INCH-POUND

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29 June 2015
SUPERSEDING
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DETAIL SPECIFICATION

FINISHES, ORGANIC, WEAPONS SYSTEMS, APPLICATION AND CONTROL OF

Reactivated after 29 June 2015 and may be used for new and existing designs and acquisitions.

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

1. SCOPE

1.1 Scope. This specification covers the detailed requirements and procedures to be followed in the application and control of organic finishing materials in order to achieve aerodynamically smooth, adherent, high quality finishes with minimum added weight to the weapon system.

2. APPLICABLE DOCUMENTS

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

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center, Aircraft Division Lakehurst, Code 4.1.2, Mail Stop 120-3, Route 547, Joint Base MDL, NJ 08733-5100 or emailed to michael.sikora@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

AMSC N/A

FSC 8010

2.2 Government documents.

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

FEDERAL SPECIFICATIONS

CCC-C-440	-	Cloth, Cheesecloth, Cotton, Bleached And Unbleached
TT-P-28	-	Paint, Aluminum, Heat Resisting
TT-P-2760	-	Primer Coating: Polyurethane, Elastomeric, High-Solids

FEDERAL STANDARD

FED-STD-595	-	Colors Used In Government Procurement Color Numbers 16473, 36440

COMMERCIAL ITEM DESCRIPTION

A-A-59166	-	Coating Compound, Nonslip (For Walkways)

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-5002	-	Surface Treatments and Inorganic Coatings For Metal Surfaces of Weapons Systems
MIL-DTL-5541	-	Chemical Conversion Coatings On Aluminum and Aluminum Alloys
MIL-C-8507	-	Coating, Wash Primer (Pretreatment) for Metals, Application of (for Aeronautical Use)
MIL-C-8514	-	Coating Compound, Metal Pretreatment, Resin-Acid
MIL-PRF-22750	-	Coating, Epoxy, High Solids
MIL-PRF-23377	-	Primer Coatings: Epoxy, High-Solids
MIL-PRF-32239		Coating System, Advanced Performance, For Aerospace Applications
MIL-DTL-53022	-	Primer, Epoxy Coating, Corrosion Inhibiting Lead And Chromate Free
MIL-DTL-53039	-	Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant
MIL-DTL-53072	-	Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection
MIL-DTL-64159	-	Camouflage Coating, Water Dispersible Aliphatic Polyurethane, Chemical Agent Resistant
MIL-PRF-81352	-	Coatings, Aircraft Touch-Up
MIL-DTL-81706	-	Chemical Conversion Materials For Coating Aluminum And Aluminum Alloys
MIL-PRF-81733	-	Sealing And Coating Compound, Corrosion Inhibitive

MIL-PRF-85285	-	Coating: Polyurethane, Aircraft And Support Equipment
MIL-PRF-85322	-	Coating, Elastomeric, Polyurethane, Rain-Erosion
MIL-PRF-85570	-	Cleaning Compounds, Aircraft, Exterior
MIL-PRF-85582	-	Primer Coatings: Epoxy, Waterborne
MIL-PRF-87937	-	Cleaning Compound, Aerospace Equipment

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-2161	-	Paint Schemes And Exterior Markings For U.S. Navy And Marine Corps Aircraft
MIL-STD-7179	-	Finishes, Coatings, And Sealants, For The Protection Of Aerospace Weapons Systems

(Copies of these documents are available online at http://quicksearch.dla.mil.)

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

UNITED FACILITIES CRITERIA

UFC 4-211-02	-	Aircraft Corrosion Control And Paint Facilities
UFC 3-410-04N	-	Industrial Ventilation
UFC 4-211-02NF	-	Corrosion Control and Paint Finishing Hangars

(Copies of these documents are available online at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4)

TECHNICAL MANUAL

NMCPHC-TM OM 6260	Navy and Marine Corps Medical Surveillance Procedures Manual

(Copies of this document are available online at http://www.med.navy.mil/sites/nmcphc/occupational-and-environmental-medicine/oemd/Pages/medical-surveillance-certification.aspx

USAF TECHNICAL ORDER

T.O. 1-1-8	Application and Removal of Organic Coatings, Aerospace and Non-Aerospace Equipment

(Copies of this document are available online at http://www.robins.af.mil/library/technicalorders.asp

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

SAE INTERNATIONAL

SAE AMS-1640	-	Corrosion Removing Compound For Aircraft Surfaces
SAE AMS-C-27725	-	Coating, Corrosion Preventative, For Aircraft Integral Fuel Tanks For Use To 250 °F (121 °C)
SAE AMS-M-3171	-	Magnesium Alloy, Processes For Pretreatment And Prevention Of Corrosion On
SAE AMS-3276	-	Sealing Compound, Integral Fuel Tanks And General Purpose, Intermittent Use To 360 °F (182 °C)
SAE AMS-C-83231	-	Coatings, Polyurethane, Rain Erosion Resistant For Exterior Aircraft And Missile Plastic Parts
SAE AMS-C-83445	-	Coating System, Polyurethane, Non-Yellowing, White, Rain Erosion Resistant, Thermally Reflective
SAE AMS-S-8802	-	Sealing Compound, Temperature Resistant, Integral Fuel Tanks And Fuel Cell Cavities, High Adhesion

(Copies of this document are available online at http://www.sae.org.)

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

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Equipment and facilities. The equipment and facilities used in applying surface finishes on weapon systems shall be subject to the approval of the procuring activity. Guidelines for paint facility design are given in UFC 4-211-02 and UFC 3-410-04N.

3.2.1 Spray guns. Spray guns and accessories shall be compatible with the applicable coatings. Hand held spray guns, such as high volume low pressure (HVLP) spray, airless/air assisted spray, and electrostatic systems may be used for aerospace painting. Coating application procedures shall be in accordance with environmental and safety regulations, which may prohibit some equipment.

3.2.2 Shop compressed air. Compressed air used for spray painting shall be of such quality to ensure effective coating properties, performance, and cosmetic appearance. Unless otherwise specified in the contract or order, the compressed air system shall be designed to meet the following requirements:

a. Dewpoint less than or equal to -40 °F
b. Oil and hydrocarbon contamination less than or equal to 0.01 mg/m^3
c. Particulate material less than or equal to 0.3 micron

3.2.3 Paint lines. All paint lines shall be kept free from oil and water condensation by blowing out the lines as necessary. Paint lines shall be cleaned out after every paint application with a solvent compatible with the paints used. Proper size hoses shall be used to compensate for friction in the line. Hoses shall not cause excessive fluid flow indicated by a heavy center spray pattern or inadequate air pressure which causes an undesirable spray pattern.

3.2.4 Spray booth.

3.2.4.1 Ventilation. Painting shall be conducted in properly ventilated spray rooms. Paint spray rooms shall be equipped with forced or induced ventilation systems capable of preventing the build-up of explosive vapors and mists. The ventilation rate shall be commensurate with the personnel protective measures necessary to protect the painters and the helpers from the health hazards created by the painting procedure or system being employed. 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 may cause irregularities in the paint film. Ventilation shall be maintained to keep dried overspray from settling on surfaces that have already been painted and are still tacky. All air entering spray booths or rooms shall be filtered to ensure that dirt and dust are kept to a minimum. Negative pressure shall be maintained in the spray booth to prevent introduction of hazardous particulates into the outside environment. UFC 4-211-02NF shall be used as guidance in paint finishing facilities.

3.2.4.2 Temperature and humidity. Relative humidity and temperature indicators shall be installed and in proper operation. Humidity and temperature controls shall be employed that are capable of meeting the coating manufacturer's recommended conditions.

3.2.4.3 Lighting. All areas of the weapons systems to be finished shall be well illuminated with lighting equivalent to 100 foot candle (1076 lumens/m^3) or greater. Where possible, lights in the floor, as well as coatings of high light reflectance, shall be used to increase light efficiency.

3.2.4.4 Cleanliness. The paint spray room floors shall be thoroughly cleaned. Paint booths shall be segregated from other areas that may introduce chemical or particulate contamination.

3.2.4.5 Scaffolding hoists. Scaffolding or staging shall be erected as needed to facilitate spraying from different levels in accordance with OSHA standards.

3.3 Safety.

3.3.1 Personnel safety requirements. All requisite safety precautions shall be taken by painter personnel, under supervision of the Safety Engineer and the Industrial Health Officer,

with regard to toxicity, industrial health hazards, etc., in accordance with existing instructions and regulations. Adequate paint spray respirators, safety shoes, etc., when required by the Safety Engineer, shall be made available to painting personnel.

3.2 Medical examinations. Baseline and `periodic medical examinations for personnel who mix or apply polyurethane coatings containing free isocyanates are required when recommended by an industrial hygiene survey. If medical surveillance is recommended, guidance for the exams may be obtained in the current edition of the Navy and Marine Corps Medical Surveillance Procedures Manual, NMCPHC-TM OM 6260.

3.3.3 Electrical grounding. All safety precautions regarding storage of finishing materials and thinners, fire prevention, nonsparking floors and handling equipment, transfer of inflammable liquids from container to container, vapor and explosion-proof lights, etc., shall be applicable to the painting of weapons systems. Prior to paint spraying, the weapons system shall be grounded as required to prevent explosion or fires caused by static discharges.

3.3.4 Other. All instructions from the local Safety Office and Industrial Hygienist shall be followed.

3.4 Materials.

3.4.1 Requirements. Unless otherwise specified in the contract or order, all materials used in the finishing and coating of weapons systems and weapons systems components shall conform to the requirements of the applicable specifications specified in 3.4.2 and shall be as specified in MIL-STD-7179. The addition of any material to the paints other than that specified by the manufacturer is prohibited unless approved by the procuring activity.

3.4.2 Characteristics of coating materials.

a. MIL-PRF-23377 is an aerospace Volatile Organic Compound (VOC) compliant solvent-borne high solids epoxy primer with corrosion inhibitors. This primer is available in the following types and classes:

Type I- Standard Pigments
Type II- Low Infrared Reflective Pigments
Class C1- Barium Chromate Based Corrosion Inhibitors
Class C2- Strontium Chromate Based Corrosion Inhibitors
Class N- Non-Chromate Based Corrosion Inhibitors

Type I primer shall be for general use. Type II primer shall be used where low infrared reflectance is required. Unless otherwise specified in the contract or order, Class C1 or Class C2 chromate based primers shall be used. Class N primers shall not be used unless approved by the procuring activity.

b. MIL-PRF-85582 is an aerospace VOC-compliant water-borne epoxy primer with corrosion inhibitors. This primer is available in the types and classes as follows:

Type I- Standard Pigments
Type II- Low Infrared Reflective Pigments
Class C1- Barium Chromate Based Corrosion Inhibitors
Class C2- Strontium Chromate Based Corrosion Inhibitors
Class N- Non-Chromate Based Corrosion Inhibitors

Type I primer shall be for general use. Type II primer is used where low infrared reflectance is required. Unless otherwise specified in the contract or order, Class C1 or Class C2 chromate based primers shall be used. Class N primers shall not be used unless approved by the procuring activity. MIL-PRF-85582 shall not be used for wet installation of fasteners or other applications where water may become trapped or where flash rusting may occur.

c. TT-P-2760 is a two-component high solids polyurethane primer with corrosion inhibitors used in lieu of MIL-PRF-23377 or MIL-PRF-85582 when a more flexible primer is needed. This primer is available in the following types and classes:

Type I- Standard Pigments
Type II- Low Infrared Reflective Pigments
Class C- Strontium Chromate Based Corrosion Inhibitors
Class N- Non-Chromate Based Corrosion Inhibitors

Type I primer shall be used for general use. Type II primer shall be used where low infrared reflectance is required. Unless otherwise specified in the contract or order, Class C chromate based primers shall be utilized. Class N primers shall not be used unless approved by the procuring activity.

d. MIL-PRF-81733 is an aerospace sealing and coating compound specification. The compounds covered by this specification are used in the production and maintenance of military aircraft exposed for prolonged periods to extreme seagoing environments not encountered by civilian aircraft. The coating compounds that are used on the most corrosion prone areas of an aircraft are defined by this specification as follows:

Type III	For spray gun application
Class 1	Polysulfide rubber base material
Grade A	Contains chromate corrosion inhibitors

e. MIL-PRF-85285 is a two component, high solids aerospace VOC-compliant polyurethane topcoat. Type IV shall be used on all gloss aircraft unless otherwise specified in the contract or order. MIL-PRF-85285 is available in gloss, semi-gloss, and flat (lusterless) colors. It shall be used over properly applied primers conforming to MIL-PRF-23377, MIL-PRF-85582, or TT-P-2760. The resulting paint system is durable, flexible, weather resistant, corrosion resistant, and chemical resistant.

f. MIL-PRF-22750 is a two component, high solids aerospace VOC-compliant epoxy topcoat. This topcoat has excellent chemical resistance; however, it is not as flexible as

polyurethane topcoat and will chalk when exposed to sunlight. MIL-PRF-22750 shall not be used on surfaces exposed to sunlight unless otherwise specified in the contract or order. MIL-PRF-22750 epoxy topcoat shall be used over properly applied primers conforming to MIL-PRF-23377, MIL-PRF-85582, or TT-P-2760.

g. MIL-PRF-32239 is an aerospace VOC-compliant coating system specification for use on the outer moldline of aircraft. This specification defines the coating system as a pretreatment, primer, and topcoat however; a coating system defined as a pretreatment and multifunctional coating is acceptable. All the performance testing in the specification is performed on the complete coating system. The coating systems available are as follows:

Type 1	Coating system containing chromium compounds with Skydrol LD-4 resistance
Type 2	Coating system, chromium free with Skydrol LD-4 resistance
Type 3	Coating system containing chromium compounds
Type 4	Coating system, chromium free
Class 1	Standard flexibility coating system
Class 2	High flexibility coating system
Grade 1	Standard pigmented coating system
Grade 2	Low-infrared (IR) pigmented coating system

h. MIL-PRF-81352 is a single component general touch-up topcoat. It is available in the following types:

Type I	Acrylic Base
Type II	Alkyd Base
Type III	Polyurethane Base

Type I is typically specified for application of temporary markings. Type I can be removed with most solvents.

i. MIL-DTL-53022 (solvent-borne) and MIL-DTL-53030 (waterborne) are chromate free epoxy primers used in Chemical Agent Resistant Coating (CARC) systems in accordance with MIL-DTL-53072 and on applicable support equipment coating systems.

j. MIL-DTL-53039 (single component) and MIL-DTL-64159 (waterborne) are topcoats that shall be used in CARC systems as specified in MIL-DTL-53072. These topcoats provide surfaces that are easily and effectively decontaminated after exposure to liquid chemical agents.

k. SAE AMS-C-83231 is a two-component, polyurethane elastomer available as either a rain erosion resistant coating (Type I) or as an antistatic rain erosion resistant coating (Type II). These coatings are designed for protecting glass fabric reinforced plastic laminates and other plastic parts of high speed aircraft and missiles from rain erosion while in flight. Type

II coatings also can discharge and dissipate static electricity, alleviating radio and radar interferences.

l. SAE AMS-C-83445 is a coating system intended for exterior laminated plastic parts of high-speed aircraft and missiles for protection from rain erosion and thermal energy while the air vehicle is in flight. This coating cannot be used on radomes and other plastic parts that have a requirement for protection against static electrical charges because it is not electrically conductive.

m. MIL-PRF-85322 is a two component polyurethane elastomer intended as a rain erosion coating for aircraft radomes and leading edges.

n. A-A-59166 non-slip walkway coating is a single component coating used to improve footing on specific aircraft surfaces. It is available in a variety of colors and in two types. Type I has a smooth texture and shall be used in areas where Type II is undesirable due to aerodynamic considerations. Type II is a gritty material that provides maximum non-slip qualities.

o. Polyurethane anti-chafe topcoats shall be used over a primer on surfaces where low friction and abrasion, impact, and chemical resistance are required to reduce chafing and wear. These coatings are available in a variety of colors.

p. Leading edge tape is utilized on aircraft leading edges to provide rain erosion protection and wear resistance. Leading edge tapes are more effective in preventing erosion than rain erosion coatings, however their use may be restricted based on location or temperature exposure. Protective boots provide the same function as leading edge tape.

q. TT-P-28 is a heat resistant aluminum coating used where high temperatures preclude the use of conventional paints. It is generally used to protect surfaces exposed to temperatures that exceed the tolerance of standard paint systems. TT-P-28, Type I can withstand temperatures up to 1200 °F. It is not intended to prevent corrosion as a primary function.

r. MIL-C-8514 is a material that combines the properties of a wash primer with the properties of a corrosion preventative primer. MIL-C-8514 is primarily used as a wash primer to enhance adhesion of subsequently applied primers and topcoats.

s. SAE AMS-C-27725 integral fuel tank coating material that prevents corrosion, typically used in fuel wetted areas. It also provides resistance to microbes and is resistant to fuel and other chemicals.

3.4.3 Preparation of coating materials.

3.4.3.1 Storage of paint materials. Weapons system finish materials shall be stored in a cool, dry place. They shall not be stored at a temperature lower than 50 °F or higher than 80 °F for long periods and may approach, but shall not exceed, 100 °F for shorter periods not

exceeding 4 months. Where high temperatures are unavoidable, the quantity on hand shall be held to a minimum, since temperatures exceeding 100 °F produces marked degradation. All conditions under which paint materials are stored shall be subject to approval by the procuring activity.

3.4.3.2 Mixing. Finished materials shall be prepared for application under clean conditions with clean equipment. Materials shall be allowed to warm to room temperature before mixing. Prior to mixing any component in which pigments have settled, the components shall be thoroughly stirred or shaken with equipment designed for mixing coatings to ensure uniform dispersion. Mixing shall be controlled by weight, volume, or viscosity to ensure complete uniformity of all material prepared for use. The mixing of coatings of the same specification but supplied by different manufacturers is prohibited to avoid problems with incompatibility in the liquid and drying phases. Catalyst shall be slowly added while stirring base material. As needed, use a Zahn No. 2 Cup or Ford No. 4 Cup to measure viscosity. Thinner beyond that packaged in the coating kit shall only be used if the addition of thinner will not cause the coating to exceed VOC requirements. Follow any induction time prior to spray as specified by manufacturer's instructions. Strain the coating through CCC-C-440, Type I, Class 2 laundered cheesecloth or commercially available paint strainer unless straining will remove solids needed for coating properties (e.g., antistatic fibers). Coatings in pressure pots shall be kept under constant agitation.

3.5 Procedures and operations.

3.5.1 Preparation of metal surfaces. Metal surfaces shall have been surface treated before assembly and the faying surfaces shall have received the requisite coatings in accordance with the requirements of MIL-STD-7179. The preparation of metal surfaces for painting, as specified herein, applies to complete assemblies.

3.5.1.1 Surface treatment. Chemical surface treatment of metals and metal parts shall be in accordance with MIL-DTL-5002 and shall be performed prior to the priming and painting operations.

3.5.1.2 Mask. Prior to surface cleaning, chemical treatment, or painting, areas such as canopies, windshields, radomes, and transparent light covers shall be masked with masking material and taped in place. On canopies or windshields, tape shall be applied to the frames adjacent to the transparent areas but shall not contact the plastic or glass. All exposed portions of actuated rods passing through hydraulic seals shall be protected from any material applications during cleaning or finishing to prevent damaging seals. All other areas requiring protection shall be masked. Any residue left by masking shall be removed with an approved solvent. The tape used shall prevent paint bleed through.

3.5.1.3 General cleaning (see 6.3). Reclaimed paint thinner or other reclaimed thinners shall not be used for cleaning purposes, since these materials may leave a grease film that causes poor adhesion of the next coat. All abrasive or foreign particles shall be removed after sanding or cutting operations before application of paint-type materials. Cleaning shall be accomplished with vacuums, tack-rags, solvents, detergents, and processes that have no deleterious effect on

the surface and which produce surfaces satisfactory for receiving subsequent finishes. Cleaning materials that may be effective against one type of contaminant may be ineffective against others. Therefore, multiple cleaning procedures may be required to provide the requisite water-break-free surface. Detergents used shall conform to MIL-PRF-85570 or MIL-PRF-87937. Acid cleaners-brighteners and surface treatments shall not be allowed to contact materials susceptible to hydrogen embrittlement. After cleaning, special precautions shall be taken to ensure thorough draining of all liquids from between faying surfaces, crevices, inspection doors, pockets, etc., by permitting the weapons system or part to stand for a sufficient time to permit drainage before paint application.

3.5.1.4 Final cleaning procedure. After general cleaning procedures to remove the major contaminants, such as oils, soil, grease, etc., additional cleaning steps shall be employed as needed immediately prior to surface treating or painting to obtain a surface capable of supporting an unbroken film of distilled water.

3.5.1.5 Removal of surface-oxide and trace contaminants on aluminum. Removal of surface oxides and trace contaminants on aluminum surfaces shall be accomplished after cleaning operations while surfaces are still wet with an abrasive pad such as Scotch-Brite (or equivalent as approved by the procuring activity) or with a cleaner-brightener conforming to SAE AMS-1640 diluted as required. When using a cleaner-brightener, masking shall be used to prevent solution entry into inaccessible areas such as lap joints, hinges, faying surfaces, access doors, and air scoops. The deoxidizer shall be applied with soft bristle brushes or equivalent working from bottom to top. Allow to react with aluminum for approximately 12 minutes and then rinse thoroughly with water to ensure removal. MIL-DTL-81706 chromate conversion coating shall be applied immediately thereafter. **CAUTION:** Deoxidizing agents shall not be applied (i.e. cleaner-brighteners) to structural steel parts such as landing gear and arresting gear. Deoxidizing agents shall also not be applied to unprotected magnesium, cadmium plated, composite, and plastic components. These parts shall be masked prior to the cleaner-brightener treatment.

3.5.1.6 Surface condition. Metal surfaces shall be water-break free prior to both surface treatment and priming when tested in accordance with 4.5.1.

3.5.1.6.1 Reaction of surface. The surface shall have a neutral or slightly acid reaction when tested in accordance with 4.5.2.

3.5.1.7 Manually applied surface treatment and touchup. For weapons systems already assembled, manually applied surface treatment is required on all surfaces before painting. For aluminum surfaces, MIL-DTL-81706 hexavalent chromium conversion coating (Type I) shall be applied in accordance with MIL-DTL-5541. For magnesium surfaces, SAE AMS-M-3171shall be applied. For other metals, a determination shall be made and a treatment that ensures adhesion shall be chosen. Manually applied surface treatment shall be applied after final cleaning and draining of the surface within 8 hours but not more than 72 hours prior to application of the finish. Special precaution shall be taken where treated magnesium surfaces are scratched. Such scratched areas inadequately surface treated shall be touched up with

SAE AMS-M-3171, Type VI manually applied chemical treatment prior to coating application to alleviate blistering or poor adhesion of subsequent coatings that are applied to these surfaces.

3.5.1.7.1 Aluminum and magnesium surface treatment thickness. Surface treatment for aluminum and magnesium surfaces shall be applied in accordance with MIL-DTL-5002 (see 4.5.3) with care not to attain a powdery surface. Paint will not adhere to a powdery surface of excessively treated magnesium or aluminum.

3.5.1.7.2 Final preparation for painting. After application and proper dwell of the surface treatment, the surface shall be flushed with clear water and tested in accordance with 4.5.3. If additional cleaning is necessary, it shall be done in such manner that the surface treatment is not damaged.

3.5.1.8 Special precautions. Painting shall begin as soon as possible after surface treatment to ensure application to a water-break free surface. If the break between conversion coating and painting exceeds 72 hours, the weapons system shall be reconversion coated. Cleaning, consisting of an additional wash with detergent solution or steam shall be required if the surface is not painted immediately after surface treatment to remove lubricants and aircraft fluids which weep from rivets and other crevices. A final hand wipe-down with an approved solvent shall be performed immediately before painting the weapons system to ensure scrupulous cleanliness and a proper paintable surface. All surfaces shall be thoroughly dry before receiving paint-type materials, taking special precautions to assure dryness of crevices, faying surfaces, and inaccessible areas.

3.5.2 Coating systems.

3.5.2.1 Selection of coating system. The coating system of MIL-PRF-85582 or MIL-PRF-23377 epoxy primer and MIL-PRF-85285 shall be applied to Navy weapons systems exterior surfaces unless otherwise specified in the contract or order. Other common coating systems are outlined in MIL-STD-7179. For detailed directions, consult the applicable specifications and drawings.

For Air Force Systems: As an alternative to the above finish systems (i.e. MIL-PRF-23377, MIL-85582, and MIL-PRF-85285), materials qualified to MIL-PRF-32239 are acceptable.

3.5.2.2 Application of paint-type materials. Application of paint materials shall be as specified herein.

3.5.2.2.1 General. Surfaces shall be warmed to room temperature before painting. The temperature shall be not less than 5 °F above the dewpoint. Unless otherwise specified herein or in the detail process specifications, paint-type protective coatings may be applied by spraying, brushing, roller coating, flow-coating, or any other approved method that shall produce an application of a smooth, continuous film is free of imperfections. Dipping shall not be used unless approved by the procuring activity because of the resulting poor film quality of most coatings. Prior to spraying of paint, the safety precautions specified in 3.3, shall be strictly

enforced. The developed and adjusted method of application of organic coatings to exterior surfaces shall provide optimum smoothness for aerodynamic considerations.

3.5.2.2.2 Air and weather conditions. Unless otherwise authorized by the procuring activity, aerospace coatings shall be applied under the atmospheric conditions as follows:

Temperature: 75 °F +/-10 °F
Relative humidity: 50 percent ±15 percent

3.5.2.2.3 Production spray test panels. Each aircraft coated shall have at least two witness test panels. Witness panels shall be a minimum of 3 X 6 X 0.016 inch, shall be manufactured from 7075 T6 or 2024 T3 aluminum, and conversion coated with MIL-DTL-81706. The test panels shall be coated under prevailing conditions with the finish system that is to be applied to the weapons system. A test panel is not required for each color, only the primary color used. Test panels shall be labeled with the aircraft bureau and sequence number (see 6.4).

3.5.2.3 Primer application. Primer shall be smooth with a minimum of specks and occlusions since they carry through to the topcoat and impart undesirable roughness to the final finish. In spraying primer, proper spray technique is necessary to avoid dry overspray which results in excessive roughness. The applied primer film shall be free from streaks, blisters, seeds, excessive silking, or other surface irregularities. Dry scuff sanding by hand, using No. 320 or No. 400 grit aluminum oxide or ceramic sandpaper shall be employed, as necessary, to remove specks or roughness that might carry through to the topcoats. The dry scuff sanding shall not result in the exposure of bare substrate. There shall be no gouging of the surface of rivets and other protuberances and edges of faying surfaces with the sandpaper because it removes the primer and exposes bare metal. If primer is removed, normal touchup with conversion coating and primer shall be accomplished. Areas where primer presents a distinctly rough appearance not removable by sanding shall be stripped and a new primer applied to the area involved. If bubbling of coatings is encountered on magnesium, it may be taken as evidence of inadequate surface treatment of the magnesium. Such bubbled coatings shall be removed immediately and the surface given a manually applied chemical surface treatment, followed by subsequent coating. There shall be no degradation of the primer while exposed to outdoor environments or sunlight.

3.5.2.4 Topcoat application.

3.5.2.4.1 General. Proper techniques of application and processing shall be employed to obtain a coating inherently smooth and free of discontinuities, such as orange peel, seeding, runs, sags, blister, etc., except to a very minor degree. Glossy finishes shall have the highest gloss possible. Topcoat shall be applied in a two coat process.

3.5.2.4.2 Reactivation of primer. To ensure adhesion, primer that exceeds the maximum timeframe until topcoat, as specified by the manufacturer, shall be scuff sanded with No. 320 grit or No. 400 grit aluminum oxide or ceramic sandpaper followed by solvent wiping with a compatible solvent. The dry scuff sanding shall not result in the exposure of bare substrate. There shall be no gouging of the surface of rivets and other protuberances and edges of faying

surfaces with the sandpaper because it removes the primer and exposes bare metal. If primer is removed, normal touchup with conversion coating and primer shall be used.

3.5.2.4.3 Overcoating with clear topcoats. Unless otherwise authorized by the procuring activity, the application of clear topcoats of over pigmented finishes shall be prohibited.

3.5.2.5 Application of insignia and markings. NAVAIR insignia and markings shall be applied in accordance with MIL-STD-2161 or as specified by the procuring activity. Approved decals may be used for insignia and markings. The additional thickness of finish resulting from the application of insignia and markings shall be within the limits specified in 3.5.2.8. 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, and the use of a knife or any metal blade on the weapons system in the application procedure is prohibited. Masking tape used in the application of insignia and markings shall be removed as soon as practicable.

For Air Force systems: Insignia and markings shall be applied in accordance with general series T.O.1-1-8 or as specified by the procuring activity.

3.5.2.6 Other exterior finishing requirements. Protection of faying surfaces and between dissimilar metals, etc. shall be in accordance with MIL-STD-7179. Aluminized and fluorescent coatings shall not be used on radome parts, Magnetic Airborne Detector (MAD) housings, and other dielectric sensitive parts. To simulate glossy aluminum color, FED-STD-595, Color No. 16473 shall be used. For low gloss aluminum color, FED-STD-595, Color No. 36440 shall be used. In painting radomes, antenna housings, and MAD housings, a minimum amount of paint shall be applied to avoid attenuation of the signal. Over-painting anywhere on the radome, or housing, is prohibited.

3.5.2.6.1 Exterior finish of glass-fiber-reinforced plastic parts. Exterior glass-fiber-reinforced plastic parts shall be scuff sanded using No. 320 or No. 400 grit wet-or-dry aluminum oxide or ceramic sandpaper to remove any glaze and to slightly abrade the surface. Remove the dust via an approved cleaning method. Apply specified coatings. Leading edges of radomes, antenna housings, fairings, etc., up to a line making an angle of 15 degrees with the fuselage reference line of the weapons system shall incorporate a rain erosion system. When experience with a particular model indicates that the erosion pattern is less extensive, the coverage may be reduced, but the reduction shall not be less than an area bounded by a line making an angle of 30 degrees with the fuselage reference line.

3.5.2.6.2 Metal leading edges. The metal leading edges of weapons systems having speeds above 250 knots (maximum velocity in level flight) shall be coated with rain-erosion-resistant finish approved by the procuring activity. Internally heated leading edges whose de-icing efficiency would be impaired by the coating shall remain uncoated. Rain erosion resistant finishes may be applied on weapons systems having speeds of 250 knots and below.

3.5.2.6.3 Sanding surfacer. Two coats of an approved sanding surfacer are permitted on composite components to fill defects. The surfacer shall be allowed to air-dry and then shall be sanded smooth with No. 320 or No. 400 grit aluminum oxide or ceramic sandpaper. After the

sanding operation, the weapons system shall be washed with water or another approved cleaning method to remove grit and foreign matter.

3.5.2.6.4 Use of masking tape. Masking tape used in the application of insignia and markings shall not 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 in accordance with 4.5.4.

3.5.2.7 Time of application of paint-type protective coatings. Manufacturer's recommendations shall be followed for drying and recoat times.

3.5.2.8 Thickness of weapon systems finish (dry thickness). The average film thickness of each single dried coat of paint-type material used on weapons systems shall be controlled within the limits specified in MIL-STD-7179. Thickness variation is expected but finish thickness in all areas shall be maintained below 1.5 times the average maximum thickness to avoid cracking of the paint finish. Due to the greatly reduced corrosion inhibiting effectiveness and coverage of dried film thickness less than 0.0003 inch, primer films on any area less than this thickness are prohibited. Thickness of coating film in exhaust trail areas shall be maintained above the minimum average thickness limit specified to provide adequate protection of these parts. Where sanding surfacer is used, which is permitted only on limited areas, the thickness of the finish may be increased in these areas by 0.002 inch. Where insignia and markings are added by painting, the total thickness of finish on these areas may be increased by 0.002 inch. Where decals are used, the additional thickness is controlled by the decal specification. The thickness of rain-erosion-resistant finish shall be held to the requisite minimum.

3.5.2.9 Identification of paint shop and the applied finish. On all weapons systems receiving paint finish on the exterior of the entire weapons system, or a major portion thereof, the identification markings, including the external finish, shall be in accordance with MIL-STD-2161.

3.5.2.10 Coating defects. All finishes on combat weapons systems having a V_{max} above 350 knots, including the joint between the two colors of the dual color schemes, shall be free of dried overspray, nibs, bumps, occluded particles, etc. (see 4.5.5). The finished coating on all aircraft shall be free of blisters and fisheye. Any orange peel shall not be visible from a distance of 6 feet. A strong light impinging on the finish at an oblique angle may be used as an aid in inspection.

3.6 Miscellaneous requirements.

3.6.1 Tack-ragging. To ensure 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 shall leave no undesirable residues.

3.6.2 Cloths, tack-rags, etc. Only new, contaminant-free, lint-free mill end cloths shall be employed in all steps of surface preparation, chemical surface treatment, cleaning, tack-ragging, and painting operations. Commercial rental wiping cloths shall not be used.

3.6.2.1 Laundered cloths. Laundered shop cloths shall be permitted only when all of 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. Marking by permanent marking inks or dyes shall be employed to ensure segregation and return of cloths used for paint shop purposes.

b. The laundered cloths shall be completely absent of any trace of silicone-type material, as determined by laboratory control tests, including Soxhlet extraction.

c. Periodic control tests as determined by the cognizant engineering authority to ensure compliance with a and b above.

3.6.2.2 Paper wiping materials. The use of disposable fiber or chemically treated paper wiping materials is permitted provided laboratory control tests are conducted on the fiber and paper wiping materials to establish the absence of alkalinity, silicones, and of sizing and residues that are leachable in water, organic solvents, or other liquids employed in the cleaning sequences. The absence of deleterious effect shall be determined by actual paint application on test panels.

3.6.3 Final finish cure. After painting, the weapons system shall dry in a dust-free atmosphere. There shall not be any damage to the finish caused by moving the weapon system before it is dry. Painted weapons systems or 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. The engines of the painted weapons systems shall not be operated for at least 48 hours after painting. All painted weapons systems shall be handled, taxied, etc., as little as possible during the first week after painting.

3.6.4 Fairing putties. The use of fairing putties/sealants in accordance with SAE AMS-S-8802, SAE AMS-3276, MIL-PRF-81733, or equivalent as approved by the procuring activity, is permitted for filling narrow gaps in the skin and between butt joints provided the material selected for this purpose, when employed in the complete finish prescribed for the weapons system, displays durability equivalent to the standard finish. Fairing putties shall not be employed unless otherwise specified on the weapons system exterior to conceal scratches, depressions, etc., except for a limited number of locations that are no larger than 1 square inch in area. In these cases, Hysol EA960 (rigid type) or equivalent as approved by the procuring activity, may be used provided the area is aft of the engine intakes. Fairing putties shall not be used for filling narrow gaps in the skin between butt joints for the purpose of aerodynamic smoothing unless approved by the procuring activity (see 6.5). The use of fairing putties (environmental sealers) is considered permissible for the purpose of preventing water from entering the weapons system interior and for preventing corrosion in seams. The use of

sealing compounds in accordance with SAE AMS-S-8802, SAE AMS-3276, or MIL-PRF-81733 is permitted in countersinks and as an overlay on high strength steel fasteners.

3.7 Control.

3.7.1 Cleanliness. Tests shall be conducted prior to application of surface treatment and paint-type coatings to ensure that the surface is thoroughly clean and free from contaminants. The water break test specified in 4.5.1 shall be applied to representative areas to ensure that adequate cleaning and rinsing procedures have been employed and to check for freedom from residual steam-cleaning compound and other cleaning material residues. If these test areas on the weapons system fail these tests, the weapons system shall be recleaned and retested.

3.7.2 Smoothness. High gloss or low gloss shall have no specks and bumps and there shall be no seediness or roughness caused by dried overspray, improper thinning, or improper gun adjustment when examined in accordance with 4.5.5.

3.7.3 Gloss. Gloss determinations on weapons systems shall be made by a gloss meter at a 60° angle of incidence. The average visual gloss reading for gloss systems shall not fall more than 10 points below the gloss requirement of the topcoat material, except for isolated areas on the weapons systems not greater than one foot square which shall not fall more than 20 points below the gloss requirement for the topcoat material. The average visual gloss reading of nonspecular and semi-gloss finishes shall be not more than 2 points and 5 points respectively above the gloss maximum of the topcoat material except for isolated areas on the weapons systems not greater than one foot square.

3.7.4 Adhesion. At minimum, wet tape adhesion tests on the complete exterior finish shall be conducted on the production weapons systems after drying for a period of at least 48 hours whenever a new supplier furnishes materials used in the production process, whenever evidence occurs of deterioration in the quality of the finish, or whenever a change of process or sequence is effected. The tests shall be conducted on a sufficient number of selected areas of the weapons system and on a sufficient number of weapons systems to ensure maintenance of a satisfactory level of adhesion on full production. The tests shall be in accordance with 4.5.6.

3.7.5 Maintaining Film thickness maintenance. The thicknesses specified in 3.5.2.8 for the overall thickness of the finish below the maxima and for exhaust trail areas the thickness of finish above the minimum shall be maintained throughout the production process when tested as specified in 4.5.7.

3.7.6 Overall quality of finish. If specified in the contract or order (see 6.2), records shall be in conformance with Appendix B for the following: At the commencement of delivery; if the finishing procedure is changed significantly at any time; records covering the actual production painting procedure and finish on the first few weapons systems; overhaul activities at the beginning of production overhaul of a new weapons system model; whenever adhesion failures or other serious deficiencies of the finish occur.

3.7.7 Laundering of cloths (if employed). If laundered shop cloths are used, regular and frequent inspection tests shall be conducted at the laundry or after return of the laundered cloths, or both. Spot-tests of the cloths shall be conducted prior to actual usage in the shop, in sufficient number to ensure compliance with the requirements of 3.6.2.2, herein.

3.8 Spare parts. Spare parts shall not be packed until the paint has adequately cured to avoid imprinting or marring the coating.

3.9 Rubbing compounds.

3.9.1 General. Rubbing compounds may be used on gloss topcoats when necessary and applicable to remove defects and produce smooth films. Only gloss coatings that are recommended by the manufacturer shall be buffed. Paint shall be cured before buffing and manufacturer instructions shall be adhered to. Buffing operations may include:

a. Using a wool buffing pad operated between 1200 and 1800 rpm.
b. Starting with a more coarse grit and ending with a finer grit compound.
c. Constantly moving the buffer to prevent buffing in one area too long.

3.10 Interior finishing procedures and operations.

3.10.1 Preparation of surface. Anodizing or chemical surface treatment of metals and metal parts in accordance with MIL-DTL-5002 shall be performed on all interior surfaces that are to be painted, prior to the priming and painting operations. In addition to the requirements of MIL-DTL-5002, the cleaning requirements of this specification shall be enforced.

3.10.2 Application of paint-type materials. Interior finishing materials shall be applied as specified in MIL-STD-7179.

3.11 General information and general requirements.

3.11.1 Thickness meter. Eddy current thickness meters shall be used for measuring the film thickness of paint on nonmagnetic metals. A panel of the same metal composition, thickness, surface treatment, and heat treatment as the painted weapons system area shall be used for zero adjustments during the measuring process to obtain the requisite accuracy.

3.11.2 Production considerations. The finishing methods specified in this specification shall not be considered a process for overcoming engineering and manufacturing defects in the construction of weapons systems. Clean aerodynamic design and careful production methods that ensure aerodynamically smooth contours are prerequisites to the successful implementation of the requirements of this specification.

3.11.3 Test flying. After test flying with unpainted or primed metal, the weapons system shall be scrupulously cleaned, tested for cleanliness and then inducted into the exterior finishing process. Test flying of the weapons system during process of manufacture or overhaul

on unpainted or primed metal is preferred, in order to avoid damage to an already applied finish, excessive touchup, accumulation of excessive paint thickness, etc.

3.11.4 Refinishing of weapons systems during maintenance and overhaul. Refinishing of weapons systems and components during maintenance and overhaul shall be in accordance with the procedures previously described in this specification.

4. VERIFICATION

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

a. First article inspection (see 4.2).
b. Conformance inspection (see 4.3).

4.2 First article inspection. When specified (see 6.2), first article inspection shall consist of all the examinations and tests of this specification.

4.3 Conformance inspection. Conformance inspection shall consist of all the examinations and tests of this specification.

4.4 Test conditions. Unless otherwise specified in the detailed test methods herein, the physical tests contained in this specification shall be made with an atmosphere having a relative humidity of 50 ±5 percent and a temperature ranging from 70 to 76 ºF.

4.5 Tests.

4.5.1 Surface condition water-break test. A mist of distilled water shall be atomized on the surface under test, representative of the larger surface being tested, using any convenient small atomizing device. If the water gathers into discrete droplets within 25 seconds, in other words, if the surface shows a “water-break” within that time, then the surface shall be considered as having failed the test. If the water forms a continuous film by flashing out suddenly over a large area, then this shall be considered presumption of the presence of an impurity on the surface and the surface shall be considered as also having failed the test. If the water droplets coalesce into a continuous film of water without a sudden flash-out and form a lens, then the surface shall be considered as having passed the water-break test.

4.5.2 Surface reaction test. Red litmus paper shall be moistened with distilled water and touched to representative surface areas. The litmus paper turning blue shall be a failure. Surfaces failing this test shall be thoroughly rinsed, recleaned and retested until satisfactorily passing this test.

4.5.3 Inspection of aluminum and magnesium surface treatment. Aluminum and magnesium surfaces shall have a surface treatment that has been applied in accordance with MIL-DTL-5002.

4.5.4. Masking tape impairment test. After tape has been applied and the painting process employed, the tape shall be removed. The surface shall then be exposed to sunlight for a minimum of 48 hours. Upon removal, the surface shall be examined for any discoloration or impairment of the paint film.

4.5.5 Roughness examination. Roughness can be determined by running a fingertip in all directions to feel for bumps, occlusions, etc., to determine whether the requirement with regard to smoothness has been met. Any bumps or specks felt by the fingertips shall be reworked until surface is examined and determined to be smooth. Any areas were seediness or roughness caused by dried overspray, improper thinning, or improper gun adjustment is observed shall be reworked by sanding to remove the defects and prevent excessive coating build up followed by repainting until the surface is examined and determined to be smooth. Compounding and rubbing operations, as recommended by the manufacturer, may be employed on compatible gloss topcoats in lieu of scuff sanding and repainting.

4.5.6 Adhesion testing. In performing this test, a piece of cloth or plastic shall be taped on the area under inspection. The test area shall be kept soaked for not less than 24 hours 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, Code No. 250, Minnesota Mining and Manufacturing Company (only newly manufactured tape shall be used) or equivalent as approved by the procuring activity, adhesive side down. Press the tape down, using two passes of a 4-1/2 pound rubber covered roller or employ firm pressure with the hand. 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 base metal. Witness test panels shall be sprayed per 3.5.2.2.3. Scratch wet tape adhesion tests shall be conducted on these panels. The scratch wet tape adhesion test is identical to the wet tape adhesion test except a 2 inch long and 1 inch apart parallel scratches joined at each end by an inverted V shall be scribed down to base metal with a suitable stylus prior to water immersion. Removable inspection plates or access doors when available and depending on aircraft configuration may be used in place of witness test panels for these tests.

4.5.7 Film thickness maintenance testing. Once the spray-gun has been adjusted and prior to spray-painting the weapons system, test panels shall be spraypainted as specified in 3.5.2.2.3. Regular and frequent paint thickness measurements as determined by the cognizant engineering authority shall be made on the production weapons systems with an eddy current type gauge or equivalent as approved by the procuring activity on a sufficient number of selected areas of the system and on a sufficient number of weapons systems to ensure maintenance throughout production process.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense

Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The application and control of organic finishing materials in order to achieve aerodynamically smooth, adherent, high-quality finishes with minimum added weight to the weapon systems.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.
b. If first article inspection is required (see 3.2).
c. If Appendix B records are required (see 3.7.6.).
d. Packaging requirements (see 5.1).

6.3 Meticulous cleaning. The meticulous cleaning and surface treatment of weapons systems prior to all painting operations cannot be overemphasized. Failure to properly clean can result in coating failures in two ways: low coating adhesion and under film corrosion.

6.4 Production spray test panels. Test panels should be filed for a minimum of one year after delivery to the customer.

6.5 Fairing putty for filling narrow gaps in the skin between butt joints for the purpose of aerodynamic smoothing justification. The weapons system manufacturer will need to submit data indicating sufficient improvement in the weapons system performance to justify application of fairing putty.

6.6 Subject term (key word) listing.

Coating
Primer
Spray
Top coat

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

SPRAY APPLICATION

A.1 SCOPE

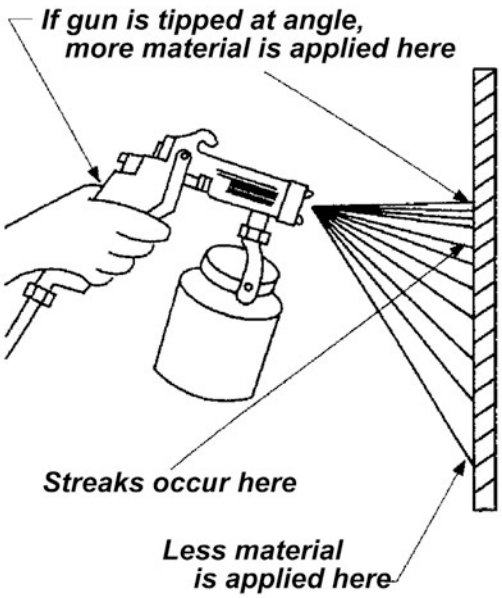
A.1.1 Scope. The spray application notes of this appendix shall be used for pertinent spray finishing information and guidance in establishing local procedures. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 Spray gun technique. Examples of correct technique are shown on Figure A-1. The spray gun shall be held so that the spray is perpendicular to the area to which the finish is being applied at all times. The gun should be held 6 to 10 inches from the work, depending on the width of the spray pattern. Generally, with a narrow pattern, the gun is held a farther distance from the work. In the use of the spray gun, great care should be taken to ensure that the prescribed distance is maintained from gun to work. For example, a distance of less than 6 inches is undesirable since the paint will not atomize properly and orange peel will result. A distance of more than 10 inches is equally undesirable, since dried particles of paint will strike the work and cause dusting of the finish, with resultant specks and lumps.

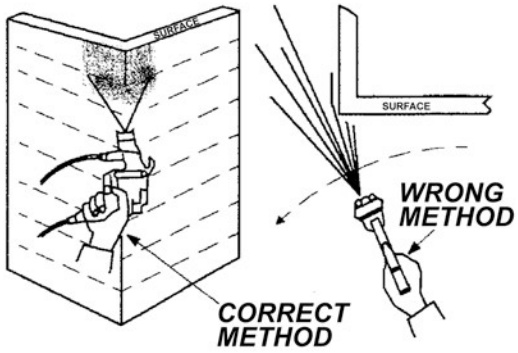
A.3 Spray adjustment. The spray pattern shall receive careful attention. Figure A-2 shows defects of finish, incorrect spray patterns, the causes, and suggested remedies. Figure A-3 illustrates how to achieve a correct pattern with a spray gun. Frequent inspections should be made of the entire spray gun and parts to ensure cleanliness at all times. Pointers on cleaning the spray gun are shown on Figure A-4.

A.4 Spray painting troubles. Possible causes and suggested remedies relating to problems encountered in spray painting are outlined in Table I.

A.5 Spraying. It is important to “trigger” the gun to avoid uneven coating caused by “buildup” at the beginning and end of the stroke (Figure A-1 Sheet 2). “Triggering” is the technique of starting the gun moving toward the area to be sprayed before the trigger is pulled and, similarly, moving the gun past the area that has just been painted after the trigger is released. Care should be taken to avoid too much overlapping on each pass of the gun, which would result in uneven paint thickness. The rate of stroke should be such to lay down a full wet coat of paint. The speed of spraying the job is very important. Once the work is undertaken, it must be carried through to completion without stopping, but this should not result in feeding of the paint at such a rate that will result abnormally thick films.

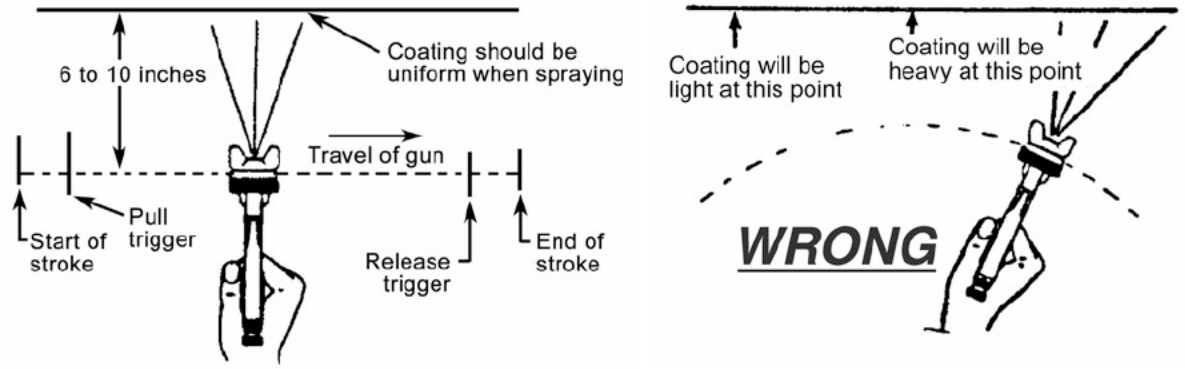


WRONG



Spray painting corners

FIGURE A-1. Spray painting technique (Sheet 1 of 2).



Move gun in straight line as arcing causes uneven application

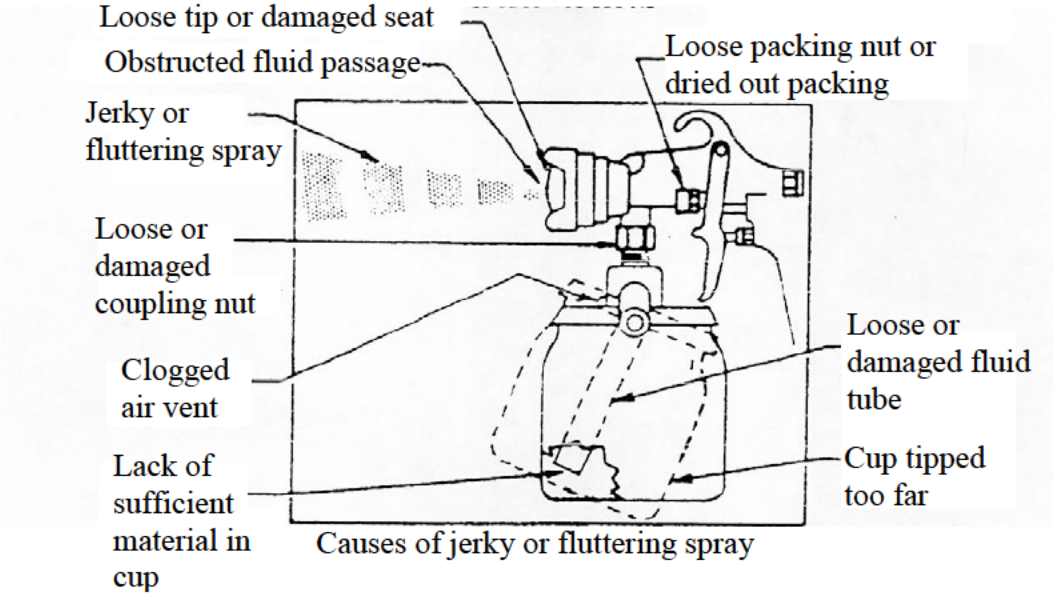


FIGURE A-1. Spray painting technique (Sheet 2 of 2).

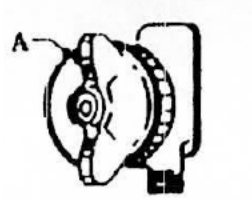
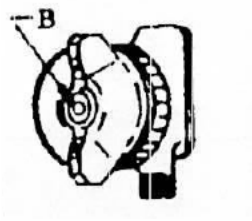
Pattern	Cause	Correction
	Dried material in side port A restricts passage of air through it. Result: Full pressure of air from clean side port forces fan pattern in direction of clogged side. 	Dissolve material in side port with thinner. Do not poke in any of the openings with metal instruments.
	Dried material around the outside of the fluid nozzle tip at position B restricts the passage of atomizing air at one point through the center opening of air nozzle and results in pattern shown. This pattern can also be caused by loose air nozzle. 	If dried material is causing the trouble, remove air nozzle and wipe off fluid tip, using rag wet with thinner. Tighten air nozzle.
	A split spray or one that is heavy on each end of a fan pattern and weak in the middle is usually caused by (a) too high an atomizing air pressure, or (b) by attempting to get too wide a spray with thin material.	Reducing air pressure will correct cause (a). To correct cause (b), open material control screw (see Figure A-3) to full position by turning to left. At the same time, turn spray width adjustment (see Figure A-3) to right. This will reduce width of spray but will correct split spray pattern.

FIGURE A-2. Faulty patterns and suggested corrections (Sheet 1 of 2).

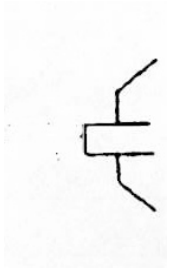
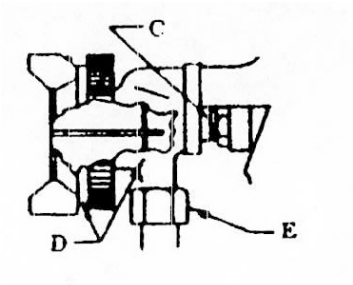
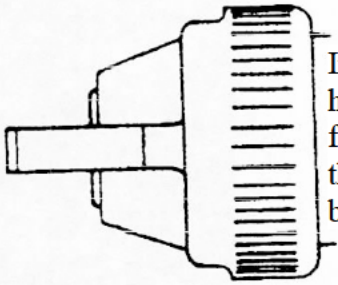
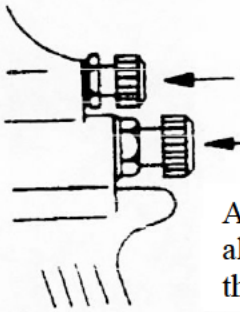
Pattern	Cause	Correction
	(a) Dried out packing around material needle valve permits air to get into fluid passageway, this results in splitting. (b) Dirt between fluid nozzle seat and body or a loosely installed fluid nozzle will make a gun spit. (c) A loose or defective swivel nut on siphon cup or material hose can cause spitting.	 To correct cause (a), back up knurled nut c, please two drops of machine oil on packing, replace nut and tighten with fingers only. In aggravated cases, replace packing. To correct cause (b), remove fluid nozzle D, clean back of nozzle seat in gun body using rag wet with thinner, replace nozzle and draw up tightly against body. To correct cause (c) tighten or replace swivel nut (e).
	A fan spray pattern that is heavy in the middle or a pattern that has an unatomized “salt-and-pepper” effect indicates that the atomizing air pressure is not sufficiently high.	Increase pressure from your air supply. Correct air pressures are discussed elsewhere in this instruction sheet.

FIGURE A-2. Faulty patterns and suggested corrections (Sheet 2 of 2).



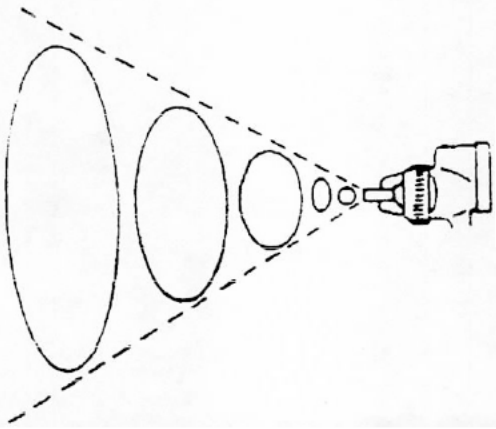
In normal operation, the wings on the nozzle are horizontal as illustrated at left. This provides a vertical fan-shaped pattern which gives maximum coverage as the gun is moved back and forth parallel to the surface being finished.



Spray width adjustment. Turn right for round, left for fan.

Material control screw. Turn right to decrease flow, left to increase.

As width of spray is increased, more material must be allowed to pass through the gun to get the same coverage on the increased area.



The spray pattern is variable from round to flat with all patterns in between.

FIGURE A-3. Correct spray patterns.

When used with a cup, the thinner or suitable solvent should be siphoned through gun by pouring solvent in open container of that liquid. Move trigger constantly to thoroughly flush passageway and to clean tip of needle. Do not atomize solvent.

When the gun is used with a pressure tank or gravity bucket, remove the air hose, turn the gun upside down and pour thinner into the fluid opening while moving the trigger constantly. This will flush all passageways.

It is extremely poor practice to place an entire gun in thinner. When this is done, the solvent dissolves the oil in the leather packing and causes the gun to spit.

It is good practice to place the nozzle and fluid connection in thinner. Vessel used should be shallow enough to prevent thinner from reaching packing.

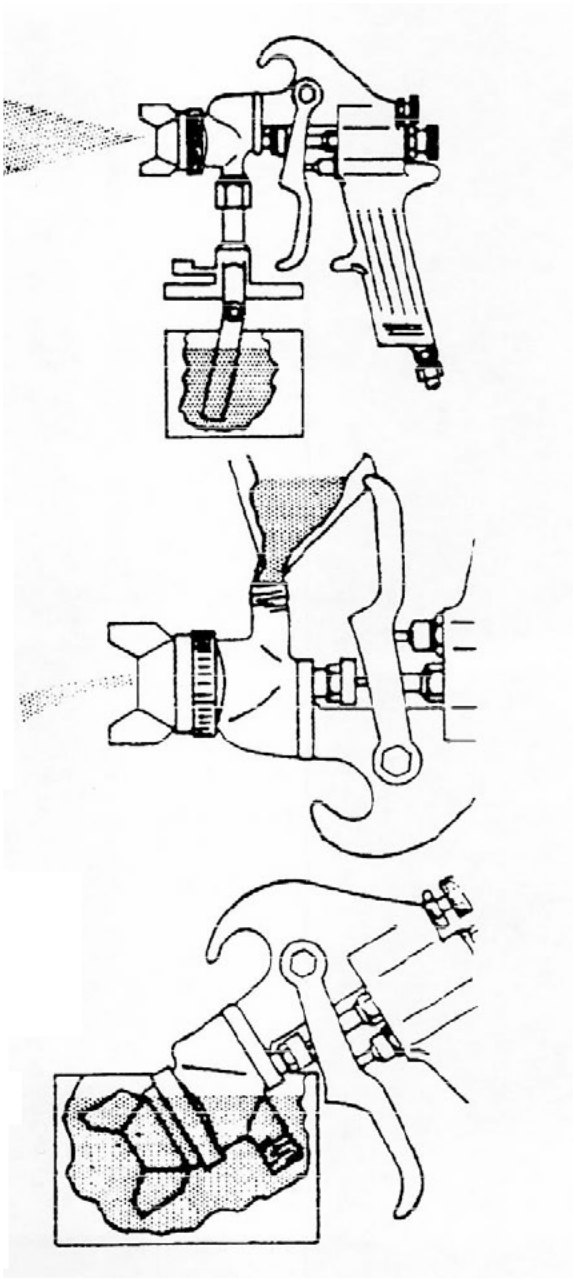


FIGURE A-4. Pointers on cleaning spray gun.

TABLE A-I. Spray painting troubles, possible causes and possible remedies.

Trouble	Possible causes	Possible remedies
Sandpaper finish	Unsatisfactory initial primer. Excessive dirt contamination from painting area. Insufficient scuff-sanding of primer. Improperly cleaned paint lines. Dried over-spray.	Laboratory analysis to verify acceptability of the material. Check primer application procedures. Provide cleaner painting areas. Flush paint lines frequently with solvent. Scuff-sand primer, using No. 360 or No. 400 grit wet-or-dry aluminum oxide or ceramic paper. Sand the complete finish until smooth to the fingertips.
Pinhole cavities	Improper surface treatment or lack of surface treatment (on magnesium). Entrapped oils, or solvents, or both. Insufficient primer drying times. Use of improper thinner. Adverse effects from high temperature or high humidity.	Apply manual surface treatment and ensure complete coverage of the magnesium with surface chemical film before wash primer application. Microscopic examination of stripped paint removed during tape test. Check mixing instructions to eliminate use of improper thinners. Review/evaluate temperature/humidity during application.
Excessive blushing	Excessive humidity.	Check humidity control equipment where used.
Dry spray	High temperature while spraying. Too much spray gun air pressure with insufficient fluid flow.	Review/evaluate temperature during application. Check paint spray gun settings.

TABLE A-I. Spray painting troubles, possible causes and possible remedies - (Continued).

Trouble	Possible causes	Possible remedies
Tape test paint transfer	Insufficient drying time of wash primer or zinc chromate primer, or both. Insufficiently cleaned aluminum surface, steam cleaning compound residue, etc. Oil seepage throughout inspection doors and blind rivets (especially jet aircraft). Entrapped oils and soil in zinc chromate shop primer. Excessively aged zinc chromate primer. Insufficient removal of shop primer or previous coatings, or both. Use of final finishes incorporating wax ingredients. Use of laundered rags containing contaminants such as silicone oils. Use of water-sensitive zinc chromate primer not conforming to specification requirements. Seepage of water containing cleaning compound residues from between faying surfaces. Wash primer applied at low relative humidity without special thinning as required by MIL-C-8507.	Perform initial wipe-down using safety solvent followed by lacquer thinner as an auxiliary cleaner. Remove all shop primers to provide a clean aluminum surface prior to any painting. Primer shop coat elimination preferred, as oil removal from shop primer coats practically impossible. Use solvent dampened cloths in lieu of dry cloths for removal of oil contamination (especially along jet engine inspection doors). Conduct laboratory analysis to determine primer acceptability. Delay wax application for 30 days after final paint application to avoid need for use of solvents by receiving activity or squadron to remove wax. Allow weapons system to stand for sufficient time to permit drainage of effluent before final cleaning. Note the type of failure, such as to bare metal or intercoat failure, and select the application cause and remedy accordingly.
Sags	(1) Dirty air cap and fluid tip (distorted spray pattern). (2) Gun stroked too close to the surface. (3) Trigger not released at end of stroke (when stroke does not go beyond object). (4) Gun stroked at wrong angle to surface. (5) Paint too cold. (6) Paint piled on too heavy. (7) Paint thinned out too much.	(1) Remove air cap and clean tip and air cap carefully. (2) Stroke the gun 6 to 10 inches from surface. (3) Operator should release the trigger after every stroke. (4) Gun should be stroked at right angles to surface. (5) Heat paint in an approved paint heater. (6) Learn to calculate depth of wet film of paint. (7) Add the correct amount of solvent by measure.

TABLE A-I. Spray painting troubles, possible causes and possible remedies - (Continued).

Trouble	Possible causes	Possible remedies
Streaks	(1) Dirty air cap and fluid tip (distorted spray pattern). (2) Insufficient or incorrect overlapping of strokes. (3) Gun stroked too rapidly ("dusting" of the paint.) (4) Gun stroked at wrong angle to surface. (5) Stroking too far from surface. (6) Too much air pressure. (7) Split spray. (8) Paint too cold.	(1) Remove air cap and clean tip and air cap carefully. (2) Follow the previous stroke accurately. Deposit a wet coat. (3) Avoid "whipping." Take deliberate slow stroke. (4) Gun should be stroked at right angles to surface. (5) Stroke 6 to 10 inches from surface. (6) Use least air pressure necessary. (7) Clean the fluid tip and air cap. (8) Heat paint to get good flowout.
Orange Peel	(1) Paint not thinned out sufficiently. (2) Paint too cold. (3) Not depositing a wet coat. (4) Gun stroked too rapidly ("dusting" the paint.) (5) Insufficient air pressure. (6) Using wrong air cap or fluid nozzle. (7) Gun stroked too far from the surface. (8) Overspray striking a previously sprayed surface.	(1) Add the correct amount of solvent by measure. (2) Heat paint to get flowout. (3) Check solvent. Use correct speed and overlap of stroke. (4) Avoid "whipping." Take deliberate slow strokes. (5) Increase air pressure or reduce fluid pressure. (6) Select correct air cap and nozzle for the material and feed. (7) Stroke the gun 6 to 10 inches from surface. (8) Spray detail parts first. End with a wet coat.
Excessive paint loss	(1) Not "triggering" the gun at each stroke. (2) Stroking at wrong angle to surface. (3) Stroking gun too far from the surface. (4) Wrong air cap or fluid tip. (5) Depositing a paint film of irregular thickness.	(1) It should be a habit to release trigger after every stroke. (2) Gun should be stroked at right angles to surface. (3) Stroke the gun 6 to 10 inches from the surface. (4) Ascertain and use correct setup. (5) Learn to calculate the depth of wet film of finish.

TABLE A-I. Spray painting troubles, possible causes and possible remedies - (Continued).

Trouble	Possible causes	Possible remedies
Excessive paint loss (con't.)	(6) Air pressure too high. (7) Fluid pressure too high. Paint too cold.	(6) Use the least amount of air necessary. (7) Reduce pressure. If pressure keeps climbing, clean regulator on pressure tank. (8) Heat paint to reduce air pressure.
Excessive spraying	(1) Too high air pressure. (2) Spraying past surface of the product. (3) Wrong air cap or fluid tip. (4) Gun stroked too far from the surface. (5) Material thinned out too much.	(1) Use least amount of compressed air necessary. (2) Release trigger when gun passes target. (3) Ascertain and use correct setup. (4) Stroke the gun 6 to 10 inches from surface. (5) Add the correct amount of solvent by measure.
Paint will not come from spray gun	(1) Out of paint (gun beings to sputter). (2) Settled, caked pigment blocking gun tip. (3) Grit, dirt, paint skins, etc., blocking gun tip, fluid valve, or strainer.	(1) Add paint, correctly thinned out and strained. (2) Remove obstruction, stir paint thoroughly. (3) Clean spray gun thoroughly and strain the paint. Always strain paint before using it.
Paint will not come from pressure tank	(1) Lack of proper air pressure in the pressure tank. (2) Air intake opening, inside of pressure thank lid, clogged by dried-up paint. (3) Leaking gaskets on tank cover.	(1) Check for leaks or lack of air entry. (2) This is a common trouble, clean the opening periodically. (3) Replace with new gasket.
Paint will not come from suction cup	(1) Dirty fluid tip and air cap. (2) Clogged air vent on cup cover. (3) Using wrong air cap. (4) Leaky connections on fluid tube or nozzle.	(1) Remove air cap and clean tip and air cap carefully. (2) Remove the obstruction. (3) Ascertain and use correct setup. (4) Check for leaks under water, and repair.
Gun sputters constantly	(1) Fluid nozzle not tightened to the spray gun. (2) Leaking connection of fluid tube or needle packing (suction gun).	(1) Tighten securely using a good gasket. (2) Tighten connections, lubricate packing.

TABLE A-I. Spray painting troubles, possible causes and possible remedies - (Continued).

Trouble	Possible causes	Possible remedies
Gun sputters constantly (con't.)	(3) Fluid pipe not tightened to the pressure tank lid.	(3) Tighten, check for defective threads.
Paint leaks from spray gun	(1) Fluid needle packing nut too tight. (2) Packing for fluid needle dry. (3) Foreign particle blocks fluid tip. (4) Damaged fluid tip or needle.	(1) Loosen nut, lubricate packing. (2) Lubricate this part daily. (3) Remove tip and clean. (4) Replace both tip and needle.

PAINTING PROCESS OUTLINE AND INSPECTION PROCEDURE REPORT

B.1 SCOPE

B.1.1 Scope. This appendix contains the format for recording the information specified in 3.7.6 . This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

B.2 A record in accordance with the following outline covering the actual production painting procedure and finish on the first few weapons systems shall be filled in by the contractor and attested to:

Date of report:
Processor and plant: City:
Weapons system model: Bu No:

1. Initial weapons system cleaning procedure:

   (a) Solvent: Steam: Detergent:
   (b) Stripper:
   (c) Others, enumerate:

2. SAE AMS 1640 deoxidation application:

   (a) Employed: ☐ Yes ☐ No

3. Results of litmus paper test:

4. MIL-DTL-81706 manually applied surface retreatment in accordance with MIL-DTL-5541 (on aluminum):

   (a) Employed: ☐ Yes Date: ☐ No
   (b) If employed, type used:
   Time of contact with surface:
   (c) Rinse schedule:
   (d) General areas treated:

5. SAE AMS-M-3171 manually applied treatment (on magnesium):

   (a) Employed: ☐ Yes ☐ No
   (b) If employed, type used:
   Time of contact with surface:
   (c) Rinse schedule:
   (d) General areas treated:

6. Water-break test for cleanliness:
   Results:

7. Final cleaning procedure:

   (a) Material employed:
   (b) Elapsed time between final cleaning procedure and application of wash primer:

8. Primer shop coat:

   (a) Employed: ☐ Yes Date: ☐ No
   (b) If employed, how prepared/removed and date:

9. Primer application:

   (a) Primer Specification No.: Type:
   Manufacturer:
   Manufacturer's Formula No:
   Purchase Order or Contract No. of primer procurement:
   Batch No.:
   Date of manufacture:
   (b) Date and time of primer application:
   Humidity reading: Temperature reading:
   Drying time allowed:
   (c) Was primer scuff-sanded?
   If so, how soon after application:
   Methods and materials used:
   (d) Average total dry thickness of primer deposit: mils
   How measured?
   Thickness limits allowed by Specification No.
   (e) Elapsed time after the surface treatment and before applying the primer: hrs
   (f) Induction time(if applicable): mins
   (g) Section 9 certified correct: Date:

10. Topcoat application

(a) Elapsed time after applying primer and before applying first topcoat:
(b) Topcoat material: Specification No.
Type: Manufacturer:
Manufacturer's Formula No.:
Purchase Order or Contract No. of topcoat procurement:
Batch No.: Date of manufacture:
(c) Mixing proportion: parts base material to parts thinner
Specification No.: Thinner Manufacturer:
Manufacturer's Formula No. of thinner: Batch No.:
Date of manufacture of thinner:
(d) Method of application:
Gloss ☐
Semi-gloss ☐
Camouflage ☐
Date and time of topcoat application:
Humidity reading: Temperature Reading:
Induction time (if applicable): mins
Drying time allowed for first coat: Drying time of second coat before moving weapons system:
(e) Average thickness of total topcoat deposit: mils
How measured: Location on weapons system:
Representative individual thickness readings:
Thickness limits allowed: mils Specification:
(f) Total in process time required for weapons system painting: hours.
This factor is based on the total time required for the entire process, exclusive of weapons system identification markings.
(g) Section 10 certified correct: Date:

11. Specialty coatings (if applicable)
(a) Elapsed time after applying previous coating:
(b) Specialty coating material: Specification No.
Type: Manufacturer:
Manufacturer's Formula No.:
Purchase Order or Contract No. of topcoat procurement:
Batch No.: Date of manufacture:
(c) Mixing proportion: parts base material to parts thinner
Specification No.: Thinner Manufacturer:
Manufacturer's Formula No. of thinner: Batch No.:
Date of manufacture of thinner:
(d) Method of application:
Gloss ☐
Semi-gloss ☐
Camouflage ☐
Date and time of specialty coating application:

Humidity reading: Temperature Reading:
Induction time (if applicable): mins
Drying time allowed for first coat: Drying time of second coat (or subsequent coats) before moving weapons system:

(e) Average thickness of total specialty coating deposit: mils
How measured: Location on weapons system:
Representative individual thickness readings:
Thickness limits allowed: mils Specification:

(g) Section 11 certified correct: Date:

12. Test on complete finish (when applicable):

(a) Wet adhesion tests on surfaces of weapons systems
Number of tests: Location on weapons system:
Test results:

(b) Section 12 certified correct: Date:

CONCLUDING MATERIAL

Custodians:
Army - CR4
Navy - AS
Air Force - 20

Preparing activity:
Navy - AS
Project 8010-2015-002

Review activities:
Army - AT, AV, MI, MR
Air Force - 84

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