Preparing Activity: USACE Superseding
UFGS-09 96 00 (July 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 09 96 00

HIGH-PERFORMANCE COATINGS
11/14

NOTE: This guide specification covers the requirements for special coatings as required for harsh indoor locations or operations (any area subjected to chemical and/or abrasive action), and all outdoor installations.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically

place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM SI10	(2016) American National Standard for Use of the International System of Units (SI): The Modern Metric System

MASTER PAINTERS INSTITUTE (MPI)

MPI ASM	(2019) Architectural Painting Specification Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

QPL-TNT-AP-28	(2004) Paint, Aluminum, Heat Resisting (1200 Degrees F)

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes

following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment List[; G[, [____]]]

SD-03 Product Data

Heat-Resistant Coatings[; G[, [____]]]

Epoxy Coatings[; G[, [____]]]

Polyurethane Coatings[; G[, [____]]]

Chlorinated-Rubber Coatings[; G[, [____]]]

SD-04 Samples

Color Chips[; G[, [____]]]

SD-07 Certificates

Heat-Resistant Coatings[; G[, [____]]]

Epoxy Coatings[; G[, [____]]]

Polyurethane Coatings[; G[, [____]]]

Chlorinated-Rubber Coatings[; G[, [____]]]

Manufacturer's Printed Instructions[; G[, [____]]]

1.3 QUALITY CONTROL

Comply with Master Painters Institute (MPI) Standards indicated and listed in "MPI Approved Products List." Comply with the requirements in "MPI Architectural Painting Specification Manual" before any project is started.

Submit an equipment list consisting of a list of proposed equipment to be used in performance of construction work.

Submit three color chips 75 millimeter by 100 millimeter 3-inch by 4-inch or manufacture's pull-down of each finish color and gloss as scheduled.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against freezing.

Store solvents, thinners, and equipment cleaners with the same care as the coating materials with ambient temperatures continuously maintained at a minimum 7 degrees C 45 degrees F.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per liter gallon

2.1.1 Heat-Resistant Coatings

****

NOTE: Heat-resistant coatings are divided into four categories, with upper temperature limits of 204 degrees C, 316 degrees C, 427 degrees C and 649 degrees C. 400 degrees F, 600 degrees F, 800 degrees F and 1,200 degrees F

Coatings above 649 degrees C 1,200 degrees F are ceramic coatings. Generally, coatings applied to substrates where surface temperatures vary radically, do not have a long life span due to vehicle solid degradation and thermoshock of the metallic pigments. In areas such as this, consider flame deposition of sacrificial metal coatings.

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2.1.1.1 Category 1, 10 to 204 Degrees C 50 to 400 Degrees F

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NOTE: Use the following for ferrous surfaces where surface temperature does not exceed 204 degrees C 400 degrees F.

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Provide alkyd resin-based material for surface temperature coatings not exceeding 204 degrees C 400 degrees F. Apply a minimum two coats of coating with a dry-film thickness of a minimum 0.1 millimeter 4 mils.

Apply an epoxy zinc primer as a first coat conforming to MPI ASM, No. 20 with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

White and color pigmented finish coats are an alkyd resin-based material with the resin solids and pigments not less than 85 percent of the total weight of the material. Ensure pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coats are an alkyd resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Provide aluminum pigmented finish coats that are an alkyd resin-based material with resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.1.2 Category 2, 149 to 316 Degrees C 300 to 600 Degrees F

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NOTE: Use the following for ferrous surfaces where surface temperature does not exceed 316 degrees C 600 degrees F.
****

Coatings for surface temperatures not exceeding 316 degrees C 600 degrees F are based on modified silicone and silicone-based resins. Apply coatings in not less than two coats with a dry-film thickness of not less than 3 mils.

Provide a silicone-based resin zinc-pigmented material with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Apply color pigmented finish coats using silicone-based resin material with the resin solids and pigments not less than 80 percent of the material's total weight. Pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coat is a silicone-based resin carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coats are a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.1.3 Category 3, 316 to 427 Degrees C 600 to 800 Degrees F

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NOTE: Use the following for ferrous surfaces where surface temperature does not exceed 427 degrees C 800 degrees F.
****

Provide a modified silicone or a silicone-based material of coating for surface temperatures not exceeding 427 degrees C 800 degrees F. Apply a minimum two coats with a dry-film thickness of a minimum 0.07 millimeter 3

mils 1 mils per manufacturer's recommendations.

Provide a silicone-based resin, zinc-pigmented material first coat with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Ensure black-pigmented finish coat is a silicone-based resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coat is a a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.1.4 Category 4, 427 to 649 Degrees C 800 to 1,200 Degrees F

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NOTE: Use the following for ferrous surfaces where surface temperature does not exceed 649 degrees C 1,200 degrees F.

****

Provide an aluminum-pigmented, silicone-resin-based coating for surface temperatures not exceeding 649 degrees C 1,200 degrees F conforming to QPL-TNT-AP-28, as modified.

Apply a minimum two coats with a minimum 0.05 millimeter dry-film thickness of 2 mils.

Ensure the coating pigment contains a minimum 28 percent aluminum, based on the total weight of the material. Ensure coating contains a minimum of 22 percent silicone resin and a maximum of 49 percent of volatile thinners and driers based on the total weight of the material.

2.2 MATERIALS

2.2.1 Epoxy Coatings

Conform to MPI ASM, No. 116 for epoxy coatings and epoxy block filler, as modified.

Resins for finish coats are based on a polyamide-cured, epoxy-resin material. Apply finish coats with a dry-film thickness of not less than 0.1 millimeter 4 mils per coat. Finish color and gloss are as indicated.

****

NOTE: Use Epoxy resin coatings where surface coatings require high corrosion resistance, chemical resistance, bond strength, UV resistance, and toughness.

Amine-cured epoxy coatings have higher resistance to chemical attack and better color retention than polyamide-cured epoxy coatings. Polyamide-cured epoxy coatings have higher water resistance and bond strength than amine-cured coatings.

NOTE: Consider the Dry-film thickness given as a minimum and may be revised as required to suit

conditions and surface use.
****

2.2.1.1 Concrete Surface Coatings

Apply a [epoxy coating system in conformance with MPI ASM, No. 77] [water-based epoxy coating system in conformance with MPI ASM, No. 115] for vertical concrete surfaces. Apply an epoxy slip-resistant deck coating system in conformance with MPI ASM, No. 82. Apply a prime coat to fill concrete surface pores with a total dry-film thickness of not less than 0.05 millimeter 2 mils.

2.2.1.2 Masonry Surfaces Coatings

Apply a[n] [Water-Based, Light-Industrial Coating System in conformance with MPI ASM, No. 110] [Epoxy Coating System in conformance with MPI ASM, No. 77] [Water-Based Epoxy Coating System in conformance with MPI ASM, No. 115] [Polyurethane, Pigmented, Over Epoxy Coating System in conformance with MPI ASM, No. 72]. Apply a block filler to fill surface pores with a total dry-film thickness of not less than 0.2 millimeter 7 mils.

2.2.1.3 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces consist of a prime coat and not less than two finish coats. Comply with MPI ASM, No. 101 for an epoxy zinc primer with a metallic-zinc pigment for the substrate to be coated and the end use of the coated surface. Ensure resin solids and zinc pigment are not less than 80 percent of the total weight of the coating material. Apply prime coat with a total dry-film thickness of not less than 0.1 millimeter 4 mils. Provide an epoxy-based finished coat as specified.

2.2.1.4 Aluminum Surface Coatings

Apply an Epoxy Coating System in conformance with MPI ASM, No. 80 and MPI ASM, No. 77. Apply a prime coat with a total dry-film thickness of not less than 0.1 millimeter 4 mils.

2.2.2 Polyurethane Coatings

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NOTE: Polyurethane-based coatings are used where surfaces to be coated require high abrasion resistance, good flexibility and chemical resistance, UV resistance, and are a two-part, prepolymer, catalytic-cured resin material.

The two-part prepolymer, catalytic-cured, resin based materials are used for heavy-duty coatings where abrasion resistance and chemical resistance are required. Catalytic-cured resins are formulated as clear coatings and in a limited range of pigmented coatings.
****

Ensure polyurethane coatings use ASTM SI10 and conform to MPI ASM for each substrate indicated.

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NOTE: Dry-film thickness given are considered minimum and may be revised as required.
****

Resins for finish coats are based on a two-part, prepolymer, catalytic-cured, polyurethane material. Apply catalytic-cured coatings with a total dry-film thickness of not less than 0.25 millimeter 10 mils per coat. Indicate finish color and gloss on the schedules.

2.2.2.1 Concrete Surface Coatings

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NOTE: Policy is to avoid coating of exposed concrete unless it is considered aesthetically desirable.
****

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72 and MPI ASM, No. 80] [Polyurethane, Clear, Two-Component Coating System in conformance with MPI ASM, No. 78]. Ensure the prime coat fills surface pores with a total dry-film thickness of not less than 0.05 millimeter 2 mils. Finish coats are polyurethane-based material as specified.

2.2.2.2 Masonry Surface Coatings

Apply a polyurethane, clear, two-component coating system in conformance with MPI ASM, No. 78. Apply block filler to fill surface pores with a total dry-film thickness of not less than 0.2 millimeter 7 mils. Finish coats are polyurethane-based material as specified.

2.2.2.3 Ferrous and Galvanized Metal Surface Coatings

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72, MPI ASM, No. 77, and MPI ASM, No. 101] [high-performance architectural latex coating system in conformance with MPI ASM, No. 134, No. 138, and MPI ASM, No. 140]. Apply a prime coat with a dry-film thickness of not less than 0.05 millimeter 2 mils. Finish coats are polyurethane-based material as specified.

2.2.2.4 Aluminum Surface Coatings

Apply a water base, light industrial coating system in conformance with [MPI ASM, No. 95] [MPI ASM, No. 77 and MPI ASM, No. 80 for epoxy coating] [MPI ASM, No. 80 for polyurethane] coats on aluminum surfaces. Prime coat is a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated. Apply prime coat with a dry-film thickness of not less than 0.05 millimeter 2 mils. Finish coats are polyurethane-based material as specified.

2.2.2.5 Wood Surface Coatings

Apply a [pigmented polyurethane coating in conformance with MPI ASM, No. 72][clear polyurethane two-component coating in conformance with MPI ASM, No. 13 and MPI ASM, No. 78]. Apply prime coat with a dry-film thickness of not less than 0.12 millimeter 5 mils. Finish coats are polyurethane-based material as specified.

2.2.3 Chlorinated-Rubber Coatings

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NOTE: Chlorinated-rubber-based coatings are used where the surface coating requires high resistance to water, salt spray, moist gases, and inorganic acids at 24 degrees C 75 degrees F.

Chlorinated rubber resins cannot be used in the unmodified state; they tend to deteriorate when exposed to heat and ultraviolet light. Chlorinated-rubber resins are generally modified with phenolic resins.

Chlorinated rubber coatings are based on modified, chlorinated-rubber, phenolic-resin materials. Coatings are formulated as gray and white coating with a wide range of tints for white base material.

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NOTE: The dry-film thickness given is considered the minimum and may be revised to suit conditions and surface use.

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Base resins for finish coats on a modified, chlorinated-rubber, phenolic-resin material. Ensure coating materials contain not less than 20 percent chlorinated rubber resin, based on the total weight of the material. Apply finish coats with a dry-film thickness of not less than 0.07 millimeter 3 mils per coat. Finish coating color is as indicated.

2.2.3.1 Concrete Surface Coatings

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NOTE: Policy is to avoid coating of exposed concrete unless it is considered aesthetically desirable.

****

Apply a minimum three coats on concrete surfaces. Provide prime coats with a chlorinated-rubber resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Ensure the prime coat fills concrete surface pores with a total film thickness of not less than 0.05 millimeter 2 mils. Finish coats are chlorinated-rubber-based coatings as specified.

2.2.3.2 Masonry Surface Coatings

Apply a minimum of two finish coats of masonry block filler on masonry surfaces. Block fillers are based on an epoxy-ester resin material as recommended by the coating manufacturer for the substrate and end use of the coated surface. Fill surface pores with block filler at a total film thickness of not less than 0.2 millimeter 7 mils. Finish coats are chlorinated-rubber-based coatings as specified.

2.2.3.3 Ferrous and Galvanized Metal Surface Coatings

Apply a minimum two coats of high performance architectural latex coating

in conformance with MPI ASM, No. 79 on ferrous and galvanized metal surfaces. Apply prime coat with a dry-film thickness of not less than 0.07 millimeter 3 mils. Finish coats are chlorinated rubber-based coatings as specified.

2.2.3.4 Aluminum Surface Coatings

Apply a minimum three coats of quick drying primer for aluminum surfaces. Ensure prime coats conform to MPI ASM, No. 80 for aluminum coating system.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Surface Preparation

Protect adjacent materials and equipment against damage from spillage, dripping, and spatter of coating materials. Leave clean building materials and equipment with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Contracting Officer, and leave in an undamaged condition. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

Provide forced ventilation for interior spaces during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Provide fire extinguishers of the required quantity and correct type to combat flammable liquid fires.

Dispose of rags that are used to wipe up coating materials, solvents, and thinners by drenching with water and placing them in a covered metal container

3.1.2 Cleaning

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Clean application equipment promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

3.1.3 Concrete Surfaces

Conform to MPI ASM for substrates indicated. Remove plates, machined surfaces, and similar items already in place that are not to be coated. Provide surface-applied protection before surface preparation and coating where removal is impractical or impossible. After completing coating operations, reinstall items that were removed.

Clean dirt, oil, grease, and incompatible paints from substrates to ensure bonding. Coordination of shop-applied prime coats with high-performance coatings is critical. Remove incompatible primers. Reprime substrate with compatible primers as required to produce coating systems indicated.

3.1.3.1 Concrete Substrates

Remove release agents, curing compounds, efflorescence, and chalk. Maximum allowable moisture content of concrete is 12 percent. Measure moisture content with an electronic moisture meter.

Clean surfaces with pressurized water. Use pressure range of [10 350 to 27 580 kPa 1500 to 4000 psi at 150 mm to 300 mm 6 inch to 12 inch][27 580 to 68 950 kPa 4000 to 10,000 psi].

Comply with SSPC 7/NACE No.4 (NACE No. 4), "Brush-Off Blast Cleaning" for abrasive cleaning.

3.1.3.2 Clay Masonry Substrates

Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.

Clean surfaces with pressurized water. Use pressure range of [690 to 4140 kPa 100 to 600 psi] [10 350 to 27 580 kPa 1500 to 4000 psi] at 150 to 300 mm6 inch to 12 inch.

****

NOTE: Delete paragraph below if primers are shop applied and are not removed in the field.

****

3.1.3.3 Steel Substrates

Remove rust and loose mill scale. Clean using methods recommended in writing by coating manufacturer. Conform to SSPC 7/NACE No.4 for blast cleaning.

****

NOTE: Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized"). If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.

****

3.1.3.4 Galvanized-Metal Substrates

Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.1.3.5 Aluminum Substrates

Remove surface oxidation.

3.1.3.6 Wood Substrates

Wood substrates that contain small surface knots are prepped by sanding surfaces smooth. Apply a thin coat of knot sealer before applying an interior latex-based wood primer. Prime edges, ends, faces, undersides, and back sides of wood. After priming, fill holes and crevices to the finished surface with putty or plastic wood filler. After finished surface is dry, smooth surface by sanding, for a finished product.

3.1.4 Coating Material Preparation

Mix and prepare coating materials in accordance with the coating manufacturer's printed instructions for applying the particular material and coat. Keep materials which are not in actual use in closed containers.

Coating materials that have been mixed with an automatic shaker are allowed to stand to let air bubbles escape, then given a final hand mixing before application. Stir materials so as to produce a mixture of uniform density. Stir at frequent intervals during application to prevent skinning. Do not stir film which may form on the surface of the material. Remove film and strain, if necessary.

3.1.4.1 Thinning

Thinning is done in accordance with coating manufacturer's printed directions for the particular material and coat.

3.1.4.2 Tinting

Ensure prime and intermediate coats of paint are slightly different tints from the finish coat to facilitate identification of each coat. Tinting is done by the coating manufacturer and clearly identified as to color and coat.

3.2 APPLICATION

Do not perform exterior painting in damp or rainy weather. Interior painting is not allowed until the building is enclosed and has thoroughly dried out. Painting is not allowed below 10 degrees C 50 degrees F or above 35 degrees C 95 degrees F. Apply paint in accordance with the coating manufacturer's recommendations, and as specified.

Ensure coating application is done by skilled applicators. Apply coatings to clean and properly prepared surfaces. Apply coatings with clean, high-quality application equipment. Allow sufficient time between coats to ensure complete drying and curing. Sand and dust surfaces between coatings, as required, to produce a surface free of visible defects. Lightly sand high gloss coatings and clear finishes between coats to ensure bond of following coats.

Apply coats to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections are not acceptable. Remove defective coating applications and re-coat as directed.

Ensure coating lines such as wainscots are sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

Ensure surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, meet the dry-film thickness not less than specified.

3.2.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

3.2.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

3.2.3 Spray Application

[Do not allow spray application of coatings.Spray application equipment is limited to airless-spray equipment and electrostatic-spray equipment. Ensure equipment is clean and operated by workmen skilled in high quality application of coating materials.

][Spray application of coatings is limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

][Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

]3.3 FIELD QUALITY CONTROL

3.3.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

3.3.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

-- End of Section --