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10 November 1975

SUPERSEDING
MIL-STD-186C(MI)
31 October 1971

MILITARY STANDARD

PROTECTIVE FINISHING FOR ARMY MISSILE WEAPON SYSTEMS

FSC MFFP

DEPARTMENT OF DEFENSE
WASHINGTON, D. C. 20301

Protective Finishing for Army Missile Weapon Systems MIL-STD-186D(MI)

1. This Military Standard is approved by the U.S. Army Missile Command, Department of the Army, and shall be used by that activity. All other military activities are required to employ this standard where suitable.

2. Recommended corrections, additions or deletions should be addressed to:

Commander
US Army Missile Command
ATTN: AMSMI-RCS
Redstone Arsenal, AL 35809

FOREWORD

The purpose of this standard is to establish minimum requirements for the protective finishing systems of rockets, guided missiles, all support equipment, and related materials.

For convenience in referencing, all procedures, whether they merely clean a surface, deposit a film, or perform some other desirable function, are regarded as "Finishes".

Examples of use of this document are as follow: Assume a part is to be finished with chromated cadmium plate, 0.0003 inch thick. Turning to table III, Metallic Coatings, find the designation for this finish to be code 305. The instructions on the drawing would be: "Code 305 MIL-STD-186." It is unnecessary to mention any preliminary steps such as cleaning, because specification QQ-P-416, Plating, Cadmium (Electro-deposited), referenced in code 305, provides for this.

Assume that an aluminum item is to be finished with semigloss enamel. According to table IV, Organic Finishes, the appropriate code might be code 425. In order to designate the color, the drawing would reference code 425, black 27038, or whichever color might be desired. Assume the preparation for painting to be wash primer, code 401, and the primer to be code 402; therefore, the complete process would require cleaning, code 106 from table I, Cleaning Methods, with the drawing instructions reading: "Finish codes 106/401/402/425, black 27038, in accordance with MIL-STD-186."

If circumstances require that parts of an assembly be primed separately and be given final coats after assembly, the instruction might read:

> "Finish Codes: 106/401/402/425, MIL-STD-186, prime before assembly."

Compliance with this standard will promote uniformity in the protective finishing of rockets, guided missiles, all support equipment, and related materials. Compliance with the standard does not relieve the supplier of his responsibility to assure satisfactory operation after storage as specified in his contract.

MILITARY STANDARD

PROTECTIVE FINISHING FOR ARMY MISSILE WEAPON SYSTEMS

1. SCOPE

1.1 Scope. This standard establishes the minimum requirements for procedures, materials, and systems for cleaning, plating, painting and finishing metals, wood electronic materials, parts and assemblies for rockets, guided missiles and components to protect them from deterioration.

1.2 Selection of finishing system. Unless otherwise specified, the responsibility for selecting the cleaning method, surface treatment, metal coating, paint system or other finish shall rest with the activity responsible for the end item. The materials treatment and finishes shall be selected from those listed herein and shall be referenced on drawings, in contracts, and item specifications by the appropriate finish numbers of MIL-STD-186. This does not preclude the acceptance of a proven commercial finish selected by the manufacturer, supplier or contractor and which is concurred in by the procuring activity. Numerous finish codes are contained in tables that are not referenced in the requirement sections, i.e., sealants, conformal coatings, lubricants, adhesives, that are satisfactory for use. Where the finish or corrosion protection processes are not adequately defined, the problem shall be brought to the attention of the procuring activity.

CODE NUMBER SYSTEM

Cleaning Methods	100 Numbers
Surface Treatment	200 Numbers
Metallic Coatings	300 Numbers
Organic Coatings	400 Numbers
Sealing and Bonding	500 Numbers
Encapsulants & Potting	600 Numbers
Lubrication & Preservation	700 Numbers
Miscellaneous	800 Numbers

1.2.1 Cross reference. A cross reference Table IX is provided to relate the present code numbers with the paint finish numbers contained in the superseded "B" issue of this standard.

2. APPLICABLE DOCUMENTS

2.1 Government documents. Issues of the following documents in effect on the date of invitation for bids form a part of the standard to the extent specified herein.

SPECIFICATIONS

FEDERAL

O-T-236	Tetrachloroethylene (Perchloroethylene) Technical Grade
P-C-436	Cleaning Compound, Alkali, Boiling Vat (Soak) or Hydrosteam
QQ-C-320	Chromium Plating (Electrodeposited)
QQ-N-290	Nickel Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-C-490	Cleaning and Pretreatment of Ferrous Surfaces for Organic Coatings
TT-E-527	Enamel, Alkyd, Lustreless
TT-E-529	Enamel, Alkyd, Semigloss
TT-E-776	Ethylene Glycol Monobutyl Ether (for use in organic coatings)
TT-I-558	Ink, Marking Stencil, Opaque, for Nonporous Surfaces (Metals, Glass, etc.)
TT-I-735	Isopropyl Alcohol
TT-L-54	Lacquer, Spraying, Acid Resistant (For Aluminum Surfaces Around Storage Batteries)
TT-P-1757	Primer Coating, Zinc Chromate, Low Moisture Sensitivity
TT-T-266	Thinner, Dope and Lacquer (Cellulose Nitrate)
TT-W-571	Wood Preservation, Treating Practices
TT-W-572	Wood Preservative, Water-Repellant
UU-T-106	Tape, Pressure-Sensitive Adhesive, Masking, Paper
VV-L-800	Lubricating Oil, General Purpose, Preservative (Water Displacing Low Temperature)

DDD-T-539	Towels, Machinery Wiping (laundered)
MMM-A-121	Adhesive, Bonding Vulcanized Synthetic Rubber to Steel
MMM-A-132	Adhesive, Heat Resistant, Airframe Structural Metal-to-Metal
MMM-A-135	Adhesive, Epoxy Resin, Metal
MMM-A-1617	Adhesive, Rubber Base, General Purpose
RIPARPD-636	Coating, Protective, Thermally Fused Epoxy Plastic (for Metal Surfaces)

MILITARY

MIL-T-152	Treatment, Moisture and Fungus Resistant, of Communications, Electronic, and Associated Electrical Equipment
MIL-V-173	Varnish, Moisture-and-Fungus-Resistant (for the Treatment of Communications, Electronic and Associated Electrical Equipment)
MIL-E-463	Ethyl Alcohol (for Ordnance Use)
MIL-F-495	Finish, Chemical, Black for Copper Alloys
MIL-S-974	Surfacer, Sanding
MIL-L-3150	Lubricating Oil, Preservative, Medium
MIL-M-3171	Magnesium Alloy, Processes for Corrosion Protection of
MIL-L-3891	Luminescent Material and Equipment (Non-radioactive)
MIL-A-3920	Adhesive, Optical, Thermosetting
MIL-S-4383	Sealing Compound, Topcoat, Fuel Tank, Buna-N Type
MIL-W-5044	Walkway Compound, Nonslip and Walkway Matting, Nonslip
MIL-W-5050	Walkway Coating, and Matting, Nonslip, Aircraft Application of

MIL-A-5540	Adhesive, Polychloroprene
MIL-C-5541	Chemical Films for Aluminum and Aluminum Alloys
MIL-A-6091	Alcohol, Ethyl, Specially Denatured, Aircraft
MIL-P-6808	Primer Coating, Zinc Chromate, for Aircraft and Missile Applications, Application of
MIL-I-6869	Impregnants for Aluminum Alloy and Magnesium Alloy Castings
MIL-T-7003	Trichlorethylene, Stabilized Degreasing
MIL-P-8116	Putty, Zinc Chromate, General Purpose
MIL-C-8507	Coating, Wash Primer (Pretreatment) for Metals, Application of (for Aeronautical Use)
MIL-I-8574	Inhibitors, Corrosion, Volatile, Utilization of
MIL-A-8576	Adhesive, Acrylic Base, for Acrylic Plastic
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8802	Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
MIL-C-8837	Coating, Cadmium (Vacuum Deposited)
MIL-A-9067	Adhesive Bonding, Process and Inspection Requirements for
MIL-M-10578	Metal Conditioner and Rust Remover (Phosphoric Acid Base)
MIL-T-10727	Tin Plating; Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals
MIL-G-10925	Grease, Automotive and Artillery
MIL-S-11030	Sealing Compound, Noncuring, Polysulfide Base
MIL-S-11031	Sealing Compound Adhesive: Curing (Polysulfide Base)

MIL-P-11414	Primer, Lacquer, Rust-Inhibiting
MIL-T-12664	Ferrous Resistant Paranitrophenol Treatment for Cork Products
MIL-S-13165	Shot Peening of Metal Parts
MIL-C-13924	Coating, Oxid, Black, for Ferrous Metal
MIL-C-14460	Corrosion Removing Compound, Sodium Hydroxide Base, for Electrolytic or Immersion Application
MIL-C-14538	Plating, Black Chromium (Electrodeposited)
MIL-C-14550	Copper Plating (Electrodeposited)
MIL-C-15328	Primer (Wash), Pretreatment, Blue, Formula No. 117-B for Metals
MIL-S-15847	Spray Gun and Accessories, Paint and Dope, Aircraft Use
MIL-T-16070	Treatment, Mildew-Resistant, for Rope
MIL-C-16173	Corrosion Preventive Compound, Solvent Cutback, Cold Application
MIL-E-16738	Enamel, Exterior, White, Vinyl-Alkyd (Formula No. 122-82)
MIL-I-16923	Insulating Compound, Electrical, Embedding
MIL-P-18317	Plating, Black Nickel (Electrodeposited) on Brass
MIL-S-18718	Cleaning Compound, Solvent
MIL-C-20218	Chromium Plating, Electrodeposited, Porous
MIL-T-21330	Treatment: Insect Resistant, for Paper
MIL-I-22110	Inhibitors, Corrosion, Volatile, Crystalline
MIL-S-22473	Sealing, Locking and Retaining Compounds, Single-Component
MIL-C-22750	Coating, Epoxy-Polyamide

MIL-T-23142	Tape, Pressure-Sensitive Adhesive, for Dissimilar Metal Separation
MIL-C-23217	Coat, Aluminum, Vacuum Deposited
MIL-P-23377	Primer, Coating, Epoxy-Polyamide Chemical and Solvent Resistant
MIL-P-23408	Plating: Tin-Cadmium (Electrodeposited)
MIL-C-23411	Corrosion Preventive Compound, Clear
MIL-S-23586	Silicone Rubber Compound, Room Temperature Vulcanizing
MIL-L-25142	Luminescent Material, Fluorescent
MIL-A-25457	Adhesive, Air-Drying, Silicone Rubber
MIL-A-25463	Adhesive, Metallic Structural Sandwich Construction
MIL-C-26074	Coating, Nickel-Phosphorous, Electroless Nickel, Requirements for
MIL-P-27418	Plating, Soft Nickel (Electrodeposited, Sulfonate Bath)
MIL-A-40147	Aluminum Coating (Hot Dip) for Ferrous Parts
MIL-I-43553	Ink, Marking, Epoxy Base
MIL-T-45035	Treatments, Mildew-Resistant, Non-Copper Processes for Cotton Duck, Webbing and Sewed Items
MIL-S-45180	Sealing Compound, Gasket, Hydrocarbon Fluid, Water Resistant
MIL-M-45202	Magnesium Alloys, Anodic Treatment of
MIL-G-45204	Gold Plating, Electrode Deposited
MIL-P-45209	Palladium Plating (Electrodeposited)
MIL-L-46002	Lubricating Oil, Contact and Volatile Corrosion Inhibited

MIL-L-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-E-46096	Enamel, Lusterless Quick-Drying Styrenated Alkyd Type, Solar Heat Reflecting
MIL-A-46146	Adhesive-Sealant, Silicon RTV, Non-Corrosive (For Use with Sensitive Metals and Equipment)
MIL-E-46117	Enamel, Alkyd, Lustreless, Solar Heat Reflecting, Olive Drab
MIL-P-46127	Coating, Gray, Undercoat (Solar Heat Reflecting)
MIL-E-46136	Enamel, Semigloss, Alkyd, Solar Heat Reflecting, Olive Drab
MIL-P-46843	Printed Circuit Assemblies, Design and Production of
MIL-S-46844	Solder Bath Soldering of Printed Wiring Assembly, Automatic Machine Type
MIL-L-46147	Lubricant, Solid-Film, Air-Cured (Corrosion Inhibiting)
MIL-P-46847	Plastic Material, Foamed Polyurethane for Encapsulating Electronic Components
MIL-P-46856	Primer, Coating, Epoxy, Process for Application
MIL-P-47298	Polyurethane Molding Compound Chemically Cured, (Polyether Based)
MIL-D-50000	Dioctyl-P-Phenyleniamine (antiozonant)
MIL-L-52043	Lacquer, Semigloss
MIL-P-52192	Primer, Epoxy
MIL-E-52227	Enamel, Semigloss

MIL-E-52798	Enamel, Alkyd, Camouflage
MIL-E-52835	Enamel, Alkyed, Camouflage (Bake Type)
MIL-N-55392	Nickel-Carbon, Porous, Electrodeposited, for Camouflage
MIL-A-81236	Adhesive, Epoxy Resin with Polyamide Curing Agent
MIL-C-81302	Cleaning Compound, Solvent, Trichloro-trifluoroethane
MIL-C-81309	Compound, Corrosion Preventive, Water Displacing, Ultra-Thin Compound
MIL-T-81533	Trichlorethane, 1,1,1 (Methyl Chloroform) Inhibited, Vapor Degreasing
MIL-C-81562	Coating, Cadmium and Zinc (Mechanically Deposited)
MIL-P-81728	Plating, Tin Lead (Electrodeposited)
MIL-C-81733	Sealing and Coating Compound, Corrosion Inhibitive
MIL-C-81740	Coatings, Aluminum and Aluminum Alloys (Metallic Compound Decomposition)
MIL-C-81751	Coating, Metallic Ceramic
MIL-C-81773	Coating, Polyurethane, Aliphatic Weather Resistant
MIL-C-81797	Coating, Inorganically Bonded Aluminum (Electrophoretically Deposited)
MIL-A-81801	Anodic Coatings for Zinc and Zinc Alloys
MIL-R-81841	Rotary Flap Peening of Metal Parts

STANDARDS

FEDERAL

Fed. Std. No. 595 Colors

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

MILITARY

MIL-STD-276	Impregnation of Porous Nonferrous Metal Castings
MIL-STD-865	Brush Plating, Electrodeposition
MIL-STD-870	Cadmium Plating, Low Embrittlement (Electrodeposition)
MIL-STD-1250	Corrosion Prevention and Deterioration Control in Electronic Components and Assemblies
MIL-STD-1501	Chromium Plating, Low Embrittlement (Electrodeposition)

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this standard to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

ASTM B 253	Preparation of and Electroplating Aluminum Alloys

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103).

NFPA No. 30	Storing
NFPA No. 33	Spray Finishing
NFPA No.	Dip Tank

(Application for copies should be addressed to the National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.)

3. DEFINITIONS

3.1 Definitions. For the purposes of this standard, the following definitions apply.

3.2 Exterior surfaces. The outward or exposed surfaces of the weapon and ground support equipment after all doors, hatches, and access ports are closed shall be considered as exterior surfaces.

3.3 Hermetically sealed. A hermetically sealed system is one that is purged and filled with a dry, inert gas medium, or one where humidity is properly controlled to less than 10 percent relative humidity before sealing. Hermetic sealing shall also be defined as sealed to the extent that there shall be no moisture-laden air or water introduced into the sealed unit or component where subjected to combination of the following:

(a) Moisture resistance testing for 15 days, moisture to be maintained at 95 percent relative humidity and temperature to be cycled at a constant rate between -65°F and 155°F during each 24-hour period.

(b) Leak testing either at a vacuum of 5 pounds per square inch absolute (psia) or at an external pressure of 20 psia for not less than 2 hours. Units of measurement for leaks shall be atmospheric cubic centimeters per second (Atm cc/sec), allowable limit for leaks shall be 10^{-8} Atm cc/sec to 10^{-5} Atm cc/sec.

3.4 Supplier. The supplier is that contractor who has accepted an order from the Government or who has entered into a contract with the Government for the purpose of furnishing parts, components, and assemblies complying with the requirements of this standard.

3.5 Nonreparable. "Nonreparable" is defined as a characteristic of assemblies or components that can only be repaired at the maintenance echelon where purging, evacuation, or pressurization described in 3.3 can be accomplished.

3.6 Similar and dissimilar metals. For the convenience of the user this standard provides tables X and XI as classification of similar bare metals which must be given prime consideration for design purposes and shall, insofar as possible, be used where different metals and platings are in close proximity.

4. GENERAL REQUIREMENTS

4.1 Applicability of requirements. The requirements specified herein shall be applicable to all parts of the weapon system except components which are encapsulated or enclosed in hermetically sealed containers.

4.2 Design usage. Reference to this standard (MIL-STD-186) and callouts of the code numbers on engineering drawings are mandatory. This is required to simplify preparation of drawings and facilitate in updating drawings affected by a major finishing change.

4.3 Materials. Materials shall conform to applicable specifications as specified herein. Materials not covered by applicable specifications shall not be used unless approved by the procuring authority.

4.4 Finishing requirements. Unless otherwise specified, all fabrication operations, such as cutting, drilling, punching, forming, grinding, honing, welding, joining, and any other operations which will affect the finish of the item as well as cleaning (see 4.6), shall be completed prior to the application of any surface treatments, metallic and nonmetallic coatings required for finishing of the metals and alloys.

4.5 Surfaces. Unless otherwise specified, parts shall conform to specified dimensions, surface roughness and condition prior to cleaning, surface treatment and plating. In the case of metals which may respond in a nonuniform manner when metal removal is accomplished with mechanical, chemical, electromechanical methods, appropriate inspection procedures shall be established and used to insure that each part has a uniform surface, including freedom from pits, intergranular attack and significant etching. Where etching has occurred, the degree found shall be demonstrated not to affect the serviceability of the parts.

4.6 Cleaning of surfaces. Prior to application of the surface treatments and metallic coatings covered by this specification, cleaning shall be as specified herein, using materials and processes which have no damaging effect on the metal, including freedom from pits, intergranular attack and significant etching. Appropriate inspection procedures shall be established and used. After cleaning, all parts shall be completely free of corrosion products, scale, paint, grease, oil, flux, and other foreign materials including other metals, and shall be given the specified treatment as soon as practicable after cleaning. Particular care shall be exercised in the handling of parts to assure that foreign metals are not inadvertently transferred to the clean surfaces as may occur when steel is allowed to come into contact with zinc surfaces. Parts having high residual tensile stresses, which are to be cleaned by chemical or electrochemical methods, shall be stress-relieved prior to cleaning. Parts which may have high sustained tensile stresses as the result of assembly, or crevices which can retain cleaning solutions, shall be cleaned prior to assembly.

4.7 Organic soil removal. Vapor degreasing shall be done with trichlorethylene conforming to MIL-T-7003 or perchloroethylene conforming to O-T-236, or trichlorethane 1,1,1 conforming to MIL-T-81553. Carbon tetrachloride shall not be used for degreasing. The use of alcohol and Freon are permitted for cleaning electronic assemblies.

4.7.1 Vapor degreasing procedure. Excess amounts of contaminants shall be removed by wiping off, immersing in or flushing with solutions listed in paragraph 4.7 before lowering the parts into the solution vapors at rate of approximately 11 feet per minute. The vapors shall be allowed to condense on and flow from the surfaces until the item has reached the vapor temperature. Condensation will cease at this point. The parts shall be removed from the vapor at a rate no greater than 11 feet per minute. When visible solid particles adhere to the surface after removal from the vapors, it shall be sprayed with liquid solvent and the vapor treatment repeated until the parts are determined by visual examination to be completely clean. Surfaces may be statically or forced air dried at 180 $\pm$ 20°F for 30 to 60 minutes.

4.8 Painting. Unless otherwise specified herein, interior and exterior surfaces of the weapon system shall be primed and painted.

4.9 Plating. All plating with the exception of nickel, chromium, gold, palladium, platinum, and rhodium shall receive a supplementary treatment such as phosphate, chromate, wash primer, varnish, or conformal coating.

4.10 Metal coupling compatibility. Metals in contact, exhibiting a potential difference greater than allowed by Table X, shall be avoided. If dissimilar metals are necessary, such galvanic couples shall be protected with compatible platings, paint, insulating tapes, or sealants.

4.10.1 Reduction of corrosion at faying surfaces. To prevent corrosion at faying surfaces, particularly joints of corrosion resistant steel, under washers, and at fasteners where there is a lack of oxygen, such faying surfaces shall be sealed with polysulfide, polyurethane, epoxy, silicone rubber, wet primer, or similar sealant.

5. DETAIL REQUIREMENTS

5.1 Cleaning requirements.

5.1.1 General.

5.1.1.1 Corrosion and heat resisting metals. Corrosion and heat resisting metals and alloys shall be cleaned by suitable chemical or mechanical processes, or combinations thereof; except materials that are sensitive to deleterious constituents such as hydrogen, oxygen, nitrogen, and chemical reactions such as hydrogen embrittlement, oxidation, or hardening. These materials shall be cleaned by mechanical processes only.

5.1.1.2 Flux removal. Soldering, welding, and brazing fluxes shall be completely removed. Washing with hot water, alcohol (ethyl alcohol per MIL-A-6091 or MIL-E-463, or isopropyl alcohol per TT-I-735), MIL-C-81302 or solvent, blend of MIL-C-81302 plus 35% isopropyl alcohol per TT-I-735 or a solvent conforming to MIL-T-7003 shall be used. Methyl or wood alcohol (methanol) shall not be used unless approved by the procuring activity.

5.1.1.3 Rinsing. Where materials are employed that show an acid or alkaline reaction, the cleaned parts shall be given a thorough water rinse to remove all acid or alkali prior to further treatment. It is advisable as a final rinsing operation to use distilled or deionized water in order to assure the complete removal of possible contaminants. (See paragraph 5.5.3)

5.1.2 Aluminum and its alloys. Aluminum and its alloys shall be either chemically or mechanically cleaned. The use of uninhibited alkaline materials, such as sodium hydroxide solutions, and of abrasives containing iron, steel wool, copper wool, iron oxide rouge, and steel wire which may become embedded and accelerate corrosion of aluminum alloys is prohibited. Materials conforming to P-C-436 shall be used for chemical cleaning. Sheet stock surfaces to receive anodic conversion coating treatment, sand castings, forging and heat treated stock shall be deoxidized (all oxide film removed with a suitable etchant) after cleaning. Other materials or methods may be used after data proving freedom from damage due to etching, pitting, and stress-corrosion cracking has been submitted to the procuring activity for approval.

5.1.3 High-hardness steels. Steels of Rockwell hardness C40 or over, including carburized and steel surfaces hardened by using other methods, shall be either sand, abrasive grit, steel shot, grit or glass bead blasted for rust or scale removal. Acid pickling or other hydrogen producing processes shall not be used.

5.1.4 Low-hardness steels. Steels of Rockwell hardness less than C40 shall be cleaned in accordance with TT-C-490 or acid pickling in as specified in Table I.

5.1.5 Magnesium and its alloys. Magnesium and its alloys shall be cleaned in accordance with MIL-M-3171.

5.1.6 Titanium and its alloys. For titanium and titanium alloys, vapor degreasing shall not be used, unless approved by the procuring activity. When permitted, the titanium parts shall be pickled after vapor degreasing. Where vapor degreasing is not permitted, a mild alkaline cleaner conforming to P-C-436b shall be used for soil removal from titanium and its alloys. For removal of contamination other than organic soil, titanium and its alloys shall be mechanically cleaned. Other cleaning methods shall not be used, unless approved by the procuring activity.

5.1.7 Copper, brass, cadmium, tin. Cleaning shall be accomplished by applicable method of table I, or as specified.

5.1.8 Wood. Wood surfaces shall be sanded or otherwise mechanically prepared to provide a clean, smooth surface free of waxes, oils, or greases.

5.2 Surface treatments. Codes for surface treatments are enumerated in table II.

5.2.1 Aluminum and aluminum alloys. All aluminum and aluminum alloys, including clad aluminum alloy surfaces, shall be anodized to produce coatings conforming to MIL-A-8625, either type I, type II, or type III. When paint finishing systems are to be applied, chemical films per MIL-C-5541 or wash primer MIL-C-15328 may be substituted for anodic coatings.

5.2.1.1 Electrically conductive surfaces. Anodic coatings shall be omitted from surfaces which require high electrical conductivity at relatively high impedance and high frequencies (RF). These areas shall be coated with an inherent corrosion-resistant metal such as nickel. Chemical films conforming to MIL-C-5541 are prohibited.

5.2.1.2 Surface treatment of assemblies. Surface treatment shall be applied to assemblies and detail parts prior to assembly, except where surface treatment will interfere with the joining processes such as brazing or welding. The assemblies, or parts, shall not contain cavities or crevices where the process solutions can be retained.

5.2.1.3 Touch-up. All surfaces which have the anodic coating or paint system removed or damaged shall be touched up with chemical film conforming to class 1A of MIL-C-5541 by grade B application (brush or swab) with the coating being confined strictly to the damaged area. This operation is required for drilled, punched, or countersunk holes unless other corrosion prevention methods are being used with procuring activity approval.

5.2.2 Magnesium alloys.

5.2.2.1 Method. All magnesium alloys shall receive an anodic coating in accordance with MIL-M-45202, Type I or Type II, Class A. Anodic coating applied in accordance with MIL-M-45202 shall be used for parts subject to abrasion, erosion, or wear. Note: MIL-M-3171 treatments shall only be used for temporary protection or as a paint base.

5.2.2.2 Touch-up. All surfaces which have the anodic coating removed or damaged shall be touched up, using either the type I or type VI process of MIL-M-3171. Damaged or touched-up magnesium surfaces, previously anodically coated in accordance with MIL-A-45202,may be reanodized.

5.2.3 Iron and steel. Immediately following cleaning and before the surfaces show any evidence of rusting or other soiling, all iron and steel surfaces to be painted shall be zinc base phosphate treated in accordance with TT-C-490, type I. Iron base phosphate treatment, TT-C-490, type II, shall be used if the paint system to be applied requires baking at temperatures exceeding 375°F or if the part is to be formed or shaped after phosphating. In the event that phosphating cannot be applied, the clean surfaces shall be coated with wash primer conforming to MIL-C-15328.

5.2.4 Corrosion and heat resistant alloys. The 200, 300, and 400 corrosion-resistant steels shall be passivated by immersion for 30 minutes in a hot (120° to 130°F) aqueous solution containing 20 percent by volume of nitric acid (specific gravity 1.42) and 2 percent by weight of sodium dichromate, rinsed in clean hot water, then thoroughly dried. This is normally the final finish requirement for the 300 grades of stainless steel. The 400 grades of stainless steel will not accept passivation unless fully hardened. Precipitation hardening stainless steels require certain preparations, if and when passivated, such as baking or shot peening. Stainless steels other than the 300 series usually require additional protective finishes. Monel, Inconel, nitrided surfaces shall not be passivated. Monel, Inconel, Hastelloys and titanium do not normally require further treatment after cleaning. Surfaces to be painted shall be coated with wash primer, MIL-C-15328.

5.2.5 Cadmium. Cleaned surfaces shall be kept free of finger marks, dirt, and dust or other contaminants and before corrosion occurs they shall be chromate treated according to QQ-P-416, type II. In the event that chromate treatments cannot be used, the surfaces shall be treated with wash primer MIL-C-15328 prior to applying a paint system.

5.2.6 Copper and copper alloys. Surfaces to be painted shall be given a black oxide coating according to MIL-F-495. The surfaces shall be protected from all contamination prior to the paint application.

5.2.7 Tin. Tin surfaces shall receive a supplementary treatment of organic coating, varnish MIL-V-173, conformal coating MIL-I-46058, or a paint system to prevent corrosion. Tin surfaces shall be coated with wash primer MIL-P-15328 prior to receiving a paint system.

5.2.8 Wood. Wood surfaces shall be treated with wood preservative conforming to composition A of TT-W-572, applied in accordance with applicable treating methods delineated by table II of TT-W-571.

5.3 Metallic coatings. Codes for metallic coatings are enumerated in table III. Metallic coatings shall be applied by electrodeposition, electroless deposition, spray metallized, or vacuum deposited methods in conformance with applicable specifications listed herein. Other processes may be used, subject to approval by the procuring activity. Necessary process and quality control requirements shall be established and technical data developed which shall be submitted to the procuring activity substantiating that the proposed coatings are equivalent to the coatings they are intended to replace relative to corrosion resistance, wear, and other functional characteristics and effect on static and dynamic properties of the metals and alloys to which they are applied. The surface roughness of the surface to be plated shall be as specified on the applicable drawing. All sharp edges shall be broken and all burrs shall be removed before coating.

5.3.1 Cadmium plating. Cadmium plating shall be in accordance with QQ-P-416. Supplementary treatments are required to provide corrosion resistance. Cadmium plating shall not be used in the following applications:

(a) Parts of hydraulic equipment which may be in contact with hydraulic fluid.

(b) Parts in frictional contact where gouging or binding may be a factor, or where corrosion would interfere with normal functioning.

(c) In confined spaces, in the presence of organic materials which give off corrosive and damaging vapors.

(d) On exterior exposed fasteners that are not to receive a subsequent paint or sealer coat.

5.3.2 Vacuum deposited cadmium. Parts which cannot be thoroughly cleaned to insure removal of the plating solution shall be vacuum coated with cadmium in accordance with MIL-C-8837. Vacuum deposited cadmium shall be used for high hardness (Rockwell C-40 or above) subject to the deleterious effects of hydrogen embrittlement.

5.3.3 Chromium plating. Chromium plating shall be used for surfaces subject to wear, abrasion or erosion, except when other surface hardening processes are used such as nitriding and carburizing, or where other wear and abrasion resistant coatings are specified. Chromium plating shall be in accordance with QQ-C-320.

5.3.4 Black chromium plating. Black chromium plating shall be used where nonreflective, abrasion- or corrosion-resistant surfaces are required. Black chromium plating shall be in accordance with MIL-C-14538.

5.3.5 Porous chromium plate. Porous chromium plate is another form of engineering chromium. The process produces etched channels or pores in the surface of the plating to retain miniature pools of lubricating oil. Porous chromium plate shall be in accordance with MIL-C-20218.

5.3.6 Gray nickel-carbon plate. Gray nickel-carbon plate is a durable, protective camouflage finish used on aluminum, copper alloys and steel such as rotary dials and knobs for improved durability under frictional contact. Gray nickel-carbon plate shall be in accordance with MIL-N-55392.

5.3.7 Nickel plating. Nickel plating shall be used for the following applications:

(a) Where temperatures do not exceed 1000°F and other coatings would not be suitable.

(b) To minimize the effects of dissimilar metal contacts, such as mild steel with unplated corrosion-resisting steel or stainless steel in contact with other stainless steel.

(c) As an undercoat for other functional coatings.

(d) As a protective finish on metals without further supplementary treatment.

Nickel plating of parts and surfaces shall be in accordance with QQ-N-290.

5.3.8 Black nickel plating. Black nickel plating shall be in accordance with MIL-P-18317.

5.3.9 Electroless nickel coating. Where specified, electroless nickel coating shall be in accordance with MIL-C-26074. Type II shall be specified where the combination of high hardness and corrosion resistance are required.

5.3.10 Tin, tin alloy plating (coating). Tin, tin alloy coatings shall be used where the properties of these materials present distinct advantages in comparison with other platings.

5.3.10.1 Tin plating (coating). A plating of tin is preferred in lieu of cadmium for use on parts that are subsequently soldered. Where tin plating is specified, it shall be applied in accordance with MIL-T-10727. Caution: Tin plating per type I, MIL-T-10727, shall not be used where electrical or electronic currents are involved, unless the plating is reflowed.

5.3.10.2 Hot-dip tin, tin alloy coatings. Hot-dip or flowed coating are preferred where tin-lead (solder) or tin coating is required. Hot-dip tin shall be in accordance with type II, MIL-T-10727. Hot-dip or flow solder (tin-lead) shall be in accordance with MIL-S-46844(MI). Tin lead plating may be applied per MIL-P-81728.

5.3.11 Tin-cadmium plating. Tin-cadmium plating shall be in accordance with MIL-P-23408. This plating has an advantage over cadmium plating of being more corrosion-resistant.

5.3.12 Silver plating. Silver plating shall be in accordance with QQ-S-365.

5.3.13 Gold plating. Gold plating shall be in accordance with MIL-G-45204. It shall be used only where its electrical and corrosion resistance characteristics are required. Precautions for electrical use are outlined in MIL-STD-1250 and shall be observed.

5.3.14 Rhodium plating. Rhodium plating shall be in accordance with MIL-R-46085.

5.3.15 Palladium plating. Palladium plating shall be in accordance with MIL-P-45209.

5.3.16 Copper plating. Copper plating shall be in accordance with MIL-C-14550.

5.3.17 Selective engineering plating (brush). Selective plating shall be in accordance with MIL-STD-865 or the most recent state-of-the-art approved methods.

5.4 Nonmetallic coatings. Codes for nonmetallic coatings are enumerated in table II.

5.4.1 Phosphate treatments. Phosphate treatments for ferrous parts, which are subsequently to be painted, shall conform to type I of TT-C-490.

5.4.2 Black oxide treatment. Black oxide treatments, conforming to MIL-C-13924 (for ferrous metals) and MIL-F-495 (for copper alloys) are primarily used for decorative purposes, to decrease light reflectance

and on moving parts that cannot tolerate the dimensional build-up of more corrosion-resistant finishes. When black oxide is applied to exterior surfaces, it shall be overcoated with clear lacquer or varnish, with paint or dry-film lubricant. When used on interior surfaces it shall be treated at least with a supplementary oil or wax coating.

5.4.3 Hard anodic coatings for aluminum and its alloys. Where hard anodic coatings are specified, they shall conform to type III of MIL-A-8625.

5.4.4 Metallo-ceramic and ceramic coatings. Metallo-ceramic and ceramic coatings shall not be used prior to approval by the procuring activity. Necessary process and quality control requirements shall be established, and technical data developed which shall be submitted to the procuring activity substantiating that the proposed coatings are entirely satisfactory for the intended use.

5.5 Organic coatings. Codes for organic coatings are enumerated in table IV.

5.5.1 General priming and painting of surfaces. Interior and exterior surfaces of the weapon system shall be painted with the materials specified herein. The painting sequence for all metals shall be preparatory treatment (i.e., anodized, chemical conversion coating, plating, or wash primer), primer, and top coats. These requirements may have been specified previously in the surface treatment paragraphs on the metal surfaces. The use of wash primer on high hardness Rc 40 steels is prohibited. High hardness Rockwell C 40 steels should be cleaned, primed, and top coated.

5.5.2 Equipment and facilities.

5.5.2.1 General. The equipment and facilities used in applying surface finishes shall be suitable and adequate for the purpose and shall be subject to approval of the procuring activity. All safety precautions contained in Standard NFPA Nos. 30, 33, and 34 shall be observed. Painting shall be conducted in properly ventilated spray rooms or areas. Paint spray rooms shall be ventilated by means of a forced draft, effecting at least three complete changes of air every hour. Doors and windows shall be kept closed to exclude dirt and dust. The air shall be introduced into the room in such manner as not to cause turbulence or excessive air currents which would have the effect of causing orange peel in the paint film. Sufficient ventilation shall, however, be maintained to keep dried overspray from settling on surfaces which have already been painted and are still tacky. Where practicable, water-washed exhaust systems or grilled flooring over flowing water should be used. Humidity and temperature indicators shall be installed in a proper operation. Controls shall be employed for humidity and

temperature or for temperature alone if a satisfactory ratio of temperature and humidity can be maintained, as defined herein. To insure that dirt and dust are kept to a minimum, all air entering spray booths or rooms shall be filtered; spray areas are to be kept clean; lint-bearing rags shall not be allowed in such areas; a positive air pressure shall be maintained in the spray booth or room. Lighting conditions shall be in accordance with the 1968 Illuminating Engineering Society Handbook. Lights in the floor, as well as coatings of high light reflectance, shall be used where required to increase lighting efficiency. The paint spray room floors shall be cleaned as frequently as required to insure good housekeeping.

5.5.2.2 Spray equipment. Spray guns and accessories shall conform to MIL-S-15847. All lines shall be kept free from condensation of oil and water by filtering the lines as necessary. It is essential that good housekeeping be practiced. Paint lines shall be cleaned with the same solvent used for thinning the particular paint, at the end of each working day and before changing color or type of paint. Traps shall be included in all air lines used with spray painting equipment in order to entrap any condensed moisture, oil, or foreign materials. Paint pressure pots shall be thoroghly cleaned at least once each week.

5.5.2.3 Personnel safety requirements. All requisite safety precautions shall be taken by painters, under supervision of the Safety Engineer and Industrial Health Officers, with regard to toxicity or industrial health hazards in accordance with existing instructions and regulations. Adequate paint spray respirators, nonsparking shoes, and other safety devices, shall be made available for and used by painters.

5.5.2.4 Electrical grounding. All safety precautions contained in Standard NFPA No. 33 regarding storage of finishing materials and thinners, fire prevention, nonsparking floors and equipment, vapor and explosion-proof requirements, are hereby applicable. The above should not be construed as covering all the requirements, but are illustrative of general safety requirements.

5.5.2.5 Infrared lamps. In the use of infrared lamps, the size of the lamps and their number and spacing shall be such as to effect a distribution of heat as evenly as possible over the painted surface. Adequate precautions shall be taken to avoid concentration of flammable vapors in the immediate area of the infrared lamps and the parts being painted. In addition, wire mesh screen with suitable opening approximately 2 inches wide shall be rigidly fixed about 3 or 4 inches above the lamps to prevent their breakage by falling objects. The individual lamps shall be tightened at frequent intervals to prevent arcing in the sockets.

5.5.3 Preparation of surface.

5.5.3.1 Cleaning, general. All metal surfaces shall be thoroughly clean and dry at the time of application of any paint-type coating. Meticulous cleaning prior to all painting operations cannot be over-emphasized since this factor is of prime importance in obtaining a satisfactory paint finish. Reclaimed paint thinner or other reclaimed thinners shall not be used for cleaning purposes, since these materials may leave a grease film which will cause poor adhesion of the next coat. All abrasive or foreign particles and rough edges shall be removed after sanding or cutting operations before application of paint-type materials. Cleaning shall be accomplished with solvents, detergents, and processes which have no deleterious effect on the surface and which produce surfaces satisfactory for receiving subsequent finishes. After general cleaning to remove the major contaminants, such as paints, oil, soil, grease, etc., the following procedures have been employed successfully. Immediately prior to painting, to obtain a surface capable of supporting an unbroken film of water:

(a) Swab on MIL-S-18718 solvent, disbursed from plunger-type safety cans, using clean cloths complying with the requirements of 5.5.4.12.2. Do not dip the cloths in the container of solvent, as this would contaminate the bulk of the solvent and result in transfer of the contaminant to the surface being prepared for painting.

(b) Next, check the surface with red litmus paper, moistened with distilled water, which should not turn blue. If the litmus paper turns blue, it will be necessary to treat the surface in accordance with the procedure specified in 5.5.3.2.1.

(c) Finally, check the surface for absence of waterbreak, employing the test procedure described in 5.5.3.2.3.

5.5.3.2 Tests for surface condition before painting. The following tests shall be conducted before actual painting:

5.5.3.2.1 Reaction of surface. The surface shall have a neutral or slightly acid reaction. Moistened red litmus paper when applied to the surface shall not turn blue, otherwise a 0.20 to 0.25 percent chromic acid solution shall be applied to achieve a neutral or slightly acid surface. The chromic acid solution shall be permitted to remain on the surface for 2 to 5 minutes followed by a water rinse, and the surface then wiped dry with clean, lint-free cloths meeting the requirements of 5.5.4.12.2.

5.5.3.2.2 Waterbreak test. Representative areas of the surface to be painted shall be tested by the procedure described in 5.5.3.2.3 for ability to support an unbroken film of distilled water.

5.5.3.2.3 Waterbreak test procedures. A mist of distilled water shall be atomized (employing any convenient atomizing device) upon a representative surface of the item to be painted. If the water gathers into discrete droplets within 25 seconds, the surface will be considered to have shown a "water break" and it shall be presumed to be contaminated with impurities such as free alkali, residual detergents, etc., and the surface shall be considered to have failed the test. The surface shall have passed the waterbreak test when the water droplets do not flash-out suddenly, but coalesce into a continuous film of water.

5.5.3.2.4 Special precautions. Solvent cleaning of the surface is a requirement if there is a break in the painting sequence of overnight or longer. A final hand wipe-down shall be performed immediately before painting to insure scrupulous cleanliness and a proper paintable surface. After cleaning, particularly after stripping operations or steam cleaning, special precautions shall be taken to assure thorough draining of all liquids from between faying surfaces, crevices, inspection doors and pockets. Preferably, this shall be accomplished by permitting the part to stand for a sufficient time to permit such drainage, after which the affected area shall be recleaned as necessary. It will be found advantageous to seal crevices, joints, seams, etc. with a plastic composition which will resist the action of paint stripper and cleaners and which subsequently can be easily removed.

5.5.4 Application of paint-type materials.

5.5.4.1 General. Unless otherwise specified herein or in the detail process specifications, paint-type protective coatings may be applied by spraying, brushing, tumbling, roller coating, flow coating, or any other approved method which will insure the application of a smooth, continuous film that is free of imperfections, such as dried overspray, runs, sags, blisters,or orange peel. The use of dipping is subject to such hazards to the quality of the finish that the use of dip coating is strongly discouraged. If, however, dipping of primer is employed, the precautions stated in the applicable specification shall be observed. PRIOR TO SPRAYING OF PAINT, THE SAFETY PRECAUTIONS WITH REGARD TO GROUNDING, AS PRESCRIBED BY 5.5.2.4 SHALL BE STRICTLY ENFORCED.

5.5.4.2 Production spray test panels. Prior to the spraying operation, the suitability of materials for the entire system shall be determined experimentally on panels approximately 4-by-7 inches in size of the same materials to be used for the finished item. The panel shall be coated under prevailing conditions with the finish system that is to be applied. If the finish system applied to the experimental panel is satisfactory, then full-scale operations may begin. Defects found in the experimental application, such as blushing, incorrect thickness, excessive orange peel, sagging, shall be corrected prior to large scale application.

5.5.4.3 Air and weather conditions. Coatings shall not be applied under unfavorable atmospheric conditions, such as high humidity, strong drafts, or low temperatures. In the event the following conditions cannot be met, painting operations shall be suspended until acceptable conditions are re-established. Data for thinning materials for spray application at other than standard room temperature and humidity conditions shall be as specified in the applicable process specifications, or shall be determined experimentally by the applicator. The application of lacquers under other than normal conditions shall be performed in accordance with MIL-F-18264.

5.5.4.3.1 Enamel. For enamel topcoats, epoxy primer, wash primer, and epoxy topcoats, air temperatures shall not be less than 15.5 degrees C (60 degrees F) nor greater than 37.7 degrees C (100 degrees F) and the relative humidity shall not be greater than 90 percent.

5.5.4.3.2 Lacquer. Air temperatures shall not be less than 15.5 degrees C (60 degrees F) nor greater than 32.2 degrees C (90 degrees F) and the relative humidity shall not be greater than 85 percent except in the case where lacquer is used with blush-retardant thinner, then 90 percent is permissible, per paragraph 5.5.4.3.

5.5.4.4 Time of application of paint-type materials.

5.5.4.4.1 First coat. Surfaces shall receive a coat of wash primer, or where other preparatory treatment has been provided previously, the first primer coat shall be applied within a 2-hour maximum period after final cleaning.

5.5.4.4.2 System. Surface coatings shall be applied as follows: Preparatory coating plus primer plus first enamel or lacquer coat shall be applied on the exterior surfaces within 24 hours. Where production operations are suspended for short periods; e.g., over week-ends, holidays, etc., this time may be extended as necessary, but not to exceed 72 hours, provided the adhesion is unaffected thereby, as determined by the wet tape scratch adhesion inspection test described in 6.3.4. OUTDOOR STORAGE OF PRIMED PARTS BEFORE SUBSEQUENT FINISHING OPERATIONS IS PROHIBITED.

5.5.4.4.3 Dry time (wash primer). The wash primer coat shall be allowed to dry a minimum of 60 minutes (although it may dry to handle within a few minutes), but not more than 4 hours prior to application of the paint system. The primer may impair the adhesion of the paint system if prematurely applied. The wash primer shall be capable of resisting removal with the fingernail prior to application of the topcoats.

5.5.4.4.4 Drying time (primer). When specification MIL-P-8585 zinc chromate primer; MIL-P-52192 epoxy primer, or MIL-P-23377 epoxy polyamide primer is used, the minimum and maximum drying times shall be those prescribed by the specifications MIL-P-6808, MIL-P-46856, or MIL-C-22751 respectively. The minimum drying time for lacquer-type primer, under ideal atmospheric conditions shall be at least one hour. Under other conditions, the drying time of the lacquer-type primer shall be extended as necessary to avoid lifting, embrittlement, and adhesion difficulties induced by the high solvency thinners in the topcoats. The precautions outlined in specification MIL-P-6808 to avoid degradation of the primer prior to topcoating, as a result of outdoor exposure, especially in sunlight, shall be scrupulously observed.

5.5.4.4.5 Lacquer topcoating. Lacquer topcoating shall be accomplished in accordance with the requirements of MIL-F-18264.

5.5.4.5 Spraying over bare metal. Wash primer shall be applied in accordance with MIL-C-8507. Zinc chromate primer shall be applied over the wash primer in accordance with MIL-P-6808. Epoxy primer shall be applied in accordance with MIL-P-46856. Epoxy-polyamide primer shall be applied in accordance with MIL-C-22751.

5.5.4.6 Thickness of finish (dry thickness). The film thickness of each single dried coat of paint-type material shall be controlled within the following limits: 0.0003 to 0.0005 inch for wash primer, 0.0006 inch for one coat of zinc chromate primer, 0.0005 to 0.0008 inch for one coat of lacquer, and 0.0008 to 0.0012 inch for one mist plus one wet coat of enamel or varnish, or as specified in the applicable finishing specification. The thickness of two coats of zinc chromate primer shall not exceed 0.0007 inch on surfaces which are to be topcoated. Because of the greatly reduced corrosion-inhibiting effectiveness and coverage in dried film thickness of less than 0.0003 inch, solitary zinc chromate primer films below this thickness should be avoided. The general finish shall be maintained below the maximum thickness specified to avoid cracking, flaking, and checking of the paint finish. Where sanding surfacers is used, which is permitted only on limited areas and subject to the restrictions contained in 5.5.4.11, the thickness of the finish may be increased in these areas by 0.0006 inch. Where insignia and markings are added by painting, the total thickness of finish on these areas may be increased by approximately 0.001 inch. Where decalcomanias are used, the additional thickness is controlled by the decalcomania specification.

5.5.4.7 Application of enamel. A thin coat or "tack" of enamel shall be applied with a light pass of the gun and, while it is still tacky, followed with one full wet coat. No mist coat shall be used after application of the wet enamel coat.

5.5.4.8 Application of lacquer. Lacquer shall be applied in accordance with applicable paragraphs of MIL-F-18264.

5.5.4.9 Application of insignia and markings. Paint used for the application of insignia and markings shall be of the same specification as the background material. On bare metal the insignia shall be applied by means of a complete wash primer plus primer plus topcoat finish scheme. On painted surfaces coated with a complete finish scheme only the top coat material is required for marking. The additional thickness of finish resulting from the application of insignia and marking shall be within the limits prescribed in 5.5.4.6. Workmanship shall be of high quality with clear, sharp outlines of characters. Any method that causes ridges in the application of insignia and markings shall be avoided as much as possible, and the use of a knife or any metal blade on the part in the application procedure is prohibited. Masking tape used in the application of insignia and markings shall be removed as soon as practicable to avoid staining of the painted surfaces.

5.5.4.10 Application of luminescent material. Luminescent material shall be the phosphorescent or fluorescent types in accordance with MIL-L-3891 or MIL-L-25142 and applied as specified by the supplier.

5.5.4.11 Application of walkway material. Walkway material shall be applied as specified by MIL-W-5044 or MIL-W-5050.

5.5.4.12 Use of masking tape. Masking tape used in the application of insignia and markings shall be such as not to impair the properties of, or discolor, the paint film when such tape is used in the particular painting process employed. Absence of these defects shall be verified by examining the painted surface after the tape has been removed and the surface exposed to sunlight for a minimum of 48 hours.

5.5.4.13 Use of sanding surfacer. In small areas on exterior surfaces that are severely scratched or abraded, or where otherwise considered necessary to obtain an aerodynamically smooth exterior surface on limited areas, one coat of MIL-S-974 sanding surfacer will be permitted but the material shall not be applied on the entire part, and its use shall be held to an absolute minimum. Only a minimum thickness of surfacer shall be applied. The material shall be sprayed on after the primer coat and immediately under lacquer or enamel top-coats. Surfacer must not be used for purposes of concealing rivet to screw heads. Allow the surfacer to air-dry at least 16 hours, and then water-sand very smooth with No. 400 wet or dry sandpaper to a thickness of 0.0006 inch. For emergency use, 4 hours air-dry before sanding will be acceptable, provided extreme care is exercised to prevent scratching of the surfaces. Sanding may extend through to the primer coat in spots but care must be exercised to avoid either sanding through to expose bare metal or removing appreciable amounts of the primer coat. After the sanding operation, the part shall be washed with water to remove

grit and foreign matter and allowed to dry thoroughly. The quantity of sanding surfacer shall not exceed 1 quart, diluted for application, per 2,500 square feet of exterior surface.

5.5.4.14 Miscellaneous requirements.

5.5.14.1 Tack-ragging. To insure that all areas to be painted are free from foreign matter, they shall be "tack-ragged" immediately before painting. The "tack-ragging" shall be accomplished on each area to be finished immediately prior to the application of finishing material to that area. Tack-ragging is more applicable to those surfaces requiring sanding to obtain aerodynamically smooth properties.

5.5.4.14.2 Cloths, tack-rags. Only clean, soft, dry, contaminant-free, lint-free, desized, wiping cloths shall be employed in all steps of surface preparation, chemical surface treatment, cleaning, tack-ragging, and painting operations. Use of commercial rental wiping cloths is prohibited. Launderedshop cloths are permitted when the following conditions are met:

(a) The cloths returned from laundering shall be only those originally sent to the laundry by the paint shops of the contractor or overhaul station. Suitable marking by permanent marking inks or dyes shall be employed to insure segregation and return of cloths used for paint shop purposes.

(b) The laundered cloths shall comply with DDD-T-539, plus the following additional requirements: Complete absence of any trace of silicone-type material as determined by laboratory tests, including Soxhlet extraction.

5.5.4.14.3 Touch-up. The use of aerosol spray cans of finishing materials is permitted for touch-up of scratches and heads of fastenings, as well as small areas not exceeding four square inches. When necessary to touch-up or refinish a bare spot on an assembly, the edges of the finish adjacent to the bare spot shall be tapered by sanding. Surfaces previously treated with chemical film shall be touched up in the damaged area with brush-up type 1A treatment per MIL-C-5541; all others shall be spotted-in over the bare area and feathered over the old finish with wash primer. The wash primer will adhere to an acceptable degree to the adjacent finish but the adhesion will not be as outstanding at these edges as it is to bare metal. The wash primer may be omitted if thin scratches or small areas are involved.

5.5.4.14.4 Smoothness of wash primer and primer coats. The wash primer should be dry scuffed with kraft paper in accordance with MIL-C-8507. The primer should be applied as smoothly as possible, since specks and occlusions will carry through to the topcoat and impart undersirable roughness to the final finish. In spraying primer, proper spray techniques are necessary to avoid dry overspray which results in excessive roughness. A properly applied primer film should be free from

streaks, blisters, seeds, excessive silkings, or other irregularities of surface. Dry scuff sanding by hand, using No. 400 or No. 320 sandpaper should be employed, as necessary, to remove specks of roughness that might carry through to the topcoats, but extreme care should be exercised to avoid removing the primer down to the pretreatment coating. Great caution is necessary to avoid gouging the surface of rivets and other protuberances and edges of faying surfaces with the sandpaper, and thus remove the primer to bare metal, which results in subsequent susceptibility to corrosion. Should this be, normal touch-up with primer should be accomplished. Areas where primer presents a distinctly rough appearance not removable by sanding should be stripped and new primer applied to the area involved. If bubbling of the wash primer and subsequent coatings are encountered on magnesium, it may be taken as evidence of inadequate surface treatment of the magnesium. Such bubbled coatings should be removed immediately and the surface given a manually applied chemical surface treatment, followed by wash primer.

5.5.4.14.5 Final dry of the finish. The parts, after painting, shall be permitted to dry in a dust-free atmosphere for a sufficient time prior to moving to insure that the paint is adequately dry and to avoid damage of the finish. Painted parts shall also be protected from condensing moisture and rain during the first 24 hours after painting. This time may vary somewhat depending on the temperature and type of paint used.

6. INSPECTION

6.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in this standard where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

6.2 General inspection requirements. All equipment being processed shall be inspected at the various stages of cleaning, surface treating, 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 shall not be considered restrictive. Any condition not in full accord with the applicable drawings and specifications shall be regarded as defective.

6.2.1 Tests. Materials, prior to their use, shall be inspected, sampled, and tested in accordance with the applicable specification and standard to determine compliance with the requirements of the particular specification.

6.3 Applications inspection.

6.3.1 General. Inspectors shall conduct frequent and regular checks to assure compliance with the requirements of this standard. The items specifically detailed below shall receive the most scrupulous attention by inspectors and quality control personnel.

6.3.2 Cleanliness. Inspectors shall conduct tests just prior to application of paint-type coatings to assure that the surface is thouroughly clean and free from contaminants. The water break test described in 5.5.3.2 and the litmus paper test described in 5.5.3.2.1 shall be applied to questionable surfaces to assure that adequate cleaning and rinsing procedures have been employed and to check for freedom from residual steam-cleaning compound and other cleaning materials residues. If representative test areas fail these tests, the parts shall be returned to the cleaning process and recleaning accomplished.

6.3.3 Hiding power, gloss, and smoothness. Inspectors shall conduct regular and frequent inspection tests to insure smoothness of finish system. Regardless of whether the finish is high gloss or low gloss, specks and bumps detected visually or by drawing the fingertips across the sanded or rubbed finish in various directions shall be removed. There shall be no seediness or roughness caused by dried overspray, improper thinning, or improper gun adjustment. The painted surfaces (when dry) shall be checked visually for hiding power and gloss by comparison with an approved sample.

6.3.4 Adhesion. Inspectors shall conduct regular and frequent wet tape adhesion tests on the exterior finish after drying for a period of at least 48 hours for a lacquer system and 72 hours for an enamel system, the test to be conducted on a sufficient number of samples to assure maintenance of a satisfactory level of adhesion on full production. In performing this test, it is suggested that a piece of cloth or plastic be taped on the area under inspection. The test area shall be kept soaked 24 hours minimum with tap or distilled water. The test areas shall have a minimum diameter of 3 inches. Remove the wet cloth and blot up the surface water. Immediately thereafter, apply a 1-inch strip of tape, UU-T-106 (only newly manufactured tape shall be used),adhesive down. Press the tape down, using two passes of a 2-1/2 pound rubber covered roller or employ firm pressure with the thumb. In general, the tape shall not be applied over rivets, skin laps, holes,

slots, or screw heads. Repeated application of the tape on one area is not necessary. Remove the tape in one abrupt motion and examine the tested area for any paint damage, such as removal of paint at one of the layers of the finish system or removal of the entire system from the metal. Test panels shall be sprayed with the complete finish, along with production items, and scratch wet tape adhesion tests per method 6301.1 of FED-STD Test Method 141 conducted on these panels after a 24-hour soaking period in distilled water, the test to be conducted immediately after removal from the water. Suitable adjustments shall be made in the materials and processes, based on the results of these tests.

6.3.5 Film thickness. Contractors, inspectors, and painters shall exercise constant diligence to maintain careful control of the thickness of paint finish during the production process to insure continual adherence to the established thickness limits as specified in 5.5.4.6. Inspectors shall conduct regular and frequent paint thickness measurements on the production parts with a suitable measuring device on a sufficient number of selected areas to assure maintenance of the overall thickness of the finish below the maxima detailed in 5.5.4.6. The thickness measurement of the paint film shall be taken after all scuffing and sanding operations are completed on the paint coat being measured. When the painter has the gun adjusted and is ready to start spray painting, he shall first spray paint test panels as prescribed in 5.5.4.2. The thickness of the paint should then be measured on the panels with a micrometer or an Ames thickness gauge or equivalent, allowing 0.0001 to 0.0002 inch for further contraction in thickness to be expected during the drying of the paint. If the film thickness exceeds the allowable maximum, as specified above, necessary adjustments shall be made of the spray gun, paint viscosity, etc., and the trial spraying repeated until proper thickness is obtained. Then the painters may proceed with painting. The approved sprayed test panels may also be utilized for verifying the process for quality control and qualifying the individual painters.

6.3.6 Sampling frequency. Sampling for the inspection tests of Section 6 shall be accomplished: (a) When a new supplier furnishes materials used in the product process, (b) when evidence occurs of deterioration in the quality of the finish, (c) when a change of process or sequence is affected, and (d) a minimum of one inspection a week for those weeks when painting facilities are used. The quality control tests of 6.3.2, 6.3.3, 6.3.4 and 6.3.5 of this standard shall be conducted at least once a week in the production painting of parts, as a minimum requirement. The results of the inspection tests shall be reviewed by the Government inspector for conformance with established quality criteria.

6.3.7 Laundering of shop cloths. When laundered shop cloths are employed, inspectors shall conduct regular and frequent inspection tests at the laundry, or after return of the laundered cloths, or both; and spot-tests of the cloths just prior to actual usage in the shop, in sufficient numbers to assure compliance with the provisions of 5.5.4.14.2 herein.

Patent Notice: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, otherwise as in any other manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

Custodian:
Army - MI
Navy
Air Force

Preparing Activity
Army - MI

Project No. MFFP-A071

Review:
Army - MI,AT,AV,EL,ME,MR,MU,PA,WC
Navy
Air Force

User:
Army - MI
Navy
Air Force

TABLE I - CLEANING METHOD

Code No.	Method
101	Cleaning, mechanical or abrasive, per TT-C-490, Method I.
102	Solvent cleaning per TT-C-490, Method II.
103	Hot Alkaline cleaning per TT-C-490, Method III.
104	Emulsion cleaning per TT-C-490, Method IV.
105	Phosphoric acid corrosion removing and metal conditioning treatment, MIL-M-10578, for ferrous and non-ferrous metals, slight etch, type shall be delineated on the drawing immediately following the code 105.
106	Alkaline cleaner for ferrous and non-ferrous alloys, boiling vat or steam cleaning, per P-C-436, nonetch to aluminum.
107	Immersion cleaning, per MIL-C-14460, Type I (for steel).
108	Electrolytic cleaning, per MIL-C-14460, Type II (for steel).
109	Sand lightly with number 400 grit paper.
110	Abrade lightly with aluminum wool; immerse for 3 minutes minimum in a solution of equal parts of nitric acid (specific gravity 1.42) and water. Follow with a water rinse and dry.
111	Magnesium cleaning, MIL-M-3171.
112	Prepare surfaces for bonding using procedures of MIL-A-9067.

Note: The above methods listed shall be specified only when applicable and when the detail finishing specification does not contain a cleaning requirement.

TABLE II - SURFACE TREATMENTS

Code No.	Treatment
201	Anodize, aluminum, chromic acid, type I, Class 1, per MIL-A-8625.
202	Anodize, aluminum, sulfuric acid, type II, class 1, per MIL-A-8625.
203	Anodize, aluminum, sulfuric acid, type II, class 2, per MIL-A-8625. Applicable colors shall be designated on the drawing immediately following the code number by delineating the color and chip code number (i.e., black, 27038; red, 31336) per FED-STD-595.
204	Use Code 203.
205	Use Code 203.
206	Use Code 203.
207	Anodize, hard coat, type III, class 1, per MIL-A-8625.
208	Chromate conversion coat per MIL-C-5541, class 1A.
209	Anodic coating, magnesium, per MIL-M-45202. Type, class, and grade shall be delineated on the drawing immediately following the code number (i.e., code 209, type I, class A, grade 2, etc.).
210	Phosphate coating per TT-C-490, type I (zinc).
211	Phosphate coating per TT-C-490, Type II.
212	Use Code 401.
213	Black oxide for copper alloys per MIL-F-495.
214	Black oxide for ferrous metals including stainless steels, per MIL-C-13924. Class shall be delineated on the drawing immediately following the code 214 (i.e., code 214, class 2).

TABLE II - Continued

Code No.	Treatment
216	Passivate by immersion for 30 minutes in a hot (120 to 130°F) aqueous solution containing 20 percent by volume nitric acid (Sp. Gr. 1.12) and 2 percent by weight of sodium dichromate, rinsed in clean hot water and then thoroughly dried (for 200/300/400 series and precipitation hardening corrosion-resistant steels).
217	Vacuum pressure or vacuum soak treatment. The clean, dry, well seasoned wood, freed of outer and inner bark, shall be surfaced to the correct cross-sectional dimension and then treated by vacuum and pressure, or vacuum and soak. The treating material shall conform to composition A of specification TT-W-572. Retention on treatment shall not be less than 3 pounds per cubic foot, and not more than 6 pounds per cubic foot for hard woods, or more than 8 pounds per cubic foot for soft woods. If retention is less than 3 pounds per cubic foot on initial test cycle, treatment shall be to maximum of 14 days after treatment, two representative samples from each charge shall be removed and tested for paintability in accordance with applicable section of TT-W-572. The temperature of the preservative during the treating process is to be at the discretion of the contractor, so long as the requirements of TT-W-571 as to penetration and the above retention requirements are met.
218	Immersion treatment. Dress the wood part to correct cross-sectional dimensions. Immerse in composition B of specification TT-W-572 for not less than 4 hours. Allow the treated wood to air-dry or kiln-dry before it is painted.
219	Surface treatment. Dress the wood part to correct cross-sectional dimensions. Apply one liberal coat of composition A of specification TT-W-572. Where practical, apply the solution by immersion for not less than 3 minutes. Otherwise, brushing or low pressure spraying (no atomization) is acceptable. Allow the treated wood to air-dry or kiln-dry before it is painted.
220	Fungus resistant paranitrophenol treatment for cork products per MIL-T-12664.

TABLE II, Continued

Code No.	Treatment
221	Treatment, mildew-resistant, for rope per MIL-T-16070. Designate type on drawing immediately following code number.
222	Treatment, mildew-resistant, noncopper process for cotton duck, webbing, and sewed items, per MIL-T-45035. Class to be designated on drawing immediately following code number.
223	Treatment, insect-resistant for paper per MIL-T-21330.
224	Anodic coating for zinc and zinc alloys per MIL-A-81801, specify class on drawing immediately following code number.

TABLE III - METALLIC COATINGS

Code No.					
*301	Cadmium plate per QQ-P-416	Type I	Class 1	No supplementary treatment.	0.005 inch Min.
*302		Type I	Class 2	No supplementary treatment.	0.0003 inch Min.
*303		Type I	Class 3	No supplementary treatment.	0.0002 inch Min.
304	Cadmium plate per QQ-P-416	Type II	Class 1	Chromate supplementary treatment.	0.0005 inch Min.
305		Type II	Class 2	Chromate supplementary treatment.	0.0003 inch Min.
306		Type II	Class 3	Chromate supplementary treatment.	0.0002 inch Min.
307	Cadmium plate per QQ-P-416	Type III	Class 1	Phosphate supplementary treatment.	0.0005 inch Min.
308		Type III	Class 2	Phosphate " "	0.0003 inch Min.
309		Type III	Class 3	Phosphate " "	0.0002 inch Min.
310	Cadmium plate, vacuum deposited, per MIL-C-8837	Type I	Class 1	No supplementary treatment.	0.0005 inch Min.
311		Type 1	Class 2	No supplementary treatment.	0.0003 inch Min.
312		Type 1	Class 3	No supplementary treatment.	0.0002 inch Min.

*Not to be used without prior approval of procuring activity.

TABLE III, CONTINUED

Code No.					
313	Cadmium plate, vacuum deposited, Per MIL-C-8837	Type II	Class 1	Chromate supplementary treatment.	0.0005 inch Min.
314		Type II	Class 2	Chromate supplementary treatment.	0.0003 inch Min.
315		Type II	Class 3	Chromate supplementary treatment.	0.0002 inch Min.
316		Type III	Class 1	Phosphate supplementary treatment.	0.0005 inch Min.
317		Type III	Class 2	Phosphate supplementary treatment.	0.0003 inch Min.
318		Type III	Class 3	Phosphate supplementary treatment.	0.0002 inch Min.

319 Chromium plate, per QQ-C-320, type I, class 1, 0.00001 to 0.00002 inch. (Usually applied over copper and nickel undercoats or applied directly to the less corrosion-resistant grades of stainless steel.)

320 Chromium plate, per QQ-C-320, type II, class 2, 0.001 inch minimum.

321 Use Code 380

322 Black chromium plate per MIL-C-14538.

323 Chromium plate, per MIL-C-20218, porous (for surfaces operating in lubricating oil). Type shall be delineated on the drawing immediately following the code 323.

TABLE III, CONTINUED

Code No.

324	Nickel plate, per QQ-N-290, class 1, Grade A, 0.0016 inch thick
325	Nickel plate, per QQ-N-290, Class 1, Grade B, 0.0012 inch thick.
326	Nickel plate, per QQ-N-290, class 1, Grade C, 0.0010 inch thick.
327	Nickel plate, per QQ-N-290, class 1, Grade D, 0.0008 inch thick.
328	Nickel plate, per QQ-N-290, class 1, Grade E, 0.0006 inch thick.
329	Nickel plate, per QQ-N-290, class 1, Grade F, 0.0004 inch thick.
330	Nickel plate, per QQ-N-290, class 1, Grade G, 0.0002 inch thick.
331	Use Code 325
332	Use code 327
333	Use Code 328
334	Nickel plate, per QQ-N-290, class 2, engineering plating, 0.002 inch minimum.
335	Use code 374.
336	Use code 375.
337	Nickel plate, per MIL-P-18317, black (similar to color #27038 FED-STD-595), 0.0002 inch minimum.
338	Silver plate, per QQ-S-365, type I, grade A (thickness 0.0005 inch minimum).

TABLE III, CONTINUED

Code No.

**339	Silver plate, per QQ-S-365, Type I, grade B, Thickness 0.0005 inch minimum.
340	Gold plate, per MIL-G-45204, type II, grade C, class 2 (0.0001 inch thick).
341	Gold plate, per MIL-G-45204, Type II, grade C, class 3 (0.0002 inch thick).
342	Gold plate, per MIL-G-45204, Type II, grade C, class 4 (0.0003 inch thick).
343	Gold plate, per MIL-G-45204, type II, grade C, class 5 (0.0005 inch thick).

**Not to be used without prior approval of procuring activity.

**344	Tin plate, per MIL-T-10727, type I (electrodeposition), 0.0003 inch minimum.
**345	Tin plate, per MIL-T-10727, type II (hot-dipped), 0.0003 inch minimum.
346	Solder, per MIL-S-46844 (tinning to meet requirements of MIL-P-46843) (printed circuit boards).
347	Rhodium plate, per MIL-R-46085, type I, class 2, 0.00001-0.00002 inch.
348	Rhodium plate, per MIL-R-46085, type II, class 3, 0.00002-0.0001 inch.
349	Copper plating, per MIL-C-14550, class 1, 0.001 inch minimum.
350	class 2, 0.0005 (undercoat for nickel and other plating).
351	class 3, 0.0002 (undercoat for nickel and other plating).
352	class 4, 0.0001 (undercoat for nickel and other plating).
353	Gold plate, per MIL-G-45204, type I, grade A, class 3.

TABLE III, CONTINUED

Code No.

354 Gold plate, per MIL-G-45204, type I, grade A, class 4.

355 type I, grade A, class 5.

356 Plating, soft nickel (electrodeposited, sulfanate bath), per MIL-P-27418 (0.002 inch).

357 Chromium plating, low embrittlement, electrodeposition per MIL-STD-1501.

** Unless otherwise prohibited, these codes shall be followed with either code 603, 604, 605, 606, as applicable, 497 or 401.

358 Cadmium plating low embrittlement, electrodeposition per MIL-STD-870.

359 Tin-cadmium plate, per MIL-P-23408, class 1 (0.0005 inch thick).

360 Tin-cadmium plate, per MIL-P-23408, class 2 (0.0003 inch thick).

361 Tin-cadmium plate, per MIL-P-23408, class 3 (0.0002 inch thick).

362 Tin-lead plating per MIL-P-81728.

363 Cadmium coating, mechanically deposited, per MIL-C-81562, Material C, Type II, class 1, chromate supplementary treatment, 0.0005 inch min.

364 Cadmium coating, mechanically deposited, per MIL-C-81562, Material C, Type II, Class 2, chromate supplementary treatment, 0.0003 inch min.

365 Cadmium coating, mechanically deposited, per MIL-C-81562, Material C, Type II, Class 3, chromate supplementary treatment, 0.002 inch min.

TABLE III, CONTINUED

Code No.

366	Coating, metallic ceramic per MIL-C-81751 (type and class to be designated on drawing following the code number).
367	Coat aluminum, vacuum deposited, per MIL-C-23217, class 1.
368	Coat aluminum, vacuum deposited, per MIL-C-23217, class 2.
369	Aluminum coating (hot dip) for ferrous parts per MIL-A-40147.
370	Coating, aluminum and aluminum alloys (metallic compound decomposition) per MIL-C-81740 (class and type to be designated on drawing immediately after Code # 370).
371	Coating, inorganically bonded aluminum (electrophoretically deposited) per MIL-C-81797 (class to be designated on drawing immediately after Code #371).
372	Palladium plating, per MIL-P-45209, 0.00001 to 0.00002 inch.
373	Brush plating, electrodeposition per MIL-STD-865, (deposit and thickness to be designated on drawing immediately after code).
374	Electroless nickel plate, per MIL-C-26074, class 1, minimum thickness of 0.001 inch (Grade A) for iron and aluminum based alloys and 0.0005 inch (Grade B) for copper, nickel, cobalt, beryllium, and titanium based alloys.
375	Electroless nickel plate, per MIL-C-26074, class 2, minimum thickness of 0.001 inch (Grade A) (heat treated for extreme hardness).
376	Electroless nickel plate, per MIL-C-26074, class 3, Grade A thickness, (Aluminum alloys non-heat-treatable and beryllium alloys processed to improve adhesion of the nickel deposit.)
377	Electroless nickel plate, per MIL-C-26074, class 4, Grade A thickness (aluminum alloys, heat-treatable, processed to improve adhesion of the nickel deposit).
378	Electroless nickel plate, per MIL-C-26074, class 1, Grade C (0.0015 inch minimum for severe corrosion envionments).

TABLE III, CONTINUED

CODE NO.

380 Nickel-carbon plate, porous, per MIL-N-55392, gray (similar to color 36440 per FED-STD-595) over nickel, over initial undercoat of copper, for aluminum copper alloys, and steel.

TABLE IV - ORGANIC COATINGS

Code No.

401 Apply wash primer per MIL-P-15328, 0.2 to 0.3 mil dry film thickness.

402 Apply zinc chromate primer, TT-P-1757, one coat, 0.3 to 0.4 mil dry film thickness.

403 Apply zinc chromate primer, TT-P-1757, two coats, 0.6 to 0.8 mil dry film thickness.

404 Apply air-drying epoxy primer per MIL-P-52192, dry film thickness of 0.8-1.2 mil.

405 Apply two coats of air-drying primer per MIL-P-52192, dry film thickness of 1.6-2.4 mils.

406 Apply lacquer primer, MIL-P-11414, one coat (0.6 to 0.8 mil dry film thickness, for use with thermoplastics).

407 Apply one coat of air-drying epoxy primer MIL-P-23377, 0.8-1.2 mils.

408 Apply two coats of air-drying epoxy primer MIL-P-23377, 1.6-2.4 mils.

409 Apply lusterless MIL-E-46096, Type I, Composition L, solar heat reflecting top coat, one coat, 0.9-1.1 mils, olive drab color number 34087 per FED-STD-595.

410 Apply one coat of solar heat reflecting undercoat MIL-C-46127 (dry film thickness of 0.9-1.1 mils).

411 Apply lusterless MIL-E-46117 solar heat reflecting top coat, one coat, 0.8-1.2 mils.

412 Apply semigloss MIL-E-46136, type I, solar heat reflecting top coat, one coat, 0.9-1.1 mils, olive drab, color number 24087 per FED-STD-595.

413 Apply semigloss MIL-E-46136, type II, solar heat reflecting top coat, one coat, 0.9-1.1 mils, olive drab, color number 24087 per FED-STD-595.

Code No.

414	Apply semigloss MIL-E-46136, type III, solar heat reflecting topcoat, one coat, 0.9-1.1 mils, olive drab, color number 24087 per FED-STD-595.
415	Apply lusterless enamel TT-E-527, one coat (0.8-1.2 mils), color olive drab 34087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 415.
416-419	Reserved for future use.
420	Apply lusterless enamel TT-E-527, two coats (1.6-2.4 mils), color olive drab 34087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 420.
421-424	Reserved for future use.
425	Apply semigloss enamel TT-E-529, one coat (0.8-1.2 mils), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 425.
426-436	Reserve for future use.
437	Apply semigloss enamel TT-E-529, two coats (1.6-2.4 mils), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 437.
438	Apply polyurethane aliphatic, weather resistant camouflage coating per MIL-C-81773, one coat (1.0 to 1.2 mils), color and code number per FED-STD-595 shall be delineated on the drawing immediately following the enamel code 438.
439	Apply polyurethane, aliphatic, weather resistant camouflage coating per MIL-C-81773, two coats (1.6 to 2.4 mils). Color and code number per FED-STD-595 shall be delineated on the drawing immediately following the enamel code 439.
440	Apply polyurethane, aliphatic weather resistant, semigloss coating per MIL-C-81773, one coat, 1.0 to 1.2 mils. Color and code number per FED-STD-595 shall be delineated on the drawing immediately following the enamel code 440.

Code No.

441 Apply polyurethane, aliphatic, weather resistant semigloss coating per MIL-C-81773, two coats, 1.6 to 2.4 mils. Color and code number per MIL-STD-595 shall be delineated on the drawing immediately following the enamel code 441.

442 Apply polyurethane, aliphatic weather resistant gloss coating per MIL-C-81773, one coat (1.0 to 1.2 mils) color and code number per MIL-STD-595 shall be delineated on the drawing immediately following the enamel code 442.

443 Apply polyurethane, aliphatic weather resistant gloss coating per MIL-C-81773, two coats (1.6 to 2.4 mils). Color and code number per MIL-STD-595 shall be delineated on the drawing immediately following the enamel code 443.

444 Apply lusterless camouflage enamel MIL-E-52798, one coat, 0.8-1.2 mils, color forest green. Color other than forest green shall be delineated on the drawing immediately following the code.

445 Apply lusterless camouflage enamel MIL-E-52798, two coats, 1.6-2.4 mils, color forest green. Color other than forest green shall be delineated on the drawing immediately following the code.

446 Apply lusterless camouflage enamel MIL-E-52835 (Bake Composition), one coat, 0.8-1.2 mils, color forest green.

447 Apply lusterless camouflage enamel MIL-E-52835 (Bake Composition), two coats, 1.6-2.4 mils, color forest green.

448 Reserved for future use.

449 Apply semigloss enamel MIL-E-52227, one coat (0.8-1.2 mils) color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 449.

450-460 Reserved for future use.

461 Apply semigloss enamel, MIL-E-52227, two coats (1.6-2.4 mils), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 461.

Code No.

462-472 Reserved for future use.

473 Apply semigloss lacquer, MIL-L-52043, two coats (0.8-1.2 mils), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 473.

474-484 Reserved for future use.

485 Apply one coat semigloss enamel, MIL-C-22750, Type II, class 1 and 2 as applicable (0.8-1.2 mils), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 485.

486 Apply two coats semigloss enamel, MIL-C-22750, Type II, Class 1 or 2 as applicable (1.6-2.4), color olive drab 24087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 486.

487 Apply one coat lusterless enamel, MIL-C-22750, Type III, class 1 or 2 as applicable (0.8-1.2 mils) color olive drab 34087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 487.

488 Apply two coats lusterless enamel, MIL-C-22750, Type III, class 1 or 2 as applicable (1.6-2.4 mils), color olive drab 34087 per FED-STD-595. Color other than olive drab shall be delineated on the drawing immediately following the code 488.

489 Luminescent material and equipment (non radioactive), MIL-L-3891. Type, form, and color shall be designated on the drawing immediately following code 489.

490 Luminescent material, fluorescent, MIL-L-25142. Class and type shall be designated on the drawing immediately following the code 490.

491 Walkway compound, nonslip and walkway matting, nonslip, MIL-W-5044. Type and color shall be designated on the drawing immediately following the code 491.

Code No.

492	Walkway coating and matting, nonslip, aircraft application of, MIL-W-5050. Type shall be designated on the drawing immediately following the code 492.
493-494	Reserved for future use.
495	Acid-resistant lacquer, TT-L-54, type I (black, 17038, per FED-STD-595, 0.8 to 1.2 mils dry film thickness).
496	Alkali-resistant vinyl enamel, MIL-E-16738 (White, 0.8 to 1.2 mils dry film thickness).
497	Moisture-and-fungus resistant varnish, MIL-V-173, Composition I or II as applicable, per MIL-T-152 (1.3 to 1.7 mils dry film thickness).

TABLE V - SEALING AND BONDING

Code No.	
501	Use code 503.
502	Seal with single-component retaining compounding per MIL-S-22473; specify grade and primer on drawing.
503	Assemble with sealing compound, MIL-S-8802, polysulfide type, class and dark number shall be delineated on the drawing immediately following the code 503.
504	Apply wet, unthinned zinc chromate primer TT-P-1757, for sealing thread areas and interface capillaries.
505	Apply zinc chromate paste, MIL-P-8116, for sealing in threaded, adjustable parts.
506	Impregnation for aluminum alloys and magnesium alloy castings, MIL-STD-276, method B, using MIL-I-6869.
507	Seal with MIL-S-4883, Buna-N rubber compound.
508	Seal with silicone sealant, one component, MIL-S-46146. Type and primer, if required, shall be specified on the drawing immediately following the code 508.
509	Apply silicone compound, two-component, MIL-S-23586. Type, class and grade to be specified on the drawing.
510	Apply tape, MIL-T-23142, dissimilar metal protection.
511	Apply sealant, MIL-S-11030, polysulfide, noncuring, for helicoils and steel inserts (type to be specified on drawing).
512	Apply sealant, MIL-S-11031, two-component, polysulfide (adhesive/sealant).
513	Sealing compound, MIL-S-45180, type II, hydrocarbon and water resistant, for sealing gaskets.
514	Adhesive, MIL-A-3920, Optical, Thermosetting (for bonding glass to glass).
515	Adhesive, MIL-A-8576, Acrylic Base, for acrylic plastics. Type shall be delineated on the drawing immediately following the code 515.

TABLE V CONTINUED

Code No.	
516	Adhesive, MMM-A-134, epoxy resin, metal-to-metal, structural bonding (specify type on drawing immediately following the code 516).
517	Adhesive, MMM-A-132, heat-resistant, airframe, structural, metal-to-metal (specify type and class on drawing immediately following the code 517).
518	Adhesive, MIL-A-81236, epoxy resin, with polyamide curing agent, Type I or II as applicable.
519	Adhesive, MIL-A-25463, metallic structural sandwich construction, type and class shall be delineated on the drawing immediately following the code 519.
520	Adhesive, MMM-A-121, bonding, vulcanizing synthetic rubber to steel.
521	Adhesive, MIL-A-25457, air drying silicone rubber for bonding silicone rubber to metal.
522	Adhesive, MMM-A-1617, rubber base, general purpose (specify type on drawing following the code 522).
523	Adhesive, bond, MIL-A-5540, rubber adhesive polychloroprene (specify class on drawing following the code 523).
524	Sealing and coating compound, inhibitive per MIL-S-81733, polysulfide type. Type and dash number shall be delineated on the drawing immediately following the code 524.

TABLE VI - ENCAPSULANTS AND POTTING COMPOUNDS

Code No.	Coating
601	Insulating compound, MIL-I-16923, electrical embedding.
602	Potting compound, MIL-P-47298, polyurethane (non-carcinogenic).
603	Conformal coating, MIL-I-46058, printed circuit board, type ER, epoxy.
604	Conformal coating, MIL-I-46058, printed circuit board, type UR, polyurethane.
605	Conformal coating, MIL-I-46058, printed circuit board, type SR, silicone.
606	Conformal coating, MIL-I-46058, printed circuit board, type XY, paraxylylene.
607	Encapsulating foam, MIL-P-46847, polyurethane, for electronic components, type shall be specified on the drawing immediately following the code 607.

TABLE VII - LUBRICATION AND PRESERVATION

CODE NO.	Treatment
701	Corrosion preventive compound, MIL-C-16173, grade 1 (hard film).
702	Corrosion preventive compound, MIL-C-16173, grade 2 (soft film)
703	Apply medium preservative lubricating oil, MIL-L-3150.
704	Apply lubricating oil, general purpose, VV-L-800, water displacing, low temperature.
705	Apply corrosion preventive compound, MIL-C-23411, ultra-thin, clear, type I or II as applicable.
706	Apply corrosion preventive compound, MIL-C-81309, water displacing, ultra-thin; grade to be designated on drawing.
707	Apply lubricating grease, MIL-G-10924.
708	Apply lubricant, dry film, MIL-L-46010, bake-type.
709	Apply lubricant, dry film, MIL-L-46147, air-drying.
710	Apply lubricating oil, VCI, MIL-L-46002. Specify grade on the drawing immediately following code 710.
711	Use solid, VCI corrosion inhibitor, MIL-I-22110, per MIL-I-8574, Type I or II as applicable.
712	Apply antiozonant, MIL-D-50000.

TABLE VIII - MISCELLANEOUS

Code No.	Treatment
801	Stress relieve prior to plating at 675° ± 25°F or 50°F below the tempering temperature, whichever is lower, for 2 to 3 hours (for ferrous alloys having a hardness greater than Rockwell C-40).
802	Hydrogen embrittlement relieve at 375°F ± 25°F for 23 hours within eight (8) hours after plating.
803	Hydrogen embrittlement relieve at 375°F ± 25°F for 3 hours within 8 hours after phosphating.
804	Hydrogen embrittlement relieve at 375°F ± 25°F for 3 hours after initial plating, then at 375°F ± 25°F for 23 hours after final plating.
805	Apply marking ink, TT-I-558, color to be specified on drawing if other than black; for metal and glass, coat with varnish MIL-V-173 (code 497).
806	Apply marking ink, MIL-I-43553, color to be specified on drawing if other than mat black, for metal and glass.
807	Apply epoxy coating meeting RIAPD-636 by the fluidized bed process in accordance with procedures recommended by fluid bed resin and process equipment manufacturers and suppliers, 0.005 inch minimum but not more than 0.013 inch. Color, if desired, to be specified on the drawing.
808	Shot peening of metal parts per MIL-S-13165.
809	Rotary flap peening of metal parts per MIL-R-81841.

TABLE IX - FINISH CROSS REFERENCE "B" ISSUE

Finish No.	"B" Issue Primer	Topcoat	Code No. Primer	"D" Issue Topcoat
50.1	TT-P-664	TT-E-529	*	437
50.2	TT-P-666	TT-E-529	*	437
50.3	MIL-P-8585****	TT-E-529	402	437
50.4	MIL-P-15930	TT-E-529	*	437
50.5	MIL-P-52192	TT-E-529	404	437
50.6	TT-P-636	TT-E-529 + TT-E-527	*	425 + 415
50.7	TT-P-636	TT-E-529	*	437
50.8	TT-P-636	TT-E-489	*	**
50.9	MIL-P-8585****	MIL-E-5556***	402	420
50.10	MIL-P-52192	MIL-E-5556***	404	420
50.11	MIL-P-8585****	TT-L-20	402	**
50.12	MIL-P-8585****	MIL-L-7178*****	402	**
50.13	MIL-P-8585****	TT-E-516	402	**
50.14	MIL-P-8585****	TT-E-516 + MIL-E-46061	402	**
50.15	MIL-P-11414	MIL-E-52043	406	473
50.16	MIL-P-15930	MIL-E-52043	*	473
50.17	MIL-P-52192	MIL-E-52043	404	473

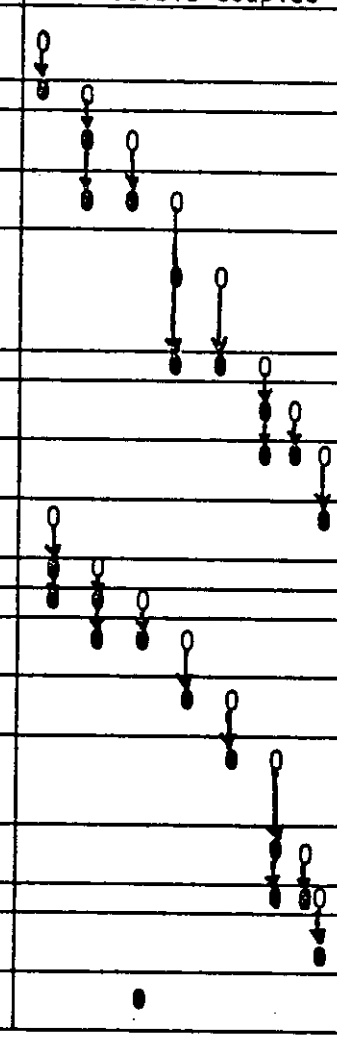
NOTE:
* Designated no comparable primer is listed in the "D" issue.
** Designated no comparable topcoat is listed in the "D" issue.
*** This specification has been superseded by TT-E-527.
**** This specification has been superseded by TT-P-1757.
***** This specification has been superseded by TT-L-32.
† This specification is now MIL-P-22808.

TABLE IX, CONTINUED

Finish No.	"B" Issue Primer	TOPCOAT	Code No. Primer	"D" Issue Topcoat
50.18	MIL-P-23377	MIL-C-22750	407	488
50.19	MIL-P-52192	MIL-C-22750	404	488
50.20	MIL-P-23377	MIL-C-22808†	407	**
50.21	MIL-P-52192	MIL-C-22808†	404	**
50.22	MIL-P-8585****	MIL-E-52227	402	461
50.23	TT-P-664	MIL-E-52227	*	461
50.24	MIL-P-52192	MIL-E-52227	404	461
50.25	MIL-P-8585****	TT-E-485	402	**

TABLE X - GALVANIC COUPLES

Group No.	Metallurgical category	E.M.F. (Volt)	Permissible couples*
1	Gold, solid and plated; gold-platinum alloys; wrought platium	+0.15	
2	Rhodium, graphite	+0.05	
3	Silver, solid or plated; high silver alloys	0	
4	Nickel, solid or plated; monel metal, high nickel-copper alloys, titanium	-0.15	
5	Copper, solid or plated; low brasses or bronzes; silver solder; German silver: high copper-nickel alloys; nickel-chromium alloys; austenitic stainless steels	-0.20	
6	Commercial yellow brasses and bronzes	-0.25	
7	High brasses and bronzes; Naval brass; Muntz metal	-0.30	
8	18% chromium type corrosion-resistant steels	-0.35	
9	Chromium, plated; tin, plated; 12% chromium type corrosion-resistant steels	-0.45	
10	Tin-plate; terneplate; tin-lead solders	-0.50	
11	Lead, solid or plated; high lead alloys	-0.55	
12	Aluminum, wrought alloys of the 2000 series types	-0.60	
13	Iron, wrought, gray, or malleable; plain carbon and low alloy steels, armco iron	-0.70	
14	Aluminum, wrought alloys other than 2000 series types; aluminum, cast alloys of the silicon type.	-0.75	
15	Aluminum, cast alloys other than silicon type; cadmium, plated and chromated	-0.80	
16	Hot-dip-zinc plate; galvanized steel	-1.05	
17	Zinc, wrought; zinc-base die-casting alloys; zinc, plated	-1.10	
18	Magnesium and magnesium-base alloys cast or wrought	-1.60	



* Members of groups connected by lines are considered as permissible couples; however, this should not be construed as being devoid of galvanic action. Permissible couples represent a low galvanic effect.

O Indicates the most cathodic member of the series, ● an anodic member, and the arrows the anodic direction.

All are based on 0.10 E.M.F. (Volt) limitation except groups 2, 3, and 4.

TABLE XI - GROUP AMPLIFICATION OF GALVANIC COUPLES

Group No. (see table I)	Metal or Alloy Description
1	Gold, solid or plated per MIL-G-45204. Gold foil per QQ-G-545. Gold leaf per QQ-G-547. Gold wire per MIL-G-2605. Gold alloys per QQ-G-540 and QQ-P-400. Platinum, wrought. Platinum foil per QQ-P-428.
2	Rodium, MIL-R-46085, graphite per MIL-G-52294.
3	Silver, solid, or plated per QQ-S-365. Silver alloys
4	Nickel, solid. Nickel plate per QQ-N-290 or MIL-C-26074. Nickel-copper alloys per QQ-N-281, QQ-N-286 and QQ-N-288. Constantin and monel.
5	Copper, solid or plated per MIL-C-14550. Silicon bronze, phosphor bronze, naval bronze, leaded bronze, hydraulic bronze, valve bronze, manganese bronze, red brass, acid-resistant bronze, manganin, gun metal, and Parr's alloy. Copper-beryllium per QQ-C-530. Copper-nickels per MIL-C-20159. Copper-silicons per QQ-C-581, QQ-C-591, and QQ-C-390. Phosphor-coppers per QQ-C-571. Phosphor-bronze per QQ-B-750. Aluminum bronze per QQ-B-654. Brazing alloys, silver base, per MIL-B-7883. Nickel sivers per QQ-C-585 and QQ-C-586. Nickel-chromiums per MIL-N-6710, MIL-N-6840, MIL-T- 7840, and MIL-B-15382. Austenitic stainless steels within the AISI 300 series; those per MIL-S-5959, MIL-T-5695, MIL-S-6721, MIL-T-8504, MIL-T-8506, MIL-T-8606, MIL-S-16538, MIL-S-20150, and MIL-S-20138, classes 1, 7, 8, 9 per QQ-S-763; classes I, II, III per MIL-S-867; FS designators 302, 304, 304L, 309, 310, 316, 316L, 321, 347 per QQ-S-766; AMS 5365A; AMS 5366A; and QQ-W-423.

TABLE XI, CONTINUED

Group No. (see table I)	Metal or Alloy Description
6	Commercial yellow brasses and bronzes. Admiralty metal. Cartridge brass per MIL-B-50. Commercial brass, composition E per QQ-B-613 and QQ-B-626. High-copper yellow and naval brass, compositions B and C per QQ-C-390.
7	Commercial brass, compositions A, B, C, D per QQ-B-613 and QQ-B-626. Commercial yellow brass per QQ-C-390. Leaded and nonleaded copper-zinc per QQ-B-626. Manganese bronzes per QQ-B-728. Naval brasses per QQ-B-637 and QQ-B-639. Die-cast brasses per MIL-B-15894. Muntz metal and Tobin bronze.
8	Corrosion resistant steels, classes 4, 10 per QQ-S-763. Corrosion resistant steel, FS-430 per QQ-S-766. 18±2% chrome-steels within the AISI 400 series. Corrosion resistant steels, 400 series per QQ-W-423.
9	Chromium plate per QQ-C-320, MIL-P-14538. Tin plate per MIL-T-10727. Corrosion resistant steels, classes 3, 5, 5 per QQ-S-763. Corrosion resistant steels per MIL-S-16993, and FS-410 per QQ-S-766. 12±2% chrome-steels within the AISI 400 series.
10	Tin-plate per QQ-T-425. Terne-plate per QQ-T-181, QQ-T-191, and QQ-T-201. Tin-lead solders per QQ-S-571.
11	Electrical lead. Sheet lead per QQ-L-201. Pig lead per QQ-L-171. Calking lead per QQ-L-156. Lead alloys.
12	Aluminum, wrought alloys of 2000 series type S.

TABLE XI, CONTINUED

Group No. (see table I)	Metal or Alloy Description
12	Aluminum alloy 2014 per QQ-A-200/2 and QQ-A-225/4. Aluminum alloy 2024 per QQ-A200/3, QQ-A-225/6 and QQ-A-250/4. Aluminum alloy 2017 per QQ-A-225/5. Aluminum alloy, compositions 1, 5, 7, 9 per QQ-A-367.
13	Wrought iron. Malleable iron per QQ-I-666. Gray iron per QQ-I-652. Steels within the AISI series 1000,1100, 1300, 2000, 3100, 3200, 3300, 4000, 4100, 4300, 4600, 4800, 5000, 5100, 6100, 8600, 8700, 9200, 9300, 9400, 9700, 8900, and 9900. Steels per QQ-S-626, QQ-S-628, QQ-S-633, QQ-S-636, QQ-S-681, QQ-S-691, QQ-S-777, QQ-S-741, and QQ-W-470.
14	Aluminum, wrought alloys other than 2000 series types. Aluminum, cast alloys of silicon type. Aluminum alloy 1100 per QQ-A-225/1 and 250/1. Aluminum alloy, 2011 per QQ-A-225/3. Aluminum alloy 3003 per QQ-A-225/2, 225/8, 250/2, and QQ-A-200/1. Aluminum alloy 6061 per QQ-A-200/8, 225/8 and 250/11. Aluminum alloy 7075 per QQ-A-200/11, QQ-A-225/9, and QQ-A-250/12. Aluminum alloy, compositions 2, 3, 6, 10, 11 per QQ-A-367. Aluminum alloy, compositions A and B per QQ-A-225/3. Aluminum alloy 5052 per QQ-A-225/7 and QQ-A-250/8. Clad aluminum per QQ-A-250/3, QQ-A-250/13, and QQ-A-250/5. Aluminum alloy, compositions A, B, K, L, M, Q per QQ-A-371. Aluminum alloy, compositions 2, 3, 10, 20 per QQ-A-601. Aluminum alloy, compositions 1, 2, 3, 12, 13 per QQ-A-591. Aluminum alloy, compositions 6, 7, 8, 9, 10 per QQ-A-596.

TABLE XI, CONTINUED

Group No. (see table I)	Metal or Alloy Description
15	Aluminum, cast alloys other than silicon type. Cadmium, plated per QQ-P-416 and MIL-C-8837. Aluminum alloy, compositions C, D, E, F, G, H, I, J, N, O, P, R Per QQ-A-371. Aluminum alloy, compositions 4, 5, 6, 7, 8, 9, 16, 17, 18, 21 per QQ-A-601. Aluminum alloy, compositions 5, 5A, 7, 9, 10, 11 per QQ-A-591. Aluminum alloy, compositions 1, 2, 3, 4, 5, 11 per QQ-A-596.
16	Galvanized iron or steel per QQ-S-775. Hot-dip zinc per QQ-S-775.
17	Zinc plating per QQ-Z-325. Wrought zinc alloys per QQ-Z-301. Die-casting zinc alloys per QQ-Z-363.
18	All magnesium alloys including those per QQ-M-31, QQ-M-38, QQ-M-40, QQ-M-44, QQ-M-55, QQ-M-56, and MIL-M-45202.

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