

# *San Antonio Water System Standard Specifications for Construction*

## ITEM NO. 857

### **Fiberglass Reinforced Pipe for Large Diameter Gravity Sanitary Sewer**

**857.1 DESCRIPTION:** This item shall govern the designing, fabricating, furnishing, installing, and joining of large diameter (24-inch or greater) fiberglass sewer piping for gravity-flow conveyance of wastewater. The pipe size, centerline alignment, and grades are presented in the project Drawings.

**857.2 REFERENCED STANDARDS:** Reference standards cited in this Specification Item No. 857 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
  - a. Specifications for Water and Sanitary Sewer Construction
  - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
  - a. Chapter 217 Design Criteria for Wastewater Systems
  - b. Chapter 213 Edwards Aquifer
  - c. Chapter 290 Rules and Regulations for Public Water Systems
4. American Society for Testing and Materials (ASTM) International:
  - a. D3236, Standard Test Method for Apparent Viscosity of Hot Melt Adhesives and Coating Materials
  - b. D3262, Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
  - c. D3681, Standard Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
  - d. D4161, Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
  - e. ASTM D 3839 Standard Practice for Underground Installation of "Fiberglass" Pipe
  - f. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
5. American Water Works Association (AWWA)
  - a. AWWA M45 Fiberglass Pipe Design
6. International Organization of Standardization (ISO)
  - a. ISO9001

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### **857.3 SUBMITTALS:**

1. All submittals shall be in accordance with Engineer's requirements and submittals shall be approved by the Engineer prior to delivery.
2. Shop Drawings:
  - a. Catalog Data Sheets for all materials.
  - b. Cut Sheets.
  - c. Details of all piping system components confirming that the pipe and fittings conform to the specified requirements.
  - d. Fabrication drawings showing:
    - 1) Wall thickness.
    - 2) Pipe length.
    - 3) Pipe joint.
    - 4) Design of pipe and fittings.
    - 5) Gasket details.
  - e. Shop drawings shall include fittings and specials that are to be installed.
  - f. Pipeline layout and profile drawings showing location, station, and invert elevation of pipe sections, fittings, closure pieces and test closures.
  - g. Test methods and results including certification that pipe exceeds the minimum requirements of ASTM D2412, ASTM D2992, and ASTM D3262 as appropriate and International Organization of Standardization (ISO) 9001 certification.
  - h. Quality control test reports shall be supplied by the manufacturer and be representative of the pipe fabricated for this project.
  - i. All testing results shall be signed and sealed by a Texas Registered Professional Engineer and shall be in full compliance with the Standards. Strain corrosion test annual reconfirmation tests reports (1000-hr test) shall be from the production facility providing pipe for the project and conducted within the previous 18 months, and shall be accompanied by the base-test report (10,000-hr test).
  - j. Design calculations to meet all loadings: In-situ, service, handling, and jacking pressure.
  - k. Calculations confirming the pipe will handle anticipated loading signed and sealed by a Licensed Professional Engineer in Texas.
  - l. Manufacturer shall verify that pipe stiffness provided meets conditions as represented in the Contract Documents. If computer calculations are used, include example calculations to show the logic employed.
  - m. Manufacturer shall provide a certificate of compliance to these specifications referencing project name and location. Manufacturer shall provide ISO 9001 certificate by a third party.
  - n. Test reports: Furnish an affidavit certifying that all Fiberglass Reinforced Pipe meets the provisions of this Section and has been tested and submit reports from tests in accordance with ASTM D3262 and ASTM D4161.
  - o. A copy of the full ASTM D3681 Strain Corrosion test report verifying that the proposed FRP meets the long-term corrosion resistance required for Septic Sanitary Sewer service when tested using 1N Sulfuric Acid.

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- p. The test report and all data shall be from sample production pipe from the plant which will be supplying pipe to this project.
- q. Data from other sites, or report with mix data are subject to rejection by the Engineer.
- r. Manufacturer shall provide a certificate confirming that it meets the required experience levels for years of production and footages and sizes as described in the specifications.
- s. Manufacturer's written instructions for handling, transporting, storage, and installation of pipe.
- t. Manufacturer shall provide as a Shop Drawing; recommendations for embedment, manhole connection details, encasement details, and any repair details.

### **857.4 MATERIALS:**

- 1. General
  - a. The work to be performed in this section includes design calculations, detailing, and fabrication of FRP for the conveyance of raw sanitary sewage. Pipe design calculations will be required for open-trench and tunneling installation methods.
  - b. Other work performed under this section includes: shop testing;
  - c. Fabrication of fittings and appurtenances; handling, storage and protection; and loading and transportation of completed fittings and appurtenances to the construction site.
  - d. All pipes shall be manufactured specifically for this project and no pipe shall be furnished from stock unless approved by the Engineer.
  - e. The internal liner shall be suitable for service in a sewer pipe and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfuric gases.
  - f. Liner shall meet or exceed requirements of ASTM D3681.
- 2. Pipe
  - a. Performance / Design Criteria
    - 1) Design in accordance with ASTM D3262 including the appendix and subsequent specifications, and in accordance with SAWS specifications. Depths shall comply with requirement of ASTM D3839.
    - 2) Design pipe for service loads that include:
      - i. External groundwater and earth loads.
      - ii. Jacking/pushing loads (Acceptable Manufacturer only).
      - iii. The allowable jacking/pushing capacity shall not exceed the maximum allowable compressive strength recommended by the manufacturer.
      - iv. Traffic loads.
        - (a) Practical considerations for handling, shipping and other construction operations.

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- 3) Design is to be conducted under the supervision of a Professional Engineer licensed in the State of Texas, who shall seal and sign the design.
  - 4) Standard lay length of 20 feet, except for special fittings or closure pieces necessary to comply with the Plans.
  - 5) Design of pipe is to include the determination of design pressures up to 25 psi, stresses, external loads, pressure class (PN), and pipe stiffness class (SN).
  - 6) Stiffness (SN) class that satisfies design requirement on the Plans, or not less than SN 72 when used in direct bury operations.
  - 7) All lines must be able to withstand a high-velocity cleaning with a water jet capable of producing a minimum volume of 50 gpm with a pressure of 1500 psi at the nozzle.
  - 8) Install a gauge to indicate working pressure on the discharge of high-pressure water pumps.
  - 9) The jet angle of the outlet must be no greater than 30° relative to the pipe axis.
  - 10) A video of pipe before and after line cleaning must be submitted of all installed lines.
  - 11) No delamination should occur.
  - 12) In no case shall pipe be installed deeper than its design allows.
  - 13) Pipe markings shall meet the minimum requirements of ASTM 3236. Minimum pipe markings shall be as follows:
    - i. Manufacturer
    - ii. Manufacturer Number (identifies factory, location, date manufactured, shift and sequence)
    - iii. Nominal diameter
    - iv. Beam load
    - v. Laying length
    - vi. ASTM designation
3. Gaskets
- a. Supply from approved gasket manufacturer in accordance with ASTM F477 and suitable for service intended.
  - b. Affix gaskets to pipe by means of suitable adhesive or install in a manner so as to prevent gasket from rolling out of pre-cut groove in pipe or sleeve coupling.
  - c. Provide the following gaskets in potentially contaminated areas.
    - 1) Petroleum (diesel, gasoline) – Viton
    - 2) Other contaminants – Manufacturer recommendation
4. Joints
- a. Joints for pipe and fitting shall conform to the material and performance requirements of ASTM D4161. Depths shall comply with requirements of ASTM D3839.
  - b. Field connect pipe with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as sole means to maintain joint water tightness.
5. Fittings

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All bends exceeding a two-degree horizontal or vertical deflection shall consist of a manufacturer fabricated fitting meeting the same requirements as the pipe material. Provide tolerance of laying length of fittings to +/-2 inches. Use only manufactured fittings. 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. For pipe diameters 18 inches or larger, lateral openings 6 inch or greater in size shall be made using inserta-tee conforming to ASTM D3034 service connections, approved by Engineer.

6. Couplings  
Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. Elastomeric sealing gaskets shall be recommended by the manufacturer for application with sanitary sewage. Chemical grout, epoxy grout, or internal repair boots will not be accepted as long-term watertight seals. The joints must meet the performance requirements of ASTM D4161.
7. Structure Connections  
Provide an FRP water stop flange (wall pipe) or raised rib for water-tight connection to a concrete cast-in-place structure/manhole.
8. Dimensional Tolerances
  - a. Inside diameter  
Pipe shall not vary more than 1/8 inch from the nominal inside diameter.
  - b. Roundness  
The difference between the major and minor outside diameters shall not exceed 0.1 percent of the nominal outside or 1/4 inch, whichever is less.
  - c. Wall thickness  
Provide minimum single point thickness no less than 98 percent of stated design thickness.
  - d. End Squareness  
Provide pipe ends square to pipe axis with maximum tolerance of 1/8 inch.
  - e. Fittings
    - 1) Provide tolerance of angle of elbow and angle between main and leg of wye or tee to  $\pm 2$  degrees.
    - 2) Provide tolerance of laying length of fitting to  $\pm 2$  inches.
9. Acceptable Manufacturer
  - a. Vendors must have approval through SAWS Standards Committee prior to product use and must meet all requirements set forth in this Specification Item No. 857 "Fiberglass Reinforced Pipe for Large Diameter Gravity Sanitary Sewer."

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

1. Quality Control

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- a. All project pipes shall be provided by a single manufacturer.
  - b. Only the pipe and fittings that will be installed during a single work day will be allowed to be stored within the barricaded work area.
  - c. Pipe manufacturing operations shall be performed under the control of the manufacturer.
  - d. All pipe furnished shall be in conformance with this Specification Item No. 857 “Fiberglass Reinforced Pipe for Large Diameter Gravity Sanitary Sewer” and ASTM D3262.
2. Delivery of Materials
- a. Provide adequate strutting during transport to prevent damage to the pipe, fittings and appurtenances in accordance with manufacturer’s recommendations.
3. Storage Requirements
- a. Gravity pipe shall be stored and handled in accordance with the manufacturer’s guidelines or Engineer’s recommendations.
  - b. All products shall be stored above the ground upon platforms, pallets, skids, or other supports supplied by the Contractor and approved by SAWS.
  - c. Products shall be kept free from dirt and other foreign matter.
  - d. All products shall be stored to permit ready access for identification and inspection by the Inspector.
  - e. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Inspector or Engineer at the Contractor's expense, before proceeding further.
  - f. Deliver, store, and handle other materials as required to prevent damage.
  - g. Pipe laid directly on the ground shall be placed on an area free of loose stones or sharp objects in accordance with manufacturer’s recommendations and approved by SAWS.
4. Pipe Handling
- a. The Contractor shall abide by the required handling techniques specified by the Manufacturer.
  - b. The Contractor shall provide suitable quantities of all lifting equipment to handle the pipe. In no case shall any equipment be used that is not rated to handle the intended loading or conditions of use to which it will be subjected, or which will damage or gouge the pipe.
  - c. Dragging or dropping the pipe shall not be allowed.
  - d. Haul and distribute pipe and fittings at the project site.
  - e. Handle piping with care to avoid damage.
  - f. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
  - g. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling pipe.
5. Pipe Installation
- a. Engineer and/or Inspector may request to inspect pipe prior to installation.

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- b. Install pipe, fittings, specials and appurtenances as specified herein, and in accordance with the pipe manufacturer's recommendations or Engineer's requirements.
- c. Must follow manufacture recommendation for initial bedding.
- d. Lay pipe to the lines and grades as indicated on the Plans.
- e. Clean ends of pipe and coupling components.
- f. Apply manufacturer approved joint lubricant to pipe ends and to the elastomeric seals of coupling.
- g. Use suitable equipment and end protection to push or pull the pipes together, applying a uniform seating force across the entire pipe and coupling circumference.
- h. Do not exceed forces recommended by the manufacturer for coupling pipe.
- i. Contractor to verify pipe is not cracked if pipe is pushed in place. If pipe is cracked, pipe must be replaced at Contractor's expense.
- j. Join pipes in straight alignment then deflect to required angle.
- k. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer, and not more than 2-degrees unless approved by the Engineer. Excavate and backfill trenches in accordance with the Specification Item No. 804 "Excavation, Trenching, and Backfill."
- l. Pipe Separation: Sewer pipe separation distances shall be maintained in accordance with TCEQ rules 30 §217.53, and as per Specification Item No. 812 "Water Main Installation."
- m. Laser Beams: The use of laser beams for vertical control shall be required.
- n. 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.
- o. Contractor shall provide a written summary to the Engineer and Inspector of all elevations that all installed, repaired, or replaced sewer main enter and exit a manhole or structure.
- p. No pipe shall be installed in tunnels except as noted in the contract documents or by approval of the Engineer.
- q. 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. This information requires review and approval prior to the commencement of work.
- r. Only SAWS Product Standards Committee approved pipe manufacturer will be allowed for tunneling.
- s. No horizontal or vertical curves shall be permitted in conformance with appropriate regulatory agency requirements.
- t. Before leaving the work unattended, the upper ends of all pipelines shall be securely closed with a tight-fitting plug or closure in accordance with manufacturers' recommendations and as approved by the Inspector.
- u. The interior of laid pipe shall be kept free from dirt, silt, gravel, or foreign material at all times.
- v. **All pipes in place must be approved by the Inspector before backfilling.**

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- w. All fabricated bends shall be encased with reinforced concrete, with #4 Bars at 12-inches on center each way completely around pipe, approximately centered in the encasement thickness, and extending longitudinally one pipe diameter each direction along trench measured from the pipe interior bend point. Concrete encasement shall extend across the full width of the trench to both trench walls. Encasement requirement may be waived by the Engineer if manufacturer certifies that fabricated bends have been designed and constructed to withstand all static and dynamic loads imposed by the service conditions
- x. When replacing an existing system in place, Contractor shall maintain screens to prevent the entrance of construction debris into the sewer system. Ensure proper temporary connection or maintain continuous by-pass.
- y. At the close of each operating day:
  - 1) Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation. Effectively seal the open end of the pipe using a gasketed night cap. When not temporarily connected. Cap shall be in accordance with manufacturer’s recommendations and approved by the SAWS.

### **857.6 TESTING:**

1. All Testing shall be performed in accordance with Specification Item No. 849 “Sanitary Sewer Testing.”
2. The Referenced Standards identified in Specification Item No. 849 shall be augmented by those identified in Specification Item No. 857 for the purpose of testing of Fiberglass Reinforced Pipe.

### **857.7 MEASUREMENT:**

1. All fiberglass gravity sanitary sewer pipes will be measured from the inside (face of wall) of structure to the center of manhole or inside of structure per Linear Foot, complete-in-place along the horizontal centerline alignment.
2. Measurement will be continuous through any fittings in the main including tee-base manholes.

### **857.8 PAYMENT:** Sewer pipe will be paid for by percentage listed below.

1. The contractor will get paid 80% of the bid item cost 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 all weather surface.
2. The contractor will get paid the remaining 20% percent of the bid item cost for the approved testing results of acceptable densities and must meet all requirement for all other testing and other incidentals necessary to complete the work.
3. Any fittings required to connect to FRP will be incidental to pipe cost.
4. Sewer pipe fittings, as part of the main line such as wyes and tees, are inclusive in the cost of Specification Item No. 854 “Sanitary Sewer Laterals.”

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5. 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.
6. Contractor to provide cut-sheets with centerline pay cuts for approval prior to installation.
7. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 "Mobilization."

**-End of Specification-**