



**WATER PRODUCTION FACILITIES DISINFECTION SYSTEMS UPGRADE PHASE II**

**Solicitation No: CO-00199**

**Job No.: 16-6002**

**ADDENDUM 1**

**Date: August 29, 2018**

To Bidder of Record:

This addendum, applicable to work referenced above, is an amendment to the bid proposal, plans and specifications and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the Addendum number and issue date on the space provided in submitted copies of the bid proposal.

**RESPONSES TO QUESTIONS**

1. **Question: Is there a bill of materials for the FRP portion of the job.**  
*Response: No, there is no bill of materials for the FRP portion of the job. The components of the job which shall be FRP are the chemical tanks and brine tanks along with the ladders and landings associated with the tanks.*
  
2. **Question: Can you please provide a specification for the buried/exposed carbon steel piping? Reference plan page M-05 & M-06.**  
*Response: See addition of specification section 40 05 24 – Steel Pipe for Water Service to the project manual.*
  
3. **Question: Reference Spec 40 05 86-7 Air Valve Schedule & Plan Page M-06. This calls for 1 each 6” combination air valve on a 36” line at the control valve assembly. Plan page M-06 shows two air valves; 1 ea on 36” & 1 ea on 30”. These both reference detail 2/M-09. Detail 2/M-09 shows using threaded galvanized fittings and threaded butterfly valves. The Air Valve Schedule shows using flange inlet connections for the air valve. Please verify**  
*Response: See changes to specification section 40 05 86 included in this addendum.*

**CHANGES TO THE SPECIFICATIONS**

1. Table of Contents  
**Add** the following to the table of contents:  
  
Steel Pipe for Water Service .....40 05 24-1
  
2. Section 40 05 24 – Steel Pipe for Water Service  
**Add** the attached specification 40 05 24- Steel Pipe for Water Service to the project manual.

3. Section 40 05 86 – Air Valves for Water Service  
 Replace Table 40 05 86-A AIR VALVE SCHEDULE as follows:

**TABLE 40 05 86-A AIR VALVE SCHEDULE**

No.	Valve Type	Service	Location	Inlet Dia. (inch)	Inlet Connection Type	Orifice (inch)	Working Pressure Range (psi)	Valve Design Pressure (psi)	Isolating Valve Type
1	CA	Water	Upstream of Control Valve Assembly	30	NPT	6	50	150	BV
2	CA	Water	Downstream of Control Valve Assembly	36	NPT	6	50	150	BV

END OF ADDENDUM

This Addendum, including these two (2) pages, is fourteen (14) pages with attachments in its entirety.  
 Attachments: Specification 40 05 24 – Steel Pipe for Water Service



Arcadis U.S., Inc.  
 Texas Firm No. F-533

SECTION 40 05 24

STEEL PIPE FOR WATER SERVICE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install steel pipe and fittings for liquid service.
2. Extent of piping is shown or indicated on the Drawings. Piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, specify pipe service, diameter, material, lining, coating, pressure rating, joint type(s), and Site quality control testing required.

B. Coordination:

1. Review installation procedures under this and other Specification Sections and coordinate the installation of items that must be installed with or before steel pipe Work.

C. Related Sections:

1. Section 09 91 00, Painting.
2. Section 33 05 05, Buried Piping Installation.
3. Section 40 05 05, Exposed Piping Installation.
4. Section 40 05 06, Couplings, Adapters, and Specialties for Process Piping.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. AASHTO, Policy on Geometric Design of Highways and Streets.
2. ANSI/ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
3. ANSI/ASME B1.20.1, Pipe Threads, General Purpose, Inch.
4. ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
5. ANSI/ASME B16.3, Malleable Iron Threaded Fittings, Classes 150 and 300.
6. ANSI/ASME B16.4, Gray Iron Threaded Fittings (Classes 125 and 250).
7. ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 Metric/Inch Standard.
8. ANSI/ASME B16.9, Factory-Made Wrought Butt welding Fittings.
9. ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
10. ANSI/ASME B18.2.1, Square and Hex Bolts and Screws, Inch Series.
11. ANSI/ASME B18.2.2, Square and Hex Nuts.
12. ANSI/ASME B31.3, Process Piping.
13. ANSI/ASME B36.10M, Welded and Seamless Wrought Steel Pipe.

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14. ANSI/ASME Boiler and Pressure Vessel Code.
15. ASTM A36/A36M, Specification for Carbon Structural Steel.
16. ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
17. ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.
18. ASTM A106/A106M, Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
19. ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
20. ASTM A139/A139M, Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
21. ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
22. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
23. ASTM A197/A197M, Specification for Cupola Malleable Iron.
24. ASTM A234/A234M, Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
25. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
26. ASTM A536, Specification for Ductile Iron Castings.
27. ASTM A865, Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.
28. ASTM D16, Terminology for Paint, Related Coatings, Materials, and Applications.
29. ASTM D297, Test Methods for Rubber Products – Chemical Analysis.
30. ASTM D395, Test Methods for Rubber Property – Compression Set.
31. ASTM D412, Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
32. ASTM D573, Test Method for Rubber – Deterioration in an Air Oven.
33. ASTM D1330, Specification for Rubber Sheet Gaskets.
34. ASTM D2240, Test Method for Rubber Property – Durometer Hardness.
35. ASTM D3359, Test Methods for Measuring Adhesion by Tape Test.
36. ASTM D3363, Test Method for Film Hardness by Pencil Test.
37. ASTM D4541, Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
38. ASTM D4752, Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.
39. AWWA C200, Standard for Steel Water Pipe - 6 in. (150 mm) and Larger.
40. AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 In. (100 mm) and Larger, Shop Applied.
41. AWWA C206, Field Welding of Steel Water Pipe.
42. AWWA C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
43. AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.

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44. AWWA C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
45. ANSI/AWWA C218, Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.
46. AWWA C219, Bolted, Sleeve-Type Couplings for Plain End Pipe.
47. AWWA C222, Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.
48. AWWA C606, Grooved and Shouldered Joints.
49. AWWA Manual M11, Steel Water Pipe: A Guide for Design and Installation.
50. AWS B2.1, Specification for Welding Procedure and Performance Qualification.
51. AWS D1.1/D1.1.M, Structural Welding Code – Steel.
52. Chlorine Institute, Pamphlet No. 6, Piping Systems for Dry Chlorine.
53. Chlorine Institute, Pamphlet No. 95, Gaskets for Chlorine Service.
54. NACE RP 0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
55. NACE RP 0274, High-Voltage Electrical Inspection of Pipeline Coatings.
56. NSF/ANSI 61, Drinking Water System Components – Health Effects.
57. SSPC-SP 1, Solvent Cleaning.
58. SSPC SP 6/NACE No. 3, Commercial Blast Cleaning.
59. SSPC-SP 10/NACE No. 2, Near-White Commercial Blast Cleaning.
60. SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

### 1.3 QUALITY ASSURANCE

#### A. Qualifications:

1. Manufacturer:
  - a. Pipe shall be the product of one manufacturer that has not less than five (5) years successful experience manufacturing pipe in the United States and can provide evidence of this at the request of the engineer. All pipe manufacturing including cylinder production, lining, coating and fittings shall be produced by one manufacturer. The pipe manufacturer must have a certified quality assurance program. This certified program shall be ISO 9001: 2000 or other equivalent nationally recognized program.
2. Welders:
  - a. Shop welding and field welding (where allowed by ENGINEER) of steel pipe and components shall be by certified welders, each having valid certificates conforming to the ANSI/ASME Boiler and Pressure Vessel Code, demonstrating qualifications under Section IX, Welding Qualifications, of the ANSI/ASME Boiler and Pressure Vessel Code, or AWS B2.1.
3. Weld Inspectors:
  - a. Inspection of shop welds and field welds (where allowed by ENGINEER) of steel pipe and components shall be by certified weld inspectors, each having valid certificates conforming to ANSI/ASME Boiler and Pressure Vessel Code Section V, or AWS D1.1, as applicable for type of inspection required.

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- B. Component Supply and Compatibility:
1. Unless otherwise approved by ENGINEER, obtain all pipe, fittings, and appurtenances included in this Section from a single steel pipe manufacturer.
  2. Steel pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all pipe, fittings, and appurtenances furnished under this Section.
  3. All components shall be suitable for specified service conditions and shall be integrated into the overall piping system by steel pipe manufacturer.
  4. Steel pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings.
- C. Regulatory Requirements:
1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable shall be certified by an accredited organization in accordance with NSF/ANSI 61 as being suitable for contact with potable water, and shall meet requirements of authorities having jurisdiction at Site.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Shop Drawings: Submit the following with submittals required under Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation:
    - a. Detailed drawings and data for pipe, fittings, joint types, gaskets, appurtenances, linings, and coatings.
    - b. Laying schedules and detailed plan and profile drawings for all steel piping showing full details of piping, valves, hangers, supports, restraints, couplings, accessories, and specials.
    - c. Written welding procedures for each type of weld and weld position.
    - d. Calculations verifying strength of pipe joints within spans between pipe supports for exposed steel pipe on supports.
    - e. Design of specials and AWWA C208 fittings, including dimensional calculations and wall thickness calculations, in accordance with AWWA C208.
  2. Product Data:
    - a. Manufacturer's literature, including materials of construction, dimensions, weights, specifications and other engineering data.
  3. Testing Procedures:
    - a. Quality control, inspection and testing procedures. Obtain ENGINEER's approval prior to performing tests.
- B. Informational Submittals: Submit the following:
1. Certificates:
    - a. Certificate signed by manufacturer of each product that product conforms to the Contract Documents and applicable standards referenced in this

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Section.

- b. Certificates of suitability of elastomers used for gaskets with specified service conditions.
2. Source Quality Control Submittals:
  - a. Pipe and fittings shop tests, including inspection and test reports, shop fit tests and required non-destructive tests.
3. Procedure Submittals:
  - a. Surface preparation and application reports and procedures as required for lining and coating of pipe and fittings. Steel pipe and fitting manufacturer and manufacturer of lining and coating, as specified, shall mutually determine recommended surface preparation and application methods, and submit written verification of mutually selected method.
4. Qualifications Statements:
  - a. Pipe Manufacturer: When requested by ENGINEER, submit list of existing installations with contact names and telephone numbers for each.
  - b. Welders: When requested by ENGINEER, submit qualifications for automatic and manual welding operators and procedures to demonstrate conformance to specified qualification requirements.
  - c. Weld Inspectors: When requested by ENGINEER, submit each certified weld inspector's QC-1 certification and qualifications.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
- B. Handling:
  1. Handling of Pipe: To maintain circular shape and prevent distortion, temporarily brace each end of each length of pipe with pipe manufacturer-approved internal spider device, where recommended by pipe manufacturer.
  2. Handling of Lined Pipe and Fittings: Lifting devices shall not contact lined surfaces. Use hooks, forks, chains, straps, and other lifting devices only on exterior of pipe and fittings. Pipe and fittings with damaged lining shall be replaced regardless of cause of damage.
  3. Handling of Coated Pipe and Fittings: Hooks, forks, chains, straps, and other lifting devices shall be rubber-coated and used on exterior of pipe and fittings only in manner that does not damage the coating. If coating is damaged, notify pipe and coating manufacturer to determine if repair of damaged area or re-coating is required. Perform repairs using manufacturer's recommended procedures and materials provided by manufacturer, as accepted by ENGINEER. Pipe and fittings requiring re-coating shall be removed from the Site and returned to pipe manufacturer's facility. Repaired or re-coated pipe and fittings shall conform to the Contract Documents.

PART 2 – PRODUCTS

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2.1 GENERAL

A. General:

1. Piping systems and components shall conform to the Contract Documents and be suitable for their intended use.
2. Joint types, linings, and coatings shall be as specified in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation. If not specified, provide flanged joints for exposed piping and welded joints for buried piping.

2.2 DETAILED REQUIREMENTS, CARBON STEEL PIPE IN LIQUID SERVICE

A. Service Conditions:

1. Pipe and fittings shall conform to the service conditions in Table 40 05 24.13-A:

**TABLE 40 05 24.13-A  
 STEEL PIPE SERVICE CONDITIONS**

<b>Liquid Service</b>	<b>Nominal Diameter (inches)</b>	<b>Max. Flow (gpm)</b>	<b>Internal Design Pressure (psi)</b>	<b>Transient Pressure (psi)</b>	<b>Maximum Operating Ambient Temperature (degrees F)</b>
Water	30	25416	65	-	120
Water	36	25416	65	-	120
Water	42	25416	65	-	120
Water	48	25416	65	-	120
Water	54	25416	65	-	120

2. Nominal diameter of pipe shall not include the thickness of lining or coating.
3. Allowable stress in pipe material shall not exceed 50 percent of material's yield stress (30,000 psi for steel). Under transient conditions, increase in hoop stress shall not exceed the smaller of the following: 75 percent of material's yield strength, or full mill test pressure.
4. For buried pipe, unless otherwise specified or indicated on the Drawings, the soil density shall be 120 pounds per cubic foot. Modulus of soil reaction shall be at least 1,000 psi in accordance with AWWA Manual M11. Include in the determination of external pressure, as applicable, AASHTO H-20 truck loading and groundwater hydrostatic loads.

B. Manufacturer: Provide products of one of the following:

1. American SpiralWeld Pipe Company.
2. Ameron International Corporation.
3. Or equal.

C. Steel pipe shall conform to AWWA C200. Pipe intended for use on potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.



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- D. Pipe Wall Thickness: Unless otherwise specified in the piping schedules at the end of Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, minimum pipe wall thickness shall be as specified in Table 40 05 24.23-B and manufactured in conformance with the applicable ASTM standards listed in Table 40 05 24.23-B:

**TABLE 40 05 24.23-B  
 STEEL PIPE WALL THICKNESS**

Nominal Diameter	Wall Thickness	ASTM Standard
Six to 12 inch	Schedule 5	A53, Type E or S, Grade B
14 to 24 inch	Schedule 10	A53, Type E or S, Grade B
30 to 36 inch	Schedule 10	A139, Grade C
42 to 54 inch	3/8-inch	A139, Grade C
60 to 66 inch	1/2-inch	A139, Grade C
72 to 92 inch	1/2-inch	A139, Grade C

- E. Minimum Length: Pipe shall be fabricated in lengths of at least 20 feet unless otherwise shown or indicated on the Drawings, or limited by transportation and handling restrictions, including Site conditions. Do not provide lengths less than 20 feet unless approved by ENGINEER in the Shop Drawings. Lengths may not be longer than 50 feet.
- F. Welds:
1. All spiral, longitudinal, and girth seams used in manufacturing pipe shall be full-penetration welded butt-joints.
  2. Fabricate pipe with no more than two longitudinal seams.
  3. Circumferential welds in straight pipe shall be no closer than seven feet apart.
  4. Use girth welds for pipe sections and mitered joints in specials and fittings only when approved by ENGINEER in the steel pipe submittals. Shop-test girth welds for pipe sections and mitered joints in specials and fittings in accordance with AWWA C200.
- G. Pipe Ends: Prepare ends of pipe in the shop in conformance with AWWA C200 for the specified joint type. Ends shall be free of notches, weld splatter, and burrs.
- H. Steel Pipe Joints and Fittings:
1. Welded Joints:
    - a. Welded joints shall conform to AWWA C200 and AWWA C206.
    - b. Fabricate ends of pipe for the specified type of welded joint.
    - c. Welded joint type shall be of one of the following:
      - 1) Lap-welded joint, with minimum lap of one inch. Standard lap shall be 2 -1/2 inch
      - 2) Single-welded butt joint.
  2. Mechanical Coupling Joints:
    - a. Mechanical coupling joints shall conform to AWWA C200 and AWWA C219.

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- b. Fabricate ends of pipe to allow installation of required type of mechanical coupling joint. Exterior surfaces of pipe ends shall be free from surface defects. Longitudinal or spiral welds shall be ground flush with plate or sheet surface for sufficient distance from pipe ends to allow coupling's gaskets to create a watertight seal. Shop-applied coatings shall be held back from pipe ends if required for field assembly. Interior linings shall be continuous to ends of pipe sections.
  - c. Mechanical coupling joints shall be restrained unless otherwise shown or indicated in the Contract Documents. Size of harnessing rods shall be sufficient for the greater of the following: specified test pressure, or transient pressure.
  - d. Conform to Section 40 05 06, Couplings, Adapters, and Specials for Process Piping.
3. Flanged Joints:
- a. Flanged joints shall conform to AWWA C200 and AWWA C207.
  - b. Exterior surfaces of pipe ends shall be free from surface defects. Longitudinal or spiral welds shall be ground flush with plate or sheet surface for sufficient distance from ends to allow proper installation of flange.
  - c. Flanges shall be flat-faced with serrated concentric or spiral finish.
  - a. Flanges shall have dimensions conforming to AWWA C207 as specified in Table 40 05 24.23-C:

**TABLE 40 05 24.23-C: FLANGES**

<b>Service</b>	<b>Flange Type</b>	<b>Pressure Rating (psi)</b>	<b>Flange Class</b>	<b>Pipe Nominal Diameter (inches)</b>
Water	Hub	150	D	30-48

- b. Weld flanges to pipe using two fillet welds per flange (inside and out), conforming to method specified in AWWA C207. When method is not practical, welding shall conform to Section VIII, Division I, of the ANSI/ASME Boiler and Pressure Vessel Code. Welding, welders, and welding operators shall be pre-qualified in accordance with AWS D1.1 or ANSI/ASME Boiler and Pressure Vessel Code, Section IX.
- b. For large-diameter flanges with outside diameter exceeding the width of available plate material, use a maximum of four welded segments for flange fabrication. Welding of flange segments shall conform to requirements for welding flanges to pipe. Welds for segmented flanges shall be radiographically or ultrasonically tested in the shop. After welding, segmented flanges shall be stress-relieved in shop.
- c. Flange bolting shall be as follows:
  - 1) Bolts: Conform to ANSI/ASME B18.2.1.

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- a) For Class B and D Flanges: ASTM A307, Grade B.
- b) For Class E and F Flanges: ASTM A193, Grade B7, Heavy hex.
- 2) Nuts: Conform to ANSI/ASME B18.2.2.
  - a) ASTM A194, Grade 2H, Heavy hex.
- d. Gaskets for Flanged Joints: Conform to AWWA C207 and the following:
  - 1) Gaskets for services up to 175 psi working pressure and 200 degrees F shall be red rubber (SBR) with Shore A hardness of 80 plus-or-minus five, with yield pressure of 200 psi (minimum) to 1,200 psi (maximum) in accordance with ASTM D1330, Grades I and II. Use SBR gaskets for the following flange Classes: B, D, and E.
  - 2) Gaskets for services up to 300 psi working pressure and 250 degrees F shall be non-asbestos type consisting of blend of synthetic fibers, fillers, and elastomeric binders. Gasket yield pressure shall be minimum 3,600 psi for 1/16-inch thickness and minimum 4,800 psi for 1/8-inch thickness, and shall be suitable for maximum seating pressure of 15,000 psi.
  - 3) Manufacturer:
    - a) Garlock 3000
    - b) John Crane Co. Style 777
    - c) Approved Equal
  - 3) Use ring gaskets with flange Classes B and D for flanges on pipe greater than 24-inch diameter, and for flange Classes E and F.
  - 4) Use full-face gaskets on flange Classes B and D for flanges on pipe up to and including 24-inch diameter.
5. Blind Flanges:
  - a. Fabrication:
    - 1) Blind flanges shall be flat-faced and conform to AWWA C207.
    - 2) For blind flanges on pipe larger than 48-inch diameter, provide blind flanges consisting of a combination of a ring flange and a flanged and dished head.
    - 3) Machine face all blind flanges to match the mating flange.
  - b. Material: Fabricate blind flanges from ASTM A36 steel plate.
  - c. Bolts: For Class B and Class D flanges, use ASTM A307, Grade B bolts. For Class E and Class F flanges, use ASTM A193, Grade B7 bolts.
4. AWWA Steel Pipe Specials and Fittings:
  - a. Specials and fittings shall be the same material as adjoining pipe. Materials and fabrication methods shall conform to AWWA C200.
  - b. Dimensions of specials and fittings shall conform to AWWA C208 unless otherwise shown or indicated in the Contract Documents.
  - c. Radius of fabricated elbows shall be at least 2.5 pipe diameters, unless the wall thickness of elbow section is provided based on formulas included in Chapter 9 of AWWA Manual M11.
  - d. Length of reducers shall be four times the difference in pipe diameters at each end of reducer. Reducers fabricated to the above dimensional requirement resulting in a half-apex angle of seven to 7.5 degrees or less shall have wall thickness equal to the wall thickness of the larger

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diameter pipe section connecting to reducer. Fabricate reducers that have half-apex angles greater than eight degrees in accordance with ANSI/ASME Boiler and Pressure Vessel Code, Section VIII, Division I.

- I. Steel Pipe Coatings and Linings:
  1. Linings for Steel Water Pipe:
    - a. Linings, General:
      - 1) Lining types are specified in the piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
      - 2) Linings shall be held back at ends of pipe as required for specified joint types.
    - b. Surface Preparation: Prepare surface in accordance with manufacturer's recommended method.
    - c. Liquid Epoxy Lining: Where specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, pipe and fittings shall be lined with liquid epoxy lining, minimum 16 mils dry film thickness, shop-applied by airless spray or centrifugal wheel equipment. Pipe and fittings shall be cleaned according to SSPC-SP 1 and abrasive blast-cleaned according to SSPC-SP 10/NACE No. 2. Linings shall be shop tested in accordance with source quality control requirement of this Section and shall conform to applicable requirements of AWWA C210.
  2. Coatings for Steel Pipe:
    - a. Coatings, General:
      - 1) Coating types are specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
      - 2) Coatings shall be held back at ends of pipe as required for specified joint types.
    - b. Surface Preparation: Prepare surface in accordance with method specified in this Section for the associated coating system.
    - c. Exposed Pipe and Fittings:
      - 1) Surface Preparation: Pipe and fittings shall be cleaned according to SSPC-SP 1 and abrasive blast cleaned according to SSPC-SP 10/NACE No. 2.
      - 2) Coat pipe and fittings with polyurethane coating, consisting of ASTM D16, Type V thermoset, polyurethane plastic polymer. Coating shall be minimum 20 mils dry film thickness, shop-applied *in accordance with* manufacturer's recommendations.
      - 3) Source Quality Control: Polyurethane coatings shall be shop tested in accordance with source quality control requirement of this Section, and shall conform to AWWA C222.
      - 4) Do not bend pipe after coating application. Pipe and fittings to be field-welded shall receive a coating holdback to allow field welding.
      - 5) Coat threads of threaded pipe and connections that will be field assembled with rust-inhibiting compound. After field assembly,

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- remove compound and coat exposed areas with polyurethane in accordance with same procedures and methods specified for shop-coated pipe and fittings.
- 6) After coating with polyurethane coat surfaces of pipe and fittings in the shop with coating system conforming to AWWA C218 and Section 09 91 00, Painting.
- e. AWWA C210 Liquid Epoxy Coating Systems for Buried or Submerged Pipe and Fittings:
- 1) Surface Preparation: Pipe and fittings shall be cleaned according to SSPC-SP 1 and abrasive blast cleaned according to SSPC-SP 10/NACE No. 2.
  - 2) Shop-apply liquid epoxy coating, minimum of 16 mils dry film thickness, to pipe and fittings, using airless spray or centrifugal wheel equipment. Epoxy coating shall be two-part, chemically cured system.
  - 3) Source Quality Control: Liquid epoxy coatings shall be shop tested in accordance with source quality control requirement of this Section, and shall conform to AWWA C210.
  - 4) Coat threads of threaded pipe and connections that will be field assembled with rust-inhibiting compound. After field assembly, remove compound and coat exposed areas with liquid epoxy in accordance with same procedures and methods specified for shop-coated pipe and fittings.
  - 5) Care should be taken to minimize coating exposure to sunlight to prevent degradation of coating surface.

### 2.3 IDENTIFICATION

- A. All pipeline materials shall be stamped, marked, or identified on interior and exterior with the following:
1. Manufacturer's name or trademark.
  2. Pipe class and reference standard designation.
  3. Size and length dimensions.
  4. Date and place of manufacture.

### 2.4 SOURCE QUALITY CONTROL

- A. Tests and Inspections:
1. Inspections: All pipe and fittings, shop applied linings and coatings, shop welds, and related Work performed in the shop shall be inspected by manufacturer in accordance with applicable reference standards and as specified in this Section. Submit inspection reports to ENGINEER prior to shipment from the shop.
  2. Tests: Perform shop tests on the following in conformance with applicable standards referenced in this Section:
    - a. Pipe:

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- 1) Pressure Test: Test each length of pipe of each diameter and working pressure to the greater of the following test pressures: at least 80 percent of pipe's yield strength, or according to the pressure testing formula in AWWA C200. Maintain test pressure for minimum of two minutes.
- 2) Welds: All fillet welds shall be examined using magnetic particle method or dye penetrant method. All welds shall be visually inspected by welding inspector certified by AWS. Welds for segmented flanges shall be radiographically or ultrasonically tested in the shop.
- b. Fittings and Specials: Test each fitting and special using at least one of the following nondestructive testing methods: visual inspection, dye penetrant examination, magnetic particle testing, radiographic testing, or ultrasonic testing.
- c. Linings and Coatings:
  - 2) Liquid Epoxy Lining: Linings shall be shop tested for adhesion in accordance with ASTM D3359 Method A and ASTM D4541, holiday tested in accordance with NACE RP0188, and cure tested in accordance with ASTM D4752 and D3363. Linings shall meet the applicable requirements of AWWA C210.
  - 5) AWWA C210 Liquid Epoxy Coating Systems for Buried or Submerged Pipe and Fittings: Coatings shall be shop-tested for adhesion in accordance with ASTM D3359 Method A and ASTM D4541, holiday tested in accordance with NACE RP0188, and cure tested in accordance with ASTM D4752 and D3363, and shall conform to AWWA C210.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. For buried piping installation, refer to Section 33 05 05, Buried Piping Installation.
- B. For exposed piping installation, refer to Section 40 05 05, Exposed Piping Installation.
- C. Field-welded joints shall conform to requirements for shop-welded joints specified in this Section.
- D. Repairs to linings and coatings shall be made as recommended by the manufacturer of pipe and coating or lining (as applicable), and as accepted by ENGINEER.

+ + END OF SECTION + +