

STANDARD SPECIFICATION
SECTION 09961 FUSION-BONDED EPOXY LINING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and testing of one part, fusion-bonded, heat cured, thermosetting, 100% solids epoxy lining and coating on steel, cast iron, and ductile iron equipment, such as valves, flexible pipe couplings, fittings, structural steel, and steel pipe. Do not apply fusion-bonded epoxy to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Standard Drawings.
- B. Record Drawings and Submittals: STD SPEC 01300.

1.03 SUBMITTALS

- A. Submit submittal packages in accordance with Standard Specification Section 01300.
- B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe application and curing procedure.
- C. Submit coating application test records for measuring coating thickness and holiday detection for each item or pipe section and fitting. Describe repair procedures used.

PART 2 - MATERIALS

2.01 PIPING AND EQUIPMENT SURFACES

The Contractor shall require the suppliers to provide bare pipe and equipment that is free of salts, oil, and grease to the coating applicator.

2.02 SHOP APPLIED EPOXY LINING AND COATING

Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. Provide: Scotchkote 134 or 206N, Lilly Powder Coatings "Pipeclad 1500 Red," H.B. Fuller 1F-3003, or District approved equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (Minimum)	Barcol 17 (ASTM D 2583) Rockwell 50 ("M" Scale)
Abrasion Resistance (Minimum)	1,000 cycles: 0.05 gram removed 5,000 cycles: 0.115 gram removed ASTM D 1044, Tabor CS 17 wheel, 1,000 gram weight

Adhesion (Minimum)	3,000 psi (Elcometer)
Tensile Strength	7,300 psi (ASTM D 2370)
Penetration	0 mil (ASTM G 17)
Adhesion Overlap Shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi (ASTM D 1002)
Impact (Minimum Value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.03 FIELD APPLIED EPOXY COATING FOR PATCHING

Use a two-component, 80% solids, liquid resin, such as Scotchkote 306 or District approved equal.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION-BONDED EPOXY - GENERAL

- A. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.
- B. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4-inch.
- C. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.
- D. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.
- E. Apply a phosphoric acid wash to the pipe, item, or piece of equipment after sandblasting. The average temperature, measured in three different locations, shall be 80°F to 130°F during the acid wash procedure. The acid wash shall be 5% by weight phosphoric acid solution. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

Pipe Temperature (°F)	Contact Time (seconds)
80	52
85	45
90	36
95	33
100	28
105	24
110	21
130	10

After the acid wash has been completed, remove the acid with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

- F. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 12 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY TO PIPE

- A. In addition to the above requirements, apply lining and coating per AWWA C213 except as modified herein.
- B. Grind 0.020-inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.03 QUALITY OF LINING AND COATING APPLICATIONS

The cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.04 SHOP TESTING OF LINING AND COATING - GENERAL

- A. Test linings and coatings with a low-voltage wet sponge holiday detector in accordance with AWWA C213, Section 5.3.3. If the number of holidays or pinholes for flat or smooth surfaces such as pipe is fewer than one per 10 square feet of coating surface, repair and retest. If the number of holidays or pinholes for valves, couplings, and fittings, 12 inches and smaller, is 5 or less per item, repair and retest. Repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of holidays or pinholes exceeds these allowable quantities, remove the entire lining or coating and recoat the pipe or item and retest.

- B. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrated at least once per eight-hour shift. Record each measured thickness value. Where individual measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below or 3 mils above the specified minimum value. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.
- C. The District's Representative will conduct in the field an independent inspection of the lining and coating for compliance with the above criteria. Coated items failing his inspection will be cause for rejection.

3.05 SHOP TESTING OF LINING AND COATING OF PIPE

In addition to the above requirements, check for coating defects on the weld seam centerlines. There shall be no porous blisters, craters, or pimples lying along the peak of the weld crown.

3.06 FIELD REPAIRS

Patch scratches and damaged areas incurred while installing fusion bonded epoxy coated items with a two-component, 80% solids (minimum), liquid epoxy resin. Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the lining or coating on the sides of the damaged area before applying the liquid epoxy coating. Apply a two-part epoxy coating to damaged linings and coatings to areas smaller than 20 square inches. Patched areas shall overlap the parent or base coating a minimum of 1/2-inch. If a damaged area exceeds 20 square inches, remove the entire lining and coating and recoat the entire item or piece of equipment and retest. Apply the liquid epoxy coating to a minimum dry-film thickness of 12 mils.

END OF SECTION