But These Steps May Also Be Required:*
Railroad Rolling Stock	Atmospheric	18 Hr.	L.I.A. No. 902 or 903	Hand Cleaning SSPC-SP 2 or Power Tool Cleaning SSPC-SP 3	Solvent Cleaning to Precede Other Cleaning SSPC-SP 1
Ships (Topsides, Interiors, Boot-Topping), Bridges Over Tidewater, Docks	Marine, Intermittent Immersion in Sea Water	6 Hr.	L.I.A. No. 302	Blast Cleaning SSPC-SP 5 or Pickling SSPC-SP 8	
Ships Topsides, Interiors, Boot-Topping), Oil Storage Tanks	Marine, Intermittent Immersion in Sea Water, Chemically Contaminated Atmospheres	1 Hr.	L.I.A. No. 300	Blast Cleaning SSPC-SP 5 or Pickling SSPC-SP 8	
Ship Bottoms, Buoys	Immersion in Sea Water	4 Hr.	L.I.A. No. 900	Blast Cleaning SSPC-SP 5 or Pickling SSPC-SP 8	
Galvanized Steel, One Coat	Atmospheric	4 Hr.	L.I.A. No. 304	Solvent Cleaning SSPC-SP 1 and Phosphate Pre-treatment SSPC-PT 2	
Weathered or Rusted Galvanized Steel, One Coat	Atmospheric	4 Hr.	L.I.A. No. 304	Solvent Cleaning SSPC-SP 1 and Wire Brushing SSPC-SP 2	
New Galvanized Steel, Top Coat to be Applied	Atmospheric	4 Hr.	L.I.A. No. 304	Solvent Cleaning SSPC-SP 1 and Phosphate Pre-treatment SSPC-PT 2	
Weathered or Rusted Galvanized Steel, Top Coat to be Applied	Atmospheric	4 Hr.	L.I.A. No. 304	Solvent Cleaning SSPC-SP 1 and Wire Brushing SSPC-SP 2	

NOTE: All L.I.A. paint formulations will be found on pages 90 to 30.
SSPC specifications can be obtained from Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh 13, Penna.
MIL specifications may be obtained from any General Services Administration regional office.

PAINTING HIGHWAY STRUCTURAL STEEL

This section offers highway engineers and others specifications for complete systems to be used in painting highway structural steel. The material contained herein is based on our own field test programs and on an extensive study of current practice of state highway departments and such authoritative sources as the American Association of State Highway Officials. Experience has shown that the practices and paints recommended will produce highly satisfactory results.

Surface Preparation

THE importance of surface preparation for proper performance of any metal protective paint cannot be over-emphasized. The method of surface preparation selected will depend upon many factors, the more important being:

1. Condition of the surface to be painted,
2. Type of exposure to which the painted structure will be subjected,
3. Practicality of using a particular method as limited by environment, and
4. The type of paint which is to be applied.

In general, more careful surface preparation is needed for fast drying (poorer wetting) paints and for severe exposure conditions.

For maximum service with paints containing synthetic vehicles, blasting to white metal is preferred. However, this is usually economically impractical, and commercial sandblasting is most often employed. Where it is impractical to sandblast, power tool or hand wire brushing is often employed. Under such conditions, high oil content primers are preferred because of their superior wetting properties.

A discussion of the recommended surface preparation will be found on page 5.

Shop Coats or Primers

FORMULA L.I.A. NO. 100

(See Page 20)

This paint is similar to Formula L.I.A. No. 103 with replacement of some of the raw linseed oil by bodied oil and additional thinner to provide similar viscosity. This formulation offers wetting characteristics almost as good as Formula L.I.A. No. 103, provides better leveling and develops lower gloss, thus offering an improved surface for recoating.

FORMULA L.I.A. NO. 103

(See Page 21)

This paint has excellent wetting and performance characteristics. It is particularly suitable for use where surface preparation is restricted to power tool or hand wire brushing.

FORMULA L.I.A. NO. 200

(See Page 23)

Where painting schedules require faster drying than are afforded by the foregoing formulations, paints formulated with alkyd resin are generally used. Formula L.I.A. No. 200 is a paint of this type and will not wet the surface as well as Formulas L.I.A. No. 100 or 103. Greater care must be employed in the preparation of the surface and sandblasting is desirable.

FORMULA L.I.A. NO. 202

(See Page 23)

A pure red lead paint which offers fast drying characteristics and outstanding performance and like Formula L.I.A. No. 200, requires careful surface preparation. Sandblasting is desirable.

Touch Up

A shop coat may become damaged during transit or erection of structural steel. The damaged areas as well as field rivets, bolts, welds, etc. should be thoroughly cleaned and touched up to provide a continuous primer coat. For touch up purposes, the same paint used for the shop coat should be applied.

First Field Coat

The formulations, L.I.A. Nos. 100, 103, 200 and 202 are intended generally for shop coat application or for use in priming structures in the field that were erected with unpainted steel.

These same primers, tinted with lamp black in oil for contrast, are generally used for the first field coat when multiple coat systems are specified.

It is often found desirable to use Formula L.I.A. No. 200 as a field coat over primers Formulas L.I.A. Nos. 100, 103 and 202. There are three reasons for this.

1. It has a contrasting color,
2. It is a fast-drying paint permitting earlier finishing, and
3. It is more economical.

If in a multiple coat system, a light finish coat is specified, a white lead base paint is generally used for the first and/or second field coat. Formulas L.I.A. Nos. 140 and 141 are typical for this application.

The following paints are intended for use as first field coats over primer Formulas L.I.A. Nos. 100, 103, 200 and 202 in three coat systems and for the third coat in four coat systems where a light color is desired. They may be used tinted.

FORMULA L.I.A. NO. 140
(See Page 22)

FORMULA L.I.A. NO. 141
(See Page 22)

Top Coats

Any of the foregoing recommendations for primer or field coats provide excellent foundations for any good top or finish coat.

The following is a typical foliage green top or finish coat of pleasing color and good durability:

FORMULA L.I.A. NO. 142
(See Page 22)

The following has a white base of good durability and can be tinted to the desired color.

FORMULA L.I.A. NO 140
(See Page 22)

Where color is not considered important, black (A.A.S.H.O. Designation M68) or aluminum (A.A.S.H.O. Designation M69) top coats may be substituted for the white or tinted paints.

Complete 3 and 4 coat paint systems for highway structural steel will be found in the table on the following page.

RECOMMENDED PAINT SYSTEMS FOR HIGHWAY STRUCTURAL STEEL

THREE-COAT SYSTEM

Surface Preparation	Hand or Power Tool	Hand or Power Tool	Sandblast	Sandblast
Primer	L.I.A. No. 103	L.I.A. No. 100	L.I.A. No. 200*	L.I.A. No. 202*
Second Coat	L.I.A. No. 103 (tinted) or L.I.A. No. 200* or L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 100 (tinted) or L.I.A. No. 200* or L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 200* (tinted) or L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 200* or L.I.A. No. 202* (tinted) or L.I.A. No. 140 or L.I.A. No. 141
Third Coat	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142

* Semi-quick drying.

FOUR-COAT SYSTEM

Surface Preparation	Hand or Power Tool	Hand or Power Tool	Sandblast	Sandblast
Primer	L.I.A. No. 103	L.I.A. No. 100	L.I.A. No. 200*	L.I.A. No. 202*
Second Coat	L.I.A. No. 103 (tinted) or L.I.A. No. 200*	L.I.A. No. 100 (tinted) or L.I.A. No. 200*	L.I.A. No. 200* (tinted)	L.I.A. No. 200* or L.I.A. No. 202* (tinted)
Third Coat	L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 140 or L.I.A. No. 141	L.I.A. No. 140 or L.I.A. No. 141
Fourth Coat	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142	L.I.A. No. 140 or L.I.A. No. 142

* Semi-quick drying.

PRIMERS FOR RAILROAD STRUCTURES AND ROLLING STOCK

This section includes primer paints formulated to meet all commonly encountered surface conditions and environments of the railroad industry. The recommended formulations include economical and high-quality primer paints for railroad bridges and other structures along the right-of-way and also two low-cost formulations designed specifically to meet the need for an improved anticorrosive primer for steel rolling stock.

RAILROAD STRUCTURES

For Steel Containing Mill Scale and Residual Rust (Slow Dry)

The following formulations are used successfully on ferrous surfaces containing tightly adherent mill scale and small amounts of rust. This type of surface is prevalent where preparation is limited to hand or power wire brushing, scraping, flame cleaning or combinations of these methods. (See Page 5.) The free linseed oil content of these paint vehicles assures the degree of wetting ability needed for good anchorage to a heterogeneous surface.

FORMULA L.I.A. NO. 100
(See Page 20)

This is a high quality primer available for shop and field priming of steel where surface preparation is limited to the methods mentioned above.

FORMULA L.I.A. NO. 102
(See Page 21)

This is a quality reduced red lead content primer suitable for use on these difficult surfaces.

For Steel Containing Mill Scale and Residual Rust (Accelerated Dry)

The following two high quality primer formulations are intended for priming, intermediate and maintenance coats on structural steel when work schedules demand accelerated drying. Although these vehicles contain enough free oil to attain reasonably good wetting of the metal surface, their wetting characteristics are limited by the presence of synthetic resins. For optimum performance they should be applied to surfaces freed of loose mill scale and corrosion products. The steel must be degreased and carefully cleaned, see page 5.

FORMULA L.I.A. NO. 200
(See Page 23)

This is a high quality specification primer that has received wide acceptance for shop and field prime coats for structural steel.

FORMULA L.I.A. NO. 201
(See Page 23)

This is an excellent and widely used red lead-iron oxide paint with good hiding power and chalk resistance.

For Steel Completely Free of Mill Scale and Rust (Fast Dry)

The following two fast drying formulations are suggested for application over steel thoroughly free from rust, mill scale and other foreign matter by pickling or sandblasting, see page 5. These synthetic vehicle primers offer outstanding protection in industrial environments where the atmosphere is contaminated with chemical fumes.

FORMULA L.I.A. NO. 300
(See Page 24)

This is a heavy duty, full red lead primer intended for use on sandblasted structures and factory fabricated equipment such as railroad cars, window sash, signal equipment, etc.

FORMULA L.I.A. NO. 302
(See Page 25)

This is a medium weight red lead paint for use on surfaces which are exposed to rural, industrial and marine atmospheres of high humidity.

RAILROAD ROLLING STOCK

Steel cars require better low-cost primers having rust inhibitive properties to protect them against corrosion. The following low-cost primers provide good protection for steel rolling stock. Each of these primers dry for handling in 4 to 6 hours and dry for recoating in about 18 hours.

FORMULA L.I.A. NO. 902
(See Page 30)

FORMULA L.I.A. NO. 903
(See Page 30)

PAINTING HYDRAULIC STRUCTURES

This section contains suggested corrosion inhibitive paint systems for steel surfaces exposed to moist and chemically contaminated atmospheric environments as well as surfaces immersed intermittently or continuously in fresh water. It describes systems specifically designed for application to dams and adjacent equipment, ships navigating in fresh waters, water storage tank interiors and heavy industrial equipment.

Several complete protective systems are described, including both anticorrosive and finish coats. Proper surface preparation procedures for each type of system are also included.

Systems for Atmospheric Exposure

The following painting schedules are suggested for interior and exterior ferrous surfaces adjacent to the water but exposed to normal atmospheric exposure. Among structures classified in this category are bridges, trusses, light standards and railings.

The surface should be free from loose mill scale and rust by sandblasting or wire brushing and scraping. Oil and grease should be removed by solvent cleaning. See section, Recommended Surface Preparation of Steel, page 5.

PAINT FORMULAS* TO BE APPLIED

For first and second coats, the dry film thickness should be 1.5 mils.
For third and fourth coats, the dry film thickness should be 1.0 mils.

1st Coat	2nd Coat	3rd Coat	4th Coat
L.I.A. No. 100	L.I.A. No. 100 (tinted)	L.I.A. No. 401 (tinted)	L.I.A. No. 401
L.I.A. No. 200	L.I.A. No. 200 (tinted)	L.I.A. No. 401 (tinted)	L.I.A. No. 401

* Complete formulas will be found as follows:
L.I.A. No. 100 — Page 20
L.I.A. No. 200 — Page 23
L.I.A. No. 401 — Page 27

Systems for Partial or Continuous Immersion in Fresh Water

The following paint systems are especially suitable for ferrous surfaces which are in whole or in part subjected to moisture condensation or immersion in fresh water. Among the structures for which these systems are suggested are crest gates, sluice gates, tainter gates and exposed structural steel at pumping stations.

Before paint application, the surface should be blast cleaned, see page 7, and treated with a chemical metal conditioner such as Formula L.I.A. No. 901, see page 29, applied to a dry film thickness of 0.3 to 0.5 mils.

PAINT FORMULAS* TO BE APPLIED

For third and fourth coats of L.I.A. No. 501 (tinted), the dry film thickness should be 1.0 mils. For all other coats, the dry film thickness should be 1.5 mils.

1st Coat	2nd Coat	3rd Coat	4th Coat
L.I.A. No. 400	L.I.A. No. 400 (tinted)	L.I.A. No. 400	L.I.A. No. 400 (tinted) or L.I.A. No. 401
L.I.A. No. 500†	L.I.A. No. 500 (tinted)	L.I.A. No. 501 (tinted)	L.I.A. No. 501

* Complete formulas will be found as follows:
L.I.A. No. 400 — Page 27
L.I.A. No. 401 — Page 27
L.I.A. No. 500 — Page 28
L.I.A. No. 501 — Page 28

† This must be preceded by metal conditioning wash coat primer such as L.I.A. No. 901, see page 29.

PRIMER FOR INDUSTRIAL AND MARINE ENVIRONMENTS

The following fast drying formulation is recommended to industrial users as a primer for paint systems to protect steel surfaces exposed in chemically contaminated atmospheres and marine environments such as storage tanks, ship superstructures, bridges and dock installations.

Surface Preparation

As with other fast drying primers, application on steel free of rust, grease and other foreign matter is essential for best performance. See page 5.

This primer has been thoroughly test evaluated with excellent results and has been adopted as a standard primer by major industrial companies.

FORMULA L.I.A. NO. 305
(See Page 26)

PRIMER FOR SEAWATER IMMERSION

FORMULA L.I.A. NO. 900
(See Page 29)

The anticorrosive primer recommended here, L.I.A. No. 900, was developed after a thorough screening by the Lead Pigments Technical Committee and full scale "service tests" conducted by the U. S. Navy. These tests, carried out on the hulls of three U. S. destroyers, were completed early in 1959. On the basis of these test results, red lead-coumarone primer (L.I.A. No. 900) appears to have performed comparably to the more expensive #14N (MIL-P-19453) coating which is the Navy standard for ship bottom service for antifouling systems other than vinyl.

On one of the three ship bottoms, it was found that this red lead primer affords protection that is equal or very slightly better than Navy standard anticorrosive #14N. In a second case, this red lead primer was judged to be slightly inferior (average merit score of 98.3 vs. 95.5). In the third case, there was no significant difference discernible in performance between this red lead primer and #14N.

A variety of antifouling coatings are in current use for ship bottoms and similar service. Cold plastic coating No. 105 (MIL-P-19451) and hot plastic No. 15 HPN (MIL-P-19452) were used in Navy tests. Others include Maritime Commission coal tar-rosin antifouling coating 52-MC-403 and Bureau of Ships Formula No. 121, a vinyl antifouling coating (MIL-P-15931). Less is known about the compatibility of the system, L.I.A. No. 900/Bu Ships 121, and should not be used without prior tests.

Fundamentally, the coating system described here consists of a red lead anticorrosive primer and a finish coating of either hot or cold plastic. For best performance of the coating, surfaces must be thoroughly cleaned and dry at the time of application.

While a metal conditioning coating prior to priming is not mandatory, the performance of the coating system is improved when the bare metal is so treated. Sandblasting to the bare metal before painting is recommended.

The Formula No. 117 pretreatment (Military Specification MIL-C-15328, available upon request to the Commanding Officer, Naval Aviation Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa., attention Code CDS) was applied in a thickness of 0.3 to 0.5 mils in the tests on three U. S. destroyer hulls. As the name implies, the surface preparatory coating is intended to condition the metal surface and insure a firm bond between it and subsequent coats of paint.

Where no metal conditioner is used, the red lead primer is applied directly over the cleaned, dry metal surface. In either case, two or three coats of the primer should be applied to reach a minimum dry film thickness of 5 mils. Records in the Bureau of Ships indicate the primers were "applied in three coats." Normal application is by spray rather than brush. In applying the primer, a minimum drying period of six hours should be allowed between coats and six hours before the antifouling paint.

PRIMER FOR RUSTED, WEATHERED OR NEW GALVANIZED STEEL

After a full six years of extensive field investigations, the performance of the following red lead-zinc dust-iron oxide primer for galvanized steel proved out tanding.

FORMULA L.I.A. NO. 304

(See Page 26)

This primer is ideally suited for maintenance painting of galvanized surfaces particularly where the condition of the surface area to be painted may vary from rusty to weathered to new. It now makes possible the use of a single primer that will effectively protect galvanized surfaces against further deterioration regardless of their condition. Formula L.I.A. No. 304 is effective as a primer in one or more coats either exposed to the weather or covered with a suitable finish coat. No matter what the surface—rusted, weathered or treated new—this primer surpasses in performance the lead-free primers generally recommended for galvanized surfaces.

Surface Preparation

To insure good adhesion and to obtain the most satisfactory protection with primer L.I.A. No. 304 on rusted galvanized surfaces, the corroded areas should be wire brushed to remove rust scale followed by washing with clean mineral spirits. On new galvanized steel, the surface should be allowed to weather for 3 to 6 months, or if time does not permit, the surface should be chemically pretreated.

A number of commonly used pretreatment procedures have been tested. However, phosphate type treatments are recommended as they effectively etch the zinc surface and greatly improve the adhesion of the paint film. Proprietary products of this type are generally available. Treatments with copper sulphate, acetic acid, or hydrochloric acid are ineffective.

L.I.A. RECOMMENDED PAINT FORMULATIONS

Although the formulations contained in this Technical Letter have been established by our Lead Pigments Technical Committee through careful evaluation, no guarantee of results is made or implied. Users are urged to make additional confirmatory evaluations for their specific requirements.

FORMULA L.I.A. NO. 100*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	99.6 min.	1840.6	24.87
	Aluminum Stearate	0.3-0.4	7.4	0.89
		100.0		
VEHICLE:	Raw Linseed Oil	35.0-50.0	276.0	35.75
	Pale Heat-Bodied Linseed Oil (Z-2 viscosity, Low acid)	15.0-30.0	82.8	10.35
	Volatile Thinner and Drier	35.0 max.	193.2	29.14
		100.0	2400.0	100.00

	Pigment by weight	77% min.
	Vehicle by weight	23% max.
	Wt./Gal.	24 lb. min.
	PV	34
DRYING TIME:	Set to Touch	6 hour max.
	Dry for Recoating	36 hour max.

* Conforms to Federal Specification TT-P-86a, Type I, and A.A.S.H.O. Designation M72, Type II.

FORMULA L.I.A. NO. 101

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	75.0	910.0	12.4
	Siliceous Iron Oxide (85% Fe_2O_3)	24.5	297.0	8.0
	Aluminum Stearate	0.5	6.0	0.7
		100.0		
VEHICLE:	Raw Linseed Oil	40.1	228.0	29.4
	Pale Heat-Bodied Linseed Oil (Z-2 viscosity, Low acid)	13.9	79.0	9.8
	Petroleum Spirits and Driers	46.0	261.3	39.7
		100.0	1781.3	100.0

	Pigment by weight	68%
	Vehicle by weight	32%
	Wt./Gal.	17.8 lb.
	PV	35
DRYING TIME:	For Handling	about 24 hours
	For Recoating	about 36 hours

FORMULA L.I.A. NO. 102*

	Component	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (95% Grade)	75.0	735.0	9.9
	Magnesium Silicate	14.7	144.0	6.1
	Diatomaceous Silica	10.0	98.0	5.9
	Aluminum Stearate	0.3	3.0	0.3
		100.0		
VEHICLE:	Raw Linseed Oil	40.0	230.0	29.7
	Pale Heat-Bodied Linseed Oil (Z-2 viscosity, Low acid)	25.0	144.0	18.0
	Petroleum Spirits	30.0	173.6	26.3
	Liquid Driers	5.0	28.7	3.8
		100.^	1556.3	100.0

	Pigment by weight	63%
	Vehicle by weight	37%
	Wt./Gal.	15.5 lb.
	PV	32
DRYING TIME:	For Handling	about 24 hours
	For Recoating	about 36 hours

* Conforms to Steel Structures Painting Council Specification SSPC-P4.

FORMULA L.I.A. NO. 103*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	99.6 min.	1879.0	25.39
	Aluminum Stearate	0.3-0.4	7.5	0.90
		100.^		
VEHICLE:	Raw Linseed Oil	90.0 min.	507.1	65.69
	Volatile Thinner and Drier	10.0 max.	56.4	8.02
		100.0	2450.0	100.00

	Pigment by weight	77-80%
	Vehicle by weight	20-23%
	Wt./Gal.	24.5 lb. min.
DRYING TIME:	Set to Touch	6 hr. max.
	Dry for Recoating	36 hr. max.

* Conforms to A.A.S.H.O. Designation: M72, Type I.

FORMULA L.I.A. NO. 140*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	White Lead	31.0 min.(1)	283.5	5.06
	Zinc Oxide	25.0-27.0	237.8	5.06
	Titanium Dioxide, (Rutile Non-Chalking Type)	11.0-13.0	100.6	2.87
	Magnesium Silicate(2)	32.0 max.	292.6	12.29
		100.0		
VEHICLE:	Raw or Refined Linseed Oil	60.0 min.	358.7	46.66
	Bodied Linseed Oil	16.0-20.0	89.7	11.21
	Thinner and Drier	20.0 max.	112.1	17.05
		100.0	1475.0	100.00

Pigment by weight 62% min.
Vehicle by weight 38% max.
Wt./Gal. 14¼ lb. min.

DRYING TIME: 18 hours max.

* Conforms to A.A.S.H.O. Designation: M70, Type I, Class B.

(1) The white lead and zinc oxide may consist of any mixture of basic carbonate white lead, basic sulphate white lead, leaded zinc oxide, and zinc oxide that meets the composition requirements. At the option of the purchaser, the white lead may be required to be basic carbonate white lead.

(2) The sum of tinting colors and magnesium silicate shall not exceed 32.0%.

FORMULA L.I.A. NO. 141*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	White Lead	99.0 min.(1)	1398.7	24.98
		100.0		
VEHICLE:	Raw Linseed Oil	70.5 min.	402.8	52.17
	Bodied Linseed Oil (Z-2 viscosity)	15.5 max.	88.5	11.06
	Thinner and Drier	14.0 max.	80.0	11.79
		100.0	1970.0	100.00

Pigment by weight 71% min.
Vehicle by weight 29% max.
Wt./Gal. 19.7 lb. min.

DRYING TIME: 18 hours max.

* Conforms to A.A.S.H.O. Designation: M70, Type III.

(1) The pigment shall be basic carbonate white lead. In the tinted paints the pigment shall contain not less than 95.0 per cent basic carbonate white lead, the remainder to be high strength tinting colors.

FORMULA L.I.A. NO. 142*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	White Lead	69.0-71.0(1)	865.2	15.45
	Zinc Oxide	14.5-15.5	185.5	3.94
	Chrome Oxide Green	14.5-15.5	185.5	4.37
		100.0		
VEHICLE:	Raw Linseed Oil	90.0 min.	523.5	67.81
	Volatile Thinner and Drier	10.0 max.	58.2	8.43
		100.0	1817.9	100.00

Pigment by weight 68% min.
Vehicle by weight 32% max.
Wt./Gal. 18.1 lb. min.

DRYING TIME: 24 hours max.

* Conforms to A.A.S.H.O. Designation: M67, Type II—Pelago Green.

(1) The white lead and zinc oxide may consist of any mixture basic carbonate white lead, basic sulphate white lead, leaded zinc oxide and lead-free zinc oxide that meets the composition requirements.

FORMULA L.I.A. NO. 200*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	65.0 min.	734.8	9.93
	Red Iron Oxide (85% Fe_2O_3)	15.0 min.	169.6	4.56
	Magnesium Silicate	14.7 max.	166.2	6.98
	Mica, 325 mesh	4.0-6.0	56.6	2.42
	Aluminum Stearate	0.3-0.4	3.4	0.41
		100.0		
VEHICLE:	Raw Linseed Oil	18.0 min.	163.1	21.12
	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type III)	28.0 min.	163.1	17.44
	Volatile Thinner and Drier	44.0 max.	256.2	37.14
		100.0	1713.0	100.00

Pigment by weight 66-69%
Vehicle by weight 31-34%
Wt./Gal. 16.7 lb. min.

DRYING TIME: Set to Touch 4 hour max.
Dry for Recoating 16 hour max.

* Conforms to Federal Specification TT-P-86a, Type II and A.A.S.H.O. Designation: M72, Type III.

FORMULA L.I.A. NO. 201*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (95% Grade)	75.40	1250	16.89
	Siliceous Red Iron Oxide	24.12	400	10.50
	Aluminum Stearate	.48	8	0.96
		100.00		
VEHICLE:	Raw Linseed Oil	56.00	306	39.50
	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type II)	20.80	115	13.14
	Petroleum Spirits and Driers	23.20	128	17.01
		100.00	220	100.00

Pigment by weight 75.2%
Vehicle by weight 24.8%
Wt./Gal. 22.04 lb.
PV 33

DRYING TIME: For Handling about 16 hours
For Recoating about 24 hours

* Conforms to Steel Structures Painting Council Specification SSPC-P-2.

FORMULA L.I.A. NO. 202*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	99.6 min.	1604.0	21.68
	Aluminum Stearate	0.3-0.4	6.4	0.76
		100.0		
VEHICLE:	Raw Linseed Oil	27.0 min.	160.8	20.83
	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type III)	26.0 min.	154.8	16.12
	Volatile Thinner and Drier	47.0 max.	280.0	40.61
		100.0	2206.0	100.00

Pigment by weight 73-76%
Vehicle by weight 24-27%
Wt./Gal. 21.4 lb. min.

DRYING TIME: Set to Touch 4 hr. max.
Dry for Recoating 16 hr. max.

* Conforms to A.A.S.H.O. Designation: M72, Type IV.

FORMULA L.I.A. NO. 300*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	99.7	1275.0	17.20
	Aluminum Stearate	0.3	3.5	0.46
		100.0		
VEHICLE:	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type III)	42.0	261.5	28.34
	Volatile Thinner and Drier	58.0	361.0	54.00
		100.0	1901.0	100.00

Pigment by weight	67.3%
Vehicle by weight	32.7%
Wt./Gal.	19 lb.
PV	38

DRYING TIME: For Handling — about 1 hour
For Recoating — about 4 hours

* Conforms to Federal Specification, TT-P-86a, Type III.

FORMULA L.I.A. NO. 301

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	75.0	774.0	10.50
	Siliceous Iron Oxide (85% Fe_2O_3)	25.0	258.0	7.00
		100.0		
VEHICLE:	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type III)	46.62	285.0	32.38
	Petroleum Spirits and Driers	53.38	326.6	50.12
		100.0	1643.6	100.00

Pigment by weight	62.8%
Vehicle by weight	37.2%
Wt./Gal.	16 lb.
PV	30

DRYING TIME: For Handling — about 2 hours
For Recoating — about 6 hours

FORMULA L.I.A. NO. 302*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (95% Grade)	55.0	380.0	5.13
	Zinc Yellow	10.1	70.0	2.33
	Mica (MIL-M-15178A)	9.4	65.0	2.77
	Indian Red	1.5	10.0	0.23
	Magnesium Silicate	23.1	160.0	6.79
	Aluminum Stearate	0.9	6.0	0.71
		100.0		
VEHICLE:	Alkyd Resin Solution (Fed. Spec. TT-R-266, Type I, Class A)	64.9	415.0	52.00
	Dipentene	3.9	25.0	3.52
	Petroleum Spirits	29.6	190.0	29.20
	Lead Drier	0.8	4.7	0.49
	Cobalt Drier	0.8	4.7	0.59
		100.0	1330.4	103.67

Pigment by weight	50%
Vehicle by weight	50%
Wt./Gal.	12.5 lb. min.
PV	35
DRYING TIME: Set to Touch	2 hours
Dry for Recoating	6 hours

* Conforms to specification of the Bureau of Ships Paint Formula No. 116, MIL-P-17543 (Ships) and is very similar in composition and approximates the performance of U. S. Maritime Administration Specification 52-MLA-301a.

FORMULA L.I.A. NO. 303

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	30.0	405.0	5.50
	Siliceous Iron Oxide (85% Fe_2O_3)	24.0	194.0	5.20
	Zinc Oxide	4.0	32.0	0.70
	Magnesium Silicate	15.0	122.0	5.40
	Diatomaceous Silica	7.0	57.0	3.40
		100.0		
VEHICLE:	Alkyd Resin Solids (Fed. Spec. TT-R-266, Type III)	46.9	280.0	32.13
	Thinners and Driers	53.1	320.0	47.67
		100.0	1410.0	100.00

Pigment by weight	57.3%
Vehicle by weight	42.7%
Wt./Gal.	14 lb.
PV	38
DRYING TIME: For Handling	about 2 hours
For Recoating	about 6 hours

FORMULA L.I.A. NO. 304

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	30.0	387.0	5.2
	Siliceous Iron Oxide (85% Fe_2O_3)	15.0	193.0	5.2
	Aluminum Stearate	0.5	6.5	0.8
	Zinc Dust (Fed. Spec. TT-Z-291)[1]	54.5	703.0	12.0
		100.0		
VEHICLE:	Alkyd Resin Solids (Fed. Spec. TT-R 266, Type II)	45.5	257.0	29.5
	Thinners and Driers	54.5	307.6	47.3
		100.0	1856.1	100.0

Pigment by weight	69.6%
Vehicle by weight	30.4%
Wt./Gal.	13.1 lb. (without zinc dust)
PV	44

(1) Zinc dust is to be packaged separately and mixed with paint at time of use.

FORMULA L.I.A. NO. 305

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	55.0	518.0	7.0
	Zinc Yellow	10.0	94.0	3.3
	Zinc Oxide	10.0	94.0	2.0
	Siliceous Iron Oxide (85% Fe_2O_3)	7.0	65.8	1.9
	Magnesium Silicate	10.0	94.0	4.0
	Diatomaceous Silica	8.0	75.3	3.9
		100.0		
VEHICLE:	Vehicle No. 27[1]	74.9	436.0	54.5
	Mineral Spirits	23.7	138.0	22.5
	Driers	1.4	8.0	0.9
		100.0	1523.1	100.0

Pigment by weight	61.8%
Vehicle by weight	38.2%
Wt./Gal.	15.23 lb.
PV	40

DRYING TIME: For Handling	1 hour
For Recoating	24 hours
Viscosity	90-95 Krebs Units
Reduction for Spray	4 parts of primer to 1 part of V M & P Naphtha
Reduction for Brush	8 parts of primer to 1 part of aromatic hydrocarbon of boiling range 320-378° F. and approximately 60% aromatic

(1) Vehicle No. 27:

Dehydrated Castor Oil Fatty Acids	31.0%
Glycerine	15.0%
Phthalic Anhydride	19.0%
Mineral Spirits	35.0%
	100.0%

Cooking Procedure: Heat the first three items to 356° F. 40 minutes with good agitation and under carbon dioxide gas, preferably in a closed kettle. Slowly increase the temperature to 473° F. and hold for approximately 105 minutes. Cool and reduce.

Properties: Nonvolatile	66% by weight
Viscosity	Z (Gardner-Holdt)
Acid Number	8 - 10 (on solids)
Phthalic Anhydride	30% (on solids)

NOTE: A vehicle of characteristics similar to those of L.I.A. Vehicle No. 27 may be made starting with dehydrated or raw castor oil and with appropriate changes in raw materials, quantities and cooking procedure. The vehicle is also available from several manufacturers including Rockhold Chemicals, Inc. (as P 923 Sorbosol) and Archer Daniels Midland Co., and is closely approximated by Rohm & Haas Co. (Duraplex C-55).

FORMULA L.I.A. NO. 400*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	85.0	950.0	12.85
	Diatomaceous Silica	8.0	89.6	5.36
	Magnesium Silicate	6.6	74.0	3.10
	Aluminum Stearate	0.4	4.4	0.53
		100.0		
VEHICLE:	Phenolic Varnish(1)	74.0	432.0	57.70
	Thinners and Driers	26.0	149.9	20.46
		100.0	1699.9	100.00

Pigment by weight	65.9%	DRYING TIME: For Handling	about 2 hours
Vehicle by weight	34.1%	For Recoating	about 6 hours
Wt./Gal.	17 lb.		
PV	41		

* Conforms to Federal Specification TT-P-86a, Type IV. This paint is also specified for water tank interiors in the American Water Works Association D102 specification.

(1) Phenolic Varnish

Phenolic Resin (100% para tertiary amyl phenol-formaldehyde resin)	30.25%
Tung Oil (Fed. Spec. TTT-O-353)	29.75%
Mineral Spirits (Fed. Spec. TTT-T-291a, Grade I)	40.00%
	100.00%

Cooking Procedure: Heat all the resin and oil to 465° F. 40 minutes. Hold the batch at this temperature long enough (35-40 minutes) to obtain the desired viscosity when thinned to the specified solids content. Water cool and thin with mineral spirits.

Properties:	Oil Length	25 gal.	Viscosity P-N (Gardner Holdt)
	Nonvolatile	59.61%	Color 9 (Halligan)
		Wt./Gal. 7.5 lb.	

DRYING TIME: Set to Touch 2 hours
Print Free 8 hours

FORMULA L.I.A. NO. 401*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Aluminum Paste (Fed. Spec. TT-A-468a, Type II, Class B)	100.0	172.0	14.1
VEHICLE:	Phenolic Vehicle (Corps of Engineers V-2)(1)	100.0	660.0	85.9
			832.0	100.0

Pigment by weight	20.7%	Wt./Gal.	8.3 lb.
Vehicle by weight	79.3%	PV	22.5

* Conforms to Federal Specification TT-P-86a, Type IV. This paint is also specified for water tank interiors in the American Water Works Association D102 specification.

(1) Corps of Engineers Vehicle V-2:

Para-Phenyl Phenol Formaldehyde Resin (Mil. Spec. MIL-R-15184)	100 lb.
Tung Oil (Fed. Spec. TT-O-395)	70 gal.
Alkali Refined Linseed Oil Mil. Spec. MIL-O-15180)	13 gal.
Mineral Spirits (Fed. Spec. TT-T-291a, Grade I)	26 gal.
Dipentene (Fed. Spec. TT-D-376)	4 gal.
Ethylene Glycol Monoethyl Ether (ASTM D-331)	3 gal.
Hi-Flash Naphtha [2]	1 gal.
Toluene (Fed. Spec. TT-T-548)	2 gal.

Cooking Procedure: Heat all of resin and all of the linseed oil to approximately 565° F. and hold for about 20 minutes. Add the tung oil, heat to 465° F. hold for 3 minutes and then allow batch to cool to 420° F. Add the thinners in the order shown and filter or centrifuge to remove foreign solid particles. Add naphthenate driers to give 0.15% lead, 0.015% cobalt and 0.007% manganese based on the weight of oil. The driers shall conform to Federal Specification TT-D-643.

Required Properties and Performances

Viscosity	C-D (Gardner-Holdt)	Cold Water Resistance	O.K. — 96 hours
Specific Gravity	0.920	Boiling Water Resistance	O.K. — 7 hours
Color	10-12 (Gardner Standards 1933)	Alkali Resistance	O.K. — 3 hours
Nonvolatile	59 ± 1.0%	Reactivity (ASTM D-154)	None
Kauri Reduction	Pass 120	Dry Dust Free	1 to 4 hours
Skinning	None in 48 hours	Dry for Recoating	12 hours (max.)

(2) High-Flash Solvent Naphtha shall conform to the following requirements:

Specific Gravity	0.855 to 0.875
Flash Point	35° C. (min.)
Distillation: Initial—145 to 156°C., 95 per cent—190°C (max.), End—220°C. (max.), Naphthalene—none, Kauri Butanol value—78 cc. (min.).	

FORMULA L.I.A. NO. 500*

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	100.0	220.0	2.9
		100.0		
VEHICLE:	Vinyl Resin(1)	19.4	145.0	12.3
	Tricresyl Phosphate (Fed. Spec. TT-T-656)	2.0	15.0	1.5
	Methyl Isobutyl Ketone(2)	39.3	295.0	43.3
	Toluene (Fed. Spec. TT-T-548)	39.3	295.0	40.0
		100.0	970.0	100.0

Pigment by weight	22.6%
Vehicle by weight	77.4%
Wt./Gal.	9.7 lb.
PV	17.4

DRYING TIME: For Handling — about 0.5 hour
For Recoating — about 1 hour

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* Conforms to the specification of the Corps of Engineers Formula V-101 and Military Specification MIL-P-15929.

(1) The resin shall be a hydroxyl containing vinyl chloride-acetate copolymer. It shall contain 89.5 to 91.5 per cent vinyl chloride, 5.5 to 7.0 per cent vinyl alcohol and 2.0 to 3.5 per cent vinyl acetate. The resin shall have a specific gravity of 1.38 to 1.40. Material shall be furnished as a powdered solid not less than 98 per cent of which passed through a No. 20 sieve conforming to Fed. Spec. RR-S-366. An 18 per cent solution of the resin in methyl isobutyl ketone shall be no darker than 10 grams of potassium chromate dissolved in one liter of water.

(2) Methyl isobutyl ketone shall have a specific gravity of 0.799 to 0.804 at 20/20° C., shall entirely distill within a 4.0° C. range which shall include 116° C. and shall be at least 95 per cent pure.

FORMULA L.I.A. NO. 501*

Aluminum Powder (Fed. Spec. TT-A-468a, Type I, Class B)	13.0%
Vinyl Resin(1)	16.5%
Tricresyl Phosphate (Fed. Spec. TT-T-656)	4.1%
Methyl Isobutyl Ketone	33.2%
Toluene (Fed. Spec. TT-T-548)	33.2%
	100.0%

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* Conforms to the specification of the Corps of Engineers Formula V-102. This material should be shipped in double compartment cans and mixed on the job.

(1) Vinyl resin shall be a vinyl chloride-acetate copolymer of medium average molecular weight and shall contain 85% to 88% vinyl chloride and 12% to 15% vinyl acetate by weight. The resin shall have film forming properties and shall, in specified formulations, produce results equal to "Vinylite" resin VYHH.

FORMULA L.I.A. NO. 903

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	47.0	332.0	4.51
	Zinc Oxide	8.3	58.1	1.24
	Zinc Yellow	8.8	62.2	2.08
	Mica, 325 Mesh	8.3	58.1	2.46
	Magnesium Silicate	27.2	192.0	8.07
	Aluminum Stearate	0.4	3.1	0.37
		100.0		
VEHICLE:[1]	Coumarone-Indene Resin (M.P.127-137° C.)[2]	25.4	166.0	18.12
	Coumarone-Indene Resin (M.P.5-15° C.)[3]	8.7	57.0	6.22
	Liquid Coal Tar (MIL-T-15194)	8.9	58.1	5.87
	Zinc Resinate ("Zinor" or equivalent)	3.2	20.8	2.17
	Chlorinated Rubber 20 Centipoise Viscosity ("Parlon" or equivalent)	6.3	41.5	3.03
	Hi-Flash Naptha (MIL-N-15178, Type A)	31.7	208.0	28.50
	Aliphatic Petroleum Spirits (B.P.205-260° F.)	15.0	98.5	16.69
	Pine Oil	0.8	5.2	0.67
		100.0	1360.6	100.00

Pigment by weight	51.9%
Vehicle by weight	48.1%
Wt./Gal.	13.6 lb.
PV	35

(1) This vehicle may be prepared by heating the coumarone resins and liquid coal tar together to a temperature of 445° F., adding the zinc resinate and holding temperature until it is all melted in. All of the petroleum spirits and 80 gallons of the required Hi-Flash naptha may then be added. The chlorinated rubber can then be dissolved into the remaining Hi-Flash naptha at room temperature. The chlorinated rubber should be blended in with the remainder of the ingredients only after the coumarone-coal tar-resinate mixture has cooled to 140° F. or less. To avoid decomposition, the chlorinated rubber should never be heated above 140° F.

Although the above method is preferred, the vehicle may also be prepared by cold cutting the indicated ingredients.

(2) A coumarone-indene resin with a melting range of 127-137° C.

(3) 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. In applying these paints in confined areas, adequate ventilation is necessary to prevent accumulation of explosive vapors and to protect the operator.

FORMULA L.I.A. NO. 901*

Ingredient Item	Lb./100 Gal.	Gal./100 Gal.
Polyvinyl-Butyral Resin[1]	56.0	6.10
Zinc Chromate "Insoluble Type"[2]	54.0	1.59
Magnesium Silicate	8.0	0.35
Lampblack	0.6	0.04
Butyl Alcohol, Normal (TT-B-846)	125.0	18.40
Alcohol, Ethyl[3] (Fed. Spec. O-A-396, Gr. III)	380.0	55.70
Diluent[4]		
Phosphoric Acid 85% (Fed. Spec. O-P-313 Class A)	28.0	2.00
Water (maximum)	35.0	2.00
Alcohol, Ethyl[3] (Fed. Spec. O-A-396, Gr. III)	102.0	15.00

* Conforms to Military Specification MIL-P-15328 and is furnished in two containers: 5 gallon can containing 4 gallons of base and 1 gallon phosphoric acid-resistant container of diluent. The mixed conditioner must be used within 24 hours after mixing.

(1) Polyvinyl partial butyral resin (18-20% vinyl alcohol and not more than 1% of vinyl acetate) viscosity of a 6% solution of the resin in methanol, 13-18 centipoise at 20° C. Specific gravity of resin 1.05 to 1.15.

(2) 16-19% CrO_3, 67-72% ZnO, not more than 1% water-soluble salts.

(3) Isopropyl alcohol (99%) may be substituted on an equal volume basis.

(4) When 1 gallon of acid component is added to 4 gallons of resin component and stirred, a smooth, homogeneous mixture shall result which does not gel for at least 24 hours. Shall dry for repainting within 15-30 minutes.

FORMULA L.I.A. NO. 902

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	39.4	258.5	3.5
	Zinc Yellow	6.9	45.1	1.3
	Siliceous Iron Oxide (70-76% Fe_2O_3)	27.8	182.4	5.0
	Magnesium Silicate	25.9	170.3	7.2
		100.0		
VEHICLE:	Ester Gum Varnish(1)	43.0	261.5	36.2
	Pale Heat-Bodied Linseed Oil (Z-2 viscosity, low acid)	22.0	133.3	14.1
	Mineral Spirits and Naphthenate Driers	35.0	212.4	32.5
		100.0	1263.5	100.0

Pigment by weight	51.9%
Vehicle by weight	48.1%
Wt./Gal.	12.6 lb.
PV	38
DRYING TIME: For Handling	4 to 6 hours
For Recoating	about 18 hours

(1) 25 gal. Ester Gum Dehydrated Castor Oil Varnish, 43% N.V.

FORMULA L.I.A. NO. 903

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	25.0	131.0	1.8
	Zinc Yellow	20.0	105.0	3.6
	Zinc Oxide	15.0	78.0	1.7
	Siliceous Iron Oxide (70-76% Fe_2O_3)	20.0	105.0	2.9
	Magnesium Silicate	20.0	105.0	4.4
		100.0		
VEHICLE:	Ester Gum Varnish(1)	35.0	215.0	29.7
	Pale Heat-Bodied Lin seed Oil (Z-2 viscosity, low acid)	18.0	111.0	11.7
	Mineral Spirits and Naphthenate Driers	47.0	289.0	44.7
		100.0	1139.0	100.0

Pigment by weight	46%
Vehicle by weight	54%
Wt./Gal.	11.4 lb.
PV	39
DRYING TIME: For Handling	4 to 6 hours
For Recoating	about 18 hours

(1) 25 gal. Ester Gum Dehydrated Castor Oil Varnish, 43% N.V.

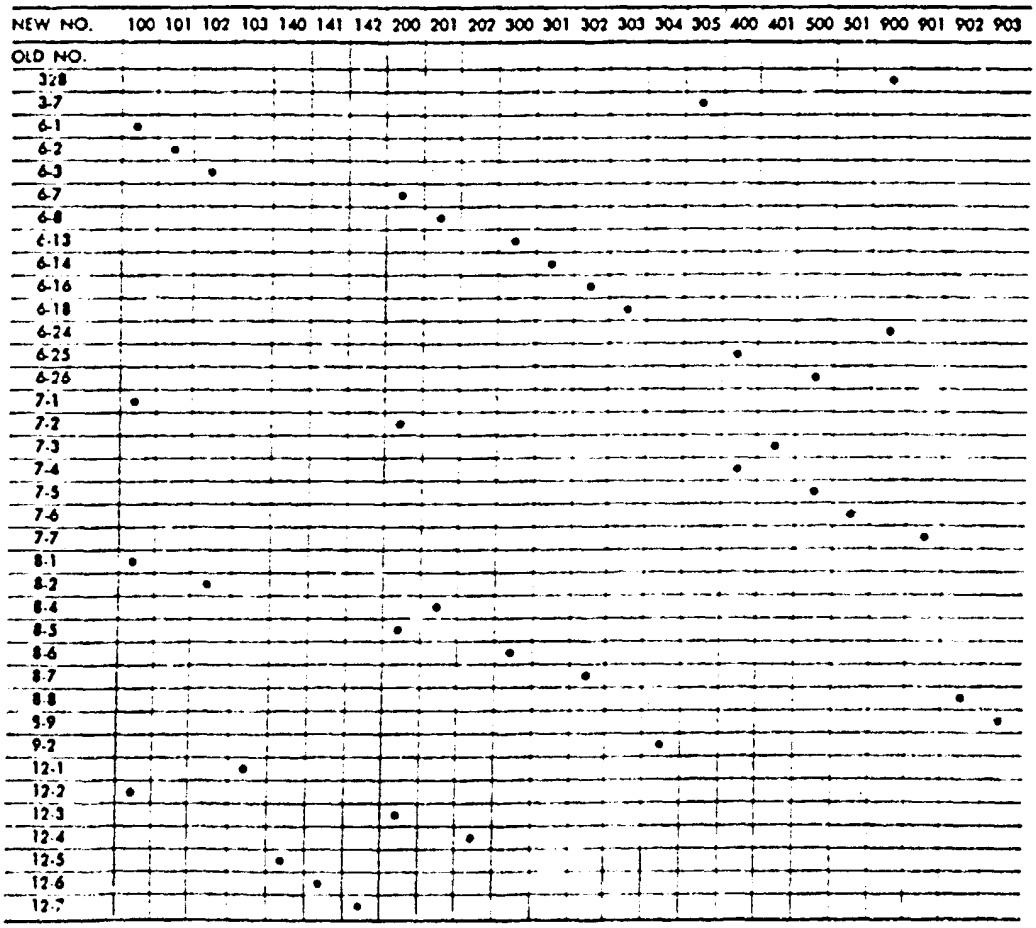
L.I.A. PAINT NUMBERING SYSTEM REVISED

With the issuance of this Technical Letter, the Lead Industries Association has adopted a new permanent paint numbering system that will indicate immediately the type of vehicle used in the paint formulation as follows:

Type of Vehicle	*Formulation Numbers*
Oil	L.I.A. No. 100 to 199
Oil-resin fortified	L.I.A. No. 200 to 299
Alkyd	L.I.A. No. 300 to 399
Phenolic	L.I.A. No. 400 to 499
Vinyl	L.I.A. No. 500 to 599
Miscellaneous	L.I.A. No. 900 to 999

A correlation between the new and old numbers of those L.I.A. paints recommended for various uses by the Lead Pigments Technical Committee will be found on the following charts:

CORRELATION BETWEEN NEW AND OLD L.I.A. PAINT NUMBERING SYSTEMS



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