ITEM NO. 853

Sanitary Sewer Glass Fiber Reinforced Polyester (FRP) Manholes and Structures

853.1 DESCRIPTION: This item shall govern the construction of FRP sanitary sewer manholes and structures, complete in place and the materials therein, including manhole ring and covers.

853.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 853 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 Domestic Wastewater Systems
   b. Chapter 213 (“Edwards Aquifer”)
4. American National Standards Institute (ANSI)
   a. ANSI B 16.1 – Cast Iron Pipe Flanges and Flanges Fittings.
5. American Society for Testing and Materials (ASTM) International:
   a. ASTM C581 Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
   b. ASTM D695 Test Method for Compressive Properties of Rigid Plastics
   c. ASTM D785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
   d. ASTM D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   e. ASTM D883 Terminology Relating to Plastics
   f. ASTM D1600 Terminology for Abbreviated Terms Relating to Plastics
   g. ASTM D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
   h. ASTM D2583 Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor
   i. ASTM D2584 Test Method for Ignition Loss of Cured Reinforced Resins
   j. ASTM D3236, Standard Test Method for Apparent Viscosity of Hot Melt Adhesives and Coating Materials
   k. ASTM D3262, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
   l. ASTM D3681, Standard Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
   m. ASTM D3892 Practice for Packaging/Packing of Plastics

n. ASTM D4161, Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
o. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
p. ASTM C 1107- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
q. ASTM D 698- Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600kN-m/m^3)
r. ASTM D 2665 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
s. ASTM D 2996 Standard Specification for Filament –Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
t. ASTM D 2997 Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber- Reinforced Thermosetting Resin) Pipe.
u. ASTM D 3753 Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.
v. ASTM D 3839 Standard Practice for Underground Installation of "Fiberglass" Pipe
w. ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

6. American Association of State Highway and Transportation Officials (AASHTO).
   a. AASHTO M306 Standard Specification for Drainage, Sewer, Utility and Related Castings.
7. American Water Works Association (AWWA)
   a. AWWA M45 Fiberglass Pipe Design
8. International Organization of Standardization (ISO)
   a. ISO9001

853.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications. All submittals shall be in accordance with Engineer's requirements and submittals shall be approved by the Engineer prior to delivery.

1. Submit proposed methods, equipment, materials and sequence of operations for sewer construction.
2. Plan operations so as to minimize disruption of utilities to occupied facilities or adjacent property.
3. Submit all test reports and pre and post sewer television inspection video.
4. Videos become property of SAWS.

853.4 MATERIALS: All constructed FRP manholes and structures shall be watertight. Sewer manhole ring and cover castings, HDPE throat rings, and miscellaneous specifications and details shall meet the current requirements of AASHTO Designation M306-10 and Specification Item No. 852, "Sanitary Sewer Manholes." See Drawing Series DD-852.

1. FRP Manholes and structures: All manholes and structures shall be watertight. Glass-Fiber Reinforced Polymer/Polyester Manholes and structures shall be a one-piece monolithic designed unit constructed of FRP or tee-based manhole and single piece riser section.
2. Exterior Surface: If required by manufacturer, the exterior surface of the manhole shall have gray pigment UV inhibitor added for a minimum thickness of 0.125 inches.
3. Dimension: Manholes and structures shall be a circular cylinder, reduced at the top to a circular manway not smaller than 30 inches (inside diameter).
   - Manholes and structures shall also be produced in whole foot increments of length +/- 2 inches.
   - Nominal inside diameter shall be 48 inches.
   - Tolerance on the inside diameter shall be +/- 1%.
   - The minimum wall thickness for all FRP manholes and structures (all depths) shall be 0.50 inches or as recommended by Manufacturer.
4. Configuration: The manway reducer must provide a bearing surface on which a standard ring and cover may be supported and adjusted to grade, to accommodate I&I barrier. The reducer must be able to fit all I&I barriers.
   - The reducer shall be joined to the barrel section at the factory with resin and glass fiber reinforcement, thus providing the required monolithic design to prevent infiltration and/or exfiltration through the manhole for both a monolithic manhole and riser section.
5. Class: Manholes shall be manufactured in one class of load rating. This class shall be AASHTO H-20 wheel load.
6. Manhole Bottom: Manholes and structures are required to have a resin fiber-reinforced bottom.
   - Deeper manholes and structures (> 6 feet) may require a minimum of two 1½ inches deep x 3½ inches wide stiffening ribs, completely enclosed with resin fiber-reinforcement.
   - All fiberglass manholes and structures with a fiberglass bottom will have a minimum 3 inch anti-flotation ring.
   - Manhole bottoms shall be a minimum ½ inch thick.
7. Marking and Identification: Each piece or component of the manholes and structures shall be marked in letters no less than 1 inch in height with the following information. Markings shall be legible and located in a place within the manhole or structure.
   - Tag and/or stamp shall be placed in a location that can clearly be seen within the manhole or structure.
   - Manufacturer's name or trademark;
   - Manufacturer's factory location;
   - Manufacturer's serial number;
   - Manhole length;
   - ASTM Designation;
   - Installation assist marks (vertical lines 90^{o} apart at base of manhole).
8. Manhole Rings and Covers: Refer to Specification Item No. 852, "Sanitary

Sewer Manholes" for HDPE throat rings and miscellaneous specifications and details associated with ring and cover design and mounting. The ring and cover shall be of ductile iron construction. The cover shall be solid with no vent or pick holes; hinged with underlying special hinge area leakage protection; the cover secured with four (4) stainless steel bolts; and shall have a recessed "pick bar" for cover opening. Cam lock type covers shall not be allowed.

- Approved manufacturers, as listed in the SAWS APL, have previously completed required inflow leakage shop testing and have met a maximum allowable leakage rate criterion of 1 gallon per minute (gpm) at 12 inches of water submergence above the manhole cover.
- The nominal cover diameter shall be 32 inches, with a 30 inch clear opening, as required by TCEQ.

9. Concrete Encasements: Concrete encasement shall conform to Specification Item No. 852, "Sanitary Sewer Manholes." Specifically, refer to Standard Detail Drawing DD-852-series.
10. Reinforcing Steel: All reinforcing steel shall conform to provisions of Specification Item No. 301, "Reinforcing Steel."
11. Initial and Secondary Backfill Material: Refer to Specification Item No. 804, "Excavation, Trenching and Backfill" for all backfill requirements.

853.5 CONSTRUCTION:

1. Manholes and structures shall be constructed of materials and workmanship as described by these specifications, at such places shown in the contract documents and in conformity with the typical details.
2. Fiberglass manholes and structures must be installed according to manufacturer's installation instructions. Correct manhole installation requires proper concrete foundation, good backfill and proper handling to prevent manhole damage and insure long-term corrosion resistant service.
3. Excavation at manhole location should be at least wide enough to accommodate the slab specified and to provide working room around manhole. Ensure the depth of manhole is sufficient to allow between two and four throat rings for adjustment of ring and cover at top of final grade. Quarter marks have been provided on barrel to facilitate alignment.
4. Manhole Base: Use initial backfill material to provide 4 to 6 inches of leveling base.
5. Set Manhole: Lift and set manholes and structures per manufacturer's recommendations. A concrete base encasement with steel reinforcements shall be placed at least 12 inches from the manhole in all directions or as per manufacture's recommendations and extend over the top of the anti-flotation ring a minimum of 12 inches.
6. Backfill Material: An approved flowable fill material shall be used for backfilling operations. See DD -853 Drawing Series.
7. Testing: All manhole/structures must pass a leakage test.
   a. The Contractor shall perform the testing for all sanitary sewer structures in accordance with this Specification (after assembly and final compaction backfill testing) for leakage, separate and independent of the all other

sanitary sewer piping, by means of either a hydrostatic test or vacuum test, or other methods approved by the Engineer.

b. Engineer of Record must witness all tests over the EARZ.

c. Contractor is hereby instructed to conduct either of the two identified tests in the following manner:

d. Hydrostatic Testing: Hydrostatic testing shall be conducted by utilizing approved plugs to seal all influent and effluent pipes in the structure and filling the structure to the top of the structure with water.

1) Additional water may be added over a 24 hour period to compensate for absorption and evaporation losses.
2) At the conclusion of the 24 hour saturation period, the structure shall be filled to the top of the structure and observed.
3) Any measurable loss within a 30 minute period shall be considered an unsuccessful test and thus require the Contractor to assess the needed repairs, perform such repairs (subject to the approval of the Engineer), and notify the Inspector when the retest will be performed.
4) All effort, materials, or other costs shall be solely at the Contractor's expense.

e. Vacuum Testing: Manhole shall be tested after construction/installation and backfilling with all connections (existing and/or proposed) in place.

1) Drop-connections and gas sealing connections shall be installed prior to testing.
2) The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole.
3) The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc.
4) Prior to performing the test, the Contractor shall plug lift holes and exterior joints with a non-shrink grout and plug all pipes entering the structure.
5) No grout shall be placed in horizontal joints prior to testing.
6) Contractor shall use a minimum 60 inch/lb torque wrench to tighten the external clamps that secure the test cover to the top of the manhole.
7) The test head shall be inflated in accordance with the manufacturer's recommendations.
8) A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off.
9) The test does not begin until after the vacuum pump is off.
10) With the valve closed, the level vacuum shall be read after the required test time.
11) If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test.
12) The required test time is 2 minutes.

f. Acceptance: Any manhole which fails the initial test must be repaired per manufacturer's recommendations.
   1) The manhole shall be retested as described above until a successful test is attained.
   2) After a successful test, the temporary plugs will be removed.
   3) To ensure that the plugs have been removed, Contractor shall only remove the plugs in the presence of the Inspector.

g. Repairs to Existing Manhole: Any existing manhole/structure which fails to pass the vacuum test shall be closely examined by the Inspector and the Contractor to determine if the manhole can be repaired.
   1) Contractor shall either repair or remove and replace the manhole as directed.
   2) The manhole shall then be retested and as stated above.
   3) The Owner may elect to simply remove and replace the existing manhole with a new one at no additional cost to the owner.
   4) Any manhole excavated for repairs or excavated for tie in, shall be encased with a minimum of 12 inches thickness of flowable fill to one foot above the top of the cone section to allow for the concrete ring encasement

853.6 MEASUREMENT: FRP sanitary sewer manholes and structures as designated in the contract documents shall be measured as the total number of such manholes and structures constructed, including those exceeding 6 feet in depth from the lowest invert elevation to the top of the ring**.**

i. FRP Sanitary Sewer Manholes and Structures will be measured as each structure complete in place.

853.7 PAYMENT: Fiberglass Reinforced Plastic Manholes and Structures will be measured as each structure complete in place. The work, as prescribed by this item, will be paid for at a Lump Sum unit price bid per each for "Fiberglass Reinforced Plastic Manholes and Structures,"

1. Sanitary sewer manholes and structures shall be paid at the contract a lump sum unit price bid for each such structure. Percentages for completion shall be as outlined below and will be based on the completion of the following milestones:
   a. Milestone 1: 40% of LS – Manhole and Structure setting to include for each such manhole and structure, excavation, compaction, setting manhole and structure base setting to include concrete base encasement with reinforcements, saw cutting of surfaces as required and connection of new or existing sewer pipes to the manhole and structure as described in this specification. After curing the manhole and structure flowline elevation shall be verified by licensed Surveyor in the State of Texas. And a certified report submitted to the inspector prior payment and uploaded to CPMS. Furnishing and placing all materials necessary to complete the work is included in Milestone 1 and must be completed prior to payment (40%).

b. Milestone 2: 40% of LS – Manhole and Structure Riser Installation and Flowable fill (up to 1 foot above cone section), drop pipes, reinforced concrete, fittings, labor, tools, equipment, tees, wyes, I&I barrier, and incidentals trench protection, and disposal of material excavated backfilling and compaction. Furnishing and placing all materials necessary to complete the work is included in Milestone 2 and must be completed prior to payment (40%).

c. Milestone 3: 20% of LS - Sanitary Sewer Manhole and Structure Encasement and Testing: This pay item includes: manhole and structure concrete encasement, rebar, HDPE throat/grade rings, ring and cover, surface restoration, includes all manhole and structure testing in accordance for leakage, separate and independent of the all other sanitary sewer piping. Furnishing and placing all materials necessary to complete the work is included in Milestone 3 and must be completed prior to payment (20%).

2. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 “Mobilization.”

3. Concrete cradles for pipes shall be measured and paid for at the contract unit price bid as provided for in Specification Item No. 858, "Concrete Encasement, Cradles, Saddles and Collars."

4. Gravel subgrade filler for manholes and structures shall not be measured separately for payment.

Pay Item	Description	Units
	(FRP) Manholes and Structures	Lump Sum
853.6.1.a	Milestone 1	40% of Lump Sum
853.6.1.b	Milestone 2	40% of Lump Sum
853.6.1.c	Milestone 3	20% of Lump Sum

- End of specification -