Item 446
Field Cleaning and Painting Steel

1. DESCRIPTION

Prepare steel surfaces for painting and apply paint.

2. MATERIALS

Provide the paint system (surface preparation, primer, intermediate, and appearance coats as required) shown on the plans. Provide System II if no system specified. Provide a concrete gray appearance coat (Federal Standard 595C, color 35630,) unless otherwise shown on the plans. Use differing colors for each individual coat with enough contrast between colors to distinguish the various steps in the painting process, including differing the color of the stripe coat relative to the primer and intermediate coat.

2.1. Paint Systems. Standard paint systems for painting new and existing steel include the following:


2.1.2. System I-B (Overcoating, High Corrosion Environment). Provide paint in accordance with DMS-8101, “Structural Steel Paints—Performance.” Provide a penetrating sealer, intermediate prime coat on bare steel areas, and an appearance coat in accordance with manufacturer’s specifications.


2.1.5. System III-B. Provide paint in accordance with DMS-8101, “Structural Steel Paints—Performance.” Provide inorganic zinc (IOZ) prime coat, epoxy intermediate, and urethane appearance coat. Provide epoxy zinc prime coat, as recommended by the IOZ manufacturer, for touchup of IOZ.

2.1.6. System IV. Provide paint in accordance with DMS-8101, “Structural Steel Paints—Performance.” Provide IOZ prime coat and acrylic latex appearance coat. Provide epoxy zinc prime coat, as recommended by the IOZ manufacturer, for touchup of IOZ.

2.2. Paint Inside Tub Girders and Closed Boxes. In accordance with Item 441, “Steel Structures.”

2.3. Paint over Galvanizing. In accordance with Item 445, “Galvanizing.”

2.4. Special Protection System. Provide the type of paint system shown on the plans or in special provisions to this Item. Special Protection System paints must have completed NTPEP Structural Steel Coatings (SSC) testing regimen as a complete system, with full data available through NTPEP unless specified otherwise.
3. **EQUIPMENT**

Ensure spray equipment:
- has adequate capacity and sufficient gauges, filters, agitators, regulators, and moisture separators to ensure delivery of clean dry air at the proper pressure and volume;
- is adequate for the type of paint being used;
- has spray heads that provide a smooth, uniform coat of paint;
- will remove moisture from air stream in contact with the paint; and
- has no dried coatings, solvents, or other foreign matter on surfaces that paint is likely to contact.

Maintain all equipment and accessories in good working order.

Keep paint pots no more than 20 ft. above or below the level of spray application of paint during painting operations. Do not allow fluid hoses to sag more than 10 ft. below the level of the bottom of the paint pot or actual spraying operations, whichever is the lowest point. Keep hoses serviceable with no cracks or deterioration. Equip paint pots (or other containers from which the paint is dispensed) with agitators that operate whenever paint is in the pot.

3.1. **Airless Spray Equipment.** Use regulator and air or fluid pressure gauges. Use fluid hoses with at least 1/4-in. inside diameter (I.D.) and a maximum length of 75 ft.

3.2. **Conventional Spray Equipment.** Use independent fluid pressure and atomization pressure regulators and gauges. Use fluid and air hoses with at least 1/2-in. I.D. and a maximum length of 75 ft.

4. **CONSTRUCTION**

4.1. **Qualification.** Certification of the cleaning and painting contractor, subcontractor, or fabricator is required as follows:

Submit to the Engineer documentation verifying SSPC QP 1 certification for work requiring the removal or application of coatings. Additionally, submit to the Engineer documentation verifying SSPC QP 2 Cat A certification when work requires removal of coatings containing hazardous materials. Maintain certifications throughout the project. No work may be performed without current and active certifications unless otherwise shown on the plans. The Engineer may waive QP 1 certification for minor, touch-up repair work and coating steel members repaired in accordance with Item 784, “Steel Member Repair.”

The Engineer may waive certification requirements, when stated on the plans, for the purpose of qualification in the SSPC QP program if the SSPC has accepted the project as a qualification project as part of the process for obtaining SSPC QP1 or QP2 Cat A certification. Submit SSPC QP applications and proof of acceptance before beginning work or provide SSPC QP 7 certification when required on the plans.

Inform the Engineer within 1 business day of all scheduled or unannounced inspections or audits by SSPC, OSHA, EPA, TCEQ, or other agencies or organizations. Furnish the Engineer a complete copy of all inspection and audit reports and any SSPC DAC actions within 7 days of receipt.

4.2. **Responsibility for Hazards.** Comply with Section 6.10., “Hazardous Materials.” Handle all paints and cleaning products in accordance with the information provided by the manufacturer and all applicable federal and state regulations.
4.3. **Access.** Provide safe access to all parts of the work for proper inspection. Do not place rigging, scaffolds, etc., in contact with previously painted surfaces until the previously applied coating has fully cured. Protect previously painted and cured surfaces with an approved padding to minimize damage when rigging, scaffolds, etc., will be placed on or hung from those surfaces. Avoid and minimize coating damage to the extent possible. Repair all coating damaged as a result of rigging or scaffolding as directed.

Remove tree limbs, bushes, grass, and other items that will interfere with the cleaning and painting operations as directed. Remove vertical clearance signs, and erect and maintain temporary ground-mounted signs matching the content and letter size on the existing sign unless otherwise directed. Re-attach permanent clearance signs as directed.

4.4. **Steel to be Painted.** Clean and paint all structural steel except weathering steel that is to remain unpainted, unless otherwise shown on the plans. Structural steel includes all main members, bearing apparatus, diaphragms, floor beams, rivets, bolts, lateral bracing, etc., where applicable. Paint the rolling faces of rockers and base plates, all surfaces of bearing plates, and all surfaces of iron or steel castings, whether or not the surfaces are milled unless otherwise shown on the plans or exempted in this Item. Perform the initial cleaning and application of required prime and intermediate coatings on new steel before shipment of the steel to the jobsite unless otherwise provided in the Contract or approved in writing.

4.5. **Special Protection System.** Apply paint as shown on the plans.

4.6. **Cleaning and Painting New Steel.** Clean and prime new steel in accordance with Item 441, “Steel Structures,” before erection or installation of repair pieces. Clean and paint unpainted areas of newly erected steel, including bolts, nuts, washers, and areas where the shop-applied paint has been damaged or fails to meet specification requirements, in accordance with the method required under the paint system specified and Section 446.4.7.3.1., “General Preparation.” Water blast exposed surfaces of all newly erected steel. Provide Tool Cleaning surface preparation to all repair areas. Prepare all unpainted areas with Abrasive Blast Cleaning. Repair primer coat and apply remaining coats after erection and maintenance work is complete. Prevent paint and overspray from coming in contact with passing traffic, private and public property, and areas of the bridge not designated to be painted.

4.7. **Cleaning and Painting Existing Steel.**

4.7.1. **Hold Points.** No work may proceed beyond the listed hold point until the Engineer has reviewed and given provisional approval. Provide the following hold points at a minimum:

- at containment completion,
- following any surface preparation,
- immediately before each coating application,
- after coating application,
- after each coat has cured, and
- after preparation of areas for repair.

4.7.2. **Containment.** Submit a plan that details the procedures and type and size of equipment proposed to keep public property, private property, and the environment from being adversely affected by the cleaning and painting operations. Approval of the plan is required before cleaning and painting operations begin. Containment is not required for painting newly erected, shop primed steel other than to comply with Section 446.4.6., “Cleaning and Painting New Steel.”

When required on the plans, submit a containment plan and engineering analysis showing the loads, including wind loads, added to the existing structure by the containment system and waste materials. Verify the forces and stresses induced in the members from these loads do not result in overstress of the members. Have a licensed professional engineer sign, seal, and date the submittal.

Provide containment during all cleaning and painting operations of existing steel structures. Obtain approval of the constructed containment system before beginning cleaning and painting.
Unless otherwise shown on the plans, construct and maintain a structure meeting the following minimum requirements:

- SSPC Guide 6, Class 1A, Level 1 Emissions;
- ability to withstand winds up to 30 mph;
- enclosure of all sides of area with air-impenetrable walls;
- illumination meeting SSPC Guide 12;
- rigid, watertight floor formed from minimum 20 gauge steel;
- overlapping seams and entryways; and
- exhaust air filtration system capable of creating negative pressure inside the enclosure causing the sides of the containment to have a concave appearance and demonstrating minimum 100 ft. per minute cross draft air flow and minimum 50 ft. per minute downdraft air flow in all areas within the containment.

In place of a full containment structure, a modified containment system may be proposed for the following situations:

- when using abrasive blasting equipment equipped with negative pressure able to contain all blast refuse. Demonstrate, for approval, the equipment’s ability to contain all blast refuse.
- when using hand tools for spot cleaning only, provide a system that will contain all removed paint, rust, and other debris. Place an airtight membrane below the member being cleaned to collect all falling debris.
- when using power hand tools for spot cleaning only that are equipped with high-efficiency particulate air (HEPA) filter vacuums that will capture all removed paint, rust, and other debris. Otherwise, provide an airtight membrane below the member being cleaned to collect all falling debris.

Provide a system meeting SSPC Guide 6, Class 1W, when using water blasting.

Store, characterize, and dispose of all recovered debris in accordance with 30 TAC 335, “Industrial Solid Waste and Municipal Hazardous Waste.” Alternatively, Universal Waste rules may be used. Discharge liquids in accordance with the TCEQ Texas Pollution Discharge Elimination Program (30 TAC 305, “Effluent Guidelines and Standards for TPDES Permits”) and Texas Surface Water Quality Standards (30 TAC 307). Alternatively, liquids may be captured, stored, and characterized for disposal at an authorized facility in accordance with 30 TAC 315, “Pretreatment Regulation for Existing and New Sources of Pollution,” or 30 TAC 335, “Industrial Solid Waste and Municipal Hazardous Waste.”

Use a skimmer when cleaning and painting over bodies of water. Remove any blast or paint material the skimmer collects the day the release occurs. Correct the containment problem that allowed the release before continuing work.

Ensure air is clear of dust and remove all blast refuse from cleaned members before the inspector enters the containment to inspect the cleaned surfaces. Remove all blast refuse from the containment before ending work for the day.

4.7.3. Preparation of Surfaces. Prepare surfaces before applying paint.

4.7.3.1. General Preparation. Clean far enough into any shop-applied paint to ensure removal of all contaminants. Feather edges of sound paint around cleaned areas.

Ensure all surfaces to be painted are completely free of oil, grease, moisture, dirt, sand, overspray, welding contamination (slag or acid residue); loose or flaking mill scale, rust, or paint; weld spatter; and any other conditions that will prevent the paint from forming a continuous, uniform, tightly adhering film. Remove all hackles, splinters, weld spatter, sharp edges, fins, slag, or other irregularities which may interfere with proper paint adhesion to the steel. Remove all steel splinters (hackles) raised or evident during cleaning. Reblast areas from which hackles are removed when abrasive blast cleaning is required.
Before other cleaning operations, remove grease-like contaminants with clean petroleum solvents or other approved methods. Contain solvents and removed material as approved. Dispose of properly or reuse solvents as approved. This requirement applies to all coats.

When abrasive blast cleaning is required, blast all flame-cut edges to produce a visible anchor pattern over the entire flame-cut surface.

Completely remove, as directed, the protective coating on machined surfaces and pins.

Do not damage adjacent materials such as concrete during surface preparation or painting.

Feather all sound, tightly adhered coating edges surrounding cleaned or repaired areas a minimum of 1 in. and ensure a smooth, blended transition.

Round all corners and edges to a 1/16-in. radius. Reblast as needed. Remove pack rust to depth of at least 0.5 in.

### 4.7.3.2. Classes of Cleaning

The requirements of Section 446.4.7.3.1., “General Preparation,” apply whether or not a class of cleaning is specified. Use an approved abrasive for abrasive blasting. Do not use steel shot. Use an abrasive recycling system with an approved recyclable abrasive when abrasive blast cleaning is used to remove existing paint containing lead or chromium. Abrasive will be considered recyclable if it is separated from the dust and paint debris before being reused. All abrasives must meet SSPC-AB1, AB2, or AB3 as appropriate.

All paint systems require water blasting to remove contaminants before any other surface preparation. Both System I-A and I-B require tool cleaning for defective areas of disbonded coating or rust. All other paint systems require abrasive blast cleaning unless otherwise shown on the plans.

### 4.7.3.2.1. Abrasive Blast Cleaning

Meet the surface preparation requirements of SSPC-SP 10 unless otherwise shown on the plans. Ensure a minimum profile of 1.5 mils. Do not add depth to existing profile when the surface profile exceeds 4.0 mils. Measure surface profile in accordance with ASTM D4417, Method C, “Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.” Containment mounting points and other repair areas under 1 sq. ft. may be tool-cleaned to SSPC SP-11 with at least a minimum 2 mil profile when approved by the Engineer.

### 4.7.3.2.2. Tool Cleaning

Meet the requirements of SSPC-SP2 or SP3 unless otherwise shown on the plans. Probe the perimeter of peeled areas of paint with a putty knife to ensure remaining paint is tightly adhered.

### 4.7.3.2.3. Water Blasting

Meet the requirements of SSPC-SP WJ-4. Tight mill scale and tightly adhered rust and paint are permitted. Probe the perimeter of peeled areas of paint with a putty knife to ensure remaining paint is tightly adhered.

### 4.7.3.3. Tape Test

Perform the tape test, as necessary to determine cleanliness, on any surface before painting as follows:

- Press a strip of filament tape onto the surface by rubbing with moderate thumb pressure 4 times, leaving approximately 2 in. of one end of the tape free from the surface.
- Grasp the free end and remove the tape from the surface with a sharp pull.

The surface will be considered to be contaminated and not adequately cleaned if visible particles cling to the tape.

### 4.7.4. Painting

### 4.7.4.1. Paint Condition

Thoroughly mix and strain paints to be applied. Mix by mechanical methods. Provide continuous mechanical agitation during painting operations to prevent settling. Ensure the paint is a completely homogeneous mixture free of lumps, skins, and agglomerates and contains all pigments, vehicle
solids, and thinners required in the original formulation. Keep paint containers tightly covered and protected from weather when not in use.

4.7.4.2. **Thinning.** Adjust paint to the correct application consistency by using suitable thinners or by using properly applied heat up to 150°F. Using heat to thin paints may decrease their useful pot life.

4.7.4.3. **Paint System Requirements.** Ensure all coatings in the paint system, including shop-applied coats, are from the same manufacturer.

4.7.4.4. **Stripe Coat.** All stripe coat, when specified, will be unthinned and worked in by brush to achieve a contiguous film over all edges, corners, bolts, nuts, threads, rivets, and weld seams, extending at least 1 in. onto adjacent steel.

4.7.4.5. **Paint Systems.**

4.7.4.5.1. **System I-A (Overcoating, One Coat).** Apply at least 4.0 mils dry film thickness (DFT) maintenance overcoat to all surfaces to be painted.

4.7.4.5.2. **System I-B (Overcoating, High Corrosion Environment).**

- **Penetrating Sealer.** Apply 0.5–1.0 mil DFT of penetrating sealer to all surfaces to be painted.
- **Prime Coat.** Apply 4.0–8.0 mils DFT of primer to areas that have received tool cleaning and to other areas where there is no existing primer.
- **Appearance Coat.** Apply 2.0–6.0 mils DFT of appearance coat.

4.7.4.5.3. **System II.**

- **Prime Coat.** Apply 3.5–10.0 mils DFT of primer in at least 2 coats.
- **Appearance Coat.** Apply 2.0–5.0 mils DFT of appearance coat.

4.7.4.5.4. **System III-A.**

- **Prime Coat.** Apply at least 3.5 mils DFT of epoxy zinc primer.
- **Stripe Coat.** Apply stripe coat of epoxy intermediate coating.
- **Intermediate Coat.** Apply at least 2.0 mils DFT of epoxy intermediate coating.
- **Appearance Coat.** Apply at least 2.0 mils DFT of appearance coating.

4.7.4.5.5. **System III-B.**

- **Prime Coat.** Apply at least 3.0 mils DFT of inorganic zinc primer to new steel in accordance with Item 441, “Steel Structures.” Spot-clean all damaged and unpainted areas in accordance with Section 446.4.6., “Cleaning and Painting New Steel.” Apply at least 3.0 mils DFT of epoxy zinc primer to the spot cleaned areas.
- **Stripe Coat.** Apply stripe coat of epoxy intermediate coating.
- **Intermediate Coat.** Apply at least 2.0 mils DFT of epoxy intermediate coating.
- **Appearance Coat.** Apply at least 2.0 mils DFT of appearance coat.

4.7.4.5.6. **System IV.**

- **Prime Coat.** Apply at least 3.0 mils DFT of inorganic zinc primer to new steel in accordance with Item 441, “Steel Structures.” Spot-clean all damaged and unpainted areas in accordance with Section 446.4.6., “Cleaning and Painting New Steel.” Apply at least 3.0 mils DFT of epoxy zinc primer to the spot cleaned areas.
- **Appearance Coat.** Apply at least 2.0 mils DFT of appearance coat.

4.7.4.5.7. **Special Protection System.** Apply paint as shown on the plans.
4.7.4.6. **Temperature.** Do not apply #810 Prime Coat when the steel or air temperature is below 50°F or when the steel or air temperature is expected to drop below 50°F within 2 hr. after application. Follow product data sheets for temperature requirements for all other paints.

4.7.4.7. **Application.** Clean steel surfaces or surfaces of previously applied coats of paint immediately before painting by blowing with clean compressed air, brushing, or both to remove traces of dust or other foreign particles. Wash the surfaces of previously applied coatings either with clean, fresh water or with a mild detergent and water mixture followed by a complete and thorough rinse with clean, fresh water when directed.

Do not apply paint to any surface with discernible moisture. Do not apply paint to any surface when steel is within 5°F of the dewpoint. Do not apply any paint when impending weather conditions might result in injury to fresh paint.

Provide environmental controls such as dehumidification, heaters, or additional containment measures as needed to control and maintain favorable atmospheric conditions in all areas of the containment. Provide environmental controls at no additional cost to the Department.

Apply each coat of paint to clean, dry, firm surfaces complying with all specification requirements. Ensure surfaces to be painted are free of all forms of contamination. Ensure each coat fully cures to form a smooth, continuous, tightly adhering film of uniform thickness and appearance, free of sags, runs, pinholes, holidays, overspray, or other defects before applying the next coat. Apply all coats by spray, except brush-applied stripe coats. Obtain Engineer approval for alternative methods of application to paint inaccessible areas.

Repair all runs, sags, and other defects in each coat of paint before application of subsequent coats.

Measure the dry film thickness of coatings in accordance with Tex-728-I.

If, in the opinion of the Engineer, there is an objectionable amount of dust in the atmosphere, discontinue painting or take necessary precautions to prevent dust and dirt from coming in contact with freshly painted surfaces or with surfaces before the paint is applied.

Provide full coverage of the steel with the concrete surface when painting steel that is in contact with concrete. Do not extend the paint more than 4 in. onto the concrete surfaces or as directed. Ensure when painting is complete the only visible paint on concrete surfaces is the finish coat. Remove excessive or objectionable paint on concrete surfaces in an approved manner.

Cure the primer, when System II is specified, in accordance with Table 1 before applying appearance coat.

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<thead>
<tr>
<th>Temperature</th>
<th>Days Cure, Min</th>
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<tbody>
<tr>
<td>77°F and above</td>
<td>2</td>
</tr>
<tr>
<td>65–77°F</td>
<td>3</td>
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<tr>
<td>55–65°F</td>
<td>4</td>
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<tr>
<td>40–55°F</td>
<td>5</td>
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Clean coated surfaces by an approved method that does not damage the paint to remove all dirt, grease, concrete, overspray, and any other substance that may impair adhesion before the application of the next coat.

Provide an even and uniform appearance throughout the painted portion of the structure.

4.7.4.8. **Workmanship.** Perform all painting with skilled painters who can adjust equipment and application techniques as dictated by the type of paint, weather conditions, environment, and size and shape of the surface being painted. Painters who, in the opinion of the Engineer, do not adjust equipment to apply coatings in a uniform, full wet coat free of runs, sags, holidays, and overspray will not be considered skilled painters.
Apply sprayed coatings essentially 90° to the surface and between 10 and 18 in. from the surface as necessary to apply a full wet coat of paint free of overspray, runs, sags, and holidays. Any spray painter who does not consistently spray in this manner or extends the spraying stroke so paint is applied to the surface at an angle of less than 80° will not be allowed to spray paint. Brush application for touchup is acceptable as long as the paint is mixed in the appropriate proportions by weight and is agitated continuously during the painting operation.

4.7.5. **Handling and Shipping.** Pad the blocks, chains, slings, braces, clamps, etc., used for handling, moving, storing, and shipping painted members so the paint will not be damaged.

4.8. **Paint Improperly Applied.** To uncover evidence of improperly applied paint, the Engineer may at any time during construction explore underneath the surface of any paint coats already applied. Repair these areas of investigation at no additional expense to the Department. Whenever unsatisfactory conditions are found, the Engineer may require remedial measures.

Repair or completely remove and replace all paint that has been applied improperly, has been applied to improperly cleaned surfaces, fails to dry and harden properly, fails to adhere tightly to underlying metal or other paint film, or does not have a normal, workmanlike appearance in conformance with this Item. When the final field coat does not have a uniform color and appearance throughout the structure, correct it by the use of whatever additional coats or other corrective measures are required. Remove freshly applied paint that has not yet set with the use of suitable solvents. Remove dried paint films with blast cleaning, scraping, or flame torches, as approved.

4.9. **Storage and Disposal.** Collect all waste generated by cleaning and painting operations as necessary to prevent release into the environment. At a minimum, collect all waste before leaving the jobsite each day. Handle and store the waste as if it was hazardous or Universal Waste until classification is made. Follow the requirements of 30 TAC 335 for on-site handling of the waste. Store waste collected in containers that comply with 49 CFR Part 178. Seal containers containing waste each day before leaving the jobsite.

Test a representative sample of waste using EPA Test Method 1311, “Toxicity Characteristic Leaching Procedure” (TCLP), to determine existing metal and organic content. Handle and dispose of non-hazardous waste as a “Special Waste” as defined in 30 TAC 330.2 or as directed. Provide documentation showing disposal of the waste was done in a suitable landfill holding permits to handle this type of material. Dispose of hazardous waste in compliance with applicable waste rules and regulations. Transport hazardous waste using a permitted transporter and dispose of in an authorized hazardous waste facility.

When the plans specify the existing coating to be removed contains hazardous materials and steel grit is used as the abrasive, the waste generated is classified as hazardous or Universal Waste regardless of the results of the TCLP. For manifesting purposes, the Department is considered the waste generator for paint removal wastes generated from structures owned or controlled by the State. Dispose of this waste in compliance with applicable waste rules and regulations as specified above and by the Contract.

Provide copies of all test reports and transportation manifests to the Engineer before shipping waste. Provide signed original manifests to the Engineer verifying all steps of the handling and disposal process were correctly handled.

4.10. **Miscellaneous.** Notify the Engineer of any condition that may require the repair or replacement of any portion of the bridge.

Stencil on the exterior face of the outside beam the control, section, and structure number upon completion of the painting operations for each structure as directed. Stencil on the interior face of the outside beam the completion date of the painting operation. Do this work at each end of the structure where painting is specified.
5. **MEASUREMENT**

When this Item is specified on the plans to be a pay item, this Item will be measured by the lump sum or by each structure, structure unit, or group of structures as shown on the plans.

6. **PAYMENT**

When this Item is specified as a pay item, the work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the price bid for “Cleaning and Painting Existing Structures,” “Cleaning and Painting Existing Railing,” or “Cleaning and Painting Existing Piling” for the system specified and, when paid by each, for the structure description by reference number. “Cleaning and Painting Existing Structures” includes painting of railing and piling unless otherwise shown on the plans. This price is full compensation for paint; cleaning, spot painting, and painting; removal of vegetative obstructions; containment systems; traffic protection and scaffolding; disposal of waste; and materials, equipment, labor, tools, and incidentals.

When the Item is not specified as a pay item, the work performed and materials furnished in accordance with this Item will not be measured or paid for directly but will be subsidiary to pertinent Items.