

POLYURETHANE LINING AND COATING ON PIPE - PENSTOCK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide pipe coating, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

AWWA C216 Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

AWWA C222 Polyurethane Coatings for Interior and Exterior of Steel Water Pipe and Fittings.

NACE SP-0188 Discontinuity (Holiday) Testing of Protective Coatings.

SSPC-SP-1 Solvent Cleaning Surface Preparation

SSPC-SP-2 Hand Tool Cleaning Surface Preparation

SSPC-SP-3 Power Tool Cleaning Surface Preparation

SSPC-SP-5 White metal Abrasive Blast Surface Preparation

SSPC-SP-10 Near White Metal Abrasive Blast Surface Preparation

SSPC-SP-11 Power Tool Cleaning to Bare Metal

ASTM D16 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products

1.3 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with this specification, unless indicated otherwise below.
- B. Submittals shall include the following information and be submitted at least 30 days prior to coating the pipe.
 - 1. Manufacturer's data sheet for each product proposed, including Statements on the suitability of the material for the intended use.
 - 2. Technical and performance information that demonstrates

compliance with the system performance and material requirements.

3. Manufacturer's instructions and recommendations on surface preparation and application.
4. Colors available for each product (where applicable).
5. Compatibility of shop and field applied coatings (where applicable).
6. Material Safety Data Sheet for each product.

1.4 QUALITY ASSURANCE

A. Coating Applicator's Experience and Certification

1. Coating application personnel, whom have direct spray application responsibility, shall be certified by the manufacturer of the selected product.

1.5 DEFINITIONS

- ##### A. DFT: Minimum Dry Film Thickness, without any negative tolerance.

1.6 ABBREVIATIONS

MDFT	Minimum Dry Film Thickness
Mil	Thousandths of an Inch

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Products must have five (5) years of case histories on pipe coating projects.
- B. Pipeline coating materials shall be the products of a single manufacturer, unless otherwise noted in this specification. Product substitutions during the project will not be considered or permitted.
- C. Coating applicator shall provide a monitoring system approved by the

coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line speed, surface preparation, holiday test and other parameters applicable to the type of coating.

- D. Substitute or "Or-Equal" Products for Coating Systems
 - 1. The CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets AWWA C222 and the property requirements listed in Section 2.2.D.6.c.
 - 2. If a proposed substitution requires changes in the WORK, the CONTRACTOR shall bear all such costs involved, as part of the WORK.

2.2 POLYURETHANE SYSTEM

- A. General: Pipe, fittings, and specials shall be lined and coated with polyurethane complying with AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings. Surfaces in contact with potable water shall receive a coating, which is certified under NSF Standard 61.
- B. Material: The coating material shall be a two-component, fast set, Type V polyurethane according to ASTM D 16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products. Solids content shall be no less than 100 percent by volume.
 - 1. Surface Preparation: SSPC-SP10, Near White Metal blast, 3.0-mil angular profile, minimum, or as required by the manufacturer, whichever is greater.
- C. Product acceptance is contingent upon:
 - 1. Submission of an independent testing report documenting conformance to the coating performance criteria specified herein.
 - 2. Verification that no significant change in product formulation has occurred since independent test was performed.
- D. Coating Performance Testing and Report
 - 1. Coating manufacturer shall submit to the Engineer for approval, test reports documenting conformance to the specified performance criteria using prepared samples and coating materials conforming

to the following general requirements:

- a. Polyurethane coating material tested shall have been manufactured within 30 days of test sample preparation.
 - b. Coating material to have a minimum of five years prior pipeline coating application history.
 - c. Extended polyurethane coatings will not be acceptable.
2. Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of samples with coating material other than those listed will result in rejection of the coating.
3. Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets for Parts A and B.
4. Test Sample Preparation:
- a. Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.
 - b. Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.
 - c. All coating test samples shall be prepared in conformance with the following general requirements.
 - d. Sample Surface preparation:
 - 1) Method: Abrasive blast, steel grit or green diamond, SSPC-SP5, white metal.
 - 2) Profile: 3.00 mils minimum, angular profile, measured and recorded using surface profilometer or surface replica tape.
 - e. Coating Application:
 - 1) Method: Spray film in accordance with manufacturer's written shop application requirements. Thickness: 30 to 50 mils.
 - 2) Cure: Air cure only, oven or other accelerated cures

will not be acceptable.

- 3) Form: Sheet, steel panel, or steel pipe as required for the test procedure.
 - f. Sample Quantity: Provide a minimum of three samples for each test performed or as required by the ASTM test standards, whichever is more stringent.
6. Coating Tests and Criteria:
- a. Testing shall be performed by a certified independent laboratory testing agency with a minimum five years experience in the performance of ASTM test procedures on coating systems.
 - b. All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.
 - c. Material property test requirements are listed in the table below:

Property	Requirement
Impact Resistance	No less than 125 inch-pounds when tested according to ASTM G14 for 40 mil thickness
Abrasion Resistance	Less than 50 mg weight loss per 1000 revolutions of a CS-17 wheel, 1 kg weight, when tested according to ASTM D4060

7. Reporting:
- a. As required by the ASTM test method and the following additional information:
 - 1) Sample panel preparation date and identification
 - 2) Surface preparation method and abrasive
 - 3) Surface preparation profile
 - 4) Coating lot and date of manufacture
 - 5) Application spray gun and equipment used

6) Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature.

- b. Show all calculations as required by the ASTM test method.
- c. Submit report in PDF format.

E. Thicknesses

Interior of pipe and fittings	30 mils DFT, minimum
Exterior pipe and fittings	25 mils DFT, minimum, per AWWA C222
Sealing areas on bells and spigots	8-mils DFT. Thicker coating which does not compromise joint tightness may be accepted.

F. Cutbacks For Field Welds

- 1. If the pipe sections are to be joined together by field welding, a 3-inch minimum band of substrate on the internal and/or the external shall be left uncoated. This band shall receive the same surface preparation as the rest of the pipe.

G. Non Welded Joints

- 1. If mechanical couplings or gaskets are used to connect the pipe sections together, the pipe shall be lined and/or coated to its ends, including sealing area, with no cut back.

H. Manufacturers, or equal

- 1. Coating: LifeLast Inc. DuraShield 110, DuraShield 210, DuraShield 310 or equal.
- 2. Lining: LifeLast Inc. DuraShield 110-61 NSF, DuraShield 210-61 NSF, DuraShield 310-61 NSF or equal

2.3 INTERIOR FIELD JOINT COATING

- A. Surface preparation shall be per the joint lining manufacturer's recommendations.
- B. Manufacturers, or equal

1. Spray Application: LifeLast Inc. DuraShield 110-61, DuraShield 210-61, or DuraShield 310-61
 2. Hand Application: LifeLast Inc. DuraShield 310-61 JARS (Joint and Repair System).
- C. Field joint coating method and system shall be determined by the engineer based on criteria such as: environmental conditions, project size (length and diameter), access and contractor experience.
- D. Field contractor must provide a letter from the coating system manufacturer stating they have been approved as an applicator.
- E. Coating applicator that does not meet the qualifications requirements may be rejected by Construction Manager.
- F. Contractor shall provide a third party NACE Level III inspector with experience with the applied coating system on steel pipe, to inspect surface preparation and application of the joint lining and document application conditions.

2.4 EXTERIOR FIELD JOINT COATING

- A. Buried: All field joints shall be coated with heat shrink sleeves per AWWA C216.
- B. Above Ground
1. Manufacturers, or equal
 - a. LifeLast Inc. DuraShield 110, DuraShield 210, DuraShield 310, DuraShield 310 JARS (Joint and Repair System).
 2. Field joint coating method and system shall be determined by the engineer based on criteria such as: environmental conditions, project size (length and diameter), access and contractor experience.
 3. Field contractor must provide a letter from the coating system manufacturer stating they have been approved as an applicator.
 4. Coating applicator that does not meet the qualifications requirements may be rejected by Construction Manager.
 5. Contractor shall provide a third party NACE Level III inspector

with experience with the applied coating system on steel pipe, to inspect surface preparation and application of the joint lining and document application conditions.

2.5 REPAIR OF COATINGS AND LININGS

A. General

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system.

B. Field Repair Coating Materials

1. Polyurethane Coating or Lining
 - a. Polyurethane coating or lining system repair shall be in accordance with the coating manufacturer's recommended procedures.
2. Curing of Field Applied Coatings
 - a. All field-applied coatings shall be completely cured prior to installation.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

- A. Skilled manufacturer, trained craftsmen and experienced supervision shall be used to perform the application. Spray application of the polyurethane, requires certification by the manufacturer, of the individual applicators.

3.2 STORAGE AND MIXING OF MATERIALS

- A. **Manufacturer's Recommendations:** Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.
- B. Materials shall be used within the manufacturer's recommended shelf life.
- C. **Storage and Mixing:** Materials shall be stored and mixed per the manufacturers recommendations.

3.3 SURFACE PREPARATION

- A. Pipe shall be clean and free of contaminants. If not the pipe surfaces shall be cleaned in accordance with SSPC-SP1, to remove oil, grease, and other soluble contaminants. No residue shall remain on the pipe. Remove burrs, weld splatter and gouges.
- B. Prepare the metal surface to achieve a metal finish and cleanliness in accordance with SSPC-SP10 to an angular profile of 3.00-mil minimum measured and recorded using surface profilometer or surface replica tape.
- C. Pipe temperatures shall be at least 5 degrees F warmer than the dew point temperature and within the coating manufacturers recommended temperature range per the technical data sheet. Pipe shall be warmed if necessary.
- D. Pipe shall not be allowed to flash rust before coating is applied.

3.4 APPLICATION

- A. Apply the coating in strict conformance to the manufacturer's recommendations.
- B. Recoating shall be performed in strict conformance to the manufacturer's recommendations.

3.5 FACTORY TESTING

- A. All testing shall be per AWWA C222 unless modified herein.
- B. Adhesion Testing
 - 1. Polyurethane coating adhesion to steel substrates shall be tested using Delfesko Positest AT-A automatic pneumatic pull off tester and 14mm dollies.
 - 2. Adhesion testing records shall include pipe identification, surface tested (interior or exterior), surface temperature, coating thickness, tensile force applied, mode of failure, and percentage of substrate failure relative of dolly surface.
 - 3. Dollies for adhesion testing shall be glued to the coating surface and allowed to cure for a minimum of 12 hours. Because of high cohesive strength, polyurethane coatings shall be scored around the

dolly prior to conducting the adhesion test. Extreme care shall be taken when scoring around the dollies.

4. Failure shall be by adhesive and cohesive failure only. Adhesion failure is defined as separation of the coating from the steel substrate. Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.
6. Partial adhesion and glue failures will be retested if the adhesion failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the adhesion criterion. Pipes that have partial adhesion failures greater than 50 percent and less than the required adhesion will be rejected as a substrate adhesion failure.
7. Adhesion tests shall be terminated once 1,500 psi is reached and considered satisfactory.
8. Adhesion tests will be conducted on polyurethane pipe coating and lining independently and will be accepted or rejected independently of the other.

3.6 FIELD INSTALLATION

- A. Pipe shall be handled at all times to minimize damage to the lining and coating. Damaged lining and coating shall be repaired.
- B. Repair of Field Welded Joints and Damaged Areas.
 1. Weld sparks and splatter shall not be allowed to damage existing lining or coating.
 2. After welding, repair the weld holdback areas and defects as recommended by the manufacturer.
 3. Test the pipe after welding for holidays per NACE SP-0188. Mark holidays and repair per the manufacturers recommendations.
 4. Use only material recommended by the manufacturer for repair. This recommendation will take into consideration pipe diameter and quantity of joints.

3.7 REPAIR OF COATING AND LININGS

- A. General

1. Areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts or other defects shall be repaired.

B. Polyurethane Coating or Lining Repairs

1. General

- a. Complete coating repairs in accordance with the coating manufacturer's written instructions and these Specifications, whichever is stricter.

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