

230.02—Detail Requirements.

- (a) **Cast bronze** shall conform to the requirements of ASTM B22.
- (b) **Copper alloy** shall conform to the requirements of ASTM B100, copper alloy No. 51000.
- (c) **Copper sheets and strips** shall conform to the requirements of ASTM B370.

SECTION 231—PAINT**231.01—Description.**

These specifications cover a mixture of pigment in a liquid vehicle that, when applied, will dry to an opaque solid film. Use of paint in these specifications refers to the requirements of highway construction. Paint materials not specified herein shall be as specified by the manufacturer.

231.02—Materials.

The paint shall not be formulated with any compounds of the heavy metals listed in 40CFR 261.24 Table 1, except that barium sulfate is allowed. Except for barium sulfate, total heavy metal levels shall not exceed 20 times the specified regulatory limits.

When Federal Standard (FS) color numbers are specified such numbers refer to color only, and not to gloss requirements.

- (a) **Paint vehicles** shall conform to the following:

Vehicle	Specification
Acrylic resin	100% straight acrylic polymer dispersed in water
Alkyd resin	FS TT-R-266, Type I, Class A or B
Linseed oil	
Boiled	ASTM D260 Type I
Heat bodied	FS TT-L-201
Raw	ASTM D234
Methyl ethyl ketone	ASTM D740
Mineral spirits	ASTM D235
Soybean oil	
Refined	ASTM D1462
Degummed	ASTM D124
Spar varnish	FS TT-V-121
Toluene	ASTM D841
Tricresyl-phosphate	ASTM D363
Volatile thinners	ASTM D235
2-ethoxyethanol acetate	ASTM D3728

- (b) **Paint pigments** shall conform to the following:

Pigment	Specification
Aluminum paste	ASTM D962
Carbon black	ASTM D561 Type I
Lamp black	ASTM D209
Magnesium silicate	ASTM D605
Micaceous iron oxide	Processed specular hematite ore with lamellar structure which conforms to the requirements of ASTM D 5532 Type I
Organo montmorillonite	Fine, creamy white powder, with high gelling efficiency in a wide range of organic liquids; water content less than 30% and fineness less than 5% retained on 75 μm sieve Fine, creamy white powder, with high gelling efficiency in a wide range of organic liquids; water content less than 30% and fineness less than 5% retained on No. 200 sieve
Raw Sienna	ASTM D765
Titanium dioxide	ASTM D476, Rutile
Yellow iron oxide	ASTM D768
Zinc dust	ASTM D520, Type II
Zinc oxide	ASTM D79

231.03—Detail Requirements.

Paints shall not settle excessively or cake in the container; shall be readily broken up with a paddle or power mixer to a smooth uniform paint of acceptable consistency and working properties with a minimum of foaming; shall not thicken, liver, skim, or curdle; and shall retain these properties in storage for at least 12 months.

When applied in accordance with the standard practice, paint shall show good leveling properties; be free from laps, brush marks, orange peel, sags, or other surface defects; and shall flow out to a uniform, smooth finish.

Paints will be inspected, sampled, and tested in accordance with the requirements of Federal Test Method Standard No. 141.

Paint containers shall be plainly marked with the name of the material, date of manufacture, lot number and/or batch number, Department color, quantity contained therein, and name and address of the manufacturer. A manufacturer's product data sheet shall also be provided. Any package or container not provided as specified will be rejected.

- (a) **No. 1 paint** shall conform to the requirements of SSPC Paint 25.
- (b) **Zinc-rich paint systems** (System B) shall consist of a zinc-rich primer, an

intermediate coat when recommended by the manufacturer and a topcoat, which shall be selected from the Department's approved products list. Acceptance to the Qualified Low Volatile Organic Compound Zinc Rich Paint Systems list (System B) shall be in accordance with the requirements of VTM-73. Zinc-rich paint systems approved by the Northeast Protective Coating Committee (NEPCOAT) or those systems meeting the requirements of AASHTO PP-30 will be prequalified for inclusion to the Qualified Low Volatile Organic Compound Zinc Rich Qualified Product List.

Paint shall not contain more than 3.5-pounds of volatile organic compound per gallon as applied. Primer for shop application shall conform to the slip coefficient requirements of AASHTO 1995 Interim Provision, Division I, Design, Table 10.32.3C, Class B.

- (c) **No. 8 paint, micaceous iron oxide**, is a high-build alkyd resin paint.

1. **Composition:**

	Percent by Weight	
	Min.	Max.
Pigment	51.0	
Micaceous iron oxide	70.0	
Tinting compound		30.0
Vehicle		49.0
Alkyd resin	71.2	
Thixotropic bodying agent	1.9	
Mineral spirits, dryers, and anti-skinning agents		26.9

Tinting compounds shall consist of primer-hiding pigments only.

Sufficient quantities of dryers shall be used to ensure satisfactory drying within the drying time specified for the paint.

Wetting and anti-skinning agents may be used in appropriate quantities as required.

Vehicle shall be free from rosin and rosin derivatives.

2. **Physical requirements:**

	Min.	Max.
Viscosity (KU)	80	88
Weight/gal (lb)	12.4	
Drying Time ASTM D1640		
Set to touch (hrs)	4	
Drying time (hrs)		24

3. **Skimming:** Paint shall not skin when allowed to stand 48-hours in a tightly closed container that is 3/4 full of paint.
- (d) **No. 14 paint, aluminum epoxy mastic** (System F) shall be a two-component, modified epoxy coating, aluminum in color.

1. **Composition:** Pigment shall be flake metallic aluminum and shall contain rust-inhibiting and inert pigments.

The paint vehicle shall be a modified epoxy resin and curing agent and shall not contain coal tar. Paint shall be supplied as a two-package material with a 1:1 mixture ratio by volume.

2. **Physical requirements:** The epoxy mastic shall contain at least 90-percent solids by weight when tested in accordance with the requirements of ASTM D1644, modified to a drying time of 72-hours at 100 degrees F.

The shelf life of epoxy mastic components shall be at least 6-months. There shall not be skinning, gelling, or hard indispensible settling.

The viscosity of mixed paints, measured immediately after blending and mixing of components, shall be from 80- to 140-Kreb units at 77 ± 2 degrees F.

The weight per gallon of mixed paint shall be at least 10.8 pounds at 77 ± 2 degrees F.

The appearance of the dry applied film shall be bright aluminum.

The epoxy mastic shall be suitable for use over properly prepared, inorganic zinc-rich primers. A mist coat may be required to minimize bubbling.

Mixed paint, when thinned in accordance with the manufacturer's recommendations for application over wire-brushed rusty steel, shall be capable of being spray applied in one coat at a wet film thickness of 10-mils without runs or sags.

The epoxy mastic, when applied in a dry film thickness of 5-mils and air dried at 75 degrees F, shall be dry to the touch within 24-hours; dry enough to handle in 48-hours; and provide a hard tough film after 5-days.

The usable pot life of the mixture of components reduced as recommended shall be at least 3-hours at 70 degrees F and 1 1/2-hours at 90 degrees F.

The epoxy-mastic coating shall possess such flexibility that, when applied in a dry film thickness of 5-mils to a 1/8-inch steel panel that has been blast cleaned in accordance with the requirements of SSPC-5 and cured for 2-weeks at 75 degrees F, it shall not display signs of cracking or loss of adhesion when the panel is uniformly bent 180 degrees around a mandrel 8-inches in diameter.

3. **Resistance:** Steel test panels conforming to the requirements of ASTM D609 shall be abrasive blasted in accordance with the requirements of SSPC-SP 5, exposed to the atmosphere for 30-days so that a uniform rusting occurs, and then hand cleaned with a wire brush in accordance with the requirements of SSPC-SP 2. The panel shall then be spray applied with epoxy mastic to achieve a dry film thickness of 5-mils and cured according to the manufacturer's recommendations.
 - a. **Fresh water:** Coated panels shall be scribed down to base metal with an X having at least 2-inch legs and immersed in fresh tap water at 75 ± 5 degrees F. Upon examination after 30-days of immersion, panels shall be unaffected except for discoloration of the epoxy-mastic coating. There shall not be blistering, softening, or visible rusting of the coating beyond 1/16-inch from the edge of the scribe mark.
 - b. **Salt water:** Panels shall be scribed down to the base metal with an X having at least 2-inch legs and immersed in a 5-percent sodium chloride solution at 75 ± 5 degrees F. Panels shall be unaffected, except for discoloration of the epoxy-mastic coating, upon inspection after 7-, 14-, and 30-days of immersion. There shall not be blistering, softening, or visible rusting of the coating beyond 1/16-inch from the center of the scribe mark. The sodium chloride solution shall be replenished with fresh solution after each examination.
 - c. **Weathering:** Panels shall be tested in accordance with the requirements of ASTM G23, Type D, at the beginning of the wet cycle. After 1,000-hours of continuous exposure, the coating shall not show rusting, loss of adhesion to the steel test panel, or blistering.
 - d. **Salt fog:** Panels shall be scribed with an X having at least 2-inch legs down to base metal. Test panels shall then be tested in accordance with the requirements of ASTM B117. After 1,000-hours of continuous exposure, the coating shall not show rusting or blistering beyond 1/16-inch from the center of the scribe mark or a loss of bond.
4. **Packaging and labeling:** Epoxy-mastic coating shall be packaged in two containers, labeled "Part A" and "Part B." Each container shall bear

a label that clearly shows the manufacturer and brand name of the paint, lot number, and date of manufacture. The label on the vehicle container shall also include complete instructions for use. The container shall be coated, if necessary, to prevent attack by the paint components.

5. **Application:** The manufacturer's current printed instructions for applying aluminum epoxy-mastic coating shall be submitted to the Department for approval prior to application.
6. **Product certification:** The manufacturer shall certify that the modified aluminum epoxy mastic has been used successfully for at least 2-years in a similar service and environment and that the material was applied in one coat at a dry film thickness of 5-mils. Successful performance shall include adhesion to steel and old coatings of the type found on bridges.

Prior to approval and use of an aluminum epoxy-mastic coat, the manufacturer shall submit a certified test report from an independent testing laboratory showing specific test results conforming to all quantitative and resistance test requirements herein. The test report shall also contain the lot numbers from which the data were compiled, manufacturer's name, and brand name of the paint. Upon approval by the Department, the product will be placed on the Department's Qualified No. 14 Aluminum Epoxy Mastic list (System F) and further resistance and quantitative tests will not be required of that manufacturer for that brand name of paint unless random samples tested by the Department show nonconformance with any of the requirements herein. The manufacturer, shall submit new certified test results when the manufacturing process or paint formulation is changed.

- (e) **Colored epoxy mastic** for use on interior beams as a finish coat, over No. 14 primer (System F) shall be supplied by the manufacturer of the primer and shall conform to the salt fog resistance requirements specified in (d)3.d herein. Upon approval by the Department, the colored epoxy mastic will be placed on the No. 14 paint, aluminum epoxy mastic (System F) as an approved colored topcoat.
- (f) **Colored urethane topcoats** for use on fascia beams and other light exposed surfaces as a finish coat over No. 14 primer (System F) shall be an aliphatic urethane as recommended and supplied by the manufacturer of the primer.
- (g) **No. 101, 102 and 103 water reducible paint**, (System W) shall be a one component acrylic water borne paint with a Volatile Organic Compound (VOC) of less than 2.8-pounds per gallon as applied.

1. **Composition:**

	No. 101		No. 102		No. 103	
	min	max	min	max	min	max
Pigment (% by weight)	20	25	35	40	10	20
Red Iron Oxide (86% Fe ₂ O ₃)	45					
Zinc Phosphate	10		5		5	
Phthalocyanine Blue		2				
Calcium Carbonate			30			
Titanium Dioxide (ASTM D476 Type II)			45			
Magnesium Silicate				12		
Tinting Compounds ¹						95
Vehicle (% by weight)	75	80	60	65	80	90
HG-54 solids	30		30		30	
Water		55		55		58
Methyl Carbitol	5		5		5	
Texanol	2		2		5	
Dibutyl Phthalate	2		2			
Paint Characteristics						
Weight per gallon (pound)	9.7		11.0		9.0	
Solids by volume	35		37		30	
Grind	5		5		5	
Viscosity (KU)	90	100	90	100	90	100
Drying time ASTM D1640						
Set to touch (hrs.)		3		3		3
Drying time (hrs.)		24		24		24
Leneta sag	10		10		10	
Ph	8.0	8.5	8.0	8.5	8.0	8.5
Adhesion (ASTM 3359)	3B		3B		3B	
Gloss, Specular @ 80 deg.					40	

¹ All tinting compounds shall be prime hiding pigments.

- Mixed paint** shall not liver, thicken, curdle or gel or settle rapidly. After mixing, all coarse particles and skins shall not amount to more than 0.05-percent by weight of the total mixture when passed through a 60-mesh screen.
- Storage life:** The paint shall not show thickening, curdling, gelling or gassing after being stored for one year from date of manufacture, when packaged in tightly covered unopened containers at a temperature between 50 degrees and 90 degrees F.
- Working properties:** The paint shall spray easily and show no streaking, running, or sagging, when tested in accordance with Federal Test Method Standard 411, Methods 4331 and 4541.