INCH-POUND

MIL-DTL-14072G
17 May 2021
SUPERSEDING
MIL-DTL-14072F
13 August 2013

DETAIL SPECIFICATION

FINISHES FOR GROUND BASED ELECTRONIC EQUIPMENT

Comments, suggestions, or questions on this document should be addressed to: US Army Communications-Electronics Command ATTN: C5ISR-CCDC-PRD, Aberdeen Proving Ground, MD 21005 or emailed to usarmy.apg.cerdec.mbx.standardization-crx@mail.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil/.

AMSC N/A AREA MFFP

CONTENTS

CONTENTS

CONTENTS

CONTENTS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers requirements for finishes necessary to protect ground electronic equipment from the deteriorating effects of climatic conditions encountered in military use. Note: This document typically will be specified as a requirement in an equipment specification and should be considered in this context.

1.2 Conditions and applicability. When it is felt that the finish requirements of this document may compromise the performance of the equipment, the designer should consider other possibilities, such as the use of compatible, inherently corrosion-resistant materials. For example, heat dissipation requirements of equipment may require special consideration to provide for optimum thermal conductivity. In such a case, the use of castings, welded pieces, clad metals, etc., which reduce the number of interfaces may be satisfactory. A prudent choice of materials in the design stage will result in fewer finishing, corrosion, and environmental problems. In addition, every effort should be made to avoid the use of pretreatments, sealers, and coatings containing hexavalent chromium, cadmium, and lead pigments. Unless contraindicated by drawing or contract, substitutions with equivalent performance should be used in lieu of those three substances.

1.3 Types.

1.3.1 Type I (Exposed). Type I surfaces are areas, either exposed to view when equipment is in operating or traveling condition, or areas not exposed to view but subject to combined direct action of climatic elements. Climatic elements include temperature extremes, humidity extremes, rain, hail, snow, sleet, salt-laden air, industrial atmospheres, direct solar radiation, dust, and wind-blown sand. For example, the outside surfaces of any equipment are Type I areas; the inside surfaces of an open frame motor are type I areas.

1.3.2 Type II (Sheltered). Type II surfaces are areas not exposed to view during equipment operation and not subject to direct action of rain, hail, snow, sleet, direct solar radiation, and sand. For example, the interior surfaces of a radio receiver or switchboard are considered type II areas.

Any type I finish is adequate protection/application for type II exposures provided fit, form or function is not degraded.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 or 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are be those cited in the solicitation or contract.

COMMERCIAL ITEM DESCRIPTIONS (CIDs)

A-A-59298	-	Tape, Pressure Sensitive Adhesive
A-A-59921	-	Cleaning Compounds, Aircraft Surface.
A-A-59313	-	Thread Compound, Antiseize, Zinc, Dust-Petrolatum

FEDERAL SPECIFICATIONS

TT-C-490	-	Chemical Conversion Coatings and Pretreatments for Ferrous Surfaces (Base for Organic Coatings)
TT-P-28	-	Paint, Aluminum, Heat Resisting (1200°F)
TT-P-1757	-	Primer Coating, Alkyd Base, One Component, Type I Class N

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-F-495	-	Finish, Chemical, Black, for Copper Alloys
MIL-PRF-8625	-	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-C-10578 (Inactive)	-	Corrosion Removing and Metal Conditioning Compound (Phosphoric Acid)
MIL-L-13808	-	Lead Plating, Electrodeposited
MIL-PRF-14105	-	Paint, Heat-Resisting (For Steel Surfaces).
MIL-DTL-15090	-	Enamel, Equipment, Light Gray (Navy Formula No. 111)
MIL-DTL-16232	-	Phosphate Coating, Heavy, Manganese or Zinc Base
MIL-PRF-22750	-	Coating, Epoxy High-Solids
MIL-PRF-23377	-	Primer Coatings, Epoxy High-Solids.
MIL-R-46085 (Inactive)	-	Rhodium Plating, Electrodeposited
MIL-DTL-11195	-	Enamel, Lusterless, Fast Dry, VOC Compliant Alkyd Type
MIL-DTL-53022	-	Primer, Epoxy Coating, Corrosion Inhibiting, Lead and Chromate Free
MIL-DTL-53030	-	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free
MIL-DTL-53039	-	Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant
MIL-DTL-53072	-	Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection
MIL-DTL-53084	-	Primer, Cathodic Electrodeposition, Chemical

		Agent Resistant
MIL-DTL-81706	-	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-R-81294 (Inactive)	-	Remover, Paint, Epoxy, Polysulfide and Polyurethane Systems
MIL-PRF-81733	-	Sealing and Coating Compound, Corrosion Inhibitive
MIL-PRF-85582	-	Primer Coatings: Epoxy, Waterborne.
MIL-C-87115 (Inactive)	-	Coating, Immersion Zinc Flake/Chromate Dispersion

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-1500	-	Cadmium-titanium Plating, Low Embrittlement, Electrodeposition
MIL-STD-1501	-	Chromium Plating, Low Embrittlement, Electrodeposition

(Copies of these documents are available online at https://assist.dla.mil/).

2.2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A123/A123M	-	Zinc (Hot Dip Galvanized) Coatings on Iron And Steel Products, Standard Specification for
ASTM A153/A153M	-	Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM B253	-	Standard Guide for Preparation of Aluminum Alloys for Electroplating
ASTM B488	-	Standard Specification for Electrodeposited Coatings of Gold for Engineering Uses
ASTM B545	-	Standard Specification for Electrodeposited Coatings of Tin
ASTM B579	-	Standard Specification for Electrodeposited Coatings of Tin-lead Alloy, (Solder Plate)
ASTM B633	-	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM B700	-	Standard Specification for Electrodeposited Coatings of Silver for Engineering Use
ASTM D1732	-	Standard Practices for Preparation of Magnesium Alloy Surfaces for Painting
ASTM D3359	-	Standard Test Methods for Measuring Adhesion by Tape Test

ASTM D6386	-	Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

(Copies of these documents are available from https://www.astm.org).

ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)

IPC-J-STD-004	-	Requirements for Soldering Fluxes
IPC-J-STD-005	-	Requirements for Soldering Pastes
IPC-J-STD-006	-	Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

(Copies of these documents are available from https://www.ipc.org/).

MASTER PAINTERS INSTITUTE

Reference No. 9	-	Exterior Alkyd Enamel, Gloss, MPI Gloss Level 6
Reference No. 19	-	Inorganic Zinc Rich Primer
Reference No. 47	-	Interior Alkyd, Semi-Gloss, MPI Gloss Level 5.
Reference No. 49	-	Interior Alkyd, Flat, MPI Gloss Level 1

(Copies of these documents are available from http://www.specifypaint.us/).

SAE INTERNATIONAL STANDARDS / Aerospace Material Specifications

SAE AMS-STD-595	-	Colors Used in Government Procurement
SAE AMS-2403	-	Plating, Nickel, General Purpose.
SAE AMS-2418	-	Plating, Copper
SAE AMS-2422	-	Plating, Gold
SAE AMS-3276	-	Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use to 360ºF (182ºC)
SAE AMS-M-3171	-	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
SAE AMS-S-8802	-	Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
SAE AMS-2404	-	Plating, Electro-less Nickel
SAE AMS-P-81728	-	Plating, Tin-Lead (Electrodeposited)
SAE AMS-QQ-P-416	-	Plating, Cadmium (Electrodeposited)

(Copies of these documents are available from https://www.sae.org).

THE ASSOCIATION FOR MATERIALS PROTECTION AND PERFORMANCE

SSPC-Paint 25	-	Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC-Paint 30	-	Weld-Through Inorganic Zinc Primer

SSPC-SP5 - White Metal Blast Cleaning

(Copies of these documents are available from https://www.ampp.org/).

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. Selection of finishes shall be in accordance with the requirements contained herein. Finishes selected shall conform to the specified thickness and shall not interfere with the performance requirements of the equipment. Finishes, applied in accordance with this specification, will inhibit the corrosion of metals and deterioration of wood as specified herein.

3.2 First article. (If required by contract or purchase order). The contractor shall furnish a sample unit(s) for first article inspection of finishes as specified in the part or equipment document and as specified herein (see 6.2). Samples shall be subjected to first article inspection in accordance with 4.3 and as required in the acquisition documentation (see 6.2).

3.3 Materials and processes. Finishing materials and processes shall be in accordance with the requirements specified herein. The contractor shall have in his possession, for examination by the contracting officer or his duly authorized representative, satisfactory evidence that materials and processes used on the order comply with this specification. The contractor shall maintain a history of Objective Quality Evidence, OQE - Any statement of fact, either quantitative or qualitative, pertaining to the quality of a product or service based on observations, measurements, or tests which can be verified. (Evidence will be expressed in terms of specific quality requirements or characteristics. These characteristics are identified in drawings, specifications, and other documents which describe the item, process, or procedures as described by the specifications contained within this document.)

3.4 Substitution for specified finishes, processes, or materials. If, due to special conditions of service or design, the contractor considers that finishes, processes, or materials other than those specified herein are necessary or more suitable, such finishes, processes, or materials shall be used only upon receipt of prior approval from the contracting officer. At the discretion of the contracting officer, samples may be required to demonstrate the suitability of proposed substitutes.

3.4.1 "P" finishes on ferrous alloys. Table I permits finishes on ferrous alloys (other than corrosion-resistant steels) when tank phosphating is not practical. Phosphating in a tank may not be practical due to size, shape, or part fabrication method such as welding. Prior to using these finishes, the contractor shall prove, to the satisfaction of the contracting officer, that tank phosphating is not practical. Only QPD listed pretreatments in TT-C-490 or those permitted by contract shall be considered.

3.4.2 Plating of holes and recesses. When it is not practicable to meet specific thickness requirements for finishes in holes or other recesses, the contractor shall submit a proposal for finishing such holes and recesses for review and approval by the contracting officer.

3.5 Operations prior to application of finishes.

3.5.1 Cut edges. The edges of all metals in exterior locations shall be rounded to promote adhesion and adequate thickness of subsequently applied pretreatments and paint which may not be practical over sharp edges. After rounding edges, applicable pretreatment coats shall be applied (table I). Rounding to a radius of approximately 3.18 mm shall be accomplished prior to electroplating to improve plating at edge areas.

3.5.2 Defect repair. The use of any material(s) for the purpose of filling or sealing nicks, dents, gouges and poor joints is prohibited.

3.5.3 Masking. Prior to painting base metal parts containing areas specifically intended for electrical contact or heat transmission, these areas shall be masked off or otherwise protected during finishing. Unless otherwise specified, plastics, rubber, fabrics and working parts of machinery shall also be masked off or otherwise protected. When masking tape is used, it shall be a type which will not adversely affect the finish or the equipment.

3.5.4 Preparatory cleaning. Prior to application of any finish, all surfaces shall be precleaned in accordance with TT-C-490 to remove dirt, grease, oil, solder flux, welding flux, sand, visible rust, scale or oxides and all other contaminants that might interfere with the adhesion of the surface treatment, underplate or final finish. Cleaning shall be done immediately before the finishing operation. If this is not feasible, suitable precautions shall be taken to ensure cleanliness during the period between cleaning, plating or other finishing process. Multiple cleaning methods may be required to maximize adhesion properties.

3.5.4.1 Blasting. If abrasive blasting is necessary to clean near critical areas having a special surface finish requirement, such areas must be protected from the abrasive. Blasting shall not be used on surfaces which might be damaged, i.e. machine parts and sheet metal thinner than 1.59 mm (16 gage).

3.5.4.2 Cleaning of aluminum shelters. Aluminum shelters shall be cleaned in accordance with TT-C-490.

3.5.4.3 Cleaning of welded sections. Weld smut formed during welding shall be removed by abrasive blasting or other suitable mechanical means, cleaned and pretreated in accordance with TT-C-490.

3.5.4.4 Use of steel wool. Steel wool shall not be used under any circumstances to clean aluminum or magnesium surfaces. Residual steel particles can become entrapped resulting in the formation of corrosion sites which may damage finish integrity and/or the basis metal. Use of emery or garnet abrasives on aluminum or magnesium is preferred.

3.6 Fabricated parts. Parts formed or fabricated by means of lock seams, lap joints, or by a means other than soldering, brazing, welding, or die forming, shall be plated, passivated, or both, prior to forming and fabricating operations. As an alternate, the design shall be such that plating, passivating, and/or neutralizing solutions will drain from the part. For example, aluminum to be lap-seamed and riveted should be anodized prior to the riveting operation.

3.7 Plated Parts. Hexavalent chromate-treated zinc-coatings, cadmium-plated, or chromated

zinc-base alloy parts shall not be used unless specified in the contract or purchase order.

3.7.1 Potential problems to be considered prior to specification of cadmium or zinc coatings.

a. Chromate-treated zinc-coatings, cadmium-plated, or zinc-base alloy parts shall not be used when such parts may be exposed to ambient temperatures above 71°C while in service. This does not apply to baking temperatures in excess of 71°C which may be required to cure paint during the finish process. MIL-PRF-14105 or TT-P-28 is a high temperature paint option where applicable.

b. Unpainted cadmium, zinc-plated and zinc-base alloy parts shall not be used in assemblies where they would be in confined unventilated spaces and subject to vapors emanating from phenolic insulating varnishes, phenolic encapsulating compounds, uncured phenolic materials, or air drying alkyd paints (e.g.; Master Painter Institute (MPI) Reference #47 and MIL-DTL-15090) as severe corrosion problems are likely to occur.

c. The use of cadmium is greatly discouraged and every effort to use zinc-nickel in accordance with MIL-PRF-32647 instead of Cd plating with Cr VI should be made.

3.8 Use of sealants and anti-seize compounds.

3.8.1 Threaded parts for aluminum and magnesium alloys. Prior to assembly, all externally threaded parts for use in aluminum and magnesium alloys shall be coated with anti-seize compound in accordance with A-A-59313. For magnesium alloys, an equal weight mixture of zinc chromate pigment and petrolatum is also acceptable.

3.8.2 Openings. To preclude unnecessary finish requirements for the interior of equipment exposed to type I environmental conditions, openings not required for an electronic system's operation shall be sealed to prevent fluid entry or direct exposure to exterior environment. Sealing around access plates shall be provided in a configuration that will allow removal of access plates without damaging the sealant or surrounding metal.

3.8.3 Sealing. Unless otherwise specified in the end item specification, sealing of the interiors of gear cases or similar compartments and reservoirs shall be in accordance with the applicable sealant specification. The sealer shall be applied prior to assembly and shall be capable of withstanding immersion in lubrication oil, hydraulic fluids, and cutting compounds for the operating temperatures and atmospheric conditions specified for the end item, without wrinkling, blistering, peeling, or loss of adhesion.

3.8.4 Press fits. Press fitting of parts not permanently housed in oil or grease shall be accomplished with sealing and coating compound conforming to MIL-PRF-81733 grade B, primer coating epoxies conforming to MIL-DTL-53022, MIL-PRF-23377 class N, or sealing compound conforming to SAE AMS-S-8802 type II. The complete assembly shall then be finished as specified in table I. Press fit(s) for parts to be permanently housed in oil or grease shall be accomplished with oil or grease similar to that to be used in their housing environment.

3.8.5 Slip fits. Slip fits of dissimilar metals exposed to corrosive conditions shall be assembled using a sealing and coating compound conforming to MIL-PRF-81733 grade B, primer coating epoxies conforming to MIL-DTL-53022. MIL-PRF-23377 class N, or sealing compound

conforming to SAE AMS-S-8802 type II.

3.9 Paint finishes. Paint finishes to be applied on equipment or parts thereof shall be in accordance with the requirements of tables I and II. Compatible paint coating system(s) shall be selected with regard to classification of the surface to be protected. For example, type I or type II. Table I calls out basic paint finishes by P numbers. A basic paint finish is a system involving steps 1 through 3 of table I and requires only the final film, step 4 of table II, for a complete finish designation. With the exception of Basic Finish Number P215, step 4 of "Finish Process" of all finishes of table I shall be considered to specify finish with compatible final film per table II. Table II provides the final film requirements by letter designation thus a complete gray paint system for a ferrous alloy may be called out as P211.1E. Either the basic designation or the final film designation may be called out independently. For example, piece part drawings might specify a P211.1 basic paint finish, in which case the assembly drawings would call for a final film such as Final Film E.

3.9.1 Basic paint finishes, P. The basic finish process, P, shall be in accordance with table I. The primers listed in Step 3 shall be applied as a single coat, except as noted in table I, to yield a dry film thickness as required by the primer specification. To prevent adhesion problems, primer application should be completed as soon as possible after the surface has been prepared. No more than 24 hours should be allowed to elapse between surface preparation and coating as indicated in TT-C-490. The dry film thickness of each final film shall be as specified in table II, unless stated otherwise in the basic paint specification.

3.9.2 Final paint film. The final paint film, Step 4 of the finish process, shall be in accordance with table II. The final paint film shall normally be applied within 24 hours after the primer has sufficiently cured in accordance with the paint manufacturer's recommendations. In the case of some of the fast drying epoxy primers, 24 hours drying prior to the topcoat application may be too long. To compensate, a shorter time between coats or a light sanding may be necessary. Check the manufacturer's recommendations. Previous coats of paint shall be fully cured before subsequent coats are applied. When finish selection (see 3.4) permits application of basic finishes only (steps 1 through 3 of table I) to piece parts, the final film (table II) shall be applied to all exposed surfaces of the parts after they have been mounted or assembled. When piece parts have been finished with complete paint finishes (steps 1 through 4 of tables I and II), fixed assemblies shall be touched up in order to provide a continuous film(s) across the interfaces. This requirement does not apply to hairline joints between mating parts, gasketed joints, or where moving parts such as hinges or catches are present. Touch-up paint used shall provide a reasonable color match with that of all other assembled parts when viewed at the normal operating distance.

3.9.2.1 Epoxies. Where resistance to solvents, alkalis and abrasion and outstanding adhesion is required, the use of MIL-DTL-53022 type IV instead of MIL-PRF-23377 primer is recommended for all metals. It is excellent for magnesium. The process for application of epoxy-polyamide coating systems shall be as specified by the manufacturer.

3.9.2.2 Film designation "AM" or "AE". Film designation "AM" or "AE" is to be applied to interior surfaces of vans or shelters.

3.9.3. Color selection of final paint film. Unless otherwise specified in the applicable equipment document, type I surfaces shall have final films of the colors per SAE AMS-STD-595 as specified as follows:

a. Large tactical equipment such as radars, vans, etc. – Green 383 #34094(Film AG) Chemical Agent Resistant Coating (CARC).

b. Small tactical equipment such as field radio sets, vehicular radio sets, switchboards, etc. – Green 383 #34094(Film AG) Chemical Agent Resistant Coating (CARC)

c. Communications equipment installed at fixed facilities such as radio station equipment, and telephone central office sets – Green 383 #34094(Film AG) as specified in the applicable equipment document, or Lusterless Gray No. 36118 (Film X).

d. Electronics test equipment – Semi-gloss Gray No. 26307 (Film E or P).

e. Automatic data processing – Green 383 #34094(Film AG) as specified in the applicable equipment document, or Lusterless Gray No. 36118 (Film X).

f. The CARC (three color) camouflage pattern colors are AG, AH, and AI for wooded and other green vegetated areas; AR, AG and AI for winter/snow conditions, and AP for desert deployments.

3.9.3.1 Unspecified colors. The use of colors other than those specified in table II or the equipment specification shall require the prior approval of the contracting officer.

3.9.4 Final paint film selection. Paints shall be selected in accordance with the following requirements:

3.9.4.1 Bake-drying and epoxy films. Except as noted in "b" below, only baking type or epoxy base coatings shall be used for the painting of metallic parts. When bake type coatings are used, follow the paint manufacturer's recommendations for temperature and dwell. In no case shall assemblies containing plastic or composite parts be baked at a temperature in excess of 121°C.

3.9.4.2 Air-drying films. Air-drying enamels shall be employed for touch-up and field repair, for parts too large to be baked, where the baking temperatures used adversely affect the required performance of the finished part, or for painting wood, plastics, or other materials which might be damaged by specified baking temperatures. Air-drying enamels shall not be used for touch-ups and field repairs on CARC or lacquer finishes. Finishing shall be in accordance with MIL-DTL-53072 on CARC.

3.9.4.3 Engines and other heated areas. Engines shall be cleaned and treated as specified herein and painted in accordance with the applicable engine specification. When cleaning and painting of exhaust manifolds, exhaust pipes, mufflers, and other parts subject to temperatures in excess of 204ºC is specified in the applicable engine specification, the paint shall conform to MIL-PRF-14105 or TT-P-28, as applicable.

3.9.5 Painting conditions and methods. Painting shall be done in a well-lighted, ventilated, protected area that is clean and dry. All painting equipment shall be properly maintained and kept free of oil, dirt, paint residues, etc. and shall be free of moisture just prior to painting. All finishing materials shall be thoroughly mixed. There shall be no stratification or separation of materials during painting operations. Materials shall have the proper consistency in accordance with the applicable specification(s) and be suitable for brush, spray, dip, roll or other methods of application being used such as electro coating of CARC primer per MIL-DTL-53084.

3.9.6 Welding, soldering and brazing. Unless otherwise specified, welding, soldering and brazing shall not be permitted on an assembly after it has been painted with CARC. If it is necessary to perform one of these procedures after an item is coated, the finish must be completely removed to the base metal in all heat affected zones which will reach 204ºC or higher. For the same conditions, this procedure must be followed for the backside if it is CARC painted. Some recommended methods for removal are plastic media blasting, the use of a paint remover such as MIL-R-81294, type I, or the use of a surface grinder, needle scaler, and wire brush combination. After the procedure is finished, the stripped surfaces shall be cleaned and pretreated in accordance with TT-C-490 and repainted in accordance with MIL-DTL-53072.

3.10 Plated finishes. Plated finishes shall be in accordance with table III. The plating process shall provide a continuous deposit free of defects. Specific finishes shall be selected with due regard to surface classification (type I or II) and the basis metal to be protected. Plated finishes are designated by the letter M followed by a number. For example, M212 is a plated nickel finish for use on iron or iron-base alloy parts to be subjected to a type I exposure. As specified in table III, Finish M212 consists of 0.0152mm minimum nickel over 0.0127mm minimum copper under coat over the basis metal.

3.10.1 Plating thickness substitution. If dimensionally acceptable, any plating thickness specified for type I surfaces may be used in lieu of the thickness required for type II surfaces. For example, a part extending in assembly from an unsheltered zone to a sheltered zone would be finished (as applicable) with a type I plate. Similarly, type II plating may be used on basis metals in unsheltered zones provided the surfaces extending to and exposed to type I conditions are painted with an applicable paint system.

3.10.2 Hydrogen-embrittlement relief. Hydrogen embrittlement of hardened, plated steel parts intended for resilient or high stress service, such as a spring or fastener, can be a serious problem. No visual or chemical inspection method to reveal this defect is known. Designers are, therefore, cautioned to avoid the use of hardened ferrous alloys requiring plating whenever possible. When this is not feasible, steels employed should be of the lowest carbon content and lowest hardness which will provide the necessary mechanical performance of the part. The microstructure of such steels should be essentially tempered martensite. The use of sharp bends in the part should be avoided, particularly if the part is to be hardened after forming. Plating baths and pre-plate cleaning processes shall be adjusted and operated in a mode designed to prevent hydrogen embrittlement. Oxide and scale removal shall be conducted by tumbling or other mechanical means wherever possible. A brief dip in an acid containing an inhibitor may be used if necessary. Cleaning should be accomplished by means of soaking or anodic treatment in alkaline cleaners. All temper-hardened parts shall be stress relieved by baking at 25ºC below draw temperature for one hour per square inch of cross section area. All hardened steel parts subject to hydrogen embrittlement shall be treated in accordance with Finish E200 (See table IV). Finish requirements, when specified on drawings or other pertinent documentation, shall include that finish designation. Thus the finish for a type I cadmium plated steel spring would be called out on drawings at “M225 and E200.”

3.10.3 High strength steel (i.e. 16.87 kg/sq cm and up). Special finishing methods, such as those specified in MIL-STD-1500 andMIL-STD-1501 , are required for materials in this class to reduce the risk of hydrogen embrittlement.

3.11 Finishes or processes other than painting or plating (E). Finishes or processes other than

painting or plating shall be in accordance with table IV. Specific finishes shall be selected with respect to surface classification (type I or type II) and the basis metal to be protected. Table IV calls out finishes by the letter E followed by a number. Thus E513 is a chemical-film finish for use on aluminum or aluminum base parts to be subjected to type II exposure.

3.12 Electrical conductivity of passivated finishes. Table V contains information on the electrical conductivity of passivated finishes. Designers specifying a passivated finish(es) for coating electronic equipment enclosures, mounting racks or associated structural framework should consider the following characteristics prior to making a selection from table V:

a. The equipment conducting frequency mechanism i.e. Power or Radio Frequency (RF).

b. The requirement for the chassis mounting points to access, or be isolated from, any or all potential grounding points.

In addition to a statement, either “yes” or “no”, regarding electrical conductivity at power frequencies and radio frequencies, table V contains a remark column which gives data concerning the use of each listed finish.

3.13 Intermetallic-couples. The finishing of metallic areas to be placed in contact presents a special problem. Intermetallic contact of dissimilar metals will result in electrolytic couples. If precautions are not taken, these sites may promote corrosion through galvanic action. Table VI from MIL-STD-889 shall be used as a reference for verifying the need for or degree of protection to be applied to couple members. This need depends on the relative position of the coupled members within the galvanic series. Table VI shows the corrosion rates of bare coupled metals and alloys (or plating alloys) in artificial seawater at a 1:1 surface area ratio. The galvanic compatibility of the bare metals of interest is indicated at the intersection point of the row and column where the anodic member of the couple is listed in the rows and the cathodic member of the couple is listed in the columns. At this intersection point, a rating from 0 - 6 is assigned based upon the corrosion rate in mils per year with 0 being the lowest and therefore indicating the lowest corrosion rate and 6 indicating highest or most severe. An empty cell at the intersection point indicates that the metal identified as anodic and cathodic should be switched. When fastening dissimilar metals, there are numerous factors to consider including anode to cathode exposed surface area ratios, the surface finishes of the mating surfaces, contaminant levels, and the overall environment. Therefore, this table shall not be used as the sole reference to indicate the level of risk associated with the galvanic couple nor shall it be used as the sole source to determine the needed level of protection required to protect the metals. It is the responsibility of the Cognizant Engineering Authority (CEA) or appropriate design authority to examine and verify all factors (see 3.13 – 3.15) to determine the necessary protection. To provide the corrosion protection required in ground electronic equipment, intermetallic couples should be restricted, where possible and verified against table VI as having a minimal tendency for galvanic interaction.

3.13.1 Use of compatible couples. The following should be considered in the selection and application of compatible couples:

a. Passivated coatings. For a compatible couple selection, passivated coatings specified herein shall be ignored and only the plating or basis metal considered. For example, all chromate or phosphate treatments of zinc or cadmium specified in tables III and IV shall be ignored in making couple selections and only zinc or cadmium considered as

acting in galvanic corrosion. Hard anodic films on aluminum-base alloys are impervious nonconductors and, therefore, contact may be made with any dissimilar metal.

b. Surface area of contacting metals. In intermetallic couples, the member with the higher anodic index is anodic to the member with the lower anodic index. It will therefore be susceptible to corrosion in the presence of an electrolytic cell or media. If the surface area of the cathodic part is significantly greater than that of the anodic part, the corrosive attack on the contact area of the anodic part may be greatly accelerated. Material selection for intermetallic contact parts should therefore establish the smaller part as the cathodic member of the couple.

c. Plating. For couple selection only the contacting metallic surfaces shall be considered for compatibility. For example, when a plated part is intended for assembly with aluminum, the compatibility of the plating, not the basis metal, with aluminum shall be considered. Likewise, when two plated parts are intended to be coupled, the compatibility of the plating not the basis metals is to be considered.

3.13.2 Exceptions to table VI. The following exceptions apply to the selection of compatible couples in accordance with table VI:

a. Special service conditions. Table VI shall be employed for ground based parts and electronic equipment(s) to be subjected to the variables of exposure(s) expected under military service conditions. For special conditions or considerations, table VI may not be applicable. These may include factors such as operational temperature differences between parts, plating thickness (es), longevity, polarity reversals, multiple contacts, etc. Zinc, for example, may become cathodic to iron in hot tap water, and tin anodic to iron in tap water at ordinary temperatures. Both of these, as isolated cases, vary from the general experience reflected by the compatibility graphs of table VI. In isolated cases, where couples are not exposed to weather or salt-laden air but are subjected to wide temperature and humidity variation with possible moisture condensation, restriction of couple members to those shown in table VI might serve to provide a part life abnormally longer than the functional requirements of the equipment. In such cases, finish needs may be met by extending the anodic index differences to 50. Generally, couple selection should be governed by previous experience with such special conditions.

b. Sealed members. The requirements specified above do not apply to intermetallic contact members which, in a clean and dry condition, are permanently sealed in noncorrosive embedding or encapsulating materials, or hermetically sealed containers that are protected from ambient atmospheric conditions.

c. Magnesium. Table VI does not permit intermetallic contact between magnesium and any other metal. If the use of magnesium in contact with a dissimilar metal is required, the metals shall be separated by a tape in accordance with A-A-59298. The tape shall extend at least 0.32 cm beyond the periphery of the joint. The use of cloth supported tapes is prohibited.

d. Fasteners for magnesium. Although not permitted by table VI, the use of aluminum alloy 5056-H32 rivets and aluminum alloys 5052, 5056, 6053 and 6063 washers and shims are allowed for assembly of magnesium alloy members. Bolts and nuts shall be

restricted to anodized 6061 aluminum alloy coated with one of the following sealers: SAE AMS-S-8802 type II, MIL-PRF-81733 grade B, SAE AMS-3276, epoxy primer MIL-DTL-53022 or epoxy primer MIL-PRF-23377 class N.

3.14 Finish selection. Unless otherwise instructed by the contracting officer, finishes applied to equipment shall be one of those specified by tables I, III, or IV. Insofar as possible, selection of finishes for all applications shall be made in accordance with table VII. All restrictive conditions applicable to finish selection not appearing in table VII must be considered prior to making a choice of finish. In this connection, it may be noted that tables I through V contain finish selection requirements applicable to particular finishes. Paragraphs 3.14.1, 3.14.2 and 3.14.3 regarding finishes covered by this document, apply to finish selection and shall be used in conjunction with table VII.

3.14.1 Finishing of type I surfaces. The following requirements apply to finishing type I surfaces:

a. Surfaces exposed to view. All type I surfaces exposed to view when equipment is in transit or operational shall be painted for protection and or the purpose of camouflage. Parts fabricated from metals or alloys in Groups 6 through 18 of table VI and copper shall be painted for protection. Those fabricated from materials listed in Groups 1 through 5 and hot-dip zinc coated parts shall be painted for camouflage purposes. The only exceptions to these painting requirements are as follows:

   1. Small copper-base alloy parts (except screws, bolts, nuts and washers) hooks, eyelets, bead-chain, etc. finished by using chemical blackening finish E311.

   2. Small parts finished with type I, dull nickel plating, or hot-dip-zinc.

   3. Assemblies requiring a sliding electrical contact surface(s) finished with dull nickel plating.

b. Surfaces not exposed to view. Type I surfaces not exposed to view when equipment is in either transit or operating condition shall be painted or plated. Exceptions to this plating or painting requirement are as follows:

   1. Magnesium-alloy parts shall be painted.

   2. Parts fabricated from metals or alloys listed in Groups I through 5 of table VI (except copper) require no further finishing.

   3. Screws, nuts, bolts, and washers fabricated from ferrous alloys and plated with cadmium shall be painted on all surfaces exposed after incorporation of these parts in assemblies.

   4. Machined or welded corrosion-resistant steel parts shall be passivated with the finish designated as E300.

3.14.2 Finishing of type II surfaces. Surfaces of parts fabricated from metals or alloys listed in Groups 1 through 11 of table VI require no further finishing. All other parts except magnesium and magnesium alloys shall be finished with any applicable type I or type II finish specified in tables I, III, or IV. Magnesium and magnesium alloys shall be painted in accordance with the requirements of table I.

3.14.3 Conditions restricting allowable finishes. In addition to the forgoing requirements, the selection of finishes shall be limited as follows:

a. Dissimilar metal contacts involving magnesium alloys. All parts shall be painted prior to assembly. The magnesium alloys shall be painted and a tape conforming to A-A-59298 shall be interposed between the two surfaces. The tape shall extend to at least 0.32 cm beyond the periphery of the joint. All exposed edges, in addition to the tape, shall be sealed with a material conforming to SAE AMS-S-8802, MIL-PRF-81733 grade B, or SAE AMS-3276. Butt joints shall be protected by grooving the seam to a width of not less than 0.32 cm and filling with sealing compound conforming to SAE-AMS-S-8802, MIL-PRF-81733 grade B, or SAE AMS-3276. The depth of the groove shall be sufficient to retain the sealing compound. After application, the compound shall be smoothed to be flush with the surface(s) of adjacent dissimilar metals. The use of cloth tapes is prohibited.

b. Dissimilar metal contacts (except those involving magnesium and magnesium alloys). When using basis metal parts intended for intermetallic contact that may form couples not allowed by table VI, the following shall govern:

1. Galvanically incompatible basis metals shall be plated in order to reduce the difference in potential to that allowed by table VI. All such plating shall be type I regardless of the exposure condition when assembled in equipment(s). For example, chromium plated parts intended for assembly with aluminum in a type II environment shall have type I chromium plating. Whenever possible, plating to permit dissimilar basis metal contact shall be selected in order to provide a small cathodic part in contact with a larger anodic piece (see paragraph 3.13.1.b).

2. Dissimilar metal contacts not permitted by table VI will be allowed provided that at least one of the contacting surfaces, preferably the cathodic or more noble metal, is finished with a complete “P” finish (includes Final Film) or those “P” finishes which include primers per MIL-PRF-23377 class N (without Final Film).

3. Dissimilar metal contacts not permitted by table VI will be allowed provided that both contact surfaces are finished with a basic “P” finish (step 1 through 3 per table I).

3.15 Workmanship. Finishes shall be applied to all surfaces, as required, to form an even, adherent, protective film. Finished surfaces shall be smooth and free from foreign debris as much as practical. They shall not exhibit burnt areas, blisters, gouge marks, peeling, flaking, checks, pits, nodules, or other significant defects. To help prevent corrosion, finished parts shall be dry and free from all residual traces of processing chemicals. Failure to meet these requirements and/or evidence of any major defect(s) as specified in table IX shall be cause for rejection and immediate corrective action. Minor defects, as specified in table IX, shall also be cause for immediate corrective action. At the discretion of the contracting officer, minor defects may be acceptable provided that the defect(s) will not be visible after assembly.

4. VERIFICATION

4.1 Classification of inspections. The inspections specified herein are classified as follows:

a. First article inspection (see 4.2).

b. Conformance inspection shall be at the discretion of the procurement authority (see 4.3).

4.2 First article requirements.

4.2.1 First article inspection. When qualifying under first article is required by the procurement authority or in the part or equipment specification (see 6.2), the finishes shall be inspected for compliance with tables VIII and IX and with equipment performance requirements.

4.2.2 Inspections to be performed. The sample will be subjected to the tests specified in 4.4. The Government may also require testing to assure conformance to any or all of the applicable requirements of this specification.

4.2.3 Rejection of first article samples. If any sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate its inspection upon failure of any sample to comply with any of the stated requirements. In the case of qualification inspection, the equipment specification requirements shall apply.

4.3 Conformance inspection. Conformance inspection of parts and equipment for finishes shall be in accordance with tables VIII and IX (see 6.2).

4.4 Methods of inspection.

4.4.1 Color. The color conformance of the specified paint film shall be verified by comparison with an appropriate SAE AMS-STD-595 color chip. CARC paints may require batch verification depending on the paint specification requirements (see para 6.3.5.1).

4.4.2 Adhesion of paint.

4.4.2.1 Tape Tests. Unless otherwise specified a minimum of two sample units or test specimens representative of each day's production shall be run through all steps of the regular production process including painting. Adhesion by tape testing of the painted specimens should be determined as indicated in the applicable paint specifications. If any test unit or specimen fails any of the tape tests, all items processed since the last acceptance shall be rejected and corrective action taken. At the discretion of the Government, any or all of the following additional tests may be performed:

4.4.2.1.1 Dry Scribed Tape (ASTM D3359 Method B).

a. Adhesion test for CARC. After the complete specified paint finish has been applied and cured, two samples from each day's production shall be selected for paint adhesion testing. Adhesion testing on the painted test specimens/coupons shall be performed after the complete paint finish has fully cured for a minimum of 168 hours at ambient conditions or by force-curing. A two coat paint system shall be tested after drying in accordance with applicable paint specifications. Each sample shall be tested using ASTM D3359, method B using any commercially available tape (1 inch width) that will yield a minimum of 80 oz of adhesive resistance (and can be verified with OQE) over the tested coating when tested in accordance with ASTM D3330/D3330M. CARC adhesion shall not be less than scale 4B with any layer of the system. Where CARC dry film thickness has exceeded 5 mils (125 microns), method A of ASTM D3359 shall be

used if permitted by the procuring authority. Nonconformance shall constitute failure of this test. All items processed since last acceptance shall be rejected and corrective action shall be taken. For a current listing of approved adhesion test tapes: Contact the DoD CARC Commodity Item Manager at US Army DEVCOM Research Laboratory, FCDD-RLW-MC, ATTN: Camouflage, Coatings and Corrosion Team, 6300 Rodman Road, Building 4600, Aberdeen Proving Ground MD 21005.

b. Adhesion test for non-CARC painted items. Unless otherwise specified by contract, coating system or engineering design when tested in accordance with ASTM D3359 method B, unsatisfactory adhesion shall be indicated by exposure of primer, bare metal, or underlying pretreatment. Adhesion shall not be less than scale 4B.

4.4.2.1.2 Wet tape test. (When required by the procuring authority) After 168 hours minimum cure, the test area on the substrate to be tested shall be covered with cheese cloth and saturated with distilled water. A plastic cover shall be taped in place to form a poultice to prevent evaporation for 24 hours. If test panels are permitted by the procuring authority, they shall be immersed in distilled water for 24 hours at room temperature. After 24 hours, remove the poultice from the substrate and dry with a soft cloth. Or, if using test panels, remove the test panels from the water and wipe dry with a soft cloth. Within 3 minutes after drying, make two parallel scribes with a stylus through the coating to the substrate. The scribes shall be ¾ of an inch apart and 2 inches long. The panels shall then be scribed to the substrate from opposing ends of the parallel scribes to form a "X". Immediately apply a 1-inch wide strip of masking tape with the adhesive side down across the scribes. Press the tape against the surface of the coating by passing a 4-1/2-pound rubber covered roller, approximately 3-1/2 inches in diameter and 1-3/4 inches in width across the tape eight times. Remove the tape with one quick motion and examine for coating damage. Examine the coating for conformance to ASTM D3359, Method A. There shall be no peeling or delamination between the primer and topcoat or at the primer and substrate interface. The coatings shall have a rating of no less than a 4A based upon the average of a minimum of 3 readings when examined in accordance with ASTM D3359. Any commercially available tape (1 inch width) that will yield a minimum of 80 oz. of adhesive resistance over the tested coating when tested in accordance with ASTM D3330/D3330M shall be used. The tape shelf life is typically one year from date of manufacture. For a current listing of approved adhesion test tapes: Contact the DoD CARC Commodity Item Manager at US Army DEVCOM Research Laboratory, FCDD-RLW-MC, ATTN: Camouflage, Coatings and Corrosion Team, 6300 Rodman Road, Building 4600, Aberdeen Proving Ground MD 21005.

4.4.3 Adhesion Test Specimens. Test specimens shall be prepared from actual production items or parts thereof. If size is prohibitive, use 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 or heat treatment. Standard test panels may be use when authorized by the contracting officer.

4.4.4 Thickness. Except where the method of determining the thickness of finishes is covered in applicable subsidiary specifications referenced herein, thickness may be determined by any method acceptable to the Government. Dry paint film thickness shall be measured at several places on each sample unit where a minimum plating thickness would be expected due to part shape, recesses, etc.

4.4.5 Hydrogen embrittlement.

4.4.5.1 Hydrogen embrittlement testing frequency. Testing to determine the adequacy of the treatment for hydrogen embrittlement relief per 3.10.2 shall be performed by the vendor or contractor at a frequency of 90-120 days to assure that the embrittlement relief treatment is adequate.

4.4.5.2 Hydrogen embrittlement test. Unless otherwise specified, testing to determine the

adequacy of the hydrogen embrittlement relief treatment shall be performed in accordance with the following:

a. For parts that require a hydrogen embrittlement relief per finish E200, testing shall be performed in accordance with ASTM F519 using type 1a cylindrical specimens to represent the parts. Coated specimens that require finish E200 shall be subjected to a sustained tensile load equal to 75 percent of the ultimate notched tensile strength of the material. The steel, 4340 at Rockwell C51-54, is acceptable for worse case situations unless otherwise specified on the drawing or in the contract.

b. Unless otherwise specified (see 6.2) the specimens shall be held under the load for a minimum of 200 hours and then examined visually under 10x magnification and an illumination of 1100 lux (lx) for cracks. The production parts covered by the test period shall be rejected if any coated specimen develops any crack or breaks as a result of the test.

4.4.6 Surface condition. The finish shall be visually examined for defects listed in table IX.

4.4.7 Spectral reflectance. Spectral reflectance of paint films listed in table II are to be tested in accordance with the applicable paint specifications. Separate test specimens may be used.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military services' system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This specification is intended for use as a subsidiary document to specifications and drawings covering ground based electronic equipment. Required finishes in detail by finish numbers shall be included.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Required finishes (see 3.1, 6.1).

c. Packaging requirements (see 5.1).

d. First Article requirements (see 4.2).

e. Conformance inspection requirements (see 4.3).

f. Type and thickness requirements (see table III).

6.3 Cross reference between discontinued and superseding finishes.

6.3.1 Discontinued paint film designators. Cross references between discontinued letters and superseding letters are in accordance with table X.

6.3.2 Discontinued plated, M finishes. Cross references between discontinued and superseding M numbers are in accordance with table XI.

6.3.3 Discontinued finishes or processes other than painting or plating, E finishes. Cross references between discontinued and superseding E numbers are as indicated in table XII.

6.3.4 Cross reference of basic paint finishes, P numbers. Revision A included, in many cases, multiple choice of treatments to be applied under the same P number. Revision B used a decimal system in these cases to assign a specific P number for each treatment. table XIII is a cross reference for Revisions A, B, C, D and E. It includes continued, superseding, and discontinued P numbers.

6.3.5 CARC paints. The CARC paint specifications are based on pigment formulations to meet specific color and spectral reflectance requirements and not a visual color match. Therefore, each film is matte or lusterless in appearance and has a slight surface texture. The visual color will vary depending on the texture and type of substrate to which it has been applied, the orientation of the paint film and the direction from which the paint film is illuminated and observed. These paints will wear as a result of handling or rubbing, especially if the paint film has not been fully cured. The marring is due to the smearing of the pigments which are close to or at the surface of these paint films. Paint films AG, AH, AI, AP and AR afford better protection against exposure of the base metal since it is applied over an epoxy primer.

6.3.5.1 CARC color inspection. Since marring, orientation and illumination variations are characteristics of CARC paints, visual color matching should not be a singular cause for rejection of end items. Batch validation, not color chip matching, should be the inspection criteria (see the applicable paint specification for color matching requirements).

6.4 Antennas. Electrically functional elements of antennas should not be painted, unless specified on equipment drawings or specific approval is obtained from the equipment design activity.

6.5 Corrosion and corrosion testing terms. Refer to ASTM G193 or standard definitions of terms relating to corrosion and corrosion testing.

6.6 Safety Data Sheets. Contracting Officers will identify those activities requiring copies of completed Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent mailing addresses for submission of data are listed in paragraph 5 of FED-STD-313.

6.7 Subject term (key word) listing.

Painting
Metal Finishing Plating
Wood finishing

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TABLE I. Basic paint finishes (P).

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON FERROUS ALLOYS OTHER THAN CORROSION RESISTANT STEELS (TANK PHOSPHATING IS PRACTICAL)					
P210	I or II	----	TT-C-490, type I	----	MIL-DTL-53022 1/, 6/
P211.1	I or II	----	TT-C-490, type I	----	SSPC-PAINT 25 1/
P216	I or II	Clean per Appendix	TT-C-490 type III, or IV	MIL-DTL-11195	MIL-DTL-11195
P216.1	I or II	Clean per Appendix	TT-C-490, type I	MIL-DTL-11195	MIL-DTL-11195
P216.2	I or II	Clean per Appendix	TT-C-490, type II	MIL-DTL-11195	MIL-DTL-11195
P217	I or II	Clean per Appendix	----	----	MIL-DTL-53030 1/, 6/
P217.1	I or II	Clean per Appendix	TT-C-490, type I	----	MIL-DTL-53084 1/, 6/
FOR USE ON FERROUS ALLOYS (TANK PHOSPHATING IS NOT PRACTICAL)					
P210.1	I or II	Sanding or abrasion or phosphoric acid etch per MIL-C-10578	----	TT-C-490	MIL-DTL-53030 1/, 6/
P213.1	I or II	See P210.1	----	----	SSPC-PAINT 25
P213.4	I or II	See P210.1	----	TT-C-490	SSPC-PAINT 25
P216	I or II	For Finish Process See P216 above.			
P217	I or II	For Finish Process See P217 above.			
FOR USE ON INSIDE OF FERROUS TUBES					
P215	II	TT-C-490, Method VI.	Priming not required. Finish by filling, draining, and drying with one coat of MIL-DTL-11195 or A-A-59295.Follow manufacture's recommendations for film build. This is normally an end point (final) coating.		

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON CORROSION RESISTANT STEELS, NICKEL BASE ALLOYS, COPPER AND COPPER BASE ALLOYS					
P210.1	I or II	For Finish Process see P210.1 above.			
P213.1	I or II	For Finish Process see P213.1 above.			
P213.4	I or II	For Finish Process see P213.4 above.			
P217	I or II	For Finish Process see P217 above.			
P218	I or II	Appendix (For corrosion resistant steel)	Appendix (For corrosion resistant steel)	----	MIL-DTL-53030 1/, 6/
P313	II	Sanding or abrasion or phosphoric acid etch per MIL-C-10578	----	TT-C-490	MIL-DTL-53030 1/, 6/
FOR USE ON ALL PLATED SURFACES EXCEPT THOSE PLATED WITH CADMIUM 12/ OR ZINC					
P310	I or II	MIL-C-10578	----	TT-C-490	MIL-PRF-23377 1/, 6/, 10/
P341.1	I or II	MIL-C-10578	----	----	TT-P-1757 1/, 8/
P341.2	I or II	MIL-C-10578	----	----	SSPC-PAINT 25
P341.3	I or II	MIL-C-10578	----	TT-C-490	TT-P-1757 1/, 8/
P341.4	I or II	MIL-C-10578	----	TT-C-490	SSPC-PAINT 25 7/
P343	II	MIL-C-10578	----	TT-C-490	----

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON CADMIUM 12/ OR ZINC PLATED SURFACES					
P310.1	I or II	----	ASTM D 6386, type I, class 1 or 2 for M228 plating (see table III); other plating specified in table III include passivation treatments	----	MIL-PRF-23377 1/, 6/, 10/
P371.1	I or II	----	----	TT-C-490	TT-P-1757 1/,8/
P371.2	I or II	----	----	TT-C-490	SSPC-PAINT 25
P373	UU	----	----	TT-C-490	7/
P374	I or II	For finish process see P218 above.			
FOR USE ON SILVER, SILVER BASE ALLOYS, LEAD AND TIN BASE ALLOYS INCLUDING SOLDER					
P310	I or II	For Finish Process see P310 above.			
P341.1	I or II	For Finish Process see P341.1 above.			
P341.2	I or II	For Finish Process see P341.2 above.			
P341.3	I or II	For Finish Process see P341.3 above.			
P341.4	I or II	For Finish Process see P341.4 above.			
P343	II	For Finish Process see P343 above.			

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON ALUMINUM AND ALUMINUM BASE ALLOYS					
P510	I or II	----	MIL-PRF-8625 9/	----	MIL-PRF-23377 1/, 6/, 10/
P510.2	I or II	----	MIL-DTL-81706 type II	----	MIL-PRF-23377 1/, 6/, 10/
P510.3	I or II	----	----	TT-C-490	MIL-PRF-23377 1/, 6/,10/
P511	I or II	----	MIL-PRF-8625 9/	----	TT-P-1757 1/, 8/
P513.1	I or II	----	MIL-DTL-81706 type II	----	TT-P-1757 1/, 8/
P513	I or II	----	----	TT-C-490	TT-P-1757 1/, 8/
P517	II	----	MIL-DTL-81706 type II	----	7/
P518.1	I or II	----	MIL-PRF-8625 9/	----	MPI Reference #19
P519.1	I or II	----	MIL-DTL-81706 type II	----	MPI Reference #19
P519.2	I or II	----	----	TT-C-490	MPI Reference #19
P520	I or II	Clean per Appendix	TT-C-490 type III or IV	----	MIL-DTL-11195
P520.1	I or II	Clean per Appendix	MIL-PRF-8625 9/	----	MIL-DTL-11195
P521	I or II	For Finish Process see P217 above.			
P522	I or II	Clean per Appendix	----	----	----
P522.1	I or II	Clean per Appendix	MIL-DTL-81706 type II	----	MIL-DTL-53084 1/, 6/

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON ZINC BASE ALLOYS					
P610	I or II	----	ASTM D6386, type I, class 2 2/	TT-C-490	MIL-PRF-23377 1/, 6/, 10/
P610.1	I or II	----	ASTM D6386, type I, class 1	TT-C-490	MIL-PRF-23377 1/, 6/, 10/
P611.1	I or II	----	ASTM D6386, type I, class 2 2/	TT-C-490	TT-P-1757 1/, 8/
P611.2	I or II	----	ASTM D6386, type I, class 2 2/	TT-C-490	SSPC-PAINT 25
P613.1	I or II	----	ASTM D6386, type I, class 1	TT-C-490	TT-P-1757 1/, 8/
P613.2	I or II	----	ASTM D6386, type I, class 1	----	SSPC-PAINT 25
P615.1	II	----	ASTM D6386, type I, class 2 2/	----	7/
P615.2	II	----	ASTM D6386, type I, class 1	----	7/
P616	I or II	For Finish Process see P520 above.			
P617	I or II	For Finish Process see P217 above.			

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON ZINC BEARING MAGNESIUM ALLOYS					
P710	I	SAE AMS-M-3171	SAE AMS-M-3171, type III	----	MIL-PRF-23377 1/, 3/, 6/, 10/
P710.1	I	SAE AMS-M-3171	ASTM D 1732, class II, type II 4/	----	MIL-PRF-23377 1/, 3/, 6/, 10/
P710.2	II	SAE AMS-M-3171	SAE AMS-M-3171, type III	----	MIL-PRF-23377 6/, 10/
P710.3	II	SAE AMS-M-3171	ASTM D1732, class II, type II 4/	----	MIL-PRF-23377 1/, 6/, 10/
P711.1	I	SAE AMS-M-3171	SAE AMS-M-3171, type III	----	MPI Reference #19 3/
P712.1	I	SAE AMS-M-3171	ASTM D1732, class II, type II 4/	----	MPI Reference #19 3/
P713.1	II	SAE AMS-M-3171	SAE AMS-M-3171, type III	----	MPI Reference #19
P713.2	II	SAE AMS-M-3171	ASTM D1732, class II, type II 4/	----	MPI Reference #19
P718	I or II	Clean per SAE AMS-M-3171	SAE AMS-M-3171	----	----
P718.1	I	Clean per SAE AMS-M-3171	----	TT-C-490 5/	1/, 3/, 6/, 7/
P718.2	II	Clean per SAE AMS-M-3171	----	TT-C-490 5/	1/, 6/, 7/
P719	I or II	For Finish Process see P217 above.			

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON MAGNESIUM ALLOYS (EXCEPT PARTS SUBJECT TO FLEXING)					
P710.4	I	SAE AMS-M-3171	ASTM D1732, class II, type III 4/	----	MIL-PRF-23377 1/, 3/, 6/, 10/
P710.5	II	SAE AMS-M-3171	ASTM D1732, class II, type II 4/	----	MIL-PRF-23377 1/, 6/, 10/
P714.1	I	SAE AMS-M-3171	ASTM D1732, class II, type III, or class II, type II 4/	----	MPI Reference #19 3/
P715.1	II	SAE AMS-M-3171	ASTM D1732, class II, type I, II or III 4/	----	MPI Reference #19
P719	I or II	For Finish Process see P217 above.			
P720	I or II	SAE AMS-M-3171	SAE AMS-M-3171, any class or grade	----	MIL-DTL-53030

TABLE I. Basic paint finishes (P) - Continued.

Finish Number	Type Exposure	Finish Process			
		Step 1 Preconditioning	Step 2 Passivation	Step 3 (see 3.9.1)	
				Pretreatment	Primer
FOR USE ON MAGNESIUM ALLOYS EXCEPT THOSE CONTAINING ZINC					
P710.4	I	For Finish Process see P710.1 above.			
P710.6	I	SAE AMS-M-3171	SAE AMS M-3171, type IV	----	MIL-PRF-23377 1/, 3/, 6/, 10/
P710.7	II	SAE AMS-M-3171	SAE AMS-M-3171, type IV	----	MIL-PRF-23377 1/, 6/, 10/
P710.8	II	SAE AMS-M-3171	ASTM D1732, class II, type II or III 4/	----	MIL-PRF-23377 1/, 6/, 10/
P712.1	I	For Finish Process see P712.1 above.			
P716.1	I	SAE AMS-M-3171	SAE AMS-M-3171, type IV	----	MPI Reference #19 3/
P717.1	II	SAE AMS-M-3171	SAE AMS-M-3171, type IV	----	MPI Reference #19
P717.2	II	SAE AMS-M-3171	ASTM D1732, class II, type II or III 4/	----	MPI Reference #19
P719	I or II	For Finish Process see P217 above.			
P720	I or II	For Finish Process see P218 above.			
FOR USE ON WOOD					
P911	I or II	Sanding	----	Appendix 11/	SSPC-PAINT 25

TABLE I. Basic paint finishes (P) - Continued.

1/ Alternate primers where lead or chromate pigments are prohibited are MIL-DTL-53022, MIL-DTL-53030 or MIL-PRF-85582. CARC primer MIL-DTL-53084 (lead and chromate free) is an option for use on ferrous alloys or aluminum (see table I). It is applied by electrocoating (see paragraph 3.9.5). For low infrared reflectance (IR) use MIL-PRF-23377, type II. Alternate primer for ferrous metals prior to spot welding is SSPC-PAINT 30.

2/ Colored chromates as they normally occur in processing operations are desired. The use of clear or bleached chromates is prohibited.

3/ Apply two coats of primer.

4/ ASTM D 1732 (heavy) coatings should not be applied to magnesium parts subject to flexing. On such parts, use light coatings.

5/ Pretreatment coating per TT-C-490 for use on magnesium alloys should have the phosphoric acid content reduced by 50 percent of that specified in TT-C-490. (This dilution is required to prevent hydrogen evolution at magnesium surfaces).

6/ To ensure proper adhesion, only epoxy primers must be used prior to top coat finishing with CARC paints.

7/ Select a suitable primer compatible with the final paint film to be applied.

8/ TT-P-1757 type I, class N or type II, class N.

9/ Unless otherwise specified by the contract or purchase order, type IC (Non-chromic acid anodizing, for use as a non-chromate alternative for type I and IB coatings) or type IIB (Thin sulfuric acid anodizing, for use as a non-chromate alternative for Type I and IB coatings) shall be used.

10/ Class N materials required unless specified by contract.

11/ Preservative treatments are often required for both painted and unpainted wood and must be used when specified. A non-pentachlorophenol preservative should be used for this purpose. Caution must be exercised in the use of preservative materials as some water based preservatives might cause objectionable swelling and/or a raised-grain in a high quality end use. When a preservative treatment is specified, the wood surface shall be dry and free from grease and other foreign matter before it is treated. Wood that is to be treated shall not have a moisture content exceeding 20 percent of its post oven drying weight. Where possible, wood parts shall be cut to final dimensions, planed or sanded smooth, and holes, rabbets, and the like, shall be made before treatments. In the event that it becomes necessary to make holes, rabbets, sawcuts, or the like, after treatment, preservative shall be applied liberally to surfaces exposed by these operations.

12/ Unless specified in the contract or purchase order, zinc-nickel in accordance with MIL-PRF-32647 should be used instead of Cd plating with Cr VI.

TABLE II. Final paint film (Step 4 of Finish Process).

FOR TYPE I (EXPOSED) APPLICATIONS				
Film Designation [1/]	Color (SAE AMS-STD595 Number)	Gloss	Dry Film Thickness (mm) (mm x 39.37 = mil) [2/ 3/]	Applicable Paint Specification
B	Black (No. 37038)	Lusterless	0.0254-0.0381	MPI Reference #49
D	Black (No. 27038)	Semi-gloss	0.0254-0.0381	MPI Reference #47
E	Gray (No. 26307)	Semi-gloss	0.0254-0.0381	MIL-DTL-15090, class 2
F	Gray (No. 26152)	Semi-gloss	0.0254-0.0381	MPI Reference #47
G	Gray (No. 16376)	Gloss	0.0254-0.0381	MPI Reference #9
K	Black (No. 17038)	Gloss	0.0170-0.0230	MPI Reference #9
N	Black (No.27038)	Semi-gloss	0.0432-0.0585	MIL-PRF-22750 grade A
P	Gray (No. 26307)	Semi-gloss	0.0432-0.0585	MIL-PRF-22750 grade A
T	Black (No. 17038)	Gloss	0.0432-0.0585	MIL-PRF-22750 grade A
X	Gray (No. 36118)	Lusterless	0.0254-0.0381	MPI Reference #49
AE	White (No. 27875)	Semi-gloss	0.0432-0.0585	MIL-PRF-22750 grade A
AG	Green 383 (No. 34094)	Lusterless	0.0509-0.0762	MIL-DTL-53039*
AH	Brown 383 (No. 30051)	Lusterless	0.0509-0.0762	MIL-DTL-53039*
AI	Black (No. 37038)	Lusterless	0.0509-0.0762	MIL-DTL-53039*
AP	Tan 686 (No.33446)	Lusterless	0.0509-0.0762	MIL-DTL-53039*
AR	White (No. 37875)	Lusterless	0.0509-0.0762	MIL-DTL-53039*

TABLE II. Final paint film (Step 4 of Finish Process) - Continued.

FOR TYPE II (SHELTERED) APPLICATIONS				
Film Designation	Color (SAE AMS-STD595 Number)	Gloss	Dry Film Thickness (mm) (mm x 39.37 = mils)	Applicable Paint Specification
A	Olive Drab (No. 34088)	Lusterless	----	MIL-DTL-53039* or MPI Reference #49
H	Olive Drab (No. 14084)	Gloss	0.0254-0.0381	MPI Reference #9
M	Olive Drab (No. 24084)	Semi-Gloss	0.0432-0.0585	MIL-PRF-22750
AL	Green (No. 24410)	Semi-Gloss	0.0254-0.0381	MPI Reference #47
AM	Green (No. 24533)	Semi-Gloss	0.0432-0.0585	MIL-PRF-22750

*CARC Finish

1/ Film designations AG, AH and AI are CARC, tricolor, camouflage. For wooded and other vegetated areas. For winter/snow conditions the colors are AR, AH and AI and for the desert only AP is used.

2/ CARC paint thickness shall be in accordance with MIL-DTL-53072

3/ DFT is per coat (typically 2 coats)

TABLE III. Plated finishes (M).

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON IRON OR IRON-BASE ALLOYS					
M211	I	Silver	0.0025 Nickel	0.0127 Silver	SAE AMS-2403 plus ASTM B700
M212	I	Nickel	0.0127 Copper	0.0152 Nickel	SAE AMS 2418, class 2, plus SAE AMS-2403, 0.0006 inch thick (Bright finish)
M213	I	Dull Nickel	0.0127 Copper	0.0152 Nickel	SAE AMS 2418, class 2, plus SAE AMS-2403, 0.0006 inch thick (Matte finish)
M214	I	Copper	None	0.0254 Copper	SAE AMS 2418, class 1
M216	I	Bright Chrome	0.0152 Nickel over 0.0127 Copper	0.0005 Chromium	SAE AMS 2418, class 2, plus SAE AMS-2403, 0.0006 inch thick plus SAE AMS 2460, type I, class 1
M217	I	Hot-dip Tin	None	0.0127 Tin	ASTM B 545, type II
M220	I	Hot-dip Terneplate	None	0.0127 Terne	Best commercial practice
M221	I	Hot solder dip (40 to 60% tin)	None	0.0127 Solder	J-STD-004, J-STD-005, J-STD-006
M222	I and II	Electroplated Tin-lead (50 to 70% tin) 1/	None	0.0076	SAE AMS-P-81728
M223	I	Lead	0.0004 Copper	0.0381 Lead	MIL-L-13808, type II 2/
M224	I	Passivated Cadmium 12/ (must be painted)	None	0.0127 Cadmium 12/	SAE AMS-QQ-P-416, type III, class 1

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON IRON OR IRON-BASE ALLOYS – Continued.					
M225	I	Olive-drab Chromate Passivated Cadmium 12/ Do not paint 3/	None	0.0127 Cadmium 12/	SAE AMS-QQ-P-416, type II, class 1
M226	I	Passivated Zinc (must be painted)	None	0.0127 Zinc	ASTM B633, type II or III, class 2
M227	I	Olive-drab Chromate Passivated Zinc	None	0.0127 Zinc	ASTM B633, type II
M228	I	Hot-dip Zinc	None	----	ASTM A123/A123M, ASTM A153/A153M
M229	I	Chromate Passivated Hot-dip Zinc	None	----	ASTM A123/A123M, ASTM A153/A153M plus ASTM D 6386, type II
M251	II	Silver	0.0025 Nickel	0.0076 Silver	SAE AMS-2403, 0.0010 inch thick plus ASTM B700
M252	II	Nickel	0.0051 Copper	0.0102 Nickel	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0004 inch thick (Bright finish)
M253	II	Dull Nickel	0.0051 Copper	0.0102 Nickel	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0004 inch thick (Matte Finish)
M254	II	Copper	None	0.0127 Copper	SAE AMS 2418, class 2

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON IRON OR IRON-BASE ALLOYS - Continued					
M255	II	Bright Chrome	0.0102 Nickel over 0.0051 Copper	0.005 Chromium	SAE AMS-2403, 0.0004 inch thick plus SAE AMS 2418, class 3, plus SAE AMS 2460
M256	II	Hot-dip Tin	None	0.0076 Tin	ASTM B 545, type II
M258	II	Hot solder dip (40 to 60% tin)	None	0.0076 Solder	J-STD-004, J-STD-005, J-STD-006
M260	II	Lead	0.0004 Copper	0.0254 Lead	MIL-L-13808, type II, class 1
M261	II	Passivated Cadmium 12/ (must be painted)	None	0.0076 Cadmium 12/	SAE AMS-QQ-P-416, type III, class 2
M262	II	Unbleached Chromate passivated Cadmium. 12/ Do not paint. 3/	None	0.0076 Cadmium 12/	SAE AMS-QQ-P-416, type II, class 2
M263	II	Passivated Zinc (must be painted)	None	0.0076 Zinc	ASTM B633, type III
M264	II	Unbleached Chromate Passivated Zinc 3/	None	0.0076 Zinc	ASTM B633, type II
M265	I and II	Electroless Nickel	None	0.0254 Electroless Nickel	SAE AMS-C-26074, grade A (Reference SAE-AMS-2404F)

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON COPPER OR COPPER-BASE ALLOYS CONTAINING LESS THAN 40% ZINC					
M221	I	Hot solder dip	See M221 above for details.		
M225	I	Olive-drab Chromate Passivated Cadmium 12/	See M225 above for details.		
M230	I and II	Electroplated Tin-Lead (50 to 70% tin) 1/	0.0025 Copper	0.0076 Tin-Lead	SAE AMS 2418, class 4 plus SAE AMS-P-81728
M258	II	Hot solder dip	See M258 above for details.		
M262	II	Unbleached Chromate Passivated Cadmium 3/ 12/	See M262 above for details.		
M310	I	Gold	0.0254	0.00254 Gold	SAE AMS-2403, 0.0010 inch thick plus SAE AMS-2422 or ASTM B488, 4/
M311	I	Silver	0.0254 Nickel	0.0127 Silver	SAE AMS-2403, 0.0010 inch thick plus ASTM B700
M312	I	Nickel	None	0.0152 Dull Nickel	SAE AMS-2403, 0.0006 inch thick (Bright finish)
M313	I	Dull Nickel	None	0.0152 Dull Nickel	SAE AMS-2403, 0.0006 inch thick (Matte finish)
M316	I	Bright Chrome	0.0152 Nickel	0.0005 Chromium	SAE AMS-2413, 0.0006 inch thick plus SAE AMS 2460
M317	I	Hot-dip Tin	None	0.0178 Tin	ASTM B545, type II
M323	I	Lead	None	0.0381 Lead	MIL-L-13808, type I

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON COPPER OR COPPER-BASE ALLOYS CONTAINING LESS THAN 40% ZINC – Continued					
M221	I	Hot solder dip	See M221 above for details.	----	----
M225	I	Olive-drab Chromate Passivated Chromium	See M225 above for details.	----	----
M230	I and II	Electroplated Tin-Lead (50 to 70% tin) 1/	See M230 above for details.	----	----
M258	II	Hot solder dip	See M258 above for details.	----	----
M262	II	Unbleached Chromate Passivated Cadmium 3/ 12/	See M262 above for details.	----	----
M310	I	Gold	See M310 above for details.	----	----
M311	I	Silver	See M311 above for details.	----	----
M317	I	Hot-dip tin	See M317 above for details.	----	----

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON COPPER-BASE ALLOYS CONTAINING 40% ZINC OR MORE					
M323	I	Lead	See M323 above for details.		
M351	II	Silver	See M351 above for details.		
M356	II	Lead	See M356 above for details.		
M412	I	Nickel	0.0051 Copper	0.0152 Nickel	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0006 inch thick plus S SAE AMS2460
M413	I	Dull Nickel	0.0051 Copper	0.0152 Nickel	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0006 inch thick plus SAE AMS2460
M416	I	Bright Chrome	0.0152 Nickel over 0.0051 Copper	0.0005 Chrome	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0006 inch thick plus SAE AMS2460
M417	I and II	Electroless Nickel	0.0051 Copper	0.0127 Electro-less Nickel	SAE AMS-2418, class 3 plus SAE AMS-C-26074, grade B
M418	I and II	Rhodium	0.0127 Silver 0.0025 Copper	0.0005 Rhodium	SAE AMS-2418, class 4 plus ASTM-B700, grade G plus MIL-R-46085, class 3
M419	I and II	Rhodium	0.0051 Nickel over 0.0025 Copper	0.0005 Rhodium	SAE AMS-2418, class 4 plus SAE AMS-2403, 0.0002 inch thick plus MIL-R-46085, class 3

TABLE III. Plated finishes (M) - Continued.

Finish Number	Type Exposure	Plate Description	Minimum Plating Thickness in mm (mm x 39.37 = mils)		Applicable Specifications
			Intermediate Plates	Final Plate	
FOR USE ON COPPER-BASE ALLOYS CONTAINING 40% ZINC OR MORE - Continued					
M452	II	Nickel	0.0051 Copper	0.0102 Nickel	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0004 inch thick
M455	II	Bright Chrome	0.0102 Nickel over 0.0051 Copper	0.0005 Chrome	SAE AMS 2418, class 3 plus SAE AMS-2403, 0.0004 inch thick plus SAE AMS2460
FOR USE ON ALUMINUM OR ALUMINUM-BASE ALLOYS 5/					
M212	I	Nickel	See M212 above and 6/ for details.		
M213	I	Dull Nickel	See M213 above and 6/ for details.		
M216	I	Bright Chrome	See M216 above and 6/ for details.		
M252	II	Nickel	See M252 above and 6/ for details.		
FOR USE ON ZINC-BASE ALLOYS					
M611	---	Nickel	0.0051 Copper	0.0152 Nickel	SAE AMS-2418, class 3 plus SAE AMS-2403, 0.0006 inch thick.

1/ Electroplated Tin-Lead is to be reflowed to provide improved coverage and protection of the basis metal.

2/ Lead plating shall be applied in accordance with MIL-L-13808 except the thickness shall be as specified herein.

3/ Colored chromates as they normally occur in processing operations are desired. The use of clear or bleached chromates is prohibited. Paint does not adhere to chromate-passivated cadmium. If cadmium is to be painted, use M261 only.

4/ The type and thickness are to be specified (see 6.2).

5/ Use of nickel or copper/nickel on aluminum for type I exposures is a questionable practice. Any porosity in the coating can lead to severe corrosion. Therefore, any such applications should be carefully weighed and avoided whenever possible.

6/ The aluminum alloys require pretreatment prior to plating. All surfaces shall be treated in accordance with ASTM B253 or given a sodium carbonate anodize in accordance with the pretreatment process for aluminum alloys.

7/ Unless specified in the contract or purchase order, zinc-nickel in accordance with MIL-PRF-32647 should be used instead of Cd plating with Cr VI.

TABLE IV. Finishes or processes other than painting or plating (E).

For Use On	Type Exposure	Finish Number	Finish Process
Plated ferrous alloys (other than corrosion-resistant steel) having a Rockwell hardness greater than C-40.	I or II	E200	1) Prior to cleaning and plating, and after forming and hardening, parts shall be stress-relieved by baking at 149ºC to 260ºC for 30 minutes. The baking temperature employed will depend on the amount of residual stress required by the part. Immediately after plating and prior to any passivation treatment, parts shall be baked at 177ºC to 204ºC for 5 hours. Parts shall not be flexed prior to baking. NOTE: Parts heat treated at less than 191ºC including carburized parts shall be treated by a method having prior approval of the contracting officer.
Ferrous alloys other than corrosion-resistant steel (Wearing parts lubricated in service).	II	E211	1) Preconditioning not required. 2) Passivate with phosphate film per MIL-DTL-16232, type Z, class 2.

TABLE IV. Finishes or processes other than painting or plating (E) - Continued.

For Use On	Type Exposure	Finish Number	Finish Process
Ferrous alloys other than corrosion-resistant steel (nonwearing parts not lubricated in service).	II	E212	1) Preconditioning not required. 2) Passivate with phosphate film per MIL-DTL-16232, type Z, class 2.
Ferrous alloys other than corrosion-resistant steel (wearing parts lubricated in service; and maximum corrosion resistance required; can be dyed to specific color).	II	E213	1) Preconditioning not required. 2) Passivate with phosphate film per MIL-DTL-16232, type M, class 4 plus supplementary treatment.
Ferrous alloys other than corrosion-resistant steel (non-wearing parts not lubricated in service and maximum corrosion resistance required; can be dyed to specific color).	II	E214	1) Preconditioning not required. 2) Conversion coat with phosphate film per MIL-DTL-16232, type Z, class 1 plus supplementary treatment.
Ferrous alloys in lieu of chromate treated zinc or cadmium plated parts that will be subjected to ambient temperatures between 71ºC and 343ºC when in service (see 3.7 for alternate methods). High strength steel parts can be coated without subjecting them to possible effects of hydrogen embrittlement resulting from an electroplating process.	I or II	E215	Precondition clean surface per Appendix A. Apply immersion zinc/chromate coating per MIL-C-87115 followed by a primer coating per the specification. Apply a final paint finish coat selected from table II or as specified on the master drawing.
Machined or welded corrosion resistant steel parts	I or II	E300 1/	Passivate per ASTM A 380.
Small copper or copper alloy parts such as buckles, hooks, eyelets, etc.	I	E311	Finish with chemical black treatment per MIL-F-495.
Aluminum and aluminum base alloys.	I or II	E511 2/	1) Preconditioning not required. 2) Anodize per MIL-PRF-8625, types I, II or III. 3/

TABLE IV. Finishes or processes other than painting or plating (E) - Continued.

For Use On	Type Exposure	Finish Number	Finish Process
Aluminum – alloys when Low Resistance Electrical Contacts are required; service temperatures not to exceed 60°C	II	E512	1) Preconditioning not required. 2) Conversion coat with chemical film per MIL-DTL-81706, type II class 3.
Aluminum and aluminum-base alloys, service temperatures not to exceed 60°C	II	E513	1) Preconditioning not required. 2) Conversion coat with chemical film per MIL-DTL-81706, type II class 1A.
Aluminum and aluminum-base alloys (for use on bearing surfaces when extreme wear resistance is necessary).	II	E514	Apply anodic hardcoat per MIL-PRF-8625, type III. Better service in bearing applications can be provided by polytetrafluoroethylene dispersion sealing of hard anodized surfaces to reduce friction.
Aluminum alloys in lieu of chromate treatment (see 3.7). This process has been classed as non-polluting. It is recommended for parts which, when in service, will be exposed to temperatures above 71°C and as an alternate to anodization if metal fatigue is a factor.	I or II	E517	Precondition cleaning of surface per Appendix A. Apply immersion zinc/chromate coating per MIL-C-87115. If parts require painting use MIL-DTL-53022 or other suitable primer per this specification. Apply a final paint film selected from table II.
Zinc-base alloys, operating temperature not to exceed 71°C.	II	E611	1) Preconditioning not required. 2) Passivate with unbleached chromate film per ASTM D6386, type II. 4/
Zinc-base alloys (must be painted).	II	E612	1) Preconditioning not required. 2) Passivate with phosphate film per ASTM D6386, type I, class 1.

TABLE IV. Finishes or processes other than painting or plating (E) - Continued.

1/ The primary purpose of this treatment is the removal of embedded iron, steel or other foreign metallic particles.

2/ Anodic films are satisfactory for type I surfaces only on small unthreaded parts.

3/ Type II is the preferred anodic treatment; however, it should not be used on surfaces subject to stresses or surfaces containing lapped joints or crevices which could entrap the sulfuric acid anodization solution. Type I anodization should be used in these cases. Type III anodization is intended to provide greater wear characteristics, abrasion resistance and improved corrosion protection.

4/ Colored chromates as they normally occur in processing operations are desired. The use of clear or bleached chromate is prohibited.

TABLE V. Electrical conductivity of passivated finishes (see para 3.12).

Alloy Part	Type Exposure	Finish Number	Finish	Conducting Frequency		Remarks
				Power	RF	
Ferrous	I II	M225 M262	Chromate-passivated Cadmium 3/	No	Yes	Electrical contact may require use of toothed type lock washers. 1/
Ferrous	I II	M227 M264	Chromate-passivated Zinc	No	Yes	Electrical contact may require use of toothed type lock washers. 1/
Ferrous	II II II	E211 E212 E213	Phosphate passivation	No	No	Since these finishes are porous, their use in contact with other metals must be restricted to those forming couples compatible with ferrous alloys (except corrosion-resistant steel).
Aluminum	II	E511	Anodize	No	No	May be used in contact with any dissimilar metal.
Aluminum	II	E512	Chemical	Yes	Yes	Electrical contact does not require use of toothed type lock washers.
Aluminum	II	E513	Chemical film	No	Yes	Electrical contact may require use of toothed type lock washers. 2/
Aluminum	II	E514	Hard anodize	No	No	May be used in contact with any dissimilar metal.
Zinc-base	II	E611	Chromate passivation	No	Yes	Electrical contact may require use of toothed type lock washers. 1/

TABLE V. Electrical conductivity of passivated finishes (see para 3.12) - Continued.

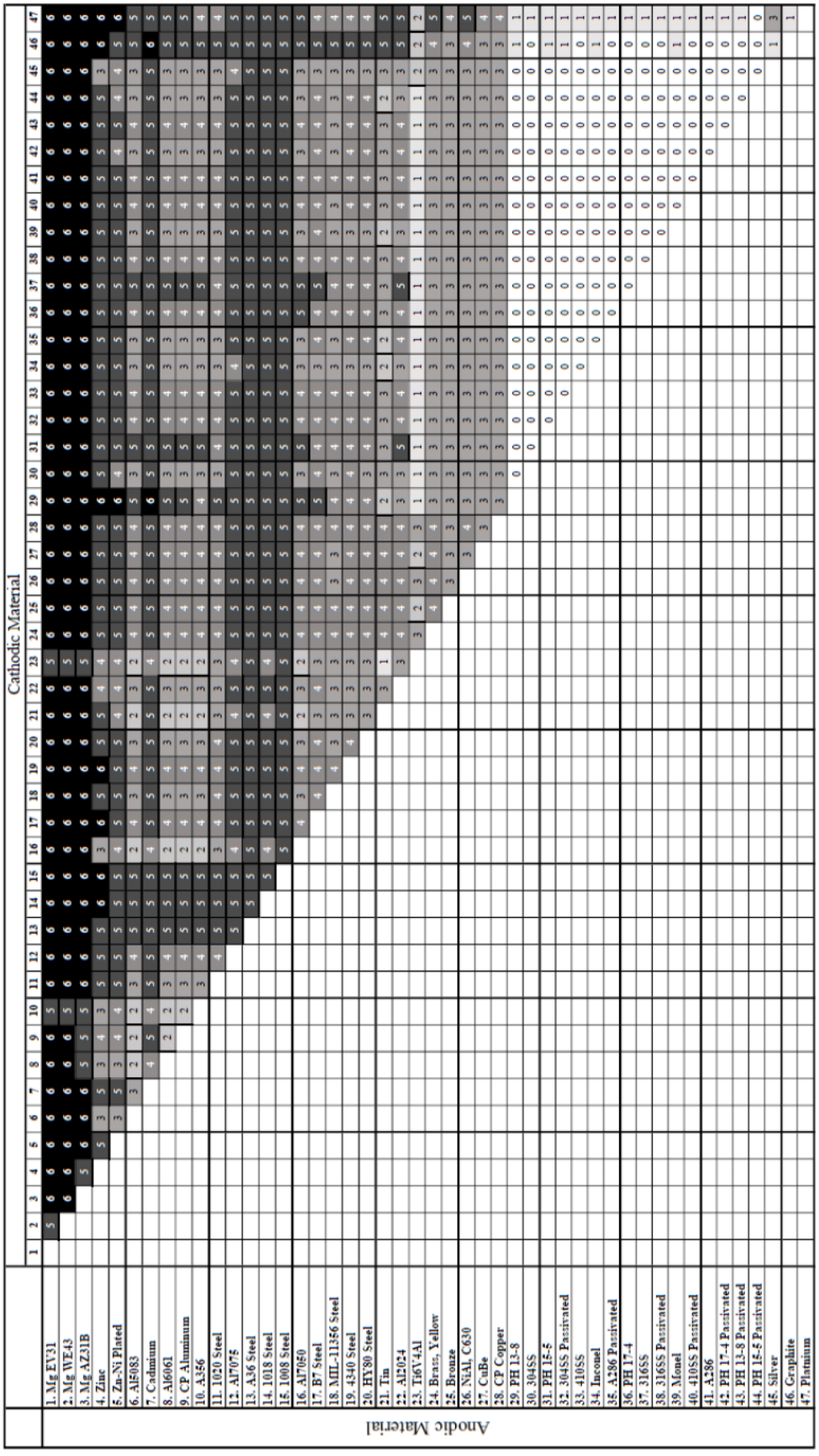
Alloy Part	Type Exposure	Finish Number	Finish	Conducting Frequency		Remarks
				Power	RF	
Zinc-base	II	E612	Phosphate passivation	No	No	Since this finish is porous, its use in contact with other metals must be restricted to those forming couples compatible with zinc base alloys.

1/ Chromate films, depending on thickness, have a relatively low electrical resistance from 0.0001 to 0.002 ohm (.1 to 2 milliohm) over a contact area of 6.45 cm^2 with contact pressure of 7.03 kg per cm^2.

2/ Touch up may be required around areas where toothed type lock washers are located. Use additional chromate conversion coating (chemical film) applied via brush to seal outside surfaces of mechanical fasteners and all abraded areas.

3/ Unless specified in the contract or purchase order, zinc-nickel in accordance with MIL-PRF-32647 should be used instead of Cd plating with Cr VI.

TABLE VI. Galvanic compatibility of bare metals in artificial seawater. 1/



Legend:
Galvanic compatibility between two metals of interest is found at the intersection point of the row and column. The anodic member of the couple is listed in the rows and the cathodic member of the couple is listed in the columns. An empty cell at the intersection point indicates that the metal identified as anodic and cathodic should be switched.
This table shall not be used to indicate the level of risk associated with the galvanic couple nor shall it be used to determine the level of protection required to protect the metals.

The CEA or appropriate design authority shall determine the necessary protection.

The corrosion rate was determined for metals in a 1:1 surface area ratio.
The number in the cells represent a range at which the anodic material will corrode when coupled with the cathodic material in artificial seawater. Any number above zero indicates galvanic incompatibility.

The range of the corrosion rate in mils/year is as follows:

Galvanically Compatible:
0: <0.009 mil/year

Galvanically Incompatible:
1: 0.01-0.09 mil/year
2: 0.1-0.9 mil/year
3: 1-4.99 mil/year
4: 5-9.99 mil/year
5: 10-99.99 mil/year

1/ MIL-STD-889

TABLE VII. Finish selection.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM FERROUS ALLOYS OTHER THAN CORROSION RESISTANT STEELS			
Massive structural parts and assemblies, such as masts, tower sections, tower assemblies, van bodies, truck bodies, large brackets, gussets and assembly hardware.	Vat passivation is practical.	I	P210 thru P217.1
	Vat passivation is not practical	I	P210.1 thru p217
	Parts have a prior hot-dip zinc (M228) and require painting for camouflage requirements.	I	P371.1 thru P373
Large bolts, nuts, washers, and similar type hardware for assembling of massive structures	Parts will require painting after assembly	I	M224, M225, M226, M227, M228 or M229
	Parts will not require painting after assembly	I	M228 or M229
Lesser structural parts and assemblies such as racks, cases, castings, housings, panels, brackets, etc.	Vat passivation is practical.	I	P210 thru P217.1
	Vat passivation is not practical	I	P210.1 thru p217
Ground rods, stakes, ground plates, etc.	Parts will be used in contact with soil.	I	M228 or M229
Hardened steel parts such as coil springs, flat springs, washers, etc. subject to hydrogen embrittlement	Plating is required for protection due to equipment design	I	Any type I plating per table III plus E200.
		II	Any type II plating per table III plus E200.

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM FERROUS ALLOYS OTHER THAN CORROSION RESISTANT STEELS – Continued.			
Small hardware (except threaded parts) such as hinges, fasteners, catches, handles, truck corners, etc.	Parts will be exposed to view when assembled in equipment	I	P211.1, P213.1 or P217.1
	Parts will not be exposed to view when assembled in equipment	I	P211.1 thru 211.3 or P213.1 thru P217.1 or any type I plating per table III
	Parts will be painted after assembly	I	M224, M226, or M227
	Parts will be exposed to view when assembled and cannot be painted.	I	M213
	Parts were finished with any plating, except cadmium 2/ or zinc, and require painting after assembly.	I	P341.1 thru P341.4
	Parts were plated with cadmium 2/ or zinc and require painting after assembly.	I	P371.1 or P371.2
Inside surfaces of open tubes.		I	P215
Any type of part (except threaded parts).	Parts will be subjected to temperatures in excess of 71°C and plating is desired.	I or II	Any type I plating per table III except cadmium 2/ or zinc.

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM FERROUS ALLOYS OTHER THAN CORROSION RESISTANT STEELS – Continued.			
Screws, bolts, nuts and washers, and small specialty parts.	Prior to assembly in equipment	I	Any type I plating per table III
	After assembly in equipment (parts were finished with any plating except cadmium 2/ or zinc) and will be exposed to view.	I	P341 thru P341.1
	After assembly in equipment (parts were plated with cadmium 2/ or zinc).	I	P371.1 or P371.2
	Parts will not be exposed to view after assembly	I	Any type I plating per table III.
	Parts will be exposed to view after assembly.	I	M213
Hardware such as hinges, catches, tube shield, clamps, brackets, clips, screws, bolts, nuts, washers, etc.	Parts will be subjected to temperatures in excess of 71°C.	II	Any type II plating per table III except cadmium 2/ or zinc
	Parts will not be subjected to temperatures in excess of 71°C.	II	Any type II plating per table III
	Parts will be in contact with uncured phenolics or subjected to phenolic vapors (see 3.7).	II	Any type II plating per table III except cadmium 2/ or zinc.

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM FERROUS ALLOYS OTHER THAN CORROSION RESISTANT STEELS – Continued.			
Gears, cams, slides, etc.	Parts cannot be lubricated and will not be subjected to high bearing pressure.	II	M262
	Parts cannot be lubricated and will be subjected to high bearing pressure	II	M252 or M255
Any type of part	An electrically conductive dissimilar metal contact is required.	II	Any plating per table III to meet table VI.
Wearing parts lubricated in service	Parts will be oiled or greased but not during operation.	II	E211 or E213
	Parts will be splash or force-feed lubricated in operation	II	E211 or E213
Sliding, wearing surfaces, such as guide rails, etc., requiring electrical conductivity.	Parts cannot be lubricated.	II	M252 or M255
FABRICATED FROM CORROSION-RESISTANT STEELS OR NICKEL-BASE ALLOYS			
Large parts	Parts will be exposed to view in assembled equipment	I	P213.1 or P213.4
	Parts will not be exposed to view in assembled equipment	I	No finish required.
Small parts	Parts will be exposed to view in assembled equipment	I	P213.1 or P213.4
	Parts will not be exposed to view in assembled equipment	I	No finish required.

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM CORROSION-RESISTANT STEELS OR NICKEL-BASE ALLOYS - Continued			
Welded or machined parts made of corrosion-resistant steel.	Parts will not be exposed to view in assembled equipment	I or II	E300
Any type of part	----	II	No finish required
FABRICATED FROM ALUMINUM-BASE ALLOYS			
Massive structural parts and assemblies such as masts, tower sections, tower assemblies, brackets, gussets, and assembly hardware.	Vat passivation is practical.	I	Any applicable paint finish per table I
	Vat passivation is not practical	I	P513.1, P517, P519.1 or P519.2
Smaller structural parts and assemblies such as racks, cases, castings, housings, panels, brackets, etc.	Vat passivation is practical.	I	Any applicable paint finish per table I
	Vat passivation is not practical	I	P513.1, P517, P519.1 or P519.2
Small hardware such as hinges, fasteners, catches, handles, screws, nuts, bolts, washers, etc.	Parts will be exposed to view when assembled in the equipment	I	P511 or P518.1
	Parts will be exposed to view when assembled and cannot be painted	I	M213
	Parts will not be exposed to view when assembled in the equipment.	I	Any type I plating per table III or E511

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM ALUMINUM-BASE ALLOYS - Continued			
Internal structural parts such as chassis, brackets, inside of panels, clamps, shields, clips, hinges, etc.	None	II	E511 or E513
	RF electrical conducting surface is required	II	E513
	A nonconducting surface is required.	II	E511 or P517
	Plating is required for contact with dissimilar metals.	II	Any type I plating to meet table VI
Parts made from alloys, 1100, 3003, 5052, and 6061 only.	A power electrical conducting surface is required.	II	I512
Parts requiring high wear resistance such as gears, cams, slides, etc.	Parts will be subjected to high bearing pressure.	II	E514
FABRICATED FROM COPPER OR COPPER-BASE ALLOYS			
Structural parts, such as castings, housings, brackets, etc.	Parts will be exposed to view	I	P213.1 or P213.4
	Parts will be exposed to view in assembled equipment and are made from alloys containing 40% zinc or more.	I	P213.1 or P213.4
	Parts will not be exposed to view and are made from alloys containing less than 40% zinc.	I	No finish required.

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM COPPER OR COPPER-BASE ALLOYS - Continued			
Small hardware such as hinges, springs, fasteners, catches, screws, bolts, nuts, washers, etc.	Parts will be exposed to view in assembled equipment.	I	P213.1 or P213.4
	Parts will be exposed to view in assembled equipment and painting is not practical.	I	M225, M313 or M413
	Parts will not be exposed to view in assembled equipment and are made from the alloys containing 40% zinc or more.	I	Any type I plating per table III
	Parts will not be exposed to view in assembled equipment and are made from alloys containing less than 40% zinc.	I	No finish required
Small specialty parts (except threaded parts) such as buckles, hooks, eyelets, bead chain, etc.	Painting is not practical	I	E311
Parts with sliding wearing surfaces that require electrical conductivity	Part is exposed to view in assembled equipment.	I	M253

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM COPPER OR COPPER-BASE ALLOYS - Continued			
Internal parts such as chassis, brackets, inside of panels, clamps, shields, clips, hinges, springs, nuts, bolts, screws, washers, gears, cams, shafts, locks, slides, etc.	None	II	No finish required
	Painting is desired or required to provide a nonconducting surface.	II	P313, P213.1 or P213.4
	Plating is required to permit contact with a dissimilar metal.	II	Any type I plating to meet table VI
	Plating is required and part will be subjected to temperatures above 71°C or part will be exposed to phenolics or phenolic vapors.	II	Any type II plating per table III except cadmium 2/ or zinc
PLATED SURFACES REQUIRING PAINTING			
All parts	Plated with any metal except cadmium 2/ or zinc.	I	P341.1 thru P341.4
		II	P343
	Plated with cadmium 2/ or zinc	I	P371.1 or P341.2
		II	P373

TABLE VII. Finish selection - Continued.

Class of Part	Conditions Affecting Finish Selection	Type Exposure	Applicable Finish 1/
FABRICATED FROM ZINC-BASE ALLOYS			
All parts	None	I	P611.1, P611.2, P613.1 or P613.2
	Part is small and painting is not practical.	I	M611
	Painting is desired or required to provide a nonconducting surface.	II	P615.1, P615.2 +P611.1, P611.2, +P613.1 or +P613.2
	Parts will be subjected to temperatures in excess of 71°C.	II	M611 or any paint finish per table I
	Parts will not be subjected to temperatures in excess of 71°C.	I	E611
	Parts will be painted after assembly.	I	E611 or E612
	Parts have prior finish (E611 or E612) and require painting.	I	P371.1 or P371.2
PARTS FABRICATED FROM MAGNESIUM-BASE ALLOYS			
All parts fabricated from zinc-bearing magnesium alloys.	None	I and II	See table I.
All parts except those subject to flexing	None	I and II	See table I.
All parts except those containing zinc.	None	I and II	See table I.
FABRICATED FROM WOOD			
All parts and assemblies	None	I or II	P911

1/ Allowable basic paint finishes (steps 1 through 3 of table I) are prefixed with +, for example +P211. When no + is shown, it is understood that complete finishes (steps 1 through 4 of table I) are required and finish call-out shall include the letter designation of the final film, for example P211A.

2/ Unless specified in the contract or purchase order, zinc-nickel in accordance with MIL-PRF-32647 should be used instead of Cd plating with Cr VI.

TABLE VIII. Inspection.

Inspection	Requirement Paragraph	Test Paragraph
Paint Finishes		
Color	Table II	4.4.1
Adhesion	3.15	4.4.2
Thickness	Tables I and II	4.4.4
Surface condition	3.15	4.4.6
Spectral reflectance of paint films	Table II	4.4.7
Plate Finishes		
Thickness	Table III	4.4.4
Hydrogen embrittlement	3.10.2	4.4.5
Surface condition	3.15	4.4.6

TABLE IX. Classification of visual finish defects.

Classification	Defect
Major See Paragraph 3.15	Color of paint film not as specified. Paint film fails to pass adhesion test. Minimum total paint film thickness is 90 percent of the values specified in tables I and II. Maximum total paint film thickness is 120 percent of the values specified in tables I and II. Paint type not in accordance with applicable specification. Blisters, nodules, sags, orange peel, chalking, mud cracking or wrinkles in finished areas visible after assembly. Spectral reflectance out of limits. Plating metal not as specified. Plating less than 90 percent of thickness as specified in table III. Plating peeling or flaking from underplate or basis metal. Hydrogen embrittlement of parts. Scratches, cuts, abrasions, etc. with exposure of bare metal. Gouge marks, checks, pits, burns with exposure of bare metal. Foreign debris where removal would expose bare metal.
Minor See Paragraph 3.15	Color of paint film as specified, but not within tolerance for shade, hue, or intensity (tolerance in accordance with applicable specification. Blisters, nodules, sags, orange peel, chalking, mud cracking or wrinkles in finished areas are not visible after assembly.

TABLE X. Cross reference of paint film designators.

Discontinued Letters	Superseding Letters
AF	AG
C	M
F1	F
I	AG
J	AG
L	None
Q	Y
R	B
S	X
U,V,W	AG
Y	AG
Z	AI

TABLE XI. Cross reference of plated finishes or M Numbers.

Discontinued M Numbers	Superseding M Numbers
M215	(M218)*
M259	M222
M315	(M218)*
M415	(M218)*

* Cancelled – No Replacement

TABLE XII. Cross reference of E Numbers.

Discontinued E Numbers	Superseding E Numbers
E516	E514
E515	E514

TABLE XIII. Cross reference of P Numbers.

Amendment 1	Revision A	Revision B	Revision C	Revision D	Revision E
	211	211.1 thru 211.3		211.1	
	212				
	213	213.1 thru 213.6		213.1 or 213.4	
	214				
	215J	215J			
	313	313			
	341	341.1 thru 341.4			
	342				
	343	343			
	371	371.1 or 371.2			
	373	373			
511	511	511			
	512				
513.1 or 513.3	513	513.1 or 513.2	513.1		
	514				
511 or 513.1	515	511 or 513.1			
	516				
	517	517			
510 or 518.1	518	510 or 518.1			
519.2 or 519.3	519	519.1			
510.2 or 510.3	519	510.1	510.2 or 510.3		
	611	611.1 or 611.2			
	612				
	613	613.1 or 613.2			
	614		522 Added		
	615	615.1 or 615.2			
	711	710 or 711.1		718.1 Added	
	712	710.1, 710.2, 710.3, or 712.1		718.2 Added	
	713	713.1 or 713.2			
	714	710.4 or 714.1			
	715	710.5 or 715.1			
	716	710.6, 710.7, 710.8, or 716.1			
	717	717.1 or 717.2			
	911	911			
	812				

APPENDIX A

CLEANING

A.1 SCOPE

A.1.1 Scope. This appendix provides requirements for surface cleaning. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 APPLICABLE DOCUMENTS.

A.2.1 General. The documents listed in this section are specified in sections 3 or 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 or 4 of this specification, whether or not they are listed.

A.2.2 Government publications.

A.2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are be those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

TT-C-490	-	Chemical Conversion Coatings and Pretreatments and Ferrous Surfaces (Base for Organic Coatings)

A.2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS-M-3171	-	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
SAE AMS-QQ-P-416	-	Plating, Cadmium (Electrodeposited)

(Copies of these documents are available from https://www.sae.org/.)

THE ASSOCIATION FOR MATERIALS PROTECTION AND PERFORMANCE

SSPC-SP 6	-	Commercial Blast Cleaning, Surface Preparation
SSPC-SP 10	-	Near-White Blast Cleaning, Surface Preparation

(Copies of these documents are available from https://www.ampp.org/.)

A.2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

APPENDIX A

A.3 REQUIREMENTS

A.3.1 Cleaning. Unless otherwise specified in the end item specification, cleaning procedures shall be in accordance with TT-C-490 or as described herein. Cleaning may be accomplished by:

a. Chemical methods such as solvent cleaning, alkaline cleaning, acid cleaning, pickling, descaling with hydride, or paint stripping; or,

b. Electrochemical cleaning methods such as electrolyte alkaline, electropolishing, or electrolytic pickling; or,

c. Mechanical means such as blasting, chipping, wire brushing, or grinding.

After cleaning, all surfaces shall be kept free from dirt, dust, finger marks, and other contaminants, until treated.

A.3.1.1 Ferrous metal surfaces. Ferrous metal surfaces to be painted shall be cleaned in accordance with A.3.1. Where blasting is appropriate, blast in accordance with The Association for Materials Protection and Performance (AMPP) SSPC-SP6, unless SSPC-SP5 or SSPC-SP10 is specified, to remove mill scale, products of corrosion, dirt, casting sand slag, and other foreign substances. (For further information, see Steel Structure Painting Council Manual, Volume 2.) Prior to blasting, the surface shall be cleaned as specified in A.3.1 to ensure that it is free from all oil and grease. The blasting medium shall be kept free from oil, grease, dirt or any other material that could contaminate the surface. Oil and grease contamination resulting from fabrication, machining, or handling subsequent to cleaning shall be removed in accordance with the appropriate method of TT-C-490. Blast cleaned surfaces shall be pretreated within four hours, and then given a prime coat as soon as possible.

A.3.1.1.1 Exemptions from abrasive blasting. Blasting shall not be used on surfaces which could be damaged by blasting, such as machined parts or sheet metal thinner that 16 gage (0.0625), or on components containing such surfaces unless protective masking has been applied. Blasting is optional on components of equipment which are painted for protection during limited storage and from which the paint will be worn off immediately when the equipment is placed into use. However, these surfaces shall be dry and free from oil, grease, dirt, and rust.

A.3.1.2 Zinc surfaces. Zinc surfaces, including zinc-coated substrates, shall be cleaned prior to painting as follows: degrease, soak in a mild and inhibited alkaline cleaner, rinse with clean overflowing water, clean anodically in an inhibited alkaline solution, hot rinse, cold rinse, neutralize in an acid (e.g., 0.25 to 0.75 percent sulfuric acid), and rinse with clean overflowing water. This shall be followed immediately by treatment as specified.

A.3.1.3 Aluminum and aluminum alloy surfaces. Aluminum and aluminum alloys shall be cleaned in accordance with A.3.1, followed immediately by treatment as specified.

A.3.1.4 Magnesium alloy surfaces. Magnesium alloy surfaces shall be cleaned in accordance with SAE AMS-M-3171

A.3.1.5 Cadmium surfaces. When specifically justified in the contract or purchase order, cadmium surfaces shall be cleaned in accordance with SAE AMS-QQ-P-416, followed immediately by treatment as specified. Whenever possible, zinc-nickel plating in accordance with MIL-PRF-32647 is a suitable substitution and should be used instead of Cd plating with Cr VI.

A.3.1.6 Wood surfaces. Wood surfaces to be painted shall be dry and cleaned of all dirt, oil, grease, and other foreign substances with an aliphatic hydrocarbon solvent, for example, mineral spirits.

A.3.1.7 Cleanliness. After cleaning, all surfaces shall be kept free from dirt, dust, finger marks, and other contaminants until treated as specified.

CONCLUDING MATERIAL

Custodian:
Army - CR

Preparing activity:
Army - CR

Review activities:
Army - CR4, EA , MI, MR
Air Force - 20, 70, 85, 170, 184

Project MFFP-2020-008

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the accuracy of the information above using the ASSIST Online database at https://assist.dla.mil/.