

Item No. 320

Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Gravity Sewer Pipe

320.1 Description

This item shall govern the construction, labor, materials, equipment and incidentals necessary to furnish and install centrifugally cast or filament wound fiberglass reinforced polymer mortar pipe and fittings in the diameters indicated. Trenching, backfilling, and pipe embedment must be in accordance with Item No. 120 "Utility Trenching and Backfill". Placement and classification of concrete must be in accordance with TxDOT Standard Specifications Item No. 420 "Concrete Substructures".

320.2 Standards

Comply with local governing regulations if more stringent than specified herein. Piping and fittings shall be in full compliance with the applicable standards and specifications for each type of pipe involved. Pipe may be rejected for failure to comply with any requirement of this Section.

A. ASTM International (ASTM) Standards:

| | |
|------------|--|
| ASTM D638 | Standard Test Method for Tensile Properties of Plastics |
| ASTM D2412 | Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading |
| ASTM D3262 | Specification for Fiberglass (glass-fiber-reinforced thermosetting-resin) Sewer Pipe |
| ASTM D3567 | Standard Practice for Determining Dimensions of Fiberglass Pipe |
| ASTM D3681 | Standard Test Method for Chemical Resistance of Fiberglass (glass-fiber-reinforced thermosetting –resin) Pipe in a Deflected Condition |
| ASTM D3754 | Specification for Fiberglass (glass-fiber-reinforced thermosetting-resin) Sewer and Industrial Pressure Pipe |
| ASTM D3839 | Standard Practice for Underground Installation of Fiberglass Pipe |
| ASTM D4161 | Specification for Fiberglass (glass-fiber-reinforced thermosetting-resin) Sewer Pipe Joints using Flexible Elastomeric Seals |
| ASTM F477 | Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

B. American Water Works Association (AWWA) Standards:

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| AWWA M45 | Fiber Glass Pipe Design |
| AWWA C950 | AWWA Standard for Fiberglass Pressure Pipe |

320.3 Submittals

The submittal requirements of this specification item must include:

- A. Certified Test Reports from the manufacturer’s testing facility or an approved testing laboratory.
- B. Manufacturer’s data on piping and jointing methods.

C. Prior to shipment of the pipe, the pipe manufacturer must submit the following:

1. A Certificate of Adequacy of Design stating that the pipe to be furnished complies with AWWA M45, ASTM D3262, ASTM D4161, ASTM D2412, ASTM D3567 and these specifications.
2. Certified Test Reports from the manufacturer's testing facility or an approved testing laboratory for materials tests (ASTM D3681 and ASTM D2412).
3. Certified Test Reports from the manufacturer's testing facility or an approved testing laboratory for load bearing tests.
4. Product data sheet which includes the following:
 - a. Pipe stiffness
 - b. Name of manufacturer
 - c. Nominal pipe diameter
 - d. Cell classification
 - e. Laying lengths
 - f. Joint methods
 - g. Minimum radii for horizontal deflection
 - h. If Applicable: Calculations for jacking pipe to verify wall thickness can withstand pressures resulting from installation of pipe

320.4 Quality Assurance

A. Experience:

1. Pipe must be the product of one manufacturer with no less than 5 years of successful experience manufacturing pipe of the type and size indicated. Pipe manufacturing operations (pipe, fittings, lining, and coating) must be performed at one location unless otherwise approved by the Engineer.
2. Furnish an affidavit that the pipe, specials, fittings, and appurtenances furnished comply with all provisions of this Section and applicable ASTM and AWWA Specifications.

B. Owner Testing and Inspection:

1. Pipe may be subject to inspection during manufacture by an independent testing laboratory selected and retained by the Owner. Representatives of the laboratory and the Engineer must have access to the Work whenever it is in preparation or progress, and the pipe manufacturer must provide proper facilities for access and for inspection. The pipe manufacturer must notify the Owner in writing a minimum of 2 weeks prior to pipe fabrication so that the Owner may advise the manufacturer as to the Owner's

decision regarding tests to be performed by the independent testing laboratory. Material, fabricated parts, and pipe found to be defective or not conforming to the requirements of this Section will be subject to rejection at any time prior to Owner's final acceptance of the Project.

C. Factory Testing:

1. At a minimum, the following tests must be conducted at the factory, with test results furnished to the Owner and Engineer:
 - a. Load bearing tests: Provide test results for the first joint manufactured of each size and class, and at least one joint per hundred joints thereafter.
 - b. Material tests: Provide material test results per the ASTM and AWWA Standards.
 - c. Pipes must be manufactured and tested in accordance with ASTM D3262.
 - d. Coupling joints must meet the requirements of ASTM D4161.

Note to Specifier: Engineer shall use SN value appropriate for loading, installation methods and usage. In no case shall SN value be less than SN 46.

- e. Minimum pipe stiffness when tested in accordance with ASTM D2412 must be 46 psi (SN 46).
- f. The extrapolated 50-year strain corrosion value must not be less than as determined in accordance with ASTM D3681 and ASTM D3262.

D. Manufacturer's Technician for Pipe Installation:

1. Pipe manufacturer must furnish the services of a factory trained, qualified, field experienced technician during installation. The technician must assist and advise the Contractor in his pipe laying operations and must instruct construction personnel in proper joint assembly and joint inspection procedures. The technician is not required to be on-site full time. However, the technician must be on-site during the first two 8-hour days of pipe laying and thereafter three additional 8-hour days as requested by the Engineer, Owner, or Contractor.

E. Acceptable Manufacturers:

1. Hobas USA
2. Thompson Pipe Group FRP.

320.5 Delivery and Storage

Packing:

- A. An inspection of the pipe will be made by a representative of the Owner after delivery. Pipe with visible defects will be rejected and replaced at no cost to the Owner. Visible defects include cracks of any type, honeycombs, delamination, or any other defects indicative of

poor workmanship. Any pipe rejected shall not be returned under any circumstances to the Project.

- B. Pipe damaged in shipment may not be unloaded at the Site.
- C. Deliver, handle, and store pipe in accordance with the manufacturer's recommendations.
- D. Marking for Identification: Each joint of pipe and each fitting must have plainly marked on the inside of the pipe at two locations, the class and stiffness for which it is designated, the date of manufacture, the name of the manufacturer, and the identification number corresponding to the laying schedule. The top centerlines must be marked on all specials.

320.6 Materials

Materials:

- A. Resin Systems: The manufacturer must use only polyester resin systems with a proven history of performance in this application. The historical data must have been acquired from a composite material of similar construction and composition as the proposed product.
- B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components must be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.
- C. Silica Sand: Sand must be minimum 98 percent silica with a maximum moisture content of 0.2 percent.
- D. Additives: When used, resin additives such as curing agents, pigments, dyes, fillers, thixotropic agents, etc. may not detrimentally affect the performance of the product.
- E. Elastomeric Gaskets: Gaskets must be supplied by qualified gasket manufacturers and be suitable for the service intended and comply with ASTM F477.

Manufactured Products:

- A. Manufacture pipes to result in a dense, non-porous, corrosion resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow must be manufactured using a resin with a 50 percent elongation (minimum) when tested in accordance with ASTM D638, or a glass reinforced liner system. The interior surface must provide crack resistance and abrasion resistance. The exterior surface of the pipes must be comprised of a sand and/or resin layer which provides UV protection to the exterior. Pipes must be Type 1, Liner 1 or 2, Grade 1 or 3 per ASTM D3262.
- B. Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings, bell-spigot joints, or double-bell joints, which utilize elastomeric sealing gaskets made of EPDM rubber compound as the sole means to maintain water tightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins may utilize a fiberglass, gasket-sealed coupling. Piping installed by jacking and boring or within casing must have low profile bell and spigot joints.

- C. Flanges, elbows, reducers, tees, wyes, laterals and other fittings must be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays, designed to perform without failure in all possible operating conditions.
- D. Pipe must be manufactured and tested in accordance with the applicable standards. Coupling joints must meet the requirements of ASTM D4161. Minimum pipe stiffness when tested in accordance with ASTM D2412 must be **[46 psi] [72 psi]**.
- E. Tee-Based Manhole fittings must be made with fiberglass pipe and must include a minimum 30-inch diameter manway.
- F. Reference Specification Item No. 312 Frames, Grates, Rings and Covers and Specification Item No. 304 Manholes.

Dimensions:

- A. Pipe size must be a minimum of 30". Dimensions called for on the Drawings are inside diameters and are minimums. The actual outside diameter shall be in accordance with applicable standards and shall be in accordance with manufacturer's literature.
- B. Pipe must be supplied in nominal lengths of 10 to 40 feet. Other lengths may be supplied upon approval of the Engineer. Actual laying length must be a nominal plus 1 inch to minus 4 inches or as approved by the Engineer. At least 90 percent of the total footage of each size and class of pipe, excluding special order lengths, must be furnished in nominal length sections.
- C. Pipe ends must be square to the pipe axis with a minimum tolerance of 1/8 inch (or 1/4 inch) as per the manufacturer's literature. It shall be the Contractor's responsibility to provide testing data once the pipe is installed that the joint has successfully passed the applicable air test.

Detectable Warning Tape:

- A. Provide detectable warning tape as follows:
 - 1. Thickness: 5.0-mil overall thickness.
 - 2. Width: 3 inches minimum.
 - 3. Weight: 27.5 pounds per inch per 1000 square feet.
 - 4. Triple layer with:
 - a. Minimum thickness 0.35-mil solid aluminum foil encased in a protective inert plastic jacket.
 - b. 100 percent virgin low density polyethylene
 - c. Impervious to all known alkalis, acids, chemical reagents and solvents within soil.
 - d. Aluminum foil visible to both sides.
 - 5. Locatable by conductive and inductive methods.

6. Printing encased to avoid ink rub-off.
7. Color and Legends:
 - a. Sewer Line:
 - i. Color: Green (in accordance with APWA Uniform Color Code).
 - ii. Legend: "Caution Sewer Line Below" (repeated every 24 inches).

320.7 Construction Methods

Preparation:

- A. Contractor: The grade elevation indicated in the Drawings is the invert elevation or lowest point of the inside barrel of the pipe. Run the pipe on straight grades between the elevations indicated. Establish the grade line in the trench from reference baseline and benchmarks identified by the Engineer. Maintain this grade control a minimum of 100 feet behind and ahead of the pipe laying operation.

Pipe Laying, Handling and Jointing:

- A. Install fiberglass pipe, fittings, specials, and appurtenances as specified and required for the proper functioning of the completed pipeline. Install pipe, fittings, and specials in accordance with the manufacturer's recommendations, ASTM D3839, and AWWA M45. Pipe shall be installed to the lines and grades indicated. Each joint of pipe must be inspected immediately prior to being lowered into the trench or bore pit. If repair of damaged areas and holidays is permitted by Engineer, repair those areas per manufacturer recommendations before the pipe is lowered into the trench or bore pit.
- B. Install pipe in trench conditions as specified, on specified embedment. Pipe installation methods will be subject to the acceptance of the Engineer or Owner's representative. Pipe must be lowered into the trench using textile slings. Chains or cables may not be used for handling the pipe.
- C. Do not damage the gaskets or the ends of the pipe joints. Prior to connecting the joints, inspect and verify that the pipe ends, and gaskets are thoroughly clean with no foreign materials adhering to them. Coat the pipe ends or groove slopes of the pipe with a lubricating material in accordance with the manufacturer's recommendations. Petroleum lubricants will not be permitted. Assemble the pipe with sufficient force necessary to make a tight seal on the gasket. Joining pipes to be accomplished using a clamp (or sling), timber at pipe end for protection, and a come-along jack. Use of backhoe or similar equipment for final "seating" of a joint may be used but only if suitable end protection is used. Extreme caution must be made by the Contractor so as not to damage the pipe. Do not exceed the forces recommended by the manufacturer for joining the pipe.
- D. Check joints with a feeler gauge. If any irregularity in the position of the gasket is detected at any point on the entire circumference of the pipe, remove the pipe and examine the gasket for cuts. If the gasket is undamaged, it may be used again, but the gasket and the joint must be re-lubricated. After the pipe section is joined, check the line and grade.

- E. Securely place covers or bulkheads to seal the ends of the pipelines when the work is stopped temporarily or at the end of the day's work to prevent trash or dirt from entering the pipe.
- F. The maximum deflection of any joint may not exceed 75 percent of the manufacturer's maximum recommended joint deflection.

Water Line Clearances:

- A. Where a gravity flow wastewater line is within 9 feet of and parallels a waterline, the pipeline must comply with ASTM or AWWA specifications with a minimum pressure rating for both the pipe and joints of 150 psi. The vertical separation must be a minimum of 2 feet between outside diameters and the horizontal separation must be a minimum of 4 feet between outside diameters. The gravity flow line must be located below the waterline.
- B. Where a gravity flow wastewater line crosses a waterline, the pipeline must comply with ASTM or AWWA specifications with a minimum pressure rating of 150 psi and maintain an absolute minimum distance of 6 inches between outside diameters. In addition, the wastewater line must be located below the waterline where possible and one length of the wastewater pipe must be centered on the waterline.
- C. Where a gravity flow wastewater line crosses over a waterline, the pipeline must comply with ASTM or AWWA specifications with a pressure rating of at least 150 psi with one joint of pipe centered on the waterline, using appropriate adapters.

Field Quality Control:

- A. Conduct pipe testing as outlined below.
- B. Hydrostatic Leak Test for Gravity Flow Sewer Lines:
 - 1. Perform hydrostatic leak tests after backfilling.
 - 2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2 feet or 2 feet above the ground water level whichever is higher and the head over the downstream crown is not more than 6 feet.
 - 3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
 - 4. Continue the test for 1 hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
 - 5. Remove the jointing material and remake the joint if any joint shows any visible leakage or infiltration.
 - 6. Remove and replace any defective or broken pipes.
 - 7. Determine the maximum allowable leakage or infiltration by the following formula:

$$L = \frac{C \times D \times S}{126,720}$$

Where L is the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; C is infiltration/exfiltration rate. Use 50 for C outside of 25-year floodplain, and 10 for C within 25-year floodplain.

8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's acceptance.
9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.

C. Low Pressure Air Test for Gravity Flow Sewer Lines:

1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F1417 except for testing times. The following test times are required:

| Pipe Diameter (inch) | Minimum Time (seconds) | Length for Minimum Time (feet) | Time for Long Length (seconds) |
|----------------------|------------------------|--------------------------------|--------------------------------|
| 6 | 340 | 398 | 0.855 (L) |
| 8 | 454 | 298 | 1.520 (L) |
| 10 | 567 | 239 | 2.374 (L) |
| 12 | 680 | 199 | 3.419 (L) |
| 15 | 850 | 159 | 5.342 (L) |
| 18 | 1020 | 133 | 7.693 (L) |
| 21 | 1190 | 114 | 10.471 (L) |
| 24 | 1360 | 100 | 13.676 (L) |
| 27 | 1530 | 88 | 17.309 (L) |
| 30 | 1700 | 80 | 21.369 (L) |
| 33 | 1870 | 72 | 25.856 (L) |

- a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
- b. Pass air through a single control panel.
- c. Provide pneumatic plugs that have a sealing length equal to or greater than the

circumference of the pipe to be tested.

- d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
 - e. Provide an air compressor of adequate capacity for charging the system.
3. Perform air test only on lines less than 36 inches in diameter. Air tests for pipes larger than 36 inches may be air tested at each joint.
 4. Check connections for leakage with a soap solution. If leaks are found, release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test.
 5. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

$$T = 0.0850 DK/Q$$

T is the time for the pressure to drop 1.0 pound per square inch gauge in seconds; K is 0.000419DL, but not less than 1.0; D is the average inside diameter in inches; L is the length of line of the same pipe size in feet; Q rate of loss, shall be 0.0015 cubic feet per minute per square foot of internal surface.

D. Air Test for Individual Joints:

1. Lines 36 inches and larger may be tested at individual joints.
2. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.
3. Pipe joints that exceed the maximum allowable pressure drop are considered defective and must be corrected.

E. Deflection Testing for Pipe:

1. Perform deflection tests on flexible and semi-rigid pipe in accordance TCEQ requirements.
 - a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5 percent, or 75 percent of the manufacturer's maximum allowable deflection, whichever is less.
 - b. Conduct test after the final backfill has been in place a minimum of 30 days.
 - c. Thoroughly clear the lines before testing.
2. Perform test by pulling a properly sized mandrel through the line up to 48-inch diameter. Larger than 48-inch which may be measured from the inside-vertical dimensions.
3. Repair pipe with deflections in excess of 5% or 75% of the manufacturer's maximum allowable deflection, whichever is less.

- F. Engineer may require additional performance tests of the joints.
- G. Contractor shall not enclose or cover any Work until inspected.
- H. CCTV sewer lines as specified in Specification Item No. 315, "CCTV Inspection".

320.8 Payment

Payment when included as a contract pay item, will be made under one of the following:

Pay Item: Fiberglass Gravity Sewer ___ in. Pipe, Class ____ Per Linear Foot.

End