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USACE / NAVFAC / AFCESA **UFGS-09971 (September 2001)**

Preparing Activity: NAVFAC **Superseding UFGS-00971 (July 2000)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Revised throughout - changes not indicated by CHG tags
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DIVISION 09 - FINISHES

SECTION 09971

EXTERIOR COATING OF STEEL STRUCTURES

09/01

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SECTION 09971

EXTERIOR COATING OF STEEL STRUCTURES
09/01

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NOTE: This guide specification covers the requirements for zinc-rich epoxy/epoxy/polyurethane coating systems for exteriors of new Navy and Air Force steel structures, such as fuel tanks, water tanks, aboveground piping, etc.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
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NOTE: For maintenance coating design, see notes herein. Severe corrosion and corrosion pitting is not addressed in this specification.
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NOTE: This specification previously referred to fuel tanks only, however, it has been modified for general use on steel structures, or miscellaneous steel appurtenances, in atmospheric service (non-immersion). This includes fuel tanks, water tanks, aboveground piping, cranes, towers, etc. It is also suitable for enclosed or exposed structural steel in buildings such as hangars, acoustical enclosures, or other facilities where a high-performance coating system is desired. This

coating system is ideal for repairing and coating of galvanized surfaces. Repair galvanizing with the zinc-rich primer, and apply general coats of intermediate and topcoat to all surfaces.
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NOTE: This specification should be edited by personnel familiar with protective coatings and coating specifications. Completion of SSPC Course "C-1 Fundamentals of Protective Coatings For Industrial Structures," or equivalent, is considered a minimal qualification, along with appropriate specification writing experience.
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NOTE: This guide specification complies with the intent of Air Force ETL 86-4, as revised on 28 April, 1999 to eliminate the "second primer coat."
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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 an industry standard, 3 Coat, thin film, coating system that is compliant with EPA VOC regulations as of June 2000:

- Epoxy coats 350 g/l 2.8#/gal max. VOC
- Polyurethane Topcoat 350 g/l 2.8#/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 components (VOC) and other chemical constituents.
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NOTE: Previous versions of this specification have included a requirement for surfaces to be abrasive blasted to SSPC SP 7, 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 Section 13205 STEEL TANKS WITH FIXED ROOFS.

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NOTE: For purposes of this specification, the term "maintenance coating" refers to maintenance overcoating as opposed to complete removal of coatings and recoating. For maintenance coating designs, or to determine if maintenance overcoating is appropriate, a coating condition survey (CCS) should be accomplished. The CCS should be accomplished by personnel from a business that routinely performs coating evaluations, and the individual investigator should be Certified by SSPC as a Protective Coatings Specialist. The CCS should be sufficiently detailed to provide all technical information about the coatings, and structures to be coated, required to properly design the project. At a minimum, the CCS should provide a detailed report of:

1. Existing coating conditions, including condition of coating film, and the existence of potentially hazardous substances that may impact coating management (i.e. lead, cadmium, chromium);

2. Analysis of remaining coating life, suitability of overcoating, and technical requirements for overcoating;

3. Technical recommendations for the most cost effective management of existing coating systems, including any hazardous materials present in paint film; and

4. Any other information of interest to the coating system management that should be identifiable by an individual trained and experienced in the field of coating analysis, coating failure analysis, and coating design.

The scope of the CCS should be tailored to the specific project, and it should be recognized that while multiple coating failures or deficiencies may look similar to the untrained eye, the risks of generalizing to save evaluation costs are potentially very high. The cost of large-scale failure of the overcoating, and complete replacement of the coating system, is far more than the cost of a CCS for all but the smallest projects.

The risks of overcoating can usually be avoided by designing project to remove all existing coatings to bare metal, then providing appropriate surface preparation and coating application. However, the extra costs of the coating removal, especially if containing hazardous material, along with the cost

of surface preparation to SSPC SP 10 Abrasive Blast to Near-White Metal, may be exorbitant compared to the costs of maintenance overcoating where the existing coating system is in fair-to-good condition.

Additionally, NAVFAC Design Policy Letter DPL-09B-0001, Lead-containing Paint on Non-residential Structures of 26 Mar 92 provides guidance for managing paints containing lead and other hazardous materials in place. The fact that lead was highly used as a primer is indicative of its value to the corrosion control industry. Premature removal of sound lead primer is not considered to be a good management practice.

Activities should consider an annual CCS to survey all structures to be authorized for design in the coming year. When accomplished for multiple projects, the per-structure cost will decrease. By accomplishing this survey prior to design, the basis for design is fully identified.

The CCS can also be a very useful tool when used to screen structures for maintenance painting requirements. A CCS can be scoped to provide a general inspection of many structures to screen for near-term overcoating or recoating requirements, and subsequent investigation can be made to provide appropriate details for project planning and design.

It should be pointed out that the aesthetic features of a coating do not define the coating condition; they only describe how the coating looks. Many coating systems have been replaced when only the topcoat is in need of "refurbishment." Likewise, many structures such as water tanks and fuel tanks have had complete coating replacement when only the roof coating needed replacement. A CCS can identify the weak components as well as the satisfactory components, and propose solutions to make maximum use of existing resources.

The Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC), has published a Technology Update titled SSPC TU 3 Maintenance Overcoating. This document should be used as a guide for scoping the CCS, for accomplishing the CCS, and for designing the coating work.

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NOTE: Designers are encouraged to contact J. H. Brandon, LANTNAVFACENGCOM 1613G, 757 322-4645, brandonjh@efdlant.navfac.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 HQ AFCESA/CESM, 139 Barnes Drive, Ste 1, Tyndall AFB, FL 32403, Tel 850-283-6217, prior to beginning new Air Force design.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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

ASTM INTERNATIONAL (ASTM)

ASTM D 1200	(1994; R 1999) Viscosity by Ford Viscosity Cup
ASTM D 3276	(2000) Painting Inspectors (Metal Substrates)
ASTM D 3925	(2002) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D 4285	(1983; R 1999) Indicating Oil or Water in Compressed Air
ASTM D 4417	(2003) Field Measurement of Surface Profile of Blast Cleaned Steel

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 2	(1996; R 2000) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2003) Newly Manufactured or Re-Manufactured Steel Abrasives
SSPC Guide 12	(1998) Guide for Illumination of Industrial Painting Projects
SSPC Guide 6	(1997) Guide for Containing Debris Generated During Paint Removal Operations
SSPC Guide to VIS 1	(1989) Guide to Visual Standard for Abrasive Blast Cleaned Steel
SSPC PA 1	(2000) Shop, Field, and Maintenance Painting

SSPC PA 2	(1996; R 2002) Measurement of Dry Coating Thickness With Magnetic Gages
SSPC QP 1	(1998; R 2000) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC SP 1	(1982; R 2000) Solvent Cleaning
SSPC SP 10	(2000) Near-White Blast Cleaning
SSPC SP 7	(2000) Brush-Off Blast Cleaning
SSPC SP COM	(2000) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(Rev B; Am 2) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(Rev C; Supp 1) Paint, Epoxy-Polyamide
MIL-DTL-24441/19	(Rev B) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(Rev A) Paint, Epoxy-Polyamide, White, Formula 152, Type IV
MIL-PRF-85285	(Rev D) Coating: Polyurethane Aircraft and Support Equipment
MIL-STD-161	(Rev F, Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev B; Am 1) Colors, Volume 1
FS TT-S-00230	(Rev C; Am 2) Sealing Compound, Elastomeric Type, Single component (For caulking, sealing, and glazing in buildings and other structures)

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 Article where used, and denoted by capital letters.

1.3 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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 information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. 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 01330 SUBMITTAL PROCEDURES:

[SD-05, Design Data

Containment System

] SD-06 Test Reports

Joint Sealant Qualification Test Reports[; G][; G, [_____]]

Coatings Qualification Test Reports[; G][; G, [_____]]

Coating Sample Test Reports[; G][; G, [_____]]

Abrasive Sample Test Reports[; G][; G, [_____]]

Daily Inspection Reports[; G][; G, [_____]]

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)[; G][; G, [_____]]

SD-07 Certificates

Work Plan[; G][; G, [_____]]

Qualifications of Certified Industrial Hygienist (CIH)[; G][; G, [_____]]

Qualifications of Testing Laboratory for Coatings[; G][; G, [_____]]

Qualifications of Testing Laboratory for Abrasive[; G][; G, [_____]]

Qualifications of Coating Contractors[; G][; G, [_____]]

[Qualifications of Coating Manufacturer's Representative[; G][; G, [_____]]

] Joint Sealant Materials[; G][; G, [_____]]

Coating Materials[; G][; G, [_____]]

Coating System Component Compatibility[; G][; G, [_____]]

Non-metallic Abrasive[; G][; G, [_____]]

Metallic Abrasive[; G][; G, [_____]]

SD-08 Manufacturer's Instructions

Joint Sealant Instructions[; G][; G, [_____]]

Coating System Instructions[; G][; G, [_____]]

SD-11 Closeout Submittals

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

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

1.4 QUALITY ASSURANCE

[1.4.1 Design Data

1.4.1.1 Containment System

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added

to the structure by the containment system and waste materials. [A registered engineer shall approve calculations and scaffold system design.]

]1.4.2 Test Reports

1.4.2.1 Joint Sealant Qualification Test Reports

Submit test results from independent laboratory of representative samples of joint sealant material. Samples must have been tested within the last three years. Submit results as required in article entitled "Quality Assurance Provisions" of FS TT-S-00230. Note that testing in accordance with "Quality Assurance Provisions" is a pre-qualification requirement.

1.4.2.2 Coatings Qualification Test Reports

Submit test results from independent laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories for purposes of compliance with "QUALIFICATION INSPECTION" requirements herein. Samples must have been tested within the last three years. Submit results for epoxy materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-DTL-24441, and as revised by article entitled "Coating System" herein. Submit results for polyurethane materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-PRF-85285, and as revised by article entitled "Coating System" herein. Note that requirement for "QUALIFICATION INSPECTION" is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See appropriate Military Specification for specific test requirements.

1.4.2.3 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.

1.4.3 Certificates

1.4.3.1 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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Submit a written plan describing in detail all phases of coating operations. Address work sequencing, surface preparation, coating application, recoat and cure time projections, as well as how each step will be controlled, tested, and evaluated. [Describe process of determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.]Describe equipment and methods used to measure and monitor weather conditions, including but not limited to temperature, relative humidity, and dew point. Provide detailed procedures, including manufacturer's instructions, for repairing defects in the coating film such

as runs, drips, sags, holidays, overspray, etc. Address safety measures, work scheduling around weather, and record keeping.

1.4.3.2 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.

1.4.3.3 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 persons performing analyses are qualified.

1.4.3.4 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 persons performing analyses are qualified.

1.4.3.5 Qualifications of Coating Contractors

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NOTE: For projects in continental US, Hawaii, Alaska, and Puerto Rico, require SSPC Certification. Use in other locations where qualified US contractor is desired. 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 NFGS 13283.

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NOTE: **WARNINGWARNING**WARNING**WARNING**Solicitations requiring SSPC Certification 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 enforcable. SSPC 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.**

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[All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 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.
][

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NOTE: When using the contractor qualification clause rather than the SSPC Certification requirement, edit to require appropriate experience.
****

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on [industrial steel structures][_____] on a minimum of three separate projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility
Employer (if other than the Contractor)
Name of facility owner
Mailing address, telephone number, and telex number (if non-US) of facility owner
Name of individual in facility owner's organization who can be contacted as a reference
Location, size and description of structure
Dates work was carried out
Description of work carried out on structure

][1.4.3.6 Qualifications of Coating Manufacturer's Representative

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NOTE: The inclusion of a manufacturers representative in the pre-application meeting is encouraged and is considered justified for large projects. For smaller projects, the NACE inspector can interface with the manufacturer for required information and guidance.
****

Evidence of experience and training of the Coating Manufacturer’s Representative(s), including name, phone number and address, a statement from the coating manufacturer certifying that the representative has successfully completed all of the manufacturer’s training for material

storage, mixing, application, and testing, has been directly involved in evaluation and application of industrial coatings for not less than 10 steel structures within the last 5 years, and is not an employee of the Contractor. The manufacturer's representative shall advise on surface preparation, inspections, surface repair materials and methods, material handling, batching and mixing, application, curing, and testing.

]1.4.3.7 Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.3.8 Coating Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.3.9 Coating System Component Compatibility

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane 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.

1.4.3.10 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 Lists (QPL) for the specified materials.

1.4.3.11 Metallic Abrasive

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

1.4.4 Product Data

1.4.4.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed 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.

1.4.4.2 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.

1.5 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 24 degrees C 40 and 75 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. Expired materials may be returned to manufacturer, tested, and if compliant, issued a shelf life extension.

1.6 COATING HAZARDS

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NOTE: This specification Section should be used with NFGS-01525 "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 all 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.

1.7 JOB SITE REFERENCES

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NOTE: Include any other jobsite related references that might be added during design.
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Make available to the Contracting Officer at least one copy each of ASTM D 3276, ASTM D 3925, ASTM D 4285, ASTM D 4417, SSPC SP COM, SSPC SP 1, SSPC SP 7, SSPC SP 10, SSPC PA 1, SSPC PA 2, [SSPC Guide 6,]SSPC Guide 12, SSPC Guide to VIS 1, SSPC VIS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

1.8 PRE-APPLICATION MEETING

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NOTE: The Coating Manufacturer's rep may be included for unusually large or complicated projects.
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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, Contracting Officer representatives, coating inspector, [and coating systems manufacturer's representative]shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: work plan, safety plan, inspection standards, inspector qualifications and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

PART 2 PRODUCTS

2.1 JOINT SEALANT

TT-S-00230, Type II, Class B

2.2 COATING SYSTEM

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

Alternate systems or products will not be considered. All primer, intermediate coat and topcoat 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. Remove all shop-applied primer prior to final field surface preparation and coating system application. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.]

The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the "QUALIFICATION INSPECTION" requirements of MIL-DTL-24441 and MIL-PRF-85285prior to contract award is required. See specific submittal requirements in Article entitled "Quality Assurance."

2.2.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

2.2.2 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.

2.2.3 Polyurethane Topcoat

****
NOTE: Check with the activity to determine the desired topcoat color and finish. Generally, use white for Navy projects and beige for Air Force projects. Color number 17925 is white, and 27769 is beige. FAA Safety colors are White 17875 and Orange 12197. Always specify contrasting colors between coats.
****

Polyurethane coating topcoat of MIL-PRF-85285, Type II, [White FED-STD-595 color number 17925][Beige FED-STD-595 color number 27769 in gloss][White FED-STD-595 color number 17875, and Orange FED-STD-595 color number 12197].

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D 1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D 1640, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

[2.3 COLOR IDENTIFICATION OF FUEL HANDLING AND STORAGE FACILITIES

Piping, conduit, and tank identification shall be in accordance with MIL-STD-161. Mark direction of fluids in accordance with MIL-STD-161. The NATO symbol for JP-8 is F-34.

]2.4 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 Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.5 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 Contracting Officer to arrange pickup, addressed to the approved coating testing laboratory.

2.6 SOLUBLE SALTS TEST KITS

2.6.1 Test Kit for Measuring Chlorides on Steel Surfaces

Provide test kits called CHLOR*TEST, 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;

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 a factory sealed titration device;

e. Kit contains new materials and solutions for each test;

f. Test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during chloride ion extraction;

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

h. Kit uses test container, with resulting chloride ion extract solution, as the titration container;

i. Chloride ion concentration is directly measured in micrograms per square centimeter without using either conversion charts or tables.

2.7 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.

****
NOTE: The following paragraph is mandatory for all PACNAVFACENGCOM 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.
]

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NOTE: Reduce allowable gross gamma radioactivity to 5 picocuries per gram for all PACDIV projects. Reduce in other areas if states or localities require.
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2.7.1 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.

2.7.2 Metallic Abrasive

2.7.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3[except that the gross gamma radioactivity shall not exceed 5 picocuries per gram].

2.7.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

PART 3 EXECUTION

[3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

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NOTE: Include NFGS 13283 in any project specification that requires removal or disturbance of coating containing hazardous materials. 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. 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 so as not to have to prepare surface twice. To accomplish the coating removal and recoating in a continuous operation, the contractors 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.

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Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 13283N REMOVAL AND DISPOSAL OF LEAD CONTAINING PAINT.

]3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

3.2.1 Coating Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide a sample collection kit as required in

Article entitled "Coating Sample Collection and Shipping Kit." Obtain a one liter quart sample of each batch of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D 3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. 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 Contracting Officer 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 Testing."

3.2.2 Abrasive Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Provide suitably sized containers for each sample to be taken. Provide a sample collection kit as required in Article entitled "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 Contracting Officer 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 Article entitled "Abrasive Sample Testing."

3.2.3 Coating Sample Test Reports

Test samples of all primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire batch represented by samples that fail one or more tests, reselect, and retest samples.

3.2.4 Abrasive Sample Test Reports

Test samples of abrasive materials for compliance with the appropriate abrasive specification. Reject entire lot represented by samples that fail one or more tests, reselect, and retest samples.

3.3 SURFACES TO BE COATED

Coat exterior surfaces of [tank][structure][_____][including steel roof, shell, legs, stair, railing, and other exterior appurtenances].

3.4 LIGHTING

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

[3.5 Containment

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NOTE: There are various reasons for use of containment in the painting process, namely to

control dust during abrasive blasting, and to control overspray during painting. These requirements need to be evaluated for each project and specified as required. The coatings specified herein are two-component coating that dry upon chemical reaction, and they have a tendency to remain wet for long periods, therefore, some containment is desirable where overspray will damage property. For preparation/painting of elevated water tanks, for instance, some measures of containment are generally desirable. SSPC Guide 6, has four classes of containment, from Class 1 being the highest level of control. Generally Classes 1 and 2 are only required for removal of hazardous materials, while Class 3 is probably desirable for repainting an elevated water tank in a congested area. Class 4 requires minimal "knockdown" of airborne debris, and is not generally usable as an airborne particulate control measure.

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The contractor shall design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this specification Section, to meet the requirements of SSPC Guide 6, Class [1][2][3]4[]. Waste materials covered by this paragraph shall not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material. It is the contractors responsibility to insure the feasibility and workability of the containment system. The contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings, without the Contracting Officers approval. If at any time during the execution of the work, the containment system fails to function satisfactory in the opinion of the Contracting Officer, the contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure. Modifications shall be approved by the Contracting Officer.

]3.6 SURFACE PREPARATION

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NOTE: When editing this specification for maintenance coating work for which SSPC SP 12 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.

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3.6.1 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 D 4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.6.2 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 Article entitled "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 D 4417. 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.

3.6.3 Pre-Preparation Testing for Surface Contamination

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

3.6.3.1 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.

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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) 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.

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.

3.6.3.2 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 Article entitled "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 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.

3.6.4 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 zinc primer. On steel that was previously prepared to a deeper depth and coated, it is not feasible to reduce the deeper depth to the preferred depth. A depth of 4 mils can be tolerated with an additional mil of zinc 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. Prepared surfaces shall conform to SSPC VIS 1 and SSPC Guide to 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 D 4417. Measure profile 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 measurements for each non-compliant measurement. When surfaces are reblasted for any reason, retest profile as specified. If Method C of ASTM D 4417 is used to measure profile, attach test tapes to Daily Inspection Reports. Following abrasive blasting, remove dust and debris by brushing, blowing with oil-free and moisture-free compressed air, or vacuum cleaning. Time interval between abrasive blasting and application of primer shall not exceed eight hours.

3.6.5 Disposal of Used Abrasive

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

3.6.6 Pre-Application Testing For Surface Contamination

3.6.6.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in Article entitled "Pre-Preparation Testing for Oil and Grease Contamination," except that only questionable areas need be checked for beading of water misted onto surface.

3.6.6.2 Pre-Application Testing for Soluble Salts Contamination

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NOTE: On new structures, require 30% of tests to be accomplished at welds. On structures that have been in service, corroded areas should also be tested for high chlorides.
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Test surfaces for chloride contamination using the Test Kit described in article entitled "Test Kit for Measuring Chlorides 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% of tests on bare steel at welds, divided equally between horizontal and vertical welds.]One or more readings greater than 5 micrograms per square centimeter of chlorides is evidence of chloride contamination. Reject contaminated surfaces, wash as discussed in article entitled "Pre-Preparation Testing for Soluble Salts Contamination," allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

3.6.6.3 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 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.

3.7 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

3.7.1 Preparation of Sealant and Coating Materials for Application

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

3.7.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in article entitled "Delivery and Storage." Allow mixed material to stand for the required induction time based on its temperature.

3.7.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in article entitled "Delivery and Storage." The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life. 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.

3.7.1.3 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. Add all required solvent at time of mixing. Do not add solvent to extend pot life. 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. Precooling or exterior icing of components for at least 24 hours to a minimum of 10 degrees C 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

3.7.1.4 Application Conditions and Recoat Windows

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NOTE: These new 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.

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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 may be required, as well as other measures, to control conditions to allow for orderly application of all required coats.

Apply coating only when ambient air and steel temperatures are between 16 and 38 degrees C 60 and 100 degrees F, and steel surface temperature is more than 3 degrees C 5 degrees F above the dew-point of the ambient air during application and the first four hours for epoxy and the first eight hours for polyurethane. Do not apply coatings above 38 degrees C 100 degrees F or below 16 degrees C 60 degrees F.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coating during appropriate RECOAT WINDOW.

If coating is not applied during RECOAT WINDOW, apply during EXTENDED RECOAT WINDOW. Application of any epoxy coat within the EXTENDED RECOAT WINDOW requires application of a TACK COAT prior to applying any full coat. Perform cure test immediately prior to application of TACK COAT to determine condition of applied coating. If CURE TEST indicates that surface is fully cured, provide GLOSS REMOVAL prior to application of TACK COAT.

If coating is not applied during EXTENDED RECOAT WINDOW, or if surface temperature exceeds 49 degrees C 120 degrees F between applications, wash surface with water and detergent, rinse clean with fresh water and allow surface to dry thoroughly, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.

RECOAT WINDOWS

EPOXY OVER EPOXY

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
EXTENDED RECOAT WINDOW (Hrs.)	72-168	60-140	48-120	36-96	18-36	6-12
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6

POLYURETHANE OVER EPOXY

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16

RECOAT WINDOWS						
EXTENDED RECOAT WINDOW (Hrs.)	96-168	72-144	48-120	36-96	24-48	16-24
TACK COAT RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16

POLYURETHANE OVER POLYURETHANE

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
Temperature degrees C	16-21	22-27	28-32	33-38	39-43	44-49
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2
EXTENDED RECOAT WINDOW (Hrs.)	NONE ----------					
TACK COAT RECOAT WINDOW (Hrs.)	NO TACK COAT USED ----------					

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.

CURE TEST - Where indicated, test surface for cure using high-flash aromatic Naphtha only (cas #64742-95-6). Do not use aliphatic VMP Naphtha. Wipe surface with rag saturated with Naphtha, and check for surface tackiness, loss of gloss, or other indications that solvent has softened surface. If softening is found on 95% of test sites, this is indication that coating has not fully cured, and GLOSS REMOVAL is not required if TACK COAT is applied within three hours and full coat is applied within the TACK COAT RECOAT WINDOW. 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.

TACK COAT - Where indicated, apply coat of intermediate coat epoxy, at 25 to 50 microns 1 to 2 mils WFT, then apply next specified full coat within TACK COAT RECOAT WINDOW. Thin TACK COAT material approximately 25% by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by hand sanding with 150-200 grit wet/dry sandpaper in a linear fashion, pressure wash or wipe down with a clean rag soaked with denatured alcohol to remove dust. Do not use rotary sanders or grinders.

3.7.2 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply 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 article entitled "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 unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. 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. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond[[15][____] feet [three][____] meters from the structure perimeter] [the tank berm]. Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

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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 limited to 12 mils to allow for maintenance overcoating without creating excessive film build.

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Apply coatings at the following specified thickness:

Coat	Desired Thickness Range Mils DFT	Minimum Mils DFT	Maximum Mils DFT
Primer	2 - 5	2	6
Intermediate	3 - 5	3	8
Top	2 - 3	2	4
Total system	-----	9	12

3.7.2.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 1 meter 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

3.7.2.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

3.7.2.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.7.2.4 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 aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

3.7.2.5 Application of Joint Sealant

Apply joint sealant to back-to-back steel joints that are less that 3/8 inches wide and are not seal welded. Apply sealant to top and bottom, or each side, of narrow joints. Apply sealant within 48 hours of application of the topcoat, and touch-up with topcoat after appropriate cure of the sealant.

3.7.2.6 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, and feather coating as required to leave 100 mm 4 inches of each succeeding coat feathered and abraded. 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 zinc-rich 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.

3.7.2.7 Structure 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.

3.8 FIELD TESTS AND INSPECTION

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

3.8.1 Coating Inspector

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NOTE: Include requirement for NACE Coating inspector

in Section 01450 QUALITY CONTROL, as a QC Specialist. See Appendix A for instructions for modifying Section 01450.

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The coating inspector shall be considered a QC Specialist, shall work for the QC Manager, and shall be qualified in accordance with Section 01450N DESIGN AND CONSTRUCTION QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, and during all coating repair work. 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 outlined in Section 01450N. The Coating Inspector shall prepare a project reference sheet outlining all requirements, tests, test methods, and evaluation criteria, and hold regular meetings with contractor personnel, including nozzlemen and applicators, to review requirements and evaluation criteria for upcoming work in advance of the work.

3.8.2 Field Inspection

3.8.2.1 Inspection Requirements

Accomplish field inspection in accordance with ASTM D 3276 and as required herein. Perform all appropriate tests and inspections, except that viscosity and weight per gallon measurements are not required. 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, 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 D 3276 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. Overnight hours may be excluded if conditions are measured and recorded through 1800 hours and then prior to dawn the next day;
d. Note location, time, and temperature of the highest and lowest surface temperatures each day.
e. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

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.

3.8.2.2 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Use ASTM D 3276 Appendix X1 Inspection Checklist to monitor daily activity and prepare Daily Inspection Report. Use of forms containing entry blocks for all required data is encouraged. The data may be in any format, but must be legible and presented so that it can be easily interpreted. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01450N DESIGN AND CONSTRUCTION QUALITY CONTROL. Submit report within 24 hours of date recorded on the report.

3.8.2.3 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. The contracting Officer will forward the Logbook to LANTNAVFACENGCOM Code 1613G, to be reviewed and filed for warranty information.

3.8.2.4 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.

3.8.3 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

Step	Action
Prior to preparation of structure(s) for cleaning and repair	Safety inspection
After cleaning of structure(s) and prior to abrasive blasting	1. Safety inspection, removal of dirt, trash, debris, and any hindrance to abrasive blasting. 2. Surface inspection for oil, grease, soluble salts, or other contaminants
Initiation of abrasive blasting, and at each work stoppage	1. Confirm environmental conditions are suitable for abrasive blasting and coating, and are expected to remain suitable to the point where the coating will be unaffected. 2. Surface inspection to insure all aspects of surface preparation are properly addressed,

	as specified in article entitled "Surface Preparation."
	3. Test compressor air for oil and water contamination
After abrasive blasting	Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
Immediately prior to coating application - provide for each coating application evolution	1. Confirm environmental conditions are suitable for coating application and are expected to remain suitable to the point where the coating will be unaffected.
	2. Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
	3. Confirm that testing equipment for monitoring for hazardous conditions during coating application are working properly and are prepared for use as outlined in contractor's Safety Plan.
During and after coating application.	Coating application inspection per paragraphs entitled "Application of Coating System" and "Field Tests and Inspection".
After final cleanup	Clean-up inspection specified in the paragraph entitled "Final Cleanup."

3.9 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 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ia - Zinc-rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatile vehicle percent	53.7	57.7	8.3	8.7	---	---
Weight,						
Kilograms/liter	0.87	1.01	3.30	3.40	---	---
Pounds/gallon	7.3	8.4	27.5	28.4	---	---
Flashpoint						
Degrees C	35.6	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Consistency, grams	---	---	250	500	---	---
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
VOC						
Grams/liter	---	---	---	---	---	304
Pounds/gallon	---	---	---	---	---	2.5

NOTES:
Test methods as specified in MIL-DTL-24441.

TABLE 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

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

Test	Component 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-volatile vehicle, percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms/liter	1.39	1.45	1.29	1.35	---	---
Pounds per gallon	11.6	12.1	10.8	11.3	---	---
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	---
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	---
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-24441/31.

TABLE 1
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table Ic - Polyurethane Topcoat MIL-PRF-85285 Type II
(White and Colors)

Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Moisture content, percent	---	1	---	---	---	---
Coarse particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	See Note 1	
Fineness of grind, Hegman	---	---	---	---	7	---
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+-1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	Conform	
Fluid resistance	---	---	---	---	Conform	
Heat resistance (cure)	---	---	---	---	Conform	
Solvent resistance (cure)	---	---	---	---	Conform	
Condition in container	---	---	---	---	Conform	
Odor	---	---	---	---	Conform	
Lead percent	---	---	---	---	---	0.06
Cadmium percent	---	---	---	---	---	0.06
Chromium percent	---	---	---	---	---	0.00

NOTES:
(1) Modify paragraph 3.6.4 Viscosity and Pot Life, of MIL-PRF-85285 as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D 1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

(2) Modify paragraph 3.7.1 Drying Time, of MIL-PRF-85285

When applied by spray techniques and when tested in accordance with ASTM D 1640, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

GENERAL NOTES:
- Test methods as specified in MIL-PRF-85285.
- Where "Conform" is indicated, refer to specific requirements of MIL-PRF-85285.

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Appendix A Instructions for Modifying Section 01450N or 01451A to add

Coating Inspector and Modify Laboratory Accreditation Requirements

Use SSPC QP 5 Certified Coating Inspection Company for all projects. Appropriate tags are in embedded in text to the extent practical. Turn Tags "ON" before copying text. Make modifications to Section 01450 as follows:

1. Under REFERENCES, add:

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC QP 5	**(1999) Evaluating Qualifications of Coating and Lining Inspection Companies**

2. Under SUBMITTALS, add:

SD-07 Certificates

Coating Inspection Company Certification[; G][; G, [_____]]

Coating Inspector Qualification[; G][; G, [_____]]

<spt>1.x Coating Inspection Company Certification

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by the Society for Protective Coatings (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.

<spt>1.x.1 Coating Inspector Qualification

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

2. Add the following to the table of article entitled "QC Specialists Duties and Qualifications" as follows, including submittal tags:

Qualification/Experience in Area of Responsibility	**Area of Responsibility**	**Frequency**
Coating Inspector (no other duties)	**Surface preparation, coating application, and testing.**	**Full time during coating system application testing, surface preparation, coating application and initial curing, testing, and repair work.**

3. In Article entitled "Accreditation Requirements," approximately 1.12.1, in the first sentence, after "Construction materials testing laboratories," insert "except laboratories for testing of coating and sealant materials."

4. Note in the PROJECT INFORMATION FORM that Section 01450 contains a special responsibility requiremet for SSPC QP 5 Certification. This requirement must be pointed out in the solicitation documents for the "prior to contract award" requirement to be enforcable.

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-- End of Section --