**********
USACE / NAVFAC / AFCEC / NASA | UFGS-09 97 13.25 (May 2011)
Change 1 - 08/17
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Preparing Activity: NAVFAC | Superseding
UFGS-09 97 13.25 (February 2010)

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated July 2023**
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SECTION 09 97 13.25

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SECTION 09 97 13.25

MAINTENANCE, REPAIR, AND COATING OF TALL ANTENNA TOWERS
**05/11, CHG 1: 08/17**

**********
**NOTE: This guide specification covers the requirements for coating of new, and repairs to existing, steel towers.**

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

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

**Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).**
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**NOTE: Due to the complexity of coating design for maintenance coating, this document is more of a compendium of "potential" requirements rather than a guide specification, and it should be edited for use only by personnel that are competent in coating design. For maintenance coating design, there is significant information that must be collected, tested, and evaluated to provide a satisfactory design. The scope of this information, particularly a coating condition survey (CCS), is discussed herein. Work covered by this specification includes replacement of structural members,coating/recoating of tower structure and minor electrical work.**
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**NOTE: New towers should be coated using one of the following systems in priority order:**

**First choice**
**Primer - Hot dip galvanizing**
**Intermediate - MIL-DTL-24441/29**
**Topcoat - MIL-PRF-85285 Type II**

**Second choice**
**Surface Preparation - SSPC SP-5**
**Primer - Spray metalizing (shop applied)**
**Sealer - MIL-DTL-24441/29 (thinned 50 percent)**
**Intermediate - MIL-DTL-24441/29**
**Topcoat - MIL-PRF-85285 Type II**

**Third choice**
**Surface Preparation - SSPC SP 5**
**Primer - DOD-PRF-24648 Type II, Class 1, Comp B**
**Inorganic zinc (shop applied)**
**Intermediate - MIL-DTL-24441/29**
**Topcoat - MIL-PRF-85285 Type II**

**New towers should be shop-coated in a shop that has SSPC QP 3 Certification, shipped to site, erected, and touched-up.**

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**NOTE: The fact that most high antenna towers were either galvanized or treated with a high-performance zinc primer requires considerable attention to the design to ensure that only the required work is scoped, and that the specified work does not damage sound zinc (galvanizing or other zinc primers) surfaces. While the coatings continue to age and degrade, the galvanized surfaces are generally found to be in good condition. A properly executed coating condition survey (CCS) will provide details of the condition of the entire coating system.**

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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: To download UFGS Forms, Graphics, and Tables, go to:** http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables

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# PART 1 GENERAL

## 1.1 REFERENCES

**********

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

**Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.**

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

**********

The publications listed below form a part of this specification to the

extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

| | |
|---|---|
| AISC 303 | (2016) Code of Standard Practice for Steel Buildings and Bridges |
| AISC 325 | (2017) Steel Construction Manual |
| AISC 326 | (2009) Detailing for Steel Construction |
| AISC 360 | (2016) Specification for Structural Steel Buildings |

AMERICAN WELDING SOCIETY (AWS)

| | |
|---|---|
| AWS D1.1/D1.1M | (2020; Errata 1 2021) Structural Welding Code - Steel |
| AWS D1.2/D1.2M | (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A36/A36M | (2019) Standard Specification for Carbon Structural Steel |
| ASTM A123/A123M | (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A153/A153M | (2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM A320/A320M | (2022a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service |
| ASTM A325 | (2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| ASTM A500/A500M | (2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A563 | (2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts |
| ASTM A666 | (2023) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar |
| ASTM A780/A780M | (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |

| | |
|---|---|
| ASTM B209 | (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B231/B231M | (2016; R 2021) Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors |
| ASTM B308/B308M | (2010; R 2020) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles |
| ASTM D1200 | (2010; R 2014) Viscosity by Ford Viscosity Cup |
| ASTM D1640/D1640M | (2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings |
| ASTM D3335 | (1985a; R 2020) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy |
| ASTM D3718 | (1985a; R 2015) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy |
| ASTM D3925 | (2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings |
| ASTM D4285 | (1983; R 2018) Indicating Oil or Water in Compressed Air |
| ASTM D4417 | (2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel |
| ASTM F436 | (2011) Hardened Steel Washers |
| ASTM F467 | (2013; E 2014; E 2014) Standard Specification for Nonferrous Nuts for General Use |
| ASTM F468 | (2022) Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use |
| ASTM F593 | (2022) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs |
| ASTM F594 | (2022) Standard Specification for Stainless Steel Nuts |
| ASTM F959/F959M | (2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series |

| | |
|---|---|
| ASTM F1077 | (2005) Selection of Committee F-16 Fastener Specifications |

NACE INTERNATIONAL (NACE)

| | |
|---|---|
| NACE SP0288 | (2011) Inspection of Linings on Steel and Concrete Equipment |

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

| | |
|---|---|
| RCSC A348 | (2020) RCSC Specification for Structural Joints Using High-strength Bolts |

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

| | |
|---|---|
| SSPC 7/NACE No.4 | (2007) Brush-Off Blast Cleaning |
| SSPC AB 2 | (2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive |
| SSPC AB 3 | (2003; E 2004) Ferrous Metallic Abrasive |
| SSPC Guide 12 | (2023) Guide for Illumination of Industrial Painting Projects |
| SSPC PA 1 | (2016) Shop, Field, and Maintenance Coating of Metals |
| SSPC PA 2 | (2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements |
| SSPC QP 1 | (2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components) |
| SSPC QP 3 | (2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators |
| SSPC SP 1 | (2015) Solvent Cleaning |
| SSPC SP 10/NACE No. 2 | (2015) Near-White Blast Cleaning |
| SSPC SP COM | (2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates |
| SSPC VIS 1 | (2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning |

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

| | |
|---|---|
| SAE AMS-STD-595A | (2017) Colors used in Government Procurement |

U.S. DEPARTMENT OF DEFENSE (DOD)

| | |
|---|---|
| MIL-A-22262 | (1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning |
| MIL-DTL-24441 | (2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for |
| MIL-DTL-24441/19 | (2009; Rev C; Notice 1 2023) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III |
| MIL-DTL-24441/31 | (2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV |
| MIL-PRF-85285 | (2022; Rev F) Topcoat, Aircraft and Support Equipment |

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

| | |
|---|---|
| EPA 530/F-93/004 | (1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846) |

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

| | |
|---|---|
| 29 CFR 1910.134 | Respiratory Protection |
| 29 CFR 1910.1000 | Air Contaminants |
| 29 CFR 1910.1018 | Inorganic Arsenic |
| 29 CFR 1926.59 | Hazard Communication |
| 29 CFR 1926.62 | Lead |
| 29 CFR 1926.1127 | Cadmium |
| 40 CFR 260 | Hazardous Waste Management System: General |
| 40 CFR 261 | Identification and Listing of Hazardous Waste |
| 40 CFR 262 | Standards Applicable to Generators of Hazardous Waste |
| 40 CFR 263 | Standards Applicable to Transporters of Hazardous Waste |
| 40 CFR 264 | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 40 CFR 265 | Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |

| | |
|---|---|
| 40 CFR 266 | Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities |
| 40 CFR 268 | Land Disposal Restrictions |

1.2 MODIFICATIONS TO REFERENCES

In AISC 325, AISC 360, AISC 303, and RCSC A348, except as modified in this section, shall be considered a part of AISC 325 and is referred to in this section as AISC 325.

1.3 DESCRIPTION OF WORK

[ Provide a brief description of the work to be covered by this specification.

]1.4 SUBMITTALS

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

**For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.**

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

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

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When

used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

[ Steel Fabrication; G[, [_____]]

][ Stainless Steel Fabrication; G[, [_____]]

][ Aluminum Fabrication; G[, [_____]]

] SD-03 Product Data

[ Exothermic Weld Kits; G[, [_____]]

][ Load Indicator Washers; G[, [_____]]

] SD-05 Design Data

[ Containment System; G[, [_____]]

] SD-06 Test Reports

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

Coatings; G[, [_____]]

Bolts, Nuts, and Washers; G[, [_____]]

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

Metallic Abrasive Media; G[, [_____]]

Daily inspection checklist; G[, [_____]]

Coating Sample Testing; G[, [_____]]

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

SD-07 Certificates

Coating System; G[, [_____]]

Abrasive Media; G[, [_____]]

Coating System Compatibility; G[, [_____]]

Galvanizing; G[, [_____]]

Bolts, Nuts, and Washers; G[, [_____]]

Work plan; G[, [_____]]

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

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

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

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

[ Qualifications of Painting Shop; G[, [_____]]

] SD-08 Manufacturer's Instructions

Coating system; G[, [_____]]

SD-11 Closeout Submittals

Disposal of used abrasive; G[, [_____]]

## 1.5 SAFETY

The Contractor shall submit an Accident Prevention Plan as per Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

## 1.6 DELIVERY, STORAGE AND HANDLING

### 1.6.1 Coating Materials

Ship, store and handle materials in accordance with SSPC PA 1. Maintain temperature in storage spaces between 5 and 24 degrees C 40 and 75 degrees F. Maintain ambient air temperature more than 3 degrees C 5 degrees F above the dew-point at all times. During mixing of polyurethane materials, maintain relative humidity below 90 percent.

### 1.6.2 Structural and Miscellaneous Materials

Handle, store, and protect materials in accordance with the manufacturer's recommendations. Replace damaged items with new items, or repair as approved by the Contracting Officer.

## [1.7 EXISTING TOWER CONDITIONS

**********

**NOTE: Include and reference Section 02 83 00 LEAD REMEDIATION if any of the existing lead paint system is to be removed. Include and reference Section 02 83 00 LEAD REMEDIATION if any structural elements are replaced which are painted with a lead based coating system.**

**********

Include detailed information, from the CCS, on the condition of the tower including type of paint system, percentage of deterioration of the paint and structure, any hazardous contents of the paint such as Lead or Chromate, and any other pertinent information about exiting conditions.

## ]1.8 COATING HAZARDS

**********

**NOTE: This specification section is based on assumption that section 01 35 26 GOVERNMENTAL SAFETY**

**REQUIREMENTS will be included in project, otherwise, requirements for preparation and submittal of a safety plan, respiratory protection plan, etc. must be included in this specification section.**
**********

**********
**NOTE: Include OSHA 29 CFR 1910.1018 for arsenic exposure and OSHA 29 CFR 1926.62 for lead exposure, and 29 CFR 1926.1127 for cadmium exposure.**
**********

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 coatings manufacturer's written safety precautions shall be followed throughout the mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are adequately protected from toxic and hazardous chemical agents which exceed the concentrations in OSHA 29 CFR 1910.1000[, OSHA 29 CFR 1910.1018, 29 CFR 1926.1127 and OSHA 29 CFR 1926.62]. Comply with respiratory protection requirements in OSHA 29 CFR 1910.134. Obtain the services of a certified industrial hygienist to review and approve the operations as to correctness of work procedures and personal protective equipment.

## 1.9 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3925, ASTM D4285, ASTM D4417, NACE SP0288, SSPC SP COM, SSPC SP 1[, SSPC 7/NACE No.4][, SSPC SP 10/NACE No. 2], SSPC PA 1, SSPC PA 2, SSPC Guide 12, [SSPC AB 2, ] and SSPC VIS 1 at the job site.

## 1.10 PRE-APPLICATION MEETING

**********
**As an alternative to a Pre-Application Meeting (PAM), a Pre-Application Test Period (PATP) may be specified. Either one will have some positive effect on the project by getting the appropriate people together. A PATP is a meeting, with the added benefit of some actual onsite evaluation of processes and procedures. This activity should be scheduled just prior to coating work beginning but after all submittals are approved. In either case, the work plan and safety plan should be fully discussed. The Coating Manufacturer's representative may be included for a large or complicated project.**
**********

Prior to any surface preparation or coating operations, 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 tank coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items to be addressed shall include: the work plan, the safety plan, inspection standards, inspector qualifications and tools, test procedures, environmental control system, safety plan, and test logs. Notify the

Contracting Officer 10 days prior to meeting.

## 1.11 QUALITY ASSURANCE

### 1.11.1 Drawings: [Steel,] [Stainless Steel,] [Aluminum] Fabrication

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

### 1.11.2 Design Data: Coating System

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 Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

### 1.11.3 Certificates

#### 1.11.3.1 Work Plan

A specific written plan describing in detail all phases of [structural repair, ][electrical repair, ][and ]coating operations. For coating work, address work sequencing, surface preparation, coating application, recoat and cure time projections, as well as how each step will be controlled, tested, and evaluated. Address safety measures, work scheduling around weather, and record keeping.

#### 1.11.3.2 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.

#### 1.11.3.3 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 the 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.

#### 1.11.3.4 Qualifications of Testing Laboratory for Abrasive Media

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

1.11.3.5 Qualifications of Coating Contractors

**********
**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 appropriate section of specification, generally where the hazardous paint removal is specified .**
**********

**********
**NOTE: Solicitations requiring SSPC Certification should point out the existence and location of the certification requirement. SSPC Certification is a special responsibility requirement pursuant to FAR 9.104-2 Special Standards. This is analogous to requiring bidders to have a specified level of experience or expertise and GAO has sustained these types of special requirements.**
**********

[ All contractors and subcontractors that perform surface preparation or coating application shall be certified 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 agency 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

]1.11.3.6 Qualifications of Painting Shop

**********
**NOTE: For construction of new tower or where shop fabrication of significant components is feasible, consider requirement for SSPC QP3 Certification (enclosed shop) for shop performing coating preparation and application. Include appropriate NACE inspection of all coating work in shop.**
**********

[ SSPC QP 3 (enclosed shop)

]1.11.3.7 Abrasive Media

Certify conformance to contract requirements and provide copies of test results required by MIL-A-22262 or SSPC AB 3 for material chosen.

1.11.3.8 Coating System 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.

1.11.4 Test Reports

1.11.4.1 Non-metallic Abrasive Media

Submit test results from independent laboratory of representative sample of abrasive media. Sample must have been tested within the last three years. Submit results as required in article entitled "QUALIFICATION INSPECTION" of MIL-A-22262, and as revised by article entitled "ABRASIVE MEDIA" 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.

1.11.4.2 Coatings

Submit test results from independent laboratory of representative samples of each coating material. 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.

1.11.4.3 Metallic Abrasive Media

Submit test results from independent laboratory testing of sample of each batch delivered to job site.

1.11.4.4 Daily Inspection Checklist

Submit one copy of daily inspection checklist, completed each day when performing work under this section, to the Contracting Officer. Submit within 24 hours of date recorded on the checklist.

1.11.4.5 Recycled Metallic Abrasive Media

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

PART 2 PRODUCTS

2.1 STEEL

New steel shall be galvanized.

2.1.1 Structural and Miscellaneous Steel

ASTM A36/A36M, hot dip galvanized.

2.1.2 Steel Tubing and Pipe

ASTM A500/A500M, Grade B, hot dip galvanized.

2.2 STAINLESS STEEL

ASTM A666, Type 316, Stainless steel shall not be galvanized.

2.2.1 Band Clamps

ASTM A666, Type 316.

2.3 ALUMINUM

2.3.1 Plates and Shapes

ASTM B209, Type 6061-T6; ASTM B308/B308M

[2.3.2 Stranded Conductor

**********
**NOTE: Include this paragraph for leg riser cables for VLF and LF transmission towers.**
**********

ASTM B231/B231M, Class A, 19 wire, 5/8 inch diameter strand (leg riser cables).

]2.4 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.4.1 Structural Steel

2.4.1.1 Bolts

**********
**NOTE: Do not galvanize ASTM A490M ASTM A490 bolts.**
**********

ASTM A325, Type 1, hot dip galvanized. Bolts shall have a maximum Rockwell hardness of 32. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength, grade and type specified by ASTM specifications.

2.4.1.2 Nuts

[Provide galvanized ASTM A563 nuts, Grade and Style as specified in the applicable ASTM standard.][Provide ASTM A563, hot dip galvanized nuts with a locking pin set in the nut. The locking pin shall slide along the bolt threads, and by reversing the direction of the locking pin, the nut shall be removed without damaging the nut or bolt. Provide noncorrosive locking pins.]

2.4.1.3 Washers

ASTM F436, hot dip galvanized steel.

[2.4.1.4 Load Indicator Washers

**********
**NOTE: Include this paragraph when needed to ensure that AISC (American Institute of Steel Construction) required bolt pretension load.**
**********

ASTM F959/F959M, hot dip galvanized steel.

]2.4.2 Stainless Steel

2.4.2.1 Bolts

ASTM F593, type 304

2.4.2.2 Nuts

ASTM F594, type 304

2.4.2.3 Washers

ASTM A320/A320M, except provide type 304

2.4.3 Aluminum

2.4.3.1 Bolts

ASTM F468

2.4.3.2 Nuts

ASTM F467

2.4.3.3 Washers

ASTM F1077

2.5 GALVANIZING

ASTM A123/A123M or ASTM A153/A153M, as applicable, unless specified otherwise. GALVANIZED SURFACES SHALL NOT BE "PASSIVATED" OR "STABILIZED".

2.5.1 Galvanizing Repair Compound

ASTM A780/A780M, cold galvanizing repair compound.

2.6 WELDING

[AWS D1.1/D1.1M for steel][AWS D1.2/D1.2M for aluminum.]

2.6.1 Exothermic Weld Kits

Exothermic weld kits specifically designed by the manufacturer for welding the types of materials and shapes provided.

2.7 COATING SYSTEM

Alternate systems or products will not be considered.

[2.7.1 Sealer for Thermal Spray Metallizing

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (thinned 50 percent using solvent recommended by manufacturer)). Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of 0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.

][2.7.2 Zinc Rich Epoxy Primer Coat

**********

**NOTE: Use this organic zinc-rich coating for repair to existing zinc primer, for repair of inorganic zinc primer, or for small projects where the tower is not to be galvanized or thermal spray metalized.**

**********

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type II). Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of

0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.

]2.7.3 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of 0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.

2.7.4 Polyurethane Topcoat

**********
**NOTE: Colors listed are as specified by FAA Advisory Circular AC 70/7460-1H, Obstruction Marking and Lighting. Always specify contrasting colors between coats.**
**********

Polyurethane coating topcoat of MIL-PRF-85285, Type II, White SAE AMS-STD-595A color number 17875, and Orange 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 D1200 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 D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

All other requirements of this Military Specification apply.

2.8 SOLUBLE SALTS TEST KITS

2.8.1 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. To be considered for approval as an "equal" test kit, each proposed test kit shall:

a. Be a completely self-contained test kit with all materials, supplies, tools and instructions to take tests and identity results;

b. Use identifiable, consistent, factory pre-measured test extract solution;

c. Provide for testing of any steel surface, regardless of orientation;

d. Provide for testing flat, curved, smooth, pitted and rough surfaces;

e. Provide for taking direct measurements of the chloride ion in micrograms per square centimeter without using conversion charts or tables;

f. Be environmentally friendly and not contain any forms of mercury;

g. Provide all new components for extraction and titration for each test;

h. Provide an encapsulated environment while extracting chlorides;

i. Provide a factory sealed titration device for each test;

j. Use the extract sampling container as the titration container.

2.8.2 Test Kit for Measuring Chlorides in Abrasives

Provide test kits called CHLOR*TEST-A, as manufactured by CHLOR*RID International Inc. of Chandler, Arizona (www.chlor-rid.com), or equal. To be considered for approval as an "equal" test kit, each proposed test kit shall:

a. Be a completely self-contained test kit with all materials, supplies, tools and instructions to take tests and identify results;

b. Use identifiable, consistent, factory pre-measured test extract solution;

c. Provide for testing equal volumes of abrasive and test solution;

d. Provide for taking direct measurements of the chloride ion in parts per million (PPM), without using conversion charts or tables;

e. Provide all new components for extraction and titration for each test;

f. Provide a factory sealed titration device for each test;

g. Use the extract sampling container as the titration container.

2.9 ABRASIVE MEDIA

The referenced abrasives specifications have been modified to place additional requirements on testing for soluble salts contamination. Other factors such as on-site handling and recycling can allow contamination of abrasives. Successful testing of chlorides in abrasives does not negate the final acceptance testing of steel surfaces.

**********

**NOTE: Following paragraph is mandatory for all NAVFAC PAC projects. All other agencies may use it**

**after checking applicability.**
**********

[ Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or OSHA 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.

]2.9.1 Non-metallic Abrasive Media

Abrasive media shall conform to MIL-A-22262, Type I (Inorganic materials) except that:

a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives."

[ b. The gross gamma radioactivity shall not exceed 5 picocuries per gram.

] Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive media that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded media. Make adjustments to processes or media gradation to achieve specified surface profile. Do not use recycled non-metallic abrasive media.

2.9.2 Metallic Abrasive Media

Use abrasive media that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Make adjustments to processes, media gradation, or media hardness to achieve specified surface profile.

2.9.2.1 New and Remanufactured Metallic Abrasive Media

Abrasive media shall conform to the chemical and physical properties of SSPC AB 3, except that:

a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives." Modify the requirements of SSPC AB 3 to substitute requirement for one chloride test for each "WATER SOLUBLE CONTAMINANTS" test required.

b. Hardness of steel grit shall be chosen to match requirements of abrasive blasting work.

[ c. The gross gamma radioactivity shall not exceed 5 picocuries per gram.

]2.9.2.2 Recycled Metallic Abrasive Media

Abrasive media shall conform to the chemical and physical properties of SSPC AB 2 except that:

a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives." Modify the requirements of

SSPC AB 2 to substitute requirement for one chloride test for each "WATER SOLUBLE CONTAMINANTS" test required.

b. The maximum allowable Chromium and Cadmium content of the work mix shall be 0.1 percent by wt. when tested in accordance with ASTM D3718 for Chromium and ASTM D3335 for Cadmium. Modify the requirements of SSPC AB 2 to add requirement for one Chromate test and one Cadmium test for each "LEAD" test required.

# PART 3 EXECUTION

## 3.1 STRUCTURAL [REPAIRS][MODIFICATIONS]

### 3.1.1 Fabrication

By mechanics skilled in the trade and in accordance with the manufacturer's directions. Metalwork shall be well formed to shape and size, with sharp lines, angles, and true curves. Work shall be fabricated to allow for expansion and contraction of materials. Provide welding and bracing of adequate strength and durability, with tight, flush joints, dressed smooth and clean. Prior to erection, members shall be identified with a painted erection mark.

#### 3.1.1.1 Measurements

**********

**NOTE: The designer shall indicate on the drawings all field measurements required to perform work.**

**********

Before fabrication, verify all measurements to ensure coordination of new members to existing tower structure.

#### 3.1.1.2 Metal Surfaces

Shall be clean and free from mill scale, flake rust and rust pitting; well formed and finished to shape and size, with sharp lines, angles, and smooth surfaces. Shearing and punching shall leave clean true lines and surfaces. Weld permanent connections. Welds shall be used and finished flush and smooth on surfaces that will be exposed after installation.

#### 3.1.1.3 Construction

Thickness of metal and details of assembly and supports shall be as indicated. Joints exposed to weather shall be formed to exclude water.

#### 3.1.1.4 Fastening

Provide the necessary brackets so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled. Joints exposed to the weather shall be formed to exclude water. Conceal fastenings where possible.

#### 3.1.1.5 Shop Fabrication

Fabrication and assembly shall be done in the shop to the greatest extent possible.

3.1.2 Galvanizing

New metal, except stainless steel, shall be galvanized. Galvanize after fabrication. Repair galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied. Coat inside of holes drilled in existing steel structure with cold galvanizing repair compound within 1 hour of drilling.

3.1.3 Welding

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M for steel and AWS D1.2/D1.2M for aluminum. Existing tower steel shall be stripped to bare metal prior to welding. Weld in a manner to prevent permanent distortion of the connected parts. Weld continuously along the entire area of contact. Provide AWS qualified welders, welding operators and tackers.

[3.1.3.1 Exothermic Welding

**********
**NOTE: Include paragraph when grounding screens or ground wires are present.**
**********

Use exothermic weld kits for connections of #3/0 AWG bare copper grounding wire.

]3.1.4 Connections

**********
**NOTE: Use AISC 360 for designs using AISC 325 (allowable stress) and for designs using AISC M020L (load and resistance factor).**
**********

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 360. Build connections into existing work. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

[3.1.4.1 Bolts

**********
**NOTE: All structural connections shall be fully tensioned.**
**********

ASTM A325 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Provide load indicator washers in all high strength bolted connections. Direct tension indicator tightening, or installation of alternate design fasteners, shall be the only acceptable tightening methods. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

]3.1.4.2 Stainless Steel Fasteners

ASTM F593 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

[3.1.4.3 Installation of Load Indicator Washers (LIW)

**********
**NOTE: Use with all structural connections.**
**********

ASTM F959/F959M. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening.

]3.2 COATING SAMPLING AND FIELD 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. 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 D3925. Prior to sampling, mix contents of 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. Ship samples to an approved laboratory for testing as required by paragraph entitled "Testing of Coating Samples."

3.2.2 Coating Sample Testing

Test samples of all primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject samples that fail tests, reselect, and retest samples.

3.3 SURFACES TO BE COATED

**********
**NOTE: Where general corrosion and light pitting is found, an additional 50 to 100 microns 2 to 4 mil DFT coat of the intermediate epoxy material should be brush applied over the corroded areas. This will increase the total coating thickness in these areas by 75 microns 3 mils DFT. This will provide additional barrier protection to these areas that are especially prone to corrosion. An engineering evaluation must be made to determine the methods of repairing the corroded areas, such as welding and grinding.**
**********

Coat all exposed surfaces, including ladders, railings, [_____], and other exterior appurtenances.

3.3.1 Protection of Items not to be Painted

**********
**NOTE: List staging, grates, railings etc. that can be easily removed, given a better paint job in a shop and then reassembled.**
**********

Remove or protect all objects not to be abrasive blasted or painted. Items that are to be removed or protected are listed below:

a. [_____]

3.4 ACCEPTABLE INSTALLERS

Contractors qualified in accordance with this section shall perform all surface preparation and coating application.

3.5 LIGHTING

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

3.6 CONTAINMENT SYSTEM

**********
**NOTE: This paragraph (and subparagraphs) should not be used for blast containment. Such containment should be specified in Section 02 83 00 LEAD REMEDIATION. Coordinate this paragraph with limitations paragraph entitled APPLICATION OF COATING SYSTEM.**
**********

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 contract. 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. Submit design drawings and calculations designed by a registered engineer, including an analysis of the load which will be added to the structure by the containment system and waste materials. The review and acceptance of the containment system shall in no way relieve the contractor of any responsibility for obtaining the degree of capture, containment, and collection. 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.

### 3.6.1 Containment System Plans

Drawings shall be a minimum of 22 inch by 36 inch with proper lettering. General notes shall be placed in the space above the title box. Show the containment system in plan and elevation views, including details of hangers and clips. Permanent attachments or fasteners to the tower shall not be allowed. Identify all containment system components on the plan sheets. Drawings shall indicate the maximum permissible loads of blast materials, waste material, and wind speeds. Indicate all framework, work platforms, scaffolding, curtains, screens, tarps, method of securement, etc.

## 3.7 Removal of Coatings Containing Hazardous Materials

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be removed in accordance with Section 02 83 00 LEAD REMEDIATION. Dispose of waste products including contaminated blasting grit, water, and the like. Coatings specified may have potential health hazards if ingested or improperly handled. Follow manufacturer's written safety precautions throughout the mixing, application, and cure of the coatings.

## 3.8 SURFACE PREPARATION

### 3.8.1 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. Filter air supply so that air is free of oil and moisture in accordance with ASTM D4285. Test compressed air quality at each startup, but in no case less often than every five operating hours.

### 3.8.2 Abrasives for Soluble Salts Contamination

Test abrasive media for chloride contamination using test kit as described in article entitled "Test Kit for Measuring Chlorides in Abrasives." The maximum allowable chloride concentration is 7 ppm. Collect composite samples using techniques described in MIL-A-22262 article entitled "QUALITY CONFORMANCE INSPECTION." Test abrasive media immediately prior to use, and in no case more than 24 hours prior to use.

#### 3.8.2.1 Pre-Preparation Testing of Abrasive Media Shipped in Bulk Containers

For bulk containers containing 1350 kg 3000 pounds or less, test one composite sample from each container. Reject entire container for non-conforming test. For bulk containers over 1350 kg 3000 pounds, test one composite sample for each 1350 kg 3000 pounds, one sample from each compartment, as appropriate. Reject entire container or compartment for non-conforming test.

#### 3.8.2.2 Abrasive Media Shipped in Bags (Nominal 50-110 lb.)

Maintain palletized grouping as provided from supplier. Test composite sample from one bag of each pallet, but no less than one sample each 1350 kg 3000 pounds of abrasive. Reject entire pallet for nonconforming test. If palletized grouping is not maintained, sample and test one bag for every 450 kg 1000 pounds of abrasive. Reject each 450 kg 1000 pounds represented by a nonconforming test. If bags are stamped with Lot number,

test composite samples from each of two bags per lot. Reject entire lot for nonconforming test.

3.8.2.3 Operational Testing of Recycled Metallic Abrasive Media

For batch processing of abrasive, test composite sample of each batch. Reprocess entire batch for non-conforming test. For continuous processing, test composite sample once per cycle, but no less that one sample every four hours. For non-conforming test during continuous processing, discontinue processing, check equipment for correct operation, and check surfaces prepared with non-conforming abrasive media as prescribed in Article entitled "Pre-Application Testing For Surface Contamination." Make adjustments to equipment or to processing as required to correct problem, and resume blasting when testing indicates that equipment is operating properly.

3.8.3 Clean[ and Repair]

**********
**NOTE: For maintenance projects, allow for inspection and repair of surfaces, as required. Brush-off blasting to remove both loose rust and pack rust facilitates chloride testing and removal as well as inspection of surface condition. Tailor this paragraph to the needs of cleaning that will be required in preparation for repairs.**
**********

Brush-off blast all surfaces in accordance with SSPC 7/NACE No.4 to remove all corrosion products, including surface rust and pack rust. After abrasive blasting, remove abrasive and dust from surfaces by brushing, blowing with dry compressed air, and remove all loose material from vicinity of areas to be painted.[ Examine tank for defects. Repair defects found, such as cracks or splits, by welding. Grind off rough surfaces on weld seams, sharp edges, and corners to a radius of not less than three mm 1/8 inch. Weld sharp depressions or deep pits and grind-off smooth.]

3.8.4 Surface Standard

Inspect surfaces to be coated, and select plate with similar characteristics and surface characteristics for use as a surface standard. Blast clean one or more 300 mm 1 foot square steel panels. Surface preparation and profile shall be as specified in paragraph 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 D4417. Seal surface standard with a clearcoat protectant, or keep wrapped and sealed in vapor-tight material, for use as a standard of comparison for steel surfaces throughout the course of work.

3.8.5 Pre-Preparation Testing for Surface Contamination

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

3.8.5.1 Pre-Preparation Testing for Oil and Grease Contamination

Ensure surfaces are oil-free by visual examination. Check entire

structure with water misted onto surface. Any beading of water is indication of oil or grease contamination. Clean contaminated surfaces in accordance with SSPC SP 1 and recheck for contamination until surfaces are grease and oil-free.

3.8.5.2 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 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 the use of wet abrasive blasting, high pressure water washing, or water washing with a soluble salt remover that is biodegradable, noncorrosive, nontoxic, and leaves no film. 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.

3.8.6 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with SSPC SP 10/NACE No. 2. Near-white metal surfaces shall conform to SSPC VIS 1 and shall match the prepared test-panels. Provide a 50 to 75 micron 2 to 3 mil surface profile. Surface profile greater than 75 microns 3 mils will not be accepted. Measure surface profile in accordance with ASTM D4417. Time interval between abrasive blasting and application of primer shall not exceed eight hours. After abrasive blasting, clean surfaces of dust and debris by brushing, blowing with oil-free and moisture-free compressed air, or vacuuming.

3.8.7 Disposal of Used Abrasive

**********

**NOTE: For recoating of existing tower structures which contain or may contain any hazardous material in existing coating, add requirement for testing of used abrasive for hazardous waste.**

**********

Dispose of used abrasive at a landfill off Government property in accordance with applicable regulations.[ Test used abrasive in accordance with EPA test procedures manual EPA 530/F-93/004 and 40 CFR 261 to determine if it is a hazardous waste using TCLP for metals. Handle and dispose of abrasive determined to be hazardous waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268. Dispose in accordance with Section 02 83 00 LEAD REMEDIATION. Payment for disposal of hazardous waste will not be made until a completed manifest from treatment or disposal facility is returned, and a copy furnished to the Government.]

### 3.8.8 Pre-Application Testing For Surface Contamination

#### 3.8.8.1 Pre-Application Testing for Oil and Grease Contamination

Ensure surfaces are oil-free by visual examination. Check questionable areas and random areas for beading of water misted onto surface. Clean contaminated surfaces in accordance with SSPC SP 1 and recheck for contamination until surfaces are oil-free. Reblast tested and cleaned areas as required.

#### 3.8.8.2 Pre-Application Testing for Soluble Salts Contamination

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 300 square meters 3000 square feet or part thereof.[ Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting.][ Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds.] One or more readings greater than 5 micrograms per square centimeter of chlorides shall be cause for rejection of surface. Wash all surfaces 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.

#### 3.8.8.3 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. Clean 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 300 square meters 3000 square feet or part thereof.

## 3.9 MIXING AND APPLICATION OF COATING SYSTEM

### 3.9.1 Preparation of Coating Materials for Application

Each of the epoxy and polyurethane products, [sealer, ][primer], intermediate, and topcoat, is a two-component coating supplied in separate containers.

#### 3.9.1.1 Mixing [Sealer, ][Primer, ]Intermediate, and Topcoat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits or alter mix ratios. Mix all coating materials in same temperature and humidity conditions specified in article entitled "DELIVERY AND STORAGE." Allow epoxy material to stand for required induction time based on its temperature. Keep coating material containers covered at all times after mixing and during application to prevent contamination. 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.

3.9.1.2 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. 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 at 21 degrees C 70 degrees F:

| | |
|---|---|
| Epoxy materials | 4 hours |
| Polyurethane materials | 2 hours. |

3.9.1.3 Application Conditions and Recoat Windows

The overcoating requirements for the coating system are very time and temperature sensitive. If ambient conditions do not allow for orderly application of primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling 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, 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 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 (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 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 |
| RECOAT WINDOW (Hrs.) | 24-96 | 24-72 | 16-48 | 12-36 | 10-24 | 8-16 |
| EXTENDED RECOAT (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 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 (Hrs.) | NONE | | | | | |
| TACK COAT RECOAT WINDOW (Hrs.) | NO TACK COAT USED | | | | | |

| RECOAT WINDOWS | | | | | | |
|---|---|---|---|---|---|---|
| EPOXY OVER EPOXY | | | | | | |
| Temperature degrees F | 60-70 | 71-80 | 81-90 | 91-100 | 101-110 | 111-120 |
| RECOAT WINDOW (Hrs.) | 24-72 | 18-60 | 16-48 | 12-36 | 8-18 | 4-6 |
| EXTENDED RECOAT (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 |
| RECOAT WINDOW (Hrs.) | 24-72 | 18-60 | 16-48 | 12-36 | 8-18 | 4-6 |
| RECOAT WINDOW (Hrs.) | 24-96 | 24-72 | 16-48 | 12-36 | 10-24 | 8-16 |
| EXTENDED RECOAT (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 |
| RECOAT WINDOW (Hrs.) | 8-48 | 6-48 | 4-36 | 3-24 | 2-12 | 1-2 |
| EXTENDED RECOAT (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 percent 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 300 square meters 3000 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 percent by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by brush-off abrasive blasting in accordance with SSPC 7/NACE No.4 or by hand sanding with 150-200 grit wet/dry sandpaper, pressure wash or wipe down with a clean rag soaked with denatured alcohol to remove dust. If zinc primer coat is brush-off abrasive blasted, touch-up or overcoat as required to restore zinc coating to 100 percent coverage of steel surfaces, to the specified primer coat thickness.

3.9.2 Application of Coating System

**********

**NOTE: For new tower construction where coating is applied in shop, the stripe coat should be applied by brush, and all other coats by spray. Although mitt application is an acceptable practice in the tower maintenance painting industry, the quality of the finished paint film by mitt application is questionable. Where painting is required due to severity of exposure, consideration should be given to excluding mitt application, particularly for primers.**

**********

**********

**NOTE: Establish reasonable limits on particulate fallout area and airborne coating droplets. the specified coatings do not "dry" during a fall, therefore, anything in the path of windblown coating droplets will get coated.**

**********

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 ][brush, roller, or mitt] application. Use appropriate controls to prevent airborne coating fog from drifting beyond[ [three][_____] meters [15][_____] feet from the structure perimeter]. 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.

[3.9.2.1 Sealer Coat for Spray Metalizing

Apply sealer coat at 25 to 50 microns 1 to 2 mils dry film thickness (DFT).

][3.9.2.2 Application of Primer

**********

**NOTE: This paragraph applies to application of organic zinc-rich primer (MIL-DTL-24441), either in the shop or when applied in field as spot primer. this paragraph also applies to application of Inorganic zinc-rich primer (DOD-P-24648.)**

**Delete primer and stripe coat if tower is hot dip galvanized or spray metallized.**

**********

Apply primer coat at 50 to 100 microns 2 to 4 mils dry film thickness (DFT). Maintain paint supply container height within 1 meter 3 feet of the paint nozzle when applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

]3.9.2.3 Application of Stripe Coat

Apply a stripe coat of succeeding coat epoxy material within RECOAT WINDOW of primer coat. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

[3.9.2.4 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of [sealer][primer] coat. Apply intermediate coat 75 to 125 microns 3 to 5 mils DFT. Check coating thickness prior to application of topcoat. If additional coating film is required, use intermediate coating material to provide desired thickness, then apply topcoat.

]3.9.2.5 Application of Topcoat

**********
**NOTE: Adjust total system to compensate for galvanizing or spray metallizing, or for existing coating, as necessary.**
**********

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Making Spot Repairs" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. Apply polyurethane topcoat 40 to 60 microns 1-1/2 to 2-1/2 mils DFT. Total system of primer, intermediate, and topcoat shall not be less than 225 microns 9 mils DFT. Apply additional topcoat, if necessary, to obtain required minimum total system thickness.

3.9.2.6 Procedure for Making Spot Repairs

Use this procedure only with written approval from the Contracting Officer. Observe all requirements for soluble salts contamination and cleanliness between coats. Apply each coat within RECOAT WINDOW of preceeding coat. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 100 mm 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 75 mm 3 inches beyond the prepared area with clean denatured alcohol. 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 by spray to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

3.10 FIELD TESTS AND INSPECTION

3.10.1 NACE Coating Inspector

**********
**NOTE: Include requirement for NACE Coating inspector in Section 01 45 00 01 45 00.00 40 QUALITY CONTROL, as a QC Specialist. Use NACE Certified inspector for most projects, NACE Basic inspector for small projects.**

**Make modifications to Section 01 45 00 QUALITY CONTROL as follows:**

**1. Requirements of the NACE Coating Inspector should be as follows:**

**"The NACE [Certified][Basic] Coating Inspector shall**

**be an independent third party hired directly by the prime construction contractor as an integral part of the prime construction contractor's Quality Control Organization. This inspector shall have no business relationships (owner, partner, operating officer, distributor, salesman, or technical representative, inspector) with any subcontractors involved with this project; or with any manufacturers, suppliers or installers for any material or equipment provided as part of this project."**

**2. The scope and duration of the NACE coating inspector should be as follows:**

**"The NACE Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of coating system, and during all repair work."**

**3. A submittal should be required as follows:**

**"Submit name, address, telephone number, FAX number, and e-mail address of the proposed coating inspector. Submit documentation that inspector is a [Certified][Basic] Coating Inspector under the National Association of Corrosion Engineers (NACE) Coating Inspector Training and Certification Program (NCITCP), including NACE inspector identification number, date of qualification, and expiration date."**

**Make modifications to Section 01 45 00 QUALITY CONTROL as follows:**

**Add NACE Coating Inspector to paragraph CQC PERSONNEL and it's associated Experience Matrix. The NACE Coating Inspector should be directly employed by the prime contractor. Use the following for the Qualifications column:**

**"[Certified][Basic] Coating Inspector under the National Association of Corrosion Engineers (NACE) Coating Inspector Training and Certification Program (NCITCP)"**

**********

The NACE Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of coating system, and during all repair work.

3.10.2 Field Inspection

The NACE Coating Inspector shall accomplish field inspection. Use the Daily Inspection Checklist forms attached to the end of this section, or a similar checklist with all pertinent data included. Record all surface preparation and coating application work accomplished, environmental conditions during this work, and results of regular inspections. Record all deviations from specifications. Accomplish testing in accordance with NACE SP0288 and as required herein.

3.10.2.1 Thickness Testing

Following application of each coat, inspect surfaces in presence of the Contracting Officer for pinholes, blisters, inadequate coating thickness, and other defects. Repair imperfections found. Measure dry film thickness in accordance with SSPC PA 2 Provide additional coating where required.

3.10.3 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

| Step | Action |
|---|---|
| Prior to preparation of surfaces for cleaning and repair | Safety inspection |
| After cleaning of structure and prior to surface preparation | Safety inspection, removal of dirt, trash, debris, and any hindrance to specified work. |
| After cleaning of structure and prior to abrasive blasting | 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 for holding the blast. |
| | 2.) Surface inspection to insure all aspects of surface preparation are properly addressed,as specified in article entitled "SURFACE PREPARATION", including visual cleanliness, surface profile, and soluble salt contamination. |
| | 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", including visual cleanliness, surface profile, and soluble salt contamination. |

| Step | Action |
|---|---|
| Immediately prior to coating application - provide for each coating application evolution | 1.) Confirm environmental conditions are suitable for coating application per |
| | 2.) Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "SURFACE PREPARATION", including visual cleanliness,surface profile, and soluble salt contamination. |
| | 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." |

## 3.11 ELECTRICAL WORK

### 3.11.1 Terminating Aluminum Stranded Conductors

a. Use particular care in making up joints and terminations. Remove surface oxides by cleaning with a wire brush or emery cloth. Apply joint compound to conductors, and use UL-listed solid aluminum connectors for connecting aluminum to aluminum conductors.

b. Terminate aluminum conductors to existing steel tower structure using a circumferential compression type, aluminum bodied terminal lug UL listed for AL/CU and steel Belleville spring washers, flat washers, bolts, and nuts. Belleville spring washers shall be cadmium-plated hardened steel. Surface of existing steel where connection is to be made shall be stripped free of paint. Special care shall be taken to avoid destruction of underlying galvanized surface. Install the Belleville spring washers with the crown up toward the nut or bolt head, with the concave side of the Belleville bearing on a heavy-duty, wide series flat washer of larger diameter than the Belleville. Tighten nuts sufficient to flatten Belleville and leave in that position. Lubricate hardware with joint compound prior to making connection. Wire brush and apply joint compound to conductor prior to inserting in lug.

c. Terminate aluminum conductors to aluminum bus by using all-aluminum nuts, bolts, washers, and lugs. Wire brush and apply joint compound to conductor prior to inserting in lug. Lubricate hardware with joint compound prior to making connection; if bus contact surface is unplated, scratch-brush and coat with joint compound (without grit).

## 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 I [_____]. - Zinc Rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159 | | | | | | |
| Test | Componenent 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-volatiles vehicle, percent | 53.7 | 57.7 | 8.3 | 8.7 | --- | --- |
| Consistency, grams | --- | --- | 250 | 500 | --- | --- |
| Weight | | | | | | |
| Kilograms / liter | 0.87 | 1.01 | 3.30 | 3.40 | --- | --- |
| Pounds / gallon | 7.3 | 8.4 | 27.5 | 28.4 | --- | --- |
| Set to touch, hours at 23 degrees C, 73 degrees F | --- | --- | --- | --- | --- | 2 |
| Dry-hard time, hours at 23 degrees C, 73 degrees F | --- | --- | --- | --- | --- | 8 |
| Flashpoint | | | | | | |
| Degrees C | 35.6 | --- | 37.8 | --- | --- | --- |
| Degrees F | 96 | --- | 100 | --- | --- | --- |

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table I [_____]. - Zinc Rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159

| Test | Componenent A | | Component B | | Mixed | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Titanium Dioxide, percent of pigment | 18 | --- | --- | --- | --- | --- |
| 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 |
| Lead, * percent, ASTM D3335 | | | | | | 0.06 |
| Cadmium, * percent, ASTM D3335 | | | | | | 0.06 |
| Chromium, * percent, ASTM D3718 | | | | | | 0.00 |

GENERAL NOTES:
Test methods as specified in MIL-DTL-24441, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441.

]

[

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS | | | | | | |
| Table I [_____]. - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (White) | | | | | | |
| Test | Componenent A | | Component B | | Mixed | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Pigment content, percent | 44.0 | 49.0 | 33.0 | 38.0 | --- | --- |
| Volatiles, percent | 29.0 | 35.0 | 16.0 | 21.0 | --- | --- |
| Non-volatiles vehicle, percent | 17.5 | 23.5 | 44.0 | 49.0 | --- | --- |
| Course particles, percent | --- | 0.3 | --- | 0.3 | --- | --- |
| Consistency, grams | 180 | 320 | 300 | 470 | --- | --- |
| Weight | | | | | | |
| Kilograms / liter | 1.39 | 1.45 | 1.29 | 1.35 | --- | --- |
| Pounds / 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 | --- | --- | --- | --- | --- |

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS | | | | | | |
| Table I [_____]. - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (White) | | | | | | |
| Test | Componenent A | | Component B | | Mixed | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Pot life, hours at 23 degrees C, 73 degrees F | --- | --- | --- | --- | 4 | --- |
| Contrast ratio, 3 miles DFT | --- | --- | --- | --- | 0.98 | --- |
| Sag resistance | | | | | | |
| Micrometers | --- | --- | --- | --- | 300 | --- |
| Mils | --- | --- | --- | --- | 12 | --- |
| Color of dry film to approximate color of standard color chip | --- | --- | --- | --- | --- | 340 |
| VOC | | | | | | |
| Grams / liter | --- | --- | --- | --- | --- | 340 |
| Pounds / gallon | --- | --- | --- | --- | --- | 2.8 |
| Lead, * percent, ASTM D3335 | --- | --- | --- | --- | --- | 0.06 |
| Cadmium, * percent, ASTM D3335 | --- | --- | --- | --- | --- | 0.06 |
| Chromium, * percent, ASTM D3718 | --- | --- | --- | --- | --- | 0.00 |
| GENERAL NOTES:<br>Test methods as specified in MIL-DTL-24441, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441. | | | | | | |

]

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS | | | | | | |
| Table I [_____]. - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (Tinted) | | | | | | |
| Test | Componenent A | | Component B | | Mixed | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Pigment content, percent | 44.0 | 49.0 | 33.0 | 38.0 | --- | --- |
| Volatiles, percent | 29.0 | 35.0 | 16.0 | 21.0 | --- | --- |
| Non-volatiles vehicle, percent | 17.5 | 23.5 | 44.0 | 49.0 | --- | --- |
| Course particles, percent | --- | 0.3 | --- | 0.3 | --- | --- |
| Consistency, grams | 180 | 320 | 300 | 470 | --- | --- |
| Weight | | | | | | |
| Kilograms / liter | 1.39 | 1.45 | 1.29 | 1.35 | --- | --- |
| Pounds / 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 | --- |

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS | | | | | | |
| Table I [_____]. - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (Tinted) | | | | | | |
| Test | Componenent A | | Component B | | Mixed | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Contrast ratio, 3 miles DFT | --- | --- | --- | --- | 0.98 | --- |
| Sag resistance | | | | | | |
| Micrometers | --- | --- | --- | --- | 300 | --- |
| Mils | --- | --- | --- | --- | 12 | --- |
| Color of dry film to approximate color of standard color chip | --- | --- | --- | --- | --- | Conform |
| VOC | | | | | | |
| Grams / liter | --- | --- | --- | --- | --- | 340 |
| Pounds / gallon | --- | --- | --- | --- | --- | 2.8 |
| Lead, * percent, ASTM D3335 | --- | --- | --- | --- | --- | 0.06 |
| Cadmium, * percent, ASTM D3335 | --- | --- | --- | --- | --- | 0.06 |
| Chromium, * percent, ASTM D3718 | --- | --- | --- | --- | --- | 0.00 |
| GENERAL NOTES:<br>Test methods as specified in MIL-DTL-24441, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441. | | | | | | |

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS | | | | | | |
| Table I [_____]. - Polyurethane Topcoat MIL-PRF-85285 Type II | | | | | | |
| Test | Componenent A | | Component B | | Mixed | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| Moisture content, percent | --- | 2 | --- | --- | --- | --- |
| Course 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 |

TABLE I

COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Table I [_____]. - Polyurethane Topcoat MIL-PRF-85285 Type II

| Test | Componenent A | | Component B | | Mixed | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. |
| 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 D1200 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 D1640/D1640M, 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, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-PRF-85285.

| DAILY INSPECTION CHECKLIST | | | |
|---|---|---|---|
| ITEM | | | REPORT # |
| SPECIFIC LOCATION | SAT | UNSAT | COMMENTS |
| I. PRE-SURFACE PREPARATION<br><br>1. Condition of Edges, Welds, etc. | | | |
| 2. Grease / Oil | | | |
| 3. Visible Moisture | | | |
| 4. Protective Coverings | | | |
| 5. Clean Dry Abrasive | | | |
| 6. Recycled Abrasive Test | | | |
| 7. Nozzle Air Pressure (Record) | | | |
| 8. Compressed Air Cleanliness (Record) | | | |
| 9. Ambient Conditions (Record) | | | Time of day: |
| II. SURFACE PREPARATION<br><br>10. Ambient Conditions (Record) | | | Wet Bulb: Humidity<br>Dry Bulb: Dew Pt.:<br>Amb. Air: Surf Temp: |
| 11. Degree of Cleanliness (Record) | | | |
| 12. Profile (Record) | | | |
| 13. Type and Size Abrasive (Record) | | | |
| 14. Dust and Abrasive Removal | | | |
| 15. Time of Surface Acceptance | | | |
| III. MIXING<br><br>16. Product Name / Mfg / Batch Numbers (Records) | | | Product Name:<br>Mfg:<br>Batch Number: |
| 17. Clean Equipment | | | |

| DAILY INSPECTION CHECKLIST | | | |
|---|---|---|---|
| ITEM | | | REPORT # |
| SPECIFIC LOCATION | SAT | UNSAT | COMMENTS |
| 18. Material Temperature / Potlife (Record) | | | |
| 19. Thinner / Type and Amount (Record) | | | |
| 20. Time of Mix (Record) | | | |
| IV. APPLICATION:<br><br>21. Ambient Conditions (Record)<br>Time of Day: | | | Wet Bulb: Humidity<br>Dry Bulb: Dew Pt.:<br>Amb. Air: Surf Temp: |
| 22. Applicator's Name (Record) | | | |
| 23. Surface Prep. to Application (Record Time) | | | |
| 24. Compressed Air Cleanliness | | | |
| 25. Protective Coverings | | | |
| 26. Time Application Began & Surf. Temp. (Record) | | | |
| 27. Surrounding Air Cleanliness | | | |
| 28. Recoat Times Observed | | | |
| 29. Intercoat Cleanliness | | | |
| 30. Proper Pot Agitation | | | |
| 31. Type of Application Equip. & Tip Size (Record) | | | |
| 32. Time Application Complete and Surf. Temp (Record) | | | |
| V. INSPECTION<br><br>33. Visual Appearance | | | |
| 34. Dry Film Thickness (Record) | | | |
| 35. Holiday Test | | | |

| DAILY INSPECTION CHECKLIST | | | |
|---|---|---|---|
| ITEM | | | REPORT # |
| SPECIFIC LOCATION | SAT | UNSAT | COMMENTS |
| 36. Cure Test | | | |
| NOTES: (use additional sheets as necessary) | | | |
| _____<br>NACE INSPECTOR | _____<br>NACE NUMBER | | _____<br>DATE |
| _____<br>QC MANAGER | | | _____<br>DATE |

-- End of Section --