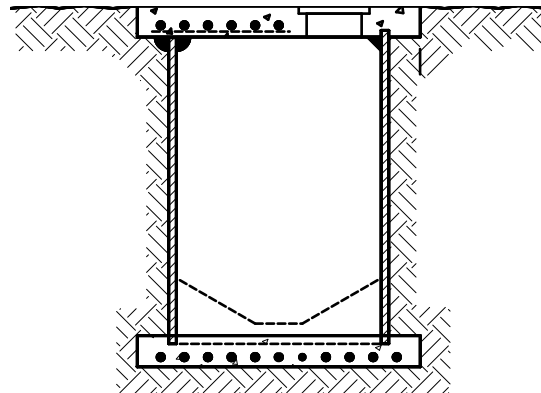




**CONTAINMENT
SOLUTIONS®**

SPECIFICATIONS

GLASS-FIBER REINFORCED POLYESTER (FRP) WETWELLS



SPECIFICATIONS

GLASS-FIBER REINFORCED POLYESTER (FRP) WETWELLS

I. SCOPE OF WORK

This specification shall govern for the furnishing of all work necessary to accomplish and complete the installation of glass-fiber reinforced polyester wetwells. Glass-Fiber Reinforced Polyester wetwells shall be a **one-piece monolithic designed unit constructed of glass-fiber reinforced, supplier certified, unsaturated commercial grade polyester resin**. FRP wetwells shall be manufactured in strict accordance with *ASTM D-3753 "Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wetwells"*, as manufactured by **Containment Solutions, Inc., Conroe, Texas, Fiberglass wetwells**.

II. GOVERNING STANDARDS

Wetwells shall conform to the following design criteria:

- A. ASTM D-3753: Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wetwells.
- B. ASTM C-581: Practice for Determining Chemical Resistance of Chemical Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service.
- C. ASTM D-2412: Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading.
- D. ASTM D-695: Test Methods for Compressive Properties of Rigid Plastics.
- E. ASTM D-2584: Test Method for Ignition Loss of Cured Reinforced Resins.
- F. ASTM D-790: Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and electrical Insulating Materials.
- G. ASTM D-2583: Test Method for Indentation Hardness of Rigid Plastics by means of a Barcol Impressor.

III. GENERAL DESCRIPTION: FIBERGLASS REINFORCED POLYESTER WETWELL DIAMETERS (I.D.): 3'- 0" through 20'- 0"

- A. **Dimensions:** The wetwells shall be a circular cylinder, sized per the plans for the applicable stations. Wetwells shall be produced in per the length in the plans +/- 1/2". Nominal inside diameters shall be 36", 42", 48", 54", 60", 66", 72", 96", 120", 132", 168", 186", 192", 216", and 240". Tolerance on the inside diameter shall be +/- 1%. Other diameters as agreed upon between purchaser and the manufacturer are covered by this specification.
- B. The manufacturer of the wetwell shall be able to show experience in the manufacture of FRP wetwells for more than five years.
- C. **Design Criteria:**
 - 1. Wetwells shall meet all requirements for pipe stiffness as required in ASTM D3753.
 - 2. The wetwells, shall be suitable for use in typical environments including storm and sanitary sewers with a temperature range not to exceed 140°F.
 - 3. Cylinders shall be designed and fabricated to provide sufficient strength for the following loading conditions:
 - a). Resistant to buckling when empty and when the groundwater elevation is at grade.
 - b). The anchoring wall structure at the embankment within the reinforced concrete base zone shall

be designed to resist external hydrostatic water forces of an empty or full cylinder with the groundwater at grade elevation.

- c.) Load Bearing Capacity: Properly installed wetwell shall be capable of withstanding AASHTO HS-20 dynamic loading (16,000 lbs.) applied vertically.
4. The FRP wetwells, shall be manufactured to the diameters and heights as shown in the plans and specifications. They shall be designed by the manufacturer to perform as underground structures at the depths required. The FRP structures shall be capable of supporting the top slab covers, frames, soil overburdens plus a live load equivalent to AASHTO HS-20 Loading.
 5. All cutouts shown in the plans and details for each FRP wetwell shall be capable of maintaining the unit's structural integrity.
 6. Wetwell FRP Tops and Hatch Openings: Resin and glass fiber reinforced wetwell tops and hatch openings may be provided upon Engineers request. Wetwells shall be provided with glass reinforced top designed to withstand backfill and concrete slab. Fiberglass Ribs or Fiberglass structural members may be utilized to meet the design criteria. **Stiffeners shall be of non-corrosive materials encapsulated in fiberglass. FRP encapsulated wood or lumber shall not be permitted.**
 - Hatch opening dimensions and position to be specified by Engineer.
 - Vapor barrier lip around hatch opening shall be 4" tall. It shall be shall be constructed of fiberglass pultruded structural shapes.
 7. Wetwell FRP Bottoms: Resin and glass fiber reinforced wetwell bottoms may be provided upon Engineers request. Upon that request, wetwells shall be provided with glass reinforced bottom section designed to withstand the hydrostatic head pressure, empty and water to grade. Fiberglass Ribs or Fiberglass structural members may be utilized to meet the design criteria. **Stiffeners shall be of non-corrosive materials encapsulated in fiberglass. FRP encapsulated wood or lumber shall not be permitted.** Bottoms sections shall be furnished with an integral 3" wide anchoring flange.
 8. Wetwell FRP bottom or top flanges: Resin and glass fiber reinforced wetwell flanges may be provided upon Engineers request. Flanges shall be 3" wide minimum.
- E. **Marking and Identification:** All Wetwells shall be marked with the following information:
- 1) Manufacturers Identification
 - 2) Manufacturers Serial Number
 - 3) Wetwell Diameter & Length
 - 4) ASTM Designation

IV. MATERIALS

- A. **Resin:** The resins used shall be unsaturated, supplier certified, commercial grade polyester resins. **Mixing lots of resin from different manufacturers, or "odd-lotting" of resins shall not be permitted.** Quality-assurance records on the resin shall be maintained. Non-pigmented resin is required to allow for light or "sand" color of wetwell surface in order to facilitate easy from grade interior inspection. **UV Inhibitors shall be added directly to resins to prevent photodegradation.**
- B. **Reinforcing Materials:** The reinforcing materials shall be commercial grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or both, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
- C. **Surfacing Material:** If reinforcing material is used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass or organic surfacing mat having a coupling agent that will provide a suitable bond with the resin.
- D. **Fillers and Additives:** Fillers, when used, shall be inert to the environment and wetwell construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the

specific manufacturing process to be used to meet the requirements of this standard. However, calcium carbonate mixed by the fabricator shall not be permitted. The resulting reinforced plastic material must meet the requirement of this specification.

- E. **Laminate:** The laminate shall consist of multiple layers of glass matting and resin. The surface exposed to the sewer/chemical environment shall be resin rich and shall have no exposed fibers.

V. MANUFACTURE

- A. Wetwell cylinders, flat tops, and flat bottoms, shall be produced from glass fiber-reinforced polyester resin. Wetwell cylinders up to 72" ID X 20' length to be manufactured by "computer regulated mandrel process". For 72" diameter and depths greater than 20', as well as all diameters greater than 72" to be manufactured by "computer regulated steel mandrel process" utilizing structural rib design.
- B. **Assembly Joints:** Product components, i.e., cylinders, tops, bottoms, and connectors, may be joined together to form a complete wetwell.

VI. REQUIREMENTS

- A. **Exterior Surface:** The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to *eliminate* fiber show. The exterior surface shall be *free of blisters* larger than 0.5" in diameter, delamination and fiber show. **Gel-coat or paint or other coatings are not allowed.**
- B. **Interior Surface:** The interior surfaces shall be resin rich with no exposed fibers. Interior surface shall be smooth for improved corrosion resistance and reduced sludge build-up. The surface shall be free of crazing, delamination, blisters larger than 0.5" in diameter, and wrinkles of 0.125" or greater in depth. Surface pits shall be permitted up to 6/ft² if they are less than 0.75" in diameter and less than 0.0625" deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted up to 4/ft² if they are less than 0.5" in diameter and less than 0.0625" thick. **Gel-coat or paint or other coatings are not allowed.**
- C. **Repairs:** Any wetwell repair is required to meet all requirements of this specification.
- D. **Wetwell Lengths:** Wetwell lengths shall be per plan requirements +/- 2".
- E. **Stiffness:** The cylindrical portion of the wetwell is to be tested in accordance with ASTM Method D 2412. The wetwell cylinder shall have the *minimum* pipe-stiffness values shown in the table below, when tested in accordance with ASTM 3753, Section 8.5, (note 1).

Wetwell Length (ft)	PSI
3 - 6	0.72
7 - 12	1.26
3 - 20	2.01
21 - 25	3.02
26 - 35	5.24

- G. **Chemical Resistance:** Per ASTM C 581; (see ASTM 3753, Section 8.7), Flexural strength, flexural modulus, and barcol hardness are plotted versus time on log-log coordinates. The line defined by these points is extrapolated to 100,000 hours. The minimum extrapolation retention allowed for any of these properties is 50%. Test samples used are actual pieces of wetwell or samples manufactured in a manner consistent in every way with the wetwell component construction.

I. **Physical Properties:**

Flexural Strength (pipe)	Hoop: 22.5 x 10 ³ psi
	Axial: 14.3 x 10 ³ psi
Compressive Strength:	8.9 x 10 ³ psi

VII. TEST METHODS

- A. All tests shall be performed as specified in ASTM 3753, Section 8, Titled "Test Methods". See ASTM 3753, Section 8, Note 5, for test method D-790 and test method D-695.

VIII. QUALITY ASSURANCE/QUALITY CONTROL

- A. **Examination:** Each FRP cylinder component part shall be examined for dimensional requirements, hardness, and workmanship.
- B. **Composition Control:** Controls on glass and resin content shall be maintained for all manufacturing processes and for each portion of the FRP cylinder fabrication. Records shall be maintained of these control checks. Proper glass content may be shown by glass usage checks, by glass and resin application rate checks, in accordance with the material composition test in ASTM D 3753, Section 8.8.1.
- C. All required ASTM D-3753 testing shall be completed and records of all testing shall be kept and copies of test results shall be presented to customer upon written request within a reasonable time period.

IX. CERTIFICATION

- A. When requested by the purchaser on his order, a certification shall be made the basis of acceptance. This shall consist of a copy of the manufacturer's test report or a statement by the supplier, accompanied by a copy of the test results, that the wetwell has been sampled, tested, and inspected in accordance with the provisions of ASTM 3753 and this specification, and meets all requirements. An authorized agent of the supplier or manufacturer shall sign each certification so furnished.

X. HANDLING AND STORAGE REQUIREMENTS

- A. FRP wetwells shall be lifted by the installation of lifting lugs as specified by the manufacturer on the outside surface near the top of the wetwell. Wetwells may also be lifted in the horizontal position with two slings on a spreader bar.
- B. FRP wetwells may be stored upright or horizontally, however, the wetwell vertical deflection shall not exceed 4% of the diameter. The wetwell shall not be dropped or impacted.
- C. Additional handling and installation instructions shall be in accordance with the FRP manufacturer's instructions.
- D. Each FRP section manufactured in accordance with the drawings shall be clearly marked to indicate the intended pump station installation location. The contractor shall be responsible for the installation of the correct FRP sections in their designated pump station locations.

XI. INSTALLATION METHODS

- A. The FRP manufacturer's written installation instructions shall be followed to ensure the wetwell will perform in accordance with the design requirements of the applicable specification.
- B. Each excavation and backfill are to be done as part of the work under this section, including any necessary sheeting and bracing. The contractor shall be responsible for handling groundwater to provide firm, dry subgrade for the structure, shall prevent water from rising on new poured in place concrete within 24 hours after placing, and shall guard against flotation of other damages resulting from groundwater or flooding.
- C. A minimum of 12-in. bedding shall be placed as a foundation for the wetwell base slabs.
- D. Backfilling: Do not backfill until concrete base has hardened sufficiently to provide rigid support for both the wetwell and backfill. Add backfill evenly in 12" lifts all around wetwell to avoid uneven backfill loads.
- D. The Cast-in-place concrete base, shall be placed on a thoroughly compacted sub-base. The bottom of the FRP sections shall be cast-in-place a minimum of 4 inches and shall be adjusted in grade so that the top slab section is at elevation specified in the contract or on approved drawings.
- E. Pre-cast concrete bases are permitted with Engineer pre-approval for installation with the wetwell. If such bases are used and are to be set with the wetwell, all lifting shall be done on the base itself with Engineer approved lifting eyes or loops and not the wetwell structure.
- F. The FRP manufacturer's written installation instructions shall be followed to ensure the wetwell will perform in accordance with the design requirements of the applicable specification.
- G. Wetwell cutouts may be made in the FRP wetwell, using a circular saw, saber saw, hole saw, or similar equipment with a masonry type blade. Axes, hammers, chisels, or similar impact type tools may not be used.
- H. Stubouts and Connections: All FRP inserts and FRP sleeves for piping shall be made as shown on installation drawings and in accordance with the manufacturer's FRP specifications for installation. Other methods of connections may be performed per Engineers request or as shown in the plans and specifications, i.e., Inserta-Tee fittings, pipe connectors which conform to ASTM C-923 or PVC sewer pipe with FRP lay-up reinforcement installed per manufacturer's recommendation.
 - 1). Inserta-Tee Fittings: Joints for sewer pipe line and drop connections sizes 4" - 15" shall be made by means of Inserta-Tee watertight compression connection. Installation shall be in strict accordance with manufacturer's written instructions utilizing installation equipment approved for use by the manufacturer of the Inserta-Tee fitting.

2). Pipe Stubouts:

- a). Install rubber gasketed PVC sewer pipe stubouts to wetwell with resin and glass-fiber reinforced lay-up. Gaskets shall meet the same performance requirements of the sewer pipe to be installed unless otherwise directed by Engineer. Resin and glass shall be of the same type and grade as used in the fabrication of the FRP wetwell.
- b). Install PVC or FRP pipe stubouts for use with resilient pipe-to-wetwell connectors (boots) which conform to the performance requirements of ASTM C-923. PVC or FRP pipe stubouts may also be used by placing incoming service piping through stubout and sealing the annular space with expandable sealing mechanism.

XII. INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the owner. Such inspections shall be made at the place of manufacture, or at site of delivery, and the sections shall be subject to rejection on account of failure to meet any of the specification requirements as specified herein. Sections rejected after delivery to the job site shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed shall be acceptable if repaired or removed and replaced at the contractor's expense.
- B. At the time of inspection, the material will be examined for compliance with the requirements of this specification and the approved drawings.

XIII. MEASUREMENT

This item will be measured will be measured by each type of individual structure completed. The depth will be measured from the flow line to the top of the rim. The size shall be nominal inside diameter. This item includes, but is not limited to the following:

- A. Structural excavation
- B. Loading, hauling, and disposing of all excess material
- C. Furnishing all labor and materials including fiberglass, concrete, mortar, bricks, drop pipe, fittings, and covers
- D. Placing and compacting all backfill
- E. Final Grading

XIV. PAYMENT

- A. This item will be paid for at the contract unit price per bid per each structure for the various sizes, types, and various depths of structures complete in place and will be full compensation for all materials required, operations, labor, tools, equipment, and all other incidentals necessary to complete the work as shown on the drawings and specified herein.