# Steel Pipe for Water Transmission
*Polyurethane Lined and Coated*

## Section I – Shop Applied Coatings

## 1. General

### 1.1. Description

Scope of Work: work in his section includes that which is specific to shop applied interior and exterior polyurethane coatings for steel pipe for use in water mains.

### 1.2. Quality Assurance

Commercial Standards: Unless otherwise stated, the latest edition for any commercial standards and all manufacturing tolerances referenced therein shall apply.

| | |
|---|---|
| ASTM D3363 | Standard Test Method for Film Hardness by Pencil Test |
| ASTM D4541 | Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers |
| ANSI/AWWA C222 | Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings |
| ANSI/NSF Standard 61 | Drinking Water System Components – Health Effects |
| SSPC-SP10 | Near-White Metal Blast |
| SSPC-SP11 | Power Tool Cleaning to Bare Metal |
| SSPC-VIS1 | Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning |
| SSPC-PA 2 | Systems and Specifications SSPC Painting Manual, Volume 2 Chapter 7: Measurement of Dry Coating Thickness with Magnetic Gages |

### 1.3. Submittals

1.3.1. The Contractor is required to submit the following for review at three (3) weeks prior to commencing the lining and coating.
1.3.2. Technical information of all coating materials.
1.3.3. Test results of the applied materials as specified in the above references.
1.3.4. Two (2) samples of finished coating and lining, 6”x6” in size.
1.3.5. Quality Control Program

## 2. Products

### 2.1. Interior Lining

2.1.1. The interior surface lining for all water mains shall be 100% solids polyurethane to AWWA C222. Approved products include:

2.1.1.1.LifeLast DuraShield 210-61

2.1.1.2.

2.1.2. The interior surface lining for all water mains shall be certified to ANSI/NSF Standard 61.

### 2.2. Exterior Coating

2.2.1. The exterior surface coating shall be 100% solids polyurethane to AWWA C222. Approved products include:

2.2.1.1.LifeLast DuraShield 210

2.2.1.2.

## 3. Execution

### 3.1. Surface Preparation

3.1.1. Exterior and interior surfaces shall be cleaned, abrasive blasted and coated to AWWA C222.

3.1.2. Blasted surfaces shall have a minimum surface profile of 3.0 mils and a maximum of 5.0 mils over the entire surface.

3.1.3. Blasted profiles shall be sharp and angular. Steel shot is not acceptable as a blast media. Blast media shall have a maximum of one percent (1%) of free silica.

3.1.4. The entire surface of the pipe length, including the holdback areas, shall be blasted to an SSPC-SP10 Near-White Metal Blast Cleaning.

3.1.5. Blast cleanliness and density shall be verified using SSPC-VIS1.

3.1.6. The application of the lining or coating shall be applied on the same day the surface is blast cleaned and prior to the formation of any rust bloom or contamination. Areas that show signs of contamination or rust bloom must be re-blasted prior to performing the coating or lining.

### 3.2. Application of Lining and Coating – General

3.2.1. Minimum steel substrate temperature shall be 5°F above the dew point to prevent condensation on the pipe and the relative humidity shall be less than 85%.

### 3.3. Polyurethane Lining

3.3.1. Prior to application of the lining, all dust and residual blast cleaning abrasive shall be removed by vacuuming or dry compressed air blast.

3.3.2. The interior of the pipe shall be lined with approved polyurethane coatings according to AWWA C222, the manufacturer's recommendations and this specification, whichever is more stringent.

3.3.3. The resultant interior lining shall be not less than 25 mils dry film thickness; follow manufacturer's requirements for maximum film thicknesses in ANSI/NSF Standard 61 potable water lining applications.

### 3.4. Polyurethane Coating

3.4.1. Prior to application of the lining, all dust and residual blast cleaning abrasive shall be removed by vacuuming or dry compressed air blast.

3.4.2. The exterior of the pipe shall be coated with approved polyurethane coatings according to AWWA C222, the manufacturer's recommendations and this specification, whichever is more stringent.

3.4.3. The resultant exterior coating shall be not less than 25 mils dry film thickness; there is no maximum allowable thickness.

### 3.5. Pipe End Finishing

3.5.1. Not used.

3.5.2. Bell ends and spigots shall have a minimum holdback of 8.5 inches.

3.5.3. Beveled end pipe shall have a minimum holdback of 6 inches.

### 3.6. Damaged Lining and Coating

3.6.1. Holidays and damaged areas shall be power tool cleaned to SSPC-SP11 to scarify and feather into adjacent tightly bonded coatings to a nominal 4 to 6 inch radius.

3.6.2. Re-apply the lining to produce a smooth repair zone equal to the specified dry film thickness.

3.6.3. All repairs shall be fully cured before the pipe is shipped to the job site.

3.6.4. Any areas subject to repair shall be holiday tested.

### 3.7. Lining and Coating Testing Repair

3.7.1. The Contractor, at his own cost, shall repair the lining and coatings damaged during the destructive quality control and quality assurance testing.

### 3.8. Polyurethane Quality Control

3.8.1. All Quality Control shall be done as per AWWA C222 by the Contractor and shall include as a minimum:

3.8.1.1. Every pipe shall be electrically holiday tested (100 percent) to ensure coating/lining is holiday free. Repairs shall be made according to Section 3.6.

3.8.1.2. Cure of polyurethane shall be tested on the first and last pipe pf the day and one random pipe in the middle of the shift in accordance with ASTM 3363 (pencil hardness 3H pencil for acceptance).

3.8.1.3. Adhesion tests shall be complete on the first and last pipe of the day and one random pipe in the middle of the shift. All tests shall be in accordance with ASTM D4541 using an apparatus with a self-aligning pull-off technique, DeFelsko PosiTest or equal. Non-self-aligning units, e.g. the HATE tester from Elcometer, are not recommended. The minimum adhesion for polyurethane coatings and linings shall be 1500 psi.

# Steel Pipe for Water Transmission
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## Section II. Field Applied Coatings

## 1. General

### 1.1. Description
Scope of Work: work in his section includes the field and fabrication shop application of corrosion protection to steel pipe. It includes protection of both interior and exterior of welded steel pipe and fittings.

### 1.2. References
Commercial Standards: Unless otherwise stated, the latest edition for any commercial standards and all manufacturing tolerances referenced therein shall apply.

| | |
|---|---|
| ASTM D3363 | Standard Test Method for Film Hardness by Pencil Test |
| ASTM D4541 | Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers |
| ANSI/AWWA C222 | Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings |
| ANSI/NSF Standard 61 | Drinking Water System Components – Health Effects |
| SSPC-SP10 | Near-White Metal Blast |
| SSPC-SP11 | Power Tool Cleaning to Bare Metal |
| SSPC-VIS1 | Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning |
| SSPC-PA 2 | Systems and Specifications SSPC Painting Manual, Volume 2 Chapter 7: Measurement of Dry Coating Thickness with Magnetic Gages |

### 1.3. Submittals
1.3.1. Within five (5) working days following the award the Contractor shall submit the following in a lining and coating procedure. This procedure should identify all proposed lining and coating application steps to include:

1.3.1.1. If different than identified products are proposed for lining and coatings, product data sheets;

1.3.1.2. certificates showing that the proposed applicator(s) have been certified by the lining/coating manufacturer;
1.3.1.3. lining and coating application work plan including schedule (i.e. location if other than work site, hours and time during work day);
1.3.1.4. storage and inventory control of materials;
1.3.1.5. Quality control of workmanship;
1.3.1.6. mixing of lining/coating materials;
1.3.1.7. application of lining/coating materials including thickness control.

## 2. Products

### 2.1. General

2.1.1. Materials applied within the requirements of this specification shall be from unopened containers that bear legible product identification, batch number, expiration date, etc.

### 2.2. Exterior Coating

2.2.1. The exterior surface coating, unless otherwise specified, shall be polyurethane according to AWWA C222. Approved products include:
2.2.1.1. LifeLast DuraShield 210
2.2.1.2. LifeLast DuraShield 310
2.2.1.3. LifeLast DuraShield 310 JARS Kits
2.2.1.4.

### 2.3. Repair of Exterior Weld Holdback Areas

2.3.1. Pipe coated with polyurethane shall have the exterior field weld holdbacks repaired with one of the following systems:
2.3.1.1. Polyurethane
2.3.1.1.1. LifeLast DuraShield 210
2.3.1.1.2. LifeLast DuraShield 310
2.3.1.1.3. LifeLast DuraShield 310 JARS Kits
2.3.1.1.4.
2.3.1.2. Shrink Sleeve
2.3.1.2.1. [Insert your choice here; two popular companies are Canusa and Raychem]

### 2.4. Interior Lining

2.4.1. The interior of surface lining for all water mains, unless otherwise specified, shall be polyurethane according to ASTM C222. Approved products include:
2.4.1.1. LifeLast DuraShield 210
2.4.1.2. LifeLast DuraShield 310
2.4.1.3. LifeLast DuraShield 310 JARS Kits
2.4.1.4.
2.4.2. The interior surface lining for all water mains shall be certified to ANSI/NSF Standard 61.

### 2.5. Blast media

2.5.1. The abrasive media shall be a commercially controlled, batched and bagged product with an appropriate mesh size and less than one percent (1%) free silica.

2.5.2. Blast abrasives shall be dry and stored at conditions that will prevent the abrasive from being contaminated by moisture.

2.5.3. The selected media shall be supplied in prime condition and, where applicable, shall be approved for use in potable water pipelines.

2.5.4. Recycled glass shall not be used.

## 3. Execution

### 3.1. General

3.1.1. All steel used in this project, including contractor supplied mainline, uncoated Corporation supplied pipe and valve chamber piping shall be protected against corrosion according to this section.

3.1.2. The Contractor shall protect the existing lining and coating from spatter generated during the welding and/or cutting, the environment and from adjacent operations.

3.1.3. Pipe lining/coating damage that occurs during the lining process, handling or storage by the Contractor shall be repaired or replaced to the satisfaction of the Corporation or its Engineer.

3.1.4. Areas that must be reworked shall have the entire applied systems removed down to bare substrate, re-preparation of the substrate and re-application in accordance with this specification and original system application procedures.

3.1.5. Spent abrasive shall be completely removed from the field joint and surrounding area prior to any lining/coating operation, and the prepared surface shall be free of imbedded abrasive and dust.

3.1.6. Spent abrasive and all other waste products from the lining and coating shall be disposed of according to appropriate legislation.

### 3.2. Surface Preparation for Polyurethanes

3.2.1. Interior and exterior surfaces shall be cleaned, sandblasted and coated to the AWWA C222 standard.

3.2.2. Blasted surfaces shall have a minimum 3.0 mil and maximum 5.0 mil profile.

3.2.3. Blasted profiles shall be sharp and angular as opposed to a peen pattern. Blast media shall have one percent (1%) maximum free silica, or approved equal.

3.2.4. Power tool prepared areas shall be prepared according to SSPC-SP11. Power tool preparation (if acceptable) shall be accomplished according to coating/lining manufacturer's recommendations.

3.2.5. Blast cleaned areas shall be prepared to an SSPC-SP10 Near-White Metal Blast Cleaning and shall provide a uniform metallic color. Surface area blast cleanliness shall be verified using SSPC-VIS1.

3.2.6. The plant applied parent coating/lining transition zone shall be feathered back at a 4 to 1 slope from sound coating and have been prepared a minimum of 4 inches beyond that.

3.2.7. The Contractor shall properly protect all threads, seals or other connection surfaces from damage during the abrasive blasting process. Masking materials and their residues shall be completely removed from all connections before coating.

3.2.8. No abrasive blasting or power tool preparation shall be performed unless the substrate temperature is at least 5°F above the dew point.

3.2.9. All sharp edges, weld spatter, slivers, under cuts, and pinholes shall be removed prior to abrasive blasting or power tool preparation.

3.2.10. The application of the lining shall be applied on the same day the surface is abraded or before any contamination or rust bloom appears. Areas that show signs of contamination or rust bloom must be re-prepared.

**3.3. Polyurethane Lining/Coating**

3.3.1. The lining/coating, field joints and repairs shall be made according to AWWA C222, this specification, or the manufacturer's recommendations, whichever is more stringent.

3.3.2. The resultant interior lining and exterior coating shall not be less than 25 mils dry film thickness. Follow manufacturer's requirements for maximum film thicknesses in ANSI/NSF Standard 61 potable water lining applications. There is no maximum allowable dry film thickness for the exterior polyurethane coating.

**3.4. Shrink Sleeves [enter appropriate recommendations based on systems selected]**

**3.5. Lining application**

3.5.1. The steel substrate shall be at least 5°F above the dew point and the relative humidity shall be less than 85%.

3.5.2. The finished film shall be free of holidays, detrimental intercoat and surface defects (inclusions, porosity, runs, orange peel, sags, fisheyes or cratering, mudcracking, wrinkling, overspray, blistering, delamination) and be smooth and glossy.

3.5.3. The flange shall receive full coating thickness through the bore and a light coat one (1) inch onto the face of the flange.

3.5.4. For liquid applied systems, all areas where holidays tend to occur (joint areas including cut backs, edges, etc.) care should be taken to ensure that the areas are adequately sealed and no void air spaces are present underneath the coating. If necessary, these areas should be pre-coated with a brush to ensure complete sealing.

3.5.5. Where the pipe is going to be entered to perform any work after the lining has been applied and set, the following requirements shall be met:

3.5.5.1. The lining shall be protected using an appropriate material to prevent scratching or impact damage to the finished system.

3.5.5.2. Extreme care shall be taken during the construction to avoid damage to the internal lining. No traffic shall pass directly over un-cured lining material and provisions for bridging these areas are required where access is necessary for the Contractor or Corporation.

3.5.6. The Contractor is advised that he will not be permitted to fill the pipe with water until, in the Engineer's opinion, the lining is "dry hard" cured and the ANSI/NFS Standard 61 cure requirements for the lining are met.

3.5.7. All coated areas shall be electrically holiday tested (100 percent) to ensure coating/lining is holiday free. Repairs shall be made according to Section 3.6.

3.5.8. Unless otherwise specified by the Corporation or its Engineer, the cure will be determined by pencil hardness testing, minimum value of 3H (ASTM D3363).

3.5.9. Adhesion testing of the lining shall be performed on every 4$^{th}$ field joint, at a minimum. All tests shall be in accordance with ASTM D4541 using an apparatus with a self-aligning pull-off technique, DeFelsko Positest or equal. Non-self-aligning units, e.g. the HATE tester from Elcometer, are not recommended. The minimum adhesion for polyurethane coatings and linings shall be 1500 psi.

**3.6. Damaged Lining/Coating**

3.6.1. Holidays and damaged areas shall be power tool prepared to SSPC-SP11 to scarify and feather into adjacent tightly bonded coatings to a nominal 4 to 6 inch radius.

3.6.2. Re-apply the coating/lining according to the manufacturer's recommendations to produce a smooth repair zone equal to the specified dry film thickness.

3.6.3. Repair procedures for unusual defects shall be submitted by the Contractor for approval to the Corporation or its Engineer prior to undertaking of repair activities.