

MIL-F-18264D

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SUPERSEDED

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MILITARY SPECIFICATION

FINISHES: ORGANIC, WEAPONS SYSTEM, APPLICATION AND CONTROL OF

This specification is mandatory 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 on weapons systems in order to achieve aerodynamically smooth, adherent, high quality exterior finishes and smooth, adherent, interior finishes, with a minimum of added weight to the weapons systems

1.2 Notes - Although the basic specification contains only the mandatory requirements, reference should be made to the notes in Section 14 for pertinent information and guidance in establishing local procedures. The details of information under these notes are not to be construed as modifying any requirement of this specification. Notes at end of paragraphs refer to Section 14.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal:

P-C-444	Cleaning Compound, Solvent, Grease Emulsifying
RR-S-366	Sieves, Standard, For Testing Purposes

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SPECIFICATIONS

Federal (Continued)

TT-B-846	Butyl Alcohol; Normal (Butanol) (For Use in Organic Coatings)
TT-E-529	Enamel, Alkyd, Semi-gloss
TT-E-776	Ethylene Glycol Monobutyl Ether (For Use in Organic Coatings)
TT-I-735	Isopropyl Alcohol
TT-L-20	Lacquer, Camouflage
TT-L-22	Lacquer, Cellulose Nitrate, Gloss, for Aircraft Use
TT-N-97	Naphtha; Aromatic
TT-R-248	Remover, Paint and Lacquer; Solvent Type
TT-R-771	Rubbing Compound (For Lacquered Surfaces)
TT-T-266	Thinner; Dope and Lacquer (Cellulose - Nitrate)
TT-T-291	Thinner, Paint, Volatile Spirits (Petroleum-Spirits)
TT-T-548	Toluene; Technical
TT-X-916	Xylene (For Use in Organic Coatings)
DDD-T-539	Towels, Machinery Wiping (Laundered)

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MIL-S-974	Surfacer; Sanding
MIL-N-3040	Resin Coating, Unpigmented, For Engine Components and Metal parts
MIL-M-3171	Magnesium Alloy; Processes for Pretreatment and Prevention of Corrosion on

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SPECIFICATIONS

Military (Continued)

MIL-S-5002	Surface Treatments and Metallic Coatings for Metal Surfaces of Weapons Systems
MIL-W-5044	Walkway Compound, Nonslip and Walkway Matting, Nonslip
MIL-W-5050	Walkway, Coating and Matting, Nonslip, Aircraft, Application of
MIL-C-5410	Cleaning Compound, Aluminum Surface, Non-Flame-Sustaining
MIL-C-5541	Chemicals, Films, and Chemical Film Materials for Aluminum and Aluminum Alloys
MIL-D-5549	Dope, Cellulose - Acetate - Butyrate, Clear, For Aircraft Use
MIL-D-5550	Dope, Cellulose - Acetate - Butyrate, Pigmented, Camouflage
MIL-D-5551	Dope, Cellulose - Acetate - Butyrate, Pigmented, Gloss
MIL-E-5556	Enamel, Camouflage, Quick Drying
MIL-A-6091	Alcohol, Ethyl, Specially Denatured, Aircraft
MIL-T-6095	Thinner, Cellulose - Nitrate - Dope, Blush-Retarding
MIL-P-6506	Primer Coating, Zinc Chromate, For Aircraft and Missile Applications, Application of
MIL-P-7094	Plastic Parts, Aircraft Exterior, General Requirements and Tests for Rain-Erosion Protection of
MIL-F-7175	Finishes and Coatings, General Specification For Protection of Aircraft and Aircraft Parts
MIL-C-7439	Coating System, Elastomeric, Rain Erosion Resistant and Rain Erosion Resistant with Anti-Static Treatment, For Exterior Aircraft and Missile Plastic Parts

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SPECIFICATIONS

Military (Continued);

MIL-S-7502	Sealing Compound. Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion. Accelerator Required
MIL-R-7705	Radomes, General Specification For
MIL-E-7729	Enamel, Gloss
MIL-D-7850	Dope, Cellulose - Acetate - Butyrate, First Coat, Fungicidal
MIL-P-7962	Primer Coating, Cellulose - Nitrate Modified Alkyd Type, Corrosion - Inhibiting, Fast-Drying (for Spray Application over Pretreatment Coating)
MIL-D-8096	Doping Aircraft Surfaces, General Specification for
MIL-C-8507	Coating, Wash Primer (Pretreatment), for Metals, Application of (for Aeronautical Use)
MIL-C-8514	Coating Compound, Metal Pretreatment, Resin-Acid
MIL-P-8585	Primer Coating, Zinc Chromate, Low - Moisture - Sensitivity
MIL-A-8625	Anodic Coatings, For Aluminum and Aluminum Alloys
MIL-L-8645	Lacquer, Cellulose Nitrate, For Aircraft Use, Application by Hot-Spray Process
MIL-C-8779	Colors, Interior, Aircraft Requirements For
MIL-S-8802	Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High-Adhesion
MIL-P-14276	Paint, Heat Resisting, Silicone, Aluminum
MIL-S-15847	Spray Guns and Accessories, Paint and Dope Aircraft Use

Military (Continued)

MIL-C-18187	Coatings, Protective, Application to Fabric Surface of Aircraft
MIL-C-18260	Colors, Exterior, Naval Aircraft, Requirements For
MIL-I-18464	Insignia and Markings for Naval Weapons Systems
MIL-L-19537	Lacquer, Acrylic - Nitrocellulose, Gloss (for Aircraft Use)
MIL-L-19538	Lacquer, Acrylic - Nitrocellulose, Camouflage (for Aircraft Use)
MIL-T-19544	Thinner, Acrylic - Nitrocellulose, Lacquer
MIL-T-19588	Toluene - Methyl Isobutyl Ketone Mixture
MIL-P-21563	Paint System, Fluorescent, For Aircraft Application
MIL-P-21600	Paint System, Fluorescent, Removable, For Aircraft Application
MIL-P-21696	Paint, Fluorescent, For Aircraft, Process For Application of
MIL-C-22543	Cleaning Compound, Water Emulsion
MIL-C-22750	Coating, Epoxy Polyamide, Chemical and Solvent Resistant, For Weapons Systems
MIL-C-22751	Coating, Epoxy Polyamide, Chemical and Solvent Resistant, Process for Application of
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-M-25047	Marking For Airplanes, Airplane Parts and Missiles (Ballistic Missiles Excluded)

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SPECIFICATIONS

Military (Continued)

MIL-C-27315	Coating Systems, Elastomeric, Thermally Reflective and Rain Erosion Resistant
MIL-C-38534	Corrosion Removing Compound, Prepaint for Aircraft Aluminum Surfaces
MIL-P-52192	Primer Coating, Epoxy
MIL-E-52227	Enamel, Semi-Gloss, Quick Drying
MIL-R-81294	Remover, Paint, Epoxy System
MIL-L-81352	Lacquer Acrylic (For Naval Weapons Systems)

STANDARDS

Federal

Fed. Test Method Std. No. 141	Paint, Varnish, Lacquer, and Related Materials, Method of Inspection, Sampling, and Testing
FED-STD-595	Colors

PUBLICATIONS

Bureau of Naval Weapons

NAVWEPS 01-1A-506	Handbook, Aircraft Maintenance Cleaning
NAVWEPS 07-1-505	Chemical Materials for Naval Weapons System Maintenance and Overhaul Operations
SAR-306	Overhaul of Naval Aircraft and Associated Components

Air Force

Technical Order 1-1-1	Cleaning of Aeronautical Equipment
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(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.)

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3. EQUIPMENT AND FACILITIES

3.1 The equipment and facilities used in applying surface finishes on weapons systems shall be suitable and adequate and shall be subject to the approval of the procuring activity.

3.2 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 blowing out the lines as necessary. Normally a minimum of two cleanings per day will be found necessary. 1/* 2/ 3/ 4/

* 3.3 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 for painting personnel. 5/

3.4 Electrical grounding, etc. - All safety precautions contained in MIL-C-18187 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., are hereby applicable to the painting of weapons systems. PRIOR TO SPRAYING OF PAINT, THE WEAPONS SYSTEMS SHALL BE GROUNDED IN ACCORDANCE WITH MIL-C-18187 TO PREVENT EXPLOSION OR FIRES CAUSED BY STATIC DISCHARGES. The above should not be construed as covering all the requirements, but are purely illustrative of several safety requirements.

4. MATERIALS

* 4.1 Material - Unless otherwise specified, all materials used in the finishing and coating of weapons systems and weapons system parts shall conform to the requirements of the applicable specifications, and as specified in MIL-F-7179. The addition to the paints of any materials other than thinners is prohibited unless approved by the procuring agency. Contractors and overhaul activities shall conduct such check tests as necessary to ensure suitability of the materials.

* 4.1.1 Characteristics of most often used coating materials -

- a. Wash primer or pretreatment coating, MIL-C-8514, used over pretreated metal as a tie between the metal and coating system. It should not be used on metal that becomes heated over 300° F and areas subject to hot diester oil spillage (over 250° F) except where its presence is essential for MIL-P-7962 primer.

*Numbers at end of paragraphs refer to notes of Section 14.

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Directions for applying under various conditions of humidity must be observed as outlined in MIL-C-8507.

- b. Epoxy primer, MIL-P-23377, used as an undercoat for epoxy coating system. Use only that which has been purchased under the latest document.
- c. Lacquer primer, MIL-P-7962, is mandatory as an undercoat for the acrylic-nitrocellulose lacquer system. Also used as a primer under air drying enamel or nitrocellulose lacquer.
- d. Zinc chromate primer, MIL-P-8585, used as a corrosion inhibiting primer under cellulose nitrate lacquer and enamel. Do not use under acrylic-nitrocellulose lacquer. It is sometimes used without topcoat.
- e. Epoxy topcoat, MIL-C-22750, is a highly resistant finish currently used as the standard finish on Navy weapons systems.
- f. Acrylic lacquer MIL-L-81352 is resistant to discoloration by heat, up to 350° F, and diester oil lubricants. It is intended for use over epoxy primer, MIL-P-23377, with or without wash primer MIL-C-8514. It is used for insignia and markings over epoxy topcoat.
- g. Acrylic-nitrocellulose lacquer, MIL-L-19537, and MIL-L-19538 is resistant to hot diester oil. It is currently used as the standard finish on Air Force weapons systems.
- h. Nitrocellulose lacquer, TT-L-20 and TT-L-32, used as a general purpose coating where diester oil is not present on interior surfaces.
- i. Fluorescent paint, MIL-P-21563 and MIL-P-21600, used when specified for high visibility.
- j. Dopes, MIL-D-5549, MIL-D-5550, MIL-D-5551, and MIL-D-7850 used as a system for treating fabric on weapons systems. Materials are applied in accordance with MIL-C-18187.
- k. Miscellaneous, MIL-P-52192, MIL-E-52227, and TT-E-529 are used extensively in finishes for the U. S. Army Missile Command.

4.2 Preparation of coating materials -

4.2.1 Mixing - Finishing materials shall be prepared for application under clean conditions with clean equipment. Materials shall be allowed to warm to room temperature before mixing. Skins, if present, shall be carefully removed from the material. The materials shall be thoroughly stirred or shaken prior to thinning or mixing and application. Non-epoxy materials, after thinning, shall be kept under constant agitation until used. Epoxy primer and top coat shall be thinned, stirring thoroughly, strained and allowed to stand for one hour prior to use. Mixing shall be controlled by weight, volume, or viscosity to ensure complete uniformity of all material prepared for use. The mixing of paints of the same specification but supplied by different manufacturers is prohibited, to avoid problems of incompatibility in the liquid and drying phases. Every effort should be made to assure that a primer of a single manufacturer is employed on the item to be finished and similarly, the topcoat should be restricted to a product of a single manufacturer. 6/ 7/

4.2.2 Selection of thinners - The thinner recommended on the package label or in the applicable process specifications shall be employed. Table I presents general thinning directions for spray application. Adjust the amount of thinner, as necessary, to obtain the prescribed thickness of coating, but avoid excessive thinning which could produce runs and sags. Temperature and humidity conditions should be determined and thinning adjusted as required by the applicable specification, for such atmospheric conditions. Other thinners as recommended by the paint manufacturer for his particular product may be employed if approved by the procuring activity. 8/ 9/ 10/

4.2.3 Aged zinc chromate primer and wash primer - Primers are more subject to deterioration with age than other weapons systems paints. Therefore zinc chromate primer, MIL-P-8585, which is over 2 years old, and wash primer, MIL-C-8514, more than 1 year old, reckoning from the date of manufacture, even though considered acceptable for use as a result of visual inspection, shall not be released for production use on exterior surfaces of weapons systems until it has been subjected to all the inspection tests of the applicable material procurement specification and, in addition, the large scale panel spray tests specified in 5.2.2.2 and the scratch wet tape adhesion test specified in 8.5. If the tests indicate the material to be satisfactory for use, it shall be consumed within 6 months from date of completion of tests; otherwise the unused material shall be retested similarly.

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TABLE I
SUGGESTED THINNING DIRECTIONS

Material	Specification	Reduction *	Spray viscosity ** seconds	
			No. 4 Ford cup	No. 2 Zahn cup
Wash primer (pretreatment coating)	MIL-C-8514	TT-L-735 isopropyl alcohol or MIL-A-6091 ethyl alcohol - with or without TT-B-846 butyl alcohol (see MIL-C-8537)	20 to 25 ***	27 to 31
Primer, zinc chromate	MIL-P-8585	TT-T-548 toluene with or without TT-X-916 xylene (see MIL-P-6808)	8 to 12	17 to 23
Primer, zinc chromate	MIL-P-7962	Two volumes of package primer to three volumes of TT-T-266	8 to 12	17 to 23
Lacquer, cellulose nitrate gloss (hot-applied)	TT-L-32	MIL-T-6095 with or without TT-E-776 (see MIL-L-8645)	24 to 26 ****	33 to 35
Lacquer, cellulose nitrate gloss	TT-L-32	One volume of package lacquer to approximately one volume of TT-T-266	12 to 18	21 to 27
Lacquer, camouflage	TT-L-20	One volume of package lacquer to approximately two volumes of TT-T-266	12 to 18	21 to 27

TABLE I (Continued)

Material	Specification	Reduction *	Spray viscosity**	
			No. 4 Ford cup	No. 2 Zahn cup
Enamel, gloss	MIL E-7729, Types I and II	Use at package consistency for brushing. Reduction is limited to four volumes of package material to one volume of TT-N-97, Type I, Grade B.	16 to 22	25 to 31
	MIL E-7729, Type III	Reduction is limited to four volumes of package material to one volume of TT-X-916.	16 to 22	25 to 31
Enamel, camouflage, quick drying	MIL E-5555	Use at package consistency for brushing. Reduction is limited to four volumes of package material to one volume of TT-N-97, Type I, Grade B.	16 to 22	25 to 31
Lacquer, acrylic	MIL L-81352	One volume of package lacquer to approximately one and one-half volumes of thinner. Thinner consists of approximately two parts toluene to one part xylene, by volume. Use more thinner if needed for leveling to reduce webbing.	10 to 15	18 to 21
Lacquer, acrylic- nitrocellulose, gloss	MIL L-19537	One volume of package lacquer to approximately one volume of MIL T-19544.	12 to 18	21 to 27
Lacquer, acrylic- nitrocellulose, camouflage	MIL L-19538	One volume of package lacquer to approximately one volume of MIL T-19544.	12 to 18	21 to 27

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TABLE I (Continued)

Material	Specification	Reduction *	Spray viscosity **	
			No. 4 Ford cup	No. 2 Zahn cup
Paint system Fluorescent	MIL-P-21600 or MIL-P-21563	Refer to MIL-P-21698	---	24 to 26
Epoxy primer	MIL-P-23377	Refer to MIL-C-22751, MIL-T-19544 and MIL-T-19588 42/	---	17 to 19
Epoxy topcoat	MIL-C-22750	Refer to MIL-C-22751 and MIL-T-19544	---	19 to 21
Dopes	MIL-D-5549 MIL-D-5550 MIL-D-5551 MIL-D-7850	Refer to MIL-C-18187	---	---

- Too much thinning is undesirable, as it would tend to produce runs in the paint. Too little thinning is equally undesirable, since roughness of the finish is likely to result.
- ** At 25 ± 0.25° C (77 ± 0.45° F) as specified in Fed. Test Method Std. No. 141, Method 4282. Spray viscosities shown in this table are below those normally used industrially for automotive work. In automotive work, coatings are usually sprayed at viscosities of 25 to 45 seconds with a No. 2 Zahn cup, and at 16 to 35 seconds with a No. 4 Ford cup. However, for weapons system spraying, viscosities must be controlled as indicated in order to reduce orange peel and achieve thinner films.
- *** Additional alcohol will be necessary to achieve this viscosity range, which is required to ensure thin, smooth wet films and prevent cobwebbing or stringing.
- **** Since unacceptable thickness of film is more likely to be applied with hot lacquer than by the conventional cold spray application, a closer viscosity range is prescribed.

4.2.4 Storage of paint materials - Weapons system finishing materials shall be stored in a cool, dry place, indoors if possible, and should not be stored at a temperature lower than 50° F or higher than 80° F for long periods and may approach, but should 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 will produce marked degradation of certain of these materials. Elastomeric compounds are most sensitive to temperature effects and should not be stored at a temperature lower than 60° F or higher than 85° F. All conditions under which paint materials are stored shall be subject to approval by the procuring activity.

4.2.4.1 Short storage life - Finishing materials which have a short storage life, such as elastomers and their primers, should be purchased as needed from local suppliers.

5. PROCEDURES AND OPERATIONS

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

5.1.1 Surface treatment - Anodizing or chemical surface treatment of metals and metal parts in accordance with MIL-S-5002 is a necessary pre-requisite on all surfaces which are to be painted, prior to the priming and painting operations. In addition, the requirements contained in 5.1.5 shall apply. 31/

5.1.1.1 Shop primer coats - Shop primer coats on exterior surfaces should be omitted in their entirety, as any use of shop coats may produce later difficulties for the processor. However, if shop coats have been used on exterior surfaces, they must be completely removed with TT-R-248 paint remover, or equivalent, to the bare metal and proceed as below. 11/

5.1.2 Mask - Prior to surface cleaning, chemical treatment, or painting, areas such as canopy, windshield, radome, transparent light covers shall be masked with masking material and taped in place (see 5.10). On canopy or windshield, 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 application 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 safety solvent conforming to O-T-620.

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5.1.3 Cleaning, general - The meticulous cleaning and surface treatment of weapons systems 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 must 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. 12/ 13/ 41/ Cleaning materials which may be effective against one type of contaminant may be ineffective against others. Therefore, multiple cleaning procedures may be required to provide the required water-break-free surface. **WARNING:** Acid cleaners or surface treatments shall not be allowed to contact materials susceptible to hydrogen embrittlement.

5.1.3.1 Remove surface-oxide and trace contaminants on aluminum and magnesium - Removal of surface oxides and trace contaminants on aluminum and magnesium surfaces after cleaning operations (5.1.3) should be accomplished while surfaces are still wet with material conforming to Type II, or Type I for heavy oxidation, of MIL-C-5410; mixed one volume of Type II with three volumes of water; for the Air Force use MIL-C-38334. Application should be with soft bristle brushes working from bottom to top. Allow to react with aluminum for as short a time as necessary, and with magnesium for 5 minutes (maximum) and then rinse with water, brushing all screws, rivet heads, and faying surfaces to insure removal, particularly on magnesium to avoid severe pitting attack. Use of vacuum, not pressure, to dry out seams, rivets, etc., is recommended.

Warning: Avoid trapping solution in crevices by adequate masking to prevent entry of solutions into inaccessible areas.

At this stage the surface should have a neutral or slightly acid reaction and be capable of passing the water-break test of 5.1.4.2.

Caution: Do not apply cleaner-brighteners to structural steel parts such as landing gear and arresting gear. Mask these parts prior to the cleaner-brightener treatment.

5.1.4 Tests for surface condition - The following tests shall be conducted on the weapons systems before surface retreatment and painting.

5.1.4.1 Reaction of surface - The surface shall have a neutral or slightly acid reaction. Red litmus paper moistened with distilled water when applied to the surface shall not turn blue, otherwise a 0.20 to 0.25 percent chromic acid solution shall be applied and 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 6.2. The surface shall then be retested with red litmus paper.

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5.1.4.2 Water-break test - Representative areas of the surface to be treated shall be tested by the procedure described in 5.1.4.2.1 for ability to support an unbroken film of distilled water.

5.1.4.2.1 Water-break test procedure - A mist of distilled water shall be atomized on the surface under test, representative of the larger surface being tested, employing 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, such as free alkali, residual detergent, etc., 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 satisfactorily passed the water-break test.

* 5.1.5 Manually applied surface treatment and touchup - For weapons systems already assembled, manually applied surface retreatment is required on all surfaces before painting. For aluminum surfaces, MIL-C-5541, manually applied surface retreatment is required. For magnesium surfaces, MIL-M-3171, Type VI, or other approved equivalent manually applied surface treatment is required. For other metals, the contractor shall determine the necessary treatment to assure adequate paint adhesion. Manually applied surface retreatment shall be applied after final cleaning and draining of the surface preferably 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 carefully touched up with MIL-M-3171 manually applied chemical treatment, or approved equivalent, prior to coating application, otherwise bubbling would be encountered when the wash primer and subsequent coatings are applied to these surfaces. 31/ 40/

5.1.5.1 Aluminum and magnesium surfaces shall be examined to determine that the optimum thickness of surface treatment has been applied. Paint will not bond to treated aluminum surfaces which are too dark, nor will it adhere to the brown powdery surface of excessively treated magnesium or aluminum.

5.1.6 Final preparation for painting - After application, and drying, of the surface retreatment the surface shall be flushed with clear water and tested in accordance with 5.1.4. If additional cleaning is necessary, it shall be done in such manner that the surface treatment will not be damaged.

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5.1.6.1 Special precautions - Painting should begin immediately after cleaning to ensure application to a water-break free surface. Solvent cleaning of the surface is a requirement if there is a break in the painting sequence on the weapons system of overnight, or longer. Additional cleaning consisting of at least an additional wash with solvent followed by a wash with detergent solution in hot water or steam will usually be required in the areas of blind rivets to remove all traces of lubricant used in driving the rivets. A final hand wipedown shall be performed immediately before painting the weapons system to ensure scrupulous cleanliness and a proper paintable surface. 14/ All surfaces shall be thoroughly dry before receiving paint-type materials, taking special precautions to assure dryness of crevices, faying surfaces, and difficulty accessible areas.

5.2 Coating systems -

5.2.1 Selection of coating system - The epoxy system of MIL-C-22751 is standard on Naval weapons systems unless otherwise specified. The other coating systems outlined in Table II are previous standards, except the acrylic-nitrocellulose lacquer system which is currently standard on Air Force weapons systems, and may be specified for specific application. For detailed directions, consult the applicable specifications.

* 5.2.2 Application of paint-type materials-

5.2.2.1 General - Surfaces shall be warmed to room temperature before painting. 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 ensure 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 MIL-P-6808 shall be observed. PRIOR TO SPRAYING OF PAINT, THE SAFETY PRECAUTIONS WITH REGARD TO GROUNDING, AS PRESCRIBED BY 3.4, SHALL BE STRICTLY ENFORCED The method of application of organic coatings to exterior surfaces shall be carefully developed and adjusted in all details to provide optimum smoothness, for aerodynamic considerations. When shop coats are stripped, the primer or insulating material between faying surfaces shall not be removed or damaged. 15/ 16/ 17/ 18/ 19/ 20/ 21/

5.2.2.2 Production spray test panels - Prior to the spraying operation, the suitability of materials for the entire system shall be determined experimentally on panels approximately 10 by 32 inches in size. The panel shall be coated under prevailing conditions with the finish system that is to

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* TABLE II *

OUTLINE OF COATING SYSTEMS USED ON WEAPONS SYSTEMS

System	Wash Primer**	Primer	Topcoat	Fluorescent ***
Epoxy New work		MIL-P-23377	MIL-C-22750	MIL P-21600
Epoxy Old work		MIL-P-23377	MIL-C-22750	MIL-P-21600
Field Green Acrylic, Nitro- cellulose over Epoxy		MIL-P-23377	MIL-L-19538	-----
Acrylic Nitro- cellulose Lacquer	MIL-C-8514	MIL-P-7962	MIL-L-19537 or MIL-L-19538	MIL-P-21563 or MIL-P-21600
Nitrocellulose Lacquer	MIL-C-8514	MIL-P-8585 or MIL-P-7962	TT-L-20 or TT-L-32	MIL-P-21563 or MIL-P-21600
Enamel	MIL-C-8514	MIL-P-7962 or MIL-P-8585	MIL-E-7729 or MIL-E-5556	MIL-P-21563 or MIL-P-21600

* Metal surfaces shall have received the requisite surface treatment to promote adhesion. This treatment may be specific for each metal. Special applications such as rain erosion systems, dopes, and radomes are not included.

** Not used on metal that becomes heated above 300° F nor where exposed to hot (over 250° F) diester oil except where its presence is essential to MIL-P-7962 primer.

*** Used only where specified. For application over epoxy a tie coat of white TT-L-32 is applied. In all cases a white undercoat is required.

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be applied to the weapons system. 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, poor adhesion, excessive orange peel, sagging, etc., shall be corrected prior to large scale application.

- * 5.3 Weapons system exterior finishing procedure (For Navy only) - Unless otherwise specified by the procuring activity, where exterior painting of weapons system surfaces is specified, except in those areas where functional requirements dictate otherwise, the procedure shall be as specified in MIL-C-22751 and outlined in Table III.

* TABLE III

OUTLINE OF APPLICATION PROCEDURE FOR EPOXY PAINT SYSTEM

Operation	Comment	Specification Number
Epoxy-Polyamide Primer	Apply a crosscoat in accordance with MIL-C-22751.	MIL-P-23377
Epoxy-Polyamide Topcoat	Apply a mist coat and allow to dry 30 minutes. Then apply a wet pass.	MIL-C-22750
Touchup	Weapons system touchup shall be performed as directed in MIL-C-22751.	
Fluorescent	Apply a white base coat of TT-L-32 lacquer to the epoxy finish, followed by the fluorescent topcoat. MIL-P-21600 or MIL-P-21563. Do not apply fluorescent paint directly over epoxy finish.	

5.3.1 Other approved finish systems - In the event of specific approval of other finish systems, the details of application, minimum and maximum drying times, minimum and maximum thicknesses, etc., of the individual components and the complete finish system shall be substituted for the corresponding requirements specified in 5.3 for the standard finish.

5.3.1.1 Acrylic-nitrocellulose lacquer - Acrylic-nitrocellulose lacquer systems, when required, shall be applied as follows. The thickness of each coat of finishing material shall be as specified in 5.4.

- a. Apply one thin coat of MIL-C-8514 wash primer applied in accordance with MIL-C-8507. Dry about 1 to 4 hours.
- b. Apply one coat of lacquer-type primer, MIL-P-7962. (Two coats of primer when prescribed for specific areas by MIL-F-7179.) Dry for 1 hour and observe the restrictions on maximum drying time specified in 5.6 herein. Use of MIL-P-7962 primer without a prior bonding coat of wash primer is prohibited anywhere on weapons systems. Epoxy primer, MIL-P-23377, applied in accordance with MIL-C-22751 may be used in place of the lacquer-type primer for field green acrylic lacquer, MIL-L-19538. 23/
- c. Apply two coats of MIL-L-19537 lacquer for high gloss finish, or MIL-L-19538 lacquer where low gloss finishes are prescribed, except for insignia white color, which may be applied with an additional coat. Dry the first coat of lacquer the requisite time before applying the second coat of lacquer. One coat of MIL-E-7729 enamel for high gloss finish, or MIL-E-5556 enamel where low gloss finishes are prescribed, or aluminum heat resistant silicone paint MIL-P-14276 should be used instead of lacquer on areas where a combination of corrosive effects, exhaust deposits and temperatures in excess of approximately 250° F may be encountered, except for the exterior of weapons systems subject to contact with diester-containing oils and greases from spillage, mist, etc. Apply extra thickness of topcoat on hull bottoms and exhaust trail areas, magnesium alloy, gun blast areas, battery vent and relief tube discharge areas, etc., where extra protection is prescribed by MIL-F-7179, to bring the total thickness of finish on these areas to the thickness range prescribed by 5.4 herein. The color and gloss of the exterior finish shall be in accordance

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with MIL-C-18263. The requirements for anti-glare finish in designated areas shall be strictly observed. 227

- d. Mask off metal leading edges of wings, horizontal stabilizers, vertical stabilizers, nose, wing tip fuel tanks, etc., right after the cleaning step in the case of aluminum and in the case of magnesium after the wash primer and zinc chromate primer have been applied. These metal leading edges shall be finished with approved rain-erosion-resistant finish. (See 5.3.2.2.)
- e. Insignia and markings shall be applied as prescribed by the procuring activity. (See 5.12.)
- f. Wax and polish, if aircraft is transport, helicopter, or trainer type and painted in high gloss finish. Waxing and polishing is prohibited on other painted weapons systems.

5.3.2 Other exterior finishing requirements, walkways, etc. -

The requirements of MIL-F-7179 relating to protection of laying surfaces and between dissimilar metals, etc., are applicable. When MIL-W-5044 walkway material is applied, as prescribed by MIL-F-7179, it shall be in accordance with MIL-W-5050, or MIL-C-22751 for the epoxy system. Glass-fiber-reinforced plastic parts shall be finished as prescribed in 5.3.2.1.

5.3.2.1 Exterior finish of glass-fiber-reinforced plastic parts -

Exterior glass-fiber-reinforced plastic parts shall be scuff sanded, using No. 400 wet-or-dry sandpaper, to remove any glaze and to slightly abrade the surface. Wash surface with toluene to remove the dust. Mask off the leading edge portions and apply rain-erosion-resistant finish conforming to MIL-C-7439 or MIL-C-27315 to the leading edges of radomes, antenna housings, Magnetic Airborne Detection (MAD) housings, fairings, etc., up to a line making an angle of 15 degrees with the fuselage reference line of the weapons system in accordance with the requirements of the radome, MIL-R-7705. When experience with a particular model indicates that the erosion pattern is less extensive, the coverage may be reduced at rework or overhaul, but to not less than an area bounded by a line making an angle of 30 degrees with the fuselage reference line. MIL-C-7439 or MIL-C-27315 finish shall not be applied over epoxy, lacquer, or enamel coatings or over sanding surfacer. The rain-erosion system may be extended or the standard coating system should be applied to the remaining areas of the glass-fiber-reinforced plastic

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part, aft of the rain-erosion-resistant finish. For Air Force weapons systems, reinforced plastic parts are not painted except for special purposes, such as erosion resistance, color matching, etc.

CAUTION: Aluminized and fluorescent coatings are prohibited on radome parts and MAD housings. To simulate glossy aluminum color, use aircraft gray, Color No. 16473 of FED-STD-595. For low gloss aluminum color, use light gull gray, Color No. 36440 of FED-STD-595. In painting radomes, antenna housings, and MAD housings, it is important that the minimum of paint be applied to avoid attenuation of the signal. The total paint thickness shall not exceed 0.0020 inch, except for leading edge portions, and over-painting anywhere on the radome or housing is prohibited.

5.3.2.2 Metal leading edges (such as stabilizers, wing tip fuel tanks, nose, etc.) - 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. This leading edge finish may be applied optionally on weapons systems having speeds of 250 knots and below. The leading edge finish shall be sandpapered with No. 360 abrasive paper, followed by No. 400 abrasive paper, stroking in the direction of the airstream until the finish is smooth to the fingertips. This operation should be performed when the paint has dried a sufficient length of time to permit sanding; apply to epoxy system in accordance with MIL-C-22751.

5.3.2.3 Engine parts - Engine parts may be coated in accordance with MIL-R-3043 for resin coating or MIL-E-7729, Type III for enamel. Proprietary high temperature paints, if used, should be applied in accordance with manufacturer's instructions.

5.3.3 Dopes - Dopes for application to fabric surfaces shall be applied as directed by MIL-C-18187.

5.4 Thickness of weapons systems finish (dry thickness) - The film thickness of each single dried coat of paint-type material used on weapons systems shall be controlled within the following limits: 0.0004 to 0.0007 inch for wash primer, 0.0003 to 0.0006 inch for one coat of zinc chromate primer, 0.0005 to 0.0008 inch for one coat of lacquer, and 0.001

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to 0.0034 inch for one mist plus one wet coat of enamel or varnish, 0.0006 to 0.0009 inch for one cross coat of epoxy primer and 0.0011 to 0.0015 inch for one mist coat plus one wet coat of epoxy topcoat. Because of the greatly reduced corrosion-inhibiting effectiveness and coverage in dried film thickness of less than 0.0003 inch, solitary primer films below this thickness should be avoided. The general weapons systems finish shall be maintained below the maximum thickness specified to avoid cracking, flaking, and checking of paint finish. Thickness of film in exhaust trail areas shall be maintained above the minimum specified to provide adequate protection of these parts. Where sanding surfacer is used, which is permitted only on limited areas, and subject to the restrictions contained in 5.9, 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. The thickness of rain-erosion-resistant finish shall be held to the requisite minimum, but in no case to exceed 0.0100 inch on the impacting area as specified by MIL-P-7094. 24/

5.5 Air and weather conditions - Coatings shall not be applied under unfavorable atmospheric conditions, such as high humidity, strong drafts, or low temperatures. When adverse atmospheric conditions are encountered, recourse to the use of blush-retardant thinner for wash primer and lacquer may be necessary. If blushing still prevails, all painting operations shall be suspended until nonblushing conditions have been reestablished. To apply wash primer under low humidity condition, the special thinning procedure of MIL-C-8507 must be followed. 25/

5.6 Time of application of paint-type protective coatings -

5.6.1 Firstcoat - Surfaces shall receive the wash primer coatings, or, where wash primer is not prescribed, the first primer coat immediately after final wipe down.

5.6.2 System - Surface coating shall be applied as follows:

5.6.2.1 Epoxy system - The epoxy system shall be applied as specified in MIL-C-22751.

5.6.2.2 Acrylic-nitrocellulose - For MIL-L-19537 and MIL-L-19538 acrylic-nitrocellulose lacquer systems, the elapsed interim times between coats are very critical. Wash primer, MIL-C-8514, should be overcoated with

45 minutes to 1 hour after application. Lacquer primer, MIL-P-7962, should be overcoated within 1 to 2 hours after application. For best results with the acrylic nitrocellulose materials, the entire paint system should be applied within an 8-hour work shift. 23/

5.6.2.3 Cellulose nitrate lacquer - For TT-L-32 and TT-L-20 cellulose nitrate lacquer systems, maximum overcoat times of the MIL-P-8585 zinc chromate primer and initial topcoat may be extended beyond the time limits set for acrylic-nitrocellulose lacquer without adverse results, provided the 1-hour maximum overcoat time for the MIL-C-8514 wash primer is observed.

5.6.3 Drying time for epoxy coating system - The drying times to be observed when applying the epoxy system are given in MIL-C-22751.

5.6.4 Drying time (wash primer) - Drying time for wash primer shall be as specified in MIL-C-8507.

5.6.4.1 Drying time (primer) - When MIL-P-8585 zinc chromate primer is used, the minimum and maximum drying times shall be those prescribed by MIL-P-6808. The minimum drying time for lacquer-type primer, MIL-P-7962, under ideal atmospheric conditions shall be at least 1 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 MIL-P-6808 to avoid degradation of either of the above primers prior to topcoating, as a result of outdoor exposure, especially in sunlight, shall be scrupulously observed. 23/

5.6.4.2 Topcoating - The first coat of lacquer shall be dried at least 45 minutes before scuff sanding, tack-ragging, or application of the second coat. The second coat of lacquer may be applied at the convenience of the manufacturer but not to exceed 96 hours later, provided, in cases where a delay occurs before application of the second coat, suitable prior cleaning and light scuff sanding is performed on the first lacquer coat to assure adequate adhesion of the second coat. A solvent wipedown is mandatory if there is an overnight delay or longer in the painting sequence. The applied finish system shall be allowed to dry 48 hours prior to operation of the engines, to achieve the necessary resistance to diester lubricants.

5.6.4.3 Fluorescent topcoats - Drying time for fluorescent topcoats shall be as directed in MIL-P-21698.

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5.7 Dopes - Dopes shall be dried in accordance with MIL-C-18187 or MIL-D-8096 as specified.

5.8 Details of application of topcoats -

5.8.1 General - With proper techniques of application and processing, it is practical to obtain a coating inherently smooth and free of discontinuities, such as orange peel, seeding, runs, sags, blisters, etc., except to a very minor degree. The weapons systems shall therefore have a smooth finish representative of high-grade weapons system practice. Glossy finishes shall have the highest gloss possible.

5.8.2 Glossy finish -

5.8.2.1 Application of glossy epoxy - Glossy epoxy is applied in accordance with MIL-C-22751. Cross coats, if used, shall be applied cautiously and the spray gun must be kept moving to avoid thick films.

5.8.2.2 Application of glossy lacquer - Glossy lacquer is normally applied by the cold spray process. In the cold spray process, in general, two full wet coats of lacquer shall be applied. This shall not be construed as two consecutive passes of the spray gun. One coat shall be applied by one double or cross pass of the gun. Followed by a second similar application after the first coat has set up. A minimum of 45 minutes drying time shall be allowed between lacquer coats. 26/

5.8.2.2.1 Overcoating with clear topcoats - The application of clear topcoats over pigmented finishes is prohibited, except where specifically authorized by the procuring activity for functional reasons such as resistance to deteriorating fluids. 27/

5.8.2.3 Application of glossy enamel - A thin first coat or "tack" of glossy 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.

5.8.3 Camouflage finish - There shall be no attempt to blend colors on frontal surfaces or horizontal leading edges. The juncture of the colors prescribed by MIL-C-18263 shall form an irregular undulating line, i.e., straight lines at the juncture shall be avoided. 22/

5.8.4 Fluorescent finish - The application of fluorescent finish shall be as directed in MIL-P-21698.

5.8.5 Use of sanding surfacer - In small areas on the exterior of weapons system surfaces that are severely scratched or abraded, or where otherwise

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considered necessary to obtain an aerodynamically smooth exterior surface on limited areas, one coat of suitable sanding surfacer will be permitted on such areas, but the material shall not be applied to the entire weapons system or 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 topcoats. Surfacer must not be used for purposes of concealing rivet or screw heads. Allow the surfacer to air-dry at least 16 hours, and then water-sand very smooth with No. 400 wet-or-dry aluminum oxide paper 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 weapons system shall be washed with water to remove grit and foreign matter and allowed to dry thoroughly. The authorized use of sanding surfacer shall not exceed 1 quart, diluted for application, per 2,500 square feet of exterior surface. 16/

5.10 Use of masking tape - Masking tape shall not be used on the leading edges of airfoil surfaces. 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.

5.11 Application of lacquer by hot spray - For the spraying of TT-L-20 and TT-L-32 lacquer by hot spray, the process shall be as specified in MIL-L-8645.

* 5.12 Application of insignia and markings - For the Bureau of Naval Weapons, insignia and markings shall be applied in accordance with MIL-I-18464 by means of the standard finishing materials specified in MIL-C-22751. For the Air Force, insignia and markings shall be applied in accordance with MIL-M-25047. Approved decals may be used for insignia and markings. On bare metal the insignia shall be applied by means of a complete finish scheme (see Table II). The additional thickness of finish resulting from the application of insignia and markings shall be within the limits prescribed in 5.4. 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 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 in order to avoid staining of the painted surfaces.

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5.12.1 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 contractor or activity performing the work shall apply markings consisting of a circular patch approximately 2-1/2 to 4 inches in diameter. The patch shall be located on the starboard side of the fuselage, under or over the horizontal stabilizer, and shall contain the following information:

- (a) Contractor or overhaul activity and locations.
- (b) Date of completion of paint application (month, day, year).
- (c) Identification by specification number of every coating of the general system applied to the exterior of the weapons system.

Stencils or approved decals may be used for this marking. Alternately, the identification of the coating materials, item (c), may be stencilled on the fuselage immediately below or alongside a circular patch containing only items (a) and (b).

5.13 Aerodynamic smoothness - All nonspecular and semigloss 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 dry sanded with No. 360 garnet or aluminum abrasive paper followed by No. 400 abrasive paper, to remove all dried overspray, nibs, bumps, occluded particles, etc. The fingertips shall be drawn in all directions over the sanded and wiped finish 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 removed by additional scuff-sanding. A strong light impinging on the finish at an oblique angle may be used as an aid in inspection. Care is necessary in performing the sanding operation to avoid sanding through the topcoat to primer or bare metal. Excessive sanding of the edges of sheets, rivet heads, fastenings, etc., shall be avoided, since these areas are susceptible to accidental removal of the topcoat, which would result in early deterioration of the finish and consequent corrosion of these areas.

Glossy finished areas on the weapons system shall be smooth and free of bumps, specks, occlusions, dried overspray, excessive orange peel, etc. Compounding and rubbing operations shall be employed on the glossy finished areas if inspection reveals the production finish to be deficient in smoothness.

5.14 Spray painting troubles - Problems encountered in spray painting are outlined in note 29/.

6 MISCELLANEOUS REQUIREMENTS

6.1 Tack-ragging - To insure that all areas to be painted are free from foreign matter, they shall be tack-ragged immediately before painting. In no case shall the tack-ragging of the entire weapons system prior to undertaking the actual painting be deemed sufficient. 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.

6.2 Cloths, tack-rags, etc. - Only new, contaminant-free, lint-free, desized, mill end 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. Laundered shop cloths are 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. 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 whatsoever, as determined by laboratory control tests, including Soxhlet extraction.
- c. Periodic control tests to assure compliance with a and b above.

Tack rags shall be prepared from new contaminant-free mill end cloths. The use of disposable fiber or chemically treated paper wiping materials is permitted instead of rags in the repainting procedures, provided laboratory control tests are conducted on the fiber or paper wiping materials to establish the absence of alkalinity, silicones, and of sizing and residues which are leachable in water or in the organic solvents and other liquids employed in the cleaning sequences. The absence of deleterious effect shall be determined by actual paint application on test panels.

6.3 Touchup - The use of aerosol spray-cans of finishing materials is permitted for touchup of scratches and beads of fasteners, as well as small areas not exceeding 1/2 square foot in area. Such usage shall be held to a minimum and to relatively few areas on individual weapons systems. 29/

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6.4 Final dry of the finish - The weapons system, after painting, shall be permitted to dry in a dust-free atmosphere for a sufficient time prior to moving the weapons system to insure that the paint is adequately dry and to avoid damage to the finish. 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. In the case of hull bottoms, placing the weapons systems in water during the first 48 hours after painting is prohibited; but wherever possible the weapons systems should be "held" for a week before placing in the water. In general, all painted weapons systems shall be handled, taxied, etc., as little as possible during the first week after painting.

6.5 Fairing putties - The use of fairing putties such as MIL-S-7502, Class B (flexible type), or MIL-S-8802, or Minnesota Mining Company 3M-EC-1184 (rigid type), or approved equivalent is permitted for filling narrow gaps in the skin and between butt joints but the material selected for this purpose, when employed on the weapons system with the complete finish system prescribed for the weapons system, shall display durability equivalent to the standard finish and in particular shall satisfactorily pass the scratch wet tape adhesion test specified in 8.5. Fairing putties shall not be employed on the rest of the weapons system exterior to conceal scratches, depressions, etc., except for a limited number of locations which are no larger than 1 square inch in area. Fairing putties shall not be used for filling narrow gaps in the skin between butt joints for the purpose of aerodynamic smoothing, unless the weapons system manufacturer submits data indicating sufficient improvement in the weapons system performance to justify application of the fairing putty. 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 compound MIL-S-8802 is permitted in countersinks and as an overlay on high strength steel fasteners.

7. HULL AND FLOAT BOTTOMS

7.1 Anodizing as specified by MIL-S-5002, in accordance with MIL-A-8625, is a necessary prerequisite on all hull and float bottom surfaces, as prescribed by MIL-F-7179. The anodized surface, in addition, shall be treated with chemical film, MIL-C-5541, manually applied. Manually applied surface retreatment is required on all hull and float bottom surfaces from which previously applied organic coating materials have been removed, for whatever reason, as prescribed by 5.1.5 herein. A finish of epoxy primer plus epoxy topcoat with or without an undercoat of wash primer in accordance with 5.3 shall be applied to the retreated surface.

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The use of MIL-E-7729 or MIL-E-8550 enamel is prohibited on hull and float bottoms. 31/

8. QUALITY AND PROCESS CONTROL.

8.1 General - Frequent and regular checks shall be conducted to assure compliance with the requirements of this specification. The items specifically detailed below shall receive the most scrupulous attention by Quality Control personnel.

* 8.2 Cleanliness - Tests shall be conducted just prior to application of resurface treatment and paint-type coatings to assure that the surface is thoroughly clean and free from contaminants. The waterbreak test described in 5.1.4.2 and the litmus paper test described in 5.1.4.1 shall be applied to representative areas to assure 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.

8.3 Smoothness - Regular and frequent inspection tests on the production weapons system shall be conducted to insure smoothness. Regardless of whether the finish is high gloss or low gloss, specks and bumps indicated by drawing the finger tips 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. Dry-sanding with No. 360 wet-or-dry aluminum oxide paper, or equivalent, followed by dry-sanding with No. 400 wet-or-dry aluminum oxide paper, or equivalent, is mandatory on weapons systems with low gloss finish or areas that fail to pass the finger tip smoothness test. Do not wet sand, as this would raise the gloss of the finish.

8.4 Gloss - Frequent and regular gloss determinations on weapons systems with glossy finished areas shall be made by any suitable method. A suggested method is outlined under note 30/. The average visual gloss reading, as compared with standard panels measured on the Hunter-Gardner Gloss Meter, or equivalent, 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 1 foot square, which shall not fall more than 20 points below the gloss requirement for the topcoat material. 30/

Frequent and regular determinations of gloss on weapons system areas with nonspecular and semigloss finishes shall be made by any suitable means. The average visual gloss reading of nonspecular and semigloss finishes, as compared with standard panels measured on the Hunter-Gardner Gloss Meter, or equivalent, shall be not more than five points above the gloss maximum of the topcoat material except for isolated areas on the

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weapons system not greater than 1 foot square, which shall not be more than seven points above the gloss maximum for the topcoat material.

8.5 Adhesion - Regular and frequent 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; the test to be conducted on a sufficient number of selected areas of the weapons system and on a sufficient number of weapons systems to assure maintenance of a satisfactory level of adhesion on full production. 39/ 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, Code No. 250, Minnesota Mining and Manufacturing Company (only newly manufactured tape shall be used), 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 metal. In addition, spot checks of the exterior finish shall be conducted on the production weapons systems with the above wet tape test with the additional feature that two parallel scratches joined at each end by an inverted V are made in the water-softened finish, down to bare metal, the scratches to be about 2 inches long and 1 inch apart and in the direction of the tape, employing a plastic or wood stylus, but taking precautions to avoid scratching the underlying metal of the area under test. Knives or metal blades shall not be used for making the scratches. This scratch wet tape test shall be conducted in only the number of places and on only the number of weapons systems necessary to establish uniformity of the finish adhesion on the production weapons systems. Test panels shall be sprayed with a complete finish, along with production, and scratch wet tape adhesion tests 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. Removable inspection plates or access doors when available and depending on aircraft configuration shall be used in place of production test panels for these tests. 39/

8.6 Film thickness - Contractors 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 5.4. Regular and frequent paint thickness measurements shall be made on the production weapons systems with a Naval Research Laboratory (NRL) Filmeter, or other suitable measuring device on a sufficient number of selected areas of the system and on a sufficient number of weapons systems to assure maintenance of the overall thickness of the finish below the maxima detailed in 5.4, and in the case of exhaust trail areas, assure thickness of finish above the

minimum detailed in 5.4. 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 the weapons system, he shall first spray-paint large test panels as prescribed in 5.2.2.2. The thickness of the paint should then be measured on the panels with a micrometer or an Ames Thickness Gauge or equivalent, allowing 0.0003 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 of the weapons system. The sprayed test panels may also be utilized for "checking out" the process for quality control and qualifying the individual painters.

8.7 Sampling frequency - Sampling for the quality control tests of Section 8 shall be accomplished: (a) Whenever a new supplier furnishes materials used in the production process, (b) whenever evidence occurs of deterioration in the quality of the finish, (c) whenever a change of process or sequence is effected, and (d) at least twice a week. The quality control tests of 8.2, 8.3, 8.4, 8.5, and 8.6 of this specification conducted at least twice a week in the production painting of weapons systems are a minimum requirement on all weapons systems receiving exterior finish. The results of the quality control tests shall be reviewed for conformance with established quality criteria.

8.5 Overall quality of finish - At the commencement of delivery on any contract, and if the finishing procedure is changed significantly at any time, during the contract, a record substantially in conformance with Appendix I covering the actual production painting procedure and finish on the first few weapons systems shall be furnished to the procuring activity for information. In addition when specifically requested by the procuring activity for a block of weapons systems under the contract, the contractor shall start to maintain records substantially in conformance with Appendix I covering the actual production painting procedure and finish of the first few weapons systems of the particular block of weapons systems. These records shall be attested and copies shall be furnished to the procuring activity.

The foregoing is also a requirement for overhaul activities, at the beginning of production overhaul of a new weapons system model; whenever significant changes are made in the painting process, and whenever adhesion failures or other serious deficiencies of the finish occur.

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8.9 Laundering of cloths (if employed) - If laundered shop cloths are employed, regular and frequent inspection tests shall be conducted at the laundry or after return of the laundered cloths, or both; and spot-tests of the cloths shall be conducted just prior to actual usage in the shop, in sufficient number to assure compliance with the provisions of 6.2 herein.

9. SPARE PARTS

9.1 General - Spare parts shall not be packed until the paint has adequately cured, to avoid imprinting or marring the coating.

9.2 Packing - Spare parts which have been rubbed or buffed shall not be packed for a minimum of 18 hours after the rubbing operation, to avoid imprinting or marring the coating.

9.3 Waxing - Spare parts shall not be waxed.

10. RUBBING, COMPOUNDING, ETC.

10.1 General - Rubbing and compounding should be used when necessary to produce smooth films. However, if all necessary precautions are observed, it should not be necessary to resort to rubbing or compounding. Such precautions as selection of the proper thinner, careful balancing of air pressure and fluid pressure, regulation of the operators' spray technique, proper preparation and agitation of the paint, elimination of drafts from the finishing room, etc., will reduce danger of orange peel, removal of which requires a considerable amount of work. 32/ 33/ 34/ 35/ 36/ 37/ 38/

11. SUBCONTRACTOR-FURNISHED AND MULTIPLE-PLANT-FURNISHED AIRFRAME PARTS

11.1 General - It is the direct responsibility of prime contractors to assure compliance by subcontractors with the requirements of this specification on weapons systems, weapons systems parts, and spares delivered to the prime contractor for installation.

11.2 Condition of parts - When weapons systems parts are delivered by subcontractors to the prime contractor for installation on weapons systems, it is strongly recommended that these be delivered in a bare condition, except for those surfaces which cannot be painted by the prime contractor. This will prevent stripping problems and other attendant processing difficulties. This applies with equal force to plants belonging to the prime contractor but physically separated from each other. Where a substantial delay occurs in the installation of the part on weapons systems, it is recommended that such wings, etc., be delivered in a bare exterior condition to the plant conducting major assembly of the weapons system, and the complete finish be applied on the entire bare weapons system as a unit.

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12. INTERIOR FINISHING PROCEDURES AND OPERATIONS

12.1 Preparation of surface - Anodizing or chemical surface treatment of metals and metal parts in accordance with MIL-S-5002 is a necessary prerequisite on all interior surfaces which are to be painted, prior to the priming and painting operations. In addition to the requirements of the above specification, the cleaning requirements of this specification shall be enforced.

12.2 Application of paint-type materials - Interior finishing materials shall be applied in the number of coats prescribed by MIL-F-7179 and in the manner prescribed for exterior finishes. The originally applied zinc chromate primer, MIL-P-8585, may be used as a base for subsequent top coating, as follows:

- a. Clean primer thoroughly.
- b. If topcoating with TT-L-32, apply a fresh coat of MIL-P-8585.
- c. If topcoating with MIL-L-19537, apply wash primer, lacquer primer and topcoat.
- d. If topcoating with epoxy, apply epoxy primer and epoxy topcoat.

Originally applied, aged, epoxy primer, MIL-C-23377, may be used as a base for subsequent topcoating by applying wash primer, epoxy primer, and epoxy topcoat. Wash primer may be omitted providing the aged primer is lightly scuff sanded with aluminum oxide paper. The requirements of 5.2.2.1 of this specification for application of paint-type materials shall be enforced. The interior colors prescribed by MIL-C-8779 shall be applied in locations specified by that document. If a considerable delay occurs between the primer and the application of topcoats, the primer shall be scuff-sanded with No. 300 wet-or-dry-aluminum oxide paper to obtain adequate adhesion of the topcoats. Scrupulous cleaning of the primer before topcoat application is a mandatory requirement. The use of a coat of wash primer on bare metal prior to MIL-P-8585 primer, even though not specifically required on interior surfaces, is permitted, if desired. The mandatory time of application of topcoats, 5.6 of this specification, is not applicable to interior finishing. Use of MIL-P-7962 primer is permitted on interior surfaces only provided a prior bonding coat of wash primer is employed.

12.3 Other interior requirements - The requirements of this specification for thickness of finish, 5.4; air and weather conditions, 5.5; application of topcoats, 5.8.1, 5.8.2, 5.8.2.1, 5.8.2.2, 5.8.2.2.1, 5.8.2.3, 5.8.3; cloths and rags, 5.2; touchup aerosol spray cans, 6.3; final dry of finish, 6.4; quality and process control, 8.1, 8.2, 8.3, 8.5, 8.6, 8.7, 8.8, and 8.9, shall be enforced, in the finishing of interiors.

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13 GENERAL INFORMATION AND GENERAL REQUIREMENTS

13.1 Thickness meter - A thickness meter suitable for measuring the film thickness of paint on nonmagnetic metals has been developed by the Naval Research Laboratory, Washington, D. C. This meter cannot, however, accurately measure films on surfaces which deviate too far from flatness. A panel of the same metal composition, thickness, surface treatment, and heat-treatment as the painted weapons system area must be used for zero adjustments during the measuring process, to obtain the requisite accuracy. Other instruments displaying accuracy and reproducibility at least equivalent to the NRL thickness meter may be employed by contractors upon specific approval of the procuring activity.

13.2 Thickness meter, where obtainable - Government aviation activities may requisition NRL thickness meters from the Aviation Supply Office, Naval Aviation Supply Depot, Philadelphia 11, Pennsylvania. Contractors may purchase the NRL thickness meter from the American Instrument Company, Silver Spring, Maryland.

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

13.4 Test flying - Test flying of the weapons system during process of manufacture or overhaul shall be conducted on unpainted metal or the complete finish scheme. The former is preferred, in order to avoid damage to an already applied finish, excessive touchup, accumulation of excessive paint thickness, etc. After test flying on unpainted metal, the weapons system shall be scrupulously cleaned (see note 14/), tested for cleanliness and then inducted into the exterior finishing process. Test flying on primers or intermediate stages of the complete finish scheme is prohibited.

13.5 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 and in accordance with Special Aeronautical Requirements SAR-306 Overhaul of Naval Aircraft and Associated Components. In case of conflict between this specification and SAR-306 for overhaul contracts, the requirements of this specification shall prevail.

13.6 Definitions -

- a. Seaplanes: For purposes of this specification, all aircraft operated wholly or in part from water, such

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as flying boats, airplanes with float-type alighting gear, airplanes with hydroskis, amphibians, or convertibles, are considered to be seaplanes.

- b. **Landplanes:** For purposes of this specification, all aircraft operated entirely with wheel-type landing gear, whether land-based or carrier-based, are considered to be landplanes.
- c. **Exterior surfaces:** All surfaces forming the exterior of the weapons systems, including well areas normally exposed to the external environment during flight or on the ground, shall be considered as exterior surfaces.
- d. **Wash primers:** For purposes of this specification, a thin organic film consisting of a polyvinyl butyral resin; a basic, insoluble-type zinc chromate, and phosphoric acid, conforming to MIL-C-8514. Used exclusively for bonding the standard finishing systems to pretreated metal surfaces with a high degree of adhesion.
- e. **Pretreatment coating:** This is another name applied to wash primer.
- f. **Hull and float bottoms:** All exterior surfaces up to a line 12 inches above the full load waterline, shall be considered as the hull or float bottom.
- g. **Chemical surface treatment:** A mild etching solution, generally acid, which converts the metal to a more stable and somewhat more corrosion-resistant state, forming an insoluble metal salt, oxide, phosphate, etc. It may be distinguished from wash primer in that it does not deposit an organic film. Its function is to serve as a suitable base for organic coatings. Often referred to as simply "chemical coatings." Often referred to as simply "chemical treatment."
- h. **Chemical surface retreatment:** Reapplication of the treatment described above.
- i. **Shop coats:** A coating employed to prevent marring of the metal surfaces during fabrication assembly.

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14. NOTES

14.1 Use of notes - The notes of this section shall be used for pertinent information and guidance in establishing local procedures. (See 1.2.)

- 1/ It is essential that good housekeeping be practiced. Paint lines should be cleaned out 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 should be included in all air lines used with spray painting equipment in order to entrap any condensed moisture. Paint pressure pots should be thoroughly cleaned at least once each week.
- 2/ **Spray room:** Painting should be conducted in properly ventilated spray rooms or areas. Paint spray rooms should be equipped with forced or induced ventilation systems capable of preventing the build-up of explosive vapors and mists. Likewise the ventilation rate should 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 should be kept closed to exclude dirt and dust. The air should 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 should, however, be maintained to keep dried over-spray from settling on surfaces which have already been painted and are still tacky. Where practicable, water-washed exhaust systems or gridded flooring over flowing water should be used. Humidity and temperature indicators should be installed and in proper operation. Controls should 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 ensure that dirt and dust are kept to a minimum, all air entering spray booths or rooms should be filtered; spray areas should be kept clean; lint-bearing rags should not be allowed to remain in such areas; a higher air pressure should be maintained in the spray booth or room than in the outside air. Lighting conditions should be such that all areas of the weapons systems to be finished are well illuminated. Where possible, lights in the floor, as well as coatings of high light reflectance, will do much to effect an increase in light efficiency. Proper lighting, which enables spray painters to ensure an even, wet coat, will save many man-hours of work in subsequent operations. The paint spray room floors should be thoroughly cleaned as frequently as required to ensure good housekeeping.
- 3/ **Hoses:** Because of friction in the hose, it is essential that proper size hoses be used. Hoses longer than 50 feet should not be used, except in the case of high-pressure air hose leading to the regulator or tank, which should be a maximum of 150 feet, and except in the painting

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of the surfaces of exceptionally large weapons systems, which are a considerable height above the ground, in which case extra lengths of hose may be attached for this use, but should be removed when no longer required for this purpose. The high-pressure air hose should have a minimum inside diameter of 7/16 inch. No less than 3/8-inch ID fluid hose should be used from the tank to the gun, and no less than 5/16-inch ID air hose from the regulator to the tank and also from the tank to the gun. Any reduction in size or increase in length from the foregoing may produce unsatisfactory results.

- 4/ Scaffolding hoists: Suitable scaffolding or staging should be erected to facilitate spraying from different levels. Use of ram-type hoists will be found a preferred procedure for smaller weapons systems.
- 5/ Infrared lamps: In the use of explosion-proof infrared lamps, the size of the lamps and their number and spacing should be such as to effect a distribution of heat as even as possible over the painted surface. Adequate precautions should be taken to avoid concentration of flammable vapors in the immediate area of the infrared lamps and the weapons system being painted. In addition, wire mesh screen with openings approximately 2 inches wide should be rigidly fixed about 3 or 4 inches above the lamps to prevent their breakage by falling objects. The individual lamps should be tightened at frequent intervals to prevent arcing in the sockets.
- 6/ Aluminum-pigmented materials: Aluminized materials may be prepared by mixing the aluminum pigment or paste and vehicle at a reasonable time prior to use. When materials are mixed immediately prior to use, every precaution should be taken to ensure complete wetting of the aluminum pigment to avoid dusting, for example, by thorough premixing with a portion of the thinner. The leafing properties of aluminized paints may be destroyed if the aluminum paste or powder is admixed with the vehicle and stored for a prolonged time.
- 7/ Finishing materials such as epoxy paints, which require the addition of an activator or hardener should be warmed to 70 - 90° F or to the temperature recommended by the manufacturer before mixing.
- 8/ Addition of thinners: The thinners should be added to the package material and not the reverse, since the latter may result in an irreversible separation of some of the paint ingredients. After thinning, and just prior to use, all materials should be strained through nainsook cloth, or comparable commercial strainer.
- 9/ Thinning as related to temperature and humidity: Table I presents

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data for thinning paint materials for spray application at standard spray room temperature and humidity. Data for thinning materials for spray application at other than standard spray room temperature and humidity conditions should be as specified in the applicable process specifications, or should be determined experimentally by the applicator. Blushing generally can be avoided when cold spraying nitro-cellulose lacquer thinned with TT-T-266 thinner by observing the following humidity schedule:

Permissible atmospheric conditions for
spraying nitrocellulose lacquer

Dry bulb temperature °F	Lacquers containing no added blush-retardant thinner. Percent relative humidity (Max)	Lacquers containing blush-retardant thinner. Percent relative humidity (Max)
95	54	57
90	56	60
85	59	64
80	63	69
75	68	75
70	74	81
65	80	87
60	85	90

Under conditions of high temperature (50 to 95° F) and low relative humidity (less than 20 percent), dry spray may be encountered. Under such conditions, blush retardant should be used to slow the drying and allow the paint to flow. Under high humidity conditions, if blushing of nitro-cellulose lacquer topcoat is observed on the test panel specified in 5.2.2.2, blush retardant thinner should also be used. Two blush retardant thinners are available covered by TT-E-776 and MIL-T-6095. The former, which is more effective, should be used with caution because of the slower release from the film. No special addition of blush-retardant thinners is usually necessary for acrylic nitro-cellulose lacquer topcoats, MIL-L-19537 and MIL-L-19538, since high boiling thinners are employed in their reduction. The use of these blush retardant thinners is as follows:

TT-E-776: For each gallon of TT-T-266 thinner, replace up to 1-1/2 pints with ethylene glycol monobutyl ether conforming to TT-E-776. Only the minimum amount necessary to alleviate blushing should be used since sagging may result. Also, drying may be retarded as much as 10 minutes if ambient temperatures are low.

MIL-T-6095: For each gallon of TT-T-266 thinner, replace

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up to a half gallon with MIL-T-6095 thinner. If replacement of TT-T-266 thinner with a greater amount of MIL-T-6095 is required, the ratio should be determined on a small scale operation as described in 5.2.2.2. Precaution is necessary to avoid the addition of excessive amounts of MIL-T-6095 thinner, as sagging may result.

Dry bulb temperature: When humidity control is not available, the relative humidity may be lowered by raising the dry bulb temperature proportionately, but not to exceed 90° F for normal operation unless TT-E-776 blush-retardant thinner is added.

Safe limits for enamel and epoxy: Enamel, epoxy primer and epoxy topcoats can safely be applied at higher relative humidities than lacquers without encountering blushing.

Suspension of painting operations: If blushing is still encountered, the requirement specified in 5.5 regarding suspension of all painting operations prevails.

- 10/ Ambient temperatures and humidity are extremely important in the selection of thinners. For example, lacquers may blush, or wash primer and epoxy paints may not dry properly, if mixing and thinning are not carried out as directed. Consult the applicable specification for the material that is to be applied as well as manufacturer's directions. Test panels should always be used before proceeding in any finishing operation.
- 11/ Shop coats: The requirement of 5.6.2 precludes use of shop primer coats as an integral part of the finish system. Removal of the yellow stain resulting from the shop coat is extremely difficult and is not required. It will be found that shop coats, where used, can be more easily removed if this be done within a relatively short time after application. The advisability of omitting shop coats is thus further emphasized. For removing shop primer, methyl ethyl ketone, ethyl acetate or a mixture of the same may be useful. Use of MIL-R-25134 remover is recommended for Air Force installations. The use of protective "strip coats," has been found to be helpful in preventing minor damage during assembly of aircraft. However, ingredients of some strip coats may affect adhesion, adversely.
- 12/ Cleaning materials: Approved cleaning materials for use on aircraft are contained in Publications NAVWEPS 07-1-503 and NAVWEPS 01-1A-506 for the Navy and T.O. 1-1-1 for the Air Force.
- 13/ Suggested final cleaning procedure: After all general cleaning to remove the major contaminants, such as paints, oil, soil, grease, etc.,

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the following steps may be employed successfully immediately prior to resurface treating or painting, to obtain a surface capable of supporting an unbroken film of distilled water:

- a. Clean with an aqueous solution of MIL-C-22543. When severely heavy soils are encountered, clean with the MIL-C-22543, TT-T-291, or hand clean with a 50-50 mixture of lacquer thinner and water, or by wiping with ethyl acetate. Wash primer residues or other hard to remove paint-type materials may be removed by hand wiping with methyl ethyl ketone, ethyl acetate, or lacquer thinner. Whenever petroleum-based cleaning materials such as P-C-444 are used, the residual oily film shall be removed by cleaning with an aqueous solution of MIL-C-22543. Solvent emulsion cleaners such as P-C-444 should not be used as a final cleaner prior to painting.
- b. Then swab on a 0.20 to 0.25 chromic acid solution, allow to remain on the surface for 2 to 5 minutes, and then rinse with water.
- c. 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 apply a 0.20 to 0.25 percent chromic acid solution to achieve a neutral or slightly acid surface, in accordance with the procedure specified in 5.1.4.1, or repeat step (b).
- d. Finally, check the surface for absence of water-break, employing the test procedure described in 5.1.4.2.1.

14 Special precautions: After cleaning, especially after stripping operations or steam cleaning, special precautions should be taken to assure thorough draining of all liquids from between faying surfaces, crevices, inspection doors, pockets, etc., preferably by permitting the weapons system or part to stand for a sufficient time to permit such drainage, after which the affected area should 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, e. g., PR No. 1301 HT, manufactured by Products Research, Los Angeles, California, or equivalent. N butyl alcohol sprayed in fastener pattern and seams after final water rinse following MIL-C-5541 or other chemical surface retreatment water rinse, will displace water retained in these areas.

15 Exterior finishing: Sections 5 to 11 inclusive, Section 13, and Appendix I of this specification govern the application of finishes on the exterior of

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the weapons system. Section 12 applies exclusively to interior finishing.

- 16/ Smoothness of wash primer and primer coats: The wash primer should be dry scuffed with kraft paper in accordance with MIL-C-8507. Kraft paper only is suitable for this purpose. The primer should be applied as smoothly as possible, since specks and occlusions will 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. A properly applied primer film should be free from streaks, blisters, seeds, excessive silking, or other irregularities of surface. Dry scuff sanding by hand, using No. 400 or No. 320 aluminum oxide paper should be employed, as necessary, to remove specks or roughness that might carry through to the topcoats, but extreme care should be exercised to avoid removing the primer down to wash primer. Great caution is necessary in order 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 would result in subsequent susceptibility to corrosion. Should this be done by accident, normal touchup 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 is 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.
- 17/ Spray gun technique: Examples of correct technique are shown on Figure 1. The spray gun should be so held at all times that the spray is perpendicular to the area to which the finish is being applied. The gun should be held from 6 to 10 inches from the work for spraying lacquer and synthetic enamel, depending on the width of the spray pattern. Generally, with a narrow pattern, the gun is held the 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. In hot spray-application, the gun distances prescribed in MIL-L-8645 should be maintained.
- 18/ Spray adjustment: The spray pattern should receive careful attention. Figure 2 shows defects of finish, incorrect spray patterns, the causes, and suggested remedies. Figure 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 given in Figure 4.

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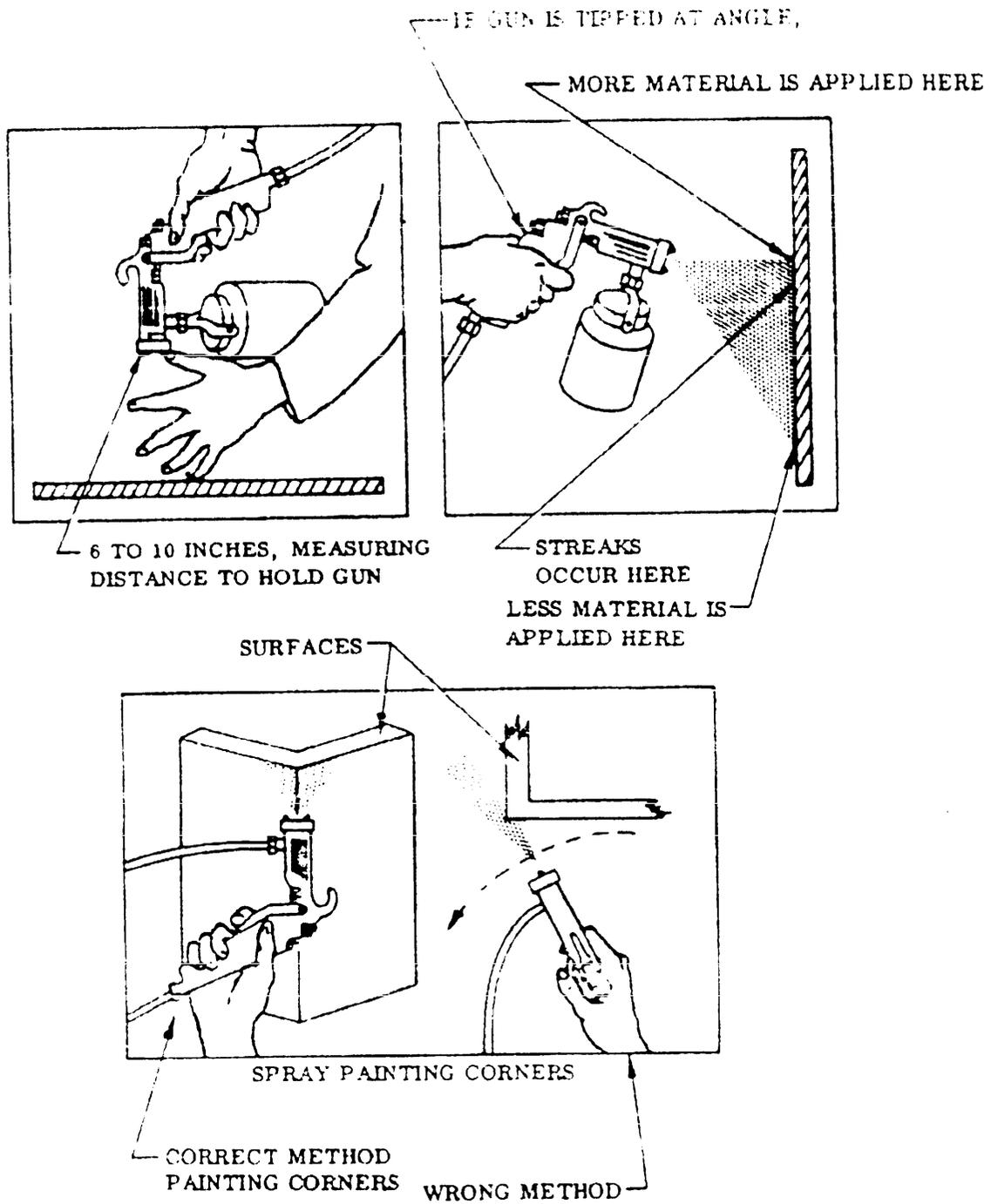


FIGURE 1 (Sheet 1 of 2). Spray painting technique

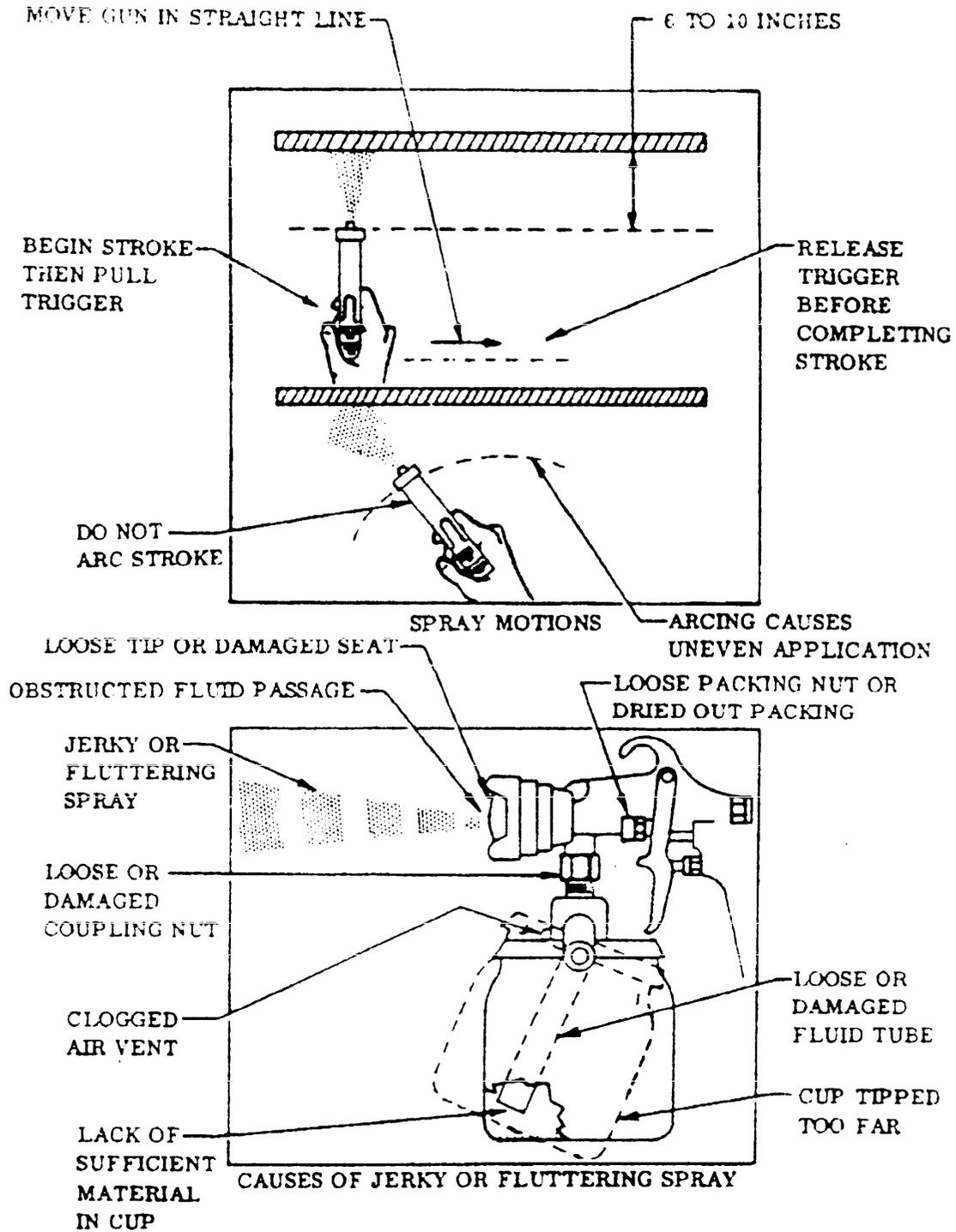


FIGURE 1 (Sheet 2 of 2). Spray painting technique

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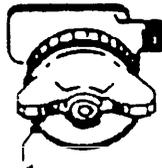
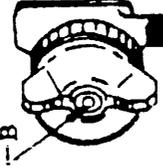
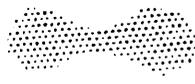
PATTERN	CAUSE	CORRECTION
	 <p>DRIED MATERIAL IN SIDE PORT A RESTRICTS PASSAGE OF AIR THROUGH IT. RESULT: FULL PRESSURE OF AIR FROM CLEAN SIDE PORT FORCES FAN PATTERN IN DIRECTION OF CLOGGED SIDE.</p>	<p>DISSOLVE MATERIAL IN SIDE PORT WITH THINNER. DO NOT POKE IN ANY OF THE OPENINGS WITH METAL INSTRUMENTS.</p>
	 <p>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.</p>	<p>IF DRIED MATERIAL IS CAUSING THE TROUBLE, REMOVE AIR NOZZLE AND WIPE OFF FLUID TIP, USING RAG WET WITH THINNER. TIGHTEN AIR NOZZLE.</p>
	<p>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.</p>	<p>REDUCING AIR PRESSURE WILL CORRECT CAUSE (a). TO CORRECT CAUSE (b), OPEN MATERIAL CONTROL (SEE FIGURE 3) TO FULL POSITION BY TURNING TO LEFT. AT THE SAME TIME TURN SPRAY WIDTH ADJUSTMENT (SEE FIGURE 3) TO RIGHT. THIS WILL REDUCE WIDTH OF SPRAY BUT WILL CORRECT SPLIT SPRAY PATTERN.</p>

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

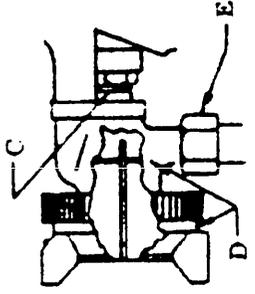
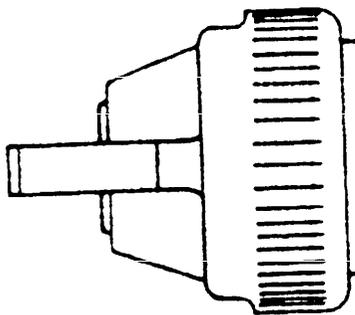
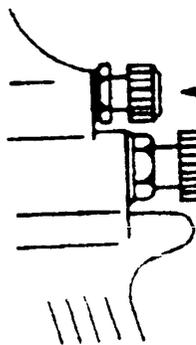
PATTERN	CAUSE	CORRECTION
	<p>(a) DRIED OUT PACKING AROUND MATERIAL NEEDLE VALVE PERMITS AIR TO GET INTO FLUID PASSAGEWAY. THIS RESULTS IN SPITTING.</p> <p>(b) DIRT BETWEEN FLUID NOZZLE SEAT AND BODY OR A LOOSELY INSTALLED FLUID NOZZLE WILL MAKE A GUN SPIT.</p> <p>(c) A LOOSE OR DEFECTIVE SWIVEL NUT ON SIPHON CUP OR MATERIAL HOSE CAN CAUSE SPITTING.</p>	<p>TO CORRECT CAUSE (a), BACK UP KNURLED NUT C, PLACE TWO DROPS OF MACHINE OIL ON PACKING, REPLACE NUT AND TIGHTEN WITH FINGERS ONLY. IN AGGRAVATED CASES, REPLACE PACKING.</p> <p>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.</p> <p>TO CORRECT CAUSE (c) TIGHTEN OR REPLACE SWIVEL NUT E.</p>
	<p>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.</p>	<p>INCREASE PRESSURE FROM YOUR AIR SUPPLY. CORRECT AIR PRESSURES ARE DISCUSSED ELSEWHERE IN THIS INSTRUCTION SHEET.</p>

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

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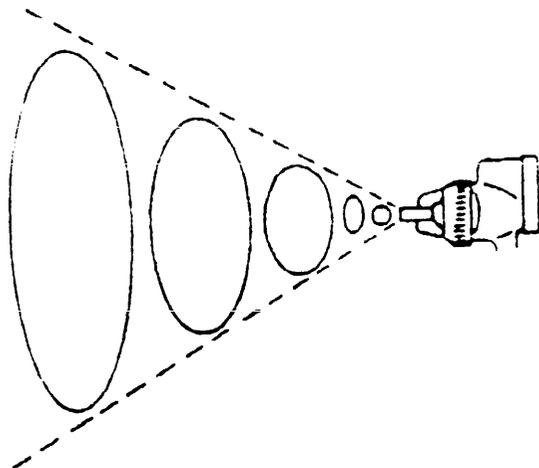
IN NORMAL OPERATION, THE WINGS ON THE NOZZLE ARE HORIZONTAL AS ILLUSTRATED AT LEFT. THIS PROVIDES A VERTICAL FAN-SHAPED PATTERN WHICH GIVES MAXIMUM COVERAGE AS THE GUN IS MOVED BACK AND FORTH PARALLEL TO THE SURFACE BEING FINISHED.



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.

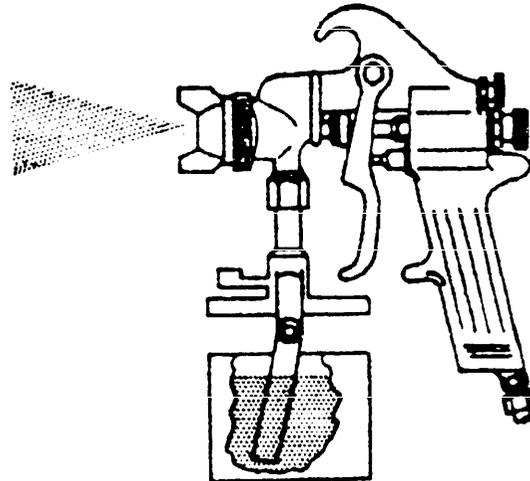


THE SPRAY PATTERN IS VARIABLE FROM ROUND TO FLAT WITH ALL PATTERNS IN BETWEEN.

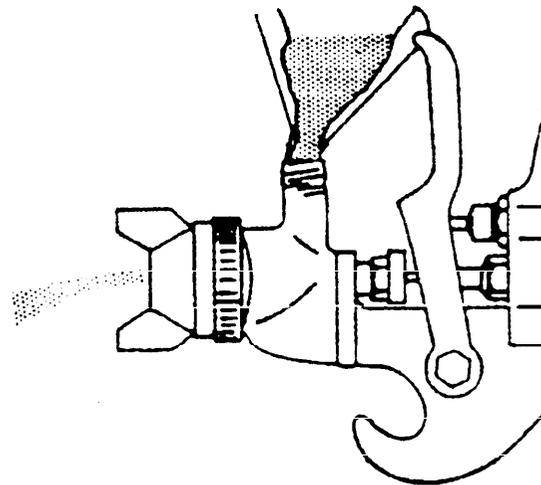
FIGURE 3. Correct spray patterns

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WHEN USED WITH A CUP,
THINNER OR SUITABLE
SOLVENT SHOULD BE
SIPHONED THROUGH GUN BY
INSERTING TUBE IN OPEN
CONTAINER OF THAT LIQUID.
MOVE TRIGGER CONSTANTLY
TO THOROUGHLY FLUSH
PASSAGEWAY AND TO CLEAN
TIP OF NEEDLE.



WHEN THE GUN IS USED WITH A
PRESSURE TANK OR GRAVITY
BUCKET, REMOVE THE HOSE,
TURN THE GUN UPSIDE DOWN
AND POUR THINNER INTO THE
FLUID OPENING WHILE MOVING
THE TRIGGER CONSTANTLY.
THIS WILL FLUSH ALL PASSAGE-
WAYS.



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 CON-
NECTION IN THINNER. VESSEL
USED SHOULD BE SHALLOW
ENOUGH TO PREVENT THINNER
FROM REACHING PACKING.

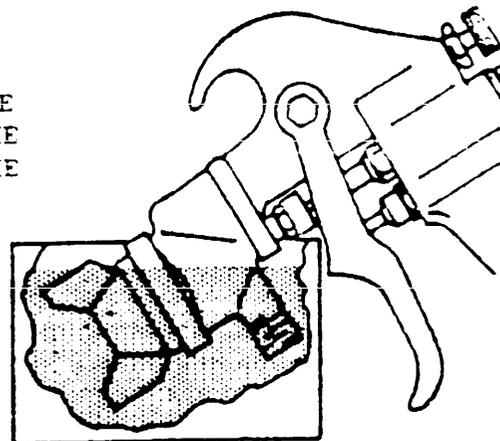


FIGURE 4. Pointers on cleaning spray gun

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- 19 Spray equipment and process: The following description of spraying procedures for lacquer and enamel applies only to spraying by the cold process. Reference should be made to MIL-L-8645 for the requirements covering the application of lacquer by the hot-spray process.
- 20 Spraying pressures. When using 20-foot air and fluid pressure hoses, a pressure of approximately 45 psi at the spray gun for lacquer, and 50 psi for enamel, should be maintained; this pressure to be measured at the gun. Sufficient pressure should be maintained at the main line pressure regulator to obtain the above pressures and to compensate for the pressure drops encountered if additional lengths of hose are employed. The pressure at the gun should be rechecked when the main line pressure has been changed for any reason. Eight- to 12-psi fluid tank pressures should be used for lacquer. A 3-pound increase above these figures should be used in the case of enamel. A proportionate increase in pressure for both lacquer and enamel should be allowed for additional lengths of hose up to 50 feet maximum. One-pound fluid pressure may be added for each foot of height of the gun from the fluid tank level. Frequent checks with a test gage should be made of air pressure at the gun. In general, the following considerations apply: Too high an air pressure alone causes dusting of the finish and rippling; too low an air pressure coupled with too high a fluid pressure causes orange peel; too high a fluid pressure alone causes orange peel and sags; too low a fluid pressure alone causes dusting.
- 21 Spraying: It is important to "trigger" the gun to avoid uneven coating caused by "buildup" at the beginning and end of the stroke. "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 which 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 as will lay down a full wet coat of paint. The speed of spraying the job is very important; and 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 abnormally thick films will result.
- 22 Application of camouflage finish (lacquer and enamel): Spray the separate colors without attempting to blend on the first coat of lacquer. In applying the second coat of lacquer, spray the solid insignia white areas first. As the second step, apply the next color; e. g., light gull gray, to areas intended to be this color, blending in small areas at a time in the boundary zone between this color and the insignia white while advancing along the work. Blend from the wet to the dry zone in order to avoid dusting of the finish as a result of dried overspray. Advance from the nose of the weapons system aft (or vice versa) in the direction

of the movement of the air in the spray booth, to avoid blowing paint spray dust on surfaces already finished. Blended areas should be blended over a vertical distance of at least 2 inches but not over a distance greater than 4 inches. No change in the regulator or spray gun settings should be made, except perhaps on the spreader adjustment valve to reduce the width of the spray pattern to blend small areas more efficiently. In this case, the gun may be moved farther away from the work, but not to so great a distance as to deposit a dried-spray coating.

- 23/ Experience with lacquer primer indicates that: (1) Application of topcoats after 1 to 2 hours drying is optimum; longer drying may result in poor intercoat adhesion; and (2) application of MIL-L-19537 acrylic-nitrocellulose lacquer requires a mist coat of the lacquer prior to the full wet coats in order to prevent penetration of the heavy solvents into the primer with the possibility of lifting or loss of adhesion.
- * 24/ Weight of finish: A properly applied weapons system finish will weigh very close to 10 pounds per 0.001 inch per thousand square feet of painted surfaces. The thickness limits of 5.4 have been increased to reflect actual production experience; however it is not desired that each coat be applied at the maximum thickness. The durability in service is greatly reduced with thick films and hence they should be avoided under all circumstances, except where prescribed by MIL-P-7179 for specific areas.
- 25/ Spray conditions: In the cold spraying of nitrocellulose lacquers containing blush-retardant thinner, if the relative humidities listed in note 9/ are exceeded, all spray painting operations should be suspended until satisfactory relative humidities are achieved. Spray painting of the surface under unfavorable weather conditions is poor economy, since early paint failure, caused by poor adhesion, of the areas thus painted will inevitably result, necessitating early stripping and repainting operations. This would mean inactivation of the weapons system and extra costs in man-hours and materials. The lower temperatures should be avoided wherever possible, as drying of the finish is greatly retarded and, among other effects, masking operations in the application of insignia are considerably delayed. In any event organic coatings should not be applied at dry bulb temperatures below 60° F.
- 26/ Sags and runs: If insufficient time is allowed for drying of the first coat and evaporation of the major portion of the thinner, the thinner in the second coat, may, when added to the unevaporated thinner remaining in the first coat, cause sags and runs. The force of the air from the spray gun would also disturb the softened first coat and produce considerable orange peel.
- 27/ Final coat of thinner: The practice of using a spray coat of approximately 90 percent lacquer thinner and 10 percent lacquer (for tint) immediately after

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the second lacquer topcoat, which has been employed by some processors on the entire surface for raising the gloss, leveling out imperfections, clearing up a blushed lacquer finish, etc., is discouraged because of the possibility of early embrittlement of the finish in service and should be confined to only small areas when necessary. The use of a final spray coat of thinner for small touch-up areas, as discussed in note 29/, remains a permissible practice.

28/ Spray painting troubles: Possible causes and suggested remedies relating to problems encountered in spray painting are outlined in Table IV.

TABLE IV

SPRAY PAINTING TROUBLES, POSSIBLE CAUSES AND POSSIBLE REMEDIES

Trouble	Possible causes	Possible remedies
Sandpaper finish:	Unsatisfactory wash primer or primer. Excessive dirt contamination from painting area. Insufficient scuff-sanding of wash primer or primer. Improperly cleaned paint lines. Dried over-spray.	Laboratory analysis to verify acceptability of the material. Check wash primer and primer application procedures. Provide cleaner painting areas. Flush paint lines frequently with solvent. Scuff-sand wash primer, using No. 360 then No. 400 wet-or-dry aluminum oxide paper. Sand the complete finish until smooth to the fingertips.
Slow drying of wash primer:	Accidental addition of TT-T-266 thinner. Excessive butyl alcohol addition. High humidity conditions. Excessive thickness. Denaturants in the alcohol such as oils, high boilers, etc., introduced by the accidental use of the wrong alcohol.	Check mix, using smaller quantities of same batch and apply to test panel. Modify quantity of thinner added and compare drying times under actual painting conditions. Incorporate use of small test panel adjacent to all weapons systems during complete painting procedure, using test panel for thickness measurements also.

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TABLE IV (continued)

Trouble	Possible causes	Possible remedies
Pinhole cavities:	Improper surface treatment or lack of surface treatment (on magnesium). Entrapped oils, or solvents, or both. Insufficient primer drying times. Excessive alcohol additions to wash primer. Use of improper thinner.	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.
Excessive blushing of topcoats:	Excessive humidity.	Check humidity control equipment where employed.
Dry lacquer film:	High temperature and low humidity while spraying.	Add small amount of ethylene glycol monobutyl ether, TT-E-776.
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.	Employ initial wipedown, 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. Employ 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

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TABLE IV (continued)

Trouble	Possible causes	Possible remedies
Tape test paint transfer: (continued)		of failure, such as to bare metal or intercoat failure, and select the applicable cause and remedy accordingly.
Sags:	<ol style="list-style-type: none"> (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. 	<ol style="list-style-type: none"> (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.
Streaks:	<ol style="list-style-type: none"> (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. 	<ol style="list-style-type: none"> (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.

TABLE IV (continued)

Trouble	Possible causes	Possible remedies
Orange-peel:	<ol style="list-style-type: none"> (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. 	<ol style="list-style-type: none"> (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	<ol style="list-style-type: none"> (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. (6) Air pressure too high. (7) Fluid pressure too high. Paint too cold. 	<ol style="list-style-type: none"> (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. (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 spray fog	<ol style="list-style-type: none"> (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. 	<ol style="list-style-type: none"> (1) Use least amount of compressed air necessary. (2) Release trigger when gun passes target. (3) Ascertain and use correct setup.

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TABLE IV (continued)

Trouble	Possible causes	Possible remedies
Excessive spray fog: (continued)	(5) Material thinned out too much.	(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 begins 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 tank 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 a 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). (3) Fluid pipe not tightened to the pressure tank lid.	(1) Tighten securely, using a good gasket. (2) Tighten connections, lubricate packing. (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.

29. Touchup: On limited areas, when necessary to touch up or refinish a bare spot on a weapons system, the edges of the finish adjacent to the bare spot should be tapered by sanding. The wash primer should then be spotted in over the bare area and feathered slightly over the old finish to as small a distance as possible. 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 less than 4 square inches in area are involved, or a system of epoxy primer and epoxy topcoat or epoxy topcoat alone may be used. Note: Lacquer primer, MIL-P-7962, will not adhere to surfaces which are not wash primed.
30. Gloss: Smoothness of weapons systems finished in the glossy scheme should be such that a No. 4 sieve will show a discernible reflected image in the surface. This test is conducted by holding the reflector edge of a strong diverging light source 5 inches from the surface being tested. A ground glass filter is placed in front of the No. 4 sieve, conforming to RR-S-366. The sieve with filter is held against the reflector of the light. The image of the wire screen should be discernible on the surface being tested. A blurred or obliterated image will be considered as unsatisfactory. The determination should be accomplished on surfaces nearest to flat, but when on a curved surface, allowance must be made for distortion but not for the clarity of lines of the wire screen. The Photovolt Photoelectric Glossmeter may be employed for this test as an alternative procedure. Readings are expressed in terms of the perfect mirror as 1000, using black carrara glass (reflecting 9.6 percent of the light incident on it) as the standard.
31. The wet adhesion of epoxy primer has been found poor over anodized surfaces; for this reason additional treatment with MIL-C-5541 chemical film is required. Note that not all MIL-C-5541 treatments are equally effective for this purpose.
32. General: Rubbing or compounding of the overall glossy finish is permitted at the option of contractors and overhaul activities. These operations are not a requirement, except where necessary to remove bad orange peel, dust nibs, etc. Cutting, buffing and polishing compounds, and waxes are listed in Table V.
33. Dilution of rubbing compounds: Most rubbing compounds are water emulsions. Thinning is not normally necessary, except where evaporation causes the compound to thicken. Water must be used for thinning unless otherwise specified by the manufacturer of the rubbing compound.
34. Smoothing of glossy lacquer: The lacquer should dry a minimum of 24 hours or preferably longer and when dry should be wet-sanded with No. 400 wet- or dry sandpaper. Apply rubbing compound conforming to TT-R-771 and

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hand-rub or disk-buff out all traces of the sanding. Caution should be exercised to avoid striking any mechanical protrusions with the polishing or buffing disks in order to avoid removing the lacquer.

35 Hand-rubbing: It is noted that the same rubbing compounds are to be used for hand-rubbing as for disk-buffing of glossy lacquer. Hand-rubbing, in general, will produce a superior finish. When either system is employed, great care should be exercised that no heavy rubbing be performed on rivet heads, edges, etc., which would rub through the finish, or materially reduce the thickness of coat at any one spot. Hand-rubbing should always be performed in locations difficult to rub with a disk. Rubbing should be in the direction of the airstream to avoid a spanwise polishing pattern, which adversely affects aerodynamic performance.

* TABLE V

SMOOTHING AND POLISHING

Topcoat	Hand Polishing	Disk buffing materials and process	(Transports, helicopters and trainers only) waxing materials	Sanding Materials
Glossy lacquer	TT-R-771 rubbing compound, lacquer	Wet and with No. 400 wet-or-dry sandpaper, or equivalent, and follow with TT-R-771 rubbing compound, lacquer	A high-grade carnauba paste wax, or equivalent.	None
Glossy enamel	DuPont Company's No. 45 Extra Fine Polishing Compound, or equivalent	No disk-buffing permitted	A high-grade carnauba paste wax, or equivalent.	None
Camouflage lacquer and Camouflage enamel	None	None	Do not wax	Dry-sand with No. 360 wet-or-dry sandpaper, or equivalent. Follow with

TABLE V (continued)

Topcoat	Hand Polishing	Disk buffing materials and process	(Transports, helicopters and trainers only) waxing materials	Sanding Materials
Camouflage lacquer and Camouflage enamel (continued)				dry-sanding, using No. 400 wet-or-dry sandpaper, or equivalent. Do not wet-sand.

- 36/ Disk-buffing: Pneumatic wheels or electric wheels should be used for disk-buffing or rubbing. Both cutting compound and polish should be applied by hand to the surface of the airplane before the wheel is used. A felt pad should be used for buffing with cutting compound; a sheep's wool pad for polishing. When using a disk for buffing lacquer, wet-sanding with No. 400 wet-or-dry sandpaper should be performed prior to such disk-buffing if any "orange-peel" is in evidence. Explosion-proof motors should be used for electric-wheel disk-buffing or polishing in confined areas where explosive or flammable vapors are present.
- 37/ Smoothing of glossy enamel: The paint coat should dry for a minimum of 48 hours, and when dry an extra fine polishing compound as specified applied for hand-rubbing. No disk-buffing is permitted on enamel. Polishing material should be applied to the smooth surface and polished with a mechanical polisher. Caution should be exercised to avoid striking the rivets with the polishing disk with resultant loss of the paint coat and avoid excessive pressure in one spot, which would induce softening of the enamel.
- 38/ Insignia and markings: Decalcomanias and other insignia and markings should be applied prior to any rubbing or waxing operation. Decalcomanias may be waxed but not rubbed or sanded. Particular care should be exercised to avoid contact with the edges of the decalcomania during such operations.
- 39/ Wet tape test may be run after 48 hours on epoxy coating, however failure of the test at this time does not indicate ultimate poor adhesion of the paint system since the full cure of the epoxy system is not developed for approximately 7 days. If early delivery of the weapons system must be made, and depending on aircraft configuration removable access plates should be removed from the painted airplane and replaced with spares.

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The removed plates should be retained for testing for ultimate paint adhesion as a check on process control.

- 40/ Experience has shown that aged chemical treatments may lose their ability to hold paint without visual signs of deterioration. It is therefore good practice to resurface treat within 15 hours of painting to insure uniformity of results. Not all MIL-C-5541 treatments are equally effective in promoting adhesion of paint to cadmium plate. Therefore to ensure good adhesion to cadmium plated screws in aluminum structures, care should be taken to select a suitable, approved MIL-C-5541 manual retreatment that will be effective on both the aluminum and the cadmium plated screws.**
- 41/ Certain weapons systems are difficult to clean due to seepage of spilled hydraulic fluid through seams and rivet holes in the bottom of the fuselage. The difficulty may be eliminated by flush cleaning the interior of the fuselage with solvents such as methyl chloroform or trichlorotrifluoroethane. The solvents are allowed to seep through the openings where oil leak and seepage are occurring. Such cleaning should be done only under the supervision of safety engineers because of fire hazard and the toxic character of the solvents.**
- 42/ Although MIL-T-19588 thinner is recommended for use with the epoxy primer, in warm climates the use of MIL-T-19544 thinner may be advantageous to provide better flow. If MIL-T-19544 is still inadequate prepare a thinner composed of approximately 3 volumes of MIL-T-19588 to 1 part cyclohexanone and add approximately 3/4 volume of this prepared thinner to 2 volumes of the admixed primer. A higher proportion of cyclohexanone may improve flow but will retard drying time. For this reason, the use of cyclohexanone should be kept to the minimum.**

14.2 Changes from previous issue - The outside margins of the document have been marked "#" to indicate where changes (deletions, additions, etc.) from the previous issue have been made. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - MR
Air Force - 11
Navy - AS

Preparing activity:

Navy - AS
Project No. 8010-0446

Review activities:

Army - MR, MU, MI, WC, AV
Air Force - 11, and 84
Navy - AS

User activities:

Army - AT

Review/user information is current as of date of this document. For future coordination of changes to this document, draft circulation should be based on information in the current DOISS.

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APPENDIX I

PAINTING PROCESS OUTLINE AND INSPECTION PROCEDURE REPORT

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PAINTING PROCESS OUTLINE AND INSPECTION PROCEDURE REPORT

20. SCOPE

20.1 This appendix contains the format for recording the information specified in 8.8.

20.2 A record substantially 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:

PAINTING PROCESS OUTLINE AND INSPECTION PROCEDURE REPORT
(Section 9 to 13 inclusive required certification)

	Date of report
Processor and plant	City
Weapons system model	BuNo.

1. Initial weapons system cleaning procedure:

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

2. MIL-C-5541 manually applied surface retreatment (on aluminum):

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

3. Results of litmus paper test:

.

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4. Chromic acid application:
- (a) Employed: Yes No
5. MIL-M-3171 manually applied treatment (on magnesium):
- (a) Employed: Yes Date 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. Zinc chromate primer shop coat:
- (a) Employed: Yes Date No.
- (b) If employed, how removed and date.
-
-
9. Wash primer application:
- (a) Specification No. Manufacturer.
- Date of manufacture Manufacturer's formula No.
- Contract No. of wash primer purchase Batch No.
- (b) Mixing. Parts resin compound to Parts acid-diluent
- (c) Type of alcohol added for thinning
- How much alcohol added to 9b mixture
- Specification No. of each alcohol.
- Manufacturer and manufacturer's No. Date of manufacture
- Composition of added alcohol: e. g., proportion of butyl alcohol, isopropyl, and ethyl alcohol in the added material
- (d) Date and time of wash primer application
- Humidity reading. Temperature reading
- Drying time allowed

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- (e) Spray gun cap, tip and needle used
- (f) Was wash primer scuff-sanded?
 If so, how soon after application?
 Methods and materials used

 Was kraft paper used? If so, how soon after applica-
 tion?
- (g) Average thickness of wash primer deposit mils
 How measured.
 Thickness limits allowed. by
 Specification No
- (h) Section 9 certified correct:
 Date

10. 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) Thinner employed:
 Specification No
 Manufacturer
 Manufacturer's Formula No.
 Batch No. Date of manufacturer of thinner
 Ratio thinner to each gallon of primer.
- (c) Date and time of primer application
 Humidity reading. Temperature reading
 Drying time allowed
- (d) Was primer scuff-sanded?
 If so, how soon after application:
 Methods and materials used

- (e) Average total thickness of primer deposit mils
 How measured?
 Thickness limits allowed. by Specification No.
- (f) Elapsed time after the wash primer and before applying the primer
 hrs

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- (g) No primer taken from dip tanks or flow coater was used on exterior surface of the aircraft. . . . True False
(Cross out one)
- (h) Section 10 certified correct: Date

11. Topcoat application.

Glossy topcoat:

- (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 manufacturer
- (c) Mixing proportion parts base material to parts thinner
Specification No. Thinner manufacturer
Manufacturer's Formula No. of thinner Batch No.
Date of manufacturer of thinner
- (d) Amount and Specification No. of blush-retardant thinners added to
topcoat mix Manufacturer
Manufacturer's Formula No. Batch No.
Date of manufacture of blush-retardant thinner

Camouflage topcoat:

- (e) Elapsed time after applying primer and before applying first topcoat
.
- (f) Topcoat material. Specification No.
Type Manufacturer Manufacturer's Formula No.
Purchase Order or Contract No. of topcoat procurement
Batch No.
- (g) Mixing proportion parts base material to
Parts thinner Specification No. thinner Thinner Manufacturer
. Manufacturer's Formula No.
Batch No. Date of manufacture of thinner
- (h) Amount and Specification No. of blush-retardant thinners added to topcoat
mix
Manufacturer Manufacturer's Formula No.
Batch No. Date of manufacture of blush-retardant
thinner

- (i) Method of application: HOT COLD (Check appropriate boxes)
- Glossy
- Camouflage

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- Date and time of topcoat application
- Humidity reading. Temperature reading.
- Drying time allowed for first coat Drying time of second
coat before moving weapons system
- (j) In the event the hot lacquer process has been employed, the following
additional data are required:
- Mixing proportions gallons topcoat material
- Specification No to gallons thinner Specification
No Percent of overlap for each pass No. of
cross coats Time between each paint application, if more than one
is employed.
- Direction of first pass. Direction of second pass
- (k) Was any portion of the final topcoat sanded or smoothed?
- (l) Was either blush-retardant thinner or regular lacquer thinner applied
after final painting to improve finish or eliminate blushing?
If so, provide details
- (m) Average thickness of total glossy topcoat deposit mils
- How measured. Location on weapons system
- Thickness limits allowed. mils by Specification No
- (n) Average thickness of total camouflage topcoat deposit. mils
- How measured. Location on weapons system
- Thickness limits allowed. mils by Specification No
- (o) 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.
- (p) Section 11 certified correct: Date
12. Test on complete finish:
- (a) Wet adhesion tests on glossy surfaces of weapons system (Unscratched)
Number of tests Location on weapons system
.
Test results
(Scratched) Number of tests Location on weapons system
Test results Location on weapons system
- (b) Average total thickness of entire glossy paint deposit mils
Number of tests Location on weapons system
Representative individual thickness readings
.
Thickness limits allowed. mils Specification
- (c) Wet adhesion tests on camouflage surfaces of weapons system
(Unscratched) Number of tests Location on weapons system
.
Test results

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- (Scratched) Number of tests Location on weapons system
- Test results
- (d) Average total thickness of entire camouflage paint deposit mils
- Number of tests Location on weapons system
- Representative individual thickness readings
- Thickness limits allowed mils Specification
- (e) Section 12 certified correct: Date

13. Hull or Float bottom finish (when applicable to the airplane type):

- (a) Anodizing: Yes No
- (b) MIL-C-5541 surface retreatment: Yes No
- (c) Describe additional measures employed not covered by foregoing sections of Appendix I
- (d) If not standard wash primer, epoxy finish, give exact finish employed
- (e) Section 13 certified correct: Date

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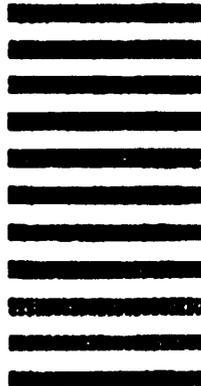
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