NOT MEASUREMENT SENSITIVE

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DEPARTMENT OF DEFENSE
MANUFACTURING PROCESS STANDARD

FINISHING OF METAL AND WOOD SURFACES

AMSC N/A AREA MFFP

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MIL-STD-171F

DEPARTMENT OF DEFENSE

WASHINGTON, DC 20301

Finishing of Metal and Wood Surfaces

MIL-STD-171**F**

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.
2. Comments, suggestions or questions on this document should be addressed to: Commander, US Army Armament Research, Development and Engineering Center (ARDEC), ATTN: RDAR-QES-E, Picatinny, NJ 07806-5000, or emailed to ardecstdzn@conus.army.mil. Since contact information can change, you may want to verify the currency of this address using the ASSIST Online database at https://assist.daps.dla.mil .

FOREWORD

The purpose of this standard is to establish finish system codes which link or cross reference specific specification information for finishing and otherwise treating metal and wood surfaces. It also serves as a general guide to the selection of suitable finishing materials, procedures, and systems. It covers both organic (paint, varnish, and the like) and inorganic (metal plating, phosphatized metal, and the like) coatings. Specialized systems particular to individual agencies are covered by drawings, specifications and standards published by those organizations and supplement this standard. Such procurement documents should make direct reference to the applicable specification. For example, MIL-STD-186 covers painting and other finishing of Army Missile weapon systems. Finish system code numbers in the tables shall not be changed in future revisions of this standard, in as much as those code numbers should be referenced on drawings, in contracts and in end items specifications. Where a system in a previous edition of MIL-STD-171 has been deleted from the revision, the system to be used as a substitute is noted in the tables.

For convenience in referencing, all procedures, whether they merely clean a surface, deposit a film, or perform some other desirable function, are cataloged as “finishes”.

As an example of how to use this standard, assume a part is to be finished with chromated zinc plate 0.001 inch (25 µm) thick. Turning to table II, Inorganic Finishes, Plating, we find the designation for this finish to be 1.9.2.1. Hence, the instructions on the drawing would be:

Finish 1.9.2.1 of MIL-STD-171.

In this particular case, it is unnecessary to mention any preliminary steps such as cleaning, because ASTM B633, Coatings of Zinc of Iron and Steel Zinc Plating Electrodeposited referenced in finish 1.9.2.1, provides for this step in these words “It (the basis metal) shall be subjected to such cleaning, pickling, and plating procedures as are necessary to yield deposits as here in after specified”.

Again, assume a 155 mm projectile body is to be finished with olive drab lusterless enamel. According to table XIII, this finish is system 20.2. Assume the preparation for painting to be phosphating (finish 5.1.1). The finishing coat would be a phosphate coating plus an enamel conforming to MIL-DTL-11195. Hence the instructions on the drawing would be:

Finish 5.1.1 plus 20.1 of MIL-STD-171, Olive Drab No. 34088 per FED-STD-595.

The subject matter of this standard is arranged in sections as prescribed in MIL-STD-962 as follows:

1. Scope; 2. Referenced Documents; 3. Definitions; 4. General Requirements;
5. Detail Requirements; and an additional section 6. Notes.

Section 6 on notes presumes that the paints have been laboratory tested against the appropriate products specification and are included in the QPD (Qualified Products Database) prior to application. However, inspection to assure that the painting operations are carried out properly is as important as the quality of the paint itself. For example, inspection of surface preparation prior to painting is of major importance. An excellent paint on an improperly prepared surface may fail prematurely. Again, the thickness of a paint coat has a direct bearing on its durability. Thus, the correct thickness of the dry film of “coating compound, metal pretreatment, Resin-Acid” (MIL-C-8514) as given in this standard is very important. In addition to these two factors, proper mixing and thinning of the paint, suitable weather at the time of painting, uniform application, suitable drying time between coats, and proper handling of painted surfaces, must be carefully observed. Admittedly this type of inspection requires sound judgment derived from long experience.

Compliance with this standard will promote uniformity in the painting and other finishing of military equipment, and will lessen the chances of error and confusion in times of emergency. The net result should be improved protection of military material from deterioration.

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1. SCOPE

1.1 Scope. This standard establishes and updates general finish codes and serves as a general guide to the selection of suitable materials, procedures, and system for cleaning, plating, painting and otherwise finishing of metal and wood surfaces.

1.2 Selection of finishing system. Unless otherwise specified the responsibility for selecting the cleaning method (if necessary), surface treatment, metal coating, paint system or other finish should rest with the activity responsible for the end item. The finishing system should be selected from those listed in this document and should be referenced on drawings, contracts, and item specifications. Finish numbers should be preceded by the word “finish” to avoid possible confusion with paragraph numbers, for example, “finish 5.1.1 plus 20.4”. This does not preclude the acceptance of a proven commercial finish selected by manufacturer, supplier, or contractor and concurred in by the procuring activity. Additional information relative to protective finishes and their selection may be found in the Appendix of this document.

1.3 Conflicts. In the event of conflict between the requirement of this standard and those of the specification on the drawings, the requirements on drawings should have first preference, those of the specifications next, and those of this standard last.

1.4 ASTM Documents. In places where ASTM documents are used, it should be understood that the test requirements are “unless otherwise specified” in lieu of ASTM’s requirements “when specified”.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 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 those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

TT-C-490	-	Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings
TT-F-325	-	Filler, Engraving, Stamped Marking
TT-P-28	-	Paint, Aluminum, Heat Resisting
TT-P-1757	-	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity

MILITARY

MIL-T-152	-	Treatment, Moisture and Fungus-Resistant of Communications, Electronic and Associated Electrical Equipment
MIL-DTL-450	-	Coating Compound, Bituminous, Solvent Type, Black (for Ammunition)
MIL-F-495	-	Finish, Chemical, Black, for Copper Alloys
MIL-PRF-3043		Resin Coating, Permanent, For Engine Components and Metal Parts
MIL-PRF-3150	-	Lubricating Oil, Preservatives, Medium
MIL-PRF-4556	-	Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-DTL-5541	-	Chemical Conversion Coatings on Aluminum and Aluminum Alloy
MIL-C-8507	-	Coating, Wash Primer, (Pretreatment) for Metals, Application of (for Aeronautical use)
MIL-C-8514	-	Coating Compound, Metal Pretreatment, Resin-Acid
MIL-A-8625	-	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-C-10578	-	Corrosion Removing and Metal Conditioning Compound (Phosphoric Acid Base)
MIL-DTL-11195	-	Enamel, Lusterless, Fast Dry, VOC Compliant, (for use on Ammunition and Other Metals)
MIL-C-11796	-	Corrosion Preventive Compound, Petrolatum Hot Application
MIL-L-13808	-	Lead Plating Electrodeposited
MIL-I-13857	-	Impregnation of Metal Castings
MIL-DTL-13924	-	Coating, Oxide, Black, for Ferrous Metals
MIL-DTL-14072	-	Finishes for Ground Based Electronic Equipment

MIL-P-14105	-	Paint Heat-Resisting (for Steel Surfaces)
MIL-DTL-14538	-	Chromium Plating, Black (Electrodeposited)
MIL-PRF-16173	-	Corrosion Preventative Compound, Solvent Cutback, Cold Application
MIL-DTL-16232	-	Phosphate Coatings, Heavy Manganese or Zinc Base
MIL-F-18264	-	Finishes, Organic, Weapons System, Application and Control of
MIL-P-18317	-	Plating, Black Nickel (Electrodeposited) on Brass, Bronze, or Steel
MIL-C-20218	-	Chromium Plating, Electro-Deposited, Porous
MIL-P-22332	-	Paint, Priming, Exterior and Interior (for Ammunition)
MIL-PRF-22750	-	Coating, Epoxy High Solids
MIL-PRF-23236	-	Coating Systems for Ship Structures
MIL-PRF-23377	-	Primer Coating, Epoxy High Solids
MIL-PRF-24667	-	Coating System, Nonskid, for Roll or Spray Application
MIL-PRF-26915	-	Primer Coating, for Steel Surfaces
MIL-PRF-46010	-	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
MIL-I-46058	-	Insulating Compound, Electrical (for Coating Printed Circuit Assemblies)
MIL-R-46085	-	Rhodium Plating, Electrodeposited
MIL-PRF-46147	-	Lubricant, Solid Film, Air Cured (Corrosion Inhibiting)
MIL-E-52891	-	Enamel, Lusterless, Zinc Phosphate, Styrenated 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-64159	-	Coating, Water Dispersible Aliphatic Polyurethane, Chemical Agent Resistant
MIL-PRF-81733	-	Sealing and Coating Compound, Corrosion Inhibitive
MIL-DTL-83488	-	Coating, Aluminum, High Purity
MIL-PRF-85582	-	Primer Coatings: Epoxy, Waterborne

STANDARDS

FEDERAL

FED-STD-595/34088	-	Colors used in Government Procurement / Olive Drab

MILITARY

MIL-STD-186	-	Protective Finishing for Army Missile Weapon Systems
MIL-STD-276	-	Impregnation of Porous Metal Castings and Powdered Metal Components
MIL-STD-865	-	Selective (Brush Plating), Electrodeposition

HANDBOOK

MILITARY

MIL-HDBK-205	-	Phosphate and Black Oxide Coating of Ferrous Metals
MIL-HDBK-2036	-	Preparation of Electronic Equipment Specifications

COMMERCIAL ITEM DESCRIPTIONS

MILITARY

A-A-3003	-	Lacquer, Spraying, Clear and Pigmented for Interior Use
A-A-59146	-	Cleaning Compound, Alkali, Boiling Vat (Soak) or Hydrosteam
A-A-59166	-	Coating Compound, Nonslip (for Walkways)

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Acquisition Streamlining and Standardization Information System website, https://assist.daps.dla.mil/online/start/.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

SSPC (THE SOCIETY OF PROTECTIVE COATINGS)

SSPC-Paint30	-	Weld-Through Inorganic Zinc Primer

(Copies of SSPC Standards may be obtained from SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656 or via their website: http://www.sspc.org/books/bookstore.html.)

MPI (THE MASTER PAINTERS INSTITUTE)

MPI#28	-	Varnish, Marine Spar, Exterior, Gloss (MPI Gloss Level 6)

(Copies of MPI Standards may be obtained from the Master Painters Institute website: http://www.specifypaint.us/MPIStore.asp.)

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

ASTM A153/A153M	-	Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A380	-	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems
ASTM A967	-	Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
ASTM A308/A308M	-	Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot-Dip Process
ASTM B200	-	Standard Specification for Electrodeposited Coatings of Lead and Lead-Tin Alloys on Steel and Ferrous Alloys
ASTM B339	-	Standard Specification for Pig Tin
ASTM B449	-	Standard Specification for Chromates on Aluminum
ASTM B488	-	Standard Specification for Electrodeposited Coatings of Gold for Engineering Uses
ASTM B545	-	Standard Specification for Electrodeposited Coatings of Tin
ASTM B580	-	Standard Specification for Anodic Oxide Coatings on Aluminum
ASTM B633	-	Standard Specification for Electrodeposited Coatings Zinc on Iron and Steel
ASTM B679	-	Standard Specification for Electrodeposited Coatings of Palladium for Engineering Use
ASTM B695	-	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM B700	-	Standard Specification for Electrodeposited Coatings of Silver for Engineering Use
ASTM B733	-	Standard Specification for Autocatalytic (Electroless) Nickel-Phosphorus Coatings on Metal
ASTM D234	-	Standard Specification for Raw Linseed Oil
ASTM D360	-	Standard Specification for Shellac Varnishes
ASTM D1730	-	Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting
ASTM D1732	-	Standard Practices for Preparation of Magnesium Alloy Surfaces for Painting
ASTM D3955	-	Standard Specification for Electrical Insulating Varnishes
ASTM D4080	-	Standard Specification for Trichloroethylene, Technical and Vapor-Degreasing Grade

(Copies of ASTM Standards may be obtained from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or via their website: http://www.astm.org.)

SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)

AMS-M-3171	-	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
AMS-S-8802	-	Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
AMS-C-8837	-	Coating, Cadmium (Vacuum Deposited)
AMS-P-38336	-	Primer Coating, Inorganic, Zinc Dust Pigmented, Self-Curing, for Steel Surfaces
AMS-C-81562	-	Coatings, Cadmium, Tin-Cadmium and Zinc (Mechanically Deposited)
AMS-QQ-C-320	-	Chromium Plating (Electrodeposited)
AMS-QQ-P-416	-	Plating, Cadmium (Electrodeposited)
AMS 2403		Plating, Nickel General Purpose
AMS 2418	-	Plating, Copper
AMS 2423		Plating, Nickel Hard Deposit
AMS 2444	-	Coating, Titanium Nitride Physical Vapor Deposition
AMS 2488	-	Anodic Treatment - Titanium and Titanium Alloys Solution pH 13 or Higher
AMS 2700	-	Passivation of Corrosion Resistant Steels
J1959	-	Corrosion Preventive Compound, Underbody Vehicle Corrosion Protection

(Copies of SAE Standards may be obtained from SAE Customer Service, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or via their website: http://store.sae.org/.)

3. DEFINITIONS

"NOT APPLICABLE"

4. GENERAL REQUIREMENTS

4.1 Materials. All materials used shall conform to the requirements of the applicable specifications. Types, classes, grades, etc., shall be specified on the part drawing by the procuring activity. Materials may be subject at any time to such tests of the pertinent specification as the procuring activity shall prescribe to determine compliance with the applicable specification.

4.1.1 Applicable documents. The specifications and standards referenced in this document shall be the issue in effect on the date of invitation for bids. The finish or system requirement in the tables does not indicate the latest document designation as evidenced by the omission of the revision letter following the document number. *

4.2 Substitution for specified finishes, processes, or materials. If, because of special conditions of service or design, the contractor considers that a finish, method, or material, other than that specified herein, is necessary or more suitable, such finish, method, or material may be used upon written approval of the contracting officer. Unless otherwise specified, the contractor shall demonstrate the suitability of the proposed substitute by submission of samples, test specimens, test data or other evidence as required by the procuring activity.

4.3 Preparation and cleaning of surfaces. Before any plating, metal conversion or painting, all surfaces shall be free from soils and corrosion; for example, grease, oil, solder flux, welding flux, weld spatter, sand, rust, scale, and all other contaminates that might interfere with the intimate application of the finish. Cleaning shall be done immediately before the finishing operation, or suitable precautions shall be taken to ensure that the surfaces remain clean until they are to be finished. When a cleaning procedure is not specified by the procuring activity or as a part of the applicable finish specification, the supplier shall use any cleaning procedure which will produce a clean surface and not adversely affect the surface being cleaned, or the subsequently applied coating.

4.3.1 Castings. Porous castings may require sealing to assure that they are leakproof, and to prevent bleeding-out of treating chemicals which would cause staining or corrosion of the metal surface and damage to the finishing system. Impregnation or sealing of castings should be accomplished after machining and complete removal of oils, greases, and other surface contaminants. Reference should be made to MIL-STD-276 or MIL-I-13857, as applicable.

4.4 Drainage of processing solutions from parts. Where possible, finishing of parts shall be done prior to assembly. For example, aluminum sheet to be lap-seamed or riveted should be anodized prior to the joining operation. Where this is not possible the finishing and fabrication of items shall be handled in such a way that processing solutions shall not become trapped within any part of the assemblies such as lock seams, lap joints, spot welds, rivets, bolts or other places where processing solutions will remain on the part.

4.5 Holes and recesses. If a method other than the one specified is necessary to attain specified thickness requirements in holes or recesses, such a method may be used upon written approval of the procuring activity. The contractor shall demonstrate that his method or methods produce the required results.

4.6 Rivets, lock bolts, blind rivets and threaded fasteners. Rivets, lock bolts, blind rivets, and threaded fasteners shall be assembled using sealant conforming to MIL-PRF-81733. Both the fasteners and the holes shall be coated with sealant. If the fasteners are dissimilar and can result in a direct contact with magnesium, a washer of 5052 aluminum alloy with a minimum overlap of one-eighth to one-fourth inch shall be used in addition to MIL-PRF-81733 sealant. Another sealing compound (----------AMS-S-8802) may be used as a substitute for MIL-PRF-81733 when approved by the procuring activity.

4.7 Compatibility of dissimilar metal couplings. The finishing of metals to be placed in intimate contact when assembled presents a special problem since dissimilar metal contact may results in electrolytic couples which promote corrosion through galvanic action. Table I lists metals and alloys by galvanic potential. To provide corrosion resistance intermetallic couples shall be selected so that there is 0.25 volts or less potential between the two metals or alloys. The proper selection of metals in the design of equipment will result in fewer intermetallic contact problems caused by corrosion at the contact points. For additional information see table XVII of MIL-HDBK-2036.

4.7.1 Reduction of corrosion at intermetallic contact points. Couples of metals selected as in 4.7 shall be painted in accordance with 5.2.4.2 as a minimum requirement. When base metals intended for intermetallic contact form couples exceeding those permitted in 4.7 they shall be plated with those metals which will reduce the potential difference or they shall be suitably insulated with a nonconducting finish such as epoxy primer or other suitable means as specified. Where magnesium is one of the metals of dissimilar metal faying surfaces, the metal shall be separated by epoxy primer and/or sealing compound such as AMS-S-8802 or MIL-PRF-81733.

TABLE I. Galvanic potential of metals in sea water.

	Potential (V) – Relative to Saturated calomel electrode @ 25 c
ANODIC END (Less noble, reactive)	
	Volts
Magnesium	-1.80
Magnesium alloys	-1.60
Zinc	-1.10
Zinc – hot dip, galvanized steel	-1.05
Aluminum – cast, other than silicone type	-0.95
Cadmium – plated and chromate	-0.80
Aluminum – wrought , other than copper type	-0.75
Aluminum – cast, silicon type	-0.75
Iron – wrought carbon or low alloy steels gray or malleable cast iron	-0.70
Aluminum - wrought, copper type	-0.60
Steel, stainless – 13% chromium, active	-0.55
Lead – solid or plated, high level alloys	-0.55
Steel, stainless – 18% chromium, active, 8% nickel	-0.50
Tin – plate, terneplate, tin-lead solders	-0.50
Chromium – plated	-0.45
Steel, stainless – 13% chromium, passive	-0.45
Brass – yellow, naval, cartridge, muntz metal	-0.40
Brass – red, gilding	-0.35
Copper – solid or plated	-0.30
Nickel – solid or plated, passive	-0.30
Monel	-0.30
Steel, stainless – 18% chromium, 8% nickel, passive	-0.20
Silver, solder	-0.20
Steel, stainless – 18%chromium, 12% nickel 3% molybdenum, passive	-0.20
Titanium, commercial	-0.15
Hastelloy C	-0.10
Silver – solid or plate, high silver alloys	0.0
Rhodium	+0.20
Graphite	+0.25
Gold – solid or plated, high gold alloys	+0.25
Platinum – wrought, high platinum alloys	+0.25
CATHODIC END (More noble, unreactive)	

4.8 Organic vapor, acid or alkaline environment. Unpainted parts of cadmium or zinc base alloys or metal parts plated with cadmium or zinc shall not be used in unventilated assemblies where formic/acetic acid or other organic vapors emanating from insulating varnishes, encapsulating compounds or uncured plastic material may contact them. Cadmium and zinc or platings of these metals shall not be used where parts are in contact with acid, unsymmetrical dimethylhydrazine, ammonia or vapors thereof.

4.9 Surfaces not to be painted. Surfaces that do not require paint for protection, and other surfaces where the paint may interfere with the function. The following are examples of surfaces that should be masked or otherwise protected during painting:

(a) Machined surfaces that move with respect to each other, such as threads, slides, bearing contacts and gear teeth.

(b) Electrical parts, such as contacts, relays, bearings, insulators, sockets, plugs, connectors, and terminals. This does not preclude the use of conformal coating in accordance with application requirements of MIL-I-46058.

(c) Plastic and rubber parts such as insulators, mounts, spacers, windshields, etc.

(d) Lubrication (zerk) fittings, cups, holes, etc.

4.10 Dressing operations. Filing, sanding or other dressing operations shall not be done on a part or assembly after it has been finished, except as permitted by drawings, other specifications, the contract or by written approval of the contracting officer. Where filing or the like is permitted, the affected area shall be refinished in accordance with the finish specified for the part.

4.11 Use of steel wool. Steel wool shall not be used in lieu of emery or garnet abrasives to clean aluminum, magnesium alloys or stainless steel surfaces unless adequate precautions are taken to remove embedded steel contaminates.

4.12 Welding, soldering, and brazing. Unless otherwise specified, welding, soldering and brazing shall not be permitted on an assembly after it has been finished with organic coatings. This restriction does not apply if the finish is SSPC-Paint30, Weld through Inorganic Zinc Primer, finish 24.1.

5.1 INORGANIC FINISHES

5.1.1 Metallic Coatings. Metals treated with electrodeposited coatings are subject to hydrogen embrittlement. Hydrogen embrittlement during plating may be avoided by the use of vacuum deposited coatings such as AMS-C-8837 or mechanically deposited coatings such as AMS-C-81562 when specified for use. The basis metal shall be substantially free from flaws or defects that will be detrimental to the appearance or performance of the deposited metal. The surface shall be cleaned and coated as required by the detail specification, drawing or contract. The procuring activity shall select the desired finish from those shown in table II, and shall reference it on drawings, in contracts or in item specifications by the number shown in the table. Unless otherwise specified, steel parts Rockwell C-35 or above hardness, shall not be electrodeposited without a proper stress relief prior to and a hydrogen embrittlement relief treatment after plating or the specific approval of the procuring activity. These parts may be either vacuum coated with cadmium in accordance with AMS-C-8837 or mechanically coated with cadmium or zinc in accordance with AMS-C-81562. There are specific applications which allow plating of steel parts exceeding HRC 35, e.g., chromium plating for high strength steel landing gear parts; reference should be made to the applicable drawing on item specification for exceptions. The plated coatings listed in table II are applied by the usual or conventional plating techniques. Where in-place plating touch-up, build-up, or repair of metallic parts or surfaces are necessary, brush plating techniques may be used. Reference should be made to MIL-STD-865.

5.1.1.1 Stress relief of ferrous alloys. Unless otherwise specified for a particular end item specification or drawing, after forming and hardening, and prior to cleaning and plating, objectionable residual stress in ferrous alloy parts having a hardness greater than Rockwell C-35 shall be relieved by suitable heat treatment. The temperature shall be such that maximum relief is given without hardness being reduced to less than the specified minimum. Stress relief is not necessary where it has been demonstrated that plating has no harmful effects on the plated part. When prestressed wire springs are to be plated, they shall be stress relieved immediately after winding.

5.1.1.2 Embrittlement relief. Unless otherwise specified by a specific end item plating requirement, all steel parts having a hardness of Rockwell C-35 and higher shall be baked at $375^{O} \pm 25^{O}$ F ($191^{O} \pm 14^{O}$ C) for three hours or more as soon after plating as practicable. Plated springs or other parts subjected to flexure shall not be flexed prior to the baking operations. If the plated part (such as cadmium or zinc plate) is to be given a supplementary surface conversion treatment, such as chromate or phosphate, it should be treated to relieve hydrogen embrittlement before applying the conversion treatment, which could be rendered ineffective by baking.

5.1.2 Conversion coatings. Unless otherwise specified, stress relief and hydrogen embrittlement relief for steel parts HRC 39 and above shall be performed to MIL-DTL-16232 or TT-C-490. Hydrogen embrittlement relief treatments above 180^{O} F (82^{O} C) for zinc phosphate and 240^{O} F (115.5^{O} C) for manganese phosphate may adversely affect the corrosion resistance of the coating.

TABLE II. Inorganic finishes, metallic coatings.

	Finish No.	Requirements
*	1.1 Cadmium coatings	
*	1.1.1	Plating, AMS-QQ-P-416, type I, without supplementary treatment
	1.1.1.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.1.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.1.1.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.2	Plating, AMS-QQ-P-416, type II, with supplementary chromate treatment; normal color; not bleached or clear (see finish 6.1.1.2)
	1.1.2.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.2.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.12.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.3	Plating, AMS-QQ-P-416, type III, with supplementary phosphate treatment (see finish 5.1.1)
	1.1.3.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.3.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.1.3.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.4	Cadmium coating (vacuum deposited) AMS-C-8837, type I, without supplementary treatment
	1.1.4.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.4.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.1.4.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.5	Cadmium coating (vacuum deposited) AMS -C-8837, type II, with supplementary chromate treatment, normal color, not bleached or clear (see finish 6.1.1.2)
	1.1.5.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.5.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.1.5.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.6	Cadmium coating (vacuum deposited) AMS -C-8837, type III, with supplementary phosphate treatment (see finish 5.1.1)
	1.1.6.1	Class 1, 0.0005 inch (13 µm) thick
	1.1.6.2	Class 2, 0.0003 inch (7.6 µm) thick
	1.1.6.3	Class 3, 0.0002 inch (5.1 µm) thick
*	1.1.7	Cadmium coating, mechanically deposited, AMS -C-81562, thickness and supplementary treatment as specified
*	1.2 Chromium coatings	
*	1.2.1	Decorative plating, AMS-QQ-C-320, class 1
	1.2.1.1	Type I, bright
	1.2.1.2	Type II, satin
	1.2.2	Engineering plating, AMS-QQ-C-320, class 2; thickness and undercoating, if necessary, as specified
	1.2.2.1	Use finish 1.2.2
	1.2.2.2	Use finish 1.2.2
	1.2.2.3	Use finish 1.2.2
	1.2.2.4	Use finish 1.2.2
	1.2.2.5	Use finish 1.2.2

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes

TABLE II. Inorganic finishes, metallic coatings. (Continued)

	Finish No.	Requirements
	1.2.3	Discontinued: Data to be specified on drawing or in contract
	1.2.4	Black, MIL-DTL-14538
	1.2.5	Porous chromium plating, MIL-C-20218
*	1.3	Lead coatings
*	1.3.1	Electrodeposited lead, MIL-L-13808, type I, without preliminary copper coatings
	1.3.1.1	Class 1, 0.001 inch (25 µm) thick
	1.3.1.2	Class 2, 0.0005 inch (13 µm) thick
	1.3.1.3	Class 3, 0.00025 inch (6.4 µm) thick
	1.3.1.4	0.0015 inch (38 µm) thick
*	1.3.2	Electrodeposited lead, MIL-L-13808, type II, or ASTM B200 with preliminary copper plating 0.000015 inch (0.38 µm) thick
	1.3.2.1	Class 1, 0.001 inch (25 µm) thick
	1.3.2.2	Class 2, 0.0005 inch (13 µm) thick
	1.3.2.3	Class 3, 0.00025 inch (6.4 µm) thick
	1.3.2.4	0.0015 inch (38 µm) thick
*	1.3.3	Hot dip lead coating, ASTM A308/A308M
	1.3.3.1	Type I (low tin content, 93.5% Lead, minimum, 5.0% Tin, minimum, 1.0% Other elements, maximum), salt spray exposure time 48 hours
	1.3.3.2	Type II (medium tin content, 89.0% Lead, minimum, 6.5 – 8.5% Tin, 1.5% Bismuth, maximum, 1.0% Other elements, maximum), salt spray exposure time 96 hours
	1.3.3.3	Type III (high tin content, 67.0% Lead, minimum, 30.0% Tin, minimum, 1.0% Antimony, maximum, 1.0% Other elements, maximum), salt spray exposure time 72 hours
*	1.4	Nickel coatings
*	1.4.1	Decorative plating, AMS 2403; bright or dull finish as specified
	1.4.1.1	Grade C, 0.0010 inch (25 µm) thick
	1.4.1.2	Grade E, 0.0006 inch (15 µm) thick
	1.4.1.3	Grade F, 0.0004 inch (10 µm) thick
	1.4.1.4	Grade G, 0.0002 inch (5 µm) thick
	1.4.1.5	Use finish 1.4.1.2 (grade E)
	1.4.1.6	Use finish 1.4.1.3 (grade F)
	1.4.1.7	Use finish 1.4.1.4 (grade G)
	1.4.1.8	Use finish 1.4.1.2 (grade E)
	1.4.1.9	Use finish 1.4.1.3 (grade F)
	1.4.1.10	Use finish 1.4.1.3 (grade F)
	1.4.1.11	Grade A, 0.0016 inch (40 µm) thick
	1.4.1.12	Grade B, 0.0012 inch (30 µm) thick
	1.4.1.13	Grade D, 0.0008 inch (20 µm) thick
	1.4.2	Engineering plating, AMS 2423, thickness as specified.
*	1.4.3	Electroless nickel coating, ASTM B733
	1.4.3.1	Class 1, as deposited, no heat treatment
	1.4.3.2	Class 2, heat treatment at 260 to 400^{O}C (500 - 752 ^{O}F) to produce minimum hardness of 850 HK100

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes

TABLE II. Inorganic finishes, metallic coatings. (Continued)

	Finish No.	Requirements
	1.4.3.3	Class 3, heat treatment at 180 to 200°C (356 - 392°F) for 2 to 4 h to improve coating adhesion on steel and to provide for hydrogen embrittlement relief
	1.4.3.4	Class 4, heat treatment at 120 to 130°C (248 - 266°F) for at least 1 h to increase adhesion of heat treatable (age-hardened) aluminum alloys and carburized steel
	1.4.3.5	Class 5, heat treatment to 140 to 150°C (284 - 302°F) for at least 1 h to improve coating adhesion for aluminum, non age-hardened aluminum alloys, copper, copper alloys and beryllium
	1.4.3.6	Class 6, heat treatment at 300 to 320°C (572 - 608°F) for 1 h to improve coating adhesion for titanium alloys
	1.4.4	Black nickel coating MIL-P-18317 (undercoat as specified)
	1.5	Use finish 1.2.4
	1.6	Use finish 1.4.4
*	1.7	Silver coating, ASTM B700
	1.7.1	Grade A, Class N, (matte)
	1.7.2	Grade D, Class N, (semibright)
	1.7.3	Grade C, Class N, (bright)
	1.7.4	Grade A, Class S, (matte)
	1.7.5	Grade D, Class S, (semibright)
	1.7.6	Grade C, Class S, (bright)
*	1.8	Tin coatings
	1.8.1	Electrodeposited, ASTM B545, thickness as specified
	1.8.2	Hot-dipped, ASTM B339, thickness as specified
*	1.9	Zinc coatings
*	1.9.1	Electrodeposited zinc, ASTM B633, type I, as plated without supplementary treatment
	1.9.1.1	SC 4, 0.0010 inch (25 µm) thick
	1.9.1.2	SC 3, 0.0005 inch (13 µm) thick
	1.9.1.3	SC 1, 0.0002 inch (5 µm) thick
	1.9.1.4	SC 2, 0.0003 inch (8 µm) thick
*	1.9.2	Electrodeposited zinc, ASTM B633, type II, with supplementary chromate treatment; normal color; not bleached or clear (see finish 6.1.1.2)
	1.9.2.1	SC 4, 0.0010 inch (25 µm) thick
	1.9.2.2	SC 3, 0.0005 inch (13 µm) thick
	1.9.2.3	SC 1, 0.0002 inch (5 µm) thick
	1.9.2.4	SC 2, 0.0003 inch (8 µm) thick
*	1.9.3	Electrodeposited zinc, ASTM B633, type IV, with supplementary phosphate treatment (see finish 5.1.1)
	1.9.3.1	SC 4, 0.0010 inch (25 µm) thick
	1.9.3.2	SC 3, 0.0005 inch (13 µm) thick
	1.9.3.3	SC 1, 0.0002 inch (5 µm) thick
	1.9.3.4	SC 2, 0.0003 inch (8 µm) thick
*	1.9.4	Zinc, hot-dipped galvanizing, ASTM A153/A153M (for hardware)
	1.9.4.1	With chromate treatment, finish 6.1.1.2
	1.9.4.2	With phosphate treatment, finish 5.1.1
	1.9.5	Zinc coating, mechanically deposited, AMS-C-81562 or ASTM B695, thickness and supplementary treatment, as specified

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishe

TABLE II. Inorganic finishes, metallic coatings. (Continued)

	Finish No.	Requirements
	1.9.6	Zinc-Nickel, Electrodeposited, AMS 2417
	1.9.6.1	0.0004-0.0007 inch (10-18 um) thick. Without supplemental treatment.
	1.9.6.2	0.0004-0.0007 inch (10-18 um) thick. With supplemental chromate(finish 6.1.1.2)
	1.9.6.3	0.0004-0.0007 inch (10-18 um) thick. With supplemental phosphate(finish 5.1.1)
	1.9.7	Zinc-Tin, Electrodeposited, AMS 2434
	1.9.7.1	0.0003-0.0005 inch (8-13 um) thick. Without supplemental treatment.
	1.9.7.2	0.0003-0.0005 inch (8-13 um) thick. With supplemental treatment as specified.
*	1.10	Copper coating, electrodeposited, AMS 2418
	1.10.1	Class 1, 0.0010 inch (25 µm) thick
	1.10.2	Class 2, 0.0005 inch (13 µm) thick
	1.10.3	Class 3, 0.0002 inch (5 µm) thick
	1.10.4	Class 4, 0.0001 inch (2.5 µm) thick

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes

TABLE II. Inorganic finishes, metallic coatings. (Continued)

	Finish No.	Requirements
*	1.11	Gold coating, electrodeposited, ASTM B488
*	1.11.1	Type I, 99.7 percent gold, minimum; hardness shall be specified
	1.11.1.1	Class 1, 0.00005 inch (1.3 µm) thick, minimum
	1.11.1.2	Class 2, 0.00010 inch (2.5 µm) thick, minimum
	1.11.1.3	Class 3, 0.00020 inch (5.1 µm) thick, minimum
	1.11.1.4	Class 4, 0.00030 inch (7.6 µm) thick, minimum
	1.11.1.5	Class 5, 0.00050 inch (13 µm) thick, minimum
	1.11.1.6	Class 6, 0.00150 inch (38 µm) thick, minimum
	1.11.1.7	Class 0, 0.00003 inch (0.76 µm) thick, minimum
	1.11.1.8	Class 00, 0.00002 inch (0.51 µm) thick, minimum
*	1.11.2	Type II, 99.0 percent gold, minimum; hardness shall be specified
	1.11.2.1	Class 1, 0.00005 inch (1.3 µm) thick, minimum
	1.11.2.2	Class 2, 0.00010 inch (2.5 µm) thick, minimum
	1.11.2.3	Class 3, 0.00020 inch (5.1 µm) thick, minimum
	1.11.2.4	Class 4, 0.00030 inch (7.6 µm) thick, minimum
	1.11.2.5	Class 5, 0.00050 inch (13 µm) thick, minimum
	1.11.2.6	Class 6, 0.00150 inch (38 µm) thick, minimum
	1.11.2.7	Class 0, 0.00003 inch (0.76 µm) thick, minimum
	1.11.2.8	Class 00, 0.00002 inch (0.51 µm) thick, minimum
*	1.11.3	Type III, 99.9 percent gold, minimum; hardness shall be specified
	1.11.3.1	Class 1, 0.00005 inch (1.3 µm) thick, minimum
	1.11.3.2	Class 2, 0.00010 inch (2.5 µm) thick, minimum
	1.11.3.3	Class 3, 0.00020 inch (5.1 µm) thick, minimum
	1.11.3.4	Class 4, 0.00030 inch (7.6 µm) thick, minimum
	1.11.3.5	Class 5, 0.00050 inch (13 µm) thick, minimum
	1.11.3.6	Class 6, 0.00150 inch (38 µm) thick, minimum
	1.11.3.7	Class 0, 0.00003 inch (0.76 µm) thick, minimum
	1.11.3.8	Class 00, 0.00002 inch (0.51 µm) thick, minimum
*	1.12	Aluminum coating
	1.12.1	Discontinued: Data to be specified on drawing or in contract
	1.12.2	Vacuum deposited aluminum, See 1.12.4
*	1.12.3	High purity aluminum, MIL-DTL-83488, Type I, without supplementary chromate treatment
	1.12.3.1	Class 1, 0.0010 inch (0.026 µm) thick (min)
	1.12.3.2	Class 2, 0.0005 inch (0.013 µm) thick (min)
	1.12.3.3	Class 3, 0.0003 inch (0.008 µm) thick (min)
*	1.12.4	High purity aluminum, MIL-DTL-83488, Type II, with supplementary chromate treatment
	1.12.4.1	Class 1, 0.0010 inch (0.026 µm) thick (min)
	1.12.4.2	Class 2, 0.0005 inch (0.013 µm) thick (min)
	1.12.4.3	Class 3, 0.0003 inch (0.008 µm) thick (min)

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

TABLE II. Inorganic finishes, metallic coatings. (Continued)

	Finish No.	Requirements
*	1.13	Palladium coating
	1.13.1	Electrodeposited palladium, ASTM B679, thickness as specified
*	1.14	Rhodium coating
*	1.14.1	Electrodeposited rhodium, MIL-R-46085
	1.14.1.1	Class 1, 0.000002 inch (0.05 µm) thick, minimum
	1.14.1.2	Class 2, 0.000010 inch (0.25 µm) thick, minimum
	1.14.1.3	Class 3, 0.000020 inch (0.51 µm) thick, minimum
	1.14.1.4	Class 4, 0.000100 inch (2.5 µm) thick, minimum
	1.14.1.5	Class 5, 0.000250 inch (6.4 µm) thick, minimum
*	1.15	Titanium nitride coating AMS 2444
	1.15.1	Class 1, 0.00005 to 0.00015 inch (1.27 to 3.81 µm) thick
	1.15.2	Class 2, 0.00010 to 0.00024 inch (2.54 to 6.10 µm) thick
	1.15.3	Class 3, 0.00025 to 0.00050 inch (6.35 to 12.70 µm) thick

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

5.1.3 Black oxide finishes. The basis metal shall be substantially free from flaws or defects that will be detrimental to the appearance or performance of the finish. The surface shall be cleaned and chemically finished as required by the detail specification, drawing or contract. The design/procuring activity shall select the desired finish from those shown in table III and shall reference it on drawings, in contracts or in item specifications by the number shown in the table.

TABLE III. Inorganic finishes, black oxide.

	Finish No.	Requirements
	3.1	Discontinued
	3.2	Black oxide for copper alloys, MIL-F-495
*	3.3	Black oxide for iron and steel, MIL-DTL-13924
	3.3.1	Class 1, alkaline oxidizing process (for wrought iron, plain carbon, low alloy steels).
	3.3.1.1	Class 1 with MIL-PRF-16173, Grade 3 supplementary oil treatment
	3.3.2	Class 2, alkaline-chromate oxidizing process
	3.3.2.1	Class 2 with MIL-PRF-16173, Grade 3 supplementary oil treatment
	3.3.3	Class 3, fused salt oxidizing process
	3.3.3.1	Class 3 with MIL-PRF-16173, Grade 3 supplementary oil treatment
	3.3.4	Class 4, alkaline oxidizing process

General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

5.1.4 Metal treatments, other than metal deposition or black oxide.

5.1.4.1 Steel, noncorrosion-resistant. Prior to being painted, surfaces of noncorrosion-resistant steel (and iron) shall be cleaned and, unless otherwise specified, shall be pretreated. The cleaning shall leave the surface substantially free from oil, grease, dirt, scale, rust, and other foreign matter. Mechanical cleaning (finish 4.1) shall be used only where contamination from the process will not harm the surface being cleaned or any adjacent ones. The design/procuring activity shall select the method of cleaning from table IV (only if the pretreatment specification does not contain a cleaning requirement) and shall reference it on drawings, in contracts, or in item specifications by the number shown on the table. For porous castings see paragraph 4.3.1.

TABLE IV. Cleaning methods [1/]

Finish No.	Requirements
4.1	Abrasive blasting (Method I of TT-C-490)
4.2	Hot alkaline cleaning - for ferrous metals (Method III of TT-C-490)
4.3	Solvent cleaning (immersion or spray) (Method II of TT-C-490)
4.4	Phosphoric acid cleaning (alcohol, detergent or solvent type with detergent) MIL-C-10578 (Method VI of TT-C-490)
4.5	Use finish 4.4
4.6	Emulsion cleaning (Method IV of TT-C-490)
4.7	Alkaline derusting (Method V of TT-C-490) Use A-A-59260.
* 4.8	Acid pickling
4.8.1	Sulfuric acid pickling. Immerse the part in a solution consisting of 5 volumes of sulfuric acid (66 Baume or 1.84 Sp Gr), 95 volumes of water, and nonfoaming liquid inhibitor, as directed by manufacturer of inhibitor, at a temperature of 170 – 180 ^{O} F (77 – 82 ^{O} C). After removal of scale (indicated by a uniform gray color), remove part from solution, allow to drain, and then rinse in fresh circulating water at 170 – 180 ^{O} F (77 – 82 ^{O} C). Immerse for 2 to 5 minutes in solution of 1 ounce (28 g) of sodium dichromate and ¾ ounce (21 g) of phosphoric acid (75% grade) per gallon (3.8 l) of water, at 190 – 205^{O} F (88 – 96 ^{O} C). Discard rinsing bath when combined sulfuric acid and iron sulfate reaches 2 grams per gallon. After surfaces are thoroughly dry, treat and/or paint as soon as possible. (Note: Where the steel parts will be used under stress cleaning by acid pickling is not recommended because of hydrogen embrittlement. Acid pickling is also not recommended prior to phosphating or painting.
4.8.2	Acid pickling – other methods as specified in detail on drawing or in contract
4.9	Hot alkaline cleaning, nonetching, for nonferrous metals. Use A-A-59146 material in accordance with specification
4.10	Vapor degreasing, N-propylbromide or use a solvent conforming to ASTM D4080

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

[1/] Additional details on cleaning methods and procedures may be found in MIL-HDBK-205 and TT-C-490.

TABLE V. Surface treatments and finishes for iron and steel.
(including corrosion-resisting steel ores)

	Finish No.	Requirements
		Finishes for iron and low-alloy steels
*	5.1	Light phosphate paint base coatings
	5.1.1	Zinc phosphate base, TT-C-490, type I
	5.1.2	Iron phosphate base, TT-C-490, type II
	5.1.3	Zinc phosphate base, TT-C-490, type V
	5.1.4	Nano base, TT-C-490, type IV
	5.2	Pretreatment coating, TT-C-490, type III (wash primer, MIL-P-8514)
*	5.3	Heavy phosphate coatings
*	5.3.1	Manganese phosphate base MIL-DTL-16232, type M
	5.3.1.1	Class 1, supplementary preservative treatment or coating, as specified.
	5.3.1.2	Class 2, supplementary treatment with lubricating oil conforming to MIL-PRF-3150
	5.3.1.3	Class 3, with no supplementary treatment
	5.3.1.4	Class 4, Chemically converted (may be dyed to color as specified) with no supplementary coating or with supplementary coating as specified
*	5.3.2	Zinc phosphate base, MIL-DTL-16232, type Z
	5.3.2.1	Class 1, supplementary preservative treatment or coating, as specified
	5.3.2.2	Class 2, supplementary treatment with preservative conforming to MIL-PRF-16173, grade 3 or MIL-PRF-3150 (as alternate for very small parts)
	5.3.2.3	Class 3, with no supplementary treatment
	5.3.2.4	Class 4, Chemically converted (may be dyed to color as specified) with no supplementary coating or with supplementary coating as specified
	5.3.3	See 5.3.2
	5.3.4	Use finish 5.3.2.4
		Finishes for corrosion-resisting steels
*	5.4	Corrosion-resisting steel not to be painted
	5.4.1	Clean and passivate, AMS 2700 or ASTM A967 (clean ASTM A380)
	5.4.2	Discontinued: Use finish 5.4.1
*	5.5	Corrosion-resisting steel to be painted
	5.5.1	Cleaning, passivation, and pretreatment coating Clean and passivate, AMS 2700 or ASTM A967 (clean ASTM A380) Surfaces to be painted shall be treated by blasting with 80 – 120 mesh aluminum oxide or sand abrasive (primer thickness shall be 1 mil minimum above blast profile)

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

5.1.4.1.1 Surface treatments for noncorrosion resistant steel. Immediately after cleaning, solvents and moisture, if any, shall be completely removed. Unless otherwise specified on the drawing or in the contract ------, the contractor may select the method of removal. Unless otherwise specified, the surfaces shall receive one of the treatments listed in table V immediately after removal of organic and inorganic contaminates. Unless otherwise specified, high strength steel parts (Rockwell C35 or higher) shall not be cleaned, phosphated, pickled or wash primed (finish 5.2) with acid containing materials without the specific approval of the procuring activity. The design/procuring activity shall select the treatment and shall reference it on drawings, in contracts or in item specifications by the number shown in the table.

5.1.4.2 Steel corrosion-resisting. Surfaces of corrosion resisting steel shall be thoroughly cleaned and treated by one or more of the finishes listed in table V. The design/procuring activity shall select the finish and shall reference it on drawings, in contracts, or in item specifications by the number shown in the tables.

5.1.4.3 Zinc and cadmium. Surfaces of zinc and cadmium shall be cleaned by degreasing (finish 4.10) or as otherwise specified. Prior to being painted, any surface without the supplementary treatments describe in table II under finishes 1.1 or 1.9 shall be given one or more of the surface treatments in table VI. The design/procuring activity shall select the cleaning method (unless cleaning is specified in the pretreatment specification) and the finish shall be referenced on drawings, in contracts or in item specifications by the numbers shown in the tables.

TABLE VI. Surface treatments for zinc and cadmium.

	Finish No.	Requirements
*	6.1.1	Type I, prepaint treatment
	6.1.1.1	Method A, phosphate (finish 5.1.1)
	6.1.1.2	Method B, chromate
	6.1.2	Type II, chromate final finish
	6.2	Use Finish 5.1.1, light zinc phosphate coating
	6.3	Use Finish 5.2 pretreatment coating
*	6.4	Phosphoric acid conditioner, MIL-C-10578
	6.4.1	Type I, wash-off
	6.4.2	Type II, wipe-off

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

5.1.4.4 Aluminum and aluminum alloys. Surfaces of aluminum or aluminum alloys shall be cleaned by vapor-degreasing (finish 4.10), nonetching alkaline cleaner (finish 4.9) or as otherwise specified (e.g., non-metallic abrasive blasting). They shall then be given immediately one -------- of the treatments specified in table VII. The design/procuring activity shall select the cleaning method (unless cleaning is covered in the treatment specifications of table VII) and the treatment, and shall reference them on drawings, in contracts or in item specifications by the numbers shown in the tables.

TABLE VII. Surface treatments and finishes for aluminum.

	Finish No.	Requirements
*	7.1	Anodic film, chromic-acid, MIL-A-8625, type I, ASTM B580, type G, or ASTM D1730, type 2, method 2
	7.1.1	Class 1, nondyed
	7.1.2	Class 2, dyed, color to be specified
	7.1.3	Anodic film, chromic-acid, MIL-A-8625, type IB (10W voltage process, 20V)
*	7.2	Anodic film, sulfuric acid, MIL-A-8625, type II or ASTM D1730, type 2, method 1
	7.2.1	Class 1, nondyed
	7.2.2	Class 2, dyed, color to be specified
*	7.3	Chemical film, chromate, MIL-DTL-5541 or ASTM B449
	7.3.1	Type II, Class 1A, for maximum protection against corrosion, painted or unpainted
	7.3.2	Discontinued: Use finish 7.3.1
	7.3.3	Class 3, for protection against corrosion where low electrical resistance is required
	7.4	Use finish 5.2, pretreatment coating
*	7.5	Hard anodic coating, MIL-A-8625, type III, or ASTM B580, type A, thickness 0.002 ± 0.0002 inch (50.8 ± 5 µm) unless otherwise specified.
	7.5.1	Class 1, nondyed
	7.5.2	Class 2, dyed, color to be specified
	7.6 thru 7.9	Discontinued: use finish 7.5

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

5.1.4.5 Magnesium alloys. Surfaces of magnesium alloys shall be cleaned by vapor-degreasing (finish 4.10), nonetching alkaline cleaner (finish 4.9) or as otherwise specified (e.g., non-metallic abrasive blasting). They shall then be given immediately one ------- of the treatments specified in Table VIII. Finish 8.1.2 is very corrosion resistant but is a hard, brittle coating and is subject to chipping, cracking or spalling, therefore is recommended only for rigid parts. The design/procuring activity shall select the finish and shall reference it on drawings, in contracts, or in item specifications by the numbers shown in the table. Finish 8.6 is used for touch-up applications or where dimensional tolerances must be maintained.

5.1.4.6 Copper and copper alloys. Surfaces of copper, brass, and bronze shall be cleaned by vapor-degreasing (finish 4.10), or as otherwise specified. Surfaces that are to be painted shall be treated with finish 3.2 or sandblasted (finish 4.1) just prior to being painted. The thickness of metal removed by blasting should not exceed 0.005 inch (130 µm). The design/procuring activity shall reference the amount on drawings. The design/procuring activity shall select the method of cleaning (unless cleaning is covered in the treatment specifications of table IX) and pretreatment coating and shall reference them on drawings, in contracts, or in item specifications by numbers shown in tables III, IV, VI and IX.

TABLE VIII. Surface treatments for magnesium alloy.

	Finish No.	Requirements
*	8.1	Anodic treatments, ASTM D1732, class II
	8.1.1	Type II, light coating (Dow 17/Tagnite) (0.2 mil)
*	8.1.2	Heavy coating (1.0 – 1.2 mil)
	8.1.2.1	Type III, HAE
	8.1.2.2	Type II, Dow 17/Tagnite
	8.2	Chrome pickle, ASTM D 1732, class I, type I
	8.3	Discontinued: Use finish 8.4
	8.4	Dichromate treatment, ASTM D 1732, class I, type III
	8.5	Galvanic anodizing, Use 8.1
	8.6	Chromic acid brush-on treatment, AMS-M-3171, type VI
	8.7	Pretreatment coating, MIL-C-8514 with 50 percent of specified phosphoric acid
	8.8	Fluoride anodizing process plus corrosion preventative treatment (for castings), AMS-M-3171, type VII
	8.9	Chromate treatment, AMS-M-3171, type VIII

*General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

TABLE IX. Surface treatments for copper and copper alloys.

Finish No.	Requirements
9.1	Phosphoric acid conditioner, use finish 6.4
9.2	Abrasive blasting, use finish 4.1
9.3	Black oxide, use finish 3.2

5.1.4.7 Terneplate. Surfaces of terneplate shall be cleaned by vapor degreasing (finish 4.10), or as otherwise specified. Surfaces that are to be painted shall then be given ------- the treatment- described in table X. The design/procuring activity shall select the method of cleaning (unless cleaning is covered in the pretreatment specification of table X) and the treatment, and shall reference them on drawings, in contracts, or in specifications by the numbers shown in the tables.

TABLE X. Surface treatments for terneplate.

Finish No.	Requirements
10.1	Discontinued: Data to be specified on drawings or in the contract
10.2	Discontinued: Data to be specified on drawings or in the contract
10.3	Pretreatment coating, use finish 5.2
10.4	Discontinued: Data to be specified on drawings or in the contract

5.1.4.8 Tin. Surfaces of tin plate that are to be painted shall be cleaned by vapor degreasing (finish 4.10), or as otherwise specified. Hot-dipped tin plate needs no other pretreatment. Tin plate, electrodeposited from an alkaline stannate bath shall be treated according to finish 11.2. The design/procuring activity shall reference the method of cleaning and the pretreatment on drawings, in contracts or in item specification by the number shown in tables IV and XI.

TABLE XI. Surface treatments for tin plate.

Finish No.	Requirements
11.1	Discontinued: Specify cleaning by finish number in table IV
11.2	Acid etch. Immerse for 5 minutes in hot [160 – 180^{O} F (71 – 82 ^{O} C)] aqueous solution maintained at pH 2 to pH 3 by the addition of a solution containing equal parts by weight of phosphoric acid and chromic acid.
11.3	Pretreatment coating, use finish 5.2

5.1.4.9 Titanium and Titanium alloys. Surfaces of titanium and titanium alloys shall be cleaned with vapor degreasing (finish 4.10), or as otherwise specified. Caution should be exercised in the use of chlorinated vapor degreasing solvents as they can cause stress corrosion cracking of titanium alloys. Surfaces that are to be painted shall then be sandblasted (finish 4.1). When sandblasting is not feasible, the clean surface shall receive finish 5.2, pretreatment coating. The design/procuring activity shall select the method of cleaning and the pretreatment, and shall reference them on drawings, in contracts, or in item specifications by the numbers shown in tables IV and XII.

TABLE XII. Surface treatments for titanium and titanium alloys.

Finish No.	Requirements
12.1	Abrasive blasting, use finish 4.1, by blasting with 80 – 120 mesh aluminum oxide or sand abrasive (primer thickness shall be 1 mil minimum above blast profile)
12.2	Pretreatment coating, use finish 5.2
12.3	Chemical film, chromate, use finish 7.3.1
12.4	Anodic treatment, AMS 2488, Type 2

5.2 Organic finishes.

5.2.1 General painting guidelines. Painting shall be done in clean, dry, well-ventilated spaces. It is preferred that the air temperature be between 60 and 90^{O}F (16 and 32^{O}C) and the relative humidity not over 65 percent. Painting should not be done when the temperature is below 50^{O}F (10^{O}C) or when the humidity is above 85 percent. Materials shall be thoroughly mixed and there shall be no settling or separation of ingredients during painting.

Unless specifically directed otherwise, coatings may be applied by any method that will ensure the application of a smooth, uniform, continuous film, free from dried overspray, runs, sags, blisters, orange peel, or other imperfections.

Unless otherwise specified, for bake type coatings, ample flash off time should be allowed before exposing the coats of paint to a temperature of 200^{O}F (93^{O}C) for 45 minutes. Freshly painted material shall not be exposed to conditions that will harm the paint. Pretreatment coating MIL-C-8514 (finish 5.2) shall be applied either in accordance with that specification or in accordance with MIL-C-8507. Prior to painting magnesium alloy, first apply one of the finishes 8.1 through 8.6 or 8.9. A surface sealing coating can then be applied. AMS-M-3171 cites a surface coating resin, baking type epoxy sealer.

When pretreatment coating MIL-C-8514 (finish 5.2) is applied to magnesium alloy, its phosphoric acid content shall be reduced to 50 percent of that specified in MIL-C-8514. Additional data on the application of finishes can be found in MIL-STD-186 and MIL-F-18264.

5.2.1.1 Previously painted surfaces. Prior to the application of paint to equipment previously painted, the surfaces shall be thoroughly cleaned. If solvent is used it shall be oil free. All loose paint shall be removed. When touching up damaged areas or applying a CARC topcoat to an existing CARC topcoat, the procedure to be followed depends upon the type and condition of the existing finish. Items previously coated with alkyds, lacquers or vinyls must be stripped down to the epoxy primer if present, or to the substrate if not. For rework, polyurethane and epoxy topcoats can only be applied over previously painted epoxy or polyurethane topcoats. When it is necessary to remove the old paint it may be done with solvent-type paint remover, by abrasive blasting (finish 4.1) or other mechanical means. Care shall be used to remove residual remover and solvent from crevices and pockets. Finish 4.1 should be used only where contamination from the process will not harm the surface being cleaned or any adjacent parts. Regardless of the method, no harmful residues shall be left on the surface. Reapplication of the paint system shall be over a proper phosphate, chromate or wash primer pretreatment.

5.2.2 Painting schedule. The first, or priming coat of paint shall be applied as promptly as possible (preferably on the same day but, in any event, within 24 hours) after the surface has been prepared for painting. This requirement shall apply particularly to metal parts that have received a surface pretreatment.

Each coat of paint shall be dry before the application of a succeeding coat. In no case shall the time allowed for drying be less than that specified for the recoating or self-lifting test (if specified) in the applicable specification. For applications of Chemical Agent Resistant Coatings (CARC), see MIL-DTL-53072.

5.2.2.1 Unassembled parts. When circumstances make it desirable, primers and intermediate coats may be applied to unassembled parts of an assembly, the final coat being applied after assembly. Prior to application of final coat, all damage to previously applied paint shall be repaired and all soils deposited on the surface during the assembly shall be removed with a cleaner which will not damage the primer or leave an oil deposit.

5.2.3 Film thickness Unless otherwise specified, the thickness of the dry paint film or one coat application on hardware items shall be as follows:

Specification	Thickness In mils
Pretreatment coating:	
MIL-P-8514	0.3-0.5
Primers:	
TT-P-1757	0.5-1.0
---	---
MIL-PRF-23377[1/]	1.0-2.0
SSPC-30	2.0-3.0
MIL-DTL-53022	1.0-2.0
MIL-DTL-53030	1.0-2.0
MIL-DTL-53084	0.8-1.5
MIL-PRF-85582	0.8-1.5

Other primers (unless otherwise specified)	
Top coats:	
MIL-PRF-22750	1.0-2.0
MIL-DTL-53039	2.0-3.0
MIL-DTL-64159	2.0-3.0
All other top coats, clear or opaque	1.0-2.0
MIL-DTL-11195	1.0-2.0

[1/] For aircraft, film thickness shall be 0.6-0.9 mils.

Note: Where multiple coats are designated in the tables for finishes the dry film thickness shall be multiplied proportionally. One coat shall be applied by a minimum of one double or cross pass of spray gun. One coat shall not be construed as one pass of the spray gun.

5.2.3.1 Film thickness for spectral camouflage. Where spectral camouflage top coats are used, a minimum of 1.8 mils dry film thickness shall be applied. A nominal thickness range of 2-3 mils is best stated to assure meeting the “minimum” requirement.

5.2.4 Faying surfaces.

5.2.4.1 Wood. Wood in contact with metal shall be painted according to finish 26.1 (table XVIII). The opposing metal surface shall receive the required thickness of epoxy primer.

5.2.4.2 Metal. All metallic faying surfaces, whether of similar or dissimilar metals shall receive the required thickness of epoxy primer except at slip fits as mentioned below. Extra protection for dissimilar metals may be provided with sheet or tape. After joining is complete and prior to topcoating, fillet seal all joints where moisture could enter from the top or horizontal with sealant MIL-PRF-81733. At slip fits or press fits, coating with one of the primers listed above, and assembling while wet, affords some protection. However, such treatments cannot take the place of proper sealing and painting of joints.

5.2.5 Adhesion. All paint finishes shall show good adhesion to substrates and to other paint coatings when tested to the applicable paint specification or as required in TT-C-490.

5.2.6 Appearance. All paint systems shall have uniform and satisfactory hiding power, color, gloss and smoothness.

5.2.7 Color. When a paint specification provides for more than one color, the design/procuring activity shall select the color and reference it on drawings, in contracts or in item specifications by the corresponding number in FED-STD-595.

5.2.7.1 Color for Army. Unless otherwise specified, all new material and material undergoing depot overhaul shall be painted with Chemical Agent Resistant Coatings (CARC) conforming to MIL-DTL-53039 in color Green 383 for exterior and with CARC conforming to MIL-PRF-22750 in the selected color for interiors. CARC painted equipment will be stenciled with the acronym “CARC” followed by the year of application. It must be located near the data plate and applied against a camouflage green or brown background, if pattern painted. For exteriors, when other colors are used, they shall be CARC conforming to MIL-DTL-53039 and will usually be color Brown 383 and Black. Other colors of CARC conforming to MIL-DTL-53039 may be used for exteriors of items having special requirements, e.g., Artic or Desert use, ammunition, aircraft, etc. An item of material painted with a three color pattern identifies the coating as CARC. The acceptance of the coating shall not be based on a specific visual color match (see 6.10)

5.2.8 Corrosion resistance. Unless otherwise specified, all primer coatings shall be capable of passing the salt spray requirements of the applicable paint specification when called out for the hardware item.

5.3 Paint finishes for metals. Tables XIII, XIV and XV list most of the paint finishes for metals necessary for a wide variety of military equipment. An overwhelming percentage of metallic surfaces that are painted are steel (iron), or aluminum and magnesium, and their alloys. Tables XIII through XVI provide specifically for these metals, but the finishes are also suitable for zinc, cadmium, copper, tin, terne and titanium. In many finishes, aluminum and magnesium, and their alloys require special primers (see paragraphs 5.3.1 and 5.3.2). Special finishes are listed in table XVI. Acid catalyzed pretreatments (wash primers) shall not be utilized on high strength steel parts (Rockwell C 40 or higher) without specific approval of the design/procuring activity. The design/procuring activity shall select the finish and shall reference it on drawings, in specifications or in contracts by the number shown in the tables.

5.3.1 Priming paint for aluminum.

5.3.1.1 Conventional primers. Primers on the QPD (Qualified Products Database) for meeting TT-P-1757 or MIL-PRF-23377 shall be used in tables XIII, XIV, XV and XVI for priming aluminum. In mixed metal assemblies with aluminum, finish 5.1.1 or 5.2 shall be specified as a pretreatment prior to application of these primers. When MIL-PRF-23377 is used, the contractor shall determine that the topcoat demonstrates adequate compatibility and adhesion to the primer, and that the primer adheres to the substrate.

5.3.1.2 Chemical agent resistant coatings (CARC) primers. MIL-DTL-53022, MIL-DTL-53030, or MIL-DTL-53084 shall be used on pretreated ferrous or non-ferrous metals, or where both ferrous and non-ferrous metals are present in the same assembly, prior to the application of the CARC topcoat. MIL-PRF-23377 or MIL-PRF-85582 may be used on pretreated non-ferrous metals or on mixed ferrous and non-ferrous assemblies (Type I only of MIL-PRF-23377).

5.3.2 Priming paint for magnesium (conventional and CARC). Unless otherwise specified, epoxy primers on the QPD meeting MIL-PRF-23377, MIL-PRF-85582, MIL-DTL-53022, MIL-DTL-53084 or MIL-DTL-53030 shall be used in tables XIII, XIV, XV, and XVI in lieu of MIL-P-11414 in priming magnesium, Unless otherwise specified, MIL-C-8514 (finish 8.7) shall be specified as a minimum pretreatment prior to application of primer and the phosphoric acid content for this pretreatment coating shall be reduced to 50 percent of that required by MIL-C-8514. When MIL-DTL-53022, MIL-DTL-53030, MIL-PRF-23377, MIL-PRF-85582 or MIL-DTL-53084 is used the contractor shall determine that the topcoat demonstrates adequate adhesion to the primer and that the primer adheres to the substrate.

5.3.3 Priming paint for dissimilar metal assemblies. The primer used with dissimilar metal assemblies shall be primer specified for the anodic or less noble member of the assembly. For example, a component composed of magnesium and steel will require the use of primers for magnesium as specified in paragraph 5.3.2. The cathode (steel) shall also be coated prior to assembly with sealant as stated in paragraph 5.2.4.2.

5.3.4 Number of coats of paint, minimum. The number of coats indicated under remarks in the following tables includes primer (if used), for example, finish 20.4 consists of one (1) coat of primer plus one (1) coat of topcoat. The coating thickness shall be as specified in paragraph 5.2.3 for the individual paints.

5.3.5 Applications of CARC/camouflage systems. Unless otherwise specified Green 383 paint shall be applied over the specified primer at a minimum dry film thickness of 1.8 mils to achieve optimum infrared camouflage characteristics. An application of 0.8-1.2 mils dry, which is the normal thickness for a paint topcoat, will only provide visual camouflage. In summary, the 1.8 mil minimum requirement provides visual and infrared camouflage as well as chemical agent resistance. Texture and type of substrate may cause variation in appearance. The acceptance of the coating shall not be based specifically on color (see 6.10).

5.3.5.1 Primer. Primer requirements include thickness, adhesion and corrosion resistance for carbon and low alloy steels. See tests in Section 6.

5.3.5.2 Top coat. Top coat requirements include thickness, adhesion and “degree of cure” for all substrate material. See tests in Section 6.

TABLE XIII. Lusterless paint finishes for metal surfaces.

Finish No.	First Coat	Topcoat(s)	Remarks
20.1		---------- MIL-E-52891	One coat finish for projectiles, grenades, etc.
20.2		MIL-DTL-11195	
20.3	Discontinued	Use finish 20.24	
20.4	Discontinued	Use finish 20.24	
20.5	Discontinued	Use finish 20.24	
20.6	Discontinued	Use finish 20.24	
20.7	Discontinued	Use finish 20.24	
20.8	Discontinued	Use finish 20.24	
20.9	Discontinued	Use finish 20.24	
20.10	Discontinued	Use finish 20.24	
20.11	Discontinued	Use finish 20.24	
20.12	Discontinued	Use finish 20.24	
20.13	Discontinued:	Data to be specified on drawing or in contract	
20.14	Discontinued	Use finish 20.24	
20.15	Discontinued	Use finish 1.9.3.3 plus 20.24	
20.16	Discontinued	Use finish 5.3.1.3 plus 20.24	
20.17	Discontinued	Use finish 5.3.2.3 plus 20.24	
20.18	Discontinued:	Data to be specified on drawing or in contract	
20.19	Discontinued	Use finish 20.24	

TABLE XIII. Lusterless paint finishes for metal surfaces. (Continued)

Finish No.	First Coat	Topcoat(s)	Remarks
20.20	Discontinued	Use finish 20.24	
20.21	Discontinued	Use finish 20.24	
20.22	Discontinued	Use finish 20.24	
20.23	Discontinued	Use finish 20.24	
20.24	MIL-DTL-53022 MIL-DTL-53030[2/]	MIL-DTL-64159 or MIL-DTL-53039	Chemical agent resistant camouflage
20.24.1	Discontinued	Use any combination of primer and top coat(s) in finish 20.24	
20.24.2	Discontinued		
20.24.3	Discontinued		"
20.24.4	Discontinued		"
20.24.5	Discontinued		"
20.24.6	Discontinued		"

[2/] MIL-PRF-23377 (Type I) or MIL-PRF-85582 may be used on aluminum and non-ferrous metals or when both ferrous and non-ferrous metals are present. MIL-DTL-53084 may be used on pretreated ferrous or non-ferrous metals, or on assemblies with a mixture of both.

TABLE XIV. Lusterless paint finishes for metal surfaces.

Finish No.	First Coat	Topcoat(s)	Remarks
21.1	Discontinued	Use finish 20.24	
21.2	Discontinued	Use finish 20.24	
21.3	Discontinued	Use finish 20.24	
21.4	Discontinued	Use finish 20.24	
21.5	Discontinued	Use finish 20.24	
21.6	Discontinued	Use finish 20.24	
21.7	Discontinued		
21.8	Discontinued	Use finish 20.24	
21.9	Discontinued	Use finish 20.24	
21.10	Discontinued	Use finish 20.24	
21.11	Discontinued	Use finish 20.24	
21.12	Discontinued	Use finish 20.24	
21.13	Discontinued	Use finish 20.24	
21.14	Discontinued		
21.15	Discontinued		
21.16	Discontinued	Use finish 1.9.3.3 plus 20.24	
21.17	Discontinued	Use finish 1.9.3.3 plus 20.24	
21.18	Discontinued	Use finish 20.24	
21.19	Discontinued	Use finish 20.24	
21.20	Discontinued	Use finish 20.24	
21.21	Discontinued		

TABLE XV. Full gloss paint finishes for metal surfaces.

Finish No.	First Coat	Topcoat(s)	Remarks
22.1	Discontinued	Use finish 24.17	
22.2	Discontinued	Use finish 24.17	
22.3	Discontinued		
22.4	Discontinued		
22.5	Discontinued		
22.6	Discontinued	Use finish 24.17	
22.7	Discontinued	Use finish 24.17	
22.8	Discontinued	Use finish 24.17	
22.9	Discontinued	Use finish 24.17	
22.10	Discontinued	Use finish 24.17	

TABLE XVI. Special paint finishes for metals.

Finish No.	First Coat	Remarks
23.1	Discontinued: Data to be specified on drawing or in contract	
23.2	Discontinued: Data to be specified on drawing or in contract	
23.3	Discontinued: Data to be specified on drawing or in contract	
23.4	Discontinued: Data to be specified on drawing or in contract	
23.5	Discontinued: Data to be specified on drawing or in contract	
24.1	SSPC-30, 2-3 mil dry film thickness	Weld through primer
24.2	MIL-DTL-450	Asphalt coating for painting the interior of ammunition items prior to being filled with explosives. Not suitable as prime coat for painting
24.3	SAE J1959 (A-A-59295), 1/16 inch minimum dry film thickness	Underbody coating for motor vehicles
24.4	Discontinued: Data to be specified on drawing or in contract	
24.5	TT-P-28 (aluminum) or MIL-P-14105 (colors)	Heat resistant finish for temperatures to 1200^{O}F (648.9^{O}C). MIL-P-14105 is used on exterior of equipment where surfaces exceed 400^{O}F (204.4^{O}C).
24.6	MIL-P-22332	Primer for painting the interior of ammunition items prior to being filled with explosives. It may also be used to prime exterior surfaces
24.7	Discontinued	
24.8	MIL-PRF-22750 (1.5 mils min dry film thickness)	Epoxy topcoat resistant to hydraulic fluid spillage
24.9	MIL-PRF-23377 (2 coats-bake) plus[4/] MIL-C-53039 (2 coats)	For magnesium or other metals subject to sever exposure
24.10	Discontinued	
24.11	Discontinued: Data to be specified on drawing or in contract	
24.12	MIL-PRF-23377 Type I (2 coats)	For missile use on parts requiring primer only. Apply over pretreatment
24.13	Discontinued Use finish 24.5	

TABLE XVI. Special paint finishes for metals. (Continued)

Finish No.	First Coat	Remarks
24.14	MIL-PRF-4556 (2 coat system, 3.0 mil minimum dry film thickness per coat)	Epoxy coating kit for interior of fuel transportation and storage tanks
24.15	MIL-PRF-23236 class 3 (3.0-4.0 mil dry film thickness) or	Zinc rich primer for steel structures that receive severe exposure to adverse weather, condensing moisture, corrosive atmospheres and marine environments
	MIL-PRF-26915 (approximately 2 mil thick)	Organic zinc rich primer for use on bare steel when pretreatment can not be formed
24.16	AMS-P-38336 (3.0-4.0 mil dry film thickness)	
24.17	MIL-PRF-23377[1/], MIL-PRF-22750	For protection of areas exposed to chemicals and solvents or for internal surfaces where chemical agent resistant coating is required
24.18	Discontinued	
24.19	Discontinued	
24.20	Discontinued	
24.21	Discontinued	
24.21.1	Discontinued	
24.21.2	Discontinued	
24.21.3	Discontinued	
24.22	Discontinued	
24.22.1	Discontinued	
24.22.2	Discontinued	
24.23	Discontinued	
24.24	Discontinued	

[1/] MIL-PRF-23377 (type I) or MIL-PRF-85582 shall be used on aluminum and nonferrous surface or when both ferrous and nonferrous materials are present. Alternative Coatings of MIL-DTL-53022, MIL-DTL-53084 or MIL-DTL-53030 may also be used on both ferrous and nonferrous materials or when both materials are present in the same assembly.

5.4 Preservative treatments for wood. Preservative treatments are often required for both painted and unpainted material and must be used when specified. A nonpentachlorophenol 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 oven dry 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 treatment. 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. Table XVII lists two treatments.

5.4.1 Preservative identification. The letters “PA” shall be annotated on all wood products subjected to the PQ80 (copper-8-quinolinolate) preservative treatment in accordance with Table XVII. The letters “PB” shall be annotated on all wood products subject to the M-GARD W550 (zinc naphthenate emulsifiable) preservative treatment in accordance with Table XVII.

5.4.2 Presence of Preservative.

5.4.2.1 Presence of PQ80 (copper-8-quinolinolate) preservative. When treated with PQ80, the box shall show evidence of discoloration when tested as specified in 5.4.4.1 and inspected in accordance with 5.4.3.1. (Do not use for wire-bound box assemblies)

5.4.2.2 Presence of M-GARD W550 (zinc naphthenate emulsifiable) preservative. When treated with M-GARD W550, the box shall show evidence of discoloration when tested as specified in 5.4.4.2 and inspected in accordance with 5.4.3.2.

5.4.3 Inspection for presence of preservative.

5.4.3.1 Presence of PQ80 (copper-8-quinolinolate) preservative. (See 5.4.2.1) Major defect. A sample of 15 boxes shall be selected at random, from each lot, for this test. Four individual boards shall be tested from each box; each board shall be from a different side of the box. The boards shall be tested in accordance with 5.4.4.1. If one board fails to meet the applicable requirement, an additional board may be tested from the box. The failure of two boards to meet the requirements shall constitute the rejection of the box and the lot.

5.4.3.2 Presence of M-GARD W550 (zinc naphthenate emulsifiable) preservative. (See 5.4.2.2) Major defect. A sample of 15 boxes shall be selected at random, from each lot, for this test. Four individual boards shall be tested from each box; each board from a different side of the box. The boards shall be tested in accordance with 5.4.4.2. If one board fails to meet the applicable requirement, an additional board may be tested from the box. The failure of two boards to meet the requirements shall constitute the rejection of the box and the lot.

5.4.4 PQ80 (copper-8-quinolinolate).

5.4.4.1 Presence of PQ80 (copper-8-quinolinolate) preservative.

5.4.4.1.1 Primary method.

5.4.4.1.1.1 Materials and equipment. The materials and equipment required are as follows:

a. PQ80 Check (indicator): The formulation contains 10 parts by weight, of sodium diethyldithiocarbamate trihydrate (see 5.4.7) and 90 parts by weight of distilled water.

b. Dropper: An ordinary glass tube eyedropper may be used.

5.4.4.1.1.2 Test procedure. Two drops of PQ80 Check (indicator) shall be applied to the wood surface at both ends of the board and the middle. An immediate dark brown coloration and the spreading of the drops shall indicate the presence of the PQ80 treatment.

5.4.4.1.2 Alternate method.

5.4.4.1.2.1 Material and equipment. The materials and equipment required are as follows:

a. Reagent. Dissolve 0.5 grams chrome axurol S concentrate (see 5.4.8) and 5.0 grams sodium acetate in 80 mL of distilled water and then dilute further to 500 mL total with distilled water.

b. Sprayer. A common manual aerosol sprayer type applicator shall be used.

5.4.4.1.2.2 Test procedure. Spray solution over surface of dried wood. A deep blue color reveals the presence of copper (from the copper-8-quinolinolate)."

5.4.4.2 Presence of M-GARD W550 (zinc naphthenate) emulsifiable preservative.

5.4.4.2.1 Primary method

5.4.4.2.1.1 Materials and equipment. The materials and equipment required are as follows:

a. Reagent. Dissolve 0.1 grams of dithizone (diphenylthiocarbazone) (see 5.4.9) in 100 mL of chloroform (Note: Solutions should be made daily)

b. Sprayer. A common manual aerosol sprayer type applicator shall be used.

5.4.4.2.1.2 Test procedure. Spray solution evenly over dried wood. The indicator will turn pink when zinc (M-GARD W550) is present. The pink color fades with light.

5.4.4.2.2 Alternate method.

5.4.4.2.2.1 Materials and equipment. The materials and equipment required are as follows:

a. Reagent. (Stock solutions).

(1) 1 gram of potassium ferricyanide dissolved in 100 mL of distilled water.

(2) 1 gram of potassium iodide dissolved in 100 mL of distilled water

(3) Starch indicator solution. Make a paste of 1 gram of soluble starch in about 5mL of distilled water, add 100mL of distilled water and boil for 1 minute with constant stirring. Cool. Note: This solution is subject to biodegradation and therefore should not be used longer than 3 days before a new batch is prepared.

b. Sprayer. A common manual aerosol sprayer or equivalent.

5.4.4.2.2.2 Test procedure. Mix 10mL each of the three stock solutions and pour into the aerosol sprayer. Spray mixture evenly over surface of dried wood. The solution will cause the treated wood to turn a deep blue instantly while the untreated part will retain its original color.

5.4.5 PQ80. Preservative for the 1.8 percent copper-8-quinolinolate solution may be obtained from ISK Biocides, Inc., 416 East Brooks Road, Memphis, TN 38109 or equivalent facility.

5.4.6 M-GARD W550 (zinc hydronap). Preservative for the 3 percent zinc as metal solution, may be obtained from the OM Group, Inc., 811 Sharon Drive, Westlake, OH 44145 or equivalent facility.

5.4.7 Sodium diethylthiocarbamate trihydrate. This reagent may be obtained from Mallinckrodt Baker Inc., 222 Red School Lane, Phillipsburg, NJ 08865, Cage Code 70829 or equivalent facility.

5.4.8 Chrome axurol “s”. This reagent may be obtained from Eastman Chemical Co., 100 N Eastman Rd, Kingsport, TN 37662-5280, Cage Code 74364 or equivalent facility.

5.4.9 Dithizone (diphenylthiocarbazone). This reagent may be obtained from Spectrum Laboratory Products Inc., 14422 S. San Pedro St., Gardena, CA 90248-2027, Cage Code 63415 or equivalent facility.

TABLE XVII. Wood preservative treatments.

Finish No.	Requirements
25.1	Discontinued
25.2	Immersion treatment. Dress the wood part to correct cross sectional dimensions. The wood item of the finished wood parts thereof shall be completely immersed for a minimum of one minute in a solution of wood preservative PQ80 reduced with water down to 1.8 percent copper-8-quinolinolate as solution (see 5.4.5) or an emulsion of wood preservative M-GARD W550 (zinc naphthenate) reduced with water down to 3 percent zinc as metal (see 5.4.6). Alternatively, the wood items or the finished wood parts thereof shall be completely flooded for a minimum of one minute in PQ80 or M-GARD W550 emulsion as to inundate all interior and exterior surfaces (when finished wood parts are dipped). Care shall be exercised to assure complete coverage of all surfaces of the board. After the dip treatment, the items must be air dried (or dried for an appropriate time in a kiln or oven) for a period of 24 hours minimum in a well ventilated area allowing full air circulation around all surfaces of the wood. The wood items must be dried prior to shipment.
25.2.1	Immersion treatment for wire-bound wood box assemblies. Use M-GARD W550 only. The treater/manufacturer will be required to obtain and provide all available safety, health and environmental data e.g., Material Safety Data Sheets.
25.3	Surface treatments. Dress the wood part to correct cross sectional dimensions. Apply one liberal coat of preservative solution. Where practical, apply the solution by immersion for not less than on minute. Otherwise brushing or flooding is acceptable. Allow the treated wood to air-dry or kiln-dry before it is painted.
25.4	Crack prevention. Soak in 25-35% by weight polyethylene glycol 1000 with water.

5.5 Paint finishes for wood. Paint finished for wood are indicated in table XVIII. The treatment of the wood in accordance with one of the systems indicated in table XVII prior to painting provides a more weather resistant finish for exterior exposure and is at the option of the procuring activity. The wood shall not have a moisture content exceeding 20 percent of its oven dry weight. Additional paint finishes for wood are indicated by table XIX.

TABLE XVIII. Paint finishes for wood.

Finish No.	Paint System	Remarks
		LUSTERLESS
26.1	Discontinued	Use finish 20.24
26.2	Discontinued	Use finish 20.24
26.3	Discontinued:	Data to be specified on drawing or in contract
26.4	Discontinued:	Data to be specified on drawing or in contract
26.5	Discontinued:	Data to be specified on drawing or in contract
		SEMIGLOSS
27.1	Discontinued	Use finish 20.24
27.2	Discontinued	Use finish 20.24
27.3	Discontinued	Use finish 20.24
27.4	Discontinued	Use finish 20.24
27.5	Discontinued	Use finish 20.24
27.6	Discontinued	Use finish 20.24
27.7	Discontinued	Use finish 20.24
27.8	Discontinued	Use finish 20.24
27.9	Discontinued:	Data to be specified on drawing or in contract
		FULL GLOSS
28.1	Discontinued	Use finish 24.17
28.2	Discontinued	
28.3	Discontinued	Use finish 24.17
28.4	Discontinued	
28.5	Discontinued	Use finish 24.17
28.6	Discontinued:	Data to be specified on drawing or in contract

TABLE XIX. Miscellaneous paint finishes for wood.

Finish No.	Requirements
29.1	Stain-varnish-wax. Apply olive-drab stain to bare wood. Let dry. Apply two coats varnish, MPI#28. Let each coat dry thoroughly. Apply wax, MIL-W-3688. Let dry. Polish with clean dry cloth.
29.2	Oil-shellac-varnish. Apply linseed oil, ASTM D234, to bare wood. Let stand for 24 hours. Squeegee off excess. Let dry for at least 16 hours. Apply one coat shellac varnish, ASTM D360, orange, grade A. Let dry. Apply two coats of varnish, MPI#28. Let each coat dry thoroughly.
29.3	Oil-shellac-clear lacquer. Apply linseed oil, ASTM D234, to bare wood. Let stand for 24 hours. Squeegee off excess. Let dry for at least 16 hours. Apply three coats of shellac varnish, ASTM D360, bleached, refined. Let each coat dry thoroughly, and rub each coat lightly with fine sandpaper. Apply two coats of clear lacquer, A-A-3003. Let dry between coats.
29.4	Oil-shellac-lacquer. Apply linseed oil, ASTM D234, to bare wood. Let stand for 24 hours. Squeegee off excess. Let dry for at least 16 hours. Apply three coats of shellac varnish, ASTM D360, bleached, refined. Let each coat dry thoroughly, and rub each coat lightly with fine sandpaper. Apply white enamel, MIL-DTL-11195 to a thickness of 2.5 to 3.0 mils, approximately 3 coats, if applied hot, 6 coats if applied cold.
29.5	Preservative-shellac-varnish. Apply finish 25.2 or 25.3 Apply one coat shellac varnish, ASTM D360, orange, grade A. Let dry. Apply one coat of varnish, MPI#28. Let dry.
29.6	Preservative-varnish. Apply finish 25.2 or 25.3. Apply two coats varnish, MPI#28.
29.7	For wood components or small arms. Apply protective finish as specified
29.8	Fire retardant paint. Apply over wood as specified on drawing or in contract

TABLE XX. Miscellaneous finishes not classified.

Finish No.	Requirements
30.1	Filler, graduation, TT-F-325, MIL-PRF-22750 or MIL-DTL-53039
30.1.1	Type I, crayon type; color as specified; black, deep red, white, translucent white
30.1.2	Type II, paste type; color as specified; black, deep red, white, translucent white
30.2[1/]	Non-skid coating, 1/32 to 1/16 inch dry film thickness, MIL-PRF-24667, color as specified
30.3[1/]	Walkway coating and matting, nonslip, A-A-59166, type and color as specified
30.4	Coating, luminescent, phosphorescent
30.4.1	Discontinued, use finish 30.4.2
30.4.2	Luminescent material as specified.
30.4.3	Discontinued, use finish 30.4.2
30.5	ASTM D3955: applied in accordance with MIL-T-152. For moisture and fungus proofing of electronic and associated equipment
30.6	MIL-I-46058, conformal coating for printed wiring boards
30.7	MIL-PRF-46010, Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
30.8	MIL-PRF-46147, Lubricant, Solid Film, Air Cured (Corrosion Inhibiting)

General finish requirement headings shall not be specified. The specific finish numbers(s) only shall be specified. See page iii for the proper method of specifying finishes.

[1/] when non-skid MIL-PRF-24667 (walkway coating and matting) or nonslip (A-A-59166) are required for CARC environments, the sequence of application shall be:

CARC primer/MIL-PRF-24667 or A-A-59166/CARC top coat

6. NOTES

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

6.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance and documentation of all inspection requirements as specified in the specific document of reference. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

6.1.1 Responsibility for compliance. All finishes must meet all requirements specified in sections 3 and 5 of the specific finishing document. The inspections set forth in the specific standardization document (including applicable ASTM specifications) should become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the standard shall not relieve the contractor of his responsibility for assuring that all products or supplies submitted to the Government for acceptance will comply with all requirements of the contract.

6.2 General inspection requirements. All equipment being processed should be inspected at the various stages of cleaning, surface treating, painting, electroplating, and application of other types of finishes and coatings, to ascertain that each process is done in strict accordance with this standard and individual specifications. The inspections and tests covered in this section should not be considered restrictive. Any condition not in full accord with the applicable drawings and specifications should be regarded as defective.

6.2.1 Tests. Materials prior to their use should be subjected to incoming inspection by sampling and testing in accordance with the applicable specification or standard to determine compliance with the requirements of the particular specification. When purchasing camouflage paint, (primer and topcoat) they should be from the QPD in effect at the time of contract award.

6.2.2 Test specimens. Test specimens should be actual production items, or parts of the items. When approved by the contracting officer, coating systems may be tested on an approved number of test panels of the same metal as and coated identically and concurrently with, the manufactured parts they represent.

6.3 Condition of surface prior to painting. All surfaces should be examined just prior to painting to assure that the previously cleaned and pretreated surface is dry and free from soil or contamination of any kind. Poor adhesion of paint should be construed as evidence of improper cleaning. When poor adhesion is indicated, the entire part should be stripped and the part should be refinished.

6.4 Continuity and uniformity of coatings. All coatings, inorganic and organic, should be visually examined for continuity and uniformity.

6.5 Thickness of coatings. All coatings, inorganic and organic, should be checked for dry film thickness as required by this standard, the applicable specification or drawing. The correct dry film thickness of pretreatment coating, MIL-P-8514 is very important. Small metal panels prepared with films, too thick, too thin, and correct, may serve as visual color guides for wash primer. Wet and dry film thickness gages should be used for all other coatings.

6.6 Paint application. The weather and other conditions should be checked during application of paint for conformance to this standard (see 5.2.1).

6.7 Paint Adhesion. Noncamoulage painted items, or specimen panels should be examined for adhesion in accordance with TT-C-490 and MIL-F-14072 after the coated items, or specimen panels, have dried for a minimum of 24 hours for baking systems, and for a minimum of 72 hours for all other non-CARC systems; the CARC/camouflage system requires a minimum of 168 hours drying time prior to testing.

6.8 Color. The color of painted surfaces should be checked against the standard color chip representing the specified color in FED-STD-595 or other standard as furnished by the procuring activity.

6.9 Hiding power, gloss, and smoothness of paint. The painted surfaces (when dry) should be checked visually for hiding power, gloss, and smoothness against samples (when available) furnished or approved by the procuring activity.

6.10 Acceptance of CARC/camouflage painting. The following are inspections that should take place before acceptance can be made on the end item:

(a) Paint manufacturers should obtain a certificate of compliance for spectral reflectance. Total acceptance of this paint should be based only upon whether the individual lot of subject paint was approved by the Army – ARL – Aberdeen Proving Ground Site, Technology Transfer Office Bldg 434, Aberdeen Proving Ground, MD 21005-5425. The acceptance of the color of the topcoat paints should not be based upon a color match to a standard color chip.

(b) Surface cleaning and treatment requirements should comply with MIL-DTL-53072 or TT-C-490.

(c) The CARC/camouflage primer and top coat should be inspected for conformance with the dry film thickness specified in paragraph 5.2.3 of this document.

(d) The top coat of the CARC/camouflage system should be from the QPD and inspected for conformance with the adhesion test specified in paragraph 4.2.3.6 of MIL-DTL-53072 or paragraph 3.5.7 of TT-C-490.

(e) The primer used in the CARC/camouflage system should be from the QPD and tested for conformance with the corrosion resistance specified in paragraph 4.2.3.7 of MIL-DTL-53072 or paragraph 3.5.8 of TT-C-490. The test panels should be tested for dry film thickness prior to the salt spray test. The dry film thickness should conform to the thicknesses specified in paragraph 5.2.3 of this document.

(f) The top coat of the CARC/camouflage system should be inspected for its performance in meeting the degree of cure when tested in the solvent wipe test specified in paragraph 4.2.3.2 of MIL-DTL-53072.

(g) The dry color should be uniform for each individual part, but not necessarily from part to part.

(h) During application, the paint should not be applied in a dry spray. A dry spray would produce a chalky effect which would allow the paint to be removed just by light rubbing.

(i) Isolated marring and scratching from handling should be allowed as long as the primer is not exposed. The slight marring and scratching will not affect the camouflage properties when observed by either visual or infrared photographic means.

6.11 Subject term (key word) listing.

Coating
Paint

6.12 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.

APPENDIX A

Selection of finishes. The finishes should be selected from this standard. The selection of finishes for any particular application should be made in accordance with the following recommendations or as otherwise indicated in this standard. However, final selection shall rest with the activity responsible for the end item.

Exposure classification. For application of finishes to materiel, surfaces are classified by exposure as follows:

Type I (Exposed). Type I surfaces are areas exposed to view when equipment is in operating or traveling conditions or areas not exposed to view but subject to combined direct action of climatic elements. Climatic elements including temperature extremes, humidity extremes, rain, hail, snow, sleet, salt, laden air, industrial atmospheres, direct solar radiation, dust and scouring action of wind-blown sand.

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 interior use for surfaces not identified for possible use in combat zones.

CARC coatings. It should be noted that the Department of the Army has mandated that CARC will be the specified finish for all painted combat materiel (tactical), based on chemical agent resistance, decontamination resistance, visual camouflage, spectral camouflage and improved durability. The material developer or design engineer should specify the CARC paints wherever there is the possibility that the exterior surface may be exposed to combat.

Finish selection. (Guidance)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
FABRICATED FROM FERROUS ALLOYS OTHER THAN CORROSION-RESISTING STEEL						
1. Massive structural parts and assemblies, such as the bodies of trucks, semitrailers, tanks and vans, special purpose vehicles and vans of all types, large brackets, gussets, and assembly hardware	a. Vat pretreated is practical	I	5.1.1			
	b. Vat pretreated is not practical	I	4.4 plus 5.2	20.24		24.17
	c. Parts which have a prior zinc coating and require painting	I	6.1.1.1			
2. Large bolts, nuts, washers, and similar type hardware for assembly of massive structures	a. Parts will require painting after assembly	I	1.1.2.3	20.24 – Paint after assembly		
	b. Parts will not require painting after assembly	I	1.9.4.1			
3. Lesser structural parts and assemblies such as racks, cases, castings, housings, panels, brackets, etc.	a. Vat pretreated is practical	I	5.1.1	20.24		
	b. Vat pretreated is not practical	I	4.4 plus 5.2			
4. Ground rods, stakes, ground plates, etc.	Parts will be used in contact soil	I				

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
5. a. Inside open hollow members		I	4.4	24.8 – Fill and drain		
b. Inside closed hollow members		I	MIL-C-11796 class 1			
6. Small hardware (except threaded parts) such as hinges, fasteners, catches, handles, etc.	a. Parts will be exposed to view when assembled in equipment	I	5.1.1 or (4.4 plus 5.2)			
	b. Parts will not be exposed to view when assembled in equipment	I	5.1.1; 4.4 plus 5.2; 1.1.2.3 or 1.9.4.1	20.24 – Paint after assembly		
	c. Parts will be painted after assembly	I	1.2.1.1, 1.9.2.2 or 1.9.4.1			
	d. Parts will be in view when assembled and cannot be painted	I	1.4.1.2 (Matte finish) ----------			
7. Screws, holes, nuts washers and small special parts	a. Prior to assembly in equipment	I	1.1.2.3			
	b. After assembly in equipment (parts were plated with cadmium or zinc	I	6.1.1.1	20.24 – Paint after assembly		

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
	c. Parts will not be exposed to view after assembly	I	1.1.2.1 or 1.9.4.1	20.24 – Paint after assembly		
	d. Parts will be exposed to view after assembly. Not painted.	I	1.4.1.2 (matte finish) ----------			
8. Any type of part except threaded part	Parts will be subjected to temperatures in excess of 160° F	I or II	1.2.2 or 1.4.2			
9. Hardware such as hinges, catches, clamps, clips, screws, bolts, nuts, washers, etc.	a. Parts will be subjected to temperatures in excess of 160° F	II	5.3.1.3 plus 30.7 or 5.3.1.3 plus 30.8	None		
	b. Parts will not be subjected to temperatures in excess of 160° F	II	1.4.1.3 or 1.2.2			
	c. Parts will be in contact with uncured phenolics or subjected to phenolic vapors (see 4.8)	II	1.2.2 or 1.4.2			

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
10. Wearing parts lubrication in service	a. Parts will be oiled or greased but not during operation	II	5.3.1.3			
	b. Parts will be splash or force-feed lubricated in operation	II	5.3.1.3			
11. Sliding wearing surfaces such as guide rails, etc., requiring electrical conductivity	Parts cannot be lubricated	II	1.4.1.3 or 1.4.1.3 Plus 1.2.2 (1.0 mil thick)			
12. Gears, cams, slides, etc.	a. Parts cannot be lubricated and will not be subjected to high temperature	II	1.1.2.2 or 5.3.1.3 plus 30.7			
	b. Parts cannot be lubricated and will be subjected to high bearing pressure	II	1.4.1.3 or 1.4.1.3 Plus 1.2.2 (1.0 mil thick)			
13. Any type of part	An electrical conductive dissimilar metal contact is required	II	Any plate providing a permissible couple per table I			

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
14. Hardened steel parts such as coil springs, washers, etc., subject to hydrogen embrittlement	Plating is required for protection due to equipment design	I or II	Any type plating required for exposure plus precautions in paragraphs 5.1.1.1 and 5.1.1.2			
15. Steel small arms parts	Parts subjected to temperature in excess of 160 F	I or II	5.3.1.2			
FABRICATED FROM STAINLESS STEEL OR NICKEL-BASE ALLOYS						
20. Large parts	a. Parts will be exposed to view in assembled equipment	I	5.5.1	20.4		24.17
	b. Part will not be exposed to view in assembled equipment	I	5.4.1			
21. Small parts	a. Parts will be exposed to view in assembled equipment	I	5.5.1	20.4		24.17
	b. Part will not be exposed to view in assembled equipment	I	5.4.1			

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Type exposure	Cleaning and pretreatment	Applicable finish recommendations: Paint finishes: Lusterless	Semigloss	Gloss
22. Welded or machined parts made of stainless steel		I	5.4.1			
23. Any type parts		II	No finish required			
24. Open hollow members		I or II		24.8 – Fill and drain		
25. Closed hollow members		I or II	MIL-C-11796 Class 1			
FABRICATED FROM ALUMINUM-BASE ALLOYS						(For applicable primers see paragraph 5.3.1)
30. Massive structural parts and assemblies brackets, gussets, and hardware assemblies	a. Vat pretreatment is practical	I	7.1.1 or 7.2.1	20.24		24.17
	b. Vat pretreatment is not practical	I	7.3.1			
31. Lesser structural parts and assemblies such as racks, cases, castings, housings, panels, brackets, etc.	a. Vat pretreatment is practical	I	7.1.1 or 7.2.1	20.24		24.17
	b. Vat pretreatment is not practical	I	7.3.1 or 5.2			

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
32. Small hardware such as hinges, fasteners, catches, handles, screws, nuts, bolts, washers, etc.	a. Parts will be exposed to view when assembled in the equipment	I	7.1.1, 7.2.1 or 7.3.1	20.24		
	b. Parts will not be exposed to view when assembled in the equipment	I	7.1.1 or 7.2.1 or 7.3.1	20.24		24.17
33. Internal structural parts such as chassis, brackets, inside of panels, clamps, clips, hinges, etc.	a. None	II	7.1.1, 7.2.1 or 7.3.1	20.24		24.17
	b. RF electrical conducting surfaces as required	II	7.3.3	None		
	c. A nonconducting surface is required	II	7.1.1 or 7.2.1	20.24		24.17
	d. Plating is required for contact with dissimilar metals	II	Any plate providing a permanent couple per table I			
34. Open hollow members		I or II	7.3.1	Fill with primer MIL-PRF-23377 and drain		
35. Closed hollow members		I or II	MIL-C-11796, class 1			
36. Parts requiring high wear resistance such as gears, cams, slides, etc.	Parts will be subjected to high bearing pressure	II	7.5.1 plus 30.8	None None		

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
PARTS FABRICATED FROM MAGNESIUM-BASED ALLOYS			(For applicable primers see paragraph 5.3.4)			
40. All large parts fabricated from magnesium alloys.	a. Where vat passivation is practical	I or II	8.1.2.1 or 8.1.2.2 or 8.4	20.24		24.17
	b. Where vat passivation is not practical	I or II	8.6 or 8.7			
41. All parts except those subject to flexing		I or II	8.1.2.1 or 8.1.2.2 or 8.7	20.24		24.17
42. All small parts fabricated from magnesium alloys		I or II	(8.1.1 or 8.4) plus 8.7	20.24		24.17
43. Open hollow members		I or II	4.4	Fill with primer MIL-PRF-23377 and drain		
44. Closed hollow members		I or II	MIL-C-11796, class 1			
45. For magnesium alloys subject to severe exposure (seashore, etc.). Paint system may also be used on steel and aluminum		I or II	8.1.2.1 or 8.1.2.2 or 8.7	20.24		24.17

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes: Lusterless	Semigloss	Gloss
PARTS FABRICATED FROM WOOD						
50. All wood surfaces otherwise specified	a. Where vacuum-soak treatment is practical b. Where vacuum-soak treatment is not practical	I or II	25.2 or 25.3	20.24		24.17
51. Varnished surfaces		I or II		29.6		
52. Panel trucks, trailers, semitrailers, etc.		I or II	25.2 or 25.3	20.24		24.17

Finish selection. (Continued)

Class of part	Conditions affecting finish selection	Applicable finish recommendations: Type exposure	Cleaning and pretreatment	Paint finishes
OTHER APPLICATIONS				
60. Crankcase sealer for cast iron housings of clutch, transmission, differential, final drive, and brakes	(Not applicable where metal to metal contact is made)	II	1/	MIL-PRF-3043
61. Components subject to high temperatures (400 to 1000 F)		I	1/	24.5
62. Storage battery areas	Acid	II	1/	24.17
63. Areas subject to spillage of hydraulic fluid		I of II	1/	24.17
64. Wrinkle finish		II	1/	As Specified
65. Inclosed surfaces subject to spot or roll welding		II	1/	24.1
66. Parts subject to spillage of red fuming nitric acid		I or II	Steel: 4.3 Aluminum: 7.3	As Specified
67. Coating for interior of ammunition items in contact with explosives		II	1/	24.6

1Cleaning and pretreatment shall be as applicable to basis metal.

CONCLUDING MATERIAL

Custodian:
Army – AR
Navy – SH
Air Force – 11

Preparing activity:
Army – AR

(Project MFFP-2010-001)

Review interest:
Army – GL, MI, MR, MD, AV
Navy – AS, OS, YD
Air Force – 99

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