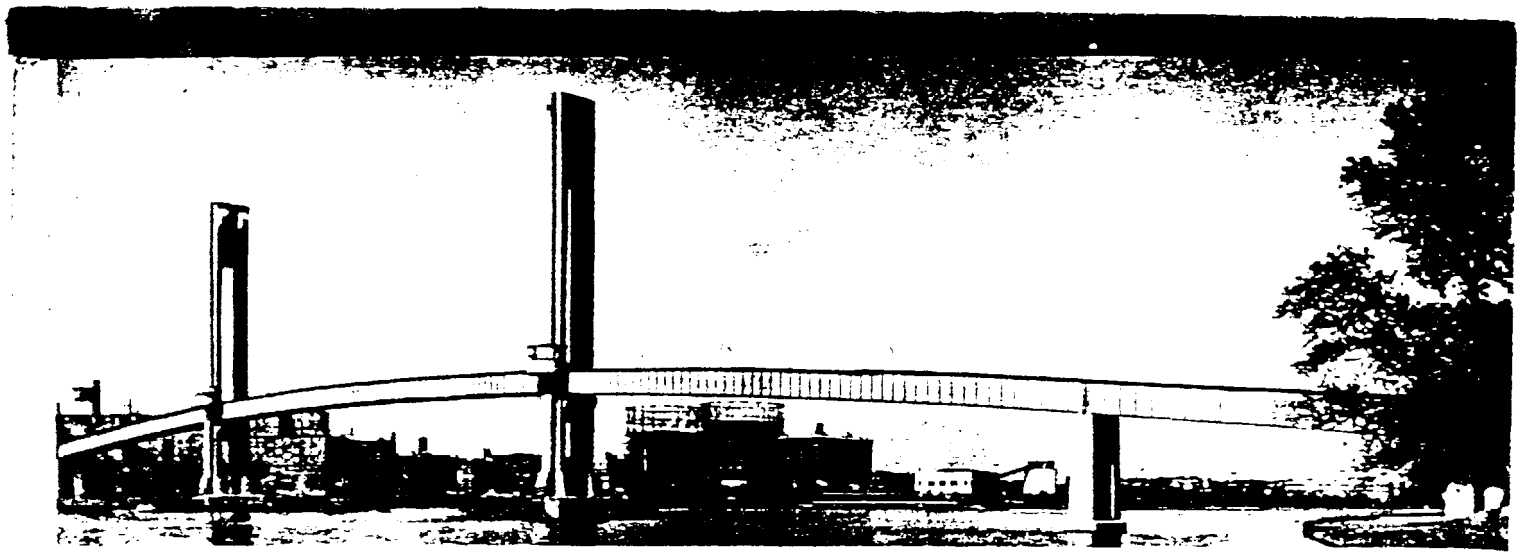


The Harlem River Pedestrian Bridge in New York City, which won first place for movable bridges in the A.I.S.C. contest, is coated with two types of red lead paints.

Prize Winning Bridges Protected With Red Lead

SOUND engineering design, utility and beauty are the criteria on which the American Institute of Steel Construction bases its award selections in the contest it sponsors each year for bridges opened in the previous year. The first prize winners in each of the four classes of the 1952 competition were the four bridges pictured on these pages and the cover of "Lead."

On each of these prize winning bridges red lead primer paints were used to afford protection against corrosion to the steel structure of the bridge. The formulations used varied according to performance requirements and the conditions prevailing. For reference, some of these formulations are given in the accompanying table.

The graceful center span of the Delaware Memorial Bridge stretches 2,150 ft. across the Delaware River three miles south of Wilmington. Carrying four traffic lanes and two sidewalks it is the sixth longest suspension bridge in the world. Length of the structure from abutment to abutment is 10,765 ft. and with embankment and highway approaches the total length of the bridge is about 24,500 ft.

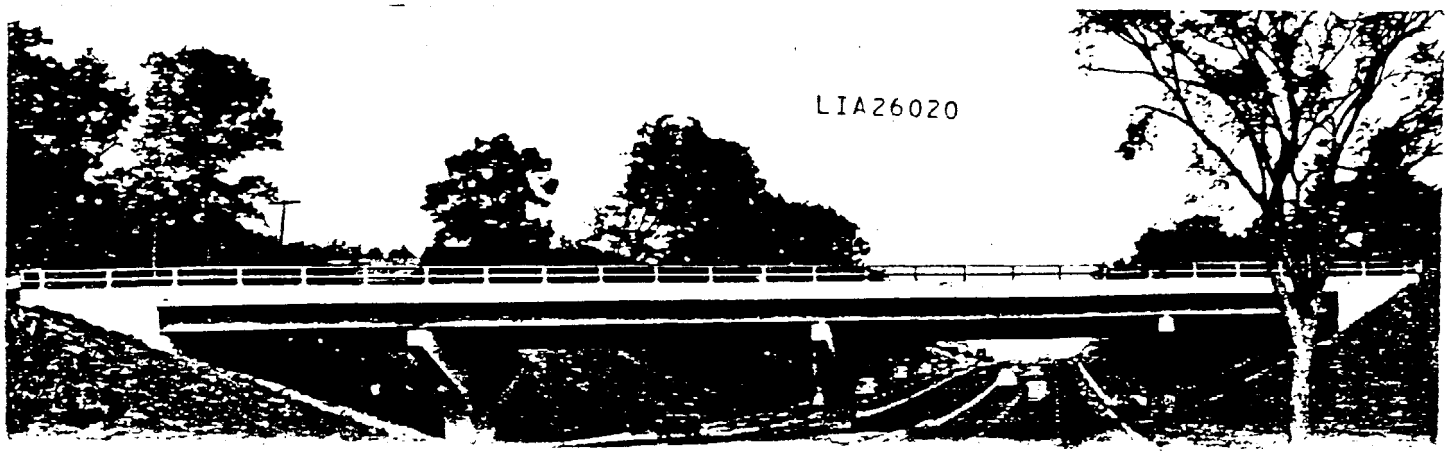
Over 6,000 gallons of red lead primer paints were consumed in the protective coating of this $44 million project. Red lead base primers were used for the shop coat and first field coat. All painting was done by brush and the steel covered was approximately 31,900 tons.

Another important use of red lead on this bridge was in the cable wrapping. Immediately in advance of the wrapping machine the cable was given a coat of red lead paste of a consistency obtained by mixing 100 lb. of dry red lead with 8½ lb. of raw linseed oil. Dry red lead used conformed to A.S.T.M. Specifications for Red Lead, Designation D83-41 and was 95 percent grade. The raw linseed oil conformed to A.S.T.M. Specification, Designation D234-28.

The Delaware Memorial Bridge is owned and operated by the Delaware Crossing Division of the Delaware State Highway Department. The New York and Kansas City firm of Howard, Needles, Tammen & Bergendoff served as engineers for the project. Associated with them on certain aspects of the design were O. H. Ammann of Ammann & Whitney, consultant on the suspended structure; George L. Freeman of Moran, Proctor, Freeman and Mueser, consultant on foundations; and A. Gordon Lorimer of Lorimer and Rose, consulting architect.

In Class II, for bridges with spans under 400 ft., costing more than $500,000, first place went to the Forebay Channel Bridge of the Davis Dam construction project in Arizona and Nevada. Fabrication of the structural steel and application of the prime coat was at the Gary, Indiana, plant of the American Bridge Co., who were the fabricators for all four of these prize winning bridges. After fabri-

A complete lead base paint system was used for this award winning bridge at Lexington, Mass.



SOME OF THE LEAD BASE PAINT FORMULATIONS USED ON PRIZE WINNING BRIDGES

(HARLEM RIVER PEDESTRIAN BRIDGE)
Federal Specification
TT-P-86A, Type I

Ingredient		Percent by wt.
Pigment	77.7	
Red Lead (97% grade)		99.6
Aluminum Stearate		0.4
		100.0
Vehicle	22.3	
Raw Linseed Oil		49.0
Pale Heat Bodied Linseed Oil		17.0
Mineral Spirits		29.0
Liquid Drier		5.0
		100.0

lb/gal—24.3, PV—36

(Similar to formulations used on DELAWARE MEMORIAL and HARLEM RIVER PEDESTRIAN BRIDGES)
Steel Structures Painting Council
Specification SSPC-2-53T

Ingredient		Percent by wt.
Pigment	75.0	
Red Lead (95% grade)		75.0
Iron Oxide (70% Fe_2O_3)		24.7
Aluminum Stearate		0.3
		100.0
Vehicle	25.0	
Raw Linseed Oil		56.0
Alkyd Resin Solution		40.0
Thinner and Driers		4.0
		100.0

lb/gal—22, PV—34

(Essentially the same and superseding formulation used on FOREBAY CHANNEL BRIDGE)
U. S. Maritime Administration
Specification 52-MC-201

Ingredient		Percent by wt.
Pigment	52.0	
Red Lead (97% grade)		55.4
Zinc Yellow		10.2
Mica		9.4
Indian Red		1.4
Magnesium Silicate		23.3
Aluminum Stearate		0.3
		100.0
Vehicle	48.0	
Alkyd Resin Solution		66.0
Aromatic Naphtha		16.7
Petroleum Spirits		17.3
		100.0

lb/gal—13.2, PV—33

(LEXINGTON, MASSACHUSETTS BRIDGE)
Commonwealth of Massachusetts
Department of Public Works
Specification P-310-50

Ingredient		Percent by wt.
Pigment	78.0	
Red Lead (97% grade)		99.65
Aluminum Stearate		0.35
		100.0
Vehicle	22.0	
Red Linseed Oil	min.	90.0
Liquid Drier and Turpentine	max.	10.0
		100.0

lb/gal—not less than 25.1, PV—28

(LEXINGTON, MASSACHUSETTS BRIDGE)
Commonwealth of Massachusetts
Department of Public Works
Specification P-320-50
Structural Blue Lead Gray

Ingredient		Percent by wt.
Pigment	75.0	
Blue Lead, Basic Sulphate		99.5
Aluminum Stearate		0.5
(Lampblack and/or Iron Blue may be used for tinting)		100.0
Vehicle	25.0	
Linseed Oil	min.	90.0
Liquid Driers & Thinner	max.	10.0
		100.0

lb/gal—not less than 21.4, PV—33

(LEXINGTON, MASSACHUSETTS BRIDGE)
Commonwealth of Massachusetts
Department of Public Works
Specification P-330-50
Structural Chrome Oxide Green

Ingredient		Percent by wt.
Pigment	68.0	
White Lead, Basic Carbonate		70.0
Zinc Oxide		15.0
Chrome Oxide Green		15.0
		100.0
Vehicle	32.0	
Linseed Oil	min.	90.0
Liquid Driers & Thinner	max.	10.0
		100.0

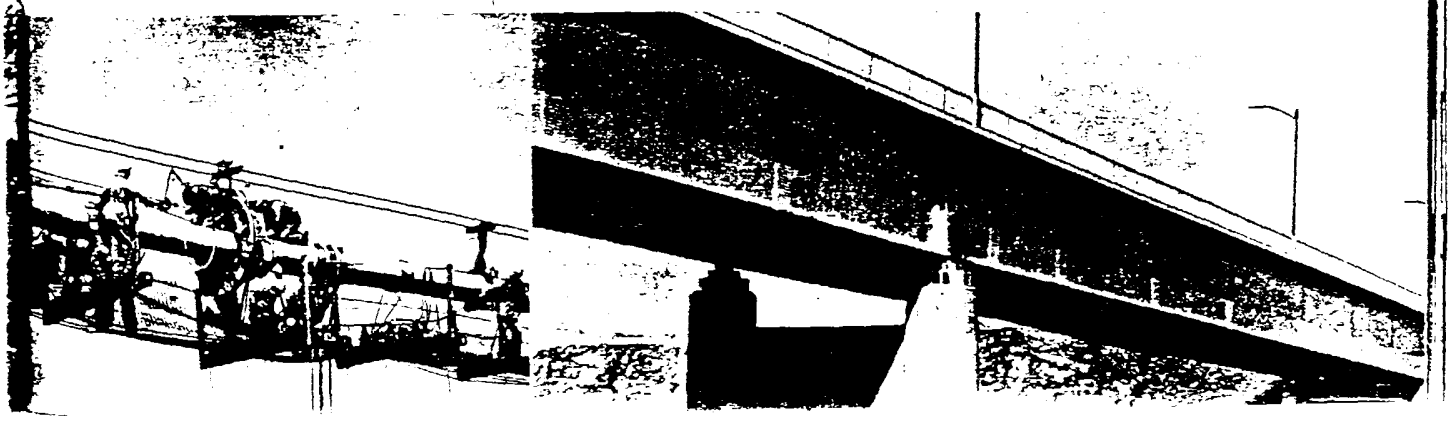
lb/gal—not less than 18.3, PV—26

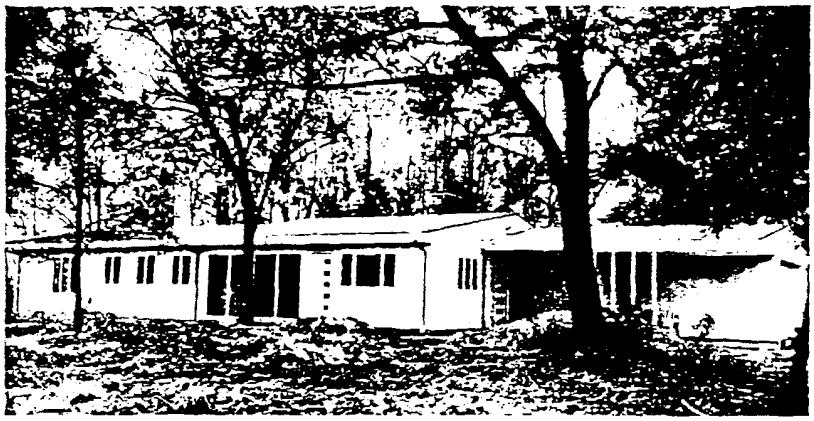
cation the steel was cleaned of all grease and oil and then flame cleaned. One coat of quick-drying, alkyd resin base, red lead primer, Maritime Commission Specification 52-MC-23, was applied by brush immediately after the cleaning. Approximately 200 gal. of the red lead primer were used to cover the 550 tons of steel used in the bridge. The design for the Forebay Channel Bridge was prepared in the office of the Chief Engineer, Bureau of Reclamation, Denver, Colorado. Bureau construction engineers H. F. Bahmeier and J. R. Walton supervised the erection and completion of the bridge.

A complete lead base paint system was used for the prize winner in Class III, for bridges with spans under 400 ft., costing less than $500,000. The bridge carries Grove Street over Route 128 in Lexington, Massachusetts. A shop coat of red lead was applied, then field coats of red lead, blue lead gray, and chrome oxide green, successively. The last named is a white lead base paint. Each of these lead base paints was formulated in accordance with specifications of the Massachusetts Department of Public Works. The coats were applied by brush. There were about 190 tons of structural steel used in the bridge and each coat of paint applied averaged about ¼ gal. per ton of steel. J. C. Rundlett, engineer of the Department of Public Works, directed work on the bridge, which was designed by Thomas Worcester, Inc.

The Harlem River Pedestrian Bridge, situated in New York City's industrial and sea air atmosphere, was coated with 1,100 gallons of red lead paint in two coats, each of a different type. The shop coat was formulated in accordance with Federal Specification TT-P-86A, Type I. The first field coat was a red lead paint containing a synthetic vehicle. Paint coats were brush applied to a total of 2,230 tons of steel. This bridge, which won first prize in the movable bridge class, was designed and is operated by the Triborough Bridge Authority. A lift bridge, it connects Wards Island with Manhattan Island at 103 Street. Ammann and Whitney of New York were the project engineers.

Below, left, cable wrapping machine on the Delaware Memorial Bridge. Red lead paste is applied to the cable just in advance of the machine. Right, the prize winning Forebay Channel Bridge at Davis Dam.





A modern home at Canfield, Ohio, with a standing seam terne plate roof.

Color and Long Service With Terne Plate Roofing

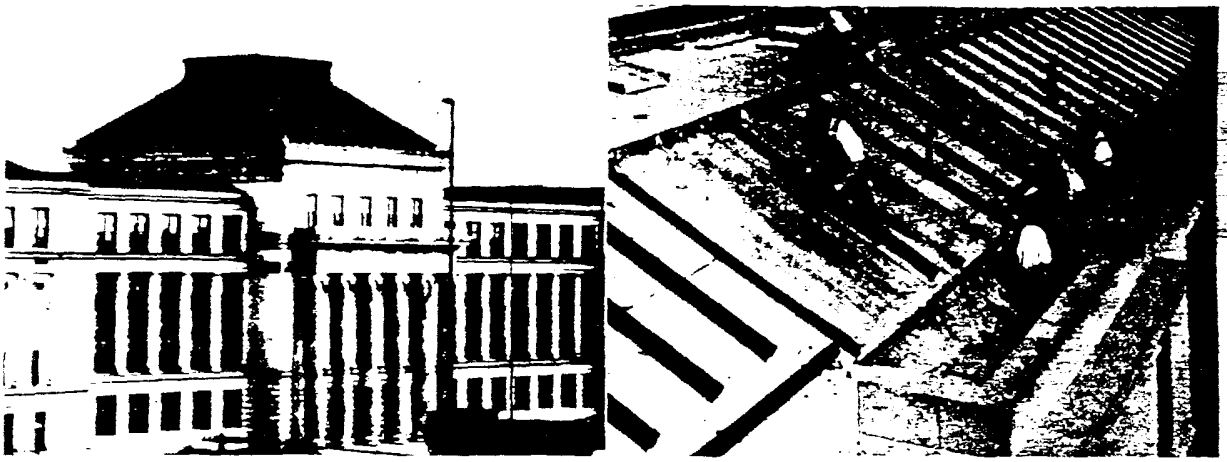
THE toughness of steel and the extremely high corrosion resistance of lead are combined in terne plate to produce one of the strongest, lightest and most durable of roofing materials. Thoroughly waterproof, hailproof and undamaged by windstorms that curl or remove other materials, terne plate roofing with occasional repainting will give decades of service. The terne plate roof of the Hermitage, the Tennessee residence of Andrew Jackson, which is over a century old, is not an unusual example of the durability of the material. The homeowner can paint his terne roofing in any color to suit his taste and harmonize with the surroundings. When house painting time comes, a refinished roof can match the freshly painted walls, or the color scheme can be completely changed for the man who decides on a new expression of his individuality. The applications of terne plate roofing, of course, extend to roofing for all types of factory, public and commercial buildings.

Terne plate is made by dip coating sheets of steel with terne metal, which is an alloy of 80 percent lead and 20 percent tin. The tin serves only to effect a better bond between the steel and the lead. It is the lead which gives terne metal its weather resistance. Terne plate is graded according to the weight of coating on a given area, and comes in 40 lb., 20 lb. and 8 lb. grades. The 8 lb. grade is utilized for special and temporary applications. For many years terne plate was available only in relatively small plates, but it can now be had in seamless rolls of fifty feet, which eliminates cross seams and in a variety of widths up to 28". Expansion and contraction of terne roofing due to changes in temperature can be disregarded since it amounts to only 0.8 in. per 100 ft. for a 100 deg. F. variation.

For best results terne plate roofs are installed on wood sheathing of good quality. Plywood, as little as $\frac{3}{8}$ in. in thickness is entirely suitable for this purpose. Rosin-sized building paper is laid over the sheathing. Tar paper or other paper containing acid must not be used. The terne plate is then cut from the rolls in lengths to provide a continuous strip from ridge to eaves. Nails are never driven through these strips. Instead, terne plate cleats are nailed to the roof, the nails being placed as close as possible to the bend in the cleat. The end of the horizontal part of the cleat is bent over to cover the nail heads. The cleats are placed at 12 inch intervals along the edge of the strip and cleats on opposite sides of the strip are staggered. After the cleats are in place along the edge of a strip, the next strip is put in place, covering the nailed part of the cleats. The edges of the two strips and the vertical part of cleats along these edges are then folded over to make a seam.

There are three standard types of terne plate roofs, named for the type of seam by which the strips are joined. Standing seam roofs have double locked unsoldered seams which, when finished, stand up about an inch from the surface of the roof. Flat-locked seams are turned over, malletted flat to the roof, and well soaked with solder. Ribbed or batten roofs have

Workmen installing a standing seam terne plate roof.



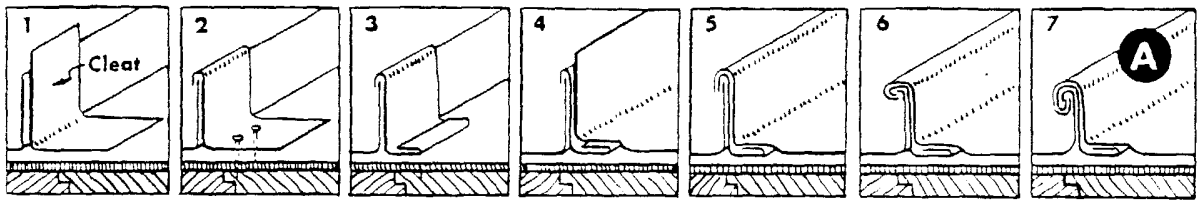
PHOTOS AND DRAWING BY FOLLANSBEE STEEL CORP.

Left, an example of a batten seam terne plate roof, that of the Taylor Allerdice High School in Pittsburgh, Pa. Installation of this roof is shown at right.

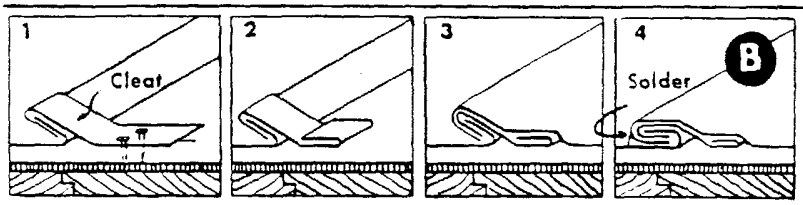
vertical battens nailed to the sheathing, and terne metal strips cover both sheathing and battens. Large roof areas lend themselves especially well to this type of treatment. Considerable variety may be introduced by using combinations of these, by varying the height and spacing of battens or whatever else the imagination of the architect may dictate.

Terne plate offers a highly receptive surface for paints. For roofs in most areas white lead-in-oil or good quality lead titanium-zinc slow chalking house paints typified by Federal Specifications TT-P-104 or TT-P-102 respectively, will provide good appearance, long life, unlimited color choice and, eventually, a sound surface for repainting. Several paint formulations suited for this are contained in White Lead Technical Bulletin No. 1, obtainable from the Lead Industries Association.

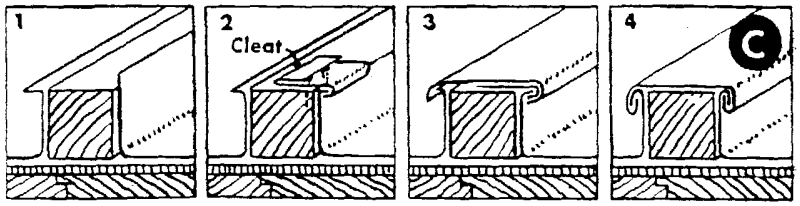
For factory buildings and other structures in industrially contaminated atmospheres a primer coat of red lead paint under suitably colored finish coats will result in less frequent need for painting and reduced maintenance cost. Many suggestions for red lead base formulations for this and other metal protective jobs are included in the Red Lead Technical Letters, available without charge from the Lead Industries Association.



STEPS IN PRODUCING STANDING SEAM ROOF



APPLICATION OF FLAT SEAM ROOF



APPLICATION OF RIBBED OR BATTEN SEAM ROOF

LEGEND

These drawings show the three standard types of terne seams A-B-C . . . progressive steps are numbered consecutively and final condition noted by letter thus (A) etc. . . . all seams are opened out to show construction clearly . . . drawings are not made to scale, being only diagrammatic.

Lead Fittings for Levitt's Towns

AMONG the outstanding developments of the post-war housing boom is the almost unbelievable accomplishments of the firm of Levitt and Sons, Inc. of Manhasset, L. I., N. Y. Beginning as traditional home builders less than a quarter of a century ago, they have grown from an organization building 35 homes a year to one that had reached, through mass production methods, the incredible rate during 1950 and 1951 of 35 completed homes a day. This record pace was set in Levittown, L. I., N. Y., a community that grew like Topsy from an originally planned project of 1,000 homes in 1946 and 1947, until on Thanksgiving Day, 1951, the last family moved into house No. 17,447.

This record pace was not to stand long as the firm embarked on another project of similar size in Bucks County, Pa., 25 miles north of Philadelphia. This new project of 16,000 homes scheduled for completion in three years has required all the tricks of mass production that had been developed on Long Island.

As presently constituted, Levitt's mass production methods transform the construction site into an assembly line with the single exception that the men move to a waiting line of materials rather than materials to the men. Trained crews move from site to site, each doing its special job, with the materials they need waiting there ready to be used.

In the case of the waste and vent roughing-in for the plumbing, as much of this as possible is prefabricated in shops in the construction area and moved to the building sites as required.

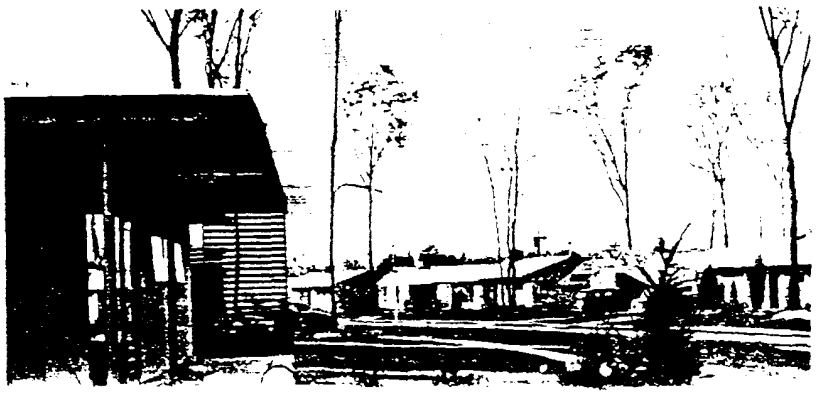
The ease with which lead fittings can be adapted to prefabrication and assembly line techniques along with the advantages that a flexible material imparts to such installations was of major importance in their selection for both the Levittown, N. Y. and Levittown, Pa. projects. When the Pennsylvania project has been completed, a total of over 65,000 lead reducing bends and lead P-traps will have been prefabricated and installed in both projects.

The builders estimate that 13,500 houses of the Pennsylvania project will be one of four variations of a three-bedroom, ranch type house with a sliding living room wall which makes the third bedroom convertible into extra daytime living space. These houses will sell for around $10,000. Another innovation is the roughing-in in place for a second water closet which can be installed at the owner's convenience. This future "powder room" is just off the main entrance and in the new home serves as a clothes closet. The remaining 2,500 houses will be considerably more elaborate, with about a $17,000 price.

The scope of the Levitt undertakings can be imagined by picturing a city the size of Sacramento, Calif. or Albany, N. Y. or Charlotte, N. C. or Austin, Tex. In less than a decade Levitt has built enough homes to house comfortably the entire population of any one of these.

Left, two lead bends and a lead P-trap are essential components of the basic Levitt plumbing "tree." From top to bottom—the units at one stage of pre-assembly at the shop—the completed unit delivered at the house site and ready for installation—calking the unit into the soil pipe — a completed installation.

Below, a street in Levittown, Pa.

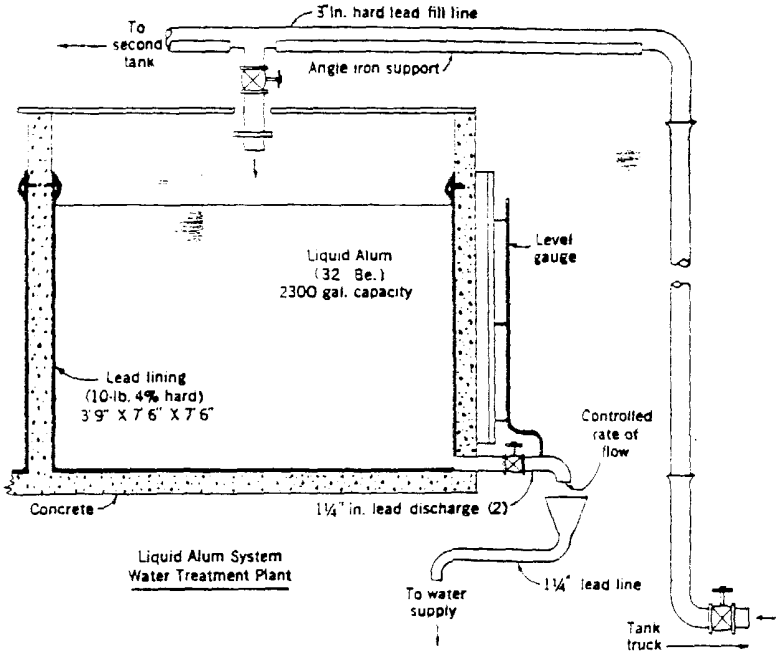


LIA26024

Liquid Alum Coagulating Systems Use Lead

MANY public water works throughout the country have recognized definite economic and technical advantages in converting their water coagulating systems from dry to liquid alum. Lead lined tanks and lead piping are used in handling the liquid form since it is corrosive to practically all of the common construction materials except lead and its alloys.

Wyandotte Water Works near Detroit, Michigan, is a typical example, having switched to liquid alum in July, 1949. Here are some of the reasons why. The unloading and storing of carload shipments of the dry form has been eliminated. It is no longer necessary to install and maintain chemical feeders such as are regularly required with dry alum. Liquid feeders are generally more accurate and much easier to maintain than dry feeders, especially if the flow or rotameter type is used, since neither of these has any moving or driven parts to wear out. The control of flow at Wyandotte has been reduced to an ordinary pinchcock at the discharge outlet. The storage and handling problem plus the labor of moving bags of dry alum from storage to feed hoppers is eliminated at a substantial cost saving. When dry alum is used some of it becomes partially hydrated, never completely dissolving, and is carried in the water stream into the settling basin, where it drops out and becomes buried in the muds. Also eliminated is the dust hazard and the expense of installing and maintaining dust collectors.



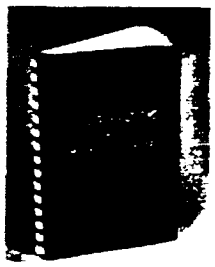
Tank trucks deliver the liquid alum directly from the manufacturer to the consumer, the optimum delivery range of 2,000 gal. being fifty miles. At the water works, an ordinary fire hose is connected to the tank truck and the liquid alum blown by air pressure or pumped from the truck through the hose into a 3-in. I.D., ¼-in. wall lead pipe (4 percent antimony) to a 2,364 gal. sheet lead lined concrete storage tank. The tank is lined with 10-lb., 4 percent antimonial lead and is 4½ ft. high, 9⅓ ft. wide and 7⅔ ft. long. The lining extends to above the liquid level, where it is secured to the concrete by a steel plate covered with ¼ in. lead. All lead construction was by Allied Lead Burning and Construction Co., Detroit. From the storage tank, located above the treating system, the alum flows by gravity to the point of application, metered through lead lines without adding diluting water. Flow rate is controlled by means of an ordinary laboratory pinchcock and acid resisting hose.

Beside the obvious advantage of corrosion resistance, lead was chosen

Below, left, lead pipe line leading from outside filler connection to liquid alum storage tank at Wyandotte, Mich. water works. Right, the lead fill line emptying into the concrete storage tank, which is lead lined to just above the liquid level. A lead covered steel plate secures top of lead lining.

The flow of liquid alum through lead pipes from the storage tank to the water tank is controlled by a pinchcock.

to handle the alum because of all the other materials that might have been considered, lead is the only one that can be profitably salvaged.



TEXTBOOK ON LEAD WORK AVAILABLE

Profusely illustrated with over 140 photographs and drawings, "Lead Work for Modern Plumbing" presents clearly to the plumbing student the necessary tools, procedures and the methods required for lead work. Each operation is given in step-by-step photographic sequence fully complemented by a detailed explanatory text.

In pocket size, with plastic ring binder, copies may be obtained for $1.50, postpaid, or $1.00 per copy in quantities of 10 or more by writing to the Lead Industries Association, 420 Lexington Avenue, New York 17, N. Y.

Liquid alum shipped directly from the manufacturer is a luxury not every water works can enjoy principally because of shipping distance limitations. Many water works engineers, while aware of the advantages of liquid alum, are located too far away from a liquid alum manufacturing plant to have it shipped to them in this readily usable form. A compromise has been made in many cases by purchasing dry alum in bulk, which is a little less expensive than in bags, and dissolving it in lead lined tanks from which it can be handled as liquid alum. This system has the advantage of only one handling by labor instead of two or more, plus the added advantage of using alum in liquid form. In such cases it is generally the practice to install a lead lined dissolving tank near enough to the car unloading platform so that the bulk alum can be emptied directly into the tank and dissolved as it is being unloaded. The dissolving tank can then also double as a storage tank. Since liquid alum at 32° Bé or 7.2 percent Al_2O_3 contains 4.45 lb. of dry alum per gal., a 1,000 gal. storage tank will hold a minimum carload (4,000 lb.) of dry alum.

THE Lead LIBRARY of Technical Information

The following articles and reprints contain information, drawings and specifications on the use of lead products helpful to architects, engineers and others interested. They are available, free of charge, except where otherwise indicated, upon request to the LEAD INDUSTRIES ASSOCIATION, 420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

LEAD IN MODERN INDUSTRY
$1.50 Postpaid
A fully illustrated, 230 page, cloth bound book describing all phases of the production and use of lead, lead alloys and lead compounds. Discussion of the physical and chemical properties of lead and its compounds is included. Sufficiently technical to be of practical value to the engineer in industry, yet broad enough for those with a more casual interest.

THE DEPENDABILITY OF FUTURE LEAD SUPPLIES
A leaflet containing a brief and non-technical discussion of the lead situation. Tells why consumers in this country may depend on adequate supplies of lead in the future.

LEAD IN MODERN PLUMBING— WHY, WHERE, HOW IT IS USED
A 24 page booklet containing descriptive information as well as four pages of detailed drawings for plumbing installations in various type houses.

FEDERAL SPECIFICATION, WW-P-325 For Pipe, Bends and Traps, LEAD
Part 5 of Section IV of the Federal Standards Stock Catalog, official publication by the Government Printing Office.

LEAD WELDING
An informative as well as practical guide to lead welding. Reprinted from the "Welding Handbook, Third Edition" published by the American Welding Society.

LEAD AND LEAD ALLOYS
The corrosion resistance of lead and its alloys as materials of construction in the chemical process industries is shown for more than 188 industrial chemicals, citing the effects of concentration and temperature. The illustrated article also describes the forms of lead available for chemical construction and gives recommended practices for fabrication as well as applications. Reprinted from "Chemical Engineering," February, 1953.

LEAD IN MODERN CHEMICAL CONSTRUCTION
What you should know about the various types of lead construction in the chemical field. Reprinted from "Chemical Engineering," Jan. 1952.

NEW DEVELOPMENTS EXPAND USE OF LEAD CONSTRUCTION
Improvements in lead fabrication and installation methods are described and illustrated in a reprint from "Materials & Methods" May, 1951. The article shows how lead construction developments have continued to keep pace with developments in the chemical and process industries.

THE USE OF LEAD IN THE PULP AND PAPER INDUSTRY
Detailed description of various applications of lead in the modern pulp and paper mill. Covers all phases of paper pulp manufacture and treatment including sulphite acid manufacture, acid pulping, bleaching and stock handling. Reprinted from "Paper Trade Journal," Oct. 26, 1950.

CONTROLLING CORROSIVE AIR POLLUTANTS
A discussion of the various methods in use today to control corrosive air pollutants. Reprinted from "Air Repair," May, 1952.

RED LEAD TECHNICAL LETTERS
A series of technical letters issued by the Red Lead Division, Lead Industries Association. The numbers and titles follow: (Available separately)
- Technical Letter No. 3—Red Lead Primers for Atmospheric Exposure
- Technical Letter No. 4—Red Lead Paints for Marine Exposures
- Technical Letter No. 5 — Red Lead-Vinyl and Coumarone Type Paints
- Technical Letter No. 6 — Red Lead Paint Formulations
- Technical Letter No. 7—Paint Systems for Hydraulic Structures
- Technical Letter No. 8—Paints for Railroads

FEDERAL SPECIFICATION TT-P-86a
Paint: Red-Lead-Base, Ready-Mixed
Covers four types of red-lead-base paints including two fast drying formulations. Many intended applications listed.

METAL PROTECTIVE RED LEAD PAINTS
The versatility of red lead in protective primers to meet a wide range of surface conditions, drying schedules and economic demands is described. Reprinted from "Paint and Varnish Production," January, 1951.

AN INVESTIGATION OF PRIMERS FOR MARINE ATMOSPHERIC ENVIRONMENTS
Results of an investigation of synthetic vehicles and red lead mixed pigment primers over an exposure period of three and one-half years in a rigorous marine atmosphere. Reprinted from "Official Digest" published by The Federation of Paint and Varnish Production Clubs.

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