

SECTION 04100 - FUSION-BONDED EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials, application and testing of one part, fusion-bonded, heat cured, thermosetting, 100% solids epoxy linings and coatings on steel, cast iron and ductile iron equipment, such as valves, mechanical clamp-type couplings, and transition couplings. Fusion-bonded epoxy shall not be applied to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

1.2 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Manufacturer's technical and material safety data sheets for the products to be applied. Data sheets shall contain the following information:
 - a. Description of the physical and chemical properties of the epoxy coating.
 - b. Description of the application and curing procedure.
 - c. Coating application test records for measuring coating thickness and holiday detection for each item.
 - d. Description of repair procedures used.

PART 2 - PRODUCTS

2.1 SHOP APPLIED EPOXY LINING AND COATING

- A. Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. The following items shall be provided: Scotchkote 134, 135, 203, or 206; "Pipe Clad" 1500 Red by Lilly Powder Coatings; or 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 (Maximum Value)	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)

2.2 FIELD APPLIED EPOXY COATING FOR PATCHING

- A. A two-component, 80% solids, liquid resin, such as Scotchkote 306 or equal shall be used.

PART 3 - EXECUTION

3.1 SHOP APPLICATION OF FUSION-BONDED EPOXY

A. General

1. Grind surface irregularities, welds, and weld spatter smooth before application of epoxy.
2. Allowable grind area shall not exceed 0.5 square feet per location, and the maximum total grind area shall not exceed 2 square feet per item or piece of equipment. An item, pipe, or piece of equipment which does not meet these requirements shall not be used.
3. Surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges shall be removed. Grind outside sharp corners, such as outside edges of flanges, to a minimum radius of 1/4-inch.
4. The pipe, item, or piece of equipment shall be uniformly preheated 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.
5. Sandblast surfaces per SSPC SP-5. Beveled pipe ends shall be protected from abrasive blast cleaning.
6. Phosphoric acid wash shall be applied 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.
7. The acid wash shall be 5% by weight phosphoric acid solution.

8. 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, the acid shall be removed with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

- F. Lining and coating shall be applied 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. Oxidation of surfaces prior to coating shall not be permitted to occur. Flash rusting of the surfaces before coating shall not be permitted.

3.2 SHOP APPLICATION OF FUSION-BONDED EPOXY

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

3.3 QUALITY OF LINING AND COATING APPLICATIONS

- A. 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.

3.4 SHOP TESTING OF LINING AND COATING

- A. General
1. 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. Holidays and pinholes shall be repaired by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and

retested. If the number of holidays or pinholes exceeds these allowable quantities, the entire lining or coating shall be removed and the pipe or item shall be recoated and retested.

2. 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.
3. The OWNER will conduct an independent field inspection of the lining and coating for compliance with the above criteria. Coated items failing his/her inspection will be subject to rejection.

3.5 SHOP TESTING OF LINING AND COATING OF PIPE

- A. 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.

3.6 FIELD REPAIRS

- A. Scratches and damaged areas incurred while installing fusion bonded epoxy coated items shall be patched with a two-component, 80% solids (minimum), liquid epoxy resin. Damaged areas shall be wire brushed and sandblasted 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. A two-part epoxy coating shall be applied 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, the entire lining and coating shall be removed and the entire item or piece of equipment and shall be recoated and retested. The liquid epoxy coating shall be applied to a minimum dry-film thickness of 12 mils.

END OF SECTION