DMS - 8101

STRUCTURAL STEEL PAINTS — PERFORMANCE

EFFECTIVE DATE: SEPTEMBER 2007

8101.1. Description. This Specification governs the performance requirements and testing of structural steel coatings and describes the pre-approval procedures.

8101.2. Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

8101.3. Material Producer List. The Materials and Pavements Section of the Construction Division (CST/M&P) maintains the Material Producer List (MPL), titled “Structural Steel Paints — Performance,” require sampling and testing before use.

Tex-736 describes the sampling procedure.

8101.4. Bidders’ and/or Suppliers’ Requirements. Before any material is considered, it must be of manufacture and product code or designation shown on the MPL.

8101.5. Regulation Compliance. It is not a requirement or intent of this Specification to cause infringement of any health, safety, or environmental regulation. Some paints are harmful to the health, and since the Engineer cannot anticipate or control the many different conditions under which cleaning and painting may be accomplished, the Contractor is responsible for the safety of his operation and for compliance with all federal, state, or local regulations.

NOTE: The material manufacturer must supply a Material Safety Data Sheet to comply with OSHA's Hazard Communication Standard 29 CFR § 1910.1200.

8101.6. Sampling and Testing. The Department or a designated commercial laboratory will sample and test in accordance with CST/M&P’s appropriate manual of test procedures.

To assure that the paints supplied to projects are of the same quality and composition as the paint samples used for pre-approval and that changes have not occurred without notifying the Department, the Department may use some or all of the following tests to characterize the paints. The Department reserves the right to use whatever tests are necessary.
• Adhesion
  ▪ ASTM D 4541
• Amine Value
  ▪ ASTM D 1652
• Bend Test
  ▪ ASTM D 522
• Blistering
  ▪ ASTM D 714
• Color
  ▪ ASTM D 2244
• Contrast Ratio
  ▪ Federal Test Method 4122
• Density
  ▪ ASTM D 1475
• Dry Time
  ▪ ASTM D 1640
• Epoxide Equivalent
  ▪ ASTM D 1652
• Flash Point, Cleveland Open Cup (COC)
  ▪ ASTM D 92
• Gloss
  ▪ ASTM D 523
• Grind
  ▪ ASTM D 1210
• Infrared Spectrum
  ▪ Tex-888-B
• Leafing
  ▪ ASTM D 480
• Minimum Film Formation Temperature
  ▪ ASTM D 2354
• Percent Pigment
  ▪ ASTM D 2698
  ▪ ASTM D 3723
  ▪ ASTM D 4451


- Percent Solids
  - ASTM D 2369
  - Tex-808-B
- Sag
  - Tex-812-B
- Skinning
  - Tex-811-B
- Viscosity (Poises)
  - ASTM D 2196
  - ASTM D 4287
- Viscosity (Krebs Unit [KU])
  - ASTM D 562
- Volume Solids
  - ASTM D 6093
- Weathering
  - ASTM G 155
- Zinc Dust
  - ASTM D 522.

Address all questions to the Texas Department of Transportation, Construction Division, Director of Materials and Pavements Section (CP51), 125 East 11th Street, Austin, TX 78701-2483.

8101.7. Costs.

Supply all materials for pre-approval testing at your expense.

The Department will normally bear the costs of sampling and testing of project paints. However, the Contractor will bear the costs of sampling and testing of materials that fail to conform to the requirements of this Specification.

The cost of sampling and testing will be that established by the Director of CST/M&P and in effect at the time of testing.

CST/M&P must receive a cashier’s check made payable to "TxDOT Fund" before scheduling a replacement batch. The Contractor may be required to reimburse the Department for the cost of storage and handling of paints failing to meet specified requirements.

The Department reserves the right to conduct random sampling of pre-approved, certified materials for testing and to perform random audits of test reports. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse.

CST/M&P reserves the right to test samples to verify compliance with this Specification.

8101.8. Finished Products. When canned, the finished product must be free from skins and foreign materials.
The Department or a designated commercial laboratory will make consistency, drying, and gallon weight (density) determinations on coatings at 77°F. Tester will measure the consistency with a Krebs Stormer Viscometer.

Tester will run density in accordance with ASTM D 1475 and viscosity in accordance with ASTM D 562.

8101.9. Containers and Markings. Ship the finished products in suitable, strong, well-sealed containers that meet specification and federal requirements and are sufficiently sturdy to withstand normal shipping and handling.

Label the sides of the containers and cases with a durable label, legibly printed with the following:

- manufacturer’s name,
- product designation, including component part,
- batch number,
- date of manufacture, and
- gross weight.

NOTE: The label must be moisture-resistant to withstand outdoor storage for a minimum of 1 yr. When palletizing for shipment, securely attach the label to the outside for easy identification.


Coatings listed in this Article are not specified as high solids (volatile organic content-compliant) coatings. The supplier may qualify a high solids version of any of the coatings providing the supplier can demonstrate that the high solids version is essentially the same coating as the pre-approved lower solid coatings.

Purchase all specified paints on the open market. Secure materials in sufficient time to allow for testing and timely execution of the work. Each of the paints must meet the specified requirements for its type.

The requirements for these paints that are proprietary in nature do not relieve the manufacturer of any obligations relating to patents nor does it give the manufacturer the right to patent infringement.

Supply the chosen coating system from the same manufacturer and one that the manufacturer recommends as a system.

Submit coating samples for preliminary evaluation to the Texas Department of Transportation, Construction Division, Director of Materials and Pavements, 9500 Lake Creek Parkway, Austin, TX 78717. Include a list of structures or jobs within the Texas coastal area that documents satisfactory performance for a minimum of 10 yr.
The Engineer reserves the right to inspect any or all sites listed by the supplier. If inspection is necessary, secure permission from the owner for inspection by Department personnel.

8101.11. **System III Inorganic Zinc Primer.** This primer is a solvent-based inorganic zinc coating of the self-curing ethyl-silicate type.

Supply the coating as either a two- or a three-component system consisting of one container of zinc dust and one or two containers of liquid components.

Package the coating, so that when mixing one can of each component with the others, the mixing of components will be the correct ratios. Applicator must mix the components before application to form the complete coating.

**A. Liquid Component.**
- The density of this component must be within ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- When determined in accordance with Tex-808-B, the percent solids by weight of the clear vehicle must be ±0.7 of the percent value determined from the preliminary evaluation sample and the percent solids of the whole vehicle must be ±1.5 of the percent value determined from the preliminary evaluation sample.
- This component must be a solution of ethyl-silicate containing suspending agents, colorant pigments, and inert filler material. An infrared spectrum of the clear vehicle, obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P. X-ray diffraction patterns of the clear and whole vehicle must match the X-ray diffraction patterns on file at CST/M&P.
- A gas chromatographic analysis of the liquid portion of the coating must match the chromatogram on file at CST/M&P.

**B. Powder Component.**
- This component must contain ±0.2 lb. per gallon of the material contained in the preliminary evaluation sample.
- This component must consist of essentially zinc dust at a minimum of 94.0% zinc metal and must be free of hard lumps or agglomerates of zinc dust.

**C. Activator (optional).**
- The density of the activator component must be within ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of the activator component must be ±1.0 of the percent value determined from the preliminary evaluation sample.
- An infrared spectrum of the activator must match the infrared spectrum of the evaluation sample on file at CST/M&P.

**D. Mixed Coating.**
- When mixed in the correct proportion of vehicle to powder, the resulting material must be of sprayable viscosity.
• Slight agitation must keep the zinc dust properly suspended.
• When applied to blasted steel to achieve a 3-mil dry film, the coating must be water insoluble within 15 min. above 32°F and within 30 min. at 32°F.
• Atmospheric moisture or spray mist must aid in achieving maximum film hardness. Alkali metal salts must not form in the curing process.
• A 3- to 4-mil dry film applied to white metal blasted steel and cured for a minimum of 24 hr. at 70 to 80°F and 50 to 100% relative humidity must withstand temperatures up to 600°F with no film deterioration.
• This coating must have a minimum of 80.0% zinc metal in the dry film.

8101.12. **Epoxy Zinc Primer.** This primer is a polyamide-cured epoxy coating containing a minimum of 84.0% zinc metal in the dry film.

Supply this primer as a three-component system with one of the components being the dry zinc dust.

- The base and curing agent portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of both liquid components must be ±1.0 of the percent value determined from the preliminary evaluation sample.

An infrared spectrum of the vehicle system obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing the two cans of vehicle and the can of zinc dust will be the correct ratio. Applicator must mix the three components before application to form the complete coating.

8101.13. **Epoxy Intermediate Coating.** This coating is a polyamide-cured or polyamide/amine-cured epoxy containing inhibitive type pigments.

- The base and curing agent portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of both liquid components must be ±1.0 of the percent value determined from the preliminary evaluation sample.

An infrared spectrum of the vehicle system, obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing one can of base and one can of catalyst, will be the correct ratio. Applicator must mix the two components before application to form the complete coating.

8101.14. **Urethane Appearance Coat.** This appearance coat is a glossy, acrylic-cured aliphatic urethane-appearance coat recommended by the manufacturer for marine service.

- **The manufacturer recommends the urethane appearance coat** for use over any pre-approved epoxy zinc primer, epoxy intermediate coating, or epoxy penetrating sealer from the same manufacturer.
- The cured film must have a minimum 60° gloss of 85.
Unless otherwise shown on the plans, the color of the urethane appearance coat is light gray to match Federal Standard 595B, Color number 34630.

8101.15. Acrylic Latex Appearance Coat. This appearance coat is a water-borne acrylic latex coating designed for long-term durability on structures.

- The resin system must be acrylic.
- Do not use vinyl-acrylic, styrene-acrylic resins, or cold blends of nonacrylic resins. (Acrylic resins with a small amount of styrene co-reacted into the polymer will be allowed if they pass the accelerated weather testing.)
- An infrared spectrum of the coating must match the infrared spectrum of the evaluation sample on file at CST/M&P.
- The coating must have a minimum Hegman grind reading of four and a minimum sag reading of 8 mils.
- The Krebs-Stormer viscosity must be ±10 KU of the pre-approved sample and have a maximum ICI Cone and Plate viscosity of 3.0 Poises.
- If more than one sample of any color is tested, the density of the subsequent samples must fall within ±0.10 lb. per gallon and the percent solids must fall within ±2.0 percentage value of the original sample.

Do not use universal tint colorants in creating the colors in these paints. Use only:
- colorants dispersed in an acrylic system designed for use with durable, exterior, acrylic latex paints and
- lightfast pigments.

When tested as an appearance coat on a panel primed with the System II epoxy zinc primer for 3,000 hr. in an Atlas Xenon Weather-Ometer (WOM), the acrylic latex must not show any serious failure. A serious failure could be peeling, chipping, blistering, discoloring, cracking, crazing, or eroding away with film thickness loss, splitting, or disbonding.
- A small amount of chalking is acceptable.
- Tester will operate the WOM in accordance with ASTM G 155 using Exposure Cycle 1 with a quartz inner filter glass and Type “S” Borosilicate outer filter glass.

After 3,000 hr. of testing, the coating must have a delta E \( (\Delta E_{L^* a^* b^*}) \) of less than three for white and light colors. For darker colors (\( L^* \) less than 80), the \( \Delta E \) must be less than five.

A pull-off adhesion test run on the panel after 3,000 hr. WOM testing must have a minimum pull-off strength of 400 psi and maximum of 20% adhesion failure of the coating from the primer or cohesive failure. Run the pull-off adhesion test in accordance with ASTM D 4541 using a Type II Fixed Alignment Adhesion Tester.

8101.16. Epoxy Penetrating Sealer. This sealer is a two-package, low-viscosity epoxy coating designed for wetting aged coatings and poorly prepared surfaces, and is essentially free of solvent.

A one mil wet film thickness application must have a set-to-touch dry time of greater than 2.0 hr.
The base and catalyst portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.

The percent solids by weight of the coating must be ±1.0 of the percent value determined from the preliminary evaluation sample. (These percent solids must be determined on the mixed coating and dried for 24 hr. in a silica gel desiccator.)

An infrared spectrum of the systems must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing one can of base and one can of curing agent, will be the correct ratio. Applicator must mix the two components before application to form the complete coating.

**8101.17. Coating Combinations.** The Department allows the use of various combinations of the listed coating on structural steel.

**A. Class “A” Blasted Steel.**

- Combination A (System III)
  - Inorganic Zinc Primer (Shop Painting)
  - Epoxy Zinc Primer (Field Touch-Up Painting)
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination B
  - Epoxy Zinc Primer
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination C
  - Epoxy Zinc Primer
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination D (System IV)
  - Inorganic Zinc Primer (Shop Painting)
  - Epoxy Zinc Primer (Field Touch-up Painting)
  - Acrylic Latex Appearance Coat.

**B. Class “B” Blasted Steel.**

- Combination A
  - Epoxy Penetrating Sealer
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination B
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
C. Class "C" Cleaning.

- Protection System I (Over Coating)
  - Epoxy Penetrating Sealer
  - Epoxy Intermediate Coating (Apply on hand-tool or power-tool cleaned areas without any old primer remaining or areas where the appearance coating is removed and the remaining primer is too thin.)
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.

8101.18. Archived Versions. Archived versions are available.