

All Regional Engineers

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Special Provision for Organic Zinc-Rich Paint System

September 25, 2009

This special provision was developed by the Bureau of Materials and Physical Research in response to the recommendations of the 1999 FHWA/IDOT Bridge Coatings Process Review. It has been revised to comply with recent changes set forth by the Illinois Environmental Protection Agency.

This special provision should be inserted into projects requiring an organic zinc-rich paint system.

The districts should include the BDE Check Sheet marked with the applicable special provisions for the January 15, 2010 letting and subsequent lettings. The Project Development and Implementation Section will include a copy in the contract.

This special provision will be available on the transfer directory September 25, 2009.

80069m

ORGANIC ZINC-RICH PAINT SYSTEM (BDE)

Effective: November 1, 2001

Revised: January 1, 2010

Add the following to Section 1008 of the Standard Specifications:

“1008.05 Organic Zinc-Rich Paint System. The organic zinc-rich paint system shall consist of an organic zinc-rich primer, an epoxy or urethane intermediate coat, and aliphatic urethane finish coats. It is intended for use over blast-cleaned steel when three-coat shop applications are specified. The system is also suitable for field painting blast-cleaned existing structures.

The coating system shall be evaluated for performance through the National Transportation Product Evaluation Program (NTPEP) for Structural Steel Coatings following the requirements of AASHTO R 31, and shall meet the performance criteria listed herein. After successful NTPEP testing, the coatings shall be submitted to the Illinois Department of Transportation, Bureau of Materials and Physical Research, for qualification and acceptance testing.

(a) General Requirements.

- (1) Compatibility. Each coating in the system shall be supplied by the same paint manufacturer.
- (2) Toxicity. Each coating shall contain less than 0.01 percent lead in the dry film and no more than trace amounts of hexavalent chromium, cadmium, mercury or other toxic heavy metals.
- (3) Volatile Organics. The volatile organic compounds of each coating shall not exceed 2.8 lb/gal (340 g/L) as applied.

(b) Panel Preparation for NTPEP testing. The test panels shall be prepared according to AASHTO R 31, except for the following: Test panels shall be scribed according to ASTM D 1654 with a single “X” mark centered on the panel. The rectangular dimensions of the scribe shall have a top width of 2 in. (50 mm) and a height of 4 in. (100 mm). The scribe cut shall expose the steel substrate as verified with a microscope.

(c) Zinc-Rich Primer Requirements.

- (1) Generic Type. This material shall be an organic zinc-rich epoxy or urethane primer. It shall be suitable for topcoating with epoxies, urethanes, and acrylics.
- (2) Zinc Dust. The zinc dust pigment shall comply with ASTM D 520, Type II.
- (3) Slip Coefficient. The organic zinc coating shall meet a Class B AASHTO slip coefficient (0.50 or greater) for structural steel joints using ASTM A 325 (A 325M) or A 490 (A 490M) bolts.

- (4) Adhesion. The adhesion to an abrasively blasted steel substrate shall not be less than 900 psi (6.2 MPa) when tested according to ASTM D 4541 Annex A4.
- (5) Unit Weight. The unit weight of the mixed material shall be within 0.4 lb/gal (48 kg/cu m) of the original qualification sample unit weight when tested according to ASTM D 1475.
- (6) Percent Solids by Weight of Mixed Primer. The percent solids by weight for the mixed material shall be a minimum of 70 percent and shall not vary more than ± 2 percentage points from the percent solids by weight of the original qualification samples when tested according to ASTM D 2369.
- (7) Percent Solids by Weight of Vehicle Component. The percent solids by weight of the vehicle component shall not vary more than ± 2 percentage points from the percent solids by weight of the original qualification samples when tested according to ASTM D 2369.
- (8) Viscosity. The viscosity of the mixed material shall not vary more than ± 10 Krebs Units from the original qualification sample viscosity when tested according to ASTM D 562 at 77 °F (25 °C).
- (9) Dry Set to Touch. The mixed material when applied at 6 mils (150 microns) wet film thickness shall have a dry set to touch of 30 minutes or less when tested according to ASTM D 1640 at 77°F (25 °C).
- (10) Pot Life. After sitting eight hours at 77°F (25 °C), the mixed material shall not show curdling, gelling, gassing, or hard caking.

(d) Intermediate Coat Requirements.

- (1) Generic Type. This material shall be an epoxy or urethane. It shall be suitable as an intermediate coat over inorganic and organic zinc primers and compatible with acrylic, epoxy, and polyurethane topcoats.
- (2) Color. The color of the intermediate coat shall be white, off-white, or beige.
- (3) Unit Weight. The unit weight of the mixed material and the unit weight of the individual components shall be within 0.20 lb/gal (24 kg/cu m) of the original qualification sample unit weights when tested according to ASTM D 1475.
- (4) Percent Solids by Weight. The percent solids by weight for the mixed material shall not vary more than ± 2 percentage points from the percent solids by weight of the original qualification samples when tested according to ASTM D 2369.

- (5) Dry Time. The mixed material shall be dry to touch in two hours and dry hard in eight hours when applied at 10 mils (255 microns) wet film thickness and tested according to ASTM D 1640.
- (6) Viscosity. The viscosity of the mixed material shall not vary more than ± 10 Krebs Units from the original qualification samples when tested according to ASTM D 562 at 77 °F (25 °C).
- (7) Pot Life. After sitting two hours at 77°F (25 °C), the mixed material shall not show curdling, gelling, gassing, or hard caking.

(e) Urethane Finish Coat Requirements.

- (1) Generic Type. This material shall be an aliphatic urethane. It shall be suitable as a topcoat over epoxies and urethanes.
- (2) Color and Hiding Power. The finish coat shall match Munsell Glossy Color 7.5G 4/8 Interstate Green, 2.5YR 3/4 Reddish Brown, 10B 3/6 Blue, or 5B 7/1 Gray. The color difference shall not exceed 3.0 Hunter Delta E Units. Color difference shall be measured by instrumental comparison of the designated Munsell standard to a minimum dry film thickness of 3 mils (75 microns) of sample coating produced on a test panel according to ASTM D 823, Practice E, Hand-Held, Blade Film Application. Color measurements shall be determined on a spectrophotometer with 45 degrees circumferential/zero degrees geometry, illuminant C, and two degrees observer angle. The spectrophotometer shall measure the visible spectrum from 380-720 nanometers with a wavelength interval and spectral bandpass of 10 nanometers.
- (3) Contrast Ratio. The contrast ratio of the finish coat applied at 3 mils (75 microns) dry film thickness shall not be less than 0.99 when tested according to ASTM D 2805.
- (4) Weathering Resistance. Test panels shall be aluminum alloy measuring 12 x 4 in. (300 x 100 mm) prepared according to ASTM D 1730 Type A, Method 1 Solvent Cleaning. A minimum dry film thickness of 3 mils (75 microns) of finish coat shall be applied to three test panels according to ASTM D 823, Practice E, Hand Held Blade Film Application. The coated panels shall be cured at least 14 days at 75 °F \pm 2 °F (24 °C \pm 1 °C) and 50 \pm 5 percent relative humidity. The panels shall be subjected to 300 hours of accelerated weathering using the light and water exposure apparatus (fluorescent UV - condensation type) as specified in ASTM G 53-96 and ASTM G 154 (equipped with UVB-313 lamps). The cycle shall consist of eight hours UV exposure at 140 °F (60 °C) followed by four hours of condensation at 104 °F (40 °C). After exposure, rinse the panel with clean water; allow to dry at room temperature for one hour. The exposed panels shall not show a color change of more than 3 Hunter Delta E Units.

(5) Dry Time. The mixed material shall be dry to touch in two hours and dry hard in six hours when applied at 6 mils (150 microns) wet film thickness and tested according to ASTM D 1640.

(f) Three Coat System Requirements.

(1) Finish Coat Color. For NTPEP testing purposes, the color of the finish coat shall match the latest applicable AASHTO R 31 specified color.

(2) Salt Fog. When tested according to ASTM B 117 and evaluated according to AASHTO R 31, the paint system shall exhibit no spontaneous delamination and not exceed the following acceptance levels after scraping after 5,000 hours of salt fog exposure:

Salt Fog Acceptance Criteria		
Blister Criteria	Rust Criteria	
Conversion Value	Maximum Creep	Average Creep
9	4 mm	2 mm

(3) Cyclic Exposure. When tested according to ASTM D 5894 and evaluated according to AASHTO R 31, the paint system shall exhibit no spontaneous delamination and not exceed the following acceptance levels after 5,000 hours of cyclic exposure:

Cyclic Exposure Acceptance Criteria		
Blister Criteria	Rust Criteria	
Conversion Value	Maximum Creep	Average Creep
9	7 mm	4 mm

(4) Abrasion. The abrasion resistance shall be evaluated according to ASTM D 4060 using a Taber Abrader with a 2.20 lb (1000 gram) load and CS 17 wheels. The duration of the test shall be 1,000 cycles. The loss shall be calculated by difference and be less than 0.00049 lb (220 mgs).

(5) Adhesion. The adhesion to an abrasively blasted steel substrate shall not be less than 900 psi (6.2 MPa) when tested according to ASTM D 4541 Annex A4.

(6) Freeze Thaw Stability. There shall be no reduction of adhesion, which exceeds the test precision, after 30 days of freeze/thaw/immersion testing. One 24 hour cycle shall consist of 16 hours of approximately -22 °F (-30 °C) followed by four hours of thawing at 122 °F (50 °C) and four hours tap water immersion at 77 °F (25 °C). The test panels shall remain in the freezer mode on weekends and holidays.

(g) Sampling, Testing, Acceptance, and Certification. Sampling, testing, acceptance, and certification of the coating system shall be according to Article 1008.01."

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