
USACE / NAVFAC / AFCEA UFGS-09973 (September 2001)

Preparing Activity: NAVFAC Superseding
UFGS-09973 (July 2000)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UML dated 22 December 2004

Revised throughout - changes not indicated by CHG tags

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SECTION 09973

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09/01

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SECTION 09973

INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS 09/01

NOTE: This guide specification covers the requirements for a three coat epoxy system for interior coating of newly constructed, Air Force bulk fuel storage tanks.

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.

NOTE: For maintenance coating design, see notes herein. Severe corrosion and corrosion pitting is not addressed in this specification.

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.

NOTE: This specification is identical to the Navy

Fuel Tank Specification, Section 09970 INTERIOR
COATING OF WELDED STEEL PETROLEUM FUEL TANKS, except
the Air Force uses an epoxy topcoat.

NOTE: The metric standard for measuring coating
thickness is microns (25.4 microns=1 mil - use
nominal 25 microns=1 mil).

NOTE: The designer should not alter the products and
processes specified herein without careful
evaluation.

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#/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.

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.

NOTE: Designs for fuel tank linings should be based
on recent inspections. Wherever possible, a coating
inspection, or coating condition survey (CCS), as
described in Section 09971 EXTERIOR COATING OF STEEL
STRUCTURES, should be accomplished prior to
designing a coating project for fuel tank interiors.

The hazard of designing a project without a recent inspection is that there is little way of knowing the condition of the coating system, or the steel surfaces, without competent inspection. 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.

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.

NOTE: Designers are encouraged to contact the Air Force Civil Engineering Corrosion Program Manager at HQ AFCEA/CESM, 139 Barnes Drive, Ste 1, Tyndall AFB, FL 32403, Tel 850-283-6217, prior to beginning new Air Force design.

PART 1 GENERAL

1.1 REFERENCES

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.

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.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 650 (1998; A 2001) Welded Steel Tanks for Oil Storage

API Std 653 (2001; A 2003) Tank Inspection, Repair, Alteration, and Reconstruction

ASTM INTERNATIONAL (ASTM)

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

NACE INTERNATIONAL (NACE)

NACE RP0178	(2003) Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
NACE RP0188	(1999) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

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 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 5	(2000) White Metal 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-24441/29 (Rev A) Paint, Epoxy-Polyamide, Green
Primer, Formula 150, Type IV

MIL-DTL-24441/31 (Rev A) Paint, Epoxy-Polyamide, White,
Formula 152, Type IV

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev B; Am 1) Colors, Volume 1

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. 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

**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.

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

Environmental Control System; G, [_____]

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

SD-06 Test Reports

Coating Sample Test Reports; G, [_____]

Abrasive Sample Test Reports; G, [_____]

Daily Inspection Reports; G

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

SD-07 Certificates

Work Plan; G, [_____]

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

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

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

Qualifications of Coating Contractors; G, [_____]

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

] Roof Joint Sealant Materials; G, [_____]

Roof Joint Sealant Compatibility; G, [_____]

Epoxy Coating Materials; G, [_____]

Non-metallic Abrasive; G, [_____]

Metallic Abrasive; G, [_____]

SD-08 Manufacturer's Instructions

Roof Joint Sealant Instructions; G, [_____]

Coating System Instructions; G, [_____]

SD-11 Closeout Submittals

Disposal of Used Abrasive; G, [_____]

Inspection Logbook; G, [_____]

1.4 QUALITY ASSURANCE

1.4.1 Design Data

1.4.1.1 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.

1.4.1.2 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.

1.4.2 Test Reports

1.4.2.1 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

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.

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.

Submit a written plan describing in detail all phases of the 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 tank temperatures and humidity. 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 based on expected weather condition extremes, and record keeping. [Describe method of removing floating pan and preparing for re-installation.] [Describe method of floating pan installation after tank lining has been applied and cured, how the coated floor and shell surfaces will be protected during pan installation, and how damaged coating will be repaired after 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.] [_____]

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 employees performing testing 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 employees performing testing are qualified.

1.4.3.5 Qualifications of Coating Contractors

NOTE: For projects in continental US, Hawaii, Alaska, and Puerto Rico, coating contractor requires 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.

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 enforceable. 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 the General Accounting Office has sustained these types of special requirements.

[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.

] [

**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 tank linings in welded petroleum storage tanks 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 in a welded petroleum storage tank including:

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

] [1.4.3.6 Qualifications of Coating Manufacturer's Representative

**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) shall include literature documenting 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, and has been directly involved in evaluation and application of industrial coatings on a minimum of 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 Roof Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements.

1.4.3.8 Roof Joint Sealant Compatibility

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

1.4.3.9 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.

1.4.3.10 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 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.

1.4.4.2 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

**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 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.

1.7 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.]

1.8 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 D 3276, ASTM D 3925, ASTM D 4285, ASTM D 4417, NACE RP0178 and companion visual comparator, NACE RP0188, SSPC SP COM, SSPC SP 1, SSPC SP 7, SSPC SP 5, SSPC PA 1, SSPC PA 2, SSPC Guide 12, SSPC Guide to VIS 1, SSPC VIS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

1.9 PRE-APPLICATION MEETING

NOTE: The Coating Manufacturer's rep may be included for unusually large or complicated projects.

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 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 weight Lead, no more than 0.06 percent by weight Cadmium, and no more than 0.00 percent by weight Chromium.

2.2 COATING SYSTEM

NOTE: Include bracketed text for new construction only.

Alternate systems or products will not be considered. All primer, intermediate, and topcoat materials shall be manufactured by one manufacturer. [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 5, and the specified coating system applied. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.]

2.2.1 Epoxy Primer, Intermediate, and Topcoats

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.

2.2.1.3 Epoxy Topcoat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White).

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 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.

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

2.5 SOLUBLE SALTS TEST KITS

2.5.1 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.

2.6 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.

**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.
]

NOTE: Reduce allowable gross gamma radioactivity to
5 picocuries per gram for all PACDIV 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 [except that the gross gamma radioactivity shall not exceed 5 picocuries per gram].

2.6.2.2 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

NOTE: Include NFGS 13283 in 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. 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 13283N REMOVAL AND DISPOSAL OF LEAD CONTAINING PAINT.

] 3.2 DOOR SHEET ACCESS WAY

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 RP0178, 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

3.3.1 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."

3.3.2 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."

3.3.3 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.

3.3.4 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.

[3.4 FUEL REMOVAL AND TANK CLEANING

Remove fuel and clean storage tanks in accordance with Section 13219 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.

3.6.1.1 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 of SSPC SP 5 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.

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

Provide and utilize dehumidification equipment to maintain relative humidity near 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

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

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

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.

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

3.9.2 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.

3.9.3 Pre-Preparation Testing for Surface Contamination

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

3.9.3.1 Pre-Preparation Testing for Oil and Grease Contamination

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 Article entitled "Black Light." Use light no more than 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.

3.9.3.2 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.

3.9.4 Abrasive Blasting

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.

Abrasive blast steel surfaces to white metal in accordance with SSPC SP 5. 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 vacuum cleaning.

3.9.5 Disposal of Used Abrasive

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

3.9.6 Pre-Application Testing For Surface Contamination

3.9.6.1 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."

3.9.6.2 Pre-Application Testing for Soluble Salts Contamination

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

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 3 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 areas using vacuum equipped blast equipment. Label all test tubes and retain for test verification.

3.9.6.3 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, 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

3.10.1 Preparation of Sealant and Coating Materials for Application

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

3.10.1.1 Mixing

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.

3.10.1.2 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. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy Primer and Intermediate Coat Materials	4 hours

3.10.1.3 Application Conditions and Recoat Windows

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.

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

Apply coating only when steel and internal air temperatures are between 16 and 38 degrees C 60 and 100 degrees F. 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, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.

RECOAT WINDOWS

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	72-168	60-140	48-120	36-96	18-36	6-12

RECOAT WINDOWS

WINDOW (Hrs.)						
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6

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, in a linear fashion, with 150-200 grit wet/dry sandpaper, followed by a solvent wiping with a clean rag soaked with denatured alcohol to remove dust. Do not use rotary sanders or grinders.

3.10.2 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 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 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. Apply all other

coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond [[15][] feet [three][] meters 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	Desired Thickness Range Mils DFT	Minimum Mils DFT	Maximum Mils DFT
Primer	3 - 5	3	8
Intermediate	3 - 5	3	8
Top	3 - 5	3	8
Total system	-----	9	20

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. Add coating as required to correct underruns, and remove coating with excess thickness to bare steel and reapply as specified in Article entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating."

3.10.2.1 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 15 mm 0.5 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.

3.10.2.2 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 15 mm 0.5 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.

3.10.2.3 Application of Primer

Apply primer coat within RECOAT WINDOW of stripe coat.

3.10.2.4 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.10.2.5 Application of Topcoat

Apply topcoat within RECOAT WINDOW of intermediate coat.

3.10.3 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 RP0188.

Repair holidays per paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating." .

3.10.4 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 5, and feather coating as required to leave 100 mm 4 inches of each succeeding coat feathered and abraded. Do not abrade the polyurethane 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. 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.

3.10.5 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.

3.10.6 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 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.

3.11.1 Coating Inspector

**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.**

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 DESIGN AND CONSTRUCTION QUALITY CONTROL. 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 nozzle men and applicators, to review requirements and evaluation criteria for upcoming work in advance of the work.

3.11.2 Field Inspection

3.11.2.1 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.

3.11.2.2 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.

3.11.2.3 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.

3.11.3 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.

3.11.3.1 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.

3.11.4 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

<u>Step</u>	<u>Action</u>
Prior to preparation of tank(s) for cleaning and repair	Safety inspection
After cleaning of tank(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, and other contaminants
Initiation of abrasive blasting, and at each work stoppage	1. Confirm environmental conditions are suitable for abrasive blasting and for holding the blast.
	2. Confirm surfacing requirements of [Section 13205 STEEL TANKS WITH FIXED ROOFS and]the
Article entitled "Use of Door	Sheet Access Way" have been satisfied.
	3. Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "Surface Preparation."
	4. 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 abrasive blasting and for holding the blast as specified in article entitled "Environmental Conditions"
	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 of hazardous conditions during coating application are working properly and are prepared for use as outlined in contractor's Confined Space Entry Plan.
During and after coating application.	Coating application inspection as specified in paragraphs entitled "Application of Coating System" and "Field Tests and Inspection".
After final cleanup	Clean-up inspection specified in the article entitled "Final Cleanup."

3.12 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	Component 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-volatile vehicle, percent	17.5	23.5	43.0	48.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams Weight	300	410	470	600	---	---
Kilograms/liter	1.33	1.39	1.33	1.39	---	---
Pounds/gallon	11.1	11.6	11.1	11.6	---	---
Set to touch, hours at 23degrees C, 73 degrees F	---	---	---	---	---	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 of pigment	18	---	---	---	---	---
Pot life, hours at 23degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of standard color chip	---	---	---	---	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-24441/29.

TABLE I
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 Weight	180	320	300	470	---	---
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 I
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

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

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 Weight	180	320	300	470	---	---
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.

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, [_____]

Coating Inspector Qualification; 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 III, 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.

-- End of Section --