

TT-C-490
March 30, 1961
(see 6.10)

FEDERAL SPECIFICATION

CLEANING METHODS AND PRETREATMENT OF FERROUS SURFACES FOR ORGANIC COATINGS

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the cleaning methods and pretreatment of ferrous metals for the application of organic coatings (paint, varnish, lacquer, enamel, etc.) and in addition ferrous metals or items having zinc or aluminum surfaces or accessory fabricated parts of zinc or aluminum requiring treatment (see 6.11).

1.2 Classification. This specification covers the following cleaning methods and surfaces pretreatment processes:

1.2.1 Surface cleaning shall be by the following methods as specified (see 6.2):

Method I - Mechanical or abrasive cleaning (sand, shot, grit, or seed blasting or tumbling preceded by degreasing if necessary to assure a grease-free surface and followed by cleaning to remove dust and metal particles) (for ferrous surfaces only).

Method II --Solvent (immersion, spray or vapor)

Method III--Hot alkaline (immersion, spray or electrolytic) (for ferrous surfaces only)

Method IV--Emulsion (with or without added water, and followed by a water rinse.)

Method V--Alkaline derusting (for ferrous surfaces only).

Method VI--Phosphoric acid (alcoholic, detergent or solvent type with detergent).

1.2.2 Chemical conversion and pretreatment coatings shall be of the following types as specified (see 6.2):

Type I--Zinc phosphate

Type II--Iron phosphate

Type III--Organic pretreatment coating

2. APPLICABLE SPECIFICATIONS AND STANDARDS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

Federal Specifications:

QQ-Z-325

-Zinc Plating (Electrodeposited)

PPP-T-60

-Tape; Pressure Sensitive, Adhesive, Waterproof - or
Packaging and Sealing.

MFP

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Federal Standards:

Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications, Standards, and Handbooks and at the priced indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications, Standards, and Handbooks from established distribution points in their agencies.)

Military Specifications:

MIL-C-15328 -Coating, Pretreatment

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Material--All material used shall be as specified herein, on the drawings, or of a quality consistent with good commercial practice. Unless otherwise specified, type III, shall conform to Military Specification MIL-C-15328 (see 6.12)

3.2 Preproduction approval (type I only). Unless otherwise specified by the procuring agency, details of the proposed procedure, chemicals and the equipment to be used by the contractor shall be submitted through the contracting officer to the bureau or agency concerned in writing and written approval received, prior to the commencement of production (see 6.3). The exact designation of any material proposed for use, together with the name of the manufacturer, should be stated. The proposed procedure should include a detailed method of control including limits for time, temperature, concentration, and all other pertinent details that will ensure conformance with the requirements of this specification. No deviation from the approved process shall be permitted without prior written approval of the bureau or agency concerned through the contracting officer. Approval of process, materials, and equipment implies no guarantee of acceptance of the results obtained in use. Regardless of any process or materials approved, items shall conform to all the applicable requirements of this specification.

3.3 Cleaning method requirements (see 6.1)

3.3.1 Removal of soils and corrosion products. Following the use of proper cleaning method, the surfaces of the parts shall be thoroughly free of oil, grease, wax, dirt, scale, rust, and other foreign matter and shall show no visible signs of corrosion products when tested as specified in 4.2.2. If not specified the method or combination of methods used shall be selected to suit the nature and the degree of contamination present. Method VI (phosphoric acid) may be used in lieu of method I (abrasive blasting) to remove light rust or mill scale at the discretion of the contractor unless specifically prohibited on the drawing or in the specification. Sulfuric or hydrochloric acid pickling shall not be used unless specifically approved or authorized by the drawing or specification of the item being processed. Pickling chemicals shall be thoroughly rinsed from the surfaces before subsequent stages. Hydrochloric or sulfuric acid pickling will not be approved for use on assemblies of certain components which may entrap acid, or when for any other reason acid pickling is considered inadvisable (see 6.3).

3.3.2. Rinsing. Adequate rinsing shall be done to remove any alkali or acid remaining from the cleaning operation. The water rinse after cleaning operation shall be checked periodically for contamination as measured by total alkali or total acid respectively. The rate of overflow of such rinses shall be so regulated that the total alkali contamination does not exceed 0.5 ml. plus any total alkalinity correction factor in the water, or the total acid contamination does not exceed 0.5 ml. when tested in accordance with method outlined in 4.2.3. Method I (abrasive blasting) and method II (solvent) do not require a water rinse.

3.3.3. Drying. --The final stage of each cleaning process shall be thoroughly drying except where the cleaning treatment is to be followed immediately by type I or type II chemical conversion process. Care shall be exercised to assure that drying is complete especially in crevices, seams and other places which are generally the last to dry.

3.4 Chemical conversion and pretreatment coating requirement.

3.4.1 Cleaning. Cleaning shall be in accordance with 3.3.3.1.

3.4.2 Final rinse (type I and type II only). The final rinse in type I and type II phosphating processes shall contain a small amount of chromic acid or mixture of phosphoric and chromic acids, sufficient to maintain a bath pH of 2.0 to 4.0. This final rinse shall be checked by a standard free and total acid titration, as specified in 4.2.4, at least once every 3 hours and the bath discarded when the total acid reading rises to more than seven times the free acid reading. The rinse shall be discarded at least every 24 hours.

3.4.3 Appearance.

3.4.3.1 Type I, zinc phosphate. Type I coating deposits shall be continuous, uniform in texture and evenly deposited and shall be gray to black in color. The coating shall not be mottled in appearance nor show any smut, powder, corrosion products, or white stains due to dried phosphating solutions. There should be a

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minimum number of contact marks from holders or racks. Nonuniformity of color due to heat treatment, composition of the basis metal, the degree of cold work performed on the basis metal or presence of brown or orange stains from the chromic rinse shall not be cause for rejection.

3.4.4.2 Type II, iron phosphate. Type II coating deposits shall be continuous uniform in texture and evenly deposited. The coating shall be golden yellow, to purple in color. There shall be no smut, powder, corrosion products, or white stains due to dried phosphating solutions. There should be a minimum number of contacts marks from racks or holders.

3.4.4.3 Type III, organic pretreatment. The organic pretreatment after drying shall be smooth and uniform in appearance and free from discontinuities.

3.4.4. Phosphate coating weight (applicable to type I and type II chemical conversion coating only) (not applicable to incidental nonferrous surfaces). For type I the minimum coating weight shall be 150 mg/sq. ft. for spray processes and 300 mg/sq. ft. for dip processes when tested as specified in 4.2.9. For type II processes, the minimum weight shall be 40 mg/sq. ft. when tested as in 4.2.9. Unless otherwise specified, the coating weight shall be tested at least every four hours (see 4.2.9)

3.4.5 Film thickness (type III, organic pretreatment only). The film thickness shall be a minimum of 0.0003 inches when tested in accordance with 4.2.5.

3.5 Application of organic coating. The surfaces shall be given the organic protective coating immediately after cleaning or pretreatment before the surfaces can show any rusting or other soiling. The temperature of the metal surface shall not be so high that blistering, poor adhesion or unsightly film results. In general, metal temperatures should be lower than 130° F for cellulose lacquers and 160° F for enamels unless coating material has been especially formulated for that purpose. Temperatures from 60° to 120° F are the most satisfactory.

3.6 Paint thickness. For all tests requiring painted panels, test specimens, or items, the paint thickness (dry film) on all surfaces shall be as specified for the end item. When the paint thickness is not covered in the end item specification, the drawing or paint specification requirement in the order cited shall be followed.

3.7 Paint adhesion. Painted items, specimens, or test panels shall show satisfactory paint adhesion when tested as prescribed in 4.2.6. Unsatisfactory adhesion shall be indicated by any of the following conditions of exposure of bare metal or underlying phosphate or organic pretreatment:

- (a) Any spot exceeding 1/8 inch average diameter.
- (b) More than one spot exceeding 1/16 inch average diameter
- (c) More than five spots any diameter.

3.8 Water resistance. Production painted items, specimens, or panels shall show no objectionable blistering when tested as specified in 4.2.7. Objectionable blistering

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when tested as specified in 4.2.7. Objectionable blistering shall be indicated by any of the following conditions on a 4- by 12-inch test panel or equivalent area of test specimen or item. On items or specimens having an area less than 48 sq. in. a proportionately smaller number of failed areas shall be permitted.

- a. The appearance of a single blister more than 3/16 inch long or more than one blister more than 1/8 inch long.
- b. The appearance of ten or more blisters 1/3 inch or less in length.

3.9 Salt spray resistance (chemical conversion and organic pretreatment coatings only). The items, specimens, or panels after pretreatment and painting, when subjected to the salt spray test required in 4.2.8 for the number of hours prescribed in the applicable paint specification, drawing, end item specification or as otherwise specified, shall show no more than 1/8 inch creepage, blistering, or loss of adhesion of the paint from the scribe mark. At all other points there shall be no more than a trace of film failure such as blistering or corrosion, and not more than 5 scattered blisters none larger than 1 mm. (3/16 inch) in diameter on a 4 by 12 inch test panel or equivalent area of test specimen or item. On items or specimens having an area less than 48 sq. in. a proportionately small number of failed areas will be permitted (see 6.9)

3.10 Relief of hydrogen embrittlement. Unless otherwise specified, parts having a hardness of Rockwell C40 to C48 shall be given a suitable heat treatment stress relief prior to acid cleaning or phosphate coating and, in addition, shall be heated after acid cleaning or phosphate coating for 15 minutes at 200° to 210° F. Parts having a hardness of Rockwell C48 or higher shall not be subjected to acid cleaning or phosphating.

4. SAMPLING, INSPECTION AND TEST PROCEDURES

4.1 Inspection. The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Tests.

4.2.1 Test specimens. Test specimens shall be prepared from actual production items or parts thereof, or if size is prohibitive from scrap parts of the same kind and finish (from the same manufacturing lot if possible) which have been rejected for causes other than phosphating, material composition, and/or heat treatment. Standard panels may be used if the size of the item is prohibitive. Specimens need not be identical in shape or size but shall be stamped, etched, or otherwise indelibly marked for identification as a test specimen. Standard panels, when used, shall be not less than 3 by 6 inches in size. If standard panels are used in lieu of test specimens for ferrous surfaces, the steel shall conform to the specification for Cold Rolled Carbon Steel.

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rip (ASTM Designation A109) or Cold Rolled Carbon Steel Sheets, commercial quality (ASTM Designation A366) having a Rockwell "B" hardness of 55 to 75, and surface roughness of 30 to 45 microinches (arithmetical average) as rolled; for aluminum surfaces use of 2017 or 2024 aluminum panels is considered acceptable; for zinc coated surfaces, the panels shall conform to class II, type 1 of Federal Specification QQ-Z-325. All test specimens of standard panels shall be processed through the cleaning phosphating painting and drying steps along with the items being processed.

4.2.2. Removal of soils and corrosion products. The items, test specimens, or panels, for test purposes after removal from the final rinse shall be rinsed in running water and the surfaces then examined for discontinuity of the water film (water break). The surface should then be dried and examined visually for rust, corrosion products, and soils. If the water film is discontinuous or the surface shows signs of corrosion products, corrective action shall be taken. Inspection for acceptance shall be stopped until corrective action has been taken. After corrective action, testing shall be continued at least once every hour until the water film maintains its continuity.

4.2.3 Rinsing. The water rinses after cleaning operation shall be tested for contamination in accordance with the following testing procedure:

4.2.3.1 Total alkali contamination test. Take a 10-ml. sample of the rinse solution, dilute to 50 ml. with distilled water and add thereto 5 drops of Bromocresol green indicator; slowly add testing solution (N/10 HCl) from burette until the color of sample changes from blue-green to pale yellow. This is the end-point and the number of mls. of acid testing solution used is known as total alkali contamination.

4.2.3.2 Total acid contamination test. Take a 10-ml. sample of the rinse solution, dilute to 50 ml. with distilled water and add 5 drops of phenolphthalein indicator; slowly add alkaline testing solution (N/10 NaOH) from burette until the first permanent pink color is produced. This is the end-point and the number of mls. of alkaline testing solution used is known as total acid contamination.

4.2.4 Final rinse. The final rinse shall be tested for total acid and free acid in accordance with the following testing procedure.

4.2.4.1 Free acid test. - Pipette a 10-ml. sample of the final rinse into a flask, add 5 drops of Bromophenol blue; slowly add testing solution (N/10 NaOH) from burette until the color the sample changes from yellow-green to blue-violet. This is the end-point and the number of mls. of testing solution is expressed as free acid points.

4.2.4.2 Total acid test. Pipette a 10-ml sample of the final rinse into a flask, add 5 drops of phenolphthalein; slowly add testing solution (N/10 NaOH) from burette until the first permanent pink color is produced. This is the end-point and the number of mls. of testing solution is expressed as total acid points.

4.2.5 Paint thickness. Paint thickness of the items, specimens, or standard panels shall be measured by a suitable instrument (see 6.6) which has been standardized on the same surface as that over which the organic finish has been applied.

4.2.6 Paint adhesion. The test shall be performed on the painted item, specimens or standard panels of the same metal (see 4.2.1) after a maximum of 24 hours drying

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unless otherwise specified (see 6.5). Water-resistant, pressure-sensitive adhesive tape (3/4 inch width) conforming to the requirements of Federal Specification PPP-T-60, type II or III, class 1 or 2, shall be used. Press a 2 inch length of a somewhat longer piece firmly onto a flat or cylindrical surface of the item, rubbing out all air bubbles under the tape. Allow approximately 10 seconds for the test area to return to room temperature. Grasp a free end of the tape and at a rapid speed strip it from the item by pulling the tape back upon itself at 180 degrees (in such a manner that the tape is folded back to back during the procedure). Observe for bared spots where the paint is removed. Disregard flecks of paint on tape where the underlying metal or phosphate coating is not visibly exposed.

4.2.7 Water resistance. Unless otherwise specified a minimum of two items, sections thereof, or panels of the same metal (see 4.2.1), from each days production shall be run through all steps of the regular production process, including painting. The specimens shall be air dried for a minimum of 96 hours or baked for the time and at the temperature specified in the applicable paint specification, followed by air drying for 24 hours (see 6.5). The specimens shall then be immersed in distilled water having a pH value of 5.0 to 7.0 at $73^{\circ} \pm 2^{\circ} \text{F.}$, for 18 hours for cleaning method processes and 24 hours for chemical conversion and organic pretreatment procedures. If the specimens fail the water resistance requirements of 3.8, acceptance of items shall be discontinued until the discrepancy has been corrected.

4.2.8 Salt spray resistance (applicable to chemical conversion and organic pretreatment coatings only). Prior to initiation of production, or whenever a change in production or paint occurs, or when required by the inspecting officer, a minimum of three items, sections thereof or standard panels of the same metal (see 4.2.1) shall be run through all steps of the regular production set-up, including painting. The specimen shall be air dried for a minimum of 96 hours or baked for the time and at the temperature specified in the applicable paint specification, followed by air drying for 24 hours. The painted specimen shall be scored through using a sharp knife. In instances where more than one metal is used, each metal shall be so scored. The specimens shall then be exposed to the 20 percent salt spray specified in Federal Test Method Std. No. 141, method 6061 for the number of hours as specified in the end item, drawing, or paint specification in the order cited. Production shall not be initiated until results of salt spray test are received, except at the contractor's risk. During production, one item, section thereof, or a panel of the same metal if the size of the item is prohibitive (see 4.2.1), from each day's production shall be subjected to the salt spray test as specified above, until five consecutive days production have successfully passed the test. Sampling shall then be reduced to one sample twice per week. If, upon reduced sampling one failure occurs, corrective action shall be taken and sampling shall revert to one specimen from each days production until five consecutive days' production have again successfully passed the test. If two consecutive failures occur after the contractor has been notified to take corrective action in either the original sampling plan or the reduced sampling plan, inspection for acceptance will be stopped until necessary corrective action has been taken.

4.2.9 Phosphate coating weight (applicable to type I and type II only). Three specimen items, sections thereof or standard panels of the same metals (see 4.2.1) at the conclusion of a maximum of each 4 hours production shall be selected by the inspector for the test. The clean, dry specimens to be tested shall be accurately weighed and the surface area of each shall be calculated. The phosphate coatings shall be completely removed by immersion in a 5 percent by weight, chromic acid,
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solution at 165° F. for 15 minutes, rinsed, dried and weighed. This process shall be continued until constant weight is attained. The chromic acid shall be used one time only. The coating weight shall be determined from the formula:

$$\text{Coating weight} = \frac{\begin{array}{l} \text{(mg/ft}^2\text{)} \\ \text{(Initial weight in gs. - Final weight in gs.)} \\ \text{x 144,000} \end{array}}{\text{Total surface area in square inches}}$$

Four hours production shall be considered acceptable provided the average coating weight of the 3 specimens equals or exceeds the minimum coating weight required for the applicable type and not more than one sample falls below the minimum. The sample falling below the minimum shall be within 10 percent of the minimum requirement. If 2 or more specimens fail to comply with the minimum coating weight, the four hours production shall be reworked and corrective action taken until production is again acceptable. When determining the surface area of irregularly shaped objects, consideration and care should be taken to correctly determine the surface area of both the inner and outer surfaces of the test piece.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery is not applicable to this specification.

6. NOTES

6.1 Cleaning methods. Cleaning methods are intended primarily for cleaning, rust removing, descaling, or surface etching purposes in conjunction with chemical pretreatment processes. Methods I (abrasive blasting) and VI (phosphoric acid) may be used alone or prior to painting but should not be considered as substitutes for a chemical pretreatment process.

6.1.1 Type I. Type I process is intended primarily for use as a general all purpose pretreatment prior to painting on tanks, trucks, sedans, ammunition and other items, as specified.

6.1.2 Type II. Type II process is intended primarily for use where metal parts are to be formed after painting and for other end items as specified.

6.1.3 Type III. Type III is intended for use where size and shape preclude the use of type I or type II and where items containing mixed metal components are assembled prior to treatment or where lack of satisfactory equipment for types I and II applications or preferences makes this the treatment of choice.

6.2 Ordering data. Procurement documents should contain the following information:

- (a) Title, number, and date of this specification.
- (b) Method and type required (see 1.2)
- (c) Approval (see 3.2)
- (d) Process (see 3.2)
- (e) Sampling and inspection (see 4.1)

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6.3 Preproduction approval (type I only)

6.3.1 Army. Unless otherwise specified for the Army, details of the proposed procedure, chemicals, and equipment to be used should be submitted through the contracting officer to the Coating and Chemical Laboratory, Aberdeen Proving Ground, Maryland. However, the procuring agency may authorize immediately production production provided the contractor's process complies with the procedure in 6.3.3. (In those instances where approval is granted by the procuring agency confirmation shall be obtained by the procuring agency from the Coating and Chemical Laboratory, Aberdeen Proving Ground, Maryland.)

6.3.2 Other activities. Preproduction approval will not be required for proposed processes for applying crystalline phosphate base coatings under type I treatments on ferrous surfaces that correspond to the procedure outlined and described in 6.3.3. Unless otherwise specified, procedures, chemicals and equipment for type I treatments which do not correspond to the procedures in 6.3.3 will require preproduction approval of the procuring agency.

6.3.3 Procedure (method of application of phosphate coating) (applicable to type I only). The phosphate coating should be applied in equipment consisting of a minimum of five stages. Additional stages may be added at the option of the contractor provided that the five basic stages are retained. The minimum requirements for either spray or dip application are as follows:

Stage 1, cleaning. The cleaning method used should be in accordance with one of the methods of 1.2.1 or a combination thereof.

Stage 2, rinse. A clean water rinse with a constant overflow maintained by the continuous addition of fresh water.

Note: This stage is not necessary when cleaning method I (abrasive blasting) or II (solvent) are used.

Stage 3, phosphating. The properly cleaned articles or items should be subjected to a balanced aqueous solution containing phosphoric acid, zinc, and accelerating agents until a uniform water insoluble phosphate coating is produced. The articles or items should be exposed to the phosphating solution for at least 3 minutes if the dip coating method is used or for at least 1 minute if the spray method is used.

The equipment used should be constructed of materials resistant to the action of the phosphating solution and should not contain copper alloy fittings or brazing where they may come in contact with the solution. The phosphating bath should be operated at temperatures and concentrations designated by the suppliers. Dated records should be maintained noting the periodic analyses and additions to the solutions. Fog sprays should be provided on both dip tanks and spray equipment to prevent the solution from drying on the work surface prior to the subsequent water rinse.

Stage 4, water rinse. A clean water rinse with a constant overflow maintained by the continuous addition of fresh water.

Stage 5, chromic acid rinse. A final hot rinse (140° to 210° F) maintained at a pH of 2 to 4 through the addition of flake chromic acid or mixtures of chromic and phosphoric acids. The work should remain in the rinse for a minimum of 1 minute, except in spray processes where the time may be reduced to 30 seconds.

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Failure to remove the water soluble chemical residue by rinsing, while its harmful effect on the paint coating is not immediately apparent, will result in early failure of the paint by blistering, flaking and rapid spread of corrosion products from a scratch.

After treatment the phosphated parts shall not be handled with bare hands, oily or contaminated gloves.

6.4 Type II. The properly cleaned articles or items should be treated with a balanced aqueous solution containing phosphoric acid or acid phosphate salts, with or without the addition of accelerating agents. Treatment should be continued until a phosphate coating is produced which is insoluble in water and has a color varying from a golden yellow to purple. The article or items should be exposed to the phosphating solution in a spray process for at least 1 minute or 3 minutes in an immersion process. The article should then be rinsed in clean water, followed by a second rinse in a dilute chromic acid or a combination chromic and phosphoric acid solution and dried.

6.5 For convenient reference, test requirements for specific paints, when applied over chemical pretreatment coatings, are listed below in table I:

Table I. - Test requirements

Test	MIL-E-10687	MIL-L-11195	MIL-L-52043	TT-P-664	MIL-P-7962	MIL-P-858
Dry film thickness, mils ¹	0.9-1.1	0.9-1.1	0.9-1.1	0.9-1.1	0.3-0.4	0.3-0.4
Salt spray						
a. Drying time, air dry, hours	96	48	48	96	96	96
b. Exposure time, hours	144	144	336	300	96	72
Adhesion						
Drying time, air dry hours,	1	1	1	1	1	1
Water resistance						
Drying time, air dry, hours	72	48	48	72	48	48

¹ 1.0 mil is equal to 0.001 inch

6.6 The following instruments for measuring paint thickness have been found to be satisfactory:

Aminco - Brenner Magnegage
American Instrument Company, Silver Spring, Md.

Elecometer - Distributed by-
Henry H. Gardner Laboratory, Inc.

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"G. E" gage- General Electric Company
Schenectady, N. Y.

Lea gage - Lea Manufacturing Company,
Waterbury, Conn.

6.7 After application of chemical conversion coating or cleaning method, changes in appearance are to be expected and may be desirable for improving paint adhesion. Type I and II phosphate coatings leave a chemical deposit. Type III leaves an organic coating. Cleaning methods leave the metal surface substantially bare. Alcoholic phosphoric acid and phosphoric acid containing a solvent and detergent (method VI) discolor the surface. Hot phosphoric acid with a detergent (method VI) etches the surface.

6.8 Cleaning material should be maintained at a concentration, temperature range and duration of treatment sufficient to remove all visible soils and corrosion products. The concentration of material should be measured and adjusted periodically and not less than once each shift on the basis of established control procedures for applicable type. The bath should be discarded when the contamination is such that the concentration can not be adjusted with additional material.

6.9 It is intended that the maximum amount of corrosion in the salt spray test (3.9) be comparable to photograph 9-1 in ASTM Standard Method of Evaluating Degree of Resistance to Rusting Obtained with Paint on Iron or Steel Surfaces, D60-43. This standard may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa. 3

6.10 Supersession data. The table below compares the classification of pretreatments in this specification and that of Military Specification MIL-C-490, which Federal Specification TT-C-490 supersedes.

Military Specification MIL-C-4900	Federal Specification TT-C-490
Grade 1-----	Type I
Grade II, type 1-----	Method I
Grade II, type 2-----	Method III
Grade II, type 3-----	Method II
Grade II, type 4-----	Method VI
Grade II, type 5-----	Method VI
Grade II, type 6-----	Method IV
Grade III-----	Type II
None-----	Method V
None-----	Type III

6.11 When aluminum, zinc or other nonferrous metals are processed separately, reference should be made to the applicable pretreatment; for aluminum, use Military Specification MIL-C-5541 or MIL-A-8625; for zinc plating use Federal Specification QQ-Z-325, for hot dip galvanizing use Military Specification MIL-T-12879(QMC), etc.

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6.12 Alternate organic pretreatment coatings (type III). Coating Compound, Metal Pretreatment, Resin-Acid, Military Specification MIL-C-8514(Aer) (a smoother finish primarily for aircraft applications) or Primer Coating, Pretreatment One-Package Wash Primer (for Steel, Aluminum and Magnesium), Military Specification MIL-P-14504A, may be used in lieu of MIL-C-15328 when approved by the procuring agency.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated furnished or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army - Ord
Navy - Sh
Air Force - ARDC