

SECTION 33 31 11

FIBERGLASS SANITARY SEWER PIPING

PART 1 – GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, materials and appurtenances necessary for the complete and satisfactory construction of all piping and fittings as shown on the Drawings and as specified herein.
- B. Fiberglass pipe shall consist of glass fiber reinforcement embedded in or surrounded by cured thermosetting resin. The composite structure may contain aggregate, fillers or coloring agents compatible with sanitary sewage use and in accordance with the Manufacturer's standards.
- C. Fiberglass pipe shall be designed for the conditions as described in this Specifications Section and in the Drawings and details.
- D. The Contractor shall test pit all connections to existing piping well in advance in order to verify the depth, orientation and materials of the existing piping, so that all of the pipe Work performed will fit together properly and will conform to the arrangement as shown on the Drawings. In selecting laying lengths of fittings, the Contractor shall be guided by the dimensions of equipment to which connections are made and by the indicated dimensions on the Drawings. All pipe and specials shall be accurate to the dimensions shown.

1.02 RELATED DOCUMENTS

- A. Section 01 33 00 – Submittal Procedures
- B. Section 31 23 10 – Trench Excavation and Backfill

1.03 REFERENCED CODES AND STANDARDS

- A. American Water Works Association (AWWA):
 - 1. M45 Fiberglass Pipe Design.
- B. American Society for Testing of Materials (ASTM):
 - 1. C1103 Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
 - 2. C33 Specification for Concrete Aggregates.
 - 3. D638 Test Method for Tensile Properties of Plastics.
 - 4. D695 Test method for Compressive Properties of Rigid Plastics.
 - 5. D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 6. D883 Terminology Relating to Plastics.
 - 7. D1600 Terminology for Abbreviated Terms Relating to Plastics.
 - 8. D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - 9. D2584 Test Methods for Ignition Loss of Cured Reinforced Resins.

10. D3262 Specification for Fiberglass (Glass-fiber-reinforced Thermosetting-resin) Sewer Pipe.
11. D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.
12. D3681 Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.
13. D3892 Practice for Packaging/Packing of Plastics.
14. D4161 Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.
15. F402 Terminology Related to Plastic Piping Systems.
16. F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.04 SUBMITTALS

- A. The Contractor shall submit Shop Drawings for all fiberglass pipe. The Shop Drawing Submittals shall include certification that the pipe and fittings are in conformance with the applicable standards and design criteria as specified. Shop Drawings shall include pipe joint details and pipe joint installation, methods of installation of pipe, methods for cutting pipe, schedule of nonstandard pipe fittings (specials), fittings and field closure pieces and details of installation to manholes and structures.
- B. Shop Drawings shall show in full detail, wall thicknesses, size and spacing of reinforcement, joints, joint construction and jointing material and all other information in order for the Engineer to ascertain if all requirements of the Specifications have been complied with. Pipe shall be stenciled with the date pipe was manufactured.
- C. Provide stiffness calculations for each pipe reach (manhole to manhole) based on pipe depth and pipe trench details provided in the Drawings.
- D. Provide floatation calculations for each pipe segment (manhole to manhole). Certify that each pipe segment will remain in place without floating with groundwater at grade (full saturation to surface) and with the pipe empty.
- E. If protection from flotation is required, provide engineering details and specifications for anti-flotation measures such as concrete caps or anchors.
- F. The Contractor shall submit information on joint testing equipment including type and Manufacturer of equipment and testing procedures.
- G. Provide complete pipe installation instructions.
- H. The pipe Manufacturer shall have no less than 5 years experience in supplying large diameter (greater than 36-inch) fiberglass pipe for sanitary sewer service. The pipe Manufacturer shall also have supplied pipe for a minimum of 3 projects in the United States for large diameter pipe (36-inches diameter and larger) of no less than 10,000 linear feet. References for at least 3 such projects shall be provided.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

- A. Pipe shall be fiberglass reinforced polymer mortar pipe (FRPMP) constructed of glass fibers, resin, aggregate and additives. Fiberglass pipe shall be dense, non-porous, corrosion-resistant and compatible for use in sanitary sewage service. Pipes shall be Type 1, Liner 1 or 2, Grade 1 or 3, per ASTM D3262.
- B. Thermosetting resin shall be polyester and vinyl ester resin type fully suitable for use in sanitary sewage service.
- C. Glass Fibers shall be sized for complete compatibility with the resin systems.
- D. Aggregate shall be silica sand and meet the requirements of ASTM C33.
- E. Pipe shall be provided with UV protection in accordance with Manufacturer's recommendations.
- F. Wall thickness of pipe shall not be less than the stated design thickness in the manufacturer's literature.
- G. Pipe material shall pass 10,000-hour test, in accordance with D3681 Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.
- H. Acceptable Manufactures:
 - 1. HOBAS Pipe USA
 - 2. Thompson Pipe Group
 - 3. Future Pipe Industries
 - 4. Or Approved Equal.

2.02 PIPE JOINTS

- A. Joints shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets. Gaskets shall meet the requirements of ASTM F477. Joints shall meet the requirements of ASTM D4161.
- B. Joints shall be capable of withstanding external and internal pressures as shown on the Drawings and as described in these Specifications.
- C. Joints shall be capable of pressure testing, in accordance with Part 3 of these Specifications. Joints shall be compatible with pressure testing equipment or have integral pressure testing ports.

2.03 JOINT TESTING APPARATAUS

- A. Joints shall have integral pressure testing ports. Alternatively, separate joint testing apparatus may be used to confirm the integrity of the joint.
- B. Joint Testing apparatus shall be Cherne Air-Loc, Plug-It Products joint testers, Or

Approved Equal.

2.04 PIPE STIFFNESS

- A. Pipe stiffness shall be calculated for each pipe segment (manhole to manhole). Pipe stiffness calculations shall be based on the requirements of this Specification and on the depths and other conditions shown on the Drawings. Pipe deeper than 18 feet shall be SN 72.
- B. Pipe stiffness rating shall be marked on each pipes segment.

2.05 PIPELINE MARKERS AND DETECTION

- A. The Contractor shall install pipeline location markers along the center of the pipeline adjacent to manholes and at locations as required by the Engineer. The pipeline marker shall be fiber reinforced plastic not subject to hazing or cracking. Markers shall be clearly marked "WARNING – SEWER PIPELINE – BEFORE DIGGING IN THIS AREA CALL MISS UTILITY." Markers shall be equipped with anchor system to prevent pull out. Markers shall be equipped with two (2) test terminals. Markers shall be Rhino TriView Flex Test Stations Or Approved Equal. Marker color shall be green.
- B. Tracer wire shall be installed at a depth of ten (10) feet where conditions allow. Tracer wire shall be installed directly over the center of the sewer interceptor. In locations where less than ten feet of cover exists above the pipe, the tracer wire depth shall be reduced to accommodate, but shall be installed a minimum of one (1) foot below the pipeline detection tape. Tracer wire shall be 12 gauge and suitable for direct bury applications. Tracer wire shall be continuous between manholes. Splicing shall not be permitted. Wire shall be connected to the terminals at the test stations. Wire shall be as manufactured by Rhino Or Approved Equal.
- C. Pipeline warning tape shall be installed two (2) feet below grade directly over the center of the sewer interceptor. Warning tape shall be three (3) inches wide, green in color, and be printed with the following legend every 36 inches: SEWER LINE BURIED BELOW. Warning tape shall be Rhino 600 Plus Or Approved Equal.

2.06 FITTINGS

- A. Connections to pipes of other materials shall be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays.
- B. Connection fabrication details shall be submitted to the Engineer for approval. Show all details of connections of other materials to the pipe.

2.07 VERTICAL SEWER VENTS

- A. Acceptable Manufacturers for 6-inch vertical sewer vents:
 - a. Wager 1800 Series with Rain Shield
 - b. Or Approved Equal

2.08 STANDARD PIPE

- A. Standard pipe lengths shall be used.
- B. Pipe shall be field cut when making connections to existing pipelines in accordance with Manufacturer's standard procedures. Field cutting shall be minimized to the extent possible.
- C. The Manufacturer shall provide the services of a trained factory representative for training as needed in joint assembly, field cutting of pipe, storage and handling of pipe and fittings, field repair of pipe, and all aspects of pipe installation in accordance with the Manufacturer's standards of good practice. The Manufacturer's representative shall be on-site for a period of no less than five days. At the end of this period, the Manufacturer shall certify in writing that the Manufacturer's representative has conducted training of the Contractor in accordance with the requirements above. U.S Based trained factory representative that is an employee of the manufacturer.

2.09 PIPE DESIGN CRITERIA

- A. Pipe design method shall meet the requirements of AWWA M45.
- B. Pipe stiffness selection shall be based on the following criteria:
 - 1. External load shall be the cover as shown on the Drawings with live loads.
 - 2. Earth loads:
 - a. Backfill Weight: 120 pounds per cubic foot.
 - b. Modulus of Soil Reaction (E'): 3000 psi.
 - 3. Live loads:
 - a. AASHTO HS-20, two trucks passing.
 - 4. Deflection:
 - a. Pipe shall be designed with a maximum deflection of 5-percent.
 - 5. Internal Pressure:
 - a. 10-feet of water.
 - 6. Fittings:
 - a. For live and dead loads: as specified for pipe.
 - 7. Submit design calculations stamped by a Registered Professional Engineer.

PART 3 – EXECUTION

3.01 TRENCH EXCAVATION AND BACKFILL

Excavation, bedding, and backfill shall be as described in Specifications Section 31 23 10 –

Trench Excavation and Backfill and as shown on the Drawings.

3.02 PIPE TRANSPORTATION

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or fittings and the joint surfaces. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.
- B. At the project Site, Contractor shall coordinate delivery of pipe when installed. Refer to Section 01 11 50 – Sequence of Construction for additional details.

3.03 PIPE PREPARATION AND HANDLING

- A. Pipe, fittings and appurtenances which are found to be cracked, broken, or otherwise damaged will be rejected and shall be removed from the job Site immediately. Pipes with minor damage may be repaired in the field under the supervision of the pipe Manufacturer's field engineer upon approval of the Engineer.
- B. Clean ends of pipe thoroughly. The Contractor shall remove all foreign matter and dirt from inside of pipe and keep it clean during and after laying. Defective pipe, discovered after it has been laid, shall be removed and replaced with sound pipe.
- C. Use proper implements, tools, and facilities for the safe and proper protection of the Work. The Contractor shall lower the pipe into the trench in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches.
- D. Regulate and control vehicles, equipment and construction operations such that the loading on the pipe does not exceed the loads for which the pipe was designed and manufactured.

3.04 LINE AND GRADE

- A. Pipe Installation:
 - 1. The Contractor shall use all needed survey instruments such as levels, theodolite, and lasers to ensure the accuracy of the line and grade. Laser beams shall be set manhole to manhole.
 - 2. Lay gravity sewers so as to maintain a true alignment and grade as indicated on the Drawings. The Contractor shall not deviate from the line or grade, as established by the Engineer, more than ½ inch for line and ¼ inch for grade, provided that such variation does not result in a level or reverse sloping invert.
 - 3. From the property lines and benchmarks shown on the Drawings, the Contractor shall run all lines and levels, furnish, set and drive guard stakes, and do all other work necessary to lay out his work in accordance with the dimensions and elevations shown on the Drawings. The Contractor shall employ properly qualified personnel to perform the work herein described. The Contractor shall also furnish and set all template and batter boards as required. The Contractor shall submit eight (8) sets of cut sheets to the

Owner for all segments of the project. The Contractor is responsible for maintaining all stakes and marks. No concrete shall be poured, or other permanent construction initiated until the Engineer has checked and approved the layout.

4. Pipe laying shall begin at the low end of a run and proceed up grade, and all pipe shall be laid with bells or sockets uphill. Each pipe shall be carefully placed in a recess prepared as above specified and checked for line and grade. Adjustments to bring pipe to line and grade shall be made by scraping away or filling in granular material under the body of the pipe and, in no case, by wedging or blocking up the barrel except where concrete encasement is required. Particular care shall be taken to insure firm support for the spigot end of the pipe barrel directly adjacent to the bell of the next adjoining pipe. The pipe shall be so fitted together and matched in laying that there will be no unevenness along the lower inside half of the pipe. As the Work progresses, the interior of the sewer shall be broom cleaned of all superfluous materials of every description. Whenever the Work ceases for any reason, the end of the sewer shall be closed with a water tight plug or cover.
5. Connect pipe segments at joints at Manholes and at connecting pipes in accordance with the Manufacturer's standards and the instructions of the Manufacturer's factory representative.

3.05 TEST FOR DISPLACEMENT OF SEWERS

All sewers will be checked by the Engineer to determine whether any displacement of the pipe has occurred. In the presence of the Engineer, the Contractor shall inspect the pipeline between manholes and structures with a laser or other approved light source. If the inspection of the interior of the pipeline shows poor alignment, displaced pipe, deflected pipe or any other defects, the defects designated by the Engineer shall be remedied by the Contractor.

3.06 ACCEPTANCE TESTING OF PIPE JOINTS AND PIPE.

A. GENERAL

1. Test the first section of pipeline as soon as it is installed to demonstrate that the Work conforms to these Specifications.
2. Sewers shall be tested from manhole to manhole.
3. Sewers shall be backfilled and compacted to a minimum of 6-feet from grade prior to start of testing.
4. Acceptance testing shall only be conducted in the presence of the Engineer or Owner.
5. All equipment and supplies necessary for acceptance testing shall be provided, installed and operated by the Contractor.

B. JOINT TEST

1. Pipe joints shall be tested for water tightness utilizing approved testing apparatus and air or water under low pressure. Joint acceptance testing will be in accordance with ASTM C 1103-02. The joint in the sewer line to be tested shall be covered completely from the inside of the pipe by a sealing ring and two end element sealing tubes. Air or water is introduced under low pressure into the annular space between the ring and joint. The amount of air or water lost over time is used to determine the acceptability of the joint.
2. If a pre-joint-testing inspection of the completed sewer or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as required.
3. Prior to beginning the joint test, determine the level of groundwater and calculate groundwater pressure over the pipeline. Dig test pits or install groundwater monitoring wells to determine groundwater elevation at time of testing. Use a conversion factor of 2.307-feet of water for each pound per square inch (psi) of water.

C. JOINT TEST PROCEDURES AND ACCEPTANCE

1. Clean all joints surfaces prior to testing.
2. Install the testing apparatus and pressurize the void volume with air or water to 3.5 psi (gauge pressure) greater than the pressure exerted by groundwater above the pipe. Allow the air or water pressure to stabilize.
3. The joint shall be accepted if the test pressure holds steady or drops less than 1-psi in 5 seconds.
4. Retest any joint that does not pass the initial test.
5. At completion of the joint test, slowly depressurize the water or air pressure.
6. Repair any joint that does not pass three consecutive joint tests.

D. SHORT-TERM PIPE DEFLECTION TESTING

1. The maximum allowable short-term pipe deflection shall be three percent (3%) of the mean inner diameter of the FRPMP as defined in AWWA C950.
2. Short-term pipe deflection testing shall be conducted at least 48 hours after final backfill has been placed and compacted to the required depth.
3. For all pipes 30 inches in diameter and smaller, a mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded.
4. For all pipes 36 inches in diameter and larger, deflection measurements shall be determined using a rigid, nonadjustable metal bar, a minimum-radius rigid template, or a method approved by the Engineer.
5. All portions of pipe which exceed three percent (3%) deflection shall be

replaced.

E. LONG-TERM PIPE DEFLECTION TESTING

1. The maximum allowable long-term pipe deflection shall be five percent (5%) of the mean inner diameter of the FRPMP as defined in AWWA C950.
2. Deflection testing shall be conducted at least six (6) months after the pipe has been placed into service.
3. Sanitary sewers shall remain active during the long-term deflection testing.
4. Contractor shall submit testing plan and method for approval by the Engineer.
5. All portions of pipe which exceed five percent (5%) deflection shall be replaced.

3.07 FINAL SEWER CLEANING

- A. Prior to final inspection and acceptance of each manhole-to-manhole section of the sewer system by the Engineer, the sewer shall be cleaned. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system. Once the large debris is removed, the sewer shall be flushed.
- B. Following final cleaning, the Contractor shall inspect each manhole-to-manhole section with a video recorder in accordance with Specifications Section 33 01 38 – CCTV Inspection of Sewers.
- C. Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, clean the sections and portions of the lines as required.
- D. Place the new line in service as soon as practical after acceptance by the Engineer.

END OF SECTION

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