

ITEM 573.1014NN10 - FIELD CLEANING AND PAINTING - TOTAL REMOVAL TO SP-10 - ZINC RICH EPOXY PRIMER PAINT SYSTEM

DESCRIPTION

This work shall consist of pressure washing, solvent cleaning as necessary, and abrasive blast cleaning steel to remove all foreign matter, corrosion producing contaminants, paint, rust, rust scale, loose and tightly adherent millscale, and painting steel surfaces with a three-coat organic zinc rich epoxy primer system.

Abrasive and Paint shall be sampled on site and tested by an independent laboratory hired by the Contractor, as per this specification.

MATERIALS

A. Water for Pressure Washing. Water for pressure washing shall be clean, fresh potable water. Use of salt water is strictly prohibited. Recycling of spent water will not be allowed.

B. Soluble Salt Remover. Chlor-Rid[®] soluble salt remover, manufactured by Chlor*Rid International Inc. or approved equal.

C. Abrasive for Blast Cleaning.

1. *Type:*

Abrasive material for blast cleaning shall be recyclable steel grit.

2. *Properties:*

a. New Abrasive:

The new abrasive shall be suitable to remove paint, rust, rust scale as well as intact, tightly adherent millscale.

The chemical and physical properties of new abrasive used in blast cleaning operations shall conform to the latest edition of SSPC AB 3 with the following modifications: Section 4.1: the Contractor shall be responsible for selecting the size, blend, and hardness of the new abrasive to meet the requirements set forth by this specification. Section 4.4: Abrasive containing heavy metals such as chromium, lead, mercury, etc. will not be allowed. The Engineer will sample the new abrasive and send to the laboratory for a sieve analysis. A record of the results shall be kept on file.

Prior to the commencement of blasting work the Contractor shall submit to the Engineer a certification of conformance to all requirements of SSPC AB 3 supplied by the abrasive supplier or the laboratory, including results of testing to substantiate the certification.

b. Recycled Abrasive:

The chemical and physical properties of abrasive shall conform to SSPC AB 2. The recycled abrasive shall be free of all paint, chips, rust, millscale and other foreign material prior to and after each use. Abrasive containing heavy metals such as chromium, lead, mercury, etc. in other than trace amounts will not be allowed. All equipment used for cleaning abrasive shall be specifically designed for this purpose and approved by the Engineer. As part of the Contractor's Quality Control Plan, the Contractor shall have samples of the recycled abrasive work mix taken daily and tested as per SSPC AB 2 for non-abrasive residue, water-soluble contaminants and oil content prior to the commencement of blasting operations. The results of such testing and any resulting actions shall be made available to the Engineer daily on a timely basis. The Contractor shall also provide the Engineer with lead-content test results weekly as performed by the laboratory.

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3. *Working Mix/Profile:*

It is the responsibility of the Contractor to maintain a balance in the size distribution of the abrasive work mix for the duration of the job. The work mix shall not be predominantly coarse or fine, and shall be maintained through proper removal of expended abrasive and its timely replenishment. Once the depth of the profile (anchor pattern) on the blasted steel is achieved to the requirements of this specification, the Engineer will take a sample of the work mix and send to the laboratory for a sieve analysis according to ASTM C 136. The results shall be made available to the Engineer and kept for reference for the project duration. A work mix sample shall be taken by the Engineer and sieve analysis performed by the laboratory as described above any time that the Engineer finds the profile is outside the specified limits, at no cost to the State.

- D. Paint and Thinner. All paint arriving at the jobsite shall be certified by the manufacturer by letter to the Contractor and the Engineer as being identical in all aspects to that most recently tested by the manufacturer under NTPEP. All batches arriving at the jobsite shall have such certification. The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. No re-qualifying of out-of-compliance paint by the manufacturer shall be allowed. Paint that has expired shall be removed from the work site immediately. Only paint and thinner arriving at the work site in new, unopened containers shall be used. Containers of paint shall be labeled with the manufacturer's name, product name, batch number, color and date of manufacture.

All new paint to be applied to the structure shall be produced by the same manufacturer. Thinners used must be appear on the data sheet for the paint being thinned.

Each single coat of paint shall be a color different from the others. The color of the primer, stripe and the intermediate paints are the Contractor's option. The colors must provide substantial contrast with the underlying substrate, and other coats. The color of the finish paint shall be as specified in the Contract Documents. The Contractor shall submit samples of each coat, in the selected color, to the Engineer at the start of cleaning work.

One of the following paint systems shall be used:

<u>Ameron</u>	<u>Carboline</u>	<u>Sherman Williams</u>
Amercoat 68HS	Carbozinc 859	Zinc Clad III HS
Amercoat 399	Carboguard 888	Macropoxy 646
Amercoat 450H	Carbothane 133 LH	Acrolon 218 HS

The zinc in the primer shall conform to ASM D520, Type II.

1. Third Party Certified Laboratory. The Contractor shall submit to the Engineer prior to commencement of work the name, address, telephone number and email address of an independent third-party laboratory selected to perform testing as outlined in these specification requirements. The Contractor shall submit to the Engineer documentation that the selected laboratory has the necessary experience and equipment to perform testing of paint, thinner and abrasive samples as outlined in these specification requirements, and that persons performing analyses are qualified to perform such tests. This third-party laboratory shall be referred to from this point forth in this specification as "the laboratory".
2. Paint and Abrasive Sampling and Testing. The paint will be sampled and tested for consistency of formulation properties between batches and in comparison to that tested under NTPEP. The Engineer

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will submit to the laboratory for testing a sample of each batch of paint (for each coat) supplied to the jobsite and considered for use. Specifically, each sample shall comprise a randomly selected, new, factory-sealed, unopened container of each paint component (Part A, Part B, etc) of the same unit volume as that supplied to the job (i.e. 5 gallon bucket). In addition, one unopened container of the thinner recommended by the paint manufacturer to be used for each coat of paint shall also be randomly selected and submitted for testing for each shipment of thinner arriving new to the job. The paint and thinner samples shall be randomly chosen and sealed with self-adhesive tags at a minimum of two spots each that extend from cover to container and tear if sample is tampered with. Each tag shall be initialed by the Engineer, and shipped to the laboratory in a manner previously agreed to between the laboratory and Contractor. Shipping costs are the responsibility of the Contractor. A chain of custody form shall be signed and dated by all handlers and laboratory with each shipment. The laboratory shall fax a copy of the chain of custody form to the Engineer upon receipt and keep the original on file. The samples shall be selected and submitted for testing with sufficient lead time to obtain test results prior to use of the sampled paint batch. Painting with a sampled batch of paint will not be allowed until satisfactory test results are obtained by the Engineer for that batch. Delays in the start of painting (and its associated costs or implications) due to late or unacceptable test results are the responsibility of the Contractor with no additional costs to the State.

The paint samples shall be tested by the laboratory for the following properties *Percent Pigment, Volume Solids, Weight Solids, weight per gallon (mixed), and Zinc Content in Dry Film (for primer)*. In addition, each sample (part A and part B separately) shall be Infrared (IR) analyzed in its wet stage upon opening at laboratory. The Engineer will give the Contractor and the laboratory a copy of the NTPEP test results for the paint system chosen. Results of paint sample testing shall be reported as PASS/FAIL when compared to the NTPEP test results: A five (5) percent deviation in these properties will be allowed, except for *Weight per Gallon*, where a maximum 0.03 kg/l deviation will be tolerated. The resulting graphs of the IR fingerprinting shall be compared visually by the laboratory to those obtained from NTPEP testing and judged for substantial conformance. Samples passing such a comparison test shall be labeled as PASS in this category in the report. Samples of thinner shall be IR analyzed as well, and results compared to IR results provided by the coatings manufacturer to the laboratory. Thinner samples exhibiting substantial conformance shall be reported as PASS.

The laboratory report for this testing shall reflect the name of the paint (or thinner) tested, product number, batch number, date sampled, date(s) tested, as well as the signature of the chief chemist.

All costs associated with sampling, shipping, testing and reporting as described above shall be included in the price of this item.

- E. Product Data and MSDS Sheets. The product data sheet accompanying the paint shall include the following information: Volume solids, Weight Solids, Finish, color, zinc content in dry film (primer only), weight per gallon, VOC content, Recommended Wet Film Thickness Range, Recommended Dry Film Thickness Range, Minimum & Maximum Drying/Recoating Schedule at various temperatures and humidity, Pot Life, Sweat-In-Time, Recommended Reducer, Minimum & Maximum Profile Range, Mixing Ratios, Temperature – Humidity – Dew Point Requirements.

The Contractor shall provide a letter from the paint manufacturer to the Engineer describing a test method and criteria to validate proper dry prior to top-coating or in the case of the finish coat, to exposure.

The latest copies of the product data and MSDS sheets for all paints, solvents and thinners will be passed out by the technical representative of the paint manufacturer to all parties present. MSDS sheets will be required for all material received.

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CONSTRUCTION DETAILS

All structural steel members, railings, downspouts, and other miscellaneous steel items as indicated by the Contract Documents shall be cleaned of dirt, debris, foreign matter, chemical contamination, soluble salts, paint, rust, rust scale, loose and tightly adherent millscale, and painted with three full coats and one stripe coat of organic zinc rich epoxy primer paint system.

A. Quality Control and Assurance. Quality Control (QC) is the responsibility of the Contractor to ensure compliance with the requirements of this specification and the Quality Control Plan. Quality Assurance (QA) is the State's prerogative to verify that Quality Control is being performed by the Contractor.

1. Quality Control Technician (QCT)

The Contractor shall provide a Quality Control Technician (QCT) that has successfully completed National Association of Corrosion Engineers (NACE) inspection training, is NACE Certified, and has a minimum of five (5) years verifiable experience performing quality control inspection on bridge painting projects that have involved full removal of coatings using abrasive blasting. The QCT shall be responsible for:

- The inspection and the acceptance of the Contractor's work prior to the QA inspection.
- Ensuring that all materials used meet the criteria set forth by this specification, that all tests outlined by this specification are performed, and that all the requirements set forth by this specification are met.
- The Quality Control Plan is enforced.
- The Contractor's work exemplifies good, industry recognized work practices in all surface preparation and coatings related work as generally described in, but not limited to, SSPC PA-1 and as amended by these specification requirements.
- Containment and environmental controls pertaining to surface preparation and coatings work

The Contractor shall hire a sufficient number of QCT's as needed to ensure that the requirements of this specification are met on all operations.

If the Engineer finds that a QCT is not competent to ensure the quality of all work as described herein, that QCT shall be replaced with one that meets the above qualifications at no additional cost to the State.

2. Quality Control Plan (QCP)

The Contractor shall submit a Quality Control Plan to the State a minimum of 14 calendar days prior to the pre-Construction meeting. The QCP shall describe in detail, but not be limited to:

- Description of equipment used to deliver all the requirements of this specification (both production and inspection), their capacity, any calibration if applicable.
- Discussion of the containment enclosure and safe inspection access.
- Detailed description of each inspection hold-point and discreet quality control activities to be carried out for each one.
- Frequency and method of QC for all aspects of pressure washing, blasting and painting operations as required by this specification and by general good work practices.
- Source of water for pressure washing.
- Techniques to address cleaning and painting of enclosed, confined or limited access areas of structural steel as may be found on the truss or other sections of the bridge(s).
- Description of frequency of sampling/testing and turnaround of results for all testing required by this specification.
- Format of logging daily QC activities, location of logs, format of daily QC reports for all operations.

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- The name and cell phone number of the QCT(s), the names of all the Contractor's representatives on the site including their position and/or duties. The Engineer may order the QCP amended as work progresses to include other information deemed necessary to ensure quality of work.

B. Inspection Equipment and Specifications

Prior to the start of work the Contractor shall supply the Engineer with the following inspection equipment and specifications. No work shall begin until these materials have been delivered and accepted by the Engineer.

1. Inspection Equipment:

- a. Two (2) Type II Magnetic Fixed (Constant Pressure) Probe Dry Film Thickness (DFT) gages for use over ferrous substrates, capable of using separate plug-in probes and equipped with three separate miniature probes (straight, 45°, 90°) for limited access areas. The gages shall have a menu-driven display, be capable of switchable metric/imperial units, be capable of guiding the user thru the calibration of the gage on a profiled, blasted surface with a sequence of on-screen instructions, have a backlight on the display, and easily provide the following statistics to the user: number of readings, mean, standard deviation, coefficient of variation, highest and lowest readings. Each gage shall be equipped with plastic or non-magnetic calibration shims of known thicknesses and certified as calibrated to NIST plates. The shim set shall contain the following thickness values: 25, 50, 125, 250, 500 µm. The gages shall be capable of operating in a temperature range of 0°- 50°C and run on AA or AAA batteries, which are easily obtainable. Type 1 Magnetic Pull-Off gages (or "banana" gages) are not acceptable.
- b. Two (2) Compact Sling Psychrometers
- c. Two (2) Spring-loaded micrometers with adequate supplies of Testex Press-O-Film X-Course Replica Tape to inspect all blast-cleaning work.
- d. Two (2) magnetic Surface Temperature Thermometers accurate within 1°C.
- e. Two (2) pocket-sized 30X microscopes with integral light source
- f. Two (2) Wet Film Thickness (WFT) Gauges, Square or Rectangular Notch Type, metallic, capable of measuring 25 µm to 500 µm in 12.5µm or 25 µm increments
- g. Two (2) Pocket Type Air Thermometers, capable of -10°C to 40°C
- h. One (1) Recording Thermometer capable of recording temperature and humidity on a paper chart for a duration of 8 days, with a temperature range of 0 - 38°C, minimum accuracy of ±1°C , and a humidity range of 0 - 100%R.H. Thermometer should come with an adequate supply of paper charts for monitoring all painting operations.
- i. One (1) portable, battery-powered light meter with digital readout, capable of 20-2000 lux.

2. Specifications

- a. One copy of SSPC Systems and Specifications Painting Manual Volume 2, 2005 Edition, or one (1) separate bound copy of each of the following Steel Structures Painting Council (SSPC) specifications:
 - i. SSPC-SP 10 – Near-White Metal Blast Cleaning
 - ii. SSPC-SP 3 - Power Tool Cleaning
 - iii. SSPC-SP 1 - Solvent Cleaning
 - iv. SSPC PA 2 Paint Application Specification No. 2- Measurement of Dry Film Thickness with Magnetic Gages
 - v. SSPC-VIS 1-02, Guide and Reference photographs for steel surfaces prepared by dry abrasive blast cleaning (Publication # 02-12).
 - vi. SSPC AB-2 Specification for Cleanliness of Recycled Ferrous Metallic Abrasives.
 - vii. SSPC AB-3 Specification for Newly Manufactured or Re-Manufactured Steel Abrasive.
 - viii. SSPC TR-3/NACE Publication 6A192 - Dehumidification and Temperature Control During Surface Preparation, Application, and Curing for Coatings/Linings of Steel Tanks, Vessels, and Other Enclosed Spaces

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- C. Surface Preparation. Steel surfaces shall be prepared for painting by a combination of pressure washing and solvent cleaning as necessary to remove dirt, grease, oil, droppings, salt and other contaminants, and abrasive blast cleaning to SSPC SP-10. Heavy deposits of rust and scale are to be removed by hand or power tools prior to pressure washing.
1. Hand and Power Tool Cleaning of Heavy Rust and Scale
Steel surfaces shall be cleaned of all heavy rust or rust scale using hand and power tools prior to pressure washing. The intent is to remove all heavy rust or scale, with only a thin, tightly adherent rust remaining. Tarps to collect debris for this operation should be in place and approved by the Engineer prior to the start of this work.
 2. Pressure Washing
 - a. *Chloride Remediation:* The soluble salt remover shall be mixed with the water for pressure washing at a dilution ratio as recommended by its manufacturer. The Contractor shall follow all recommendations and methods from the soluble salt remover manufacturer regarding use of the remover and recommended equipment to assure that proper dilution of the soluble salt remover is maintained during the pressure washing operations.
 - b. *Equipment Requirements:* All steel surfaces to be painted shall be pressure washed using equipment operating at a minimum pressure of 21 MPa, with a minimum flow of 15 L/minute.
 - c. *Cleanliness:* Diligence shall be used when pressure washing to ensure that all areas of steel are properly cleaned, including interior areas of complicated members such as lattice boxes, chords, etc of any truss section. When pressure washing rusty or pitted areas, the wash speed shall be slowed to enable the soluble salt remover to penetrate. These areas of rust shall be washed at a maximum rate of 0.5 m² per minute. The pressure washer nozzle shall be held at a distance of 150 mm to 300 mm from the steel surface. Any cleaning that is done at distances greater than this shall be rejected and re-cleaned as per this specification at no additional cost to the State. Steel surfaces shall be cleaned from the top down to avoid re-contaminating areas already washed. When the washing is completed, the cleaned surfaces shall be visibly free of dust, dirt, oil and grease, animal waste, salts, and other debris. All surfaces shall be visually inspected for oil and/or grease contamination. Suspect areas should be tested using a clean, white lint-free cloth or by spraying with an atomized mist of distilled water. Staining on the white cloth or beading of the mist into droplets of water indicates the presence of oil or grease contamination. Any areas displaying oil or grease contamination shall be cleaned as per SSPC SP-1 Solvent Cleaning. If a degreaser is used it shall be water-based and pH neutral and shall be completely rinsed off. Upon completion of cleaning the areas shall be free of oil and grease. *Grease or oil left remaining on the surface will be picked up by the abrasives during blasting and possibly re-deposited on bare steel during recycling.*
 - d. *Ambient Conditions:* Pressure washing shall only be allowed when ambient air temperatures are greater than 4.5°C and rising. In no case shall pressure washing be allowed when spent wastewater could freeze on roadway or bridge surfaces, or in any other way create a hazardous situation. The steel surfaces shall be allowed to completely dry after pressure washing and before subsequent abrasive blast cleaning.
 - e. *Containment:* During washing operations, a containment shall be suspended around and beneath the work area to contain all paint chips, corrosion residue, and other solid particles that become dislodged by pressure washing. The containment for pressure washing is intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. The

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containment may be constructed of water permeable or water impermeable materials. Spent washwater will not require collection and will be allowed to fall to the underlying road, ground, or waterway, providing the other requirements of this specification are met. The exception for the collection of spent washwater will be for structures over a public water supply. When a bridge crosses a public water supply the spent washwater must be diverted, or collected, and disposed of on the adjoining land mass, at a location away from the waters edge. All solid residue shall be contained, collected, and allowed to air dry for treatment and disposal as hazardous paint removal waste under a separate item. The containment provided shall also prevent all spray and residue from falling on or interfering with traffic, pedestrians, or surrounding property, above or below the structure. Care shall be exercised to ensure that vehicles, pedestrians, and property are not exposed to the cleaning process.

- f. *Maximum Delay to Blast Cleaning:* To minimize salt contamination of the washed surfaces, subsequent blast cleaning work shall be performed as soon as the steel is deemed dry by the Engineer. No more than 48 hours shall elapse between determination of dry steel by the Engineer and commencement of blast-cleaning work of the washed steel. If more than 48 hours elapse or the steel surfaces have become dirty or salt-laden, they shall be rewashed in accordance with this specification at no additional cost to the State.

3. Blast Cleaning

- a. *Blast Equipment:* The equipment shall sustain blast nozzle pressures of 620-689 kPa regardless of the number of blast operators employed in the blast cleaning operations. Nozzle pressure at each nozzle shall be checked at the beginning of each blast shift by the Contractor using a needle gauge in the presence of the Engineer. All equipment and compressors used in the cleaning operation shall be equipped with filters and traps to prevent moisture, oil, and other contaminants from being deposited on clean surfaces. The air cleanliness shall be verified with the white blotter test in accordance with ASTM D 4285 at least once per shift for each compressed air system.
- b. *Inspection Access.* The Contractor shall provide safe, stable, and direct access to the work area with a minimum of 535 lux of light for the Engineer's inspection.
- c. *Local Work Standard.* Steel surfaces to be blast cleaned shall be accepted by visual comparison to a prepared "local work standard". A 300 mm by 300 mm local work standard shall be prepared for each blasting shift, and shall represent steel that is typical of the surface conditions found in the area to be blasted. More than one local work standard may be necessary if the cleaned steel differs significantly from the photographic standards due to surface conditions or other factors. If the size of the local work standard as defined above cannot be achieved due to the configuration or size of the steel being cleaned, then the Engineer will dictate the size of the local work standard necessary. The local work standard shall be blasted to meet both the SSPC Blast Cleaning and Anchor Profile requirements described below. The following parameters shall be recorded upon approval of the local work standard: blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle to the steel, and approximate angle of blast. The local work standard shall be coated with a clear urethane to protect it from flash rusting or contamination with the exception of a 100 mm by 100 mm strip which shall not be urethane-coated and left bare. This section shall be used to reference the anchor profile imparted to the work standard. Blast cleaning shall not begin until a local work standard that meets both the SP-10 and anchor profile requirements of this specification is approved by the Engineer for that work area. Once all blast cleaning work is performed and approved for the work area, the local work standard shall be re-cleaned and prepared for painting.

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- d. *SSPC Blast Cleaning Specification:* Abrasive blast cleaning shall be done on all steel surfaces to be painted in accordance with SSPC SP-10 Near White Blast Cleaning. The prepared work standard(s) shall conform to SSPC VIS 1-02, "Guide and Reference Photographs for Steel Surfaces Prepared By Dry Abrasive Blast Cleaning" as agreed upon by the Contractor and the Engineer. In the event of dispute regarding the required blast cleaning, the written SSPC SP-10 specification shall prevail.
- e. *Anchor Profile.* The blast cleaning shall impart a 50 to 100 micron anchor profile to the blasted steel. It is the responsibility of the Contractor that the profile on all blasted steel meet the criteria set forth in these specification requirements prior to inspection by the Engineer. The Contractor may use any method described by ASTM D 4417 for anchor profile control during work, but must include at least five measurements in his log using Method C (using X-Course replica tape) for every 100 square meters of steel prepared. At least one of the measurements shall be performed on the bottom face of the bottom flange of stringers, girders or floor beams if these elements are in the (blasting) work area. Anchor profile measurements should be performed only after the surfaces have been blown down, or debris may interfere with measurements.

If the anchor profile imparted by the blasting operation does not meet the requirements of this specification, blast cleaning shall be discontinued immediately. The process and/or materials shall be modified to provide the specified profile. A sample of the work mix will be taken by the Engineer, tested and results reported for sieve analysis as described in section Materials, C., 3 of this specification, and compared to that originally taken on the job. All costs relating to this sampling, shipping, testing and reporting shall be paid for by the Contractor. The boundaries of the non-compliant profile areas should be established by taking as many additional anchor profile measurements as necessary. Areas that exhibit insufficient profile depth shall be re-blasted to the proper profile. Areas that contained excessive profile shall be primed as per specific recommendations made by the paint manufacturer by letter to the Contractor and the Engineer.

The profile measurements shall be taken on smooth, non-pitted areas. The existing steel surface may be rough due to pitting. Anchor profile measurements for compliance to this specification will be made in non-pitted areas. Smoothing of pitted steel is not required.

- f. *Calibration of Dry Film Thickness (DFT) gage(s).* After approval of the blast cleaning work by the Engineer, the Contractor shall calibrate all DFT gages used for quality control of the work over the steel surface according to the gage manufacturer's directions prior to applying the primer coat. The Contractor shall ensure that all gages used for quality control are equipped with NIST traceable standards (or "foils") for calibration purposes. These should include a foil for thicknesses just below and above the recommended thickness range of the primer coat and combined thicknesses of successive coats. A record of calibration of gages and a description of the method used shall be kept on log by the Contractor.
- g. *Removal of Fins, Tears, or Slivers.* A grinder shall be used to remove all fins, tears, slivers or any other burred or sharp edges that become evident after blasting, and retextured to reproduce an acceptable anchor profile as per this specification or the paint manufacturer's minimum recommendations. The Contractor may elect to satisfy the requirements of this section after the prime coat of paint has been applied provided that such imperfections are ground, the steel retextured, and re-primed in accordance to the requirements of this specification.

Any sharp defects of considerable size shall be brought to the attention of the Engineer prior to grinding, particularly if located on the bottom third of rolled beams, riveted girders or truss members. Cracks in steel shall be brought to the immediate attention of the Engineer. The

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manufactured edge of the structural members shall not be ground; only random, sharp anomalies on these edges.

- h. *Miscellaneous:* All cleaned surfaces will be inspected by the Engineer prior to painting. Any areas that are painted before being inspected shall be cleaned and restored to the SP-10 blast specification and repainted at no additional cost to the State. If the cleaned surface begins to rust or becomes contaminated in any matter prior to applying primer, the surface shall be restored to the SP-10 specification at no additional cost to the State.

Throughout abrasive blast cleaning work, care shall be taken to protect newly painted surfaces from the cleaning operations. Tarps, covers, or other devices approved by the Engineer shall be used to protect new paint from contamination or damage. Contaminated areas of new paint shall be cleaned as necessary prior to the next coat of paint in a manner that does not cause damage or otherwise have a detrimental effect on the paint. Damaged paint shall be re-blasted to the required condition, and then repainted at no additional cost to the State.

Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, structural steel surrounding bridge joints, and similar surfaces that are marginally accessible and difficult to clean.

All blast-cleaned surfaces shall be blown down with clean compressed air to remove spend abrasive dust and shall be free of all abrasive, paint debris, oil or grease.

After cleaning operations are completed and prior to inspection, all residue generated by the cleaning work shall be removed by vacuuming using HEPA filtered vacuums. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3µm in diameter, or larger.

D. Painting

1. Coats of Paint. Painting shall consist of applying three full coats of new paint and one stripe coat to all surfaces cleaned to SSPC SP-10. The paint shall be applied in the following order; primer, stripe coat using primer paint, intermediate coat, and the finish coat.
2. Enclosure. All painting shall be performed within the containment enclosure with adequate mechanical ventilation to meet OSHA regulations for worker exposure to solvents, fumes, lead and other provisions. When mechanical ventilation is provided, filtration of the exit air shall not be required. No additional payment shall be made for the cost of ventilation. All lighting used in a containment or enclosure must be explosion proof.
3. Material Storage. Paint in storage shall be protected from damage and maintained between 4.5°C and 29.5°C unless the manufacturer's recommendations for temperature are more restrictive.
4. Mixing Paint. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use. The primer paint must remain under continuous agitation during application to prevent settlement of zinc dust unless prohibited by the paint manufacturer in writing. Use of partial kits will not be allowed.
5. Solvents and Thinners. Paint may be thinned only if approved by the Engineer and performed in the presence of the Engineer. The Contractor shall keep a record of thinner type and amounts used, and at which locations on the bridge (bridge ID, span#, exact description of steel painted). If approved, the

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paint may be thinned to the limits recommended by the paint manufacturer in the data sheet but under no circumstance should thinning cause the paint to exceed VOC levels of 340 grams/liter (500 grams/liter for primer). Use of unauthorized solvents and thinners, or using excess amounts of solvents and thinners is prohibited. Any area where unauthorized or excessive solvents or thinners are used shall be restored to SP-10 by the Contractor at no expense to the State.

6. Ambient Conditions.

- a. *Temperature.* Paint shall be applied only when the receiving (steel) surface and ambient temperatures are 5°C to 38°C unless the manufacturer's recommendations for temperature are more restrictive.
- b. *Humidity.* Paint shall not be applied when the relative humidity is more than 85% unless the coating manufacturer's requirements are more stringent. Minimum humidity requirements shall also be met.
- c. *Dew Point Differential.* Paint shall not be applied unless the steel and air temperatures are at least 3° C greater than the dew point temperature. No paint shall be applied unless the receiving surface is absolutely dry.
- d. *Inspection of Temperature, Humidity and Dew Point.* The Contractor shall check ambient conditions before paint work begins each day and every four (4) hours thereafter, recording all conditions in a log book that is to be presented to the Engineer upon request. Ambient conditions shall be checked more frequently if weather appears to be worsening or if weather changes for the bridge location are predicted by the National Weather Service. If indirect heating or humidification/dehumidification of the enclosure is employed, ambient and steel conditions shall be checked on an hourly basis or at a frequency deemed appropriate by the Engineer.

7. Humidification and Heating. Use of indirect heating or humidity conditioning equipment for the containment enclosure will be allowed for painting provided:

- a. the proper steel surface temperature, humidity, ambient (enclosure) temperature and dew point differential are maintained at all locations to be painted immediately prior to, during and after painting for a duration as recommended by the paint manufacturer for proper film drying. The Contractor should assure that the proper conditions are maintained at steel locations close to the tarps, such as the fascia beams.
- b. The conditioning of the containment enclosure is performed according to the guidelines of SSPC TR-3/NACE 6A192.
- c. The Contractor certifies and provides evidence that the equipment employed is capable of providing the required conditions with reasonable reserve capacity for temperature/humidity fluctuations.
- d. The Contractor can demonstrate ability/resources to repair malfunctioning equipment immediately on-site or has backup equipment available on-site or nearby without a lapse in surface & ambient specification requirements in the event of a heating or humidification equipment failure.
- e. Improper film drying/curing as a result of equipment malfunction or lack of capacity shall result in the affected areas being re-cleaned and repainted according to this specification at no additional cost to the State.
- f. No painting shall be allowed with or without containment-conditioning equipment during the months of December, January and February.

8. Paint Application.

- a. *Method of Application.* Paint shall be applied using spray methods. Airless spray will be allowed if it does not deposit excessive material or creates a situation where it is impossible to avoid excessive paint build-up on trusses, lattice-work, areas of excessive bolts or confined areas. If

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conventional spray is used, the air cleanliness shall be verified with the white blotter test in accordance with ASTM D 4285 at least once per shift for each compressed air system.

Bolt and rivet heads shall be sprayed from at least two directions to ensure coverage. Spray application can be supplemented with brushes as needed to work the coating into irregular surfaces. Areas that cannot be painted using spray due to space constrictions shall be painted using small rollers, brushes, sheepskins or daubers if recommended by the paint manufacturer and approved by the Engineer. Areas that may be impossible to paint using spray must receive prior approval by the Engineer for manual paint application. The quality, material and nap length of all roller covers, brushes, and/or daubers shall be as recommended by the paint manufacturer - inferior or unapproved materials shall not be allowed as these can deposit fibers or bristles into the paint film. Paint shall be applied so as to produce a uniform, even coating free of defects including but not limited to runs, sags, drips, ridges, blisters, bubbles, mud cracking, fish eyes, orange peel, cracking, variations in color or gloss, excessive film build, foreign contaminants, or dry overspray. The applied paint shall be clean, dry, cured for the recommended time, and free from surface contamination prior to the application of the next successive coat.

Runs, sags and drips shall not be reason for rejection in difficult to reach areas such as inside lattice, boxes or chords, however every reasonable effort should be made to minimize these defects in such areas.

- b. *Stripe Coat.* The stripe coat shall be applied after the full coat of primer has sufficiently dried as recommended by the paint manufacturer. The stripe coat shall be applied by brush and shall extend a minimum of 25mm away from the following surfaces: all welds, rivets, bolts, nuts, edges of plates and structural members, angles, bearings, lattice pieces or other shapes, corners, and crevices. The stripe coat shall be the same paint used for the primer but with a contrasting color to the prime coat. The stripe coat shall be worked into all crevices and hardware (rivets, bolts, nuts, etc.). All instructions for use of primer paint in this application by the paint manufacturer shall be followed, including but not limited to agitation, mixing, ambient and steel application conditions. No thinning or spraying of the stripe coat paint shall be allowed under any circumstances. Any thinned paint shall be discarded. If it is determined that thinned stripe paint was used on any steel surfaces, these areas shall be allowed to fully dry, and subsequently shall receive an additional stripe coat with unthinned paint at no additional cost to the State. The stripe coat shall be allowed to fully dry as per the manufacturer's instructions prior to application of the next successive coat.

- c. *Paint Film Thickness.* Paint shall be applied to produce a film on all painted surfaces whose dry film thickness (DFT) complies with the range specified by the manufacturer for that coat in the product data sheet. The Contractor shall assure compliance of the DFT for each coat on all painted surfaces prior to inspection by the Engineer. The DFT shall be measured using Type II magnetic gages that have been calibrated over the blasted steel surface as described in section 1.C.vi above to ensure that all measurements indicate thickness of the film above the peaks of the anchor profile.

For all coats, the number and location of DFT measurements and their acceptance/rejection criteria shall be performed in accordance with SSPC-PA 2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness with Magnetic Gages, using Type 2 fixed probe magnetic gages. The Contractor shall take DFT measurements in strict accordance with the SSPC PA-2 specification and keep a log of such readings. The log should indicate where the DFT

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measurements were taken using bridge ID, span#, coat of paint, location (girder, beam, diaphragm, etc) and area(s) checked. Area of steel (in square meters or square feet) shall be accurately estimated for this purpose.

The Contractor shall apply paint at the wet film thickness (WFT) recommended by the paint manufacturer to assure a DFT within the expected range throughout the painted steel.

The boundaries of areas failing to meet the specified minimum DFT shall be delineated with additional readings, and be top-coated with the same type of paint to bring the coat into compliance within the recommended dry film thickness range. The top-coating must be performed within the paint manufacturer's specified recoat window.

Similarly, if the DFT for the applied coat is above the maximum allowed, the non-complying area shall be delineated with additional readings. These areas will be allowed to remain if the Contractor provides the Engineer a written statement from the paint manufacturer indicating that the excess thickness is not detrimental to the adhesion of the system over the actual anchor profile under thermal expansion and contraction stresses for temperature variations between -49°C to 49°C.

- d. *Painting and Drying Schedule.* The prime coat shall be applied to blast-cleaned surfaces immediately upon approval by the Engineer. Under no circumstances shall approved, blast-cleaned steel remain unprimed for longer than six (6) hours. Failure to apply primer to such surfaces within six hours shall result in re-blasting the surface in accordance with the local work standard or SSPC SP-10 at no additional cost to the State. If blast-cleaned surfaces do not retain their approved cleanliness within the time frame above prior to painting, they shall be re-cleaned to match the local work standard or SSPC SP-10 at no additional cost to the State.

The Contractor shall abide by the drying schedule for each coat as recommended by the paint manufacturer at the preconstruction meeting. The Contractor shall then verify proper dry of the applied coat using a test method recommended by the paint manufacturer, and report its result to the Engineer prior to requesting approval for top-coating. No more than 48 hours shall lapse between the identification of proper dry of a coat and the application by the Contractor of the subsequent coat. This restriction is intended to reduce the likelihood of salt contamination between coats of paint.

9. *Enclosure Operations.* When painting inside an enclosure adequate mechanical ventilation shall be supplied to meet OSHA regulations for worker exposure to solvents, fumes, lead and other provisions. When mechanical ventilation is provided, filtration of the exit air shall not be required. No additional payment shall be made for the cost of ventilation. Any lighting used in a containment or enclosure must be explosion proof.
10. *Protection of Surrounding Areas.* Complete protection against paint spatter, spillage, wind blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular, marine or other traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure.
11. *Stenciling.* After the finish coat of paint has dried, the Contractor shall stencil the following information on the inside face of one fascia member at the northern (or eastern) abutment of each bridge, at a location close to the Bridge Identification Number (BIN) Plate and easily discernable, unless otherwise directed by the Engineer:
- Month and year of completion

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- Contract number
- SP10
- Name of Paint Manufacturer
- Name of Primer/Name of Intermed/Name of Finish Coat
- Name of Contractor
-

The stenciled lettering should be 150 mm in height and be a contrasting paint color to the top coat.

METHOD OF MEASUREMENT

The work under this item will be measured on a lump sum basis.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work. The cost of providing protection against damage during pressure washing and paint application shall be included in the bid price. Payment for the containment and disposal of dust and paint waste generated by surface preparation work shall be paid for under other items; however, payment for the collection of paint removal waste for deposition in the paint removal containers shall be included in this item. Progress payments shall be made based on the percentage of the structure cleaned and paint applied.