

San Antonio Water System Standard Specifications for Construction

ITEM NO. 848 Sanitary Sewers

848.1 DESCRIPTION: This item shall govern the furnishing, installation, adjustment, or replacement of sanitary sewer pipe of the size and type specified in the contract documents.

848.2 REFERENCED STANDARDS: The following standards are referenced herein or otherwise related to the project work and shall be the current edition

3. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
4. City of San Antonio (COSA) Specifications for Construction
5. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 (“Edwards Aquifer”)
6. American Society for Testing and Materials (ASTM)
 - a. ASTM C 150 - Standard Specification for Portland Cement.
 - b. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.
 - c. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.
 - d. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
 - e. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.
 - f. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.
 - g. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
 - h. A. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.
 - i. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - j. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - k. ASTM D 2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - l. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

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- m. ASTM D 2310 - Standard Classification for Machine-Made Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
- n. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- o. ASTM 2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
- p. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- q. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.
- r. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- s. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- t. ASTM D 2992 - Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting) Resin Pipe and Fittings.
- u. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- v. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- w. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- x. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- y. ASTM D 3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
- z. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- aa. G. ASTM D 3681 - Method for Determining Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin Pipe in a Deflected Condition.
- bb. H. ASTM D 3754 - Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
- cc. I. ASTM D 4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
- dd. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- ee. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- ff. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

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- gg. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - hh. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.
 - ii. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
 - jj. ASTM G 62 - Standard Test Methods for Holiday Detection in Pipeline Coatings.
 - kk. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
 - ll. ASTM F 2487 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines.
 - mm. ASTM F 2510 – Standard Specification for Resilient Connectors between Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.
7. American Water Works Association (AWWA)
- a. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water.
 - b. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.
 - d. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.
 - e. AWWA M23 – PVC Pipe – Design and Installation
 - f. W. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.
 - g. AWWA C 105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - h. AWWA C 300 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.
 - i. AWWA C 600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - j. AWWA C 950 – Fiberglass Pressure Pipe
 - k. AWWA M 45 – Fiberglass Pipe Design
8. American National Standards Institute (ANSI)
- a. ANSI A 21.4 (AWWA C 104) - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.

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- b. ANSI A 21.10 (AWWA C 110) - Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in.
- c. ANSI A 21.11 (AWWA C 111) - Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- d. ANSI A 21.15 (AWWA C 115) - Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.
- e. ANSI A21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey iron Fittings for Water Supply Service.
- f. ANSI A 21.50 (AWWA C 150) - Standard for Thickness Design of Ductile-Iron Pipe.
- g. ANSI A 21.51 (AWWA C 151) - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
- h. ANSI A 21.53 (AWWA C 153) - Standard for Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for Water Service.
- i. ANSI/AWS D11.2 –Guide for Welding Iron Castings
- 9. American Society of Civil Engineers
 - a. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings
- 10. National Science Foundation
 - a. NSF Standard 61 - Drinking Water System Components - Health Effects.
- 11. Society of Protective Coatings
 - a. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.
- 12. Uni-Bell
 - a. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

848.3 SUBMITTALS: Contractor shall submit manufacturer’s product data, instructions, recommendations, shop drawings, and certifications.

- 1. Contractor to submit cut sheets prior to commencement of work.
- 2. Submit proposed methods, equipment, materials and sequence of operations for sewer construction.
- 3. Plan operations so as to minimize disruption of utilities to occupied facilities or adjacent property.
- 4. Submit test reports and inspection pre and post construction.
- 5. Videos become property of SAWS.

848.4 MATERIALS: Materials for sanitary sewer pipe and fittings shall be either rigid or flexible. All pipe not listed shall be subject to pre-approval by the Engineer.

- 2. Rigid Pipe:
 - a. Lined Ductile iron pipe shall, for the purpose of this specification, be known as rigid pipe.
 - b. Concrete Pipe: Concrete pipe shall not be used.

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- c. Concrete Steel Cylinder Pipe: Concrete Steel Cylinder Pipe shall not be used.
- d. Asbestos-Cement (AC) Pipe: AC pipe shall not be used. Refer to Specification Item No. 3000, "Handling Asbestos Cement Pipe."
- 2. Flexible Pipe: Pipe consisting of materials other than those listed above.
 - a. Any flexible pipe having a deflection of the inside diameter greater than 5% after 30 days of installation will not be accepted.
 - b. Testing shall as per SAWS Test Specification Item No. 849 Sanitary Sewer Pipe Air and Deflection Testing
 - c. Working room for flexible pipe shall be as per Specification Item No. 804 Excavation Trenching and Backfill.
 - d. Polyvinylchloride (PVC) Sewer Pipe: Pipe shall be made from class 12454 materials as described in ASTM D1784.
 - i. For pipes 4 inches to 15 inches in diameter, fittings and joints shall conform to ASTM D3034 and D3212, with the exception that solvent cement joints shall not be used.
 - ii. All pipes that are 18 inches to 36 inches in diameter shall meet the requirements of ASTM F679.
 - iii. All PVC water mains are to be SDR 18 PVC (ASTM 2241) with a minimum pressure rating of 235 psi
 - iv. **All sanitary sewer PVC pipe shall be green. White pipe is prohibited.**
 - v. At waterline crossings and where water and sewer mains are parallel and separation distance cannot be achieved as per 30 TAC 217.53, use extra stiff pipe SDR 26 PVC (ASTM D2241) with a minimum pressure rating of 160 psi.
 - vi. This shall include all lateral piping as well.
 - e. Fiberglass Reinforced Sewer Pipe, Non-Pressure Type:
 - i. Fiberglass reinforced sewer pipe, non-pressure type, shall be a factory-formed conduit of polyester resin, fiberglass and silica sand built up in laminates and shall conform to the requirements of ASTM D3262, including the appendix and subsequent specifications, and in accordance with SAWS' material specifications.
 - ii. Depths shall comply with requirement of ASTM D3839.
 - iii. Joints for pipe and fittings shall be confined compression rubber gasket bell and spigot type joints conforming to the material and performance requirements of ASTM D4161. Depths shall comply with requirement of ASTM D3681.
 - iv. Flanges, elbows, reducers, tees, wyes, laterals, and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber reinforced overlays.

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- v. For pipe diameters 15 inches or larger, lateral openings 6 inch or greater in size shall be made using PVC sewer saddles conforming to ASTM D2661 or insert a tee connection conforming to ASTM D3034, approved by the Engineer, and found in SAWS' Material Specifications.
- vi. Minimum pipe stiffness shall not be less than SN 72 for direct bury applications
- f. High density, high molecular weight polyethylene pipe (HDPE) material
 - i. HDPE shall meet requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248.
 - ii. Material meeting requirements of cell classification 345434D or E, in accordance with ASTM D 3350, are also suitable for making pipe products under these specifications.
 - iii. Inner wall of pipe shall be of light color for television inspection purposes.
- 3. Pressure Pipe/Force Mains:
 - a. Pipe shall be made from Class 1254-A or 1254-B, as defined in ASTM D1784.
 - b. All pipe, fittings, and joints shall meet or exceed the requirements of ASTM D2241, with the exception that solvent cement joints shall not be used.
 - c. The pressure rating, size, and pressure class shall be as shown in the contract documents.
 - d. Pipe shall have an integral bell and gasket seal with the locked-in type gasket reinforced with a steel band or other rigid material conforming to ASTM F477.
 - e. The joint shall comply with the requirements of ASTM D3139.
 - f. All required joint restraint shall be approved by the Engineer prior to the work being accepted.
 - g. Pressure pipe/Force mains are required to have modified grade 5 material used as bedding.
 - h. Pipes also shall be hydrostatically tested at a minimum of 100 psi after their construction to ensure proper construction.
- 4. Mechanical or compression joints, concrete jointing collars, or non- reinforced rubber adaptors shall be used only as approved by the Engineer.
- 5. Ductile Iron Pipe and Fittings:
 - a. Ductile iron pipe shall be centrifugally cast of 60-42-10 iron and shall conform to the requirements of the latest revision of ANSI Standard A21.51/American Water Works Association (AWWA) C151.
 - b. Ductile iron pipe may be "thickness designed" in accordance with requirements of the latest revision of ANSI Standard A21.50/AWWA C150.
 - c. Thickness design shall be based on standard laying conditions 4 or 5 in accordance with actual conditions at the site.
 - d. Fittings for ductile iron pipe shall have not less than the thickness, class, or pressure rating specified for ductile iron pipe.

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- e. Fittings shall be furnished with all necessary glands, gaskets, bolts, etc. as may be required to complete the joints.
 - f. Rubber gasket joints for mechanical joints or push on type joints shall conform to the requirements of ANSI Standard A21/AWWA C111.
 - g. All ductile iron pipe and fittings shall be cement mortar-lined or polyethylene-lined.
 - h. The cement mortar lining shall be in accordance with ANSI A21.4/AWWA C104.
 - i. Contractor shall also be required to protect the pipe by externally wrapping it in accordance with Specification Item No. 814, "Ductile Iron Pipe."
 - j. The polyethylene lining material for pipe and fitting shall be virgin polyethylene complying with ANSI/ASTM D1248, compounded with inert filler and with sufficient carbon black to resist ultraviolet rays during storage of the pipe and fittings.
 - k. The polyethylene shall be bonded to the interior of the pipe or fitting by heat.
 - l. Polyethylene lining in pipe and in fittings shall be 40 mils nominal thickness.
6. All sanitary sewer pipe and fittings utilized within the jurisdiction of SAWS shall be tested by a manufacturer-approved laboratory at the source of supply.
 7. All shipments of pipe shall be accompanied by a certificate of compliance to these specifications prepared by an independent testing laboratory and signed by a Texas registered professional engineer.

848.5 CONSTRUCTION: All sanitary sewer mains shall be constructed in accordance with the specifications herein outlined and in conformity with the required lines, grades, and details shown in the contract documents and as directed by the Engineer.

1. Successful passage of the Hydrosatatic, air test and mandrel test (for flexible pipe, 30 days after installation), as described under TCEQ criteria, shall be required for the acceptance of the mains.
2. Mains shall be properly backfilled as per Specification Item No. 804 prior to the start of the 30 day installation period.
3. Water Main Crossings: Where gravity or force main sewers are constructed in the vicinity of water mains, the requirements of the 30 TAC§ 217.53 shall be met.
4. For excavation, trenching and backfill requirements see Specification Item No. 804, "Excavation, Trenching and Backfill."
5. Pipe Installation: The Inspector will inspect all pipe before it is placed in the trench and will reject any sections found to be damaged or defective to a degree that would affect the structural integrity of the pipe.
6. Rejected pipe shall be immediately removed from the site of the work and replaced with new acceptable pipe.
7. The Contractor shall commence installation of the pipe at the downstream end of the sanitary sewer line and proceed non- stop in a forward upstream direction.

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8. No pipe shall be laid within 10 feet of any point where excavation is in progress. Pipe installation shall proceed upgrade with the bell pointing in the upstream direction of flow.
9. Pipe shall be lowered into the trench without disturbing the prepared foundation or the trench sides.
10. The drilling of lifting holes in the field will not be permitted.
11. Pipe shall be installed by means of a concentric pressure being applied to the pipe with a mechanical pipe puller. Pulling or pushing a joint of pipe in place by using a crane, bulldozer, or backhoe will not be permitted.
12. Pipe shall be “pulled home” in a straight line with all parts of the pipe on line and grade at all times.
13. No side movement or up and down movement of the pipe will be permitted during or after the pulling operation.
14. Should coupled joints of pipe be out of line or off grade, they shall be removed one joint at a time in the presence of the Inspector and brought to the proper line and grade.
15. The lifting or moving of several joints of coupled pipe at one time to close a partially open joint or to fine grade under laid joints of pipe will not be permitted.
16. Contractor shall insure that all existing or proposed manholes or structures shall remain visible and accessible at all times.
17. No manhole or structure covers shall be covered by pavement, equipment, or other obstructions other than a removable, steel plate (min thickness of ½ inch and H-20 traffic bearing rated), temporary lid provided for safety.
18. Inspector shall cause all work to be suspended until this requirement is met without any valid claims of costs or schedule delays.
19. Pipe Separation: Sewer pipe separation distances shall be maintained in accordance with TCEQ rules 30 §217.53. See Drawing Series DD-848.
20. Laser Beams: The use of laser beams for vertical control shall be required. Contractor shall also make available to the Inspector, when requested, a level and rod, of sufficient sensitivity, to accurately determine differences in elevation between points 300 feet apart with one instrument set-up.
 - a. Contractor shall provide a written summary to the Inspector of all elevations that all installed, repaired, or replaced sewer main enter and exit a manhole or structure.
21. No pipe shall be installed in tunnels except as noted in the contract documents or by approval of the Engineer.
 - a. If the Contractor finds it necessary to install pipe in tunnels not provided in the contract documents, he shall submit to the Engineer a detailed outline of procedures, methods, and use of materials depending on existing soil conditions.
 - b. This information requires review and approval prior to the commencement of work.
22. No horizontal or vertical curves shall be permitted in conformance with appropriate regulatory agency requirements.

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23. Before leaving the work unattended, the upper ends of all pipelines shall be securely closed with a tight fitting plug or closure.
24. The interior of laid pipe shall be kept free from dirt, silt, gravel, or foreign material at all times.
25. All pipes in place must be approved by the Inspector before backfilling.
26. When replacing an existing system in place, Contractor shall maintain screens to prevent the entrance of construction debris into the sewer system.

848.6 MEASUREMENT: All sewer pipes will be measured from center of manhole to center of manhole or end of main.

1. Measurement will be continuous through any fittings in the main, even though the fittings are pay items of the contract.

848.7 PAYMENT: Sewer pipe will be paid for at the contract bid price per linear foot complete in place for the types, size and depth constructed.

1. Said price shall be full compensation for furnishing all materials, including pipe, couplings, trenching, pumping, concrete, plugs, laying and jointing, backfilling, select bedding and initial backfill material, tamping, water, labor, tools, equipment, and where required all weather surface, acceptable densities and must meet all requirement for testing and other incidentals necessary to complete the work
2. When the minimum separation distances for any water and sewer piping facilities cannot be maintained per 30 TAC §217.53, Contractor shall install SDR-26 PVC pipe (160 psi pressure rated). Payment for this higher pressure rated pipe shall be made the contract bid price per linear foot complete in place for the type, and size constructed.
3. Sewer pipe fittings, as part of the main line such as wyes and tees, are inclusive in the cost of Item No.854, (“Sanitary Sewer Laterals.”)
4. Pay cuts will be measured from the top of ground prior to the Contractor's operation and along the centerline of the pipe to the invert of the pipe, to be submitted with cut sheets.

End of Specification