

Section 02502

STEEL PIPE AND FITTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Steel pipe and fittings for water lines for aerial crossings, aboveground piping, and encasement sleeves. Do not bury steel pipe, unless it is large diameter water line.
2. Specifications identify requirements for small-diameter less than or equal to 20 inches.

1.2 MEASUREMENT AND PAYMENT

1. Unit Prices.
 1. No payment will be made for steel pipe and fittings under this Section. Refer to Section 02511 - Water Lines for measurement and payment.
 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
2. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

1. AASHTO - Standard Specifications for Highway Bridges.
2. ASME B 16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.
3. ASTM A 36 - Standard Specification for Carbon Structural Steel.
4. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
5. ASTM A 105 - Standard Specification for Carbon Steel Pipe Forgings for Piping Applications
6. ASTM A 106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
7. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
8. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).

9. ASTM A 1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
10. AWWA C 200 - Standard for Steel Water Pipe 6 in. and Larger.
11. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.
12. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
13. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
14. SSPC Good Painting Practice, Volume 1.
15. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.
16. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.
17. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.
18. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.
19. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.4 SUBMITTALS

1. Conform to requirements of Section 01330 - Submittal Procedures. For aerial crossings and above ground piping, include lay schedule of new pipe and fittings indicating alignment and grade, laying dimensions, lining and coating systems, proposed welding procedures, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings.
2. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200.
3. Submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:
 1. Polyurethane coatings were applied in strict accordance with manufacturer's recommendation and allowed to cure at temperature 5 degrees above dew point.
 2. Linings were applied and allowed to cure at temperature above 32 F.

4. Submit certification from NACE Certified Coatings Inspector, having Level III certification for coatings and linings that steel pipe furnished on project was properly inspected and defective coatings detected were properly repaired.

1.5 QUALITY CONTROL

1. Prior to start of work, provide proof of certification of qualification for welders employed for type of work, procedures and positions involved. Provide welder qualifications in accordance with AWWA C 206.
2. Shop-applied coatings and linings; provide services of an independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector verifying compliance with same requirements specified in Paragraph 3.03.
3. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.
4. Final Inspection:
 1. Before shipment, inspect each finished pipe, fitting, special and accessory for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.
 2. Inspect for coating placement and defects. Test exterior coating for holidays.
 1. Inspect linings for thickness, pitting, scarring, and adhesion.
5. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

PART 2 PRODUCTS

1.6 STEEL PIPE

1. Manufacture pipe with nominal diameter 20 inches and less but more than 2 inches to conform to ASTM A106 or A 53 Grade B, standard weight.
2. Provide steel pipe and encasement sleeves designed and manufactured in conformance with AWWA C 200 and AWWA M 11 except as modified herein. Steel to be minimum of ASTM A 36, ASTM A 1011 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, or ASTM A 139 Grade B.

- Minimum Allowable Steel-Wall Thickness: Inside clear diameter to be minimum of nominal diameter of pipe specified.

CARRIER PIPE			
Nom. Pipe Size (In.)	Min. Wall		Approx. Wt. Per Lin. Ft. Uncoated (Lb.)
	O.D. (In.)	Thick. (In.)	
4	4.50	0.250	11.35
6	6.625	0.280	18.97
8	8.625	0.322	28.55
10	10.75	0.365	40.48
12	12.75	0.375	49.56
16	16.00	0.375	62.58
20	20.00	0.375	78.60

Notes:

- Review pipe and fitting design for conditions exceeding those specified herein.
- Provide pipe with wall thickness of no less than listed in table above.

MINIMUM DIAMETER CASING PIPE (ENCASEMENT SLEEVES)			
Corresp. Casing Pipe Size (In.)	Min. Wall		Approx. Wt. Per Lin. Ft. Uncoated (Lb.)
	O.D. (In.)	Thick. (In.)	
8	8.625	0.219	19.64
10	10.75	0.219	24.60
12	12.75	0.219	29.28
16	16.00	0.219	36.86
18	18.00	0.25	47.39
20	20.00	0.250	52.73
24	24.00	0.250	63.41

Notes:

- Provide casing pipe with wall thickness of no less than listed in table above.
- Casing pipe: AWWA C 200 new uncoated welded steel.
- Verify casing diameter required with dimensions of casing spacer.
- Provide pipe sections in lengths of no less than 16 feet except as required for special sections, and no greater than 40 feet.

5. Provide short sections of steel pipe no less than 4-feet in length unless indicated on Drawings or specifically permitted by City Engineer.
6. Fittings: Factory forged for sizes 4 inches through 20 inches; long radius bends; beveled ends for field butt welding; wall thickness equal to or greater than pipe to which fitting is to be welded unless otherwise shown on Drawings.
7. Joints:
 1. Standard field joint for steel pipe and encasement sleeve: AWWA C 206. Single-welded, butt joint.
 2. Provide mechanically coupled or flanged joints for valves and fittings, as shown on Drawings. Flanges: AWWA C 207, Class D; same diameter and drilling as Class 125 cast iron flanges ASME B 16.1. Maintain electrically isolated flanged joints between steel and cast iron by using epoxy-coated bolts, nuts, washers and insulating type gasket.
 3. Elbows to be standard weight seamless elbows per ASTM A106, Grade A or B.
 4. Flanges for pipe 20 inches in diameter and smaller shall be ANSI 150 lb. flat face, slip on or weld neck flanges, meeting ASTM A105 requirements. Where flanges are to join to valves with raised face flanges, use ANSI 150 lb. raised flange.
 5. Provide same coating for exposed portions of nuts and bolts as flanges, which they secure.
8. Fabricate flanges with over-size bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.

1.7 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

1. Supply steel pipe with epoxy lining, capable of conveying water at temperatures not greater than 140 degrees F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61 and certification to be from organization accredited by ANSI. Unless otherwise noted, coat exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, etc., with epoxy lining, as specified.
2. Epoxy Lining AWWA C 210, White, or approved equal for shop and field joint applied, except as modified in this Section. Provide material from same manufacturer. For Pipe larger than 2 inches in diameter protect interior surface with liquid two-part chemically cured epoxy primer specified for interior surfaces.

Surface Preparation 2.0 to 3.0 mils surface profile	SSPC-5 (64) White Blast Clean
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Prime Coat 4.0 to 6.0 mils DFT	ACRO 4460 NSF Certified Epoxy - Buff, or approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	ACRO 4460 NSF Certified Epoxy - Buff, or approved equal
Finish Coat 4.0 to 6.0 mils DFT	ACRO 4460 NSF Certified Epoxy - White, or approved equal

1. Total allowable dry film thickness for system:
 1. Minimum: 12.0 mils.
 2. Maximum: 18.0 mils.
 3. Minimum field adhesion: 700 psi.
2. Dry film thicknesses for approved alternate products in accordance with product manufacturer's recommendations.
3. Lining system may consist of three or more coats of same approved alternate epoxy lining without use of separate primer.

1.8 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVEGROUND AND IN VAULTS (EXPOSED)

1. Provide 3-coat epoxy/polyurethane coating system as designated below. Provide material from same manufacturer.

Surface Preparation 2.0 to 3.0 mils surface profile	SSPC SP 10 Near White Blast Clean
Prime Coat 2.0 to 4.0 mils DFT	ACRO 4422 Inhibitive Epoxy Primer, or approved equal
Intermediate Coat 4.0 to 6.0 mils DFT	ACRO 4460 Chemical Resistant Epoxy, or approved equal
Finish Coat 1.5 to 2.5 mils DFT	ACRO 4429 Polyurethane, or approved equal

2. Total Allowable Dry Film Thickness (DFT) for System:

1. Minimum: 7.5 mils.
2. Maximum: 12.5 mils.
3. Clean bare pipe free from mud, mill lacquer, oil, grease, or other contaminant. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use only approved safety solvents, which do not leave residue. Use preheating to remove oil, grease, mill scale, water, and ice provided pipe is preheated in uniform manner to avoid distortion.
4. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges, presence of metallic defects may be cause for rejection of pipe.

PART 3 EXECUTION

1.9 PIPING INSTALLATION

1. Conform to applicable provisions of Section 02511 - Water lines, except as modified in this Section.
2. Comply with the following:
 1. Bedding and Backfilling: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.
 2. For pipes with coating: Do not roll or drag pipe on ground, move pipe in such a manner as not to damage pipe or coating. Carefully inspect pipe for abrasions and repair damaged coating before pipe is installed.
3. Static Electricity:
 1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.
 2. Electrically test where required after installation is complete.
4. Use adequate surveying methods and procedures and employ competent surveying personnel at times to ensure that pipe joints are laid to line and grade and within stipulated tolerances. Measure and record in form approved by City Engineer, survey data for pipe laid each day and submit copy of data to City Engineer at end of that day.

1.10 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM.

1. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.
2. Workmanship:
 1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.
 2. Paint Application Procedures: SSPC Good Painting Practices, Volume 1.
3. Surface Preparation:
 1. Prepare surfaces for painting by using abrasive blasting.
 2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.
 3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.
 4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to 1/4-inch minimum radius.
 5. Abrasive Material:
 1. Blast only as much steel as can be coated same day of blasting.
 2. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to job site in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.
 3. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Text Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to City Engineer.
 4. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F above dew point.
 6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.
 7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing 3/4-inch by 4-inch piece of

clear Scotch type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

4. Coating and Lining Application:

1. Environmental Conditions: Do not apply coatings or linings when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels.
2. Application Procedures:
 1. Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.
 2. Thin materials only with manufacturer's recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.
 3. Discard catalyzed materials remaining at end of day.
3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.
4. Cure a minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed with ACRO 4460, or approved equal, and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coatings are applied, provide forced air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

5. Testing of Coatings and Linings:

1. Inspect pipe for holidays and damage to coating:

1. If test indicates no holidays and coating is damaged, remove damaged layers of coating and repair in accordance with coating manufacturers recommendations.
2. Perform holiday test in accordance with NACE Standard Recommended Practice, RPO 188-90, Discontinuity (Holiday) Testing of Protective Coatings.
3. Begin testing of completed coating after coating has sufficiently cured, usually one to 5 days. Consult coating manufacturer for specific curing schedule.
4. Perform adhesion test on pipe in accordance with ASTM D 4541.
5. For coating thickness of 20 mils or less, test with wet sponge low-voltage holiday detector. For coating thickness in excess of 20 mils, test with high-voltage holiday detector. Perform electrical holiday test with 60-cycle current audio detector. Select test voltage as suggested in table below.

MINIMUM VOLTAGES FOR
 HIGH VOLTAGE SPARK TESTING

Total Dry Film Thickness (mils)	Suggested Inspection (V)
8 to 11	1,500
12 to 15	2,000
16 to 20	2,500
21 to 40	3,000
41 to 55	4,000
56 to 80	6,000

1.11 JOINTS AND JOINTING

1. Welded Joints:

1. Conform to requirements of Section 02511 - Water Lines.
2. Field weld to be full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.
3. Employ an independent certified testing laboratory, approved by City Engineer, to perform weld acceptance tests on welded joints. Include cost of such testing in contract unit price bid for water line. Furnish copies of test reports to City Engineer

for review. Test by X-ray methods for butt welds, for 100 percent of joint welds. City Engineer has final decision as to suitability of welds tested.

2. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.
3. Joint Grouting and Testing: Conform to requirements of Section 02511 - Water Lines.

1.12 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

1. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. City Engineer is responsible for quality assurance and reserves the right to inspect or acquire services of an independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at all phases of coatings and linings work, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not City Engineer provides such inspection.

END OF SECTION