Section 02527

POLYURETHANE COATINGS AND LININGS ON STEEL PIPE

PART 1 GENERAL

1.01 SUMMARY

This Section includes two-component polyurethane coating and lining systems for use as external coating for steel pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for Work performed under this Section. Include cost of polyurethane coatings in contract unit prices for steel pipe.

2. Refer to Section 01270 – "Measurement and Payment" for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D522/D522M - Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.

B. AWWA C 210 - Standard for Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

C. AWWA C 222 – Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.

D. SSPC-PA 2 – Procedure for Determining Conformance to Dry Coating Thickness Requirements.

E. E. SSPC-PA Guide 10 - Guide to Safety and Health Requirements E. SSPC-SP1 - Solvent Cleaning

F. F. SSPC-SP10 - Near-White Blast Cleaning.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 – "Submittal Procedures".

B. Submit coating manufacturer's catalog sheets and technical information for approval, prior to delivery of pipe.

C. Obtain from coating manufacturer and submit coating "affidavit of compliance" to requirements of this Section stating that coatings were applied in factory and in accordance with manufacturer's minimum requirements.

1.05 RELATED REQUIREMENTS

A. Section 01270 – "Measurement and Payment"

B. Section 01330 – "Submittal Procedures"

C. Section 02501 – "Ductile Iron Pipe and Fittings"

D. Section 02502 – "Steel Pipe and Fittings"

E. Section 02518 – "Steel Pipe and Fittings for Large Diameter Water Lines"

F. Provide full access to Project Manager for all facilities and documentation regarding surface preparation, environmental conditions and coating applications.

G. Observation by Project Manager or waiver of observation does not relieve Contractor of his responsibility to perform Work in accordance with Specifications.

H. Project Manager may retain services of independent, third-party NACE CIP Level III-Certified Inspector for partial or full-time inspection of the Work.

I. Safety Requirements

1. Secure, from manufacturer, Material Safety Data Sheet (MSDS) for polyurethane coatings and repair materials listed in this Section.

2. Safety requirements stated in this specification and in related sections apply in addition to applicable federal, state, and local rules and regulations. Comply with instructions of coating manufacturer and requirements of insurance underwriters.

3. Follow handling and application practices of SSPC-PA Guide 10;; Coating Manufacturer's Material Safety Data Sheet.

1.06 QUALITY ASSURANCE

A. Shop and Field Coating Applicator's Experience and Certification:

1. Minimum 2 years' practical experience in application of the specified products required for Coating Applicator and the coating application supervisor (Certified Applicator).

2. Minimum 2 years' practical experience in application of the specified coating system required for Coating application personnel whom have direct coating application responsibility.

3. Certification by coating manufacturer as an approved coating applicator required for Coating Applicator.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

A. Use standard containers to prevent gelling, thickening deleteriously or forming of gas in closed containers within period of 1 year from date of manufacture.

B. Label each container of separately packaged component clearly and durably to indicate date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification, number of coatings together with special instructions. Do not use coating components older than 1 year.

C. Deliver coating materials to pipe manufacturer in sealed containers showing designated name, batch number, color, date of manufacture, and name of coating manufacturer.

D. Store material on site in enclosures, out of direct sunlight in warm, ventilated and dry area, or protect as recommended by manufacturer.

E. Prevent puncture, inappropriate opening, or other action which may lead to product contamination.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Coating Material:

B. Polyurethane (two-component) or approved equal; mix in accordance with coating manufacturer's recommendations.

1. For areas less than or equal to 6 inches in diameter, brush apply.

2. For areas greater than 6 inches in diameter, spray apply.

C. Coating System: Use Type V system which is 2-package polyisocyanate, polyol-cured urethane coating, mixed in 1:1 ratio at time of application. Components shall be balanced viscosities in their liquid state and not require agitation during use.

D. Exterior Coating Material: Per AWWA C222 The Valspar Corporation or approved equal.

E. Internal Lining Material: Joint Coating Material CORROPIPE II-PW, manufactured by Carboline, Futura or Lifelast or approved equal.

F. Cured Properties:

1. Conversion to Solids by Volume: 97 percent plus or minus 3 percent.

2. Temperature Resistance: Minus 40°F and plus 130°F.

3. Cure Time: For handling in 1 minute at 120°F, and full cure as follows:

Ambient Temperature	Minimum Full Cure Time
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

4. Maximum Specific Gravities: Polyisocyanate resin, 1.20. Polyol resin, 1.15.

5. Minimum Tensile Strength: 2,000 psi.

6. Minimum Hardness: 55 plus or minus 5 Shore D at 70°F.

7. Flexibility Resistance: ASTM D 522 using 1-inch mandrel. Allow coating to cure for 7 days. Perform testing on test coupons held for 15 minutes at temperature extremes specified in this paragraph.

G. Repair and Touchup Material

CORROPIPE II PW - TOUCHUP (two-component, brush applied, or approved equal). Mix in accordance with coating manufacturer's recommendations.

2.03 FABRICATION

A. Surface Preparation:

1. Remove deposits of oil, grease or other organic contaminates before blast cleaning by using solvent wash as specified in SSPC-PA Guide 10. Clean and dry surfaces, keep free of moisture, dust, grit, oil, grease, or other deleterious substances prior to application of coating.

2. Exterior and Interior Surfaces: SSPC-SP10, near-white metal blast cleaning. Blast with clean, hard, sharp cutting abrasives with no steel or cast iron shot in mix.

B. Thickness

1. External Coatings: Minimum DFT of 25 mils (0.025 inch).

2. Internal Coatings: Minimum DFT of 20 mils.

3. Thickness Determinations: Use Type 1 magnetic thickness gauge as described in SSPC-PA2 specification. Individual readings below 90 percent of specified minimum are not acceptable. Average individual spot readings (consisting of three point measurements within 3 inches of each other) less than 95 percent of minimum are not acceptable. Average of all spot readings less than minimum thickness specified are not acceptable.

C. Factory Application of Polyurethane Coating

1. Equipment: As required by manufacturer.

2. Temperature: Minimum 5°F above dew point temperature. Temperature of surface shall not be less than 60°F during application.

3. Humidity: Heating of pipe surfaces may be required to meet requirements of paragraph 2.01E, Cured Coating Properties, when relative humidity exceeds 80 percent.

4. Do not thin or mix resins; use as received. Store resins at temperature above 55°F at all times or as manufacturer's recommendation.

5. Application: Conform to coating manufacturer's recommendations. Apply directly to substrate to achieve specified thickness. Multiple-pass, one-coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.

6. Recoat only when coating has cured less than maximum time specified by coating manufacturer. When coating has cured for more than recoat time, follow coating manufacturers recommendations for recoating.

7. Cure at ambient temperature above 0°F. Do not handle pipe until coating has been allowed to cure as follows:

Ambient Temperature	Minimum Full Cure Time
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

D. Factory Inspection

1. Project Manager may inspect coatings at coating applicator's facilities.

2. Secure approval of surface preparation by coating manufacturer's representative prior to coating application.

3. Inspection procedures to be in accordance with AWWA C222. Conduct inspection any time after coating has reached initial cure. Repair in accordance with manufacturer's requirements and these specifications.

4. Remove rejected coating from the full length of pipe to bare metal and reapply using proper application methods.

E. Factory Repair of Linings and Coatings

1. The procedures listed below are for repairs made to internal and external coatings in the factory. For field repairs, see Part 3 – Execution.

2. Defect size is defined as follows: Minor – less than 6 inches by greatest dimension. Major – exceeds 6 inches by greatest dimension.

3. General

a. Repair areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts, or other defects.

b. Provide coating repair materials that are compatible with the shop-applied coating system and approved by coating manufacturer.

c. Provide repair materials as required for the coating system and repair classification.

4. Repair Materials:

a. Provide polyurethane, single use kits that are supplied by parent coating manufacturer.

b. For major repairs in the shop, reapply using plural component spray equipment by a manufacturer certified coating applicator.

5. For internal coatings, five repairs maximum allowed per 100 square feet of pipe for internal linings. If this number is exceeded, pipe must be stripped of lining, re-blasted, and recoated in factory.

2.04 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Joints

1. Apply coating to unlined pipe surfaces including inside of bell socket and outside of spigot.

2. Coating thickness on sealing areas of spigot end of pipe exterior: Minimum 8 mils (0.008 inch), maximum of 10 mils (0.010 inch). Maximum 10 mils may be exceeded in spigot end provided maximum spigot diameter as specified by pipe manufacturer is not exceeded.

3. Provide holding primer for corrosion protection of cutbacks or holdbacks compatible with specified joint coating system and weld after backfill requirements, where applicable.

4. Holdback coating to prevent corrosion of prepared pipe ends for duration of storage and construction, and recommended for buried exposures.

5. Primer should not result in running or melting of coating and causing toxic fumes when heated during welding on weld after backfill joints.

6. Apply holding primer in accordance with primer manufacturer's recommendations, but maintain clearances required for proper joint installation as recommended by pipe manufacturer.

7. Welded joints:

a. Field welded on the inside: Provide four-inch coating holdback on spigot end and six-inch coating holdback on bell end.

b. Field welded on the outside: Provide six-inch coating holdback on the spigot end, and four-inch coating holdback on the bell end.

B. Pipe Installation

1. When required by Project Manager, provide services of manufacturer's representative for period of not less than 2 weeks at beginning of actual pipe laying operations to advise Contractor regarding installation including but not limited to handling and storing, cleaning and inspecting, coatings repairs, and general construction methods as to how they may affect pipe coatings.

2. Use nylon straps, padded lifts and padded storage skids. Field cuts should be kept to minimum. Repair damage to coating due to handling or construction

practices. See Section 02501 – "Ductile Iron Pipe and Fittings" and Section 02502 – "Steel Pipe and Fittings" for additional requirements.

3. Just before each section of pipe is to be placed into trench, conduct visual and holiday inspection in accordance with AWWA C222. Repair defects in coating system before pipe is installed.

4. For field-welded joints, drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on each side of the coating holdback to protect from weld splatter.

3.04 REPAIR/RESTORATION

A. Repair and Field Touchup

1. Apply repair and touchup materials in conformance with manufacturer's recommendations.

2. Repair Procedure - Holidays:

a. Remove traces of oil, grease, dust, dirt, and other deleterious materials

b. Roughen area to be patched by sanding with rough grade sandpaper (40 grit).

c. Apply one coat of repair material described above. Work repair material into scratched surface by brushing.

3. Repair Procedure - Field Cuts or Large Damage:

a. Remove burrs from field cut ends or handling damage and smooth out edge of polyurethane coating.

b. Remove traces of oil, grease, dust, dirt, and other deleterious materials

c. Roughen area to be patched with rough grade sandpaper (40 grit). Feather edges and include overlap of 1 inch to 2 inches of roughened polyurethane in area to be patched.

d. Apply thick coat of repair material described above. Work repair material into scratched surface by brushing. Feather edges of repair material into prepared surface. Cover at least 1 inch of roughened area surrounding damage, or adjacent to field cut.

4. Repair Procedure – Joints:

a. External Joints. Provide heat shrink sleeve in accordance with Section 02518 – "Steel Pipe for Large Diameter Water Lines". Metal surface

must be free of all dirt, dust, and surface corrosion prior to sleeve application.

b. Internal Joints. Prepare surface and provide environmental controls in accordance with manufacturer's recommendations.

1) Remove oil or grease by solvent wiping pipe and adjacent coating in accordance with SSPC-SP1, Solvent Cleaning.

2) Abrasively blast in the field in accordance with SSPC-SP10, Near-White Metal Blast Cleaning. Clean the full circumference of the pipe and feather the edges of the existing polyurethane coating a minimum of two inches.

3) Remove loose or damaged pipe lining at joint and repair as specified herein, or extend joint lining.

4) Apply lining material by hand or spray equipment. Provide material that is compatible with shop lining and approved by manufacturer.

5) Provide a NACE Level II or III inspector experienced with the applied coating system to inspect surface preparation of the joint lining and document application conditions. Submit documentation to Project Manager.

5. Repair Procedure - Thermite Brazed Connection Bonds:

a. Remove polyurethane coating with power wire brush from area on metal surface which is to receive thermite brazed connection.

b. Grind metal surface to shiny metal with power grinder and coarse grit grinding wheel.

c. Apply thermite-brazed connection using equipment, charge, and procedure recommended by manufacturer of thermite equipment.

d. Drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on all sides during welding to protect from weld spatter.

e. After welded surface has cooled to temperature below 130°F, apply protective coating repair material to weld, exposed pipe surface and damaged areas of polyurethane coating.

f. Do not cover or backfill freshly repaired areas of coating at thermite-brazed connection until repair material has completely cured. Allow material to cure in conformance with manufacturer's recommendations.

3.05 – 3.10 NOT USED

END OF SECTION