

Pretreatment Specifications

No. 2 Cold Phosphate Surface Treatment



Approved as Tentative, March 26, 1953
Steel Structures Painting Council
4400 Fifth Avenue
Pittsburgh 13, Pa.

This publication is one of a series of
PRETREATMENT SPECIFICATIONS

The purpose of these pretreatment specifications is to establish current good practice in the pretreating of structural steel surfaces prior to painting. They were prepared and revised in collaboration with many representatives of various steel fabricators, erectors, constructors, railroads, highway departments, consulting engineers, paint manufacturers, commercial cleaning and painting contractors, manufacturers of pretreatment, and other organizations concerned with the cleaning and painting of steel. It is intended that these specifications be included in contracts by reference to their title and number. Any suggestions for improvement or other correspondence should be addressed to the Secretary, Steel Structures Painting Council.

These specifications have been prepared by the Research Committee and approved for publication by the Executive Committee of the Steel Structures Painting Council. The membership of the Research Committee that prepared these specifications is as follows:

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Steel Structures Painting Council Pretreatment Specifications

No. 2 Cold Phosphate Surface Treatment

1. Scope

1.1 This specification covers the procedure required for the cold phosphate surface treatment of structural steel surfaces prior to painting.

2. Definitions

2.1 Cold Phosphate Surface Treatment is a method of converting the surface of steel to insoluble salts of phosphoric acid for the purpose of inhibiting corrosion and improving the adhesion and performance of paints to be applied.

2.2 These treatments have been proven beneficial for steel surfaces free of rust, scale, dirt, or paint, also for clean galvanized steel surfaces. It is not contemplated that they will be used for scaled or heavily rusted surfaces, but very light deposits of rust present on the surface may be converted in the treatment. Neither is it contemplated that these treatments will be used in conjunction with touch-up maintenance painting where the acid might damage existing painted areas.

3. Procedures

3.1 Cold Phosphate Surface Treatment shall consist of the following sequence of procedures:

3.1.1 Oil or grease shall be removed from the surface by methods specified in Spec. SSPC-SP 1-67T, "Solvent Cleaning."

3.1.2 The clean steel surface shall be treated by one of the following methods:

3.1.2.1 Wetting (by brushing, spraying, dipping, or flow-coating) with a solution made by mixing one volume of Compound, Metal Conditioner and Rust Remover (Phosphoric Acid type) MIL-C-10578, Type I, with three volumes of water. The solution shall be permitted to remain on the surface long enough to wet the steel and to react with or

loosen light deposits of rust, if present. The residue shall be washed from the surface by rinsing with water (preferably hot). The washed surface shall be free of rust and shall be a gray-white color, otherwise the operation shall be repeated.

3.1.2.2 Wetting (by brushing, spraying, dipping, or flow-coating) with a solution made by mixing one volume of Compound, Metal Conditioner and Rust Remover (Phosphoric Acid Type) MIL-C-10578, Type II, with three volumes of water. The solution shall be permitted to react with the steel and to dry until a gray-white deposit forms on the surface. Any dark, sticky residue which remains on the surface shall be wiped off with damp rags and the surface dried until a white deposit appears (See 3.6). All excessive or loose powdery deposit shall be brushed from the surface with dry brushes, or wiped off with dry rags, or removed by compressed air or vacuum.

3.1.2.3 Treating with proprietary cold phosphate or phosphate-chromate solutions (containing phosphoric acid, phosphates, or chromates) that have been approved by the owner. Such solutions shall be used in accordance with the manufacturer's directions. The solution must be capable of producing a water insoluble phosphate coating weighing at least 7½ milligrams per square foot of surface area when used in accordance with the manufacturer's directions. (See A.9 and A.10).

3.2 The temperature of the steel surface and of the surrounding air shall be between 50° F. and 120° F. when treated.

3.3 Unneutralized residue (dark, gummy, or sticky paste) shall be removed from any area, but particular care shall be exercised to remove residue from corners, ledges, crevices, and places where the liquid tends to drain and collect.

3.4 Large areas of sticky residue indicate necessary

adjustment should be made in phosphate solution concentration. The provisions of preceding paragraphs shall then be waived to permit greater dilution of phosphate solution.

3.5 Solutions shall not be stored or mixed in uncoated steel vessels; galvanized containers must not be used; glass or earthenware containers are suitable.

3.6 No excessive or loose powdery deposit or dust shall be permitted to remain on the surface, particularly if the prime coat of paint is to be applied by spray.

3.7 After treating, the surface when viewed without magnification shall be found free of visible rust, even when the surface is scraped to remove phosphate layers.

3.8 The prime coat of paint shall be applied to the treated surface as soon as practicable, but in any event before deterioration of the surface occurs.

4. Safety Precautions

4.1 Concentrated solutions may contain dangerous concentrations of acid and necessary precautions shall be taken to protect the hands, faces, and clothing of workmen from accidental splashes.

4.2 Any of these solutions will cause painful irritation or damage to eyes and sensitive tissues. Splashproof eye shields or goggles should be worn when working with these solutions.

4.3 If prolonged exposure of hands to solution cannot be avoided, rubber gloves shall be worn.

4.4 It may be necessary to provide acid and solvent resistant boots and aprons in addition to gloves and face shields.

4.5 Fresh air should be provided when working in closed spaces.

5. Inspection

5.1 All work under this specification shall be subject to inspection by the owner or his representative. All parts of the work shall be accessible to the inspector. The contractor shall correct such work as is found defective under the specifications. If the contractor does not agree with the inspector, the arbitration or settlement procedure established in the contract, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

Appendix

A.1 SCOPE. The recommendations contained in this appendix are believed to represent current good practice, but are not to be considered as requirements of the specifications.

A.2 Cold Phosphate Surface Treatment is intended as a pretreatment for thoroughly cleaned steel. It should not be used over mill scale since it may cause the mill scale to loosen and lift the paint. Poor results have been realized when these cold phosphate treatments have been used over badly rusted steel. If the deposit of rust is very light and the rust is completely converted to iron phosphate by the pretreatment, excellent results may be obtained. However, it should be kept in mind that the pretreatment is intended for use on steel free of mill scale, heavy rust, and paint.

A.3 Cold phosphate treatments may be used to protect blast cleaned steel from rusting before the priming paint is applied. These treatments are of particular value when used on steel to be immersed in water after painting.

A.4 Cold phosphate treatments do not work well under wash primers (such as SSPC-PT 3-33T Basic Zinc Chromate - Vinyl Butyral Washcoat) and should not be used if such pretreatments are specified.

A.5 Material which meets the requirements for Compound, Metal Conditioner and Rust Remover (Phosphoric Acid type) MIL-C-10572, Type I or Type II must equal or surpass the performance of the following control formulas for the respective type.

	TYPE I TYPE II	
Orthophosphoric acid, 85%;		
milliliters.....	118	35
Trilon N-100 (wetting agent);		
milliliters.....	5	5
Butyl Cellulosive (water soluble		
solvent); milliliters.....	40	62.5
Water sufficient to bring total		
volume in milliliters to.....	250	250

No. 2. COLD PHOSPHATE SURFACE TREATMENT

Note that these are concentrated solutions and must be diluted with three volumes of water before use.

A.6 The inclusion of inhibitors in cold phosphate treatments is believed to be detrimental since they reduce the reaction of the phosphoric acid with the steel.

A.7 The Type I conditioner is used where facilities are available for rinsing off the surface after treatment. It is advantageous to add a small quantity of chromic acid or mixture of chromic and phosphoric acids to the final rinse (about 0.2 to 0.5 total per cent acid by weight). Type I is the more effective conditioner if deposits of rust are present.

A.8 The Type II conditioner is used where it is not desirable or possible to rinse off the surface. The treatment must be used cautiously to avoid a residue of unreacted acid. It may be necessary to dilute the conditioner more than specified if it dries too fast, or if there is a tendency to leave a sticky residue of phosphoric acid. Under some circumstances, it may be best to avoid formation of sticky residue by immediately wiping off the conditioner with dry rags without allowing time for the solvent to completely evaporate and deposit free phosphoric acid (which is hard to wipe off). A second wipe with rags saturated with a 50-50 mixture of alcohol and water may be necessary to remove all sticky residue. Otherwise, a final rinse may be used in the manner outlined in A.7 if desired. Generally, however, the surface will dry without a sticky residue or excessive loose powdery deposits and no further brushing, wiping or rinsing is required.

A.9 The weight of phosphate coating may be determined by treating a small, thin, clean panel (about 3" x 6") of the same type of steel in a manner identical to the full scale operation. The panel is dried and weighed; it is immersed in a 10 per cent solution of sodium hydroxide (or other suitable reagent) and the surface scrubbed until all of the phosphate coating is removed (about 10 to 15 minutes). The panel is rinsed, dried and weighed, and the coating weight calculated as follows:

Weight of phosphate coating in milligrams per sq. ft.	Weight loss of panel in grams x 144,000

Total square inches of treated surface	

A.10 The alternative method of determining the weight of phosphate coating, and perhaps one more desirable, is to weigh the test panel to the nearest milligram; immerse the panel in a stripping solution for approximately 90 seconds; rinse; dry and reweigh panel; repeat this procedure until the panel comes to a constant weight. The weight of the coating in milligrams per square foot will be equal to the loss in weight in milligrams divided by the surface area in square feet. The stripping solution should be maintained at 200° F.; its composition should be 800 grams of chromic acid (CrO_3) and water to make a gallon.

A.11 If the weight of coating is small, the test method outlined in A.10 should be used, since the phosphate coating may not be completely soluble in sodium hydroxide.

STEEL STRUCTURES PAINTING COUNCIL

PURPOSES

1. To review the art of cleaning and painting steel structures through literature surveys, conferences and other means, to determine and outline the best methods developed up to the present time.
2. To issue, if found feasible, a code or specification covering practical and economical methods of surface preparation and painting steel structures, based on the present knowledge of the membership of the Council.
3. To perform in its own organization, or by engaging outside individuals or organizations, further research to reduce or prevent the corrosion of steel structures by surface preparation and by the application of coatings, paint and other materials and to determine the initial and annual costs thereof.
4. To issue from time to time recommendations intended to further improve, and to make more effective and more economical the protection of steel structures; such recommendation to be made available to specification and code writing committees.

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 American Institute of Steel Construction
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 American Society of Civil Engineers
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 National Association of Corrosion Engineers
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