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USACE / NAVFAC / AFCEC / NASA **UFGS-09 97 13.15 (February 2010)**

Preparing Activity: NAVFAC **Superseding UFGS-09 97 13.15 (August 2009)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2014
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DIVISION 09 - FINISHES

SECTION 09 97 13.15

EPOXY/FLUOROPOLYURETHANE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS

02/10

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SECTION 09 97 13.15

EPOXY/FLUOROPOLYURETHANE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS
02/10

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NOTE: This guide specification covers the requirements for epoxy/fluoropolyurethane coating systems for interiors of newly constructed, Navy bulk fuel storage tanks. For maintenance coating design, see notes herein. Severe corrosion and corrosion pitting is not addressed in this specification.

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 items(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).
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NOTE: TO DOWNLOAD UFGS GRAPHICS
Go to http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf.
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NOTE: This specification should be edited by an SSPC certified Protective Coatings Specialist (PCS) that has five or more years of experience preparing coating specifications.

The designer should not alter the products and processes specified herein without thorough knowledge of the need for the changes and the implications of those changes.

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NOTE: For Air Force tanks, use UFGS 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS, which is identical to this specification, except that it specifies a three-coat epoxy system.
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NOTE: The metric standard for measuring coating thickness is microns (25.4 microns=1 mil - use nominal 25 microns=1 mil).
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NOTE: This specification is for a 3 Coat, thin film system, which is compliant with EPA VOC regulations as of June 2000.

- Epoxy Coats 350 g/l 2.8 lbs/gal max. VOC
- Fluoropolyurethane Topcoat 350 g/l 2.8 lbs/gal max. VOC

The designer shall review state and local regulations and determine whether the coating in this Section complies with restrictions on volatile organic compounds (VOC) and other chemical constituents.
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NOTE: For tanks of limited requirement, 10 years or less expected life, the appropriate substitution for the Modified FPU topcoat is Mil-DTL-24441/31, Formula 152 (white), Type IV. In this situation, use UFGS 09 97 13.17THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS, which is identical to this Section except for the topcoat. Do not make this substitution as a cost-savings tool on permanent tanks.
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NOTE: Previous versions of this specification have included a requirement for surfaces to be abrasive blasted to SSPC 7/NACE No.4, inspected, and repaired, prior to coating. That requirement has been removed from this specification, and if required for a repair project, it should be included in the structural repair Section of the project specification. Tailor the paragraph to the needs of cleaning that will be required in preparation for repairs, and note that the abrasive blasting for inspection should be accomplished in such a manner that it does not conflict with any surface condition requirements in this Section, such as creating excessive surface profile that may require excessive

primer thickness. For repair projects, specify appropriate portions of the steel surfacing requirements (according to NACE RPO178) from UFGS 33 56 13.13 STEEL TANKS WITH FIXED ROOFS.
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NOTE: Designs for maintenance painting of fuel tank linings should be based on recent inspections. Wherever possible, a coating inspection, or Coating Condition Survey (CCS), as described in UFGS 09971, should be accomplished prior to designing a coating project for fuel tank interiors. Without a competent inspection, there is no reliable way to determine the type or condition of the existing coating system. Without knowing the existing conditions, proper (effective and financially supportable) surface preparation or coating system selection cannot be made. It is not always cost effective to replace the entire coating system in a fuel tank, however, this is the tendency in preparing a design without inspection results.

Do not provide general overcoat to a fuel tank lining unless recommended in a CCS to add corrosion protection. Provide complete removal and replacement, or repairs to existing, as deemed appropriate. Overcoating the interior of a tank is generally a liability unless extraordinary measures are taken to ensure adhesion to the old coating, regardless of whether it is epoxy or urethane.
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NOTE: Designers are encouraged to contact J. H. Brandon, NFESC Code 63, 757 322-4645, Joseph.Brandon@navy.mil prior to beginning a new Navy design.
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NOTE: Designers are encouraged to contact the Air Force Civil Engineering Corrosion Program Manager at AFCEC/COSM, 139 Barnes Drive, Suite 1, Tyndall AFB, FL 32403, Tel 850-283-6070, prior to beginning new Air Force design.
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PART 1 GENERAL

1.1 REFERENCES

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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 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.

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

AMERICAN PETROLEUM INSTITUTE (API)

API Std 650	(2013; Errata 2013) Welded Tanks for Oil Storage
API Std 653	(2009; Addendum 1 2010; Addendum 2 2012; Addendum 3 2013) Tank Inspection, Repair, Alteration, and Reconstruction

ASTM INTERNATIONAL (ASTM)

ASTM D1210	(2005; R 2010) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D1475	(2013) Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D2369	(2010; E 2011) Volatile Content of Coatings
ASTM D3276	(2007) Painting Inspectors (Metal Substrates)
ASTM D3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D3335	(1985a; R 2009) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
ASTM D3718	(1985a; R 2010) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy
ASTM D3925	(2002; R 2010) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D3960	(2005; R 2013) Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4285	(1983; R 2012) Indicating Oil or Water in

	Compressed Air
ASTM D4400	(1999; E 2012; R 2012) Sag Resistance of Paints Using a Multinotch Applicator
ASTM D476	(2013) Dry Pigmentary Titanium Dioxide Pigments
ASTM D562	(2010) Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer
ASTM D7127	(2013) Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2008; Corr 1 2009) Quality Management Systems- Requirements

NACE INTERNATIONAL (NACE)

NACE SP0178	(2007) Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be for Immersion Service
NACE SP0188	(1999; R 2006) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007; E 2004) Brush-Off Blast Cleaning
SSPC AB 2	(1996; E 2004) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2003; E 2004) Ferrous Metallic Abrasive
SSPC Guide 12	(1998; E 2004) Guide for Illumination of Industrial Painting Projects
SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PA 2	(2012) Measurement of Dry Coating Thickness With Magnetic Gages
SSPC QP 1	(1998; E 2004) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC QP 5	(1999; E 2004) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2004) Standard Procedure for Evaluating a

	Contractor's Advanced Quality Management System
SSPC SP 1	(1982; E 2004) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP COM	(2004) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 2 1996) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/29	(2009; Rev B) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV
MIL-DTL-24441/31	(2009; Rev B) Paint, Epoxy-Polyamide, White, Formula 152, Type IV

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-141	(Rev D) Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing
FED-STD-595	(Rev C; Notice 1) Colors Used in Government Procurement

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1910.1000	Air Contaminants
29 CFR 1910.134	Respiratory Protection
29 CFR 1926.59	Hazard Communication

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters. The following definitions are used throughout this Section:

a. CEILING - interior tank surfaces that extend from the horizontal plane at the designated maximum fuel line upward, including the upper portion of the tank shell (walls), columns, structural steel, the underside of the roof plates and other steel components in this area.

b. SHELL - interior tank surfaces that extend along the vertical tank

walls between the horizontal planes approximately 1 meter 40 inches above the shell to bottom joint upward to the horizontal plane at the designated fuel line, including columns, wall plates, and other steel components in this area.

c. FLOOR - interior tank surfaces below the horizontal plane approximately 1 meter 40 inches above the shell to bottom joint, including columns, wall plates, piping, pipe supports, bottom plates, and other steel components in this area.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated 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 submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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 projects.

Submittal items not designated with a "G" are considered as being for Contractor Quality Control approval.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05, Design Data

Environmental Control System

Use of Door Sheet Access Way[; G][; G, [_____]]

SD-06 Test Reports

Metallic Abrasive Qualification Test Reports

Coating Sample Test Reports

Abrasive Sample Test Reports

Inspection Report Forms

Daily Inspection Reports

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

SD-07 Certificates

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Coating Work Plan

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications Of Individuals Performing Abrasive Blasting

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Qualifications of Coating Contractors

Roof Joint Sealant Materials

Roof Joint Sealant Compatibility

Epoxy Coating Materials

PTFE-Pigmented Fluoropolyurethane Coating Materials

Coating System Component Compatibility

Non-metallic Abrasive

Metallic Abrasive

SD-08 Manufacturer's Instructions

Roof Joint Sealant Instructions

Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive[; G][; G, [_____]]

Inspection Logbook[; G][; G, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

1.4.3 Coating Work Plan

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NOTE: For maintenance painting, add requirement for pre-work determination of the existing surface profile. If paint removal is specified in another Section, such as a blast cleaning prior to inspection or repair, or in the lead removal Section, include this evaluation of existing profile such that the paint removal operation does not create excessive profile.
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NOTE: Choose the options pertaining to the floating pan that apply to the project. The pan should be removed for any significant coating work on the SHELL and CEILING, and for all but minor repairs on the FLOOR.
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This work plan shall be considered as part of the Quality Control Plan.

Provide procedures for reviewing contract documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.

Provide procedures for verification of key processes during Initial Phase to ensure that contract requirements can be met. Key processes shall include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.

Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of non-compliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.

[Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.][Provide procedures for removing floating pan and preparing for re-installation.][Provide procedures for installing floating pan after tank lining has been applied and cured, how the coated floor and shell surfaces will be protected during pan installation.][Describe how the floating pan will be protected, and procedures for evaluating and repairing damage to pan. The floating pan shall not be used as staging or as a work platform.][_____]

Provide procedures for correcting non-compliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to correct coating thickness non-compliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.

If a procedure is based on a proposed or approved request for deviation, the deviation shall be referenced. Changes to procedures shall be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

1.4.4 Design Data

1.4.4.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist shall approve calculations, work procedures and personal protective equipment.

1.4.4.2 Use of Door Sheet Access Way

If use of a door sheet access way is desired, submit design drawings and calculations that address all aspects of the door sheet opening in accordance with API Std 653 and API Std 650, including cutting of door sheet, tank stabilization, door sheet replacement, weld testing, and final acceptance. A registered engineer shall approve all calculations and procedures prior to submittal for government approval.

1.4.5 Test Reports

1.4.5.1 Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of SSPC AB 3. Submit test results from independent laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of prequalifying the abrasive.

1.4.5.2 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by SSPC AB 2, as modified in paragraph ABRASIVE.

1.4.6 Qualifications

1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS shall remain certified during the entire

project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. The PCS shall not be the designated coating inspector.

1.4.6.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by SSPC to the requirements of SSPC QP 5 prior to contract award, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

1.4.6.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to SSPC QP 5, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

1.4.6.5 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

1.4.6.6 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified.

1.4.6.7 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that employees performing testing are qualified.

1.4.6.8 Qualifications of Coating Contractors

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NOTE: If project involves removal of paint containing hazardous materials, add requirement for SSPC QP-2 certification in section of specification

where the hazardous paint removal is specified, generally UFGS 02 83 13.00 20 LEAD IN CONSTRUCTIONor 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD.

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NOTE: Solicitations requiring certification for prequalification should point out the existence and location of the certification requirement on the PROJECT INFORMATION FORM. This requirement must be pointed out in the solicitation documents for the "prior to contract award" requirement to be enforceable. Certification is a special responsibility requirement pursuant to FAR 9.104-2. This is analogous to requiring bidders to have a specified level of experience or expertise and GAO has sustained these types of special requirements.

****

All Contractors and Subcontractors that perform surface preparation or coating application shall be certified to either ISO 9001 or SSPC QP 1 and SSPC QS 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting Contractors and painting Subcontractors must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status.

1.4.6.9 Roof Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.6.10 Roof Joint Sealant Compatibility

Provide manufacturer's certification that the selected joint sealant is compatible with the epoxy primer.

1.4.6.11 Epoxy Coating Materials

Provide manufacturer's certification that the epoxy lining materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials.

1.4.6.12 PTFE-Pigmented Fluoropolyurethane Coating Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.6.13 Coating System Component Compatibility

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and fluoropolyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products,

including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

1.4.6.14 Non-metallic Abrasive

Provide manufacturer's certification that the materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products List (QPL) for the specified materials.

1.4.6.15 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

1.4.7 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

1.4.8 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

1.5 PRODUCT DATA

1.5.1 Roof Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, minimum and maximum application temperatures, and curing procedures. Include Materials Safety Data Sheets (MSDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Materials Safety Data Sheets (MSDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 5 and 29 degrees C 40 and 85 degrees F, and air temperature more than 3

degrees C 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples may be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer may issue an extension, referencing the product evaluation and the review of storage records. Products may not be extended longer than allowed in the product specification.

1.7 COATING HAZARDS

****
NOTE: This specification Section should be used with UFGS 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.
****

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

1.8 WORK SEQUENCE

****
NOTE: Modify tank construction specification to indicate that floating pan will be installed over coated floor and that the coating should be fully protected during pan installation with protective mats. Any required repairs should be done according to paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating."
****

[Coat tank interior following tank tightness testing.] [Coat tank interior before installation of floating pan.][_____].

1.9 JOB SITE REFERENCES

****
NOTE: Include any other job site related references that might be added during design.
****

Make available to the Contracting Officer at least one copy each of API Std 653, ASTM D3276, ASTM D3925, ASTM D4285, ASTM D7127, NACE SP0178 and companion visual comparator, NACE SP0188, SSPC SP COM, SSPC SP 1, SSPC 7/NACE No.4, SSPC SP 10/NACE No. 2, SSPC PA 1, SSPC PA 2, SSPC Guide 12, SSPC VIS 1, SSPC QP 1, SSPC QS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

PART 2 PRODUCTS

2.1 ROOF JOINT SEALANT

Industrial grade, two component, minimum 95 percent solids by volume, polysulfide type caulking material that has a minimum history of 10 years acceptable service in fuel tanks. Sealant shall be compatible with the epoxy primer and suitable for direct application to prepared steel surfaces. Sealant shall contain no more than 0.06 percent by dry weight Lead, no more than 0.06 percent by dry weight Cadmium, and no more than 0.00 percent by dry weight Chromium.

2.2 COATING SYSTEM

****
NOTE: Include bracketed text for new construction only.
****

Alternate systems or products will not be considered. All primer and intermediate coat materials shall be supplied by one supplier. [The entire coating system is intended to be applied in the field. Alternatively, surface preparation may be accomplished in the shop, following all temperature, humidity, and testing requirements listed herein, followed by an application of a hold-primer. Upon completion of field fabrication, all shop-applied coatings shall be removed, surfaces prepared to SSPC SP 10/NACE No. 2, and the specified coating system applied. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.]

2.2.1 Epoxy Primer and Intermediate Coats

The epoxy coating materials shall be approved by the Naval Sea Systems Command and listed on their current Qualified Products List (QPL) for the specified materials.

2.2.1.1 Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/29 (Formula 150, Type IV, Green).

2.2.1.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately FED-STD-595 color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

2.2.2 Fluoropolyurethane Topcoat

Formulate fluoropolyurethane topcoat as specified in Table II - Modified PTFE-Pigmented Fluoropolyurethane topcoat.

2.3 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one liter quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to to be shipped, and packing material. Mark cans for the appropriate

component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.4 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.5 TEST KITS

2.5.1 Test Kit for Measuring Chloride, Sulfate and Nitrate Ions on Steel and Coated Surfaces

Provide test kits called CHLOR*TEST CSN Salts, as manufactured by CHLOR*RID International Inc. of Chandler, Arizona (www.chlor-rid.com) or equal. An "equal" test kit shall meet the following requirements:

a. Kit contains all materials,supplies, tools and instructions for field testing and on-site quantitative evaluation of chloride, sulfate and nitrate ions;

b. Kit extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;

c. Kit components and solutions are mercury free and environmentally friendly;

d. Kit contains new materials and solutions for each test extraction;

e. Extraction test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during salt ion extraction;

f. Test extract container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;

g. All salt ion concentrations are directly measured in micrograms per square centimeter.

2.5.2 Test Kit for Identifying Amine Blush on Epoxy Surfaces

After coating and/or primer has hardened and prior to applying the next coat, test for unreacted amines using the AMINE BLUSH CHECK, manufactured by Elcometer, Rochester Hills, Michigan, or equal. To be considered for approval as an "equal" test kit it shall meet the following requirements:

a. Be a completely self-contained field test kit with all materials, supplies, tools and instructions to perform tests and indicate the presence of unreacted amines;

b. Use an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;

c. Kit contains no mercury or lead and is environmentally friendly;

d. Kit contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

2.6 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

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NOTE: The following paragraph is mandatory for all NAVFAC PAC projects. All other agencies may use it after checking applicability.
****

[Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.
]

****
NOTE: Reduce allowable gross gamma radioactivity to 5 picocuries per gram for all NAVFAC PAC projects. Reduce in other areas if states or localities require.
****

2.6.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials)[except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Abrasive shall be approved by the Naval Sea Systems Command and listed on the appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.6.2 Metallic Abrasive

2.6.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 Class 1 (Steel) only[, except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 to 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project.

Such grit shall be considered to conform if it can be traced to new grit conforming to SSPC AB 3 Class 1 and it meets all cleanliness requirements of SSPC AB 3 Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

2.6.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.

[3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

****

NOTE: Include UFGS 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEADin any project specification that requires removal or disturbance of coating containing hazardous materials in conjunction with a coating project. Include a contractor qualification requirement similar to the article entitled "Qualifications of Coating Contractors" in Part 1 of this Section, except that the contractor shall be qualified to SSPC QP 2, Category A. The removal of coatings containing hazardous materials and application of new coating system can be accomplished in a continuous operation if the contractor provides appropriate coordination of removal, cleaning, and coating application. It is specified as two separate operations to allow separate contractors to accomplish different phases of project. With the use of SSPC QP 1 and QP 2 requirements in contracts, the same contractor will generally be accomplishing both phases of work, and will probably want to perform both phases as a single operation to avoid preparing surfaces twice. To accomplish the coating removal and recoating in a continuous operation, the contractor's plan must be scrutinized for appropriate controls on the removal process, and on the surface preparation/coating application process. Delete this paragraph if no paint containing hazardous material is to be removed.

****

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD. Coordinate surface preparation requirements from Section 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD with this Section.

][3.2 DOOR SHEET ACCESS WAY

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NOTE: Tanks should be evaluated during inspection and design for appropriateness of cutting out a door sheet. If there is a reason not to allow a door sheet to be cut into a particular tank, delete this paragraph and the related paragraph in Part 1.

****

A door sheet may be cut out of a tank to facilitate personnel and equipment access. The door sheet shall be removed in accordance with API Std 653 and API Std 650, including all structural, welding, testing, and evaluation requirements. After completion of coating CEILING and SHELL and prior to preparation and coating of FLOOR, the door sheet shall be installed, tested, and accepted. The door sheet and surrounding areas shall be surfaced in accordance with Section 4 of NACE SP0178, and accompanying Visual Comparator, to the condition described and shown for NACE Weld Surface Preparation Designation ”C” welds for interior surfaces and "D" Welds for exterior surfaces. The door sheet and the feathered areas of the SHELL shall be prepared and coated with the FLOOR in accordance with all requirements of this Section. The Contractor is responsible for cutting out the door sheet, stabilizing the tank or openings while the door sheet is out, replacing the door sheet, and testing the replaced door sheet using qualified engineering and testing services. Perform tank tightness testing after coating where a door sheet access way was installed for this project.

]3.3 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite. Notify Contracting Officer three days in advance of sampling. The QC Manager, and either the PCS or coating inspector, shall witness all sampling.

3.3.1 Coating Sample Collection

Provide a sample collection kit as required in paragraph COATING SAMPLE COLLECTION AND SHIPPING KIT. From each lot, obtain a one liter quart sample of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The QC Manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph entitled "Coating Sample Test Reports."

3.3.2 Abrasive Sample Collection

Provide a sample collection kit as required in paragraph ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT. For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques

and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC Manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph ABRASIVE SAMPLE TEST REPORTS.

3.3.3 Coating Sample Test Reports

Submit test results for each lot of coating material delivered to the jobsite. Test samples of primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire batch represented by samples that fail one or more tests, select new lots, and test samples.

3.3.4 Abrasive Sample Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of metallic abrasive to the requirements of paragraph REQUIREMENTS of SSPC AB 3, except paragraph 4.1.5 DURABILITY. Test samples of non-metallic abrasive as required in paragraph QUALITY CONFORMANCE INSPECTION of MIL-A-22262. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

[3.4 FUEL REMOVAL AND TANK CLEANING

Remove fuel and clean storage tanks in accordance with Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS.

]3.5 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

3.6 ENVIRONMENTAL CONDITIONS

3.6.1 Control System Requirements

Provide and utilize dehumidification and ventilation equipment to control humidity, temperature, and vapor levels in tank from beginning of abrasive blasting through coating application and for four days after the last coating is applied. System shall maintain vapor concentrations at or below 10 percent of Lower Explosive Limit (LEL). System may incorporate any combination of solid desiccant and direct expansion refrigeration equipment. No liquid, granular, calcium chloride, or lithium chloride drying systems will be accepted. Use only electric, indirect fired combustion, indirect friction, or steam coil auxiliary heaters. System shall be compatible with removal of dust and solvent vapors, and shall have fail-safe measures to ensure reliability during operations.

3.6.2 Automated Monitoring Requirements

Provide continuous monitoring of DH equipment, and temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. Locate sensors to provide pertinent data for the surface preparation and coat application being performed. Make data available to the Contracting Officer through Internet access. Provide monitoring equipment to perform as follows:

a. Data is collected in the field unit in one minute increments, and available for download (on-site) in a standard format. Contractor shall collect this data and make available to the Contracting Officer;

b. Monitoring equipment shall have backup power such that data collection and transmission to web server will be uninterrupted during the entire period of the dehumidification requirement;

c. Monitoring equipment shall have capability to measure surface temperatures at a minimum of four locations anywhere on a 150 foot diameter by 50 foot high tank;

d. Monitoring equipment shall have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP);

e. Data shall be available continuously through secure Internet connection, using widely available web browsers;

f. Internet accessible data shall be collected and stored in maximum 15 minute increments, and lag time between data collection and online availability shall be no greater than 70 minutes;

g. Internet accessible data shall be available for viewing online in tabular format, and graphical format using selected data;

h. Internet accessible data shall be available for download in user-defined segments, or entire project to date, in a standard format usable by Microsoft Excel and other spreadsheet programs.

i. Internet-based controls shall provide alerts to pre-designated parties through email messaging;

j. Internet-based controls shall monitor data uploads from field unit and issue alert if data not initiated within 60 minutes of last upload;

k. Internet-based controls shall monitor operation of DH equipment and issues alert when power remains off for more than 15 seconds, or if pre-determined temperature, RH, or DP conditions are exceeded;

The requirements listed here were developed around the Munters Exactaire Monitoring System, as this was the only monitoring system having Internet connectivity known to be commercially available. There is no requirement for connectivity of the monitoring system to control the DH equipment, therefore, any combination of equipment having the required functionality will be accepted.

3.6.3 Humidity Control for Surface Preparation and Primer Application

Provide and utilize dehumidification equipment to maintain relative humidity at appropriate level to prevent prepared steel surfaces from corroding at all times during abrasive blasting through primer application. Failure of humidity control system, or failure to maintain proper conditions, during surface preparation stage may allow surface rusting, which will be rejected and require rework. All surfaces to be coated must meet all requirements at time of primer application. Failure of humidity control system during primer application stage will be cause for removal and replacement of all materials applied and cured while conditions were not as prescribed above.

3.6.4 Humidity Control for Application of Intermediate and Topcoats and Initial Curing

Provide and utilize dehumidification equipment to maintain relative humidity at the coldest steel surface in tank below 55 percent at all times during coating application, and during the first four days of initial curing after application of topcoat. This measurement is not the same as measuring the relative humidity of ambient air in the tank, and will require either electronic equipment to monitor relative humidity at the steel surface, or complex calculations to convert relative humidity of air in tank to relative humidity at steel surface. An approved alternative method of monitoring dehumidification that requires less sophisticated equipment or calculations is to maintain a minimum dew point depression of 10 degrees C 18 degrees F below coldest steel surface temperature. This is in lieu of specific relative humidity and dew point requirements in this Section. Failure to maintain specified humidity control during this phase will be cause for extension of humidity controlled cure time to ensure four consecutive days at specified relative humidity at steel surfaces. Formation of condensation in coating application stage prior to the indicated dry-hard time will be cause for removal and replacement of all materials contacted by condensation.

3.7 EQUIPMENT USED IN TANK

Equipment used in the tank after surface preparation begins shall not leave any oily residue from exhaust or other sources. Internal combustion driven equipment, other than that powered by natural or bottled gas, shall not be used.

3.8 SURFACES TO BE COATED

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NOTE: See MIL-HDBK 1022 for guidance on which interior tank surfaces should be coated.

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Prepare and coat interior tank surfaces, including[FLOOR][, SHELL][, CEILING][spot repair of [_____] spots of [_____] square meters square feet]. Remove interior piping to ensure complete coverage of floor and underside of pipe supports. [Do not coat aluminum floating pan.]

3.9 SURFACE PREPARATION

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NOTE: When editing this specification for maintenance coating work for which SSPC SP 12/NACE No.5 Water Cleaning or Jetting surface preparation is to be allowed, include note for the contractor to use potable water, monitor the quality of the water, and adjust water quality to assure appropriate surface preparation and final surface requirements. There are many problems that might arise from both dissolved and suspended material. A common occurrence is water with high-chlorides, even in potable water, which may leave unacceptable contamination on cleaned surfaces, and may not be suitable for water jetting.

****

3.9.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 650 kPa 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.9.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

3.9.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more 300 mm 1 foot square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D7127. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

3.9.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

3.9.4.1 Pre-Preparation Testing for Oil and Grease Contamination

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NOTE: When specifying maintenance painting, use a water based pH neutral degreaser to avoid damaging existing coating.
****

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) BLACK LIGHT TEST, and 4) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean [using a water based pH neutral degreaser]in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

BLACK LIGHT TEST - Inspect surfaces for oil and grease contamination using the light specified in the paragraph BLACK LIGHT. Use light no more than 381 mm 15 inches from surface unless testing indicates that the specific oil or grease found in tank fluoresce at a greater distance. Use light in tank that is completely sealed from light infiltration, under a hood, or at night. Any fluorescing on steel surfaces is indication of petroleum oil/grease contamination. Use either WATER BREAK TEST or CLOTH RUB TEST to confirm both contaminated and non-contaminated areas detected by BLACK

LIGHT TEST. The BLACK LIGHT TEST may not be used during inspection of prepared surfaces for oil and grease contamination unless proven to fluoresce the oil and/or grease found in the specific tank and documented during testing prior to abrasive blasting. Generally, only petroleum oil/grease will fluoresce, however, some may not fluoresce sufficiently to be recognized and other methods, such as the WATER BREAK TEST or CLOTH RUB TEST, must be used to confirm findings of the BLACK LIGHT TEST.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

3.9.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with a soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

3.9.5 Abrasive Blasting

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NOTE: The issue of maximum profile on new structures is an important one. Once a profile is established, it is nearly impossible to reduce it, therefore, the initial profile will dictate the profile for the life of the structure.

The specified 2-3 mil surface profile is the preferred depth for preparing for the primer. On steel that was previously prepared to a deeper depth and coated, a depth of 4 mils can be tolerated with an additional mil of primer thickness.

To validate contractor claims of pre-existing profile greater than allowed, test an appropriate number of representative spots with abrasive that removes paint but does not affect profile, such as bicarbonate of soda, or other soft abrasive, or waterblasting, etc.

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Abrasive blast steel surfaces to near-white metal in accordance with

SSPC SP 10/NACE No. 2. Prepared surfaces shall conform to SSPC VIS 1 and shall match the prepared test-panels. Provide a 50 to 75 micron 2 to 3 mil surface profile. Reject profile greater than 75 microns 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D7127, using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three test areas for the first 100 square meters 1000 square feet plus one test area for each additional 100 square meters 1000 square feet or part thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

3.9.6 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State and Local mandated regulations.

3.9.7 Pre-Application Testing For Surface Contamination

3.9.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION.

3.9.7.2 Pre-Application Testing for Soluble Salts Contamination

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NOTE: In new tanks, require 30 percent of tests to be accomplished at welds. In tanks that have been in service, corroded areas should be tested for high chlorides.

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Test surfaces for chloride contamination using the Test Kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE AND NITRATE IONS ON STEEL SURFACES. Test all surfaces at rate of three tests for the first 100 square meters 1000 square feet plus one test for each additional 200 square meters 2000 square feet or part thereof. [Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting.][Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds.]One or more readings greater than nondetectable for chlorides, sulfates, or nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as discussed in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show allowable results. Reblast tested areas using vacuum equipped blast equipment. Label all test tubes and retain for test verification.

3.9.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of three tests for the first 100 square meters 1000 square feet plus one test for each additional 100 square meters 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

3.10 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

Mix, thin, and apply in accordance with approved procedures, which may differ for each product. Do not mix partial kits or alter mix ratios.

3.10.1 Preparation of Sealant and Coating Materials for Application

Each of the different products, sealant, epoxy primer, epoxy intermediate, and fluoropolyurethane topcoat, is a two-component material supplied in separate containers.

3.10.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

3.10.1.2 Mixing Topcoat Material

Mix fluoropolyurethane coating materials in same temperature and humidity conditions specified in paragraph HUMIDITY CONTROL FOR APPLICATION OF INTERMEDIATE AND TOPCOATS AND INITIAL CURING. The Component A (base) material should be thoroughly mixed with mechanical agitation and the Component B (activator) should be lightly shaken prior to mixing. Do not "box" (pour from can to can) except one time to examine the bottom of Component A can to ensure pigment has been mixed. After Component A has been thoroughly mixed, pour contents of Component B into Component A while under light agitation and stir well for approximately three to five minutes prior to application. Use a mixer that does not create a vortex. Do not add solvent without specific written recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material. The fluoropolyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life.

3.10.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. Add all required solvent at time of mixing. Pot life is based on standard conditions at 21 degrees C 70 degrees F and 50 percent relative humidity. For every 10 degrees C 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 10 degrees C 18 degrees F drop, it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. In hot climates, precooling or exterior icing of components for at least 24 hours to a minimum of 10 degrees C 50 degrees F will extend pot life. High humidity at the time of mixing and application shortens pot life of the Modified PTFE-Pigmented Fluoropolyurethane material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy Primer and Intermediate Coat Materials	4 hours
Fluoropolyurethane Topcoat Material	3 hours.

3.10.1.4 Application Conditions and Recoat Windows

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NOTE: These requirements are provided in an attempt to prevent the significant number of intercoat delamination failures that are frequently found on industrial structures. The very strict requirements on application conditions and recoat windows may require work during abnormal hours, including weekends. Contractor work hours should allow for such during coating application.
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NOTE: Cold-weather application is not covered by this specification. If a project is designed for coating in cold weather, then the enclosure and heating requirements may be significant. It is not intended that contractors be forced to apply coatings in cold weather, however, the underlying premise is that coatings must be applied within the specified temperature ranges. A cold-weather specification should not be used to simply save money, as the coating system will generally not have the same longevity as one applied within 60-100 degrees F.
****

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 16 and 38 degrees C 60 and 100 degrees F during application and the first four hours of cure for epoxy coats and the first eight hours of cure for polyurethane coats.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 49 degrees C 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as non-compliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
EPOXY OVER EPOXY						
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
FLUOROPOLYURETHANE OVER EPOXY						
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
FLUOROPOLYURETHANE OVER FLUOROPOLYURETHANE						
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

RECOAT WINDOWS						
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
EPOXY OVER EPOXY						
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
FLUOROPOLYURETHANE OVER EPOXY						
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
FLUOROPOLYURETHANE OVER FLUOROPOLYURETHANE						
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to

the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 38 degrees C 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 50 to 75 microns 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 25 microns 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

3.10.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 100 square meters 1000 square feet plus one test for each additional 200 square meters 2000 square feet or part thereof. If one or more tests show positive results for amine blush contamination, either treat all surfaces using the approved amine blush removal procedure or increase testing to ensure that all contamination is located, and then treat identified contamination using the approved procedure.

3.10.3 Application of Coating System and Roof Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply sealant and coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and the quality of air entering tank is controlled. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than 150 mm six inches from welds. Apply stripe coat by brush. For convenience,

stripe coat material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond [[three][_____] meters [15][_____] feet from the tank perimeter] [the tank berm]. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of portable shelters or other appropriate controls.

****
NOTE: Maximum thickness measurements are to limit internal stresses in each coat and in total system. Internal stresses of epoxy and polyurethane coatings on steel can be significant, and unless limited through thickness, can cause premature failure as the coating ages. Such failures as shrinkage cracking and delamination, either from the substrate or between coats, are common. This system is not expected to receive a maintenance overcoat.
****

Apply coatings at the following specified thickness:

Coat	Minimum DFT (Microns)	Maximum DFT (Microns)
Primer	75	125
Intermediate	75	125
Top	50	100
Total system	200	350
Coat	Minimum Mils DFT	Maximum Mils DFT
Primer	3	5
Intermediate	3	5
Top	2	4
Total system	8	14

Measure coating thickness in accordance with SSPC PA 2 to confirm that coating application is within the specified range and within the tolerances of that standard. For non-compliant areas, increase number of test areas to identify all non-compliant application as required by SSPC PA 2.

3.10.3.1 Application of Roof Joint Sealant

Apply sealant to the roof-to-shell joint, to all roof plate lap joints, and to roof-to-rafter joints up to 25 mm 1 inch gap to exclude moisture from these marginally prepared crevice areas. Allow sealant to cure according to manufacturer's instructions prior to application of the stripe coat.

3.10.3.2 Application of Stripe Coat

Apply stripe coat of epoxy primer material prior to application of general primer coat on CEILING and SHELL. Apply stripe coat of epoxy intermediate coat material after application of general primer coat on FLOOR. Where stripe coat is applied to areas of joint sealant, allow appropriate curing time for joint sealant. Apply stripe coat by brush, working the material into corners, crevices, pitted areas, and welds, and onto outside corners and angles. Where roof-to-rafter joints exceed 25 mm 1 inch gap and roof joint sealant was not applied, use appropriate application tools to provide "best effort" coating of all exposed steel surfaces in the gap. Mini-rollers or other tools may be required.

3.10.3.3 Application of Primer

Apply primer coat within RECOAT WINDOW of stripe coat.

3.10.3.4 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.10.3.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired required thickness. Consult manufacturer for application procedures for anticipated temperature and humidity conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat.

3.10.4 Holiday Testing

No sooner than 48 hours after application of the topcoat, perform holiday testing in accordance with the low voltage wet sponge method of NACE SP0188. Repair holidays per paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating." Do not allow moisture from sponge to remain on the coated surfaces more than ten minutes. Remove excess moisture with a clean rag when testing fluoropolyurethane topcoat.

3.10.5 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 100 mm 4 inches of each succeeding coat feathered and abraded. Do not abrade the fluoropolyurethane topcoat. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 100 mm 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system. If one percent or more of the total surface area, or more than one spot per 200 square meters 2000 square feet, of the FLOOR area requires repair to any coat or coats, including feathered areas, the entire FLOOR coating system

shall be removed and reapplied. The limit on FLOOR repairs includes repairs made before and after floating pan installation. If 5 percent or more of the total surface area, or more than one spot per 100 square meters 1000 square feet, of the CEILING area requires repair to any coat or coats, including feathered areas, the entire CEILING coating system shall be removed and reapplied. Repairs on the SHELL are not limited.

3.10.6 Tank Occupancy After Coating Application

Use clean canvas, or other approved, shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

3.10.7 Extended Cure of Coating System Prior to Immersion Service

Allow a cure time of at least 14 days after the final coating material has been applied before introducing water or fuel into tank. [Allow a cure time of 12 days after the final coating material has been applied before beginning installation of the floating pan.]

3.11 PROJECT IDENTIFICATION

At the completion of the tank work, stencil the following information on the exterior of the tank adjacent to the main manway opening in 3/4 to one inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date Interior coated:
Project Number:
Contractor:
Address:
Coating System
Surface Prep: SSPC SP __ Profile: ____
Primer: _____ Thickness: ____
Intermediate: _____ Thickness: ____
Topcoat: _____ Thickness: ____
Total Thickness: ____

3.12 FIELD QUALITY CONTROL

Project documentation, including inspection and testing records, shall be used to determine the Contractor's compliance with contract requirements and approved procedures. The Contractor's certifications of completion, for both invoices and for project completion, shall be based on documented evidence of compliance with all requirements and approved Coating Work Plan procedures. Track inspections and tests in the Test Plan & Log.

3.12.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements

for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL.

3.12.2 Field Inspection

3.12.2.1 Inspection and Documentation Requirements

Perform field inspection in accordance with ASTM D3276 and the approved Coating Work Plan. Document Contractor's compliance with the approved Coating Work Plan.

Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

a. Location or area;
b. Purpose (required or special);
c. Method;
d. Criteria for evaluation;
e. Results;
f. Determination of compliance;
g. List of required rework;
h. Observations.

Collect and record Environmental Conditions as described in ASTM D3276 on a 24 hour basis, as follows:

a. During surface preparation, every two hours or when changes occur;
b. During coating application and the first four days of initial cure, every hour, or when changes occur;
c. Note location, time, and temperature of the highest and lowest surface temperatures each day;
d. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

NOTE: Data collected on Environmental conditions in paragraph AUTOMATED MONITORING REQUIREMENTS may be used for overnight data, however, the data must be constantly verified as to location of sensors and validity of data with respect to the coating work being accomplished.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed. Work documented using data from equipment found to be out of calibration shall be considered as non-compliant since last calibration or calibration check, as required.

3.12.2.2 Inspection Report Forms

Develop project-specific report forms as required to report measurement and test results and observations being complete and compliant with contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of compliance of each inspected item. Annotation of non-compliance shall be conspicuous so

as to facilitate identification and transfer to the Rework Log. Report forms shall include requirements and acceptance and rejection criteria, and shall be legible and presented so that entered data can be quickly compared to the appropriate requirement.

3.12.2.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. Each report shall be signed by the coating inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

3.12.2.4 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

3.12.3 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

3.12.3.1 Black Light

Use a black light having a 365 nanometer intensity of 4,000 microwatts per square centimeter minimum at 380 mm 15 inches. The Spectroline BIB-150P from Spectronics Corporation satisfies this requirement.

3.13 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat MIL-DTL-24441/29 Formula 150 Type IV (Green)						
Test	Componenent A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	45.0	50.0	35.0	40.0	---	---
Volatiles, percent	29.0	35.0	15.0	20.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	43.0	28.0	---	---
Course particles, percent	---	.03	---	.03	---	---
Consistency, grams	300	410	470	600	260	410
Weight						
Kilograms / liter	1.33	1.39	1.33	1.39	1.33	1.39
Pounds / gallon	11.1	11.6	11.1	11.6	11.1	11.6
Set to touch, hours at 23	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	6
Fineness of grind, Hegman	3	---	2	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent	18	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of FED-STD-595 color 24272	---	---	---	---	---	Conform

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat MIL-DTL-24441/29 Formula 150 Type IV (Green)						
Test	Componenent A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in MIL-DTL-24441. Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/29.						

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Componenent A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	44.0	49.0	---	---
Course particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	180	245
Weight						
Kilograms / liter	1.39	1.45	1.29	1.35	1.34	1.40
Pounds / gallon	11.6	12.1	10.8	11.3	11.2	11.7
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))

Test	Componenent A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Mils	---	---	---	---	12	---
Color of dry film to approximate color of FED-STD-595 color 27778	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8

GENERAL NOTES:
Test methods as specified in MIL-DTL-244441.
Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.

TABLE I				
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS				
Table Ic - Fluoropolyurethane Topcoat (Modified PTFE-Pigmented Fluoropolyurethane)				
	Component A		Mixture A & B	
	Min.	Max.	Min.	Max.
Grind, Hegman ASTM D1210	5.0	---	---	---
Viscosity, Krebs Units ASTM D562	58	75	---	---
Pigment, percent BY weight FED-STD-141 Method 4021	43.9	46.9	36.6	38.6
Volatiles, percent by weight	28.5	31.5	24.1	26.1
ASTM D2369 Nonvolatiles, percent by weight	68.5	71.5	73.9	75.9
Weight kg per liter, ASTM D1475	1.32	1.37	1.27	1.32
Drying time, hours, tack free	---	---	---	6.0
Sag, ASTM D4400, Method A (microns)	---	---	153	305
Flash Point, Degrees C, Seta ASTM D3278	38	---	38	---
VOC, ASTM D3960, g/l.	---	---	---	340
Lead percent by weight ASTM D3335				0.06
Cadmium percent by weight ASTM D3335				0.06
Chromium percent by weight ASTM D3718				0.00

TABLE I				
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS				
Table Ic - Fluoropolyurethane Topcoat (Modified PTFE-Pigmented Fluoropolyurethane)				
	Component A		Mixture A & B	
	Min.	Max.	Min.	Max.
Grind, Hegman ASTM D1210	5.0	---	---	---
Viscosity, Krebs Units ASTM D562	58	75	---	---
Pigment, percent BY weight FED-STD-141 Method 4021	43.9	46.9	36.6	38.6
Volatiles, percent by weight	28.5	31.5	24.1	26.1
ASTM D2369 Nonvolatiles, percent by weight	68.5	71.5	73.9	75.9
Weight per gallon, pounds, ASTM D1475	11.0	11.4	10.6	11.0
Drying time, hours, tack free	---	---	---	6.0
Sag, ASTM D4400, Method A (mils)	---	---	6	12
Flash Point, Degrees F, Seta ASTM D3278	100	---	100	---
VOC, ASTM D3960, lb./gal.	---	---	---	2.8
Lead percent by weight ASTM D3335				0.06
Cadmium percent by weight ASTM D3335				0.06
Chromium percent by weight ASTM D3718				0.00

Table II		
COATING MATERIAL COMPOSITION REQUIREMENTS		
Table IIa Composition of Polyurethane Topcoat (Modified		
	Composition	
Ingredient	Kilograms	Liters
Component A		
Poly(tetrafluoroethylene) *	112.95	52.65
Titanium Dioxide (ASTM D476, Type IV)	68.04	17.03
Thixotrope **	---	---
Modified Fluoropolyol MODFPWC-50-85 (Non-volatile) ***	97.80	82.02
Methyl Amyl Ketone (MAK)	119.95	147.20
Dibutyl tin dilaurate, 1.17 percent (wt) solution in MAK	2.27	2.76
Component B (See "Note" below)		
Desmodur N-3200 ****	84.64	75.70
	Total	378.50

Table II		
COATING MATERIAL COMPOSITION REQUIREMENTS		
Table IIa Composition of Polyurethane Topcoat (Modified		
	Composition	
Ingredient	Pounds	Gallons
Component A		
Poly(tetrafluoroethylene) *	249.00	13.91
Titanium Dioxide (ASTM D476, Type IV)	150.00	4.50
Thixotrope **	---	---
Modified Fluoropolyol MODFPWC-50-85 (Non-volatile) ***	215.60	21.67
Methyl Amyl Ketone (MAK)	264.45	28.89
Dibutyl tin dilaurate, 1.17 percent (wt) solution in MAK	5.0	.73
Component B (See "Note" below)		
Desmodur N-3200 ****	186.60	20.00
	Total	100.00

* Pigment-grade poly(tetrafluoroethylene) (less than 6 microns average particle size) is available as SST-3 from Shamrock Technologies, MP-1200 from Dupont, PEFLU-727FX from Astor.

** Thixotrope (Rheological additive) - The amount of thixotrope (between 5 and 12 pounds) and type shall be selected by the manufacturer, from the following list, to meet all requirements

of the composition and general specification.

"Claytone APA"	Southern Clay Products
"Garamite 1958"	Southern Clay Products
"Thixogel EZ200"	United Catalyst
"Bentone SD-2"	Rheox

*** Approved Modified Fluoropolyol MODFPWC-50-85 is available only from 21st Century Coatings America, Inc., Chevy Chase, MD, phone (301) 657-6230 or (301) 654-0099, facsimile (301) 657-6234. This material is available in approximately 85 percent weight solids solution only, which must be converted into the above formula.

**** Aliphatic polyisocyanate "N-3200" is available from Bayer Corporation.

Note: Purge Component B with dry nitrogen before sealing container.

Manufacturing Note - Disperse the pigment and thixotrope used in Component A with a high speed dispersion mixer to a North Standard 5 on a Hegman gauge, using as much of the resin and solvent blend as required for a good working viscosity. To prevent deformation of the PTFE pigment particles, add the chosen Poly(tetrafluoroethylene) to the dispersed material following the grind operation, under moderate agitation to separate the particles using the remaining resin and solvent. Agitate until complete separation of the PTFE has been accomplished. Add any remaining resin and solvent to completion.

Availability Note - Contact 21st Century Coatings America, Inc., Chevy Chase, MD, phone (301) 657-6230 or (301) 654-0099, facsimile (301) 657-6234 for the current list of approved manufacturers.

Manufacturers typically require payment for this material prior to ordering raw materials for production and/or manufacturing.

-- End of Section --