SECTION 02420 - FABRICATED STEEL PIPE AND SPECIALS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing fabricated steel pipe, specials and connections to new and existing piping. Polyurethane and fusion bonded epoxy lining and coating material shall be furnished only by an OWNER-approved manufacturer.

1.2 REFERENCE SPECIFICATIONS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ANSI B16.3	Malleable Iron Threaded Fittings, Class 150 and 300
2.	ANSI B16.11	Forged Steel Fittings, Socket-Welding and Threaded
3.	ASTM A 36	Structural Steel
4.	ASTM A 47	Ferritic Malleable Iron Castings
5.	ASTM A 53	Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
6.	ASTM A 105	Forgings, Carbon Steel, for Piping Components
7.	ASTM A 106	Seamless Carbon Steel Pipe for High-Temperature Service
8.	ASTM A 197	Cupola Malleable Iron
9.	ASTM A 234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
10.	ASTM A 283	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
11.	ASTM A 536	Ductile Iron Castings
12.	ASTM A 570	Hot-Rolled Carbon Steel Sheet and Trip, Structural Quality
13.	ASTM A 572	High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
14.	ASTM D 16	Definition of Terms Relating to Paint, Varnish, Lacquer, and Related Products

15. ASTM D 471 Test Method for Rubber Property - Effect of Liquids

16. ASTM D 2240 Test Method for Rubber Property - Durometer Hardness

17. ASTM D 4060 Test Method for Abrasion Resistance for Organic Coatings by the Taber Abraser

18. ASTM D 4541 Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

19. ASTM E 96 Test Method for Water Vapor Transmission of Materials

20. AWWA C200 Steel Water Pipe 6 In. and Larger

21. AWWA C203 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines--Enamel and Tape--Hot-Applied

22. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe--4 In. and Larger--Shop Applied

23. AWWA C208 Dimensions for Fabricated Steel Water Pipe Fittings

24. AWWA C209 Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines.

25. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipeline

26. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances

27. AWWA C602 Cement-Mortar Lining of Water Pipelines - 4-In. and Larger - In Place

28. AWWA M11 Steel Pipe--A Guide for Design and Installation

29. SSPC SSPC: The Society for Protective Coatings Specifications

1.3 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300:

1. Shop Drawings

a. Shop drawings showing dimensions and details of pipe joint fittings, fitting specials, valves and appurtenances.

b. Detailed layout, spool or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings and pipe supports not indicated in the Contract Documents.

c. Shoring and bracing drawings in accordance with Section 02000.

d. Manufacturer's technical data and installation instructions.

2. Design Calculations

a. Calculations and drawings for anchorage where applicable.

1.4 INSPECTION

A. Factory Inspection

1. All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein.

2. The CONTRACTOR shall notify the OWNER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.

3. During the manufacture of the pipe, the OWNER shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

1.5 TESTING

A. Except as modified herein, pipe shall be tested in accordance with the requirements of this Section and AWWA C200 and C205 respectively, as supplemented by the requirements herein.

1. The OWNER shall have the right to witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR's schedule will not be delayed for the convenience of the OWNER.

2. All expenses incurred in obtaining samples for testing shall be borne by the CONTRACTOR at no increased cost to the OWNER.

3. In addition to those tests specifically required, OWNER may request additional samples of any material for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Fabricated steel pipe and joints shall comply with SSPWC Section 207-10.2.

B. Linings and coatings, except for cement mortar, shall be inspected electrically for continuity at the place of application.

2.2 STEEL PIPE

A. Steel pipe shall comply with ASTM A 53 (Type E or S), ASTM A 106 or AWWA C200

B. Schedule 40 for pipe 10 inches diameter and smaller, and schedule 80 for pipe larger than 10 inches diameter shall be used, except as otherwise indicated.

C. Steel Pipe Fabricated to meet requirements of AWWA C200:

1. Fabricated pipe shall comply with ASTM A 36, ASTM A 572 (Grade 42), ASTM A 570, (Grades 33 and 36), or ASTM A 283 (Grade D), except that ASTM A 53 and ASTM A 106 pipe shall be grade B, straight or spiral seam.

2. Pipe shall have minimum wall thickness of 7 gauge for pipe 24 inches in diameter and smaller, and a minimum wall thickness of 1/4-inch for pipe larger than 24 inches diameter.

2.3 FITTINGS

A. Threaded Steel Fittings

1. Threaded steel fittings shall comply with ASTM A 47, ASTM A 197 or ANSI B16.3.

B. Forged Steel Fittings

1. Forged steel fittings shall comply with ASTM A 234, ASTM A 105 or ANSI B16.11.

C. Fabricated Steel Fittings

1. Fabricated steel fittings shall comply with AWWA C208

D. Grooved Fittings

1. Grooved fittings shall comply with full-flow cast fittings, or segmentally welded fittings with grooves or shoulders designed and fabricated for standard grooved-end piping.

E. Cast Fittings

1. Cast fittings shall comply with ductile iron conforming to ASTM A 536 or malleable iron conforming to ASTM A 47.

2.4 PIPE LINING

A. Where indicated, pipe linings shall comply with the following:

1. Surfaces shall be prepared in accordance with SSPC-SP 10 for Near White Blast Cleaning, and the lining shall be applied as recommended by the manufacturer.

2. Pipe and fittings shall be centrifugally lined with cement mortar complying with AWWA C205. If the special cannot be lined centrifugally, it shall be lined by hand in compliance with AWWA C602.

3. Fittings and specials larger than 24 inches, not fabricated from centrifugally formed straight sections, shall require 2-inch by 4-inch WO.5 x WO.5 gage self-furring wire mesh reinforcement for hand-applied lining. Wire mesh shall be positioned approximately in the center of the lining. The wires spaced 2 inches on centers shall run circumferentially around the pipe with the fabric securely fastened to the pipe. Splices shall be lapped 4 inches and the free ends tied or looped to assure continuity.

B. Glass Lining

1. Pipe and fittings shall be glass lined with a vitreous material to a minimum thickness of 10 mils.

2. Pipe and fittings shall have all internal welds ground smooth and voids and slag holes ground out, rewelded and ground smooth.

3. Glass lining shall provide continuous coverage when tested by a low voltage holiday detector.

2.5 PIPE COATING

A. Where indicated, pipe coatings shall comply with the following:

1. Coal-tar protective coating shall be a multi-layer coal-tar enamel fibrous glass mat and mineral glass felt wrap conforming to AWWA C203 except as indicated below:

2. Pipe surfaces shall be prepared by solvent cleaning (SSPC-SP1) followed by blasting to at least Commercial Blast Cleaning (SSPC-SP6) conditions.

3. Pipe temperatures shall be at least 85 degrees F.

4. Primer shall be in accordance with AWWA C209.

5. Specially processed coal-tar pitch combined with inert filler, having no asphalt or petroleum of natural origin, of [Type 1], shall be applied hot.

6. Glass fiber wrap shall be non-woven, either reinforced or non-reinforced, glass fiber mat uniformly impregnated with material compatible with coat-tar enamel.

7. Primer plus coal-tar enamel shall be 3/32 inch thick, plus or minus 1/32 inch.

8. The entire coated surface of the pipe shall be electrically tested for continuity.

$$V = 1250[T]^{1/2}$$

Where: V = Test voltage, volts

T = Total coating system thickness, mils

2.6 PREFABRICATED TAPE COATING

A. Tape coating shall be in accordance with Section 02410. Holiday testing shall be calculated from:

$$V = 1250[T]^{1/2}$$

Where: V = Test voltage, volts

T = Total tape coating system thickness, mils

2.7 POLYURETHANE COATING AND LINING

A. Polyurethane material shall be a 1 to 1 polyol resin to isocyanate resin 2-component mixture, of [Type V] according to ASTM D 16.

B. Pipe surfaces shall be prepared by solvent washing (SSPC-SP1) followed by near white blast (SSPC-SP10) with an angular profile of at least 2.5 microns.

C. Pipe temperatures shall be at least 5 degrees F warmer than the dewpoint in the area of the application equipment. Pipe shall be warmed if necessary.

D. Material components shall be stored at temperatures warmer than 50 degrees F and shall not be stored longer than 6 months. Older components shall not be used.

E. The entire pipe surface coated and lined with polyurethane shall be tested at 200 volts per mil for holidays after curing. Every holiday shall be repaired as indicated below.

F. Entire pipe surface shall be inspected visually. Pipe with sharp protuberances or significant sags, dimples, or curtains will not be accepted.

G. The OWNER will select one section of pipe from each lot of 20 sections for thickness testing by the CONTRACTOR. Tests shall be made by a Type 1 magnetic thickness gage. OWNER will designate locations for spot measurements taken at the points of an equilateral triangle 3 inches on a side: the triangles shall be located at both ends, in the middle, and at the midpoints of each half of the pipe, plus 5 randomly-selected individual points.

H. No single spot measurement shall be less than 75 percent of the indicated minimum nominal thickness.

I. The average of three spot measurements from any triangle shall not be less than 80 percent of the indicated minimum nominal thickness.

J. The average of all spot measurements on a pipe shall not be less than the indicated minimum nominal thickness.

K. Sections of pipe selected by the OWNER for thickness testing will also be tested by the OWNER for delamination by scoring and prying with a pocket knife.

L. If the tested pipe complies with the thickness criteria above and shows no sign of delamination by knife test, all pipe in the lot of 20 will be considered as complying with requirements and the tested pipe may be repaired for installation.

M. If the tested pipe fails either test, five additional sections from the same lot will be tested in similar fashion, and if all five pass all tests, then the lot, except for the pipe which failed, will be considered in compliance. If any of the additional sections fail, the entire lot will be considered non-compliant and shall not be used.

N. Holidays and cut ends shall be repaired by solvent cleaning, roughening with coarse sand paper, and application of brushable 2-component material recommended by the manufacturer for such purposes. Overlap the acceptable coating and lining at least one inch in all directions. Mix repair material and apply in accordance with the manufacturer's recommendation.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Pipe shall be installed in accordance with AWWA M-11, Chapter 16.

B. Sleeve-type pipe couplings shall be installed in accordance with AWWA M-11.

C. Pipe lining and coatings at field joints shall comply with Section 04100.

D. Buried couplings and valves shall be field coated complying with Section 04000.

END OF SECTION